United States Department of the Interior

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In Reply Refer to:
Consultation 02ETAU00-2016-F-0216

AUG 15 2016

Stephen Brooks
Chief, Regulatory Branch
U.S. Army Corps of Engineers
P.O. Box 17300
Fort Worth, Texas 76102-0300

Dear Mr. Brooks:

This transmits the U.S. Fish and Wildlife Service's (Service) biological opinion for the U.S. Army Corps of Engineers (USACE) proposed authorization under section 404 of the Clean Water Act (CWA)(33 U.S.C. 1251 – 1376) for activities that are part of the development of the New Braunfels Utilities (NBU) Comal Springs Conservation Center (CSCC) in New Braunfels, Comal County, Texas. The USACE is proposing authorization of partial removal of the concrete spring cap at the head of Comal Springs spring run 4 under a CWA Nationwide Permit. The spring cap modification is part of an 18-acre project to replace the NBU service yard with an educational facility focused on conservation.

The NBU proposes to build the CSCC on its property near Landa Lake, Comal Springs spring run 4, and Blieders Creek. In accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*)(Act), the USACE has determined this project may affect four listed endangered species: Peck's cave amphipod (*Stygobromus comalensis*), Comal Springs dryopid beetle (*Stygoparnus comalensis*), Comal Springs riffle beetle (*Heterelmis comalensis*), and fountain darter (*Etheostoma fonticola*). In addition, the USACE has determined the project may affect federally designated critical habitat of Peck's cave amphipod, Comal Springs dryopid beetle, and Comal Springs riffle beetle. There is no critical habitat designated for the fountain darter in the Comal Springs ecosystem.

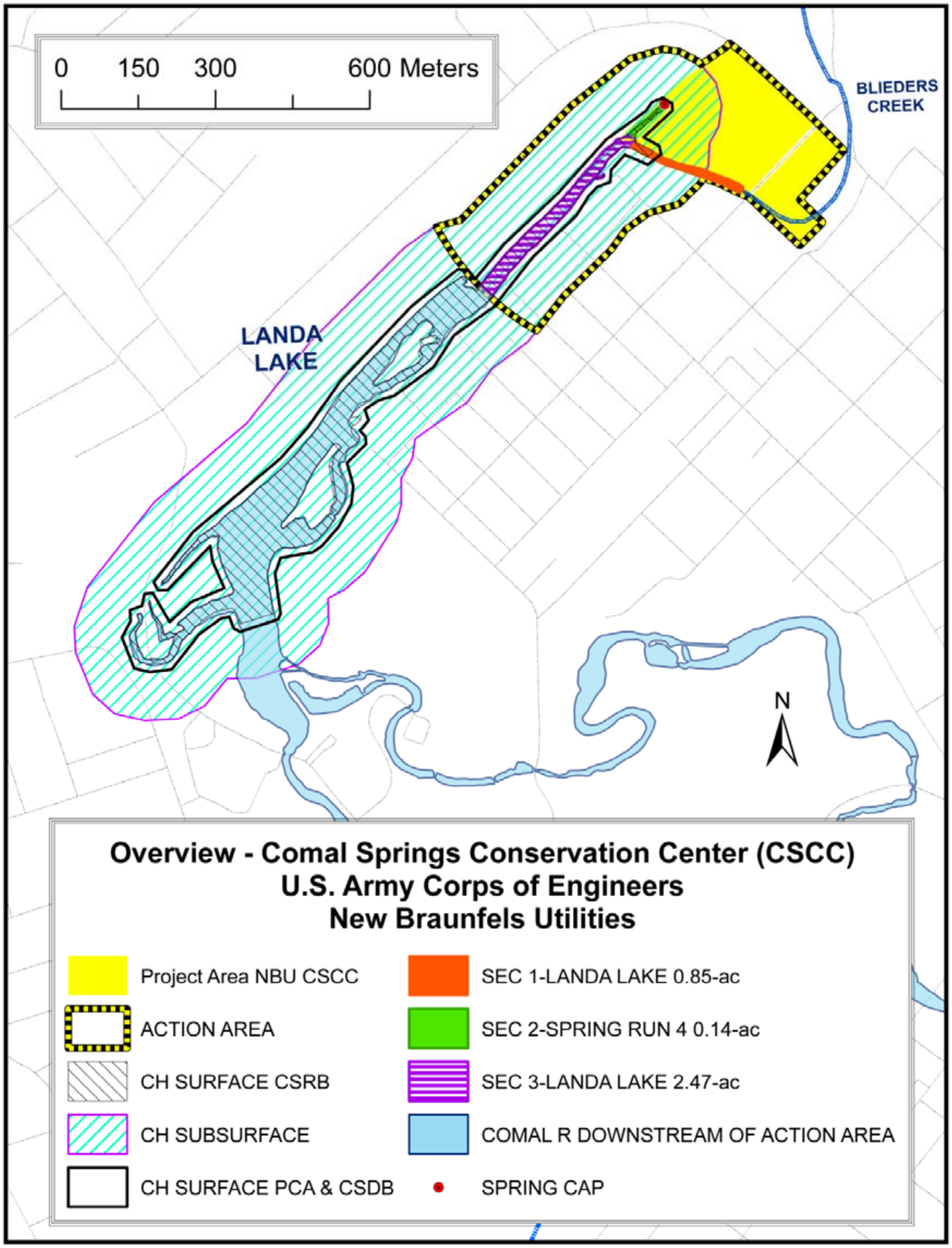
The USACE is the Federal agency authorizing this project. The USACE has provided a biological assessment (BA) of the project prepared by Zara Environmental, LLC (Zara) for NBU as part of the initiation package received February 17, 2016. On June 3, 2016 we received an updated description of the project that added bank stabilization in part of spring run 4 to the project as well as addressing the effects of bank stabilization. This biological opinion is based on information from: (1) the BA, (2) information from the USACE, NBU, Zara, (3) field investigations by the Service and Zara, and (4) other sources of information. A complete administrative record of this consultation is on file at our office.

Consultation History

January 22, 2014	Service, consultants, USACE and NBU visit the site .
December 11, 2015	Biological Assessment forwarded to Service.
February 16, 2016	Service receives USACE request for formal consultation.
February 29, 2016	Service acknowledges request and initiation of formal consultation.
June 3, 2016	Service receives an updated biological assessment to include bank stabilization along parts of the left bank looking downstream of spring run 4.
July 27, 2016	Service provides a draft biological opinion to USACE, the applicant, and TPWD.
August 2, 2016	USACE provides its comments on the draft biological opinion.

The BA provides more details on the consultation history particularly the earlier coordination efforts. Figure 1 shows an overview of the location of the project in the Comal Springs system.

Figure 1. An overview of the Comal Springs system, the project area, and the action area.



CH = critical habitat; CSRB = Comal Springs riffle beetle; CSDB = Comal Springs dryopid beetle; PCA = Peck's cave amphipod; ac = acre; R = river

BIOLOGICAL OPINION

Following early discussion about the project, the USACE and NBU determined that the project may affect, and is likely to adversely affect the Peck's cave amphipod, Comal Springs riffle beetle, Comal Springs dryopid beetle, and the fountain darter. The BA also discusses the Texas blind salamander. The Service is reviewing information that may result in a revision of the recognized range of the Texas blind salamander, *Eurycea* (= *Typhlomolge*) *rathbuni,* to include springs and wells associated with the Edward Aquifer in Comal County, including Panther Canyon Well and Comal Springs. However, since that review is ongoing but incomplete, this biological opinion will only address the Peck's cave amphipod, Comal Springs dryopid beetle, Comal Springs riffle beetle (collectively, the Comal Springs invertebrates), their respectively designated critical habitats (CH), and the fountain darter.

I. Description of Proposed Action

New Braunfels Utilities proposes to build the Comal Springs Conservation Center (CSCC) in four phases (Figure 3 of BA):

Phase 1. Focus will be on the western and southern portions of the Project Area, including facility access, native riparian and upland habitat restoration, spring habitat restoration, construction of building C, and an enhanced stormwater management system.

Phase 2. Construction of Buildings A, B, and D.

Phase 3. Xeric upland habitat restoration near Klingemann Street and Lakeview Boulevard.

Phase 4. Additional riparian and upland habitat restoration and parking facilities east of Klingemann Street.

More construction details are available in the BA and its appendices.

Comal Springs spring run 4 is the target of habitat restoration in Phase 1 and this includes modifying the spring cap by removing part of the top and part of the sides (Figure 2). About one third of the top will be removed and a v-notch will be put in the part of the wall facing spring run 4 and Landa Lake. Additionally after landscaping, as detailed in the BA's Figure 24, water northeast of the spring cap will be rerouted towards the enhanced stormwater management system. This system will also handle emergency outflow events from the NBU water supply tank.

Among the first actions will be management of stormwater with temporary and permanent best management practices (BMPs) to capture, reduce, delay, and treat stormwater runoff improving the water quality of runoff reaching the Comal Springs system. Ultimately, the project will have a variety of habitat restoration zones including midgrass prairie, savannah, upland xeric, vegetated swales, and riparian woodland.

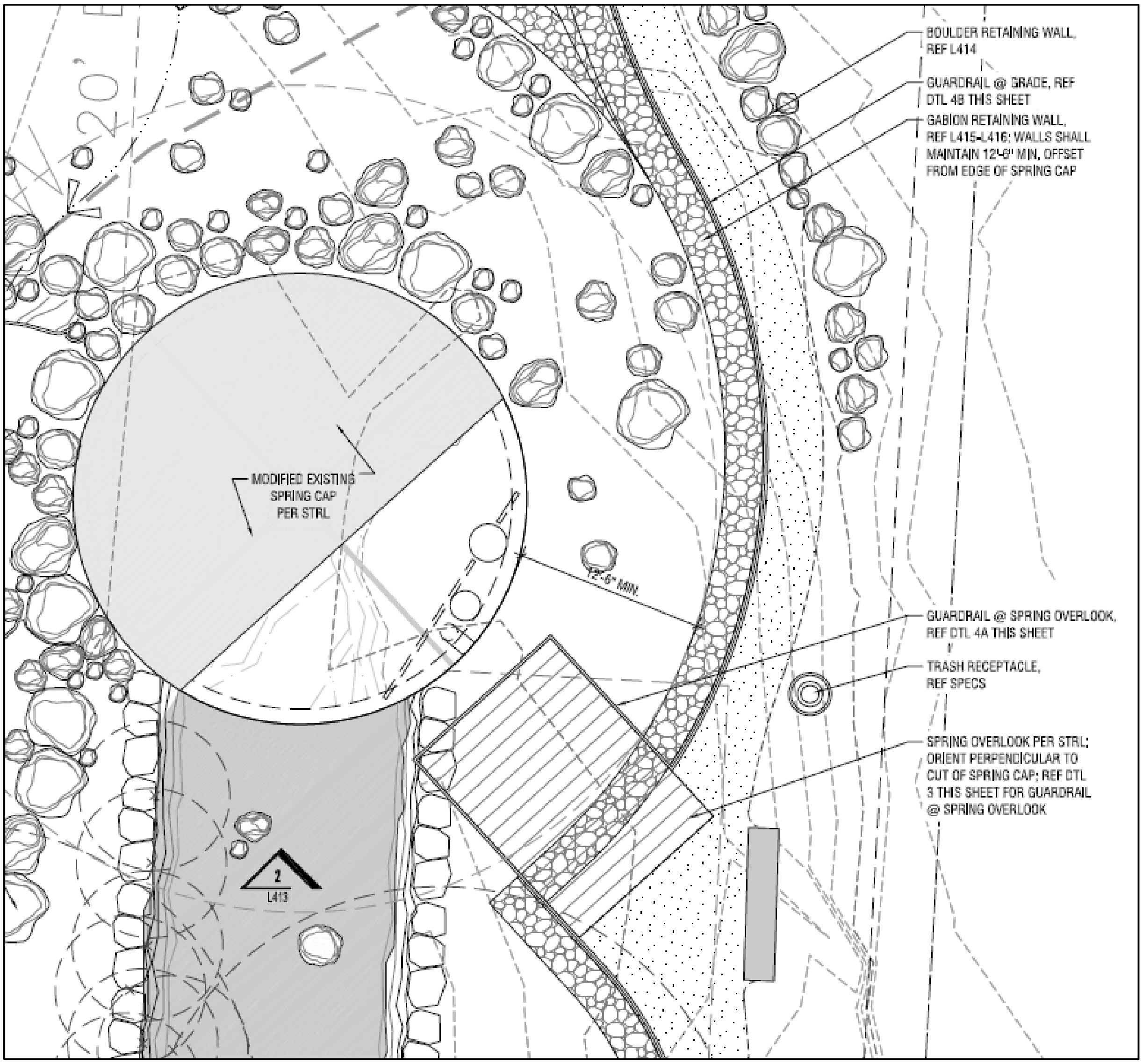


Figure 2. Comal Springs Conservation Center detail of upper Comal Springs spring run 4 and partial removal of spring cap.

The project will remove the asphalt pavement that dominated the NBU service yard including about 10 acres of impervious cover. Significantly, the permanent BMPs, collectively called the enhanced stormwater management system (ESMS), will decrease the flash flood nature of local runoff by retaining and treating water. The ESMS will improve the water quality of runoff to the Comal Springs ecosystem. For example, in summer, the water temperature of runoff will be reduced compared to current conditions. The levels of certain metals, organic compounds, and suspended sediment will be lowered in the ESMS's bio-retention areas, reducing the total load of pollutants to spring run 4 and Landa Lake. The project will stabilize about 27.4 meters of the left bank (looking downstream) of spring run 4 (Figure 3).

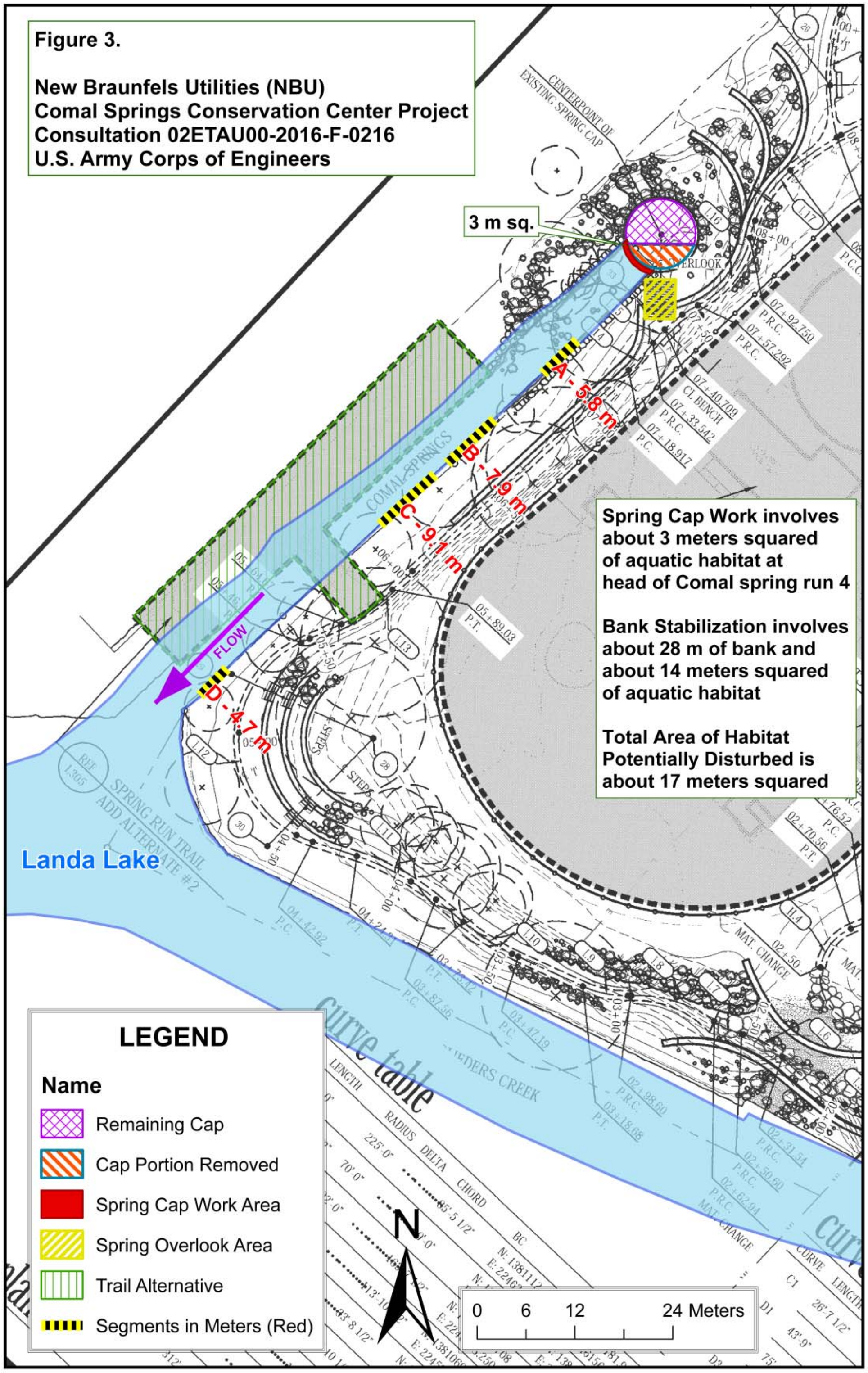


Figure 3. Proposed bank stabilization on the left bank looking downstream in spring run 4. The length of bank segment (in meters) to be stabilized is labeled in red. The purple arrow show the direction of flow.

Conservation Measures

The primary conservation measure of the project will be to improve the water quality of stormwater runoff compared to the current conditions. The project area (17.5 acres) is currently about 80 percent impervious cover (14 acres of impervious cover). The project will remove about 10 acres of asphalt pavement and other hard surfaces. This will reduce impervious cover to about 8 percent. Additionally, the project includes rainwater harvesting, which will reduce the amount of runoff normally discharge after a rain event. Enhanced stormwater management employing structural best management practices are planned throughout the project area to help protect Comal Springs spring run 4 and Landa Lake from pollutants. Storm pulses will be attenuated and thermal pollution (a concern during hot summer months with low aquifer levels) will be reduced. The project proponent has designated the area near spring run 4 as highly sensitive and the area near Landa Lake as sensitive. The design of parking spaces in Phase 4 puts a relatively small, 1-acre parking lot on Klingemann Street and about 280 meters from spring run 4.

The project includes increasing the area of native vegetation as shown in Figure 27 of the BA. By increasing native vegetation, the adjacent aquatic habitats benefit in at least two ways: improving the quality of water running off or infiltrating the ground and providing leaf litter and woody material to Landa Lake. Leaf litter reaching aquatic habitat may become coarse particulate organic matter, which is important for aquatic invertebrate ecology and Comal Springs invertebrates in surface habitats.

Non-structural best management practices such as public outreach and education are at the core of the CSCC project. The center will provide a positive example of landscaping with native and xeric species and living lightly on the land particularly in highly sensitive areas like the Edwards Aquifer recharge zone and transition zone.

Description of the Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The BA describes the project area as the immediate areas involved with the construction of the CSCC. For the purposes of this biological opinion, the action area includes the project area and an adjacent part of Landa Lake to a point 500 m downstream of the spring cap (Figure 4).

The action area is shown highlighted in yellow in Figure 4 including a subset of the designated critical habitat (surface and subsurface) for Comal Springs invertebrates within 500 m of the spring cap. The subsurface critical habitat is included because the Comal Springs spring openings in the action area under drought conditions may become recharge features. The action area is expected to capture the effects of the project activities. Some of the beneficial effects may actually extend further downstream to middle and lower Landa Lake.

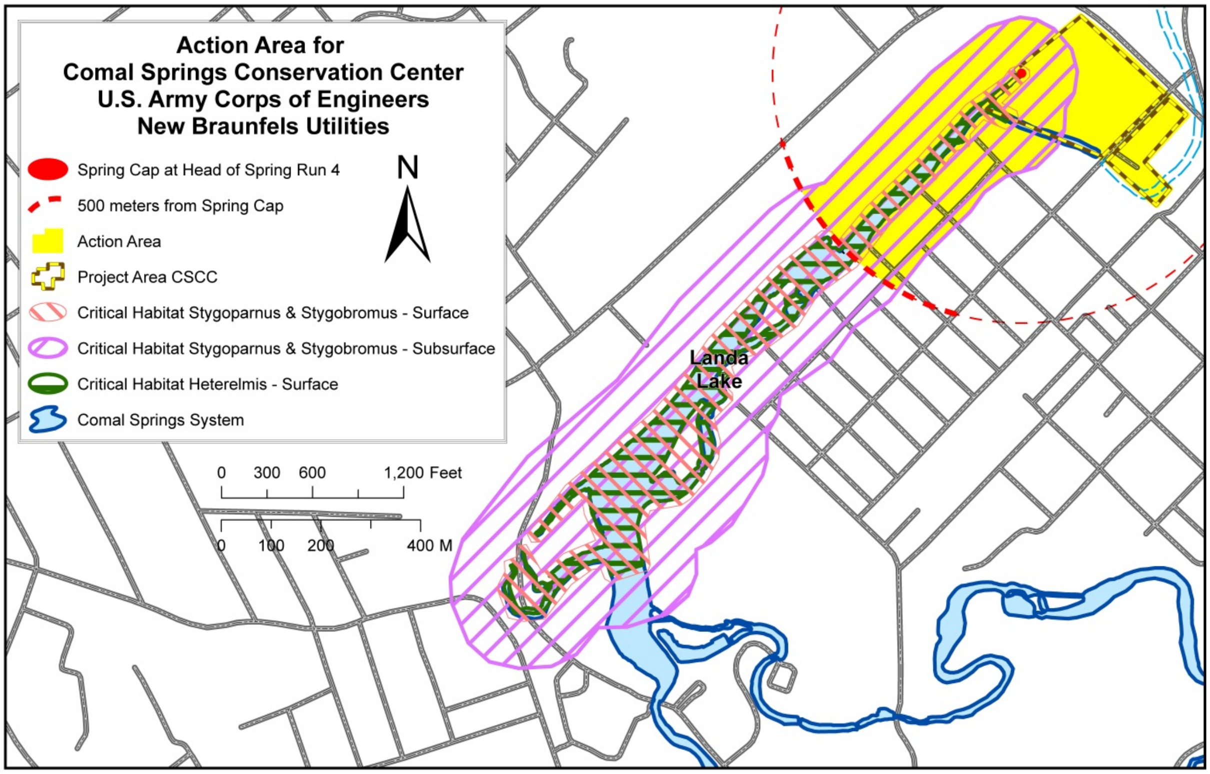


Figure 4. Action Area for Consultation.

II. Status of the Species and Critical Habitat

A. PECK'S CAVE AMPHIPOD

Species Description and Life History

Peck's cave amphipod was listed as endangered on December 18, 1997 (Service 1997). Critical habitat units were designated at Comal and Hueco springs in Comal County, Texas on July 17, 2007 (Service 2007).

This small subterranean aquatic species was first collected by Stewart Peck in June 1964 at Comal Springs (Holsinger 1967). Peck's cave amphipod has adaptations typical of cave-dwelling fauna. It is eyeless and unpigmented. Subterranean amphipods may feed on fragments of dead vegetation and biofilm on submerged surfaces (Pennak 1989) and available evidence suggests Peck's cave amphipod is an omnivore. In the Edwards Aquifer, it may act as a scavenger and a detritivore. Little is known about Peck's cave amphipod reproduction and life span in the wild. Limited and intermittent reproduction has occurred with captive stock in aquaria at the San Marcos Aquatic Resources Center (SMARC).

The Peck's cave amphipod occurs in surface habitats associated with springs and spring runs in Landa Lake. It has been collected among varied course substrates and organic material (e.g., submerged wood, leaves) near springs. Peck's cave amphipod also occurs in the subterranean habitats of the Edwards Aquifer at depths greater than 60 feet below the land surface. Groundwater food webs lack light energy and rely on the transport of resources from the surface.

Tree roots may grow in groundwater-filled voids near springs and tree roots have been shown to support a diverse groundwater fauna (Jasinska et al. 1996). Gibson et al. (2008) found Peck's cave amphipod in gravel, rocks, and organic debris (leaves, roots, wood) immediately inside of or adjacent to springs, seeps and upwellings of Comal Springs and their impoundment, Landa Lake.

Historic and Current Distribution

The species is known primarily from Comal Springs. Comal Springs is the largest spring system in Texas and most of the recharge occurs at great distances from the springs. A few specimens have been collected from Panther Canyon Well and Hueco Springs. The current distribution is similar to 1997, when it was listed. The only extension of its range since 1997 is Panther Canyon Well, which is about 105 m from the head of spring run 2. The lack of specimens from a survey of 22 other wells (Barr 1993) suggests that this species may be confined to the groundwater conduits near spring openings as opposed to generally inhabiting the aquifer at large.

Gibson et al. (2008) found the rate of Peck's cave amphipods caught at Comal Springs (9.2 individuals per day) to be similar to the results (9.6 per day) of Barr (1993). The rate of Peck's cave amphipods captured by Gibson ranged from 0.2 per day to 9.6 per day. In 2010, Gibson found three Peck's cave amphipods at a site just downstream from the wading pool on spring run 2. He also found one Peck's cave amphipod on the right bank (looking downstream) of spring run 3 less than 6 m from the Landa Park gazebo. Gibson has also reported Peck's cave amphipods from spring run 2 in the first spring going upstream from Gazebo Circle Bridge (on the western side or right bank looking downstream).

In February, April, and May 2015, Zara conducted surveys for aquatic invertebrates in spring run 4 and nearby parts of Landa Lake. The survey methods included kick samples, buried pleated cloth lures, and hand picking. There were 39 samples made, mostly with cloth lures, and only one sample resulted in the capture of a listed invertebrate. A Peck's cave amphipod was found in spring run 4 on the right bank looking downstream about 32 m upstream of the confluence with Landa Lake.

Reasons for Decline and Threats to Survival

The main threat to this species is a reduction or loss of water in its habitat due primarily to human withdrawal of water from the San Antonio segment of the Edwards Aquifer. This species requires adequate dissolved oxygen, therefore, a reduction or cessation of spring flows, even if standing water remains around the spring openings, may suffocate amphipods. Peck's cave amphipods may be removed from their subterranean habitats when entrained into water wells near Comal and Hueco springs. This species is also threatened by groundwater pollution. Another threat is the potential introduction of nonnative species that may prey upon amphipods or compete for resources (Service 2007).

Range-wide Survival and Recovery Needs

The chief recovery need for this and other Edwards Aquifer dependent species is implementation of an aquifer management plan that maintains adequate habitat to sustain populations. Maintenance of habitat includes: (1) continuous natural springflow at Comal and Hueco springs and (2) adequate water quality of groundwater and springwater.

Status of Peck's Cave Amphipod Critical Habitat

Critical habitat for Peck's cave amphipod (78 FR 63100) was designated October 23, 2013. Two units of critical habitat were designated: (1) Comal Springs (37.9 acres) surface and (124.3 acres) subsurface and (2) Hueco Springs (0.4 acres) surface and (13.5 acres) subsurface. The Comal Springs unit of Peck's cave amphipod critical habitat includes parts of Landa Lake and the spring runs in Landa Park. It does not include human-made structures and the land on which they are located that existed on November 22, 2013, the effective date of final rule designating critical habitat. The designated critical habitat of the amphipod at both springs comprises habitat within 15.2 m (50 feet) of the spring orifices. Critical habitat does not include other areas of the lake bottom where springs do not occur. A separate unit of critical habitat is designated at Hueco Springs about 3.2 miles north of Comal Springs.

The Service identified three features essential to Peck's cave amphipod critical habitat: (1) high quality water with no or minimal levels of pollutants such as detergents, heavy metals, pesticides, fertilizers, and organic contaminants, (2) aquifer water temperatures between 20 to 24°C, and (3) food supplies including detritus, leaf matter, living plant material, algae, fungi, bacteria and other microorganisms, and decaying roots. Water quality in the aquifer and spring habitats occupied by Peck's cave amphipod may be related to springflow rates. Access to Hueco Springs for surveys has been unavailable for several years. The status of the Peck's cave amphipod population associated with Hueco Springs is unknown. Since designation of critical habitat in 2013, the Service has implemented changes to the regulations for designating critical habitat (81 FR 7414) and now in lieu of primary constituent elements, we refer to identifying physical and biological features essential to the conservation of the species at an appropriate level of specificity using the best available scientific data.

B. COMAL SPRINGS DRYOPID BEETLE

Species Description and Life History

Comal Springs dryopid beetle was listed as endangered on December 18, 1997 (Service 1997) and two critical habitat units were designated at Comal Springs in Comal County and Fern Bank Springs in Hays County, Texas (Service 2007).

The Comal Springs dryopid beetle is the only known subterranean member of the family Dryopidae. Barr and Spangler (1992) described this genus and species based on its unique morphological distinctions including vestigial (poorly developed and non-functioning) eyes and wings. Mature larvae are typically 6 to 8 mm long. Little is known about its life history and pupae for this species have not been described. Adult dryopids generally feed on biofilm (microorganisms and detritus) scraped from various surfaces, including rocks, wood, and vegetation (Brown 1987).

Habitat requirements of the larvae are unknown. Other larvae in the family Dryopidae do not have gills and are considered terrestrial or semi-aquatic. Some adult Comal Springs dryopid beetles have survived 21 months in captivity but its lifespan in the wild is unknown.

Historic and Current Distribution

The Comal Springs dryopid beetle is known primarily from Comal Springs. The first Comal Springs dryopid beetles were collected in 1987 in Comal County, Texas, from Comal Springs spring run 2 (Barr and Spangler 1992). Barr collected specimens at Comal Springs spring runs 3 and 4 and documented the species at Fern Bank Springs (20 miles northeast of Comal Springs in Hays County) in the summer of 1992 (Barr 1993). Collections made from 2003 to 2009 further extended the known range of the beetle within the Comal Springs system to: (1) Comal Springs spring runs 1 - 5, (2) seeps along the western shoreline of Landa Lake, (3) Landa Lake upwellings in the Spring Island area, and (4) Panther Canyon Well, located about 105 m from the head of Comal Springs spring run 2 (Bio-West 2007; Bio-West 2011; J.R. Gibson, pers. comm., 2012). The species has been confirmed at Fern Bank Springs once since 2003, when a single larva was collected after 305 hours of sampling spring orifices with drift nets (Gibson et al. 2008).

Researchers from Texas State University recently discovered the Comal Springs dryopid beetle at Sessom Creek Spring by (Gibson 2016, SMARC, pers comm). Cheryl Barr made the identification of the adult specimen collected there.

Reasons for Decline and Threats to Survival

The listing rule states that reduction or loss of water of adequate quality and quantity constitutes the main threat to this species. Contamination from a variety of sources including, but not limited to, human waste (particularly from septic tanks), agricultural chemicals, urban runoff, and transportation of hydrocarbons and other potentially harmful materials throughout the Edwards Aquifer recharge zone and watershed are identified threats to water quality. Water withdrawal from the San Antonio segment of the Edwards Aquifer and drought are believed to be the primary threats to water quantity (Service 2007).

Range-wide Survival and Recovery Needs

Additional information is needed to direct and assist in completing recovery actions. A better understanding of Comal Springs dryopid beetle habitat requirements, reproduction, survivorship, and distribution is needed. The chief recovery need for this and other Edwards Aquifer dependent species is implementation of an aquifer management plan that maintains adequate habitat to sustain populations. Maintenance of habitat includes: (1) continuous natural springflow at Comal and Fern Bank springs and (2) adequate water quality of groundwater and springwater.

Status of Comal Springs Dryopid Beetle Critical Habitat

Critical habitat for Comal Springs dryopid beetle (79 FR 63100) was designated October 23, 2013. Two units of critical habitat were designated: (1) Comal Springs (37.9 ac) surface and 124.3 ac subsurface and (2) Fern Bank Springs (1.4 ac) surface and (15.0 ac) subsurface. Comal Springs dryopid beetle critical habitat includes parts of Landa Lake and the spring runs in Landa Park. The critical habitat unit designated at Fern Bank Springs (near the Blanco River in Hays County) is about 20 miles north of Comal Springs. Four physical and biological features were identified: (1) high quality water with no or minimal levels of pollutants such as detergents, heavy metals, pesticides, fertilizers, and organic contaminants, (2) aquifer water temperatures between 20 to 24°C, (3) a hydrologic regime with adequate springflow and dissolved oxygen, and (4) food supplies including detritus, leaf matter, living plant material, algae, fungi, bacteria and other microorganisms, and decaying roots. Water quality in the aquifer and spring habitats occupied by Comal Springs dryopid beetle may be related to springflow. Access to Fern Bank Springs for surveys has been unavailable for more than 7 years. Fern Bank Springs discharge is unknown.

C. COMAL SPRINGS RIFFLE BEETLE

Species Description and Life History

Comal Springs riffle beetle was listed as endangered on December 18, 1997 (Service 1997) and critical habitat was designated at Comal Springs in Comal County and San Marcos Springs in Hays County, Texas (Service 2007). The Comal Springs riffle beetle is a small aquatic beetle known from Comal and San Marcos springs (Bosse et al. 1988). This species was first collected in 1976 and described in 1988 (Bosse et al. 1988). Adult Comal Springs riffle beetles are reddish-brown and range in length from 1.7 - 2.1 mm. The hind wings of Comal Springs riffle beetle are short and non-functional (Bosse et al. 1988) making this species incapable of flying.

Larval and adult populations at Comal Springs reach their greatest densities (about 5 per m^2) in late fall through winter, but all life stages can be found throughout the year suggesting multiple broods in a season with overlapping generations (Bowles et al. 2003). The number of larval instars among species in the family Elmidae ranges from 5 to 8 (Brown 1987), but the specific number of instars for Comal Springs riffle beetle is unknown. The incubation period of elmid eggs typically ranges from 5 to 15 days, and the larval stages may last from 3 to 36 months (Brown 1987) before pupation occurs. Brown (1987) noted that mature elmid larvae pupate in protected areas above the water line. Adult Comal Springs riffle beetles, collected in the wild, have been kept alive for over one year in aquaria at the SMARC.

Historic and Current Distribution

Historically, the Comal Springs riffle beetle is known from Comal Springs and from a single specimen was collected at San Marcos Springs (Barr 1993). Arsuffi (1993) searched for the Comal Springs riffle beetle at several central Texas springs, but only found specimens at Comal spring run 3. Currently, Comal Springs riffle beetles are found at Comal Springs spring runs 1, 2, and 3, at several spring outflows and seeps along the northwestern shore of Landa Lake, and near springs in Landa Lake and on Spring Island. It has not been found J.R. Gibson (pers. comm. 2012) sampled the upper part of spring run 2 and found about 350 Comal Springs riffle beetles on a single cloth lure. Surveys in 2014 and 2015 have found very few Comal Springs riffle beetles in Comal Springs spring run 1. The aquatic beetle surveys of Gibson, Bio-West, Zara Environmental, Bowles et al., Barr, and Arsuffi have not found Comal Springs riffle beetles in Landa Lake any further upstream than the vicinity of Spring Island. Comal Springs riffle beetles have not been found at either spring run 4 or spring run 5. Gibson et al. (2008) collected Comal Springs riffle beetles at San Marcos Springs from the springs along the escarpment by the Aquarena Center and at a few springs in upper Spring Lake.

In December 2011, Bio-West's surveys in Comal Springs spring run 3 and at several Landa Lake locations (western shoreline and upstream of Spring Island) documented occupation of historic sites by Comal Springs riffle beetle. The Comal Springs riffle beetle is not known from any other locations outside of the Comal Springs in New Braunfels and San Marcos Springs in San Marcos.

Gonzales (2008) surveyed molecular genetic variation at seven Comal Springs riffle beetle localities (six at Comal Springs – Landa Lake and one at San Marcos Springs). She found four of the seven collection sites (spring runs 1, 2, and 3 and Backwater Spring near Spring Island) were invariant for mitochondrial DNA, hypothetically the result of a severe population bottleneck or founder effect. Three of the populations (western shoreline, Spring Island, and San Marcos Springs) were found to have high levels of mitochondrial DNA variation and Gonzales recommended each be considered a separate evolutionarily significant unit (ESU) within *Heterelmis comalensis*.

Reasons for Decline and Threats to Survival

The 1997 listing rule states that reduction or loss of water of adequate quality and quantity constitutes the main threat to this species. Surface water and groundwater contamination throughout the Edwards Aquifer recharge zone and contributing zone are identified as threats to water quality.

The presence of nonnative species may affect the continued existence of the Comal Springs riffle beetle. Nonnative species (such as the snails *Thiara granifera*, *Melanoides tuberculata*, and *Marisa cornuarietis*), which may compete directly or indirectly for food resources, have been identified as an ongoing threat to the continued survival of the Comal Springs riffle beetle throughout all or a significant portion of its range (Service 1997).

Range-wide Survival and Recovery Needs

Additional information is needed to direct and assist in completing recovery actions. A better understanding of Comal Springs riffle beetle habitat requirements, reproduction, survivorship, and distribution is needed. The chief recovery need for this and other Edwards Aquifer dependent species is implementation of an aquifer management plan that maintains adequate habitat to sustain populations. The conservation and maintenance of Comal Springs riffle beetle habitat includes: (1) continuous natural springflow at Comal and San Marcos springs and (2) adequate water quality of groundwater and springwater.

Status of Comal Springs Riffle Beetle Critical Habitat

Critical habitat for Comal Springs riffle beetle (78 FR 63100) was designated October 23, 2013. Two units of critical habitat were designated: Comal Springs (37.9 ac) and San Marcos Springs (16.2 ac). San Marcos Springs is about 18 miles northeast of Comal Springs.

The designated critical habitat of the Comal Springs riffle beetle encompasses all spring outlets in Landa Lake and Spring Lake (San Marcos). Critical habitat for the Comal Springs riffle beetle is centered on springs and includes habitat within a 15.2 m radius of spring outlets. Comal Springs riffle beetle designated critical habitat at Landa Lake does not include areas adjacent to aquatic habitat.

Comal Springs riffle beetle critical habitat includes parts of Landa Lake and the spring runs in Landa Park. Critical habitat does not include man-made structures (such as buildings, roads, and other paved areas) that existed before November 22, 2013 (effective date of critical habitat designation). Critical habitat is only designated for areas where springs occur and does not include areas of the lake bottom beyond a radius of 50 ft (15.2 m) from the spring outlet. A separate unit of critical habitat is designated at San Marcos Springs. Five essential physical and biological features were identified: (1) high quality water with no or minimal levels of pollutants such as detergents, heavy metals, pesticides, fertilizers, and organic contaminants, (2) aquifer water temperatures from 20 to 24°C, (3) a hydrologic regime with adequate springflow and dissolved oxygen, (4) food supplies including detritus, leaf matter, living plant material, algae, fungi, bacteria, other microorganisms, and decaying roots, and (5) bottom substrate in surface water habitat that is free of sand and silt, and composed of gravel and cobble ranging from 8 to 127 millimeters (mm). Water quality in the aquifer and spring habitats occupied by Comal Springs riffle beetle may be related to springflow.

D. FOUNTAIN DARTER

Species Description and Life History

The fountain darter was listed as endangered on October 13, 1970 (35 FR 13507). The Endangered Species Act went into effect on December 28, 1973. The fountain darter was incorporated into the list of endangered wildlife on September 26, 1975 (40 FR 44412). Though there were two fountain darter populations (Comal River including Landa Lake, and San Marcos River including Spring Lake) when critical habitat was designated for the fountain darter (45 FR 47355, July 14, 1980), critical habitat was only designated in the San Marcos River (including Spring Lake).

The fountain darter is a small benthic, reddish-brown fish. Adult fountain darters range in length from 19 to 38 mm. Fountain darter habitat requirements as described in the San Marcos and Comal Springs and Associated Aquatic Ecosystems (Revised) Recovery Plan (Service 1996) include: undisturbed stream floor habitats; a mix of submergent plants (algae, mosses, and vascular plants), in part for cover; clear and clean water; invertebrate food supply of living organisms; constant water temperatures within the natural and normal river gradients; and adequate springflows.

Historic and Current Distribution

The historic range of the fountain darter includes the San Marcos and Comal rivers in central Texas (Service 1996). In 1884, Jordan and Gilbert (1886) collected the type specimens of *E. fonticola* in the San Marcos River from immediately below the confluence of the Blanco River.

The fountain darter is found in Spring Lake and the San Marcos River downstream to an area just below the emergency spillway to the Smith Ranch impoundment. The population of fountain darters in the San Marcos River was estimated to be approximately 103,000 by Schenck and Whiteside (1976) and 45,900 (downstream of and excluding Spring Lake) by Linam (1993). Fountain darter densities appear to be highest in the upper segments of the San Marcos River and decrease markedly below Cape's Dam (Linam 1993).

In the Comal River, Evermann and Kendall (1894) collected 43 *E. fonticola* specimens in 1891, the first collection record for that locality. It appears the fountain darter was extirpated from the Comal Springs ecosystem when flow at Comal Springs ceased for six months in 1956 (Schenck and Whiteside 1979). Intensive surveys for the fountain darter were made from 1973 to 1975 with negative results supporting the hypothesis that the fountain darter was extirpated from the Comal Springs ecosystem for nearly 20 years. In 1975, Whiteside and others took 457 adult fountain darters from San Marcos and stocked them into Landa Lake and its spring runs (Schenk and Whiteside 1976, Olsen et al. 2016). Within months of the stocking, fountain darter reproduction in the Comal Springs ecosystem was evident when juvenile fountain darters were found.

Presently, the fountain darter is found in Landa Lake, accessible parts of Comal spring runs, and throughout the Comal River system downstream to the confluence with the Guadalupe River (Service, unpublished data, 1996). Olsen et al. (2016) recently estimated the effective population size of fountain darters in the Comal (N_e = 899) and San Marcos (N_e = 9,234) systems.

Reasons for Decline and Threats to Survival

The Recovery Plan (Service 1996) identifies several threats to the fountain darter. The primary threats are related to the quality and quantity of aquifer and spring water. Drought conditions, groundwater use, and lower than average springflows threaten the species recovery. Activities that may pollute the Edwards Aquifer and its springs and streamflows may also threaten or harm the species (Service 1996) and pollution events may be more serious during low springflows. Additional threats include effects from increased urbanization near the rivers, recreational activities, alteration of the rivers, habitat modification (e.g., dams, bank stabilization, flood control), predation, competition, habitat alteration by nonnative species, and introduced parasites (Service 1996).

The trematode parasite *Centrocestus formosanus* was discovered to infect the gills of the fountain darter in the Comal Springs ecosystem in 1996. Multiple researchers have documented that this parasite threatens the health of fountain darters (Mitchell et al. 2000, McDonald et al. 2006). The adverse effect of this parasite on darters is likely to increase during stressful periods of low spring discharge (Cantu 2003) and the parasite's adverse effects may be greater to younger fountain darter life-stages (McDonald et al. 2006). It appears that the only aquatic habitat in the Comal Springs system where fountain darters are free from parasites (including *Centrocestus*) is found in the spring runs (T. Brandt, pers. comm., 2011). This trematode is also present in certain reaches of the upper San Marcos River. The experimental removal of the snail host (*Melanoides tuberculata*) appears to have slightly lowered the abundance of the trematode near Spring Island (Service and Bio-West 2011). However, more research is needed to determine if snail removal is beneficial to fountain darters in the Comal Springs ecosystem.

One of the local threats is habitat degradation caused by nonnative fish species including suckermouth catfish (Loricariidae) that burrow extensively into river banks (Hoover et al. 2004, Pound et al. 2010). In addition, recreational use of the river adversely impacts aquatic vegetation. Fountain darters have reduced densities (or are absent) in areas lacking submergent vegetation (Bio-West 2007). One recovery task calls for the enhancement of habitats and for the fountain darter, this would include restoration of native submerged aquatic plants in the Comal and upper San Marcos rivers. Rooted submergent plants are an important component of fountain darter habitat. Aquatic plants provide: (1) surface area for egg attachment (breeding); (2) nursery habitats; (3) habitat for prey species such as amphipods; and (4) cover from predators. One recovery need involves managing river recreation ingress-egress areas to help reduce damage to aquatic plants and sensitive habitat.

Range-wide Survival and Recovery Needs

There are numerous actions listed in the Recovery Plan regarding specific regional and local recovery efforts. The Recovery Plan recommends region-based recovery efforts aimed at maintaining adequate springflows, protecting water quality, and reducing local threats to fountain darter habitat.

Status of Fountain Darter Critical Habitat

No fountain darter critical habitat will be affected by the project, as critical habitat for the fountain darter was not designated in the Comal Springs system.

III. Environmental Baseline

This section is an analysis of the effects of previous and ongoing factors (natural and anthropogenic) leading to the current status in the action area. The primary factor affecting all of the Comal Spring invertebrates and the fountain darter is the recharge, management, and use of the Edwards Aquifer. The level of the Edwards Aquifer affects groundwater near Comal Springs and discharge from Comal Springs. The Edwards Aquifer level is dynamic because of annual and seasonal variation in recharge and discharge. Water quality of the Edwards Aquifer in the New Braunfels area has generally been good. A secondary factor is human disturbance of surface water habitats.

Status of the Species with the Action Area

This section describes the status of the Peck's cave amphipod, Comal Springs dryopid beetle, Comal Springs riffle beetle, their respective federally designated critical habitats in the action area, and the fountain darter. For the Comal Springs invertebrates, we estimated the size of local populations based on surveys of Bowles, Stanford, and Bio-West. The area of habitat, densities, and local population size for known surface populations were estimated for the Comal Springs system.

Peck's Cave Amphipod

The status of Peck's cave amphipod (PCA) in the action area is not well known. Since it was listed in 1997, two specimens have been collected from spring run 4. There is an estimated 12 m^2 of spring habitat in spring run 4.

As stated in the BA, most of the PCA collections are from spring runs 1, 2, and 3, western shoreline (springs), near Spring Island, with few from spring runs 4, 5, and 6. There are no clear imminent threats to Peck's cave amphipod in the action area and this species is considered stable.

Peck's Cave Amphipod Critical Habitat

The action area includes 7.0 acres of the designated surface critical habitat in the Comal Springs unit. This subset represents about 18 percent of the Peck's cave amphipod Comal unit surface critical habitat (37.9 ac). The action area includes about 35.9 acres of the designated subsurface critical habitat in the Comal Springs unit. This represents about 29 percent of the designated subsurface critical habitat in the Comal Springs unit (124.3 ac). The physical and biological features essential to the conservation of Peck's cave amphipod are: (1) high quality water,

(2) aquifer water temperatures from 20 to 24°C, and (3) food supplies. All three of these features are present in the action area.

Comal Springs Dryopid Beetle

Recovery criteria for the Comal Springs dryopid beetle are not available as the Recovery Plan for this species is being drafted. To ensure healthy and self-sustaining populations of each Comal Springs invertebrate species, various actions such as monitoring the population size and genetic variability will be needed. To maintain a healthy population, abundance in the wild needs to remain above some yet to be determined level. Spring run 2 consists of small springs (seeps) that produced about 3 percent of all Comal Springs dryopid beetles collected by Bowles and Stanford (1994). Data on the vagility (ability to move) in the wild of Comal Springs dryopid beetles are not available.

The status of the Comal Springs dryopid beetle in the action area is similar to its status when listed in 1997. Bowles and Stanford sampled occasionally in the action area from July 1993 through April 1994 (Bowles and Stanford, unpublished data, 1994; Bowles et al. 2003) and because so few CSDB were found, the density in Comal Springs spring run 4 is estimated to be about 0.5 individuals per m^2, which is about half the density found in spring run 1.

Based on the numbers of Comal Springs dryopid beetles previously collected and distribution of springs and seeps, the surface habitat in action area is estimated to support about six Comal Springs dryopid beetles. This is based on the presence in spring run 4 of about 12 m^2 of spring-dominated habitat. CSDB surface habitat in the action area is still subject to the threat of siltation from the steep escarpment, potentially degrading springs along the escarpment bank of upper Landa Lake. Although survey data are few, CSDB in the action area is inferred to have a small surface population. The 2015 Zara surveys did not find CSDB in the action area but those samples were made during a drought and low springflow period and thus CSDB may be present under different conditions.

Comal Springs Dryopid Beetle Critical Habitat

The boundaries of the surface and subsurface critical habitat for the CSDB are the same as for Peck's cave amphipod. The aquatic habitat in action area includes 7 acres of the designated surface critical habitat in the Comal Springs unit. Of that 7 ac, about 12 m^2 is considered to be supportive of CSDB due to proximity to spring openings. The physical and biological features essential to the conservation of the Comal Springs dryopid beetle are: (1) high quality water, (2) aquifer water temperatures (20 to 24°C), (3) hydrologic regime with adequate springflow and dissolved oxygen, and (4) food supplies. All four of these features are present in the action area, particularly among rock dominated seeps and springs.

Comal Springs Riffle Beetle

The status of the Comal Springs riffle beetle in the action area is unknown. Bowles and Stanford sampled extensively in the action area from July 1993 through April 1994 (Bowles et al. 2003). The site was sampled in 2015 by Zara. However, no CSRB were found and suboptimal habitat conditions (drought and accumulation of fine sediment) were suggested as factors resulting in low CSRB numbers. While no CSRB have been collected in the action area, it is possible that CSRB are present but have not been detected due to inadequate surveys across a range of hydrologic conditions.
There are no apparent threats on a local scale affecting surface habitat in the upper Landa Lake population of Comal Springs riffle beetles but due to an absence of this species in surveys in the action area, the status of the CSRB in action area is unknown.

Comal Springs Riffle Beetle Critical Habitat

The aquatic habitat in the action area includes 6.8 acres of the designated critical habitat in the Comal Springs unit. The physical and biological features essential to the conservation of the Comal Springs riffle beetle are: (1) high quality water, (2) aquifer water temperatures (20 to 24°C), (3) hydrologic regime with adequate springflow and dissolved oxygen, (4) food supplies, and (5) a gravel and cobble substrate free of silt and sand. All five of these features are present in the action area. While the CDRB has not been documented in the action area, the presence of CSDB and PCA in the action area is an indication that the water quality, food sources, and substrates in spring run 4 and spring run 5 (near Nolte Village Apartments) would likely be supportive of CSRB.

Fountain Darter

The fountain darter occupies virtually all of the action area with varying densities. Fountain darters are sparse where there are few submerged aquatic plants and numerous where mosses, algae, and rooted submergent plants occur. Spring run 4 has sparse vegetation and a clumped distribution of fountain darters centered on vegetative cover. However, nearby parts of Landa Lake that are not impacted by swimming or wading have both submergent plants and higher numbers of fountain darters. Occasionally, flooding in New Braunfels results in changes to the aquatic vegetation in Landa Lake. For example, *Riccia* sp. (a moss known as liverwort) has no roots and high water velocities associated with flooding may dislodge *Riccia* in Landa Lake and move these plants downstream potentially to the Guadalupe River. In the period between flood events, *Riccia* tends to increase in abundance and fountain darter habitat is more productive in terms of recruitment with abundant submergent plants mixed with *Riccia*.

The Service and cooperators surveyed for fountain darters in the action area from July 1993 to April 1994, and in July 1996. The fountain darter densities in study section 1, 2, and 3 were determined to range from 1 to 6 fountain darters per m^2. The status of the fountain darter in upper Landa Lake including spring run 4 is considered stable.

Factors Affecting Species Environment within the Action Area

Factors affecting these species and their respective habitats can be divided into two classes: regional and local. As previously mentioned, the regional factors include effects to the hydrology and water quality of the Edwards Aquifer. Local factors include, but are not limited to, effects to the species and their habitats such as storm water pollution, water recreation effects to habitats, and competition and predation from nonnative and exotic species. In the summer, turbidity appears to increase during daylight hours in reaches downstream of water recreation, particularly tubing. Water recreation in part of Landa Lake is managed by the City. The City rents paddleboats on Landa Lake. Wading and swimming in the spring runs (except certain parts of spring run 2), Landa Lake, and upper part of the new channel are prohibited.

<u>Water Quantity</u>

Edwards Aquifer (Southern Segment)

The Edwards Aquifer underlies portions of Texas from Kinney and Uvalde counties (on its western edge) to the Kyle groundwater divide in Hays County (on its northeastern boundary). The Edwards Aquifer stretches for about 290 km with a width varying from about 8 to 64 km. Water within the Edwards Aquifer generally flows from areas of higher elevation in the southwest to areas of lower elevation to the northeast. The Edwards Aquifer is the primary water source for municipal, industrial, agricultural, and domestic uses for over two million people throughout the region.

The Edwards Aquifer has three distinct zones, each with unique hydrogeological characteristics. The contributing zone consists of about 13,986 km^2 and includes portions of Kinney, Edwards, Real, Uvalde, Bandera, Medina, Kerr, Kendall, Bexar, Comal, Blanco, and Hays counties. The contributing zone is composed of the watersheds of the creeks and streams that cross the recharge zone, thereby providing most of the water entering the aquifer.

The recharge zone consists of about 3,237 km^2 of porous Edwards limestone that lies exposed at the ground surface. Recharge takes place as runoff infiltrates the exposed geologic strata in this zone. Creeks and streams flowing generally south and east across central Texas often lose much or all of their baseflow to the aquifer as they cross the recharge zone. Water enters the Edwards Aquifer by infiltration through the soils and rock strata overlying the aquifer, by percolation through upland recharge features (caves, sinkholes, faults, fractures, and other open cavities), by percolation through recharge features in creeks that cross the recharge zone, and by cross-boundary flow from the Trinity Aquifer (Jones 2011).

The artesian zone of the Edwards Aquifer is characterized by several large and many smaller springs. Springflow results from the hydraulic pressure of the confined waters in this zone. The porous water bearing strata of the Edwards Aquifer are surrounded in the artesian zone by less permeable geology that confines waters flowing down gradient from the recharge zone. Faults and fissures through these overlaying strata allow these pressurized waters to be released at the surface in numerous springs and seeps. Johnson and Schindel (2008) defined fault blocks near Comal and San Marcos springs. The Artesian fault block (Figure 9, Johnson and Schindel 2008) appears to be the main source of the Comal Springs, particularly when Comal Springs discharge is less than 100 CFS. Dye tracing efforts in March 2002 indicated that some of Comal Springs flow (specifically small springs in spring run 3) comes from the Comal Springs fault block (Schindel 2007). However, Johnson and Schindel (2008) indicated that during dry periods the Comal Springs fault block does not contribute to springflow.

Springflows at Comal (and San Marcos) springs are directly related to water use from the Edwards Aquifer. The average discharge at Comal Springs from 1927 to 2009 was about 291 CFS. Comal Springs ceased flowing for 144 consecutive days in 1956 during the extended drought period referred to as the drought of record. These springflow conditions likely affected the Comal Springs invertebrates, Comal population of fountain darters, and their habitat. There are no records of population distribution or abundance for the Comal Springs invertebrates prior to, during, or after the drought of record event (until various efforts by biologists; Holsinger 1967; Barr and Spangler 1992; Bosse et al. 1988; Bowles et al. 2003; and, Gibson et al. 2008). The Edwards Aquifer has a high capacity for rapid recharge, and rainfall over the contributing and recharge zones can quickly increase water levels within the aquifer. The Edwards Aquifer can also experience rapid drops in water levels due to pumping, especially during drought periods.

Continued population growth in the region and associated increases in water demand may exacerbate declining springflows if future water needs are met by increased pumping from the Edwards Aquifer. Water conservation programs that reduce per capita water use and overall Edwards Aquifer water demand help to maintain springflows.

An underground water authority, the Edwards Aquifer Authority (EAA) was created (Chapter 626, Laws of the 73rd Texas Legislature, 1993, as amended by Chapter 621, Laws of the 74th Texas legislature, 1995), to manage and issue permits for the withdrawal of groundwater from the Edwards Aquifer for the purposes of water conservation and drought management. The EAA was designated a special regional management district and charged with protecting terrestrial and aquatic life, domestic and municipal water supplies, the operation of existing industries, and the economic development of the State of Texas.

The EAA is mandated to pursue all reasonable measures to conserve water; protect water quality in the aquifer; protect water quality of surface streams provided with springflows from the aquifer; maximize the beneficial use of water available to be drawn from the aquifer; protect aquatic and wildlife habitat; protect threatened and endangered species under Federal or State law; and provide for instream uses, bays and estuaries.

The monthly mean discharge for all of Comal Springs was less than 90 cfs for August, September, and October 2014. When Comal Springs discharge reaches this level, springflows in spring runs 1 and 2 are reduced to nearly zero. Since that event, Peck's cave amphipods and Comal Springs riffle beetles have been found in spring run 1. However, no Comal Springs dryopid beetles have been found in spring run 1 despite two rounds of aquatic invertebrate sampling in 2015.

Formal Consultations pursuant to Section 7 of the Act

We have completed formal consultation with the Department of Defense related to the operation of its missions in the San Antonio region and use of the Edwards Aquifer (January 11, 2008). We consulted with the USACE on the encasement of a New Braunfels Utilities water main crossing the Comal River (May 21, 2009). We have consulted with the Service's Fisheries Program on their use of the Edwards Aquifer as a water supply for the San Marcos National Fish Hatchery and Technology Center (currently SMARC) and Uvalde National Fish Hatchery and have finalized a biological opinion covering those Service activities (March 1, 2010). Comal County has received a regional HCP – incidental take permit (TE-223267-0) for land-use changes affecting the golden-cheeked warbler (GCWA) and black-capped vireo (BCVI). We conducted an intra-Service consultation on the issuance of that permit including the Comal Springs invertebrates and fountain darter as well as the covered species (GCWA and BCVI).

Formal consultations over the past decade have authorized take associated with their respective actions. Since February 2002, there have been seven biological opinions for projects where the action area included the Comal Springs ecosystem. Those biological opinions determined the total incidental take of fountain darters at 3,683. The biological opinion for bank stabilization in Landa Park (March 16, 2012) accounts for 3,168 fountain darters in that total.

In the past six years, there have been five formal consultations that have included the Comal Spring invertebrates: San Marcos Aquatic Resources Center and Uvalde National Fish Hatchery use of Edwards Aquifer water (March 1, 2008), Department of Defense use of Edwards Aquifer water (January 11, 2008), USACE authorization for bank stabilization in Landa Park (March 16, 2012), USACE authorization for repair of Gazebo Circle Bridge (October 18, 2012), and for Service's issuance of an incidental take permit for the Edwards Aquifer Recovery Implementation Program HCP (January 28, 2013). A following represents the total number of individuals since 2010 for which incidental take has been authorized:

- Peck's cave amphipod – 18,907
- Comal Springs dryopid beetle – 1,636
- Comal Springs riffle beetle – 11,487
- fountain darters from the Comal River – 800,312.

IV. Effects of the Action

Factors to be considered

In spring run 4, the water surface elevation (stage) is normally determined by: (1) flow from the small springs; (2) local runoff from the escarpment and NBU service yard; and (3) the overall stage for Landa Lake. The width of spring run 4 near the spring cap is about 6 m. Bank stabilization is proposed on the left bank looking downstream and total length of bank to be stabilized is 27.4 m. For both partial removal of the spring cap and bank stabilization, we anticipate that physical disturbance, if it happens, will occur within 0.5 m of the spring cap and within 0.5 m of the left bank's edge of water.

A Texas Parks and Wildlife Department effort to map, name, and characterize the myriad of Comal Springs has been completed but a final report is has not been issued. Additional delineation of springs under different hydrologic conditions is expected in the future. As the results of this effort become available, better estimates of the quantity of spring-influenced habitat in the Comal Springs ecosystem will be possible. Norris and Gibson (2013) indicated a handful of small springs in spring run 4 and the action area subset of Landa Lake. The springs and seeps that Norris and Gibson delineated in the spring run 4 were on the right bank looking downstream (escarpment side). However, small areas of the action area in downstream areas are spring-influenced and may support Comal Springs invertebrates.

Analyses for effects of the action

The effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action that will be added to the environmental baseline. For analyses of effects to listed species, we review changes in demographics and distribution. For analyses of effects to critical habitat, we review changes to the essential physical and biological features to resolve the action's impact on the function and conservation role of critical habitat in the future. Peck's cave amphipod and Comal Springs dryopid beetle designated critical habitat included an area within 15.2 m of aquatic habitat specifically to include a riparian component, i.e., woody vegetation (for food supply). Roots near springs may have an extensive surface area and biofilm (microbial) production. The proposed action involves conservation of the woody vegetation (with their roots) and the following analyses focus on aquatic habitat with the assumption that the woody vegetation near springs will remain unchanged by the action.

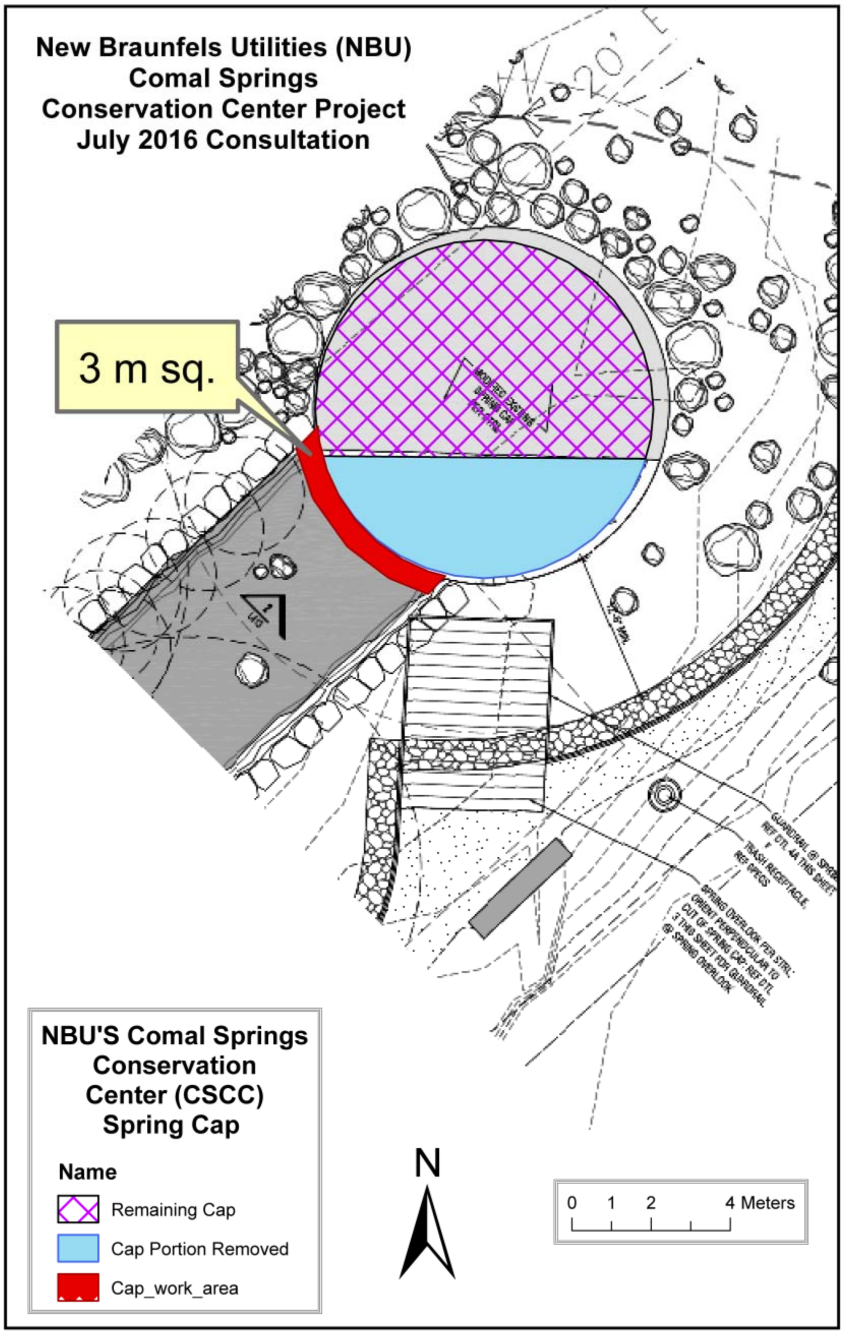


Figure 5. Spring Cap Work Area

The proposed action also includes a limited amount of bank stabilization along the left bank looking downstream of spring run 4. About 27.4 m of bank in total will be stabilized (Figure 3). The following analyses are based on the exposure of Peck's cave amphipods, Comal Springs dryopid beetles, Comal Springs riffle beetles, their respectively designated critical habitat (CH), and fountain darters to effects of the action. The estimated amphipod, dryopid beetle, riffle beetle, and fountain darter densities are based on best available information including Service, TPWD, and Bio-West research on the fountain darter. NBU provided construction drawings of the CSCC plans including stormwater management.

Effects to Peck's Cave Amphipod

The work on the spring cap and uppermost part of spring run 4 is a small subset of the action area. The aquatic area involved is about 3 m^2 for the spring cap and 14 m^2 for spring run 4 (Figure 5). The project effects to Peck's cave amphipod are expected to occur primarily in the immediate area of the spring cap in the form of turbid water lasting less than 4 hours. It is possible that the work to remove part of the spring cap will not disturb benthic species of the spring cap. A floating barrier may be employed to help catch material falling down inside the spring cap (e.g., when a concrete saw cuts the spring cap roof).

Opening the spring cap will allow primary productivity to increase among the substrates and roots in the spring cap. Aufwuchs is the assemblage of small organisms growing on surfaces of substrates submerged in water (e.g., on wood, gravel, and sand). Amphipods graze on aufwuchs. The periphyton, aufwuchs, and biofilm resulting from more natural lighting conditions may increase the carrying capacity of the spring cap for surface dwelling individuals of *Stygobromus*, *Stygoparnus*, and *Heterelmis*.

Slight changes in turbidity may occur downstream of the work area but this change in water quality would not be expected to affect Peck's cave amphipods, which are typically found in the gravel interstices.

It is noteworthy that springs and seeps in spring run 4 are predominantly on the escarpment side (the right bank looking downstream) and the bank stabilization work (Figure 3) is expected to disturb less than 14 m^2 of aquatic habitat.

On June 30, 2011, Gibson collected 10 lures in spring run 3 that were placed on May 31, 2011. This effort resulted in 5 positively identified Peck's cave amphipods and 21 amphipods identified only to genus (*Stygobromus*). Generally, about half of the smaller unidentified amphipods in Comal Springs spring runs are estimated to be *Stygobromus pecki*, the other half are likely *Stygobromus russelli* (J.R. Gibson, pers. comm, 2012). We estimate the density of Peck's cave amphipods in spring run 3 at 6.6 individuals per m^2. This density of Peck's cave amphipods is likely to be much higher than the amphipod density in the spring cap, spring run 4, and remaining parts of the action area with springs. The extent of impacts to the Peck's cave amphipod will be assessed in terms of area of aquatic habitat disturbed rather than numbers of PCA since there are no density estimates available for the action area.

Effects to Peck's Cave Amphipod Critical Habitat

Habitat Quantity

The spring cap and spring run 4 restoration work will potentially affect about 17 m^2 of aquatic habitat in designated Peck's cave amphipod critical habitat. The effects will involve temporary disturbance as collapsed stone walls are carefully removed prior to stabilization of the left bank. The Comal unit of critical habitat for the Peck's cave amphipod has a total area of about 81,520 m^2 but that includes parts of Landa Lake not within 15.2 m of a spring opening. The action will reduce habitat quantity (17 m^2) in this Comal Springs critical habitat unit only intermittently and of limited duration (probably less than one week).

Habitat Quality and Essential Biological and Physical Features

Habitat quality in spring run 4 and upper Landa Lake is expected to be maintained if springflows and Landa Lake's water surface elevation (stage) are maintained throughout the work schedule with the exception of brief localized turbidity events. Outside of spring run 4, no change or degradation of the physical or biological features essential to Peck's cave amphipod is anticipated.

We anticipate that the critical habitat that is disturbed will return to suitability within days or weeks after bank stabilization is completed. High-quality water and improved water temperatures ranging from 20 to 24°C would result from the construction of the enhanced stormwater management system. We do not know how long it will take Peck's cave amphipods to colonize the disturbed areas. Since springs and seeps are generally on the right bank looking downstream, we do not anticipate any of the 12 m^2 of spring dominated habitat in spring run 4 will be disturbed. The project will disturb less than 3 m^2 of spring-influenced habitat in spring run 4 in the spring cap vicinity.

Effects to Comal Springs Dryopid Beetles

The density of Comal Springs dryopid beetles in spring run 4 is estimated as 0.5 individuals per m^2. Note this density is specific to the spring-dominated microhabitat and not to spring run 4 in general.

No other areas affected by the proposed action are expected to have Comal Springs dryopid beetles. The proposed bank stabilization is estimated to result in the disturbance of about 27 m^2 of aquatic habitat that: (a) has not had CSDB collected therein and (b) is presumed to have a very low density of Comal Springs dryopid beetles. Only a small area of about 3 m^2 near the spring cap is expected to be disturbed by the spring cap removal. Proposed conservation measures include methods that minimize or avoid disturbance of wetted habitat such as scaffolding.

We anticipate that spring run 4 (post-construction) will continue to maintain a local population of Comal Springs dryopid beetles, which should be determined by annual (or more frequent than annual) surveys with varied capture techniques such as hand picking, pleated cured cotton lures, and kick sampling.

Effects to Comal Springs Dryopid Beetle Critical Habitat

Habitat Quantity
Similar to Peck's cave amphipod critical habitat effects, the proposed alteration of the spring cap (3 m^2) and bank stabilization (14 m^2) will disturb about 17 m^2 of Comal Springs dryopid beetle critical habitat. About 67 m^2 of aquatic habitat will be temporarily degraded from turbidity due to wading in the work area.

The Comal unit of critical habitat for the Comal Springs dryopid beetle has a total area of about 81,520 m^2, but that includes parts of Landa Lake more than 50 ft from a spring opening. The project will temporarily reduce the water quality in a fraction of that Comal Springs dryopid beetle critical habitat in the Comal Springs unit for two months by 41 m^2.

Habitat Quality and Essential Biological and Physical Features
Habitat quality in spring run 4 is expected to be maintained in the work area assuming average aquifer conditions and average Comal Springs discharge during the work schedule affecting the spring cap and spring run 4.

Effects to Comal Springs Riffle Beetles

Comal Springs riffle beetle densities have been estimated for spring runs 1, 2, and 3 from unpublished data by Bowles and Stanford (1994). There are no estimates for the density of CSRB in the action area since the closest CSRB collected to the action area is near Spring Island.

Effects to Comal Springs Riffle Beetle Critical Habitat

Habitat Quantity
The project will temporarily disturb about 17 m^2 of Comal Springs riffle beetle critical habitat in spring run 4. Under normal aquifer levels, there is an estimated 12 m^2 of spring-dominated microhabitat in spring run 4 and these areas are associated with springs along the right bank looking downstream (the side closest to the Balcones escarpment). However, this spring-dominated microhabitat will not be disturbed and is not expected to be impacted by the project. About 1,579 m^2 of the project area overlaps with the CSRB critical habitat. That is about 2 percent of CSRB critical habitat in the Comal Unit. Additionally, neither the spring cap partial removal nor the bank stabilization is expected to result in any permanent changes to the total habitat. The project will temporarily disturb about 17 m^2 of spring run 4 aquatic habitat.

Habitat Quality and Essential Biological and Physical Features
Habitat quality throughout most of spring run 4 would be maintained except for a possible brief episode of turbidity.

The Comal Springs system has about 3,300 m^2 of spring-dominated habitat fitting the description of Comal Springs riffle beetle critical habitat. This project would negatively affect about 17 m^2 of spring run habitat during partial removal of the spring cap and bank stabilization. Post-project construction, this habitat is expected to return to current suitability for the Comal Springs riffle beetle.

Effects to the Fountain Darter

The project will not result in loss of any currently occupied fountain darter habitat. However, fountain darters, depending on the particular aquatic plants in the area, may be present in moderate to low densities in spring run 4. There are no barriers for fountain darters to enter spring run 4 from Landa Lake. Fountain darters have been found to occur in spring run 4 in a density of about 6 per m^2 based on drop net samples. The fountain darter also occurs in Landa Lake and only slight temporary changes in water quality including turbidity are expected to occur during the bank stabilization work. The fountain darter densities in study sections 1 and 3 were 1 and 4 fountain darters per m^2, respectively. However, with the exception of brief periods of turbidity in study section 3, no adverse effects to fountain darters are anticipated in study sections 1 and 3.

The fountain darter is most common in parts of Landa Lake with submerged aquatic vegetation. Landa Lake is effectively a large spring run and with a large and diverse submergent plant community, it likely supports a very large population of fountain darters (greater than 200,000).

The proposed action may include removal of boulders, concrete blocks, and other anthropogenic materials in spring run 4. This may include areas where previous bank walls have failed or material been carried in during flooding. With large substrate removed, potential habitat for submergent plants will be increased on par with the area uncovered.

V. Cumulative Effects

Cumulative effects include the effects of future State, local or private actions that are reasonably certain to occur in the action area. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. The USACE, Service, Federal Highway Administration, Federal Emergency Management Agency, and the U.S. Environmental Protection Agency are the most likely Federal agencies to authorize or fund projects warranting section 7 review in New Braunfels, Texas.

<u>Regional Factors</u>
The Recovery Plan for the fountain darter (Service 1996) discusses the various regional and local threats to these species. Overpumping from the Edwards Aquifer remains the most significant regional threat. Given current aquifer conditions and seasonal forecast, we believe Comal Springs discharge in 2016 is likely to remain near average. Management of the Edwards Aquifer (with implementation of conservation management actions to benefit the fountain darter and Comal Springs invertebrates) is the crux of the Edwards Aquifer Recovery Implementation Program (EARIP) and proposed Edwards Aquifer Habitat Conservation Plan (2012).

Habitat conservation planning for the Edwards Aquifer species is under the aegis of the Edwards Aquifer Authority and other stakeholders in the EARIP (which includes the City of New Braunfels and NBU). The EAHCP, has an incidental take permit issued in March 2013, pursuant to section 10(a)(1)(B) of the Act, to address the effects of Edwards Aquifer management (which includes pumping) on federally listed threatened and endangered species dependent on the Edwards Aquifer. One of the major goals of the HCP is to maintain adequate and continuous springflow at Comal Springs even during a drought with the duration and intensity of the 1951-1956 drought.

Local Factors

The Veramendi mixed use development in the Blieders Creek watershed (2,430-ac) may reduce the water quality in Blieders Creek and potentially Comal Springs and Landa Lake. Ongoing impacts from water recreationists remain a serious local threat to fountain darter habitat. Invasive nonnative mollusk and fish species are adversely affecting habitat suitability in the Comal Springs ecosystem. Additional future introductions (unintentional or not) and establishment of other nonnative plants seem likely to occur. Flooding, varying from mild to severe, is expected in the action area during the construction phases of the project (next 3 to 5 years). Flood control projects in the Comal area have reduced the severity of flooding in the action area. However, as the immediate watershed becomes more developed, the stormwater hydrograph and water quality are expected to be altered. Comal Springs invertebrates and fountain darters, and other biota of the Comal River may be affected by contaminants associated with land-use near the river.

Cumulative Effects to Designated Critical Habitat

The magnitude of the effects of future non-Federal actions on critical habitat depends on: (1) implementation of regional and local water conservation efforts (including diversification of water supply), and (2) the intensity and duration of the next drought. Regional efforts that effectively manage Edwards Aquifer pumping would reduce the effects of drought on Comal Springs discharge and the water-related essential features. If cumulative groundwater use during a severe and extended drought is not effectively managed by the EARIP HCP, flow at Comal Springs will fail. If springflows fail, the function and value of critical habitat for the Comal Springs invertebrates will be diminished or lost. We do not know how long each of the listed Comal Springs invertebrates species can survive if Comal Springs fails. Comal Springs associated with spring runs 1, 2, 3, and 4 failed to flow for almost 6 months in 1956. We do not know what the population sizes were before or after that event. If the populations were large before springs failed, potentially they were reduced to a moderate population size after spring failure. Alternatively, they could have been reduced to a low number of individuals, and under those circumstances, they managed to recruit young and eventually colonize available suitable habitats. However, we are unaware of any means to determine the likelihood that the listed spring-dependent invertebrate species would survive a similar event in the timeframe for the proposed action (2016).

VI. Conclusion

The following analysis is based on these components: (1) the status of the species, (2) the environmental baseline, (3) the effects of the action, and (4) the cumulative effects. After reviewing the current status of the Peck’s cave amphipod, Comal Springs dryopid beetle, Comal Springs riffle beetle, and fountain darter, the environmental baseline for the action area, the effects of the proposed action, and cumulative effects, it is the Service's biological opinion that the proposed removal of part of spring cap, bank stabilization in spring run 4, and construction of the Comal Springs Conservation Center will not jeopardize the continued existence of the Peck’s cave amphipod, the Comal Springs dryopid beetle, the Comal Springs riffle beetle, or the fountain darter. This is based on: (1) the current stable status of these species, (2) the number of individuals likely to be taken by the project as proposed, and (3) the expected persistence of an adequate population of Peck's cave amphipods, Comal Springs dryopid beetles, Comal Springs riffle beetles, and fountain darters in areas not affected by the project.

The reduction of the habitat in spring run 4 for the Comal Springs invertebrates is expected to be brief related to the duration of work removing part of the spring cap and stabilizing the bank nearby. This proposed project would adversely affect about 17 m^2 of Comal Springs invertebrate habitat for two months.

The proposed action will not adversely modify designated critical habitat of the Peck's cave amphipod, the Comal Springs riffle beetle, or the Comal Springs dryopid beetle. Although a small area (17 m^2) of critical habitat for these species will be temporarily disturbed during bank stabilization, we anticipate the biological and physical features essential to the conservation of these three species will be present in its same configuration after spring run 4 restoration work is finished. Restoration of four features (water quality, water temperature, springflow regime, and food supply) is expected within one month of completion of construction. The substrate that supports Comal Springs riffle beetle (gravel and cobble substrate) will be enhanced as larger, less suitable substrate are removed. With concrete cinder blocks and other man-made materials removed from spring run 4, the total area of gravel substrate with spring water moving through and above it will be slightly increased. Eventually, tree plantings near spring run 4 may result in more roots near springs improving habitat suitability for listed beetles and Peck's cave amphipod.

This conclusion is based in part on the small area and small percent of critical habitat for each species that would be adversely affected by bank stabilization. Water quality would be degraded temporarily where substrates are disturbed in the form of turbidity. Turbidity would decrease as springflow moves to Landa Lake particularly if overall aquifer conditions provide average spring discharge. Mean daily discharge ($feet^3$ per second; cfs) at Comal Springs for August 10, 2016 was provisionally estimated at 340 cfs (August 10, 2016). The current discharge of Comal Springs is above the annual mean (Water Years 1933-2015) of 286 cfs.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary, and must be undertaken by the USACE so that they become binding conditions of any authorization issued to the applicant, as appropriate, for the exemption in section 7(o)(2) to apply. The USACE has a continuing duty to regulate the activity covered by this incidental take statement. If the USACE: (1) fails to assume and implement the terms and conditions or (2) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. To monitor the effect of incidental take, the USACE must report the progress of the action and its effect on the species to the Service as specified in the incidental take statement [50 CFR §402.14(i)(3)].

Amount or Extent of Take Anticipated

Incidental Take

The following table (Table 1) summarizes the incidental take of Peck's cave amphipod, Comal Springs dryopid beetle, Comal Springs riffle beetle, and fountain darter. It is based on the assumption that the effects of the project are limited primarily to the immediate work areas.

Table 1. Area of Habitat as Surrogate for incidental take

Species	**Locality**	**Area of Aquatic Habitat Affected, m^2**
Peck's cave amphipod	spring cap and spring run 4 bank stabilization	17
Comal Springs dryopid beetle	spring cap and spring run 4 bank stabilization	17
Comal Springs riffle beetle	spring cap and spring run 4 bank stabilization	17
fountain darter	spring run 4 (entire run)	580

Total estimated fountain darter habitat affected in spring run 4 is 580 m^2. The abundance of fountain darters near the spring cap is expected to be low due to a lack of submergent plants. It may be practicable to attempt to capture and relocate fountain darters and Comal Springs invertebrates in the spring run 4 work area. We assume 100 percent of the Peck's cave amphipods, Comal Springs dryopid beetles, Comal Springs riffle beetles, and fountain darters remaining in affected areas will be killed. Fountain darters in the area near the bank stabilization or spring cap work may be physically harmed if trampled while sheltering among gravels.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the effects of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The USACE must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

Effect of the take

In the accompanying biological opinion, we have determined that the level of anticipated take is not likely to result in jeopardy to the species or the destruction or adverse modification of critical habitat for the reasons stated in Section VI above.

REASONABLE AND PRUDENT MEASURES

Pursuant to section 7(b)(4) of the Act, we believe the following reasonable and prudent measures (RPM) are necessary and appropriate to minimize effects of incidental take.

(1) Disturbance of the (a) substrate, (b) water quality, (c) plants, and (d) animals of the Comal Springs, Landa Lake, and Comal River due to the construction of the Comal Springs Conservation Center, the alteration of the spring cap of spring run 4, habitat restoration of spring run 4, and bank stabilization must be avoided when possible and reduced to the maximum extent practicable where disturbance is unavoidable.

(2) The applicant must monitor the project and ensure appropriate and relevant information (as specified below) on the project is provided in a timely manner to the USACE and Service.

Terms and conditions

To be exempt from the prohibitions of section 9 of the Act, the USACE must ensure compliance with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting and monitoring requirements. The applicant will be responsible for complying with these terms and conditions, which are non-discretionary.

Terms and conditions that implement RPM 1:

(1) The USACE will ensure project-related work is actively monitored by the applicant (NBU and its contractors), who will help ensure that actions taken on-site are consistent with approved plans and this biological opinion.

(2) The USACE will require the applicant to ensure that precautions are taken to avoid accidental impacts to spring run 4 and other downstream habitats.

(3) Work by the applicant and the contractor will be done with careful staging of heavy equipment by the river and inspections for leakage of fuels, hydraulic fluids, coolants, and any other fluids are required. If fluid leakage is detected, equipment must be repaired and

cleaned prior to working in or along the river. Care must be taken to prevent material falling into the river.

(4) Turbidity will be visually monitored daily during construction including from pumped water. If construction-related turbidity in Landa Lake is greater than 5 nephelometric turbidity units for a period longer than 24 hours, the applicant will contact the Service to discuss measure to abate the turbidity. If indicated, additional measures to reduce turbidity may be recommended.

Terms and conditions that implement RPM 2:

(5) The USACE will ensure that the applicant contact the USACE and the Service's Austin Ecological Services Field Office at: (a) the beginning of work, (b) the end of work, and (c) any notable or unforeseen event that may affect the aquatic community in a manner not considered in this biological opinion. Examples of notable events would be flooding or encountering a groundwater flowpath when drilling. Contact with the Service can be made by phone (512 490-0057), facsimile (512 490-0094), or by e-mail (Patrick_Connor@fws.gov). Similarly, if it is deemed necessary to disturb aquatic habitats in a manner not described in the project description, the applicant will contact the USACE and Service prior to any ground disturbing activities and receive approval of the project modification prior to commencement. In addition, the applicant must provide a one-page summary report of construction activities to the USACE and Service no later than 30 days after construction is complete.

Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. We provide the USACE with the following conservation recommendations:

(1) In coordination with the Service, plan and implement a study to assess the current (pre-project) status of Comal Springs invertebrates in spring run 4. Re-assess post-construction to determine the extent of colonization of disturbed habitat by Comal Springs invertebrates. If feasible, allow Service biologists to sample pumped water from boreholes and available wells on NBU property for Comal Springs invertebrates to help resolve their potential occurrence in groundwater near spring run 4.

(2) Assist with restoration and protection of native trees in spring run 4. Assist with restoration of macrophytes in upper Landa Lake and the lowest reach of Blieders Creek.

(3) Assist with the implementation of recovery tasks for the fountain darter in the revised Recovery Plan and when the next revision to the Recovery Plan is finalized, assist with implementation of recovery tasks for the Comal Springs invertebrates when the recovery

plan for these species is available.

(4) Assist with research on the distribution of the Comal Springs invertebrates by encouraging access to non-production water wells in the project area. Bottle traps may be used in certain wells to capture subterranean beetles and amphipods.

We request notification of the implementation of any conservation recommendations so we may be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats.

Reinitiation Notice

This concludes formal consultation on the actions outlined in the request. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

We look forward to completion of this project that is expected to improve habitat conditions for all four species in this consultation. If you have any questions, please contact Tanya Sommer at extensions 222. Thank you for your interest and help in conserving our Nation’s natural resources.

Sincerely,

/s/

Adam Zerrenner
Field Supervisor

cc: Julie Wicker, TPWD, Austin, TX

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