



SOLICITATION, OFFER AND AWARD

City of New Braunfels
Purchasing
424 S. Castell Avenue
New Braunfels, Texas 78130

Solicitation No. 12-026
Restore Habitat of Old Channel

☐ Invitation for Bid (IFB)
☒ Request for Proposal (RFP)

Date Issued:
September 11, 2012

SOLICITATION

Page 1 of 27 Pages

Proposers must submit sealed proposals in triplicate signed original and one CD for furnishing the services identified in the Schedule. Proposals will be received at the office of the City Secretary at the address shown above until: 10:00 a.m. on September 26, 2012. Proposals received after the time and date set for submission will be returned unopened.

For Information Call: Mary Quinones

Phone No.: (830) 221-4389

Fax No.: (830) 608-2112

(NO collect calls, Telegraphic, Email, On-Line or Fax offers accepted)

Email: mquinones@nbtexas.org

5% Proposal Bond Required: ☐ YES ☒ NO (If YES, See Para 4(d) of Terms and Conditions)

100% Performance Bond Required: ☐ YES ☒ NO (If YES, See Para 4(d) of Terms and Conditions)

OFFER (Must be fully completed by offeror)

Offeror's State of Residence: Texas (See Para. 6(f) of Terms and Conditions)

Pre-Proposal Conference on September 17, 2012 at 10:00 am. in Parks Admin Office. 100 Golf Course Rd. New Braunfels, TX 78130.

Prompt Payment Terms: ___% Discount if paid within ___ days.

In compliance with the above, the undersigned offers and agrees to furnish any or all items or services awarded at the prices stipulated for each item delivered At the designated point(s) and within the time specified herein. Award shall include all solicitation documents and attachments.

FOR INFORMATION, CONTACT THE PERSON ABOVE.

MANUALLY SIGN ALL COPIES SUBMITTED. SIGNATURE IS MANDATORY.

Submit Signed Offers in Triplicate Original

Proposer E-Mail Address: ecoborny@bio-west.com

Name BIO-WEST, Inc.

And 1812 Central Commerce Court

Address Round Rock, Texas 78664

of Offeror

Name and Title of Person Authorized to Sign Offer (Type or Print):

Edmund L. Oborny, Jr.

Principal

Signature

Date: 9-25-12

Phone No.: (512) 990-3954

Fax No.: (512) 990-5153

Name, Address and Telephone No. of Person authorized to conduct negotiations on behalf of Offeror. (Applies to Request for Proposal only)

AWARD (To be Completed by CITY)

Contract #
NB 13-009

Awarded as to item(s):
All

Contract Amount:
\$349,300

Vendor Code #:

Delivery Date or Term of Contract:
August 31, 2013

Remarks: This contract incorporates the RFP, attachments and the contractor's response.

This contract issued pursuant to award made by City Council.

Date: December 10, 2012 Agenda Item No.: 4C

Important: Award may be made
on this form or by other
authorized official written notice.

Michael Morrison
City Manager

12-11-12
DATE

PROPOSAL - Solicitation # 12-026
Restore Habitat of Old Channel
New Braunfels, Texas

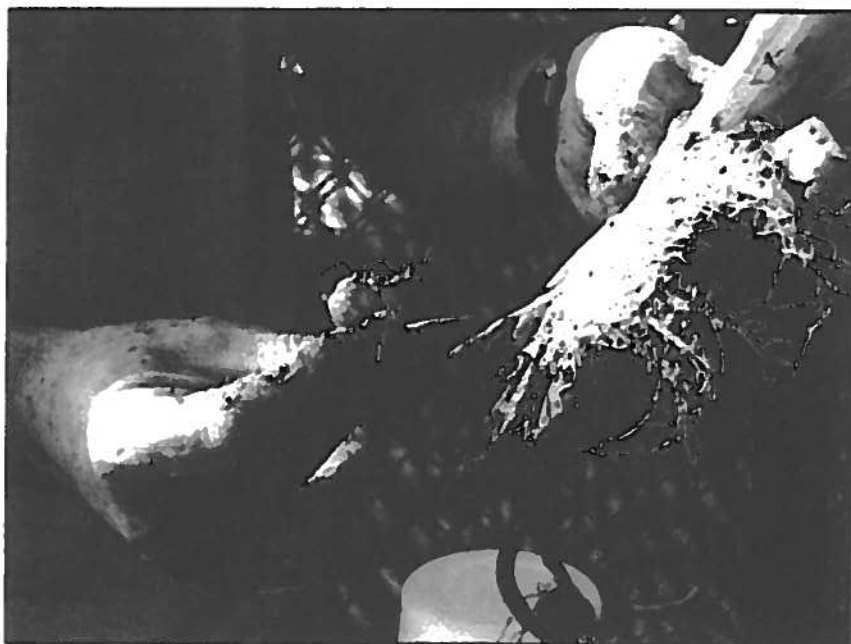


PREPARED FOR:

City of New Braunfels
Purchasing
424 S. Castell Ave.
New Braunfels, Texas 78130

PREPARED BY:

BIO-WEST, Inc.
1812 Central Commerce Court
Round Rock, Texas 78664
&
Center for Reservoir and
Aquatic Systems Research
Baylor University
Waco, Texas 76798



September 26, 2012



BIO-WEST, Inc.

812 Central Commerce Court
Round Rock, Texas
78664-8546
Ph: 512.990.3954
Fx: 512.990.5153
www.bio-west.com

26 September 2012

City of New Braunfels
Attention: Purchasing Department
424 S. Castell Avenue
New Braunfels, Texas 78130

RE: BIO-WEST, Inc. Proposal for Solicitation No. 12-026

Dear Reviewer,

Enclosed please find BIO-WEST's proposal and cost estimate to Restore habitat in the Old Channel for the City of New Braunfels. BIO-WEST, Inc. is a multi-discipline, environmental consulting firm specializing in environmental services focused on endangered species and associated habitat. Established in 1976, BIO-WEST conducts research, inventories, and assessments of natural resource systems throughout the United States. The firm is a leader in environmental consulting and problem solving, and has earned a widely acknowledged reputation for providing objective, credible services and superior products to a wide variety of agencies, organizations, and private clients.

BIO-WEST has extensive experience and expertise with the aquatic vegetation and endangered species of the Comal Springs ecosystem. We have had the privilege of conducting comprehensive and critical period monitoring in the Old Channel for over a decade. In addition to BIO-WEST's experience, we have enlisted the assistance of Dr. Robert Doyle of Baylor University who is the foremost expert on aquatic vegetation restoration in the Comal system. We are excited about this opportunity and feel our team, assembled specifically for this project, has unparalleled experience and expertise that can provide the City with the best services possible in the context of the Habitat Conservation Plan.

We appreciate the opportunity to bid on this exciting project and look forward to hearing from you. If you have any questions or comments concerning our proposal, please contact me at your earliest convenience at the contact information below:

Sincerely,

Ed Oborny

Enclosures

Edmund L. Oborny, Jr.
Principal
BIO-WEST, Inc.
1812 Central Commerce Court
Round Rock, TX 78664
Phone: (512) 990-3954
Email: eoborny@bio-west.com

Environmental
Analysis
and
Permitting

Environmental
Engineering

Fisheries

Landscape
Architecture

Resource
Planning

Vegetation

Water
Resources

Wetlands

Wildlife



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Submit Signed Offers in Triplicate Original

Proposer E-Mail Address: eoborny@bio-west.com

Name BIO-WEST, Inc.
And 1812 Central Commerce Court
Address Round Rock, Texas 78664
of Offeror

Name and Title of Person Authorized to Sign Offer (Type or Print):
Edmund L. Oborny, Jr.
Principal

Signature: *Edmund L. Oborny*

Date: 9-25-12

Phone No.: (512) 990-3954

Fax No.: (512) 990-5153

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AWARD (To be Completed by CITY)

Contract #

Awarded as to item(s):

Contract Amount:

Vendor Code #:

Delivery Date or Term of Contract:

Remarks:

This contract issued pursuant to award made by City Council

Date:

Agenda Item No.:

Important: Award may be made
on this form or by other
authorized official written notice.

DATE

II. Executive summary

As is evident in the attached proposal, BIO-WEST, Inc. has assembled a project team with extensive experience regarding aquatic vegetation restoration and successful transplant techniques, unmatched familiarity of the Old Channel ecosystem and technical expertise with the endangered species of the Comal Springs/River. To accomplish this project, BIO-WEST has enlisted the assistance of 1) Dr. Robert Doyle of Baylor University to lead aquatic vegetation restoration efforts, 2) Mr. Tim Osting of RPS Espey to assist with hydraulic modeling, and 3) D&M Owens construction for vegetation removal and disposal as well as any project-related construction activities. Weaved together, the BIO-WEST project team is perfectly suited for assisting the City of New Braunfels with developing and implementing a plan for aquatic vegetation restoration in the Old Channel of the Comal River. Factors that set the BIO-WEST study team apart from the competition include:

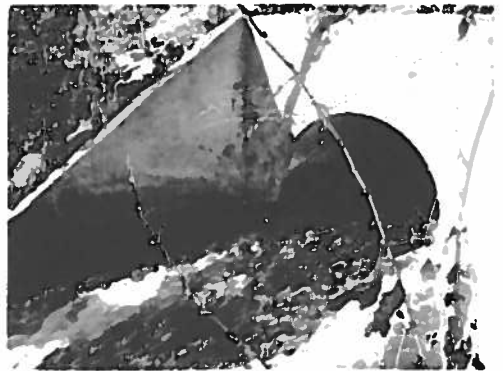
- The Project Team's commitment to the community of New Braunfels and health of the Comal River.
- ❖ Over the course of the Variable Flow Study (2000 to present), BIO-WEST has routinely donated time to conduct teacher workshops, student field trips, and even demonstrations for inspiring young artists, through outreach activities in Landa Park.



BIO-WEST in Landa Park - Melissa Fontenot (Upper Left and Lower Right), Ed Oborny (Upper Right and Lower Left)

- ❖ D&M Owens has been a family run business in the New Braunfels community for over 30 years with a sincere appreciation for the Comal River.

- ❖ Both Mr. Ed Oborny (BIO-WEST) and Dr. Robert Doyle (Baylor) have spent the majority of their careers working with aquatic plants and animals of the Comal ecosystem. We have seen the good times and the not-so-good (droughts and floods), and are dedicated to making this system the best resource it can be for the community.
- ❖ Another community highlight during our tenure has been the cooperative agreement formed with the Comal chapter of the Texas Master Naturalist Program. Since 2006, local volunteers from the Master Naturalist program have participated in weekly data collection activities.
- An extensive knowledge of the aquatic biota and ecological relationships of the Comal River/Springs Ecosystem. BIO-WEST fisheries biologists have been conducting continuous monitoring and research related to the endangered species in the Comal System (including the Old Channel) for over 12 years. As a result, study team biologists are acutely familiar with the endangered species and associated aquatic vegetation within the project area.
- ❖ BIO-WEST has mapped aquatic vegetation and sampled for fountain darters in the Old Channel at least twice a year since 2001.
- ❖ BIO-WEST has experienced first-hand the changes in aquatic vegetation in the Old Channel and resulting decline in the fountain darter densities in the Old Channel following the USFWS installation of a new culvert system in Landa Lake. (see detailed case-study described in Section V.)
- BIO-WEST contributed significantly to the development and writing of the HCP.
 - ❖ BIO-WEST developed the biological goals for the Habitat Conservation Plan which include the aquatic vegetation restoration goals (Table 4.6 of the HCP specifically referenced in the RFP).
 - ❖ BIO-WEST used the Variable Flow Study aquatic vegetation mapping, 2009 River Systems Institute mapping described in the RFP, and post June 2010 flood mapping of the Old Channel that BIO-WEST conducted to write the HCP Chapter on estimated take in the HCP relative to aquatic habitat and the fountain darter.
- Dr. Robert Doyle (Director of the Center for Reservoir and Aquatic Systems Research at Baylor University) is the foremost expert in aquatic vegetation restoration in the Comal and San Marcos rivers. Dr. Doyle mapped the entire Comal River aquatic vegetation in the late 1990s and he and his students subsequently conducted numerous experimental plantings in the Comal system with the majority of the aquatic vegetation they restored still present in the system today.
- Sponsored by the EARIP, BIO-WEST conducted a specific study relative to the need for aquatic vegetation restoration for the protection of the fountain darter in the Old Channel. For this Study, Mr. Tim Osting (RPS Espey) assisted the BIO-WEST project team with both hydraulic modeling and water quality modeling specific to the Old Channel.
- BIO-WEST has all the necessary federal and state endangered species permits to begin this work immediately upon award.
- Unparalleled scientific integrity. Both, Dr. Doyle and Mr. Oborny are active members of the Southern Edwards Aquifer Species Recovery Team.



Finally, BIO-WEST clearly understands the vital importance of the Old Channel Restoration in the context of the HCP. Many assumptions were made regarding the development of the flow regime for the Comal System that was incorporated into the final HCP. The uncertainty embedded in those assumptions is the very reason that so much applied research and restoration is being conducted during Phase 1 of the HCP. During Phase 1 and beyond, the Old Channel aquatic vegetation restoration project is vital to provide the protection necessary to support the species while questions and uncertainty are being addressed. As such, a well defined workplan, scope of work and associated \$400,000 budget was assigned to the 2013 Old Channel restoration effort. BIO-WEST thoroughly understands the EARIP approved scope and budget. This is simply NOT a project that someone can come in, tear out some vegetation, re-plant some vegetation, bid half or two-thirds the price to pretend it is a cost savings and meet the intent of the HCP. The high profile nature and critical importance to the fountain darter in the Comal system requires highly qualified professionals, careful design and implementation, and understanding and achieving the level of intent of the HCP.

The BIO-WEST project team meets these qualifications and because of our intimate knowledge of the HCP and presence in the Comal system, we can legitimately provide cost savings as follows. Our bid to conduct this project as a stand-alone project and meet the intent of the HCP is \$389,450. The reason we are under the \$400,000 approved budget is that as part of the Variable Flow Study we will already be mapping the aquatic vegetation in the entire Comal system in January 2013, so we can use that data rather than conduct a separate vegetation assessment as outlined in the RFP. Additionally, our same project team is bidding on the Landa Lake Restoration project (RFP 12-028) and with D&M Owens as the prime, recently bid on the Sediment Island removal project (RFP 12-033). These two projects along with the Old Channel Restoration (RFP 12-026) require detailed planning, vegetation cultivation, extensive field efforts and subsequent monitoring. All these activities have costs that if combined allows for efficiency in project management, travel, supplies, and resources. As such, should the BIO-WEST project team be awarded all three projects, a cost savings of nearly \$55,000 collectively is possible.

We are pleased to submit this proposal and cost estimate to the City of New Braunfels. It will become evident as you explore this proposal that project team personnel have extensive experience and expertise in aquatic vegetation restoration and the ecology of the Comal River System. Examples of relevant experience are included along with an overview of the proposed technical approach. Information on key team members is included and costs are detailed by task in the proposal pricing.

RIGHT - Melissa Fontenot (BIO-WEST) showing area middle school teachers the differences between native and non-native aquatic vegetation of Comal Springs.



III. DEGREE OF COMPLIANCE

All services quoted in this proposal are in full accord with the general requirements of the RFP (12-026). The BIO-WEST project team has all the resources necessary to perform the services outlined in the RFP.

IV. PROPOSAL PRICING

The total costs for the 2013 Old Channel Restoration as described in RFP (12-026) and consistent with the level of effort and intent of the approved EARIP workplan is \$389,450. As described in the Executive Summary, it is important to note that BIO-WEST was heavily involved in the development of the biological goals (that provide the foundation for the Habitat Conservation Plan [HCP]), subsequent preparation of the HCP and associated mitigation and applied research measures. As such, BIO-WEST is thoroughly familiar with the questions being asked and the level of work necessary to meet the intent of the approved EARIP workplans and budgets. Other bidders will likely considerably under bid the approved \$400,000 EARIP workplan budget for this specific effort, not truly understanding the intent of the EARIP workplan and critical nature of this project. A detailed cost breakdown designed to meet the needs of the HCP is presented on the following page.

The costs have been divided into five primary tasks including 1) Project Management, Meetings, Work Plan and Reporting, 2) Vegetation Assessment, Modeling, and Design; 3) Vegetation Cultivation; 4) Removal, Re-vegetation, Channel adjustments, and 5) Monitoring and Aquatic Gardening. Details are provided in the General Methodology discussion in the next section.

As described in the Executive Summary, the BIO-WEST project team can legitimately provide cost savings as follows. The reason our bid is under the \$400,000 approved budget is that as part of the Variable Flow Study we will already be mapping the aquatic vegetation in the entire Comal system in January 2013, so we can use that data rather than conduct a separate vegetation assessment as outlined in the RFP. Additionally, our same project team is bidding on the Landa Lake Restoration project (RFP 12-028) and with D&M Owens as the prime, recently bid on the Sediment Island removal project (RFP 12-033). These two projects along with the Old Channel Restoration (RFP 12-026) require detailed planning, vegetation cultivation, extensive field efforts and subsequent monitoring. All these activities have costs that if combined allows for efficiency in project management, travel, supplies, and resources. As such, should the BIO-WEST project team be awarded all three projects, a cost savings of nearly \$55,000 collectively is possible.

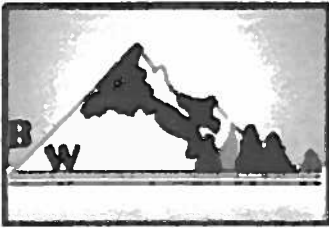


Detailed Cost Breakdown by Task.

RFP - 12-026 Old Channel Restoration								
Position	Rate	Project Management, Meetings, Work Plan, Reporting (Task 1)	Vegetation Assessment / Modeling / Design (Task 2)	Vegetation Cultivation (Task 3)	Removal, Re-vegetation, Channel (Task 4)	Aquatic Gardening / Monitoring (Task 5)	Total Hours	Cost
Project Principal	136.23	76	36	32	50	16	210	\$ 28,608.30
Landscape Architect	136.23	72	64	64	128	50	378	\$ 51,494.94
Senior Engineer	145.73	32	72		24		128	\$ 18,653.44
Senior Researcher	105.18	72	56	124	200	50	502	\$ 52,800.36
Senior Plant Ecologist	95.42	48	42	104	248	128	570	\$ 54,389.40
Senior Ecologist	92.34				64		64	\$ 5,909.76
Ecologist / GIS specialist	87.80	12	36		64		112	\$ 9,833.60
Aquatic Technicians	59.03				640		640	\$ 37,779.20
Administrative	55.25	84		104	640	320	84	\$ 4,641.00
Technician I	43.27			64	640	320	1064	\$ 46,039.28
Technician II	26.42						1024	\$ 27,054.08
Total Labor		396	306	492	2,698	884	4776	\$ 337,203.36
TRAVEL								
Per diem / Travel / etc.		125	1,150	1,750	10,500	2,750		\$ 16,275.00
Mileage (\$.555 per mile)	0.555	600	450	3,500	6,500	1,250	12300	\$ 6,826.50
Total Travel								\$ 23,101.50
OTHER DIRECT COSTS:								
Equipment				12,250	9,500	1,350		\$ 23,100.00
Supplies		35	25	1,125	2,750	1,375		\$ 5,310.00
Phone / Fax / Copies		175	135	125	150	150		\$ 735.00
Total Other Direct Costs		\$ 210	\$ 160	\$ 13,500	\$ 12,400	\$ 2,875		\$ 29,145.00
Total Estimated Cost		43,341.12	38,733.83	59,427.54	192,863.88	55,083.49	Total	\$ 389,449.86
	Subtasks							
	TASKS							\$389,449.86

V. DESCRIPTIVE LITERATURE

PROJECT TEAM



BIO-WEST, Inc.

BIO-WEST, Inc. is a multi-discipline, environmental consulting firm with a permanent core staff of senior level scientists and an experienced support staff. Established in 1976, BIO-WEST conducts research, inventories, and assessments of natural resource systems throughout the United States. The firm is a leader in environmental consulting and problem solving, and has earned a widely acknowledged reputation for providing objective, credible services and superior products to a wide variety of agencies, organizations, and private clients. BIO-WEST strives to maintain an outstanding reputation for fisheries, aquatic

vegetation, and endangered species investigations throughout the United States. BIO-WEST has extensive knowledge of the aquatic biota and ecological relationships of the Comal River/Springs ecosystem as they have conducted continuous monitoring and research related to the endangered species in the Comal System for over 12 years. This includes extensive work in the Old Channel and immediate project area. Finally, BIO-WEST has all state and federal endangered species permits necessary to conduct this work upon award.



the focus for almost four decades has been on understanding the basic scientific principles that control the structure and function of aquatic environments. Dr. Robert Doyle is the Director of the CRASR and he and his students continue to explore novel ideas and creative techniques to maximize aquatic vegetation restoration in spring ecosystems.

The Center for Reservoir and Aquatic Systems Research (CRASR) is a research and education partnership

between Baylor University and the City of Waco focused on aquatic resources. This Center is a natural outflow of many years of collaboration between these institutions as over the years Baylor and the City have each developed significant water-related expertise and capabilities. At Baylor,



D&M Owens, Inc. has been in the construction industry for over thirty eight years. Established by David Owens Sr. and wife Mary in 1972, D&M was soon known in New Braunfels and the surrounding areas for their quality workmanship and excellent reputation. D&M Owens, Inc. specializes in a wide variety of commercial and residential construction services which include site

work, excavation, detention and sedimentation ponds, underground storm drainage systems, asphalt paving, concrete curbing, and flat work. D&M is equipped with a Topcon HiPerlite GPS System which ensures the accuracy of elevations and jobsite layout as per engineered plan specifications. D&M has the equipment and personnel to handle a wide range of construction projects. D&M now employs approximately twenty five employees. D&M believes that the keys to success are strong faith, determination, honesty, and family support.

Additionally, BIO-WEST has enlisted the services of Mr. Tim Osting (RPS-Espey Consultants) who specializes in 2-D hydraulic modeling associated with designing environmental restorations projects. BIO-WEST has worked in close association with Mr. Osting to conduct 2-D hydraulic modeling and water quality modeling in the Old Channel of the Comal River, and jointly to conduct 2-D hydraulic modeling to evaluate aquatic habitat on the San Antonio River, Cibolo Creek, and Colorado River. Specific information highlighting key team members experience and expertise are provided in the Key Team Members section below and attached resumes.

OLD CHANNEL, COMAL RIVER – THEN AND NOW – CASE STUDY

BIO-WEST long-term monitoring has shown that discharge related impacts to the aquatic community in the Old Channel have clearly taken place over the past decade. As shown in **Figure 1**, the discharge in the Old Channel at the start of the Variable Flow Study (fall 2000) was approximately 40 cfs. This level of discharge was fairly consistent because of the culvert system that was in place during that time. In 2003, a USFWS sponsored project was implemented that added a new culvert setup for the Old Channel. The new culvert system allowed for increased discharge capacity. Subsequent to the completion of that project, significant rainfall occurred, increasing recharge and causing the Comal Springs system to flow well above average conditions. These conditions prompted the manipulation of the new culvert structure to allow greater flow through the Old Channel, which released pressure on the embankment adjacent to the swimming pool. As shown in **Figure 1**, the discharge during the spring 2003 nearly tripled and since that time has been a function of culvert operations.

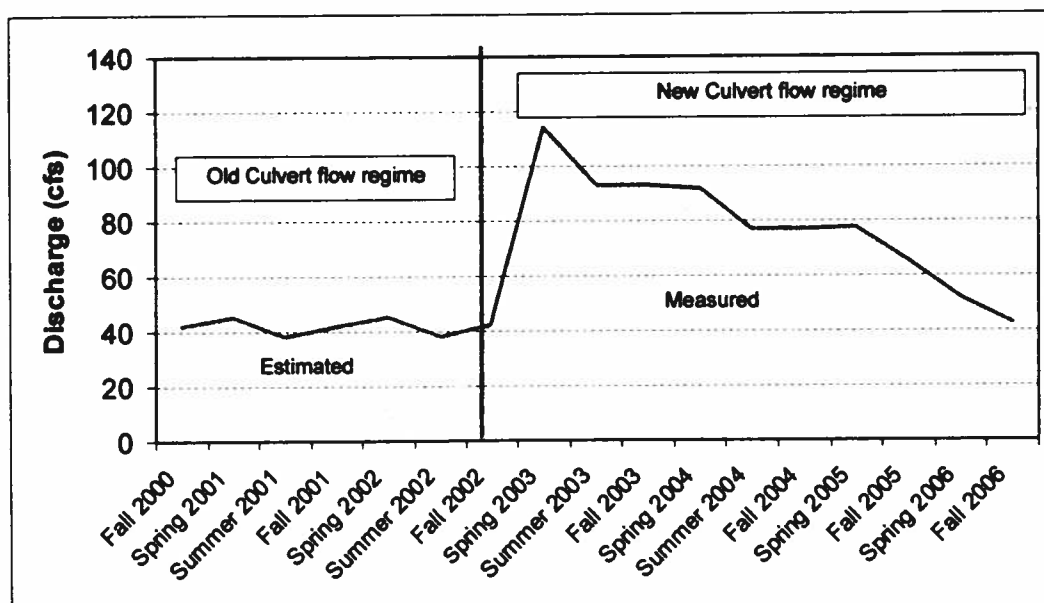


Figure 1 – Discharge changes in the Old Channel, Comal River.

Prior to the increased discharge conditions, the Old Channel was characterized by large expanses of filamentous algae. During the three-fold increase in discharge, most of this native vegetation type was completely scoured out of the routine monitoring site. A period of very limited vegetation growth within the channel was then followed by the establishment of native *Ludwigia* and non-native *Hygrophila*. *Hygrophila* proceeded to take over areas of *Ludwigia* and at present (2012) dominates the aquatic vegetation community of the Old Channel. **Figure 2** shows the described aquatic vegetation response.

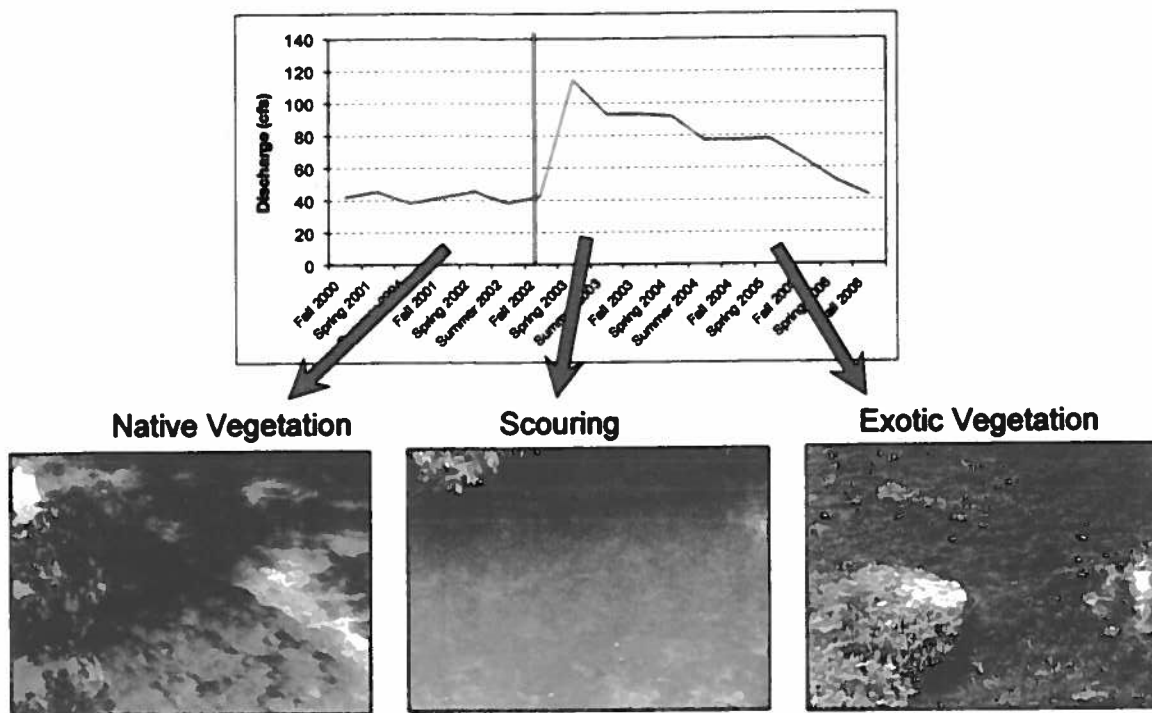


Figure 2 – Aquatic vegetation response to changing discharge in the Old Channel, Comal River.

Over the course of the study, fountain darter abundance per vegetation type has been documented. **Figure 3** shows the number of darters per meter squared found in the various native (green) and non-native (gold) vegetation types. It is evident that native vegetation is highly preferred by the fountain darter. For example, there is a five-fold increase in fountain darter density in filamentous algae compared to *Hygrophila*.

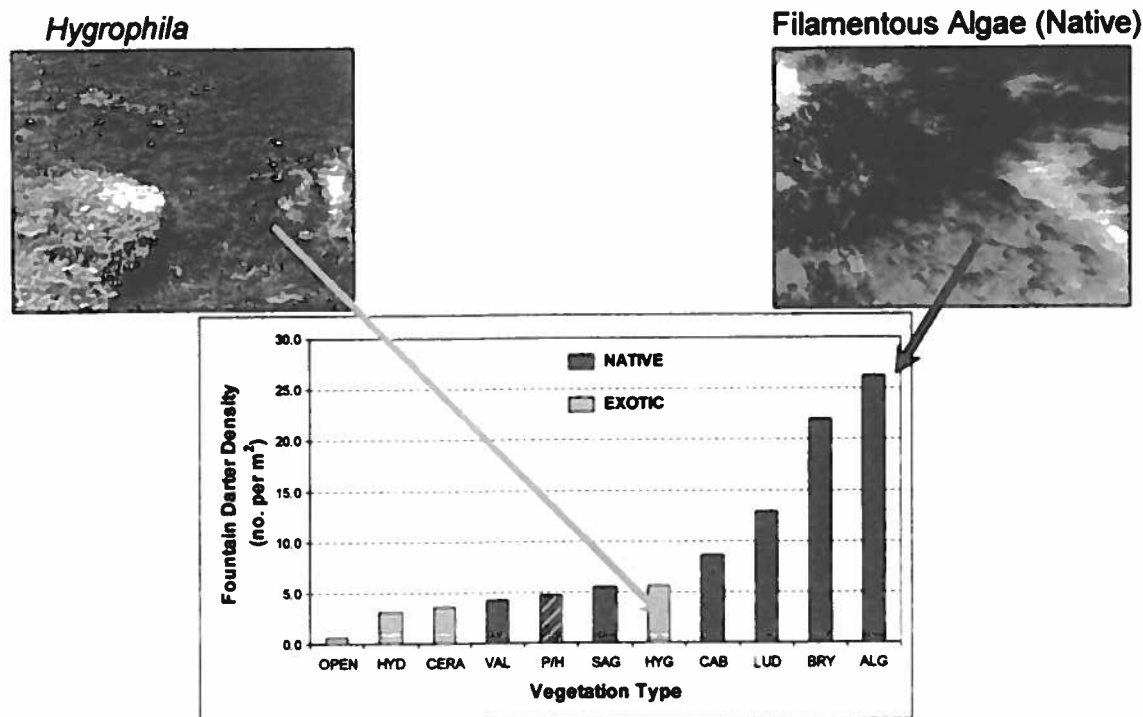


Figure 3 – Fountain darter density to aquatic vegetation type.

Figure 4 shows the resulting fountain darter population dynamics experienced in the Old Channel study reach over the same time period. With the filamentous algae, the Old Channel supported a high abundance of fountain darters as well as a normal size class distribution. Year-round reproduction was also evident under these conditions. From 2003-2005, more variable conditions were evident in the Old Channel reach. However, when the exotic vegetation started to dominate in the Old Channel reach, the fountain darter population declined considerably and the size class distribution shifted to larger adults. Typical with other areas of lower quality habitat in these systems, the reproductive pattern of the fountain darter shifted back to spring time only.

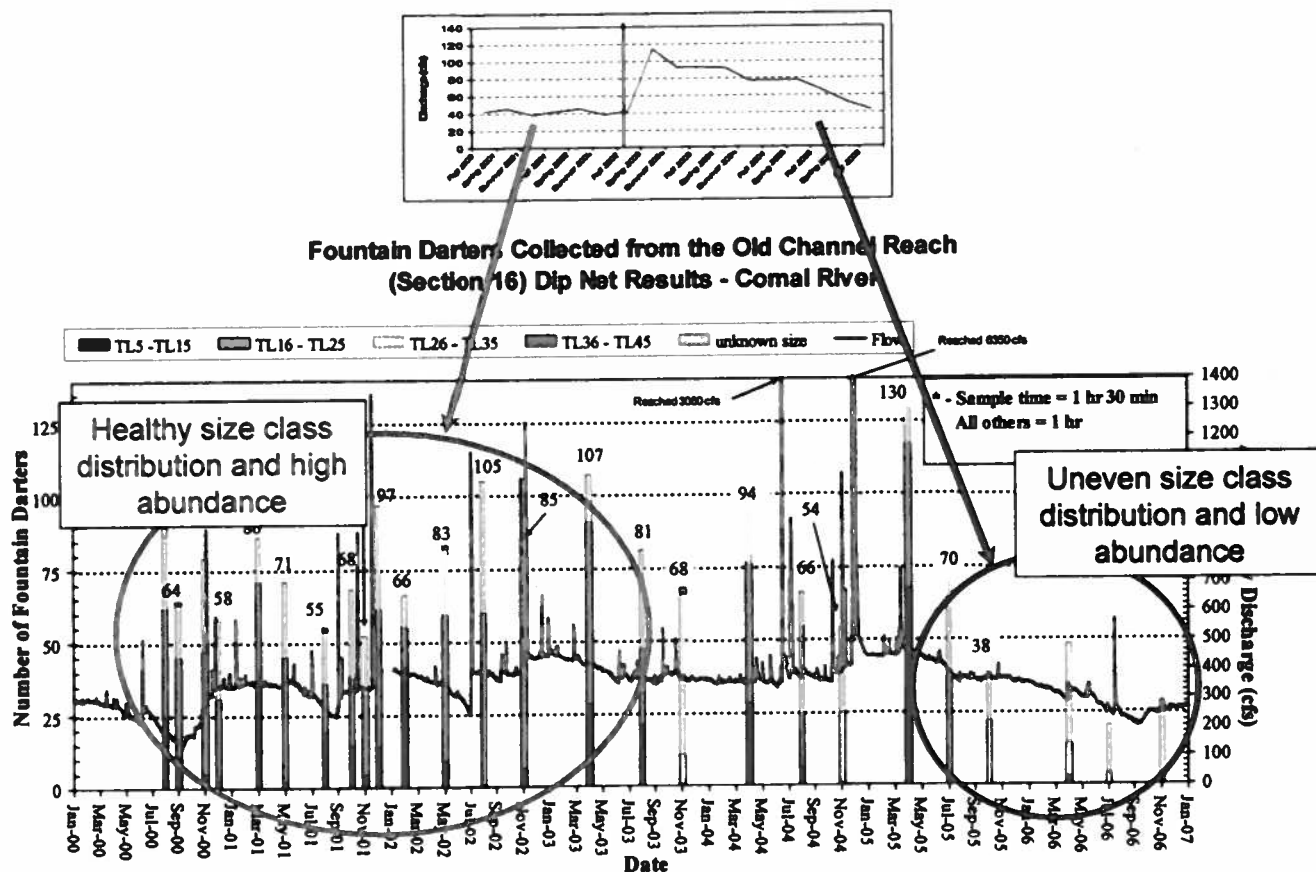


Figure 4 – Fountain darter size class and abundance data from dip netting samples in the Old Channel, Comal River from 2000 - 2007.

All data discussed in the case study was collected by BIO-WEST during the Variable Flow Study. It is exciting how the Variable Flow monitoring program has allowed the determination of these key ecological linkages:

Discharge ---- Aquatic Vegetation ---- Fountain Darter population dynamics

Through the physical habitat, the fountain darter dynamics can be linked directly to discharge. It is also clear from this example that aquatic vegetation is a key indicator. With knowledge of this habitat to fountain darter dynamics linkage, potential impacts to the fountain darter population via aquatic vegetation were detectable (although unknown at that time) as early as 2003. However, fountain darter data did not show a change until late 2005. In 2012, non-native aquatic vegetation and reduced fountain darter conditions in the Old Channel remain. BIO-WEST is excited to assist the City and the EARIP in doing our part to reverse this trend and bring the system back to the health it once exhibited.

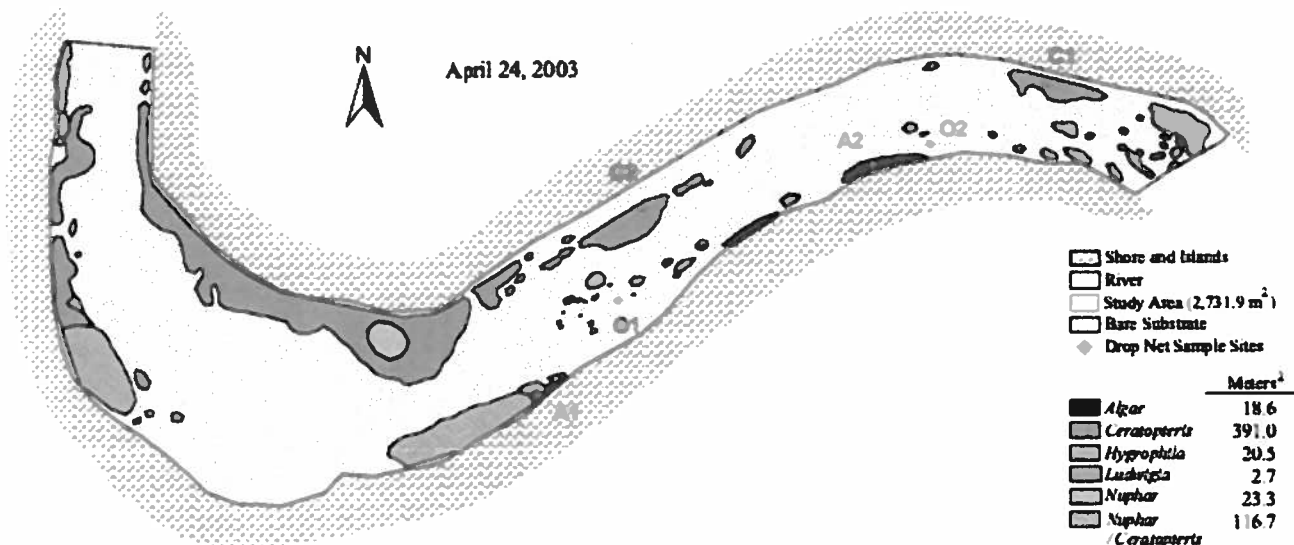
GENERAL METHODOLOGY

As shown in the cost estimate, the project has been divided into five primary tasks including 1) Project Management, Meetings, Work Plan and Reporting, 2) Vegetation Assessment, Modeling, and Design; 3) Vegetation Cultivation; 4) Removal, Re-vegetation, Channel adjustments, and 5) Monitoring and Aquatic Gardening.

Task 1 includes all project management, meetings, and reporting associated with the project. Project and task management, and internal and external communication will be critical to ensure coordination amongst on-going EARIP activities. In the Old Channel alone, 2013 projects will be conducted to repair the culverts at Landa Lake, stabilize the banks along the golf course, and remove a sediment island just upstream of Golf Course road. The BIO-WEST project team is very familiar with the scope and schedules of each of these activities, as we participated in the development of the mitigation measures for the HCP. Secondly, monthly progress reporting will be provided to the City with each invoice. Monthly progress reports will include summaries of the work accomplished to date, remaining tasks, support anticipated to be required from the City, upcoming activities to be coordinated with other contractors and project activities, and any expected deviations from the work plan. Additionally, when appropriate, progress reports will include results and photographs.

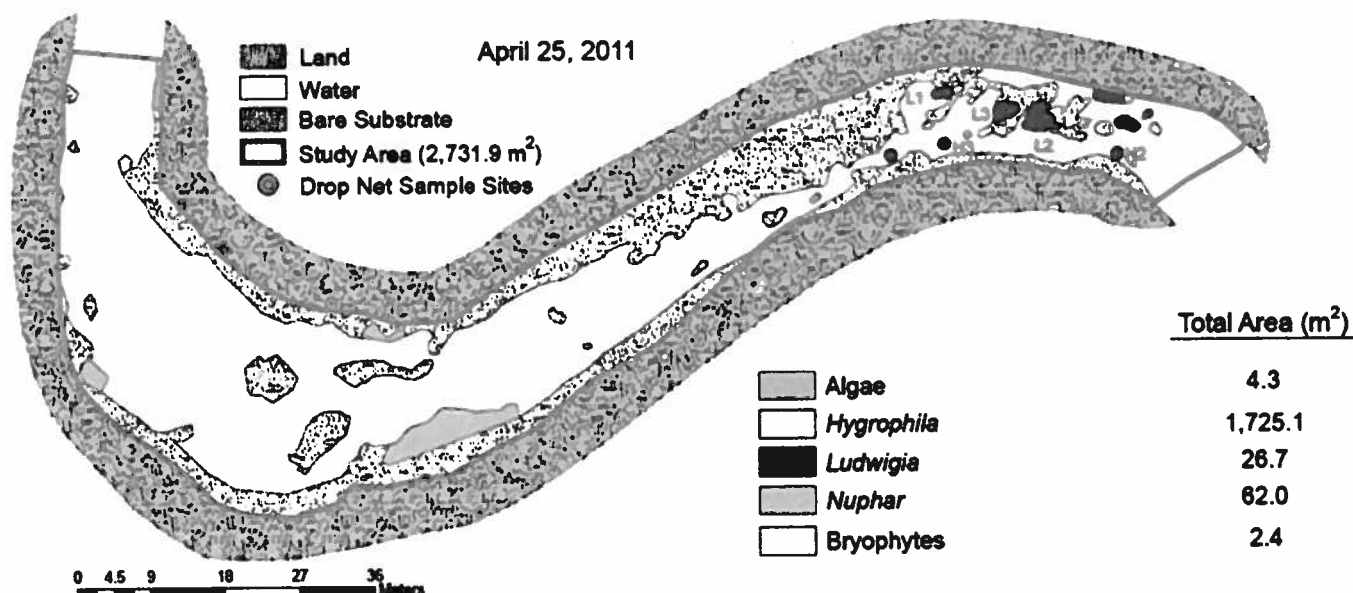
For Task 1, the BIO-WEST project team will also integrate the vegetation assessment and hydraulic model evaluation to be conducted during Task 2 and prepare a work plan for submittal to the City. This initial report will describe the results of vegetation assessment and proposed methodologies for the work plan. Specifically, the work plan will outline the costs and methodologies recommended to remove non-native vegetation and plant native vegetation in its place. The proposed work approach will be submitted to the City of New Braunfels by March 1, 2013.

Task 2 involves a reassessment of the 2009 full-system vegetation survey. In the RFP, on-the-ground activities are proposed for this activity with an associated cost. However, BIO-WEST feels this aspect of the scope can be reduced for the following reasons. Dr. Doyle, of the project team, mapped the aquatic vegetation in the entire Comal system in the late 1990s. Starting in 2000, BIO-WEST has mapped the aquatic vegetation in the Variable Flow Study Old Channel representative reach 25 times prior to the RFP mentioned 2009 full survey. Subsequent to the 2009 full survey, BIO-WEST has



mapped the Old Channel representative study reach 6 times. It should be noted that the Old Channel representative study reach that BIO-WEST has mapped over 30 times in the past decade is just

downstream of the 2013 proposed Old Channel restoration project area. However, the experience gained during all these mapping activities relative to Old Channel aquatic vegetation and responses provides the BIO-WEST project team with extensive experience and first-hand knowledge of the aquatic vegetation in the Old Channel.



Within the 2013 project reach, as part of BIO-WEST's detailed 2010/2011 evaluation of the Old Channel for restoration, we conducted aquatic vegetation mapping of the upper portion of this segment in Spring 2010 (pre-flood), Summer 2010 (immediately after the June 2010 flood), and then again in Fall 2010 to assess the recovery. Finally, starting January 1, 2013, BIO-WEST will be mapping the aquatic vegetation in the entire Comal system as per the Variable Flow Study. As the contractor, we will start the Old Channel project reach first, and have the detailed mapped completed within a few weeks for use in this effort. As such, no additional on-the-ground activities are proposed for the reassessment of aquatic vegetation per the RFP.

Task 2 will also include a hydraulic model evaluation of the project area using the 2-D hydraulic model to be provided by the Meadows Center for Water and the Environment. As discussed throughout this proposal, BIO-WEST is extremely familiar with the hydraulics of this section of the Old Channel through our work investigating restoration opportunities in the Old Channel as well as in our assisting the preparation of long-term biological goals and mitigation measures for the HCP. Within the upper segment of the project area, BIO-WEST has surveyed the channel dynamics in 2004, and twice in 2010 (pre- and post flood). Mr. Osting (BIO-WEST's project team member) conducted hydraulic evaluations in this reach during the water quality modeling that he conducted for us in assisting the HCP flow-regime development. Additionally, Mr. Osting is an expert in 2-D hydraulic modeling conducting this very modeling for numerous complex instream flow studies in Texas. As such, Mr. Osting will be able to smoothly use and update to the degree necessary, the original 2-D modeling developed for the EARIP. We say update as this will be a necessity because of the upcoming Old Channel activities including culvert repair, sediment island removal, and bank stabilization. All three activities will affect the hydraulics in the Old Channel to some degree. Initially, Mr. Osting will use the designs for each of those projects and incorporate the appropriate updates into the existing model for use in this project. The focus of the hydraulic modeling will be to assess the depth, velocity and substrate conditions of the Old Channel in a means of understanding where to plant certain aquatic vegetation types based on their habitat requirements. *Contractors not familiar with the system, will most likely leave out one of the most critical uses of the model. As the 2013 project reach is a fairly swift moving portion of the Old*

Channel, identifying velocity shelters or pockets for the protection of certain types of aquatic vegetation (bryophytes, Cabomba, etc.) that are highly utilized by the fountain darter.

BIO-WEST will use the detailed 2013 aquatic vegetation map of the Old Channel (conducted under separate contract thus, reducing costs) and the hydraulic model evaluation to develop the work plan described in Task 1. Careful planning, a series of project team scoping meetings, and detailed landscaping plans are envisioned as this step is critical to the success of the overall project.

Task 3 involves obtaining and providing the necessary plant material for restoration activities in the Old Channel. As previously mentioned, Dr. Doyle through his continued research over the years at the USACE Lewisville Aquatic Vegetation Station; University of North Texas Aquatic Laboratory; and presently as Director of Baylor University's Aquatic Vegetation Laboratory is the foremost expert on aquatic vegetation restoration in spring ecosystems. Coupled with his extensive experience and working history at Comal Springs, Dr. Doyle will serve as Principal Researcher relative to design and restoration in the Old Channel. However, prior to restoration, the source material for the project must be available. As described in the RFP, a couple of local sources (USFWS NFH&TC and Texas State) are available for purchasing aquatic vegetation. We concur that this is a viable option for some of the source material, but in Dr. Doyle's opinion, purchasing material is not the most efficient or effective way to accomplish a project of this magnitude. Ms. Rachel Bormann and Dr. Doyle just finished several years of work on establishment of native aquatic plants in the San Marcos River. For the vast majority of their work, they initially established propagules in the greenhouse at the USFWS NFH&TC in San Marcos. Although these techniques worked well, they were very labor-intensive. In addition, Dr. Doyle believes that the initial establishment of propagules in the low-flow environments of the recirculating tanks in a greenhouse or within ponds produces propagules that may be sub-optimally adapted for survival and expansion under field conditions. Specifically, he felt that the long "stringy" propagules (see picture to right) of *Heteranthera* and *Ludwigia* which were produced were not well-adapted for the flowing water conditions into which they were planted. Additionally, the *Sagittaria* plants cultured off-site were robust, but always emergent (picture below). When planted in deeper water of



flowing water, the emergent leaves were not advantageous to these plants. Another consideration for culturing in the greenhouse of the USFWS NFH&TC and especially at Texas State University is the need to quarantine any plant materials brought from the field and especially anything brought from the Comal River. This has been accomplished for many years at the NFH&TC so we know it is doable but with an associated expense.

Therefore, as part of the Old Channel restoration project, our goal is to develop in-situ culturing racks in both the Old Channel and Landa Lake. Racks will be constructed and put in areas of the river and lake currently devoid of vegetation (to eliminate impacts on plants currently in the river).

Pots will be secured and it is anticipated that viable propagules will be cultured within 2-3 months. Pre-culturing under flow and light conditions approximately similar to where plants will be planted has the advantage of increasing initial survival and enhance short-term expansion once planted in the river. In addition, this eliminates the need for quarantine and allows for culturing of more genetically diverse

propagules. For the Old Channel restoration, all vegetation types excluding *Ludwigia* will be grown or harvested for use within the Comal system. As *Ludwigia* is limited in the system at present time, it will be purchased and brought in for cultivation from the NFH&TC. BIO-WEST has a long-standing working relationship with the NFH&TC and has secured *Ludwigia* plants to be used to supplement seed stock for restoration efforts. The number of plants to be purchased will be determined during the work plan development phase. However, all seed stock will be from original Comal springs populations following NFH&TC quarantine protocol.

Task 4 involves the active removal of non-native vegetation and subsequent planting of native vegetation within the Old Channel. The RFP specifies five polygons of high priority for evaluation during the vegetation assessment and hydraulic modeling evaluation. These polygons will serve as the foundation for the work to be conducted in 2013 starting from downstream, just above Elizabeth Street and working upstream towards Landa Lake. Areas containing vegetation will first be sampled to remove fountain darters and then any vegetation removed will be placed on tarps adjacent to the stream where permitted biologists will examine plants for fountain darter life stages, including eggs. Additionally, visual searches for Comal Springs riffle beetle adults and larvae will be conducted as floating leaf litter and bryophytes from Landa Lake have the potential to house these endangered species as well. Any darters captured will be immediately returned to the Old Channel downstream of the area being restored. Any riffle beetles collected will be returned to Landa Lake. D&M Owens will haul all non-native vegetation to the City of New Braunfels composting facility.

As previously mentioned, BIO-WEST played a major role in the development of the long-term biological goals for the fountain darter, which includes the habitat-based goals of aquatic vegetation referenced in the RFP (Table 4-6 of the HCP). This first-hand knowledge of the HCP goals along with our extensive experience in the Old Channel will allow the BIO-WEST project team to design a restoration pattern to maximize the success of the restoration efforts. The success of the Old Channel restoration is NOT based on how many plants get taken out or put in, but rather on the creation of

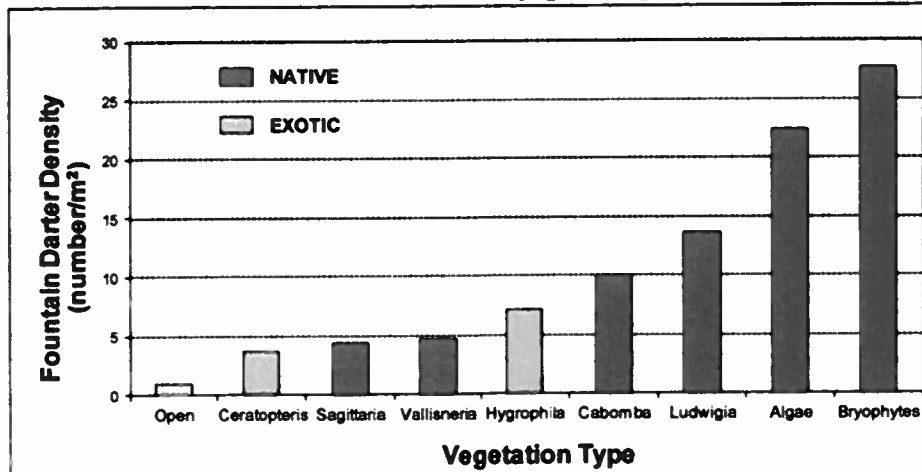


Figure 13. Density of fountain darters collected by vegetation type in the Comal Springs/River ecosystem from 2000 - 2011.

habitats that can be protected for the enhancement of the fountain darter. The figure to the left is from the 2011 EAA Variable Flow annual report which highlights 11 years of data regarding fountain darter preference of aquatic vegetation (both native and non-native). Simply pulling out all the *Hygrophylla* and slapping back in a bunch of *Ludwigia* does not meet the intent of the restoration. Rather, we propose a carefully thought out plan for establishing high quality fountain darter habitat in a fashion that will allow for continued protection and preservation of this high-quality habitat during all flow conditions. This will involve using the existing channel to create habitat conditions that maximize the success of certain vegetation types. For instance, *Cabomba* needs slower velocity areas with finer substrates to thrive. Areas of the existing channel that meet these criteria will be targeted for *Cabomba*. Bryophytes are not rooted and thus, restoration of bryophytes will require a design to create velocity shelters within existing vegetation types allowing for pockets of high quality bryophyte habitat. The Old Channel is one of the only areas in the springs ecosystems that harbors high-quality filamentous algae.

BIO-WEST has first-hand experience sampling this habitat, which holds the EAA Variable Flow study record for the most darters collected per meter squared of aquatic vegetation. Presently, this high quality filamentous algae is essentially non-existent in the 2013 project area. However, prior to 2005, this was a key habitat type in the Old Channel. Similar to bryophytes, the restoration of filamentous algae will require a conscientious design to allow for protection and maintenance of this habitat during a range of flow conditions.

Several additional components are also important to this removal and re-planting effort. First, it is understood that prior to removal activities, the BIO-WEST project team will have to obtain proper Texas Parks and Wildlife Department (TPWD) permits (i.e. Sand and Gravel permit, non-native species), as well as the appropriate City permits to conduct these activities. It is also acknowledged that the work will be conducted under the Nationwide permit for the HCP, so no additional permit will be needed from the USACE regarding sediment removal activities. BIO-WEST already has all necessary state and federal scientific collection permits for the endangered species in the Comal system. It is important that both the fountain darter and Comal invertebrates be covered as bryophytes and leaf litter floating from Landa Lake have the potential to house endangered Comal invertebrates. Additionally, it is understood that this Task is linked to three other HCP work items including Old Channel culvert repair (slated for completion by April 2013), Old Channel bank stabilization (slated for completion by June 2013), and Old Channel sediment island removal (slated for completion by July 2013), all of which are being completed under separate contracts. As such, the schedule for Task 4 will be flexible to allow for coordination with those activities. Finally, it is acknowledged that should total Comal discharge fall below 150 cfs, no removal or re-planting activities would be performed.

As specified in the RFP, non-native vegetation removal and replacement with natives will occur simultaneously, but will not involve more than 100ft of stream bed being denuded of vegetation at any one time. It is anticipated that some minimal sediment removal and channel configuration will be required to enhance channel conditions for aquatic vegetation establishment. As such, D&M Owens who specializes in sediment removal in the Comal River, was added to the BIO-WEST project team. Should any sediment work be necessary, the use of retaining structures such as containment booms, aquatic silt curtains, and/or fencing to collect floating vegetation will be installed as deemed necessary.

Task 5 involves aquatic gardening to ensure the survival and expansion of transplanted vegetation, as well as subsequent long-term monitoring. As per the RFP, monitoring will assess the reestablishment of non-native vegetation and effectiveness of the native vegetation plantings two weeks after the treatment and then bi-monthly thereafter through 2013. Additionally, maintenance through aquatic gardening will take place as necessary during the monitoring period. This will include but is not limited to removal of invasive non-native plants, removal of dense vegetative mats, removal of trash, and potential modification of substrate if necessary. During the aquatic gardening period it may be necessary to re-plant native vegetation to ensure successful recolonization of plants during 2013.



VI. CONTRACTOR BACKGROUND INFORMATION

Comal and San Marcos Springs Variable Flow Monitoring Program (2001 to Present)

Beginning in 2001, BIO-WEST contracted with the Edwards Aquifer Authority (EAA) to conduct a multi-year applied research effort with the goal of augmenting the available data on population dynamics of threatened and endangered species in the San Marcos and Comal Rivers/Spring Ecosystems and its relationship to springflow. Over the past 12 years, BIO-WEST biologists have collected and analyzed data on a variety of components within these systems including: aquatic vegetation, exotic species, water quality, Texas wild-rice, fountain darters, salamanders, and invertebrates.



This study incorporates regular quarterly sampling in several locations in the two systems, with flow dependent sampling conducted when the discharge in one or both of the rivers falls below or rises above specified "trigger" levels. The primary goal is to establish baseline data for each of the endangered species' populations and track habitat usage and population dynamics as spring flow decreases during drought conditions. Specialized techniques such as drop netting, drift netting, in-situ water temperature loggers, and SCUBA surveys, are being used to sample these unique ecosystems.

Through this extensive multi-component monitoring program BIO-WEST personnel have become very familiar with the Comal River/Springs Ecosystem (in particular the Old Channel and immediate project area) and the ecological interactions which influence endangered species and their habitat.

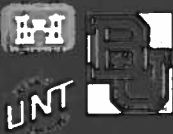
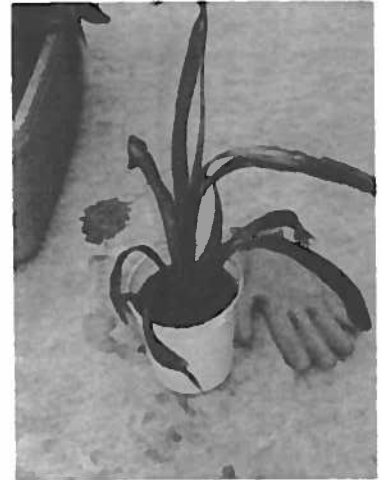


Comal River Aquatic Vegetation Restoration (1997 to Present)

In 1997, Dr. Robert Doyle was invited by the USFWS to visit the Comal River and provide expert opinion on the die-off of native plants in the Comal River. At the time there was widespread concern about Marisa snail damage to native plants. From that initial visit, a contract from USFWS was obtained that resulted in mapping the aquatic plant communities of both the Comal and San Marcos rivers - a task which resulted in complete vegetation maps of both rivers for 1998, 1999 and

2000. While working at the US Army Corps of Engineer's Waterways Experiment Station and University of North Texas, Dr. Doyle conducted applied research focused on investigating and developing novel ideas about native plant community restoration and enhancement. Contracted through the USFWS, Dr. Doyle conducted

numerous experimental plantings of native species in both the Comal and San Marcos River.



Sagittaria platyphylla

6-12 months

4-6 weeks

Planting day

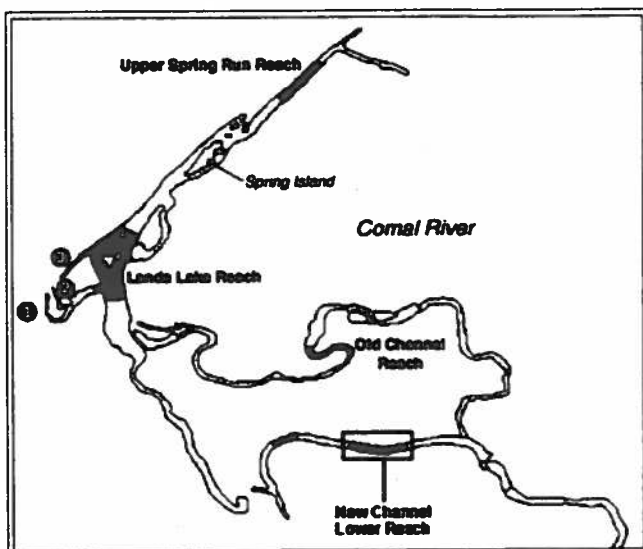
Very large colonies can be established

As the Director for the Center for Reservoir and Aquatic Systems Research at Baylor University, one of Dr. Doyle's key duties is mentoring graduate students who are evaluating new and exciting techniques for establishing native aquatic plant species in spring-fed ecosystems.

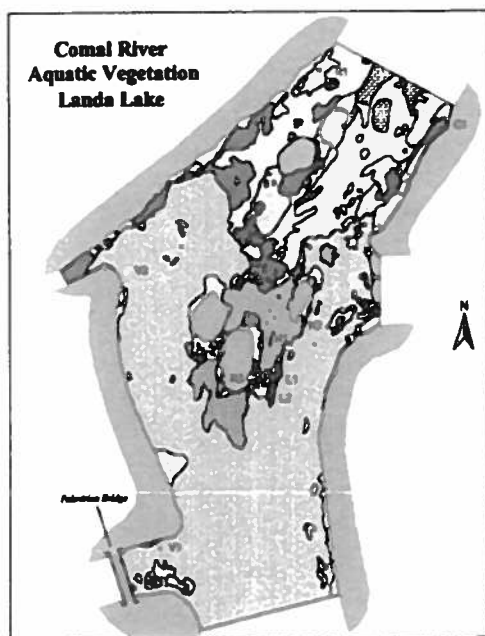
AQUATIC VEGETATION Mapping

Objective: Aquatic vegetation plays a key role in governing the health of spring-fed aquatic ecosystems. Mapping of this resource continues to assist in the evaluation of changes to the system over time relative to physical habitat and organism populations.

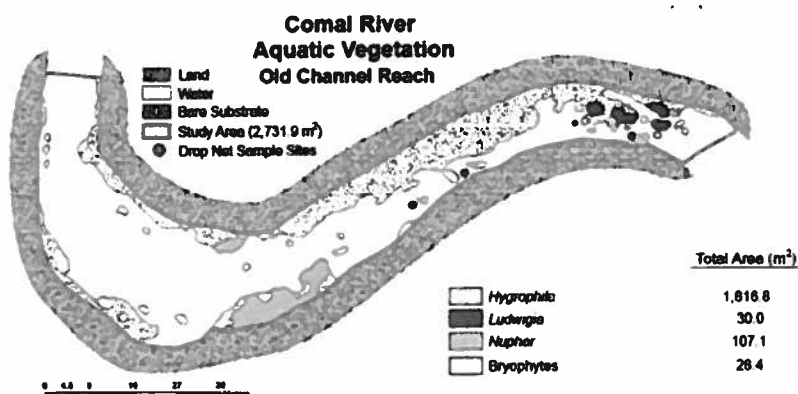
Location: Four reaches in the Comal system; three reaches in the San Marcos system.



One fact is clear, the aquatic vegetation in the Comal system is directly related to the health and population of the fountain darter. Certain types of aquatic vegetation provide better cover and food supply than others.



Data Analysis and Results: From Fall 2000 through Fall 2012, the project team mapped the same reaches in the Comal and San Marcos systems. Two example figures are presented on this page with figures of the aquatic vegetation observed during each sample effort found in each of the annual reports (BIO-WEST 2002-2011). It is difficult to make sweeping generalizations about seasonal and other trip-to-trip characteristics, since most changes occurred in fine detail; however, overall trends are discussed in each annual report.



A second fact is that native vegetation is preferred to non-native vegetation by the fountain darter.

Task Description: Aquatic vegetation mapping was conducted using a global positioning system (GPS) unit with real-time differential correction capable of submeter accuracy. The receiver was linked to a Windows CE device with specialized software that displays field data as it is gathered and improves efficiency and accuracy. The GPS unit was placed in a kayak with the GPS antenna mounted on the bow (see photo at top).

SPECIAL STUDY

Aquatic Vegetation Lab Study

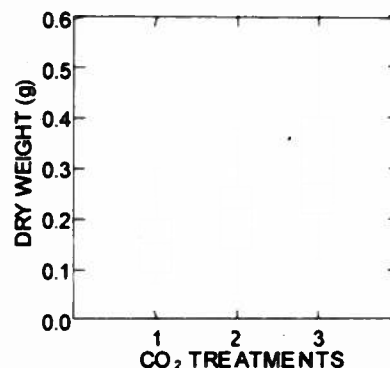
Objective: Submerged aquatic vegetation provides extremely important habitat for the endangered fountain darter. Therefore, understanding factors that influence aquatic vegetation growth and reproduction is critical to maintaining fountain darter populations. Objectives of this study were to evaluate the effects of varying spring flows and resulting water quality parameters on the growth of several aquatic plant species which occur in the Comal and San Marcos Rivers, including endangered Texas wild-rice *Zizania texana*.

Task Description: This study was conducted in two phases. In Phase 1, *Vallisneria* sp. and *Ludwigia repens* plants in outdoor raceways were exposed to varying flows of Edwards Aquifer water. Under each flow level water quality parameters were closely monitored and growth of both species was measured at the end of the study and compared between treatments. In Phase 2, flow levels and temperature were held constant, and carbon dioxide (CO₂) concentrations were manipulated between treatments to examine effects on growth of Texas wild-rice, *Ludwigia repens*, *Vallisneria* sp., *Hydrocotyle umbellata*, *Riccia* sp., and *Amblystegium* sp.



Location: This study was conducted at the aquatic nursery/greenhouse facilities of the San Marcos National Fish Hatchery and Technology Center.

Zizania Below Ground Biomass



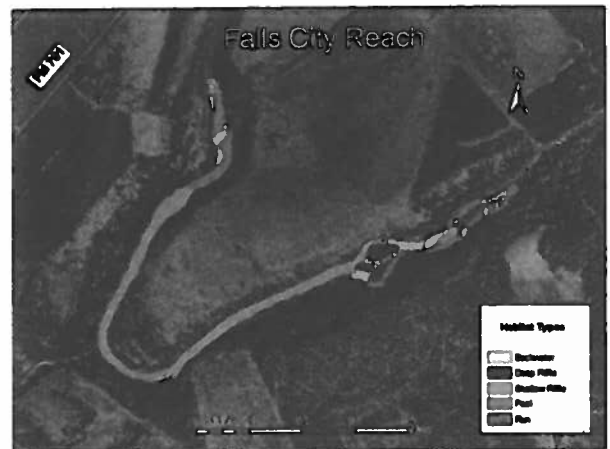
Data Analysis and Results: Results from Phase 1 of this study showed that growth of both aquatic plant species tested were greatest under higher flow conditions, mainly as a result of higher CO₂ concentrations. Therefore, in Phase 2 the impact of CO₂ concentrations were tested. When flow and temperature were held relatively constant most plants exhibited increased growth in the higher CO₂ treatment. In summary, dissolved CO₂ concentrations appear to be important in shaping the aquatic plant communities of the San Marcos and Comal Rivers, and therefore, play an important role in maintaining populations of Texas wild-rice and in maintaining quality habitat for fountain darters.

Recent Instream Flow Studies using complex 2-Dimensional Hydraulic Modeling to assess aquatic habitat conditions.

Within the last 10 years, BIO-WEST has completed or is presently working on instream flow studies using 2-D hydraulic modeling to assess aquatic habitat conditions in the San Antonio River, Colorado River, Brazos River, Guadalupe River, Cibolo Creek, and the Clear Fork of the Brazos. Many of these efforts have involved collaboration with Mr. Tim Osting of RPS Espey, and thus our confidence is his abilities to use the existing EARIP hydraulic model developed for the Comal River system. A few recent projects are highlighted below.

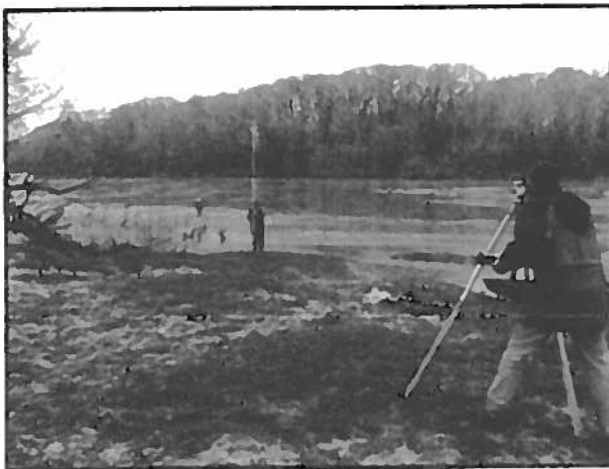
San Antonio River and Cibolo Creek Instream Flow Study

The San Antonio River Authority (SARA) hired BIO-WEST to conduct a comprehensive instream flow study that integrates biology, hydrology, geomorphology, and water quality concerns within the basin while addressing input from a variety of stakeholders. BIO-WEST and SARA are conducting this study in collaboration with state environmental agencies through the Texas Instream Flow Program (TIFP). Five representative study sites were selected to model aquatic (fish) and riparian habitat under a range of flow conditions. Approximately three years later, a wealth of hydrological, biological, geomorphological, and water quality information has been collected and analyzed in support of the SB2 instream flow study. The impact of various flow regimes on fish habitat were assessed by combining habitat suitability criteria generated for several fish-habitat use guilds with output from a state-of-the-art, two-dimensional hydrodynamic model.



Colorado River Flow Relationships to Aquatic Habitat

The purpose of this project was to determine instream flow requirements necessary to preserve aquatic resources in the lower Colorado River in Texas. The Lower Colorado River Authority contracted BIO-WEST to assess potential impacts/benefits on the aquatic resources with and without a water diversion project and to quantify the condition of the aquatic environment under different flow scenarios to ensure minimal environmental impact of the proposed project. This study integrates biology (aquatic and riparian), hydrology, water quality, and fluvial geomorphology to conduct a comprehensive assessment of water development and instream flow strategies. BIO-WEST conducted field investigations to develop a two-dimensional hydraulic model of habitat availability. These data were analyzed to characterize the flow-habitat and flow-ecological relationships within the lower Colorado River from just downstream of Austin, Texas to the Gulf of Mexico (292 river miles).



Recent Stream Restoration Projects involving endangered species throughout the Western United States

BIO-WEST has completed numerous stream restoration projects throughout the U.S. specific to endangered fishes. We welcome the opportunity to provide more detailed project descriptions, sample work products, and additional client reference information upon request.

Lower Provo River Delta Restoration

The purpose of the project is to restore, re-create, and enhance the ecological character of the historic Provo River delta and Utah Lake interface to support survival of June sucker. This would be accomplished by developing a new river channel to provide suitable instream habitat and sufficient slope to transport young fish to a developed bay, or delta, at Utah Lake with depths and vegetation cover suitable for June sucker rearing and recruitment. The project is intended to recover the June sucker by re-establishing essential habitat through restoration of the lower Provo River ecosystem to a more natural condition, as has been identified in the June Sucker Recovery Plan. BIO-WEST is under contract with the Utah Reclamation Mitigation and Conservation Commission (Mitigation Commission), the U.S. Department of the Interior's Central Utah Project Completion Act Office, and the Central Utah Water Conservancy District, on behalf of JSRIP, to assist with conceptual designs and the NEPA process for the proposed restoration of the lower Provo River and its Utah Lake interface. 2009–present.

Client contact: Mark Holden, 801.524.3146



Hobble Creek Stream Restoration

In 2007 the June Sucker Recovery Implementation Program (JSRIP) retained BIO-WEST to develop a stream channel design and perform environmental clearances for the lower Hobble Creek restoration project in Utah County. Efforts for this project involved a 21-acre parcel (owned by the JSRIP) between I-15 and Utah Lake. The primary objective of the project was to restore a naturally functioning interface with Utah Lake that would enable spawning access and provide high-quality rearing habitat for June sucker. Post-construction monitoring indicates that this objective has been met and that fish are now readily accessing the creek to spawn. Modification of the stream channel necessitated a full environmental analysis under NEPA guidelines. Public and agency involvement were included and potential partnerships with local communities and state and Federal agencies were pursued. BIO-WEST's efficient project team helped enable this project to proceed through design, environmental compliance, and construction within a rapid 17-month time period. Under contract with the Central Utah Water Conservancy District. 2007–2008. **Client contact:** Michael Mills, 801.226.7132



Bureau of Reclamation Bernalillo and Sandia Rio Grande Restoration



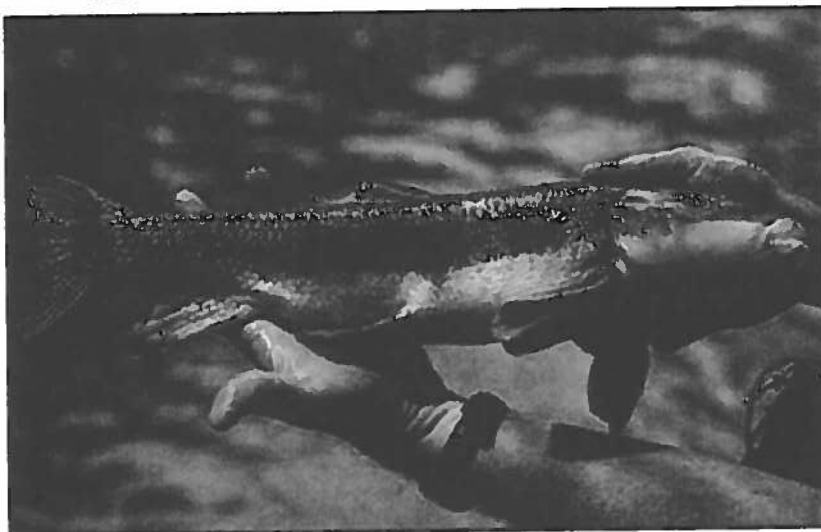
BIO-WEST provided design alternatives and analysis of habitat restoration for the Rio Grande silvery minnow (*Hybognathus amarus*) and southwestern willow flycatcher (*Empidonax traillii extimus*) along an 11-mile reach of the Rio Grande in New Mexico. Alternative analysis, detailed construction plans, and Biological Assessments and Environmental Assessments (EAs) were prepared for two priority sites covering nearly 2 river miles. As required by NEPA, public meetings were held to gather comments on the projects, and these comments were addressed in the Final EAs. The design included additional flood protection for the Rio Grande levee system while restoring channel

dynamics, and riparian and instream habitat for native species, including willow and cottonwood recruitment. Native materials, (e.g., root wads and woody debris piles) were part of the design. The channel was permanently moved away from the levee system by creating a new floodplain. 2005–2006.

Client contact: Nancy Umbreit, 505.462.3599

Provo River Restoration Project (in collaboration with Allred Restoration)

This project involves design and construction management for a large-scale river restoration project (approximate budget: \$40 million) on the Provo River near Heber City, Utah. Tasks include the following: hydrologic, hydraulic, and geomorphic analyses; restoration design; and construction oversight of a complete floodplain/riparian/aquatic restoration of approximately 10 miles of Provo River, which was straightened and leveed in the 1950s. Tasks also included review of available biological data and



integration of biological conclusions into finished designs, followed by construction oversight to ensure that all aspects of the design were properly incorporated on the ground. The project is one of the premier river restoration projects in the western United States, providing habitat benefits for native fish species and sensitive frog species, as well as recreation and terrestrial habitat benefits. The project restored more than 12 miles of the Provo River and its floodplain. This project provides environmental mitigation for the U.S. Department of Interior's Central Utah Water Project. **Client contact:** Mark Holden, 801.524.3146



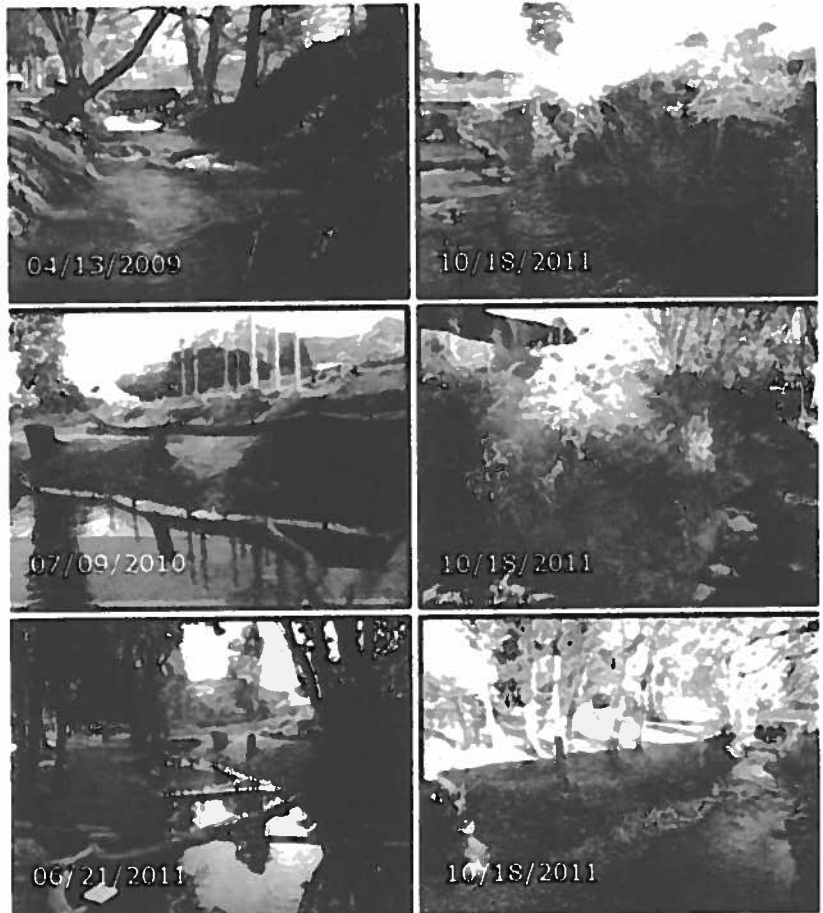
Recent Riparian Restoration and Long-term Monitoring Projects

Additionally, BIO-WEST has completed numerous river/stream/creek restoration projects throughout the U.S. to enhance aquatic and riparian habitat. These projects often involve detailed landscape architect designs and subsequent vegetation establishment to ensure success.

Red Butte Creek Oil Spill Restoration Design, Riparian Evaluation

BIO-WEST is working with EarthFax Engineering to assess and conduct remediation efforts related to the 2010 pipeline leak. Efforts have involved participating in repeat field evaluations of instream contamination levels as part of multiagency assessment teams; evaluating the impacts of the spill and associated clean-up activities on stream channel, physical habitat, and riparian vegetation; participating in post-spill macroinvertebrate monitoring; and developing and implementing site-specific recommendations for weed control, revegetation, and streambank repairs to remedy damage from the spill and cleanup efforts. BIO-WEST also conducted site surveys, developed conceptual designs and revegetation plans, prepared construction documents, and oversaw construction of stream channel and streambank restoration at the immediate spill site. BIO-WEST staff prepared a complete set of construction documents for the spill site.

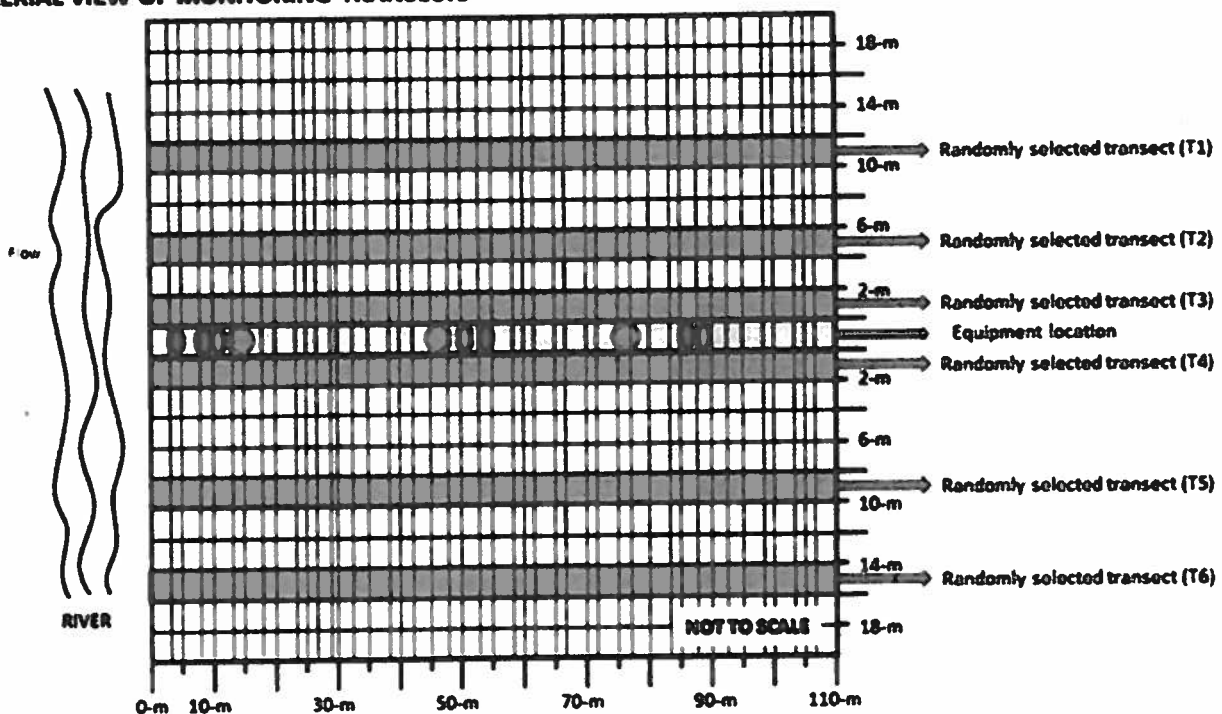
These included project feature layout, grading, erosion control, planting, and irrigation plans and details. Stream channel and streambank design elements included bioengineered bank stabilization, creation of a low floodplain shelf to promote development of diverse herbaceous wetland and riparian shrub habitats, construction of rock weir grade-control structures, and use of deep-aeration techniques to decompact the soil and establish native understory plants in a high-use, shady area. BIOWEST was also responsible for providing construction cost estimates and facilitating contractor bidding and selection.



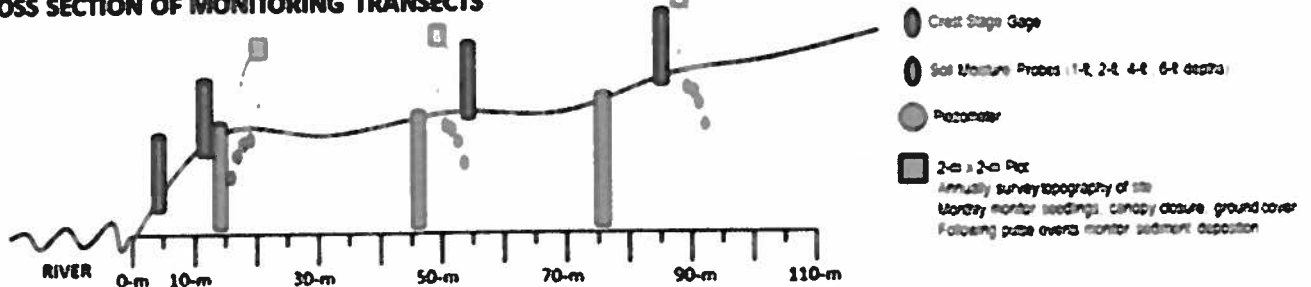
San Antonio River Riparian Recruitment Study

The San Antonio River Authority (SARA) is currently collaborating with scientists and resource agency personnel to study environmental flows of the San Antonio River. An interim recommendation based on biology, water quality, geomorphology and hydrology components was compiled by the Senate Bill 2 Texas Instream Flow Program (TIFP) study team, SARA, and BIO-WEST in 2011. From that initial work, it was determined that additional information was needed to characterize the riparian communities response to varying flow regimes. Two key problems in identifying the flow needs of riparian trees are the physical and hydrological complexity of this transitional zone in the landscape and the differing germination and growth requirements of the diverse group of taxa that occur in it. In order to enhance the riparian study component, SARA contracted BIO-WEST to monitor seedling recruitment at two sites on the San Antonio River to determine the influence of environmental flows on germination and survival. The extent of inundation of the riparian zone by pulse and overbank flows, in addition to microhabitat characteristics, will be assessed in relation to recruitment areas and seedling survival between spring 2012 through 2014.

AERIAL VIEW OF MONITORING TRANSECTS



CROSS SECTION OF MONITORING TRANSECTS



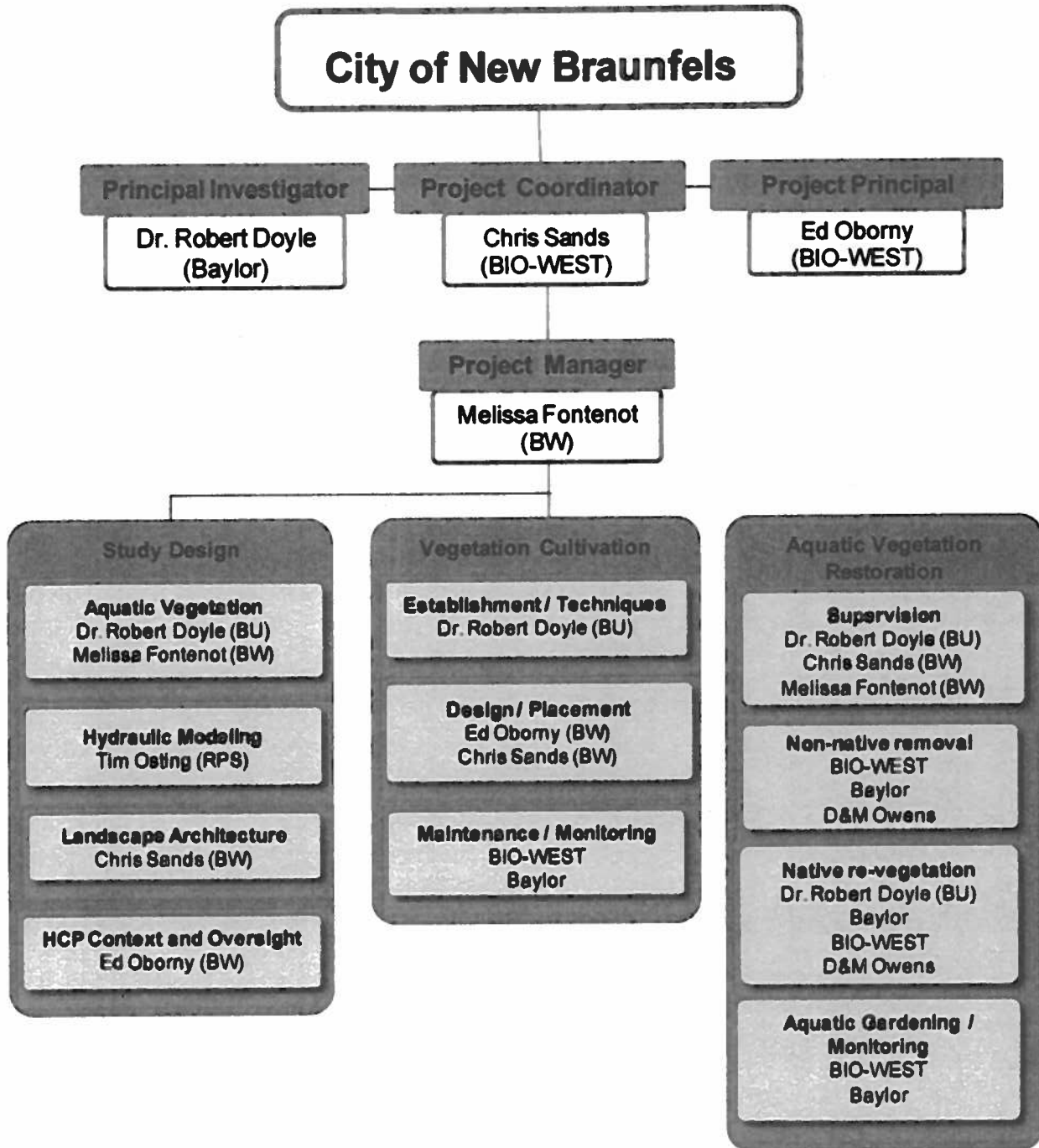
Diamond Fork and Sixth Water Creeks Monitoring

This project involves conducting long-term channel geomorphology, sediment transport, benthic macroinvertebrate, and riparian vegetation monitoring of Diamond Fork and Sixth Water Creeks. Historically, these two streams have been significantly altered by water imports from Strawberry Reservoir and the Central Utah Project. A pipeline was recently constructed to carry excess imported water that was previously conveyed through the Diamond Fork and Sixth Water channels.

The Utah Reclamation Mitigation and Conservation Commission is interested in collecting data on how the channel adjusts to the re-naturalized hydrology to help determine whether active channel restoration efforts will be necessary in the watershed. Specific monitoring activities include: establishing permanent channel monitoring sites/transects; annually surveying channel cross-sections and longitudinal profiles at the monitoring sites; annually mapping channel substrate composition; collecting bedload and suspended sediment samples during the spring runoff period; collecting spring and fall macroinvertebrate samples; and mapping riparian vegetation including monitoring permanent transects across different floodplain surfaces to quantify change in species composition, density, and structure (i.e., habitat) following implementation of the Diamond Fork System. This task also includes monitoring the Ute Ladies'-tresses (*Spiranthes diluvialis*), an endangered plant known to exist along Diamond Fork Creek. Under contract with the Bureau of Reclamation. 2005–present.



ORGANIZATIONAL CHART



KEY TEAM MEMBERS

Dr. Robert Doyle – Principal Researcher



Dr. Robert Doyle currently serves as the Director for the Center for Reservoir and Aquatic Systems Research, Professor, and Department Chair in Biology at Baylor University. Dr. Doyle has nearly 30 years of experience specializing in aquatic plant ecology and community dynamics (year-to-year variability, impacts of disturbance, etc), impacts and control of non-native species (*Hydrilla* & *Hygrophila*), and aquatic vegetation restoration and establishment of native species. Dr. Doyle has worked in the Comal River since the 1990s when he first completed aquatic vegetation

maps for the entire Comal System. Following, that initial mapping Dr. Doyle conducted numerous experimental plantings of native species in both the Comal and San Marcos River. Many of these activities were completed in Landa Lake with the majority of plantings still viable today. Since those initial transplants, Dr. Doyle together with colleagues and students have actively researched the ecology of native and non-native aquatic vegetation as well as transplant methodologies. In 2012, an MS student under Dr. Doyle's supervision completed a 2-year evaluation of techniques for establishing native aquatic plant species in the San Marcos River. Like Mr. Oborny, Dr. Doyle also serves on the USFWS Recovery Team for the endangered species in the Comal ecosystem. Dr. Doyle's extensive knowledge of aquatic vegetation in the Comal River, and unparalleled expertise in aquatic vegetation restoration in spring ecosystems provides an outstanding compliment to the project team.



Christopher Sands – Project Coordinator

Mr. Sands is a BIO-WEST Principal and serves as project manager, senior planner, landscape architect, environmental analyst, and resource management specialist. He has 24 years of professional experience and holds a M.S. degree in Landscape Architecture and Environmental Planning. Under EARIP directions, Mr. Sands is presently project manager providing third-party assistance to the USFWS and is assisting with the successful publishing of the Environmental Impact Statement associated with the EARIP HCP. Mr. Sands is no stranger to high profile, complex endangered species restoration efforts as six of his recent projects involved

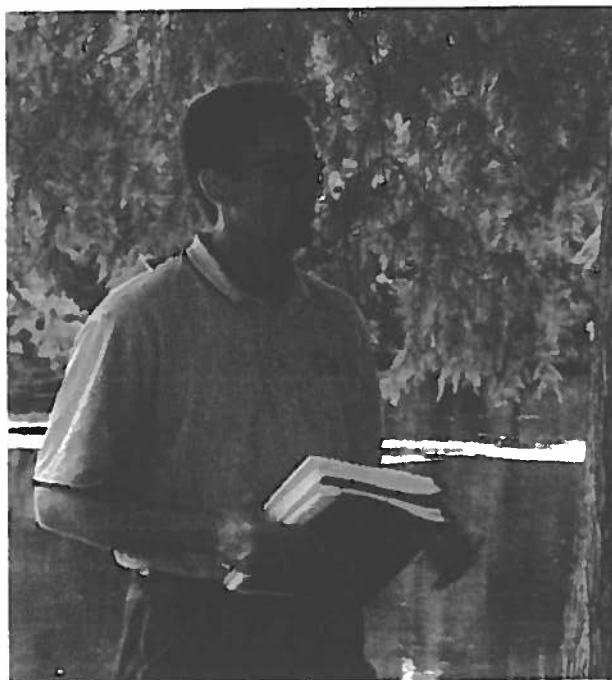


stream restoration affecting endangered fish species., including his role as senior landscape architect on the priority site designs for enhancement of endangered Rio Grande silvery minnow (*Hybognathus amarus*) habitat along the Middle Rio Grande; and with design and coordination associated with restoring, re-creating, and enhancing the ecological character of the historic Provo River delta and Utah

Lake interface to increase survival of the endangered June sucker (*Chasmistes liorus*). For that project, Mr. Sands was instrumental in designing a new river channel with suitable instream habitat and sufficient slope to transport young fish to a developed bay or delta at Utah Lake, which has depths and vegetation cover suitable for June sucker rearing and recruitment. Mr. Sands is a Licensed Landscape Architect and his studies emphasize natural resource management and environmental restoration throughout western North America.

Edmund L. Oborny, Jr. – Project Principal

Mr. Oborny is the Fisheries Section Leader and BIO-WEST's Vice-President. He specializes in aquatic ecology, threatened and endangered species, water quality, biological modeling, and instream flow issues and concepts. He has 18 years of professional extensive experience and expertise with fisheries investigations throughout Texas and the western United States. Mr. Oborny has been the project manager and principal aquatic resources investigator for the multi-discipline, multi-year Variable Flows and Water Quality Study for the Edwards Aquifer Authority since its inception. This large-scale applied research project involves intensive sampling, data analyses and interpretation regarding the importance of various flow regimes and associated impacts to the threatened and endangered species of the Comal and San Marcos Springs/River ecosystems.



Mr. Oborny's experience and expertise with complex ecological issues is also illustrated by the number of professional appointments that he has received in the past 5 years. These appointments are listed in their entirety in Mr. Oborny's resume, but are summarized below:

- ❖ **State wide Environmental Flows Science Advisory Committee Member: 2009-present**
- ❖ **Southern Edwards Aquifer Species Recovery Team Member: 2008-present.**
- ❖ **Special Consultant to the Biological Working Group (BWG) in Spring Valley, Nevada: 2007 – present.**
- ❖ **Blue Ribbon Science Advisory Panel Member (Aquatic Resources) in Owens Valley, California: 2009-present.**
- ❖ **Edwards Aquifer Recovery Implementation Program (EARIP) Science Subcommittee Member: 2008-2011.**
- ❖ **Third Party Independent Review of Mono Basin Stream Ecosystem Flows Recommendations: 2009.**
- ❖ **Edwards Aquifer Recovery Implementation Program (EARIP) Biological Modeling Team: 2008 – 2010.**

Melissa M. Fontenot – Project Manager

Ms. Fontenot is a senior level ecologist at BIO-WEST with considerable experience in aquatic and riparian habitat assessment, vegetation monitoring and restoration, and ecological studies. Ms. Fontenot is highly involved in all aquatic vegetation activities associated ongoing long-term variable flow monitoring study on the San Marcos and Comal Rivers. Her focus has been on understanding interactions between native and non-native aquatic vegetation relative to the threatened and endangered species in both systems. Additionally, Ms. Fontenot has conducted aquatic vegetation mapping, monitoring and riparian habitat assessments across Texas from participating in riparian assessments as well as instream flow studies on the lower San Antonio River, Cibolo Creek, Martinez Creek, Salatrillo Creek, lower Colorado River, Hamilton Creek, and the upper Brazos River. Ms. Fontenot maintains professional certifications with the Ecological Society of America and the Society of Wetland Scientists, and has performed ecological studies, native and invasive vegetation surveys, water-quality assessments, wetland delineations, and habitat assessments for multiple projects. Ms. Fontenot is also well-versed in the use of GPS equipment and the principles and techniques of mapping and statistical software.



Currently, Ms. Fontenot is serving as the project manager and principal riparian investigator for a riparian monitoring study in collaboration with the San Antonio River Authority to collect valuable recruitment and growth information for native riparian tree species along the San Antonio River. This study incorporates environmental influences of river flow, pulse flow events, groundwater levels, precipitation, soil moisture, and sedimentation on vegetation within the riparian zone at two locations between San Antonio and the Gulf coast. BIO-WEST is also currently beginning a similar effort to study riparian responses to instream flows along the Guadalupe River. In addition to participating in and managing field data collection efforts, Ms. Fontenot also has considerable expertise in data analysis and report preparation. She has been heavily involved in spatial analysis of aquatic and riparian vegetation datasets to develop relationships between environmental parameters, topography, and vegetation maps. She is also proficient in analysis of ecological data using standard and multivariate statistical techniques.

Tim Osting – Senior Hydraulic Modeler

Mr. Osting is Managing Engineer in the water resources / environmental section of RPS Espey in Austin, TX. His specialties include *multidimensional hydrodynamic modeling*, hydrology, water quality evaluation and modeling, habitat modeling, river-floodplain and riparian area interaction, GIS analysis and hydrographic field studies utilizing state-of-the-art, high-resolution data collection equipment. Mr. Osting has worked exclusively with BIO-WEST on several contracts involving these specific duties, and most recently assisted BIO-WEST with a detailed examination of the flow, water quality, and aquatic habitat dynamics of the Old Channel of the Comal River.



BIO-WEST REFERENCES

REFERENCES	
Edwards Aquifer Authority 1615 N. St. Mary's Street San Antonio, Texas 78215	Rick Illgner – Research Coordinator Phone: (210) 222-2204 Email: rillgner@edwardsaquifer.org
Lower Colorado River Authority 3700 Lake Austin Blvd. Austin, Texas 78767	Leah Manning – Project Manager Phone: (512) 473-3589 Email: leah.manning@lcra.org
San Antonio River Authority PO Box 839980 San Antonio, Texas 78283-9980	Steve Raabe – Director of Technical Services Phone: (210) 302-3614 Email: sraabe@sara-tx.org
Texas Parks and Wildlife Department Resource Protection, River Studies Program Aquarena Center, The Landing San Marcos, TX 78666	Kevin Mayes – Senior Aquatic Biologist Phone: (512) 754-6844 Email: kevin.mayes@tpwd.state.tx.us
U.S. Fish and Wildlife Service National Fish Hatchery and Technology Center 500 E. McCarty Lane San Marcos, Texas 78666	Tom Brandt – Supervisor Phone: (512) 353-0011 ext. 224 Email: Tom.Brandt@fws.gov

Evaluation Criteria	Max point value	BIO-WEST / Baylor Highlights	Score
Experience with riparian restoration, including non-native vegetation removal and re-vegetation projects. Experience with vegetation establishment monitoring.	15	BIO-WEST project team scientists have worked with aquatic vegetation and endangered species in the Comal system since the 1990s. Dr. Doyle has extensive experience with aquatic vegetation restoration in the Comal and San Marcos rivers. As shown throughout this proposal, BIO-WEST has extensive experience with vegetation establishment and river restoration monitoring in Texas and throughout the western U.S.	
Experience with environmental restoration and/or other projects of a similar type, especially projects assisted with public funds.	15	River restoration and endangered species is what BIO-WEST is known for throughout the U.S. BIO-WEST just completed a monitoring project associated with environmental restoration in Brackenridge Park in San Antonio funded with public funds, and is working for TPWD on a threatened species study on the lower Sabine River on public grant monies.	
Experience with two-dimensional hydraulic modeling.	10	Within the last 10 years, BIO-WEST has completed or is presently working on instream flow studies using 2-D hydraulic modeling to assess aquatic habitat conditions in the San Antonio River, Colorado River, Brazos River, Guadalupe River, Cibolo Creek, and the Clear	

		Fork of the Brazos. Many of these efforts have involved collaboration with Mr. Tim Osting of RPS Espey, and thus our confidence is his abilities to use the existing EARIP hydraulic model developed for the Comal River system.	
Experience with conducting a site assessment as part of work plan tasks.	10	Conducted hundreds of biological site assessments since our inception in 1976. BIO-WEST helped develop the biological goals and Take assessment in the EARIP HCP so we are thoroughly familiar with EARIP work plans.	
Demonstrate collaboration with other firms/entities to achieve work plan tasks.	10	During the decade plus of monitoring at Comal and San Marcos Springs, BIO-WEST has supported 5 M.S. degree students working collaboratively with TSU. Additionally, BIO-WEST is currently working collaboratively with the Texas Instream Flow Program (TPWD, TWDB, TCEQ) on instream flow studies in multiple river basins.	
Demonstrate capability to complete work plan tasks on time and within budget.	10	As a consulting firm, this is mandatory to ensure repeat work and client satisfaction. We have an exemplary record on both budget and schedule and encourage this question be asked of any of BIO-WEST's references.	
Demonstrate success on projects within region and knowledge of regional hydrology, geography, and environmental characteristics.	10	Extensive experience within the region starting with over a decade of work on Comal and San Marcos Springs. Additional river basins include San Antonio, Guadalupe, Colorado, Brazos, Trinity, and Sabine. Mr. Oborny is also an active member of the Science Advisory Committee for the SB 3 Environmental Flows process.	
Demonstrate ability to obtain or possess necessary permits within project time frame, including construction permits and endangered species handling.	5	BIO-WEST possesses federal and state endangered species collection permits for the Comal River allowing us to initiate work upon selection. BIO-WEST is aware of the necessary TPWD and City permits and is prepared to submit applications upon award.	
Demonstrate past performance confidence.	5	Please contact any BIO-WEST reference and/or state or federal agency scientist or stakeholder familiar with the Edwards Aquifer system.	
Competitive fee structure and valuation of 3 plots.	10	Detailed cost breakdown as shown above. Being a small business with lower overhead than large engineering firms, coupled with teaming with Baylor and their graduate student workforce, our structure is extremely competitive. Our knowledge of the EARIP and the Comal system, allows BIO-WEST to offer legitimate cost savings while still meeting the intent of the HCP.	
Maximum Points	100		

APPENDIX B: PAST AND PRESENT PERFORMANCE SURVEY

Appendices
Appendix B - Performance Survey

PAST AND PRESENT PERFORMANCE SURVEY

Company Name: BIO-WEST, Inc.
Street Address: 1812 Central Commerce Court
City, State, and ZIP Code: Round Rock, Texas 78664

1. GENERAL BUSINESS INFORMATION

Date Firm Organized/Established: 1976
Company President: Darren Olsen
Vice President: Edmund L. Oborny, Jr.
Point of Contact: Edmund L. Oborny, Jr.
Contract Number: _____
Telephone Number: (512) 990-3954
Contract/Subcontract Amount: \$ _____
Location: Round Rock, Texas
General Scope of Project:
Environmental Consulting services specializing in endangered species - See below for 3 project references.

Your Role (*Price [], Joint Venture [], or Subcontractor []*) and the work your firm performed:

Contract State Date: 2001
Contract Completion Date: Present

Dun & Bradstreet Number: 020911756
Is Company a: ☒ Partnership ☐ Separate entity ☐ Division ☐ N/A ☐

2. CONTRACTS/SUBCONTRACTS COMPLETE OR IN PROGRESS

Complete and submit the information requested below on prime contracts or subcontracts completed or in progress. Government contracts are preferred, but if you have not performed Government contracts, indicate any other contracts completed or in progress.

a. First Contract

Contracting Agency or Company: Edwards Aquifer Authority
Point of Contact: Rick Ilgner
Contract Number: 05-194-GM
Telephone Number: (210) 477-5140
Contract/Subcontract Amount: _____
\$ 238,151 Location: Comal and San Marcos Springs

General Scope of Project:

BIO-WEST has been conducting long-term monitoring of the endangered species and their habitat in Comal and San Marcos Springs since 2001. This includes both comprehensive sampling and critical period sampling during high and low-flows. Sampling components: aquatic vegetation mapping, fountain darter and other fish sampling, macroinvertebrate sampling, water quality, discharge, gill parasite, non-native species (fauna and flora) and analysis. Extensive work has been conducted in Spring Run 3 and the Western Shoreline with respect to the federally listed endangered Comal Invertebrates.

Your Role (*Price [], Joint Venture [], or Subcontractor []*) and the work your firm performed:
Prime Contractor

Contract State Date: January 2001
Contract Completion Date: On-going

b. Second Contract

Contracting Agency or Company: San Antonio River Authority
Point of Contact: Steve Raabe
Contract Number: 1300031
Telephone Number: (210) 302-3614
Contract/Subcontract Amount: \$ 163,152

Location: Lower San Antonio River and Cibolo Creek

General Scope of Project:

BIO-WEST participated with the Texas Instream Flow Program and San Antonio River authority to conduct a multi-faceted instream flow study on the San Antonio River and Cibolo creek. This 2012 contract is for follow-up long-term monitoring of the aquatic and riparian communities. A key component of the monitoring is the assessment of non-native vs. native species and their habitat requirements.

Your Role (*Price [], Joint Venture [], or Subcontractor []*) and the work your firm performed:
Prime Contractor

Contract State Date: July 1, 2006
Contract Completion Date: On-going

c. Third Contract

Contracting Agency or Company: Texas A&M Agri-life Extension Service
Point of Contact: Robert Gulley
Contract Number: 449024
Telephone Number: (210) 477-8521
Contract/Subcontract Amount: \$ 44,920
Location: Comal Springs, New Braunfels, Texas

General Scope of Project:

BIO-WEST, in conjunction with the U.S. Fish and Wildlife Service was contracted to conduct a pilot-study in Comal Springs to examine the effect of removing a non-native snail on the concentrations of gill parasites in the water column. BIO-WEST conducted a statistical rigorous experiment to quantify the effects of snail removal near Spring Island in Landa Lake. The work was specifically designed to limit any affect to the Comal Springs Riffle Beetle and other Comal Invertebrates during study activities.

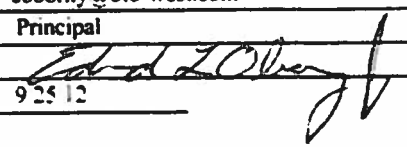
Your Role (*Price [], Joint Venture [], or Subcontractor []*) and the work your firm performed:
Prime Contractor.

RFP 12-026

Contract State Date: November 1, 2010

Contract Completion Date: February 28, 2011

4. CERTIFICATION OF PAST AND PRESENT PERFORMANCE INFORMATION

Type or Print Information	
Name of Survey Preparer: <u>Ed Oborny</u>	Phone: <u>(512) 990-3954</u>
E-Mail: <u>eoborny@bio-west.com</u>	
Title: <u>Principal</u>	
Signature: <u></u>	
Date: <u>9/25/12</u>	

APPENDIX C: KEY TEAM MEMBER RESUMES

Robert D. Doyle, Ph.D.
Baylor University, Department of Biology
PO Box 97388, Waco, TX 76798
254-710-2911, Robert_Doyle@Baylor.edu
Update 6/2012

PART I. BASIC INFORMATION

EDUCATION:

- 1991 Ph.D. Marine, Estuarine, and Environmental Sciences: University of Maryland.
Dissertation Title: *Primary Production and Nitrogen Cycling Within the Periphyton Community Associated with Emergent Aquatic Macrophytes in an Amazon Floodplain Lake.*
- 1985 M.S. Biology: Baylor University
Thesis Title: *Phytoplankton Production of Tropical Lake Chapala, Mexico.*
- 1981 B.S. Biology: Baylor University, Waco, TX.

PROFESSIONAL EXPERIENCE:

- 2005-present Chair, Department of Biology, Baylor University
- 2003-present Director, Center for Reservoir and Aquatic Systems Research (CRASR)
- 2008-present Professor, Baylor University
- 2001-2008 Associate Professor, Baylor University
- 1998-2001 Assistant Professor, University of North Texas.
- 1996-1998 Research Biologist, US Army Corps of Engineers, Waterways Experiment Station, Lewisville Aquatic Ecosystem Research Facility, Lewisville TX.
- 1991-1998 Adjunct Assistant Professor, Un of North Texas, Department of Biological Sciences
- 1993-1996. Research Scientist II, University of North Texas, Institute of Applied Sciences.
- 1991-1993 Research Scientist I, University of North Texas, Institute of Applied Sciences.
- 1986-1991 Graduate Research Assistant, University of Maryland, Marine, Estuarine, Environmental Science Program. .
- 1985-1986 Research Associate, University of Maryland, Amazon Floodplain Research Project.

CERTIFICATION:

- 1995- present Professional Wetland Scientist, *Society of Wetland Scientists*

HONORS AND AWARDS:

- 2003-present Fellow, Texas Academy of Sciences
- 1997, 1998 Department of the Army, Official Commendation for exceptional performance of duties as Research Biologist.
- 1995 UACE Wetlands Research Program, Commendation for contribution to the WRP,
- 1981 Recipient of the Cornelia M. Smith Award for Outstanding Biology Senior at Baylor University.
- 1981 Graduated *cum laude* from Baylor University.

This grant provides partial support for our second year restoration efforts on the San Marcos River, TX. which includes efforts to eradicate an exotic aquatic plant and re-establish desirable native vegetation.

***Cryptocoryne beckettii* control in the San Marcos River- Phase I, 2002-2003. (\$25,000-USFWS).**

A cooperative agreement has been established with the USFWS for on-going research and management efforts on the San Marcos River. The first phase of this cooperative agreement was funded at \$25,000. This funding continued a fruitful and long-term cooperative agreement. In the past the USFWS has funded me for about \$350,000 of research on the San Marcos. Additional funds followed this grant (see above).

Evaluation of the peroxidase enzyme assay with respect to insect herbivory on *Hydrilla verticillata* (2001-02, \$5,825-Baylor URC).

1998-2001 Funding while a tenure-track faculty at UNT

Impacts of *Hydrellia pakistanae* on plant competitive interactions -COE Waterways Experiment Station \$20,000.

Impacts of *Hydrellia pakistanae* on *Hydrilla verticillata* -COE Waterways Experiment Station \$33,081.

Assessment of Factors Influencing Texas Wildrice (*Zizania Texana*) Sexual and Asexual Reproduction , Edwards Aquifer Authority (Co-PI with P. Power for grant received by USFWS-NFH), \$63,060.

Development of Water Quality Monitoring System for Lake Texoma, Co-investigator with Dickson, Waller, Atkinson - US Army Corps of Engineers via Wendy Lopez and Associates- \$299,059.

Inter-personnel Act Agreement-US Army Corps of Engineers Waterways Experiment Station- Summer salary support for Robert Doyle 1999 & 2000, \$ 39,296.

Inter-personnel Act Agreements- US Army Corps of Engineers Waterways Experiment Station Salary support for Dr. Gary Dick 10/98-9/00, \$119,750.

Inter-personnel Act Agreements- US Army Corps of Engineers Waterways Experiment Station Salary support for Mr. Matt Francis 2/00-12/00, \$31,334.95.

Inter-personnel Act Agreements- US Army Corps of Engineers Waterways Experiment Station 50% salary support for Mr. David Honnell 6/99-5/01, \$61,836.

Establishment of native aquatic plants for lake restoration and fish habitat enhancement- Texas Parks and Wildlife Department, Co-investigator with Dickson and Dick, \$137,684.

Development of Aquatic Ecosystem Restoration Technologies- Aquatic Ecosystem Restoration Foundation, \$36,500.

Determination of the carbon sources for Texas Wildrice and other aquatic plants of the Comal and San Marcos Rivers, UNT Faculty Development Grant, \$3,800.

1992-1998 Funding (Prior to joining faculty at UNT in 1998)

1998, Effects of Biocontrol Agents on the Competitive Interactions Between Exotic and Native Plant Species (COE, 70,000, Co-PI w/ M. Smart)

1998, Assessment of Vegetation Loss During Low Flows for Development of Adaptive Management Recommendations (USFWS, \$101,000)

1998, Restoration of TX Wildrice and Other Vegetation: Comal and San Marcos Rivers, (USFWS, \$14,333)

1998, Effects of Inorganic Clay Turbidity on the Growth and Reproductive Potential of Native Submersed Plants (COE, \$12,500)

1998, Lake Wister Native Plant Establishment (Tulsa COE, \$13,250)

1998, Eradication of Hydrilla on the Comal River and Restoration with Native Species (USFWS, \$6,000)

1998, Development of a Wetland For Water Quality Benefits of Oyster Creek, TX. (Brazos River Authority, \$15,000)

- periphyton growing on nutrient diffusing substrata: evidence for differential nutrient limitation in stream periphyton. *J. North American Benthological Association*. 28(1):57-68.
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 23. Scott, J.T., R.D. Doyle. 2006. Coupled photosynthesis and heterotrophic bacterial biomass production in a nutrient-limited wetland periphyton mat. *Aquatic Microbial Ecology* 45:69-77.
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 12. Doyle, R.D. and R.M. Smart. 2001. Effects of drawdown and dessication on tubers of *Hydrilla verticillata*, an exotic aquatic weed. *Weed Science* 49:135-140.
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- Fisher, T.R. and R.D. Doyle, 1987. Nutrient cycling in Chesapeake Bay. pps. 49-53 IN G.B. Mackiernan (ed.) *Dissolved Oxygen in the Chesapeake Bay: processes and effects*. MD Sea Grant Pub. no. UM-SG-TS-87-03. (peer reviewed)

- Huang, H., R.D. Doyle, J.T. Scott, 2007. Spatial and temporal patterns of planktonic and community metabolism in Texas reservoirs: a test of the reservoir zonation model. ASLO, February 2007, Santa Fe, NM.
- Scott, J.T. Doyle, R.D., Prochnow, S.J., White, J. D., 2007. Watershed and pelagic predictors of Cyanobacterial n₂ fixation in a eutrophic Reservoir. ASLO, February 2007, Santa Fe, NM.
- Conry, S., M.L. Mullins, R.D. Doyle. 2007. The distribution and expansion of *Arundo donax* (giant reed), an invasive riparian plant species, along the Lake Brazos corridor. Texas Academy of Science, March 2007, Waco, TX.
- Mullins, M.L. R.D. Doyle. 2007. Restoring aquatic plant communities: the San Marcos River experience. Texas Academy of Science, March 2007, Waco, TX.
- Doyle, R.D., M.L. Mullins, 2007. Marsh madness: a science education adventure focused on wetland environments. Texas Academy of Science, March 2007, Waco, TX.
- Scott, T., R.D. Doyle, J. White, S. Prochnow. 2006. Identifying watershed and pelagic thresholds favoring planktonic N₂ fixation in a eutrophic reservoir: A combined mechanistic-empirical modeling approach. North American Lake Management Society, November 8-11. Indianapolis, IN.
- Mullins, M., and R.D. Doyle, 2006. Aquatic macrophyte restoration in the San Marcos river following removal of an invasive species. TX Society for Ecological Restoration, August 18-20, Hunt, TX.
- Scott, T. and R.D. Doyle. 2006. Identifying watershed and pelagic thresholds favoring planktonic n₂ fixation in a eutrophic reservoir: a combined mechanistic-empirical modeling approach. TRRMS, May 18-19, Austin, TX.
- Scott, T. and R.D. Doyle. 2006. Coupled photosynthesis and bacterial biomass production in a nutrient-limited wetland periphyton mat. Society of Wetland Scientists, 27th International Meeting, Cairns, Australia.
- Huang, H., and R.D. Doyle, 2006. Patterns of planktonic and community metabolism along the riverine-lacustrine gradient in texas reservoirs. TRRMS, May 18-19, Austin, TX.
- Conry, S., M. Mullins, and R.D. Doyle, 2006. Expansion of the invasive riparian plant, the giant reed (*Arundo donax*), along the lake brazos corridor. TRRMS, May 18-19, Austin, TX.
- Doyle, R.D., M Mullins, P Power, V Cantu, 2005. A Central Texas restoration project-- removal of an exotic aquatic macrophyte in a spring-fed system. International Spring Symposium, Mexico.
- Doyle, R.D. M. Mullins. 2005. Restoration of the lower San Marcos River: Removal of the exotic plant *Cryptocoryne beckettii* and re-establishment of natives. (SWS Regional Mtg, San Marcos, TX.)
- Doyle, R.D., S. Conry, and J.T. Scott. 2005. Lake Waco Wetland: habitat, research and water quality. (SWS Regional Mtg, San Marcos, TX.)
- J. Thad Scott and Robert D. Doyle, 2005. Enzymatic Controls On Metaphyton Primary Production And Cnp Stoichiometry In A Created Wetland. TRRMS Annual Meeting, Baylor University.
- Scott, J.T. and R. Doyle. 2005. Nitrogen Fixation and natural abundance of nitrogen isotopes in wetland periphyton communities. (SWS Regional Mtg, San Marcos, TX. Winner student competition w/ airfare to international SWS in Australia!).
- Doyle, R.D. J.T. Scott, and T. Conry, 2005. Can the Wetlands Save the Lake? The Role of a Constructed Wetland in Protecting the Water Quality of Lake Waco. 9th International Symposium on Biogeochemistry of Wetlands, March 20-23, 2005, Baton Rouge, Louisiana
- Doyle, R.D., T. Conry, J.T. Scott. 2005. Baylor university Center for Reservoir and Aquatic Systems Research (CRASR): promoting interdisciplinary aquatic research and education. ASLO winter meeting, Salt Lake City.
- Doyle, R. D., J.T. Scott, and T. Conry. 2005. Planktonic nitrogen fixation in a texas reservoir: hot spots and hot moments. ASLO winter meeting, Salt Lake City.
- Scott, J.T. R. Doyle, T. Conry. 2005. Periphyton nutrient limitation and nitrogen fixation along a differential wetland nutrient depletion gradient. ASLO winter meeting, Salt Lake City.

- Doyle, R.D. and R.M.Smart. 2001. *Hydrilla verticillata*: distribution, impacts, and ecological considerations for the control of this exotic aquatic macrophyte. 104th Annual meeting, Texas Academy of Science, San Marcos, TX (invited presentation)
- Doyle, R.D. and P. Power. 2001. Ecology and management of Texas Wild Rice and the aquatic plant community of the San Marcos River, Texas. 104th Annual meeting, Texas Academy of Science, San Marcos, TX (invited presentation)
- Doyle, R.D. and M. Smart. 2000. Flood disturbance increase abundance of non-native aquatic macrophytes in Texas rivers. 20th International Symposium of the North American Lake Management Society, (Miami, FL).
- Doyle, R.D. 2000 Potential control of *Hydrilla verticillata* by use of an insect biocontrol agent in combination with a competitive native species. TX Aquatic Plant Management Society (Denton, TX).
- Doyle, R.D., M. Smart, M. Grodowitz. 2000. Potential control of *Hydrilla verticillata* by use of a classical biocontrol agent in combination with a competitive native species. III International Weed Science Congress, invited presentation, (Iguacu, Brazil).
- Doyle, R.D. and M. Francis. 2000. Impact of the flood of 1998 on the aquatic plant communities of the Comal and San Marcos rivers, TX. 103rd Meeting Texas Academy of Science (Kingsville, TX).
- Doyle, R.D., 1999. Protecting the Native Aquatic Plant Communities of the Comal and San Marcos River, TX. 39th International Meeting of the Aquatic Plant Management Society (Asheville, NC.)
- Grodowitz, M., R.D. Doyle, R. M. Smart. 1999. Effects of biocontrol agents on the competitive interactions between nuisance exotics and desirable native aquatic plants. 39th International Meeting of the Aquatic Plant Management Society (Asheville, NC.).
- Doyle, R.D., P. Power, and K. Kennedy. 1999. Assessment of Reintroduction Potential of Texas Wildrice (*Zizania texana*) into the San Marcos River. Wild Rice: Research and Management Conference, (Duluth, MN.)
- Francis, M. and R.D. Doyle. 1998. Intraspecific competition between *Hygrophila polysperma* and *Ludwigia repens* in the Comal River, New Braunfels, TX (Denton, TX).
- Pennington, T., A.W. Groeger, P.Power, and R.D. Doyle. 1998. Identifying nutrient content and composition to further characterize the habitat associated with the endangered Texas Wildrice (*Zizania texana* Hitch). Texas River and Reservoir Management Society (Denton, TX).
- Doyle, R.D. P. Power, P. Connor. 1998. Assisted Recovery of Texas Wildrice (*Zizania texana*) in the San Marcos River. Society of Ecological Restoration (Austin, TX).
- Smart, R.M., G. Dick, and R.D. Doyle. 1998. Ecological Effects of Native Aquatic Plants. 38th Meeting of the Aquatic Plant Management Society (Memphis, TN)
- Grodowitz, R.M., R.D. Doyle, M. Smart. 1998. Effects of biocontrol agents on the competitive interactions between nuisance exotics and desirable native aquatic plants. 38th Meeting of the Aquatic Plant Management Society (Memphis, TN).
- Forbes, M., R. Doyle, T. Conry, H. Chen. 1998. Wetland creation in Sugarland, TX: building a hydrophytic community. Society of Wetland Scientist (Memphis, TN)
- Doyle, R.D. 1998. Effects of inorganic turbidity on the growth and reproductive potential of native macrophytes. American Society of Limnology and Oceanography (St. Louis, MO).
- Doyle, R.D. and R.M. Smart. 1997. Role of aquatic macrophytes in reservoir ecosystems. 17th International Symposium of the North American Lake Management Society, (Houston, TX)
- Doyle, R.D. 1997. Effects of inorganic turbidity on the growth and reproductive potential of native macrophytes. Aquatic Plant Management Society Meeting (Fort Meyers, Florida.)
- Doyle, R.D. and R.M. Smart. 1996. Establishing Native Vegetation in Southern Reservoirs: Why and How. Aquatic Plant Management Society Meeting, (Burlington, VT)
- Doyle, R.D., R. M. Smart, G.O. Dick, and M. Webb. 1996. Ecological restoration of Lake Conroe, TX: Establishment of native submersed aquatic macrophytes. Texas Academy of Sciences. Galveston.

- Fisher, T.R., L. Smith-Morrill, R.D. Doyle, and E.R. Peele. 1988. Productivity and nutrient cycling on the Amazon's floodplain. Chapman Conference on Amazon Dispersal Systems.
- Doyle, R.D., T.R. Fisher, and E.R. Peele. 1987. Biomass and productivity of periphyton on the Amazon's floodplain. ASLO.
- Fisher, T.R., R.D. Doyle, and E.R. Peele. 1987. Uptake and regeneration of phosphate on the Amazon's floodplain. ASLO.
- Fisher, T.R., R.D. Doyle, and E.R. Peele. 1987. Size-fractionated uptake and regeneration of ammonium and phosphate in a tropical lake. SIL Congress. New Zealand.
- Fisher, T.R. and R.D. Doyle, 1987. Nutrient cycling in Chesapeake Bay. MD Sea Grant conference on

PART III. PROFESSIONAL MEMBERSHIP AND SERVICE

oxygen in the Chesapeake Bay and related processes.

- Fisher, T.R. and R.D. Doyle. 1986. N and P cycling in an Amazon River floodplain lake. Freshwater Wetlands and Wildlife Symp. Univ. of Georgia.
- Doyle, R.D. and L. Davalos. 1985. Phytoplankton production in a large tropical lake (Lago Calado, Mexico) II. factors controlling biomass and production. 48th ASLO meeting.

MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS:

American Society of Limnology and Oceanography,
Society of Wetlands Scientist,
Aquatic Plant Management Society,
North American Lake Management Society,
Society for Ecological Restoration
Texas River and Reservoir Management Society,
Texas Aquatic Plant Management Society,
Texas Academy of Sciences, Fellow

EDITORIAL AND REVIEW ACTIVITIES:

Associate Editor: (2000-2002)

Associate Editor of *Wetlands* (peer reviewed journal of the Society of Wetlands Scientists)

Manuscript Reviewer for Journals:

Aquatic Botany. (International peer-review journal, highest rated journal in aquatic botany field).

Lake and Reservoir Management. (Peer-reviewed journal of the North American Lake Management Society)

Journal of Aquatic Plant Management, (Peer-reviewed journal of the Aquatic Plant Management Society).

Wetlands (Peer-reviewed journal of the Society Wetland Scientists).

Hydrobiologia (International peer-review journal).

Sida: Contributions to Botany, (National peer-review journal).

Journal of Environmental Quality (International peer-reviewed journal)

Estuaries (International peer-reviewed journal)

Science of the Total Environment (peer-reviewed journal)

Grant Reviews:

National Fish and Wildlife Foundation
UNT/Baylor Faculty Research Grant Reviewer.
International Technical Referee, New Zealand Foundation for Research, Science and Technology. New Zealand Aquatic Plant Management Program Review (1998-2000)
Technical Review Panel, Ohio Sea Grant Program.

- 2004 San Marcos Recovery Team
- 2003 Golden Algae Workshop, TPWD 10/24-25, Fort Worth, TX (invited participant)
- 1998 Texas Parks and Wildlife Department Aquatic Vegetation Committee, ABass n= Grass@, forum for discussion of effects of vegetation on reservoir fisheries (invited aquatic vegetation expert).
- 1998 US Army COE, AUpper Mississippi River Project: Plant Modeling Workshop@, Oak Ridge, TN, (invited expert on the effects of inorganic turbidity on growth of submersed macrophytes).
- 1997 US Army COE, AModeling Integration and Simulation Team Meeting@, New Orleans, LA. (invited to provide information on the affects of clay turbidity on the growth of aquatic plants).
- 1997 Maryland Department of Natural Resources, AChesapeake Bay Submerged Aquatic Vegetation Re-seeding and Transplanting Workshop@, Belvue, MD., (invited national aquatic plant expert).
- 1996 Southwest Florida Water Management District, ARainbow River - *Lyngbya* Workshop@, Gainesville, FL., (invited expert on the use of macrophytes to control mat-forming algae).
- 1996 US Army COE, AUpper Mississippi River Project: Plant Modeling Workshop@, Oak Ridge, TN, (invited expert on the effects of inorganic turbidity on growth of submersed macrophytes).
- 1996 U.S. Fish and Wildlife Service, ASan Marcos and Comal Spring Ecosystem Viability Assessment and Management Planning: Texas Wild-rice Group@, Austin, TX. (invited aquatic plant expert).
- 1995 US EPA National Conference for Enhancing the State=s Lake Management Programs, Chicago, (representative of the Texas River and Reservoir Management Society, Texas= NALMS affiliate)
- 1994 4th Annual Review Meeting of the Guntersville Joint Agency Project (Tennessee Valley Authority - Corps of Engineers), Vicksburg, MS, (participant)
- 1994 US Army COE Aquatic Plant Control Research Program, Vicksburg, MS (research presentation)
- 1993 US Army COE Aquatic Plant Control Research Program, Baltimore MD (research presentation)
- 1993 3rd Annual Review Meeting of the Guntersville Joint Agency Project (Tennessee Valley Authority - Corps of Engineers), Guntersville, AL, (technical paper presentation and participant)
- 1992 US Army Corps of Engineer Aquatic Plant Control Research Program, Bellevue, WA. (technical paper presentation and participant)
- 1992 2nd Annual Review Meeting of the Guntersville Joint Agency Project (Tennessee Valley Authority - Corps of Engineers), Guntersville, Alabama, (technical paper presentation)

PART IV. TEACHING AND STUDENT DEVELOPMENT

COURSES TAUGHT AT BAYLOR

Although I currently have a high administrative load (Chair Department of Biology (50%) and Director Center for Reservoir and Aquatic Systems Research (12.5%)) I continue to teach at least one course most semester. I very much enjoy teaching and my student evaluations always exceed comparison norms.

Co-director, Baylor in Brazil Summer Abroad (2006-2011)

Dr. Eva Doyle and I direct a summer abroad educational program.

Courses taught at Baylor on a regular rotation:

Wetland Ecology and Management (Bio 5304), graduate course
 Restoration Ecology (Bio 4381), Senior level course for majors
 Principles of Biology II (Bio 1306), Freshman level course for majors

Other courses taught

Stream Ecology, Senior level majors' course

Christopher W. Sands, Senior Planner
and Landscape Architect



BIO-WEST, Inc.

Mr. Sands is a principal, project manager, senior planner and landscape architect, environmental analyst, and recreation/visual resource management specialist for BIO-WEST. His studies emphasize natural resource management, resource management planning, recreation planning, and land use planning throughout western North America. Mr. Sands possesses 24 years of professional experience, including 20 years with BIO-WEST and 12 months with the U.S. Forest Service (USFS). He holds an MLA in landscape architecture and environmental planning from Utah State University and a BLA in landscape architecture from the University of Georgia.

BIO-WEST PROJECT WORK

Provo River Delta Restoration ♦ Senior Planner

BIO-WEST is restoring, re-creating, and enhancing the ecological character of the historic Provo River delta and Utah Lake interface to increase survival of the endangered June sucker (*Chasmistes liorus*). Project tasks include developing a new river channel with suitable instream habitat and sufficient slope to transport young fish to a developed bay or delta at Utah Lake, which has depths and vegetation cover suitable for June sucker rearing and recruitment. Project work also includes preparing a conceptual design and initiating the NEPA process. Under contract with the Utah Reclamation Mitigation and Conservation Commission, U.S. Department of the Interior's Central Utah Project Completion Act Office, and Central Utah Water Conservancy District (CUWCD), on behalf of the June Sucker Recovery Implementation Program (JSRIP). 2008–present.

Edwards Aquifer Recovery Implementation Program Habitat Conservation Plan Environmental Impact Statement ♦ Senior National Environmental Policy Act Specialist

The Edwards Aquifer Recovery Implementation Program (EARIP) completed the development of a regional Habitat Conservation Plan and is in the final stages of completing the associated EIS. BIO-WEST is under contract to provide third-party assistance to the U.S. Fish and Wildlife Service and is assisting with the successful publishing of the EIS document, which includes thoroughly reviewing and editing the entire EIS; offering suggestions for streamlining, modifying, and providing technical analysis; identifying and responding to public comments on the Draft EIS; and incorporating all agency-approved comments into the EIS document. Mr. Sands is responsible for managing all aspects of this project, as well as overseeing all editorial tasks related to the production of the Draft and Final EIS documents. Under contract with EARIP. 2012.

SPECIAL TRAINING AND CERTIFICATION

- ▶ licensed landscape architect (State of Utah no. 288588)
- ▶ certified planner (certificate no. 126168)

AWARDS, HONORS, MEMBERSHIPS

- ▶ 2008: Merit Award for Salt Lake County Natural Areas Land Management Plan, American Society of Landscape Architects
- ▶ 2006: Utah Governor's Quality Growth Commission Award for planning and design
- ▶ 2005: Utah Governor's Quality Growth Commission Award for critical land planning
- ▶ 1999–2011: American Planning Association
- ▶ 1994–2011: American Society of Landscape Architects
- ▶ 1991: American Society of Landscape Architects Honor Award for scholastic achievement
- ▶ 1990: Clay Adamson Scholarship
- ▶ 1989: Scholastic Honor Award from *Sigma Lambda Alpha*
- ▶ 1988: Toro Irrigation Scholarship

EDUCATION

- ▶ 1994: MLA landscape architecture and environmental planning, Utah State University, Logan
- ▶ 1991: BLA landscape architecture, University of Georgia, Athens

ownership, legal condition, ecological values, scenic values, and land use information for each of the properties. The report also included recording human-made features, completing a photographic record, and preparing maps for each of the properties that meet Internal Revenue Service (IRS) requirements. Each master plan project involved meeting regularly and coordinating with County staff, researching and obtaining existing conditions information, developing and analyzing conceptual alternatives, and preparing draft and final master plan documents. The master plan documents addressed issues such as restoration potential, access feasibility, environmental constraints, public safety, trail connectivity, conservation easement stipulations, and development costs. Under contract with Salt Lake County Division of Parks & Recreation. 2010–2012.

Clear Creek Ranch Pond Designs ♦ Project Manager

Clear Creek Ranch is located in the scenic Prince Mountains above Panguitch Lake in Iron County, Utah. The ranch owner hired BIO-WEST to develop detailed plans for a series of created ponds near a new house on the ranch. BIO-WEST designed the ponds to look natural and provide year-round fish habitat for recreational fishing. The project included a jurisdictional wetland delineation and survey, joint Clean Water Act Section 404/Stream Alteration Permit, wetland mitigation and monitoring plans, and pond construction drawings. The pond designs emphasized native plant and fish habitat features. BIO-WEST also prepared water rights applications for the project. Under contract with a private client. 2006–2007.

Salt Lake City Riparian Corridor Stream Study ♦ Senior Planner

BIO-WEST conducted a Riparian Corridor Study of four streams (Emigration, Red Butte, City, and Parleys Creeks) in Salt Lake City, Utah. Project work consisted of assessing baseline stream and riparian-vegetation conditions and developing stream corridor future vision and management plans for each stream. The project involved extensive public outreach/involvement; development of educational materials; assessment of stream-channel geomorphic conditions, historical trends, and riparian-vegetation community types; identification of invasive species problems; development of BMP recommendations for stream and riparian improvements; and identification of appropriate locations for stream and riparian improvements. Regular stakeholder meetings and a series of four public workshops were held for each stream corridor. Stream-channel and riparian assessments included compiling low-flow and high-flow field evaluations, as well as compiling existing data and using remote-assessment methods. Results were assembled into a GIS-compatible format. Under contract with the Salt Lake City Public Utilities Department. 2008–2010.

Salt Lake County Natural Areas ♦ Project Manager

BIO-WEST was contracted to prepare a Natural Areas Land Management Plan for lands within Salt Lake County, Utah. The plan did not focus on specific parcels of land, it was a detailed, complete manual that guided Salt Lake County Parks and Recreation in its annual maintenance activities and care for natural areas throughout Salt Lake County. It established standards and guidelines for (1) defining and classifying natural areas by landscape type, (2) maintaining natural areas and open space, and (3) rehabilitating disturbed natural areas. The plan also (1) identified native plants to use in various landscape types, (2) included enhancement and restoration techniques, (3) incorporated water-management and erosion-control methods, (4) detailed weed-management techniques, and (5) outlined fire-management policies. Under contract with Salt Lake County. 2007–2008.

Mr. Oborny specializes in aquatic ecology, threatened and endangered species, water quality, biological modeling, and instream-flow issues and concepts. He has 18 years of professional project experience, and is familiar with all levels of project management and complex study design. Mr. Oborny possesses technical expertise in fisheries biology, instream and environmental flow, water quality, ichthyology, aquatic ecology, and modeling. He has worked on many projects with endangered-species components in Texas, and the southwestern United States; prepared Environmental Impact Statements and other environmental documents; and participated in freshwater and coastal monitoring programs, water-quality investigations, instream-flow analyses, radio-telemetry studies, and numerous other fishery- and water-related projects. Mr. Oborny has also managed several large ecological- and water-resource projects; taken courses in two-dimensional modeling with SMS, instream-flow incremental methodology (IFIM), physical-habitat simulation modeling, water-surface profiling and floodplain analysis, and applied river geomorphology; and used indicators of hydrologic alteration and range of variability approach to assess ecological impacts associated with groundwater withdrawal on the Comal and San Marcos Springs aquatic ecosystems. In addition, he has used habitat suitability indices (HSI) and hydraulic modeling to evaluate impacts/benefits to the aquatic habitat of riverine species/life stages and HSI and habitat evaluation procedures to evaluate the impacts/benefits to estuarine species with respect to changes in salinity. Mr. Oborny received an MS in wildlife and fisheries sciences from Texas A&M University and a BS in wildlife biology from Eastern New Mexico University.

A brief summary of Mr. Oborny's relevant experience is presented below.

BIO-WEST PROJECT WORK

Edwards Aquifer Variable-Flow Study ♦ Project Manager/Principal Aquatic Resources Investigator

This BIO-WEST project entails a multi-discipline, multi-year variable-flow and water-quality study for the Edwards Aquifer Authority (EAA). BIO-WEST was contracted to research population dynamics of several threatened and endangered species (two fish, two salamander, one plant, and three invertebrate species) in the spring-fed Comal and San Marcos Rivers, Texas. The variable-flow study incorporates comprehensive sampling and flow-dependent sampling that is conducted when the discharge in one or both of the rivers falls below (low-flow) or rises above (high-flow) specified "trigger" levels. The overall study objectives are to (1) establish baseline data for each studied population, (2) track habitat usage and population dynamics as springflow decreases during drought

EXPERIENCE

- ▶ instream-flow analysis
- ▶ project management
- ▶ study design
- ▶ freshwater and coastal monitoring

SKILLS

- ▶ two-dimensional hydraulic modeling
- ▶ instream-flow habitat modeling (PHABSIM, MesoHABSIM, and HSI)

PROFESSIONAL SOCIETIES

- ▶ 2003–2012: Desert Fishes Council
- ▶ 2000–2010: Texas Rivers and Reservoirs Management Society
- ▶ 2000–2012: American Fisheries Society
- ▶ 2007–2010: Ecological Society of America

EDUCATION

- ▶ 1993: MS wildlife and fisheries sciences (fisheries), Texas A&M University, College Station
- ▶ 1991: BS wildlife biology, Eastern New Mexico University, Portales

BIO-WEST PROJECT WORK (cont.)

Bernalillo to Alameda Bridge River Restoration ♦ Senior Fisheries Biologist

BIO-WEST was contracted to provide technical expertise to the U.S. Bureau of Reclamation (Reclamation) project team on several components of a multi-faceted restoration effort on 10 miles of the middle Rio Grande, New Mexico. Mr. Oborny's responsibilities included assembling and presenting existing southwestern willow flycatcher (*Empidonax traillii extimus*) and Rio Grande silvery minnow (*Hybognathus amarus*) data, evaluating methods for creating a two-dimensional model of existing conditions, reviewing existing information on endangered species, and presenting potential benefits of creating a two-dimensional model for quantifying hydraulic conditions/endangered species habitat at selected index sites. Under contract with Reclamation. 2003–2005.

Provo River Flow Study ♦ Assistant Project Manager/Principal Aquatic Resources Investigator

This BIO-WEST study was designed to determine the effects of alternative-flow regimes to the middle and lower sections of the Provo River, Utah, and the remaining portions of its riparian corridor. The project area encompassed approximately 30 miles of the Provo River and its riparian ecosystem from Jordanelle Dam to Utah Lake. The objective of the project was to collect field data and develop modeling capabilities for use in the characterization of flow-channel processes and flow-ecological relationships (within the Provo River and its riverine ecosystem). The results of this study provided modeling/prediction capabilities necessary to evaluate the effects of alternative-flow regimes on ecological components (including the endangered June sucker [*Chasmistes liorus*]) throughout the annual hydrologic cycle and helped predict how aquatic habitat and recruitment of riparian vegetation would likely change over time. Under contract with the Utah Reclamation Mitigation and Conservation Commission. 2002–2004.

Comal Springs Riffle Beetle Habitat and Population Evaluation ♦ Principal Investigator/ Project Manager

BIO-WEST conducted an intensive search effort for the endangered Comal Springs riffle beetle (*Heterelmis comalensis*) and documented an extension of the known range of species in Comal Springs. Mr. Oborny coordinated field crews of two to three biologists who searched spring habitats along the Landa Lake shoreline (along spring-run habitat) and in several locations where springs were evident within the lake to find populations of species outside of the known range. Mr. Oborny performed quantitative measurements to examine the relative densities of the Comal Springs riffle beetle and a similar riffle beetle species where populations of the former were found. The range extension of this species was developed into a manuscript for submission to a peer-reviewed journal. Under contract with EAA. 2001.

Comal Springs Riffle Beetle and Fountain Darter Laboratory Studies ♦ Principal Investigator/ Project Manager

After the Comal Springs riffle beetle habitat and population evaluation, BIO-WEST raised questions about responses to changes in springflow, both laterally and vertically, and studied concerns regarding changes in the laboratory. Mr. Oborny managed laboratory studies and participated in project development including narrowing study foci to address specific questions and assisting with designing the laboratory setup. BIO-WEST also raised questions about the response of fountain darter (*Etheostoma fonticola*) reproduction to diel fluctuations in temperature that are observed in the wild, but not addressed in previous laboratory studies. Mr. Oborny worked closely with Dr. Tim Bonner of Southwest Texas State University, who was

PUBLICATIONS / PRESENTATIONS (cont.)

Southern Edwards Aquifer Species Recovery Team ♦ Team Member

Appointed by the Regional Director of USFWS to be part of the Southern Edwards Aquifer Species Recovery Team. The objective of the team is to update and revise a Recovery Plan for seven Federally listed endangered species and one Federally listed threatened species in the Comal and San Marcos Springs ecosystems and in Edwards Aquifer. 2008–present.

The Biological Working Group of Spring Valley, Nevada ♦ Special Consultant

Retained to assist with (1) developing a multi-year, multi-faceted monitoring plan to further the understanding of groundwater-influenced ecosystem dynamics and (2) tracking biotic-community responses to SNWA's groundwater withdrawal from the Spring Valley Hydrographic Basin in east-central Nevada. The monitoring plan was the result of a stipulated agreement between SNWA and four U.S. Department of the Interior bureaus: the Bureau of Indian Affairs, the Bureau of Land Management, USFWS, and the National Park Service. 2007–present.

The Blue Ribbon Science Advisory Panel of Owens Valley, California ♦ Panel Member (Aquatic Resources)

Appointed to the Blue Ribbon Science Advisory Panel to analyze hydrology, hydrogeology, geology, and existing natural resources that depend on groundwater within Owens Valley, California, relative to proposed projects. The panel will perform an assessment of possible impacts from groundwater withdrawals on resources and evaluate proposed methods to avoid or mitigate impacts. 2009–present.

PUBLICATIONS / PRESENTATIONS

Johnson, M. S., A. Bolick, M. Alexander, D. Huffman, E. L. Oborny, and A. Monroe. 2012. Fluctuations in densities of the invasive parasite *Centrocestus formosanus* (Trematoda: Heterophyidae) in the Comal River, Comal County, Texas, U.S.A. *J Parasitol* 98(1):111-116.

McDonald, D.L., T.H. Bonner, E.L. Oborny, and T.M. Brandt. 2007. Effects of fluctuating temperatures and gill parasites on reproduction of the fountain darter, *Etheostoma fonticola*. *Journal of Freshwater Ecology*. Forthcoming.

Oborny, E.L., et al. [BIO-WEST]. 2012. Comprehensive and critical period monitoring program to evaluate the effects of variable flow on biological resources in the Comal Springs/River aquatic ecosystem. 2001–2011 Annual Reports. Prepared for Edwards Aquifer Authority.

Oborny, E.L., et al. [BIO-WEST]. 2012. Comprehensive and critical period monitoring program to evaluate the effects of variable flow on biological resources in the San Marcos Springs/River aquatic ecosystem. 2001–2011 Annual Reports. Prepared for Edwards Aquifer Authority.

Oborny, E.L., et al. [BIO-WEST], San Antonio River Authority and Texas Instream Flow Program. 2011. Instream flow study of the lower San Antonio River and lower Cibolo Creek. Interim Progress Report and Instream Flow Recommendations. Texas Instream Flow Program and San Antonio River Authority. August 2011.

PUBLICATIONS / PRESENTATIONS (cont.)

- Oborny, E.L., et al. [BIO-WEST]. 2002. Comal Springs riffle beetle laboratory study: evaluation under variable flow conditions. Final report prepared for Edwards Aquifer Authority, San Antonio, Texas.
- Oborny, E.L., et al. [BIO-WEST]. 2002. Fountain darter laboratory study: reproductive response to parasites and temperature fluctuations. Executive summary prepared for Edwards Aquifer Authority, San Antonio, Texas.
- Oborny, E.L. 1997. Evaluation of fish assemblages in the Houston Bayou System. In papers presented at the 14th Annual Gulf Coast Environmental Management Symposium, Pasadena, Texas.
- Oborny, E.L., and B. Gearhart. 2000. Underwater remote-sensing survey and biological sampling: channel to Smith Point, Galveston Bay, Texas. Prepared for the U.S. Army Corps of Engineers, Galveston District, Document No. 000081.
- Oborny, E.L., and P. Jensen. 1999. Thermal effects assessment: Bastrop Reservoir. Prepared for GenTex Power Corporation, Document No. 990923.

SPECIAL TRAINING AND CERTIFICATION

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| 2009 | Stream Temperature Modeling - IF 312, U.S. Geological Survey (USGS) Mid-continent Ecological Science Center |
| 2003 | Two-Dimensional Hydraulic Modeling of Complex Waterways with SMS Training |
| 2000 | Applied River Geomorphology and Biotechnical Engineering for Fisheries Biologists, American Fisheries Society |
| 1998 | Using the Computer Based Physical Habitat Simulation System - IF 310, USGS Mid-continent Ecological Science Center |
| 1997 | Theory and Concepts of the IFIM - IF 250, USGS Biological Resources Division |
| 1997 | Water Surface Profiling and Floodplain Analysis Seminar featuring HEC-RAS (Haestad Methods) |
| 1996 | GIS, Internet, and Fish & Wildlife Microcomputer Applications Course, American Fisheries Society |
| 1994-1999 | Mine, Safety, and Health Administration Training Certificate |
| 1989 | PADI Open Water SCUBA Diver Certification |

Ms. Fontenot specializes in water resources, aquatic ecology, wetland and coastal habitats, and natural resources assessment. She has more than 9 years of experience in ecological research and practice. She has conducted vegetation monitoring and riparian habitat assessments across Texas from participating in riparian assessments as well as instream flow studies on the lower San Antonio River, Cibolo Creek, Martinez Creek, Salatrillo Creek, lower Colorado River, Hamilton Creek, and the upper Brazos River. Additionally, Ms. Fontenot has been participating in an ongoing long-term variable flow monitoring study on the San Marcos and Comal Rivers, which has involved native, non-native, and threatened and endangered species assessment, including monitoring of the endangered Texas wild-rice plant, *Zizania texana*. She maintains professional certifications with the Ecological Society of America and the Society of Wetland Scientists, and has performed ecological studies, native and invasive vegetation surveys, water-quality assessments, wetland delineations, and habitat assessments for multiple projects. Ms. Fontenot is also well-versed in the use of GPS equipment and the principles and techniques of mapping and statistical software. She received an MS in wildlife and fisheries sciences and a BS in marine sciences from Texas A&M University.

BIO-WEST PROJECT WORK

Lower San Antonio River Riparian Study ♦ Riparian Ecologist

BIO-WEST is conducting a detailed evaluation of instream flow needs in the lower San Antonio River (SAR), Texas. This instream flow collection effort will help determine appropriate flow and habitat conditions necessary to support a sound ecological environment for resident fish and riparian species and provide better understanding of biological assemblage dynamics within the lower SAR watershed. Currently, Ms. Fontenot is serving as the project manager and principal riparian investigator for a riparian monitoring study in collaboration with SARA to collect valuable recruitment and growth information for native riparian tree species along the San Antonio River. This study incorporates environmental influences of river flow, pulse flow events, groundwater levels, precipitation, soil moisture, and sedimentation on vegetation within the riparian zone at two locations between San Antonio and the Gulf coast. Under contract with the San Antonio River Authority. 20010–present.

Edwards Aquifer Variable-Flow Study ♦ Aquatic Vegetation Specialist

BIO-WEST was contracted to research population dynamics of several threatened and endangered species (two fish, two salamanders, one plant, and three invertebrates) in the spring-fed Comal and San Marcos Rivers in San Antonio, Texas. Additionally, BIO-WEST is conducting a variable-

EXPERIENCE

- ▶ riparian studies
- ▶ environmental, aquatic habitat, and water-quality assessments
- ▶ vegetation surveying
- ▶ wetland delineations

SKILLS

- ▶ ArcGIS
- ▶ Trimble® GPS software and equipment

AWARDS, HONORS, MEMBERSHIPS

- ▶ 2006–2009: Ecological Society of America
- ▶ 2010–2011: Certified Ecologist, Ecological Society of America
- ▶ 2003: W.G. Mills Scholarship in hydrology, Texas Water Resources Institute
- ▶ 2002: Regents Fellowship, Texas A&M University
- ▶ 2002: National Collegiate Natural Sciences Award
- ▶ 1997: Congress–Bundestag Exchange Scholarship

EDUCATION

- ▶ 2005: MS wildlife and fisheries sciences, Texas A&M University, College Station
- ▶ 2002: BS marine sciences, Texas A&M University, Galveston

Lower Colorado River Multi-Species Conservation Program Vegetation Monitoring Study ♦ Ecologist

BIO-WEST conducted a multi-year effort to successfully monitor the progression of created and restored habitat management areas by establishing a comprehensive, long-term vegetation monitoring program using permanent study sites. Ms. Fontenot assisted with collecting data, which were obtained by conducting baseline evaluations of each study site using standard vegetation monitoring protocols, vegetation cover types, and species structure within each type. The objective of this study was to assist the U.S. Bureau of Reclamation (Reclamation), Lower Colorado Region, with long-term management decisions pertaining to the success of habitat creation areas within the Lower Colorado River Multi-Species Conservation Program. Under contract with Reclamation. 2008–2011.

Nevada Springs Biological Evaluation ♦ Ecologist

Freshwater spring systems in Nevada serve as important food and water sources, nesting grounds, and habitat for a variety of aquatic and terrestrial organisms in the desert landscape. Ms. Fontenot is contributing to baseline assessments of fish, endemic springsnail (*Pyrgulopsis* sp.) populations, and northern leopard frog (*Rana pipiens*) in the spring systems of Spring Valley. She is also responsible for assisting with plant identification and vegetation community mapping around the springs. The goal of this project is to identify the condition of aquatic communities in more than 20 springs in the region. Under contract with the Southern Nevada Water Authority. 2008–present.

City of Huntsville Environmental Assessment ♦ Ecologist

BIO-WEST was contracted to provide the City of Huntsville with an EA of a utility line in southeast Texas. Project work includes documenting environmental conditions and determining potential, adverse effects to the environment in the area of the utility line. Ms. Fontenot is providing a field assessment, assisting with data inventory and reporting, and overseeing the coordination required for submission of an EA document to the U.S. Forest Service. Under contract with the City of Huntsville. 2010–present.

Grand Prairie Environmental Information Document ♦ Project Manager

BIO-WEST was contracted to assess and document environmental conditions, as well as determine potential, adverse effects to the environment in the vicinity of a utility line in north Texas. Ms. Fontenot is conducting a field assessment, assisting with data inventory and reporting, and overseeing the coordination required for submission of an Environmental Information document to the U.S. Army Corps of Engineers (Corps) for an EA. Under contract with the City of Grand Prairie. 2009–present.

Lower Colorado River Authority/San Antonio Water System Water Project, Matagorda Bay Health Evaluation ♦ Biologist II

BIO-WEST is serving as the lead for the habitat component of a bays and estuaries study in Austin, Texas. Ms. Fontenot is contributing to the baseline assessment of Matagorda Bay health and developing a GIS-based habitat model to assess habitat availability in relation to key fishery species in the Matagorda Bay system. Other responsibilities include coordinating seasonal field sampling activities and cooperating with the Texas Parks and Wildlife Department for aquatic and wetland sample collection. Under contract with the Lower Colorado River Authority. 2005–present.

Lower Colorado River Authority/San Antonio Water System Water Project, Instream-Flow Study ♦ Biologist II

This project involves developing tools to evaluate flow-ecological relationships of more than 200 miles of the Lower Colorado River between Austin and Bay City, Texas. BIO-WEST is overseeing the development of several key components including environmental/instream-flow analysis (including channel maintenance flows and instream flows to preserve native biodiversity and special aquatic sites) and threatened and endangered species evaluations (particularly blue sucker [*Cypleptus elongatus*] spawning, migration, and

U.S. Army Corps of Engineers, Galveston, Texas ♦ Physical Science Trainee

Assisted with planning leads; and aided economists with research, ecosystem restoration planning, flood control, navigation, water quality, beach and bank erosion, and other civil works projects. Utilized ArcGIS to assist economic analysts with floodplains analysis in the Houston, Texas, area; performed environmental assessments of temporary housing units after Tropical Storm Allison; and contributed to the preparation of Preliminary Restoration Plans for wetlands and submerged aquatic vegetation habitat on the Texas coast. 2001–2002.

PUBLICATIONS / PRESENTATIONS

Romigh [Fontenot], M.M. 2005. Organic carbon flux at the mangrove soil-water column interface in the Florida Coastal Everglades [M.S. Thesis]. College Station (TX): Texas A&M University. 45 pp.

Romigh [Fontenot], M.M., S.E. Davis, III, V. Rivera-Monroy and R.R. Twilley. 2005. Flux of organic carbon in a riverine mangrove wetland in the Florida Coastal Everglades. *Hydrobiologia* 569:505–516.

Romigh [Fontenot], M.M. Tidal and intra-annual variability in fluxes of carbon between a mangrove forest and tidal creek in Florida. Student Research Symposium in Conservation, Ecology and Evolutionary Biology, College Station, TX. 21 February 2004.

Romigh [Fontenot], M.M. Dissolved organic carbon flux at the mangrove-water column interface in the Florida Coastal Everglades. American Society of Limnology and Oceanography Annual Meeting, Savannah, GA. 14 June 2004.

Romigh [Fontenot], M.M. Structural comparisons of created and natural wetlands in Galveston Bay, Texas. Wildlife and Fisheries Department Seminar, College Station, TX. 11 April 2003.

Romigh [Fontenot], M.M. Benthic macro-invertebrate communities and habitat characteristics of created and natural marshes in Galveston Bay, Texas. Society of Wetland Scientists Annual Meeting, New Orleans, LA. 10 June 2003.

Romigh [Fontenot], M.M. Carbon exchange between an Everglades riverine mangrove wetland and adjacent tidal creek. Long-Term Ecological Research All Scientists' Meeting, Seattle, WA. Contributed poster. 19-20 September 2003.

TIM D. OSTING, P.E., D.WRE

Managing Engineer - RPS Espey

PROFESSIONAL EXPERIENCE

Mr. Tim Oosting is Managing Engineer in the water resources/environmental section of RPS Espey in Austin, TX. Mr. Oosting has many years of engineering experience in water resources analysis, modeling and environmental field study design in Texas, including experience managing technical and professional personnel on multi-disciplinary projects; experience collaborating with state of Texas resource agencies and university researchers; and interacting on complicated environmental issues with stakeholder groups. Mr. Oosting's recent work has been related to instream flow analyses, river hydraulics, lake and coastal water quality, coastal processes, bay and estuary inflow analyses. His specialties include multidimensional hydrodynamic modeling, hydrology, water quality evaluation and modeling, habitat modeling, river-floodplain and riparian area interaction, GIS analysis and hydrographic field studies utilizing state-of-the-art, high-resolution data collection equipment. Mr. Oosting has successfully designed and implemented complex, multi-agency, multi-year, multi-disciplinary data collection programs in Texas streams and estuaries.



Education

M.S., Engineering, Environmental and Water Resources, University of Texas at Austin, 2007
B.S., Civil Engineering, University of Texas at Austin, 1998

Professional Registration

Texas Professional Engineer, No. 91931, 2003

Professional Affiliations

Diplomat of the American Academy of Water Resources Engineers (ASCE), No. 564, 2010

TECHNICAL REPORTS, PUBLICATIONS AND CONFERENCE PRESENTATIONS

- Morgan, T. and Oosting, T., 2012, "Lake Granbury Watershed Protection Plan – Accepted by stakeholders, TCEQ and EPA." Texas Water Conservation Association (TWCA).
- Oosting, T., 2011, "Approach for water quality evaluation for instream flows in Texas," EWRI 2011, Palm Springs, CA.
- Oosting, T., 2010 and 2011, "Environmental Flow Studies: Linking ecosystem indicators with hydrological metrics." Invited Guest Lecture at Spatial Sciences Laboratory (SSL) – Texas A&M University.
- Oosting, T., 2010, "Blending biology and engineering: linking ecosystem indicators with hydrological metrics." Invited lecture, 46th Annual Meeting Texas Section, American Society of Agricultural and Biological Engineers (ASABE).
- Oosting, T, J Furnans, R Mathews, 2004, "Surface connectivity between six oxbow lakes and the Brazos River, Texas," Texas Water Development Board, Surface Water Resources Division, December 6, 2004.
- Chowdhury, A., Oosting, T., Furnans, J., Mathews, R., 2010, "Groundwater-surface water interaction in the Brazos River Basin: Evidence from lake connection history, chemical and isotopic compositions," Texas Water Development Board Report R-375.

San Antonio River Instream Flow Planning Project – San Antonio River, TX (completed 2011): The San Antonio River Authority (SARA), in collaboration with the Texas Instream Flow Program, is conducting a basin specific study of the lower San Antonio River Basin. SARA initially selected the team of BIO-WEST and Espey team to serve in an advisory role to SARA, but the project team's role has evolved and now includes field, technical and professional services covering project oversight, study design development, historical document reviews, methodology evaluations, data analysis, field data collection, habitat modeling, water quality modeling, sediment transport analysis, report preparation and meeting with State agencies, local officials or the public. Mr. Osting has participated with SARA and the TIFP throughout the SB2 Study Design process, and Mr. Osting is currently managing execution of a field study program to evaluate changes in aquatic habitat across a low range of flows. Mr. Osting has developed preliminary 1D (HECRAS) and 2D hydraulic (River2D) and habitat models to assess habitat at low flows and is currently collecting data to develop 2D hydraulic models at five sites and water quality models (TBD; thus far DO sag models, QUALTX and WASP).

TRA Trinity River Instream Flows Reconnaissance (2011 - ongoing) – The Trinity River Authority (TRA) is interested in identifying study sites characteristic of conditions existing in the Trinity River through the DFW area and downstream to the headwaters of Lake Livingston. Mr. Osting was asked by TRA to participate by assisting TRA identify appropriate data methods guided by analysis endpoints, initiate field data collection, and participation in post-trip assessment leading to overall characterization of the river. The field data collection effort involves navigation of over 300 river miles between Fort Worth and Midway, TX. Mr. Osting also provided an outline for future comprehensive environmental flow studies. Mr. Osting is continuing to assist TRA and state resource agency staff with site-selection as comprehensive instream flow studies begin.

TRA Long-term monitoring (2012 - in-progress) – Using results of the 2011 instream flow reconnaissance survey, this project is initiating long-term sampling to monitor river channel stability and active processes. We are installing 4 long-term site locations (benchmarks), measuring cross-sections, flow, local bathymetry, vegetation, sediment sampling (grain size analysis) and have installed sediment pins and erosion chains for followup monitoring.

BRA Water Management Plan Studies Development (Short-term and Long-Term) (ongoing) – The Brazos River Authority (BRA) is required to develop a Water Management Plan (WMP) before using water authorized under the currently draft System Operations Permit. Mr. Osting is leading this project to identify necessary required environmental studies and to develop a Work Plan to execute studies over the next three to five to ten years. The studies in the Work Plan will allow development and submittal of a first-of-it's-kind WMP to Texas resource agencies. This study will include development of a study design document for the Upper Basin instream flow study, consistent with the existing SB2 TIFP Study design document covering the middle Brazos. Mr. Osting led this project through the initial Tier A tasks including preliminary hydrology and biology field studies and analysis. This survey was conducted in support of Brazos River Authority (BRA) initiatives to collect baseline data on current conditions of the Brazos River, and data may be useful for evaluation of water quality protection points identified in the draft System Operation Permit currently pending before the Texas Commission on Environmental Quality (TCEQ). Biological data collection has occurred in the vicinity (within 1 mile downstream) of this

BRA Chloride/TDS Concentration Predictive Tool, Texas (ongoing): Mr. Osting is Espey's project lead for the development of a tool to predict chloride and total dissolved solids (TDS) concentration at select locations within the Brazos River basin. The tool should provide a forecast of chloride and TDS concentration at Possum Kingdom Lake, Lake Granbury and Lake Whitney, to be used by Brazos River Authority staff to more effectively manage water supply in the basin. The concentration forecast will consider antecedent conditions in the watershed and upstream water bodies. Uncertainty in the underlying datasets and in the forecast will be evaluated.

TCEQ/TIFP/SARA Instream Flow Water Quality Modeling (2010) – Mr. Osting of Espey is overall project manager for this project involving the TCEQ, Texas Parks and Wildlife Department, Texas Water Development Board, San Antonio River Authority, BIO-WEST, Inc., and James Miertschen and Associates, Inc. To address the needs of the **Texas Instream Flow Program (TIFP)**, the Texas Commission on Environmental Quality (TCEQ) has sponsored this project through SARA to identify instream flow water quality evaluation needs, and to make recommendations on approaches and/or models applicable to instream flow studies across the state of Texas.

Lake Granbury Watershed Protection Plan – Lake Granbury, TX (completed 2010): Mr. Osting is Espey's project lead for water quality modeling to support the ongoing Watershed Protection Plan managed by the Brazos River Authority, sponsored by TCEQ and EPA. The project includes water quality data collection and analysis of nutrients, bacterial, dissolved oxygen, pH and temperature as well as determination of important circulation patterns. Mr. Osting is responsible for the data evaluation, model selection, development and utilization. Mr. Osting recommended the type of models to be developed (Segmented CSTR and SELECT) that will analyze water quality parameters of interest and managed a project identifying most likely potential sources of bacteria. Mr. Osting conducted a detailed analysis of alternative management measures including development of annualized costs for each alternative including regional sewer treatment, and vetted this through the stakeholder group over the course of four stakeholder meetings.