State Office of Administrative Hearings

Kristofer S. Monson
Chief Administrative Law Judge

June 20, 2022

Mary Smith
General Counsel
Texas Commission on Environmental Quality
12100 Park 35 Circle, Bldg. F, Room 4225
Austin TX 78753

Re: SOAH Docket No. 582-20-1895; TCEQ Docket No. 2019-1156-IWD-MWD; Port of Corpus Christi Authority of Nueces County

Dear Ms. Smith:

The above-referenced matter will be considered by the Texas Commission on Environmental Quality on a date and time to be determined by the Chief Clerk's Office in Room 201S of Building E, 12118 N. Interstate 35, Austin, Texas.

Enclosed are copies of the Proposal for Decision and Order that have been recommended to the Commission for approval. Any party may file exceptions or briefs by filing the documents with the Chief Clerk of the Texas Commission on Environmental Quality no later than **July 11, 2022.** Any replies to exceptions or briefs must be filed in the same manner no later than **July 21, 2022**.

This matter has been designated **TCEQ Docket No. 2019-1156-IWD; SOAH Docket No. 582-20-1895**. All documents to be filed must clearly reference these assigned docket numbers. All exceptions, briefs and replies along with certification of service to the above parties shall be filed with the Chief Clerk of the TCEQ electronically at http://www14.tceq.texas.gov/epic/eFiling/ or by filing an original and seven copies with the Chief Clerk of the TCEQ. Failure to provide copies may be grounds for withholding consideration of the pleadings.

Sincerely,

Rebecca S. Smith
Administrative Law Judge

Cassandra Quinn
Administrative Law Judge

Enclosures

cc: Mailing List

SOAH DOCKET NO. 582-20-1895
TCEQ DOCKET NO. 2019-1156-IWD

APPLICATION OF PORT OF CORPUS CHRISTI AUTHORITY OF NUECES COUNTY FOR TPDES PERMIT NO. WQ00052530001	**§**	**BEFORE THE STATE OFFICE**
	§	**OF**
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APPLICATION OF PORT OF CORPUS CHRISTI AUTHORITY OF NUECES COUNTY FOR TPDES PERMIT NO. WQ00052530001	**§**	**BEFORE THE STATE OFFICE**
	§	**OF**
	§	**ADMINISTRATIVE HEARINGS**

PROPOSAL FOR DECISION ON REMAND

The Port of Corpus Christi Authority of Nueces County (Applicant or Port Authority) filed an application on March 7, 2018 (Original Application), with the Texas Commission on Environmental Quality (TCEQ or Commission) for new Texas Pollutant Discharge Elimination System (TPDES) Permit No. WQ00052530001. The Port Authority seeks the permit to discharge treated effluent from a proposed marine seawater desalination plant to be located in Nueces County, which would be the first such plant in the State of Texas. A hearing was held on the Original Application, and the Administrative Law Judges (ALJs) issued a Proposal for Decision (Initial PFD) recommending that it be denied. The Commission considered the Initial PFD and remanded this proceeding so that additional evidence could be taken.

On remand, the Port Authority revised its application (the Revised Application) and provided additional evidence, and the Executive Director (ED) of the Commission prepared a revised draft permit (Revised Draft Permit). The ED recommends that the Revised Application be approved and that the Revised Draft Permit be issued.

For reasons set out below, the ALJs conclude that the evidentiary record supports issuance of the Revised Draft Permit, but with modifications to ensure appropriate conditions are in place to limit and monitor the concentration of salinity in the discharge. With these modifications, the ALJs recommend that the TCEQ grant the Revised Application.

I. PROCEDURAL HISTORY ON REMAND[1]

The Initial PFD was issued in this matter on February 5, 2021, recommending denial of the Port Authority's Original Application. The Commission considered the Initial PFD at an open meeting held on May 19, 2021, and determined that this matter should be remanded to the State Office of Administrative Hearings (SOAH) to:

1. Apply the appropriate legal standard for non-numeric criteria found in 30 Texas Administrative Code § 307.6(e)(1) for evaluating the impacts to aquatic organisms that move through a zone of initial dilution (ZID); and

2. Take additional evidence on the following issues:[2]

   A. Whether the proposed discharge will adversely impact: the marine environment, aquatic life, and wildlife, including birds and endangered or threatened species, spawning eggs, or larval migration;

   C. Whether the proposed discharge will adversely impact recreational activities, commercial fishing, or fisheries in Corpus Christi Bay and the ship channel;

   D. Whether the Application, and representations contained therein, are complete and accurate;

   G. Whether the modeling complies with applicable regulations to ensure the draft permit is protective of water quality, including utilizing accurate inputs;

   H. Whether the Executive Director's antidegradation review was accurate; and

   I. Whether the draft permit includes all appropriate and necessary requirements.[3]

The Commission's interim order remanding this proceeding (Interim Order) also set certain deadlines. The Port Authority had 30 days from the issuance of the Commission's order "to

[1] The procedural history prior to the remand is set forth in the Initial PFD.

[2] The lettering of the remanded issues corresponds to their lettering in the Initial Proceeding.

[3] Ex. AR-R 2 (Tab G – TCEQ Interim Order).

provide revised information to all parties including the depth of the channel, site-specific ambient velocity, and the depth of the diffuser." Then, the parties were allowed 30 days to review the revised information before a preliminary hearing would be set. Finally, the maximum duration of the hearing was set at 120 days from the first day of the preliminary hearing on remand to the issuance of the PFD. The parties agreed to, or did not oppose, extending each of these designated timeframes.[4] The parties proposed an agreed procedural schedule, which was adopted by the ALJs.[5]

The preliminary hearing on remand was held on January 25, 2022, via Zoom videoconference. At the preliminary hearing, the ALJs admitted supplements to the administrative record (Exhibits AR-R 1 through AR-R 5).[6] Further supplements to the administrative record (Exhibits AR-R 6 and AR-R 7) were admitted at a prehearing conference held on March 11, 2022.[7]

The hearing on the merits convened via Zoom videoconference on March 14, 2022, and concluded on March 25, 2022. The record closed on April 22, 2022, after the parties submitted their final closing arguments and proposed findings of fact and conclusions of law.

The parties to this proceeding are: the Port Authority; ED; TCEQ's Office of Public Interest Counsel (OPIC); Audubon Texas (Audubon); Port Aransas Conservancy (PAC); the following individuals represented by counsel: James Harrison King, Tammy King, Edward Steves, and Sam Steves (collectively, Kings/Steves); the following aligned individuals representing themselves: Stacey Bartlett, Jo Ellen Krueger, Sarah Searight, and Lisa Turcotte (collectively, pro se group);[8] and Cara Denney, Aldo Dyer, and Mark Grosse. As in the Initial Proceeding, all parties participated at the hearing, except for Ms. Denney, Mr. Dyer, and Mr. Grosse.

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[4] *See* SOAH Order No. 12 (July 28, 2021) (extending ED's technical review period); SOAH Order No. 16 (Nov. 10, 2021) (adopting agreed procedural schedule).

[5] SOAH Order No. 16 (Nov. 10, 2021).

[6] SOAH Order No. 18 (Feb. 14, 2022).

[7] SOAH Order No. 22 (Mar. 14, 2022).

[8] The individuals in the pro se group were aligned with Ms. Turcotte designated as their representative, and non-party Cathy Fulton acting on their behalf at the hearing.

II. BURDEN OF PROOF

The Original Application was filed after September 1, 2015, and the TCEQ referred it under Texas Water Code § 5.556, which governs referral of environmental permitting cases to SOAH based on a request for a contested case hearing.[9] Therefore, this case is subject to Texas Government Code § 2003.047(i-1)-(i-3),[10] which provides:

> (i-1) In a contested case regarding a permit application referred under Section 5.556 . . . [of the] Water Code, the filing with [SOAH] of the application, the draft permit prepared by the executive director of the commission, the preliminary decision issued by the executive director, and other sufficient supporting documentation in the administrative record of the permit application establishes a prima facie demonstration that:
>
> (1) the draft permit meets all state and federal legal and technical requirements; and
>
> (2) a permit, if issued consistent with the draft permit, would protect human health and safety, the environment, and physical property.
>
> (i-2) A party may rebut a demonstration under Subsection (i-1) by presenting evidence that:
>
> (1) relates to . . . an issue included in a list submitted under Subsection (e) in connection with a matter referred under Section 5.556, Water Code; and
>
> (2) demonstrates that one or more provisions in the draft permit violate a specifically applicable state or federal requirement.
>
> (i-3) If in accordance with Subsection (i-2) a party rebuts a presumption established under Subsection (i-1), the applicant and the executive director may present additional evidence to support the draft permit.

[9] Tex. Water Code §§ 5.551(a), .556.

[10] Acts 2015, 84th Leg., R.S., ch. 116 (S.B. 709), §§ 1 and 5, eff. Sept. 1, 2015.

Although this law creates a presumption, sets up a method for rebutting that presumption, and shifts the burden of production on that rebuttal, it does not change the underlying burden of proof. Accordingly, the burden of proof remains with the Applicant to establish by a preponderance of the evidence that the Application would not violate applicable requirements and that a permit, if issued consistent with the draft permit, would protect human health and safety, the environment, and physical property.[11]

In this case, the parties went through this process, and in the Initial PFD, the ALJs found that the Port Authority did not meet its burden of proof on certain issues. The Commission then remanded the case to use a different standard for lethality in the ZID and to take additional evidence on the topics where the ALJs found that the Port Authority had not met its burden of proof.

Based on the remand posture, the ALJs determined that the parties had already completed the shifting steps set out in the statute. The protestants had rebutted the presumption and, initially, the Port Authority's evidence was insufficient to meet its burden of proof on the remanded topics. Because the remand was to take additional evidence on those topics where the presumption had already been rebutted, the presumptions were not reinstated.

Before the hearing, the Port Authority argued that because it had revised its Original Application and the ED had issued the Revised Draft Permit, it was entitled to a new presumption. The ALJs determined the Port Authority's interpretation would be inconsistent with the Commission's Interim Order. Thus, the purpose of this remand proceeding was to take additional evidence on the specific issues set out by the Commission.

III. DISCUSSION AND ANALYSIS

Several of the issues included in the Commission's remand inquire about the proposed discharge's impact on the environment and human health. These issues rely on a common set of

[11] 30 Tex. Admin. Code § 80.17(a), (c).

law and facts, which are discussed first. Thereafter, each issue included in the remand is addressed separately. The issues related to the ED's modeling and antidegradation review (Issues G and H) have implications for the other issues, so they are taken up first, with the remaining issues following in the order laid out in the Commission's Interim Order.

A. Background and Applicable Law

1. Description of the Proposed Facility and Discharge

The Port Authority seeks a wastewater discharge permit for a proposed marine seawater desalination plant (the Facility) to be located on Harbor Island in Nueces County, Texas. The Facility will pump seawater from the Gulf of Mexico and use reverse osmosis to produce potable water. The draft permit prepared by the ED would authorize the discharge of treated effluent from the Facility, consisting primarily of the concentrated brine resulting from the desalination process. The draft permit specifies daily maximum and daily average flow limits of 110 million gallons per day (MGD) and 95.6 MGD, respectively. The treated effluent would be discharged via a pipeline into the Corpus Christi Ship Channel approximately 229 feet off Harbor Island's shoreline.[12] The discharge site is identified as Outfall 001. The Port Authority plans to use a diffuser at the discharge site to enhance mixing of the treated effluent with the ambient water.

2. Texas Surface Water Quality Standards (TSWQS)

The Facility's proposed discharge is subject to the Texas Surface Water Quality Standards (TSWQS) found in title 30, chapter 307 of the Texas Administrative Code (TAC). The TSWQS identify appropriate uses for the state's surface waters (e.g., aquatic life, recreation, and public water supply), and establish narrative and numerical water quality standards to protect those uses. The TCEQ has standard procedures for implementing the TSWQS, referred to as the Implementation Procedures (IPs), which are approved by the U.S. Environmental Protection

[12] As discussed below, the Revised Application moved the discharge location approximately 70 feet closer to the shoreline.

Agency (EPA).[13] The TSWQS and IPs are used to set permit limits for wastewater discharges and other activities that may have an effect on water quality.

To assess the potential water quality impact of a proposed discharge, the TSWQS establish "mixing zones" in the receiving water body, which are defined areas contiguous to the permitted discharge where the effluent mixes with the receiving waters.[14] Acute toxicity to aquatic organisms is not allowed in a mixing zone, and chronic toxicity to aquatic organisms is not allowed beyond a mixing zone.[15] There are three applicable mixing zones, listed here from smallest to largest and in order of their proximity to the discharge: the zone of initial dilution (ZID),[16] aquatic life mixing zone (ALMZ), and human health mixing zone (HHMZ). The ED conducts modeling, as discussed further below, to determine the percentage of effluent (the "effluent percentage" or "critical dilution") that is predicted to occur at the edge of each regulatory mixing zone. For toxic substances where adequate toxicity information is available, the TSWQS establish numerical water quality standards for acute and chronic toxicity that apply at the mixing zone boundaries.

The main constituent of concern in this case is salinity.[17] The Facility's discharge will consist primarily of the concentrated salts that remain after the desalination process. With regard to salinity, the TSWQS provide that "[c]oncentrations and the relative ratios of dissolved minerals such as chloride, sulfate, and total dissolved solids must be maintained such that existing,

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[13] 30 Tex. Admin. Code § 307.2(e); Ex. ED-MW-3 ("Procedures to Implement the Texas Surface Water Quality Standards (RG-194)").

[14] 30 Tex. Admin. Code § 307.3(a)(40).

[15] *Id.* Acute toxicity is defined as "[t]oxicity that exerts a stimulus severe enough to rapidly induce an effect. The duration of exposure applicable to acute toxicity is typically 96 hours or less. Tests of total toxicity normally use lethality as the measure of acute impacts. (Direct thermal impacts are excluded from definitions of toxicity.)" 30 Tex. Admin. Code § 307.3(a)(1). Chronic toxicity is defined as "[t]oxicity that continues for a long-term period after exposure to toxic substances. Chronic exposure produces sub-lethal effects, such as growth impairment and reduced reproductive success, but it may also produce lethality. The duration of exposure applicable to the most common chronic toxicity test is seven days or more." 30 Tex. Admin. Code § 307.3(a)(12).

[16] 30 Tex. Admin. Code § 307.3(a)(87) (defining the ZID as "[t]he small area at the immediate point of a permitted discharge where initial dilution with receiving waters occurs and that may not meet certain criteria applicable to the receiving water").

[17] Salinity is defined as "[t]he total dissolved solids in water after all carbonates have been converted to oxides, all bromide and iodide have been replaced by chloride, and all organic matter has been oxidized. For most purposes, salinity is considered equivalent to total dissolved salt content. Salinity is usually expressed in parts per thousand." 30 Tex. Admin. Code § 307.3(a)(55).

designated, presumed, and attainable uses are not impaired."[18] The TSWQS do not provide specific numeric criteria for salinity for Texas estuaries, but require careful consideration and that aquatic life uses be supported:

> Salinity gradients in estuaries must be maintained to support attainable estuarine dependent aquatic life uses. Numerical salinity criteria for Texas estuaries have not been established because of the high natural variability of salinity in estuarine systems, and because long-term studies by state agencies to assess estuarine salinities are still ongoing. Absence of numerical criteria must not preclude evaluations and regulatory actions based on estuarine salinity, and careful consideration must be given to all activities that may detrimentally affect salinity gradients.[19]

The TSWQS also generally provide that "surface waters must not be toxic to man from ingestion of water, consumption of aquatic organisms, or contact with the skin, or to terrestrial or aquatic life."[20] In addition, the TSWQS require that "[w]ater in the state must be maintained to preclude adverse effects on aquatic life."[21]

The TSWQS also require that proposed wastewater discharges undergo an antidegradation review, which is designed to ensure that standards for protecting existing uses and water quality are met.[22] The antidegradation review process for TPDES permits is described in the IPs.[23]

3. Legal Standard for Evaluating Impacts to Aquatic Organisms

In the Initial Proceeding, the parties disagreed about what legal standard applies for evaluating impacts on aquatic organisms. In the Initial PFD, the ALJs concluded that the standard that applied, based on 30 TAC §§ 307.6(c)(6) and 307.8(b)(2), was that there "must be *no lethality*

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[18] 30 Tex. Admin. Code § 307.4(g)(1).

[19] 30 Tex. Admin. Code § 307.4(g)(3).

[20] 30 Tex. Admin. Code § 307.4(d).

[21] 30 Tex. Admin. Code § 307.6(b)(4).

[22] 30 Tex. Admin. Code § 307.5.

[23] 30 Tex. Admin. Code § 307.5(c)(1)(A); *see also* Ex. ED-1 Remand at 55-69.

to aquatic organisms that move through a ZID."[24] The Commission disagreed with that conclusion and as part of the Interim Order instructed the ALJs to apply the standard set out in 30 TAC § 307.6(e)(1), which states that "there must be no *significant* lethality to aquatic organisms that move through a ZID."[25]

On remand, the parties now disagree about the scope of that standard. The Port Authority argues there could be no significant lethality from the ZID because only a small percentage of red drum larvae will pass through it. They argue that "significant lethality" means lethality that would affect the population dynamic in the adult recruited population[26] and this sort of effect can only be examined by looking at the entire adult population of red drum in the Corpus Christi Bay region.[27] According to the Port Authority, significant lethality cannot be examined by only looking at the ZID.

PAC, on the other hand, argues the language of the rule—"there must be no significant lethality to aquatic organisms in the ZID"—means that it applies to organisms in any life stage that move through the ZID. It argues that because the rule refers to organisms in the ZID, it is the population in the ZID, not in the larger body of water, that is of concern. The rest of the channel is irrelevant for the rule: "the concern is not the impact on the species as a whole, but rather the impact upon the specific organisms in the ZID."[28]

The ALJs agree with PAC that an examination under 30 TAC § 307.6(e)(1) looks at the effect on aquatic organisms that actually pass through the ZID, not at whether there is a population-wide effect in the entire waterbody. The language of the rule makes this clear: there can no significant lethality to aquatic organisms *in the ZID*. Whether there might be greater effects

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[24] Emphasis added.

[25] Emphasis added.

[26] This argument is based on the testimony of PAC witness Dr. Gregory Stunz. Port Authority Closing Argument at 3 (citing Remand Tr. Vol. 5 at 1072).

[27] Port Authority Closing Argument at 3-4.

[28] PAC Closing Argument at 5.

could be relevant for other issues, such as the effect on commercial fishing and fisheries, but for purposes of this rule, the examination must address what happens to organisms in the ZID.

4. Characteristics of the Outfall Location

The Facility would be located on the southeastern tip of Harbor Island, an island situated between the Texas coast and the barrier islands of San Jose Island and Mustang Island. Harbor Island is located at the mouth of the Aransas Pass inlet, which separates the two barrier islands and connects the Gulf of Mexico to Texas's bays and estuaries. The outfall would be located to the south of Harbor Island near the confluence of the Corpus Christi Ship Channel, Lydia Ann Channel, and Aransas Pass inlet. The receiving waters are subject to tidal influence, and the discharge will flow either into the Gulf of Mexico via the Aransas Pass inlet or through the Corpus Christi Ship Channel toward Corpus Christi Bay.[29]

The proposed discharge is to Segment 2481 (Corpus Christi Bay) of the Texas classified surface water segments.[30] The designated uses for Segment 2481 are primary contact recreation, exceptional aquatic life use, and oyster waters.[31]

5. Data Collection and Revisions After Remand

After the remand, the Port Authority collected site-specific data at the proposed discharge site regarding channel bathymetry, water quality, salinity levels, and ambient velocities. The Port Authority also engaged a laboratory to conduct salinity toxicity testing to determine the sensitivity of aquatic organisms to changes in salinity. In addition to collecting this data, the Port Authority made two revisions to its application: (1) the proposed discharge location moved approximately 70 feet closer to the Harbor Island shoreline, and (2) the proposed diffuser design

[29] Ex. AR-4 at S-App. 000037.

[30] Ex. ED-PS-1 Remand at 25.

[31] Ex. ED-PS-1 Remand at 28.

was revised. Given the additional data and changes to the Original Application, the Port Authority also updated its modeling of the discharge.

These changes necessitated updates to the ED's review. The ED conducted updated modeling of the discharge and an updated antidegradation review. The ED then prepared a Revised Draft Permit.

6. Revised Draft Permit Requirements

The Revised Draft Permit prepared by the ED includes daily monitoring requirements for total suspended solids, total dissolved solids, chloride, and sulfate; and effluent limitations for flow and pH.[32] However, because the Facility has not been constructed or commenced discharge yet, the ED did not have analytical data for the actual effluent to be discharged and, therefore, was unable to determine the reasonable potential of the effluent to cause toxicity on the receiving water.[33] To address this lack of data, Other Requirement No. 8 was added to the draft permit requiring sampling and analysis of the effluent upon commencement of discharge. Based on a review of the data, the permit may be reopened to incorporate additional effluent limitations or monitoring requirements, if needed.[34]

The Revised Draft Permit also requires the Port Authority to maintain the diffuser at Outfall 001 to achieve a maximum dilution of 14.6% effluent at the edge of the ZID (rather than the 18.4% limit in the original Draft Permit).[35]

In addition, in response to concerns raised during the public comment phase of this proceeding, the ED added requirements to the draft permit obligating the Port Authority to:

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[32] Ex. ED-SG-1 Remand at 0026.

[33] Ex. ED-SG-1 Remand at 0016.

[34] Ex. ED-SG-1 Remand at 0026.

[35] Ex. AR-R 6 (Tab K) at 00014 (Other Requirement No. 4).

(1) study and report on the ambient water velocity at the outfall location,[36] and (2) conduct whole effluent toxicity (WET) testing on the effluent during the first year of the discharge, in particular, a 24-hour test every six months.[37] The Revised Draft Permit requires chronic biomonitoring in place of the 48-hour acute biomonitoring that was required in the original Draft Permit.[38]

7. EPA's Objection

On December 15, 2021, EPA sent an Interim Objection—Request for Additional Information regarding the Revised Draft Permit.[39] In this letter, EPA expressed a concern that TCEQ had improperly characterized the Facility as a minor facility, as opposed to a major facility. This matters because EPA has waived review of minor facilities but has not waived review of major facilities. EPA requested additional information and noted that it had 30 days to make general objections to the proposed permit. According to the letter, EPA would then have 90 days to provide specific objections. The EPA attached some comments and recommendations to the letter.

EPA sent a follow-up letter on March 1, 2022, indicating that it was still awaiting additional information.[40] EPA also requested a copy of this PFD once issued. In addition, EPA indicated that if TCEQ issued a TPDES permit without responding to EPA's objections in violation of the agreement between EPA and TCEQ, then it would not be a validly issued final NPDES permit.

The ED argued that the concerns raised by this correspondence are not at issue in this proceeding. Although PAC and the Kings/Steves do not argue that the EPA information is

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[36] Ex. AR-R 6 (Tab K) at 00015 (Other Requirement No. 9 states that "During the term of the permit, the permittee shall complete a study of ambient water velocity and submit a report to the TCEQ Water Quality Assessment Section (MC-150) summarizing measured ambient water velocity at the location of Outfall 001. The report must include results of measurements of speed and direction of the tidal current collected at the depth of the proposed/installed diffuser barrel. The measurements shall capture velocities encompassing a complete tidal cycle and be collected during a period in which maximum tidal amplitude typically occurs.").

[37] Ex. AR-R 6 (Tab K) at 00019 – 00026.

[38] Ex. ED-SG-1 Remand at 0011.

[39] Ex. PAC-59R.

[40] Ex. PAC-89R.

dispositive, they do contend that certain concerns EPA raises are relevant to some of the issues in this case. In particular, they cite EPA's statements about the potential invalidity of a permit issued without responding to its objections.[41]

The ALJs agree with the ED that disputes between EPA and TCEQ over whether the Facility is properly classified as a major or minor facility are outside the scope of the issues the Commissioners remanded. Nor are any concerns about the validity of a TPDES permit issued without complying with EPA's request before the ALJs. Thus, the ALJs will not address classification of the Facility and will not address the effects of any potential dispute between EPA and TCEQ on the validity of any permit.

B. Whether the modeling complies with applicable regulations to ensure the draft permit is protective of water quality, including utilizing accurate inputs. (Issue G)

The accuracy of the modeling performed by the ED (Issue G) has implications for several issues remanded by the Commission, including Issues A, C, D, and H, and therefore, is discussed first. PAC, the Kings/Steves, OPIC, and the pro se group contend the ED used inaccurate inputs that render the modeling unreliable and failed to consider the impact of site-specific conditions that cannot be modeled.[42] The Port Authority and ED assert that the modeling complied with all applicable requirements and is sufficiently reliable to ensure the Revised Draft Permit is protective of water quality.[43]

1. Background

For TPDES permit applications with a diffuser at the outfall, the ED uses the Cornell Mixing Zone (CORMIX) model to predict effluent percentages at the edges of the regulatory

[41] PAC Reply at 62-63.

[42] PAC Closing Argument at 29-51; Kings/Steves Closing Argument at 6-11; OPIC Closing Argument at 24-32; Pro Se Group Closing Argument at 10-11.

[43] Port Authority Closing Argument at 47-56; ED Closing Argument at 16-18.

mixing zones.[44] The effluent percentage is determined based on where the model predicts the effluent plume intersects the edge of each regulatory mixing zone. The ED uses the highest predicted effluent percentages to set limits in the permit.[45]

The predicted effluent percentages at the edges of the ZID and mixing zones have evolved throughout this case. In the Original Application, the Port Authority identified "target levels of mixing performance" of 2.5% for the ZID, 1.5% for the ALMZ, and 1.0% for the HHMZ.[46] The initial CORMIX modeling performed by the ED appeared to meet these targets, showing 1.95% at the ZID, 1.34% at the ALMZ, and 1.20% at the HHMZ.[47] However, after this case was referred to SOAH for the Initial Proceeding, the ED acknowledged an error in how the results were initially interpreted and found that the predicted effluent percentage at the ZID boundary was actually 18.4%.[48] In the Initial Proceeding, the evidence indicated that the proposed diffuser design could not meet this higher limit at the ZID boundary.[49] On remand, the Port Authority has proposed a revised diffuser design, and the ED updated the CORMIX modeling accordingly to use the new design. The ED's modeling now predicts effluent percentages of 14.6% at the ZID, 8.9% at the ALMZ, and 5.4% at the HHMZ.[50]

Because the ED uses the predicted effluent percentages to set permit limits, the accuracy of the predictions, and in turn the accuracy of the modeling inputs that produce them, has implications for whether the draft permit is protective. In the Initial Proceeding, the ALJs concluded that certain inputs to the model were not accurate, including the depth of the channel, slope of the channel bottom, and ambient velocity of the water in the channel.[51]

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[44] Ex. ED-KC-1 Remand at 0018.

[45] Ex. ED-KC-1 Remand at 0006-07.

[46] Ex. AR-4 (Tab D) at S. App. 000339.

[47] Ex. AR-8 (Tab F) at ED-0069 – ED-0070.

[48] *See* Initial PFD at 14-15; Ex. AR-8 (Tab F) at ED-0059.

[49] Initial PFD at 17-19, 67.

[50] Ex. ED-KC-1 Remand at 0010; Ex. AR-R 5 (Tab J) at 00147.

[51] Initial PFD at 31-32.

On remand, the parties generally agree that, depending on the inputs, the CORMIX model can provide valuable information for evaluating the proposed discharge in this case.[52] However, certain limitations of the model are undisputed. Most notably, CORMIX cannot model the exact bathymetry of the discharge location.[53] Instead, the model requires "schematization," which the CORMIX user manual defines as "the process of describing a receiving water body's actual geometry with a rectangular cross section."[54] CORMIX's conservative module (the primary module used by all parties on remand) essentially views the receiving water body as a rectangular prism. As ED witness Katie Cunningham testified, "CORMIX simulates the geometry of the receiving water body as a rectangle with a flat bottom and vertical sides."[55] As a result, it does not account for variations in channel depth or a sloping bank.

In addition to the CORMIX modeling, the Port Authority also modeled the proposed discharge in 2019 using the SUNTANS model.[56] SUNTANS was run to evaluate the "far field" effects of the discharge, in comparison to CORMIX, which generally provides results for the near field and the edge of the far field.[57] The goal of the SUNTANS modeling was to determine whether the discharge would result in the formation of a high-salinity water layer along the channel bottom, or would result in an overall or accumulating increase in salinity throughout portions of the Corpus Christi Bay system.[58] In the Initial Proceeding, Port Authority witness Dr. Jordan Furnans concluded based on the modeling results that the desalination brine discharge increases computed salinity by 0-1 parts per thousand (ppt) in the vicinity of the discharge and throughout the Corpus

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[52] *See* PAC Reply at 39-40.

[53] Ex. APP-CJ-1-R at 14; PAC Closing Argument at 38. Bathymetry refers to the depth, shape, and contours of the floor of the receiving waters, including whether there are slopes, pitches, and holes. Initial Proceeding Tr. Vol. 2 at 89.

[54] Ex. ED-5 Remand (CORMIX User Manual) at 0026; *see also* Ex. APP-LT-1-R at 53 ("Numerical simulation of the physical dimensions and configuration of a water body always requires some degree of schematization because natural conditions are never perfectly uniform.").

[55] Ex. ED-KC-1 Remand at 0026.

[56] SUNTANS is an acronym for the Stanford Unstructured Nonhydrostatic Terrain-Following Adaptive Navier-Stokes Simulator. Ex. APP-JF-1 at 8.

[57] "The near-field is where the initial jet momentum and density of the discharge have a dominant effect on the mixing and transport of the plume. The far-field is where the hydrodynamics of the receiving water play a dominant role in the plume mixing and transport." Ex. APP-CJ-1-R at 9-10.

[58] Ex. APP-JF-1-R at 4.

Christi Bay system, with daily tidal fluctuations continuously mixing the discharge so that stratification is never persistent.[59] On remand, he testified that the changes to the proposed discharge location and diffuser design were minor and that the results of the 2019 SUNTANS modeling would still be applicable.[60]

The parties' arguments about the accuracy of the modeling generally pertain to CORMIX rather than SUNTANS. The CORMIX modeling inputs and assumptions are discussed first, followed by concerns that were raised about how the ED used the CORMIX results to define the critical conditions for the Revised Draft Permit and the impact of CORMIX's margin of error.

2. Accuracy of Modeling Inputs and Assumptions

a. Channel Depth

The depth at the discharge location is a required input for the CORMIX model and is a variable that influences near-field mixing predictions.[61] The Original Application identified the channel depth at the discharge location as 63 feet.[62] However, in the Initial Proceeding, it was undisputed that, due to the presence of a depression/hole[63] near the outfall site, the depth was closer to 90 feet.[64] Given this discrepancy, the channel depth was one of the items the Commission required the Port Authority to provide revised information on as part of the remand.[65] On remand, the Port Authority submitted a memorandum prepared by Dr. Lial Tischler confirming that the

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[59] Ex. APP-JF-1-R at 5.

[60] Ex. APP-JF-1-R at 7-9.

[61] Ex. ED-KC-1 Remand at 0009. The CORMIX model also requires *average* depth as an input, but this variable only affects far-field transport, not near-field mixing. Ex. ED-KC-1 Remand at 0025.

[62] Ex. AR-4 at S-App. 000357.

[63] In the Initial Proceeding, this feature was commonly referred to as a "hole," but on remand, the Port Authority contends it is more properly considered a "depression" because it has only 10-degree sloping sides. *See* Port Authority Reply at 45. Both terms are used throughout the evidentiary record and the parties' arguments, and therefore, this PFD uses them interchangeably.

[64] *See* Initial PFD at 26, 30.

[65] Ex. AR-R-2 (Tab G) at 2.

channel depth at the point of discharge is 27.4 meters, or 90 feet.[66] The Port Authority and ED, therefore, used a depth of 90 feet when conducting their respective CORMIX modeling analyses on remand.[67]

However, PAC argues that, because the Port Authority moved the proposed discharge location closer to shore after the remand, the 90-foot channel depth is now inaccurate, as demonstrated by the Port Authority's bathymetry map, which shows the diffuser will be located where the channel depth is approximately 65 feet.[68] According to PAC, the channel only gets to a 90-foot depth around 60 to 70 feet south of the Revised Application's discharge location.[69] Additionally, PAC contends the diffuser location is not in a steeply sloping area such that it is 90 feet immediately adjacent to the diffuser, so using that input remains incorrect.

The discrepancy in depth impacts the modeling results, in part, because another input to the modeling is the depth of the diffuser, which is specified in reference to the channel depth. Specifically, the Port Authority identified the depth of the diffuser as 25 feet above the channel bottom, which, assuming a 90-foot depth, would be 65 feet below the water surface. As PAC points out, if the depth of the channel is actually only 65 feet, the diffuser would be directly on the bottom of the channel.[70] PAC acknowledges the actual diffuser would not be installed on the channel floor, but instead uses this detail to highlight the Port Authority's and ED's inaccurate inputs to the modeling (i.e., inputting a 90-foot channel depth and 65-foot diffuser depth, when the channel is only 65 feet deep).[71]

In response, the Port Authority notes that the Initial PFD found the actual channel depth near the diffuser was approximately 90 feet.[72] Furthermore, Dr. Tischler testified on remand that

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[66] Ex. AR-R-4 (Tab I) at 00248.

[67] Ex. AR-R-5 (Tab J) at 00137-00138; APP-LT-1-R at 53-54.

[68] PAC Closing Argument at 33-34 (citing Ex. AR-R-4 (Tab I) at 00254, Fig. 1).

[69] PAC Closing Argument at 35.

[70] PAC Closing Argument at 31.

[71] PAC Closing Argument at 31.

[72] Port Authority Reply at 40.

using that depth was appropriate because, during slack tide when the ambient current is less than approximately 0.15 meters per second (m/s), the effluent plume will descend directly to the bottom of the 90-foot depression after initial dilution.[73] The Port Authority also points out that PAC witness Dr. Scott Socolofsky stated he ran the model with a 90-foot depth when appropriate and testified that, although he had used shallower depths in some situations, "I have not criticized simulations with 90-foot depth."[74] Moreover, Dr. Socolofsky's modeling runs using a depth of 72 feet did not show a meaningful difference from those using 90 feet.[75] Dr. Socolofsky also testified that he would not expect a big difference even if the depth was moved up directly beneath the diffuser.[76]

The ED agrees that the Port Authority provided sufficient information regarding the depth at the diffuser location.[77] The ED notes that, as part of the remand, Ms. Cunningham, who performed the CORMIX modeling analysis for the ED, requested clarification from the Port Authority regarding the depth and was ultimately satisfied that using 90 feet was appropriate.[78]

b. Distance from Shore

The distance from shore to the diffuser is a required input in CORMIX,[79] referred to as "DISTB" in the CORMIX user manual.[80] The Port Authority's Revised Application indicates that the distance from the shoreline (i.e., where the water surface meets the shore) to the diffuser is

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[73] Ex. APP-LT-1-R at 53.

[74] Ex. PAC-51R at 40.

[75] *See* Ex. APP-51-R at 2 (*compare* SS_Summer 50%_95_Salinity (0.8)_35mFrom Bank *with* SS_Summer 50%_95_Salinity (0.8)_Shallow).

[76] Remand Tr. Vol. 7 at 1733-34.

[77] ED Reply at 6.

[78] Ex. ED-KC-1 Remand at 0008 ("[B]ecause the location is on a steeply sloping side of the channel and because the ports discharge towards the opposite shoreline at an angle of 30 degrees to the horizontal, the resulting depth of the channel where the diffuser ports discharge is approximately 90 feet.").

[79] Ex. ED-KC-1 Remand at 0010.

[80] Ex. ED-5 Remand (CORMIX User Manual) at 0022 (defining "Distance From Shore (DISTB)").

229 feet.[81] The Port Authority and ED used this distance for DISTB in their CORMIX modeling on remand.[82]

The input for DISTB has important implications for the CORMIX modeling results. As stated above, CORMIX requires schematization of the receiving water body's actual geometry, and its conservative module essentially represents the modeled area as a rectangular prism. The location of the shore defines one boundary of this rectangular prism, and CORMIX assumes the identified channel depth (e.g., 90 feet) is uniform between the diffuser and the shore. Given this schematization, the shore placement effectively creates a vertical wall behind which no mixing is determined to take place.[83] The farther the modeled bank is from the discharge location, the more water the model predicts will be available for mixing and dilution of the effluent. In addition, CORMIX is designed to evaluate the discharge plume's interaction with boundaries, such as the bank, and therefore, the placement of the bank impacts the results by determining where the plume "attaches" to a boundary.[84] When the plume becomes shoreline attached, the model prevents any water from mixing on the dry shoreline side.[85]

PAC and OPIC argue that the Port Authority and ED were incorrect in using the distance from the diffuser to where the bank emerges from the waterline as the input for DISTB.[86] They note that the CORMIX user manual defines DISTB as "the average distance between the outfall location (or diffuser mid-point) and the shoreline. It is also specified as a cumulative ambient discharge divided by the product UA times HA."[87] In this definition, "HA" is the average depth of the receiving water body, and "UA" is the mean ambient velocity.[88] The CORMIX user manual

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[81] Ex. AR-R-4 (Tab I) at 00254, Fig. 1.

[82] Ex. AR-R-4 (Tab I) at 00254, Fig. 1; Ex. APP-LT-1-R at 18; Ex. ED-KC-1 Remand at 0012, 0026.

[83] Remand Tr. Vol. 1 at 204.

[84] Ex. PAC-51R at 13.

[85] Ex. APP-CJ-R-1 Rebuttal at 7.

[86] PAC Closing Argument at 36-37; OPIC Closing Argument at 28-31.

[87] Ex. ED-5 Remand (CORMIX User Manual) at 0022.

[88] Ex. ED-5 Remand (CORMIX User Manual) at 0021, 0024 (defining "Average Depth (HA)" and "Mean Ambient Velocity (UA)").

includes a graphic that illustrates "[e]xamples of the schematization process for preparing CORMIX input data on ambient cross-sectional conditions," which shows where DISTB is measured in relation to a sloping bank, as in this case.[89] As PAC and OPIC note, the graphic shows DISTB is measured at a point between the discharge location and the shoreline, not at the shoreline itself. Thus, they argue the Port Authority's and ED's modeling failed to conform to the CORMIX user manual's guidelines.

PAC also asserts that the Port Authority's and ED's modeling consequently overestimates the dilution of the effluent by assuming the presence of water for mixing where there is a significant amount of land, specifically in assuming a 90-foot water depth where it is actually zero feet deep at the shoreline.[90] PAC notes that Port Authority witness Dr. Craig Jones testified that it is appropriate in sloping conditions to account for the lack of available water for mixing close to the shoreline by locating the bank away from the actual shoreline for CORMIX modeling purposes.[91] Additionally, PAC states that, by assuming the discharge is not near the bank, the modeling eliminated the possibility of plume interaction with the bank, which is not reflective of the actual bathymetry of the area.[92]

In contrast, PAC and OPIC explain that PAC witnesses Dr. Socolofsky and Tim Osting ran the model using a variety of inputs for DISTB as a "sensitivity analysis" to determine the effect of moving the bank closer to the discharge location.[93] These sensitivity analyses included modeling runs using DISTB values of 0, 3, 5, 15, 20, and 35 meters.[94] Based on these modeling runs, PAC argues the plume-bank interaction will occur closer than 229 feet (69.8 meters) from the diffuser,

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[89] Ex. ED-5 Remand (CORMIX User Manual) at 0072 (Fig. 4.4, example b). The parties do not dispute that the proposed discharge is "unbounded." Therefore, the relevant example in Figure 4.4 is example b.

[90] PAC Closing Argument at 38-39; Ex. PAC-51R SS-6 at 10.

[91] Remand Tr. Vol. 2 at 307-08.

[92] PAC Closing Argument at 39.

[93] PAC Closing Argument at 38-42; OPIC Closing Argument at 29-30.

[94] *See* Ex. PAC-51R at 23; Ex. PAC-51R SS-5; Ex. PAC-49R at 13-15.

resulting in poorer mixing. For example, when using 0 and 3 meters for DISTB, the model predicts an effluent percentage of 55% at the ZID boundary and a 16 ppt increase in salinity over ambient.[95]

Additionally, PAC and OPIC contend that a bathymetry map submitted on rebuttal by Port Authority witness Dr. Jones showed the distance from the discharge location to the nearest shore as approximately 160 feet despite the Port Authority using a distance of 229 feet in its CORMIX modeling.[96] Dr. Jones testified that he used that value because the mean lower low water line is 160 feet from the diffuser.[97] OPIC asserts that, at the least, the 160 feet would be a more reasonable choice than the 229 feet used in the Port Authority's and ED's modeling.[98]

In response, the Port Authority and ED both assert that "shoreline" is an undefined term in the CORMIX user manual and that their experts, Dr. Tischler and Ms. Cunningham, respectively, used the common meaning of the term—the point where the water meets the land.[99] The ED confirms Ms. Cunningham has used this plain interpretation of the term in all her diffuser reviews.[100] Additionally, the Port Authority states that the CORMIX user manual provides two alternate definitions of DISTB, the first of which is the average distance from the outfall location to the shoreline.[101] According to the Port Authority, the 229-foot distance used by it and the ED is a reasonable interpretation for DISTB under this first definition, noting that although there are outcroppings closer than 229 feet, the shoreline is further than that distance beyond the outcroppings.[102]

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[95] PAC Closing Argument at 39-40; Ex. PAC-51R SS-5.

[96] Ex. APP-CJ-20-R at Fig. 2; Remand Tr. Vol. 1 at 259.

[97] Remand Tr. Vol. 1 at 358-59.

[98] OPIC Closing Argument at 30.

[99] Port Authority Reply at 36-37; ED Reply at 7.

[100] Ex. ED-KC-1 Remand at 0026.

[101] Port Authority Reply at 37-38.

[102] Port Authority Reply at 37; Remand Tr. Vol. 9 at 2326-27; Ex. APP-RP-11-1R.

The Port Authority also urges rejection of PAC's "radical schematization of putting a fictitious vertical wall in close proximity to the diffuser because it is divorced from reality."[103] Such "sensitivity analyses," in the Port Authority's view, do not test the plume's interaction with the actual boundary it may contact (i.e., the slanting bottom of the channel), but instead force the model to treat the plume as if it will contact a vertical wall, which eliminates all water on the shoreside of the diffuser for mixing purposes.[104] The Port Authority alleges PAC's diagram illustrating the diffuser location in relation to the shore (Ex. PAC-51R SS-6) is misleading because the x and y axes do not use the same scale, which results in the bank appearing steeper, and thus more like a wall, than in reality.[105]

Additionally, the Port Authority contends that only radical differences have an impact on the modeling results. The Port Authority points out that, in one of the modeling runs where PAC witness Dr. Socolofsky changed the input for DISTB from 70 meters (229 feet) to 35 meters (115 feet), the resulting effluent concentrations were 14.1%, 8.6%, and 4.4% at the ZID, ALMZ, and HHMZ, respectively,[106] which were less than the Draft Permit's requirements of 14.6%, 8.9%, and 5.4%, respectively. Thus, shortening the distance by over 100 feet did not affect mixing and would still comply with the Draft Permit. The Port Authority and ED also point out that, although Dr. Socolofsky ran the model with varying inputs for DISTB, he did not identify which value is the correct one to use for the model.[107]

The Port Authority also asserts that PAC's own exhibits demonstrate that the average distance to the shoreline is further than 35 meters, even when considering the closest point of the two outcroppings that extend from Harbor Island (discussed below).[108] Dr. Socolofsky's

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[103] Port Authority Closing Argument at 52.

[104] Port Authority Closing Argument at 52-53.

[105] Port Authority Closing Argument at 53-55.

[106] Port Authority Closing Argument at 51; Ex. APP-51-R at 2 (SS_Summer 50%_95 Salinity (0.8)_35mFromBank). For this modeling run, Dr. Socolofsky kept the depth of the diffuser ports at 64 feet and the depth of the channel at 90 feet, as used in the ED's modeling.

[107] Port Authority Closing Argument at 55; ED Reply at 7.

[108] Port Authority Reply at 37 (citing Ex. PAC-49R TO-3).

sensitivity analyses show there is essentially no difference in the CORMIX modeling results when using 35 meters versus the 69.8 meters (229 feet) used by the Port Authority and ED. As PAC witness Mr. Osting testified, "[w]ith the bank more distant than 15 meters (49 feet), the plume exhibits similar percent effluent characteristics as the ED simulation with the bank at 69.8 meters."[109] Because more than one input provides the same result, the Port Authority states that both should be considered accurate when determining if the modeling shows that the Revised Draft Permit will be protective.[110]

Finally, the Port Authority disagrees that Dr. Jones indicated 160 feet is the appropriate distance. The diagram Dr. Jones was asked about on cross-examination does not include any measurements and was used to show the slope of the channel, not for determining DISTB.[111] Dr. Jones also testified that reducing the distance as close as 10 feet would not be appropriate because it would deprive the diffuser of available water for mixing and would implicate the CORMIX model's formulations for a shore-attached discharge.[112]

c. Use of the CORMIX Brine Module

As stated above, the parties primarily used CORMIX's conservative module to model the proposed discharge in this case. However, PAC witnesses Dr. Socolofsky and Mr. Osting also conducted modeling runs using CORMIX's brine module. The CORMIX user manual indicates the brine module is appropriate "for brine and/or sediment discharges from single port, multiport diffusers, or negatively buoyant surface discharges in laterally unbounded coastal environments with sloping bottoms."[113]

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[109] Ex. PAC-49R at 15.

[110] Port Authority Reply at 38.

[111] Port Authority Reply at 39; Ex. APP-CJ-20-R.

[112] Remand Tr. Vol. 2 at 307-08.

[113] Ex. ED-5 Remand at 0049.

PAC and OPIC question why the Port Authority and ED did not run the CORMIX model using the brine module.[114] According to PAC, the conditions at the proposed discharge site are consistent with the CORMIX user manual description quoted above for when using the brine module is appropriate.[115] Even though Dr. Tischler and Ms. Cunningham testified on remand that the brine module was not appropriate in this case, PAC notes they each performed modeling runs using the brine module in the Initial Proceeding and that the discharge location has only moved 70 feet.[116] PAC also emphasizes that the modeling runs its experts performed using the brine module showed worse mixing, with 7% higher effluent at the mixing zones.[117] In addition, OPIC points out that Ms. Cunningham testified the brine option provides information that is relevant to far-field mixing, which here begins in the HHMZ and ALMZ, and thus, is relevant to this proceeding. Therefore, OPIC recommends that the effect of the discharge be evaluated through additional modeling using the brine option.[118]

The Port Authority and ED disagree that the brine module should be used in this case. Port Authority witness Dr. Tischler testified that, for Dr. Socolofsky to use the brine module in CORMIX, he had to reduce the DISTB to 75 feet, which reduced the available dilution water and likely contributed to any predicted reductions in dilution of the plume.[119] Additionally, the Port Authority notes that using the brine module in place of the conservative module did not adversely impact mixing efficiency.[120] The ED also states that Ms. Cunningham did not use the brine option in her review because it applies to open ocean offshore discharges, and thus, was not appropriate here, where the proposed discharge is in the middle of a confined ship channel.[121]

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[114] PAC Reply at 36-37; OPIC Closing Argument at 31.

[115] PAC Reply at 37.

[116] PAC Reply at 36.

[117] PAC Reply at 37 (citing Ex. PAC-49R at 16; Ex. PAC-51R at 21-22).

[118] OPIC Closing Argument at 31.

[119] Ex. APP-LT-1-R Rebuttal at 10.

[120] Port Authority Closing Argument at 50; Ex. APP-LT-1-R Rebuttal at 10.

[121] ED Reply at 8-9; ED-KC-1 Remand at 0029, 0031.

d. Ambient Velocity (Including Presence of an Eddy)

The ambient velocity of the receiving waters is a required input for the CORMIX model. In the Initial Proceeding, the ED's modeling used an ambient velocity of 0.05 m/s for the receiving waters, which is the default value provided by the CORMIX SOPs.[122] However, the ALJs concluded that this value was materially inaccurate because the velocities in the channel exceeded that amount 95% of the time and the higher velocities, which were more representative, resulted in poorer mixing.[123] The Commission's Interim Order remanding this case required the Port Authority to provide site-specific ambient velocities.[124]

After the remand, the Port Authority engaged Parsons to collect ambient tidal data in the Corpus Christi Ship Channel near the proposed discharge site using two types of Acoustic Doppler Current Profilers (ADCPs).[125] The first ADCP was mounted in a fixed position at approximately five feet deep on a piling near the northern shore of the Corpus Christi Ship Channel aimed south-southwest across the deepest part of the depression.[126] The data from this fixed ADCP was collected continuously for approximately 48 hours from June 8-10, 2021. The second ADCP was attached to a survey boat and mounted in a downward-looking vertical position.[127] The boat-mounted ADCP data was collected as the survey boat made passes north to south across the channel. Data was collected for five north-south pathways (referred to as "transects") with the boat making multiple passes along each transect from June 7-10, 2021.[128] Transect 1 passed directly through the proposed discharge site at its northernmost end. The nearest transects to Transect 1 were Transects 2 and 4, which were approximately 200 feet to the east and west, respectively.

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[122] Ex. ED-4 Remand at 0001.

[123] Initial PFD at 31-32.

[124] Ex. AR-R 2 (Tab G) at 2.

[125] Ex. APP-KD-1-R at 7. An ADCP is a hydroacoustic current meter, similar to sonar, that measures water current velocities over a depth range using the Doppler effect of sound waves scattered back from particles within the water column. Ex. APP-KD-3-R at 3.

[126] Ex. APP-KD-3-R at 3-4.

[127] Ex. APP-KD-3-R at 4.

[128] Ex. APP-KD-3-R at 22-54; *see also* Ex. APP-KD-4-R (map showing diffuser and transect locations).

The collected data showed velocities in the Corpus Christi Ship Channel ranging from -1.25 m/s to +1.4 m/s.[129] All parties on remand looked at a broad range of ambient velocities in performing their CORMIX modeling.[130] Thus, the primary issue raised in the Initial Proceeding, i.e., the appropriate input for ambient velocity, has been addressed.

However, PAC, the Kings/Steves, and OPIC continue to raise concerns about non-uniform ambient velocities, particularly whether an eddy is present at the discharge location.[131] It is undisputed that CORMIX cannot simulate an eddy.[132] In the Initial Proceeding, there was evidence that an eddy caused the 90-foot depression near the proposed discharge location. The evidence consisted primarily of a statement by Sarah Garza, the Port Authority's director of environmental planning and compliance, that there was a "natural eddy" in the area.[133] In addition, Dr. Tischler testified that the 90-foot depression was a "scour hole" created by the velocity of the current at the bottom of the channel that is caused by the bend in the channel and the nearby intersection with the Lydia Ann and Aransas Channels.[134] The Port Authority argued that the presence of an eddy would improve mixing.[135] Nevertheless, based on the site-specific ambient velocity data the Port Authority collected on remand, it ultimately concluded that an eddy is not present at the discharge location.[136]

PAC, the Kings/Steves, and OPIC disagree that the Port Authority proved an eddy does not exist. In Dr. Tischler's June 24, 2021 memorandum regarding the diffuser design, he continued

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[129] Ex. APP-KD-1-R at 13.

[130] ED witness Ms. Cunningham used ambient velocities from 0.05 m/s to 2.0 m/s; Port Authority witness Dr. Tischler used ambient velocities from 0.05 m/s to 1.2 m/s; PAC witness Dr. Socolofsky used ambient velocities from 0.0 m/s to 1.2 m/s. Ex. ED-KC-1 Remand at 0014, 0020; Ex. APP-LT-5-R at 3; Ex. PAC 51-R SS-5.

[131] PAC Closing Argument at 48-50; Kings/Steves Closing Argument at 6-9; OPIC Closing Argument at 26-28.

[132] Remand Tr. Vol. 2 at 280 (Jones), Vol. 9 at 2324 (Cunningham).

[133] Ex. PAC-23 ("The Corpus Christi Ship Channel is dredged and maintained at -47 feet. However, in that area, there is a natural eddy as a result of the Ship Channel, the Aransas Channel, and the Lydia Ann Channel confluence and that area is naturally deeper.").

[134] Ex. APP-LT-1 at 33, 39.

[135] Ex. APP-LT-1 at 33, 39.

[136] Port Authority Closing Argument at 40; Ex. APP-CJ-R at 19-20.

to refer to the depression/hole as "eddy-generated."[137] PAC also criticizes the Port Authority for relying solely on four days of data at a site where flow conditions vary.[138] Nevertheless, according to PAC, even the Port Authority's data tend to show an eddy. PAC witness Dr. Barney Austin testified that the data collected closest to the proposed diffuser location indicated the presence of an eddy.[139] Specifically, at the northern end of Transect 1, he concluded that the ADCP data showed the flow near the proposed discharge point is not uniform and appears to be circular.[140] In addition, Dr. Austin discovered a 1956 aerial photograph of the proposed discharge location that both he and Dr. Socolofsky interpreted as showing an eddy in the area.[141] Dr. Socolofsky also observed evidence of eddies when he visited the site.[142] Further, even though Port Authority witnesses Dr. Kirk Dean and Dr. Furnans asserted that the ADCP data did not show evidence of an eddy, they acknowledged that it is possible an eddy could have been missed if it occurred between the transects.[143] PAC, the Kings/Steves, and OPIC argue that the potential presence of an eddy adds uncertainty to the modeling results and creates the possibility for aquatic organisms to be recirculated through effluent, thereby increasing exposure times.

Apart from the eddy, PAC and the Kings/Steves also raise general concerns about non-uniform velocities near the outfall location.[144] PAC witness Mr. Osting testified that near the north bank closest to the proposed outfall, the velocity was approximately one-half of the velocity closer to the middle of the channel.[145] Dr. Socolofsky opined that non-uniform flows exist due to the outfall location's proximity to two outcroppings extending off Harbor Island and forming a sort of "cove" (discussed in the next section), which causes channel velocities to drop north of the

[137] Ex. AR-R-4 (Tab I) at 00248 ("The diffuser will be located on the north slope of the eddy-generated 'hole' in the channel.").

[138] PAC Closing Argument at 48-49.

[139] Ex. PAC-44R Revised at 10-11.

[140] Ex. PAC-44R Revised at 13-24.

[141] Ex. PAC-44R Revised at 24, Fig. 9; Ex. PAC-51R at 29.

[142] Ex. PAC-51R at 29.

[143] Remand Tr. Vol. 3 at 709-10, Vol. 4 at 810.

[144] PAC Closing Argument at 49-50; Kings/Steves Closing Argument at 9-11.

[145] Ex. PAC-49R at 26.

discharge location.[146] Because the CORMIX model requires the use of a uniform ambient velocity, it does not account for such variations.

The Port Authority responds that no witness, not even PAC witness Dr. Austin, testified that a persistent eddy exists near the proposed discharge or the depression.[147] Dr. Austin testified that he believes an eddy is present "occasionally" and acknowledged that he did not have a basis for concluding the depression was formed by an eddy.[148] Furthermore, the Port Authority contends Dr. Austin misinterpreted the data collected at the northernmost point of Transect 1 near the discharge location. The velocity vectors Dr. Austin relied on represent approximately 30 seconds of data and all start at nearly the same spot, which Port Authority witness Dr. Dean testified indicates the boat collecting the ADCP data was turning around at that time.[149] The Port Authority also criticizes PAC for relying on an aerial photograph from 1956 purportedly showing an eddy on the surface of the water, which is 65-90 feet above the general area of the discharge and the depression. Finally, the Port Authority asserts that PAC and Dr. Austin are relying more heavily on anecdotal accounts than data.[150]

The ED notes that, although CORMIX does not have the ability to model an eddy, the ED added Other Requirement No. 9 to the Draft Permit, requiring the permittee to complete a study of ambient water velocity at the outfall location.[151] According to the ED, collecting this additional information will ensure the ED staff is aware of channel conditions and allow the Commission to further confirm that the ED's reviews are accurate.

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[146] PAC Closing Argument at 50; Ex. PAC-51R at 9-10.

[147] Port Authority Reply at 49.

[148] Remand Tr. Vol. 6 at 1523-24.

[149] Remand Tr. Vol. 3 at 630-31.

[150] Port Authority Reply at 49.

[151] ED Closing Argument at 17-18; Ex. AR-R 6 (Tab K) at 00015.

e. Impact of Site-Specific Bathymetry (Including the "Cove" and "Hole")

PAC, the Kings/Steves, and OPIC argue that the Port Authority's and ED's CORMIX modeling is not conservative or reliable because it fails to account for the impact of site-specific bathymetry.[152] PAC points out that Port Authority witness Dr. Jones testified that "*[s]ite-specific spatio-temporal variations in bathymetry*, salinity, temperature, currents, and waves must be evaluated in terms of their effects on the discharge plume and the potential reduction of dilution . . . ."[153]

One site-specific feature they each identify is the presence of two points of land (referred to as groins or outcroppings) extending underwater off the shore of Harbor Island that form a sort of "cove" near the proposed discharge location.[154] According to PAC, the Port Authority moved the discharge location on remand such that it is now closer to this feature and surrounded by obstructions on three sides. As a result, PAC contends the discharge plume will interact with and "attach" to the sides of the cove before reaching the bank, and thus, slow down and mix more poorly than CORMIX predicts. PAC contends that the plume-boundary interactions with the cove sides will occur within the ZID and other mixing zones, making the modeling results unreliable.[155]

Another site-specific feature highlighted by PAC, the Kings/Steves, and OPIC is the 90-foot depression/hole near the proposed outfall. PAC disagrees with the Port Authority that the channel currents will constantly flush the dense brine effluent out of the area. Instead, as Dr. Socolofsky testified, the effluent plume will continually feed into the hole due to its higher density and will maintain a dense pool at the bottom, which will then overflow and move along the bottom of the channel, similar to how a bathtub overflows when the water is left running.[156] Since the bottom of the channel away from the hole is not uniform, the plume would move to lower

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[152] PAC Closing Argument at 44-48; Kings/Steves Closing Argument at 5; OPIC Closing Argument at 25-26.

[153] Remand Tr. Vol. 1 at 201-02 (emphasis added).

[154] *See* Ex. AR-R 4 (Tab I) at 00254.

[155] PAC Closing Argument at 45-46.

[156] Ex. PAC-51R at 26; Remand Tr. Vol. 7 at 1659.

areas, possibly creating pools of the effluent in low spots.[157] PAC states that the CORMIX modeling predicts such bottom plumes will exist where the near field ends and a mile or so into the far field,[158] which controverts the Port Authority's SUNTANS modeling predicting bottom plumes will not form.[159] PAC contends the SUNTANS modeling is unreliable because it was not updated on remand to account for the higher effluent percentages now predicted at the start of the far field. In addition, Port Authority witness Dr. Jones agreed that CORMIX's predictions are more reliable than those of SUNTANS in the far field for at least a kilometer or so from the discharge.[160]

OPIC contends the site-specific bathymetric features should be considered in some independent fashion to ensure that the mixing of the effluent with the ambient water is accurately predicted.[161] Doing so is especially important, in OPIC's view, because the Revised Draft Permit does not require testing of the water body at the ZID to verify that the Port Authority complies with the permit's effluent percentage limit.

The Port Authority responds by first refuting the characterization of the bathymetry near the discharge location as a "cove."[162] In the Port Authority's view, this term is intended to evoke a sense of closure around the location, when it is actually a "gently sloping area." As Dr. Tischler testified, when the plume encounters the bottom, it will continue to move with the current, and while it will curve along with the bathymetry, there continues to be water on both sides, so mixing will not be significantly impacted.[163] The Port Authority asserts that Dr. Tischler's conclusion is further supported by PAC witness Dr. Socolofsky's modeling runs and testimony (discussed above) that indicate using shallower channel depths does not significantly change the modeling results.[164] Thus, the claims that a "cove" creates a blockage are inconsistent with such results.

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[157] Ex. PAC-51R at 28.

[158] Ex. PAC-51R at 16.

[159] PAC Reply at 27-30.

[160] Remand Tr. Vol. 1 at 226-27.

[161] OPIC Closing Argument at 25-26.

[162] Port Authority Reply at 45.

[163] Ex. APP-LT-R Rebuttal at 4-5; *see also* Ex. APP-CJ-20-R.

[164] Port Authority Reply at 46.

In addition, the Port Authority argues that PAC's claim that the depression will fill up with a dense plume is inconsistent with the facts.[165] The modeling shows the plume will be carried toward the gulf or the bay when ambient speeds are 0.15 m/s or greater, which occurs 85% of the time. At slack tides, when the plume heads across the channel toward the depression, the salinity plume will be approximately 1.35 ppt above ambient or less when it reaches the 90-foot floor. According to Dr. Tischler, the speed of the current during every tidal cycle will flush out any higher density effluent that has settled in the depression.[166] He stated that, for example, with the 2.0 ppt salinity difference between 35 ppt and 37 ppt salinity at 25°C, the density difference between the effluent plume centerline and the ambient water is only 0.16%, which is easily moved out of the depression by the current.[167]

Furthermore, the theory that denser water will settle in the depression presupposes steeper slopes than actual conditions, and in particular, the actual bathymetry does not resemble the shape of a bathtub. The Port Authority further notes that PAC witness Dr. Austin, after reviewing the velocity data collected by the Port Authority, emailed PAC's counsel stating that "the velocity bins across the scour hole appear to be higher than they are in the main channel. This is curious, and may explain why there is a scour hole there."[168] Thus, according to the Port Authority, several witnesses have supported that the depression is maintained by the speed of the flow of water through the area.

As to the far-field bottom plumes predicted by CORMIX, the Port Authority states that, based on the modeling, they will be less than 2.0 ppt above ambient even in the 50% recovery, 95th percentile summer salinity conditions, which result in the highest effluent percentages modeled.[169] Dr. Tischler testified that differences this small will be unstable, especially at the wide

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[165] Port Authority Reply at 46-49.

[166] Ex. APP-LT-1-R at 58; *see also* Ex. APP-CJ-1-R at 28; Ex. APP-JF-1-R Rebuttal at 10-11.

[167] Ex. APP-LT-1-R Rebuttal at 20.

[168] Ex. APP-JF-1-R Rebuttal at 4-5.

[169] Port Authority Reply at 48-49.

range of current velocities that occur in the ship channel, and the SUNTANS modeling shows that they will not persist.[170] Dr. Furnans also testified that CORMIX predictions in the far field are no substitute for a long-term model such as SUNTANS.[171] He stated that the proposed discharge does not result in a buildup of salinity due to the rapid and dynamic non-uniform flow within the vicinity of the discharge, which SUNTANS captures in the far field to a much better degree than CORMIX.[172]

3. Salinity Concentrations

ED witness Ms. Cunningham used her CORMIX modeling results to develop the effluent percentages she recommends in the critical conditions memorandum.[173] She testified that the modeling runs producing the highest effluent percentages were used in the final critical conditions recommendation.[174]

PAC contends the ED failed to use the worst-case salinity concentrations when setting the critical conditions for the Draft Permit.[175] According to PAC, the highest predicted effluent percentages will represent the worst case for most chemicals in the discharge because they are not also found in the receiving waters, but the same is not true for salinity. Because the discharge of brine is being added to already-saline receiving waters, the salinity of both must be considered to determine the worst case.[176] The distinction is highlighted in Exhibit Kings/Steves-21R by comparing Ms. Cunningham's recommended critical conditions at line 8 (highlighted in red and designated "W_40_c") to her modeling runs at lines 19 and 20 (highlighted in yellow and designated "S_50_b_95" and "S_50_c_95"). At the ZID boundary, the critical conditions at line 8

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[170] Ex. APP-LT-1-R Rebuttal at 20-21.

[171] Ex. APP-JF-1-R Rebuttal at 1-3, *see also* Ex. APP-LT-1-R Rebuttal at 20-21.

[172] Ex. APP-JF-1-R Rebuttal at 2.

[173] Ex. ED-KC-1 Remand at 0009-10; *see also* Ex. AR-R 5 (Tab J) at 00135-36 (Critical Conditions Recommendation Memorandum dated August 10, 2021).

[174] Ex. ED-KC-1 Remand at 0022.

[175] PAC Closing Argument at 43-44.

[176] *See* Remand Tr. Vol. 9 at 2275-76.

show a salinity level of 25.09 ppt, which is an increase of 1.85 ppt (or 8%) over ambient, whereas the runs at lines 19 and 20 are significantly higher, showing respectively, a salinity level of 44.68 ppt, which is an increase of 4.11 ppt (or 10%) over ambient, and a salinity level of 33.43 ppt, which is an increase of 3.50 ppt (or 12%) over ambient. Similarly, at the ALMZ, the ED's critical conditions show 1.13 ppt as the salinity increase, whereas line 19 shows 2.5 ppt as the increase. Based on these modeling results by the ED, PAC asserts that if the Commission adopted a 2.0 ppt limit, as the Texas Parks and Wildlife Department (TPWD) and General Land Office (GLO) have recommended,[177] then the permit would have to be denied.[178]

In response, the Port Authority explains that it and the ED both modeled all combinations of the 5th and 95th percentile salinity and temperature, in both summer and winter.[179] Contrary to PAC's assertion, the Port Authority emphasizes the worst-case salinity scenario was far from ignored and instead was extensively used for comparison purposes.[180] This modeling run (S_50_b_95) considered the 95th percentile summer salinity at the intake water and used the highest (50%) reverse osmosis recovery for the plant process to produce the highest salinity discharge (68.7 ppt). This scenario was then combined with the highest (95th percentile) summer salinity for the receiving waters (40.57 ppt). Moreover, the Port Authority argues that PAC focuses on the worst-case scenario as if it represents normal conditions when it does not. According to the Port Authority, the only modeling runs resulting in salinity that is not less than 2.0 ppt within 100 meters of the discharge are those with 50% recovery and 95th percentile salinity.

On this issue, the ED asserts that Ms. Cunningham performed her review according to TCEQ's standard practice and that the critical dilutions for salinity were based on sound modeling.[181]

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[177] *See* Ex. PAC-7 (TPWD/GLO, *Marine Seawater Desalination Diversion and Discharge Zones Study* (Sept. 1, 2018)) at 5; Ex. PAC-37 (TPWD comment letter (Aug. 24, 2018)) at 2. The 2.0 ppt limit recommended by TPWD/GLO is discussed in detail in Section III.D.4 below.

[178] PAC Closing Argument at 44.

[179] Port Authority Reply at 43.

[180] Port Authority Reply at 43-44.

[181] ED Reply at 9.

4. CORMIX Margin of Error

PAC, the Kings/Steves, and OPIC contend that the Port Authority and ED failed to account for CORMIX's margin of error.[182] The CORMIX session reports generated by each model run indicate that the results have a 50% margin of error.[183] Similarly, the CORMIX user manual states, "[w]henever the model is applicable, extensive comparison with available field and laboratory data has shown that CORMIX predictions on dilutions and concentrations, with associated plume geometries, are generally accurate to within ± 50% (standard deviation) or less."[184] PAC notes that, with this margin of error, a predicted effluent percentage of 10% would actually range from 5% to 15%. According to PAC, this margin of error would not be important if the Port Authority's original target of 1.5% at the ALMZ or the ED's original modeling result of 1.34% at the ALMZ had been accurate. However, the predictions are now higher (8.9% at the ALMZ). PAC argues that, even assuming the ED's modeling results are accurate, the margin of error should not be ignored.

The Port Authority disagrees that the margin of error renders the modeling defective. It notes that CORMIX is the most widely used model for near-field mixing and is used by the EPA, TCEQ, and numerous other states for setting regulatory parameters. Additionally, PAC's own experts testified that CORMIX is a reliable modeling tool, and PAC did not cite precedent for making an accommodation for the margin of error. Finally, the Port Authority notes that the Revised Draft Permit sets a limit of no more than 14.6% effluent at the ZID and does not allow the Port Authority to operate at 14.6% ± 50% (i.e., 7.3% to 21.9% effluent). Thus, if the Facility does not operate at the prescribed mixing efficiency, it cannot continue to operate. In addition, if the ALJs or the Commission believe the modeling needs verification, the Port Authority agrees to work with TCEQ staff to develop a plan to validate the mixing efficiency of the diffuser in

[182] PAC Closing Argument at 42-43; Kings/Steves Closing Argument at 5; OPIC Closing Argument at 30-31.

[183] Remand Tr. Vol. 9 at 2304.

[184] Ex. ED-5 Remand at 0051.

operation.[185] The Port Authority states that validation testing on diffusers designed by Dr. Tischler using CORMIX have shown they perform as well or better than the CORMIX modeling predicted.[186]

The ED notes that no modeling is free from a margin of error.[187] The ED explains that, while the CORMIX model is not perfect, it is a valuable regulatory tool to evaluate discharges and is the best option available to TCEQ. Further, the ED confirms that Ms. Cunningham's CORMIX review was consistent with TCEQ procedures and that such procedures must be uniformly applied to every application.

5. ALJs' Analysis

The TCEQ's rules do not expressly require modeling of wastewater discharges, but pursuant to its rules, the Commission has adopted the IPs, which establish methods and protocols approved by both the Commission and EPA for implementing the TSWQS. The IPs specifically provide for the use of the CORMIX model when a diffuser will be used, and the TCEQ has developed a manual titled "Mixing Analyses Using CORMIX" (CORMIX SOPs) to provide guidance on how to run the model. Accordingly, in addressing this remanded issue, the ALJs consider whether the modeling performed in this case complies with the TCEQ's IPs and CORMIX SOPs. In addition, to fully address the Commission's remanded issue, the ALJs also consider whether the modeling "ensure[s] the draft permit is protective of water quality, including utilizing accurate inputs."

The concerns raised regarding the inputs to the CORMIX model generally relate to the need for schematization of the actual channel bathymetry. The Port Authority's proposed discharge site does not, as the CORMIX conservative module assumes, have a uniform channel depth, a vertical bank, or steady-state ambient velocities, so some professional judgment will be necessary

[185] Port Authority Reply at 43, 55.

[186] Ex. APP-LT-1-R Rebuttal at 19-20, Ex. APP-LT-18-R.

[187] ED Reply at 8.

when selecting the inputs. As a result, what is "accurate" may not be a single value, but a range of reasonable values. With schematization, there will necessarily be some variation between what the model predicts and the actual discharge. The modeling is a tool to assist in evaluating the potential impacts of a discharge and in setting permit limits.

For the channel depth, CORMIX's conservative module requires the modeler to select a single value and is not capable of modeling a depression or hole, such as exists near the proposed discharge site. The Initial PFD found that the channel depth near the proposed diffuser location was approximately 90 feet.[188] However, that finding is no longer conclusive because the diffuser location moved after the remand. It is now closer to shore, and based on the Port Authority's bathymetry map, the channel depth at that point is closer to 65 feet, as PAC contends.[189] Even so, Dr. Tischler testified that the diffuser ports would be oriented so that the discharge would point across the 90-foot depression toward the channel and that, during slack tide, the discharge would descend into the depression.[190] In addition, Dr. Socolofsky's modeling runs using a reduced depth of 72 feet did not produce materially different results.[191] Accordingly, the ALJs conclude that the 90-foot depth was among the range of reasonable options a modeler could select and was not inaccurate.

The input for distance from shore, i.e., DISTB, is also impacted by the need for schematization. For the distance selected, CORMIX assumes a uniform bottom with a vertical bank, whereas the bank from Harbor Island's shoreline to the proposed discharge site slopes at approximately 20 degrees.[192] In considering this issue, a hypothetical presented at the hearing to Port Authority witness Dr. Jones is particularly instructive.[193] Assuming a DISTB of 100 feet with a 45-degree sloping bank, then one half of the area to be modeled would be land and one half

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[188] Initial PFD at 30-31.

[189] *See* Ex. AR-R-4 (Tab I) at 00254, Fig. 1.

[190] Ex. APP-LT-1-R at 53; Ex. APP-LT-1-R Rebuttal at 1.

[191] *See* Ex. APP-51-R at 2 (*compare* SS_Summer 50%_95_Salinity (0.8)_35mFrom Bank *with* SS_Summer 50%_95_Salinity (0.8)_Shallow).

[192] *See* Ex. APP-CJ-1-R Rebuttal at 3.

[193] Remand Tr. Vol. 2 at 307-08.

would be water. However, in CORMIX, using a DISTB of 100 feet would assume the entire area between the diffuser and shoreline is water and therefore overpredict the amount of water available for mixing. Conversely, using a DISTB of zero feet would assume the entire area is land and therefore underpredict the amount of water available for mixing. Dr. Jones testified that in such a scenario it might be reasonable to use a DISTB of half the distance.[194]

Similarly, for the conditions at the Port Authority's proposed discharge site, if the input for DISTB is the full distance to the shoreline (229 feet), as in the Port Authority's and ED's modeling, then mixing will be overpredicted due to the sloping bank. Yet, using zero feet for DISTB, as in some of Dr. Socolofsky's sensitivity analyses, will underpredict mixing for the same reason. The CORMIX user manual appears to contemplate this issue by setting, at least in some circumstances, the DISTB at a point between the shoreline and the point of discharge.[195] However, this adjustment does not appear to be required, as the manual also defines DISTB as "the average distance between the outfall location (or diffuser mid-point) and the shoreline."[196] The term shoreline is undefined, but generally appears to have its standard meaning as the point where the water meets the land.[197]

The Port Authority's and ED's modeling used the distance directly between the proposed diffuser location and the shoreline, and thus, does not appear to have used the *average* distance to the shoreline, as provided in the CORMIX user manual's definition. The parties have not explained how the "average" distance is measured (for instance, how much of the shoreline is being averaged). However, because Dr. Socolofsky and Mr. Osting modeled a variety of DISTBs, the impact of using a different value is known. Their modeling showed that even dividing the distance for DISTB in half did not materially change the results. Thus, to the extent that the Port Authority's and ED's modeling input for DISTB deviated from the CORMIX user manual's definition, it was not materially inaccurate.

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[194] Remand Tr. Vol. 2 at 307-08.

[195] *See* Ex. ED-5 Remand (CORMIX User Manual) at 0072 (Fig. 4.4, example b).

[196] Ex. ED-5 Remand (CORMIX User Manual) at 0022 (defining "Distance From Shore (DISTB)").

[197] *See, e.g.*¸ Ex. ED-5 Remand (CORMIX User Manual) at 0035 (Fig. 2.1), 0051 (Fig. 3.2 c).

Because PAC relies in part on the results of its witnesses' sensitivity analyses to estimate what percentages of effluent aquatic organisms may encounter, the ALJs also address the accuracy of those results. The ALJs find that performing sensitivity analyses was appropriate to test the impact of varying the DISTB input, particularly given the sloping channel floor and the nearness of two outcroppings extending off Harbor Island. However, there is no dispute that the diffuser will not actually be located directly on the channel floor, and the closest distance to the shoreline, even considering the outcroppings, is further than 35 meters.[198] Accordingly, the ALJs conclude that the modeling runs using distances shorter than 35 meters for DISTB should not be relied on for determining effluent percentages.

PAC and OPIC question whether CORMIX's brine module should have been used, particularly given its ability to consider a sloping bank. However, all of the modeling experts in this case testified that CORMIX's conservative module was appropriate for modeling the proposed discharge, and there is some indication that, due to the slope of the channel at the site, the brine module is either not appropriate or requires adjusted inputs to the DISTB.[199] Additionally, although the CORMIX user manual identifies the brine module as an option, the parties have not identified any applicable regulatory requirement that is violated by not using it here. Therefore, the ALJs find that, while the additional modeling using the brine module appears to provide useful information, and generally, corroborates the predictions of the conservative module, using the brine module was not required in this case.

Next, as to ambient velocity, the ALJs find that the primary concern raised in the Initial Proceeding has been addressed through the Port Authority's collection of velocity data and the fact that the parties modeled several inputs for velocity. This additional data and modeling also inform the remaining issues raised on remand regarding the potential presence of an eddy and non-uniform velocities. While it was undisputed in the Initial Proceeding that an eddy occurred near the outfall location, on remand no party found a "persistent" eddy.[200] At most, based primarily on anecdotal

[198] Ex. PAC-49R TO-3.

[199] Ex. APP-LT-5-R at 4 n.4; Ex. APP-LT-1-R Rebuttal at 10.

[200] *See* Remand Tr. Vol. 6 at 1523-24.

evidence, an eddy occasionally forms in the area. To the extent that an eddy does occasionally exist, the impact is not clear. There is some indication that its movement could enhance mixing, but alternatively, that it could trap organisms and lengthen exposures times. Given that the existence of an eddy has not been confirmed, despite data collection in the area, and that it is not persistent, the ALJs find that its potential to occasionally exist does not invalidate the CORMIX modeling results or indicate that inaccurate inputs were used. In addition, although non-uniform velocities were observed near the north bank closest to the proposed outfall, the parties modeled a range of velocities, and thus, mixing has been considered under a variety of conditions. Therefore, the ALJs conclude that the modeling sufficiently addressed ambient velocity.

The remaining three issues raised by the parties—the site-specific bathymetry that cannot be modeled, salinity concentrations the ED used to define the critical conditions, and CORMIX's margin of error—do not criticize the modeling inputs themselves, but rather implicate how the outputs should be evaluated. As discussed in Section G below, the uncertainty these issues introduce is one factor the ALJs believe supports the need for setting a permit limit on the salinity of the discharge.

For the site-specific bathymetry, the specific features identified were the two outcroppings extending from the shoreline and the 90-foot hole/depression, neither of which can be represented in the CORMIX model. These features have the potential to reduce mixing through plume-boundary interactions and by allowing the denser brine effluent to settle in the depression. As a result, they introduce some uncertainty into the CORMIX modeling results, but the ALJs are not convinced they make the results inaccurate. Instead, the ALJs agree with PAC and OPIC that the potential for the site-specific bathymetry to impact the modeling predictions should be independently considered. The reasonableness of doing so is further supported by Port Authority witness Dr. Jones.[201]

Similarly, although the ED used the CORMIX modeling run with the highest predicted effluent percentages to determine the critical conditions, other modeling runs by the ED showed

[201] Remand Tr. Vol. 1 at 201-02.

larger increases in salinity over ambient. Thus, the ED did not use the worst-case scenario for salinity. Yet, this fact does not indicate an error in the modeling, but instead calls into question whether the critical conditions derived from the modeling are protective of aquatic life with respect to salinity. In this context, salinity is somewhat unique because it is in both the effluent and the receiving waters. The worst-case scenarios identified in the ED's modeling were considered by the parties in this proceeding, but without a salinity limit in the permit, the Facility could exceed even those levels, thus providing further support for setting a salinity limit to ensure the permit is protective.

Finally, despite the CORMIX margin of error, it was undisputed that the model is widely used and relied on to predict effluent percentages. In addition, the existence of a margin of error does not authorize the exceedance of the modeled effluent percentages when they are used to set permit limits, such as the 14.6% effluent percentage limit in the Revised Draft Permit. Accordingly, the ALJs find the margin of error does not invalidate the results. Further, although the Port Authority has offered to perform testing to validate the mixing efficiency of the diffuser once in operation, the ALJs conclude that setting a salinity limit in the permit accomplishes the same goal and, moreover, ensures the permit is protective of the marine environment and aquatic life, while also providing the Commission a means of enforcement, if necessary. Thus, the ALJs find it is unnecessary for the Port Authority to separately validate the modeling.

In summary, the Port Authority's and ED's modeling inputs are either within the range of reasonable values or are not materially inaccurate. The parties also have not identified any regulatory requirement that the modeling failed to comply with. However, several factors, including the need for schematization when using the CORMIX model, warrant a conservative approach to using the modeling results and the need for setting a permit limit on the salinity of the discharge.

C. Whether the Executive Director's antidegradation review was accurate. (Issue H)

The Commission's antidegradation policy is set out in 30 TAC § 307.5(b). In this case, Tier 1 and Tier 2 antidegradation reviews are required due to the exceptional aquatic life use

designation at the outfall location.[202] Tier 1 requires that "[e]xisting uses and water quality sufficient to protect those existing uses must be maintained."[203] Tier 2 is more stringent and generally prohibits the lowering of water quality by more than a de minimis amount, as follows:

> No activities subject to regulatory action that would cause degradation of waters that exceed fishable/swimmable quality are allowed unless it can be shown to the commission's satisfaction that the lowering of water quality is necessary for important economic or social development. Degradation is defined as a lowering of water quality by more than a de minimis extent, but not to the extent that an existing use is impaired. Water quality sufficient to protect existing uses must be maintained.[204]

The term "de minimis" is not defined by the rule or in the Texas Water Code. The Commission's IPs,[205] however, provide that for constituents with numeric criteria, an increase of less than 10% is considered de minimis.[206]

But for certain constituents of wastewater discharge, the TSWQS contain narrative criteria, not numeric criteria, for water quality. These narrative criteria include those for salinity:

> Salinity gradients in estuaries must be maintained to support attainable estuarine dependent aquatic life uses. Numerical salinity criteria for Texas estuaries have not been established because of the high natural variability of salinity in estuarine systems, and because long-term studies by state agencies to assess estuarine salinities are still ongoing. Absence of numerical criteria must not preclude evaluations and regulatory actions based on estuarine salinity, and careful consideration must be given to all activities that may detrimentally affect salinity gradients.[207]

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[202] Ex. ED-PS-1 Remand at 0029.

[203] 30 Tex. Admin. Code § 307.5(b)(1).

[204] 30 Tex. Admin. Code § 307.5(b)(2).

[205] TCEQ's antidegradation rule adopts the process set out in the IPs: "[f]or TPDES permits for wastewater, the process for the antidegradation review and public coordination is described in the standards implementation procedures." 30 Tex. Admin. Code § 307.5(c)(1)(A).

[206] Ex. ED-6 at 0042.

[207] 30 Tex. Admin. Code § 307.4(g)(3).

The antidegradation review for the Revised Application was performed by ED witness Peter Schaefer, an aquatic scientist and the Team Leader of the Standards Implementation Team at TCEQ.[208] Mr. Schaefer described the steps he took to perform an antidegradation review, as set out in the TCEQ's IPs. He testified that by following the guidance in the IPs, he is able to ensure that a permit will not result in degradation of the receiving waters.[209] According to his testimony, the first step was to determine the appropriate water quality uses and criteria for the receiving waters, in this case Segment 2481 (Corpus Christi Bay). The next step was to assign critical conditions for the outfall location. In this case, Ms. Cunningham performed this step. The third step was to evaluate the impacts on the water quality of the receiving waters to ensure that the permit limits will maintain instream criteria for dissolved oxygen, nutrients, turbidity, dissolved solids, temperature, and toxic pollutants.[210] On this topic, Mr. Schaefer noted that for constituents with numeric criteria, the IPs provide that degradation is not likely to occur if less than 10% of the assimilative capacity of the receiving waters are used.[211] For constituents without numeric criteria, he uses a weight of the evidence approach.[212] He testified that although there are no numeric criteria for dissolved salts, the results of Dr. Furnans's salt mass calculations show that at the most extreme conditions, the total salt mass would increase by less than 1% at the diffuser location. He added that Dr. Furnans's results "provid[ed] additional information in the weight of evidence concluding that the discharge of brine as proposed would not constitute degradation of the receiving waters with respect to salts."[213]

He also testified that he relied on information from the SUNTANS modeling to indicate that there would be sufficient vertical mixing.[214] He added that the Revised Draft Permit was drafted to not result in a tipping point for the aquatic community.

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[208] Dr. Mary Ann Wallace performed the antidegradation review for the Original Application.

[209] Ex. ED-PS-1-Remand at 0024.

[210] Ex. ED-PS-1 Remand at 0025.

[211] Ex. ED-PS-1 Remand at 0026.

[212] Ex. ED-PS-1-Remand at 0034.

[213] Ex. ED-PS-1 Remand at 0026.

[214] Ex. ED-PS-1 Remand at 0020.

For the Tier 1 review, Mr. Schaefer concluded that the designated uses of primary contact recreation, exceptional aquatic life use, and oyster waters that apply to Segment 2481 (Corpus Christi Bay) will not be impaired. Among the items he considered in this review were the Port Authority's WET tests, CORMIX modeling, and static 2-minute acute tests at various salinity levels.[215] For the Tier 2 review, Mr. Schaefer concluded that no significant degradation of water quality in Corpus Christi Bay is expected. In part, he relied on Dr. Furnans's SUNTANS modeling as additional information to confirm his view that "due to the large volume of water receiving the effluent and the tidal exchange, the result of the discharge would have little effect on the receiving waters."[216] He added that his opinion that water quality will not be degraded is supported by the requirement that the Port Authority must submit effluent data within 90 days of beginning to discharge.[217]

Mr. Schaefer's antidegradation determination is memorialized in his memorandum dated August 19, 2021.[218] On that same date, Mr. Schaefer also completed a permit review checklist addressing antidegradation review.[219]

Both the Port Authority and ED generally argue that Mr. Schaefer's antidegradation review was accurate because it was based on appropriate modeling and complied with the TCEQ's procedures. On the other hand, PAC and OPIC argue that Mr. Schaefer's review was insufficient. Their arguments against the antidegradation review largely break down into two categories. In the first set of arguments, PAC contends that, for various reasons, Mr. Schaefer's antidegradation review was not actually a review. In their second set of arguments, PAC and OPIC assert that to the extent that the review was performed, it relied on inaccurate data—specifically the CORMIX modeling and Dr. Furnans's salt mass analysis. Those two sets of arguments will be discussed separately.

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[215] Ex. ED-PS-1 Remand at 0028-29.

[216] Ex. ED-PS-1 Remand at 0040.

[217] Ex. ED-PS-1 Remand at 0039.

[218] Ex. AR-R-5 (Tab J) at ED-00101-02.

[219] Ex. AR-R-5 (Tab J) at ED-00103-05.

1. Mr. Schaefer's Knowledge and His Review Process

As discussed, many of the arguments involve Mr. Schaefer's knowledge and experience and his review process.

a. Parties' Arguments

Initially, the ED and Port Authority each cite Mr. Schaeffer's extensive work history of reviewing permit applications for the TCEQ and argue that Mr. Schaeffer followed the appropriate steps, as set out in the IPs, for performing this review. When there are no numeric criteria, those appropriate steps include using a weight-of-the-evidence approach to conduct an antidegradation review, as Mr. Schaefer did here.

The ED, in particular, argues that PAC cannot show that Mr. Shaefer deviated from TCEQ's standard procedures. Additionally, the ED notes that Mr. Schaeffer performed his own reviews and prepared new memos after requesting and receiving new information from the Port Authority, instead of simply relying on previous work. Along those lines, the Port Authority cites Dr. Tischler's testimony that Mr. Schaefer's antidegradation review was "even more thorough"[220] than the original review. The ED adds that the agency's interpretation is entitled to deference, citing to *BFI Waste Systems of North America, Inc. v. Martinez Environmental Group*, 93 S.W.3d 570, 575 (Tex. App.—Austin 2002, pet. denied).

For its part, PAC argues that no matter how experienced Mr. Schaeffer is, his say-so cannot, by itself, establish a fact. Relatedly, PAC argues that despite his experience, at the hearing, Mr. Schaefer could not provide definitions for two key terms he used in his analysis: "salinity gradient" and "de minimis." They question how Mr. Schaefer could have actually analyzed whether salinity gradients will be maintained and whether there will be more than a de minimis degradation of water uses without a definition of those terms. Finally, they suggest that the result

[220] Ex. APP-LT-1-R at 39.

of his antidegradation review was preordained by noting his testimony that he has never found degradation in a permit. As support, they cite to his deposition testimony about why he has never done the analysis of economic and social development that would be required upon a finding of degradation: "And so it's applicants [who] don't want to do that. They don't want to go that route, and we don't want them to go that route either. We don't want them to have to deal with that."[221]

In response to PAC's arguments, the ED contends that Mr. Schaefer knows the meaning of both salinity gradient and de minimis, but that he was unable to provide a definition because "TCEQ's rules do not include a definition."[222] According to the ED, following the IPs ensures that water quality will be protected from degradation, regardless of any definitions.

The ED also dismisses as misleading PAC's argument that Mr. Schaefer has never found degradation in an application. In context, the ED argues, it is clear that Mr. Schaefer's testimony was that the ED has never issued a permit that would cause degradation. As support, the ED cites the following testimony from Mr. Shaefer: "We do not issue permits that might degrade the receiving waters. If during the course of our review, we determine that degradation is likely, we'll inform the applicant that we cannot permit the facility under their current proposal and they'll have to revise their application or withdraw it."[223]

b. ALJs' Analysis

The ALJs agree with PAC that Mr. Schaefer's experience does not, by itself, justify accepting his conclusions. Relatedly, the ALJs disagree with the ED's suggestion that Mr. Schaefer's determinations are subject to deference.[224] But, in the larger picture, there is more

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[221] Remand Tr. Vol. 9 at 2372.

[222] ED Reply Brief at 10.

[223] Ex. ED-PS-1 Remand at 0030.

[224] Under *BFI Waste Systems*, the Commission's determinations are subject to deference. *BFI Waste Systems*, 93 S.W.3d at 575 ("But if there is vagueness, ambiguity, or room for policy determinations in the regulation, we will defer to the agency's interpretation unless it is plainly erroneous or inconsistent with the language of the rule."). The reasoning in the case does not support a conclusion that the decisions of an individual employee of the agency are entitled to the same deference.

that was discussed about Mr. Schaefer's analysis than his experience or his position. He testified about the steps he went through, the various items he reviewed, and other people's work he relied upon. As there is a standard procedure he used, the one set out in the IPs, it is not the case his experience or his say-so is the only support for his conclusion.

The ALJs also agree that it is misleading to contend that Mr. Schaefer has never found degradation. He testified that he has never drafted a permit finding Tier 2 degradation that would require an analysis of the important economic or social development that would justify a reduction in water quality. Instead, he asks applicants to revise their application so as not to cause degradation. Sometimes they make necessary revisions; sometimes they withdraw their applications.[225] He testified about the important economic or social development review as, "I don't think the applicant wants to go through that process, and we would rather not have to deal with, you know, potentially degrading waters if we can have the applicant change their plan so that it doesn't degrade waters."[226]

That Mr. Schaefer was unable to define either "salinity gradient"[227] or "de minimis," sounds alarming. On closer examination, however, his testimony and discussion show a general understanding of the concepts. In fact, although Mr. Schaefer testified that he could not provide "a precise definition" of "salinity gradient," he knew what it is, and "could give you a definition . . . just from the head, so to speak."[228] He also testified that based on his review of a Texas Water Development Board (TWDB) paper with an optimal salinity level for red drum of 20 to 35 ppt and he used that in part of his decision.[229]

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[225] Remand Tr. Vol. 9 at 2388, 2390.

[226] Remand Tr. Vol. 9 at 2389.

[227] As the ED has pointed out, TCEQ does not provide a definition of "salinity gradient." Federal regulations provide that "[s]alinity gradients form where salt water from the ocean meets and mixes with fresh water from land." 40 C.F.R. § 230.25.

[228] Remand Tr. Vol. 9 at 2349.

[229] Remand Tr. Vol. 9 at 2368-69.

Mr. Schaefer testified that "de minimis" is not defined by the Texas Water Code, TCEQ rules, or IPs.[230] He also testified how he determined de minimis in the absence of any definition from the rules. First, he indicated that by following the IPs' guidance, he can ensure no more than de minimis degradation.[231] At the hearing, he testified that his process—finding red drum's salinity tolerance from that TWDB paper; calculating the effluent percentage in light of the optimal range of 20-35 ppt; seeing that the salinity would be within that level; confirming that through modeling, WET test results, and PAC witness Dr. Nielsen's data (discussed below)—ensures that the receiving water will not be degraded.[232] He then used that optimal range and calculated the effluent percentage. As discussed below, he was able to define items like salt mass flux in a way that reflected an understanding of them.

2. Weight of the Evidence Review

a. Parties' Arguments

PAC makes two arguments specifically regarding Mr. Schaefer's weight of the evidence review. First, it argues that Mr. Schaefer did not comply with EPA's weight of the evidence process, or any articulable process. PAC adds that nowhere in his testimony or his memos does he describe what his weight of the evidence process consists of and notes that at hearing, he testified that there was "little guidance" from TCEQ about how to conduct a weight of the evidence analysis.[233] Second, PAC argues that Mr. Schaefer did not weigh all the evidence, but instead chose to rely on the Applicant's and ED's evidence, while ignoring PAC's evidence.

The ED agrees that the TCEQ does not follow EPA's process for the weight of the evidence review but argues it should not: TCEQ has instead adopted its own IPs, which EPA has approved. Following the IPs provides the process PAC claims is absent. The ED also argues that Mr. Schaefer

[230] Ex. ED-PS-1 Remand at 0024.

[231] Ex. ED-PS-1 Remand at 0025.

[232] Remand Tr. Vol. 9 at 2384-85.

[233] Remand Tr. Vol 9 at 2359.

did, in fact, examine PAC witness Dr. Nielsen's work, and noted that it confirmed his previous conclusions that the discharge would not have adverse effects on aquatic life, particularly red drum.[234] The ED agrees that Mr. Schaefer did not rely on PAC's CORMIX modeling, but argues that his decision was an appropriate exercise of his discretion. As for the specific modeling at issue, the ED argues that Mr. Schaefer was not the modeling expert; Ms. Cunningham was. It was appropriate for him to rely on her review and conclusions, which, as reflected in her testimony, showed she considered the information from PAC but disagreed with its experts' approach to modeling in this case.

b. ALJs' Analysis

As for the arguments that Mr. Shaefer ignored PAC's information or discounted it to zero, the ALJs do not find that the evidence PAC cites supports the conclusion drawn from it. The specific question on this topic asked about Mr. Osting's and Dr. Socolofsky's CORMIX runs, not about PAC's evidence altogether.[235] With regard to those runs, Mr. Schaefer testified that he relied on information from sources he knew, and that his use of data depended on the value of that data.[236] For most of the runs, except where the shoreline is placed next to the diffuser, PAC's runs are similar to Ms. Cunningham's and Dr. Tischler's runs. It is within Mr. Schaefer's discretion to heavily discount the outlier CORMIX runs. He was also entitled to rely on a fellow employee's evaluation. Mr. Schaefer did not testify that he decided to assign a value of zero to all data from PAC. To the contrary, he considered Dr. Nielsen's study.

Nor do the ALJs find convincing the argument that Mr. Schaefer's weight of the evidence process was too vague to be a process. Although Mr. Schaefer testified that the Commission had not provided much guidance about how to perform weight of the evidence reviews, he also testified that his weight of the evidence process began by first getting the percentage of the effluent at the edge of the ALMZ, then calculating the expected salinity at the edge of that mixing zone based on

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[234] Ex. ED-PS-1 Remand at 36.

[235] Remand Tr. Vol. 9 at 2360-61.

[236] Remand Tr. Vol. 9 at 2361.

Dr. Tischler's memo about the expected salinity of the effluent.[237] He started to add that he then compared that salinity to something, but was cut off and from that point, the questioning went in a different direction.[238] The ALJs agree that Mr. Schaefer was not required to follow the EPA's procedures, but rather the TCEQ's, and the fact that those procedures are not clearly set out in steps is not fatal to his analysis. Mr. Schaefer began explaining the steps he took, but he did not get the opportunity to finish that discussion. The evidence does not support a finding that the antidegradation review was inaccurate because Mr. Schaefer's weight of the evidence review had too little of a set process.

3. Use of CORMIX Modeling and Salt Mass Analysis

PAC and OPIC argue that Mr. Schaefer's antidegradation analysis depended on incorrect CORMIX modeling. For the reasons discussed previously, the Port Authority and ED argue that their CORMIX modeling was correctly performed. The arguments with the CORMIX modeling have already been addressed. Because the CORMIX modeling was acceptable, reliance on that modeling does not create a problem for the antidegradation review. The salinity limits recommended below will—in addition to ensuring that any salinity issues not fully accounted for in the CORMIX modeling will be accounted for—help protect from degradation.

In its reply brief, PAC argued, for the first time, that Dr. Furnans's salt mass analysis, which is one of the items Mr. Schaefer examined in his antidegradation review, is flawed. According to PAC, the primary flaw is that the analysis contains a significant mathematical error in the conversion between MGD to cubic meters (m^3). PAC also argues that the salt mass analysis does not account for the varying velocities and flows within the ship channel. As these issues were not raised until PAC's reply brief, no other party addressed them.

Dr. Furnans testified that he performed a salt mass balance to compare the salt mass flux—the movement of the mass of the salt through a certain area—from the brine discharge to the

[237] Remand Tr. Vol. 9 at 2359-62.

[238] Remand Tr. Vol 9 at 2360.

ambient salt mass flux throughout the ship channel.[239] He added that this work was performed to confirm the results of his SUNTANS modeling.[240] Although he was questioned by OPIC, neither PAC nor the Kings/Steves cross-examined Dr. Furnans at the hearing.[241]

It appears to the ALJs that PAC is correct: the exhibit containing the spreadsheet of the salt mass flux contains an incorrect conversion from MGD to m^3 per day.[242] The calculation on the cover page of the exhibit begins with a discharge amount of 95.6 MGD, which it then appears to convert to 36,218.86 m^3 per day. As PAC correctly points out, this calculation is incorrect by approximately a factor of ten. 95.6 MGD is 361,781 m^3 per day, not 36,216.86m^3. As a result, the next calculation—which is of the kilograms of salt being discharged per day—was off by a factor of 10, as well.

The rest of the exhibit contains a graph and spreadsheet showing what percentage of the salt flux—the movement of mass of salt—in a 6,146 m^2 area[243] would be due to a brine discharge with a salinity of 68.7 ppt at 95.6 MGD. It is worth noting, once again, the total amount of discharge appears to be off by a factor of ten.[244]

The graph and spreadsheet reflect calculations for different ambient salinity levels, ranging from 15 ppt to 40 ppt and for different ambient velocities, with ranges from 0.05 m/s to 1.0 m/s. The highest percentage of salinity flux due to brine discharge is found at the lowest ambient velocities and at the lowest ambient salinities. Thus, the highest percentage is found where there is an ambient salinity of 15 ppt and an ambient velocity of 0.05 m/s, or roughly slack tide.[245] Under those conditions, Dr. Furnans's calculation shows that the brine discharge is expected to result in 0.62% of the salinity flux within the 6,145 m^2 area. At 20 ppt ambient salinity, even with the same

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[239] Ex. APP-JR-1-R at 6, Ex. APP-JR-3-R, Remand Tr. Vol. 6 at 808.

[240] Ex. APP-JR-1-R at 10.

[241] Remand Tr. Vol. 6 at 802.

[242] Ex. APP-JF-3-R.

[243] This area is larger than the ALMZ, but smaller than the HHMZ. See Ex. AR-R 5 (Tab J) at 00135.

[244] Ex. APP-JF-3-R at 3 shows in the "discharge influx" of 2,488,235.61 kg/day, which is incorrect.

[245] As set out above in IV.B.d, the velocities in the channel exceeded that amount 95% of the time.

low velocity, this percentage decreases to 0.47%. The chart reflects a sharp decrease in percentage of salt flux when the ambient velocity increases to 0.1 m/s. At that velocity, with an ambient salinity of 15 ppt, the percentage of salt mass flux due to the brine discharge would be 0.31%. By the time the ambient velocity increases to 0.35 m/s, the percentage of salt mass flux due to the brine discharge is below 0.10% for all ambient salinities (from 15 ppt through 40 ppt). Above 0.95 m/s, for all of the ambient salinities, the percentage of salt flux due to the discharge is 0.03% or less.

As PAC pointed out, there appears to be an input error in the spreadsheet. But again, neither the ALJs nor PAC has confirmation that the apparent error is, in fact, an error because no one questioned Dr. Furnans or any other witness about it. Nor did PAC offer other exhibits explaining this error or offering a different analysis. Given this absence, the ALJs do not have a good way to determine the effect of this error. Without evidence, they cannot conclude that the error means that the calculation of 0.62% at the lowest velocity and ambient salinity should really be 6.2%. The ALJs note that the inability to determine the significance of the error is compounded by PAC's raising this issue for the first time in its reply brief, which does not allow any other party to respond to it.

Regardless, even if the error means that the percentages in the salt mass flux were off by a factor of ten—if the 0.62% at the most extreme end (15 ppt ambient salinity and 0.05 m/s ambient velocity) really should be 6.2%—the ALJs do not find that, without any evidentiary support explaining it, this difference is sufficiently significant to upend the antidegradation review. That discharge of this amount under these particular conditions would amount to 6.2% of the mass of salt flowing through an area smaller than the HHMZ does not seem to result in degradation, especially since the salt mass would be most significant at times when the naturally fluctuating salinity level was low. In that case, the increase in salinity from the discharge would not necessarily raise the salinity level of the receiving water to an alarming level.[246]

[246] Elsewhere, PAC's concerns have focused on conditions when the ambient salinity was already high.

PAC raises other concerns with Dr. Furnans's salt mass balance for the first time in its reply brief, as well. These include that the salt mass balance does not account for the varying velocities and the non-uniform directions of the flow through the ship channel. However, none of this argument is presented with evidentiary support, except for two charts showing a lack of uniformity of velocity or flow direction, which were offered in a different context.[247] These charts do not establish the unreliability of Dr. Furnans's calculations, which is a subject about which they chose not to cross-examine him. Instead, as far as the ALJs can find, the only questioning about the salt-mass balance was in the Kings/Steves's questioning of Mr. Schaefer:

> Q. So here you — this is where you're explaining how — you rely on Dr. Furnans, or at least you rely in part on Dr. Furnans' analyses of total amount of salt that's in the fluxes passing by this point, right?
> . . .
> Q. Now, here you say, "The total mass of salt flow in and out of the channel." So is that the sum of the salt that flowed in plus the sum of the salt that flowed out?
> A. No. My understanding is it's the amount that — that is flowing by at any given time. So it's the amount — so it's not doubling up on the amount of salt.
> Q. And what is the — let's get — what are the—what are the normal —you say it is in and out of the channel under normal ambient conditions. What —what are normal ambient conditions?
> A. Just normal — any — any sort of daily tidal flow that comes through there when you're not subject to, you know, lots of incoming tide from, say, there's a hurricane out in the gulf and pushing a lot of gulf water in there or, say, after a hurricane comes through, you're pushing a lot of freshwater in there. So it's not during those extreme periods. It's just during normal ambient type conditions.[248]

The ALJs do not conclude that Mr. Schaefer's use of Dr. Furnans's salt-mass balance in his antidegradation review renders it inaccurate. As shown in his testimony above, he appears to

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[247] Exs. PAC-44R BA-3, PAC-44R BA-4. In fact, Dr. Austin, who created these charts, testified that "As the scale for this figure shows, water in the vicinity of the proposed discharge point was moving at about 0.25 m/s, while water within the middle of the channel was moving closer to 0.5 m/s, with some areas of water within the channel moving as quickly as 1.0 m/s." Ex. PAC-44R at 10. While this shows variation in velocity, it also shows velocities significantly higher than 0.05 m/s, the lowest velocity on the salt mass balance.

[248] Remand Tr. Vol. 9 at 2365-66. OPIC asked Mr. Furnans a single question about the definition of salt mass balance in the Initial Proceeding. Initial Tr. Vol. 3 at 171-72.

have an accurate understanding of what the salt-mass flux calculation would show, and its limits. When combined with the other elements of the review, it appears to have been an appropriate item to examine. To the extent that there are concerns with increasing the salinity at slack tides when there is low ambient salinity, a salinity permit limit would address those concerns.

4. Conclusion

In short, the ALJs find that the ED's antidegradation review of the Revised Application was sufficient. The circumstances are different from those in the Initial Proceeding and PFD. Although the ALJs noted in the Initial PFD that merely showing compliance with the steps of the IPs is not sufficient to establish an accurate antidegradation review, it was also clear from the testimony that Dr. Wallace had not, in fact, done so. On cross-examination, she agreed that she did not have enough time to determine whether there was more than a de minimis change to water quality as required by Tier 2.[249] Unlike with the Initial Proceeding, Mr. Schaefer did not testify that an antidegradation analysis was based on feelings or looking through a gazing ball. He testified that it "is based on rigorous technical reviews by several different staff members each with very specialized areas of expertise and training."[250] In the Initial PFD, the ALJs were also concerned about Dr. Wallace's inability to mention an optimal range of salinity. Here, in contrast, Mr. Schaefer provided one from the TWDB study and also examined Dr. Nielsen's study to determine optimal salinity for red drum.

D. Whether the proposed discharge will adversely impact: the marine environment, aquatic life, and wildlife, including birds and endangered or threatened species, spawning eggs, or larval migration. (Issue A)

The Port Authority and ED maintain that the Revised Draft Permit is protective of the marine environment, aquatic life, and wildlife. PAC, the Kings/Steves, OPIC, Audubon, and the pro se group disagree.

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[249] Tr. Vol. 5 at 185.

[250] Ex. ED-PS-1 at 0005.

1. Background

The Aransas Pass inlet is one of five major coastal passes connecting the Gulf of Mexico with Texas's bays and estuaries.[251] In the Initial Proceeding, evidence was presented showing the Aransas Pass inlet's importance in sustaining the life cycle of "estuarine-dependent" marine species.[252] PAC witness Scott Holt described the life cycle of such species as follows:

> While details differ among species, the process goes something like this: the adults mostly live permanently in offshore, typically coastal, ocean waters; they spawn in these offshore waters and the eggs and early larvae drift for days or weeks in coastal currents; the larvae eventually arrive at the coast and many are ultimately drawn into tidal inlets that connect the ocean with the estuary. Some of those larvae drawn into the inlet on the flood tide are carried into the estuary to suitable habitat where they remain to develop into juveniles and sub-adults. This development into the sub-adult stage takes one or more years before they return to the ocean as maturing adults.[253]

Estuarine-dependent marine species include a variety of fish and shellfish,[254] but in the Initial Proceeding, the focus was primarily on red drum, which PAC witness Dr. Andrew Esbaugh stated was the most sensitive species he identified.[255] In addition, as discussed further below, the focus is narrowed further to concentrate on the early life stages, specifically eggs and larvae, because they are more sensitive to changes in salinity than juveniles and adults. Larvae are essentially planktonic, without the ability to swim, and as such, they are dependent on the tidal currents to move them from the Gulf of Mexico to the nursery grounds.[256]

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[251] Ex. PAC-7 at 13.

[252] *See* Initial PFD at 11-12.

[253] Ex. PAC-4 at 9-10.

[254] These species include members of the Drum Family like Red Drum, Atlantic Croaker, Silver Perch, Gulf Whiting, Black Drum, and Star Drum, and other species such as Southern Flounder, Stripped and White Mullet, Gulf Menhaden, White and Brown Shrimp, and Blue Crabs. Ex. PAC-4 at 11.

[255] Initial Proceeding Tr. Vol. 3 at 59-60.

[256] Ex. PAC-4 at 10-11.

The ALJs concluded in the Initial Proceeding that the Port Authority had not met its burden to show that the proposed discharge would not adversely impact the marine environment, aquatic life, and wildlife.[257] After the remand, the Port Authority and PAC each conducted laboratory testing to assess the impact of salinity changes on aquatic organisms. Their testing protocols and results are described first, followed by the parties' arguments regarding the impact of salinity on the marine environment and aquatic life, whether the Revised Draft Permit should include a limit for salinity, and the impact of the proposed discharge on birds and endangered and threatened species.

2. Laboratory Testing to Assess Impacts of Salinity

a. Port Authority's Salinity Toxicity Testing

The Port Authority engaged Stillmeadow Inc. Environmental Toxicology Laboratory (Stillmeadow) to conduct chronic and acute toxicity testing of salinity on two species: mysid shrimp (*Mysidopsis bahia*) and inland silverside (*Menidia beryllina*).[258] Stillmeadow is a third-party laboratory accredited by the National Environmental Laboratory Accreditation Program.[259] In performing the tests, Stillmeadow applied EPA's chronic and acute WET testing methods.[260] For both chronic and acute exposures, the tests determined a "no observed effect concentration" (NOEC), which is the concentration at which an organism will not suffer any observable effect if exposed to a chemical for a given period of time.[261] The tests were performed using mysid shrimp that were 7 days old and inland silverside that were 7 to 11 days old. For each

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[257] Initial PFD at 62-69.

[258] Port Authority Closing Argument at 9, 27-28; Ex. APP-RP-1-R at 15-16. Stillmeadow also conducted chronic toxicity testing on sheepshead minnow (*Cyprinodon variegatus*), but the testing was not addressed in the parties' closing arguments. *See* Ex. APP-RP-8-R. ED witness Michael Pfeil testified that EPA Region 6 replaced sheepshead minnow with inland silverside as the standard marine vertebrate test species for WET testing because the sheepshead minnow was deemed not sensitive enough to toxins. Ex. ED-MP-1 Remand at 0007.

[259] *See* Ex. APP-RP-6-R at 4.

[260] For chronic toxicity testing, these are Methods 1006.0 and 1007.0 found in EPA-821-R-02-014 (2002). For acute toxicity testing, these are Methods 2006.0 and 2007.0 found in EPA-821-R-02-012 (2002).

[261] Ex. APP-RP-1-R at 18; Ex. PAC-48R at 12.

species, the chronic and acute tests exposed five replicates of eight organisms each to each test concentration.

For the chronic toxicity testing, the mysid shrimp and inland silverside were exposed to salinity concentrations of 25 (control), 30, 35 , 40, and 45 ppt over seven days.[262] At each concentration, the testing evaluated (1) lethal effects by counting how many test organisms survived and (2) sub-lethal effects by measuring growth. For survival and growth, the chronic testing showed a NOEC for both species of 45 ppt, the highest salinity tested. Based on the results of the chronic testing, the Port Authority concludes that marine species will not be adversely impacted by seven-day exposures to 45 ppt of salinity.[263]

The acute toxicity testing exposed mysid shrimp and inland silverside to salinity concentrations of 35 (control), 40, 45, 50, and 55 ppt for two minutes.[264] These tests provided a "shock" exposure to higher salinity concentrations intended to simulate an organism passing through the ZID.[265] The acute toxicity testing showed a NOEC of 55 ppt for both species tested. Stillmeadow noted that 100% of the organisms survived the two-minute testing, and "no significant mortality" was observed even 24 hours later.[266]

b. Parties' Arguments Regarding the Port Authority's Testing

PAC and OPIC argue that the Port Authority's testing should be discounted because the species tested are not particularly relevant in this case.[267] According to PAC witnesses Dr. Gregory Stunz and Dr. Kristin Nielsen, mysid shrimp and inland silverside are not as sensitive to salinity as other species found in the Corpus Christi Ship Channel and are not estuarine

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[262] Ex. APP-RP-6-R; Ex. APP-RP-7-R.

[263] Port Authority Closing Argument at 27-28.

[264] Ex. APP-RP-9-R.

[265] Ex. APP-RP-1-R Rebuttal at 3-4.

[266] Ex. APP-RP-9-R at 5.

[267] PAC Closing Argument at 19-20; OPIC Closing Argument at 10-11.

dependent.[268] Dr. Stunz also noted that the Port Authority's testing used organisms at least seven days old, but the ship channel is full of younger organisms that are "far more sensitive to abrupt changes in salinity."[269]

The Port Authority and ED respond that mysid shrimp and inland silverside are appropriate test organisms because they are the marine species approved for use in WET testing by the EPA and TCEQ.[270] In addition, the Port Authority disagrees with the premise that these standard test species are materially less sensitive than other organisms.[271] In support, the Port Authority cites a study by Pillard et al. (1998)[272] that exposed mysid shrimp and inland silverside to a range of salinity concentrations and concluded that at 48 hours the median lethal concentration (LC50) was 43 ppt for mysid shrimp and 44 ppt for inland silverside.[273] When questioned about this finding on cross-examination, PAC witness Dr. Stunz agreed that it indicated inland silverside and mysid shrimp have "roughly equivalent" sensitivity to salinity as red drum larvae.[274]

Similarly, ED witness Michael Pfeil testified that the EPA does not require use of resident species because the standard test species represent the sensitive range of all ecosystems analyzed.[275]

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[268] Ex. PAC-52R at 26; Ex. PAC-48R at 19-20.

[269] Ex. PAC-52R at 26.

[270] Port Authority Closing Argument at 9, 62-63; ED Closing Argument at 6-7; *see also* Ex. ED-MP-1 Remand at 0005-06.

[271] Port Authority Closing Argument at 28-29.

[272] Pillard et al., *Response of Mysid Shrimp, Sheepshead Minnow, and Inland Silverside Minnow to Changes in Artificial Seawater Salinity* (1998). This study is not in the evidentiary record, but is briefly summarized in the testimony of the Port Authority's witnesses and was discussed on cross-examination with PAC witness Dr. Stunz. *See* Ex. APP-LF-1-R Rebuttal at 35; Ex. APP-RP-1-R Rebuttal at 8; Remand Tr. Vol. 5 at 1289-92.

[273] Port Authority Closing Argument at 28.

[274] Remand Tr. Vol. 5 at 1292.

[275] ED Closing Argument at 7; Ex. ED-MP-1 Remand at 0012.

c. Dr. Nielsen's Salinity Toxicity Testing on Red Drum

PAC witness Dr. Nielsen, an Assistant Professor at the University of Texas at Austin Marine Science Institute (UTMSI) with a Ph.D. in Aquatic Toxicology,[276] conducted laboratory tests to evaluate the salinity tolerance of early life stages of red drum (*Sciaenops ocellatus*), specifically embryos and larvae.[277] She performed two types of tests. The first type was designed to find the median lethal concentration (LC50), which is the concentration that will cause 50% of larvae to die at pre-set timepoints (here, 24, 48, and 72 hours).[278] The LC50 testing also results in a prediction of the NOEC (no observable effect concentration) and LOEC (lowest observable effect concentrations). The LOEC is the lowest treatment concentration that had a statistically significant effect, whereas the NOEC is the concentration just below the LOEC (in which any effects were not yet statistically significant). The second type of test was designed to find the median lethal time (LT50), which is the length of time required to kill 50% of embryo-larval red drum that drift into full-strength brine.[279] For both the LC50 and LT50 tests, Dr. Nielsen performed two rounds of testing.

The first round of LC50 testing (Test 1) was a "rangefinder" test, a type of preliminary study where the researcher starts with a broad range of concentrations and uses the results to refine the final study design.[280] Dr. Nielsen's rangefinder test exposed red drum eggs to concentrations of 31 (control), 35, 40, 45, 50, 60, and 68.7 ppt.[281] Survival was evaluated at 24, 48, and 72 hours after starting the test. Red drum eggs typically hatch around 24 hours post-fertilization, so at 24 hours, the test looked at successful egg hatch, and at 48 and 72 hours, it looked at survival of the larvae that had hatched. The study results indicated that (1) at test hour 24, 50% of red drum

[276] Ex. PAC-48R at 4.

[277] Ex. PAC-48R at 5-6; Ex. PAC-48R KN-3; Ex. PAC-48R KN-4.

[278] Ex. PAC-48R at 12.

[279] Ex. PAC-48R at 12.

[280] Ex. PAC-48R at 12.

[281] Ex. PAC-48R KN-3 at 2.

eggs will fail to hatch around 49 ppt; (2) at test hour 48, 50% of larvae will die at 43.8 ppt; and (3) at test hour 72, 50% of larvae will die at 40.4 ppt.[282]

The second round of LC50 testing (part of Test 3)[283] used the results of the rangefinder test to evaluate a narrower range of salinities with smaller gaps between the concentrations tested (2 ppt increments, instead of 5 ppt increments). This test started with red drum eggs spawned at 35 ppt of salinity and exposed them to concentrations of 35 (control), 37, 39, 41, 43, and 45 ppt.[284] The study results indicated that (1) at test hour 24, 50% of red drum eggs will fail to hatch at 50.8 ppt; (2) at test hour 48, 50% of larvae will die at 44.8 ppt; and (3) at test hour 72, 50% of larvae will die at 37.7 ppt.[285] Dr. Nielsen testified that the LOEC for all timepoints (i.e., the concentration at which adverse effects on hatch and survival first started to occur) was 37 ppt. [286] Thus, the only treatment that did not cause significant lethality to larvae was the 35 ppt control treatment—in other words, the NOEC for salinity is essentially the salinity they were spawned in.[287]

Dr. Nielsen also conducted two LT50 tests (Test 2 and part of Test 3, respectively), each exposing red drum larvae to salinity of 68.7 ppt.[288] The first test used larvae spawned in 28 ppt, and the second test used larvae spawned in 35 ppt.[289] During both rounds of LT50 testing, lethality was observed at every timepoint evaluated, including the first timepoint, which was 4 minutes for the first test and 10 minutes for the second test.[290] Based on these results, Dr. Nielsen concluded

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[282] Ex. PAC-48R at 13.

[283] "Test 3" referred to the second rounds of both the LC50 and LT50 testing. Remand Tr. Vol. 8 at 2074.

[284] Ex. PAC-48R KN-3 at 10.

[285] Ex. PAC-48R at 13.

[286] Ex. PAC-48R at 13-14.

[287] Ex. PAC-48R at 14.

[288] Ex. PAC-48R KN-3 at 10.

[289] Ex. PAC-48R KN-3 at 10.

[290] Ex. PAC-48R at 14.

that significant effects on the survival of larval red drum in the ZID will begin sometime between 0 and 4 minutes, with 50% mortality between 47.7 and 55.4 minutes.[291]

d. Parties' Arguments Regarding Dr. Nielsen's Testing

The Port Authority and ED argue that the Commission cannot consider Dr. Nielsen's testing in this proceeding because her laboratory is not an accredited environmental testing laboratory.[292] They both contend that accreditation is required by Texas Water Code § 5.134(a), which states that:

> The commission may accept environmental testing laboratory data and analysis for use in commission decisions regarding any matter under the commission's jurisdiction relating to permits or other authorizations, compliance matters, enforcement actions, or corrective actions only if the data and analysis is prepared by an environmental testing laboratory accredited by the commission under Subchapter R or an environmental testing laboratory described in Subsection (b) or (e).

The Port Authority also claims that Dr. Nielsen's testing contained many data errors and failed to account for temperature, salinity, and dissolved oxygen fluctuations.[293] Due to the alleged failure to control dissolved oxygen, Port Authority witness Dr. Dean opined that Dr. Nielsen's test results may be explained by "gas bubble disease," a sickness in fish resulting from supersaturation of dissolved oxygen.[294] Dr. Dean also raised the following concerns with Dr. Nielsen's testing:[295]

- The study design deviates from EPA WET testing methods.
- Dr. Nielsen used non-standard endpoints to measure growth, and in Dr. Dean's view, her analysis of those non-standard endpoints introduced subjective bias into her results.

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[291] Ex. PAC-48R at 14.

[292] Port Authority Closing Argument at 34-35; ED Closing Argument at 6.

[293] Port Authority Closing Argument at 35.

[294] Ex. APP-KD-1-R at 29.

[295] Ex. APP-KD-1-R at 26-30.

- The EPA methods require randomization, and the information provided by Dr. Nielsen does not demonstrate that the design was appropriately randomized, which would potentially bias the results and thus invalidate the statistical conclusions.

- Dr. Nielsen's data tables for Tests 2 and 3 introduce a variable "cohort" to divide the treatments, but this "cohort" is not described in the report. According to Dr. Dean, "If the organisms or experimental conditions were different for the two cohorts, they are not true replicates, nor can they be directly compared to a control treatment for different conditions."

- For Test 3, there were only four replicates in the control. Thus, Dr. Dean stated, "it is very hard to determine if the data follow the normal distribution or not, so there is a strong possibility that inappropriate statistical methods could be applied, and incorrect conclusions could be made."

- There were quality assurance and control issues, including measured temperatures and salinities in some treatments that varied by an amount greater than is allowed in EPA WET testing methods.

- The statistical analysis methods used in Dr. Nielsen's study were not those recommended by the EPA. When Dr. Dean used the recommended EPA statistical methods, his calculations resulted in substantially different results than Dr. Nielsen reported.

- The testing failed the EPA acceptability criteria due to insufficient survival in the control.

- Dr. Dean got different results in the growth analysis, seeing no statistically significant differences in length or body surface area, in contrast to Dr. Nielsen's report of a statistically significant difference.

Separately, Port Authority witness Dr. Fontenot also questioned the reliability of Dr. Nielsen's results because they indicate the natural environment in the ship channel (which regularly exceeds 37.7 ppt) is harmful to red drum, and they are at odds with other published literature on the early life stages of red drum.[296]

[296] Ex. APP-LF-1-R Rebuttal at 3.

In response, PAC and OPIC disagree that Texas Water Code § 5.134 applies to Dr. Nielsen's testing.[297] They note that the accreditation requirement only applies to "environmental testing laboratory data" and that an "environmental testing laboratory" is defined as "a scientific laboratory that performs analyses to determine the chemical, molecular, or pathogenic components of environmental media for regulatory compliance purposes."[298] In their view, the plain language seeks to regulate laboratories analyzing components of environmental media, which is not what Dr. Nielsen did. Her tests did not seek to determine the level of salinity in a particular media, but instead evaluated the effect of salinity on aquatic organisms. Furthermore, PAC asserts that if the accreditation requirement is applied as broadly as the Port Authority and ED propose, then much of the other evidence in the record could not be considered because many of the experts in this case, including those of the Port Authority, relied on testing and peer-reviewed literature that has not been shown to have been conducted in an accredited laboratory.

PAC also responded to the Port Authority's criticisms of Dr. Nielsen's testing.[299] As an initial matter, PAC notes that Dr. Dean is not a toxicologist or biologist, which calls into question the reliability of his critiques.[300] For example, PAC notes that his claim that larvae could have died from gas bubble disease due to elevated dissolved oxygen is contrary to Dr. Nielsen's testimony that the tests have "exceptionally high survival" of the control groups, which is the most important factor in determining whether the treatment (here, salinity) or some other factor (such as gas bubble disease) was the cause of mortality.[301] In addition, Dr. Dean speculates that *if* randomization was improper and *if* the two cohorts were treated differently, it could have compromised Dr. Nielsen's study. However, Dr. Nielsen testified that the study "was sufficiently random" and the two cohorts "were treated the same."[302]

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[297] PAC Reply at 7; OPIC Closing Argument at 11-12.

[298] Tex. Water Code § 5.801; 30 Tex. Admin. Code § 25.2(6).

[299] PAC Reply at 16-18.

[300] PAC Reply at 16.

[301] Remand Tr. Vol. 8 at 2126-27.

[302] Remand Tr. Vol. 8 at 2129-31.

Moreover, PAC asserts that the remainder of Dr. Dean's criticisms are simply extensions of his first complaint, that Dr. Nielsen's testing deviated from EPA methods.[303] Yet, Dr. Nielsen explained that deviations were necessary in order to study early-life-stage red drum, including altering the duration of the test,[304] the way in which growth was measured,[305] and the acceptable control survivability.[306] In addition, PAC notes that the Port Authority's laboratory testing also had to adjust the EPA methods because they are designed to test toxicants other than salinity, and therefore, require salinity to be controlled.[307]

PAC also disagrees with Dr. Fontenot that Dr. Nielsen's work is at odds with published literature on early-life-stage red drum, noting that the sources he cites can be distinguished because they either did not address red drum larvae; studied embryos, not larvae; lumped together conclusions about embryos and larvae; or studied the Laguna Madre, where red drum larvae are not found.[308] PAC also contends Dr. Nielsen's results are consistent with the Thomas et al. (1989) study (discussed further below). Furthermore, despite criticizing Dr. Nielsen's work, the Port Authority and its experts also rely on her results for some of their positions.

3. Impact of Salinity on the Marine Environment and Aquatic Life

a. Port Authority's Arguments

The Port Authority contends that red drum is the most sensitive resident marine species to changes in salinity concentrations, and thus, if it will not be adversely affected by the proposed

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[303] PAC Reply at 17.

[304] Remand Tr. Vol. 8 at 2117-19.

[305] Ex. PAC-48R KN-3 at 2.

[306] Remand Tr. Vol. 8 at 2119-20.

[307] PAC Reply at 8. Pursuant to the EPA testing methods, the salinity when testing mysid shrimp or inland silverside may not exceed 30 ppt or 32 ppt, respectively. Ex. Kings/Steves-17R (Test Method 1006.0 for Inland Silverside) at § 13.6.13.1; Ex. Kings/Steves-23R (Method 1007.0 for Mysid) at § 14.6.11.1.

[308] PAC Reply at 17-18.

discharge, then no species will be.[309] According to the Port Authority, the parties generally agree that red drum is the most sensitive species.[310] PAC expert Dr. Esbaugh confirmed on remand that red drum remains his biggest concern regarding acute effects of the desalination effluent.[311] Additionally, PAC experts Dr. Schlenk, Dr. Stunz, and Dr. Nielsen testified that early life stages of red drum are sensitive to salinity changes.[312] The Port Authority's expert on this topic, Dr. Lance Fontenot, also agreed that red drum is a useful surrogate species for determining the effects of salinity on marine life in the ship channel.[313]

The Port Authority emphasizes that red drum thrive in the Nueces/Mission-Aransas estuary systems, including the Corpus Christi Ship Channel, with naturally occurring salinities that fluctuate substantially.[314] Dr. Fontenot testified that salinities can fluctuate daily from <1 ppt to >5 ppt, as well as experience large ups or downs over days or weeks in response to droughts, excessive rainfall, or seasonal changes.[315] He further opined that "aquatic estuarine species that live and thrive in such an environment have evolved physiological mechanisms to cope with the constantly changing salinity levels in their environment."[316] In the Port Authority's view, this fact refutes PAC's claim that 37.7 ppt is the LC50 for red drum (i.e., the concentration where half die), given that the species naturally tolerates salinities ranging from 28 ppt to 42 ppt.[317] If that were the case, then naturally occurring salinities would be lethal to red drum for several months per year.[318]

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[309] Port Authority Closing Argument at 2, 21.

[310] Port Authority Closing Argument at 21-23. To the extent that PAC's experts have indicated on remand that red drum is not the *most* sensitive species, the Port Authority asserts they are being inconsistent. Port Authority Reply at 7.

[311] Ex. PAC-45R at 10-11.

[312] Remand Tr. Vol. 5 at 1299, Vol. 8 at 1924, 1928-29; Ex. PAC-48R at 8, 11; Ex. PAC-52R at 15.

[313] Ex. APP-LF-1-R at 25.

[314] Port Authority Closing Argument at 23-25; *see also* Ex. APP-LF-1-R at 41-42.

[315] Ex. APP-LF-1-R at 42.

[316] Ex. APP-LF-1-R at 42.

[317] Port Authority Closing Argument at 6, 24-25.

[318] *See* Ex. APP-LF-1-R at 41.

The adult and juvenile[319] life stages of red drum can tolerate significant instantaneous changes in salinity (up to 30 ppt) without suffering adverse effects.[320] At the hearing, the Port Authority questioned PAC witness Dr. Esbaugh about a study he conducted in which red drum of approximately 6 to 12 months old were moved from salinity of 30 ppt to 60 ppt, an increase of 100%, with no time for acclimation.[321] The test lasted 72 hours, during which time none of the red drum died.[322] Dr. Esbaugh agreed that, based on this test, he would not expect survivability to be a concern for red drum adults or juveniles that pass through the ZID.[323]

Given the resilience of older red drum, the focus on remand has generally been on red drum eggs and larvae, which are more sensitive to salinity changes. Even so, the Port Authority contends that studies indicate red drum eggs and larvae can tolerate at least 24 hours of exposure to salinity concentrations greater than 45 ppt without suffering adverse effects.[324] In particular, the Port Authority references the following study results, including some by PAC witnesses Dr. Stunz and Dr. Nielsen:[325]

- Robertson et al. (1988):[326] This study evaluated the effects of osmotic shock and latent mortality by instantaneously exposing morula-stage embryos (1.5 to 2 hours post-fertilization) and tail-bud-stage embryos (12 to 13 hours post-fertilization) of red drum reared at 30 ppt to salinities of 37.5 ppt, 45 ppt, 60 ppt, and 95 ppt for 20 minutes, after which the test organisms were returned to 30 ppt and monitored.

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[319] "Juvenile" generally refers to a fish between free swimming stage and sexual maturity. Remand Tr. Vol. 8 at 1877, 1891.

[320] Port Authority Closing Argument at 25-26.

[321] Remand Tr. Vol. 8 at 1957-60; Ex. APP-53R (Leighann Martin & Andrew J. Esbaugh, *Osmoregulatory plasticity during hypersaline acclimation in red drum, Sciaenops ocellatus*, Journal of Comparative Physiology B (2021)).

[322] Remand Tr. Vol. 8 at 1959, 1963.

[323] Remand Tr. Vol. 8 at 1960, 1962.

[324] Port Authority Closing Argument at 26.

[325] Port Authority Closing Argument at 29-30. Some of these studies are not in the evidentiary record, but were discussed with expert witnesses at the hearing. Counsel for the Port Authority indicated that, pursuant to Texas Rule of Evidence 803(18), statements contained in learned treatises and periodicals may be read into evidence, but not offered as exhibits. *See* Remand Tr. Vol. 6 at 1451-52. For studies that are not in the record, the citations in this PFD are to the portions of the transcript where the studies are discussed.

[326] Remand Tr. Vol. 8 at 2066-73 (discussing Robertson et al., *Toxicity of the Cryoprotectants Glycerol, Dimethyl Sulfoxide, Ethylene Glycol, Methanol, Sucrose, and Sea Salt Solutions to the Embryos of Red Drum*, The Progressive Fish-Culturist, Vol. 50 at 148-54 (1988)).

Unhatched, dead, and living embryos were counted 40 hours after fertilization to determine hatching success and survival. The results showed no effect at 45 ppt and a significant effect at 60 ppt.

- Brauner et al. (2013):[327] This study states that 15 drum species have been found in the Laguna Madre lagoon at salinities greater than 60 ppt and an additional 10 species are known to be able to tolerate even higher salinities. However, it notes that at higher salinities few species dominate, and only larger individual fish are found, indicating a lack of recruitment.

- Stunz et al. (2015):[328] "Marine organism salinity tolerances: The Corpus Christi Bay system has natural salinities ranging from 28 - 42 ppt, with an average around 35 ppt. We know that the resident marine species can tolerate salinities within this range . . . ."

- Kesaulya et al. (2018):[329] "This study shows that red drum eggs can hatch within a wide range of salinities with best hatch-out and growth rates occurring between 33 – 43 ppt." "Red drum eggs held at the 38 ppt showed the highest percentage of hatching success, . . ."

- Nielsen et al. (2021), LT50 tests from Tests 2 and 3:[330] Abrupt short-term salinity tolerance testing of red drum larvae demonstrated by transfer of larvae from 28 ppt to 68.7 ppt, and 35 ppt to 68.7 ppt; demonstrating larvae had an LT50 for 47.7 minutes and 65.0 minutes, respectively, after this shock treatment of over 245% and 196%, respectively, above culture/hatch water.

- Nielsen et al. (2021), LC50 test from Test 1:[331] Dr. Nielsen found that red drum eggs and early-stage larvae had same hatch and survival success at 31 (control), 35, 40, and 45 ppt – a NOEC of at least 45 ppt.

These studies, according to the Port Authority, indicate that red drum, including their eggs and larvae, can tolerate hours of exposure to increased salinities and will not experience adverse

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[327] Remand Tr. Vol. 5 at 1097-1106 (discussing *Extreme Environments: Hypersaline, Alkaline, and Ion-Poor Waters*, Fish Physiology, Ch. 9 at 454-55 (2013)).

[328] Ex. APP-56R at 11 (Greg Stunz & Paul Montagna, *Identification and Characterization of Potential Environmental Impacts Mitigation Measures Related to Intake and Discharge Facilities of Seawater Desalination Plants*, Variable Salinity Desalination Demonstration Project City of Corpus Christi (2015).

[329] Ex. APP-55R at 119-20 (Irma Kesaulya et al., *Effects of Hypersaline Conditions on the Growth and Survival of Larval Red Drum,* Jordan Journal of Biological Science, Vol. 12, No. 1 at 119-22 (2019)).

[330] Ex. PAC-48R KN-3 at 10.

[331] Ex. PAC-48R KN-3 at 2.

impacts from exposures of seconds or minutes.[332] The Port Authority also asserts the study results are consistent with the results of its laboratory testing on mysid shrimp and inland silverside (described above).

In contrast, when considering the relevant studies, the Port Authority criticizes PAC for relying on the Thomas et al. (1989) study.[333] In closing arguments, PAC highlights that the Thomas study shows that, for red drum larvae reared at 32 ppt, the median lethal dose (LD50)[334] (where half of subjects died) is 41 ppt for 1-day-old larvae; 33 ppt for 3-day-old larvae; 42 ppt for 5-day-old larvae; 45 ppt for 7-day-old larvae; and 45 ppt for 9-day-old larvae.[335] The Port Authority, however, questions the reliability of these results, particularly for the 3-day-old larvae. It notes that contrary to expectation, the study indicates 3-day-old larvae exposed to a 25 ppt salinity decrease had *better* survival than the control group.[336] In addition, the data for 3-day-old larvae appear to be an outlier because Figure 19 of the Thomas study otherwise shows red drum larvae better tolerate salinity increases as they get older. Further, the Port Authority argues that using the Thomas study to suggest a 1 to 2 ppt salinity increase will have adverse effects on red drum larvae is contrary to the findings of the other studies listed above, as well as the Port Authority's salinity toxicity testing.

Having considered the data on the tolerance of red drum eggs and larvae to increases in salinity, the Port Authority contends the next step is to consider the extent and duration of exposure.[337] The Port Authority notes that scientific literature considers lethality/toxicity as a function of the "dose" of a given toxicant (e.g., salinity) and the time of exposure.[338] Although

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[332] Port Authority Closing Argument at 30.

[333] Port Authority Reply at 9-12; *see also* Ex. PAC-85R at 68 (PDF pagination), Fig. 19 (Peter Thomas et al., *Salinity Requirements for Reproduction and Larval Development of Several Important Fishes in Texas Estuaries* (1989)).

[334] The parties did not explain the difference between LD50 and LC50, but the terms appear to be interchangeable in this context.

[335] PAC Closing Argument at 9-10 (citing Ex. APP-LF-1-R at Ex. EFA 1-3, page 2 of 3).

[336] Remand Tr. Vol. 5 at 1281-82.

[337] Port Authority Closing Argument at 2-4, 12-17, 31-32.

[338] Port Authority Closing Argument at 26.

billions of red drum larvae are carried by tidal currents through the Aransas Pass inlet during the spawning season,[339] the Port Authority emphasizes that only a small percentage of organisms are likely to encounter increased salinities in the mixing zones.[340]

Several factors limit the number of organisms that would be exposed. First, the Port Authority notes that organisms entering the Aransas Pass inlet have three alternate pathways to travel to the estuaries: Corpus Christi Ship Channel, Lydia Ann Channel, and Aransas Channel. Research studies conducted in 2021, 2004, and 2000 estimated the percentage of larvae that take each of these pathways after entering the inlet.[341] The studies disperse passive particles—intended to serve as a proxy for larvae—near the entrance of the Aransas Pass inlet and then track their movement. The most recent study (Dawson 2021) found that less than 20% of the particles traveled down the Corpus Christi Ship Channel, with the remainder using the other two pathways. The earlier studies (Brown/Holt 2004 and Brown 2000) found approximately 50% traveled down the ship channel. Thus, according to the Port Authority, 50% to 80% of the larvae entering the Aransas Pass inlet would bypass the Corpus Christi Ship Channel altogether and not be exposed to the discharge.

For the larvae entering the ship channel, exposure is limited by the existence of a zone of passage around the regulatory mixing zones. Port Authority witness Mr. Palachek calculated that the cross section of the channel where the concentrated salinity plume would be greater than 45 ppt is less than 5% (depending on the speed of the tidal currents).[342] Similarly, PAC witness Dr. Stunz estimated that only approximately 2% of larvae would flow through the mixing zones.[343] Thus, larvae in the remaining approximately 95% to 98% of the ship channel would not be impacted.

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339 Port Authority Closing Argument at 3 n.10.

340 Port Authority Closing Argument at 2-4, 12-17.

341 Remand Tr. Vol. 6 at 1397-1406.

342 Ex. APP-RP-1-R at 22; Ex. APP-RP-10-R.

343 Remand Tr. Vol. 5 at 1071.

Additionally, the Port Authority points to several studies, including two co-authored by PAC witness Mr. Holt, indicating that red drum eggs and larvae are buoyant in salinities greater than 25 ppt and tend to be found near the surface of the water.[344] TPWD marine biologist Dr. James Tolan confirmed that, based on sampling he had done as a graduate student for Mr. Holt, red drum larvae were much more abundant on the surface.[345] This factor further reduces exposures, according to the Port Authority, because eggs and larvae would float above the discharge, which would be 65 feet below the water surface, and thus, not come into contact with it.

For those larvae that are exposed, only a portion will be 3-day-old larvae, which PAC has identified as a vulnerable stage.[346] The Port Authority further posits that these larvae are unlikely to reach and successfully settle in estuarine nursery grounds because they are insufficiently developed (precompetent phase) prior to reaching two to three weeks old.[347] In contrast, those in the competent phase are fully capable of osmoregulation to avoid any adverse consequence of a relatively brief exposure to a higher salinity concentration.

Finally, the amount of time that larvae would be exposed to increased salinities as they pass through the ZID is a few minutes or less.[348] In contrast, the exposure times for red drum eggs and larvae in the literature that Dr. Fontenot reviewed were many times higher, even when considering the shortest exposure durations. According to Mr. Palacheck, "under no scenario will any marine organism be exposed to 45 ppt from the Outfall for longer than a few minutes."[349]

Given all these factors, the Port Authority concludes that the percentage of larvae that will be exposed is small,[350] and essentially all will survive given exposure times to greater than 45 ppt

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[344] Port Authority Closing Argument at 13-14; Remand Tr. Vol. 6 at 1381-97.

[345] Ex. APP-JT-1-R at 181-82.

[346] Port Authority Closing Argument at 3-4, 15.

[347] Port Authority Closing Argument at 15-16.

[348] Port Authority Closing Argument at 32-34.

[349] Ex. APP-RP-1-R at 17.

[350] Port Authority Closing Argument at 3-4.

for only seconds or minutes, not hours or days. Accordingly, the Port Authority contends that the discharge will not have a significant effect on aquatic life in the Corpus Christi Ship Channel.[351]

b. ED's Arguments

The ED concurs with the Port Authority that larval and other sensitive-stage organisms will have a zone of passage in the Corpus Christi Ship Channel and will only be subject to exposures in the ZID and ALMZ for short periods.[352] The longest amount of time planktonic organisms could remain in the mixing zone would occur during slack tide conditions, which the ED notes occur infrequently (twice per day) and for short duration (scale of minutes). In addition, during slack tide conditions, the CORMIX modeling predicts better mixing, i.e., lower effluent percentages.[353] Because the effluent percentage limit in the Revised Draft Permit is based on the highest predicted effluent percentages, the ED contends the permit will be protective under all tidal conditions, including slack tide.[354]

Other factors the ED asserts show the permit will be protective include the Port Authority's SUNTANS modeling, which according to the ED, indicates the salinity gradient of the estuaries will be maintained, and the regular ship traffic that occurs in the ship channel, which will further mix the treated effluent in the receiving waters.[355]

In contrast, the ED criticizes PAC witness Dr. Esbaugh's testimony that studies, including Dr. Nielsen's, support an acute water quality standard for salinity of 37.7 ppt for the ZID.[356] The ED explains that water quality criteria and effluent percentage limits are not the same.[357] In

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[351] Port Authority Closing Argument at 34.

[352] ED Closing Argument at 7.

[353] Ex. ED-KC-1 Remand at 0014.

[354] ED Closing Argument at 7-8.

[355] ED Closing Argument at 10.

[356] *See* Ex. PAC-45R at 8-9.

[357] ED Closing Argument at 8-10.

particular, mixing zones are allowed at the point of discharge,[358] and water quality criteria for toxic substances do not have to be met at the end-of-pipe where the treated effluent first meets the receiving water.[359] While the specific numerical criteria for toxic substances apply to all water in the state, they may be exceeded in the ZID.[360] The ED notes that the Revised Draft Permit requires the Port Authority to submit sampling data once the Facility commences discharging, and at that time, the ED will perform a full screening analysis and may reopen the permit to include additional monitoring requirements and/or effluent limits.[361]

Considering all these factors, the ED concludes the evidence indicates no more than a *de minimis* change to water quality and that aquatic life will not be significantly impacted by the proposed discharge.[362]

c. PAC's Arguments[363]

PAC argues that much of the Port Authority's evidence and argument can be disregarded as irrelevant to the issues in this proceeding.[364] Given that "significant lethality" is determined by looking at the discharge's impact on organisms that pass through the ZID, PAC argues it is not relevant how many organisms will *not* pass through the ZID. PAC also contends that Dr. Fontenot's opinions on the eggs and adults of marine species, including red drum, are not relevant because those life stages have not been identified as a significant cause of concern.[365] In addition, Dr. Fontenot's exhibits regarding "risk estimation" show modeled salinities at

[358] 30 Tex. Admin. Code § 307.8(b).

[359] 30 Tex. Admin. Code § 307.6(c)(6).

[360] 30 Tex. Admin. Code § 307.6(c)(6).

[361] ED Closing Argument at 9-10.

[362] ED Closing Argument at 10.

[363] The Kings/Steves join in these arguments. Kings/Steves Closing Argument at 1, 3.

[364] PAC Closing Argument at 5-7.

[365] PAC Closing Argument at 8.

84.3 meters from the discharge, which is half the length of the ALMZ, and therefore does not reflect the salinity in the ZID.[366]

When considering what is relevant, PAC asserts the Port Authority's own evidence shows significant lethality.[367] Of the many sources Dr. Fontenot cites, only one reports on the mortality of red drum larvae due to salinity, the Thomas et al. (1989) study.[368] As discussed above in connection with the Port Authority's arguments, the Thomas study identifies the LD50 (where half of subjects died) for red drum larvae spawned at 32 ppt, which PAC asserts is probably the most relevant piece of information from the report because it is most comparable to the circumstances in this case.[369] PAC highlights that the Thomas study found the LD50 for 3-day-old red drum larvae was 33 ppt (1 ppt over spawning salinity). PAC claims Dr. Fontenot omitted this information from his exhibits and additionally failed to consider the following other data regarding mortality from the Thomas study:[370]

- Atlantic croaker larvae (1) had narrower limits for salinity tolerance than fertilized eggs; (2) 3-day-old survival was only high in the range of 10 to 25 ppt; and (3) survival was severely reduced at salinities greater than 30 ppt.
- Half of 3-day-old spotted seatrout larvae, reared at 32 ppt, died at 43 ppt.
- "Salinity limits for no salinity related mortality during the pelagic larval stage spawned in near full strength sea water and reared under optimum temperature conditions" are (1) 15-33 ppt for red drum and Atlantic croaker, and (2) less than 10 to 40 ppt for spotted seatrout.

Significant lethality, PAC argues, was also demonstrated by its witnesses Dr. Stunz, Dr. Nielsen, Dr. Larry McKinney, Dr. Daniel Schlenk, Dr. Esbaugh, and Mr. Holt.[371] Except for

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366 PAC Closing Argument at 9.

367 PAC Closing Argument at 9-11.

368 *See* Ex. PAC-85R (Peter Thomas et al., *Salinity Requirements for Reproduction and Larval Development of Several Important Fishes in Texas Estuaries* (1989)).

369 PAC Closing Argument at 9-10.

370 PAC Closing Argument at 10-11 (citing Ex. PAC-85R at 32, 41, 47-48 (PDF pagination)).

371 PAC Closing Argument at 11-14.

Dr. Schlenk, whose expertise relates to the impact of desalination discharges, these witnesses study the specific waterbody and aquatic species at issue.

Dr. Stunz testified regarding his personal experience transporting early life phases (20-30 days old and younger) of red drum to his research laboratory.[372] He noted that even modest differences between the tanks where they were spawned and the transport coolers could cause up to 100% mortality. To estimate mortality from the Port Authority's proposed discharge, Dr. Stunz assumed mortality of 25% (either immediate or delayed), which would result in 767,552 dead red drum larvae per day on the incoming tide alone.[373] For more abundant species, mortality would be even higher.[374] Dr. Stunz also disagreed that the exposure time for organisms would be brief. He said the outfall area is referred to as "the washing machine" as "it's just so dynamic, so the larvae will be coming in, they'll be going back and forth, they'll be up and down in the water column."[375] He also pointed out that larvae entering the discharge area will be doubly stressed by having to osmoregulate to adjust to the higher salinity, but then also having to osmoregulate again as they exit the area.[376]

PAC witness Dr. Nielsen, as discussed above, conducted salinity toxicity testing on early-life-stage red drum. PAC highlights that she found a NOEC of 35 ppt, LOEC of 37 ppt, and LC50 (death to half of subjects) of 37.7 ppt.[377] According to Port Authority witness Dr. Dean, relevant summer water salinities in the receiving waters are usually below 37.0 ppt. Thus, PAC asserts that an increase of ambient salinity by 2.0 ppt would alter the receiving environment so that summer salinities are normally above the 37.0 ppt level at which Dr. Nielsen observed effects on lethality, and above the 37.7 ppt threshold at which Dr. Nielsen observed death of 50% of the subjects. Furthermore, she testified that larvae and other organisms entering the ZID would also

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372 Ex. PAC-52R at 23.

373 PAC Closing Argument at 12; Remand Tr. Vol. 5 at 1244-48.

374 *See* Ex. PAC-52R GS-2 at 4-5.

375 Remand Tr. Vol. 5 at 1063-65.

376 Remand Tr. Vol. 5 at 1237-39.

377 PAC Closing Argument at 12-13.

be subject to additional stressors, such as varying dissolved oxygen levels, elevated temperatures, intense sunlight, predators, and mechanical forces from waves, wind, and the velocity of the discharge.[378]

The remaining PAC witnesses concurred that significant lethality would be expected from the proposed discharge.[379] Dr. McKinney also noted that the Corpus Christi Bay is already salinity stressed 53% of the time and the addition of 96 MGD of highly concentrated brine will likely lead to a significant decrease in biodiversity within the bay.[380]

Separate from lethal effects, PAC also asserts there will be sub-lethal effects.[381] To support this position, PAC again points to the Thomas study, the Port Authority's own evidence, and the testimony of PAC's experts.[382] PAC notes that the Thomas study indicates salinity extremes significantly impaired all phases of reproduction and larval development examined in spotted seatrout, Atlantic croaker, and red drum.[383] PAC then identifies several findings from the Thomas study indicating various salinity limits for each species.[384] In addition, PAC asserts that Dr. Fontenot's Exhibit EFA 1-3 reflects the following lethality information:

- For spotted seatrout: (1) the LD50 for 3-day-old larvae is 42.5 ppt; and (2) larvae and/or juveniles experienced 100% mortality at 45 ppt and temperatures of 24 and 28 degrees C.
- For Atlantic croaker: (1) the LOEC for eggs and larvae was 45 ppt; and (2) the LD50 for 5-day-old larvae was 33 ppt.

[378] Ex. PAC-48R at 29.

[379] Ex. PAC-46R at 5, 17-19; Ex. PAC-47R at 14; Ex. PAC-50R at 15; Ex. PAC-45R at 6.

[380] Ex. PAC-47R at 14.

[381] PAC Closing Argument at 14-20.

[382] PAC Closing Argument at 17-20.

[383] Ex. PAC-85R at 7 (PDF pagination).

[384] PAC Closing Argument at 17.

- For red drum: (1) for eggs, the best hatch-out and growth rates were at 33-43 ppt; and (2) the LD50 for 3-day-old larvae was 33 ppt.

Under critical conditions, PAC contends the proposed discharge will elevate salinity levels above these ranges.[385]

As to the evidence of PAC's witnesses on sub-lethal effects, PAC notes that Dr. Nielsen found significant effects on body size and eye size of larval red drum exposed to 45 ppt as compared to 40 ppt or lower.[386] Mr. Holt calculated an amount of ambient water (of 30 ppt) required to dilute 96 MGD of discharge (of 60 ppt) down to 40 ppt and lower.[387] To achieve that dilution requires 191 MGD of ambient water, and such water is full of marine organisms.[388] According to Mr. Holt, the 191 MGD of ambient water required to dilute the effluent "could equate to approximately 723,000 red drum larvae during the peak of spawning season, or up to 1.8 million Atlantic croaker larvae, or 32 million shrimp postlarvae."[389]

Dr. Stunz testified regarding the potential for delayed latent mortality, sublethal effects, and compounding multiple stressors affecting the short- and long-term survival of marine organisms.[390] For example, exposure to a toxicant may cause impaired reproduction, inability to avoid predation, or food procurement challenges leading to starvation or reduced growth rate. Dr. Stunz identified "the very low (even zero) dissolved oxygen concentration" in the area of the hole sampled by the Port Authority and turbulence caused by the discharge as multiple stressors that will be present at the outfall that are not accounted for in WET or other similar testing.[391]

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[385] PAC Closing Argument at 18.

[386] Ex. PAC-48R KN-3 at 8.

[387] Ex. PAC-46R at 14.

[388] Ex. PAC-46R at 15.

[389] Ex. PAC-46R at 13.

[390] Ex. PAC-52R at 9.

[391] Ex. PAC-52R at 20-21.

Dr. Esbaugh elaborated on the expected harm that could result from a persistent bottom layer plume of effluent that would reduce oxygen levels. Stratified layers tend to result in lower dissolved oxygen, since aquatic organisms will consume the limited oxygen available within that stratified layer.[392] The Port Authority's water quality data reflected ambient oxygen levels of approximately 35% saturation.[393] Dr. Esbaugh testified that declines below 35% could be damaging to local wildlife, including fish, bivalves (i.e., oysters), and crabs, by causing hypoxia.[394]

In contrast, PAC argues the Port Authority did not properly evaluate adverse impacts from salinity.[395] It is not enough, PAC contends, for the Port Authority to show, as Dr. Fontenot testified, that natural background salinities in the water fluctuate greatly on a seasonal basis and that the estuarine species have adapted to survive and thrive with constantly changing salinity levels.[396] By definition, estuarine-dependent species can tolerate changing salinity levels. This fact, however, does not address data indicating that salinity levels in the area are rising, such that small increases could add further pressure to a system that is already experiencing salinity stress.[397] In addition, the capacity of a species to tolerate a range of conditions does not mean that an abrupt change within that range will not kill or otherwise harm an individual organism.[398]

PAC also criticizes the Port Authority's focus on exposure duration. Laboratory testing that evaluates durations of 24 (or 48 or 72) hours cannot be discounted, PAC argues, simply because expected real-world durations may be shorter. According to PAC, such a standard would be impossible to apply with any measure of confidence. Further, Dr. Esbaugh explained why the regulations do not work that way for any toxicant:

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[392] Ex. PAC-45R at 14.

[393] Ex. PAC-45R at 14.

[394] Ex. PAC-45R at 15.

[395] PAC Closing Argument at 14-17.

[396] PAC Closing Argument at 14-15; *see* Ex. APP-LF-1-R at 28.

[397] PAC Closing Argument at 15.

[398] PAC Closing Argument at 15-16.

> [T]here's a lot of uncertainty about what exactly exposure duration is, and it's also very hard to assess what the significance of exposure duration is at different developmental time points. So, for example, one hour at one development stage is very different than one hour at another developmental stage. That is why, in general, the water quality standards procedures avoid this entire issue by advocating for set duration testing that applies to acute tests, chronic tests, and of course, the human – human mixing – human health mixing zone. . . . If you were meant to, say, draw analogies to copper or aluminum or any of the other toxicants that were in the permit. There's no discussion of exposure duration, and that's because the water quality standards effectively exclude that.[399]

As a result, PAC advocates that the Port Authority's arguments about exposure times be disregarded.[400]

d. OPIC's Arguments

OPIC focuses on two topics related to adverse impacts. First, OPIC addresses multiple stressors and latent mortality.[401] PAC witness Dr. Stunz testified that a major shortcoming of WET testing is its failure to consider the multitude of challenges an organism faces in the wild, in addition to an abrupt change in salinity.[402] Multiple stressors can then contribute to latent mortality, which occurs when an organism does not die directly after exposure, but dies later due to an effect of the exposure.[403] Because WET testing cannot account for multiple stressors or latent mortality, OPIC concludes that information gathered from such testing should be considered a conservative estimate of potential harm resulting from the discharge.

The second topic OPIC raises is the potential adverse impact to benthic organisms, which are organisms living along the channel floor.[404] Port Authority witness Dr. Fontenot testified that, due to dredging of the Corpus Christi Ship Channel, there was a "disturbed benthic community,"

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399 Remand Tr. Vol. 8 at 1955-56, 1972; *see also* Ex. PAC-45R at 10.

400 PAC Closing Argument at 17.

401 OPIC Closing Argument at 14-16.

402 Ex. PAC 52R at 10-11.

403 OPIC Closing Argument at 14.

404 OPIC Closing Argument at 16-18.

but nevertheless, that benthic organisms residing there would not be adversely affected because effluent would be rapidly dispersed along the lower water column of the channel.[405] However, PAC witness Dr. Stunz disagreed that the ship channel represents a disturbed benthic community, noting that birds that feed on benthic infauna are in those areas, so "by definition, it's functioning at some level in the ecosystem."[406] Dr. Socolofsky, Dr. McKinney, and Dr. Esbaugh also raised concerns that an accumulation of brine on the channel floor and associated drops in dissolved oxygen levels could harm benthic organisms.[407] OPIC concurs with PAC regarding potential impacts for benthic organisms.

Given these concerns, OPIC concludes the Port Authority has not carried its burden of proof on this issue.

e. Pro Se Group's Arguments

The pro se group concludes that the Port Authority has failed to show there will not be harm to aquatic life from the proposed discharge. The pro se group raises similar concerns to those of PAC and OPIC above, but highlights the "washing machine" effect that Dr. Stunz identified around the confluence of the channels, and points out that, although slack tides may be as short as 10 or 15 minutes, they can also last for several hours, as Dr. Stunz and Mr. Holt testified.[408] In addition, the pro se group raises concerns about the water exchange rate in the Corpus Christi Bay system of only 1.4 years, as well as the possibility that an increase in salinity could contribute to red tide outbreaks.[409] The group also emphasizes that Harbor Island is not an industrialized area.[410]

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[405] Ex. APP-LF-1-R at 29, 77.

[406] Remand Tr. Vol. 5 at 1256.

[407] Remand Tr. Vol. 7 at 1659; Ex. PAC-47R at 12; Remand Tr. Vol. 8 at 1997-98.

[408] Pro Se Group Closing Argument at 3, 5.

[409] Pro Se Group Closing Argument at 5-6.

[410] Pro Se Group Closing Argument at 12-13.

4. Lack of Permit Limit for Salinity

PAC and the Kings/Steves contend that, if a permit is issued, it should include a limit on salinity.[411] They note that TPWD and GLO recommend a standard for marine seawater desalination discharges that "limit[s] salinity increases at the mixing zone boundary to no more than 5% (or an absolute increment of 2 [ppt], whichever is less) of that occurring naturally in the waters around the discharge."[412] TPWD and GLO recommend applying this standard 100 meters from the discharge. PAC witness Dr. Schlenk testified that most international standards use such a 2.0 ppt/5% limit on the increase in salinity to protect marine species.[413] A 2.0 ppt limit is further supported by two Port Authority witnesses, Dr. Jones, who has argued in another permitting case that the 2.0 ppt standard is actually too high,[414] and Dr. Knott, who agreed that the 2.0 ppt standard was a "sound and scientifically based standard."[415] In addition, ED witness Mr. Schaefer agreed that including a salinity limit in the permit would be more protective.[416]

When considering what level of salinity increase is consequential, PAC criticizes Port Authority witness Dr. Fontenot for relying on the 4.0 ppt (or 10% increase) standard set forth in EPA's "Gold Book."[417] PAC notes that the book's ten pages on salinity touch on estuarine

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411 PAC Reply at 46; Kings/Steves Closing Argument at 3-5. As ED witness Ms. Gibson testified, the effluent percentage limit in the Revised Draft Permit does not limit the salinity of the discharge:

> The facility would be limited on how much saline water it could discharge but it would not be limited on the salinity of the discharge and the facility could discharge any saline concentration and still comply with its permit. The percent effluent at the edge of the mixing zone would be limited. (e.g., no matter the saline concentration of the effluent, it could not comprise more than 14.6% of the water at the edge of the ZID).

Ex. ED-SG-1 Remand at 0024.

412 Ex. PAC-7 (TPWD/GLO, *Marine Seawater Desalination Diversion and Discharge Zones Study* (Sept. 1, 2018)) at 5; Ex. PAC-37 (TPWD comment letter (Aug. 24, 2018)) at 2.

413 Ex. PAC-50R at 14.

414 Ex. PAC-78R at 10.

415 Remand Tr. Vol. 4 at 956.

416 Remand Tr. Vol. 9 at 2381.

417 PAC Closing Argument at 8; Ex. APP-LF-1-R at 55; *see also* Ex. PAC-86R (EPA, *Quality Criteria for Water 1986* (May 1, 1986) at Bates 041912-041920.

species only briefly, citing to a 1953 paper and 1968 NTAC report.[418] In addition, the 4.0 ppt "variation permitted" is linked to natural salinity of 13.5 to 35 ppt to protect "desirable food plants and other habitat-forming plants,"[419] which do not exist near the outfall. Nevertheless, PAC asserts that even that standard is exceeded in the ED's modeling results, which show salinity at the edge of the ZID will increase as much as 4.11 ppt in some cases and 12% in others.[420]

Consequently, PAC argues that, based on the ED's modeling, the Revised Application would have to be denied if the TCEQ adopted the 2.0 ppt standard.[421] To illustrate the alleged exceedances, PAC overlaid the 2.0 ppt limit on Dr. Fontenot's Exhibit RE 1-1, which compares various CORMIX modeling predictions of the salinity increase (measured in ppt) over ambient conditions to the 4.0 ppt standard identified in the EPA's Gold Book.[422]

The Kings/Steves contend that the 2.0 ppt standard would have been met if the proposed discharge had been able to meet the initial targets contained in the Original Application (2.5%, 1.5%, and 1.0% at the ZID, ALMZ, and HHMZ, respectively). However, they similarly point to the ED's modeling as showing exceedances, including a 2.5 ppt increase in salinity concentrations at the ALMZ, which is somewhat closer to the proposed discharge that the 100-meter distance proposed by TPWD and GLO. In addition, the modeling shows salinity levels may reach 43.07 ppt as far out as the ALMZ boundary when the ambient water is already at 40.57 ppt.[423]

The Port Authority responds by first noting that PAC has asked that the Revised Draft Permit include some of the requirements from the Carlsbad Desalination Plant NPDES Permit No. CA0109223 (Carlsbad Permit).[424] The Carlsbad Permit contains a salinity limit of 2.0 ppt

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[418] NTAC refers to the National Technical Advisory Committee to the Secretary of the Interior.

[419] Ex. PAC-86R at Bates 041917.

[420] Ex. PAC-65R.

[421] PAC Closing Argument at 44.

[422] PAC Closing Argument at 10; *see also* Ex. APP-LF-1-R at Ex. RE 1-1.

[423] Ex. Kings/Steves-21R, line 19 (S_50_b_95).

[424] Port Authority Reply at 44.

above ambient measured at *200 meters*.[425] According to the Port Authority, the modeling that it and the ED conducted shows that in all cases, under all conditions, the effluent plume is below 2.0 ppt above ambient before 200 meters from the discharge.[426] Additionally, only the worst-case conditions modeled (the 50% recovery cases at 95th percentile salinity) did not meet the 2.0 ppt within 100 meters. In all cases run with the facility operating at 40% recovery, even those at the 95th percentile salinity, the change in salinity was below 2.0 ppt above ambient at 100 meters from the diffuser. For the 95th percentile salinity at 50% recovery they were at 2.32 ppt above ambient at 100 meters and 2.0 ppt above (at the centerline) by less than 140 meters. According to the Port Authority, during average fall conditions, at 50% recovery the plant operation essentially meets the 2.0 ppt above ambient at 100 meters.[427]

The Port Authority also contends that PAC has misapplied the EPA Gold Book standard when it asserts that a 4.11 ppt increase *at the ZID* would violate the 4.0 ppt standard.[428] The 4.11 ppt is a calculated salinity increase over ambient for a specific location (at the edge of the ZID), while the 4.0 ppt Gold Book standard is a more general standard that does not define a specific distance for evaluation. In the Port Authority's view, there is no reason to believe the EPA Gold Book standard was intended to apply at a specific location only 28 meters from the point of discharge. Instead, it argues, context indicates the standard is intended as authority that a 4.0 ppt salinity gradient is generally protective of marine life.

Similarly, the Port Authority alleges that PAC's overlay of the TPWD/GLO 2.0 ppt standard on Dr. Fontenot's Exhibit 1-1 is misleading because the scales differ.[429] Dr. Fontenot's exhibit showed CORMIX modeling runs predicting salinity concentrations at 84.3 meters from the diffuser, whereas TPWD/GLO proposed applying the 2.0 ppt standard at 100 meters. Moreover,

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[425] Ex. Kings/Steves-11R at 14 ("The discharge shall not cause or contribute to an exceedance of 2.0 parts per thousand (ppt) above natural background salinity throughout the water column, measured at a point 200 meters from the end of the discharge channel.").

[426] Port Authority Reply at 44-45 (citing Ex. APP-KD-9-R; Ex. App-KD-10-R; Ex. APP-41-R).

[427] *See* Ex. APP-RP-18-R (50% recovery at median salinity plume centerline at 100 meters is 2.07 ppt above ambient).

[428] Port Authority Reply at 8.

[429] Port Authority Reply at 12-15.

the Port Authority emphasizes that the TPWD/GLO standard is not Texas law, but rather a *proposed* standard more strict than is even applied in California, as shown by the Carlsbad Permit.[430] For a 2.0 ppt standard to be properly considered, the distance from the proposed discharge must be included. Citing other state and international standards, the Port Authority states that a 2.0 ppt limit might be properly applied at distances of 100 meters,[431] 120 meters,[432] 200 meters,[433] or 300 meters.[434]

5. Impact on Birds and Endangered and Threatened Species

ED witness Mr. Schaefer testified that no federal endangered or threatened species are found in the watershed, apart from the piping plover.[435] The ED states that, although the piping plover is found in the area, EPA review is only required for applications for petroleum facilities.[436]

Audubon raises concerns about the proposed discharge's potential to indirectly impact birds, including one endangered species (whooping crane) and one threatened species (piping plover).[437] Audubon contends the Port Authority used an overly constrained definition of the project area when considering impacts to birds. In particular, Dr. Fontenot looked solely at direct impacts, concluding that no impacts would occur because the effluent will be "60+ feet below the surface" and "out of reach for birds foraging and nesting in the shallow habitats elsewhere in the Nueces estuary."[438] Yet, according to Audubon, Dr. Fontenot failed to consider potential "cascading effects" that could occur if the discharge negatively impacts the organisms that birds

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[430] *Compare* Ex. PAC-7 (TPWD/GLO Study) at 18 *with* Ex. Kings/Steves-11R (Carlsbad Permit) at 14.

[431] Ex. PAC-7 (TPWD/GLO Study).

[432] Ex. PAC-50R DS-2 at 14 (Gold Coast, Australia permit sets performance limit of gradient no more than 2 ppt at 120 meters).

[433] Ex. Kings/Steves-11R (Carlsbad Permit) at 14.

[434] Ex. PAC-50R DS-2 at 14 (Oman permit sets performance limit of gradient no more than 2 ppt at 300 meters).

[435] Ex. ED-PS-1 at 0032.

[436] ED Closing Argument at 10-11; Ex. ED-PS-1 at 0032; Ex. ED-1 Remand at 22.

[437] Audubon Closing Argument at 1.

[438] Ex. APP-LF-1-R Rebuttal at 37-38.

forage on.[439] In particular, he did not consider key species, such as blue crab, that are foundational to the diets of endangered and threatened birds.[440] Audubon also asserts that Dr. Fontenot failed to follow the methodology for ecological risk assessment he purportedly applied because he did not more broadly consider effects on marine/estuarine-dependent populations, communities, or ecosystems.[441]

Audubon also considers the ED's review insufficient. While the ED looked at a broader impact area than the Port Authority by considering the critical habitat unit for piping plover, the ED still concluded there would be no impacts on the basis that the discharge is not a petroleum discharge. Audubon notes, however, that the IPs state a petroleum discharge south of Copano Bay necessarily triggers a screening for the piping plover, but they otherwise allow discretion in applying the screening.[442]

The Port Authority responds by first noting that Audubon has not cited any evidence of *direct* impacts and that, as Dr. Fontenot testified, none would be expected,.[443] As to *indirect* impacts, the Port Authority contends that Audubon ignores the evidence regarding no significant lethality to aquatic organisms in the ZID, as well as Dr. Fontenot's testimony specifically addressing blue crab, the food source for whooping crane.[444] According to the Port Authority, if there is no significant lethality in the ZID, there will be no significant loss of food sources, and thus, no adverse impact, whether direct or indirect, as a result of the Facility.[445]

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[439] Audubon Closing Argument at 7.

[440] Audubon Closing Argument at 18-19.

[441] Audubon Closing Argument at 8-10, 20-21.

[442] Audubon Closing Argument at 16; Ex. ED-1 Remand at 22.

[443] Port Authority Reply at 26.

[444] Ex. APP-LF-1-R at 27-47.

[445] Port Authority Reply at 26.

6. ALJs' Analysis

The parties do not dispute that the Corpus Christi Ship Channel provides a conduit for estuarine-dependent marine species, such as red drum, to move from the Gulf of Mexico to their nursery grounds in the estuaries, thereby sustaining their life cycles. While the Port Authority emphasizes on remand that, for organisms entering the Aransas Pass inlet, the ship channel is only one of three pathways to the estuaries, studies indicate that up to half of the larvae entering the inlet will use the ship channel to make that journey.[446] Therefore, it plays an important role in sustaining populations of estuarine-dependent marine species, and the evidence continues to support the conclusion that the Port Authority's proposed discharge site is in a sensitive area.

The evidence also continues to establish that high salinity or saline imbalances can be fatal to aquatic life, particularly early life stages. The focus on remand has generally been on what salinity concentrations and exposure times begin to produce adverse effects.

A significant amount of data on the sensitivity of aquatic organisms to salinity was presented. In theory, the analysis for determining whether the proposed discharge will result in adverse impacts to aquatic life should be a simple exercise of comparing the data on acceptable salinity ranges for aquatic organisms with the predicted salinity concentrations produced by the modeling. However, as discussed in connection with the modeling, there will necessarily be some variation between what the CORMIX model predicts and the actual discharge due to schematization. Similarly, the reliability and relevance of the data regarding the impact of salinity on aquatic life depends on what specifically was being studied, as well as the study methods.

To inform the analysis of this issue, the Port Authority and PAC each conducted laboratory toxicity testing. The Port Authority's testing was criticized for using mysid shrimp and inland silverside because they are less sensitive to salinity than other species in the ship channel and are not estuarine dependent. However, both species have been approved by the EPA and TCEQ for use in WET testing because they are generally representative of other species, and therefore, it was

[446] Remand Tr. Vol. 6 at 1403-04.

reasonable for the Port Authority to test them here. Even so, the evidence demonstrated that red drum are more sensitive than these species, particularly in the early life stages.[447] As a result, such testing may not be representative of the impacts on more sensitive species or earlier life stages. Thus, the ALJs find that, although the Port Authority's testing provides relevant information, it is not definitive.

As to Dr. Nielsen's toxicity testing, the ALJs begin by addressing the legal argument that it cannot be considered because her laboratory is not an accredited "environmental testing laboratory."[448] Based on the plain language of the relevant statute, the ALJs agree with PAC and OPIC that the accreditation requirement does not apply because Dr. Nielsen was not analyzing the components of environmental media.[449] Moreover, a broader reading of the accreditation requirement would preclude consideration of much of the peer-reviewed literature in the evidentiary record in this case, which would hinder the Commission's ability to assess the potential impacts of the Port Authority's proposed discharge.

Regarding the substance of Dr. Nielsen's testing, the ALJs find that using red drum was appropriate, as it is an estuarine-dependent species that relies on the Corpus Christi Ship Channel and is known to have early life stages that are sensitive to salinity changes. The Port Authority generally criticizes Dr. Nielsen for not following EPA WET testing methods when conducting her LC50 testing for Test 3. The ALJs find that many of these deviations were adequately explained (e.g., the need to use a 72-hour testing period), but others were not. Most notably, in 18 of the 44 test replicates, the salinity in the test chambers varied between water change times (occurring each 24 hours) by more than 1 ppt, including a replicate intended to test an exposure of 45 ppt that was

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[447] Ex. PAC-52R at 26; Ex. PAC-48R at 19-20. The Port Authority contends the Pillard et al. (1998) study on mysid shrimp and inland silverside shows they are "roughly equivalent" to red drum. However, this study is not in the record, and PAC cites a portion of the study that calls into question whether such a conclusion is accurate. *See* PAC Reply at 9. Therefore, the ALJs find that a sufficient basis has not been provided for relying on the study.

[448] *See* Tex. Water Code § 5.134(a).

[449] *See* Tex. Water Code § 5.801 (defining "environmental testing laboratory" as "a scientific laboratory that performs analyses to determine the chemical, molecular, or pathogenic components of environmental media for regulatory compliance purposes.").

at 50 ppt.[450] Given that the test was evaluating increments of 2 ppt of salinity, it is not clear why variations of more than 50% were sufficient quality control. The temperature variations and supersaturated dissolved oxygen levels the Port Authority points out are also concerning. Further, the salinity in the Corpus Christi Bay system naturally varies from 28 to 42 ppt,[451] which casts some doubt on Dr. Nielsen's results of a NOEC of 35 ppt, LOEC of 37 ppt, and LC50 (death to half of subjects) of 37.7 ppt. Therefore, the ALJs do not find the results of the LC50 testing for Test 3 sufficiently reliable to infer that 37.7 ppt of salinity will result in significant lethality of larval organisms. The parties have not raised any concerns regarding Dr. Nielsen's LT50 testing, and the ALJs consider the results of that testing reliable.

In addition to the parties' laboratory testing, a few peer-reviewed studies were introduced. Among these studies, the parties emphasize different results. PAC focused on the finding in the Thomas et al. (1989) study of an LD50 of 33 ppt for 3-day-old larvae as an indication that a 1 ppt increase over spawning salinity could result in significant lethality.[452] However, the result for 3-day-old larvae appears to be an outlier when considering the data for younger and older larvae.[453] While Dr. Nielsen testified that red drum larvae are particularly sensitive at this stage,[454] she also noted that one of the difficulties of running a test on early-life-stage red drum for longer than 72 hours is that they require feeding, which could introduce a confounding variable as seen in the Thomas study.[455] Thus, while the Thomas paper provides valuable data, the ALJs find the specific result for 3-day-old larvae is not sufficiently reliable to conclude that a 1 ppt change will cause significant lethality.

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[450] Remand Tr. Vol. 9 at 2190-91; *see also* Ex. APP-KD-19-R, "Survival" tab.

[451] Ex. APP-56R at 11.

[452] Ex. APP-LF-1-R at Ex. EFA 1-3, page 2 of 3.

[453] *See* Ex. PAC-85R at 68 (PDF pagination), Fig. 19.

[454] Remand Tr. Vol. 9 at 2164-65.

[455] Remand Tr. Vol. 8 at 2119.

The Port Authority highlighted Kesaulya et al. (2018),[456] Robertson et al. (1988),[457] and Stunz et al. (2015).[458] Kesaulya and Robertson studied early life stages of red drum, and the referenced report by Dr. Stunz broadly indicated that the Corpus Christi Bay system's salinities naturally vary from 28 to 42 ppt. The salinity ranges the Port Authority cites from Kesaulya and Robertson relate to red drum eggs, rather than larvae. Kesaulya showed eggs can hatch within a wide range of salinities with best hatch-out and growth rates occurring between 33 to 43 ppt, and Robertson showed no effect at 45 ppt, but a significant effect at 60 ppt. PAC witness Dr. Nielsen persuasively explained why 3- to 5-day-old larvae would be more sensitive to salinity changes than eggs,[459] but the ALJs nevertheless find the studies relevant given that they tested the specific species the parties have focused on here, and red drum eggs will be found in the channel (albeit in lesser numbers than larvae).

While there was some debate about whether red drum is the *most* sensitive species found in the ship channel, it was undisputed that its early life stages are sensitive to salinity changes, and therefore, the ALJs find that red drum is reasonable to use as a surrogate for impacts more broadly. PAC's closing arguments identify data points from the Thomas study indicating that Atlantic croaker and spotted seatrout larvae are also sensitive to salinity changes,[460] but the Port Authority responded with other data points from the Thomas study indicating they are not as sensitive as PAC claims.[461] Because the focus in this proceeding has been on red drum, there is little context in the record regarding this data, and the ALJs therefore give it little weight.

When considering red drum, the evidence indicates that the primary concern is a narrow window of their life cycle, particularly 3-day-old, and possibly up to 5-day-old, larvae.[462] The parties do not dispute that adults and juveniles successfully tolerate significantly high salinities, as

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[456] Ex. APP-55R.

[457] Remand Tr. Vol. 8 at 2066-73.

[458] Ex. APP-56R at 11.

[459] Remand Tr. Vol. 9 at 2164-65.

[460] PAC Closing Argument at 10-11.

[461] Port Authority Reply at 15-17.

[462] *See* Ex. PAC-85R at 68 (PDF pagination), Fig. 19; Remand Tr. Vol. 9 at 2164-65.

shown by those living in the Laguna Madre at salinities exceeding 60 ppt. In addition, PAC indicates that red drum *eggs* are also not a significant concern.[463] Due to the estuarine-dependent life cycle of red drum, the ALJs find that the concern for 3-day-old larvae is justifiable. The Port Authority's claims that these larvae would not ultimately settle in the estuaries anyway because they are precompetent is unfounded. The evidence shows that red drum eggs are spawned near the mouth of the Aransas Pass inlet, and the tidal currents move them through the channels to the estuaries. Thus, it is logical that the larvae closest to the inlet would be younger than those that have made it to the estuaries, where at that point they would need to be competent to settle.

While the Port Authority emphasizes that an adequate zone of passage exists such that most organisms will not experience any exposure, the ALJs find that the analysis must address the impact to organisms that move through the ZID because the significant lethality standard applies to exposures *within* the ZID.

In assessing impacts in the ZID, the parties dispute whether real-world exposure times may be considered. The Port Authority argues that most organisms will not be exposed at all, and for those that are, exposure times will be much shorter than used in the various studies—thus, the study results should be considered a conservative estimate of potential impacts. On the other hand, PAC contends exposure times cannot be considered, noting that the TSWQS for other toxicants like copper and aluminum do not look at shorter exposure times.[464] However, while shorter durations are not considered in WET testing, the ALJs conclude that real-world exposure times do not have to be ignored when assessing whether the Facility can operate in a protective manner. The Revised Draft Permit includes a requirement for WET testing, and thus, the Port Authority will still have to ensure its effluent can comply with the longer timeframes used for acute and chronic toxicity testing.

The record shows that exposure times will be longest during slack tide conditions, but still on the order of seconds and minutes, rather than hours. While some evidence indicates that slack

[463] PAC Closing Argument at 8.

[464] Remand Tr. Vol. 8 at 1955-56, 1972; *see also* Ex. PAC-45R at 10.

tides may occur more frequently or for longer periods than the Port Authority estimated, the ALJs conclude the Port Authority demonstrated that exposure times to the highest concentration of salinities in the ZID will be brief. In addition, although eggs and larvae may be somewhat mixed within the water column, the evidence showed they are more concentrated in the upper portion of the water column due to their buoyancy, thereby further limiting their exposure to the discharge, which will be approximately 60 feet below the surface.

However, concerns were also raised about the abruptness of the change in salinity that organisms would experience. The parties' laboratory testing specifically evaluated this issue. The Port Authority's acute toxicity testing provided a two-minute "shock" exposure to mysid shrimp and inland silverside and showed no impact at 55 ppt, the highest salinity tested. In contrast, Dr. Nielsen's two LT50 tests showed lethality when exposing red drum larvae to 68.7 ppt after 4 and 10 minutes, respectively. Given that the ED's modeling runs show salinity as high as 68.7 ppt at the ZID and that red drum larvae, which are particularly sensitive to salinity changes, showed mortality after relatively brief exposures to that level of salinity, the evidence shows that some mortality could occur due to abrupt changes.

The risk of abrupt changes in salinity due to desalination discharges is an issue that other states and countries have already considered in evaluating adverse impacts to aquatic life. They address this concern by setting limits on the change in salinity over ambient, generally a limit of a 2.0 ppt increase at some distance measured from the outfall. While the TSWQS have not set numeric criteria for salinity, they do require that salinity gradients in estuaries "be maintained to support attainable estuarine dependent aquatic life uses" and that careful consideration "be given to all activities that may detrimentally affect salinity gradients."[465] The Revised Draft Permit does not currently contain any limit on salinity.[466] Without such a limit, the ALJs conclude that the preponderance of the evidence does not demonstrate the Revised Draft Permit would ensure compliance with the narrative criteria for salinity quoted above. Imposing such a limit would

[465] 30 Tex. Admin. Code § 307.4(g)(3).

[466] Ex. ED-SG-1 Remand at 0024.

address the adverse impacts to aquatic life of abrupt changes in salinity, as well as address the uncertainty discussed above regarding the modeling results.

The question then is what limit is appropriate. Citing other state and international standards, the Port Authority states that a 2.0 ppt limit might be properly applied at distances of 100 meters,[467] 120 meters,[468] 200 meters,[469] or 300 meters.[470] Because the parties' arguments have generally been targeted at either granting or denying the Revised Application in its entirety, there has been little discussion about these various distances. In closing arguments, PAC and the Kings/Steves contend that, if the permit is issued, it should contain a 2.0 ppt limit at 100 meters, as recommended by TPWD and GLO. However, the Port Authority points out that PAC has sought other permit limits from the Carlsbad Permit issued in California, which sets a 2.0 ppt limit at 200 meters. Given the importance of the proposed discharge site for estuarine-dependent species and the likelihood that the more sensitive early life stages of such organisms will encounter the discharge, the ALJs conclude that the more conservative distance of 100 feet is warranted and is further supported by the recommendation of TPWD and GLO. The Port Authority represents that, based on the modeling, the Facility meets this standard under all conditions modeled when operating at 40% recovery.[471] In addition, for 50% recovery, it meets that standard under all conditions except the worst case modeled (95th percentile salinity).

Finally, the Commission's remanded issue also references impacts to birds and endangered or threatened species. The primary concern here is the potential for impacts to aquatic life to have "cascading effects" on birds, including the endangered whooping crane and threatened piping plover. However, because the ALJs conclude the discharge will not adversely impact aquatic life if an appropriate limit on salinity is imposed, they likewise conclude that birds, including the threatened and endangered birds, will not be adversely impacted.

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[467] Ex. PAC-7 (TPWD/GLO Study).

[468] Ex. PAC-50R DS-2 at 14 (Gold Coast, Australia permit sets performance limit of gradient no more than 2 ppt at 120 meters).

[469] Ex. Kings/Steves-11R (Carlsbad Permit) at 14.

[470] Ex. PAC-50R DS-2 at 14 (Oman permit sets performance limit of gradient no more than 2 ppt at 300 meters).

[471] Port Authority Reply at 44.

Accordingly, after considering the evidence and argument, the ALJs conclude that, with the addition of a permit limit of 2.0 ppt at 100 meters from the proposed discharge, the Port Authority has met its burden to prove that the proposed discharge will not adversely impact the marine environment, aquatic life, and wildlife, including spawning eggs and larval migration.

E. Whether the proposed discharge will adversely impact recreational activities, commercial fishing, or fisheries in Corpus Christi Bay and the ship channel. (Issue C)

As in the Initial Proceeding, all of the parties directly addressing this issue rely in part on their analyses presented under Issue A.

The Port Authority asserts that, because the proposed discharge will not adversely impact the marine environment, as a natural consequence, it also will not impact recreational activities, commercial fishing, or fisheries in Corpus Christi Bay and the ship channel.[472] Mr. Palachek testified that the "TSWQS were developed to be protective of aquatic organisms and human health through water consumption, fish consumption, recreational uses, including swimming, fishing, etc. They are also protective of all designated uses established for each water quality segment."[473] Moreover, it is undisputed that the diffuser will be more than 60 feet below the water surface and therefore will not interfere with boating or other surface water uses of the ship channel.

The ED cites Mr. Schaefer's antidegradation review as supporting that there will not be an adverse impact.[474] Mr. Schaefer's Tier 2 review determined that no significant degradation of water quality is expected in Corpus Christi Bay, and his Tier 1 review determined the permit will not impair primary contact recreation, exceptional aquatic life use, oyster waters, or existing water uses.[475] Mr. Schaefer also testified that an ample zone of passage exists to allow a vastly greater proportion of the organisms passing by to avoid the ZID in waters that are essentially at

[472] Port Authority Closing Argument at 44.

[473] Ex. APP-RP-1-R at 27.

[474] ED Closing Argument at 11-13.

[475] Ex. ED-PS-1 Remand at 0022.

background concentrations.[476] Additionally, due to water currents and the velocity of effluent coming out of the diffuser, "there are physical limitations to the number of organisms that could occupy the ZID space," which the ED asserts further demonstrates the limited impact the permit will have on fisheries.[477]

PAC highlights the testimony of its witnesses regarding potential adverse impacts on fisheries.[478] PAC witness Dr. McKinney testified that the reproductive activity that occurs in the Aransas Pass tidal inlet in one of the most important factors in maintaining healthy and productive populations of red drum, spotted seatrout, sheepshead, black drum, and southern flounder.[479] Harbor Island is adjacent to the Redfish Bay State Scientific Area, which Dr. McKinney testified contains examples of every major type of Texas coastal habitat important to recreational and commercial fisheries and is central to sportfishing economies in the Coastal Bend.[480] PAC witness Dr. Stunz testified that marine fisheries are driven by year class strength, and if one year is impaired, it can be catastrophic.[481] Similarly, Dr. Nielsen explained that the sudden reduction in the number of red drum larvae that successfully reach the seagrass beds in any given year would mean lower adult fish numbers available to fishermen three to five years later.[482] Fewer adults means fewer successful spawns the next year, further depressing fish populations through a series of feedbacks. She testified that, because red drum are long lived, adverse impacts to seasonal recruitment of the young can impact the health of fisheries for years, as occurred due to the Deepwater Horizon oil spill where the red drum population is not expected to recover until 2053. Dr. Nielsen also testified that Texas has a $3.2 billion recreational fishing industry, two thirds of which comes from red drum and speckled seatrout fisheries, both of which are estuarine-dependent species in the Coastal Bend area.[483]

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476 Ex. ED-PS-1 Remand at 0010.

477 Ex. ED-PS-1 Remand at 0014.

478 PAC Closing Argument at 20-22.

479 Ex. PAC-47R at 14-15.

480 Ex. PAC-47R at 15.

481 Remand Tr. Vol. 5 at 1234-35.

482 Ex. PAC-48R at 10.

483 Ex. PAC-48R at 9-10.

OPIC states that, because aquatic species such as red drum, blue crab, and benthic organisms will be adversely impacted by the proposed discharge, recreational activities dependent on healthy populations of such species, including fishing and birding, will also be negatively impacted.[484]

The pro se group is also concerned about potential impacts to fisheries, noting that Redfish Bay adjacent to the proposed discharge site is the primary bay for larval recruitment and survival that supports fish populations for the surrounding bay systems.[485]

The ALJs find that, because the discharge will not adversely impact aquatic life if an appropriate limit on salinity is imposed, there will not be resulting adverse impacts to fishing or fisheries. Accordingly, the ALJs conclude that with the addition of a permit limit of 2.0 ppt over ambient at 100 meters from the proposed discharge, the Port Authority has met its burden to prove that the proposed discharge will not adversely impact recreational activities, commercial fishing, or fisheries in Corpus Christi Bay and the ship channel.

F. Whether the Application, and representations contained therein, are complete and accurate. (Issue D)

In its closing arguments, PAC argues that the Revised Application was incomplete and its representations inaccurate. In particular, it raises the following as issues:

1) no sponsoring witness swore to the Revised Application's completeness or accuracy at hearing;

2) the ED only verified some of the information in the Application but otherwise relied on the applicant to provide correct information;

3) the Revised Application did not accurately provide the channel depth at the outfall;

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[484] OPIC Closing Argument at 18-20.

[485] Pro Se Group Closing Argument at 7-9.

4) the Revised Application was inconsistent in the location of the outfall and contained errors;

5) the Port Authority's sampling did not comply with 30 TAC § 307.9(b); and

6) the Revised Application was flawed because no sediment sampling was performed.[486]

The Kings/Steves separately argue that the Port Authority has hidden or failed to disclose the changing velocities in the flow near the discharge point. They also argue that the Port Authority's position that there is no eddy is incorrect, which in turn makes the data it presented inaccurate.

OPIC contends that the Revised Application is deficient because the exact latitude and longitude of the discharge location remains unknown and there may be effects on the CORMIX results from the lack in certainty. Additionally, OPIC argues that because there is a dispute about whether the facility is considered a major facility or a minor facility, "there is too great a risk in issuing a permit that may not be viewed as valid by the EPA." OPIC also argues that the Application is incomplete because it does not specify the chemicals that will be used in the desalination process.

In general, the Port Authority emphasizes the changes it made to the Original Application when it submitted the Revised Application and the amount of data it provided to the TCEQ following those changes. It points out testimony confirming the completeness of the Revised Application and argues that it provided more information, including a detailed bathymetry, than was required. It also argues that many of the items PAC indicates are missing do not, in fact, need to be part of an application. The Port Authority argues that Protestants are attempting to say that minor differences in the diffuser location are significant issues, but their own expert shows that those differences do not impact modeling.

[486] Protestants also allege inaccuracies in the Application related to the modeling inputs, which are addressed above in connection with the modeling.

1. Absence of Sponsoring Witness and Verification

Although PAC acknowledges that the Application is signed by an authorized person, it argues that the Port Authority failed to have a sponsoring witness who was willing to swear to its completeness or accuracy at hearing. PAC also argues that Mr. Schaefer, who works for the TCEQ, was unwilling to testify under oath that the information in the Application was complete or accurate.

The ALJs note that contrary to PAC's arguments, there is no requirement that a witness individually swear to completeness of the Application when sponsoring it as an exhibit.[487] Additionally, Port Authority witnesses, although not Port Authority officers or employees, testified that the Application was complete.[488] The ALJs are unclear on the significance of PAC's assertion that it was notable that Mr. Schaefer, an ED witness who was in charge of doing work related to part of the Application, only testified that the Revised Application contained what he needed for his review.[489] But to the extent that PAC complains about the lack of an ED witness testifying to the completeness of the Revised Application, Ms. Gibson did just that, testifying "[t]o the best of my knowledge the application, as amended, and the representations in the application are complete and accurate."[490]

Alternatively, PAC's argument about ED testimony could be viewed as part of its argument that the ED staff cannot possibly know whether the representations are complete and accurate because they do not verify every one of them. The ALJs agree that the testimony supports PAC's assertions that ED staff did not verify the accuracy of all the information in the Revised Application.[491] PAC has not, however, pointed to a requirement that staff verify every representation in an application. The ALJs decline to find that the Revised Application is

[487] There is no dispute that the Port Authority complied with 30 Texas Administrative Code § 305.44, which requires a corporate officer to certify that an application is complete and accurate.

[488] Ex. APP-LT-1-R at 40-41.

[489] Ex. ED-PS-1 Remand at 0023.

[490] Ex. ED-SG-1 Remand at 0013.

[491] Ex. ED-SG-1 Remand at 0013.

incomplete or inaccurate because it lacked a sponsoring witness at the hearing on the merits or because the ED did not independently verify every representation contained within it.

2. Channel Depth and Location of the Outfall

The primary disputes related to the completeness and accuracy of the Revised Application have to do with location of the outfall and the channel depth at that point. In the Original PFD, the ALJs found that the channel depth provided in the Original Application was not accurate.

Protestants have made much of the requirement that, on an application, an applicant must provide the latitude and longitude of the proposed facility. PAC argues that latitude and longitude are necessary for CORMIX modeling. The Port Authority disagrees. As discussed in the section on modeling, moving the location of the diffuser by a small distance will not make a difference in the CORMIX modeling results.

Turning to the issue of depth, ED's witness Katie Cunningham testified to her initial confusion about the depth of the discharge in the Revised Application and the information she received from the Port Authority following her request for additional information:

> I sought clarification on the discharge depth because in the June 24, 2021 memo from Dr. Tischler, the depth at the discharge location was stated to be approximately 90 feet. However, the depth of the diffuser barrel, as depicted in the bathymetry map included with the Memo, appeared to be approximately 65 feet. In response to this request for clarification, the applicant explained that the depth at which the diffuser discharges is 65 feet below the surface. However, because the location is on a steeply sloping side of the channel and because the ports discharge towards the opposite shoreline at an angle of 30 degrees to the horizontal, the resulting depth of the channel where the diffuser ports discharge is approximately 90 feet.[492]

[492] Ex. ED-KC-1 Remand at 0008.

At this point, both the ED and the Port Authority agree that the outfall will discharge 64 or 65 feet[493] below the surface and would be within 68 to 70 feet of water on four-to-six-feet risers. PAC notes this shows problem with Figure 1 of Dr. Tischler's Memo, which indicated that the proposed discharge would be located at an area with a depth of 65 feet. PAC argues that Dr. Tischler's remand rebuttal testimony, which contains a chart showing a diffuser with an outfall point 64 feet below the surface, with ports at a 30-degree angle, on a sloping bottom, makes Figure 1 of his Memo inaccurate. They note that Figure 1, which is also inconsistent with other bathymetry, has not been withdrawn from the Application.

The ALJs agree that Figure 1 created some confusion that required clearing up. By the time of hearing, that confusion was resolved.

As for the channel depth of 90 feet, the ALJs agree that the diffuser barrel will be put in an area within 68 to 70 feet depth, and that this area will be in front of the 90-foot depression. The 90-foot depth was used for some of the modeling. Given the clarifications provided, the ALJs do not find that the Revised Application was incomplete or inaccurate at this point.

3. Changes in Velocity

As support for their assertion that the Port Authority should have disclosed the changing velocities that were shown in the Acoustic Doppler Current Profiler (ADCP) data, the Kings/Steves cited two pieces of evidence—Mr. Osting's testimony and a photograph taken by Dr. Socolofsky. But in his testimony, Mr. Osting relied on the ADCP data that was included in Appendix A to the Parsons Memorandum that the Port Authority provided to the ED on June 25, 2021.[494] Although the Kings/Steves argue that the Port Authority chose to hide this information, it appears to the ALJs that, in fact, the very data Mr. Osting was discussing came

[493] The difference appears related to the conversion from meters. Although in its briefing, the Port Authority puts the blame for this on Protestants, as shown from the response to Ms. Cunningham, the Port Authority appears to be the source of the error.

[494] Ex. AR-R 4 (Tab I) at 00188-221.

from the Port Authority's submissions.[495] As for the photograph, it is just that, only a photograph. The Kings/Steves point to no testimony indicating its significance. Although the Kings/Steves argue that it shows "water to the north of the discharge flows slower than to the south,"[496] they do not point to evidence explaining that is the case, nor do they indicate how that information about velocity is left out of the ADCP data. The ALJs do not find that the Revised Application was incomplete for omitting information about changing velocities.

4. Sampling

PAC also contends that the Port Authority's water sampling for the Revised Application did not comply with 30 TAC § 307.9(b) because the samples, taken over two days in June 2021, are not representative of typical water quality or contaminant concentrations, in part because they were taken during a period with abnormally high rainfall. As support, PAC cites Dr. Nielsen's testimony in which she states that that the samples were taken during a period of abnormally high rainfall in Port Aransas.[497] To show this, Dr. Nielsen referred to a rainfall chart showing the amount of rain in May and June 2020 and in those two months in 2021.[498] That chart shows total rainfall for those two months was higher in 2021 than in 2020. PAC also argues that the Revised Application was flawed because no sediment sampling was performed.

In response, the Port Authority argues, citing to Dr. Dean's rebuttal testimony, that 30 TAC § 307.9 does not apply to the Revised Application. According to Dr. Dean, the samples in question were whole water samples taken at the intake location, and their purpose was to provide information about the concentrations of constituents and contaminants that would be in untreated effluent.[499] In contrast, 30 TAC § 307.9 provides the testing procedures only for determining if

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[495] *See, e.g.*, Mr. Osting's description of an exhibit as one "I prepared using Parsons field data and excerpts from the Parsons Field Sampling Technical Memorandum dated June 24, 2021." Ex. PAC-49R at 25.

[496] Kings/Steves Closing Argument at 10.

[497] Ex. PAC-48-R at 24.

[498] Ex. PAC-48-R KN-6.

[499] Ex. APP-KD-1 Rebuttal at 8.

water quality standards are attained in waterbodies.[500] This is, the Port Authority argues, an entirely different purpose. The Port Authority also argues that the samples were not taken during a period of abnormally high rainfall, but rather during a period of typical rainfall. As support, it cites Dr. Dean's testimony that the meteorological conditions were typical for June, and that the "average flows in the Nueces River at the USGS gauging station at Calallen, Texas (near Corpus Christi Bay) from June 7 to 10 represented the 66th to 69th percentiles of daily average flows at this gage over its full period of record (October 1, 1989 to September 30, 2021)." He added that it "is far from an extreme hydrodynamic condition."[501]

The Port Authority also contends that sediment sampling is not required, or even requested, in an application. The Port Authority argues that intake is not an issue in this proceeding because it is part of another permitting process, but that if sediment were a problem, it would have been reflected in the whole water samples that were taken.

The ALJs agree with the Port Authority that 30 TAC § 307.9 does not apply to the whole water sampling here. That section sets out procedures "solely for the purposes of assessing water quality monitoring data to determine if water quality standards are attained in individual water bodies."[502] The water sampling in question is not for those purposes and accordingly not subject to those particular requirements.

To the extent that PAC raises questions about the quality of that testing separate from those requirements, specifically by expressing concerns about the extent of rainfall preceding the sampling, the ALJs find the Port Authority's evidence more credible than PAC's. Dr. Nielsen's exhibit simply looked at two months in two consecutive years. There was no evidence whether 2020, which had less rainfall, was typical or abnormally dry. While PAC's exhibit shows one day of over four inches of rainfall in mid-May 2021, there is no indication of how long a period of time four inches of rain would continue to affect the water quality in the Gulf. It is also notable that the

[500] Ex. APP-KD-1 Rebuttal at 8.

[501] Ex. APP-KD-1 Rebuttal at 9.

[502] 30 Tex. Admin. Code § 307.9(a).

day with the highest rainfall in the exhibit actually appears to be in July 2021, but still appears in a chart that is supposed to examine rainfall in May and June. The ALJs find Dr. Dean's testimony comparing the river flow conditions to the conditions collected over 30 years to be more convincing. The Revised Application is not incomplete or inaccurate based on the timing of the whole water sampling.

As for sediment sampling, although PAC has provided evidence that Mr. Wiland thinks sediment sampling would be helpful, it has not cited anything indicating that such sampling is required for the application process. Accordingly, the ALJs do not find that the Port Authority was required to provide sediment sampling in order to have a complete application.

5. Major or Minor Facility

The ALJs do not accept OPIC's argument that an issue of whether the facility should be classified as major or minor affects the completeness and accuracy of the Revised Application or any representations contained in it. The Revised Application did not use those terms in characterizing the facility, and the issue is between TCEQ and EPA.

6. Chemicals are Unknown

There is sufficient evidence that TCEQ does not require applications to specify the exact chemicals that will be used, but it will instead require information and review before those chemicals are used. Ms. Cunningham described the pre-approval process for any chemicals that would be used.[503] While the desire to be aware of those chemicals and be part of that process for reviewing them is understandable, it appears to the ALJs that TCEQ's process of not requiring that level of particular information in the original application, but rather conducting a review before their use, does not violate any rule or statute and still provides sufficient evidence for a review. The ALJs do not find the Revised Application was incomplete because it did not specify which chemicals would be used in the treatment process.

[503] Remand Tr. Vol. 9 at 2238.

G. Whether the draft permit includes all appropriate and necessary requirements. (Issue I)

PAC and OPIC both argue that the Revised Draft Permit does not include all appropriate and necessary requirements.

OPIC first argues that the Revised Draft Permit should contain a salinity limit above which the Facility could not operate. It also contends that the Revised Draft Permit should contain effluent percentage limits at the HHMZ and ALMZ boundaries. OPIC further argues the Revised Draft Permit lacks explicit requirements or limits for the chemicals the Facility will use as part of its desalination process.

PAC argues that because the representations in the application cannot be relied upon, and the CORMIX modeling relies on a precise application, the Revised Draft Permit cannot be said to include sufficiently protective requirements. Additionally, PAC argues that the EPA's letter indicates that the Revised Draft Permit does not include all appropriate and necessary requirements.

PAC also provides a list of proposed permit terms that it contends would be necessary for a protective permit:

1. The latitude, longitude, and depth of the discharge.

2. Limits on the increase in salinity at appropriate measuring points within the ZID or ALMZ.

3. Mixing limits, i.e., percentage of effluent at the boundaries of all three mixing zones.

4. Effluent limits for total dissolved solid concentrations and/ flow volume that would limit any increase of salinity to 2 ppt over ambient at the critical conditions for salinity.

5. All chemical additives used at the facility must comply with NSF-60, whether water is provided for potable use or non-potable use.

6. Applicant must conduct before and after biological surveys similar to those in the Carlsbad Desalination Plant, NPDES Permit No. CA0109223.

7. WET Testing must use Sea Urchin (EPA Method 1008.0), as modified to evaluate changes in salinity.

8. Salinity constraints of EPA Methods 1006.0 and 1007.0 do not apply to WET testing required by the permit.

9. The critical dilution for WET testing should be set to the salinity concentration that best represents dilution at the mixing zone boundary.

10. A monitoring plan for 1) validating the CORMIX modeling predictions and 2) compliance with the receiving water that has to be presented by the Port Authority in its application and therefore can be evaluated by experts with the ED, TPWD, EPA, and the public.

11. The Draft Permit should require that the Port Authority submit the information required by 30 TAC §308.91 prior to construction of the intake structure, obtain approval prior to construction, and require that design and construction comply with requirements of 30 TAC § 308.91.

Some of these proposed conditions are discussed in greater detail than others. The ED, in particular, responded to each of these proposed conditions, which are discussed below.

1. Latitude, Longitude, and Depth of the Discharge

PAC argues that a permit should have an updated latitude and longitude of the discharge location, in addition to greater clarity of the depth of the discharge. The ED argues that a new permit requirement should not be added because that information is already in his possession. The ED notes that the Draft Permit already requires the Port Authority to provide notice of any changes, so he will also be informed of any changes the Port Authority wants to make.

The ALJs disagree that there needs to be an additional change to the latitude and longitude of the outfall reflected in the Application. As for the diffuser depth, the ALJs find that it is sufficiently clear from the Port Authority's current representations.

2. Salinity Limits, Mixing Limits, and Effluent Limits

In its proposed terms 2, 3, and 4, PAC also makes suggestions for three types of limits that it contends should be added to the Draft Permit: limits on the increase in salinity, mixing limits, and actual effluent limits for salinity.

To begin with, PAC argues that mixing limits—in other words, percentage of effluent at the boundaries of all three mixing zones—should be added to the Draft Permit. The ED argues against imposing mixing limits, noting that Ms. Cunningham already recommended effluent percentages at the ZID, ALMZ, and HHMZ and that these percentages are reflected in the Statement of Basis. Nevertheless, Ms. Cunningham testified that she would have no objections to adding limits for the ALMZ and HHMZ and added that, in fact, recent permits are including such requirements.[504] The ALJs find that it would be reasonable to add mixing limits—the effluent percentages at the boundaries of the ZID, ALMZ, and HHMZ. Based on this testimony, and the other evidence in this case, the ALJs recommend adding such a provision to the Draft Permit.

Additionally, PAC argues that there should be limits on the increase in salinity at appropriate measuring points within the ZID or ALMZ. The ED argues that specific salinity limits are unnecessary because the Draft Permit already requires the Port Authority to achieve specific effluent dilutions at the boundary of the ZID. But there is a difference between effluent dilutions and salinity increases.

Relatedly, PAC also argues in favor of effluent limits for total dissolved solid concentrations and/ flow volume that would limit any increase of salinity to 2 ppt over ambient at the critical conditions for salinity. The ED argues that this is not necessary, but requests that if a limit is included, it be established to apply at the outfall (in other words, at the "end of pipe.")[505]

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[504] Remand Tr. Vol. 9 at 2286-87.

[505] The ED adds, "[t]o ensure the assumptions of effluent salinity are met, the [ED] could include salinity limits if the ALJs and Commissioners determine a salinity limit is appropriate and necessary." ED's Reply at 17.

The ALJs agree that, for the reasons discussed above relating to adverse impact, a salinity limit of 2 ppt over ambient at 100 meters, as recommended by TPWD and GLO, should be added to the Draft Permit. The ALJs note that the most serious modeling concerns raised by the parties—the site-specific bathymetry that cannot be modeled, salinity concentrations the ED used to define the critical conditions, and CORMIX's margin of error—create some uncertainty over what the actual salinity levels will be. Given the nature of these concerns, testing the salinity over ambient at the end of the pipe appears to the ALJs to be insufficient. Addition of the salinity limit should satisfy the concerns about salinity measurements at other locations.

3. Chemicals

PAC, in its proposed term 5, argues that any permit should require that chemical additives used at the facility must comply with NSF-60, whether water is provided for potable use or non-potable use. PAC's only citation to in support of this is the testimony of Alex Wesner, who testified that the Facility would need to comply with those standards.[506] The ED argues that this requirement is unnecessary because the Port Authority is already required to disclose any treatment chemicals or additives before using them. These chemicals will be evaluated, and if necessary, limits, monitoring, or other requirements will be added. The ALJs find that adding this condition is unnecessary at this time, given the review by the ED before the Port Authority may use any of these chemicals. Because of this future review, the ALJs also decline to find that the Draft Permit should contain limits for these chemicals at this time, as OPIC urges.

4. Biological Surveys

PAC additionally argues that the Draft Permit is deficient for not requiring biological surveys similar to those in the Carlsbad Desalination Plant, NPDES Permit No. CA0109223. The only support for this that PAC cites is 6 pages of the Carlsbad permit. The ED notes that the Carlsbad plant is part of a different regulatory framework. Additionally, the ED states that the

[506] Remand Tr. Vol. 1 at 178.

TCEQ's rules do not require those kinds of surveys and the ED has determined they are not necessary. The ALJs agree that such surveys are not necessary requirements for the Draft Permit.

5. WET Testing

In its proposed terms 7, 8, and 9, PAC makes several suggestions related to changes to the WET testing contained in the Draft Permit. In response to the suggestions that it alter the Draft Permit terms about what species should be used and what constraints found in EPA methods should be excluded, the ED argues that it is required to follow what the EPA has approved for WET testing, both involving the species that may be used and the methods that must be followed.[507] As for the critical dilution, PAC provides no citation or argument in support of this condition. The ED notes that, according to Mr. Pfeil's testimony, the dilution series is based on the critical dilution determined by the Critical Conditions memo.[508] At this time, the ALJs do not recommend adding additional requirements to the WET testing.

6. Monitoring Plan

PAC also argued in favor of adding a requirement for a monitoring plan. The Port Authority argues that such a plan is unnecessary, but stated that if determined to be necessary, it will work with TCEQ staff to develop a plan to validate the mixing efficiency in operation. The ALJs find that a monitoring plan would be helpful, given that the Facility is the first of its kind to be built in Texas, and recommend adding such a plan.

7. Intake Structure

Although PAC argues that a provision related to the intake structure should be added to the Draft Permit, the Port Authority point out that the intake structure will be the subject of a separate permitting process. The ED points out that the rule PAC cites, 30 TAC § 308.91 applies to cooling

[507] Remand Tr. Vol. 10 at 2425-26 (WET testing is limited to three species: mysid shrimp, inland silverside, and the sheepshead minnow); Ex. ED-MP-1 at 0005-06.

[508] Ex. ED-MP-1 at 0010.

water intake structures, and that nothing in the Revised Application indicates that any water obtained would be used for cooling purposes.[509] Given the inapplicability of the rule, and the Port Authority's representation that the intake will be the subject of a separate permit application, the ALJs do not find that the Draft Permit needs to contain a term or condition requiring the intake structure to comply with 30 TAC § 308.91.

8. PAC's Other Arguments

Issues relating to PAC's argument about the CORMIX modeling and the need for precision have already been addressed in the modeling section.

As for PAC's argument that the EPA's letter indicates that the Revised Draft Permit does not include all appropriate and necessary requirements, the ALJs note that the correspondence does not support that argument. In the follow-up letter, the director of the water division states:

> In our Interim Objection letter, the EPA requested additional information regarding the draft permit to determine whether the permit meets the guidelines and requirements of the Clean Water Act (CWA), specifically information and the rationale to support the best professional judgment (BPJ) reporting and monitoring requirements included in the permit for total dissolved solids, sulfates, and chlorides. This letter is a reminder that, pursuant to 40 CFR § 123.44(d)(2), the full period of time for the EPA's review of the permit will recommence when the EPA receives the information requested.[510]

This reminder that information has been requested but not received does not indicate that EPA has determined the Revised Draft Permit lacks certain appropriate and necessary requirements. The ALJs decline to find that EPA's request for additional information is persuasive evidence that necessary permit terms or conditions are absent.

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[509] The ALJs also note that this rule has been repealed, effective April 21, 2022.

[510] Ex. PAC-89R.

IV. TRANSCRIPT COSTS

The Port Authority argues that it incurred reporting and transcription costs in the amount of $51,106.50 for the March 11, 2022 prehearing conference and hearing on the merits on March 14-25, 2022.[511] The Port Authority contends that Protestants should bear 100% of those transcript costs.[512] Protestants disagree, first contending that the majority of the costs the Port Authority seeks to allocate are not the actual transcription cost, but rather costs (such as expediting fees and rough drafts) that are connected to the Port Authority's obtaining of its own written copies. Accordingly, Protestants argue that the amount subject to allocation is $3,825.00. Second, Protestants argue that the Port Authority should bear 100% of the costs because it, not the Protestants, requested a remand. Neither the ED nor OPIC may be assessed transcript costs.

The Commission's rules require consideration of the following factors in assessing transcription costs:

(A) the party who requested the transcript;

(B) the financial ability of the party to pay the costs;

(C) the extent to which the party participated in the hearing;

(D) the relative benefits to the various parties of having a transcript;

(E) the budgetary constraints of a state or federal administrative agency participating in the proceeding;

(F) in rate proceedings, the extent to which the expense of the rate proceeding is included in the utility's allowable expenses; and

(G) any other factor which is relevant to a just and reasonable assessment of costs.[513]

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[511] *See* Port Authority Closing Argument at 63 & Att. A.

[512] No party asserts that costs should be allocated to Audubon, the pro se group, Ms. Denney, Mr. Dyer, or Mr. Grosse.

[513] 30 Tex. Admin. Code § 80.23(d).

Protestants do not dispute that they have the ability to pay or deny they actively participated in the hearing. Instead, they argue that the remand solely was a benefit to the Port Authority, who should pay the related costs. (In contrast, the Port Authority argues that all the costs belong to the Protestants who originally requested the hearing.)

The ALJs find the Commission's remand of this matter to be a relevant other factor. What initially was a remand for additional evidence became much larger once the Port Authority filed a Revised Application. Given those factors, the ALJs recommend that the transcript costs be allocated entirely to the Port Authority. Should the Commission disagree, the ALJs also agree that the costs in question should only include the hourly transcribing costs and a transcript for the Commission and SOAH, not the costs to receive expedited or rough draft copies, for a total of $22,675.50.

V. CONCLUSION

In conclusion, the ALJs recommend that the Revised Application be granted with the additional salinity limit, mixing limits in the ALMZ and HHMZ, and monitoring requirement set out above. The ALJs further recommend that the Commission adopt all Findings of Fact and Conclusions of Law in the Proposed Order on these issues. The ALJs recommend that the Commission not adopt the parties' proposed Findings of Fact and Conclusions of Law that the ALJs did not include in the Proposed Order, based on the reasoning set out in the Proposal for Decision on Remand.[514]

SIGNED June 20, 2022.

CASSANDRA QUINN
ADMINISTRATIVE LAW JUDGE
STATE OFFICE OF ADMINISTRATIVE HEARINGS

REBECCA S. SMITH
ADMINISTRATIVE LAW JUDGE
STATE OFFICE OF ADMINISTRATIVE HEARINGS

[514] 30 Tex. Admin. Code § 80.252(d).

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

AN ORDER
GRANTING THE APPLICATION OF
PORT OF CORPUS CHRISTI AUTHORITY OF NUECES COUNTY FOR
TPDES PERMIT NO. WQ00052530001;
TCEQ DOCKET NO. 2019-1156-IWD;
SOAH DOCKET NO. 582-20-1895

On _____, the Texas Commission on Environmental Quality (TCEQ or Commission) considered the application of the Port of Corpus Christi Authority of Nueces County for a new Texas Pollutant Discharge Elimination System Permit in Nueces County, Texas. A Proposal for Decision on Remand (PFD) was issued by Rebecca S. Smith and Cassandra Quinn, Administrative Law Judges with the State Office of Administrative Hearings, and considered by the Commission.

After considering the PFD, the Commission makes the following findings of fact and conclusions of law.

I. FINDINGS OF FACT

Background

1. The Port of Corpus Christi Authority of Nueces County (Applicant or Port Authority) filed an application (Application) for a new Texas Pollutant Discharge Elimination System (TPDES) permit with TCEQ on March 7, 2018.

2. The Application requests authorization to discharge treated effluent into the Corpus Christi Ship Channel in Nueces County, Texas.

3. TCEQ's Executive Director (ED) declared the Application administratively complete on June 26, 2018.

4. The ED completed the technical review of the Application and prepared a draft permit (Draft Permit).

Notice and Jurisdiction

5. The Notice of Receipt of Application and Intent to Obtain Water Quality Permit (NORI) was published on July 25, 2018, in the *Aransas Pass Progress*, *Ingleside Index*, and *Corpus Christi Caller-Times*. The NORI was also published on July 26, 2018, in the *Port Aransas South Jetty*.

6. The Notice Application and Preliminary Decision (NAPD) was published on November 21, 2018, in the *Aransas Pass Progress* and *Ingleside Index*. The NAPD was also published on November 22, 2018, in the *Port Aransas South Jetty* and *Corpus Christi Caller-Times*.

7. Copies of the Application were placed in La Retama Central Library, Sinton Public Library, Ed and Hazel Richmond Public Library, and the Port Aransas City Hall.

8. A public meeting was held on April 8, 2019, at the Port Aransas Civic Center in Port Aransas, Texas.

9. The public comment period ended at the close of the public meeting.

10. TCEQ received public comments on the Application, and the ED prepared a Response to Comments, which was filed with the Chief Clerk on July 3, 2019.

11. On November 21, 2019, the Commission issued an interim order granting certain hearing requests, referring certain hearing requests to the State Office of Administrative Hearings (SOAH) for an affectedness determination, denying certain hearing requests and requests for reconsideration, and referring the Application to SOAH for a contested evidentiary hearing on the following nine issues:

A. Whether the proposed discharge will adversely impact: the marine environment, aquatic life, and wildlife, including birds and endangered or threatened species, spawning eggs, or larval migration;

B. Whether the proposed discharge will adversely impact the health of the requesters and their families, including whether fish and other seafood will be safe for human consumption;

C. Whether the proposed discharge will adversely impact recreational activities, commercial fishing, or fisheries in Corpus Christi Bay and the ship channel;

D. Whether the Application, and representations contained therein, are complete and accurate;

E. Whether the Applicant substantially complied with applicable public notice requirements;

F. Whether the draft permit is consistent with the Texas Coastal Management Program's goals and policies;

G. Whether the modeling complies with applicable regulations to ensure the draft permit is protective of water quality, including utilizing accurate inputs;

H. Whether the Executive Director's antidegradation review was accurate; and

I. Whether the draft permit includes all appropriate and necessary requirements.

Proceedings at SOAH

12. The preliminary hearing was initially scheduled to be held in Port Aransas, Texas, on March 24, 2020, but due to the COVID-19 pandemic, was rescheduled and set to convene via Zoom videoconference.

13. Notice of the rescheduled preliminary hearing was mailed by TCEQ on May 28, 2020, and published by the Port Authority in the *Aransas Pass Progress* and *Corpus Christi Caller-Times* on June 3, 2020, and the *Port Aransas South Jetty* on June 4, 2020.

14. The preliminary hearing was held before Administrative Law Judges (ALJs) Rebecca S. Smith and Cassandra Quinn on July 9, 2020, via Zoom videoconference.

15. At the preliminary hearing, the ALJs determined that SOAH had jurisdiction, named parties, and admitted the administrative record into evidence for all purposes.

16. Before the evidentiary hearing, various named parties withdrew. The remaining parties are: the Port Authority; ED; TCEQ's Office of Public Interest Counsel (OPIC); Audubon Texas; Port Aransas Conservancy (PAC); the following individuals represented by counsel: James Harrison King, Tammy King, Edward Steves, and Sam Steves (collectively, represented protestants); and the following individuals representing themselves: Stacey Bartlett, Jo Ellen Krueger, Sarah Searight, Lisa Turcotte, Cara Denney, Aldo Dyer, and Mark Grosse.

17. The evidentiary hearing convened on November 4-6 and 9-10, 2020, via Zoom videoconference, with ALJs Rebecca S. Smith and Cassandra Quinn presiding. All parties participated at the hearing except for Ms. Denney, Mr. Dyer, and Mr. Grosse. The record closed on January 12, 2021, after the parties submitted written closing arguments and proposed findings of fact and conclusions of law.

18. On February 5, 2021, the ALJs issued a Proposal for Decision (PFD) recommending that the Application be denied.

19. On May 19, 2021, the Commission considered the ALJs' PFD during an open meeting and voted to remand the matter to SOAH for additional proceedings.

20. The Commission issued an Interim Order on May 26, 2021, remanding the case to SOAH for the ALJs to "[a]pply the appropriate legal standard for non-numeric criteria found in 30 Texas Administrative Code § 307.6(e)(1) for evaluating the impacts to aquatic organisms that move through a zone of initial dilution;" and to take additional evidence on the following issues:

    A. Whether the proposed discharge will adversely impact: the marine environment, aquatic life, and wildlife, including birds and endangered or threatened species, spawning eggs, or larval migration;

    C. Whether the proposed discharge will adversely impact recreational activities, commercial fishing, or fisheries in Corpus Christi Bay and the ship channel;

    D. Whether the Application, and representations contained therein, are complete and accurate;

    G. Whether the modeling complies with applicable regulations to ensure the draft permit is protective of water quality, including utilizing accurate inputs;

    H. Whether the Executive Director's antidegradation review was accurate; and

    I. Whether the draft permit includes all appropriate and necessary requirements.

21. The Applicant subsequently submitted a revised application (Revised Application) to change the location of the discharge (outfall), to revise its proposed diffuser design, and to present additional modeling and data, among other things.

22. The ED then prepared a revised draft permit (Revised Draft Permit).

23. On November 10, 2021, the ALJs issued Order No. 16, adopting the parties' agreed procedural schedule on remand for this case.

24. The preliminary hearing on remand was held before ALJs Rebecca S. Smith and Cassandra Quinn on January 25, 2022, via Zoom videoconference.

25. The evidentiary hearing on remand (Remand Hearing) convened on March 14-25, 2022, via Zoom videoconference, with ALJs Rebecca S. Smith and Cassandra Quinn presiding. The record closed on April 22, 2022, after the parties submitted written closing arguments and proposed findings of fact and conclusions of law.

Description of Proposed Facility and Discharge

26. The Port Authority seeks a wastewater discharge permit for a proposed marine seawater desalination plant (the Facility) to be located on Harbor Island in Nueces County, Texas.

27. Harbor Island is situated between the Texas coast and the barrier islands of San Jose Island and Mustang Island, at the mouth of the Aransas Pass inlet, which connects the Gulf of Mexico to Texas's bays and estuaries.

28. The Facility will pump seawater from the Gulf of Mexico and use reverse osmosis to produce potable water.

29. The proposed discharge is for treated effluent from the Facility, consisting primarily of the concentrated brine resulting from the desalination process.

30. If the Revised Draft Permit is issued, the treated effluent will be discharged into the Corpus Christi Ship Channel approximately 229 feet off Harbor Island's shoreline. The outfall location is near the confluence of the Corpus Christi Ship Channel, Lydia Ann Channel, and Aransas Pass inlet.

31. The proposed discharge is to Segment 2481 (Corpus Christi Bay) of the Texas classified surface water segments.

32. The designated uses for Segment 2481 are primary contact recreation, exceptional aquatic life use, and oyster waters.

33. The Port Authority plans to use a diffuser at the discharge site to enhance mixing of the treated effluent with the ambient water.

Texas Surface Water Quality Standards (TSWQS)

34. The TSWQS were developed to protect surface water quality in regards to human health, aquatic life, terrestrial life, and the environment.

35. The TSWQS designate uses for the state's surface waters, and establish narrative and numerical water quality standards to protect those uses.

36. The TCEQ has adopted standard procedures to implement the TSWQS, which are approved by the U.S. Environmental Protection Agency (EPA) and set forth in "Procedures to Implement the Texas Surface Water Quality Standards (RG 194)" (IPs).

37. The TSWQS and IPs are used to set permit limits for wastewater discharges.

38. The TSWQS establish "mixing zones" in the receiving water body, which are defined areas contiguous to the permitted discharge where the effluent mixes with the receiving waters. Acute toxicity to aquatic organisms is not allowed in a mixing zone, and chronic toxicity to aquatic organisms is not allowed beyond a mixing zone.

39. There are three applicable mixing zones: the zone of initial dilution (ZID), aquatic life mixing zone (ALMZ), and human health mixing zone (HHMZ).

40. For toxic substances where adequate toxicity information is available, the TSWQS establish numerical water quality standards for acute and chronic toxicity that apply at the mixing zone boundaries.

41. The TSWQS do not contain numerical criteria for salinity. However, concentrations and the relative ratios of dissolved minerals such as chloride, sulfate, and total dissolved solids must be maintained such that existing, designated, presumed, and attainable uses are not impaired.

42. Under the TSWQS, salinity gradients in estuaries must be maintained to support attainable estuarine-dependent aquatic life uses, and careful consideration must be given to all activities that may detrimentally affect salinity gradients.

Revised Draft Permit Requirements

43. The Revised Draft Permit specifies daily maximum and daily average flow limits of 110 million gallons per day (MGD) and 95.6 MGD, respectively.

44. No analytical data regarding the effluent was provided in the Application because the Facility has not yet been constructed or begun discharging, and consequently, screening against the water-quality-based effluent limits in the TSWQS could not be accomplished.

45. The Revised Draft Permit includes the following requirements:

    a. The effluent must be monitored daily for total suspended solids, total dissolved solids, chloride, and sulfate.

    b. The effluent's pH must be not less than 6.0 standard units (SU) and not more than 9.0 SU.

    c. The maximum effluent percentage limit at the ZID boundary is 14.6%.

d. The Port Authority must conduct effluent sampling within 60 days of the initial discharge and submit the analytical data to TCEQ for screening against the water-quality-based effluent limits in the TSWQS.

e. The Port Authority must complete a study of ambient water velocity at the outfall location and report the results to the TCEQ.

f. The Port Authority must conduct whole effluent toxicity (WET) testing on the effluent during the first year of the discharge, with a 24-hour test every six months. The 24-hour test requires the test species to be submerged in 100% effluent from the Facility for 24 hours. The Port Authority must also conduct quarterly chronic biomonitoring for both mysid shrimp and inland silverside, using five effluent dilution concentrations and a control. If none of the first four consecutive tests demonstrates significant toxicity, the testing frequency will be reduced.

Modeling Analysis

46. The Cornell Mixing Zone (CORMIX) model is the most commonly used model to design diffusers and evaluate mixing near outfalls.

47. The TCEQ's IPs provide for the use of the CORMIX model when a diffuser will be used, and the TCEQ has developed a guidance manual for running the model titled "Mixing Analyses Using CORMIX" (CORMIX SOPs).

48. Use of the CORMIX model was appropriate in this case.

49. The ED uses the CORMIX model to predict the percentage of effluent present at the edge of each regulatory mixing zone, and then sets permit limits based on the highest predicted effluent percentages.

50. In running the model, the ED relied on information provided in the Application and the CORMIX SOPs.

51. For the Revised Application, the ED's CORMIX modeling predicts effluent percentages of 14.6% at the ZID boundary, 8.9% at the ALMZ boundary, and 5.4% at the HHMZ boundary.

52. Use of the CORMIX model requires "schematization," the process of describing a receiving water body's actual geometry with a rectangular cross section. CORMIX's conservative module simulates the geometry of the receiving water body as a rectangle with a flat bottom and vertical sides, and does not account for variations in channel depth or a sloping bank.

53. Due to the need for schematization, some professional judgment will be necessary when selecting the inputs to the CORMIX model and a range of values may be reasonable.

54. The depth of the water body at the discharge point is an important model input because it is a variable that influences near-field mixing.

55. The depth of the channel at the outfall location is close to 65 feet but is adjacent to a 90-foot depression.

56. Using a 90-foot depth was among the range of reasonable options a modeler could select and was not inaccurate.

57. The distance from shore to the diffuser (DISTB) is an input to the model that impacts mixing predictions. Due to schematization, the shore placement effectively creates a vertical wall behind which no mixing is determined to take place; thus, the further it is located from the diffuser, the more water the model predicts will be available for mixing and dilution of the effluent.

58. The distance directly between the proposed diffuser location and the shoreline is 229 feet, but because the channel floor slopes downward from the shoreline, using that value for DISTB will overpredict mixing.

59. The modeling results were not materially different using 35 meters (114.8 feet) for DISTB, so the ED's use of 229 feet for the modeling was not materially inaccurate.

60. Using CORMIX's brine module was not required in this case.

61. The ED's modeling used reasonable inputs for ambient velocity based on data collected at the proposed discharge site.

62. The potential for an eddy to form occasionally near the proposed discharge site does not invalidate the CORMIX modeling results or indicate that inaccurate inputs were used.

63. The presence of two outcropping extending from the shoreline and the 90-foot depression introduces some uncertainty into the modeling results, but does not make them inaccurate.

64. Because salinity is in both the effluent and receiving waters, the highest predicted effluent percentages from the ED's CORMIX modeling do not provide the worst-case scenario for salinity.

65. CORMIX's margin of error does not invalidate the modeling results.

66. Including a limit on salinity in the permit is supported by the uncertainty introduced into the modeling results by the site-specific bathymetry, basing the ED's critical conditions on modeling results that do not represent the worst-case scenario for salinity, and CORMIX's margin of error.

67. The ED's CORMIX modeling inputs are either within the range of reasonable values or are not materially inaccurate.

68. The ED's CORMIX modeling is sufficient to ensure the Revised Draft Permit is protective of water quality.

69. The Port Authority separately conducted modeling with the SUNTANS model to evaluate the proposed discharge's effects in the far field as the effluent moves further from the mixing zones.

70. The SUNTANS modeling predicts that the desalination brine discharge increases computed salinity by 0-1 parts per thousand (ppt) in the vicinity of the discharge and throughout the Corpus Christi Bay system, with daily tidal fluctuations continuously mixing the discharge so that stratification is never persistent.

71. SUNTANS modeling is not required by the applicable regulatory requirements.

Antidegradation Review

72. An antidegradation review is designed to ensure that a proposed discharge does not impair the uses or degrade the water quality of the receiving waters.

73. Tier 1 and Tier 2 antidegradation reviews are required due to the exceptional aquatic life use designation at the outfall location.

74. The ED's antidegradation review for the Revised Application was performed by Peter Schaefer.

75. In conducting his Tier 1 review, Mr. Schaefer examined the Port Authority's WET tests, CORMIX modeling, static 2-minute acute tests at various salinity levels, and the SUNTANS modeling.

76. For his Tier 1 review, Mr. Schaefer also relied on the SUNTANS modeling, the salt mass balance, and the requirement that the Port Authority submit effluent data within 90 days of beginning to discharge.

77. Mr. Schaefer used a Texas Water Development Board paper to determine the optimal salinity level of red drum for his review, and also examined salinity toxicity testing by PAC witness Dr. Kristen Nielsen.

78. The ED's antidegradation review demonstrates that the proposed discharge will maintain existing uses and not lower water quality by more than a de minimis amount.

Impact on the Marine Environment, Aquatic Life, and Wildlife

79. Aransas Pass is one of five major coastal passes connecting the Gulf of Mexico with Texas's bays and estuaries. The next closest inlets are Packery Channel, a very small

channel over 20 miles to the south, and the channel at Port O'Connor over 80 miles to the north.

80. Aransas Pass is the main source of productivity (e.g., spawning, migrating, and feeding) and connectivity with the Gulf of Mexico for all the fish and invertebrate populations in the entire region.

81. The Gulf-bay connection created by the Aransas Pass inlet is necessary for the life cycle of certain estuarine-dependent marine species. The adults of these species typically live and spawn offshore, and their eggs and larvae drift in coastal currents until a portion of them arrive at the coast and are drawn into the inlet. From there, some of the larvae are carried on the flood tide into the estuary where they can develop into juveniles and sub-adults, before eventually returning to the ocean as mature adults.

82. Because the inlet compounds and magnifies the marine life abundance, the impact of the proposed discharge will be disproportionately greater than what would occur in other areas with less densities and concentrations of marine life.

83. Organisms entering the Aransas Pass inlet have three alternate pathways to travel to the estuaries: Corpus Christi Ship Channel, Lydia Ann Channel, and Aransas Channel. Approximately 20% to 50% of larvae are estimated to use the Corpus Christi Ship Channel for this journey.

84. There is a zone of passage for aquatic organisms around the ZID and mixing zones. However, early life stages of aquatic species cannot swim around the effluent plume and will enter the ZID and mixing zones, and thus, come into contact with the undiluted effluent.

85. High salinity or saline imbalances can be fatal to aquatic life, particularly early life stages, such as embryos and larvae.

86. While levels of salinity rise and fall, they do so over time, allowing time for acclimation by aquatic species that protects them.

87. The ambient salinity in the Corpus Christi Ship Channel naturally fluctuates between 28 ppt and 42 ppt.

88. Salinity toxicity testing provided by the Port Authority showed that the no observable effect concentration (NOEC) for two species approved by the EPA and TCEQ for WET testing, mysid shrimp and inland silverside, were the highest concentrations tested, 45 ppt for a seven-day exposure and 55 ppt for a two-minute exposure.

89. Using mysid shrimp and inland silverside for testing was reasonable, but red drum (redfish) are more sensitive than these species, particularly in early life stages. As a result, the Port Authority's testing may not be representative of the impacts on more sensitive species or earlier life stages.

90. Salinity toxicity testing by PAC witness Dr. Nielsen did not require the use of an accredited environmental testing laboratory because she was not analyzing the components of environmental media.

91. Red drum is a reasonable surrogate for evaluating potential adverse impacts of the proposed discharge because it is an estuarine-dependent species that relies on the Corpus Christi Ship Channel and its early life stages are sensitive to salinity changes.

92. Red drum adults and juveniles successfully tolerate significantly high salinities, including those exceeding 60 ppt. Red drum eggs and larvae are more sensitive to salinity changes, especially 3- to 5-day-old larvae.

93. Red drum eggs have been shown to hatch within a wide range of salinities with best hatch-out and growth rates occurring between 33 and 43 ppt.

94. Early life stages of red drum, including 3- to 5-day-old larvae, will pass through the ZID and mixing zones.

95. Under the worst-case conditions modeled by the ED, the proposed discharge will result in salinity levels at the ZID boundary as high as 68.7 ppt.

96. Exposure times will be longest during slack tide conditions, but will still be on the order of seconds and minutes, rather than hours.

97. Although eggs and larvae may be somewhat mixed in the water column, they are more concentrated in the upper portion of the water column due to their buoyancy, thereby further limiting their exposure to the discharge, which will be approximately 60 feet below the surface.

98. Abrupt changes in salinity at levels that may occur in the ZID under worst-case conditions will cause mortality to red drum larvae.

99. Other states and countries address the risk of abrupt changes in salinity from desalination discharges by setting limits on the change in salinity over ambient, generally limiting salinity increases to 2.0 ppt over ambient measured at some distance from the outfall.

100. For marine seawater desalination discharges, the Texas Parks and Wildlife Department and Texas General Land Office recommend limiting salinity increases to no more than 2.0 ppt over ambient measured at 100 meters from the outfall.

101. Because the TSWQS do not contain numeric criteria for salinity, the Revised Draft Permit's requirement to test the effluent after the discharge commences and screen it against the TSWQS's water-quality-based effluent limits does not address the concerns about salinity.

102. Including a salinity limit in the permit of 2.0 ppt over ambient to be measured at 100 meters from the outfall is necessary and appropriate to protect aquatic organisms that will be exposed to the proposed discharge.

103. The careful consideration required for evaluating the impacts of a discharge of salinity was performed.

104. With the addition of a salinity limit in the Revised Draft Permit, the proposed discharge will not adversely impact the marine environment, aquatic life, and wildlife, including spawning eggs and larval migration.

105. The piping plover is a threatened species found in Segment 2481, and the whooping crane is an endangered species that has been sighted in the Corpus Christi Bay area.

106. Because the proposed discharge will not adversely impact aquatic life, there will not be cascading effects on aquatic-dependent species, including birds.

107. The proposed discharge will not adversely impact birds and endangered or threatened species.

Impact on Recreational Activities, Commercial Fishing, and Fisheries

108. The Aransas Pass tidal inlet is a multi-species spawning site for the most economically valuable sportfishes in the region.

109. The productivity of local populations of sportfishes, including red drum, spotted seatrout, sheepshead, black drum, and southern flounder, is directly linked to, and dependent upon, the reproductive activity that occurs in the Aransas Pass inlet.

110. The fisheries in the Corpus Christi Bay, Aransas Pass inlet, and Texas Gulf of Mexico support a multi-billion-dollar commercial fishing industry for finfish, crab, and shrimp.

111. Because the proposed discharge will not adversely impact aquatic life, there will not be cascading effects on recreational and commercial fishing, or fisheries.

112. The proposed discharge will not adversely impact recreational activities, commercial fishing, and fisheries in Corpus Christi Bay and the ship channel.

Impact on Human Health

113. No party presented evidence challenging whether the proposed discharge will adversely impact the health of the requesters and their families, including whether fish and other seafood will be safe for human consumption.

114. The proposed discharge will be located at least 50 feet below the water surface, so humans will not be directly exposed to the discharge.

115. The proposed discharge will not adversely impact the health of the requestors or their families.

Accuracy and Completeness of the Application

116. That the Revised Application did not have a sponsoring witness at the Remand Hearing does not make it incomplete or inaccurate.

117. The Revised Application and supporting documentation correctly identified the Port Authority as the owner and operator of the Facility, the locations of the proposed Facility and outfall, changing velocities near the outfall, and the depth of the channel at the outfall location.

118. The whole water sampling for the Application was not conducted in a period of abnormally high rainfall.

119. Sediment sampling was not required for a complete Application.

120. Whether the Facility is properly characterized as a minor or major facility does not affect whether the Application is accurate or complete.

121. The Revised Application was complete despite not specifying the exact chemicals that will be used to treat water.

Permit Requirements

122. The Revised Draft Permit should include additional provisions requiring mixing limits for percentages of effluent at the boundaries of all three mixing zones; imposing a salinity limit of 2.0 ppt over ambient to be measured at 100 meters from the outfall; and requiring a monitoring plan.

123. Additional provisions related to the latitude, longitude, and location of the outfall; related to chemical additives' compliance with NSF-60; related to biological surveys; and related to the intake structure do not need to be included in the Revised Draft Permit.

124. Changes to the WET testing requirements do not need to be made to the Revised Draft Permit.

Notice Requirements

125. Notice was properly mailed and published, and a copy of the Application was made available at appropriate public locations. The location of the outfall determines the owners of properties that are required to be identified in the Application as affected landowners.

126. Protestants have not challenged their own notice.

Texas Coastal Management Program

127. The ED appropriately reviewed the Application for consistency with the Texas Coastal Management Program's goals and policies.

Transcription Costs

128. For the Initial Proceeding, the total cost for recording and transcribing the prehearing conference and hearing on the merits was $17,861.26, which has been paid by the Port Authority.

129. The transcript was required by SOAH's rules.

130. No party asserts that transcript costs should be allocated to Audubon or the self-represented protestants.

131. Transcript costs cannot be assessed against the ED and OPIC because they are statutory parties who are precluded from appealing the decision of the Commission.

132. The Port Authority, PAC, and represented protestants fully participated in the hearing.

133. The Port Authority, PAC, and represented protestants have the financial ability to cover the costs associated with the transcript.

134. The Port Authority, PAC, and represented protestants benefitted equally from having a transcript.

135. It is reasonable and appropriate for PAC and represented protestants to reimburse the Port Authority $8,930.63 for transcript costs for the Initial Proceeding.

136. For the Remand Hearing, the total cost for recording and transcribing the prehearing conference and the hearing on the merits was $3,825.00.

137. The Port Authority, PAC, and represented protestants fully participated in the Remand Hearing and benefitted from a transcript.

138. That the Remand Hearing was to allow the Port Authority to provide additional evidence for its own benefit, and because once the Port Authority filed a Revised Application, the remand's scope increased are factors relevant to a just and reasonable assessment of costs.

139. It is reasonable and appropriate for the Port Authority to bear the entire transcript costs for the Remand Hearing.

II. CONCLUSIONS OF LAW

1. The Commission has jurisdiction over water quality and the issuance of TPDES permits. Tex. Water Code §§ 5.013, 26.003, 26.011, 26.027, and 26.028.

2. The Application was referred to SOAH under Texas Water Code § 5.556.

3. SOAH has jurisdiction to conduct a hearing and prepare a proposal for decision in contested cases referred by the Commission under Texas Government Code § 2003.047.

4. Notice of the Application and the hearing were properly provided to the public and to all parties. Tex. Water Code §§ 5.115, 26.022, 26.028; Tex. Gov't Code §§ 2001.051-.052; 30 Tex. Admin. Code ch. 39.

5. The Application is subject to Texas Government Code § 2003.047(i-1)-(i-3).

6. In the Initial Proceeding, the filing of the Application, the Draft Permit, the preliminary decisions issued by the ED, and other supporting documentation in the administrative record of the Application established a prima facie case that: (i) the Draft Permit meets all state and federal legal and technical requirements; and (ii) the permit, if issued consistent with the Draft Permit, would protect human health and safety, the environment, and physical property. Tex. Gov't Code § 2003.047(i-1).

7. A party may rebut the prima facie demonstration by presenting evidence that: (1) relates to an issue directly referred; and (2) demonstrates that one or more provisions in the Draft Permit violates a specifically applicable state or federal requirement. Tex. Gov't Code § 2003.047(i-2); 30 Tex. Admin. Code §§ 80.17(c)(2), .117(c)(3).

8. Applicant retains the burden of proof on the issues regarding the sufficiency of the Application and compliance with the necessary statutory and regulatory requirements. 30 Tex. Admin. Code § 80.17(a).

9. The Remand Hearing was to allow the Applicant to present additional evidence on specified issues. Therefore, the process of rebutting a prima facie case has previously occurred. The Applicant was not entitled to another presumption.

10. The administrative record is admitted into evidence for all purposes. 30 Tex. Admin. Code § 80.127(h).

11. There must be no significant lethality to aquatic organisms that move through a ZID. 30 Tex. Admin. Code § 307.6(e)(1).

12. Water in the state must be maintained to preclude adverse toxic effects on aquatic life. 30 Tex. Admin. Code § 307.6(b)(4).

13. Surface waters must not be toxic to man from ingestion of water, consumption of aquatic organisms, or contact with the skin, or to terrestrial or aquatic life. 30 Tex. Admin. Code § 307.4(d).

14. Salinity gradients in estuaries must be maintained to support attainable estuarine-dependent aquatic life uses. 30 Tex. Admin. Code § 307.4(g)(3).

15. An attainable use is a use that can be reasonably achieved by a water body in accordance with its physical, biological, and chemical characteristics whether it is currently meeting that use or not. 30 Tex. Admin. Code § 307.3(a)(4).

16. Careful consideration must be given to all activities that may detrimentally affect salinity gradients. 30 Tex. Admin. Code § 307.4(g)(3).

17. The ED's antidegradation review ensures compliance with the Tier 1 and Tier 2 antidegradation standards. 30 Tex. Admin. Code § 307.5(b).

18. The ED's modeling analysis of the proposed discharge is sufficient to ensure the Revised Draft Permit is protective of water quality.

19. The Commission may accept environmental testing laboratory data and analysis for use in Commission decisions regarding any matter under the Commission's jurisdiction relating to permits or other authorizations only if the data and analysis is prepared by an accredited environmental testing laboratory. Tex. Water Code § 5.134(a).

20. The accreditation requirement applies to "environmental testing laboratory data," and an "environmental testing laboratory" is "a scientific laboratory that performs analyses to determine the chemical, molecular, or pathogenic components of environmental media for regulatory compliance purposes." Tex. Water Code § 5.801; 30 Tex. Admin. Code § 25.2(6).

21. With the additional permit requirements described in Finding of Fact No. 122, the Revised Draft Permit includes all appropriate and necessary requirements to protect the marine environment, aquatic life, wildlife, recreational activities, commercial fishing, and fisheries.

22. With the additional permit requirements described in Finding of Fact No. 122, the Revised Draft Permit is protective of water quality and the uses of the receiving waters under the applicable TSWQS. 30 Tex. Admin. Code ch. 307.

23. The Revised Draft Permit contains sufficient provisions to protect the health of the requesters and their families.

24. The Revised Draft Permit is consistent with the Texas Coastal Management Program's goals and policies. 30 Tex. Admin. Code ch. 281, subch. B.

25. The Port Authority substantially complied with all applicable notice requirements. 30 Tex. Admin. Code ch. 39.

26. No transcript costs may be assessed against the ED or OPIC because the TCEQ's rules prohibit the assessment of any cost to a statutory party who is precluded by law from

appealing any ruling, decision, or other act of the Commission. Tex. Water Code §§ 5.275, .356; 30 Tex. Admin. Code § 80.23(d)(2).

27. Factors to be considered in assessing transcript costs include: the party who requested the transcript; the financial ability of the party to pay the costs; the extent to which the party participated in the hearing; the relative benefits to the various parties of having a transcript; and any other factor which is relevant to a just and reasonable assessment of the costs. 30 Tex. Admin. Code § 80.23(d)(1).

28. Considering the factors in 30 Texas Administrative Code § 80.23(d)(1), a reasonable assessment of Original Hearing transcript costs against parties to the contested case proceeding is that the Port Authority, PAC, and represented protestants should split the costs evenly, with PAC and represented protestants reimbursing the Port Authority $8,930.63.

29. Considering the factors in 30 Texas Administrative Code § 80.23(d)(1), a reasonable assessment of Remand Hearing transcript costs against parties to the contested case proceeding is that the Port Authority should bear the entire $3,825.00 costs.

NOW, THEREFORE, BE IT ORDERED BY THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY, IN ACCORDANCE WITH THESE FINDINGS OF FACT AND CONCLUSIONS OF LAW, THAT:

1. The Revised Application of the Port of Corpus Christi Authority of Nueces County for Texas Pollutant Discharge Elimination System Permit No. WQ00052530001 is granted, with the following additions: a provision requiring mixing limits for percentages of effluent at the boundaries of all three mixing zones; imposing a salinity limit of 2.0 ppt over ambient to be measured at 100 meters from the outfall; and a monitoring plan.

2. PAC and represented protestants shall pay $8,930.63 of the transcription costs for the Initial Proceeding, with the Port Authority paying the remainder of transcription costs for all other proceedings.

3. All other motions, requests for entry of specific Findings of Fact or Conclusions of Law, and any other requests for general or specific relief, if not expressly granted herein, are hereby denied.

4. The effective date of this Order is the date the Order is final, as provided by Texas Government Code § 2001.144 and 30 Texas Administrative Code § 80.273.

5. TCEQ's Chief Clerk shall forward a copy of this Order to all parties.

6. If any provision, sentence, clause, or phrase of this Order is for any reason held to be invalid, the invalidity of any provision shall not affect the validity of the remaining portions of this Order.

ISSUED:

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

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Jon Niermann, Chairman For the Commission