

Section 6 Revised Final Report  
4/7/2006

Grant Title:  
**Enhancement of a three-kilometer segment of the San Marcos River  
and eradication of the invasive aquatic plant *Cryptocoryne beckettii***

TPWD Abbreviated Title  
**Plant Removal SM River (E45)**

Grant #: E-45  
Project #: WER01  
Contract #: 129861

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## **I. ABSTRACT**

Efforts have continued on the lower San Marcos River to eradicate the invasive exotic aquatic plant *Cryptocoryne beckettii* and to re-establish desirable native plants to provide habitat and cover for fish and invertebrate species.

During the 2002-2003 dredging operations were initiated under other funding to remove *C. beckettii* from San Marcos River. Prior to the initiation of the Section 6 project, approximately 132 m<sup>2</sup> of the exotic species was removed by human-operated dredging efforts.

The Section 6 Project provided funds for continuing the dredge removal operations during the fall of 2003 and spring –summer 2004. During the Section 6 project period, approximately 515 additional m<sup>2</sup> of *C. beckettii* were removed from the section of the San Marcos River downriver of the “powerline” and in the vicinity of the San Marcos Waste Water Treatment Plant. This effort was accomplished by use of a suction dredge operated for 62 days by paid field assistants. Subsequent monitoring of these areas in June and September 2004 revealed the presence of relatively few small colonies. These were also removed by suction dredge. A final survey in December 2004 found no additional colonies re-growing in the cleared reach.

## II. INTRODUCTION

In 1993 TPWD personnel discovered an unusual plant growing in the lower reaches of the Upper San Marcos River but within the lower portion of the range of Texas wild-rice. This plant has been identified as the aquarium plant, *Cryptocoryne beckettii*, and is currently known in only two locations in the United States, the San Marcos River (Rosen, 2000) and one county in Florida (Colette Jacono, USGS, *pers. comm.*). Although initially something of a mild curiosity item in a river with many well-recognized nuisance exotics, *Cryptocoryne beckettii* attracted the attention of river researchers as it became apparent that the species was expanding at a very rapid rate. Between 1998 and 2001, *C. beckettii* in the San Marcos River increased from 11 to 87 stands and areal cover increased from 171 m<sup>2</sup> to 874 m<sup>2</sup> (Doyle, 2001; Robert Doyle, *pers.comm.*). Concerns increased as it has become obvious that *Cryptocoryne beckettii* has nearly identical habitat preference as Texas wild-rice with respect to depth and flow preferences (Doyle 2001). Although all known colonies of *C. beckettii* are currently downstream of Texas wild-rice, concerns are mounting that the continued presence of *C. beckettii* in the San Marcos River will prohibit recovery efforts for the endangered fountain darter and Texas wild-rice by displacing native plant species that provide habitat for fountain darters and occupying microhabitats suitable for colonization by Texas wild-rice. Furthermore, *C. beckettii* will be the source for downstream infestations, potentially disrupting ecosystems from central Texas to the Gulf of Mexico.

Currently, a rare opportunity exists: eliminating an invasive species from Texas. However if action is not taken, the cost to eradicate this exotic species will be prohibitive and there will be a higher long-term cost associated with controlling the exotic species in critical habitat for endangered species and downstream ecosystems.

The San Marcos River Coalition is providing general direction and goals for this restoration project. The San Marcos River Coalition is an informal partnership between US Fish and Wildlife Service (Service), Baylor University, Lady Bird Johnson Wildflower Center (Wildflower Center), the City of San Marcos, Guadalupe Blanco River Authority (GBRA) and the San Marcos River Foundation that evolved from the need to respond quickly to an issue of common interest, the explosive expansion of an exotic plant in the San Marcos River in critical habitat for the fountain darter and Texas wild-rice. Personnel from each agency and organization bring together, individually and collectively expertise in stream restoration, endangered species issues, native plant conservation, river management, and volunteer coordination. For more information on each partner and their contribution to the coalition see Appendix 1.

### **III. OBJECTIVE**

To continue efforts to eliminate 450 m<sup>2</sup> of *Cryptocoryne beckettii* from the Lower San Marcos River, TX.

### **IV. LOCATION**

A three km section of the San Marcos River which extends from the power line which crosses the San Marcos River near the A.E. Wood State Fish Hatchery downstream to its confluence with the Blanco River. This section of river was extensively studied by personnel from Texas Parks and Wildlife Department (TPWD) during 1995 and was identified as Segment 1 in their study (Saunders, et al., 2001).

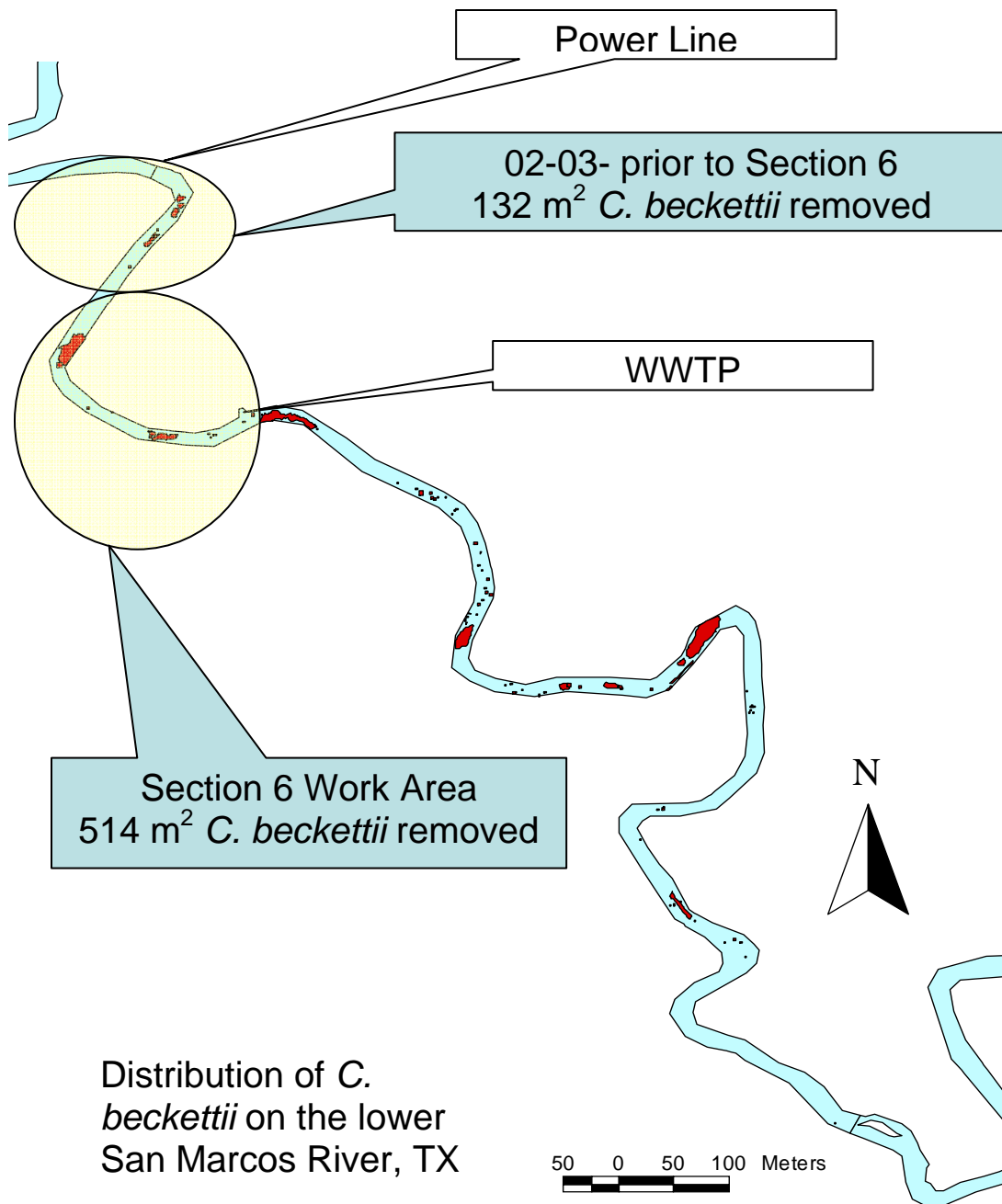
### **V. METHODS**

Work on this project began at the most upstream location of *C. beckettii*. In the original proposal, we had thought that would be approximately at the San Marcos Waste Water Treatment Plant. However, due to the explosive expansion of the pest species in that region of the river, we were forced to begin closer to the “powerline” boundary). The growth rate of the plant during the early expansion period was calculated to be about 80% increase per year! Work conducted prior to the initiation of the Section 6 funds removed the colonies just downstream of the powerline (Figure 1). A total of approximately 132 m<sup>2</sup> of the problem plant were removed prior to the Section 6 funding.

For this project we committed funds to support workers for 45 work days of dredging operations. Based on actual dredging rates from 2002 we estimated that this effort would allow us to clear about 450 m<sup>2</sup> of *C. beckettii*. In actuality, we supported 62 days of work and estimated the removal of over 500 m<sup>2</sup> of the exotic pest.

A 24 hp suction dredge mounted on floats was utilized to manually dredge target plants from the river bottom. The dredge was operated by personnel with previous experience in dredging plants from aquatic systems. The dredge “vacuumed” plants, roots, and sediment and deposits the material, or tailings, in a mesh basket near the shoreline. From there it was manually moved to a location away from the shoreline. Dredges have been used to remove unwanted sediments from waterways for many years and recently have been adapted for aquatic plant control and site preparation activities prior to restoration projects.

*A TPWD Sand and Gravel permit was issued by Texas Parks and Wildlife Department, a Section 404LP of the Clean Water Act was issued by the Army Corps of Engineers, and a Section 7 Biological Opinion of the Endangered Species Act was written, all granting the San Marcos River Coalition permission to use a suction dredge and proceed with this project.*



Distribution of *C. beckettii* on the lower San Marcos River, TX

Figure 1. Location of project activities in the Lower San Marcos River. About 132 m<sup>2</sup> of the problem plant was removed prior to the start of the Section 6 project. The area dredged using Section 6 funds is shown- and a total of 514 m<sup>2</sup> of the plant was removed.

*PROCEDURES:*

- 1) Dredging took place only when water was clear enough to easily see the target colonies and flow is not prohibitively high. As it turns out, this was rarely a limiting factor for this work.
- 2) Before work begins, each stand of *C. beckettii* was swept for the endangered fountain darter using a dip net. Any fountain darters collected were moved to a safe location nearby. However, actual capture of fountain darters was extremely rare.
- 3) Target stands were removed with a suction dredge.
- 4) Disposal of tailings. Tailings were disposed of on land adjacent to the project site owned by the City of San Marcos and Texas Parks and Wildlife Department. The tailings are primarily composed of gravel, sand, rocks, empty snail shells, organic matter (leaves, bits of branches, etc.) and target plant material. Tailings were pumped through the suction dredge into a mesh basket at the shoreline and moved by hand to the disposal location. We had originally thought a front-end loader and roll-off dumpster would be needed for the disposal process, but this proved to be unnecessary. Funds saved from this were used to increase the number of days worked on the river.
- 5) Project Evaluation and Reporting. The project's benefit for Year 2 was demonstrated by the continued elimination of *C. beckettii* from the river. A field assistant experienced in GPS/GIS technologies will map *C. beckettii* stands prior to the removal effort. This will establish baseline data on stand location and size. Six and 12 months after the removal effort, field assistants will survey the target area for regrowth of *C. beckettii*. By comparing baseline data on stand size and location with post-removal data it will be possible to quantify regrowth if regrowth occurs.

*REQUIRED TASKS:*

The contract between Baylor and TPWD (not implemented until November 2003) required Baylor University to complete the following tasks during the project.

1. Continue to eradicate *C. beckettii* in a section of the San Marcos River.
  - a. Delivery of 45 days of dredging to eliminate approximately 450m<sup>2</sup> of *C. beckettii*.
  - b. Focus efforts in the vicinity of the San Marcos waste water treatment plant, and ensure eradication as we move downstream- creating a buffer between existing stands of *Z. texana* and the invasive species.
2. Monitor periodically to evaluate the efficacy of *C. beckettii* removal and native plant re-establishment.

3. Provide Interim Report before 31 October, 2004. Provide Final Report before August 31, 2005

## VI. RESULTS & DISCUSSION

The targets of Task I were exceeded during this period due to the efficient project coordination by Ms. Paula Power, my USFWS project collaborator. Also, the GIS mapping was conducted prior to the beginning of the Section 6 project, freeing up funds to support additional field work days. The following has been accomplished since official implementation of this contract in November, 2003.

1. **GIS mapping.** Although we initially projected the need for a GIS survey of the area to be conducted under this funding, there was an extensive delay in getting the Section 6 award (not awarded until November 2003). Consequently, the GIS survey was actually conducted using other funding. This survey was conducted during the summer 2003 (figure 1). Savings from this were used to extend the number of days in the field for the dredging crews.
2. **Continued removal of *C. beckettii*.** This task was carried out as described in the contract, with the exception that we exceeded stated deliverables (more work days and larger area dredged). Also, our initial projections thought that previous funding would clear the river of *C. beckettii* all the way down to the waste water treatment plant. Unfortunately, the removal of the plant was more difficult than initially estimated, and only the first 150 m reach of the river had been cleared. However, that effort provided valuable experience, and the efficiency of our efforts increased significantly. Consequently, we began dredging at the most upstream colony still present in the river in November 2003.
  - a. The suction dredge was operated for 62 days by paid field assistants on this project. Based on our initial surveys, we estimate a total of 515m<sup>2</sup> of water trumpet were removed during the portion of the effort supported by Section 6 funds. This exceeds the contractual obligation of 45 field days and removal of 450 m<sup>2</sup> of the invasive plant. Before plants were dredged, the site was swept for fountain darters to reduce the chance of passing fountain darters through the dredge. The dredge vacuumed leaves, stems, roots and sediment and discharged the material into a mesh basket that was mounted on pontoons. It was essential to the project to remove every root because water trumpet will re-sprout from small root fragments left behind. The material is manually removed from the basket and deposited on shore behind silt fencing. Personnel from the City of San Marcos wastewater treatment plant transported the material from the silt fence area to an upland site using a bobcat. Focus efforts in the vicinity of the San Marcos waste water treatment plant, and ensure eradication as we move downstream- creating a buffer between existing stands of *Z. texana* and the invasive species.

**3. Monitor periodically to evaluate the efficacy of *C. beckettii* removal.**

- a. In June and September 2004 areas that had been dredged were inspected for re-growth. In June 2004, 18 colonies were found in two days of searching and in September 2004, 23 colonies were found in three days of searching. All colonies were removed with the dredge. A final survey in December 2004 found no regrowth of plants in the cleared zone.
- b. The removal efforts have created approximately 500+ m buffer between existing stands of *Z. texana* and the invasive species.

**4. Reports.** An interim report was submitted in October 2004. This document constitutes the final report and completes the requirements for this task.

Associated with this project (but not paid for with Section 6 funds) were the initial dredging efforts just below the powerline (132 m<sup>2</sup> of *C. beckettii* removed) and efforts to re-establish desirable native aquatic species in this portion of the river. This associated work was conducted by Ms. Paula Power (USFWS National Fish Hatchery). Three “run mesohabitats” were selected for native species restoration. Ten native species, including *Z. texana*, were planted into these restoration areas. The total number of plants placed in study sites was 2,371 covering 297 m<sup>2</sup>. This includes planting of 650 transplants of *Z. texana* into approximately 127 m<sup>2</sup> of the river.

**VII. ACKNOWLEDGEMENTS.**

- Funding for this project was provided by TPWD Section 6.
- The capable administration of Craig Farquhar, Ph. D., Section 6 Coordinator, Wildlife Diversity Program is gratefully acknowledged.
- Field assistants were Valentin Cantu, Andrew Winn, Eileen Murphy, and Trey Kunz.
- The on-site supervision and coordination of Ms. Paula Power made this effort possible.
- The support and generous technical and practical input from Dr. Tom Brandt made these efforts much more effective.

**VIII. LITERATURE CITED**

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## **IX. APPENDIX**

### **U.S. FISH AND WILDLIFE SERVICE, SAN MARCOS NATIONAL FISH HATCHERY AND TECHNOLOGY CENTER**

Paula Power, botanist with the U.S. Fish and Wildlife Service has worked extensively in the San Marcos River on restoration projects, surveys, and studies on the endangered Texas wildrice. She will contribute her expertise on Texas wildrice, native plant propagation, and river restoration to this project.

### **U.S. FISH AND WILDLIFE SERVICE, ECOLOGICAL SERVICES**

Staff in the Austin ES Field Office will collaborate closely with all partners in this project on planning, permit, and Section 7 issues.

### **BAYLOR UNIVERSITY**

Dr. Robert Doyle, an Associate Professor from Baylor University, has mapped the vegetation of the San Marcos River and identified, mapped, and quantified important growth trends in *Cryptocoryne beckettii*, the species central to this project, and published numerous papers on restoration and plant distribution. He has collaborated with Paula Power from U.S. Fish and Wildlife Service on a number of projects including work which identified Texas wildrice as an obligate CO<sub>2</sub> user, a critical aspect of the physiology of the species. Dr. Doyle will provide expertise in mapping, experimental design and data analysis for documentation of the project, and technical advise in the field.

### **LADY BIRD JOHNSON WILDFLOWER CENTER**

Ms Flo Oxley, Director of Conservation at the Lady Bird Johnson Wildflower Center, and currently conducting research on the pollination biology of Texas wildrice, brings over 10 years experience at the Wildflower Center working with native plants to this project. She will provide assistance in native plant selection for the project.

### **GUADALUPE BLANCO RIVER AUTHORITY**

The GBRA is responsible for managing the water resources of the San Marcos, Blanco, and Guadalupe rivers from their headwaters to the Gulf of Mexico. The Authority will contribute experienced field assistance to the project.

**THE SAN MARCOS RIVER FOUNDATION**

SMRF is a local grassroots organization committed to preserving the natural beauty and resources of the San Marcos River for nearly 20 years. Volunteers from the San Marcos River Foundation will contribute volunteer labor to the project.

**THE CITY OF SAN MARCOS**

The San Marcos River originates within the City of San Marcos and provides an economic base for the city through recreation and tourism. The City will provide experienced field personnel for this project.