

San Marcos/Texas State University 2014 Work Plan

5.3.1/5.4.1 Texas Wild-Rice Enhancement and Restoration

Texas State University and the City of San Marcos are partnering to undertake a program of Texas wild-rice (TWR) enhancement and restoration in Spring Lake and the San Marcos River. No changes will be made to this measure because 2013 work has just begun due to delays in contracting.

Long-term Objective (Phase D): To restore 8000 m² of TWR (in addition to the existing 4000 m²) and successfully implement the State Scientific Area (SSA) protection program for existing and restored areas of TWR during flows of 120 cfs and below (see HCP Section 5.6).

Assumptions: Existing areal coverage of TWR is approximately 4000 m². The average long term biological goal for TWR is 12,000 m² (see Table 4-10; pg 4-16 EAHCP). To achieve this goal, an 8000 m² increase over the first phase of the HCP period would be required with an annual goal of approximately 1100 m² of TWR restoration each year. It is also assumed that production of Texas wild-rice will occur at the Freeman Aquatic Building at Texas State University and the U.S. Fish and Wildlife Service San Marcos Aquatic Research Center. Production of plants at the FAB is incorporated into this work plan budget.

Enhancement and restoration of TWR focuses on the removal of non-native vegetation within mixed stands of TWR and removal of non-native vegetation in areas adjacent to existing TWR stands. The work plan also includes selective TWR planting in up to 20% of the areas where non-native vegetation and sediment is removed as discussed in HCP measures 5.3.6/5.4.4 (Sediment removal) and 5.3.8/5.4.3/5.4.12 (Control of non-native plant species).

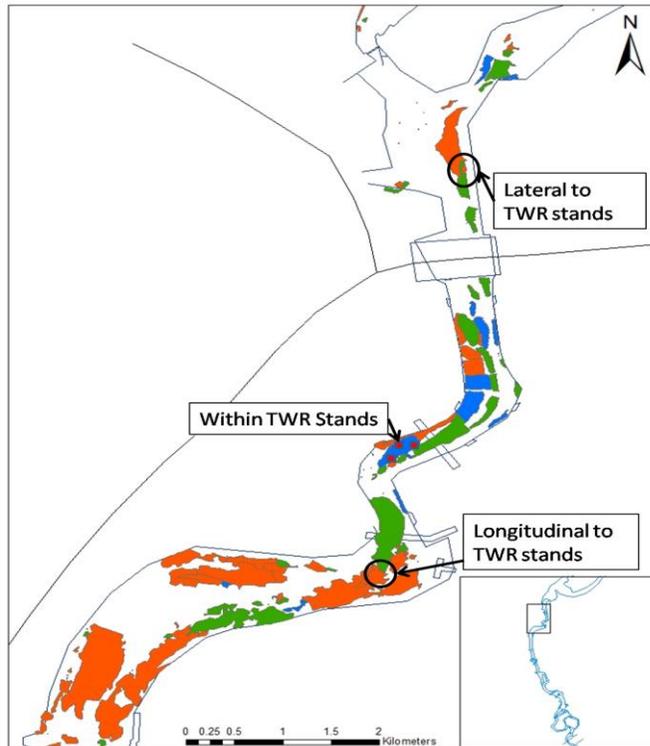
Hardy et al. (2011a) estimated that the removal of non-native plants within TWR stands and in a 2-meter buffer around those stands could potentially provide over 1,000 m² of additional TWR stands within the San Marcos River downstream of Spring Lake. In addition, TWR areal coverage within Spring Lake is targeted for 1500 m².

Target 2014/Performance Measure: Successful expansion of TWR stands through selective gardening within and around existing stands and plantings where non-native vegetation and silt is removed. These strategies will target a goal of 1100 m². This 1100 m² will optimally be in addition to an 1100 m² completed in 2013. The 2014 target goal may be adjusted depending on “lessons learned” from 2013 work. Due to contractual delays and testing of various methods, 2013 work did not begin until April. Given the four-month delay, it may (or may not) be necessary to carry 2013 funds over to 2014 to achieve the 2013 target before starting on the 2014 work.

Methods: Model results from Hardy et al. (2011a) were used to identify restoration/enhancement areas for TWR that would have sustainable depth and velocity during low flows below 90 cfs (optimal habitat). *Hydrilla* and *Hygrophila* were selected as target species for removal due to their high relative abundance in the San Marcos River. In mixed stand areas, the non-natives will be removed and the original TWR stand monitored for expansion. Similarly, for TWR

stands occupying optimal areas with adjacent non-native vegetation, the non-native plants will be removed and the TWR monitored for expansion. Finally, in optimal areas for TWR that are unoccupied by TWR, any non-native vegetation that is present will be removed and TWR planted and monitored to assess the success of transplants.

The specific areas chosen for field trials will first consider only optimal habitat areas that remain suitable over the full range of discharges between the long-term average and lower flows as show in model results from Hardy et al (2011a). In 2013, TWR stands will be selected upstream of IH-35. TWR stands will be selected based on predicted TWR optimal conditions and a practical working environment (i.e. manageable current velocity).



When removing non-native vegetation, the non-native vegetation will be fanned to displace fountain darters prior to uprooting the vegetation. The non-native aquatic plants will be shaken, fountain darters (or other native species) salvaged and returned to the river, and the non-native vegetation bagged for disposal at the city's or university's composting facility.

Monitoring: Replanted areas will be monitored weekly for the first three months, then monthly to evaluate success. Plants will be tagged and gps'd; each plant will be re-measured on monitoring visits. The treatment areas will be weeded as needed. Turbidity will be monitored during and after all removal efforts. Success will be determined by the amount of areal coverage as well as the success rate for newly planted TWR. Success will be based on the rate of success achieved by Dr. Robert Doyle and his student Rachel Bormann in 2012. They achieved a 78% (tillers) to 92% (whole plant) success rate with TWR.

Allocated funds for 2014 from Table 7.1: \$ 175,000

Signage & Marketing: \$1000 (For all projects, wherever it said "not included in the budget", I deleted that and adjusted the
Estimated Budget)

Estimated Budget: \$176,000

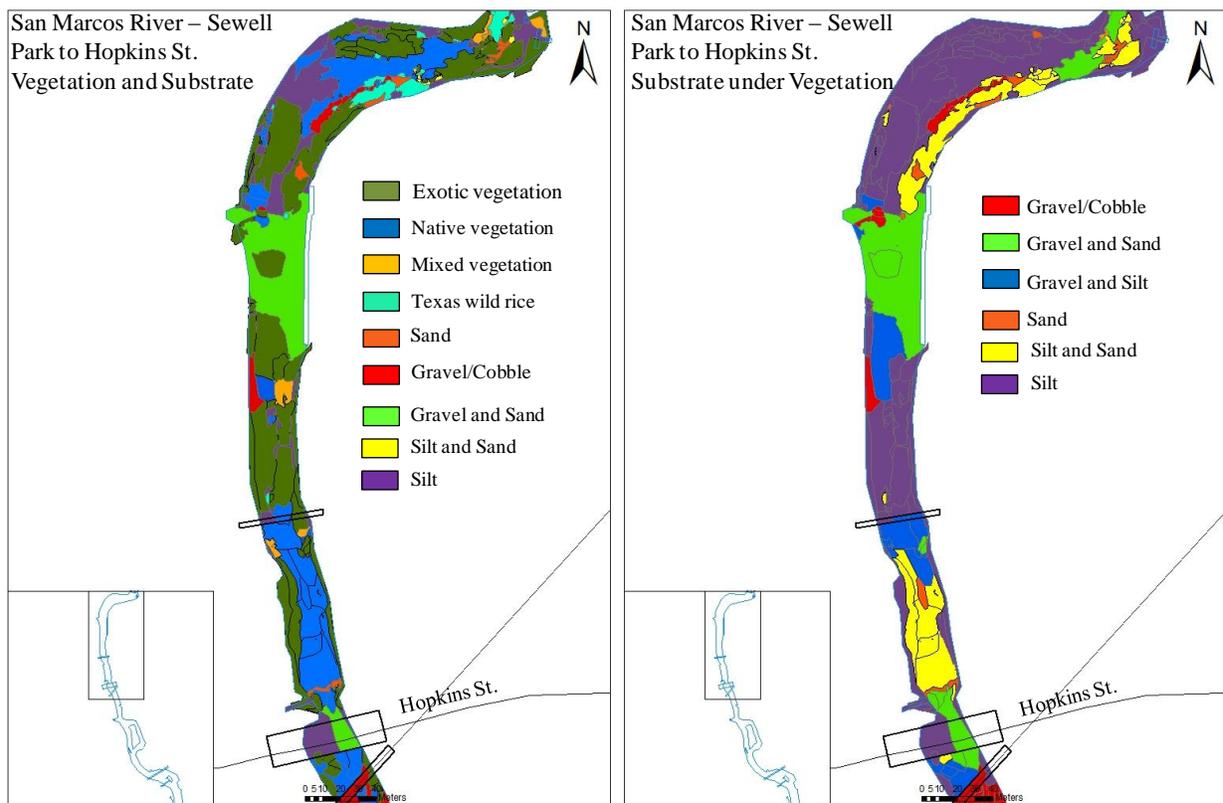
5.3.6/5.4.4 Sediment Removal

The City of San Marcos and Texas State University to implement an ongoing program of sediment removal from the river bottom at various locations from Spring Lake to IH-35. No changes will be made to the 2014 measure because 2013 work has not yet begun due to delays.

Long-term Objective: Initial removal of targeted fine sediments and then maintenance removal of accumulations of sediment for the purpose of optimizing quality of riverine habitat.

Assumptions: FY 2014 sediment removal efforts and budget target a practical restoration effort that is integrated with other Work Plan efforts and minimizes potential negative impacts on the aquatic ecosystem and Covered Species habitats.

Hardy et al. (2011b) estimated 21,645 m² (12,749 m³) of fine sediment in the San Marcos River between City Park and Rio Vista Falls. As illustrated in figure below, a high correlation can be observed between the distribution of silt and non-native vegetation. The reasons for this correlation are unknown. This correlation will be used to target areas with fine sediment accumulation and associated non-native vegetation for simultaneous removal. Native replanting is addressed in Measure 5.7.1. In addition, approximately 150 m² of fine sediment is targeted for removal in Spring Lake based on a site reconnaissance by TPWD and Meadows Center. Estimates for upper and lower Sewell Park still need to be accomplished.



Target 2014/Performance Measure: Successful removal of 3000 m² (and associate volumes) of fine silt and associated non-native vegetation. The 2014 target goal may be adjusted depending

on “lessons learned” from 2013 work. Due to contractual delays and testing of various methods, 2013 in-river work began in April. Given the four-month delay, it may (or may not) be necessary to carry 2013 funds over to 2014 to achieve the 2013 target before starting on the 2014 work.

Methods: Removal of non-native vegetation prior to sediment removal is covered under Work Plan elements 5.3.8, 5.4.3, and 5.4.12. As specified in the HCP, hydrosuction will be used to remove accumulations of sediment. Divers will be trained on equipment operations, diving safety protocols, and recognition of all stages of listed species from larval to adult. Sediment will be vacuumed using a hose and a 1” strainer will be used on the front of the dredge pump.

Divers will fin the area proposed for sediment removal, remove all vegetation and then scan the area for the presence of listed species and other biota. In addition, placement of stakes around the area prior to vegetation removal will keep divers within designated area. One diver floats on surface to relay information to the dredge operator, one worker will be stationed by the geotube to monitor operations and answer public questions. Based on discussions with the Meadows Center Diving Control Officer, it is assumed that sediment removal will be accomplished through a maximum of three 2-hour dive cycles each day with a one hour surface interval between dives. During the recreation season, this may be reduced to one 2-hour cycle prior to 1100 and a possible evening suctioning after 1900. Disposal of removed sediment will be at the Texas State University Composting Center or Animal Shelter compost site.

Permits: Prior to work beginning in 2014, the COSM and TxState will have to complete a turbidity study for TPWD. This is an important component of the TPWD sand & gravel permit that must be in place prior to any sediment can be removed in 2014 and the remainder of Phase I.

Monitoring: Turbidity will be monitored during and after all removal efforts. In addition, colonization of vegetation, macroinvertebrates, and fish will be monitored in all treatment areas and compared to the reference site for each reach. After targeted depth of fine sediment removal has been achieved, the bed elevation will be measured from existing benchmarks and the sediment composition delineated (i.e., sand, gravel, etc). Bed elevation and substrate composition will then be monitored at each location before and after the recreation season. Measure success will be determined by the volume of sediment removed.

Allocated funds for 2014 from Table 7.1: \$ 25,000

Turbidity Study: \$5000

Estimated Budget: **\$180,000**

This project was awarded \$500,000 in 2013. Due to permit restrictions, (TPWD only allowed the removal of 1750 CY in 2013) and the physical and temporal limitations of this project - it was not possible to expend the entire \$500,000 in 2013. Therefore, only \$151,800 from \$500,000 budget was requested for 2013, with the intent to spread the remainder over the next three years (2014-2016). **For 2014, \$150,000 plus \$25,000 as noted above is being requested for an estimated budget of \$180,000.**

5.3.8/5.4.3/5.4.12 Control of Non-Native Plant Species

The City of San Marcos and Texas State University are partnering to implement an on-going non-native plant replacement program for the San Marcos River from Spring Lake to city limits. Non-native species of aquatic, littoral, and riparian plants will be replaced with native species to enhance Covered Species habitat.

Long-term Objective: To keep the density of invasive aquatic and littoral plants as low as possible through monitored removal along the San Marcos River.

Assumptions: Non-native aquatic plants will be removed in association with fine sediment removal and TWR enhancement as described in conservation measures 5.3.6/5.4.4 and 5.3.1/5.4.1. It is also assumed that production of native aquatic plants will continue at the Freeman Aquatic Building at Texas State University and the U.S. Fish and Wildlife Service San Marcos Aquatic Research Center. Funding for the production of plants at the FAB and SMARC is incorporated into this work plan budget.

Target 2014/Performance Measure: *Non-native Aquatic* - Non-native aquatic plant removal will occur in conjunction with sediment removal. Therefore the optimal 2014 goal is 3000 m² of plant removal, but this amount may be adjusted depending on what work is accomplished in 2013. Due to contractual delays and testing of various methods, 2013 in-river work began in April. Given the four-month delay, it may (or may not) be necessary to carry 2013 funds over to 2014 to achieve the 2013 target before starting on the 2014 work.

Littoral – areas cleared of elephant ears in 2013 will be re-visited for the next phase of elephant ears and planted with native littorals. Work will be continued downstream of San Marcos Plaza (Veramendi to Rio Vista)

Methods

Non-native Aquatic Plants - Divers that will be conducting sediment control will first remove non-native aquatic plant species from the area to be worked that day. Prior to plant removal, the area will be fanned to help remove fountain darters and other native species. The non-native aquatic plants will be removed, shaken and bagged for disposal at the composting facility. Denuded areas will either be targeted for TWR and/or selected native species planting. TWR and native species will be obtained from the SMARC, Tx State FAB, the San Marcos River, or approved vendors. Initial efforts for restoration of TWR or native vegetation will target planting of approximately 20 percent of the surface area restored.

Littoral - On the banks, elephant ear (*Colocasia esculentes*) is the focus of removal efforts. *C. esculenta* primarily reproduces by producing additional tubers beneath the soil or by sending off long runners called stolens which attempt to root in the soil or in any nearby body of water. The species also produces an inflorescence with a spathe tube that is green but the blade is orange on both sides. The spathe will reflex to expose spadix. When pollinated the fruit (berries) will be orange. (<http://www.exoticrainforest.com/Colocasia%20esculenta%20large%20pc.html>)

Mechanical removal will be used wherever possible. Chemical removal consists of the use of glyphosate dripped onto the surface of the leaves to remove more “entrenched” elephant ear plants.

Monitoring: *Aquatic vegetation* – Newly planted areas will be monitored monthly to evaluate success rate. The planted areas will be weeded (non-native species removed) and replanted as needed to meet target areal coverage. An annual river inventory will be conducted to identify the presence and location of new non-native vegetation establishment. Turbidity will be monitored during and after all removal efforts. Success will be measured by the surface area cleared of non-native plants and the success rate of replanted TWR or native plants (based on Dr. Doyle’s field work –input success rates).

Allocated funds for 2014 from Table 7.1: \$ 175,000

Signage & Marketing: \$1000

Estimated Budget: \$176,000

5.3.3/5.4.3 Management of Floating Vegetation Mats and Litter

The City of San Marcos and Texas State University are partnering to implement an ongoing program to manage floating vegetation and litter removal for the enhancement of listed species habitat. Management activities will include removal of vegetation mats that form on top of the water surface as well as on top of Texas wild-rice plants, particularly during low flows, and removal of litter for the littoral zone, stream bottom and tributaries. Texas State University will manage aquatic vegetation in Spring Lake through use of its harvester boat and through hand cutting of vegetation by divers authorized to dive in Spring Lake.

Long-term Objective: Minimize impacts of floating vegetation and litter on TWR stands and overall aquatic community within the San Marcos River.

Assumptions: Existing vegetation management activities in Spring Lake will continue to follow the Spring Lake Management Plan (approved by the President's Cabinet) and the EAHCP, as described under Methods. Litter and floating vegetation mat removal will follow the existing protocol and schedules currently employed by the City of San Marcos and the EAHCP, as described below under Methods.

Target 2014/Performance Measure: Continued implementation of the established protocols.

Methods: *Spring Lake* - Each week about five springs are cut, with divers returning to cut the same springs every two to three weeks. During summer algal blooms, the springs will be managed more frequently (up to four springs per day), but mostly to remove algae. Texas State employees and supervised volunteers will fin the area around the springs to remove accumulated sediment, and then clear a 1.5 meter radius around each spring opening in Spring Lake with a scythe. Over the next 1.5 meter radius around the spring opening, they will shear vegetation to a height of 30 cm, and then to one meter over the following three meter radius. Plant material will not be collected, but carried away by the current. Cumulatively, about six meters of vegetation around each spring opening will be modified. Mosses will not be cut. The volume of plant material to be removed will vary by the amount of time between cuttings, and season. The harvester boat will remove a range of 15 to 20 boatloads of plant material a month from Spring Lake. The harvester will clear the top meter of the water column, cutting vegetation from sections one, two, and three once a week (See HCP Figure 5.2). The harvested vegetation will be visually checked by driver for fauna caught in the vegetation. If the driver observes fauna, he/she will stop work and put the animal(s) back into Spring Lake if appropriate. Texas State employees and supervised volunteers are trained to recognize the Covered Species through the Diving for Science program (Section 5.4.7.1), and avoid contact with them. Vegetation mats will be removed from zones four and five on an as-needed basis (See HCP Figure 5-2). The total area cut will equal about nine surface acres. The Spring Lake Area Supervisor also schedules cleanup of nuisance floating species such as water hyacinth and water lettuce from Spring Lake. The floating plants will be collected by hand and shaken prior to removal from the river to dislodge any aquatic species caught in the plant. The plants will be deposited into dump trucks and taken to the Meadows Center compost area. **The activities described in this section are not funded by the EAHCP. They are fully supported by Texas State University.**

San Marcos River – Floating vegetation will be pushed downstream and inorganic litter will be picked up weekly from the substrate, surface and littoral zones of the San Marcos River from upper Sewell Park to IH-35 during the recreational season (May 1st to September 30th) and monthly during offseason. Litter will also be picked up from public lands within the four tributaries. Monitoring of downstream Texas wild-rice stands to keep the stands clear of drifting vegetation will also be undertaken. Divers will not pick up litter within Texas wild-rice stands. The contractor will tour the river with HCP manager for the purpose of recognizing Texas wild-rice. On Texas wild-rice stands, contractor will lift (not push) the floating material from the top of the Texas wild-rice stands and allow it to float downstream.

Monitoring: Floating vegetation and litter are targeted for weekly removal during the recreation season and then monthly during the remainder of the year. In the event of low flows, this activity will be monitored for potential impacts on listed species and will be suspended if impacts are observed. Volume of litter will be tracked.

Allocated funds for 2014 from Table 7.1: \$ 80,000

Estimated Budget: \$80,000

5.3.5/5.3.9/5.4.11/5.4.13 Non-Native Species Control

The City of San Marcos, in partnership with Texas State University, will implement a program of invasive faunal control in the San Marcos River on a periodic basis with expanded efforts of control, if needed, at low flows. The species include suckermouth catfish, tilapia, and *Melanoides* and *Marisa cornuarietis*. Educational materials will be provided to local pet shops and commercial outlets who sell aquarium species. Alternatives, such as a university release pond, will be offered to fish and snail owners.

Long-term Objective: Reduction of non-native, invasive species in the San Marcos River to levels that minimize their direct and indirect impacts on Covered Species and the aquatic ecosystem.

Assumptions: The primary effort in 2014 will continue to use the methods that have proven to be effective in 2013 and to test other control measures for the more elusive target species within Spring Lake and the San Marcos River.

Target 2014/Performance Measure: Refine population numbers for each species and begin measuring reduction percentages for species (suckermouth catfish) with an established removal method. For the species that are more difficult to capture (tilapia), contractor will test and refine control measures. Produce monthly maps of the populations showing population changes (# and location).

Methods: In Spring Lake, tilapia removal will be targeted during the winter to early spring period. Methods will be undertaken in a manner that avoids impacts to resident turtles and other native species. Block seining could be employed in shallow areas. Catfish control will be approached using divers and gigs within Spring Lake and the San Marcos River. The level of effort for all testing of control measures will be confined to the existing budget allocation for FY2014.

Although not targeted for systematic removal during 2014, effective removal of *Melanoides* and *Marisa cornuarietis* will continue to be accomplished by determining the locations of highest snail density and using dip nets to remove the snails weekly. The species will be controlled by diving several hours after sunset to hand-pick the snails from the submergent vegetation as well as setting baited traps.

Monitoring: It is assumed that the integrated biological monitoring program will assess the status of non-native animal species. Established population counts will be used as baseline to track success of efforts along with the biomonitoring program.

Allocated funds for 2014 from Table 7.1: \$ 35,000

Estimated Budget: \$35,000

5.4.6 Sessom Creek Sand Bar Removal

Based on the 2013 study results, it is assumed for the purpose of budgeting that Texas State University and the City of San Marcos will completely remove the sediment island at Sessom Creek and the 'cut-grass' island below University Bridge.

Long-term Objective: Remove the necessary amount of sediment in the channel at Sessom Creek confluence and in Sewell Park necessary to maintain optimal conditions for listed species in the San Marcos River.

Assumptions: To meet the 2014 work plan deadlines, it is assumed that the entire islands at confluence and Sewell Park will be removed.

Target 2014/Performance Measure: Removal of the islands at confluence and in Sewell Park in accordance to the recommendations from the 2013 study results.

The analysis and sand bar removal recommendations produced by the Meadows Center should be presented to the Science Committee. The turbidity report required by TPWD for this action and the general sediment removal program should be presented to the Science Committee when complete.

Methods: The specific methodology will follow the recommendations contained in the 2013 work plan study results but will possibly be the use of backhoes and hydro-suction for the island at Sessom Creek.

Monitoring: Not Applicable. Measures of success include increased coverage of TWR as well as no uprooting of Sewell Park stands due to flow regime changes upon completion of island removal/modification.

Allocated funds for 2014 from Table 7.1: \$ 75,000

Estimated Budget: \$ 75,000

5.3.7 Designation of Permanent Access Points/Bank Stabilization

The City of San Marcos and Texas State University will stabilize banks and establish permanent river access points in eroded areas, to include locations such as Clear Springs Apartments, City Park (targeted for completion in 2013), Hopkins Street Underpass, Bicentennial Park, Rio Vista Park, Cheatham Street underpass, and Ramon Lucio Park and potentially other areas (as determined during the Adaptive Management Process). Areas around and between access points will be planted with vegetation that discourages streamside access (e.g., agarita, lote bush and acacia). River trail location will be revised to maximize width of riparian vegetation and ease of use for the public. Public access is causing increasingly eroded bank areas that contribute to river turbidity. Turbidity has been shown to have a direct impact on fountain darter feeding ability (Dr. Caitlin Gabor presentation, April 2013). Creating public access areas is critical to the total effort of reducing sediment input and resulting turbidity.

Long-term Objective: To reduce bank loss and sediment input through the stabilization of banks and minimization of access at non-designated sites through provision of safe access for the public.

Assumptions: Design, dimensions and materials will differ between access points.

Target 2014/Performance Measure: Implement one or more site construction projects based on the designs completed in 2013 as funding allows.

Methods: *Bank Stabilization/permanent access points* – Design specifications and construction plans will be followed. Prior to each construction period, the area will be swept clean of darters and exclosures (silt fence) will be put into place to keep darters out of the construction area. No work outside this area will occur.

Monitoring: Surveys will be performed by the contracted conservation resource to determine use of access points (once construction is complete) versus use of unauthorized access. The surveys will be accomplished throughout the recreation season (Memorial Day to Labor Day). Turbidity measurements prior to construction and post-construction will be taken.

Allocated funds for 2014 from Table 7.1: \$20,000

Signage, Identification & Marketing: \$2000 on-site signage & public meetings

Estimated Budget: \$667,450

In 2013, \$469,200 of the allocated \$500,000 was spent on design, plans and specifications (\$172,000) with the remaining \$297,200 to be spent on one of the six bank stabilization sites (completed by December 31, 2013). The remaining five bank stabilization sites total \$665,850. The original cost estimate, and basis for the \$500,000 allocation, was obtained in 2011 from a local engineer. In this paragraph, I removed the range of costs of the projects and focused on the total cost of all five sites.

5.7.1 Native Riparian Habitat Restoration

The City of San Marcos and Texas State University will undertake a program to increase the area and density of the riparian zone on public and private lands from the Spring Lake Dam to IH-35 using native vegetation. As plans take shape for the enhancement of the riparian zone, private landowners will be asked to participate in the plan.

Long-term Objective: Establish a robust native riparian community that benefits Covered Species and the habitat quality adjacent to and within the San Marcos River as well as prevents public access in undesirable locations to decrease bank erosion. A zone of prohibitive vegetation along the uppermost edge of the riparian community will be established to encourage river users to access the river via hardened access points.

Assumptions: Removal of non-native riparian vegetation (Measure 5.3.8) will occur prior to or simultaneous with Measure 5.7.1 and is funded from the Measure 5.7.1.

Target 2014/Performance Measure: Seven segments (upper Sewell Park to Ramon Lucio Park) along the San Marcos River were bid in 2013, so the cost of implementing this measure is now firm. Out of the seven segments, one and one-half segments (Bicentennial Park & half of Veramendi Park) were completed with 2013 funding. In 2014, the rest of Veramendi and the remaining upstream segments (3.5 segments) are proposed for invasive removal and native plantings. These segments have had elephants ears removed which exposed the bank to compaction and erosion, so replanting and fencing (city-funded) is critical.

Methods: Identify and remove invasive trees, shrubs and vines (Ligustrum sp., Chinaberry, Chinese Tallow, Paper Mulberry and Japanese Honeysuckle). Remove woody species to be spot treated with approved herbicide to prevent regrowth. All removed material must be recycled on site. A dense barrier (5 – 10 ft deep) of prohibitive native species will be planted behind and along fence line. Open areas behind barrier will be filled in with native trees and shrubs as funding allows and hands-on public workshops will be used to educate and stretch funding. Vegetation such as big bluestem, switchgrass, Indian grass, black willow, Texas red oak, bur oak, pecan, bald cypress, American beautyberry, and buttonbush will be used. Prefer use of plants achieving a USDA bank stabilization rating of 6 or greater. Adequate erosion control on slope and drainage areas will be provided by contractor. Bare slopes will be planted or stabilized to avoid bank erosion after removal of existing trees and shrubs. Fencing, provided by the City, will stay in place for at least two years to prevent foot traffic and allow the establishment of the newly-planted species. Plants will be irrigated by contractor for the first year to optimize their survival rate. Weeding and pruning will be done by contractor for length of project.

Monitoring: Monitoring will occur weekly in newly planted areas to ensure success and revise methods as needed. Success will be measured in two ways: first, (once the fence has been removed) undesirable public access will be surveyed throughout the recreation season; second, riparian coverage will be measured prior to enhancement efforts and post-completion to determine amount of increased coverage and continued annually to track changes.

Allocated funds for 2014 from Table 7.1: \$ 20,000

Signage: \$3000 – on-site signage & public meetings

Estimated Budget: \$203,000 (Moving \$180,000 from HCP Measure 5.7.6 - Impervious Cover/WQ Protection)

The cost of riparian restoration was originally based on vegetative transects performed in 2011. Surveys by the contractor have shown a higher percentage of invasive trees, shrubs and vines than was estimated by the vegetative transects. Increased tree removal and required plantings have increased the overall cost of this critical effort. This is a critical measure in that riparian restoration not only increases riverine integrity, but it provides the barrier to prevent undesired access and subsequent bank erosion and river sedimentation. The total cost for restoration from upper Sewell Park to Ramon Lucio was bid at \$537,404. After the completion of the 2013 riparian restoration, the remaining cost is approximately \$437,500. The City has provided and will continue to provide all fences to protect the sites as well as game cameras and other security measures as needed to prevent theft, vandalism and unauthorized access. Theft, vandalism and unauthorized access occurred within the two days of the first plantings. The fence was cut and both planted trees and potted plants were stolen. A portion of the fence was bent to achieve access to the river and minor cases of graffiti have occurred.

5.3.2/5.4.2 Management of Recreation in Key Areas

Public recreational use of the San Marcos Spring and River ecosystems include, but are not limited to swimming, wading, tubing, boating, canoeing, kayaking, golfing, scuba diving, snorkeling and fishing. To minimize the impacts of incidental take resulting from recreation, the City of San Marcos will implement the Recreation Mitigation Measures adopted by the San Marcos City Council on February 1, 2011 (Resolution 2011-21). The City of San Marcos and Texas State University will enforce these measures (as covered in HCP Section 5.3.2.1) to ensure their success. Section 5.3.2.1 includes multiple educational and public outreach suggestions for implementation:

Education of the river user and the community. Suggestions include:

- a. Signage. Post signage at the City Park tube rental facility, Rio Vista Falls and at proposed hard access points along the river. Signage will be simple, natural, and when possible the existing sign locations will be used (trying to avoid too many signs). Signs will have the same template and coloration so they are recognized up and down the river. Signs will cover the rules of the river and educate the public on the importance of the resource. All signs will be bilingual.
- b. Video Loop at City Park offering information about the river and safety rules while people are waiting for shuttle or tubes. Possibly also at Rio Vista Falls.
- c. Posted maps showing trail, access points, fishing access and other amenities. Include a map at Stokes Park to help inform about the San Marcos River/Blanco confluence.
- d. Recreation information at hotels/restaurants, bed and breakfast facilities, Chamber of Commerce, Visitor's Center, City of San Marcos internet site, etc. could include information on restrictions so river users are prepared prior to entering the river.
- e. Park Rangers. Include a section on river biology in the training of the park rangers so they can help disseminate the information.
- f. School Outreach. Implement an outreach program for San Marcos Consolidated Independent School District (SMCISD) so this information can be relayed to youth in San Marcos and indirectly to the parents.
- g. Overall Interpretation Plan. This would pull all the informational ideas together for conformity, continuity, and implementation.

Long-term Objective: To establish a trained seasonal conservation resource that will monitor recreational activities and ongoing HCP measures in and along the San Marcos River while educating the public about the Covered Species and importance of their protection as part of our enforcement obligations under the SSA and HCP measures

Target 2014/Performance Measure: Educate the public engaged in water-based recreation on sustainable river use that protects listed species and their habitats. Collect data on recreational activities to determine impacts on listed species and success of HCP measures. The seasonal workers will also conduct miscellaneous cleanup while walking/kayaking.

Methods: The contracted conservation resource will monitor river user activities from May to September from Wednesday/Thursday through Sunday and holidays to actively engage in public education and outreach about target species and their habitats. In addition, they will collect data on specific recreational activities to provide insights for the HCP programs.

Monitoring: The public will be surveyed annually during the recreation season to assess the level of understanding of Covered Species, ongoing HCP Measures, effectiveness of the public outreach and education program, and the impacts of recreational activities on species and habitat.

Allocated funds for 2014 from Table 7.1: \$ 56,000

Estimated Budget: \$56,000

5.7.6 Impervious Cover/Water Quality Protection

The City of San Marcos and Texas State University will implement the program to protect water quality and reduce the impacts incentives for the program based upon the LID/BMP practices. Urban land development tends to increase the intensity of storm water flows and the amount of nonpoint source (NPS) pollution reaching local water resources. Buildings, roads, and other impervious surfaces shed rain more rapidly than areas covered by vegetation, and most typical urban land uses require rapid drainage of storm water. The very rapid, direct connection of developed land across paved surfaces and through drainage conveyances to waterways tends to carry more pollutants more quickly from the land surface to water resources. A number of water quality problems and impairments in Texas are attributed in full or in part to such urban storm water runoff carried through storm sewers and channelized streams. The science committee stated this measure was one of great importance to the success of the EAHCP for listed species protection (May 9, 2013).

Long-term Objective: Implement a program that minimizes the impacts associated with urbanization and changes in land use/cover in the Upper San Marcos watershed; manages stormwater as close to its source as possible, treats stormwater as a resource rather than a waste product; emphasizes conservation and the use of on-site features to protect water quality; and increases infiltration to groundwater and aquifer recharge for the protection of riverine integrity.

Assumptions: Construction of the proposed sediment retention ponds under Measure 5.7.4 will be funded under this Measure.

Target 2014/Performance Measure: Begin the implementation of the Water Quality Protection Plan by Texas State University and City of San Marcos that incorporates all jurisdictional watershed areas that directly or indirectly impact Covered Species' critical habitat for the purpose of meeting the goals stated in the long-term objective. Include public education, staff integration, five conceptual designs for retrofit water quality projects, grant proposals, and coordination with ongoing stormwater management plans for city and university. Upon completion, the WQPP should be provided to the Science Committee. The Science Committee has also requested an opportunity to review the Watershed Protection Plan (WPP) under development by the Meadows Center with funding from the Texas Commission on Environmental Quality.

Methods: City of San Marcos and Texas State University have a contract for the implementation of the developed plan.

Monitoring: N/A

Allocated funds for 2014 from Table 7.1: \$ 500,000

Estimated Budget: \$320,000 (Moved \$180,000 to HCP Measure 5.7.1 – Riparian Restoration)

5.7.5 Management of Household Hazardous Waste

The City of San Marcos will maintain a HHW program that involves the periodic collection of Household Hazardous Waste Collection (HHWC) and its disposal.

Long-term Objective: Provide a place for citizens of San Marcos and Hays County to safely dispose of HHW.

Assumptions: City of San Marcos will continue its existing program.

Target 2014/Performance Measure: Continue outreach to 1400 participants; contract with two additional part-time personnel to conduct public outreach events and then collect or dispose of the HHW between events. Fund outreach to surrounding communities within the San Marcos River watershed that cannot afford to partner in a HHWC program.

Methods: Open drop-off opportunities two days a week (Tuesday and Friday) from 12:00 noon to 3:30 p.m. to the public. Conduct HHWC events to correspond with the National Pharmaceutical Take Back Day Events as announced by the EPA. Cover disposal costs for the four to six calls annually.

Monitoring: Track the amount of HHW received and number of participants from San Marcos, Hays County, and surrounding communities. All necessary documentation will be turned in to TCEQ. Identify the HHW that comes from communities within the San Marcos River watershed and the cost of collecting, processing and disposing of HHW from these communities.

Allocated funds for 2014 from Table 7.1: \$30,000

Estimated Budget: \$30,000

5.3.4 Prohibition of Hazardous Materials Transport Across the San Marcos River and Its Tributaries

The City of San Marcos will coordinate with the Texas Department of Transportation to designate hazardous materials routes which minimize the potential for spills into the San Marcos River. This effort will include legislation, if necessary, and additional signage.

Long-term Objective: Reduce the potential of spill of hazardous materials in the San Marcos River and its tributaries.

Assumptions: The primary effort will involve stakeholder engagement, public meetings, and coordination with TXDOT.

Target 2014/Performance Measure: Coordination with TXDOT for the implementation of hazardous materials restrictions and establishment of signage.

Methods: Identify all transport routes that cross the San Marcos River and its primary tributaries. Identify any that have hazardous material traps. This information will be used to initiate public meetings, drafting of City ordinances, and coordination with TXDOT.

Monitoring: Bi-annual monitoring of hazmat traps on designated roadways to determine functionality and annual monitoring of all installed signage will be accomplished. Substandard conditions will be repaired or replaced as necessary.

Allocated funds for 2014: \$ 0

Estimated Budget: \$ 0

5.7.3 Septic System Registration and Permitting Program

The City of San Marcos will undertake an aerobic and anaerobic septic system registration, evaluation, and permitting program to prevent subsurface pollutant loadings from potentially being introduced to the San Marcos Springs ecosystem within city limits.

Long Term Objective: To continue the registration, permitting and inspection of all new or existing septic systems installed or modified in the City of San Marcos jurisdiction. This has and will continue to be done to ensure compliance of all Texas Commission on Environmental Quality (TCEQ) regulations governing septic systems.

Assumptions: The existing program is adequate to meet the intent of this Measure.

Target 2014/Performance Measure: To have an accurate record of new and existing septic systems installed and modified in city jurisdiction. Also, by ordinance, to have all owners of septic systems connect to municipal sewer lines as they become available.

Methods: It is required by law that all septic systems are permitted by the local Designated Representative (DR), which is the City of San Marcos Environmental Health Department. Plans are submitted with the application and reviewed by the DR for TCEQ compliance. Once these are met, the permit to construct is issued. The design, site evaluation, installation and inspections can only be performed by individual that are licensed by TCEQ. Before the installation or modification is approved, inspections are made by the DR to ensure that the system installed corresponds with the design. Once completed, a license to operate is issued to the property owner by the DR. All DRs are subject to TCEQ Compliance Reviews.

Monitoring: The City of San Marcos Environmental Health Department reviews all applications and inspects the installations of all new and modified septic systems within the City's jurisdiction. The Department also monitors maintenance and responds to all complaints reported or observed.

Allocated funds for 2014: None

Estimated Budget: N/A

5.7.4 Minimizing Impacts of Contaminated Runoff

The City of San Marcos will construct two sedimentation ponds along the river to help reduce the amount of contaminated material that enters the river as a result of rain events. The first pond will be located in Veramendi Park beside Hopkins Street Bridge. The second pond will be created by widening the drainage ditches that run alongside Hopkins Street and cut directly to the San Marcos River.

Long-term Objective: Reduce the input of sediment and roadway pollutants into the San Marcos River.

Assumptions: Construction of the proposed sediment retention ponds are funded under Measure 5.7.6.

Target 2014/Performance Measure: Design the Best Management Practices (BMPs) to be constructed at Veramendii Park and along Hopkins Street that will reduce total suspended solids (TSS) by 85%. The designs for these BMPs should be presented to the Science Committee. Baseline water quality measurements should be taken prior to BMP installation. Storm water discharge should be re-sampled after BMP installation to measure success.

Methods: A contractor will be retained to research applicable BMP designs and recommend the most economic and efficient methods to control contaminants.

Monitoring: N/A

Allocated funds for 2014: \$0

Estimated Budget: See Measure 5.7.6

5.4.5 Diversion of Surface Water

Texas State University will curtail its permitted surface water diversions as a function of total San Marcos spring flow to protect the aquatic resources as specified under the HCP flow management strategy. Under TCEQ Certificates 18-3865 and 18-3866, Texas State University's total diversion rate from the headwaters of the San Marcos River for consumptive use is limited to 8.1 cfs (See HCP Section 2.5.5). The total diversion rate from Spring Lake is limited to 4.88 cfs; the total diversion rate from the San Marcos River at Sewell Park is limited to 3.22 cfs (See HCP Section 2.5.5.1 and 2.5.5.2 respectively).

Long-term Objective: Meet diversion restrictions specified under the HCP.

Assumptions: None

Target 2014/Performance Measure: Restriction of surface pumping as specified under the HCP.

Methods: To minimize the impacts of these diversions, when flow at the USGS gauge at the University Bridge reaches 80 cfs, Texas State University will reduce the total rate of surface water diversion by 2 cfs, *i.e.*, to a total of approximately 6.1 cfs. This reduction in pumping will occur at the pump just below Spring Lake Dam in order to maximize the benefits to salamanders, Texas wild-rice, and other aquatic resources in the San Marcos River below Spring Lake Dam. The University will reduce the total rate of surface water diversion by an additional 2 cfs when the USGS gauge reaches 60 cfs. The additional 2 cfs reduction will be made from the pumps located in the slough arm of Spring Lake, and, therefore, maximize the benefits to the aquatic resources within the main stem San Marcos River below Spring Lake Dam. When the USGS gauge reaches 49 cfs, Texas State University will reduce the total diversion rate to 1 cfs. This further reduction will be made by restricting the pumps located in the Sewell Park reach. The diversion of water will be suspended when the springflow reaches 45 cfs.

Monitoring: Pumping rates will be reported on a daily basis when any of the pumping restrictions are in force.

Allocated funds for 2014: \$ 0

Estimated Budget: \$ 0

5.4.7 Diving Classes in Spring Lake

Access to Spring Lake is strictly controlled and regulated in accordance to federal, state and local laws. City ordinance and state law designate the public waters of Spring Lake as restricted to activities authorized by the University. All diving activities in Spring Lake are governed by the Spring Lake Management Plan.

Long-term Objective: Maintain the integrity of the ecology and cultural resources within Spring Lake.

Assumptions: All diving activities in Spring Lake are governed by the Spring Lake Management Plan.

Target 2014/Performance Measure: Implement the diving protocols as outlined in the Spring Lake Management Plan and the Edwards Aquifer HCP Incidental Take Plan.

Methods: The Diving Safety Officer will monitor all diving activities in Spring Lake, assuring all guidelines contained in the Diving Safety Manual for Spring Lake and the EAHCP ITP are observed.

Monitoring: The Lake Manager, with assistance from the Diving Safety Officer, will compile an annual summary of diving activities conducted in Spring Lake and provide to the Diving Control Board for its review.

Allocated funds for 2014: \$ 0

Estimated Budget: \$ 0

5.4.8 Research Programs in Spring Lake

Access to Spring Lake is strictly controlled and regulated in accordance to federal, state and local laws. City ordinance and state law designate the public waters of Spring Lake as restricted to activities authorized by the University. Proposals for research projects in Spring Lake must be submitted to the Environmental Review Committee, through the Lake Manager, for review and approval.

Long-term Objective: Maintain the integrity of the ecology and cultural resources within Spring Lake.

Assumptions: All research activities in Spring Lake are governed by the Spring Lake Management Plan.

Target 2014/Performance Measure: Implement the protocols for research as specified in the Spring Lake Management Plan and the EAHCP ITP.

Methods: 1. Proposals for research projects in Spring Lake must be submitted to the Environmental Review Committee, through the Lake Manager, for review and approval.

Proposals for research projects must be submitted in writing and include:

- Name and contact information of the responsible party conducting the research,
- Purpose and expected outcomes of the activities, including a description of how the project contributes to science,
- Description of activities, including, if appropriate, measures to be taken to minimize any impact on endangered species or their habitat, or any cultural resources found in the lake,
- Methodology, including literature review,
- Type of equipment used, how much; where it will be placed, and for how long it will remain in lake (see Equipment in Lake Section E of the Spring Lake Management Plan)
- Expected impact, and
- Timeline of Project

A copy of the final report and any publications on a research project will be provided to the Lake Manager.

Monitoring: The Lake Manager will compile an annual summary of the research conducted in the lake, including statements on the impact of these activities on the health of the lake.

Allocated funds for 2014: \$ 0

Estimated Budget: \$ 0

5.4.10 Boating in Spring Lake and Sewell Park

Access to Spring Lake is strictly controlled and regulated in accordance to federal, state and local laws. City ordinance and state law designate the public waters of Spring Lake as restricted to activities authorized by the University. All activities involving access to the lake, including glass bottom boat operations, will abide by the rules and intentions of the Edwards Aquifer Recovery Implementation Program Habitat Conservation Plan.

Long-term Objective: Maintain the integrity of the ecology and cultural resources within Spring Lake and San Marcos River.

Assumptions: All boating activities in Spring Lake are governed by the Spring Lake Management Plan and the EAHCP ITP.

Target 2014/Performance Measure: Implement the protocols for boating as specified in the Spring Lake Management Plan in support of the EAHCP ITP.

Methods: Boats (canoe, kayak) used for educational activities, excluding glass bottom boats:

- All boats must be properly washed/disinfected before being placed in lake and once they are removed (see Equipment in Lake in the Spring Lake Management Plan).
- Participants must receive an orientation prior to boating including: instruction on safety, basic boat handling, and on-site rules and regulations. The orientation will cover information specific to Spring Lake's sensitivity and endangered species.
- All boating events must be designed to keep participants away from glass bottom boat operations.

To minimize the impacts of boating on the Covered Species' habitat in Sewell Park, canoeing/kayaking classes in Sewell Park will be confined to the region between Sewell Park and Rio Vista dam. Students will enter/exit canoes/kayaks at specified access points to avoid impacting the flora and fauna along the bank. Classes will be no longer than two hours and up to three classes will be held per day. Classes will have a maximum of 20 students in 10 canoes. All classes will be supervised.

Monitoring: The Lake Manager will compile an annual summary of boating activities conducted on the lake, including statements on the impact of these activities on the health of the lake.

Allocated funds for 2014: \$ 0

Estimated Budget: \$ 0

5.4.9 Management of Golf Course and Grounds

Texas State University will develop a golf course management plan that will document current practices and include an Integrated Pest Management Plan (IPMP). The golf course management plan and IPMP will incorporate environmentally sensitive techniques to minimize chemical application, improve water quality, and reduce negative effects to the ecosystem. Expanded water quality sampling targeted at Golf Course operations will be conducted as described in Section of 5.7.2. of the HCP.

Long-term Objective: Management of the golf course and grounds to minimize and reduce negative effects to aquatic ecosystem in Spring Lake and the San Marcos River.

Assumptions: None

Target 2014/Performance Measure: Implementation of the Golf Course Management Plan and Integrated Pest Management Plan. Research the Audubon Certification for Golf Courses to determine if it further protects the San Marcos River against golf course impacts.

Methods: The golf course and grounds will be maintained in an aesthetically pleasing, yet environmentally sensitive manner. It is the responsibility of the Golf Course Manager to maintain the course and grounds in accordance with the Integrative Pest Management Plan (IPM). This plan will describe the activities and materials to be used to control pests (i.e. insects, weeds, and other living organisms requiring control) on the golf course in a way that minimally impacts the environment. The IPM will be developed and updated by the Golf Course Manager, in consultation with the Lake Manager and the Environmental Review Committee. The Golf Course Manager will consult with the Lake Manager on any unique situation that may arise outside of routine maintenance that could impact Spring Lake.

Monitoring: Each year the Golf Course Manager will report to the Lake Manager detailed information on maintenance activities and materials used during the year. The water quality monitoring program performed by the Edwards Aquifer Authority will sample for runoff from the golf course.

Allocated funds for 2014: \$ 0

Estimated Budget: \$ 0

Protocol for Implementation of HCP Measures Requiring Diving and/or Boating

All activities in Spring Lake must be submitted to the Spring Lake Environmental Review Committee and/or the Spring Lake Diving Control Board for approval as outlined in the Spring Lake Management Plan. This includes required training and orientation for any diving based activities in Spring Lake by the RSI Diving Safety Officer, using guidelines set out in the RSI Diving Safety Manual for Spring Lake and the San Marcos River. This includes an orientation that covers: instruction on safety, basic boat handling, and on-site rules and regulations. The orientation will cover information specific to Spring Lake's sensitivity, endangered species as well as cultural resources.

All personnel implementing any portion of the HCP for the City of San Marcos and Texas State University will undergo an orientation at the SMARC to ensure awareness of the listed species and safe procedures while working in and along the San Marcos River.