City of San Marcos/Texas State University 2020 Work Plan

2020 San Marcos/Texas State University Work Plan Budget

EAHCP Section	Conservation Measure	Table 7.1	Available Budget for 2020	Estimated 2020 Budget	Selected Contractor
5.3.1/5.4.1	Texas wild-rice Enhancement	$100,000	$100,000	$73,750	Texas State
5.3.6/5.4.4	Sediment Management	$25,000	$0**	$0	
5.3.8/5.4.3/ 5.4.12	Control of Non-Native Plant Species	$50,000	$50,000	$76,607 $42,670	Texas State EBR
5.3.3/5.4.3	Management of Floating Vegetation Mats and Litter	$80,000	$80,000	$44,688	TxSt/Cuda/Atlas
5.3.5/5.3.9/ 5.4.11/5.4.13	Non-Native Species Control	$35,000	$35,000	$27,285	Atlas
5.3.7	Designation of Permanent Access Points/Bank Stabilization	$20,000	$0	$0	
5.7.1	Native Riparian Restoration	$20,000	$20,000	$20,000	Cuda
5.3.2/5.4.2	Management of Recreation in Key Areas	$56,000	$56,000	$56,000	TxSt
5.7.6	Impervious Cover/Water Quality Protection	$200,000	$225,000**	$200,000	JGLLC/EPR*
5.7.5	Management of HHW	$30,000	$30,000	$30,000	TBA
5.3.4	Prohibition of Hazardous Material Transport	$0	$0	$0	
5.7.3,4,5,7,8,9 & 10	Various unfunded Measures	$0	$0	$0	
	Total	***$616,000***	***$596,000***	***$571,000***	

***Will add construction costs when bid is tabulated. Construction is anticipated from 2021-2023.**

****Sediment Management funding will go towards the Impervious Cover and Water Quality Protection Conservation Measure (5.7.6) per the 2017 Sediment Removal and Impervious Cover/Water Quality Protection nonroutine adaptive management**

5.3.1/5.4.1 Texas Wild-Rice Enhancement and Restoration

Long-term Objective:
To achieve 8,000 – 15,450 m^2 of Texas wild-rice (TWR) and maintain existing and restored areas of TWR as required by the EAHCP.

Target for 2020:

The target area for planting TWR in 2020 is Spring Lake. The primary focus area within Spring Lake that has been identified for new plantings is the area above the eastern spillway. The entire lake, except for the area adjacent to the Meadows Center for Water and the Environment headquarters, is also targeted for planting of TWR in areas of hygrophila removal. The remainder of the TWR, from Spring Lake Dam to IH-35, will be encouraged to expand through invasive removal within and around the perimeter of TWR stands, or planted if needed. These efforts work toward attaining 2027 biological goals as shown in Table 1.

Table 1. TWR expansion since 2013 relative to 2027 biological goals

Reach	2013	2014	2015	2016	2017	2018	2027 Goal
Spring Lake	0	0	0	47	184	246	1000
Spring Lake Dam	199	360	573	887	1389	1088	700
Sewell Park	666	839	1202	1186	1811	1191	1100
Below Sewell-City Park	1212	1963	2253	2429	2810	2726	2300
City Park	384	603	1348	1562	2247	1361	1750
Hopkins St-Snake Island	0	0	693	0	1169	815	950
Cypress Island-Rio Vista	0	0	123	238	247	249	350
IH-35 (Upper & Lower)	0	0	82	276	512	621	1050
Below IH-35	-	-	-	-	56	76	280

Methodology: The optimal conditions for TWR are sandy to coarse soils with water depths generally greater than 1 meter in areas of higher current velocity. In stands of TWR that have non-native plant species intermixed, the non-natives are removed and the original TWR stand is monitored for expansion. Similarly, for TWR stands adjacent to non-native vegetation; the non-native plants in the San Marcos River are removed and TWR is planted. Finally, in sites that are potentially suitable for TWR but are unoccupied by TWR in Spring Lake and downstream of IH-35, any non-native vegetation that is present is removed and TWR planted and monitored to assess the success of transplants.

Removal of invasive non-natives around existing TWR stands occurs by hand, with divers allowing the non-native plants to drift into a seine, bag, or catch net set up downstream. The removed vegetation is moved to the shore and plant debris is transferred to the work truck or trailer. There, the plants are shaken to remove trapped fauna which are returned to the river. The plants are then disposed at the COSM or Spring Lake composting facility. Denuded areas are monitored and any regrowth of non-native plants is removed. If TWR does not expand, other native aquatic plants will be planted to secure the area.

The contractor will grow TWR from both tillers and seeds with mature seeds being collected from the panicle by gently pulling upwards until seeds are released. Mature seeds are plump, filled out, and either green or brown in color. Seeds are then placed in a plastic bag during collection and counted and potted within 24 hours following collection. Tillers of TWR are collected by removing them from floating vegetation mats or from fragments attached to mature plants in the river. TWR tillers are transported to the raceways located at the Freeman Aquatic Biology (FAB) and potted in soil that consists of a bulk mixture containing top soil and mushroom compost. TWR tillers are planted in an 8-inch pot with the soil being highly saturated with water so that the tillers can be inserted without causing damage to the plant. Density of fragments per pot is generally 3-10 individuals depending on the species. TWR seeds are placed on top of inundated soil in 8-inch pots and covered with pea gravel to secure the seeds from floating in the water. Seeds are spread out evenly within each pot, and gently pushed into the saturated soil and gravel mixture. Once TWR seeds have germinated they will be separated out and planted in a similar manner as TWR tillers.

The pots are placed into the FAB raceways with pumps generating current velocity over the newly planted fragments. Plants remain in the raceways until roots are firmly established in the pots.

The process of planting in the river begins by transporting potted TWR individuals from the FAB to the planting site. A diver and a handler carry the plants to the designated section, and while the diver digs a hole in the substrate using a trowel, the handler gives the diver a pot of TWR. The contents are removed from the pot and inserted into the hole. The diver works downstream to upstream in a linear pattern of planting. Individuals are placed about 0.5 meters apart and gardened as needed to remove invading plants. This process is adjusted as needed to meet the varying conditions of each planting site and species.

Production of TWR plants at the FAB is incorporated into this Work Plan budget (TWR Enhancement & Removal of non-natives). These methodologies may be adjusted as more is learned about collection and planting procedures.

Monitoring:

All planted areas are monitored via quadcopter and scuba divers. This data is mapped and analyzed via GIS. Monitoring thus far has shown that invasive plants move into cleared areas more quickly than TWR, so cleared areas are now planted with either TWR or an approved native plant (see conservation measure 5.3.8/5.4.3/5.4.12 Control of Non-Native Plant Species). TWR distribution is also monitored annually through the EAA BioMonitoring program. The data collected is used to evaluate TWR coverage and identify areas of concern.

Budget:

Table 7.1:

$100,000

Available budget for 2020

$100,000

Estimated 2020 budget:
$73,750*
*Transferring $26,250 to Control of Non-native Plant Species

5.3.6/5.4.4 Sediment Management

The City of San Marcos (COSM) and Texas State University (TXSTATE) are partnering to remove sediment from the river bottom in support of the native SAV planting program from Spring Lake to IH-35.

Long-term Objective:
The removal of sediment in support of native aquatic planting activities has proven to be both ineffective and expensive. From 2013 to 2015, three of the six required sites have received only 158 m^3 of sediment removal costing approximately $555,000. In 2017, an Adaptive Management Proposal to amend this conservation measure in the EAHCP was approved.

The Sediment Removal and Impervious Cover/Water Quality Protection are combined into one conservation measure that addresses sediment control within the upper San Marcos River watershed to minimize sediment and other contaminated runoff. The primary focus is the Sessom Creek watershed, which contributes a heavy load of sediment during rain events; in the 2015 October flood, Sessom Creek dumped sediment on TWR stands and other native plant stands down to City Park.

The COSM will provide; (1) design of wastewater relocation and erosion/sediment control in Sessom Creek; (2) Sessom wastewater line rehab and relocation; and (3) construction of stormwater control (SWC) features and associated land management tasks that control erosion, minimize sedimentation, and reduce pollutants in the Sessom Creek watershed.

Additionally, TXSTATE has received 319 funding from the TCEQ for SWCs in the Sessom Creek watershed. The Meadows Center for Water and the Environment is the point of contact for the EPA 319 funds.

Target for 2020:
See discussion in Section 5.7.6 Impervious Cover/Water Quality Protection

Method:
See discussion in Section 5.7.6 Impervious Cover/Water Quality Protection

Budget:
Table 7.1:
$25,000

Available budget for 2020:
$25,000*

Estimated budget for 2020:
$0

***These funds will be transferred to the Impervious Cover and Water Quality Protection measures.**

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

Long-term Objective:
To decrease the density of invasive aquatic and littoral plants or eliminate as possible through monitored removal in and along the San Marcos River and to enhance fountain darter habitat by increasing the distribution of native aquatic flora as assigned by the submerged aquatic vegetation (SAV) nonroutine adaptive management long-term goals

Target for 2020:
In 2020, the removal of non-natives and planting of natives will adopt the following strategy in an effort to ensure best use of EAHCP funds and facilitate the achievement of long-term biological goals.

Hygrophila will be removed from various sites within Spring Lake (Figure 1). In Spring Lake, volunteers will be used to remove non-natives and plant non-TWR natives because at this time the EAHCP only covers planting of TWR in Spring Lake. TWR plantings have not been successful in areas of high silt. This reach will receive repeated removal treatments until non-native regrowth is slow enough to allow natives to outcompete them. Figure 2 represents the 2020 work zone for removal of non-natives. The 2019 work zones will be classified as recovery zones in 2020 (Figure 3). These recovery zones will be managed so that native species can expand either naturally or via planting while maintenance zones will be regularly swept for remnant hydrilla plants (Figure 4). The contractors will continue utilizing extended hours from May to October to take advantage of the extended periods of daylight and to avoid hours of heavy river recreation.

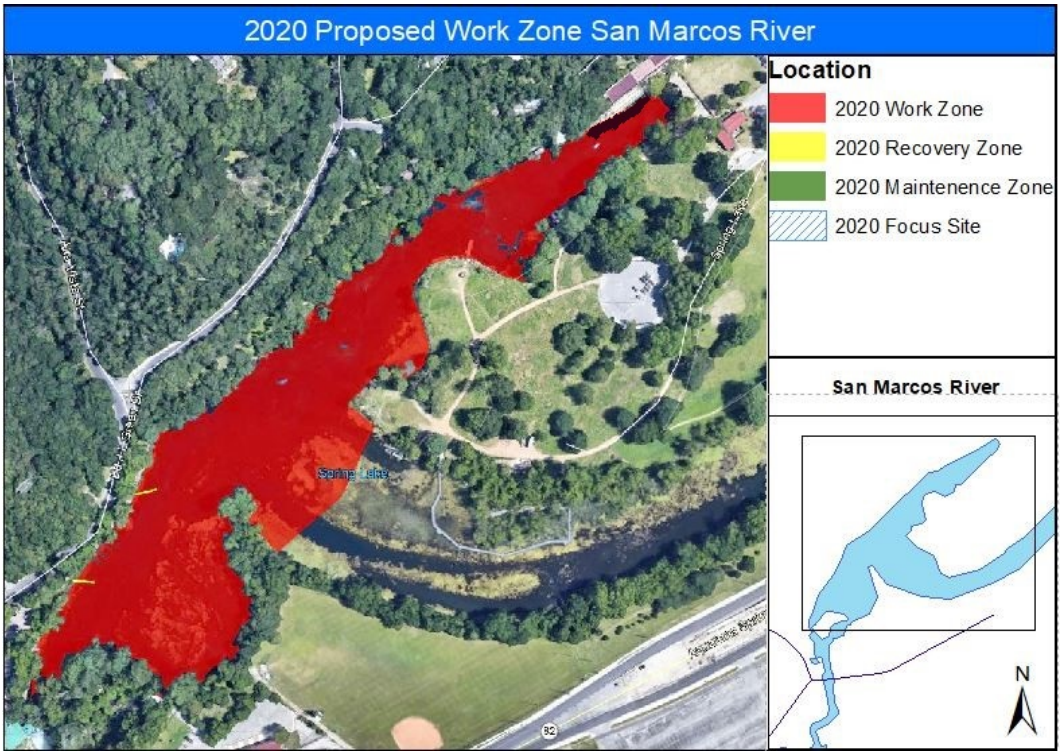

Figure 1. Proposed work zone for non-native removal and TWR planting in 2020.

Figure 2. Proposed work zone for non-native removal and native aquatic planting in 2020.

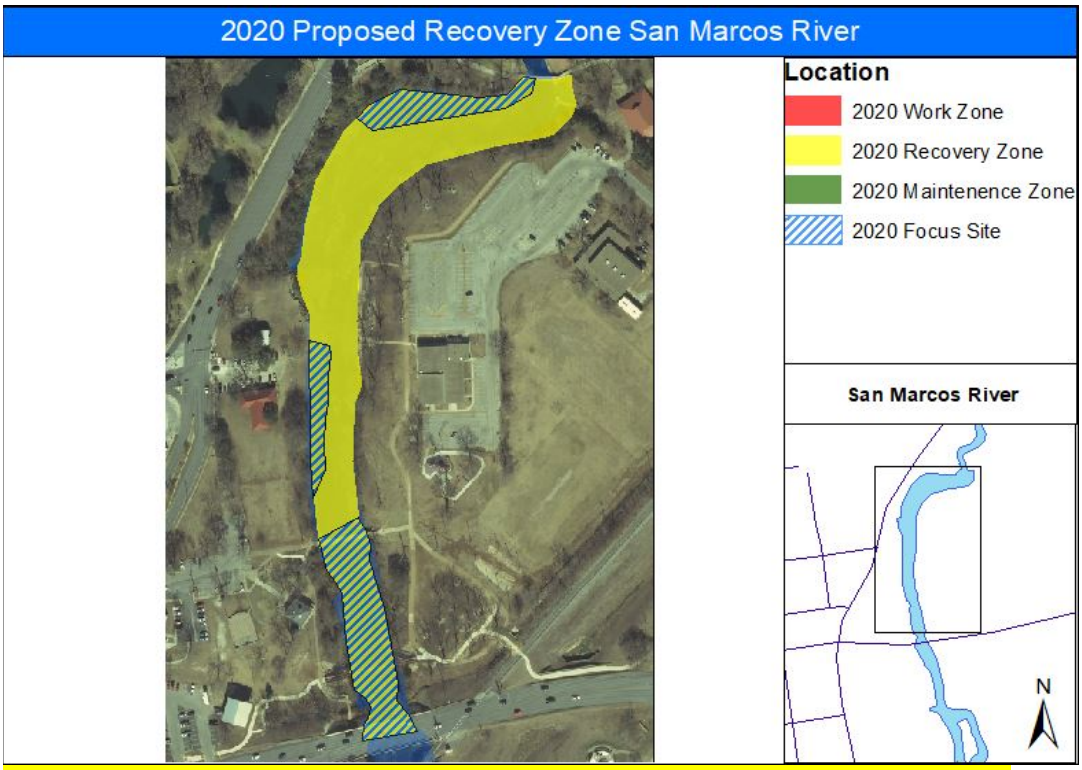

Figure 3. Proposed 2020 recovery zones and areas of focused recovery effort.

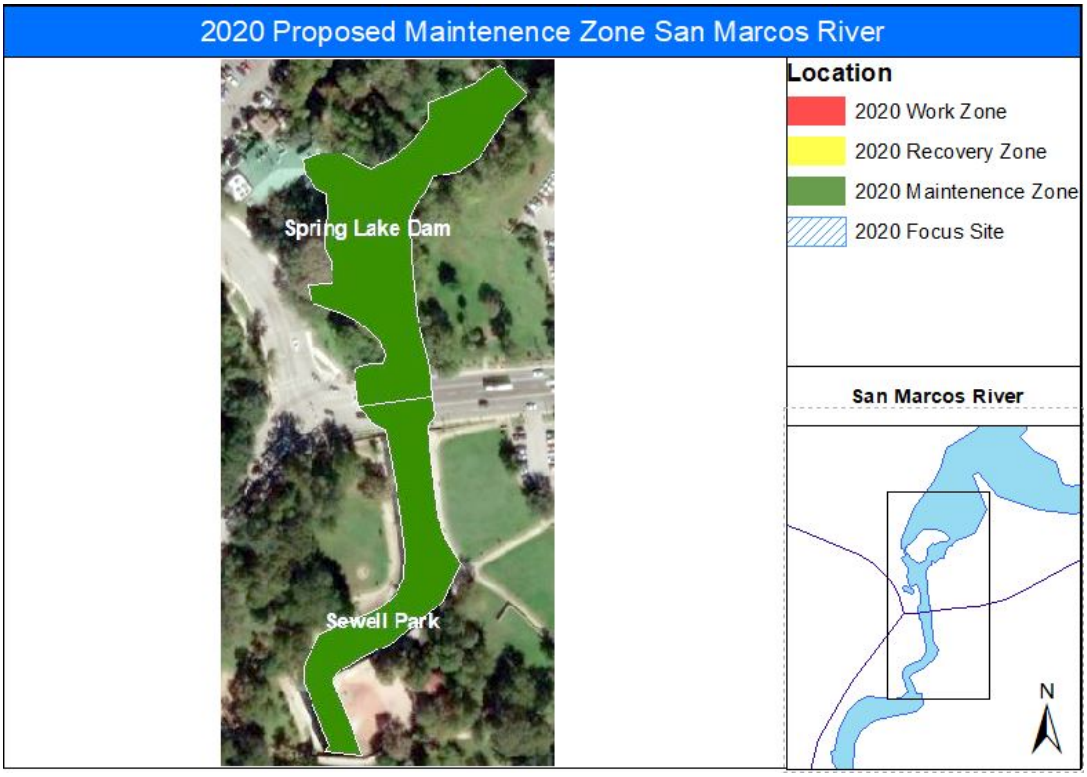

Figure 4. Proposed 2020 maintenance zones.

Methodology:

Non-Native Aquatic Plant Removal

Work efforts will focus on replacing 20 – 50% of removed non-native species within a given reach with natives, focusing on species diversity, species habitat preferences, and available habitat at the time of planting. The goal will be to eliminate dense stands of non-native species that then allow the native species to maintain and/or expand their distribution. The mean number of fountain darters per square meter will be an important factor when replacing the non-native species with native species so total fountain darter numbers are not reduced following removal and planting efforts.

Non-native aquatic plants will be removed and replaced with native aquatic plants in association with TWR enhancement as described in conservation measure 5.3.1/5.4.1. Divers remove non-native aquatic plants by hand, allowing them to drift into a seine, bag, or catch net set up downstream. The removed vegetation is moved to the shore and plant debris is transferred to the work truck or trailer. There, the plants are shaken to remove trapped fauna which are returned to the river. The plants are then disposed at the COSM or Spring Lake composting facility. Denuded areas are left alone for several weeks and any regrowth of non-native plants is removed, then the area is planted with native aquatic vegetation.

Hydrilla Removal

The upper San Marcos River was separated into eleven reaches from Spring Lake to Stokes Park. Hydrilla has been removed from seven of these reaches since 2013 with limited success. Hydrilla was removed from these reaches regardless of reach location along the upper river, which left large areas of untouched hydrilla upstream of removed areas that resulted in the cleared areas being quickly repopulated with large stands of this invasive species. Beginning in 2018, HCP contractors began a systematic upstream to downstream removal strategy beginning in the Spring Lake Dam reach. Currently there is very little hydrilla within Spring Lake and it is managed to a level that the lake should not be an upstream source of hydrilla fragments or tubers.

Hydrilla is now being systematically removed reach by reach. Reaches that have been thoroughly cleared of large hydrilla patches for two or more years are considered maintenance zones while reaches in which large amounts of hydrilla are being removed are designated as work zones. A work zone in which all hydrilla has been thoroughly removed during the previous year are considered a recovery zone. These recovery zones may still require additional effort to ensure the thorough removal of hydrilla root systems and tubers, which can remain viable for multiple years despite being buried over 12 inches beneath the sediment. Downstream reaches with large areas of hydrilla are considered future work zones. Two reaches are currently considered in maintenance condition and three reaches are currently considered work zones.

Hydrilla is removed by hand and then transported to a trailer for eventual dumping and composting. Areas of removal are then de-rooted, which includes meticulous removal of roots, small plants, and tubers. This process is repeated until no hydrilla is observed. After an area has been effectively de-rooted and no regrowth occurs, native plants are either planted or allowed to populate the cleared areas through natural expansion.

Planting of Native Species

The planting of native species begins once the designation of a work zone changes to recovery zone, as this maximizes reduction of invasive regrowth and subsequent outbreak. This is expected to take 3-6 months from when the site is finished as a work zone, depending on the density and area of non-natives originally present in the site. Efforts primarily focus on preserving areas surrounding existing native species to allow for the natural expansion of those populations throughout the river system. In addition to the use of natural expansion, areas that have been stripped of all vegetation will be planted with native species best suited to that habitat type while ensuring a high level of biodiversity is maintained for that given area. The goal provides species presence within all reaches to allow for natural expansion downstream of each population. An exception to this will include areas within Spring Lake where the Hygrophila will be removed, and replaced by native expansion according to the appropriate substrate, flow, depth, and sunlight.

The practice of removing non-native aquatic plant stands from upstream to downstream is anticipated to reduce labor hours spent on gardening unwanted growth that results from non-native plant fragments drifting from upstream sources, reduce competition for newly planted and existing natives, and allow more time to be spent on planting (as needed). Large homogenous stands of non-native aquatic vegetation will be targeted while mixed stands of native and non-native species will be monitored. Non-native species within mixed stands will be removed if expansion is observed. The plant species designated in Table 2 below will be prioritized for planting after removal of non-native species depending on available habitat and history of the plant species' success in the available habitat at a given site. If the prioritized species has not been successful in the habitat type to be planted, another species will be planted in its place. Plantings will not occur in areas impacted by intense recreation.

SAV Restoration

In 2018, the SAV and TWR restoration progress in the San Marcos River was evaluated. Based on the results, the species' coverage estimates were adjusted and **Table 2** shows how the coverage estimates compare to the EAHCP biological goals**.**

Table 2: Current aquatic vegetation coverage relative to the overall restoration goals, in meters squared (m^2) within San Marcos LTBG reaches and restoration reaches.

Reaches	Species	Coverage[#] (m^2)	Restoration Goal
		Oct 2018	2027
LTBG Reaches[1]			
Spring Lake Dam	*Ludwigia*	22.44	100
	Cabomba	1.52	50
	Potamogeton	147.99	200
	Sagittaria	22.29	200
	Hydrocotyle	51.08	50
City Park	*Ludwigia*	65.28	150
	Cabomba	50.1	90
	Potamogeton	203.34	1450
	Sagittaria	106.84	300
	Hydrocotyle	0	10
IH-35	*Ludwigia*	10.12	50
	Cabomba	31.98	50
	Potamogeton	0	150
	Sagittaria	17.11	150
	Hydrocotyle	3.81	50
Restoration Reaches[1]			
Sewell Park	*Ludwigia*	3.8	25
	Cabomba	3.4	25
	Potamogeton	113.8	150
	Sagittaria	0	25
	Hydrocotyle	0	10
Below Sewell to City Park	*Ludwigia*	5.4	50
	Cabomba	2.2	50
	Potamogeton	386.1	500
	Sagittaria	392.4	700
	Hydrocotyle	38	20
Hopkins St to Snake Island	*Ludwigia*	2.4	50
	Cabomba	108.3	50
	Potamogeton	63.5	475
	Sagittaria	1258.6	750
	Hydrocotyle	0	10
Cypress Island to Rio Vista Falls	*Ludwigia*	18.24	50
	Cabomba	200.52	50
	Potamogeton	6.12	150
	Sagittaria	14.02	50
	Hydrocotyle	0	0
IH-35 expanded	*Ludwigia*	194.11	50

Reaches	Species	Coverage[#] (m^2)	Restoration Goal
		Oct 2018	2027
	Cabomba	63.52	100
	Potamogeton	0	250
	Sagittaria	373.18	450
	Hydrocotyle	5.47	50

[1]2018 coverage values were mapped in October 2018

Production of native SAV will continue at the FAB at Texas State University as described in the TWR Enhancement section. Fragments and tillers of native aquatic plants removed from floating vegetation mats or from fragments attached to mature plants in the river are used for propagation at FAB. Funding for the production of SAV at the FAB is incorporated into this Work Plan budget.

Native vegetation species are planted using a team that, at times, includes a diver(s). A hole is made in the substrate using a hand shovel and the native plants are hand planted until the denuded area is approximately 20-70% coverage, depending on species and area planted. The pots are removed before planting and handed back to the assistant for reuse. Planting native plants soon after removal of non-natives is needed to stabilize the substrate.

Environmental conditions at the time of planting determine which native species are planted. *Cabomba* and *Sagittaria* have exhibited greater success in finer substrates (silt) with areas of slower moving water. Both can be planted in a range of water depths. However, some reaches are challenging, such as Cypress Island, where only TWR and *Heteranthera* have shown success in outcompeting *Hydrilla*.

In the San Marcos River, *L. repens* has been planted in a wide variety of habitat types ranging from areas with shallow depths, high velocities over coarse substrates to areas with slackwater habitat over silt substrate to determine which habitat results in greatest rates of expansion and persistence. In 2019, *L. repens* patches have expanded and contracted with fluctuations in recreational areas. This species' coverage expanded in reaches upstream of Hopkins Street, with many of the new patches being relatively small and occupying areas recently cleared of non-natives. This is possibly occurring, because for the first time, *L. repens* has multiple source populations in the upper San Marcos River. Hygrophila has been observed to reduce the expansion of *L. repens*. Their habitat preference seems to be shallow, moderate flow and non-silty substrate, although *L. repens* in City Park is thriving in soft silty substrate.

In 2016, *Hydrocotyle verticillata* was accepted as an approved native species to plant in the San Marcos River. *Hydrocotyle verticillata* can become a littoral species, persisting in areas of

shallow water. Therefore, this species is utilized to replant river margins or areas of very shallow water depths.

Non-Native Littoral Plant Removal

Removal of littoral plants and other small caliper invasive plants in the riparian zone is also included in this budget. In 2020, removal efforts for littoral invasives will target areas shown in Figure 5 below. Littoral invasive removal efforts will address seed source and regrowth of invasive plants from above Spring Lake to Stokes Park (Section 5.3.8). Removal of elephant ears may be greater in fall and winter before spring growth. Removal efforts will also extend to treat hot spots that contribute to regrowth**.** The littoral zone will be replanted as needed to stabilize the bank.

Figure 5. Locations of remaining littoral invasive plant stands.

Re-growth of invasive species will continue to be removed to maintain the desired state. Seed sources will also be targeted.

The herbicide mix used for littoral removal is Aquaneat (glyphosate-based herbicide) for elephant ears and other non-native plants encountered in the littoral zone. This herbicide will be mixed with Aqua King Plus Surfactant and Turf Mark Blue, a blue dye. Chemicals are applied by a licensed applicator with a one-gallon pump-up sprayer set on a steady stream for a more precise target hit to minimize leaching and non-target plant damage. Roots of woody plants are scarred to expose the cambium layer before treated.

Monitoring:

For aquatic plants, newly planted areas are monitored monthly to evaluate success rate. All planting and removal areas are monitored via quadcopter and/or visual observation by snorkelers and scuba divers. Both planting and removal efforts are mapped and quantified via GIS techniques. Work sites are separated into reaches to assess changes among and within reaches of

the San Marcos River and to identify presence of non-native vegetation and also to assess the expansion of native vegetation.

Progress for non-native littoral vegetation removal will be tracked with polygons containing the species removed, estimated area (m^2) and percent removed. A composite map depicting the routine maintenance required to remove large areas of non-native aquatic vegetation will also be generated using weekly polygons.

Budget:

Table 7.1:
$50,000

Available budget for 2020:
$50,000

Estimated 2020 budget:
$119,277*

***$79,607 TxSt & $42,670 EBR; transfer $69,277 from measures specified in budget table.**

5.3.3/5.4.3 Management of Floating Vegetation Mats and Litter

Long-term Objective:
Minimize impacts of floating vegetation and litter on TWR stands and overall aquatic community within the San Marcos River, as well as keep springs clear to enhance San Marcos salamander habitat.

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 Methodology.

Target for 2020:
Management activities include removal of litter from the littoral zone, stream bottom and portions of the major tributaries, and vegetation mats from Spring Lake Dam reach to IH-35. The Meadows Center team removes floating mats from the entire reach they are working. Texas State University will manage aquatic vegetation in Spring Lake through use of its harvester boat and trained divers authorized to dive in Spring Lake.

Methodology:
Spring Lake: Each week about five springs are gardened, with divers returning to garden the same springs every two to three weeks. During summer algal blooms, the springs are managed more frequently (up to four springs per day), primarily to remove algae. Texas State employees and supervised volunteers 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 shear vegetation to a height of 30 cm, and then to one meter over the following three meter radius. Plant materials are not collected, but rather carried away by the current. Cumulatively, about six meters of vegetation around each spring opening is modified. Mosses are not 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 clears 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 is visually checked by the driver for fauna caught in the vegetation. If the driver observes fauna, he/she will stop work and return 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 are removed from zones four and five on an as-needed basis (See HCP Figure 5-2). The total area cut equals 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 are collected by hand and shaken prior to removal from the river to dislodge any aquatic species caught in the plant. The plants are deposited into dump trucks and taken to the MCWE 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 in Texas wild-rice stands is lifted off the stands and removed. Inorganic litter is picked up weekly from the substrate, surface and littoral zones of the

San Marcos River from Clear Springs Natural Area to City Park and from IH-35 to Stokes Island during the recreational season (May 1st to September 30th) and monthly during offseason. Litter is also removed from public lands within the four tributaries.

Monitoring:

In the event of low flows, this activity will be monitored by the EAA contractor for potential impacts on listed species and will be suspended if impacts are observed. Volume of litter removed will be tracked. Removal of vegetation mats will be tracked with polygons delineating work areas and attribute data that include date, location, and percent species composition.

Budget:

Table 7.1:
$80,000

Available budget for 2020:
$80,000*

Estimated 2020 budget:
$44,688*

***$35,312 to be transferred to Control of Non-native Plant Species**

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

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

Target for 2020:
Contractor will use methods that have proven to be successful in efficient removal of invasive species from Spring Lake to IH-35. Contractor will measure length and weight for fish species. The targeted species include suckermouth catfish, tilapia, nutria and two snail species, *Melanoides* and *Marisa cornuarietis.*

Methodology:
Fyke nets, spear and bow fishing continue to be effective methods for fish removal. Contractor uses spearfishing tournaments, permitted through the municipality, to increase total removal, while saving costs and providing an educational awareness component to participants. Contractor ensures that all methods avoid impacts to resident turtles and other native species.

Effective removal of *Melanoides* and *Marisa cornuarietus* is accomplished by determining the locations of highest snail density and using dip nets to remove the snails weekly. These species are best controlled by diving several hours after sunset to hand-pick the snails from the substrate and SAV.

Box traps baited with carrots, sweet potatoes, and apples will be used to capture nutria. Traps will be placed in areas frequented by nutria. The traps will be checked in the late afternoon and again the next morning at about 0730. Captured nutria will be euthanized. Removed nutria will be measured and weighed prior to being disposed of.

City of San Marcos has an ordinance prohibiting the dumping of aquaria into the San Marcos River (Sec. 58.037) and accepts unwanted aquatic fauna at the Discovery Center.

Monitoring:
In order to monitor the reduction of overall non-native species abundance in the San Marcos ecosystem, the COSM and TXSTATE will compile information regarding the size (weight and total length) of the individual animals removed. This information may assist in determining overall effectiveness of this conservation measures impact of species population dynamics.

Budget:
<u>Table 7.1:</u>
$35,000

<u>Available budget for 2020:</u>
$35,000

<u>Estimated 2020 budget</u>
$27,285*
***$7,715 to be transferred to Control of Non-native Plant Species**

5.3.7 Designation of Permanent Access Points/Bank Stabilization

Long-term Objective:
Maintain integrity of structures that serve to control bank erosion, protect Texas wild-rice and listed species habitat in the recreation traffic areas.

Target for 2020:
The City of San Marcos completed the construction of bank stabilization/access points at seven locations along the San Marcos River in 2014 with repairs made in 2017.

Monitoring:
A diver will measure possible undermining at each site twice yearly. The surface of each site will also be inspected for damage.

Budget:
Table 7.1:
$20,000

Available budget for 2020:
$0

Estimated 2020 budget:
$0

5.7.1 Native Riparian Habitat Restoration

Long-term Objective:
Establish a robust native riparian and water quality buffer community that benefits Covered Species through increasing the habitat and water quality within the San Marcos River down to city limits. The buffer will also prevent public access which causes bank erosion and impacts TWR stands. A zone of prohibitive vegetation along the uppermost edge of the riparian and water quality buffer community will be established to encourage river users to access the river via hardened access points. Private riverside landowner participation in this program will be encouraged and the EAHCP will provide the labor and plants as practical. EAHCP-funded contractor(s) will perform invasive removal and maintenance. Native plantings and maintenance will be done by volunteers during regular planting events.

Target for 2020:
Contractor (funded through the EAHCP and COSM) and volunteers will maintain all treated areas from Spring Lake to Stokes Park, and any new adjacent areas to address invasive regrowth and/or seedbank source as appropriate. Volunteers plant natives in previously worked areas during regular planting days as needed. Initial invasive removal has been completed from headwaters to Thompson's Island, so maintenance of all treated areas and initial removal from Thompson's to Stokes will be the primary focus with secondary seed source removals.

Methodology:
Contractor removes and treats invasive regrowth using a glyphosate/trichlopyr herbicide mix to treat the stumps and/or roots. On upland trees, shrub stumps and root buttresses, Relegate **(**Triclopyr-based herbicide) is used. The Relegate is mixed with glyphosate, Drexel Surf Ac 820 Surfactant and Turf Mark Blue, a blue dye. Roots are scraped and treated with herbicide mix then monitored. Volunteers complete all other native riparian habitat restoration as described above using plants propagated at the Discovery Center. Treated and adjacent areas will be monitored for re-growth and seed sources.

Monitoring:
Monitoring will occur monthly to check for re-growth and treat as needed. Maintenance will continue to be a mix of contract work funded by EAHCP and COSM, as well as volunteerism. The City 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.

Budget:
Table 7.1:
$20,000

Available budget for 2020:
$20,000

Estimated 2020 budget:
$20,000

5.3.2/5.4.2 Management of Recreation in Key Areas

Long-term Objective:

To minimize the impacts of incidental take resulting from recreation which includes, but is not limited to swimming, wading, tubing, boating, canoeing, kayaking, golfing, scuba diving, snorkeling and fishing.

Target for 2020:

1. Hire 10 Conservation Crew members that work 16 hours/week (Wed to Sun) from May to September with 2 – 3 members working prior to summer season and after to continue public outreach, recreation impact minimization efforts, and assists the MCWE HCP team in their efforts to remove floating plants mats and non-native vegetation.

2. Continue the implementation of the following recreational management goals at a minimum:

a. Signage. Signs have been posted in kiosks at most of the river access points. Signs cover the rules of the river and educate the public on the importance of the resource.

b. Video Loop at City Park and Rio Vista Falls offering information about the river and safety rules while people are waiting for shuttle or tubes. Video was finished and installed in 2016/2017 for Lion's Club and will be updated and distributed electronically for increased exposure.

c. Posted maps showing trail, access points, fishing access and other amenities. River maps are located at the Discovery Center which serves as the trailhead to the San Marcos River and help inform visitors and recreationists about the San Marcos River/Blanco confluence.

d. Work with the Tourist Information Bureau (TIB) to include information on the endangered species and ongoing HCP projects at hotels/restaurants, bed and breakfast facilities, Chamber of Commerce, Visitor's Center, City of San Marcos internet site, etc. along with the recreational information**.** EAHCP brochures have been placed at the TIB for visitors and associated facilities.

e. Park Rangers. Training materials covering the river flora and fauna have been developed and provided for 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. The San Marcos Discovery Center is a facility dedicated to public education and outreach regarding the San Marcos River. Outreach efforts include the production of an interactive river habitat card game that was introduced into the curriculum for SMCISD elementary schools.

g. Continue to provide EAHCP presentations to TXST Outdoor Recreation class and Wildlife Society club and partner with TXST Geography Intern Program to increase volunteer participation.

h. Continue to provide outreach at booths including Concert Series (Earth & Water), Passport SMTX, Business Expo, Mermaid Society events, San Marcos Sustainability Fair, and Don't Mess with Texas Litter Cleanup.

j. Continue to educate the public during volunteer planting days.

k. Continue to educate the public engaged in water-based recreation on sustainable river behaviors that protect listed species and their habitats through interns and Conservation Crew program.

l. Introduce the COI program to qualified third parties conducting recreational activities in and along the San Marcos River.

m. Monitor and educate recreationists about the invasive zebra mussels.

Monitoring:

Litter removed from the river during the recreation season is tracked. Also, the Conservation Crew will monitor boats and river structures for the presence of zebra mussels from Spring Lake Dam to IH-35.

Budget:

Table 7.1:
$56,000

Available budget for 2020:
$56,000

Estimated 2020 budget:
$56,000

5.7.6 Impervious Cover/Water Quality Protection

Long-term Objective:

The EAHCP commitment for a combined effort (Sediment Management and Impervious Cover & Water Quality Protection) includes construction of Sessom Restoration Phase 1 starting fall of 2020.

The most cost-effective strategy identified under the AMP was implementation of stream restoration projects in the middle reach of Sessom Creek. Restoration will also address a tributary flowing into the middle reach, the Windmill Tributary, that is experiencing accelerated stream erosion and also contributing high sediment loads. Primary objectives of the AMP strategies are (1) reduce existing stream erosion, and (2) accelerate the natural re-stabilization process for Sessom Creek, i.e., to return it to a state of geomorphic equilibrium.

The preliminary recommendations address Phase 1, approximately 1400 linear feet of Sessom Creek, from above North LBJ Drive upstream to the Windmill Tributary confluence and Phase 2, approximately 565 linear feet from the confluence to the Loquat/Canyon intersection, plus 550 linear feet of Windmill Tributary. A future Phase 3 addresses Sessom Creek above the Loquat/Canyon intersection (an additional 800 linear feet) (Figure 6). Stream and watershed restoration practices identified for each project reach include grade control, bank stabilization, gully control, stormwater management ponds, natural channel design, and riparian restoration.

In addition, the City of San Marcos has identified several other projects and concerns within the same geographic area. These include wastewater improvements, road repair and improvements, site-specific erosion repairs, and a water main project. These improvements will work in concert with the stream restoration and stormwater management practices to the maximum extent practical. The wastewater improvement project is separate but is planned to occur concurrently with the other projects.

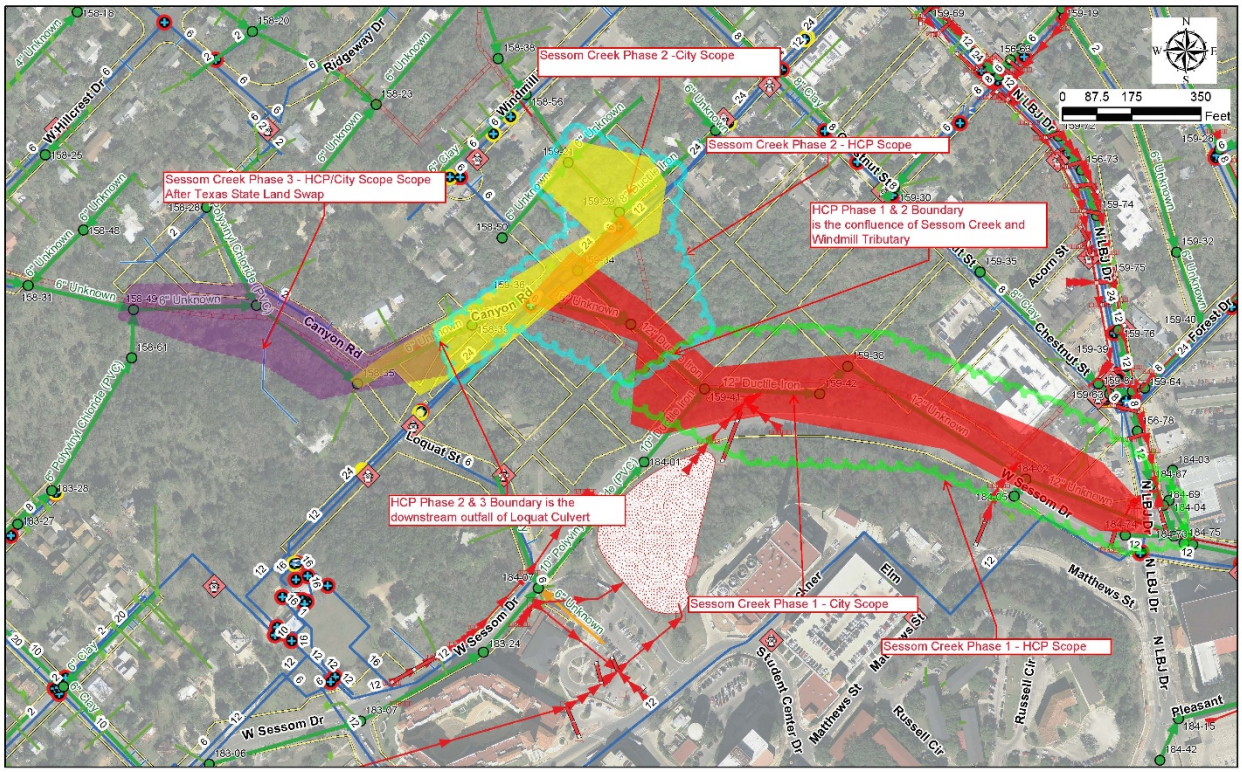

Figure 6. Sessom Creek Proposed Project Reaches - Phase 1 (green outline), Phase 2 (blue outline), Phase 3 (purple area)

Target for 2020:

Complete bid preparation for Phase 1 and begin construction in the fall. Phases 2 & 3 will begin construction in 2021. Continue working with TXST to control sediment loss into Sessom Creek from campus sites.

Monitoring:

Water quality monitoring program managed by the EAA will set the pre-construction parameters. The EAA Sessom Real-Time station and the applied research water quality sampling at the Freeman Aquatic Building will supply the data.

Budget:

Table 7.1

$200,000

Available budget for 2020:

$225,000

Estimated 2020 budget:

$200,000*

***$1,528,200.00 was approved for this conservation measure in 2019. $1,528,200.00 is expected to be spent from 2019 through 2023. As of the May 2019, the City of San Marcos has invoiced $99,344 for reimbursement**

from the EAHCP toward this conservation measure. Designs for stream restoration on Sessom Creek are scheduled for completion in 2019 with a total estimated design cost around $645,000. Construction funds will be included in future funding applications when the construction bids are tabulated.

5.7.5 Management of Household Hazardous Waste

Long-term Objective:
Strengthen the COSM existing program that provides a place for citizens of San Marcos and Hays County to safely dispose of HHW. This prevents the dumping of HHW into the river or recharge zone and thus impacting listed species.

Target 2020:
Target 3000 participants for public outreach events. Staff will conduct these events and convert 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. Mailing quick fact flyers out with HHW information.

Methodology - open drop-off opportunities two days a week (Tuesday and Friday) from 12:00 noon to 3:30 p.m. to the public.

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 with the San Marcos River watershed and the cost of collecting, processing and disposing of HHW from these communities.

Budget:
Table 7.1:
$30,000

Available budget for 2020:
$30,000

Estimated 2020 budget:
$30,000

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

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

Target for 2020:
Produce map with TxDOT limitations and obtain TxDOT approval.

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

Budget:
Table 7.1:
$0

Available budget for 2020:
$0

Estimated 2020 budget:
$0

5.7.3 Septic System Registration and Permitting Program

Long Term Objective:
To ensure 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.

Target for 2020:
To have an accurate record of new and existing septic systems installed and modified in city jurisdiction. In addition, city ordinance requires all owners of septic systems connect to municipal sewer lines as they become available.

Methodology - 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 requirements 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.

Budget:
Table 7.1:
$0

Available budget for 2020:
$0

5.7.4 Minimizing Impacts of Contaminated Runoff

Long-term Objective:
The goal of this measure is to reduce the input of sediment and roadway contaminates into the San Marcos River. In order to leverage existing investment from the COSM, the EAHCP will assist in completing two ponds currently under construction. Both ponds are designed for high pollutant load reduction and have been identified as a priority management strategy.

Target for 2020:
All activities and funds associated with this measure have been completed

Budget:
Table 7.1:
$0

Available budget for 2020:
$0

5.4.5 Diversion of Surface Water

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

Target for 2020:
Restriction of surface pumping as specified under the HCP. 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).

Methodology - 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 52 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.

Budget:
Table 7.1:
$0

Available budget for 2020:
$0

5.4.7 Diving Classes in Spring Lake

Long-term Objective:
Maintain the integrity of the ecology within Spring Lake through controlling access to Spring Lake in accordance to federal, state and local laws.

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

Target for 2020:
Implement the diving protocols as outlined in the Spring Lake Management Plan and the Edwards Aquifer HCP Incidental Take Plan with the following modifications: No more than 20 volunteer divers will be allowed in the lake per day, with not more than ten at one time.

Methodology - 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.

Budget:
Table 7.1:
$0

Available budget for 2020:
$0

5.4.8 Research Programs in Spring Lake

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 within Spring Lake through controlling access to Spring Lake in accordance to federal, state and local laws. All research activities in Spring Lake are governed by the Spring Lake Management Plan.

Target for 2020:
Implement the protocols for research as specified in the Spring Lake Management Plan and the EAHCP ITP.

Methodology - 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:

1. Name and contact information of the responsible party conducting the research,
2. Purpose and expected outcomes of the activities, including a description of how the project contributes to science,
3. 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,
4. Methodology, including literature review,
5. 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)
6. Expected impact, and
7. Timeline of Project

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.

Budget:
Table 7.1:
$0

Available budget for 2020:
$0

5.4.10 Boating in Spring Lake and Sewell Park

Long-term Objective:
Maintain the integrity of the ecology within Spring Lake and San Marcos River through controlling access to Spring Lake in accordance to federal, state and local laws. All boating activities in Spring Lake are governed by the Spring Lake Management Plan and the EAHCP ITP.

Target for 2020:
Implement the protocols for boating as specified in the Spring Lake Management Plan in support of the EAHCP ITP.

– Follow the below protocol for all boats (canoe, kayak, and paddleboards) used for educational activities, excluding glass bottom boats:

1. 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).
2. 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.
3. 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. 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.

Budget:
Table 7.1:
$0

Available budget for 2020:
$0

5.4.9 Management of Golf Course and Grounds

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

Target for 2020:
Continued implementation of the Grounds Management Plan and Integrated Pest Management Plan.

Methodology - the grounds will be maintained to meet the recreational function, yet in an environmentally sensitive manner. It is the responsibility of the Manager to maintain the 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) in a way that minimally impacts the environment. The IPM updated as needed by the Grounds Manager, in consultation with the Lake Manager and the Environmental Review Committee. The Grounds 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 Grounds Manager will report to the Lake Manager detailed information on maintenance activities and materials used during the year.

Budget:
Table 7.1:
$0

Available budget for 2020:
$0