EDWARDS AQUIFER
HABITAT CONSERVATION PLAN

TRANSITION FROM PHASE I TO PHASE II

Summary Report and Administrative Record:

Process, Activities, and Decisions

March 31, 2020

HABITAT CONSERVATION PLAN EDWARDS AQUIFER

Prepared by

Blanton & Associates, Inc.

Environmental Consulting • Planning • Project Management

Prepared for

THE EDWARDS AQUIFER HABITAT CONSERVATION PLAN PERMITTEES

Edwards Aquifer Habitat Conservation Plan

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EXECUTIVE SUMMARY

The Edwards Aquifer Habitat Conservation Plan (EAHCP) is a regional plan to mitigate for the "incidental take" of federally listed species inhabiting the southern segment of the Edwards Aquifer. The EAHCP was approved by the U.S. Fish and Wildlife Service (USFWS), which issued an Incidental Take Permit (ITP) under the federal Endangered Species Act of 1973, with an effective date of March 18, 2013. The EAHCP outlines activities to be taken to comply with the ITP.[1] The five cooperating Permittees are the Edwards Aquifer Authority, the City of New Braunfels, the City of San Marcos, Texas State University, and the City of San Antonio acting by and through its San Antonio Water System Board of Trustees.

The EAHCP contains a two-phased implementation strategy (EAHCP § 1.3.2). Phase I of the EAHCP Implementation Strategy (Phase I), that began on the effective date of the ITP (March 18, 2013) and continued for seven years (until March 17, 2020), involved prompt implementation of a package of Conservation Measures to protect the Covered Species and their ecosystems. Phase II of the EAHCP Implementation Strategy (Phase II) began on the seventh anniversary of the effective date of the ITP (March 18, 2020) and continues for eight years until expiration of the ITP (March 31, 2028).

The EAHCP directed the Permittees to perform certain Springflow Protection and Habitat Restoration Conservation Measures to meet the Biological Goals and Objectives of the EAHCP. The EAHCP also acknowledged the need for adaptive management and included a framework for Adaptive Management Process (AMP) decisions at three levels: 1) Routine Adaptive Management Decisions; 2) Non-routine Adaptive Management Decisions; and 3) Strategic Adaptive Management Decisions.

The five Permittees established a Funding and Management Agreement (FMA), that became effective January 1, 2012, to administer the EAHCP. FMA Articles 4 and 7 contained specific requirements related to the AMP and the transition from Phase I to Phase II. The Strategic Adaptive Management Process (SAMP) was the process specified in the FMA to guide considerations related to the transition from Phase I to Phase II (EAA et al. 2012). This *Edwards Aquifer Habitat Conservation Plan Transition from Phase I to Phase II Summary Report and Administrative Record: Process, Activities, and Decisions* serves as the official record for the SAMP and all activities undertaken through this process.

EAHCP staff initiated focused SAMP discussions with the EAHCP Committees in May 2018, with a presentation to the Implementing Committee (IC) about the timeline and process to facilitate the SAMP. The SAMP was formally initiated when the Phase II Work Group convened on November 29, 2018, to review an initial draft of the Phase II Work Plan. On May 23, 2019, the IC approved the Phase II Work Plan, EAHCP Resolution No. 05-19-001, and the Nonroutine AMP Proposal to amend the EAHCP

[1] The Edwards Aquifer Recovery Implementation Plan Habitat Conservation Plan was approved by the USFWS and is entitled *Edwards Aquifer Recovery Implementation Program Habitat Conservation Plan* (Nov. 2012) (prepared by RECON Environmental, Inc., Hicks & Company, Zara Environmental LLC, and BIO-WEST). This document is now referred to as the EAHCP.

Voluntary Irrigation Suspension Program Option (VISPO) Springflow Protection Conservation Measure. The IC's approval of the Phase II Work Plan concluded activities during the SAMP. This six-month process culminated in the submission of documents to the USFWS on June 5, 2019 regarding the Phase II Work Plan and Resolution No. 05-19-001, and on June 7, 2019 regarding a request for a minor amendment to the EAHCP VISPO Conservation Measure. The USFWS approved the VISPO minor amendment on June 26, 2019.

The EAHCP SAMP implementation efforts from 2018 to 2019 included a detailed process and timeline to develop the Phase II Work Plan. The SAMP depended on the work of multiple committees and work groups, including the Science Review Panel(SRP)/National Academies of Sciences (NAS), the IC, the Comprehensive Phase II Work Group (Phase II Work Group), the Comal Springs Riffle Beetle Work Group (CSRB Work Group), the Adaptive Management Stakeholder Committee, and the Adaptive Management Science Committee.

The most critical component of the SAMP that determined EAHCP Committee decisions to transition from Phase I to Phase II, however, was the completion of the National Academies of Sciences – *Review of the Edwards Aquifer Habitat Conservation Plan: Report 3* (NAS *Report 3*). In that report, the SRP/NAS determined that the Biological Objectives were meeting the Biological Goals and that the Conservation Measures were achieving the Biological Objectives, and was unable to determine if the Conservation Measures related to the CSRB were achieving those Biological Objectives. Because the SRP/NAS determined that the Phase I Conservation Measures were achieving the Biological Objectives, the EAHCP Committees did not pursue the Presumptive Phase II Conservation Measure or any other new Phase II Conservation Measures.

Therefore, no SAMP decisions were made to transition from Phase I to Phase II of the EAHCP. The EAHCP Committees, however, conducted the following activities and made the following decisions to transition:

- Phase II Work Plan: Created the Phase II Work Group to review and comment on EAHCP staff's initial draft of the Phase II Work Plan and submit a Work Group report to the IC for the IC's use in review and approval of the Phase II Work Plan.
- EAHCP Resolution No. 05-19-001: Approved this Resolution to formalize EAHCP Program actions for Phase II of the ITP based on NAS *Report 3*, validate EAHCP Program actions for Phase II of the ITP pursuant to FMA § 7.13.7, and explain the purpose and rationale for Phase II activities.
- Nonroutine AMP VISPO Proposal: Approved a Nonroutine AMP Proposal to increase VISPO forbearance from 40,000 ac-ft to 41,795 ac-ft to achieve 30 cfs at Comal Springs.
- CSRB Work Group: Continued the CSRB Work Group in response to NAS *Report 3* conclusions related to CSRB riparian habitat.

Lastly, with SAMP activities now concluded, the EAHCP will move forward with addressing the three topics raised during this process: 1) implementation of CSRB Work Group recommendations; 2) creation of a Springflow Habitat Protection Work Group; and 3) completion of the USGS MODFLOW model uncertainty analysis.

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LIST OF ACRONYMS AND ABBREVIATIONS

ac-ft	acre-foot/acre-feet
AMP(s)	Adaptive Management Process(es)
ASR	Aquifer Storage and Recovery
B&A	Blanton & Associates, Inc.
cfs	cubic feet per second
CONB	City of New Braunfels
COSM	City of San Marcos
CSRB	Comal Springs riffle beetle
CSRB Work Group	Comal Springs Riffle Beetle Work Group
DOR	drought-of-record
EAA	Edwards Aquifer Authority
EAHCP	Edwards Aquifer Habitat Conservation Plan
EARIP	Edwards Aquifer Recovery Implementation Program
EcoModel	Ecological Model
ESA	federal Endangered Species Act of 1973
FMA	Funding and Management Agreement
GBRA	Guadalupe-Blanco River Authority
HCP	Habitat Conservation Plan
IC	Implementing Committee
ITP	Incidental Take Permit
LTBG(s)	Long-Term Biological Goal(s)
MODFLOW model	MODFLOW Groundwater Model
NAS	National Academies of Sciences
NAS *Report 1*	National Academies of Sciences – *Review of the Edwards Aquifer Habitat Conservation Plan: Report 1*
NAS *Report 2*	National Academies of Sciences – *Review of the Edwards Aquifer Habitat Conservation Plan: Report 2*
NAS *Report 3*	National Academies of Sciences – Review of the Edwards Aquifer Habitat Conservation Plan: Report 3
Phase I	Phase I EAHCP Implementation Strategy was defined as the time period that began on the effective date of the ITP (March 18, 2013) and continued for seven years, or until March 17, 2020.
Phase II	Phase II EAHCP Implementation Strategy was defined as the time period that began on the seventh anniversary of the effective date of the ITP (March 18, 2020) and continued for eight years until expiration of the ITP (March 31, 2028).
Phase II Work Group	Comprehensive Phase II Work Plan Work Group
Phase II Work Plan	Comprehensive Phase II Work Plan
Presumptive Phase II Conservation Measure	EAHCP § 5.5.2 - Expanded Use of the SAWS Aquifer Storage and Recovery and the Water Resources Integration Program Pipeline
Resolution No. 05-19-001	Resolution No. 05-19-001 of the Implementing Committee of the Edwards Aquifer Habitat Conservation Plan Program Relative to Action on the Science Review Panel's Determinations Pursuant to § 7.13.7 of the Funding and Management Agreement
SAMP	Strategic Adaptive Management Process
SAV	submerged aquatic vegetation
SAWS	San Antonio Water System

LIST OF ACRONYMS AND ABBREVIATIONS

SC	Adaptive Management Science Committee
SER	Scientific Evaluation Report
SH	Adaptive Management Stakeholder Committee
sp./spp.	species (singular)/species (plural)
SRP	Science Review Panel
SRP/NAS	Science Review Panel/National Academies of Sciences
TPWD	Texas Parks & Wildlife Department
USFWS	U.S. Fish & Wildlife Service
USGS	U.S. Geological Survey
VISPO	Voluntary Irrigation Suspension Program Option

1.0 BACKGROUND

The Edwards Aquifer Habitat Conservation Plan (EAHCP) is a regional plan to mitigate for the "incidental take" of federally listed species inhabiting the southern segment of the Edwards Aquifer (RECON et al. 2012). The EAHCP was approved by the U.S. Fish and Wildlife Service (USFWS), which issued an Incidental Take Permit (ITP) under the federal Endangered Species Act of 1973 (ESA), with an effective date of March 18, 2013. The EAHCP outlines activities to be taken to comply with the ITP.[2]

The EAHCP was the product of years of work by stakeholder parties in the region. Completion of this effort in late 2012 resulted in a plan to protect the species of the Edwards Aquifer and the Comal Springs and San Marcos Springs ecosystems, while helping to ensure availability of the aquifer as a water supply for the region.

The ITP authorizes certain Covered Activities, including circumstances where those activities may incidentally take a listed species, as the term "take" is defined under the ESA. EAHCP § 2.1 identifies four categories of Covered Activities that may result in incidental take: 1) the regulation and use of the aquifer; 2) recreational activities in the Comal and San Marcos springs and river ecosystems; 3) other activities in, and related to, the Comal and San Marcos springs and river ecosystems; and 4) activities involved in and related to the implementation of the minimization and mitigation measures in these ecosystems. The ITP provides incidental take coverage for Covered Activities in the portions of Uvalde, Medina, Atascosa, Bexar, Comal, Guadalupe, Hays and Caldwell counties, Texas, within the Edwards Aquifer Authority (EAA) jurisdictional boundary, which is the area in which pumping from the Edwards Aquifer is regulated by the EAA (**Figure 1-1**). As shown in **Figure 1-1**, the Contributing Zone is part of the Edwards Aquifer *system* but is not technically a part of the Edwards Aquifer itself.

By issuance of the ITP, the USFWS approved Conservation Measures in the EAHCP, allowing affected parties in the region to manage the aquifer to balance the needs of the Covered Species and water supply. The ITP, Permit No. TE-63663A-1, as amended January 21, 2015, was issued to five cooperating Permittees: the EAA; the City of New Braunfels (CONB); the City of San Marcos (COSM); Texas State University; and the City of San Antonio acting by and through its San Antonio Water System (SAWS) Board of Trustees.

[2] The Edwards Aquifer Recovery Implementation Plan (EARIP) Habitat Conservation Plan (HCP) was approved by the USFWS and is entitled *Edwards Aquifer Recovery Implementation Program Habitat Conservation Plan* (Nov. 2012) (prepared by RECON Environmental, Inc., Hicks & Company, Zara Environmental LLC, and BIO-WEST). This document is now referred to as the EAHCP.

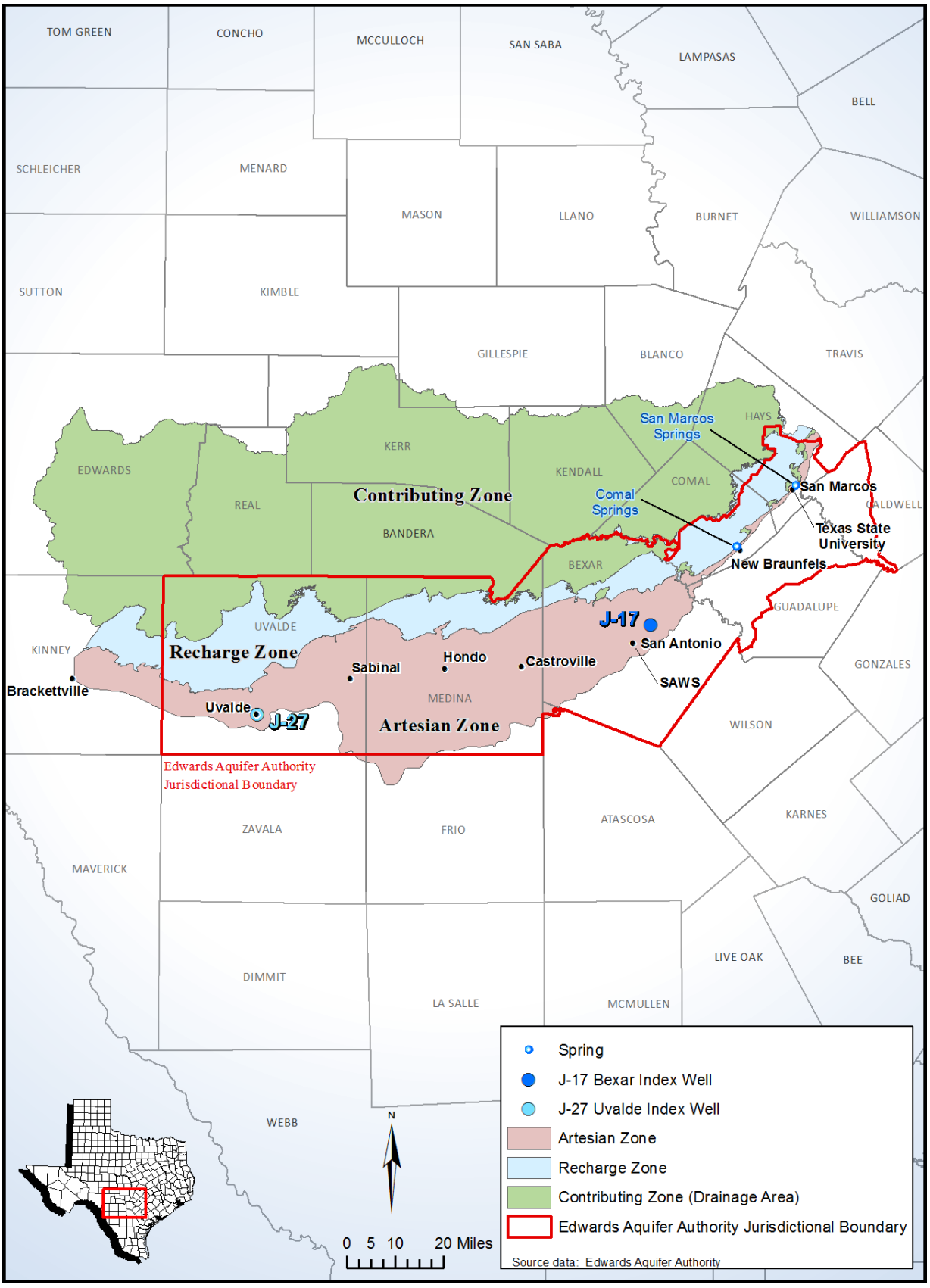

Figure 1-1. Incidental Take Covered Area for ITP No. TE-63663A-1 (EAA Jurisdictional Boundary).

The ITP Covered Species are listed in **Table 1-1**.

Table 1-1. Covered Species under the EAHCP ITP

Common Name	Scientific Name	Federal Status[a]	Associated Springs in the EAHCP
Fountain darter	*Etheostoma fonticola*	Endangered	Comal & San Marcos
San Marcos gambusia	*Gambusia georgei*	Endangered	San Marcos
Comal Springs dryopid beetle	*Stygoparnus comalensis*	Endangered	Comal
Comal Springs riffle beetle	*Heterelmis comalensis*	Endangered	Comal & San Marcos
Peck's cave amphipod	*Stygobromus pecki*	Endangered	Comal & San Marcos
Texas wild-rice	*Zizania texana*	Endangered	San Marcos
Texas blind salamander	*Eurycea* (=*Typhlomolge*) *rathbuni*	Endangered	San Marcos
San Marcos salamander	*Eurycea nana*	Threatened	San Marcos
Texas cave diving beetle*	*Haideoporus texanus*	Petitioned	Comal & San Marcos
Comal Springs salamander	*Eurycea* species (sp.)	Petitioned	Comal & San Marcos
Texas troglobitic water slater	*Lirceolus smithii*	Petitioned	San Marcos

[a] Source: USFWS 2020.
* Also known as the "Edwards Aquifer Diving Beetle."

1.1 Origins of the Edwards Aquifer Habitat Conservation Plan Adaptive Management Process

The EAHCP directed the Permittees to perform certain Springflow Protection and Habitat Restoration Conservation Measures to meet the Biological Goals and Objectives of the EAHCP. The EAHCP acknowledged the need for adaptive management. Therefore, the EAHCP § 2.8 included a framework for Adaptive Management Process (AMP) decisions at three levels: 1) Routine Adaptive Management Decisions; 2) Non-routine Adaptive Management Decisions; and 3) Strategic Adaptive Management Decisions. When making an AMP decision, the Implementing Committee (IC) was to use information and data collected to evaluate technical and engineering alternatives and improved groundwater, biological and ecological models, to modify the Conservation Measures, as needed.

The EAHCP contained a two-phased implementation strategy (EAHCP § 1.3.2). Phase I of the EAHCP Implementation Strategy (Phase I), began on the effective date of the ITP (March 18, 2013) and continued for seven years (until March 17, 2020), involved prompt implementation of a package of Conservation Measures to protect the Covered Species and their ecosystems.

The EAHCP also contemplated implementing additional specified measures, if necessary, to achieve the Biological Goals and Objectives during the Phase II implementation strategy. Phase II of the EAHCP Implementation Strategy (Phase II) began on the seventh anniversary of the effective date of the ITP (March 18, 2020) and continued for eight years until expiration of the ITP (March 31, 2028).

Lastly, the EAHCP provided for the Permittees to develop a Funding and Management Agreement to further establish procedures and their commitments to fund, implement, and manage the EAHCP and the AMP (RECON et al. 2012).

The five Permittees established a Funding and Management Agreement (FMA), that became effective January 1, 2012. FMA Articles 4 and 7 contained specific requirements related to the AMP and the

transition from Phase I to Phase II. The Strategic Adaptive Management Process (SAMP) was the process specified in the FMA to guide considerations related to the transition from Phase I to Phase II (EAA et al. 2012).

1.2 Purpose and Scope of Report

The *Edwards Aquifer Habitat Conservation Plan Transition from Phase I to Phase II Summary Report and Administrative Record: Process, Activities, and Decisions* (Report and Administrative Record) serves as the official record for the SAMP and all activities undertaken through this process. The firm of Blanton & Associates, Inc. (B&A) was retained by the EAA to: 1) document all SAMP activities, agendas, minutes, and activities; 2) produce the Administrative Record; and 3) assist with documentation needed for the USFWS, if necessary.

The EAHCP is described in **Section 1.0** above, including an introduction to the EAHCP requirements for AMP decisions and the SAMP. The SAMP is later described in in **Section 2.0** of this Report and Administrative Record.

Section 3.0 of this Report and Administrative Record describes EAHCP SAMP implementation efforts from 2018 to 2019, including the timeline and the various steps taken through the process (**Section 3.1**). The SAMP depended on the work of multiple committees and work groups, including the Science Review Panel (SRP)/National Academies of Sciences (NAS)[3], the IC, the Comprehensive Phase II Work Plan Work Group (Phase II Work Group), the Comal Springs Riffle Beetle Work Group (CSRB Work Group), the Adaptive Management Stakeholder Committee (SH), and the Adaptive Management Science Committee (SC) that provided critical input into the SAMP. These activities are described in **Section 3.2**.

Numerous key issues reviewed and considered throughout the process are described in **Section 3.3**, including the MODFLOW Groundwater Model (MODFLOW model) evaluations and results, the Ecological Model (EcoModel) (comprised of four major components for river hydraulics, water quality, submerged aquatic vegetation, and fountain darter population), and habitat restoration results. **Section 3.4** summarizes, the SRP/NAS review of the EAHCP included in National Academies of Sciences – *Review of the Edwards Aquifer Habitat Conservation Plan: Report 3* (NAS *Report 3*). **Section 3.5** documents the activities undertaken during the SAMP, including IC approval of Resolution No. 05-19-001 relative to EAHCP action based on the SRP's determinations pursuant to FMA § 7.13.7[4] and the Comprehensive Phase II Work Plan (Phase II Work Plan).

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[3] The NAS/National Research Council Committee served as the EAHCP SRP during the Phase I implementation strategy.

[4] The complete caption of this Resolution as approved by the IC on May 23, 2019, is "Resolution No. 05-19-001 of the Implementing Committee of the Edwards Aquifer Habitat Conservation Plan Program Relative to Action on the Science Review Panel's Determinations Pursuant to § 7.13.7 of the Funding and Management Agreement." This Resolution is referenced as Resolution No. 05-19-001 throughout this Report and Administrative Record. Exhibit A to the Resolution is a memorandum entitled "EAHCP National Academies of Sciences *Report 3* and Funding and Management Agreement § 7.13.7" to the EAHCP Committees (Storment 2019).

Section 4.0 describes the Nonroutine AMP Decision to amend the EAHCP Voluntary Irrigation Suspension Program Option (VISPO) Conservation Measure, and **Section 5.0** discusses planned EAHCP Phase II implementation. **Section 6.0** summarizes the EAHCP's activities to transition to Phase II.

2.0 EDWARDS AQUIFER HABITAT CONSERVATION PLAN AND FUNDING AND MANAGEMENT AGREEMENT ADAPTIVE MANAGEMENT AND STRATEGIC ADAPTIVE MANAGEMENT PROCESSES

As stated previously, the EAHCP and FMA outlined the requirements and deadlines for the AMP and the SAMP. This section provides a summary of the relevant provisions in EAHCP § 6.0 and FMA Articles 4 and 7.

2.1 Adaptive Management Process

The EAHCP is designed around a two-phased implementation strategy. Phase I included Conservation Measures that were to be implemented upon issuance of the ITP, relying on the best available scientific information. EAHCP § 6.0 described an AMP that would use information from monitoring data collected during Phase I, along with evaluation of technical and engineering alternatives and improved groundwater, hydrologic, biological and ecological models, to make appropriate modifications to the conservation program, as necessary (RECON et al. 2012).

FMA Article 4 outlined the process and deadlines for developing annual program Work Plan and budget approvals, including development of a Phase II Work Plan and IC approval of the Work Plan by March 1, 2019. FMA Article 7 outlined the procedural steps and considerations, and the responsibilities of the Permittees for making Routine and Nonroutine AMP Decisions, and SAMP Decisions related to selecting Phase II Conservation Measures (EAA et al. 2012).

FMA § 7.13 outlined the requirements for the Scientific Record to be supplemented during Phase I pursuant to EAHCP § 6 to include the best scientific information available to evaluate: 1) if the Conservation Measures are necessary and adequate to meet the Biological Objectives; and 2) if the Biological Objectives in the EAHCP are necessary and adequate to meet the Biological Goals (EAA et al. 2012). The Scientific Record is to be supplemented with research and modeling, such as ecological modeling, support and coordination of the construction of an applied research facility to provide data and information to inform Phase I and Phase II AMP Decisions, groundwater modeling improvements, and any other studies, research, or experimentation determined to be necessary during the AMP. **Table 2-1** summarizes the FMA § 7.13 deadlines for supplementing the Scientific Record.

Table 2-1. FMA § 7.13 Deadlines for Supplementing Scientific Record for EAHCP Covered Species

FMA § Number	FMA § Summary	FMA Deadline
§ 7.13.4	EAHCP Program Manager was to compile all relevant completed research, modeling and other data.	December 31, 2017
§ 7.13.5	EAHCP Program Manager to submit research and modeling results, and other data compiled to the SC, and simultaneously to the SRP, IC, and SH.	January 15, 2018
§ 7.13.5	SC was to complete review and comment on information submitted on January 15, 2018.	May 15, 2018
§ 7.13.5	EAHCP Program Manager was to submit the SC report to the SRP, IC and SH.	As soon as possible after completion
§ 7.13.6	EAHCP Program Manager was to deliver results of research, modeling, and other compiled data and the SC report, to the SRP and is to request their determinations regarding the Scientific Record through a written report addressing the list of possible outcomes as stated in FMA § 7.13.7.	June 1, 2018
§ 7.13.6	The SRP was to provide a written report with their determinations of their requirements stated in FMA § 7.13.7.	September 30, 2018
§ 7.13.6	EAHCP Program Manager was to distribute the SRP report to the IC, SH, and SC.	October 15, 2018

FMA § 7.13.7 also identified the IC's actions in response to the SRP's written report regarding their Scientific Record determinations. **Table 2-2** summarizes the list of possible SRP Scientific Record determinations and possible IC actions.

Table 2-2. FMA § 7.13.7 Science Review Panel Scientific Record Determinations and Possible IC Actions

FMA § Number	FMA § Summary	Possible IC Actions
§ 7.13.7.a.	Established that some of the Biological Objectives were not necessary to meet the Biological Goals.	The IC would have proposed changes to the Biological Objectives for that Covered Species based on the Scientific Record.
§ 7.13.7.b.	Established that the Biological Objectives were not adequate to achieve the Biological Goals.	The IC would have proposed changes to the Biological Objectives for that Covered Species based on the Scientific Record.
§ 7.13.7.c.	Established whether any of the Phase I Conservation Measures were not needed to achieve the Biological Objectives.	The IC would have proposed discontinuation of that Phase I Conservation Measure.
§ 7.13.7.d.	Established that the Phase I Conservation Measures were achieving the Biological Objectives.	Neither the Presumptive Phase II Conservation Measure nor any other Phase II Conservation Measure would have been pursued.

Table 2-2. FMA § 7.13.7 Science Review Panel Scientific Record Determinations and Possible IC Actions

FMA § Number	FMA § Summary	Possible IC Actions
§ 7.13.7.e.	Established that the Phase I Conservation Measures were not sufficient to achieve the Biological Objectives.	Two possible IC actions: 1. If the SRP determined that the Phase I Conservations Measures were not sufficient to achieve the Biological Objectives, the IC was to consider modifications to the Phase I Conservation Measures; or 2. If the IC did not recommend modifications to the Phase I Conservation Measures to achieve the Biological Objectives based on information received from the SRP, the IC would direct the EAHCP Program Manager to initiate procedures for SAMP Decision-making by January 31, 2019.
§ 7.13.7.f*	Failed or was inconclusive about whether the Phase I Conservation Measures were achieving the Biological Objectives.	The IC was to coordinate with the USFWS as part of the AMP and attempt to reach a conclusion that the Presumptive Phase II Conservation Measure or another Phase II Conservation Measure either was or was not necessary to achieve the Biological Objectives.

* FMA § 7.13.7.f. contemplated IC coordination with the USFWS through the AMP to reach conclusion that the Presumptive Phase II Conservation Measure (EAHCP § 5.5.2 - Expanded Use of the SAWS Aquifer Storage and Recovery and the Water Resources Integration Program Pipeline) or another Phase II Conservation Measure was or was not needed to achieve the Biological Objectives.

2.2 Strategic Adaptive Management Process

SAMP Decision-making procedures are defined in FMA § 7.14. Major elements included the submission of proposals, SC review, SH review, and IC decisions (EAA et al. 2012).

3.0 STRATEGIC ADAPTIVE MANAGEMENT PROCESS IMPLEMENTATION FOR TRANSITION FROM PHASE I TO PHASE II: 2018 AND 2019

While EAHCP staff initiated focused SAMP discussions with the EAHCP Committees in May 2018, it is important to note they had been laying the groundwork for this approaching process through background discussions related to EAHCP activities as early as 2014. Those discussions held during open meetings were reflected in either EAHCP Committee meeting agendas or minutes as part of discussions related to other items, such as development of the EcoModel and updates to the MODFLOW model. The results of these modeling analyses ultimately would be considered during the SAMP.

With the transition from Phase I to Phase II of the EAHCP approaching, EAHCP staff discussed the need to begin preparing for the SAMP and the transition to Phase II of the EAHCP in a presentation made to the IC on August 20, 2015, and to the SC on September 9, 2015. Both initial staff discussions were expanded upon at a joint meeting of the EAHCP Committees on December 17, 2015, where staff presented the details of the SAMP Decision-making process and convened a panel discussion to review and discuss this upcoming process. **Table 3-1** lists all EAHCP Committee discussions regarding the SAMP that occurred prior to May 2018.

Table 3-1. EAHCP Committee Strategic Adaptive Management Process-Related Discussions Prior to May 2018

EAHCP Committee	Meeting Date	Agenda Item/Action
SC	April 8, 2014	• Received a presentation and prioritization of potential 2015 Applied Research projects based on current need for the EcoModel including discussion of the fact that the purpose in building the model and updating the other (hydro) model was to appropriately determine the solution for Phase II decisions.
IC	August 20, 2015	• Presentation by EAHCP Program Manager on Phase II SAMP Decision-making.
SC	September 9, 2015	• Presentation from EAHCP Program Manager on EAHCP Phase II SAMP Decision-Making.
Joint – IS, SH, and SC	December 17, 2015	• Presentation and update on the Hydrologic Model. • Presentation and update on the EcoModel. • Presentation on the EAHCP SAMP (Phase II) Decision-making process. • Panel discussion regarding EAHCP SAMP (Phase II) Decision-making process.
IC	June 23, 2016	• During a discussion of EAHCP budget overview, EAHCP Program Manager reported mentions potential cost of Phase II not contemplated in EAHCP Table 7.1.
IC	October 20, 2016	• Discussion of an agenda item to be placed on November 17, 2017 agenda related to Phase II timeline.
Joint – IS, SH, and SC	December 15, 2016	• Reference to an agenda item related to Phase II discussion, including utilization of models to be included on a future meeting agenda.
IC	January 19, 2017	• Report from EAHCP Program Manager on various topics including Phase II planning.
SC	May 10, 2017	• Update on the Hydrologic Model and use in Phase II.
SH	June 15, 2017	• Update on the Hydrologic Model and EcoModel and their use in Phase II.
Joint – IS, SH, and SC	July 28, 2017	• Detailed overview of the EcoModel including a review of the role of the EcoModel in SAMP and report on the EcoModel SAMP run results, and future use of the EcoModel.
SC	August 7, 2017	• Report from the Program Manager regarding the Hydro model update – final report to be submitted in fall 2017. • Presentation by EAHCP staff on the EcoModel Workshop and EAHCP Phase II considerations.
IC	August 17, 2017	• Update from EAHCP Program Manager on plan to present the Hydrologic Model in a special meeting organized like the EcoModel held in summer 2017.

Table 3-1. EAHCP Committee Strategic Adaptive Management Process-Related Discussions Prior to May 2018

EAHCP Committee	Meeting Date	Agenda Item/Action
		• Presentation by EAHCP Program Manager on the EcoModel workshop and EAHCP SAMP considerations.
SH	September 21, 2017	• Update from EAHCP Program Manager on Hydrologic modeling workshop for SH and SC in fall 2017 and timeline for use of the hydrologic model through Phase II SAMP Decision-making. • Presentation on the EcoModel workshop and EAHCP SAMP considerations.
Joint – IS, SH, and SC	December 14, 2017	• Update from EAHCP Program Manager on NAS Phase 3. • Presentation by EAA staff on EAA's updated MODFLOW model and rerun of the EAHCP Springflow Protection "Bottom-Up" Package model results.

Appendix A1, Appendix A2, and Appendix A3 contain the meeting agendas, minutes, and presentations, as applicable, for the IC, SH, and SC, respectively, from 2014 – 2017.

3.1 Strategic Adaptive Management Process Implementation and Timeline

Preparation for the SAMP began in May 2018, with a staff presentation to the IC about the timeline and process to facilitate the SAMP (Pence 2018a). The SAMP was formally initiated when the Phase II Work Group convened on November 29, 2018, to review an initial draft of the Phase II Work Plan (Storment 2019). On May 23, 2019, the IC approved the Phase II Work Plan, EAHCP Resolution No. 05-19-001, and the Nonroutine AMP Proposal to amend the EAHCP VISPO Springflow Protection Conservation Measure. The IC's approval of the Phase II Work Plan concluded activities during the SAMP. This six-month process culminated in the submission of documents to the USFWS on June 5, 2019 regarding the Phase II Work Plan and Resolution No. 05-19-001, and on June 7, 2019 regarding a request for a minor amendment to the EAHCP VISPO Conservation Measure. The USFWS approved the VISPO minor amendment on June 26, 2019.

Table 3-2 contains an estimated timeline of key events leading up to and including the SAMP that was presented to the IC on May 17, 2018 and to the SH on June 21, 2018, and the timeline of these events as they occurred in 2017, 2018, and 2019.

Table 3-2. Strategic Adaptive Management Process Timelines: Estimated and Actual Events (2017, 2018 and 2019)

YEAR	Estimated SAMP-Related Event Timeline (as presented in 2018)	Actual SAMP-Related Event Timeline
2017		
	EAA to finalize the updated MODFLOW model.	A final report entitled *Updates to the MODFLOW Groundwater Model of the San Antonio Segment of the Edwards Aquifer* was published in November 2017 (Liu et al. 2017). The MODFLOW model was reviewed by the Groundwater Modeling Advisory Panel and the SRP/NAS (B&A 2018).
	EAHCP Committees to attend EcoModel Workshop.	Results of the EcoModel fountain darter survival were presented to the EAHCP Committees at a workshop on July 28, 2017 (B&A 2018).
	EAHCP Committee to review results of the rerun of the "Bottom Up Package" using updated MODFLOW model.	Results of the rerun of the "Bottom Up" Package[5] using the updated MODFLOW model were presented at a joint meeting of the EAHCP Committees on December 14, 2017 (**Appendix B1, Appendix B2, and Appendix B3**).
	SC to review the EAHCP Scientific Record.	As noted in EAHCP Annual Reports 2013 – 2018, the SC held meetings to continuously review the Scientific Record (SWCA 2014, B&A 2015 - 2019).
	EAHCP Program Manager to provide the EAHCP Scientific Record to the SRP/NAS.	As noted in EAHCP Annual Reports 2014 – 2018, the EAHCP Program Manager worked with the SRP/NAS to continuously provide them with the information related to the EAHCP Scientific Record (B&A 2015 - 2019).
2018		
	EAA to conduct SAMP hydro modeling.	EAHCP a presentation to the IC on May 17, 2018 regarding the SAMP, timeline and MODFLOW model run inputs and assumptions (**Appendix B1**). EAHCP staff presentation to the SH on June 21, 2018 regarding SAMP MODFLOW model run inputs and assumptions (**Appendix B2**). EAHCP staff presentation to the SC on August 9, 2018 regarding the SAMP, timeline and MODFLOW model run inputs and assumptions (**Appendix B3**).
	EAHCP Program Manager to provide any remaining scientific information to the SRP/NAS.	As noted in EAHCP 2018 Annual Report, the EAHCP Program Manager worked with the NAS/SRP to provide them with data and information (B&A 2019).

[5] HDR performed the original analysis of springflow that resulted from a "Bottom Up" approach to implementation of the Springflow Protection Conservation Measures through the DOR. The original HDR analysis, using the MODFLOW model available at that time, revealed predicted shortfalls in Comal Springs flow during a repeat of the DOR (HDR 2011).

Table 3-2. Strategic Adaptive Management Process Timelines: Estimated and Actual Events (2017, 2018 and 2019)

YEAR	Estimated SAMP-Related Event Timeline (as presented in 2018)	Actual SAMP-Related Event Timeline
	SRP/NAS to deliver Phase 3 report to the EAHCP Program Manager.	NAS *Report 3* delivered to the EAA in September 2018. The EAHCP Program in turn distributed the NAS *Report 3* to the EAHCP Committees in October 2018. The NAS also issued a Certification of Compliance with the completion of NAS *Report 3*. Delivery of the final report in December 2018 completed the activities of the SRP/NAS under FMA §§ 7.9 and 7.13 (B&A 2019).
	EAHCP Committees to review NAS *Report 3* conclusions and SAMP hydro modeling.	EAHCP staff presentation to the IC and SH on October 18, 2018 regarding MODFLOW modeling results and assumptions (**Appendix B1 and Appendix B2**). EAHCP staff presentation to the SC on November 7, 2018 regarding MODFLOW modeling results and assumptions (**Appendix B3**). NAS presentation during a joint EAHCP Committee meeting on December 20, 2018 to review the NAS *Report 3* conclusions (**Appendix B1, Appendix B2, and Appendix B3**). EAHCP staff presentation on preliminary results of model runs using the updated MODFLOW model and "Bottom Up" implementation of the Springflow Protection Conservation Measures during the first five years of the EAHCP to the IC and the SH on October 18, 2019 (**Appendix B1 and Appendix B2**).
	(THIS ITEM WAS NOT INCLUDED IN THE 2018 TIMELINE.)	Phase II Work Group began a review of EAHCP staff draft Phase II Work Plan on November 29, 2018 (**Appendix B4**).
	EAHCP Committees to determine the following: • If Biological Objectives were or were not adequate to meeting the Biological Goals, or • If Phase I Conservation Measures were or were not meeting the Biological Objectives.	*See related discussion below under the item "IC to meet to consider the SH Report on SAMP proposal(s)" below.*
2019		
	IC to direct the EAHCP Program Manager to initiate the SAMP proposal to establish Phase II Conservation Measures.	On January 24, 2019, IC approved extending the FMA SAMP proposal and Phase II Work Plan dues dates to May 23, 2019 (**Appendix B1**).
	IC to direct the EAHCP Program Manager to initiate the SAMP proposal to change Biological Objectives.	*See related discussion below under the item "IC to meet to consider the SH Report on SAMP proposal(s)" below.*

Table 3-2. Strategic Adaptive Management Process Timelines: Estimated and Actual Events (2017, 2018 and 2019)

YEAR	Estimated SAMP-Related Event Timeline (as presented in 2018)	Actual SAMP-Related Event Timeline
	SC to meet and consider SAMP proposal(s) and draft recommendation to the SH.	On March 27, 2019, the SC voted to approve Nonroutine AMP Proposal related to VISPO. The SC also approved submission of the Scientific Evaluation Report (SER) through the SC chairs to the SH per inclusion of the requested Aquifer Storage and Recovery (ASR) Forbearance schedule assumptions used to generate the recent model runs (**Appendix B3**).
	SH to review SC Report, consider SAMP proposal(s) and draft recommendation to the IC.	On May 23, 2019, the SH voted to recommend that the IC approve the March 14, 2019 Nonroutine AMP Proposal for VISPO, create a work group to address springflow-related issues raised in the discussion document circulated to the SH members by Myron Hess on May 21, 2019 (for issues not related to federal pumping), and that the IC support the evaluation process and any recommended studies that come out of the work group. The SH also approved the Nonroutine AMP SH Report and its submission to the IC (**Appendix B2**).
	IC to meet to consider the SH Report on SAMP proposal(s).	On May 23, 2019, the IC approved Resolution 05-19-001 that among other findings requested the Program Manager: 1) to take no action to propose discontinuing any of the existing Biological Objectives; 2) to take no action to propose any changes to any of the existing Biological Objectives; 3) to take no action to propose discontinuing any existing Phase I Conservation Measures; 4) to take no action to propose the Presumptive Phase II Conservation Measure or any other new Phase II Conservation Measure; 5) to take no action to propose any changes to the existing Phase I Conservation Measures other than the proposed changes to the VISPO necessary for the modeled results of implementing these measures demonstrated they were sufficient to achieve the 30 cubic feet per second (cfs) flow-related Biological Objective for Comal Springs using the procedures for a Nonroutine AMP decision set out in the FMA; and 6) engage the CSRB Work Group to address the issues raised by the SRP/NAS in NAS *Report 3.* On May 23rd, the IC also approved the EAHCP VISPO Nonroutine AMP Proposal with the understanding that the EAHCP Program Manager would provide updates to the IC on the SH's recommendations to create a springflow work group and voted to direct the EAHCP Program Manager to submit the necessary documentation regarding the Nonroutine AMP Proposal to the USFWS on behalf of the IC (**Appendix B1**).

Table 3-2. Strategic Adaptive Management Process Timelines: Estimated and Actual Events (2017, 2018 and 2019)

YEAR	Estimated SAMP-Related Event Timeline (as presented in 2018)	Actual SAMP-Related Event Timeline
	EAHCP Program Manager to complete the Phase II Work Plan.	On May 23, 2019, the IC approved the Phase II Work Plan (**Appendix B1**).
	EAHCP Committees to make the final decision to implement Phase II Conservation Measure.	*See previous discussion above under the item "IC to meet to consider the SH Report on SAMP proposal(s)."*
2020 & 2021		
	EAHCP Program to implement Phase II Conservation Measure(s) by March 18, 2021.	*See previous discussion above under the item "IC to meet to consider the SH Report on SAMP proposal(s)."*

3.2 EAHCP Committees

FMA Article 7 established the four EAHCP Committees and their roles and responsibilities in AMP and SAMP Decision-making. The four committees were the IC, SH, SC, and SRP (EAA et al. 2012). The activities of these four committees and their work groups through the SAMP are described below. Because of the significance of the SRP's review of the EAHCP and the conclusions of the SRP/NAS in NAS *Report 3* regarding the Scientific Record, the activities of this committee are recapped first in the EAHCP Committee discussion below.

3.2.1 Science Review Panel/National Academies of Sciences

In December 2013, the EAA entered into a contract with the NAS to create an independent SRP as defined in FMA § 7.10. The purpose of the SRP/NAS was to provide scientific advice in support of the EAHCP on several scientific initiatives: 1) ecological modeling; 2) hydrologic modeling; 3) biological and water quality monitoring; 4) applied research; and 5) resolve major scientific issues in the EAHCP and AMP, including the determination of the issues specifically identified in FMA § 7.13.7. The twelve SRP/NAS members were selected by the NAS.[6]

The SRP/NAS conducted a multi-year, formal review process in three distinct phases. The final deliverable for each phase consisted of a published report. Phase 1 was completed in February 2015 with the publication of NAS *Report 1* (NAS 2015) that focused on the EAHCP's hydrologic and ecological models, water quality and biological monitoring, and applied research programs.

The second phase of the SRP/NAS process was completed on December 30, 2016, with the publication of NAS *Report 2* (NAS 2016). For this second report, the SRP/NAS focused its evaluation and recommendations on implementation of NAS *Report 1* recommendations, EAHCP monitoring programs, scenarios for ecological and hydrological modeling, and Conservation Measure implementation. NAS

[6] The NAS/National Research Council Committee served as the EAHCP SRP.

Report 2 determined that satisfactory progress was achieved in several different EAHCP programs and identified areas for continued improvement.

The third and final phase of the SRP/NAS process was completed in December 2018 with the publication of NAS *Report 3* (NAS 2018). This final report focused on the relationships among proposed EAHCP Conservation Measures (including springflow protection and habitat restoration), Biological Objectives (such as water quality criteria, habitat condition, and specified spring flow rates), and Biological Goals (such as maintaining populations of the Covered Species), and analyzed the effectiveness of the Conservation Measures in meeting the Biological Objectives and the likelihood the Biological Objectives were achieving the Biological Goals (Storment 2019). The NAS Chairman made a presentation on NAS *Report 3* during a joint meeting of the EAHCP Committees on December 20, 2018 (Reible 2018). With the delivery of the final NAS *Report 3*, the activities of the SRP/NAS under FMA §§ 7.9 and 7.13 were completed.

A discussion of the findings of the NAS *Report 3* as they relate to the SAMP, is provided in this Report and Administrative Record under **Section 3.4,** National Academies of Sciences – Review of the Edwards Aquifer Habitat Conservation Plan: Report 3.

3.2.2 Implementing Committee

The IC supervises implementation of the EAHCP and ensures compliance with documents such as the ITP, EAHCP, and FMA. Specifically, FMA § 7.14 set out the IC's role regarding initiating the procedures for SAMP Decisions and approval of SAMP Decisions. There are five voting members of the IC who represented the five Permittees, and one representative of the Guadalupe-Blanco River Authority (GBRA) who serves as a non-voting member. The IC discussed or considered items related to SAMP issues during four meetings in 2018, and at three meetings in 2019. Highlights of those IC meetings and discussions related to the SAMP are listed in **Table 3-3** below.

Table 3-3. 2018 and 2019 Implementing Committee Meeting Strategic Adaptive Management Process Discussion or Action Item(s)

Meeting Date	IC Meeting Discussion or Action Item(s)
2018	
March 22, 2018	• Report on general topics related to the EAHCP, including an update on SAMP Planning.
May 17, 2018	• Presentation of the timeline and process to facilitate the SAMP.
October 18, 2018	• Discussion of future meeting agendas, including a report that a working draft of the EAHCP Comprehensive Phase II Work Plan would be submitted at the joint EAHCP Committee meeting on December 20, 2018, and work group to review the draft Phase II Work Plan to be appointed.
December 20, 2018 (Joint meeting - IC, SH and SC)	• Report on general topics related to the EAHCP, including an update on the Phase II Work Group. • Presentation on the NAS *Report 3*.

Table 3-3. 2018 and 2019 Implementing Committee Meeting Strategic Adaptive Management Process Discussion or Action Item(s)

Meeting Date	IC Meeting Discussion or Action Item(s)
2019	
January 24, 2019	• Report on the draft Phase II Work Plan. • Approval of extending the FMA SAMP proposal and Phase II Work Plan due dates to May 23, 2019.
March 21, 2019	• Reports on EAHCP Resolution No. 05-19-001 and the final draft of the Phase II Work Plan.
May 23, 2019	• Approval of EAHCP Phase II Work Plan. • Approval of Resolution No. 05-19-001. • Approval of the Nonroutine AMP Proposal VISPO. • Approval to direct the Program Manager to submit documentation for the approved Nonroutine AMP Proposal VISPO to the USFWS on behalf of the IC.

The agendas, minutes, presentations, and other SAMP-related documentation for these meetings are provided in **Appendix B1**.

In addition to the Phase II Work Group created by the IC to assist in the SAMP Process, the IC also created the CSRB Work Group. Activities of both Work Groups as part of the SAMP are summarized below.

3.2.2.1 Comprehensive Phase II Work Plan Work Group

As stated in FMA § 4.3, the IC was to develop and approve a Phase II Work Plan. As part of the process to develop the Phase II Work Plan, EAHCP staff planned to receive input from the IC, SH, SC and the public in early 2019 on a draft Work Plan, and to submit the Work Plan for IC consideration of approval in spring 2019.

In advance of the public comment process, the EAHCP Program Manager created the Phase II Work Group in late 2018. The members of the Phase II Work Group were Cindy Loeffler (Texas Parks & Wildlife Department [TPWD]), Mark Enders (CONB), Patrick Shriver (SAWS), Julia Carrillo (EAA), Nathan Pence (GBRA), and Melani Howard (COSM). Ms. Loeffler and Mr. Enders served as Phase II Work Group co-chairs. The Phase II Work Group was charged with, while operating on a consensus-basis, reviewing and providing comments to the EAHCP Program Manager on the draft Phase II Work Plan prepared by EAHCP staff. To prepare the initial draft of the Work Plan, EAHCP staff considered the recommendations contained in the National Academies of Sciences – *Review of the Edwards Aquifer Habitat Conservation Plan: Report 1* (NAS *Report 1*), the National Academies of Sciences – *Review of the Edwards Aquifer Habitat Conservation Plan: Report 2* (NAS *Report 2*), NAS *Report 3*, the EAHCP SAMP Management white paper (Pence 2018a), EAA drought-of-record (DOR) MODFLOW model simulations, the FMA, and six years of EAHCP Program experience.

The Phase II Work Group met on November 29, 2018 and December 5, 2018, to consider and develop their recommendations. The final Phase II Work Group Report was presented at the IC meeting on January 24, 2019. Copies of the Phase II Work Group's charge, meeting agendas, and final report entitled

Edwards Aquifer Habitat Conservation Plan Report of the 2018 Phase II Work Plan Work Group can be found in **Appendix D**.

Discussion of key issues highlighted by the Phase II Work Group in developing the Phase II Work Plan are provided in this Report and Administrative Record under **Section 3.4.1**, Comprehensive Phase II Work Plan.

3.2.2.2 Comal Springs Riffle Beetle Work Group

The EAHCP had previously appointed a CSRB Work Group to examine questions related to three primary areas: 1) sampling methodology; 2) field activities; and 3) EAHCP CSRB Long-Term Biological Goals (LTBGs). In late 2018, the CSRB Work Group was further charged with evaluating the issues raised in NAS *Report 3* regarding riparian management measures used to achieve the Biological Objectives for the Comal Springs riffle beetle (CSRB). The CSRB Work Group's charge included examining the CSRB sampling methodology, biological monitoring, refugia, and applied research collections, and the EAHCP CSRB LTBGs. The members of the CSRB Work Group for 2019 were Conrad Lamon (SC), Chad Norris (SC and TPWD), Floyd Weckerly (SC), Ken Ostrand (USFWS), and Tom Arsuffi (SC).

The CSRB Work Group met five times in 2019 to discuss cotton lure methodology, CSRB collection routines, and CSRB LTBGs. The CSRB Work Group's charge, meeting agendas, presentations, and final report entitled *Edwards Aquifer Habitat Conservation Plan Comal Springs Riffle Beetle Work Group Report* are provided in **Appendix C**.

3.2.3 Adaptive Management Stakeholder Committee

FMA § 7.14 established the SH's role in the SAMP Decision-making process and in formulating recommendations to the IC and the USFWS regarding SAMP Decision proposals. The SH discussed or considered items related to the SAMP issues in three meetings in 2018, and in one meeting in 2019. Highlights of these SH meetings and discussions are listed in **Table 3-4**.

Table 3-4. 2018 and 2019 Adaptive Management Stakeholder Committee Meeting Strategic Adaptive Management Discussion or Action Item(s)

Meeting Date	SH Meeting Discussion or Action Item(s)
2018	
June 21, 2018	• Presentation of the timeline and process to facilitate the SAMP. • Presentation on model inputs and assumptions for SAMP hydromodeling.
October 18, 2018	• Presentation and discussion of the NAS *Report 3*. • Presentation and discussion of MODFLOW modeling results and assumptions.
December 20, 2018 (Joint meeting of the IC, SH and SC)	• Report on general topics related to the EAHCP, including an update on the Phase II Work Group. • Presentation on NAS *Report 3*.

Table 3-4. 2018 and 2019 Adaptive Management Stakeholder Committee Meeting Strategic Adaptive Management Discussion or Action Item(s)

Meeting Date	SH Meeting Discussion or Action Item(s)
2019	
January 24, 2019	• Report on EAHCP Phase I to Phase II Transition Process.
May 23, 2019	• Approval of the Nonroutine AMP Proposal for the EAHCP VISPO. • Approval of the Nonroutine AMP SH Report and submission to the IC.

The agendas, minutes, presentations, and other SAMP-related documentation for these meetings are provided in **Appendix B2**.

Discussion related to key SAMP issues raised by the SH during consideration of the Nonroutine AMP Proposal VISPO is provided in this Report and Administrative Record under **Section 4.1**, Voluntary Irrigation Suspension Program Option Conservation Measure – Minor Amendment.

3.2.4 Adaptive Management Science Committee

FMA § 7.14 established the SC's role in evaluating SAMP Decision proposals and formulating recommendations to the SH regarding those proposals. The SC discussed and considered items related to SAMP issues during three meetings in 2018, and in one meeting in 2019. Highlights of these SC meetings and discussions are listed in **Table 3-5**.

Table 3-5. 2018 and 2019 Adaptive Management Science Committee Meeting Strategic Adaptive Management Discussion or Action Items

Meeting Date	SC Meeting Discussion or Action Item(s)
2018	
August 9, 2018	• Presentation of the timeline and process to facilitate the SAMP. • Presentation on model inputs and assumptions for SAMP hydromodeling.
November 7, 2018	• Presentation and discussion of NAS *Report 3.* • Presentation and discussion of the MODFLOW model DOR simulations. • Presentation of the timeline and process to facilitate the SAMP Phase II Work Plan.
December 20, 2018 (Joint meeting of the IC, SH and SC)	• Report on general topics related to the EAHCP, including an update on the Phase II Work Group. • Presentation on NAS *Report 3*.
2019	
March 27, 2019	• Report from EAHCP Program Manager, including a CSRB Work Group update and Phase II Work Plan update. • Approval to recommend the Nonroutine AMP Proposal for the EAHCP VISPO be approved by the SH. • Approval to submit the Nonroutine AMP SER through the SC Chairs to the SH.

The agendas, minutes, presentations, and other SAMP related documentation for these meetings are provided in **Appendix B3**.

Discussion related to key SAMP issues raised by the SC in considering the VISPO Nonroutine AMP Proposal is provided in this Report and Administrative Record under **Section 4.1**, Voluntary Irrigation Suspension Program Option Conservation Measure (EAHCP § 5.1.2) – Minor Amendment.

3.3 Key Issues and Considerations

The following discussion summarizes the key issues and considerations impacting EAHCP activities undertaken through the SAMP that consisted of MODFLOW model evaluations and results, EcoModel evaluations and results, habitat restoration results, and the NAS *Report 3*. For MODFLOW model evaluations, the SRP/NAS determined in NAS *Report 3* that the Springflow Protection Conservation Measures were effective in meeting the flow component of the Biological Objectives for all listed species after examining updated MODFLOW model DOR, calibration, and validation model runs. EAHCP staff also determined that a minor adjustment to the VISPO Conservation Measure was needed to meet the Comal Springs 30 cfs minimum springflow requirement. Using the EcoModel completed in 2016, EAHCP staff confirmed that fountain darter incidental take during a repeat of the DOR with the EAHCP Conservation Measures fully implemented did not appreciably reduce the likelihood of their survival and recovery in the wild once drought conditions ended.

The most critical component of the SAMP that determined EAHCP decisions to transition from Phase I to Phase II, however, was the completion of NAS *Report 3*. In that report, the SRP/NAS determined that the Biological Objectives were meeting the Biological Goals and that the Conservation Measures were achieving the Biological Objectives, and was unable to determine if the Conservation Measures related to the CSRB were achieving those Biological Objectives. Because the SRP/NAS determined that the Phase I Conservation Measures were achieving the Biological Objectives, the EAHCP Committees did not pursue the Presumptive Phase II Conservation Measure or any other new Phase II Conservation Measures.

Therefore, no SAMP decisions were made to transition from Phase I to Phase II.

3.3.1 MODFLOW Groundwater Model Evaluations and Results

As required in EAHCP § 6.3.2, the EAA began efforts to update the MODFLOW model in 2013. Those efforts were completed in 2017, with the publication of a report entitled *Updates to the MODFLOW Groundwater Model of the San Antonio Segment of the Edwards Aquifer* (Liu et al. 2017). In December 2017, EAHCP staff made a presentation during a joint meeting of the IC, SH, and SC on the updated MODFLOW model and results of model runs using the "Bottom Up" implementation of the EAHCP Springflow Protection Conservation Measures.

On May 17, 2018, June 21, 2018, and August 9, 2018, EAHCP staff reviewed with the IC, SH, and SC, respectively, the EAHCP SAMP proposed timeline, and the SAMP MODFLOW model runs and assumptions as summarized in a staff memorandum (Pence 2018a). The purpose of the MODFLOW model runs was to evaluate whether the Springflow Protection Conservation Measures (Regional Water Conservation Program [EAHCP § 5.1.3], Critical Period Management – Stage V [EAHCP § 5.1.4], VISPO [EAHCP § 5.1.2], and SAWS ASR Springflow Protection Program [EAHCP § 5.5]) were meeting

the minimum springflow Biological Objectives as implemented and analyzed using the updated MODFLOW model completed in November 2017[7] (Liu et al. 2017).

Initially, EAHCP staff outlined five SAMP model runs that would be analyzed using the updated MODFLOW model (Pence 2018a, p. 4):

1. EARIP Daily Minimum: 1947 - 1960 copy of the HDR "Bottom Up" model runs that used the updated MODFLOW model – to examine Comal and San Marcos daily springflows through the DOR (HDR 2011).
2. EARIP Long-Term Average: 1947 – 2000 copy of the HDR "Bottom Up" model runs that used the updated MODFLOW model – to examine Comal and San Marcos long-term average springflows over a minimum 50-year modeling period, including the DOR.
3. EAHCP SAMP Daily Minimums: 1947 – 1958 with current implementation of Springflow Protection Conservation Measures – that examined minimum daily springflows at Comal and San Marcos springs through the DOR with current Phase I Conservation Measures as implemented, and to determine if additional Conservation Measures were needed to meet the Biological Objectives.
4. EAHCP SAMP Long-Term Average: 1947 – 2000 with current implementation of Springflow Protection Conservation Measures – same as Run 3 above but over a longer time period.
5. Phase I Conservation Measures Plus Phase II Conservation Measure(s) – if needed to achieve minimum springflows.

On June 21, 2018, EAHCP staff provided a memorandum entitled "SAMP Model Runs and Inputs and Assumptions" to the EAHCP Committees (Pence 2018b). Staff also made presentations to the SH and the SC on the SAMP model run inputs and assumptions. The memorandum and presentations provided the following:

1. A summary of updates to the MODFLOW model completed in 2017.
2. A summary of three types of hydrologic modeling simulations that would be conducted:
    - Two "Baseline Runs" of the HDR EARIP model runs using the updated MODFLOW model to produce daily minimum and long-term average springflows (Model Runs 1 and 2),
    - Two "SAMP Runs – Actual" using the updated MODFLOW model and model inputs based on the first five years of EAHCP implementation to produce daily minimum and long-term average springflows (Model Runs 3 and 4),
    - One "SAMP Run – Expanded Phase I Conservation Measures and/or Phase II Conservation Measures" to be conducted if springflow shortfalls continued after analysis of the "SAMP Runs – Actual" model runs.

[7] This modeling analysis was contemplated by the EARIP Steering Committee when initial predictive modeling by HDR using the MODFLOW model in place at that time to develop the EAHCP revealed deficits of 3 cfs (minimum springflows) and 29 cfs (long-term average springflow) at Comal Springs.

3. A review of the model assumptions for each of the Springflow Protection Conservation Measures and pumping to be used in these model runs, as applicable.

The memorandum included the following estimated completion timeframes for these model runs:

Model Run 1 (Baseline Minimum Total Springflows) – This run was completed and the results indicated a minimum daily springflow average of 29.71 cfs at Comal Springs and 48.1 cfs at San Marcos Springs during a repeat of the DOR (1947 - 1958) using the updated MODFLOW model with full implementation of the "Bottom Up" package of Springflow Protection Conservation Measures consistent with the original HDR analysis.

Model Run 2 (Long-Term Average Total Springflows) – Fall 2018 (estimated completion). This run would estimate springflow from 1947 – 2000 and included the same inputs as Model Run 1.

Model Runs 3 and 4 (SAMP Runs – Actual or As Implemented) – Fall 2018/spring 2019 (estimated completion). These model runs would be for the same time periods as Runs 1 and 2, respectively, using updated data gathered during EAHCP implementation, and include VISPO and ASR forbearance assumptions as outlined in the June 21, 2018 memorandum (Pence 2018a).

Model Run 5 (SAMP Run -Expanded Phase I Conservation Measures and/or Phase II Conservation Measures – Completion timeframe to be determined.

On October 18, 2018, EAHCP staff presented preliminary model simulation results using the updated MODFLOW model and "Bottom Up" implementation of the Springflow Protection Conservation Measures during the first five years of the EAHCP to the IC and the SH. Staff also made this presentation to the SC on November 7, 2018. **Table 3-6** provides a summary of the model simulations and results presented on October 18, 2018 and November 7, 2018, respectively (Winterle 2018a and 2018b).

Table 3-6. Updated MODFLOW Groundwater Model Simulations and Minimum Springflow Results for Comal and San Marcos Springs

MODFLOW Model Simulation	Minimum Springflow Results
Repeat of "Bottom Up" analysis using updated MODFLOW model.	Comal Springs: 29.7 cfs (August 31, 1956) San Marcos Springs: 48.1 cfs (August 31, 1956)
Repeat of "Bottom Up" analysis using new SAWS ASR leasing structure and trigger.	Comal Springs: 29.8 cfs San Marcos Springs: 48.0 cfs
New "Bottom Up" analysis using "as implemented" Conservation Measure forbearance and pumping assumptions described in June 21, 2018 memorandum for this model run.	Comal Springs: 23.8 cfs San Marcos Springs: 46.9 cfs
New "Bottom Up" analysis using "as implemented" Conservation Measure forbearance and pumping assumptions described in June 21, 2018 memorandum for this model run with modified SAWS ASR forbearance.	Comal Springs: 29.1 cfs San Marcos Springs: 48.1 cfs

Table 3-6. Updated MODFLOW Groundwater Model Simulations and Minimum Springflow Results for Comal and San Marcos Springs

MODFLOW Model Simulation	Minimum Springflow Results
New "Bottom Up" analysis using "as implemented" Conservation Measure forbearance and pumping assumptions described in June 21, 2018 memorandum for this model run with modified SAWS ASR forbearance and VISPO enrollment of 40,921 acre-feet (ac-ft).	Comal Springs: 29.6 cfs San Marcos Springs: 48.3 cfs

EAHCP staff discussed the following challenges associated with modeling long-term average springflows:

- Updated MODFLOW model not calibrated to long-term period of 1947-2000 used in original analyses.
- Mass balance constraints dictated that long-term average springflows cannot exceed long-term average recharge minus long-term average pumping.
- With substantially similar recharge and pumping inputs as the HDR 2011 analysis, results of a long-term model run with updated MODFLOW model would likely not differ significantly.
- Results would likely be a few cfs lower due to the inclusion of federal pumping (6,000 ac-ft) not included in the HDR 2011 analysis (Winterle 2018a and 2018b).

EAHCP staff noted that long-term goals could not be met with the pumping assumptions that were required and suggested it would be more productive to use data from 2001 – 2017 to demonstrate long-term springflow objectives based on actual recent experience.

Also, in October 2018, the SRP/NAS determined in NAS *Report 3* that the Springflow Protection Conservation Measures would be effective in meeting the flow component of the Biological Objectives for all listed species after examining updated MODFLOW model DOR, calibration and validation model runs (NAS 2018).

EAHCP staff would ultimately use the MODFLOW model runs summarized in **Table 3-6** to determine that a minor increase in the amount of groundwater enrolled in the VISPO Conservation Measure was needed to meet the Comal Springs 30 cfs minimum springflow requirement, and to develop the Nonroutine AMP Proposal VISPO presented to the EAHCP Committees in the spring of 2019. Further discussion of SC and SH considerations of the model runs related to the Nonroutine AMP Proposal VISPO, are provided in **Section 4.0**, Voluntary Irrigation Suspension Program Option Conservation Measure – Minor Amendment, of this Report and Administrative Record**.**

3.3.2 Ecological Model Evaluations and Results

The EAA developed the EcoModel for the fountain darter and submerged aquatic vegetation (SAV) as a predictive tool to assess the potential adverse ecological effects from Covered Activities, and to determine the extent and magnitude to which they might occur (Grant et al. 2017). The EcoModel results could then be used to develop alternative approaches or mitigation strategies, if necessary (EAHCP § 6.3.3). The

EcoModel was completed in 2016 to represent fountain darter population dynamics using EAHCP biological monitoring data collected since 2002. With the completion of the EcoModel, the SAV component was linked to the fountain darter component to comprise the "coupled" model (B&A 2018).

The EcoModel was run to affirm whether fountain darter incidental take during a repeat of the DOR would appreciably reduce the Covered Species' likelihood of survival and recovery in the wild once the drought subsided and all EAHCP Conservation Measures were fully implemented (Pence 2018a). In 2016, BIOWEST performed this model run for the EAA and the results showed that the fountain darter incidental take during a repeat of the DOR with the EAHCP Conservation Measures fully implemented did not appreciably reduce the likelihood of their survival and recovery in the wild once drought conditions ended.

3.3.3 Habitat Restoration Results

As discussed below in Section 3.5, the NAS in NAS *Report 3* was unable to determine whether the Riparian Management Conservation Measures would contribute to achieving the Biological Objectives for the CSRB. In response to this determination, the EAHCP continued the work of the CSRB Work Group to review and make recommendations on CSRB sampling methodology, field activities, and LTBGs. The CSRB Work Group delivered their final report in late 2019. Documents related to the CSRB Work Group are in **Appendix C**.

3.4 National Academies of Sciences – *Review of the Edwards Aquifer Habitat Conservation Plan: Report 3*

As mentioned previously, FMA § 7.10.3 established the role of the SRP/NAS on issues related to AMP proposals and charged the SRP/NAS with definitively determining if the Scientific Record established each of the conclusions in FMA § 7.13.7. The NAS *Report 3*, therefore, was the most critical component of the SAMP process for determining the decisions to be made to transition from Phase I to Phase II of the EAHCP.

In preparation for the receipt of NAS *Report 3*, EAHCP staff reported to the EAHCP Committees that the NAS *Report 3* would evaluate the Springflow Protection and Habitat Restoration Conservation Measures and determine if they were achieving the EAHCP's Comal and San Marcos springs minimum springflows and habitat quantity and quality. Staff also outlined possible NAS *Report 3* determinations (Pence 2018a).

The SRP/NAS delivered a pre-publication draft of NAS *Report 3* to the EAHCP on September 26, 2019, and EAHCP staff distributed the draft report to the EAHCP Committees on October 9, 2019. Below is a summary of NAS *Report 3* findings and conclusions that ultimately informed the EAHCP staff recommendations and EAHCP Committee activities during the SAMP.

To determine whether the Biological Objectives would meet the Biological Goals, the SRP/NAS first reviewed the Biological Goals for the Covered Species and noted that they reflected a population goal and a habitat goal. Of the eight Covered Species listed in the EAHCP, the SRP/NAS identified four of them as "indicator species" that served as representative of all Covered Species throughout NAS *Report 3*: 1)

fountain darter; 2) CSRB; 3) Texas wild-rice; and 4) San Marcos salamander. The NAS provided the following conclusions or recommendations for these "indicator species" and their Biological Goals (NAS 2018, pp. 4-5):

- The habitat-based approach for fountain darter Biological Goals (fountain darter density times SAV acreage), rather than an actual measure of fish abundance, was reasonable.
- The LTBGs for Texas wild-rice (desired acreage in various reaches of the San Marcos River) were appropriate, and this species has benefited from extensive monitoring and decades of study.
- The LTBGs for CSRB density (number of beetles per cotton lure) should be updated during Phase II of the EAHCP to reflect more quantitative and standardized methods.
- Both LTBGs for the San Marcos salamander – target densities in three reaches and maintenance of silt-free gravel – were reasonable and biologically justified.

To determine if the Biological Objectives would meet the Biological Goals, the SRP/NAS noted that while Biological Objectives were different for each species, they had three similar components: 1) flow; 2) water quality; and 3) habitat (NAS 2018). The SRP/NAS assessed the likelihood that the combined effects of these three components could achieve the Biological Goals for the Covered Species and assigned one of four possible ratings: *highly likely*; *likely*; *somewhat likely*; or *unlikely*. The SRP/NAS noted the following conclusions about whether the Biological Objectives would meet the Biological Goals (NAS 2018, pp. 6-7):

- It was *likely* that the Biological Objectives would meet the Biological Goals for the fountain darter.
- It was *likely* that the Biological Objectives would meet the Biological Goals for the Texas wild-rice.
- It was *somewhat likely* that the Biological Objectives would meet the Biological Goals for the CSRB.
- It was *somewhat likely* that the Biological Objectives would meet the Biological Goals for the San Marcos salamander.

To assess whether the Conservation Measures would meet the Biological Objectives, the SRP/NAS combined the Conservation Measures into the following five categories: 1) flow protection measures; 2) water quality protection measures; 3) SAV planting and removal of nonnative vegetation; 4) recreation management; and 5) riparian restoration. The SRP/NAS then evaluated whether each category was *highly effective*, *effective, somewhat effective*, *ineffective*, or *it cannot be determined with the available information*, in meeting the Objectives. The SRP/NAS noted the following conclusions for each Conservation Measure category (NAS 2018, pp. 8-11):

- The Springflow Protection Conservation Measures would be *effective* in meeting the flow component of the Biological Objectives for all Covered species.
- The Water Quality Protection Conservation Measures, focusing primarily on storm-water control, would be *somewhat effective* in meeting the water quality component of the Biological Objective for the fountain darter in the Comal and San Marcos stream systems.

- The SAV Restoration Conservation Measures, including the replanting of Texas wild-rice, would be *effective* in meeting the habitat component of the Biological Objectives for Texas wild-rice and the fountain darter.
- The Recreation Management Conservation Measures would be *effective* in meeting the habitat component of the Biological Objectives for the San Marcos salamander and Texas wild-rice.
- The SRP/NAS was *unable to determine* whether the riparian management Conservation Measures would contribute to achieving the CSRB Biological Objectives.

In summary, the SRP/NAS determined that the Biological Objectives were meeting the Biological Goals, that the Conservation Measures were achieving the Biological Objectives, and was unable to determine if the Conservation Measures related to the CSRB were achieving those Biological Objectives.

Lastly, the SRP/NAS noted overarching issues for the EAHCP to consider for implementation in Phase II and renewal of the ITP. Those areas noted related to fountain darter Biological Goals, SAV targets, macroinvertebrate data analysis incorporation, early detection of non-native invasive species and exotics plants, and evaluation of catastrophic events for possible inclusion in future ITPs and EAHCP planning.

EAHCP staff carefully reviewed NAS *Report 3* and used it as the basis for developing the draft Phase II Work Plan that was reviewed with the Phase II Work Group in November and December of 2018.

Discussion related to considerations of NAS *Report 3* during the development of the Phase II Work Plan is provided in this Report and Administrative Record under **Section 3.5.1**, Comprehensive Phase II Work Plan.

3.5 Strategic Adaptive Management Process Activities

As provided for in FMA § 7.13.7.d, because the SRP/NAS determined in NAS *Report 3* that the Phase I Conservation Measures were achieving the Biological Objectives, the EAHCP Committees did not pursue the Presumptive Phase II Conservation Measure or any other new Phase II Conservation Measures. Therefore, no SAMP decisions made to transition from Phase I to Phase II.

The EAHCP Committees, however, conducted the following activities and made the following decisions to transition from Phase I to Phase II:

- Phase II Work Plan: Created the Phase II Work Group to review and comment on EAHCP staff's initial draft of the Phase II Work Plan and submit a Work Group report to the IC for the IC's use in review and approval of the Phase II Work Plan.
- EAHCP Resolution No. 05-19-001: Approved this Resolution to formalize EAHCP Program actions for Phase II of the ITP based on NAS *Report 3*, validation of EAHCP Program actions for Phase II of the ITP pursuant to FMA § 7.13.7, and explanation of the purpose and rationale for Phase II activities.
- Nonroutine AMP VISPO Proposal: Approved the Nonroutine AMP VISPO Proposal to increase VISPO forbearance to achieve 30 cfs at Comal Springs.

- CSRB Work Group: Continued the CSRB Work Group in response to the NAS *Report 3* conclusions related to CSRB riparian habitat.

These activities, to be discussed later in this Report, were reflected in the Phase II Work Plan and Resolution No. 05-19-001 approved by the IC on May 23, 2019, which summarized the EAHCP's actions in response to the NAS *Report 3* findings. In summary, the Phase II Work Plan provides the USFWS, EAHCP Permittees and Stakeholders with a plan that outlines the EAHCP efforts during Phase II of the ITP, while the Resolution provides an explanation of the why rationale for the EAHCP efforts during Phase II.

3.5.1 Comprehensive Phase II Work Plan

FMA § 4.3 required that by March 1, 2019, the IC was to develop and approve a Phase II Work Plan that included descriptions, schedules, and cost estimates for on-going Phase I Conservation Measures, for Phase II Conservation Measures, and for all EAHCP Program activities funded by the EAHCP for the Phase II period beginning on January 1, 2020 and continuing until expiration of the ITP (EAA et al. 2012). Additional discussion related to the process of developing and reviewing the draft Phase II Work Plan is provided in this Report and Administrative Record under **Subsection 3.2.2.1**, Comprehensive Phase II Work Plan Work Group.

A Phase II Work Plan was drafted by the EAHCP staff from the results of the *NAS Report 3,* EAA DOR MODFLOW model simulations, and the first six years of EAHCP monitoring and management. The Phase II Work Group was created to review and comment on the draft Phase II Work Plan prior to review by the IC (Storment 2019).

Work Group members reviewed the draft Phase II Work Plan and provided comments to EAHCP staff. As noted in EAHCP staff memoranda, the following four potential outcomes were to guide consideration of Phase II Conservation Measures through the SAMP (Pence 2018a, Storment 2019):

1. Continue Phase I Conservation Measures without change.
2. Continue Phase I Conservation Measures with changes or expansion.
3. Continue Phase I Conservation Measures, plus new Phase II Conservation Measures.
4. Continue Phase I Conservation Measures with changes, plus a new Phase II Conservation Measure.

By consensus, the Phase II Work Group agreed to develop the Phase II Work Plan based on outcome No. 2 above - Continue the Phase I Conservation Measures with changes or expansion.

In 2018, the Phase II Work Group completed their report entitled *Edwards Aquifer Habitat Conservation Plan Report of the 2018 Phase II Work Plan Work Group*. Table 1 of the Phase II Work Group Report (Loeffler et al. 2018) provides a summary of the Work Group's comments on the Phase II Work Plan and EAHCP staff's responses to each comment.

In addition to providing comments on the Conservation Measures in the draft Phase II Work Plan, the Work Group noted the following additional concerns or considerations for EAHCP Committees (Loeffler et al. 2018):

- The Phase II Work Group suggested the IC direct the EAHCP Budget Work Group to review the Phase II Work Plan costs because the Phase II Conservation Measure costs were based on Phase I costs.
- The Phase II Work Group noted that Appendix E to their report contained a matrix developed by EAHCP staff that summarized NAS *Report 3*, and Work Group and EAHCP staff discussions of NAS *Report 3*.
- The Phase II Work Group suggested significance of the Monitoring and Reduction of Gill Parasites Conservation Measure (EAHCP § 5.2.6) in the CONB Work Plan should be re-evaluated during the transition to the next ITP based on EAHCP research and program experience.
- For activity under the Minimizing Impact of Contaminated Runoff Conservation Measure (EAHCP § 5.7.4) in the COSM Work Plan, the Work Group suggested either summarizing the work completed under this measure throughout Phase I or removing it from the Phase II Work Plan.
- The Phase II Work Group recommended that the CSRB Work Group discuss incorporating quantitative monitoring of native habitat restoration and sedimentation rates to improve the CSRB-related Conservation Measures.
- The Phase II Work Group considered the springflow deficit between the draft MODFLOW model simulations and the 30 cfs minimum springflow target requirement for Comal Springs to be an issue in developing the Phase II Work Plan and the Springflow Protection Conservation Measures.

On December 18, 2018, EAHCP staff provided an update on development of the Phase II Work Plan during a joint EAHCP Committee meeting. Staff noted that they were still working on the draft Work Plan to be submitted to the IC in January 2019. They also reported they would be including a public comment phase to receive comments and integrate them into the final proposed work plan. They noted that the public comment would add time to the Work Plan development process.

On January 24, 2019, the IC received a presentation from the Phase II Work Group on their final report and EAHCP staff presented the draft Phase II Work Plan. The public comment period on the draft Phase II Work Plan then began on January 24, 2019 and concluded on February 15, 2019. The IC was briefed on the public comments received and reviewed the final draft of the Phase II Work Plan during a meeting on March 21, 2019, and subsequently approved the Phase II Work Plan on May 23, 2019. A copy of the Phase II Work Plan was submitted to the USFWS on June 5, 2019.

Appendix D contains a copy of the January 24, 2019 draft of the Phase II Work Plan, a summary of the comments received during the public comment period and EAHCP staff's responses, the final Phase II Work Plan approved by the IC on May 23, 2019 , and the letter from S. Storment, EAHCP Program Manager, to A. Zerrenner, USFWS, dated June 5, 2019, transmitting a copy of the Phase II Work Plan.

3.5.2 EAHCP Resolution No. 05-19-001 and Memorandum

On January 24, 2019, the EAHCP Program Manager presented the IC with draft Resolution No. 05-19-001. Exhibit A to the draft Resolution was a memorandum entitled "EAHCP National Academies of Sciences *Report 3* and Funding and Management Agreement § 7.13.7" to the EAHCP Committees regarding the NAS *Report 3* findings related to FMA § 7.13.7 (Storment 2019). EAHCP staff reported that the purpose of the Resolution was to:

1. Formalize EAHCP Program actions for Phase II based on NAS *Report 3* findings.
2. Validate EAHCP Program actions for Phase II pursuant to FMA § 7.13.7.
3. Explain the purpose and rationale for EAHCP Phase II activities.

EAHCP also staff reviewed the following series of FMA § 7.13.7 determinations based on the NAS *Report 3* conclusions summarized in the memorandum (Storment 2019, p. 3 of 6):

NAS *Report 3* did not find any:

- Biological Objectives that were not necessary to meet any of the Biological Goals for the "indicator species" (FMA § 7.13.7.a.).
- Biological Objectives that were not adequate to meet any of the Biological Goals for the "indicator species" (FMA § 7.13.7.b.).
- Existing Phase I Conservation Measures that were not needed to achieve the existing Biological Objectives (FMA § 7.13.7.c.).
- Existing Phase I Conservation Measures that were not achieving the existing Biological Objectives (FMA § 7.13.7.e.).

NAS *Report 3* did find:

- The existing Phase I Conservation Measures were achieving the Biological Objectives (FMA § 7.13.7.d.).
- The Scientific Record was inconclusive about whether the Phase I Conservation Measure – Native Riparian Habitat Restoration (EAHCP § 5.2.8) was achieving the Biological Objectives for the CSRB (FMA § 7.13.7.f.).
- The flow protection measures were "effective" in achieving flow-related Biological Objectives relative to the Covered Species but noted concerns about flow protection measures achieving 30 cfs at Comal Springs that need to be addressed.

Staff noted that NAS *Report 3* did not determine or was inconclusive regarding Phase I Conservation Measure – Native Riparian Habitat Restoration (EAHCP § 5.2.8) for the CSRB, and the CSRB Work Group would be considering these issues noted by the SRP/NAS and would make recommendations in late 2019 regarding sampling methodology, field activities, and LTBGs.

EAHCP staff reported on the MODFLOW model simulations that were used to determine the solution to achieving the 30 cfs Comal Springs flow deficit and indicated that a proposal would be considered

through the Nonroutine AMP as provided in FMA § 7.12. Staff reported that the MODFLOW model results indicated that an increase of 1,795 ac-ft in VISPO forbearance would achieve 30 cfs at Comal Springs. The Nonroutine AMP VISPO Proposal to modify forbearance under this Conservation Measure would be submitted to the EAHCP Committees for consideration.

Additional discussion regarding the Nonroutine AMP VISPO Proposal and EAHCP Committee consideration is provided in this Report and Administrative Record under **Section 4.1**, Voluntary Irrigation Suspension Program Option Conservation Measure (EAHCP § 5.1.2) – Minor Amendment.

Lastly, EAHCP staff reported that the final Resolution would be submitted to the IC for consideration of approval at the May 23, 2019 IC meeting. On May 23rd, the IC approved Resolution 05-19-001. A copy of Resolution 05-19-001 was sent to the USFWS on June 5, 2019.

Copies of Resolution 05-19-001 and memorandum, and the transmittal letter from S. Storment, EAHCP Program Manager, to A Zerrenner, USFWS, dated June 5, 2019, can be found in **Appendix E**.

4.0 EDWARDS AQUIFER HABITAT CONSERVATION PLAN AMENDMENT

4.1 Voluntary Irrigation Suspension Program Option Conservation Measure (EAHCP § 5.1.2) – Minor Amendment

Consistent with FMA § 7.12, on March 14, 2019, the EAHCP Program Manager issued a Nonroutine AMP Proposal to the EAHCP Committees regarding VISPO (EAHCP § 5.1.2) volume changes. In summary, the proposed amendment to the EAHCP would increase the amount of VISPO forbearance from 40,000 ac-ft to 41,795 ac-ft., at a cost of $1,733,970.

During the SC meeting on March 27, 2019, EAHCP staff presented to the SC the Nonroutine AMP VISPO Proposal to increase the VISPO Conservation Measure forbearance to achieve the 30 cfs minimum springflow objective at Comal Springs during a repeat of the DOR.

Staff noted that based on the current enrollment amount of 40,921 ac-ft, the proposed amendment would require enrollment and new VISPO leases for an additional 874 ac-ft. The EAHCP staff presentation reviewed:

- Nonroutine AMP Proposal VISPO.
- AMP to develop and propose Nonroutine AMP Proposal VISPO.
- EAHCP Springflow Protection Conservation Measures and whether they achieve EAHCP flow objectives.
- EAHCP phased implementation to address the flow objective shortfall.
- EAA MODFLOW model update, schedule of SAMP model run, and result presentations and discussions.
- NAS *Report 3* review of Springflow Protection Conservation Measures.
- Rationale for EAHCP staff model runs after NAS *Report 3*.
- Initial and modified SAWS ASR pumping, and forbearance schedule model run considerations.

- Three SAMP DOR model runs to achieve 30 cfs minimum flow at Comal Springs, with the final one of the SAMP DOR runs based on expanded use of the VISPO Phase I Conservation Measure.[8]
- EAHCP staff timeline of previous model run presentations to the EAHCP Committees.
- Challenges achieving long-term flow objectives through modeled results and use of empirical record to determine if objectives were met.
- 80 cfs flow objective for six-month low-flow time period.

In summary, EAHCP staff reported that increasing the VISPO volume goal to 41,795 ac-ft ensured a modeled 30 cfs daily average minimum springflow in the Comal Springs system during a repeat of DOR scenario, thereby fulfilling the springflow shortfall according to MODFLOW model simulations. EAHCP staff also reported that the long-term flow averages and the 80 cfs pulse flow requirement would be achieved by the Nonroutine AMP VISPO Proposal (Furl 2019).

The SC discussed the distribution and duration of existing and proposed Nonroutine AMP VISPO Proposal leases consisting mostly of groundwater withdrawal permits in Uvalde and Medina counties. The status of the U.S. Geological Survey (USGS) sensitivity analysis of the updated MODFLOW model was also discussed, with one committee member noting it was not possible to make an effective decision on the VISPO forbearance modification without first understanding the model's uncertainty.

The SC also discussed long-term average flow model simulations. The HDR 2011 analysis resulted in Comal Springs long-term average springflow of 196 cfs, which was 29 cfs less than the long-term average amount of 225 cfs specified in Table 4-2 of the EAHCP. As they did in October and November 2018, EAHCP staff again offered that long-term goals could not be met with the pumping assumptions required regardless of the model being used. Instead, staff suggested the empirical springflow record of the last four decades indicated there was little chance of not meeting the 50-year long-term average springflow goals. Committee members expressed concern that future recharge rates may decrease because of climate change and pumping increases resulting from population growth.

Lastly, the SC committee discussed the 80 cfs pulse flow requirements related to the minimum flow requirements for Comal and San Marcos springs. EAHCP Table 4-2 states that, during DOR conditions, the minimum flow cannot exceed six months in duration followed by 80 cfs (daily average) flows for three months. EAHCP staff noted that the current Nonroutine AMP Proposal would not trigger the 80 cfs requirement.

After lengthy discussion, the SC approved the Nonroutine AMP VISPO Proposal and approved submission of the SER through the SC chairs to the SH with the inclusion of the requested ASR forbearance schedule assumptions used to generate the recent model results.

[8] This SAMP DOR Run included "As implemented" forbearance measures, 6,000 ac-ft/year of federal pumping, modified ASR forbearance schedule, 41,795 ac-ft of VISPO leases, and use of the updated MODFLOW Groundwater Model.

On May 1, 2019, the EAHCP Program Manager distributed the Nonroutine AMP Proposal VISPO and the SC SER to the SH in preparation for the joint IC and SH meeting on May 23, 2019, where this AMP Proposal would be considered.

On May 21, 2019, Mr. Myron Hess, SH Committee Chair, distributed a discussion document stating his concerns regarding Item 6.1 on the May 23, 2019 SH Committee Agenda – Consider staff recommendation to approve the EAHCP Nonroutine AMP Proposal as the mechanism for ensuring compliance with EAHCP Phase II flow targets.

In summary, Mr. Hess expressed concerns that the EAHCP was lacking key information to make this decision and that developing this information could take some time, but that he also did not believe action to address predicted springflow shortfalls should be delayed. He outlined the following items for the SH to consider recommending to the IC:

1. Technical evaluations of water quality impacts of predicted extended periods with flow below 80 cfs in both spring systems.
2. Technical evaluation of potential impacts of predicted extended periods with flow below 80 cfs on the CSRB.
3. Technical evaluation of potential impacts of predicted extended periods with flow below 80 cfs on the San Marcos salamander and Texas wild-rice.
4. Use of reasonable assumptions for exempt pumping, including for federal facilities.
5. A rigorous review process to include experts and the SC to provide input on study design for the evaluations mentioned above, and to assess the extent that EAHCP flow-related adaptive management study commitments have been met, should be met or should be adjusted.
6. A deadline of December 31, 2020 to complete all technical evaluations mentioned above.
7. Complete an evaluation by December 31, 2023 of whether adaptive management action is needed to address adverse impacts predicted by the technical evaluations and provide for SC and SH input into the decision process (Hess 2019).

The SH met on May 23, 2019 and held a facilitated discussion on the Nonroutine AMP VISPO Proposal. As a precursor to discussions by SH members, EAHCP staff made the same presentation regarding the Nonroutine AMP VISPO Proposal that was made to the SC on March 27, 2019. The SH considered the concerns expressed by Mr. Hess about the ability to meet the 80 cfs pulse flow requirement in the EAHCP. After much discussion, the SH voted to recommend that the IC: 1) approve the March 14, 2019 Nonroutine AMP VISPO Proposal, 2) create a work group to address springflow-related issues raised in the discussion document circulated by Mr. Hess to SH members on May 21, 2019 (for issues not related to federal exempt pumping), and 3) support the evaluation process and any recommended studies that come out of the work group. In addition, the SH approved the Nonroutine AMP VISPO Proposal, and the SH Report and its submission to the IC.

In a subsequent meeting on May 23, 2019, the IC voted to approve the Nonroutine AMP VISPO Proposal VISPO with an understanding that the EAHCP Program Manager would provide updates to the IC on the SH's recommendation to create a work group. The IC also voted to direct the EAHCP Program Manager

to submit the necessary documentation regarding the Nonroutine AMP VISPO Proposal to the USFWS on behalf of the IC. The EAHCP Program Manager submitted the Nonroutine AMP Proposal increasing the VISPO volume goal from 40,000 ac-ft to 41,795 ac-ft on June 7, 2019 and the USFWS approved the Proposal on June 26, 2019.

Copies of the Nonroutine AMP VISPO Proposal, SER-related documents, SH documents, the letter from S. Storment, EAHCP Program Manager, to A. Zerrenner, USFWS, dated June 7, 2019, requesting approval of the EAHCP VISPO Conservation Measure (EAHCP § 5.1.2) – Minor Amendment, and the letter from A. Zerrenner to S. Storment, dated June 26, 2019, with the USFWS approval of this minor amendment to the EAHCP, are included in **Appendix F**.

5.0 PLANNED EDWARDS AQUIFER HABITAT CONSERVATION PLAN PHASE II ACTIVITIES

Having completed the SAMP and received USFWS approval of the Nonroutine AMP Proposal VISPO that achieves the 30 cfs minimum average springflow requirement at Comal Springs, the EAHCP Program will turn attention in Phase II to addressing the following topics raised during this process.

5.1 Recommendations from Comal Spring Riffle Beetle Work Group

As discussed in **Section 3.3.3**, Habitat Restoration Results, the CSRB Work Group delivered their final report in late 2019 and offered conclusions and recommendations to improve CSRB sampling techniques associated with the EAHCP Biological Monitoring and Refugia programs (Lamon et al. 2019).
The Work Group's recommendations result in continued use of the CSRB monitoring methodology conducted during biological monitoring surveys and will add two system wide population surveys before 2028. The Work Group also offered the following conclusions and recommendations to improve CSRB sampling techniques associated with the EAHCP Biological Monitoring and Refugia programs (Lamon et al. 2019):

1. An in-situ experiment will be conducted to assess cotton lure sampling efficiency.
2. The Biological Monitoring Program will continue using the cotton lure method to monitor CSRB at LTBG reaches twice a year; two system-wide population surveys will be added before 2028.
3. The Refugia Program will reduce standing stock numbers to 150 individuals (or 75 individuals per refugia facility).
4. Refugia collections will retain 100% of CSRB captured by cotton lure; sampling collection locations must be alternated between collection events, and collection events are to occur separate from biological monitoring events.
5. An annual meeting will be held to discuss CSRB topics.

5.2 Springflow Habitat Protection Work Group

In response to action taken by the IC on May 23, 2019, the Springflow Habitat Protection Work Group will be appointed in 2020 to address springflow-related issues raised in Mr. Hess' discussion document distributed to SH members on May 21, 2019. The SH recommended a technical evaluation be completed

to understand the potential impacts of predicted extended low-flow periods on water quality in both spring systems, and on the CSRB, San Marcos salamander, Texas wild-rice, and fountain darters.

5.3 U.S. Geological Survey Uncertainty Analysis

EAHCP staff anticipates that the MODFLOW model uncertainty analysis being conducted by the USGS under a joint funding agreement with the EAA will be completed in 2020. Once completed, EAHCP staff will forward the report to the EAHCP Committees for discussion and consideration.

6.0 SUMMARY

The EAHCP SAMP implementation efforts from 2018 to 2019 included a detailed process and timeline to develop the Phase II Work Plan. The SAMP depended on the work of multiple committees and work groups, including the SRP/NAS, IC, Phase II Work Group, CSRB Work Group, SH, and SC.

Numerous key issues were reviewed and considered throughout the process, including the MODFLOW model evaluations and results, the EcoModel, habitat restoration results, and the NAS *Report 3*.

In NAS *Report 3*, the SRP/NAS determined that:

- The existing Phase I Conservation Measures were achieving the Biological Objectives (FMA § 7.13.7.d.).
- The Scientific Record was inconclusive about whether the Phase I Conservation Measure – Native Riparian Habitat Restoration (EAHCP § 5.2.8) was achieving the Biological Objectives for the CSRB (FMA § 7.13.7.f.).
- The Springflow Protection Conservation Measures were effective in achieving flow-related Biological Objectives for the Covered Species, but concerns noted about these Conservation Measures achieving 30 cfs at Comal Springs.

NAS *Report 3* also did not determine, or was inconclusive, regarding the Phase I Conservation Measure – Native Riparian Habitat Restoration (EAHCP § 5.2.8) for the CSRB.

Because the SRP/NAS determined in NAS *Report 3* that the Phase I Conservation Measures were achieving the Biological Objectives, the EAHCP Committees did not pursue the Presumptive Phase II Conservation Measure or any other new Phase II Conservation Measures. Therefore, no SAMP Decisions made to transition from Phase I to Phase II of the EAHCP.

The EAHCP Committees , however, conducted various activities and made several key decisions during the SAMP to transition from Phase I to Phase II:

- Phase II Work Plan: Created the Phase II Work Group to review and comment on EAHCP staff's initial draft of the Phase II Work Plan and submit a Work Group report to the IC for the IC's use in review and approval of the Phase II Work Plan.
- EAHCP Resolution No. 05-19-001: Approved this Resolution to formalize EAHCP Program actions for Phase II of the ITP based on NAS *Report 3*, validate EAHCP Program actions for

Phase II of the ITP pursuant to FMA § 7.13.7, and explain the purpose and rationale for Phase II activities.

- Nonroutine AMP VISPO Proposal: Approved a Nonroutine AMP Proposal to increase VISPO forbearance from 40,000 ac-ft to 41,795 ac-ft to achieve 30 cfs at Comal Springs.
- CSRB Work Group: Continued the CSRB Work Group in response to NAS *Report 3* conclusions related to CSRB riparian habitat.

Lastly, with SAMP activities now concluded, the EAHCP will move forward with addressing the three topics raised during this process: 1) implementation of CSRB Work Group recommendations; 2) creation of a Springflow Habitat Protection Work Group; and 3) completion of the USGS MODFLOW model uncertainty analysis.

7.0 REFERENCES

Blanton & Associates, Inc. (B&A). 2015. *Edwards Aquifer Habitat Conservation Plan 2014 Annual Report.*

_____. 2016. *Edwards Aquifer Habitat Conservation Plan 2015 Annual Report.*

_____. 2017. *Edwards Aquifer Habitat Conservation Plan 2016 Annual Report.*

_____. 2018. *Edwards Aquifer Habitat Conservation Plan 2017 Annual Report.*

_____. 2019. *Edwards Aquifer Habitat Conservation Plan 2018 Annual Report.*

Furl, C. 2019. Presentation to EAHCP Science Committee: *Nonroutine Adaptive Management VISPO Flow Protection Measure*. March 27, 2019.

Edwards Aquifer Authority, City of New Braunfels, City of San Marcos, City of San Antonio, acting by and through its San Antonio Water System Board of Trustees, and Texas State University – San Marcos. 2012. Funding and Management Agreement to Fund and Manage the Habitat Conservation Plan for the Edwards Aquifer Recovery Implementation Program.

Grant, W., T. Swannack, H-H. Wang, T. Hardy, G. Ward, R. Doyle, T. Bonner, and BIO-WEST. 2017. Fountain darter modeling system for the Comal and San Marcos rivers. Edwards Aquifer Habitat Conservation Plan Contract No. 13-637-HCP.

HDR. 2011. *Evaluation of Water Management Programs and Alternatives for Springflow Protection of Endangered Species at Comal and San Marcos Springs*.

Hess, M. 2019. Discussion Document: Possible Components of Stakeholder Committee Recommendation. May 2019.

Lamon, C., Norris, C., Weckerly, F., Ostrand, K., and Benbow, E. 2019. *Edwards Aquifer Habitat Conservation Plan Comal Springs Riffle Beetle Work Group Report*.

Liu, A., N. Troshanov, J. Winterle, A. Zhang, and S. Eason. 2017. Updates to the MODFLOW Groundwater Model of the San Antonio Segment of the Edwards Aquifer.

Loeffler, C., M. Enders, P. Shriver, M. Howard, N. Pence, and J. Carrillo. 2018. *Edwards Aquifer Habitat Conservation Plan Report of the 2018 Phase II Work Plan Work Group*.

National Academies of Sciences (NAS). 2015. *Review of the Edwards Aquifer Habitat Conservation Plan: Report 1*. Washington, D.C. The National Academies Press.

_____. 2016. *Review of the Edwards Aquifer Habitat Conservation Plan: Report 2*. Washington, D.C. The National Academies Press.

_____. 2018. *Review of the Edwards Aquifer Habitat Conservation Plan: Report 3*. Washington, D.C. The National Academies Press.

Pence, N. 2018a. EAHCP Strategic Adaptive Management Process. Memorandum to EAHCP Committees, May 11, 2018.

_____. 2018b. SAMP Model Runs Inputs and Assumptions. Memorandum to EAHCP Committees, June 21, 2018.

RECON Environmental, Inc., Hicks & Company, Zara Environmental, LLC., and BIO-WEST. 2012. *Edwards Aquifer Recovery Implementation Program Habitat Conservation Plan*.

Reible, D. 2018. Presentation to EAHCP Implementing, Stakeholder and Science Committees: *Review of the Edwards Aquifer Habitat Conservation Plan: Report 3.* December 20, 2018.

Storment, S. 2019. EAHCP National Academies of Sciences Report 3 and Funding and Management Agreement § 7.13.7. Memorandum to EAHCP Implementing Committee, March 18, 2019.

SWCA Environmental Consultants. 2014. Edwards Aquifer Habitat Conservation Plan USFWS Permit No. TE63663A-0 2013 Annual Report, SWCA Project Number 27474-SAN. March 11, 2014.

U.S. Fish & Wildlife Service (USFWS). 2020. Environmental Conservation Online System (ECOS) data.

Winterle, J. 2018a. Presentation to EAHCP Implementing and Stakeholder Committees: *Preliminary Bottom Up Model Runs with "As Implemented" Conservation Measures*. October 18, 2018.

_____. 2018b. Presentation to EAHCP Science Committee: *Preliminary Bottom Up Model Runs with "As Implemented" Conservation Measures*. November 7, 2018.