



Edwards Aquifer Habitat Conservation Plan
2016 Biological Monitoring Program Work Group

**Report of the 2016 Biological Monitoring Program
Work Group**

DRAFT

May 16, 2016

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Abbreviations and Acronyms

Biological Monitoring Program Work Group.....	BioMWG
Biological Monitoring Program.....	BioMP
Edwards Aquifer Authority.....	EAA
Edwards Aquifer Habitat Conservation Plan.....	EAHCP
Expanded Water Quality Monitoring Program Work Group.....	WQWG
Expanded Water Quality Monitoring Program.....	WQP
National Academy of Sciences.....	NAS
Standard Operating Procedures.....	SOP
Texas Commission on Environmental Quality.....	TCEQ
Texas Parks and Wildlife Department.....	TPWD
Texas Wild-rice.....	TWR
Water Quality.....	WQ

Suggested Citation

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Executive Summary

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Introduction

The *Edwards Aquifer Habitat Conservation Plan* (2012) (EAHCP) calls for the Biological Monitoring Program (BioMP) to fill important gaps in knowledge about, and to refine estimates of, the ecological condition of the Comal and San Marcos springs and river ecosystems through an ongoing program of collection of baseline and critical period biological monitoring data (§6.3.1). This program provides a means of monitoring changes to habitat availability and population abundance of the Covered Species that may result from Covered Activities (§6.3.1).

In 2015, the EAHCP received the National Academy of Sciences (NAS) *Report 1* (2015), containing recommendations for all EAHCP programs, including the BioMP. From *Report 1*, a list of biological monitoring-related recommendations was presented to the NAS Recommendation Review Work Group (NAS Work Group). Based on the NAS Work Group assessment (2015), at its February 18, 2016 meeting, the Implementing Committee approved the creation of the 2016 EAHCP BioMP Work Group (BioMWG) whose charge is to carry out a holistic review of the BioMP, taking into account the recommendations of NAS and the NAS Work Group, and the input of the Science Committee, the Permittees, and subject matter experts. The purpose of the Work Group is the production of this final report for review by the Implementing Committee, developed through a consensus decision-making process.

On February 18, 2016, the Implementing Committee assigned the following members to the Biological Monitoring Program Work Group and approved its charge: Tyson Broad (Texas Tech University), Jacquelyn Duke (EAHCP Science Committee/Baylor University), Mark Enders (City of New Braunfels), Rick Illgner (Edwards Aquifer Authority), and Doyle Mosier (EAHCP Science Committee). The Work Group held meetings from March to May 2016. To help coordinate and lead efforts, Steven Raabe was appointed as joint Chair of both the WQWG and BioMWG. Meetings were held as open forum where attendees actively participated in the discussion and provided valuable input. The charge, agendas and minutes from each meeting are included here in the Appendix.

Operational Principles and Guidelines

In its first meeting, the BioMWG identified basic operational principles and guidelines to ensure a holistic review and focused discussion regarding any possible modifications to the Scope of Work for the existing EAHCP Biological Monitoring Program. The BioMWG approved guidelines at its March 29 meeting; with the condition that budget should not affect scientific recommendations for the Biological Monitoring Program.

1. Consensus-approved

Formulating recommendations, through group discussion and consensus, to ensure that everyone has a voice in the process.

2. Stewards dollars

Prioritizing modifications to the Scope of Work that may have impacts on the allocation of finite available program resources. Some Work Group members maintained that this consideration, while important, should not compromise science-based decision-making; this advice was heeded over the course of both Work Group processes.

3. Species-driven

Confirming sampling methods are reliable, valid measures of conditions that have a potential impact on the health of the species.

4. Supports Habitat Conservation Plan Biological Goals and Objectives

Ensuring recommendations relate to habitat conservation, consistent with Biological Objectives and Goals.

Six additional points to consider were agreed upon as important, but not required, as the group performed its duties. These points are listed below.

- Does it eliminate duplication?
- Does it enable the evaluation of long-term trends?
- Does it integrate data collected by the EAHCP water quality monitoring program, EAHCP biological monitoring program and other monitoring programs?
- Does it contribute to an understanding of the effectiveness of conservation measures?
- Does it consider point and non-point sources?
- Does it demonstrate an awareness of strategies employed by others?

Modifications to the Scope of Work for EAHCP Biological Monitoring

The Work Group followed a thoughtful, deliberative process over the course of considering possible modifications to the existing EAHCP Biological Monitoring Program. Each meeting featured a great deal of productive discussion by Work Group members. Work Group meetings were facilitated by EAHCP staff, as well as Design Workshop, a facilitation firm retained by staff to assist with the meetings.

The Work Group process began with a presentation of an overview of the background of the the Biological Monitoring Program, in that it is a mature program requiring minimal changes. As such, the EAHCP proposed minimal modifications to the Scope of Work (SOW) for the EAHCP Biological Monitoring Program. These modifications considered recommendations made by the National Academy of Sciences, the EAHCP Science Committee, and various other entities and stakeholders since the EAHCP's inception, as well as lessons learned from subject matter experts and data collected over 15 years.

At the work session meeting on March 29, 2016, the Work Group considered these proposed modifications. The Work Group first discussed the proposed modification to substitute macroinvertebrate food source sampling with rapid bioassessments (RBAs). Members discussed the benefits of both options of RBAs, including that they are more cost effective than the food source sampling, but that Option 1 is more economical than Option 2.

At the work session meeting on April 27, 2016, the Work Group approved the removal of flow-partitioning within Landa Lake, because EAA will be able to conduct this monitoring. The Work Group also approved staff's recommendation for the Option 1 RBA sampling method, primarily because it is more pragmatic and is effective for a long-term monitoring program.

Table B1 below lists the proposed modifications to the SOW with the rationales that were discussed by the Work Group.

Table B1.

Current BioMP Sampling Method	Proposed Modification and Rationale
Fixed station photography	No modification <ul style="list-style-type: none">• Valuable historical baseline
Aquatic vegetation mapping, including Texas Wild-rice	No modification <ul style="list-style-type: none">• Valuable baseline, trend and compliance information

Current BioMP Sampling Method	Proposed Modification and Rationale
Fountain Darter sampling	No modification <ul style="list-style-type: none"> • Valuable indices to fish population health
Fish community sampling	No modification <ul style="list-style-type: none"> • Provides macro information pertinent to Covered Species
Invertebrate sampling – Covered Species	No modification <ul style="list-style-type: none"> • Provides macro information pertinent to Covered Species
Macroinvertebrate food source monitoring	Modify <ul style="list-style-type: none"> • Substitute rapid bioassessments <ul style="list-style-type: none"> – <u>Option 1</u> <ul style="list-style-type: none"> ○ Purpose: TCEQ/TPWD Rapid Bioassessment Protocol for macroinvertebrate community health without variables. ○ Frequency and locations: Samples the five (5) Reaches in Comal system; four (4) reaches in San Marcos system. One (1) composite sample per reach. Thus, nine (9) samples for both systems per Comprehensive and Critical Period Event. ○ Sampling details: The result is only one sample per reach. ○ Logistics: To be conducted at the same time as fixed drop-net sampling for Fountain Darters. ○ Procedural details: Collect and identify (to lowest practical taxonomic level) first one hundred (100) macroinvertebrates. ○ Cost: More economical option.
Salamander visual observations	No modification <ul style="list-style-type: none"> • Necessary to monitor population health
Comal Springs discharge measurement	No modification <ul style="list-style-type: none"> • Important environmental measure
Flow partitioning within Landa Lake	Remove from Program <ul style="list-style-type: none"> • Done through EAA
Water quality grab sampling	No modification <ul style="list-style-type: none"> • Continue—important accompaniment to biological information
Critical period (high and low-flow events)	No modification <ul style="list-style-type: none"> • Important index during critical periods

Current BioMP Sampling Method	Proposed Modification and Rationale
ITP (Take, 10% Disturbance)	No modification <ul style="list-style-type: none">• Required for permit

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National Academy of Sciences *Report 1* and NAS Work Group Recommendations

In 2015, the EAHCP received the *National Academy of Sciences (NAS) Report 1* (2015), containing recommendations for all EAHCP programs, including the BioMP. From *Report 1*, a list of biological monitoring-related recommendations was presented to the NAS Recommendation Review Work Group (NAS Work Group). The NAS Work Group deferred certain NAS recommendations associated with biological monitoring for consideration by this Work Group. At the March 29, 2016 meeting, the BioMWG considered both the recommendations from the National Academy of Sciences' *Review of the Edwards Aquifer Habitat Conservation Plan: Report 1* (2015), as well as the *Final Report* of the National Academy of Sciences Work Group (2015). **Table B2** summarizes the Work Group's rationale and recommendations for each recommendation from the NAS.

Table B2.

NAS Report 1	NAS Work Group	BioMWG Recommendations
Sampling not randomized; cannot extrapolate. Expand reaches to system-wide sampling.	If a reason to scale results to the entire spring system is identified, then consider through by work group.	Extrapolation unnecessary. Continue to use Intensive Study Reaches.
Cotton-lure approach for riffle beetle sampling needs to be improved.	Supportive of optimizing the sampling methods for the Comal Springs Riffle Beetle.	Addressed by Comal Springs Riffle Beetle Cotton-lure SOP Work Group.
Increased coordination and integration of the monitoring activities is needed.	None	WQWG and BioMWG addressed the coordination and integration which is summarized in the next section.
None	Determining if the Covered Species are impacted by anthropogenic parameters.	WQWG to address if the Covered Species are impacted.

Synergies between the Monitoring Work Groups

While the NAS in its first report recognized that the EAHCP monitoring programs have provided a wealth of information on the physical, chemical, and biological characteristics of the springs ecosystems, they recommended an increase in the coordination between the monitoring programs in order to fully assess the systems' environmental conditions.

Throughout their meetings, the WQWG and the BioMWG discussed the importance of integrating the two programs in order to improve overall effectiveness and efficiencies the EAHCP monitoring efforts. They also discussed how monitoring data can assist in implementing some of the habitat restoration measures.

At their final meeting on May 20, 2016, the WQWG and the BioMWG explored these specific interactions of activities between the programs that if implemented, will be beneficial to the implementation of the EAHCP. These synergies are presented below:

1. Using rapid bio-assessments (EAHCP Bio-Monitoring) to help identify toxic water quality impairments
2. Using water quality data collected through the Bio-Monitoring program to measure nutrient impairments, such as SRP
3. Analyzing data from the Expanded Water Quality program, Bio-Monitoring program, EAA Well Sampling program and Clean Rivers Program, collectively
4. Collecting more real-time water quality data because it is more biologically-relevant
5. Requiring monitoring of riparian conditions as a part of Permittees' Work Plans
6. Exploring the feasibility of coordinating sampling at the same locations and/or times.

Conclusion

At their final meeting on May 20, 2016, the BioMWG unanimously approved this draft report, along with the below tables which summarize their final recommendations to the SOW for EAHCP Biological Monitoring Program (**Table B3**), their final recommendations related to the Bio-Monitoring program recommendations from the *NAS Report 1* (**Table B4**) and the Bio-Monitoring program synergies with the Expanded Water Quality Monitoring Program (**Table B5**).

Table B3.

Scope of Work Sampling Methods	Final Recommendations
Fixed station photography	No modification
Aquatic vegetation mapping, including TWR	No modification
Fountain Darter sampling	No modification
Fish community sampling	No modification
Invertebrate sampling – Covered Species	No modification
Macroinvertebrate food source monitoring	<p>Substitute rapid bioassessments</p> <ul style="list-style-type: none"> ○ Use TCEQ/TPWD Rapid Bioassessment Protocol for macroinvertebrate community health without variables. ○ Frequency and locations: Samples the five (5) Reaches in Comal system; four (4) reaches in San Marcos system. One (1) composite sample per reach. Thus, nine (9) samples for both systems per Comprehensive and Critical Period Event. ○ Sampling details: The result is only one sample per reach. ○ Logistics: To be conducted at the same time as fixed drop-net sampling for Fountain Darters. ○ Procedural details: Collect and identify (to lowest practical taxonomic level) first one hundred (100) macroinvertebrates.

Salamander visual observations	No modification
Comal Springs discharge measurement	No modification
Flow partitioning within Landa Lake	Remove from Program
Water quality grab sampling	Continue to collect but modify method detection limit (MDL) for SRP from 50 ug/L to at least 5 ug/L
Critical period (high and low-flow events)	No modification

Table B4.

Recommendations from NAS Report 1	Final Recommendations
Sampling not randomized; cannot extrapolate. Expand reaches to system-wide sampling.	Continue to use Intensive Study Reaches.
Cotton-lure approach for riffle beetle sampling needs to be improved.	Addressed by Comal Springs Riffle Beetle Cotton-lure SOP Work Group.
Increased coordination and integration of the monitoring activities is needed.	Synergies between monitoring programs are summarized below.

Table B5.

Synergies with the Expanded Water Quality Monitoring Program	
Synergy	Comments
Using rapid bio-assessments (EAHCP Bio-Monitoring) to help identify toxic WQ impairments.	RBAs will be included in the Bio-Monitoring program as a first screening of water quality impairments in the springs' systems.
Using WQ data from Bio-Monitoring to measure nutrient impairments, such as SRP	Modify method detection limit (MDL) for SRP from 50 ug/L to at least 5 ug/L.

Analyzing data from Expanded Water Quality, Biological, EAA Well Sampling & Clean Rivers Program, collectively.	To be discussed at meeting on May 20, 2016.
Collecting more real-time water quality data because it is more biologically-relevant.	One additional data sonde will be installed in each springs system.
Requiring monitoring of riparian conditions as a part of Permittees' Work Plans.	Require monitoring before and after riparian conditions as part of the Permittees' Riparian Work Plans, such as light penetration and potentially other measures - depending on the project footprint and design.
Explore the feasibility of coordinating sampling at the same locations and/or times.	To be discussed at meeting on May 20, 2016.
Other	To be discussed at meeting on May 20, 2016.
Other	To be discussed at meeting on May 20, 2016.
Other	To be discussed at meeting on May 20, 2016.

With these summaries, the BioMWG recommends this report to the Implementing Committee as its final deliverable for approval and adoption.

References Cited

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Appendix A: Charge

EAHCP Staff

February 25, 2016

Charge of the 2016 EAHCP Biological Monitoring Program Work Group (BioMWG)

Overview: The Edwards Aquifer Habitat Conservation Plan (EAHCP) calls for the Biological Monitoring Program (BioMP) to fill important gaps in knowledge about, and to refine estimates of, the ecological condition of the Comal and San Marcos springs and river ecosystems through an ongoing program of collection of baseline and critical period biological monitoring data (§6.3.1). This program provides a means of monitoring changes to habitat availability and population abundance of the Covered Species that may result from Covered Activities (§6.3.1).

Charge: In 2015, the EAHCP received the National Academy of Sciences (NAS) *Report 1*, containing recommendations for all EAHCP programs, including the BioMP. From *Report 1*, a list of biological monitoring-related recommendations was presented to the NAS Recommendation Review Work Group (NAS Work Group). Based on the NAS Work Group assessment, at its February 18, 2016 meeting, the Implementing Committee approved the creation of the 2016 EAHCP BioMP Work Group (BioMWG) whose charge is to carry out a holistic review of the BioMP, taking into account the recommendations of NAS and the NAS Work Group, and the input of the Science Committee, the Permittees, and subject matter experts. The purpose of the Work Group is to produce a final report for review by the Implementing Committee.

Membership & Meeting Organization: The Implementing Committee will appoint work group membership at its February 18, 2016 meeting. If desired, the Work Group will nominate and elect a Chair. The Work Group will develop its final report through a consensus decision-making process. The Work Group will hold all meetings from March-May 2016 (see proposed schedule attached). The final draft of the *Report of the 2016 EAHCP Biological Monitoring Program Work Group* will be presented to the Implementing Committee for approval at their June 16, 2016 meeting.

Appendix B: Agendas and Meeting Minutes of the BioMWG

EAHCP Staff

March 15, 2016



NOTICE OF OPEN MEETING

Available at eahcp.org

As requested by the EAHCP Implementing Committee, the **2016 EAHCP Biological Monitoring Program Work Group (BioWG)** and the **2016 EAHCP Expanded Water Quality Monitoring Program Work Group (WQWG)** have been formed to produce final reports for review by the Implementing Committee providing their assessment of recommendations made for each of the EAHCP Monitoring Programs. The Work Groups are comprised of representatives from throughout the Edwards Aquifer Region. An initial joint meeting of both Work Groups is scheduled for **Tuesday, March 15, 2016, at 11 a.m. at the San Marcos Activity Center (Room 1), 501 E. Hopkins, San Marcos, Texas 78666**. Lunch will be provided. Please RSVP to dlarge@edwardsaquifer.org.

Members of the BioWG include: Tyson Broad (Texas Tech University), Jacquelyn Duke (EAHCP Science Committee/Baylor University), Mark Enders (City of New Braunfels), Rick Illgner (Edwards Aquifer Authority), and Doyle Mosier (EAHCP Science Committee).

Members of the WQWG include: Ken Diehl (San Antonio Water System), Melani Howard (City of San Marcos/Texas State University), Charles Kreidler (EAHCP Science Committee), Steven Raabe (EAHCP Stakeholder Committee/San Antonio River Authority), Benjamin Schwartz (Texas State University), and Michael Urrutia (Guadalupe-Blanco River Authority).

At this meeting, the following business may be considered and recommended for Work Group action:

1. Call to Order.
2. Public Comment.
3. Introduction of WG members, EAHCP staff, and facilitators.
Purpose: To introduce the Work Group membership, the EAHCP staff, and the facilitators who will be participating in or supporting the Work Group process.
Action: None required.
4. Nomination and election of the Work Groups Chair.
Purpose: To elect a Work Groups Chair.
Action: To nominate and elect a Work Groups Chair.
5. Presentation of schedule options and determination of a schedule for following Work Group meetings.
Purpose: To provide Work Group members with schedule options and determine their availability to provide set dates for the Work Groups meeting schedule.
Action: To adopt a Work Group meeting schedule.

6. Discussion of the Work Group Charges, general information about the Work Groups, and overview of the Monitoring Programs and their background (Attachments 1 & 2).
Purpose: To inform the Work Groups about their Charges, about the Work Groups more generally, and about the Monitoring Programs.
Action: None required.
7. Discussion of and possible endorsement of the basic operational guidelines and principles which will direct the Work Groups in carrying out their charges.
Purpose: To inform the Work Groups about the proposed basic operational guidelines and principles which are intended to direct the Work Groups' deliberations in carrying out their charges.
Action: To possibly endorse the basic operational guidelines and principles which will direct the Work Groups in carrying out their charges.
8. Presentation of current EAHCP Expanded Water Quality Monitoring Program (WQP) (SWCA, Phil Pearce)
Purpose: To inform the Work Groups concerning the monitoring findings identified to date through the WQP.
Action: To obtain feedback on the WQP findings and answer any questions that Work Group members may have.
9. Presentation of current EAHCP Biological Monitoring Program (BioMP) (BIO-WEST, Ed Oborny)
Purpose: To inform the Work Groups concerning the monitoring findings identified to date through the BioMP.
Action: To obtain feedback on the BioMP findings and answer any questions that Work Group members may have.
10. Presentation of Budget Info related to the WQP and BioMP.
Purpose: To inform the Work Groups concerning budgetary considerations associated with the Monitoring Programs.
Action: To obtain feedback from the Work Groups concerning budgetary considerations and answer any questions that Work Group members may have.
11. Next Steps – timeline and associated list of goals.
Purpose: To inform the Work Groups concerning budgetary considerations associated with the Monitoring Programs.
Action: To obtain feedback from the Work Groups concerning budgetary considerations and answer any questions that Work Group members may have.
12. Consider future meetings, dates, locations, and agendas.
13. Questions and comments from the public.
14. Adjourn.



NOTICE OF OPEN MEETING

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As requested by the Edwards Aquifer Habitat Conservation Plan (EAHCP) Implementing Committee, the 2016 EAHCP Biological Monitoring Program Work Group (BioWG) and the 2016 EAHCP Expanded Water Quality Monitoring Program Work Group (WQWG) have been formed to produce final reports for review by the Implementing Committee providing their assessment of recommendations made for each of the EAHCP Monitoring Programs. The Work Groups are comprised of representatives from throughout the Edwards Aquifer Region.

The second meeting for the **Biological Monitoring Work Group** is scheduled for **Tuesday, March 29, 2016, at 1 p.m. at the San Marcos Activity Center (Room 1), 501 E. Hopkins, San Marcos, Texas 78666**. Please RSVP to dlarge@edwardsaquifer.org.

Members of the BioWG include: Tyson Broad (Texas Tech University), Jacquelyn Duke (EAHCP Science Committee/Baylor University), Mark Enders (City of New Braunfels), Rick Illgner (Edwards Aquifer Authority), and Doyle Mosier (EAHCP Science Committee).

At this meeting, the following business may be considered and recommended for Work Group action:

1. Call to Order.
2. Public Comment.
3. Recap of Work Group Meeting #1.
Purpose: To provide an overview of activities and outcomes from the previous meeting.
Action: None required.
4. Review and achieve consensus on revised basic operational principles and guidelines.
Purpose: To confirm how basic operational principles and guidelines were revised based on Meeting #1 discussions.
Action: Achieve consensus on basic operational principles and guidelines, which will direct the work groups in carrying out their charges.
5. Presentation and discussion of draft modifications to the Scope of Work for the EAHCP Biological Monitoring Program.
Purpose: To discuss staff-generated proposal modifying the Scope of Work for the EAHCP Biological Monitoring Program.
Action: None required.
6. Presentation and discussion of National Academy of Sciences (NAS) recommendations.
Purpose: To discuss recommendations from the *NAS Report 1* for the EAHCP Biological Monitoring Program.
Action: None required.

7. Presentation and discussion of the Draft Report.
Purpose: To present and discuss a draft of the Work Group's final report.
Action: None required.
8. Consider future meetings, dates, locations, and agendas.
9. Questions and comments from the public.
10. Adjourn.



NOTICE OF OPEN MEETING

Available at eahcp.org

As requested by the EAHCP Implementing Committee, the **2016 EAHCP Biological Monitoring Program Work Group** (BioWG) and the **2016 EAHCP Expanded Water Quality Monitoring Program Work Group** (WQWG) have been formed to produce final reports for review by the Implementing Committee providing their assessment of recommendations made for each of the EAHCP Monitoring Programs. The Work Groups are comprised of representatives from throughout the Edwards Aquifer Region.

The third meeting for the Biological Monitoring Work Group is scheduled for **Wednesday, April 27, 2016, at 12 p.m. at the Dunbar Recreation Center, 801 W. Martin Luther King Drive, San Marcos, TX 78666**. Please RSVP to dlarge@edwardsaquifer.org. Lunch will be provided.

At this meeting, the following business may be considered and recommended for Work Group action:

1. Call to Order.
2. Public Comment.
3. Recap of Work Group Meeting #2.
Purpose: To provide an overview of activities and outcomes from the previous meeting.
Action: None required.
4. Presentation, discussion and possible recommendation of Scope of Work for the EAHCP Biological Monitoring Program.
Purpose: To discuss staff-generated proposal modifying the Scope of Work for the EAHCP Biological Monitoring Program.
Action: To consider and possibly recommend Scope of Work modifications for the program.
5. Presentation and discussion of the Draft Report.
Purpose: To present and discuss a draft of the Work Group's final report.
Action: None required.
6. Consider future meetings, dates, locations, and agendas.
7. Questions and comments from the public.
8. Adjourn.



NOTICE OF OPEN MEETING

Available at eahcp.org

MINUTES

As requested by the EAHCP Implementing Committee, the **2016 EAHCP Biological Monitoring Program Work Group** (BioWG) and the **2016 EAHCP Expanded Water Quality Monitoring Program Work Group** (WQWG) have been formed to produce final reports for review by the Implementing Committee providing their assessment of recommendations made for each of the EAHCP Monitoring Programs. The Work Groups are comprised of representatives from throughout the Edwards Aquifer Region. An initial joint meeting of both Work Groups was held **Tuesday, March 16, 2016, at 11 at the San Marcos Activity Center (Room 1), 501 E. Hopkins, San Marcos, Texas 78666.**

Members of the BioWG include: Tyson Broad (Texas Tech University), Jacquelyn Duke (EAHCP Science Committee/Baylor University), Mark Enders (City of New Braunfels), Rick Illgner (Edwards Aquifer Authority), and Doyle Mosier (EAHCP Science Committee).

Members of the WQWG include: Ken Diehl (San Antonio Water System), Melani Howard (City of San Marcos/Texas State University), Charles Kreidler (EAHCP Science Committee), Steven Raabe (EAHCP Stakeholder Committee/San Antonio River Authority), Benjamin Schwartz (Texas State University), and Michael Urrutia (Guadalupe-Blanco River Authority).

All members were present. The following business was considered.

1. Call to Order.
11:06 a.m.
2. Public Comment.
Public attendees introduced themselves. Refer to sign-in sheets for attendees.
3. Introduction of WG members, EAHCP staff, and facilitators.
Nathan Pence, EAHCP Program Manager, introduced the WQWG and BioWG participants, EAA staff members, and Design Workshop (DW) meeting facilitators.
4. Nomination and election of the Work Groups Chair.
The Work Groups unanimously elected Steve Raabe as Work Group chair.
5. Presentation of schedule options and determination of a schedule for following Work Group meetings.
DW proposed a meeting strategy and dates of March 29, April 7, April 27, May 9, May 11 and May 20. All proposed dates were approved by the WG, with the exception that Steve Raabe cannot participate the morning of March 29, Ben Schwartz cannot attend April 7 and Jacquelyn Duke cannot attend April 27. The WQWG will meet in the morning. The BioWG will meet in the afternoon. EAA provided an overview of outreach efforts and requested recommendations for additional entities that the Work Group would like to involve. No additional comments.

6. **Discussion of the Work Group Charges, general information about the Work Groups, and overview of the Monitoring Programs and their background (Attachments 1 & 2).**
Nathan Pence presented the charges of each group. The charge is to carry out a holistic review, take into account the recommendations of the National Academy of Sciences, and produce a final report for review by the Implementing Committee.
7. **Discussion of and possible endorsement of the basic operational guidelines and principles which will direct the Work Groups in carrying out their charges.**
Tyson Broad stated that the group needs to define "holistic" and "species-driven". Charlie Kreidler stated that caffeine detections may affect the species. Ken Diehl inquired if there will be an effort to look at compatibility and long-term trends. Nathan Pence confirmed that fifteen years of data will be shared. There is not yet adequate trend data to determine the long-term effects of caffeine on the species. Doyle Mosier stated that enabling long-term monitoring is an important outcome. Some measures will fluctuate, and others will not. Melani Howard stated that the Work Group should consider ways to minimize duplicative efforts. Nathan Pence states that this means focusing on meeting the goals and objectives of HCP. Ken Diehl states that turbidity, sedimentation and construction impacts on waterways should be considered. Melani Howard states that it would be beneficial for the Work Groups to be aware of watershed protection efforts. Ken Diehl recommends that the Work Group consider MS4 permits. It would be advantageous to eliminate duplicative sampling in certain areas. The Work Groups agree to add "integrate data collection" as an operational guideline. The Work Groups agree to add "support biological goals and objectives of the HCP". Steve Raabe, the Work Group chair, requests that DW simplifies the guidelines. He also requests that they are categorized into "guidelines" versus "strategies". Ken Diehl asks if the Work Group has alternates. Nathan Pence confirms that the Implementing Committee did not approve alternates, but they will note this for future work group efforts.
8. **Presentation of current EAHCP Expanded Water Quality Monitoring Program (WQP) (SWCA, Phil Pearce)**
Phil Pearce provides a summary of annual water quality sampling efforts (for surface water, stormwater, sediment, passive diffusion and groundwater sampling). Tyson Broad asks if groundwater samples are taken at the same locations. Phil Pearce states that samples require close proximity to the springs. If spring flow drops below 30 cfs, additional parameters apply. Ken Diehl asks whether an analysis of sheet flow from the golf course, and entrance into the tributary, maximizes the location of sampling value to constituents. EAA states that sampling locations above Hinman Island Drive are beyond the flow going into the channel. Sampling depths of 18 inches are not arbitrary and were approved by the Science Committee. Phil Pearce states that sampling occurs multiple times during each storm event and in real time. Ben Schwartz states that many samples for DEET organochloride have been gathered. Is that something that the PHB program is analyzing or do HCP samplings need to include? The Work Groups agree that this is a parking lot topic. EAA is to provide DEET sampling protocols and compare to EAA's. EAA is collecting for rivers, and SWCA is collecting for springs. Ben Schwartz asks if there are data points that minimize manmade impacts. EAA states that this human-related topic is the jurisdiction of TCEQ. This effort should focus on species-related data points. The HCP presents data at TCEQ meetings, but it is not formerly reported. Charlie Kreidler inquires if more sampling points are needed. Ed Oborny states that they have gathered 15 years of data.

9. Presentation of current EAHCP Biological Monitoring Program (BioMP) (BIO-WEST, Ed Oborny)

Ed Oborny provides an overview of fifteen years of biological monitoring data. In areas where storms and recreation did not disturb native vegetation, species growth occurred. Aquatic vegetation took a hit during the 2013-2014 droughts, followed by invasive plant growth. With Seasonal HCP restorations, reproduction of the Fountain Darter is occurring. Parking lot: EAA to provide comparisons for how these data points compare to other years. Ed Oborny states that measurements are taken twice a year. This year, due to storm events, Bio-West completed two additional trips in June and November. Bio-West monitors for changes in biological conditions. If there's not enough data or no changes ecologically, they are unable to draw correlations. For invertebrates, immediate changes correlate with spring flow. For vertebrates, changes correlate to vegetation and silt. The addition of real time monitoring stations that pick up turbidity and flows would be beneficial. Nathan Pence states that today EAA operates a total of six stations (three in both systems). EAA has learned from all monitoring consultants that stations produce the most useful data for both programs by far. Ed Oborny states that using the macroinvertebrate rapid bioassessment approach could save budget that could then be reallocated to riparian restoration efforts.

10. Presentation of Budget Info related to the WQP and BioMP.

Nathan Pence provided an overview of the EAHCP program historically budget. Prior to 2013, EAHCP staff performed all sampling and tasks. In 2014, EAHCP staff hired sampling teams, and the budget increase reflects this. Springs communities are currently formulating a 2017 annual work plan that will be implemented starting in January.

11. Next Steps – timeline and associated list of goals.

Future agenda items will include discussing draft modifications to the Scope of Work for the EAHCP Water Quality Monitoring and Biological Monitoring programs.

12. Consider future meetings, dates, locations, and agendas.

Upcoming Work Group meetings will be held on March 29. Location to be determined. DW is to provide each Work Group member with calendar reminders for upcoming meetings.

13. Questions and comments from the public.

None.

14. Adjourn.

3:25 p.m.



MARCH 29, 2016 MEETING MINUTES

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As requested by the Edwards Aquifer Habitat Conservation Plan (EAHCP) Implementing Committee, the 2016 EAHCP Biological Monitoring Program Work Group (BioWG) and the 2016 EAHCP Expanded Water Quality Monitoring Program Work Group (WQWG) have been formed to produce final reports for review by the Implementing Committee providing their assessment of recommendations made for each of the EAHCP Monitoring Programs. The Work Groups are comprised of representatives from throughout the Edwards Aquifer Region. The second meeting for the **Biological Monitoring Work Group** was held **Tuesday, March 29, 2016, at 1 p.m. at the San Marcos Activity Center (Room 1), 501 E. Hopkins, San Marcos, Texas 78666**. The following members of the BioWG were present: Tyson Broad (Texas Tech University), Mark Enders (City of New Braunfels), Rick Illgner (Edwards Aquifer Authority), and Doyle Mosier (EAHCP Science Committee). Jacquelyn Duke (EAHCP Science Committee/Baylor University) was not in attendance.

At this meeting, the following business was considered by the Work Group.

1. Call to Order.
1:10 p.m.
2. Public Comment.
No comment or questions.
3. Recap of Work Group Meeting #1.
Rebecca Leonard provided an overview of activities and outcomes from Meeting #1.
4. Review and achieve consensus on revised basic operational principles and guidelines.
*Rebecca Leonard presented how the basic operational principles and guidelines were revised based on Meeting #1 discussions. Rick Illgner requested that "Does it enable long term trends?" be revised to: "Does it enable long term trend analysis?" **Meeting facilitators are to revise basic operational principles and guidelines to address this request.** Tyson Broad asked if being "budget neutral" is required by the group's charge. Nathan Pence clarified that it is not a required charge. Doyle Mosier stated that there is a limited source of money. Steve Raabe stated that the budget is a reality that will have to be considered. Tyson Broad stated that he would not like budget to be a limiting factor. He fears that important recommendations could be removed because funding is yet unavailable. Nathan Pence clarified that HCP staff is recording all of the Work Group recommendations; even those prioritized out due to budget constraints or other considerations. The Work Group unanimously approved the operational guidelines.*

5. Presentation and discussion of draft modifications to the Scope of Work for the EAHCP Biological Monitoring Program.

*Nathan Pence provided an overview of the background and work to date in creating the Biological Monitoring Program. It is a mature program. As such, HCP staff members are proposing minimal changes to the Biological Monitoring Scope of Work. The first change is modifying macroinvertebrate food source monitoring. HCP staff recommended substituting rapid bio assessment. Tyson Broad asked what is being done now. Ed Oborny (BIO-WEST) stated that vegetation-specific sampling is being conducted for seven species in the Comal system and six species in the San Marcos system (triplicate samples per system on each vegetation type). This is quite expensive. Doyle Mosier stated that the benefit of rapid bioassessment is that it allows you to sample a large area and provides an example of how these samples work in the field. Rapid bioassessment is effective, and TPWD has spent years developing it. Bob Hall stated that Option 2 will be more expensive than Option 1. Rick Illgner asked why Option 2 is being discussed, if Option 1 is more economical. Nathan Pence stated that HCP staff wanted to provide multiple options for the Work Group's discussion. Both options also represent potential cost savings from current practices, although Option 1 is more of a cost savings than Option 2. The Work Group requested that the second bullet point on the "Proposed Changes to Bio Monitoring Rapid Bioassessment" slide be changed to **include the verbiage "most economical methods." Also, include "clarify and simplify the number of reaches."** Meeting facilitators are to reformat the slide, so that the group can come to consensus on the wording at the next meeting. Nathan Pence asked the group if there is any additional information that they need to consider the Scope of Work modifications. Tyson Broad stated that the Work Group's charge is also to consider the National Academy of Sciences (NAS) recommendations. The Work Group agreed to hold discussion until they have received the NAS recommendations presentation.*

6. Presentation and discussion of National Academy of Sciences (NAS) recommendations.

*Nathan Pence provided an overview of recommendations from the NAS Report 1 for the EAHCP Biological Monitoring Program. HCP staff recommended continuing to utilize Intensive Study Reaches. In reviewing the NAS Report, HCP staff did not find reason to scale results to the entire spring system. Tyson Broad stated that the Work Group's focus is on compliance with the take permit, however, down the road, answering system-wide questions may prove beneficial. Rick Illgner shared a different perspective. He feels the use of adaptive management strategies should be to fix a specific problem identified through data, not just to do things differently. Doyle Mosier stated that rapid bioassessment is great for sampling vegetation, but it's less useful for sampling riffle beetles. They require specialized sampling. HCP agreed with NAS recommendations regarding the Cotton-lure. Looking at invertebrates would be a special study of the Applied Research Group. Does the Work Group have any strategies that are missing from the list? San Marcos is conducting PPCP study. Nathan Pence provided an overview of strategies discussed in Water Quality Work Group that may overlap with the Biological Monitoring Work Group, such as personal care products, and fish tissue sampling. A future joint meeting between Work Groups will focus on how to create synergies between the programs. Are there items that staff is missing that should be added to the list? **Tyson Broad is to share an article with HCP staff regarding the effects of hand sanitizer on water quality. No further comments or objections to the approach as written. The Work Group unanimously approves the inclusion of EAHCP staff recommendations for the draft report.***

7. Presentation and discussion of the Draft Report.

Rebecca Leonard presented a draft of the Work Group's final report. No additional comments.

8. Consider future meetings, dates, locations, and agendas.

Doyle Mosier requests that the April 27 meeting be extended to its full duration. The Work

EAHCP Staff

March 29, 2016

Group agrees to meet from noon to 3:00 p.m., to be held at the Dunbar Recreation Center, 801 W. MLK, San Marcos, TX 78666.

9. Questions and comments from the public.

*Ken Diehl asks if there are ongoing efforts for gill species. Ed Oborny states that parasite monitoring is done by New Braunfels. **Each Work Group member is to email HCP staff any other articles about threats they may be aware of so that we can address and discuss at next meeting. HCP staff is to share with Doyle Mosier the recent report reviewing the NAS report.***

10. Adjourn.

2:52



NOTICE OF OPEN MEETING

Available at eahcp.org

MINUTES

As requested by the EAHCP Implementing Committee, the 2016 EAHCP Biological Monitoring Program Work Group (BioWG) and the 2016 EAHCP Expanded Water Quality Monitoring Program Work Group (WQWG) have been formed to produce final reports for review by the Implementing Committee providing their assessment of recommendations made for each of the EAHCP Monitoring Programs. The Work Groups are comprised of representatives from throughout the Edwards Aquifer Region.

The third meeting for the Biological Monitoring Work Group is scheduled for Wednesday, April 27, 2016, at 12 p.m. at the Dunbar Recreation Center, 801 W. Martin Luther King Drive, San Marcos, TX 78666. Please RSVP to dlarge@edwardsaquifer.org. Lunch will be provided.

At this meeting, the following business may be considered and recommended for Work Group action:

1. Call to Order.

Rebecca Leonard called the meeting to order at 12:45.

2. Public Comment.

No questions or comments.

3. Recap of Work Group Meeting #2.

Tyson Broad stated for the record that "steward dollars" is not the charge of the Work Group. Nathan Pence confirmed that this is correct and that this operational guideline applies more to the Water Quality Work Group, but it was a guideline identified and discussed at the joint work group kick-off meeting that has been considered during the process. No further comments.

4. Presentation, discussion and possible recommendation of Scope of Work for the EAHCP Biological Monitoring Program.

Action: To consider and possibly recommend Scope of Work modifications for the program.

Nathan Pence provided an overview of program purpose. Flow partitioning within Landa Lake by EAA was discussed as a possibility in Meeting 2. As an update since Meeting 2, EAA has agreed to conduct and manage flow partitioning within Landa Lake. This is reflected in the Scope of Work overview slide seen today. Mark Enders asked how WQ phosphorus sampling efforts differ from BioM. Nathan Pence clarified that EAHCP is recommending maintaining WQ component in BioM in lieu of doing surface grabs in water quality program. Coming out of the WQWG this morning, EAHCP has been tasked with doing more research, working with Texas State professors, who have been researching this issue. Soluble reactive phosphorus is only being tested through the WQ program. Anticipate that the WQ work group will identify a lowered detection limit. The BioM should be aware that this is an ongoing discussion and may affect recommendations of the

BioMWG as well. Doyle Mosier stated that an important consideration will be to explore and address the logistics of conducting the sampling. Jacquelyn Duke asked if there are any rapid bioassessment methods that would affect riparian shading. It is a valuable opportunity for EAHCP to take some of the riparian related monitoring parameters and ensure that these promote the health of the species. Melani Howard stated that there has been a change from ubiquitous edge and is now is a diverse habitat of natives. This would link back as available habitat near waters' edge. Tyson Broad stated that Hardy's model looked at repaired habitat and shading, that could provide options. Nathan Pence stated that we can add, at certain key locations where we know restoration is going on, additional focused measurement efforts. BioWest does not agree with the idea that adding light measurements would add much value to long-term analysis, unless it is done with thermistors and light measurements. Does the group feel we should add that as a recommendation that there could be some before and after light penetration measurements taken? Bob Hall provided a summary of proposed changes to monitoring using rapid bioassessment and comparison of options for macroinvertebrate RBA methods. RBA option one is recommended by EAHCP staff as the most economical, able to provide the most valuable information, and is tailored for monitoring the health of the system. Doyle Mosier supported staff recommendation for Option 1. Option 2 would be much more challenging to ensure that the number of samples would be statistically valid. Option 1 is more pragmatic for long-term monitoring, as Option 1 provides both useful information and stewards dollars. Tyson Broad asked if there is any benefit to increasing frequency (sampling more than biannually). BioWest stated that other sampling is being conducted biannually. It is ideal to consistently sample. Originally sampled four times a year, but found that only spring emergence and fall is when most changes occur and provides useful data. Taking grab samples immediately after a flood is not recommended because species will be disturbed, so your measurements will be skewed. Waiting one to three weeks after the critical period is the current practice because this allows time for the species to resettle. Remove flow partitioning in Landa Lake as it is done through EAA and use Option 1 for rapid bioassessment. Jacquelyn Duke requested that a riparian linkage is included as assessments are made of other variables. Asked if Jacquelyn Duke is in favor of contractors taking light measurement before, during and after restoration of an area? Jacquelyn Duke confirmed, yes. Other water quality variables may change – such as runoff and turbidity. Measure what has changed with riparian restoration, and planning to measure before or after to report on that. Jacquelyn Duke makes the motion to include EAHCP recommendation to remove flow partitioning, **take Option 1, add RBA sampling events to critical period monitoring (low and high flow, and require monitoring of before riparian conditions and after riparian conditions as part of the Riparian work plans (light penetration and potentially other measures, depending on the project footprint and design).** Doyle Mosier seconds the motion. No objections or concerns.

5. Presentation and discussion of the Draft Report.
Work Group members to review the draft report and provide comments by Wednesday, May 4, 2016. A new draft will be provided to the work group by May 13 for their review in advance of the meeting.
6. Consider future meetings, dates, locations, and agendas.
The Work Group's next meeting will be held May 20th at the San Marcos Activity Center (Multipurpose Room), 501 E. Hopkins, San Marcos, TX 78666.
7. Questions and comments from the public.
No questions or comments.
8. Adjourn.
1:00 p.m. Rebecca Leonard concluded the meeting.



NOTICE OF OPEN MEETING

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APRIL 27, 2016 MEETING MINUTES

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At this meeting, the following business may be considered and recommended for Work Group action:

1. Call to Order.
Rebecca Leonard called the meeting to order at 12:45.
2. Public Comment.
No questions or comments.
3. Recap of Work Group Meeting #2.
Tyson Broad stated for the record that "stewarding dollars" is not the charge of the Work Group. Nathan Pence confirmed that this is correct, and that this operational guideline applies more to the Water Quality Work Group, but it was a guideline identified and discussed at the joint work group kick-off meeting that has been considered during the process. No further comments.
4. Presentation, discussion and possible recommendation of Scope of Work for the EAHCP Biological Monitoring Program.
Nathan Pence provided an overview of program purpose. Flow partitioning within Landa Lake by EAA was discussed as a possibility to drop from program in Meeting 2. As an update since Meeting 2, EAA has agreed to conduct and manage flow partitioning within Landa Lake. This is reflected in the Scope of Work overview slide seen today. Mark Enders asked how WQ phosphorus sampling efforts differ from BioM. Nathan Pence clarified that EAHCP is recommending maintaining WQ component in BioM in lieu of doing surface grabs in water quality program. Coming out of the WQWG this morning, EAHCP has been tasked with doing more research, working with Texas State professors, who have been researching this issue. Soluble reactive phosphorus is only being tested through the BioM program. Anticipate that the WQ work group will identify a lowered detection limit. The BioM should be aware that this is an ongoing discussion and may affect recommendations of the BioMWG as well. Doyle Mosier stated that an important consideration will be to explore and address the logistics of conducting the sampling. Jacquelyn Duke asked if there are any rapid bioassessment methods that would affect riparian shading. It is a valuable opportunity for EAHCP to take some of the riparian related monitoring parameters and ensure that these promote the health of the species. This would link back as available habitat near water's

edge. Tyson Broad stated that Hardy's model looked at riparian habitat and shading, that could provide options. Nathan Pence stated that we can add, at certain key locations where we know restoration is going on, additional focused measurement efforts. Ed Oborny does not agree with the idea that adding light measurements would add much value to long-term analysis, unless it is done with thermistors and light measurements. Does the group feel we should add that as a recommendation that there could be some before and after light penetration measurements taken? Bob Hall provided a summary of proposed changes to monitoring using rapid bioassessment (RBA) and comparison of options for macroinvertebrate RBA methods. RBA option one is recommended by EAHCP staff as the most economical, able to provide the most valuable information, and is tailored for monitoring the health of the system. Doyle Mosier supported staff recommendation for Option 1. Option 2 would be much more challenging to ensure that the number of samples would be statistically valid. Option 1 is more pragmatic for long-term monitoring, as Option 1 provides both useful information and stewards dollars. Tyson Broad asked if there is any benefit to increasing frequency (sampling more than biannually). Ed Oborny stated that other sampling is being conducted biannually. It is ideal to consistently sample. Originally sampled four times a year, but found that only spring emergence and fall is when most changes occur and provides useful data. Taking grab samples immediately after a flood is not recommended because species will be disturbed, so your measurements will be skewed. Waiting one to three weeks after the critical period is the current practice because this allows time for the species to resettle. Remove flow partitioning in Landa Lake as it is done through EAA and use Option 1 for rapid bioassessment. Jacquelyn Duke requested that a riparian linkage is included as assessments are made of other variables. Asked if Jacquelyn Duke is in favor of contractors taking light measurement before, during and after restoration of an area? Jacquelyn Duke confirmed, yes. Other water quality variables may change – such as runoff and turbidity. Measure what has changed with riparian restoration, and planning to measure before or after to report on that. Jacquelyn Duke makes the motion to **include EAHCP recommendation to remove flow partitioning, take RBA Option 1, add RBA sampling events to critical period monitoring (low and high flow, and require monitoring of before riparian conditions and after riparian conditions as part of the Riparian Work Plans (light penetration and potentially other measures, depending on the project footprint and design).** Doyle Mosier seconds the motion. No objections or concerns.

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6. Consider future meetings, dates, locations, and agendas.
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7. Questions and comments from the public.
No questions or comments.
8. Adjourn.
3:00 p.m. Rebecca Leonard concluded the meeting.