United States Department of the Interior

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MAR 16 2012

Stephen Brooks
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Consultation No. 02ETAU00-2012-F-0021

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 (33 U.S.C. 1251 – 1376) for bank stabilization and replacement of retaining walls in Landa Park, New Braunfels, Comal County, Texas. The USACE is considering a Nationwide Permit (SWF-2009-00512) to authorize work (including fill) in the Comal River, including tributary spring runs, Landa Lake, and the upper reach of the new channel of the Comal River.

The City of New Braunfels Parks and Recreation Department (City) proposes to replace existing walls in Landa Park with new walls made of Redi-Rock blocks on a gabion foundation. The City proposes to replace 1,384 meters (m) of retaining walls in Landa Park. 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.

The USACE is the Federal agency authorizing this project. The USACE has provided a biological evaluation (BE) of the project prepared by Halff Associates, Inc. for the City in an October 3, 2011, e-mail. A November 8, 2011, letter from the USACE to the Service stated formal consultation was initiated through the October 3, 2011, e-mail. This biological opinion is based on information from: (1) the BE, (2) discussions with the USACE, City, and Halff Associates, Inc., (3) field investigations by the Service, Texas Parks and Wildlife Department (TPWD), Texas State University – San Marcos, and BIO-WEST, Inc., and (4) other sources of information. A complete administrative record of this consultation is on file at our office.

Consultation History

January 27, 2010	Meeting with the City, Halff Associates, Inc., Service, and USACE (by phone).
October 3, 2011	Meeting with the City, Halff Associates, Inc., Service, and USACE (by phone); BE transmitted by e-mail from USACE to Service.
November 3, 2011	Service sent a letter to USACE on information needed in the biological evaluation.
November 8, 2011	USACE letter stating that formal consultation was initiated with its October 3, e-mail.
November 17, 2011	Halff Associates, Inc. provided Service with a revised BE.
December 16, 2011	Telephone conference with Service, USACE, and Halff Associates, Inc.
December 20, 2011	E-mail from Brian Longworth of Halff Associates, Inc. regarding water velocities and scour potential.
January 19 & 20, 2012	E-mails from Danny Griffith of Halff Associates, Inc. with schematic plans for four types of retaining walls, placement of gabion relative to aquatic habitat, and estimated time to complete construction.
February 14, 2012	E-mail exchange between Service and USACE with agreement to extend formal consultation 30 days to March 16, 2012.
February 17, 2012	Meeting with City, Halff Associates, Inc., USACE, and Service to discuss and clarify construction methods in Spring Run 1.
February 28, 2012	Service provides draft biological opinion to USACE, City, and Halff Associates, Inc.
March 15, 2012	USACE provides comments on draft biological opinion.

BIOLOGICAL OPINION

The BE lists 18 species considered threatened or endangered by the Service and/or the State of Texas in reviewing the retaining wall project. However, the only federally listed species known to occur in the Comal Springs ecosystem near Landa Park retaining walls are the four species that the USACE determined may be affected by the project.

The BE list included 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 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.

This biological opinion does not rely on the regulatory definition of "destruction or adverse modification of critical habitat" at 50 CFR 402.02. Instead, we have relied on the statutory provisions of the Endangered Species Act to complete the following analysis with respect to critical habitat.

I. Description of Proposed Action

The City proposes to replace (or in some areas, build new) about 1,384 m of the retaining walls in Landa Park with Redi-Rock blocks. The location and type of retaining wall are shown in the layout figures provided by Halff Associates, Inc. Redi-Rock blocks are made from concrete and weigh up to 1800 kilograms. The number and type of stacked Redi-Rock blocks will depend on the local height of wall needed. One or two types of temporary dams will be used to manage water near the retaining wall and its foundation: (1) water-filled cofferdams or (2) a cofferdam made of a free standing steel support system and impervious fabric membrane. Water from inside the temporary dam would be pumped, filtered, managed for erosion issues, and allowed to return to the spring run, Landa Lake, or new channel of the Comal River. The proposed construction of new retaining walls will involve:

(1) placing a temporary dam 0.9 to 1.5 m from the current bank's edge of water (type of temporary dam to be determined by site);
(2) lowering the water level in the work area (inside the temporary dam) with pumps; specifically for Spring Run 1, springflows would be managed to maintain at least 3 cm (0.1 ft) depth of water over substrate; outside of Spring Run 1, pumps will dewater the work area;
(3) excavating substrates for wall types A and B for wall base scour protection;
(4) excavating the bank for the wall foundation;
(5) construction of a gabion mattress foundation with the following dimensions: 0.6 m (height), various lengths, and depending on the wall type, a width of 0.9 to 1.8 m (horizontal and perpendicular to water flow); plastic-coated galvanized steel wire with a graded rock fill (various sizes of cobble, 64 to 256 mm); for wall types A and B, a gabion mattress will be constructed in parts of Landa Lake and the Comal River – new

channel for scour protection;
(6) placement of Redi-Rock (width varies from 0.7 to 1.5 m);
(7) backfill behind Redi-Rock with coarse aggregate;
(8) covering the aggregate and parts of the Redi-Rock with a 0.3 m clay cap and then with 0.15 m soil; and
(9) topping the Redi-Rock with a 0.6 m thick, 0.9 m wide stone cap.

Figure 1 shows a plan view of the proposed retaining wall in Comal Spring Run 1. Permeability is a key feature of the proposed retaining wall. The new retaining walls will allow groundwater behind the wall to flow to the spring run (or Landa Lake, depending on the section). Personnel from Halff Associates, Inc. have stated that groundwater will be able to move through the retaining wall through designed seams in the Redi-Rock and the gabion.

The City proposes to use four types of retaining walls depending on proximity to springs and the presence of trees and tree roots (see Halff Associates, Inc. layout figures). Types A and A1 have a 1.8 m wide gabion mattress foundation (gabion). Types B and B1 have a 0.9 m wide gabion foundation and are designed for use near trees and tree roots. It is our understanding that all trees and their roots reaching aquatic habitats (near the retaining wall types A1 and B1) will be preserved. Wall types A and B will be used along the shoreline of Landa Lake and upper part of the new channel of the Comal River channel. Two other wall types (A1 and B1) will be used in the spring runs and parts of Landa Lake. Wall types A1 and B1 are similar to wall types A and B, but wall types A1 and B1 lack the scour protection at the footing of the wall structure.

The City proposes to construct the retaining wall in sections ranging from 30 to 46 m (or longer for wall types A and B). Each new retaining wall section will take about 3 weeks to construct. Total time needed to complete the project is estimated at 9 to 12 months.

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). For the purposes of this biological opinion, the action area includes: (1) Landa Park, (2) associated aquatic habitats including the Comal River downstream to its confluence with the Guadalupe River, (3) Landa Lake downstream of Pecan Island, (4) critical habitat of the Comal Springs invertebrates downstream of Pecan Island, (5) the old (original) and new channels of the Comal River downstream to their confluence upstream of Clemens Dam, and (6) roads and bridges in New Braunfels over the Comal River that are used to transport materials and equipment for the project (Figures 2 and 3).

II. Status of the Species and Critical Habitat

Regarding the Settlement Agreement on Critical Habitat of the Comal Springs Invertebrates
On July 17, 2007, the Center for Biological Diversity, Citizens Alliance for Smart Expansion, and Aquifer Guardians in Urban Areas provided the Service with a 60-day notice of intent to sue on the final critical habitat rule for Peck's cave amphipod, Comal Springs dryopid beetle, Comal

Springs riffle beetle, and other listed invertebrate species. On January 14, 2009, the plaintiffs filed suit in U.S. District Court for the Western District of Texas on issues related to sections 3(5)(A) and 4(b)(2) of the Act. On December 18, 2009, the parties filed a settlement agreement where the Service agreed to submit to the *Federal Register*: (1) a revised proposed rule for designation of critical habitat for the Comal Springs invertebrates on or before October 17, 2012 and (2) a final rule for critical habitat on or before October 13, 2013. The currently designated critical habitat will be used until any subsequent final rule (that may revise critical habitat) becomes effective.

A. Peck's Cave Amphipod

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). The designated critical habitat of the amphipod at both springs comprises habitat within 15.2 m of the spring orifices. Part of Landa Lake is designated critical habitat, specifically the lake area within 15.2 m of springs. Critical habitat does not include other areas of the lake bottom where springs do not occur.

Species Description and Life History
This small subterranean aquatic species was first collected by Peck in 1964 at Comal Springs. It is eyeless and unpigmented. Little is known of its life history. 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 aquifer, it may act as a scavenger and a detritovore. 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 National Fish Hatchery and Technology Center.

Peck's cave amphipod has adaptions typical of cave fauna. However, it also occurs among substrates in surface water near springs as well as in groundwater. 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 (Figures 4 and 5). Comal Springs is the largest spring system in Texas and recharge occurs at great distances from the springs. A few specimens have been collected from Panther Canyon Well (in Landa Park) 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 (Comal Springs). The lack of specimens from a survey of 22 other wells (Barr 1993) suggests that this species may be confined to the groundwater conduits in the vicinity of 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. Gibson (2010) 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.

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. These invertebrates require 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 non-native species which may prey upon amphipods or compete for resources.

Range-wide Survival and Recovery Needs
Additional information is needed to direct and assist in completing recovery actions. A better understanding of Peck's cave amphipod habitat requirements, reproduction, survivorship, and distribution is needed.

Genetic analyses using mitochondrial DNA of known Peck's cave amphipod populations were made by Nice and Ethridge (2011). They found two distinct haplotype groups without an apparent geographic structure with respect to the groups. A haplotype is defined by Allendorf and Luikart (2007) as "a combination of alleles at loci that are found on a single chromosome or DNA molecule." One hypothesis is the presence of two cryptic species (in the Comal Springs - Edwards aquifer system) within the nominal species *Stygobromus pecki*. However, more genetic analyses (including nuclear DNA) are needed to test this hypothesis.

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 (72 FR 39248) was designated July 17, 2007. Peck's cave amphipod critical habitat includes parts of Landa Lake and the spring runs in Landa Park. A separate unit of critical habitat is designated at Hueco Springs about 3.2 miles north of Comal Springs - Landa Park. Three primary constituent elements 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, 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. Currently (February 2012), Comal Springs is flowing at a rate of 267 cubic feet per second (cfs) and Hueco Springs is flowing at a rate of 84 cfs (U.S. Geological Survey provisional data; 1 cfs equals 0.028317 m^3 per second).

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.

B. Comal Springs Dryopid Beetle

Comal Springs dryopid beetle was listed as endangered on December 18, 1997 (Service 1997) and critical habitat units were designated at Comal Springs in Comal County and Fern Bank Springs in Hays County, Texas (Service 2007). The designated critical habitat of the Comal Springs dryopid beetle at both units is comprised of habitat within a radius of 15.2 m from spring outlets.

Species Description and Life History

The Comal Springs dryopid beetle is the only known subterranean member of the Dryopidae family. 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. Barr and Spangler (1992) noted that collections of this species in Spring Run 2 were primarily in the headwater outlets and outlets beneath either bank. Bowles et al. (2003, and unpublished data) found 120 adults and 44 larvae in their surveys of Spring Runs 1 through 4. The highest density of Comal Springs dryopid beetles they found was in Spring Run 1, 1.00 individuals per m^2, (132 larvae and adults in 132 samples) (Table 1).

Historic and Current Distribution

The Comal Springs dryopid beetle is known primarily from Comal Springs (Figures 4 and 5). 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 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 Spring Run 2 (BIO-WEST 2003-2009; 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).

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 (72 FR 39248) was designated July 17, 2007. Comal Springs dryopid beetle critical habitat includes parts of Landa Lake and the spring runs in Landa Park. A separate unit of critical habitat is designated at Fern Bank Springs (near the Blanco River in Hays County) about 20 miles north of Comal Springs - Landa Park. Four primary constituent elements 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. Currently (February 2012), Comal Springs is flowing at a rate of 267 cfs. Fern Bank Springs discharge is unknown. In 2011, most of Texas, including south-central Texas, experienced a record-setting year for lack of precipitation (Nielsen-Gammon 2011). The lack of rainfall in 2011 led to lower than average springflow at Comal Springs. Access to Fern Bank Springs for surveys has been unavailable for more than 7 years.

C. Comal Springs Riffle Beetle

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 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.

Species Description and Life History
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 San Marcos National Fish Hatchery and Technology Center.

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 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. 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. Gibson et al. (2008) collected Comal Springs riffle beetles at San Marcos Springs from the springs along the escarpment by the Aquarena Center and a few springs in upper Spring Lake.

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 (Spring Runs 1, 2, and 3 and Backwater Spring near Spring Island) were invariant for mitochondrial DNA (mtDNA), hypothetically the result of a severe population bottleneck or founder effect. Three of the populations (West shoreline, Spring Island, and San Marcos Springs) were found to have high levels of mtDNA variation and Gonzales recommended each be considered a separate evolutionarily significant unit (ESU) within *Heterelmis comalensis*.

In December 2011, BIO-WEST's surveys in Comal 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 Comal Springs – Landa Lake in New Braunfels and Spring Lake in San Marcos.

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 non-native species may affect the continued existence of the Comal Springs riffle beetle. Non-native 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 (72 FR 39248) was designated July 17, 2007. Comal Springs riffle beetle critical habitat includes parts of Landa Lake and the spring runs in Landa Park. A separate unit of critical habitat is designated at San Marcos Springs. Five primary constituent elements 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. Currently (February 2012), Comal Springs is flowing at a rate of 267 cfs and San Marcos Springs is flowing at a rate of 165 cfs.

D. Fountain Darter

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).

Species Description and Life History

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. Fountain darters have reduced densities (or are absent) in areas lacking submergent vegetation (BIO-WEST 2007).

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 adult fountain darters from San Marcos and stocked them into Landa Lake and its spring runs. 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).

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 non-native species, and introduced parasites (Service 1996).

The trematode parasite *Centrocestus formosanus* (Trematoda: Heterophyidae) was discovered to infect the gills of the fountain darter in the Comal Springs ecosystem in 1996. Multiple researchers have documented the abundance of this parasite that threatens the health and lives 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.

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.

One of the local threats is habitat degradation caused by non-native 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. 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.

Status of Fountain Darter Critical Habitat
Designated critical habitat includes the San Marcos River, including Spring Lake downstream to approximately 805 m below the Interstate Highway 35 Bridge (45 FR 47355). It is outside the action area and not considered in this biological opinion

III. Environmental Baseline

This section is analysis of the effects of previous and ongoing factors (natural and anthropogenic) leading to 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, fountain darter, and their respective federally designated critical habitats in the action area. For the Comal Springs invertebrates, we estimated the size of local populations based on surveys of Bowles, Stanford, and BIO-WEST. Table 2 shows the area of habitat, densities, and local population size for known surface populations in the Comal Springs system. Areas associated with local populations from this table are shown Figures 4 and 5.

Peck's Cave Amphipod

The status of Peck's cave amphipod in the action area is similar to its status when listed in 1997. Bowles and Stanford sampled extensively in the action area from July 1993 through April 1994. Most of their sampling effort used a kick net which is better suited for capture of listed beetles. However, they did set drift nets and reported Peck's cave amphipods from Comal Spring Runs 1, 2, and 3. Using cloth lures and drift nets, J.R. Gibson has reported Peck's cave amphipods from Spring Runs 1, 2, and 3 over the period from 2004 to 2011.

Based on the number of collection sites and Peck's cave amphipod abundance at those sites, we estimate the surface population of Peck's cave amphipod in the action area is about 17,724. This represents about 82 percent of the estimated surface population for the Comal Springs system (21,757). Based on the numbers of Peck's cave amphipods collected and distribution of spring habitat of Peck's cave amphipod in the Comal Springs system, Spring Runs 1 and 3 are estimated to support about 77 percent of the Comal system surface population. Almost all of the collections outside Spring Runs 1, 2, and 3 are from sites sampled by Gibson elsewhere in Landa Lake (western shoreline, near Spring Island, and 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 53,240 m^2 (33 percent) of the designated critical habitat in the Comal Springs unit. However, suitability of habitat within the Comal Springs unit appears to vary with an absence of amphipods in areas lacking springs or appropriate substrate. The Peck's cave amphipod critical habitat primary constituent elements are: (1) high quality water, (2) aquifer water temperatures from 20 to 24°C, and (3) food supplies. All three of these PCEs are present in the action area.

Comal Springs Dryopid Beetle

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 extensively in the action area from July 1993 through April 1994 (Bowles and Stanford, unpublished data, 1994; Bowles et al. 2003). With the exception of Spring Run 4, Bowles and Stanford did not sample areas surveyed by Gibson (2011) elsewhere in Landa Lake (western shoreline, near Spring Island, and Spring Runs 5 and 6). They collected a total of 164 Comal Springs dryopid beetles (larvae and adults) and 132 (80 percent) of those came from Spring Run 1. Gibson has reported Comal Springs dryopid beetles from Spring Runs 1, 2, and 3 for sampling efforts with cloth lures and drift nets for period 2004 - 2011.

Based on the number of collection sites and Comal Springs dryopid beetle abundance at those sites, we estimate the surface population of Comal Springs dryopid beetles in the action area is about 1,527. This represents about 83 percent of the estimated surface population for the Comal Springs system (1,839). Based on the numbers of Comal Springs dryopid beetles collected and distribution of springs and seeps, the upper part of Spring Run 1 is estimated to support 1,310 Comal Springs dryopid beetles (71 percent) of the surface population for the Comal Springs system. There are no apparent negative factors on a local scale impacting the Landa Park population of Comal Springs dryopid beetles. In brief, this species in the action area is considered stable.

Comal Springs Dryopid Beetle Critical Habitat
The action area includes 53,240 m^2 (33 percent) of the designated critical habitat in the Comal Springs unit. However, the habitat within the Comal Springs unit likely varies in terms of dryopid beetle habitat suitability. Areas lacking springs are not likely to have Comal Springs dryopid beetles. The Comal Springs dryopid beetle critical habitat primary constituent elements 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 PCEs are present in the action area.

Comal Springs Riffle Beetle
The status of the Comal Springs riffle beetle in the action area is similar to its status when listed in 1997. Bowles and Stanford sampled extensively in the action area from July 1993 through April 1994 (Bowles et al. 2003). They collected a total of 875 Comal Springs riffle beetles (larvae and adults) and 435 (50 percent) of those came from Spring Run 1. Gibson (2011) has reported Comal Springs riffle beetles from Spring Runs 1, 2, 3, and 6 from cloth lures and drift nets for period sampling from 2004 through 2011.

Based on the number of collection sites and Comal Springs riffle beetle abundance at those sites, we estimate the surface population of Comal Springs riffle beetles in the action area is about 10,127. This represents about 92 percent of the estimated surface population for the Comal Springs system (10,959). In terms of numbers of Comal Springs riffle beetles collected by Bowles and Stanford, Spring Runs 1, 2, and 3 produced all of the riffle beetles; none were found in Spring Run 4. Gibson (2011) has regularly surveyed for Comal Springs riffle beetles but in the action area that effort has been focused primarily on Spring Run 2 above Gazebo Drive bridge and Spring Run 3.

There are no apparent negative factors on a local scale impacting the Landa Park population of Comal Springs riffle beetles. In brief, this species in the action area is considered stable.

Comal Springs Riffle Beetle Critical Habitat
The action area includes 27,791 m^2 (34 percent) of the designated critical habitat in the Comal Springs unit. However, the habitat with the Comal Springs unit critical habitat boundary likely varies in terms of riffle beetle habitat suitability. Areas lacking springs are not likely to have Comal Springs dryopid beetles. The Comal Springs dryopid beetle critical habitat primary constituent elements 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 PCEs are present in the action area.

Fountain Darter
The fountain darter occupies virtually all of the action area. The only habitats not likely to support fountain darters are the upper reaches of Spring Runs 2 and 3, which have little vegetation. In the case of Spring Run 2, the wading pool weir acts as a fish barrier.

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 abundances in Spring Runs 1, 2, and 3 were low compared to nearby habitat in Landa Lake and Comal River – new channel. Dammeyer (2010) conducted a mark and recapture study in the Comal River – old channel and estimated the number of fountain darters in a 100 m section as 2,732. Assuming homogeneity of channel width, habitat quality, and fountain darter density throughout the Comal River – old channel (the old channel is 2,550 m long), the fountain darter population in the old channel is estimated at 6,967.

The Edwards Aquifer Recovery Implementation Program's Habitat Conservation Plan (HCP) application includes a STELLA® model for fountain darter numbers in the Comal system for average to low springflow. At 225 cfs total springflow, the model estimates an average of 114,837 fountain darters (EARIP 2011). The status of the fountain darter in the Comal system 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 non-native 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.

Water Quantity

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. Water enters the 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); or by percolation through recharge features in creeks that cross the recharge 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.

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 indicate that some of Comal Springs flow (specifically small springs in Spring Run 3) comes from the Comal Springs fault block. 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.

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.

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.

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. 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 and Uvalde National Fish Hatchery and have finalized a biological opinion covering those Service activities (March 1, 2010). Comal County has applied for 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 will conduct an intra-Service consultation on the proposed 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 determinations of take associated with their respective actions (projects). Since February 2002, there have been six biological opinions for projects where the action area included the Comal Springs ecosystem. Those biological opinions determined the incidental take to fountain darters would be 515. Since February 2002, there have been no biological opinions where incidental take was determined for any of the Comal Springs invertebrates. None of these biological opinions involved jeopardy to any listed species. None of these biological opinions involved a determination of adverse modification to any designated critical habitat.

IV. Effects of the Action

Factors to be considered

In the upper part of the action area, the water surface elevation (stage) is normally determined by: (1) flow from Comal Springs; (2) local runoff including tributaries of Landa Lake (Panther Canyon and Blieders Creek) during periods of precipitation; (3) the LCRA weir crest elevation, and (4) gate settings at (a) LCRA weir (b) the spring-fed pool, (c) a pair of 0.6 m diameter culverts flowing to the old channel bypass, and (d) a 1.2 m diameter culvert flowing to the old channel bypass. Accumulated debris, including mats of aquatic vegetation, may also occasionally affect flow through these culverts and over the LCRA weir.

An effort to map, name, and characterize the myriad Comal Springs is being planned. As the results of that effort become available, better estimates of the quantity of spring-influenced habitat in the Comal Springs ecosystem will be possible.

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: (1) habitat quantity, (2) habitat quality, and (3) the primary constituent elements to resolve the action's impact on the function and conservation role of critical habitat in the future. Critical habitat for each of the Comal Springs invertebrates in the strict sense is only that subset of the designated critical habitat that is near spring openings. 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 woody vegetation (PCE 4, food supply). Roots near springs may have an extensive surface area and biofilm (microbial) production. The proposed action involves conservation of the woody vegetation and the following analyses focus on aquatic habitat with the assumption that the woody vegetation near springs will remain unchanged by the action.

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. Halff Associates, Inc. provided maps and retaining wall drawings.

Effects to Peck's Cave Amphipod

Peck's cave amphipods have been collected with a cotton cloth lure method, which typically has been used in spring habitats known to have Peck's cave amphipods. A 15 cm by 15 cm cloth lure is crumpled and covered with a small layer gravel and cobble, and in about a week, the lure becomes covered in biofilm that attracts various amphipod species and other aquatic invertebrates. The area (in plan view) of a crumpled rag is about 0.01 – 0.02 m^2. It is uncertain how far amphipods move to occupy the lure. We assume for the purpose of estimating Peck's cave amphipod density that amphipods are attracted within a 30 cm radius of the lure, yielding a sample area of 0.28 m^2 per lure.

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 Spring Runs are estimated to be *Stygobromus pecki*, the other half are likely *Stygobromus russelli* (J.R. Gibson, pers. comm, 2012). Based on this sample effort, we estimate the density of Peck's cave amphipods in Spring Run 3 at 6.6 individuals per m^2. We use this density to estimate to the number of Peck's cave amphipods in the areas to be dewatered.

The proposed construction involves temporary dams and lowering the water level in Spring Run 1. Water depth inside the temporary dam in Spring Run 1 will be maintained above 3 cm (0.1 ft). Peck's cave amphipod mortality in Spring Run 1 due to disturbance associated with temporary dam is not easily quantified. We anticipate that use of a water-filled cofferdam will alter the way water flows through Spring Run 1 substrate, particularly directly below the cofferdam membrane. Similarly, a cofferdam using a frame and impermeable membrane will alter the movement of water into substrate at the gravel-membrane interface. However, we are uncertain how many Peck's cave amphipods will be affected in Spring Run 1 by the temporary dam. Construction in the lower part of Spring Run 2, the lowest part of Spring Run 3 and Landa Lake will involve dewatering and is expected to result in the death of all Peck's cave amphipods in the dewatered zone, 77 individuals. Peck's cave amphipods are likely to be entrained into pumps when a work area has water removed. Some Peck's cave amphipods may remain in the dewatered gravel and die as the area is disturbed or from a lack of water among the gravel interstices. Nice and Ethridge (2011) stated that "for aquatic organisms such as *Stygobromus*, connectivity of habitable space varies with space and time because water level and direction of flow changes with changing hydrological conditions. Some unknown but presumed small fraction of Peck's cave amphipods inside the temporary dams may succeed in moving down to lower interstitial zones that remain saturated with water. Some unknown number of Peck's cave amphipods will be harmed by disturbance (e.g., compression of gravel substrate) associated with setting up, maintaining, and removing the temporary dam.

The proposed gabion foundation, common to all four wall types, will extend up to 0.3 m perpendicular from the current edge of water. In some sections, the edge of the gabion would be at the current edge of water and on occasion, be placed behind the current edge of water. However, Halff Associates, Inc. and the City have not specified the where 0.3 m of the gabion foundation for the retaining wall will encroach on current aquatic habitat. We have analyzed the proposed action with the assumption that the edge of gabion will encroach 0.3 m from the current edge of water for half of the new retaining wall. For Spring Run 1, we anticipate a narrow zone of adverse effects (parts of Spring Run 1, 0.15 m wide, on spring run margins near new retaining walls) where all Comal Springs invertebrates present will be killed, 337 individuals. No additional take is anticipated from the gabion placement because the dewatering of the area is expected to result in the loss of all Peck's cave amphipods in the dewatered zone, which includes the gabion foundation. However, the abundance of Peck's cave amphipods after completion of retaining walls may be lower (relative to current conditions) where the gabion occurs due the replacement of suitable habitat with less suitable gabion. The total number of Peck's cave amphipods anticipated to be killed by the project is 414.

Effects to Peck's Cave Amphipod Critical Habitat

<u>Habitat Quantity</u>
The construction of the proposed retaining wall will negatively affect about 63 m^2 of spring influenced habitat in designated Peck's cave amphipod critical habitat. About 51 m^2 of spring-influenced critical habitat in Spring Run 1 will be negatively affected by construction of gabion foundation. About 12 m^2 of spring-influenced critical habitat in Spring Run 2 and nearby areas downstream of Spring Run 2 will be affected by temporary dams, dewatering, and gabion scour protection. The Comal unit of critical habitat for the Peck's cave amphipod has a total area of about 15,476 m^2 but that includes parts of Landa Lake not within 15.2 m of a spring opening. The action will reduce habitat quantity (63 m^2) in this Comal Springs critical habitat unit for several months.

<u>Habitat Quality and Primary Constituent Elements</u>
Habitat quality in Spring Run 1 is expected to be maintained in the work area where there is at least 3 cm of water flowing over its substrates throughout construction. Outside of Spring Run 1, dewatering degrades the water-related PCEs (1 and 2) by adversely affecting water quality and water temperature. Lack of water during the proposed three weeks of construction removes the value of critical habitat for Peck's cave amphipods.

It is anticipated that the critical habitat that is dewatered will remain unsuitable and unoccupied for an unknown period (weeks, perhaps months) after construction is completed. The PCE 1 and PCE 2 would be restored to the dewatered zone sometime after construction, but we do not know how long it will take for Peck's cave amphipods to colonize the disturbed areas. Spring-dominated habitats in the Comal Springs system comprising Peck's cave amphipod critical habitat are estimated at 3,297 m^2. The project will degrade about 51 m^2 of spring-dominated habitat in Spring Run 1 (effect of gabion foundation marginally encroaching on aquatic habitat). Post-construction, we are uncertain as to extent of use by Peck's cave amphipods of various sized rocks in the gabion foundation and gabion scour protection.

Effects to Comal Springs Dryopid Beetles
The density of Comal Springs dryopid beetles in Spring Run 1 work area is estimated as 1.0 individual per m^2. The density of Comal Springs dryopid beetles in Spring Run 3 work area is estimated 0.1 individuals per m^2 (Bowles and Stanford, unpublished data). The proposed temporary lowering of water levels in part of Spring Run 1 to no less than 3 cm above the bed is expected to maintain habitat and not result in the harm to Comal Springs dryopid beetles where water is sustained. Along the margins of Spring Run 1 where the retaining walls will be built, we anticipate there will be a narrow zone of adverse effects, about 0.15 m wide, where the gabion foundation will be built. In this zone, we anticipate about 51 Comal Springs dryopid beetles will be killed when substrates are excavated for the gabion. We do not know how may Comal Springs dryopid beetles currently on surface that will be able to survive disturbance in the work area (i.e., the area enclosed and affected by the temporary dam, including beneath the temporary dam).

A Comal Springs dryopid beetle (n = 1) in the work area of lower Spring Run 2 is expected to be killed. Some Comal Springs dryopid beetles may be entrained into pumps when a section (e.g., Spring Run 2) is dewatered. No other areas involved with new retaining walls are expected to have Comal Springs dryopid beetles. The proposed action would likely result in the loss of a total of 52 Comal Springs dryopid beetles or about 2.8 percent of the estimated total surface population of the Comal Springs system (1,839). Losing less than 3 percent of the Comal Springs population is not considered likely to have a serious negative effect on this species. This species has a small range and it occurs at a lower density and abundance relative to the Comal Springs riffle beetle and Peck's cave amphipod. Scant information is available on its distribution, abundance, and density below the surface. However, construction methods have been developed to limit impacts in Spring Run 1.

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 1 consists of small springs (seeps) that produced 80 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. We anticipate that Spring Run 1 (post-construction) will continue to maintain a local population of Comal Springs dryopid beetles similar to the size inferred from the Bowles and Stanford study, roughly about 1,300 individuals.

Effects to Comal Springs Dryopid Beetle Critical Habitat

Habitat Quantity

Similar to Peck's cave amphipod critical habitat effects, the construction of the proposed retaining wall will negatively affect about 63 m^2 of Comal Springs dryopid beetle critical habitat. About 51 m^2 of spring-influenced critical habitat will be degraded from gabion foundation construction. About 12 m^2 of spring-influenced critical habitat outside of Spring Run 1 will be affected by temporary dams, dewatering, and gabion foundation.

The Comal unit of critical habitat for the Comal Springs dryopid beetle has a total area of about 15,476 m^2 but that includes parts of Landa Lake not under the influence of springs. The project will reduce the Comal Springs dryopid beetle critical habitat in the Comal Springs critical habitat unit for several months by about 63 m^2.

Habitat Quality and Primary Constituent Elements

Habitat quality in Spring Run 1 is expected to be maintained in the work area where there is at least 3 cm of water flowing over its substrates throughout construction. Outside of Spring Run 1, dewatering will temporarily degrade all PCEs by adversely affecting water quality, water temperature, the flow regime, and food supply. Lack of water during the proposed three weeks of construction removes the value of critical habitat for Comal Springs dryopid beetles for those three weeks and some unknown period after construction, potentially several months.

It is anticipated that the critical habitat that is dewatered will remain unsuitable and unoccupied for an unknown period (perhaps months) after construction is completed. The PCEs 1 and 2 would be restored to the dewatered zone post-construction, but we do not know how long it will take for Comal Springs dryopid beetles to colonize the disturbed areas. Spring-dominated habitats in the Comal Springs system comprising Comal Springs dryopid beetle critical habitat are estimated at 3,297 m^2. The project will degrade about 63 m^2 of spring-dominated critical habitat. We anticipate critical habitat will not be permanently degraded. Critical habitat would be degraded for a minimum of one month. With springflows (PCE 3) restored (post-construction), PCE 1 (water quality with low salinity, low turbidity) and PCE 2 (water temperatures between 20 and 24°C) are expected to return. After several weeks of normal springflows, we anticipate biofilm production (food supply or PCE 4) will return and all critical habitat PCEs will be present.

Effects to Comal Springs Riffle Beetles

Comal Springs riffle beetle densities were estimated for distinct parts of Spring Runs 1, 2 and 3 from unpublished data by Bowles and Stanford (1994). The proposed work in Spring Run 1 and dewatering along the shoreline of Landa Lake and a small part of Spring Run 3 is expected to result in the death of all Comal Springs riffle beetles in the dewatered zone, totaling 174. Some Comal Springs riffle beetles are likely to be entrained into pumps when a section is dewatered. While this species may move down in the substrates to remain in water, we do not know how far this species will move or if the conditions at lower elevation will provide suitable habitat. Some Comal Springs riffle beetles would be killed if they remain in substrates which are excavated for the gabion foundation.

The new retaining wall foundation will slightly encroach into aquatic habitat in some areas of Spring Run 1, Spring Run 2, and seeps along the embayment of Landa Lake (Figure 5). The gabion foundation is common to all four wall types. The gabion foundation requires excavation up to 0.6 m along the bank edge. We are uncertain if the submerged part of the gabion will be suitable Comal Springs riffle beetle habitat. We do not know if Comal Springs riffle beetles will use the cobble in the gabion. Initially, the cobble will lack the epilithic microbial community on which elmids feed but some of the gabion may be suitable and habitable over time.

Effects to Comal Springs Riffle Beetle Critical Habitat

Habitat Quantity

The construction of the proposed retaining wall gabion foundation will negatively affect about 51 m^2 of spring-influenced Comal Springs riffle beetle critical habitat in Spring Run 1. Spring Run 1 will have a temporary dam but water will be maintained to a depth of at least 3 cm. We anticipate maintenance of water continuously about the substrates will maintain suitable habitat within the substrates. The Comal Springs riffle beetles along the margins of Spring Run 1 will likely be killed when the gabion foundation is excavated. Outside of Spring Run 1, the project will impact about 12 m^2 of spring-influenced critical habitat when Spring Run 2 and the embayment shoreline are enclosed by a temporary dam and dewatered.

The Comal unit of critical habitat for the Comal Springs riffle beetle has a total area of about 15,476 m^2 but the area of habitat near springs within that area is about 3,297 m^2. The project will reduce the Comal Springs riffle beetle critical habitat in the Comal Springs critical habitat unit for several months by 63 m^2.

Habitat Quality and Primary Constituent Elements

Habitat quality throughout most of Spring Run 1 will be maintained. Outside of Spring Run 1, dewatering will degrade four of the five Comal Springs riffle beetle PCEs by adversely affecting water quality, water temperature, the flow regime, and food supply. Lack of water during the proposed three weeks of construction removes the value of critical habitat for Comal Springs riffle beetles for those three weeks and some unknown period after construction.

It is anticipated that the critical habitat that is dewatered will remain unsuitable and unoccupied for an unknown period after construction is completed. PCE 1 (high-quality water with low salinity and low turbidity), PCE 2 (water temperatures between 20 and 24°C), and PCE 3 (an adequate springflow regime) would be restored to the dewatered zone post-construction after the temporary dams are removed. In several weeks after springflows return, we anticipate the food supply (biofilm and particulate organic matter) will return, re-establishing PCE 4. The proposed gabion foundation will replace gravel and cobble with larger rocks and permanently degrade PCE 5 where the gabion encroaches on present day aquatic habitats. The rocks used in the gabion are expected to be larger than cobble. We do not know how long it will take for Comal Springs riffle beetles to colonize the dewatered zone after the temporary dams are removed.

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 63 m^2 of spring-influenced critical habitat during construction. Post-construction, 51 m^2 would be permanently affected by replacement of the current substrate with cobbles of unknown suitability.

Effects to the Fountain Darter
The project will replace retaining walls in Spring Runs 1 and 2, the lowest part of Spring Run 3, and parts of Landa Lake and the new channel of the Comal River. The fountain darter is common in all of these areas except the spring runs. 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). Lowering the water level in Spring Run 1 to 3 cm will likely affect the areal extent aquatic plants in Spring Run 1. We estimate about 6 fountain darters will be killed in Spring Run 1 from the setup, maintenance, and removal of the temporary dam.

Outside of Spring Run 1, dewatering of areas for retaining wall replacement will adversely affect about 1,745 m^2 of suitable fountain darter habitat. About 227 m^2 of Spring Run 2 is proposed to be dewatered, but fountain darters are not likely to be in Spring Run 2. Fountain darter density in lower Landa Lake is estimated at 2.8 fountain darters per m^2. Fountain darter density in the upper part of the new channel is estimated at 1.0 fountain darter per m^2. The Service estimates 3,168 fountain darters will be killed within the work area (temporary dam footprint and area dewatered). Most of the fountain darter deaths (2,525) are expected in the Landa Lake. Given the reproductive potential of fountain darters and assuming an adequate Comal Springs flow regime is maintained during the project, we expect that the Landa Lake and Comal River – new channel population of fountain darters to be a source of fountain darters that will reoccupy habitats near the new retaining wall once temporary dams are removed.

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.

Regional Factors
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 drought forecast, we believe Comal Springs discharge in 2012 is likely to remain near or below 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 (2011).

Habitat conservation planning is progressing at a regional level for Edwards aquifer species through the EARIP. The EARIP is a collaborative consensus-based process that involves many stakeholders. An objective of the EARIP is to receive by December 31, 2012, an incidental take permit 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. The HCP application is currently under review by the Service. One of the goals of the proposed 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

Ongoing impacts from water recreationists remain a serious local threat to fountain darter habitat. Invasive non-native mollusk and fish species are adversely affecting habitat suitability in the Comal Springs ecosystem. Additional future introductions (unintentional or not) and establishment of other non-native plants seem likely to occur. Flooding, varying from mild to severe, is expected in the action area during the life of the project. 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 the primary constituent elements 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 primary constituent elements. If cumulative use of the Edwards aquifer 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 2012.

VI. Conclusion

Jeopardy Determinations

The following analysis relies on the following 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 construction of 1,384 m of retaining wall 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 killed 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 1 for the Comal Springs dryopid beetle is a function of the duration of construction and the area impacted by construction. This proposed project would leave the Comal Springs dryopid beetle in a more vulnerable state. If, additionally, the Comal Springs system and Comal Springs dryopid beetle were hit by an inadequate water flow regime (caused by continued drought and use of the Edwards aquifer), the species could be extirpated from Spring Run 1. Among the Comal spring runs, Spring Run 1 is the first to lose flow when the aquifer is stressed.

Adverse Modification Determinations

Implementation of the proposed project will not adversely modify designated critical habitat of the Peck's cave amphipod, Comal Springs riffle beetle, or Comal Springs dryopid beetle. Although critical habitat for these species will be degraded during construction, we anticipate the loss of the primary constituent elements will be temporary. Restoration of four of the primary constituent elements (water quality, water temperature, springflow regime, and food supply) is expected within several months of completion of construction. The primary constituent element (PCE 5) for the Comal Springs riffle beetle involving gravel and cobble substrate will be affected where suitable substrate is replaced by gabion mattress foundations. However, PCE 5 will be maintained in other areas (adjacent to the proposed gabion) during and after construction.

This conclusion is based in part on the percent of critical habitat for each species that would be adversely affected by temporary dams and dewatering. PCE 1 (water quality) would be impaired and habitat would no longer be expected to support listed dryopid and riffle beetles for the duration of the project and for some unknown period afterwards. Little to no water in critical habitat may subject the exposed spring run to higher than normal temperatures (PCE 2). The dewatering would interrupt the natural hydrologic regime (PCE 3). Dewatering would reduce food supplies (PCE 4), which require water for biofilm production. Gabion foundations will replace current substrates with larger rocks in areas on the margins of Spring Run 1, lower Spring Run 2, and the lowest reach of Spring Run 3. Spring Run 1 is an important area of habitat for all three Comal Springs invertebrates. However, the restoration of springflow over the dewatered zone should result in a return of habitat suitability over an unknown period of time.

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

Table 3 summarizes the incidental take of Peck's cave amphipod, Comal Springs dryopid beetle, Comal Springs riffle beetle, and fountain darter.

The incidental take for construction is considered to be all fountain darters within the 1,949 m^2 of habitat impacted. Those areas with wall scour protection (part of wall types A and B) are not likely to support rooted aquatic plants and the suitability of those areas for fountain darters will be decreased.

Fountain darter habitat suitability in this project area varies from the spring runs downstream to the LCRA weir (downstream boundary of work) and we have taken that into account in estimating the total incidental take fountain darters, if the retaining walls were built as proposed. Incidental take of fountain darters is estimated at 2,951.

Capturing and moving fountain darters for areas inside the temporary dams (clearing) would reduce the amount of fountain darters killed. Clearing the fountain darters also represents take. However, this measure has not been proposed. As detailed below, efforts to clear fountain darters from areas to be disturbed requires permits from the Service and Texas Parks and Wildlife Department.

We assume 100 percent of the darters remaining in affected areas will be killed. While it is likely that some of the darters in the construction area will escape, we are uncertain how many will successfully colonize nearby habitats. The construction phase of the project is expected to result in the death (take) of 2,951 fountain darters.

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 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 retaining wall replacement shall be avoided when possible and reduced to the maximum extent practicable where disturbance is unavoidable.

(2) The applicant shall 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 shall be responsible for complying with these terms and conditions, which are non-discretionary.

Terms and conditions that implement RPM No. 1:

(1) The USACE will ensure project-related work will be actively monitored by the applicant

(City 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: (a) equipment will be readied and mobilized in a manner to minimize the duration of disturbance, (b) equipment will be demobilized if a precipitation event and runoff is likely to flood the area, and (c) flow in Spring Run 1 (springflow and runoff) will be controlled by a water-filled flexible membrane tube with the minimum practicable size. The type of temporary dam used outside of Spring Run 1 is left to the discretion of the City, its contractors, and the USACE.

(3) Work by the applicant and the contractor shall 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) The biologists working to clear listed species (primarily, the fountain darter) from the area will carefully move any algal or moss mats, to nearby areas with macrophytes.

(5) Captured fountain darters will be removed and released in a manner that avoids predation by larger fishes, by releasing individuals with aquarium nets near plant cover on the river bed. Persons involved in these efforts should have proper equipment and authorizations/permits from the Service (section 10(a)(1)(A)) and Texas Parks and Wildlife Department (Scientific Permits pursuant to Texas Parks and Wildlife Code Chapter 43, subchapter C).

(6) Temporary work areas will be swept with small (D-frame type or similar) dipnets to salvage fountain darters immediately prior to placing the geotextile fabric and rock. The amount of time that netted fountain darters are out of water must be kept to a minimum. Persons involved in these efforts should have proper equipment and authorizations/permits from the Service (section 10(a)(1)(A)) and Texas Parks and Wildlife Department (Scientific Permits pursuant to Texas Parks and Wildlife Code Chapter 43, subchapter C).

(7) Turbidity will be visually monitored daily during construction including from pumped water. If construction related turbidity in Landa Lake or the new channel of the Comal River greater than 5 nephelometric turbidity units persists longer than 24 hours, the applicant will contact the Service to discuss the source of turbidity. If indicated, additional measures to reduce turbidity may be recommended.

Terms and conditions that implement RPM No. 2:

(8) 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. An example of a notable event would be

flooding. Contact with the Service can be made through 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 shall 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) Plan and implement a study to assess the current (pre-project) status of Comal Springs invertebrates in Spring Run 1. Re-assess post-construction to determine the extent of colonization of disturbed habitat by Comal Springs invertebrates.
(2) Assist with restoration and protection of native trees near Landa Lake and its spring runs. Assist with restoration of macrophytes in Landa Lake and the Comal River.
(3) Assist with efforts to further reduce the likelihood of traffic accidents and contaminant spills near Landa Lake, the Comal River, and its tributaries.
(4) Assist with efforts to improve the water quality of runoff from New Braunfels to the Comal River including but not limited to stormwater associated with roads.
(5) Assist with additional efforts to avoid and minimize disturbance of the Comal River by people.
(6) Assist with the implementation of recovery tasks for the fountain darter in the revised Recovery Plan.

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. If the final action to be carried out differs from the proposed action that our opinion is based on, the USACE needs to communicate with the Service to make sure the effects to species and the amount of take are not changed. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation. Reinitiation would be indicated if final plans differ from the proposed action in a manner that additional aquatic habitats or species numbers are affected. Regarding item 4, if a revision to the designated critical habitat for the Comal Springs invertebrates results in a determination that implementation of this project would adversely modify critical habitat, then any activities causing such effects must stop, until a subsequent formal consultation is complete. We will keep the USACE and City apprised of proposed and final rules published in the *Federal Register* related to any revision of the designated critical habitat for the Comal Springs invertebrates.

If you have any questions about this biological opinion for the proposed replacement of retaining walls in Landa Park, please contact Patrick Connor at (512) 490-0057, extension 227. Thank you for your interest and help in conserving our Nation's natural resources.

Sincerely,

/s/

Adam Zerrenner
Field Supervisor

cc: Scott Kelly, U.S. Army Corps of Engineers, Fort Worth, Texas

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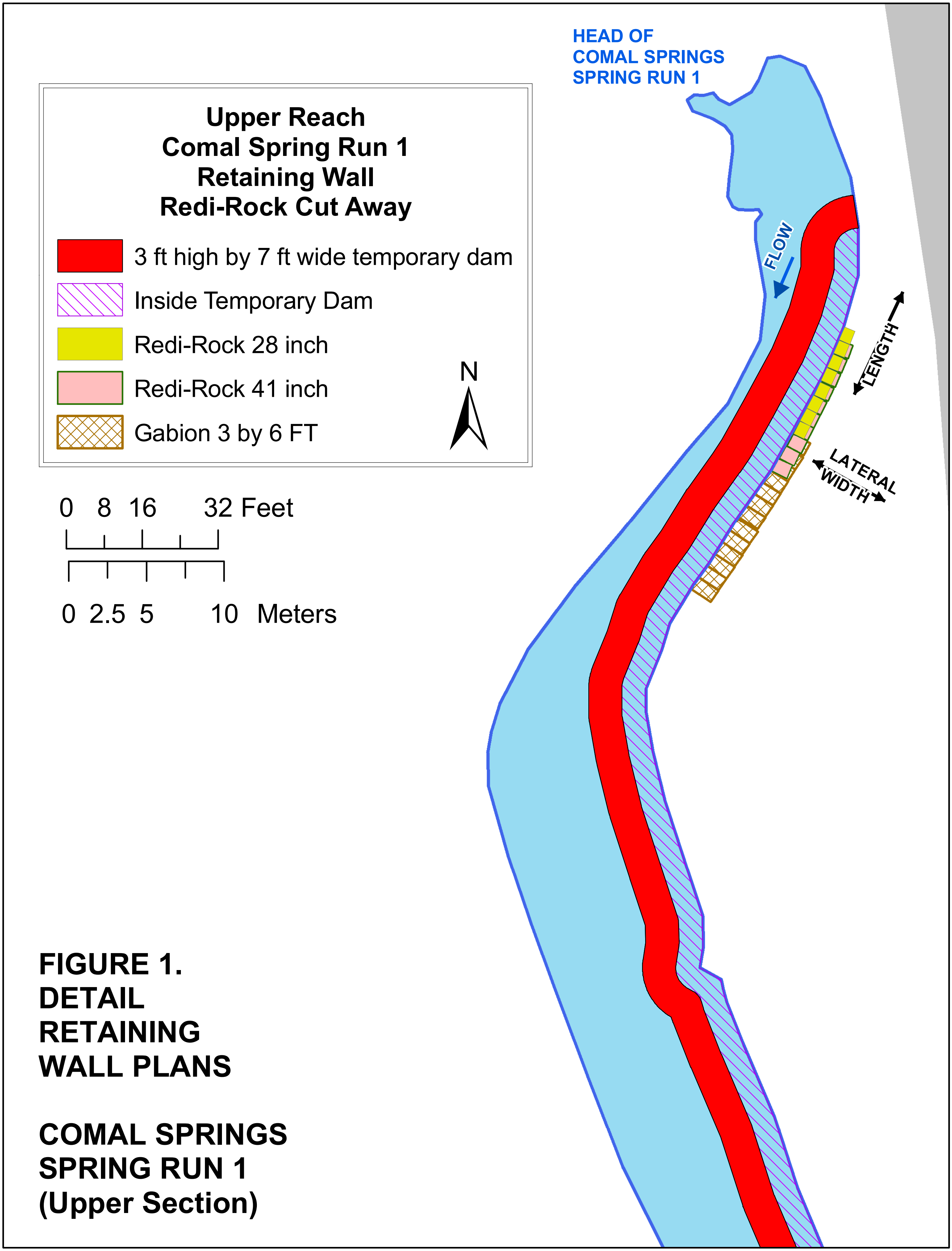


FIGURE 1.
DETAIL
RETAINING
WALL PLANS

COMAL SPRINGS
SPRING RUN 1
(Upper Section)

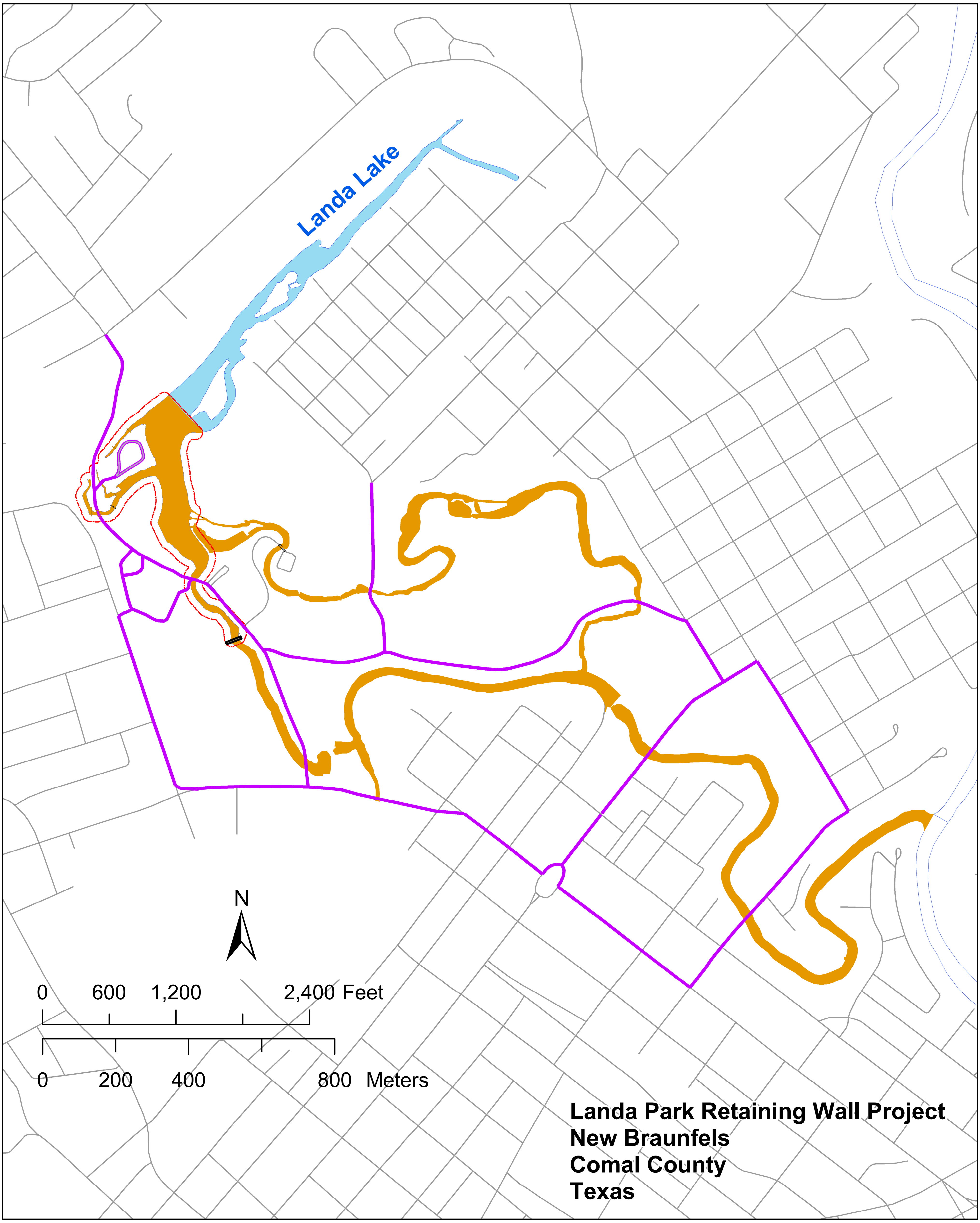
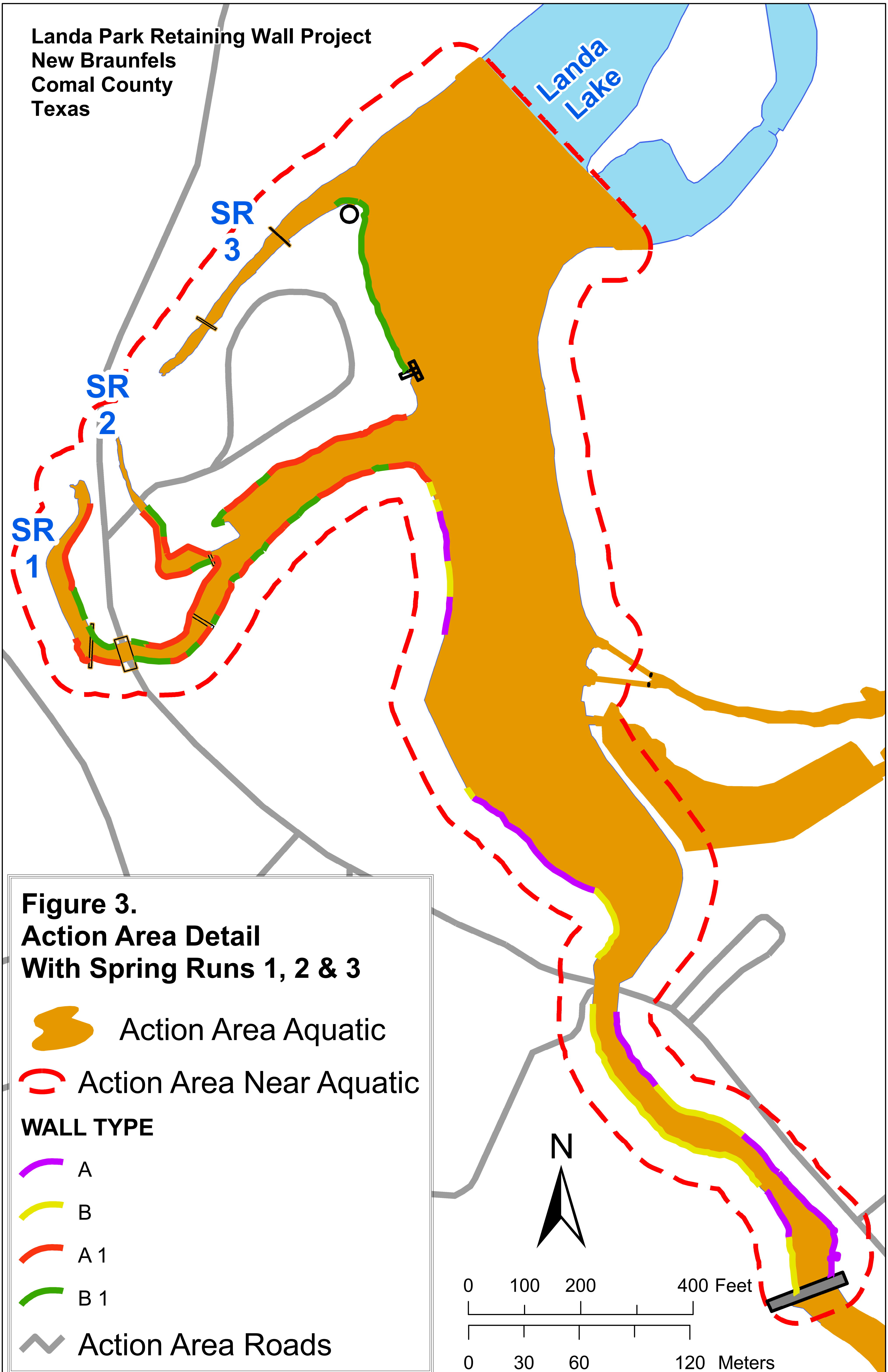


Figure 2. Action Area Overview

Action Area Aquatic

Action Area Near Aquatic

Action Area Roads


Landa Park Retaining Wall Project
New Braunfels
Comal County
Texas
Landa Lake
SR 3
SR 2
SR 1
Figure 3.
Action Area Detail
With Spring Runs 1, 2 & 3
Action Area Aquatic
Action Area Near Aquatic
WALL TYPE
A
B
A 1
B 1
Action Area Roads
N
0 100 200 400 Feet
0 30 60 120 Meters

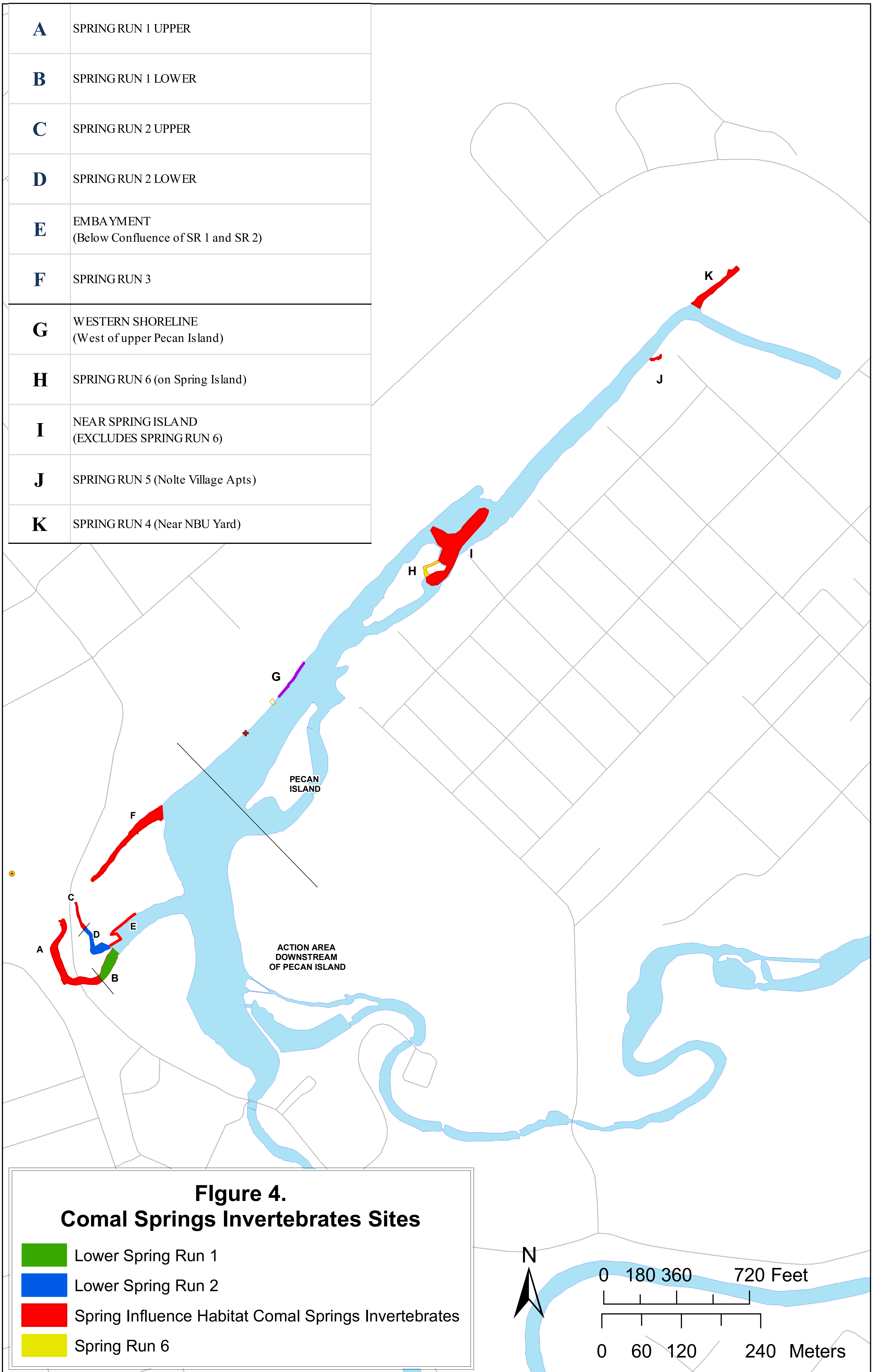


Figure 4.
Comal Springs Invertebrates Sites

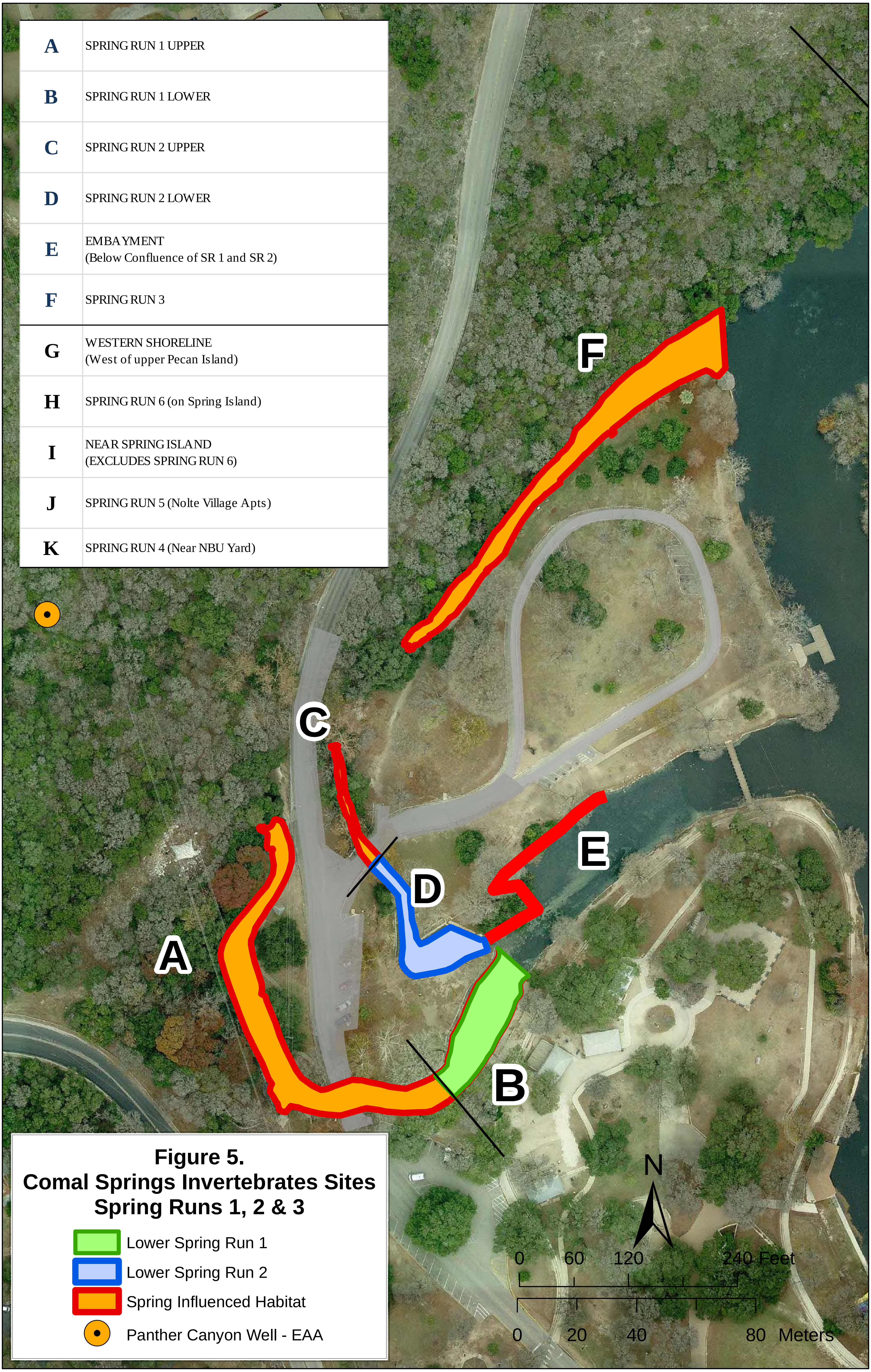


Figure 5.
Comal Springs Invertebrates Sites
Spring Runs 1, 2 & 3

Comal Springs Data David Bowles & Ruth Stanford	Samples July 1993 - April 1994	**Spring Run 1**	**Spring Run 2**	**Spring Run 3**	**Spring Run 4**	Row Total		**Spring Run 1**	**Spring Run 2**	**Spring Run 3**	**Spring Run 4**
Species	No of Samples	**132**	**41**	**87**	**31**	**291**					
			Counts								
Stygoparnus comalensis	Larva	95	18	7	0	120	% Larva	72.0%	85.7%	87.5%	0.0%
Stygoparnus comalensis	Adult	37	3	1	3	44	% Adult	28.0%	14.3%	12.5%	100.0%
Stygoparnus comalensis	**Total Individuals**	**132**	**21**	**8**	**3**	**164**	% Spring Run of Total	80.5%	12.8%	4.9%	1.8%
Heterelmis comalensis	Larva	326	108	195	0	629	% Larva	74.9%	92.3%	60.4%	n/a
Heterelmis comalensis	Adult	109	9	128	0	246	% Adult	25.1%	7.7%	39.6%	n/a
Heterelmis comalensis	**Total Individuals**	**435**	**117**	**323**	**0**	**875**	% Spring Run of Total	49.7%	13.4%	36.9%	0.0%

			Densities Individuals per square meter		
Stygoparnus comalensis	Larva	0.72	0.44	0.08	0.00
Stygoparnus comalensis	Adult	0.28	0.07	0.01	0.10
Stygoparnus comalensis	**Total Individuals**	**1.00**	**0.51**	**0.09**	**0.10**
Heterelmis comalensis	Larva	2.47	2.63	2.24	0.00
Heterelmis comalensis	Adult	0.83	0.22	1.47	0.00
Heterelmis comalensis	**Total Individuals**	**3.30**	**2.85**	**3.71**	**0.00**

Table 1.
Results of Federally Listed Endangered Aquatic Beetle Collections by David Bowles and Ruth Stanford at Comal Springs, New Braunfels, Texas

Table 2. Estimated Densities and Local Population Size for
Peck's Cave Amphipod, Comal Springs Dryopid Beetle & Comal Springs Riffle Beetle
Landa Park Retaining Wall Project

					Density Individuals Per M^2			Population Size Estimate		
Zone	COMAL SPRINGS ZONE	Area M^2	AREA M^2 OF SPRING DOMINATED HABITAT IN ZONE	PERCENT OF ZONE WITH SPRING HABITAT	PECK'S CAVE AMPHIPOD	COMAL SPRINGS DRYOPID BEETLE	COMAL SPRINGS RIFFLE BEETLE	PECK'S CAVE AMPHIPOD	COMAL SPRINGS DRYOPID BEETLE	COMAL SPRINGS RIFFLE BEETLE
A	Spring Run 1 Upper	1,310	1,310	100%	6.6	1.0	3.3	8,648	1,310	4,324
B	Spring Run 1 Lower	590	59	10%	6.6	1.0	3.3	389	59	195
C	Spring Run 2 Upper	101	101	100%	6.6	0.5	2.9	670	52	1,200
D	Spring Run 2 Lower	408	20	5%	6.6	0.1	0.0	135	2	1
E	Embayment (Below Confluence of SR 1 and SR 2)	2,934	29	1%	6.6	0.0	2.9	194	0	85
F	Spring Run 3	1,165	1,165	100%	6.6	0.1	3.7	7,689	105	4,322
G	Western Shoreline (West of upper Pecan Island)	65	46	70%	6.6	0.5	2.9	300	23	130
H	Spring Run 6 (on Spring Island)	95	95	100%	6.6	0.5	2.9	627	48	271
I	Near Spring Island (Excludes Spring Run 6)	3,028	151	5%	6.6	0.5	2.9	999	77	431
J	Spring Run 5 (Nolte Village Apts)	49	49	100%	6.6	0.5	0.0	323	25	0
K	Spring Run 4 (Near NBU Yard)	540	270	50%	6.6	0.5	0.0	1,783	138	0
Total	Comal Springs Ecosystem All Zones (A - K), Total	10,286	3,297		Total Comal Springs System (Surface) Population Estimate			**21,757**	**1,839**	**10,959**
Action	Action Area, Zones A - F	6,508	2,685		Total Population Estimate for Action Area			**17,724**	**1,527**	**10,127**

Table 3. Summary of Incidental Take by Species and Area

Area	Primary Effect	Peck's Cave Amphipod	Comal Springs Dryopid Beetle	Comal Springs Riffle Beetle	Fountain Darter
Spring Run 1	Gabion	337	51	168	6
Spring Run 2 (Lower)	Dewater	64	1	0	0
Embayment - Landa Lake downstream to critical habitat boundary	Dewater	13	0	6	1,234
Landa Lake Gazebo to Fishing Pier	Dewater	0	0	0	500
Landa Lake Embayment to Paddleboats	Dewater	0	0	0	208
Landa Lake Downstream of Paddleboats	Dewater	0	0	0	583
New Channel	Dewater	0	0	0	637
	Total Incidental Take	414	52	174	3,168