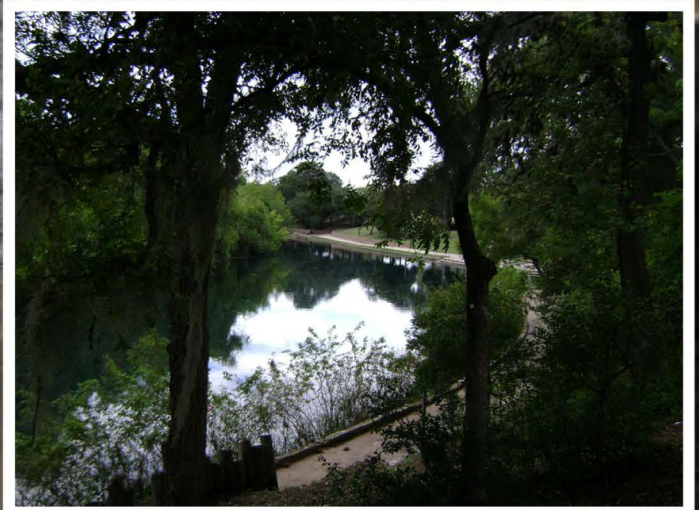


Initial Study on the Recreational Impacts to Protected Species and Habitats in the Comal and San Marcos Springs Ecosystems

Part 3





EARIP

Recreation Areas

New Braunfels

Comal County, Texas

Map Key

- Recreation Area
- Entry/Exit Area
- Tube Rental Locations
- Paddle Boat, Kayak, Canoe Rental Locations

Recreation Areas

Tube, Paddle Boat, Kayak, Canoe Rentals

NB.6

05501,100

Feet

OCT 2010

AVO 27520



EARIP

Recreation Areas

New Braunfels

Comal County, Texas

Map Key

- Recreation Area
- Entry/Exit Area
- Parks
- TCEQ Clean Rivers Water Quality Stations

Recreation Areas

Fishing

NB.7

05501,100

Feet

OCT 2010

AVO 27520



EARIP
Recreation Areas
New Braunfels
Comal County, Texas

Map Key

- Recreation Area
- Entry/Exit Area
- Parks
- TCEQ Clean Rivers Water Quality Stations

Recreation Areas
Wading, Lounging,
Playing, Rope Swing
NB.8

0 550 1,100
Feet

HALFF

OCT 2010

AVO 27520



EARIP
Recreation Areas
New Braunfels
Comal County, Texas

Map Key

-  Recreation Area
-  Entry/Exit Area
-  Parks
-  TCEQ Clean Rivers Water Quality Stations

Recreation Areas

All Uses
NB.9

0 550 1,100
Feet





OCT 2010

AVO 27520

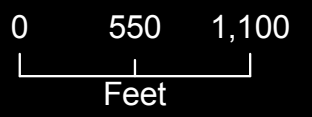


EARIP
Potential Wildlife Habitat
New Braunfels
Comal County, Texas

Map Key

-  Area of Potential Habitat
-  Parks
-  TCEQ Clean Rivers
-  Water Quality Stations

Potential Wildlife Habitat
Comal Springs Dryopid Beetle,
Peck's Cave Amphipod
NB.10



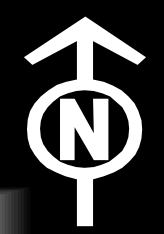
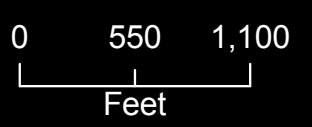


EARIP
Potential Wildlife Habitat
New Braunfels
Comal County, Texas

Map Key

-  Area of Potential Habitat
-  Parks
-  TCEQ Clean Rivers
Water Quality Stations

Potential Wildlife Habitat
Comal Springs Riffle Beetle
NB.11



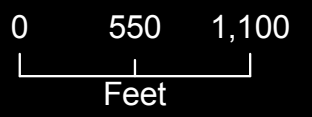


EARIP
Potential Wildlife Habitat
New Braunfels
Comal County, Texas

Map Key

-  Area of Potential Habitat
-  Parks
-  TCEQ Clean Rivers
-  Water Quality Stations

Potential Wildlife Habitat
Fountain Darter
NB.12





EARIP

Recreation Areas

San Marcos

Hays County, Texas

Map Key

- Recreation Area
- Entry/Exit Area
- Parks
- TCEQ Clean Rivers Water Quality Stations

Recreation Areas

Tubing

SM.1

0

500

1,000

Feet

OCT. 2010

AVO 27520



EARIP

Recreation Areas

San Marcos

Hays County, Texas

Map Key

- Recreation Area
- Entry/Exit Area
- Parks
- TCEQ Clean Rivers Water Quality Stations

Recreation Areas

Fishing

SM.2

05001,000

Feet

OCT. 2010

AVO 27520



EARIP

Recreation Areas

San Marcos

Hays County, Texas

Map Key

- Recreation Area
- Entry/Exit Area
- Parks
- TCEQ Clean Rivers Water Quality Stations

Recreation Areas

Kayaking, Canoeing

SM.3

0

500

1,000

Feet

OCT. 2010

AVO 27520



EARIP

Recreation Areas

San Marcos

Hays County, Texas

Map Key

- Recreation Area
- Entry/Exit Area
- Parks
- TCEQ Clean Rivers Water Quality Stations

Recreation Areas

Picnicking

SM.3

0

500

1,000

Feet

OCT. 2010

AVO 27520



EARIP

Recreation Areas

San Marcos

Hays County, Texas

Map Key

- Recreation Area
- Entry/Exit Area
- Parks
- TCEQ Clean Rivers Water Quality Stations

Recreation Areas

Swimming

SM.5

0

500

1,000

Feet

OCT. 2010

AVO 27520



EARIP
Recreation Areas
San Marcos
Hays County, Texas

Map Key

- Recreation Area
- Entry/Exit Area
- Tube Rental Location
- Kayak, Canoe Rental Locations

Recreation Areas
Tube, Kayak, Canoe
Rental Locations
SM.6

0 1,000 2,000
Feet





EARIP

Recreation Areas

San Marcos

Hays County, Texas

Map Key

- Recreation Area
- Entry/Exit Area
- Parks
- TCEQ Clean Rivers Water Quality Stations

Recreation Areas

Dog Parks

SM.7

0

500

1,000

Feet

OCT. 2010

AVO 27520



EARIP

Recreation Areas

San Marcos

Hays County, Texas

Map Key

- Recreation Area
- Entry/Exit Area
- Parks
- TCEQ Clean Rivers Water Quality Stations

Recreation Areas

Wading, Lounging

SM.8

0

500

1,000

Feet

OCT. 2010

AVO 27520



EARIP

Recreation Areas

San Marcos

Hays County, Texas

Map Key

- Recreation Area
- Entry/Exit Area
- Parks
- TCEQ Clean Rivers Water Quality Stations

Recreation Areas

All Uses

SM.9

0

500

1,000

Feet

OCT. 2010

AVO 27520

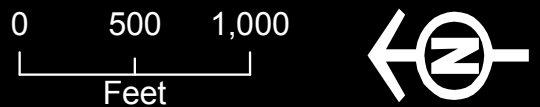


EARIP
Potential Wildlife Habitat
San Marcos
Hays County, Texas

Map Key

-  Area of Potential Habitat
-  Parks
-  TCEQ Clean Rivers
Water Quality Stations

Potential Wildlife Habitat
Fountain Darter
SM.10



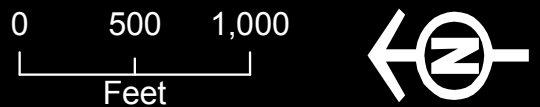


EARIP
Potential Wildlife Habitat
San Marcos
Hays County, Texas

Map Key

-  Area of Potential Habitat
-  Parks
-  TCEQ Clean Rivers
Water Quality Stations

Potential Wildlife Habitat
San Marcos Gambusia
SM.11



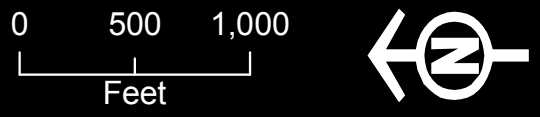


EARIP
Potential Wildlife Habitat
San Marcos
Hays County, Texas

Map Key

- Area of Potential Habitat
- Parks
- TCEQ Clean Rivers
Water Quality Stations

Potential Wildlife Habitat
San Marcos Salamander, Texas Blind
Salamander, Comal Springs Riffle Beetle
SM.12



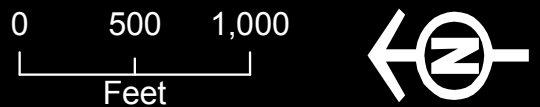


EARIP
Potential Wildlife Habitat
San Marcos
Hays County, Texas

Map Key

- Area of Potential Habitat
- Parks
- TCEQ Clean Rivers
- Water Quality Stations

Potential Wildlife Habitat
Texas Wild-rice
SM.13



OCT. 2010 AVO 27520



APPENDIX B: EARIP Interviews 6/30/2010 NEW BRAUNFELS

	NB-1	NB-2& NB-3	NB-4	NB-5	NB-6	NB-7	NB-8
1. What are the peak times of recreation use: days, seasons, months, holidays, hours?	Peak times 1-6 pm. Saturdays heavier than Sunday unless it is a holiday weekend.	Rent tubes/allow kayak on property – let tubers *** on shuttle back to drop in point. 1/1 weekends – week before Monday – close Labor Day. Holidays busiest. July/May busiest months. (10a.m. – 5p.m. July – close @ 8p.m.	Year round open -- Memorial Day to Labor Day. River used anytime school is out and weather is warm. Memorial Day was over crowded. Canyon Lake was at right level in January, which guaranteed continue flow at 300cfs throughout the summer on Guadalupe River. Last 2 seasons there was 60 cfs flow (slow), now good flow is 200 cfs for good tubing on Guadalupe	Herron Island closed to vehicle traffic (weekends during Memorial/Labor Day) No need to restart times of use.	Memorial Day to Labor Day, primarily weekends, during afternoon hrs.	April thru first of September with peak useage on two holiday weekends	
a. How many people are using the river at these times?			Heat, drought, crowding made last year rough.	Hinman Island Drive 16 th and 17 th Lots of trash blows in from River area. Noise from adjacent foot traffic toward golf 18 th fairway has stray golf balls into parking lot. Not enough parking for patrons.	Per typical peak season weekend: Comal – 3,000 – 5,000; Guadalupe in city limits 500 – 2,000	Unknown as the fee is not broken out by river. In one year the total in the City Limits between the rivers was 187,000 Divided by the 110 days of season is about 1700 people per day split between 10+ miles of rivers	
b. What areas of the river see the highest amount of use?	Hinman Island to last tubers exit				Comal: Hinman Island to last exit; Guadalupe: Gruene Bridge to Cypress Bend Park Exit	Those with free entrance	
2. Should there be restrictions on times of use or hours of use?					Daylight hours only – safety factor	You can legally limit public property access but not private So use of the river cannot be restricted by State Law	No
3. Does use have any correlation with water flow or river levels?	Comal River is almost constant flow. Guadalupe river varies with season and year. When Guadalupe River has low flow, tubers switch to Comal River.		Perception people have of water flow – flood is worse because visitors think it is unsafe.	POS visual beauty of river adjacent to golf course, wonderful experience. Small % of golfers use river.	Use increases with CFS flow > 150. Declines when <750 CFS	Use is limited based on too much or too little flow and limits to public access, however, State Law supersedes and enables access to all Texans unless under a Declaration of Disaster	Yes. This user recirculates the river water, and there was a time in the 1980's that the river was low enough to cause concern about availability to recirculate the water. But in general, what occurs on one part of the river, or rivers, affects use on the other parts. For example, a flooding event on the Guadalupe River might have a negative affect on the Comal because visitors would think both rivers had been damaged in the flood. The New Braunfels Chamber recently did a study that indicated that the City lost over \$1 million of potential business each day as a result of the recent flood.
4. Can recreational activities on the river continue at current levels of activity?	#'s in park are highest. Lots of wear and tear in park. Picnic areas are always at or beyond capacity. City trying to limit # of people who rent pavilion areas, and also breaking rental units up into smaller components (Dance Slab only rented with Area #4).			Fishing; tubing; camp out; swimming;	Yes	Price point dictates volume, behavior, and resource support.	Yes
a. Why or why not?	Trying to use capacity of restrooms to determine maximum number of people who can be in an area, or when to rent porta-potties. City needs to update picnic ordinances (killing grass, stopped up restrooms) Real solution is to develop Fisher Park. Spring Fed Pool, Hinman Island.				Very limited already due to summer vacation schedules. Basically 20/30 days/afternoon per year for peak use.	The above and State Law says it belongs to Texas Citizens	Activities have occurred on the river for years and the habitats are surviving and thriving.



APPENDIX B: EARIP Interviews 6/30/2010 NEW BRAUNFELS

5. If arriving at the river by vehicle, where do people park (private lots, owned by recreation outfitters or other private lots? Street? Public park?).	All outfitters run shuttles, All outfitters at Prince Solms across street.				Designated lots by city ordinance. Businesses/outfitters provide majority of space.	Satellite lots and shuttled in, small on street parking, and public owned lots	
a. Do the majority of recreational users use commercial shuttle buses and are those desirable?	Shuttle 50/50 tube rental vs. bring own tube. Circle Arts parking lot allows parking. Elizabeth Street parking lots used by picnickers.				No. Trend is for private equipment/tubes and non-use of outfitters.	70% use outfitters and 30% or less have the ability to access public locations or public parking. Outfitters shuttle 20% of private equipment users	
b. How many people (or what percentage of people) arrive at river tubing/raft launch locations by private vehicle versus shuttle bus?					60 private/40 shuttle	15%	
c. Is one method of arrival preferable over the other?					Prefer all shuttle	Shuttle is preferable	
6. Do most users access / launch from public/city owned property or private property?					Public	On the Comal – public 50% Private 50% (including Texas Tubes and Wurstfest) On Guadalupe all access via Private Property with one publicly owned exit on the Guadalupe	Most of the users form this providers facility enter and exit the river on this user's property.
a. Please list all known points of access and launching.	Hinman Island, Prince Solms				Comal: Wurstfest grounds, Hinman Island, Prince Solms Park/Tube Chute	Comal – launch at Wurstfest, Texas Tubes, Hinman & Prince Solms as well as from Resort properties that line the Comal River. Guadalupe launch from private property	
7. Do most users exit the river at public/city owned property or private property?	Public				Public	70% public exit on Comal and 30% private. On Guadalupe 100% launch private and 35% exit public	
a. Please list all known points of exit.	Last tubers exit (Union St.) Garden Street Tube Chute Gruene Bridge @ Cypress Bend Park (Guadalupe River)				Comal: Last exit & Union St. & Garden St. Guadalupe: Gruene Bridge or Cypress Bend Park	Resort Properties, Rockin R, and Last Public Exit on Comal, Guadalupe – private property and Cypress Bend or River Acres	
8. What recreational activities other than tubing, rafting and fishing occur along the river?	Tubing/swimming majority on Comal. Scuba diving. Swift water training at tube chute during off season. Socializing, wading, water play, drinking, grilling Off season: swift water rescue training Difference between tubers and picnickers – picnic and barbeque all day. No open containers in Herron Island Park	Picnicking Nefarious activity		picnicking	Camping along Guadalupe. Comal is primarily Surstfest Grounds, City property and Schlitterbahn before private residences. Not much camping along comal except across Wurstfest grounds.	Scuba, Swift water rescue and triathlon training on Comal, Fishing, Kayaking, and rafting on the Guadalupe	
9. What specific locations are most frequented by these other users?	Hinman Island, Prince Solms, Landa Park	Picnicking at Wurstfest & parks Wading at parks Nefarious activity up stream from Wurstfest		Hinman Island	Gruene	Tube Chute and Hinman Island	The new channel



APPENDIX B: EARIP Interviews 6/30/2010 NEW BRAUNFELS

10. What are the positive aspects of recreation on the river?	Rivers are best of what NB know for, character, notoriety. Reason was settled. Positive on the economy	Economics – employment for young people, education for young in town (31 employees) **** large part of business is visitors. *****		Nice backdrop for the golfcourse	Outdoor enjoyment, fresh air, relaxation, cool water	Tourism generated 469.7 million dollars to the New Braunfels economy in 2009.	Positive impacts to local economy; job creation, pleasure or recreation in natural setting.
11. What are the negative aspects of recreation on the river?	Behavior/mess and trash/infrastructure needs re-investment (the stairway going down to the Tube Chute needs a face lift) Parks are at overcapacity/degradation of parks, landscape	Kayakers stop at their property without paying	70% of trouble on the river is alcohol related	Trash on the golfcourse that is carried in by wind	Sunburn, dehydration	Same as at any major attraction with high visitation – litter and behavior	River has to be managed. Police it, preserve it, maintain it.
12. How important are river-based recreational activities to the local economy?					Water is the brand of New Braunfels. Impacts entire economy of tourism, even those not water-related.	Huge – they are the anchors to our community from a heritage point of view, a cultural point of view, industrial relocation, as well as quality of life – besides being the “only place in Texas” anchor for our number 1 industry – tourism – as it has been for over 150 years.	VERY
a. What are its contributions: i.e. sales tax, property taxes, other taxes/fees, spin-off businesses (related revenue sources for the city)?				Convention \$: some people golf, some people tube		According to a recent study done by Impact Data Sources – 469.7 Million in 2009, employed 5181, another 1798 indirect jobs, paid over 70-.3 million in local wages and supported another 51.5 Million in wages to indirect workers. Hospitality industry paid over 10.5million in taxes and other revenues to the City of New Braunfels and in total contributed 13.7 million in taxes and all local taxing districts.	
b. How much does recreation activity contribute to the local economy? (in \$ or % of city revenue)		Lots of restaurants, souvenir shops, etc. Water 72-degrees year round; people use water year round.	River makes it desirable as a backdrop and as an attractant.		\$12 million annually direct to tax rev. contribution/economy. Indirect - \$1 Million per day if not operating.	\$469.7 million in 2009	
13. What is your perception of the level of enforcement on the river? Too much, not enough? Why?	Enforcement in fluid situation – changes every day, every year. More people, more behavior issues. 3 to 5% of visitors cause trouble – 1/2 of them for New Braunfels (less than River Walk) Attraction-based leisure visitation. The River has been an attraction for over 125 years. Hard to enforce so many rules.	Locking lid requirement for coolers is good. The size restriction limitation is bad.		Good as it is. Police Dept. does good job at keeping rowdy people off (golf) course.	Anouth. Has been consistent for several years – needed.	Admirable and good Why? Courteous and proud of our community.	Fine as is. July 4 th holiday seemed to be a little overstaffed, but other than that is OK.



APPENDIX B: EARIP Interviews 6/30/2010 NEW BRAUNFELS

14. Is the amount of regulation with regards to activities on the river acceptable? Should there be more? Or less?	Alcohol is an issue. Hard to enforce all rules. Park rangers not certified peace officers, hey collect picnic fees. Can't legislate stupidity; price point dictates everything; value correlates with expectations	Too many regulations to be enforced. Cooler law increases # of tubes b/c of limit of cooler size and limited # of coolers per tube. City occasionally closes river due to bacteria due to overcrowding (but not public access points) Union Street is better exit point (free) Garden Street is smaller, less developed exit point. Entrance at **** no regulation to dropping off tubers.	Alcohol causes 70% of problems on river. Mob mentality; legal to drink. Visitors are slobs, they litter and they have basic disregard for environmental responsibility. Enforcement difficult with large masses or people.	Better regulation/reduction in alcohol use.	No more. Just right.	Yes Should there be more? Or less? No more – price point dictates behavior, demographic, etc...	Fine as is, but maybe a little over regulated. Some ordinances seem to be attempts to control issues that no longer exist. Regulations need to be periodically reevaluated for applicability.
a. Are there certain things that should be regulated that aren't currently?			Editor of local paper called for a ban of alcohol on the river		Access points aren't managed - controlled	No	
b. Are there certain things that are currently regulated that shouldn't be?					No	Maybe	
15. What is your perception of the level of maintenance? Too much, not enough? Why?	Pay company to scuba dive and clean river. Trash is big issue. Litter contract to clean parks and separate contract to work river edge. River fund contributes to this (in addition to other river management issues).	OK as is; Trash Fest in October at end of the summer season, and another night after Labor Day and small ones through out season			Good. Consistent last 3 years with new river manager	Infrastructure needs some help...	Acceptable
16. Are there operational issues with regards to emergency flood situations?	Fees – \$1.25 for every tube that's rented goes to river fund litter bags, litter pick-up, the Watershed Program Manager's salary, police overtime, and ½ of a Park Ranger salary. Study done 2 years ago about river recreation impacts to economy. Overall impact positive, but not as great as people thought.				None	Our community takes care of itself and always has.	
	Additional notes: regulating alcohol is an ongoing contentious issue		Additional Notes: NBU has waster water plant that has flooded 3 times in last 12 years. Unnecessary contaminate; 100 yards away is land above 100 year floodplain				

APPENDIX C: EARIP Interviews 6/29/2010 SAN MARCOS

	SM-1	SM-2 SM- 3	SM-4, SM-5, SM-6	SM-7, SM-7	SM-8	SM-9	SM-10
1. What are the peak times of recreation use: days, seasons, months, holidays, hours?	Long weekends and in general: Memorial Day to Labor Day/Kids out of school/would start during Spring Break, but didn't happen this year because no bldg. (at Lions Club). Rio Vista Dam brought new group to the city. Very popular with visitors – not allow pop up tents or barbecue pits on Cheatham Street side of River. Limited space for people to get out of river w/tents and pits in the way there at Cheatham Street.	Sat/Sun in the Summer Canoes & kayaks 9pm-9am during tubing months to avoid conflicts	11 – 4 pm on weekends for tubers. Lots of kayakers in the off season. .Kayakers allowed at Rio Vista Falls after 10 p.m. and before 9 a.m. Last Lion's Club shuttle at 7p.m.. Lions Club dictates when season starts (1-2 weeks before Memorial Day.)	Canoeing in early May & September. All during school year when weather is nice people are at Sewell Park (TSU).		<i>Weekends, summer time, June-early August, especially holidays, noon-4 pm</i>	
a. How many people are using the river at these times?	There have been tube counts, Melanie has some of these. Weekends highest use.	+/- 3400 people/year on river in kayaks. Boaters/swimmers #'s dwindling. Majority of users are tubers/waders, but also a lot of people on the shore barbecuing and waiting on bus.	Jack has counts of people on river. 2005 tube rentals: 29,829 (May- Sept)			<i>I don't know, but either the numbers or the practices indicate too many.</i>	
b. What areas of the river see the highest amount of use?	Rio Vista; Sewell Park	Launch @ City Park and pick people up 7 miles out of town. Swimming by Salt Grass Restaurant (former Ice House)	Ducky Derby – Duck Raffle; Occasional big raft w/rafting groups; kayak events 2 times/year (kayak basketball or rugby) Cables are installed at Rio Vista from Oct thru Feb for kayak events.		Rio Vista	<i>City Park and Rio Vista (bank users) and from city park to Rio Vista (tubers)</i>	
2. Should there be restrictions on times of use or hours of use?	Restrictions on alcohol use have been suggested, but might not be good for city because of actual volume of alcohol sales.	No restrictions on times of use		April – May for this park. 10 a.m. – 6 p.m. Outdoor center closes @6 pm. "Thug" community comes out at 6 pm	No issue w/ current hours restrictions	No	
3. Does use have any correlation with water flow or river levels?	Float time varies with river flow. 45 minutes to 1 hour depending on amount of flow.	River is hardly used in winter months, except by kayakers (Nov-May). Water flow has no real impact on # of users. If Guadalupe River slows down, and/or Comal gets too busy, San Marcos River use increases.	City has low flow/high flow #'s. Melanie has city counts. Katherine Nichols has #'s posted on website. TX State has done studies. Geography Dept has done counts. 50 – 60% of tubes are Lion's Club tubes	More a correlation with Weather than water flow. If Guadalupe floods, will see more users on the San Marcos		<i>No, not direct river use. Aquifer use does.</i>	
4. Can recreational activities on the river continue at current levels of activity?	Tubing is limited by having only one tubing vendor	Too many tubers in river spoil experience for other users. Yes ...see a. below	Appendix in Master Plan discusses overcrowding issues and encroachments on bank at Rio Vista by shore users; lack of signage or bad signage		No issue with # people on river, don't want any limitations.	<i>Yes it can, but</i>	
a. Why or why not?		With good rules, good patrol, good park maintenance Huge increases would be detrimental to everyone's enjoyment				<i>Yes it can, but the quality of water and parks will continue to be degraded at this rate. If we wish to see the quality of water and parks maintained or even enhanced then something has to give. Either the recreational activities, including the sheer number of users, or the practices of recreational users must change. I'd prefer that it be done by creating a culture of respect and stewardship of the river, rather than totalitarian regulations. I believe this can be achieved, but then again I have full faith in my fellow man and woman.</i>	
5. If arriving at the river by vehicle, where do people park (private lots, owned by recreation outfitters or other private lots? Street? Public park?).	Parking is an issue; not enough	'I do not think we should building parking lots anywhere near the river to accommodate river use. Having people park in university parking lots on the weekend and getting shuttled to the river is a good idea. Those parking lots are basically empty except during occasional special events. This would require an interlocal agreement with the university.	Street & park parking	Parking is an issue in County. Lots of people parking illegally on campus property. (no public parking at TSU) Crowding/traffic		<i>City parking lots (public parks)</i>	<i>Parking is always an issue. Will change configuration of parking around the river corridor; purchased 3 trolleys from Austin to move people between hotels. Could use as a pilot program to move people around.</i>
a. Do the majority of recreational users use commercial shuttle		Blue Bus. Shuttle around (leased bus for Lions Club.	Majority use trails along the river to repeat tube float		Springtown Shopping Center is vacated; could be used for remote	<i>No. Most people drive. Even those that use commercial shuttle buses</i>	

APPENDIX C: EARIP Interviews 6/29/2010 SAN MARCOS

buses and are those desirable?					parking and shuttled to the river.	<i>drive to get to the river and then they get a shuttle back to their car. I'd prefer that those who are able bodied walk back to their car. It's about a 10-15 minute walk.</i>	
b. How many people (or what percentage of people) arrive at river tubing/raft launch locations by private vehicle versus shuttle bus?						<i>I don't think that the person who wrote this questionnaire lives in, or understands how people use the San Marcos River. Again, the majority of people drive to the river. Then some people tube the river from City Park to Rio Vista. Then some of those people take a shuttle back to their car, which again is parked at a city park parking lot.</i>	
c. Is one method of arrival preferable over the other?						<i>Walking and/or riding a bicycle. Driving to the river is kind of like shitting in the river.</i>	
6. Do most users access / launch from public/city owned property or private property?	Parks & University	Most use public property to launch	90% of users launch at City Park and take out at Rio Vista. City will eventually have designated in and out locations				
a. Please list all known points of access and launching.	Sewell Park, City Park, Dog Park(San Marcos Plaza), Don's Fish Camp (tube rentals)	City Park	City Park			<i>Public. City parks and university property.</i>	
7. Do most users exit the river at public/city owned property or private property?	*** Outdoor Center has kayak week at Rio Vista Falls to teach kayaking						
a. Please list all known points of exit.		Beyond city limits	out at Rio Vista		Other than Rio Vista: Cape's Camp and Don's fish Camp, Hwy 123, Redwood	<i>City parks.</i>	
8. What recreational activities other than tubing, rafting and fishing occur along the river?	Swimming/kayaking/canoeing	Wading, Swimming, canoeing & kayaking (3400/yr), dog play, picnicking, Running, wading, sitting and staring. Used to be diving but now too shallow	Kayak, canoe	Picnicking & glass bottom boat tours	Water lounging (chairs in the river/drinking/eating) Special Olympics and junior Olympic kayak trials, veteran's rehabilitation program	<i>Well, swimming constitutes the highest percentage of all uses. There is also the praying, the drinking, the snorkeling, the thinking, the watching, the eating, the singing and the living.</i>	
9. What specific locations are most frequented by these other users?	Outdoor Center has kayak week at Rio Vista Dam to provide kayak instruction & kayak course	Spring Lake Dam/Icehouse (swim), wading @ Rio Vista, dog play at Dog Park (San Marcos Plaza)	Kayak slalom in October Canoe Race from Aquarena City Park to Rio Vista	Picnics & glass bottom boat tours at Spring Lake	Above occur at Rio Vista	<i>All city and university parks.</i>	
10. What are the positive aspects of recreation on the river?	Tourism; enjoy beauty of river. Constant 72 water temperature. November – March	Positive: exercise, being in nature, economic good, creating an appreciation for nature and the river will help protect it (stewardship) No restrictions on times of use.		Spring Lake recreation is good because it frames the golf course		<i>The re-creation of ourselves</i>	Health/wellness of community; Quality of life; more families to river together, sense of community, increase use increases care stewardship of river
11. What are the negative aspects of recreation on the river?	Trash; parking shortage; more traffic; perception of gang activities because of sports wear.	Not a lot of funds to clean up/maintain river, so nip it in the bud. Erosion on the banks, litter, damage to endangered species, loud obnoxious boom boxes, smell of smoking, cars congestion, bad language, dog feces	Water safety problem – people do un-smart things. More warning signs? More education. People don't pay attention. Provide a video to show users various features along the river. Not Schlitterbahn – natural river that changes daily. Have users understand (not a man made environment. Naturally flowing stream.)			<i>The lack of respect and stewardship, or culture, leads to all of the negative aspects of river usage. This leads to trash, degraded banks, ripped up stands of Texas wild-rice, loud music, fist fights, dog poop, point and non-point source pollution.</i>	Population growth has issues; lewd acts, illicit & nefarious activities, Flow of water over falls and currents that people aren't prepared for. EMS response/access and /crowd control/management. Too many people: sanitary issues



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			Crowding issues including pop-up tents & too many barbecues Not enough facilities: restrooms				
12. How important are river-based recreational activities to the local economy?		Recreational aspects are important to the economy, but not driving factor. Politicians should realize this and help to keep river nice. 900k/year to maintain river use in New Braunfels is not effective. Fairly important but there are a lot of costs to patrolling and keeping the river clean, and the additional congestion to city streets (probably a wash)		It is the setting for TSU and students are attracted here because of it. River is a draw for Golfers			
a. What are its contributions: i.e. sales tax, property taxes, other taxes/fees, spin-off businesses (related revenue sources for the city)?	Restaurants/bars close to river. (Herbert's on Riverside Drive)			River recreation is a desirable feature to economics and quality of life, if not able to quantify amount. Tom Keys, Wal Mart busy w/visitors to his camp. Water Safari – Starts at Aquarena Springs and to the coast. 6, 4, 3 solo teams. Several thousand people buy gas, stay @ nearby lodging, etc. .		<i>I don't know the numbers, but you can attribute every single dollar that I've ever spent in this town to the river.</i>	
b. How much does recreation activity contribute to the local economy? (in \$ or % of city revenue)	A lot, but hard to calculate improvements to river are starting to generate businesses year round.		Lion's Club gives \$110-125k/yr to local charities. That amount again for training staff to help tube business. TSU geography dept may have studies (Michael Ravel) (geography dept: Richard Earl)	Quality of life facility attracts people to move to the area.		<i>I would imagine a large amount, but I don't know.</i>	Not major economic draw, but a reason for people to come. One of top 10 reasons to come to town.
13. What is your perception of the level of enforcement on the river? Too much, not enough? Why?	OK w/current, but more OK. A 'surcharge' for river maintenance would be OK.	About right in town, too little east of the interstate.	1 full time park ranger. More part time staff (rangers) along the river during peak season. Have off duty police officers and use volunteers. All EMT certified.		Enforcement not really an issue	<i>I've never seen an officer cite someone for littering, yet I see trash at all parks all the time.</i>	Law enforcement – add more officers/enforcement each year.
14. Is the amount of regulation with regards to activities on the river acceptable? Should there be more? Or less?		It would be great to regulate the use of Styrofoam, glass, aluminum, and plastic bags in and around the river. It would be great to keep dogs out of the SM river within the city limits. It would be great to have a designated area for BBQing that was not to close to the river. It would be great to limit alcohol consumption in the river and parks within town. I'd also be in favor of eliminating loud music – but that is probably not possible.		No, Be careful about restricting recreation on river because users need to learn about the river. Save the wild rice, but don't prohibit use of the river as a recreational resource.			Ensure that there is order and safety, but not ever regulate. Stabilizing banks at City Park and at Rio Vista could help disperse crowds better
a. Are there certain things that should be regulated that aren't currently?		Better litter control/laws needed. Better regulations on type of containers that food/drinks are stored in. Tubers have more impact to environment than swimmers or canoers. No BBQ pits close to river at Rio Vista Dam. Pull them away. Looks like Woodstock. Dangerous for coal disposal. Dog Beach good for dog owner use – but no designated dog area. Dogs are supposed to be on leash. Alcohol is big cause of problems along river. Regulations are administered well with current regulations. Need more trash pick up: would be ice to park rangers or volunteer rangers in the river in canoes going up and down the river on weekend s picking up trash and reminding tubers of the litter rules.	Eliminate alcohol in river and in parks. Make it a family friendly river. City caters to families.	Limit # of people at Rio Vistsa; Limit # of people at Sewell Park; Limit # of people at Lion's club tube rental. Limit access to spring Lake – Texas river safari already limits access to Spring Lake, scuba diver are all people allowed in the lake.		<i>No Styrofoam. No pop-up tents within 100' of the river. No bar-b-q pits within 100' of the river. No loud stereo systems.</i>	Provide more access points to disperse the crowds. More public access and****.
b. Are there certain things that are currently regulated that shouldn't be?	Don't understand concern w/saving natural organisms	Limit dog areas More stringent litter laws				No.	Alcohol on the river may be an issue.
15. What is your perception of	More would be good. Better manage	Never enough; too much trash	More funding needed for	Maintenance – good job w/yearly		<i>Not enough.The University has</i>	Perception that dredging should



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the level of maintenance? Too much, not enough? Why?	floating islands of debris.		maintenance and cleanup along river. Trash; bbq coals/pup up tents are an issue. Pop up tent overcrowd access points to river and cause conflicts with tubers and swimmers.	cleanups all the way to Gonzalez, but not enough funding. Numerous small cleanups on upper river are good idea. Better control of use and abuse of river – more funding. Volunteers make it a lease viable. Too much trash along the shores – more control in this area would be good. Ban glass bottles on river. Container deposit would be a good idea. with more education. Limit alcohol		<i>removed a trash can from the headwaters. Trash cans should also be located 100’ from the river. The city and university should also abide by storm water protection standards and practice erosion control.</i>	resume to keep flows to where they used to be. People don't trust science or understand it (dredging the river & it's positive and negative impacts).
16. Are there operational issues with regards to emergency flood situations?	Dams control a lot of severe floods.					<i>The university should regularly clean the silt out the retention ponds on Sessom’s creek so that this sediment doesn’t continue to be deposited into the river at times of flooding.</i>	Well prepared for floods/****. Well invested in the facilities More wild****
	Additional Notes: Nobody taking initiative w/signage along the River. “Everything” is about the experience of tubing on the river.	Having some informational/ warning signs around the wild rice areas would probably be a good idea.	Additional Notes: Mem. Day – Labor Day – TIBH Easter Seal Group 1 – 9 p Sat/Sun pick trash & empty trashcans. City removed over 60 cubic yards of trash at Rio Vista Dam during memorial day 2010. Provide “boat trash cans” in river to throw empties in. Parking is a huge issue due to shortage of available spaces. Issue more extreme of the extremities of park areas. Parking out of neighborhoods is a good thing. Restrooms are an issue. Drinking fountains are concern as well, and are a big issue during heavy use period of the year. Need to seek balance for demand. Changing rooms needed as well. Lion's Club will have better location.	Additional Notes: Land owners fill stock ponds w/river water and claim it is for domestic use (Smith Ranch) San Marcos River Ranch uses river water to fill lakes on site	Additional Notes: Education Center. Off Site Parking? What about entity?		Additional Notes: Rehab – for veterans coming back from war & folks with disabilities. Junion Olympic trials (kayak)

Appendix D: USGS Water-Quality Assessment of the Comal Springs Riverine System, New Branfels, Texas, 1993-94



Comal Springs of Central Texas are the largest springs in the southwestern United States. The long-term average flow of the Comal River, which essentially is the flow from Comal Springs, is 284 cubic feet per second (ft³/s). The artesian springs emerge at the base of an escarpment formed by the Comal Springs fault. The Comal River (fig. 1) is approximately 2 miles (mi) long and is a tributary of the Guadalupe River. Most of the Comal River follows the path of an old mill race, here referred to as New Channel, then flows through a channel carved by a tributary stream (Dry Comal Creek), eventually rejoining its original watercourse. The original watercourse, here referred to as Old Channel, has been reduced to a small stream, the source of which is water diverted from Landa Lake and several springs in

the channel. In addition to being an important economic resource of the region, the springs and associated river system are home to unique aquatic species such as the endangered fountain darter (*Etheostoma fonticola*). The Comal Springs riffle beetle (*Heterelmis comalensis*), which exists in the springflow channel upstream of Landa Lake, has been proposed for listing as endangered. The Comal Springs dryopid beetle (*Stygoparmus comalensis*) and the Peck's cave amphipod (*Stygobromus pecki*) are two subterranean species associated with Comal Springs also proposed for endangered listing.

The population in the region has increased 20 to 30 percent per decade for the last 3 decades. This increase in population has correspondingly increased the use of both surface- and ground-

water resources in the region, which in turn has prompted concern for habitats of endangered species that depend on the spring water. To better understand the environmental needs of threatened or endangered species, the U.S. Fish and Wildlife Service (USFWS) undertook an intensive ecological assessment of the Comal Springs riverine system. One component of the study involved the effects of varied springflows on water chemistry and aquatic-species habitat in the riverine system. For that study component, the U.S. Geological Survey (USGS) provided continuous monitoring of selected water-quality properties and collected discrete water samples for analysis at selected sites along the Comal Springs riverine system. The purpose of this fact sheet is to summarize the principal results of the USGS water-quality monitoring, sampling, and analyses for selected properties, major ions, nutrients, trace elements, and pesticides during selected periods in the summer and winter of 1993–94. Only high flow (greater than 300 ft³/s) occurred during the monitoring periods; therefore, effects of lesser flows on water quality were not measured. Data collected from this study and subsequent monitoring

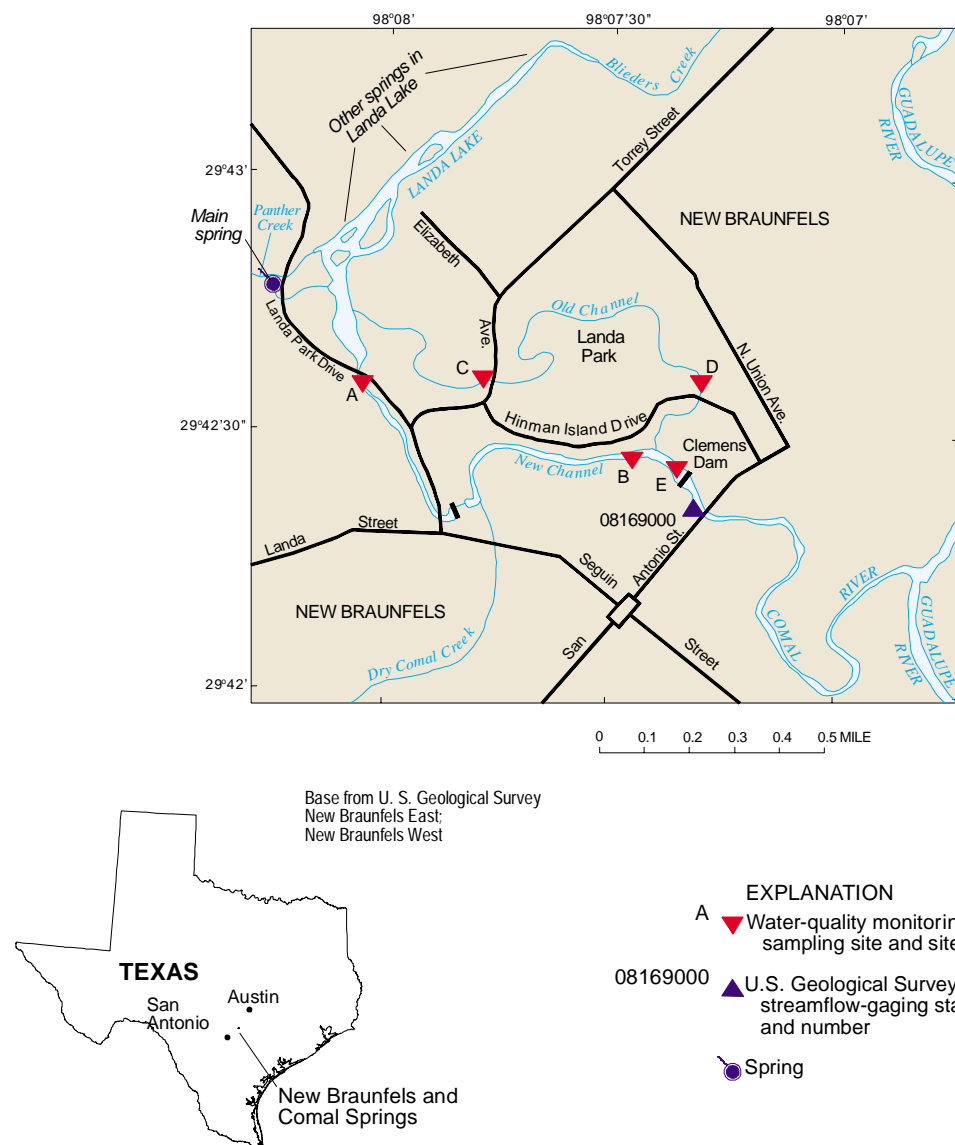


Figure 1. Comal Springs riverine system, New Braunfels, Texas.

can be used to evaluate instream flow habitat requirements of the fountain darter and other aquatic species.

During the monitoring periods, the New Channel received approximately 92 percent of the total volume of springflow by way of Landa Lake. New Channel has a uniform stream channel and higher velocities than Old Channel. In the upper reach of New Channel, west of Landa Park Drive, stream velocities are lowest and the bottom is predominantly large gravel and cobbles. In the lower reach, from Landa Park Drive to Clemens Dam, the velocities are highest and the streambed predominantly is bedrock and large gravel. In contrast, Old Channel received about 8 percent of the total volume of springflow. Old Channel has the meandering characteristics of a natural stream. In the upper reach of Old Channel, from Landa Lake to Elizabeth Avenue, are intermittent riffles and pools and a streambed of silt and assorted gravels. Downstream of Elizabeth Avenue, the stream mostly comprises slow runs and pools with very little riffle habitat; water velocities are minimal and the water appears turbid. The streambed is mostly coarse sediment and mud.

Collection of Water-Quality Data

Site selection and data collection were designed to evaluate physical and chemical properties of the riverine system. Five sites were selected for monitoring the upper and lower reaches of the two stream channels. These sites were evaluated to ensure uniform mixing of water and that monitoring points were representative of the sites. Two sites were selected on New Channel. Site A is at the Landa Lake outfall into New Channel. This site

represents the start of the riverine system and a composite of the spring-fed lake waters. Site B is immediately upstream of the confluence of Old and New Channels. This site was selected to monitor changes to water chemistry that might have occurred as water passed through New Channel. Within Old Channel, two sites also were selected. Site C is immediately upstream of Elizabeth Avenue and represents a composite of spring-fed lake water as it enters Old Channel. Site D is on Old Channel upstream of Hinman Island Drive and the confluence of Old and New Channels. Data from site E, downstream of the confluence of the two channels and on the Comal River immediately upstream of Clemens Dam, represent the cumulative effects of Old and New Channels.

The properties of pH, temperature, specific conductance, and dissolved oxygen were monitored continuously during selected periods in the summer and winter of 1993–94. Continuous monitoring of water properties required use of a four-parameter monitoring probe, which was connected to a data storage device and powered by a solar battery. The sites are inaccessible and required use of portable, self-contained floating shelters. To ensure data quality, the instruments were calibrated before and periodically during operation. Monitors measured and logged parameters at 30-minute intervals for periods of 3 to 8 weeks, depending on the site. Property data at the New Channel sites were monitored in the summer from August 20 to September 20, 1993, and in the winter from January 4 to February 3, 1994. Property data at the Old Channel sites were monitored in the summer from June 30 to August 18, 1993, and in the winter from

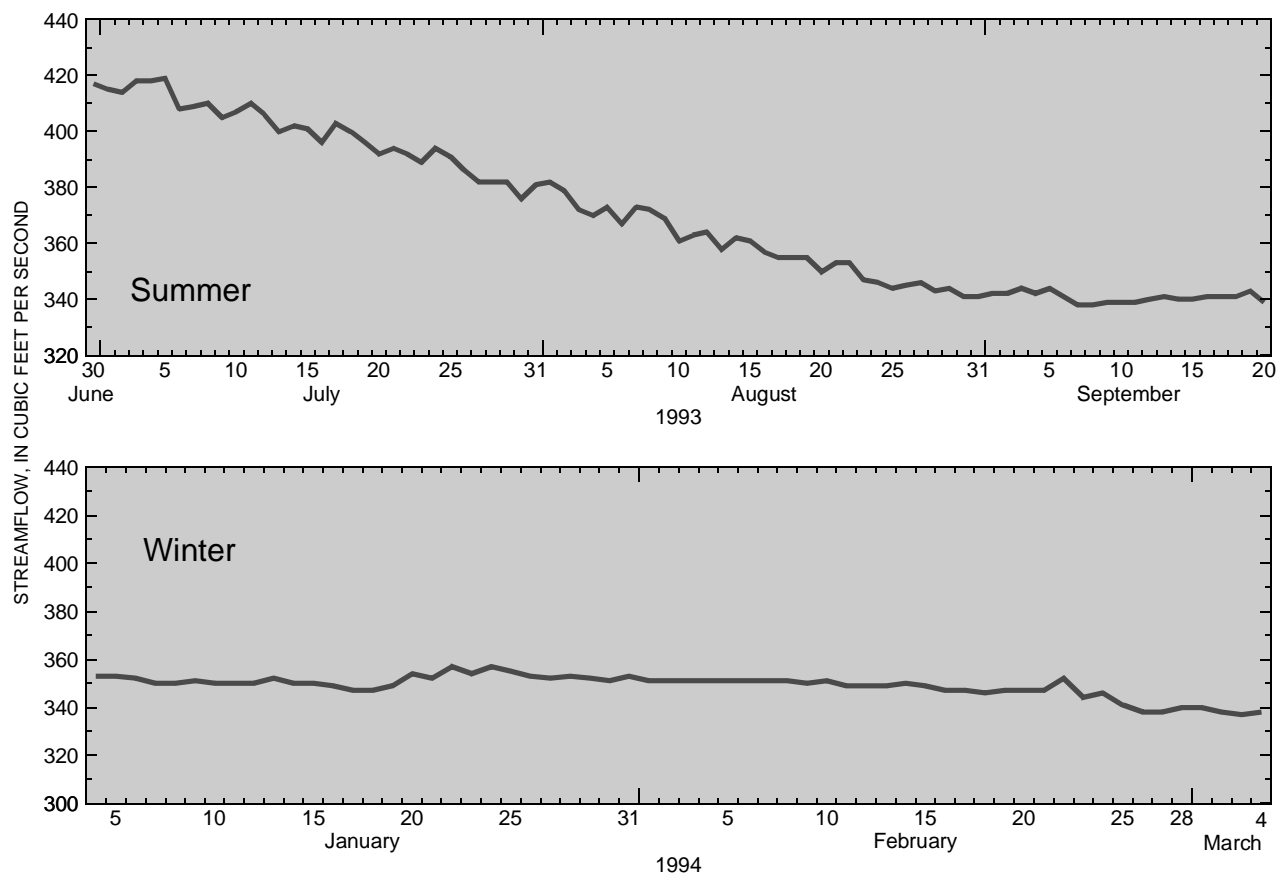


Figure 2. Daily mean streamflow, Comal River at New Braunfels, Texas, during water-quality monitoring periods, 1993–94.

February 7 to March 4, 1994. Property data at the Comal River site were monitored during all four periods. Periodic water-quality samples were collected at each of the five sites. Samples from New Channel and the Comal River were collected near the end of the monitoring periods on September 20, 1993, and February 3, 1994. Samples from Old Channel and the Comal River were collected on August 20, 1993, and March 3, 1994. Samples for major ions, nutrients, and trace elements were collected using a depth-integrated method at multiple intervals along the cross section, then composited. Samples for pesticides were collected using a depth-integrated method at a single interval at the midpoint of the stream.

Streamflow

Continuous stream-flow data (fig. 2) were collected from USGS streamflow-gaging station 08169000 Comal River at New Braunfels during the water-quality monitoring periods. Initial daily mean streamflow of the Comal River for the summer monitoring period was 417 ft³/s on June 30, 1993, and ending streamflow was 339 ft³/s on Sept. 20, 1993. A peak flow of 419 ft³/s occurred on July 5, 1993, and a minimum flow of 338 ft³/s occurred on Sept. 7 and 8, 1993. Initial daily mean streamflow for the winter monitoring period was 353 ft³/s on January 4, 1994, and ending streamflow was 338 ft³/s on March 4, 1994. A peak flow of 357 ft³/s occurred on January 22 and 24, 1994, and a minimum flow of 337 ft³/s occurred on March 3, 1994.

Water Quality

Water Properties

Boxplots summarize the distributions of continuously monitored water-property data at the five sites (fig. 3). In some instances, the median is the same as the 25th or 75th percentile.

Table 1. Water properties and major ion concentrations, Comal Springs riverine system, New Braunfels, Texas, 1993–94

[μS/cm, microsiemens per centimeter at 25 °C; °C, degrees Celsius; mg/L, milligrams per liter; CaCO₃, calcium carbonate; <, less than; NA, not available; ft³/s, cubic feet per second]

Constituent	New Channel				Comal River ¹	
	Site A		Site B		Site E	
	Summer (9/20/93)	Winter (2/3/94)	Summer (9/20/93)	Winter (2/3/94)	Summer (9/20/93)	Winter (2/3/94)
Specific conductance (μS/cm)	548	509	547	509	544	514
pH (standard units)	7.6	7.4	7.8	7.3	7.8	7.1
Temperature (°C)	24.0	23.0	24.0	22.5	24.5	22.0
Dissolved oxygen (mg/L)	7.2	8.2	9.0	9.5	9.0	9.4
Calcium, dissolved (mg/L)	83	82	81	82	80	82
Magnesium, dissolved (mg/L)	16	16	16	16	16	16
Sodium, dissolved (mg/L)	9.9	9.7	11	10	10	10
Potassium, dissolved (mg/L)	.70	1.3	.70	1.3	.70	1.3
Alkalinity (mg/L as CaCO ₃)	230	230	230	230	240	230
Sulfate, dissolved (mg/L)	23	24	24	24	23	24
Chloride, dissolved (mg/L)	15	16	15	16	15	16
Fluoride, dissolved (mg/L)	.20	.20	.20	.20	.20	.20
Silica, dissolved (mg/L)	12	11	12	11	12	11
Dissolved solids, sum of constituents (mg/L)	307	309	308	309	307	310

Constituent	Old Channel				Comal River ¹	
	Site C		Site D		Site E	
	Summer (8/20/93)	Winter (3/3/94)	Summer (8/20/93)	Winter (3/3/94)	Summer (8/20/93)	Winter (3/3/94)
Specific conductance (μS/cm)	552	529	565	523	547	541
pH (standard units)	7.7	6.9	7.5	7.3	7.6	7.3
Temperature (°C)	24.0	21.5	25.5	20.5	26.0	23.0
Dissolved oxygen (mg/L)	8.1	11.4	4.4	11.8	9.2	12.0
Calcium, dissolved (mg/L)	83	82	85	81	84	81
Magnesium, dissolved (mg/L)	16	16	16	16	16	16
Sodium, dissolved (mg/L)	9.6	10	10	11	9.5	11
Potassium, dissolved (mg/L)	1.9	1.3	1.6	1.3	<.10	1.3
Alkalinity (mg/L as CaCO ₃)	230	240	240	240	230	240
Sulfate, dissolved (mg/L)	25	24	26	24	25	24
Chloride, dissolved (mg/L)	16	15	16	16	16	15
Fluoride, dissolved (mg/L)	.30	.20	.20	.20	.20	.20
Silica, dissolved (mg/L)	12	12	11	10	12	11
Dissolved solids, sum of constituents (mg/L)	309	310	314	310	NA	309

¹ Daily mean flow, 08169000 Comal River at New Braunfels: 350 ft³/s - 8/20/93, 339 ft³/s - 9/20/93, 351 ft³/s - 2/3/94, 337 ft³/s - 3/3/94.

Data were edited to correct for instrument drift and to exclude instrument malfunction. The number of data values per property per site ranged from 1,054 to 2,644.

For New Channel and Comal River, summer median specific conductance shows little variability along the reach, ranging from 547 to 551 microsiemens per centimeter at 25 °C (μS/cm). Winter median specific conductance shows more variability than summer, ranging from 525 μS/cm at site A to 551 μS/cm at site E. Summer median pH increases downstream from 7.3 at site A to 7.6 at sites B and E. Similarly during winter, median pH increases from 7.2 to 7.5. Summer median water temperature increases downstream from 23.5 degrees Celsius (°C) at sites A and B to 23.7 °C at site E.

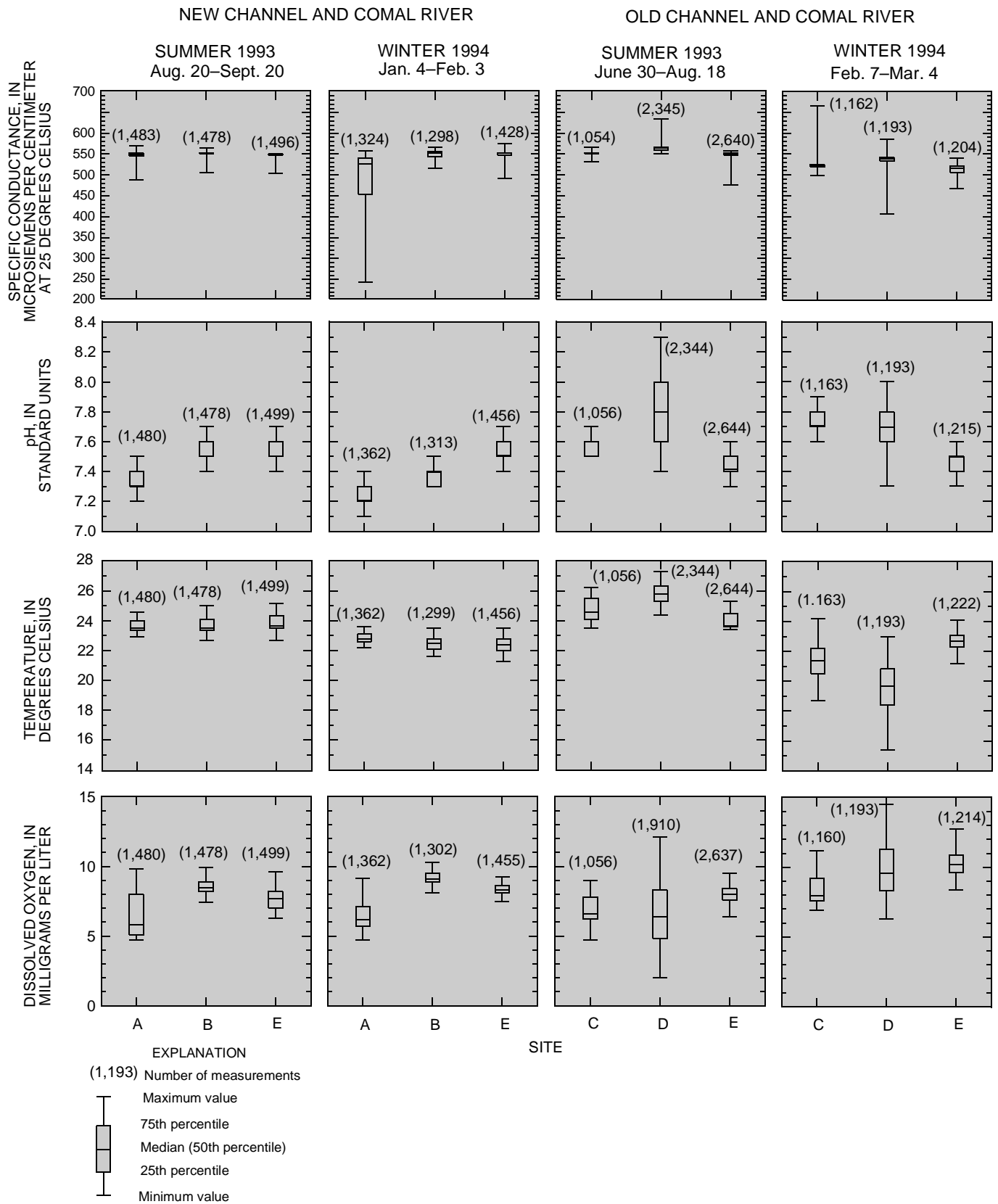


Figure 3. Distributions of specific conductance, pH, temperature, and dissolved oxygen, Comal Springs riverine system, New Braunfels, Texas, 1993–94.

Conversely, winter median water temperature decreases from 22.8 to 22.4 °C. Summer median dissolved oxygen increases

downstream from 5.8 milligrams per liter (mg/L) at site A to 8.5 mg/L at site B and subsequently decreases to 7.7 mg/L at site E.

Table 2. Nutrient concentrations, Comal Springs riverine system, New Braunfels, Texas, 1993–94

[mg/L, milligrams per liter; NA, not available; <, less than; ft³/s, cubic feet per second]

Constituent (mg/L)	New Channel				Comal River ¹	
	Site A		Site B		Site E	
	Summer (9/20/93)	Winter (2/3/94)	Summer (9/20/93)	Winter (2/3/94)	Summer (9/20/93)	Winter (2/3/94)
Nitrogen, nitrate, dissolved	NA	1.87	NA	1.87	NA	2.38
Nitrogen, nitrite, dissolved	<0.010	.030	<0.010	.030	<0.010	.020
Nitrogen, ammonia, dissolved	.030	.020	.030	.030	.030	.050
Nitrogen, organic, dissolved	NA	NA	NA	NA	NA	NA
Phosphorus, dissolved	<.010	<.010	<.010	<.010	<.010	<.010
Phosphorus, ortho, dissolved	NA	NA	NA	NA	.03	NA
Phosphate, ortho, dissolved (as P)	<.010	<.010	<.010	<.010	.010	<.010

Constituent (mg/L)	Old Channel				Comal River ¹	
	Site C		Site D		Site E	
	Summer (8/20/93)	Winter (3/3/94)	Summer (8/20/93)	Winter (3/3/94)	Summer (8/20/93)	Winter (3/3/94)
Nitrogen, nitrate, dissolved	NA	NA	1.39	NA	NA	NA
Nitrogen, nitrite, dissolved	<0.010	<0.010	.010	<0.010	<0.010	<0.010
Nitrogen, ammonia, dissolved	.030	.020	.060	.030	.030	.010
Nitrogen, organic, dissolved	NA	NA	NA	0.27	NA	NA
Phosphorus, dissolved	<.010	.010	<.010	.050	<.010	.010
Phosphorus, ortho, dissolved	.03	NA	.06	NA	.03	NA
Phosphate, ortho, dissolved (as P)	.010	<.010	.020	<.010	.010	<.010

¹ Daily mean flow, 08169000 Comal River at New Braunfels: 350 ft³/s - 8/20/93, 339 ft³/s - 9/20/93, 351 ft³/s - 2/3/94, 337 ft³/s - 3/3/94.

Similarly, winter median dissolved oxygen increases from 6.2 mg/L at site A to 9.1 mg/L at site B, then decreases to 8.3 mg/L at site E.

For Old Channel and Comal River, summer median specific conductance increases from 550 μ S/cm at site C to 562 μ S/cm at site D, then decreases to 549 μ S/cm at site E. Similarly, winter median specific conductance increases from 523 μ S/cm at site C to 540 μ S/cm at site D, then decreases to 517 μ S/cm at site E. Summer median pH increases downstream from 7.6 at site C to 7.8 at site D, then decreases to 7.4 at site E. Winter median pH is 7.7 at sites C and D and 7.5 at site E. Summer median temperature increases from 24.6 °C at site C to 25.8 °C at site D and subsequently decreases to 23.8 °C at site E. Conversely, winter median temperature decreases from 21.4 °C at site C to 19.7 °C at site D, then increases to 22.7 °C at site E. Summer median dissolved oxygen decreases from 6.6 mg/L at site C to 6.4 mg/L at site D and increases to 8.0 mg/L at site E. Winter median dissolved oxygen increases from 8.0 mg/L at site C to 10.2 mg/L at site E.

In general, specific conductance, pH, temperature, and dissolved oxygen measured at the time of collection of discrete samples (table 1) fall within the range of measurements made by the continuous monitors.

Major Ions

Only slight variability in concentrations of major ions either along reaches or between seasons (along a reach) is observed for the periodic water-quality samples collected during high-flow conditions (table 1). For example, dissolved solids range from 307 to 309 mg/L for New Channel and from 309 to 314 mg/L for Old Channel.

Nutrients

Where measured, concentrations of nutrients and variations in concentrations (table 2) are small. For all sites, nitrate nitrogen concentrations range from 1.39 to 2.38 mg/L, nitrite nitrogen concentrations range from less than 0.010 to 0.030 mg/L, and ammonia concentrations range from 0.010 to 0.060 mg/L. Phosphorus concentrations range from less than 0.010 to 0.050 mg/L, orthophosphorus concentrations range from 0.03 to 0.06 mg/L, and orthophosphate concentrations range from less than 0.010 to 0.020 mg/L.

Trace Elements

Trace elements (table 3) show little variability in concentration either along the reaches or between seasons. Differences in concentrations between sites in the same reach and seasons are small, less than 5 micrograms per liter (μ g/L), except for strontium in Old Channel, which decreases by 50 μ g/L from site D to site E in both seasons and increases by 50 μ g/L from summer to winter at site C. Concentrations of strontium (610 to 690 μ g/L) are 1 to 2 orders of magnitude larger than that of other trace elements. Trace elements for which analyses were below detection limits are beryllium (less than 0.5 μ g/L), cadmium (less than 1.0 μ g/L), chromium (less than 5 μ g/L), cobalt (less than 3 μ g/L), copper (less than 10 μ g/L), mercury (less than 0.1 μ g/L), molybdenum (less than 10 μ g/L), nickel (less than 10 μ g/L), silver (less than 10 μ g/L), and vanadium (less than 6 μ g/L).

Pesticides

Of 29 pesticides for which samples were analyzed (table 4) only diazinon was detected during the summer at sites D and E, in concentrations of 0.01 and 0.02 μ g/L, respectively.

Selected References

Brown, D.S., Petri, B.L., and Nalley, G.M., 1992, Compilation of hydrologic data for the Edwards aquifer, San Antonio area, Texas, 1991, with 1934–91 summary: San Antonio, Edwards Underground Water District Bulletin 51, 169 p.

Table 3. Trace element concentrations, Comal Springs riverine system, New Braunfels, Texas, 1993–94

[Constituents not detected include beryllium, cadmium, chromium, cobalt, copper, mercury, molybdenum, nickel, silver, and vanadium. µg/L, micrograms per liter; <, less than; ft³/s, cubic feet per second]

Constituent (µg/L)	New Channel				Comal River ¹	
	Site A		Site B		Site E	
	Summer (9/20/93)	Winter (2/3/94)	Summer (9/20/93)	Winter (2/3/94)	Summer (9/20/93)	Winter (2/3/94)
Arsenic, dissolved	<1	<1	<1	<1	<1	<1
Barium, dissolved	51	51	52	51	52	51
Iron, dissolved	<3	<3	<3	<3	3	<3
Lead, dissolved	<10	<10	10	<10	<10	<10
Lithium, dissolved	7	6	8	6	7	7
Manganese, dissolved	<1	<1	<1	<1	<1	<1
Selenium, dissolved	1	<1	1	<1	1	<1
Strontium, dissolved	610	610	620	620	610	620
Zinc, dissolved	3	<3	<3	5	<3	<3

Constituent (µg/L)	Old Channel				Comal River ¹	
	Site C		Site D		Site E	
	Summer (8/20/93)	Winter (3/3/94)	Summer (8/20/93)	Winter (3/3/94)	Summer (8/20/93)	Winter (3/3/94)
Arsenic, dissolved	<1	2	<1	1	<1	1
Barium, dissolved	51	55	53	55	49	51
Iron, dissolved	3	<3	4	<3	<3	<3
Lead, dissolved	<10	10	<10	10	<10	<10
Lithium, dissolved	12	8	13	8	12	8
Manganese, dissolved	2	2	5	4	<1	2
Selenium, dissolved	<1	<1	<1	<1	<1	1
Strontium, dissolved	620	670	650	690	600	640
Zinc, dissolved	6	<3	4	<3	<3	5

¹ Daily mean flow, 08169000 Comal River at New Braunfels: 350 ft³/s - 8/20/93, 339 ft³/s - 9/20/93, 351 ft³/s - 2/3/94, 337 ft³/s - 3/3/94.

Rothermal, S.R., and Ogden, A.E., 1987a, Hydrochemical investigation of the Comal and Hueco Springs systems, Comal County, Texas: Edwards Aquifer Research and Data Center Report R1–87, 182 p.

_____, 1987b, Hydrochemical investigation of the Comal and Hueco Springs systems, Comal County, Texas: Edwards Aquifer Research and Data Center Report R2–86, 151 p.

Wells, F.C., 1985, Statistical summary of water-quality data collected from selected wells and springs in the Edwards aquifer near San Antonio, Texas: U.S. Geological Survey Open-File Report 85–182, 162 p.

William F. Guyton and Associates, 1979, Geohydrology of Comal, San Marcos, and Hueco Springs: Texas Department of Water Resources Report 234, 85 p.

—Lynne Fahlquist and R.N. Slattery

Table 4. Pesticide concentrations, Comal Springs riverine system, New Braunfels, Texas, 1993–94

[µg/L, micrograms per liter; compound in bold was detected]

Pesticide	Detection limit (µg/L)
PCB	0.1
Polychlorinated naphthalenes	.10
Aldrin	.010
Chlordane	.1
DDD	.010
DDE	.010
DDT	.010
Diazinon	.01
Dieldrin	.010
Disyston	.01
Endosulfan	.010
Endrin	.010
Ethion	.01
Heptachlor	.010
Heptachlor epoxide	.010
Lindane	.010
Malathion	.01
Methoxychlor	.01
Methylparathion	.01
Mirex	.01
Parathion	.01
Perthane	.1
Phorate	.01
Silvex	.01
Toxaphene	1
Trithion	.01
2,4-D	.01
2,4-DP	.01
2,4,5-T	.01

Any use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

U.S. DEPARTMENT OF THE INTERIOR U.S. GEOLOGICAL SURVEY

Information on technical reports and hydrologic data related to this and other studies can be obtained from:



San Antonio Subdistrict Chief
U.S. Geological Survey
435 Isom Road, Suite 234
San Antonio, Texas 78216
Phone: 210–321–5200
FAX: 210–530–6008
E-mail: gbozuna@usgs.gov
World Wide Web: <http://txwww.cr.usgs.gov/>

Appendix E: Lodging Revenues

New Braunfels

Hotel / motel tax receipts (rate = 13%) full year		1 st & 2 nd Quarters
2005	\$ 1,875,936.60	\$1,424,537.30
2006	\$ 1,991,734.20	\$ 1,452,416.00
2007	\$ 2,116,439.60	\$ 1,458,819.80
2008	\$ 2,319,141.70	\$ 1,682,902.80
2009	\$ 2,151,495.20	\$ 1,548,257.20

San Marcos

Hotel / motel taxes

2008	\$ 1,698,905.00
2009	\$ 2,030,247.00

Appendix F: Response to TWDB Comments



November 4, 2010
AVO 27520

Mr. Robert L. Gulley, Program Director
Edwards Aquifer Recovery Implementation Program
2632 Broadway, South Building, Suite 301
San Antonio, Texas 78215

RE: Response to TWDB comments to Draft Report for "Initial Study of Recreational Impacts to Protected Species and Habitats in the Comal and San Marcos Springs Ecosystems", as a part of the Research Contract for the Implementation of the Edwards aquifer Recovery Program between the Texas Water Development Board (TWDB) and the Texas AgriLife Extension Service (TAES). TWDB Contract No. 1004831037

Dear Mr. Gulley:

Halff Associates has read the comments to the draft report identified above, submitted by the TWDB. As an aid to clarify our responses and proposed actions, we will refer to Attachment I of the TWDB comments by paragraph. Our responses are as follows:

Paragraph One – Executive Summary

The Executive Summary portion of the report revised during preparation of the Final Report to conform to the requirements of Task 11j of the Contract Scope of Work.

Paragraph Two – Tabular Format

Available information has been presented in tabular format throughout the report when possible.

Paragraph Three – Recreational Providers (Pages 4-7)

The list of tube rental and other recreational providers was current during assembly and preparation of data for the report. As mentioned in the body of the report, the tube rental business is a seasonal enterprise, and new businesses readily come and go. Significant flooding events also occurred immediately before and during the time when data was assembled along the Comal River, which resulted in several businesses ceasing to operate for the remainder of the summer season or until further notice. The information shown reflects what was available at the time of the study.

Paragraph Four – Data Collection (Page 7)

Data collection activities conformed to the approved scope of work for the project. All information provided by and for recreational providers is illustrated in the report.

HALFF ASSOCIATES, INC.

4030 WEST BRAKER LANE, SUITE 450
AUSTIN, TX 78759-5356

TEL (512) 252-8184
FAX (512) 252-8141

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Paragraph Five – Interview Documentation (Pages 28-38)

Stakeholder participation has been documented in the final report, including number of participants, and locations and dates of interviews.

Paragraph Six – Prioritized Needs and Desires List (Pages 28-38)

Based on comments received from stakeholders who participated in the study, a list of issues, both negative and positive, was compiled. This list of issues is ranked by priority, to coincide with the number of responses and issue related comments provided by stakeholder participants.

Paragraph Seven – Sampling Appendix (Page 39)

In the Final Report, a list of the TCEQ Clean Rivers Program water quality sampling parameters has been included in a tabular format. There is no longer a reference to an appendix in the document.

Paragraph Eight – TCEQ Water Quality (Page 39)

The Final Report discusses the two fact sheets prepared by the USGS between 1994 and 1998, and the relevance to future studies. The TCEQ Clean Rivers data, which includes the same parameters as the previous USGS, is the preferred source for electronic water quality data. The TCEQ data includes more sampling point locations, and is the umbrella program for the state that includes data collected by various agencies such as Texas State University data.

Paragraph Nine – Scientific Studies (Page 41)

The final report includes several scientific studies that are pertinent to the issue of recreational impacts on the two springs and their ecosystems, in addition to those provided in the draft report. As noted in the final report, there were several previous studies that were not accessible by members of the Halff Associates team, including three previous studies cited in the TWDB comment letter. There are also several other research teams and consulting groups conducting on-going projects in the two spring watersheds. Information from these on-going studies was largely unavailable to the Halff team, but may have a bearing on the final outcome of the study of recreational impacts in either watershed.

Paragraph Ten – Economic Studies (Page 50)

The three previous economic studies cited in the final report were the only resources available for review, according to the Chambers of Commerce for both New Braunfels and San Marcos.

Paragraph Eleven – Assessment of Recreational Impacts (Page 55)

In accord with our scope of services, Halff Associates reviewed and recorded data provided by the EARIP, the cities of New Braunfels and San Marcos, their Chambers of Commerce, and various other participants in the study. The final report identifies the results of this data gathering, and summarizes the next steps in the study process that might be undertaken by the EARIP. The final report also offers a conclusion that there is a



Mr. Robert L. Gully, Program Manager
E-ARIP
November 4, 2010
Page 3

significant shortfall in available data related to recreational impacts to listed species and their habitats within either spring's ecosystems. In the absence of any studies that specifically identify recreational activities as an impact or hazard to the ecosystems, there can be no assessment of recreational impacts, or suggestions for mitigation measures to lessen impacts from recreational activities

As stated in the letter from the TWDB to the TAES, Halff Associates will include a copy of this response letter, along with the review comments from the TWDB to the TAES, bound into our final report. Please feel free to contact me via e-mail at wcooper@halff.com, or via telephone at (512) 252-8184 with any questions or comments that you may have.

Sincerely,
HALFF ASSOCIATES, INC.

A handwritten signature in blue ink, reading "H. Wayne Cooper", with a long horizontal flourish extending to the right.

H. Wayne Cooper, ASLA, AICP
Vice President

Attachments



TEXAS WATER DEVELOPMENT BOARD



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Executive Administrator

Jack Hunt, *Vice Chairman*
Thomas Weir Labatt III, *Member*
Joe M. Crutcher, *Member*

October 22, 2010

Dr. Edward G. Smith
Director
Texas AgriLife Extension Service
2147 TAMU
College Station, Texas 77843-2147

Re: Research Contract for the Implementation of the Edwards Aquifer Recovery Program between the Texas Water Development Board (TWDB) and the Texas AgriLife Extension Service (TAES), TWDB Contract No. 1004831037, Draft Report Comments for "Initial Study of the Recreational Impacts to Protected Species and Habitats in the Comal and San Marcos Springs Ecosystems"

Dear Dr. Smith:

Staff members of the TWDB have completed a review of the draft report prepared under the above-referenced contract. ATTACHMENT I provides the comments resulting from this review. As stated in the TWDB contract, the TAES will consider incorporating draft report comments from the EXECUTIVE ADMINISTRATOR as well as other reviewers into the final report. In addition, the TAES will include a copy of the EXECUTIVE ADMINISTRATOR'S draft report comments in the Final Report.

The TWDB looks forward to receiving one (1) electronic copy of the entire Final Report in Portable Document Format (PDF) and six (6) bound double-sided copies. The TAES shall also submit one (1) electronic copy of any computer programs or models, and, if applicable, an operations manual developed under the terms of this Contract.

If you have any questions concerning the contract, please contact Matt Nelson, the TWDB's designated Contract Manager for this project at (512) 936-2550.

Sincerely,

Carolyn L. Brittin
Deputy Executive Administrator
Water Resources Planning and Information

Enclosures

c: Matt Nelson, TWDB

Our Mission

To provide leadership, planning, financial assistance, information, and education for the conservation and responsible development of water for Texas

P.O. Box 13231 • 1700 N. Congress Avenue • Austin, Texas 78711-3231
Telephone (512) 463-7847 • Fax (512) 475-2053 • 1-800-RELAYTX (for the hearing impaired)
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TNRIS - Texas Natural Resources Information System • www.tnris.state.tx.us
A Member of the Texas Geographic Information Council (TGIC)





Attachment I

Review of TWDB Contract No. 1004831037

"Initial Study on the Recreational Impacts to Protected Species and Habitats in the Comal and San Marcos Springs Ecosystems"

Executive Summary: Report does not provide an executive summary "suitable for distribution to third party reviewers and the general public that provides an overview of the study process and resulting recommendations." Please provide an executive summary in the final report that is in accordance with Task 11j of the Contract Scope of Work that includes specific recommendations out of the report.

Throughout report: Report findings in report are not provided in tabular format. Please present report findings in tabular format in accordance with Tasks 11a, 11b, 11c, 11e, 11f, 11g of the Contract Scope of Work.

Pages 4-7: Report lists 6 entities that rent inner tubes in New Braunfels and San Marcos. Please confirm that there are not additional entities that should be included in the report (e.g., R B's Tube Rental, New Braunfels; Riverbank Raft & Tube Rentals, New Braunfels). Please confirm that the report includes a comprehensive list of recreational providers in accordance with Task 11a of the Contract Scope of Work.

Page 7, Section I: Data collection appears incomplete. Information cited as deliverables in the Contract Scope of Work Task 1a (e.g., areas of service, access points, periods of operation, number of participants etc.) are absent for many of the recreational providers. Please include all information for recreational providers in accordance with Task 1a of the Contract Scope of Work.

Pages 28-38: Interviews are not documented in the draft report. Please document the number of interviewees, locations, and dates of occurrence of interviews performed for both the Comal and San Marcos systems under task 11d of the Contract Scope of Work.

Pages 28-38: Report does not provide a prioritized list of needs, desire, likes, and dislikes or an evaluation matrix. Please provide 1) a prioritized list of needs, desire, likes, and dislikes, and 2) an evaluation matrix in accordance with Task 11d of the Contract Scope of Work.

Page 39: In the final paragraph on page 39 there is mention of an appendix containing the parameters that were sampled, yet there is no such appendix. Please include the appendix in the final report.

Page 39 Section V: Report only mentions TCEQ water quality data under Task 11f. Other sources of water quality data should also be considered under Task 11f of the Contract Scope of Work, (if appropriate) including, for example, USGS and Texas State University data. The US Geological Survey collected four water quality samples at the Highway 82 Bridge below Spring Lake (location of USGS gage 08170500) between August 1994 and October 1996. The USGS



has produced a fact sheet related to water quality data collections at other locations on the San Marcos (<http://pubs.usgs.gov/fs/fs05997/05997.pdf>). On the Comal River, the USGS collected 29 water quality samples at the San Antonio Street Bridge (location of USGS gage 08169000) between August 1995 and June 1998. A fact sheet <http://pubs.usgs.gov/fs/fs09997/09997.pdf> describes a water quality assessment of the Comal River carried out in 1993 and 1994. Water quality data from the USGS is available online (<http://nwis.waterdata.usgs.gov/>).

Page 41: Report Section VI includes five scientific studies. Please consider summarizing other pertinent studies under Task 11g of the Contract Scope of Work including, for example:

- Variable Flow Study published in August 2007 (http://edwardsaquifer.org/files/Summary_of_Monitoring_and_Research_for_2000-2007.pdf) which provides information about the impact of recreation on threatened and endangered species in these systems. Other studies of the Comal and San Marcos systems that should be summarized include:
- Bradsby, D.D., 1994, A recreational use survey of the San Marcos River: San Marcos, Tex., Southwest Texas State University, M.S. thesis, 82 p.
- Breslin, S. L. 1997. The impact of recreation on Texas wild rice. M.S. thesis, Southwest Texas State University, San Marcos, TX. 69 pp.
- Stanton, L. L. 1992. Assessment of changes in the aquatic macrophyte community in the upper San Marcos River. M.S. thesis, Southwest Texas State University, San Marcos, TX.
- Owens, et al. 2001 <http://www.apms.org/japm/vol39/v39p75.pdf>

Page 50, Section VII: Report identified and summarized three economic study components. It is unclear if these are all the existing economic study components that are available. Please clarify if these are the only existing study components available related to Task 11h of the Contract Scope of Work.

Page 55, Section VIII: Report does not include two key scope of work deliverables: assessment of recreational impacts; and, suggested actions to reduce negative impacts as required by Task 11e, 1 and 4 of the Contract Scope of Work (Task 11e budget \$10,140). Please provide further explanation for why this information required under the scope of work was not included in the report.