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# CEMEX Balcones Quarry Northeast Area Habitat Conservation Plan

Applicant

**CEMEX Construction Materials South, LLC**

Prepared by

**SWCA Environmental Consultants**

August 2015

# CEMEX
# BALCONES QUARRY NORTHEAST AREA
# HABITAT CONSERVATION PLAN

Applicant

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# 1.0 INTRODUCTION

CEMEX Construction Materials South, LLC (CEMEX) owns and operates the Balcones Quarry located in New Braunfels, Comal County, Texas. The Balcones Quarry property consists of approximately 2,400 acres. The quarry started operation in 1969 under different ownership and was acquired by CEMEX in 1994. The Balcones Quarry currently produces and sells approximately 10 to 12 million tons of limestone raw materials per year, nearly all of which is used as cement feed or as aggregate products in the construction industry. The aggregates produced at this facility are used in the construction of homes, roads, schools, businesses, hospitals, and other infrastructure. As a result, the CEMEX Balcones Quarry is a key economic generator in the New Braunfels community and surrounding area.

Since 1969, the limestone extraction area progressed northward from the central portion of the property toward its northern boundary and has since continued to progress eastward toward what is generally referred to as the Balcones Quarry Northeast Area and within which has been defined the *Permit Area*. The Permit Area consists of approximately 199.4 acres, most of which is wooded. The 199.4 acres includes 143.9 acres that is considered the occupied area by the GCWA that requires mitigation and 55.5 acres that includes a 300-foot buffer area around the perimeter of the 143.9 acres. The location of the Permit Area is depicted on Fig. 1.

CEMEX retained SWCA Environmental Consultants (SWCA) to conduct a survey in the spring of 2013 to determine whether the federally listed endangered golden-cheeked warbler (*Setophaga chrysoparia*; GCWA) occurred in woodlands of the Balcones Quarry Northeast Area in preparation for mining this area. Based on the results of the 2013 survey and a follow-up survey conducted in 2014, CEMEX is applying to the U.S. Fish and Wildlife Service (USFWS or Service) for a section 10(a)(1)(B) incidental take permit (Permit) to authorize any incidental take of the GCWA resulting from activities associated with mining in the Permit Area (Proposed Covered Activities). This habitat conservation plan (HCP) has been prepared in support of that Permit application and in accordance with the applicable requirements of the Endangered Species Act (ESA) and its implementing regulations.

An ESA 10(a)(1)(B) permit is a tool by which a non-federal entity may voluntarily obtain authorization to conduct activities such as clearing in anticipation of mining that might otherwise cause the unlawful "take" of species listed as threatened or endangered under the ESA. Among other things, an HCP specifies measures that will be implemented to minimize and mitigate to the maximum extent practicable the impacts of a specified level of incidental take of listed species. "Incidental take" is described by the ESA and relevant regulations as take of any federally listed wildlife species that is incidental to, but not the purpose of, otherwise lawful activities (ESA section 10(a)(1)(B)).

Two groups of species are addressed in this HCP, *Covered Species* and *Evaluation Species*. Covered Species are those species for which incidental take authorization is being sought, which in this case is limited to the GCWA. Evaluation Species are federally listed and candidate species known to occur in the region that were examined from the standpoint of assessing the risk of their being incidentally taken as a result of activities associated with quarrying in the Permit Area. For all Evaluation Species examined in this HCP, the risk of incidental take was deemed sufficiently low as to not appear likely, much less reasonably certain to occur. Incidental take of Evaluation Species is not expected and will not be covered by the Permit. The Evaluation Species are discussed in Section 3.2.

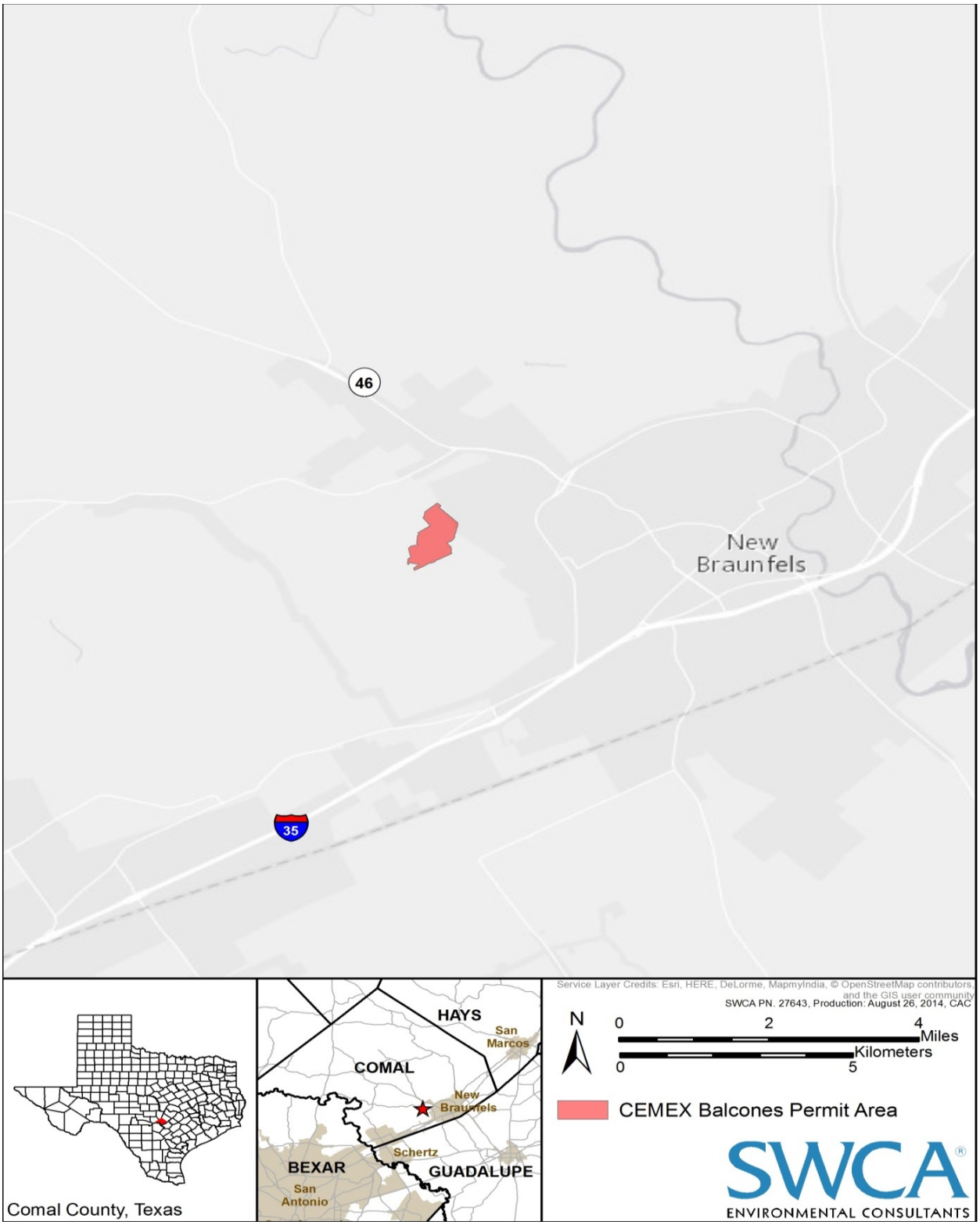


**Figure 1. Balcones Quarry Northeast Area Location Map**

# 2.0 PURPOSE AND NEED

The purpose of the HCP is to support an ESA section 10(a)(1)(B) incidental take permit to authorize incidental take of the GCWA within the Permit Area in order for CEMEX to continue mining its proven limestone reserves within the existing quarry site that was established in 1969. The taking of the GCWA as described in this HCP would be incidental to otherwise lawful activities.

The HCP has been prepared in accordance with the ESA and its implementing regulations to satisfy issuance criteria for the Permit. Pursuant to the ESA and Service regulations and guidance, this HCP describes the following:

- The amount of GCWA habitat that may be directly cleared for quarrying activities in the Permit Area;
- The amount of incidental take of GCWA proposed to be authorized by the requested Permit;
- The measures that will be implemented to minimize and mitigate to the maximum extent practicable the impacts of the authorized taking of the GCWA;
- The measures that will be implemented to avoid potential impacts to the Evaluation Species;
- The biological goals and objectives of the HCP;
- The funding to implement the HCP;
- Permit duration; and
- Monitoring

## 2.1 LEGAL AND REGULATORY FRAMEWORK FOR THE HCP

### 2.1.1 Endangered Species Act

Section 9 of the ESA prohibits the *take* of any federally listed endangered wildlife species (16 United States Code (USC) 1538(a)). The ESA defines "take" as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (16 USC 1532(19)). The Service defines "harm" as "an act which actually kills or injures wildlife and may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns including breeding, feeding or sheltering." Harass is defined by the Service as an "intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding and sheltering" (50 CFR 17.3 (2005)). Section 10(a)(1)(B) of the ESA (16 USC 1539(a)(1)(B)) authorizes the Service to issue a permit allowing take that is "incidental to, and not the purpose of, the carrying out of an otherwise lawful activity."

Section 10(a)(2)(A) of the ESA provides that in order to obtain an incidental take permit, the applicant must submit an HCP that identifies or satisfies several substantive criteria: 1) the impacts that will likely result from the taking; 2) the steps the applicant will take to minimize and mitigate the impacts of the taking and the funding available to implement those steps; 3) what alternative actions to the taking were considered and the reasons the alternatives were not chosen; and 4) other measures that the Service may require as necessary or appropriate for purposes of the conservation plan (16 USC 1539(a)(2)(A)). The Service's ESA implementing regulations also give permittees "no surprises" assurances, which provide certainty as to their future obligations under an HCP (50 CFR 17.22, 17.32, 63 FR 8859). The Service's Habitat Conservation Planning Handbook ("HCP Handbook") provides overall guidance on the elements of an HCP (USFWS and National Marine Fisheries Service [NMFS] 1996).

Section 10(a)(2)(B) of the ESA states the Service shall issue an incidental take permit if the agency finds: 1) the taking will be incidental; 2) the applicant will minimize and mitigate the impacts of the taking to the maximum extent practicable; 3) the applicant will ensure adequate funding for the HCP is provided; 4) the taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild; and 5) that any other measures required by the Service will be met. The HCP Handbook describes how the Service determines whether or not minimization measures and mitigation proposed in an HCP meets the "maximum extent practicable" standard. It states:

> "*This finding typically requires consideration of two factors: adequacy of the minimization and mitigation program, and whether it is the maximum that can be practically implemented by the applicant. To the extent maximum that the minimization and mitigation program can be demonstrated to provide substantial benefits to the species, less emphasis can be placed on the second factor. However, particularly where the adequacy of the mitigation is a close-call, the record must contain some basis to conclude that the proposed program is the maximum that can be reasonably required by that applicant. This may require weighing the costs of implementing additional mitigation, benefits and costs of implementing additional mitigation, the amount of mitigation provided by other applicants in similar situations, and the abilities of that particular applicant. Analysis of the alternatives that would require additional mitigation in the HCP and NEPA analysis, including the costs of the applicant is often essential in helping the Services make the required finding.*"

Section 7(a)(2) of the ESA requires that each federal agency consult with the Service to ensure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat (16 USC 1536(a)(2)). *Jeopardize* is defined by the regulations as engaging in an action that would reasonably be expected, directly or indirectly, to appreciably reduce the likelihood of the survival and recovery of the species in the wild (50 CFR 402.02). Issuance of an incidental take permit is considered an action for which the mandate of consultation applies (HCP Handbook at 1–6). According to the HCP Handbook, the consultation must include consideration of direct and indirect effects on the species, as well as the impacts of the proposed project on listed plants and critical habitat, if any (HCP Handbook at 3-17 through 3-19).

### 2.1.2 National Environmental Policy Act

The Service considers issuance of an incidental take permit to be a federal action subject to the requirements of the National Environmental Policy Act (NEPA) (42 USC 4321–4327). NEPA requires federal agencies to: 1) study proposed projects to determine if they will result in significant environmental impacts; and 2) review the alternatives available for the project and consider the impact of the alternatives on the environment (42 USC 4332(c)). The scope of NEPA is broader than the ESA in that it requires the agency to consider the impacts of the action on the human environment, including a variety of resources such as water, air quality, and cultural resources. In the context of an HCP and incidental take permit, the scope of the NEPA analysis covers the direct, indirect, and cumulative effects of the proposed permit issuance and implementation of the HCP and its associated minimization and mitigation measures (HCP Handbook at 5-1). The HCP Handbook describes the Service's procedures for complying with NEPA with respect to HCPs.

### 2.1.3 Edwards Aquifer Authority

The Permit Area is located within the recharge zone for the Edwards Aquifer (see Section 2.2, Hydrology and Water Resources). CEMEX, through Edwards Aquifer Authority (EAA) Permit No. P100-671 (CO00106), has the right to withdraw 2,288.225 acre-feet (before critical period reductions) of water per year from the Edwards Aquifer, which it does through on-site wells located outside of the Permit Area. As a permitted water user of the Edwards Aquifer, CEMEX is required to contribute $84.00 per acre-foot of water rights annually, a portion of which constitutes an aquifer management fee and the remaining portion of which constitutes an implementation fee for the Edwards Aquifer Recovery Implementation Program (EARIP).

The EARIP is a regional HCP approved by the Service on 18 March 2013 that authorizes incidental take of certain federally listed aquatic species that may result from the pumping of groundwater from the Edwards Aquifer for industrial, municipal, and agricultural uses as permitted by the EAA. These species, referred to collectively herein as the *Edwards Aquifer species*, include the fountain darter (*Etheostoma fonticola*), San Marcos salamander (*Eurycea nana*), Texas blind salamander (*Typhlomolge rathbuni*), Comal Springs dryopid beetle (*Stygoparnus comalensis*), Comal Springs riffle beetle (*Heterelmis comalensis*), Peck's cave amphipod (*Stygobromus pecki*), and Texas wild-rice (*Zizania texana*). CEMEX does not believe its activities create realistic potential to take any of the Edwards Aquifer species. Nonetheless, because any future take of these species that could result from CEMEX water withdrawals would be authorized through its participation in the EARIP, these species need not and will not be addressed further in this document.

# 3.0 DESCRIPTION OF AREA TO BE ANALYZED

A composite aerial photograph of the Permit Area is provided as Fig. 2. As can be seen on Fig. 2, quarry pits are present near the southern and western boundaries of the Permit Area, and the area is bounded to the north and east by residential portions of the City of New Braunfels. Residential neighborhoods are present directly north and northeast of the Permit Area, and limited amounts of woodland are present immediately to the east and southeast. Woodland is also present to the northwest of the Permit Area, although over the past few years and as discernible on Fig. 2, a residential subdivision has been developing within this area.

Lands within the Permit Area are privately held and largely inactive, except for property inspections conducted by CEMEX employees. An overhead transmission line formerly ran along the southern edge of the Permit Area, but it has been re-located in anticipation of future mining. No livestock grazing occurs in the Permit Area.

The Permit Area lies on the southeastern edge of the Edwards Plateau. Elevations in the Permit Area range from approximately 780 to 900 feet above mean sea level. Topography is rolling to gently rolling except for some steep but low banks of ephemeral drainage channels in the southern and eastern portions of the Permit Area. Topography of the Permit Area is depicted on Fig. 3. Approximately 4,200 feet southeast of the Permit Area is the Balcones Escarpment, a fault that demarcates the southeastern boundary of the Edwards Plateau.

## 3.1 GEOLOGY AND SOILS

The Edwards Plateau is largely composed of flat-lying sedimentary rocks, mostly Lower Cretaceous marine carbonates, that were elevated en masse during or prior to the Miocene epoch (Spearing 1991). The predominant carbonate geology of the Edwards Plateau has resulted in widespread presence of karstic topography in the region. Surface geology of the Permit Area consists of the Lower Cretaceous Person Formation of the Edwards Group (Collins 2000). The Person Formation is a unit composed of limestone, dolomite, and dolomitic limestone. The Person Formation is underlain by the Kainer Formation of the Edwards Group, which similarly consists of beds of limestone, dolomite, and dolomitic limestone.

Quarrying by CEMEX and others on adjacent properties has resulted in local removal of the Person Formation and caused exposure of a unit mapped by Collins (2000) as the undivided Person and Kainer formations. Surface exposure of the Edwards Group of carbonates form the recharge zone for the Edwards Aquifer. Soils in the Permit Area have been classified within the "Rumple-Comfort association, undulating" mapping unit (Batte 1984). This association consists of shallow to moderately deep soils formed on hilly terrain over indurated limestone of the Edwards Plateau (Batte 1984). Soils within the association are typified by a surface layer consisting of stony, reddish-brown clay loam overlying dark reddish-brown, extremely stony clay (Batte 1984). Chert derived from decomposition of the Edwards Group of limestones is typically abundant in this soil association.

**Figure 2. Aerial View of the Permit Area**

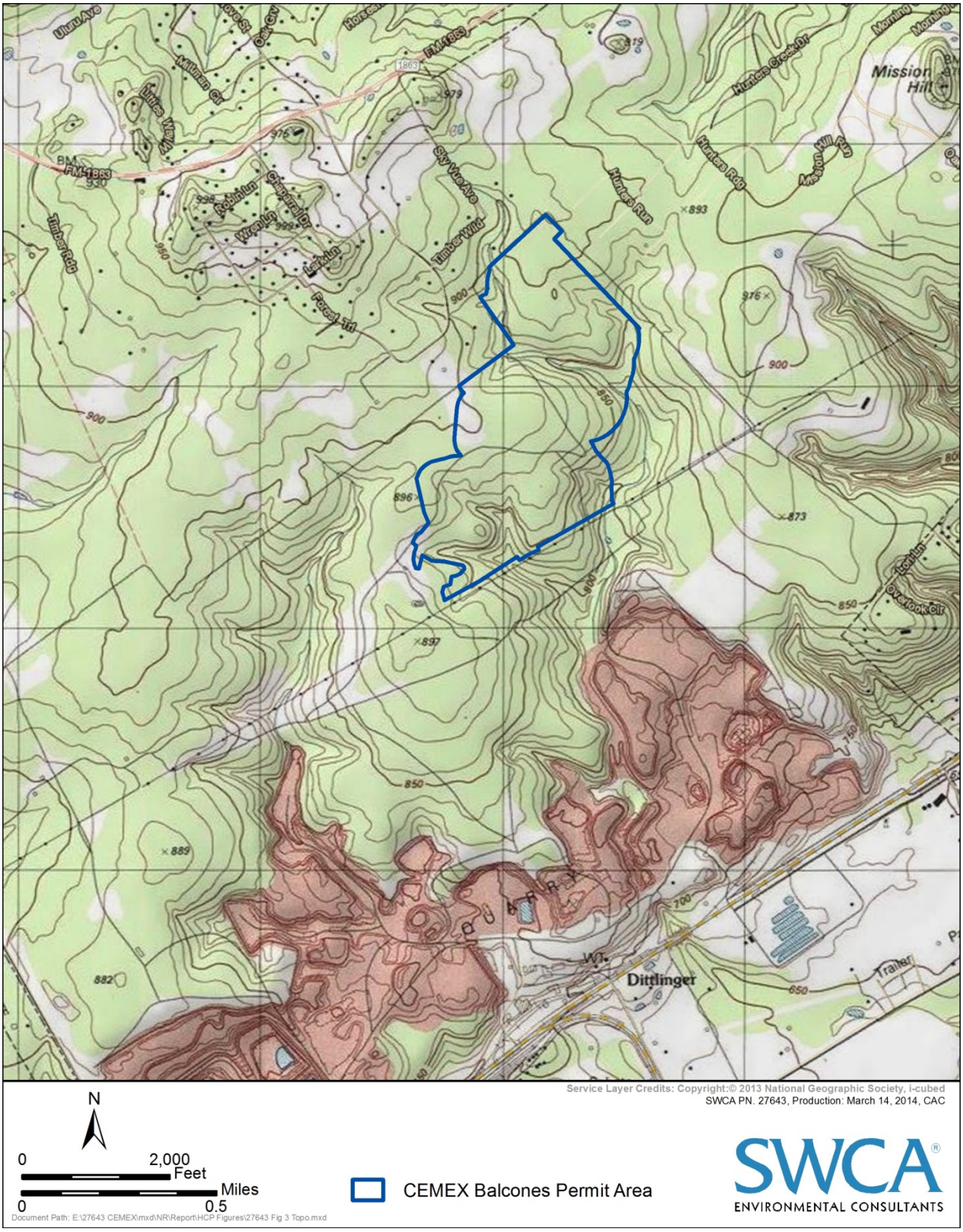


**Figure 3. Topographic Map of the Permit Area**

## 3.2 HYDROLOGY AND WATER RESOURCES

The Permit Area contains no permanent surface water and no wetlands. Two ephemeral drainage channels are present in the Permit Area but they have been truncated off-site to the south by quarrying activity conducted by an adjacent land owner. The Permit Area lies within the watershed of Dry Comal Creek, although most surface water runoff from the property currently drains into the adjacent quarry pits with some storm water runoff being maintained onsite.

The Permit Area is located in the Edwards Aquifer recharge zone. The recharge zone is that surface area where precipitation and stream flow are able to infiltrate and percolate through the bedrock to become groundwater for that aquifer. Groundwater can be held within subterranean void space to create a pooled aquifer, it can travel down-gradient to be discharged back at the surface as spring flow, or, as in the case of water of the Edwards Aquifer, it does both.

The Edwards Aquifer is divided into distinct hydrological segments. The Permit Area is located within the recharge zone for the San Antonio Segment of the Edwards Aquifer (SASEA). The recharge zone for the SASEA extends for approximately 180 miles between groundwater divides in Kinney County to the west and Hays County to the northeast (EAA 2012). The recharge zone for the SASEA covers approximately 1,250 square miles or 800,000 acres (EAA 2012).

Water within the SASEA discharges at many springs located along the breadth of the southern and eastern edges of the recharge zone. Primary discharges at the lower, northeastern end of the SASEA include Comal Springs and Hueco Springs in Comal County and San Marcos Springs in Hays County. Based on information provided in Appendix A (Hydrology of the Permit Area) water reaching the SASEA from the Permit Area is expected under normal conditions to travel toward San Marcos Springs, but under certain flow regimes it may also be capable of contributing to discharge at Comal Springs. It is not possible to quantify the respective amount of contribution at each set of springs.

Water from San Marcos Springs flows into Spring Lake and forms the headwaters of the San Marcos River. The San Marcos River ultimately joins the Guadalupe River in Gonzales County. Water from Comal Springs enters Landa Lake and from there flows into both the old and new channels of the Comal River. The Comal River is short and joins the Guadalupe River as it flows through New Braunfels.

## 3.3 VEGETATION

Woodland is present across approximately 195.9 acres of the 199.4-acre Permit Area. The remaining approximately 3.5 acres of the Permit Area support herbaceous communities, with these communities situated in narrow corridors along the property margins and alignments of interior roads.

Land encompassing the Permit Area was historically managed to promote livestock grazing and is believed to have previously supported mostly open live oak woodland that since acquisition for mining has been progressively filled in by Ashe juniper trees. Review of historical aerial photography (circa 1980) contained in the *Soil Survey of Comal and Hays Counties, Texas* (Batte 1984) indicates that what is now the Permit Area at that time supported semi-open woodland

with an average tree cover across the area of roughly 50%. Woodland in the Permit Area now has a closed or nearly closed canopy, with canopy closure ranging from approximately 75% to nearly 100% depending on location.

Woodlands in the Permit Area are composed primarily of Ashe juniper (*Juniperus ashei*) and plateau live oak (*Quercus fusiformis*) trees, with cedar elm (*Ulmus crassifolia*) trees present in low to very low densities. Average canopy height of the woodland is 22 to 28 feet in upland areas and 26 to 34 feet along the ephemeral drainages. Average tree heights in upland areas generally decrease upslope.

Plateau live oak trees in the Permit Area have trunk diameters-at-breast-height (dbh) up to at least 24 inches, although most range from 6 to 16 inches dbh. Most Ashe juniper trees in the Permit Area have trunk dbh ranging from 2 to 8 inches, suggesting that many are reasonably young.

Somewhat xeric woodlands dominated by Ashe juniper, plateau live oak, and mesquite (*Prosopis glandulosa*) are typical of the Edwards Plateau. Upland areas on the Edwards Plateau receive comparatively low levels of precipitation and are subjected to high temperatures during the summer, leading to high evapotranspiration rates (Sanford and Selnick 2013), with these two factors undoubtedly inhibiting deciduous tree growth. Broad-leaf deciduous trees, which for the most part require more water than do Ashe juniper and plateau live oak, are most common on the Edwards Plateau in canyons where water availability is typically greater (Griffith et al. 2007, Van Auken 1988).

SWCA believes the dearth of deciduous trees in the Permit Area, as across much of the Edwards Plateau, is also partially a result of surface geology. Being highly permeable, the Edwards Group allows precipitation to infiltrate the ground and percolate below the tree root zone, further decreasing water availability. Deciduous tree development on the Edwards Plateau is greatest in the canyons incised along the eastern and southern margins of the plateau (Griffith et al. 2007). Not only is this because topography allows for greater water availability as surface water runoff from upland areas travels downslope into canyons, but because the contact between the Edwards Group and underlying impermeable formations can be exposed on canyon slopes. Water often seeps from the ground along the exposed basal contact of the Edwards Group, which typically results in Texas oak (*Quercus buckleyi*) and other broad-leaf deciduous trees being concentrated in horizontal bands on canyon slopes along the exposed zone of contact. This phenomenon can be observed in northern Comal County where topography is more highly dissected in the general vicinity of Canyon Lake, at Lost Maples State Natural Area in Bandera County, at Friedrich Park in Bexar County, along the margins of the Jollyville Plateau in Travis County, and elsewhere.

Shrub development is generally poor throughout the Permit Area. Texas persimmon (*Diospyros texana*), agarita (*Mahonia trifoliolata*), hog-plum (*Colubrina texensis*), twist-leaf yucca (*Yucca rupicola*), prickly pear (*Opuntia* spp.), and tasajillo (*Opuntia leptocaulis*) are present in low to very low densities in upland woodlands. Some whitebrush (*Aloysia gratissima*), Roosevelt weed (*Baccharis neglecta*), and small huisache (*Acacia minuta*) and mesquite trees occur along the edges of the woodland along the margins of interior roads. A sub-shrub, bush croton (*Croton fruticulosus*), is relatively common in the understory of woodland developed along drainages and

adjacent lower slopes. Also present in the woodland understory along these lower slopes are cedar sedge (*Carex planostachys*), frostweed (*Verbesina virginica*), and lindheimer senna (*Cassia lindheimeri*).

### 3.4 WILDLIFE

No species-specific wildlife surveys have been conducted in the Permit Area beyond those performed to establish the status of the GCWA. In general, the Permit Area is expected to support common wildlife species typical of juniper-dominated woodlands of the Edwards Plateau. Species of mammals known or expected to occur in woodlands of the Permit Area include Virginia opossum (*Didelphis virginiana*), nine-banded armadillo (*Dasypus novemcinctus*), eastern cottontail (*Sylvilagus floridanus*), rock squirrel (*Spermophilus variegatus*), eastern fox squirrel (*Sciurus niger*), Merriam's pocket mouse (*Perognathus merriami*), Texas mouse (*Peromyscus attwateri*), coyote (*Canis latrans*), common gray fox (*Urocyon cinereoargenteus*), ringtail (*Bassariscus astutus*), common raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), and white-tailed deer (*Odocoileus virginianus*) (Kutac and Caran 1994). Brazilian free-tailed bats (*Tadarida brasiliensis*) undoubtedly forage over the Permit Area on a seasonal basis, as might cave myotis (*Myotis velifer*), eastern red bat (*Lasiurus borealis*), evening bat (*Nycticeius humeralis*), and some other species of Chiroptera (Kutac and Caran 1994).

Based on observations made by SWCA durings its surveys for the GCWA, permanent resident species of birds occurring in the Permit Area include black vulture (*Coragyps atratus*), turkey vulture (*Cathartes aura*), red-shouldered hawk (*Buteo lineatus*), great horned owl (*Bubo virginianus*), white-winged dove (*Zenaida asiatica*), mourning dove (*Zenaida macroura*), golden-fronted woodpecker (*Melanerpes aurifrons*), ladder-backed woodpecker (*Picoides scalaris*), western scrub-jay (*Aphelocoma californica*), American crow (*Corvus brachyrhynchos*), Carolina chickadee (*Poecile carolinensis*), black-crested titmouse (*Baeolophus atricristatus*), Carolina wren (*Thryothorus ludovicianus*), Bewick's wren (*Thryomanes bewickii*), northern mockingbird (*Mimus polyglottos*), rufous-crowned sparrow (*Aimophila ruficeps*), and northern cardinal (*Cardinalis cardinalis*) (P. Sunby/SWCA, pers. obs.).

During the breeding season, these species are known or expected to be joined by migratory species such as yellow-billed cuckoo (*Coccyzus americanus*), Chuck-will's-widow (*Antrostomus carolinensis*), black-chinned hummingbird (*Archilochus alexandri*), ash-throated flycatcher (*Myiarchus cinerascens*), white-eyed vireo (*Vireo griseus*), blue-gray gnatcatcher (*Polioptila caerulea*), summer tanager (*Piranga rubra*), painted bunting (*Passerina ciris*), and lesser goldfinch (*Spinus psaltria*) (Lockwood and Freeman 2014, P.Sunby/SWCA, pers. obs). Some migratory species of birds known or expected to winter in the Permit Area include house wren (*Troglodytes aedon*), ruby-crowned kinglet (*Regulus calendula*), hermit thrush (*Catharus guttatus*), American robin (*Turdus migratorius*), cedar waxwing (*Bombycilla cedrorum*), orange-crowned warbler (*Oreothlypis celata*), yellow-rumped warbler (*Setophaga coronata*), spotted towhee (*Piplio maculatus*), chipping sparrow (*Spizella passerina*), Lincoln's sparrow (*Melospiza lincolnii*), and American goldfinch (*Spinus tristis*) (Lockwood and Freeman 2014, P.Sunby/SWCA, pers. obs).

Relatively few species of amphibians are expected to occur in the Permit Area owing to a lack of permanent sources of water. Amphibians occurring in the Permit Area likely include Gulf Coast toad (*Incilius nebulifer*), red-spotted toad (*Anaxyrus punctatus*), and western narrowmouth toad (*Gastrophryne olivacea*) (Dixon 2013). Reptiles occurring in the Permit Area are expected to include prairie lizard (*Sceloporus consobrinus*), Texas spiny lizard (*Sceloporus olivaceus*), green anole (*Anolis carolinensis*), short-lined skink (*Plestiodon tetragrammus brevilineatus*), little brown skink (*Scincella lateralis*), common spotted whiptail (*Aspidoscelis gularis*), Texas threadsnake (*Rena dulcis*), Great Plains ratsnake (*Pantherophis emoryi*), Texas ratsnake (*Pantherophis obsoleta*), western coachwhip (*Masticophis flagellum testaceus*), rough greensnake (*Opheodrys aestivus*), bullsnake (*Pituophis catenifer sayi*), Texas patch-nosed snake (*Salvadora grahamiae lineata*), flat-headed snake (*Tantilla gracilis*), Texas coralsnake (*Micrurus tener*), and western diamondback (*Crotalus atrox*) (Dixon 2013).

## 3.5 THREATENED, ENDANGERED, AND CANDIDATE SPECIES

As noted in Section 1.0, the GCWA is the only species proposed to be covered under the Permit. This HCP covers the potential for expected clearing of habitat to cause take of the GCWA. Although the ESA does not define "take" to include habitat modification, Service regulations have defined "take" and, specifically, the term "harm" to include significant habitat modification that results in death or injury to a member of a listed species by significantly impairing essential behavioral patterns such as breeding, feeding, or sheltering.

### 3.5.1 Golden-cheeked Warbler

The GCWA is a small migratory songbird. The breeding range of the GCWA is largely restricted to the Edwards Plateau and Cross Timbers regions of central and north-central Texas (USFWS 1992). Most birds arrive on their breeding grounds in early to mid-March. Breeding habitat typically consists of relatively dense and mature woodland composed of a combination of Ashe juniper and broad-leafed hardwood tree species, especially oaks such as Texas oak and plateau live oak. Other hardwood tree species often found in GCWA breeding habitat include shin oak (*Quercus sinuata*), Lacey oak (*Quercus glaucoides*), post oak (*Quercus stellata*), escarpment black cherry (*Prunus serotina* var. *eximia*), walnut (*Juglans* spp.), Texas ash (*Fraxinus texensis*), and cedar elm. No critical habitat has been designated for the GCWA. The Texas Parks and Wildlife Department (TPWD) describes woodlands "with mature Ashe juniper (cedar) in a natural mix with oaks, elms, and other hardwoods, in relatively moist (mesic) areas such as steep canyons and slopes, and adjacent uplands" and having 50-100% canopy closure and a canopy height of 20 feet or more as being highly likely to be used by GCWAs (Campbell 2003).

GCWAs generally begin their migration south in July or early August and winter in the highlands of southern Mexico and northern Central America (USFWS 1992). Research by Rappole et al. (1999, 2000) indicates that GCWAs on their wintering grounds prefer oak or oak/pine woodlands occurring at elevations between approximately 3,600 to 7,900 feet.

The quality of golden-cheeked warbler habitat varies across a spectrum of suitability. Habitat parameters that affect suitability include percent deciduous tree cover, relative abundance of mature Ashe juniper trees, average tree height, percent canopy closure, and patch size, among others (Campbell 2003). Productivity is the ultimate measure of habitat quality, with the number

of young produced per unit area increasing with increased habitat quality. However, determining productivity rates for the GCWA can be time-consuming and costly. As a result, when studying this species many researchers often use the number of territories per unit area as an easier to derive indicator of habitat quality, with increasing habitat quality assumed to be reflected by increasing density of occupation. Pulich (1976) defined excellent, average, and marginal habitat for the GCWA based on an average density of one pair of birds per 20, 50, and 85 acres of woodland, respectively. Monitoring studies performed for the Balcones Canyonlands Conservation Plan indicate that GCWAs in the Jollyville Plateau region of Travis County can occur at densities of one pair per 5 to 7 acres of habitat (City of Austin et al. 2012). Actual GCWA territory size can range from about 3.2 to 21.0 acres (Pulich 1976, Kroll 1980). In general, it is expected that GCWA territory size increases as habitat quality decreases.

GCWA research indicates that occupancy and productivity are significantly lower in small patches of habitat than in larger ones (Maas-Barleigh 1997, Coldren 1998). Populations of GCWAs also appear to be less stable in small habitat patches surrounded by development (Coldren 1998, Engels 1995, Arnold et al. 1996, Moses 1996). Some studies indicate that the abundance of the GCWA is reduced within 656 to 1,640 feet of an urban edge (Engels 1995, Arnold et al. 1996, Coldren 1998). Coldren (1998) reported that warbler occupancy declined with increasing residential development and roadway width.

During a 2009 survey of 287 patches of potential habitat, Morrison et al. (2010) detected GCWAs in 4 of the 33 patches (12.1%) that were less than 24.7 acres in size. Occupancy rates were found to be 37.6% in patches that ranged from 24.7 to 123.5 acres, 67.7% for patches ranging from 247 to 1,235 acres, and 93.3% for patches in excess of 2,470 acres (Morrison et al. 2010). Butcher et al. (2010) found that no more than one pair of golden-cheeked warblers would occur in a patch of woodland less than 37 acres.

The relationship between probability of GCWA occurrence and habitat patch size is likely tied to the total amount of woodland present on the landscape. Magness et al. (2006) developed a method for predicting presence or absence of GCWAs in a given landscape and found that the birds occurred in a habitat patch only when landscape composition within a 400-meter (1,312-foot) radius exceeded 40% woodland, and that the likelihood of occupancy was greater than 50% only when landscape composition exceeded 80% woodland. While they could not rule out a relationship between habitat fragmentation and overall habitat quality as measured by nesting success and recruitment, Magness et al. (2006) did conclude that common measures of habitat fragmentation, including edge density, mean-nearest neighbor, and distance between woodland patches, were poor predictors of species occurrence across all spatial scales.

### *Threats and Trends*

The GCWA was listed as endangered in 1990 because of imminent and continuous destruction of breeding habitat (USFWS 1990a). Continuing loss of habitat from urbanization, suburban development, and clearing associated with agricultural practices remains the greatest threat to the continued existence of the GCWA (USFWS 2012). At the time of its listing as endangered, human agricultural activities during the middle 20$^{th}$ century had eliminated a considerable amount of GCWA habitat within the range of the species. The Service (USFWS 1992) estimated the GCWA population as of 1990 to be approximately 13,800 territories based largely on the

work of Wahl et al. (1990). This estimate was based on availability of suitable habitat as assessed through examination of satellite imagery taken in the 1970s and early 1980s (Wahl et al. 1990). Wahl et al. estimated that at that time, approximately 79,408 to 263,737 acres of habitat suitable for use by GCWAs was present on the landscape.

Habitat loss has continued since the warbler was listed as endangered as suburban developments spread into GCWA habitat along the Balcones Escarpment, especially in a growth corridor from Austin to San Antonio. At the same time, grazing and browsing pressure by goats has been reduced greatly in rural areas. The number of goats clipped annually for mohair in Texas, an industry centered on the Edwards Plateau, dropped from an average of more than 4,000,000 in the early 1960s to approximately 1,500,000 in the 1970s. This number held fairly steady through the 1980s and early 1990s, but then dropped again once a federal subsidy on mohair production ended in 1994. The number of goats clipped annually for mohair in Texas averaged approximately 300,000 in the early 2000s and has continued to drop, with an average of 120,000 goats clipped per year from 2008 through 2012, and an all-time low of 75,000 goats clipped in 2013 (U.S. Department of Agriculture 2013).

The decline in number of goats on the rural landscape of the Edwards Plateau over the past 50 years appears to have allowed Ashe juniper/oak woodland to develop on many lands that were formerly kept cleared of trees and brush to facilitate goat production. Through interpretation of 2001 satellite imagery, Loomis-Austin, Inc. (LAI, 2008) estimated that approximately 4,149,478 acres of GCWA habitat was present on the landscape across the breeding range of the species, and Diamond (2007) estimated that approximately 4,378,400 acres of habitat were present rangewide.

Morrison et al. (2010) performed their own mapping of the distribution of GCWA habitat through assessment of 2007 and 2008 Landsat 5 imagery and ground truthing at 1,000 points spread randomly across the range of the warbler. This mapping resulted in the identification of approximately 4,148,138 acres of potential GCWA habitat across the range of the species encompassed in 63,616 discrete patches. This acreage is similar to that identified by LAI (2008) and Diamond (2007) and almost 1,475% greater than the maximum amount of suitable habitat identified as being present on the landscape by Wahl et al (1990).

The previously mentioned surveys by Morrison et al. (2010) were performed to field-truth their habitat assessment. They found that rates of GCWA occupancy increased as patch size increased, and that density of warbler occupation generally increased across the breeding range from north to south. Based on the results of their field surveys, Morrison et al. (2010) estimated the 2009 population of singing male GCWAs to be approximately 220,615. This number is almost 1,500% greater than the 1992 estimate of 13,800 males in 1990. Morrison et al. (2010) used average regional densities of GCWA occupancy to derive the total singing-male population estimate for the species. As discussed later with regard to the Permit Area, these average densities are certainly not attained on a property-by-property basis.

SWCA is aware that not all students of the GCWA believe that the population estimate derived by Morrison et al. (2010) is accurate. However, comparison of recent aerial photography against historical aerial photography (e.g., such as that contained in soil surveys of Texas counties produced by the Soil Conservation Service of the U.S. Department of Agriculture, mostly in the

late 1970s and early 1980s), and the mapping of GCWA habitat independently performed by Morrison et al. (2010), LAI (2008) and Diamond (2007), indicate that a considerably greater amount of potentially suitable GCWA habitat is currently present on the landscape than was present on the landscape in the 1970s and 1980s as examined by Wahl et al. (1990). Whether the population estimate made by Morrison et al. (2010) is close to the mark or not, SWCA believes the results of the field surveys that enabled them to reach this estimate indicate strongly that the GCWA population has been able to expand to take advantage of increased habitat availability.

In our experience, the Service has, in Section 7 consultations and in Section 10(a)(1)(B) permit negotiations with other applicants, traditionally considered the noise and activity associated with construction projects as having potential to disturb GCWAs. Known regular occurrence of GCWAs on heavily visited state parks and active military reservations such as Fort Hood and Camp Bullis, as well as observations by SWCA of GCWAs occurring directly adjacent to active home construction sites and heavily traveled roads suggest to us that GCWAs acclimate to human activity and sources of anthropogenic noise. This position is supported by a recent three-year study on the effects of road construction activity and noise on GCWAs performed by Lackey et al. (2011). This study examined warbler behavior and productivity in habitat subjected to traffic noise, habitat subjected to traffic and construction noise, and, as quiet control sites, in habitat remotely situated from traffic and construction noise. Results of the study indicate that "construction noise does not appear to affect behavior, reproductive success, or vocalization characteristics of GCWAs" (Lackey et al. 2011).

The U.S. Environmental Protection Agency (EPA) recently identified the GCWA as highly vulnerable to climate change (EPA 2009). This designation was based on modeling that included, among others, factors such as population size, historic trends in population and range size, estimated physiological vulnerability to temperature and precipitation change, and likely extent of habitat loss due to climate change. Data used by the model concerning trends in warbler population and range was at the time almost two decades old and appears to no longer reflect current conditions. The model also did not contemplate what seems to us to be real potential for GCWAs to shift their breeding season to earlier in the year in order to avoid any climate-change induced hotter summer seasons.[1] Nonetheless, we agree that GCWAs are likely more vulnerable to climate-change related impacts than many other species given that their breeding range is comparatively restricted in extent.

***Recovery***

The Golden-cheeked Warbler Recovery Plan was issued in 1992 (USFWS 1992). The Recovery Plan divided the range of the species into eight recovery regions and identified a goal of protecting a viable breeding population in each of the eight regions as a criterion of recovery. Comal County is located within Recovery Region 6, along with Bexar and Kendall counties and portions of Bandera, Blanco, Kerr, and Gillespie counties.

[1] Golden-cheeked warblers already migrate south from their breeding grounds one to two months earlier than most other migratory birds that breed within their range. The reason for this is not known for certain, but likely is related to the decreased availability of insect prey caused by the hot, dry summers typical of central Texas.

“Viable population” is not defined in the Recovery Plan, although it was suggested that a viable population of GCWAs could range from 500 pairs to a few thousand individuals. More recently, the Service indicated a viable population of GCWAs may need to be as large as 3,000 pairs (USFWS 1996, Alldredge et al. 2002). If this number and the Morrison et al. (2010) population estimate are accurate, then the GCWA population rangewide is currently about 70 times greater than the minimum viability threshold.

The Golden-cheeked Warbler Recovery Plan is now over 20 years old. The Service has re-formed a Golden-cheeked Warbler Recovery Team to address recovery of the species and consider information gained from more recent GCWA studies. The work of this team is expected to result in issuance by the Service of a revised Recovery Plan for the species. Prior to its disbanding, the original Recovery Team recommended revising the number of recovery regions from eight to six, while retaining the original recovery criterion of protection of eight viable warbler populations (Golden-cheeked Warbler Recovery Team 1998). It is unknown whether the new Recovery Team will adopt this recommendation, or how, if at all, the recovery goals of the 1992 Recovery Plan could change in a revised plan.

Morrison et al. (2010) identified 389,436 acres of potential GCWA habitat in Recovery Region 6. LAI subdivided the potential habitat identified by its model into three categories: potential habitat not likely to be occupied, potential habitat that may be occupied, and potential habitat likely to be occupied. LAI (2008) identified a total of 689,259 acres of potential GCWA habitat in Recovery Region 6, with 242,625 of those acres considered likely to be occupied. Diamond (2007) identified a total of 769,581 acres of potential GCWA habitat in Recovery Region 6. The Diamond acreage was obtained from Diamond Model C, which used forest/woodland cover as identified in the USGS National Land Cover Dataset as adjusted to account for patch size and edge effects. The Service in 2004 identified approximately 70,059 acres of potentially suitable GCWA habitat as being present in Comal County (USFWS 2004).

Since the time that the GCWA was listed as endangered, several conservation actions have occurred or have been initiated that have or would result in the preservation of substantial amounts of GCWA habitat. These include the Balcones Canyonlands National Wildlife Refuge (BCNWR) in Burnet, Travis, and Williamson counties, the Balcones Canyonlands Preserve (BCP) in Travis County, the Williamson County Regional Habitat Conservation Plan, the Hickory Pass Ranch Conservation Bank and Clearwater Conservation Bank in Burnet County (1400-acre perpetual easement established), and the Bandera Corridor Conservation Bank and Festina Lente Conservation Bank in Bandera County (No credits have been sold yet). Other conservation actions expected to contribute to the conservation of GCWA habitat upon implementation include the Hays County Regional Habitat Conservation Plan, the Comal County Regional Habitat Conservation Plan, and the conceptual Southern Edwards Plateau Regional Habitat Conservation Plan. The Nature Conservancy and other private conservation organizations also hold lands that protect GCWA habitat, and habitat has been preserved in many additional private property conservation easements.

Currently, three large GCWA breeding populations receive some degree of protection. These include those GCWAs breeding at Fort Hood Military Reservation in Coryell and Bell counties, those on BCP lands in Travis County, and those on the BCNWR in Burnet, Travis, and Williamson counties. At Fort Hood, GCWA detections along point count routes almost doubled

from 1992 to 2003 (Peak 2003). Based on extrapolation from GCWA densities in established study areas, the total GCWA population on Fort Hood in 2003 was estimated to be approximately 4,514 pairs (Peak 2003, USFWS 2005). The GCWA population at the BCNWR is estimated to range from 800 to 1,000 males (C. Sexton, USFWS, pers. comm. to SWCA Environmental Consultants [SWCA], 2007). Lands contained in the BCP are believed to support "hundreds" more (J. Kuhl, Travis County, pers. comm. to SWCA, 2007). The BCNWR and BCP are relatively close together, being separated by a distance of approximately 5 miles.

***Status in the Permit Area***

As described in Section 2.3 (Vegetation), the Permit Area formerly supported semi-open woodland. It is believed likely that Ashe juniper was periodically cleared from the property to facilitate grazing and that woodland in the Permit Area was historically unsuitable for use by GCWAs. However, reflecting what seems to have happened across much of the range of the species in recent decades, active juniper management in the Permit Area ceased upon its purchase for mining and since then the woodland has closed with increasing relative abundance of Ashe juniper.

Prior to conducting the spring 2013 GCWA survey, SWCA concluded that most of the woodland in the Permit Area appeared unlikely to support GCWAs because it lacked appropriate densities of hardwood trees, was too heavily dominated by smallish Ashe juniper, and appeared too xeric. SWCA also concluded that some limited amount of woodland present along drainages shared characteristics with known GCWA habitat and that a survey was necessary to determine conclusively whether the species occupied the Permit Area.

The 2013 survey was performed across all woodland present in the northeastern portion of the Balcones Quarry property, which covered approximately 246 acres and included all wooded portions of the Permit Area. The survey was conducted in accordance with the USFWS Section 10(a)(1)(A) Scientific Permit Requirements for Conducting Presence/Absence Surveys and Habitat Assessments for Endangered Golden-cheeked Warblers (last updated 01/13/10). This protocol identifies survey methods and minimum procedures to be used for conducting presence/absence surveys for the GCWA. The protocol requires the surveys to be conducted between March 15 and June 1 with 60 percent of the surveys being conducted prior to May 15, and a minimum of five survey visits with no more than one visit every five days.

The 2013 GCWA survey for the Permit Area was conducted on 15, 21, and 26 March and 1 and 8 April. To our knowledge, this was the first GCWA survey to have been performed in the Permit Area. No GCWAs were detected in or adjacent to the Permit Area during the first three survey visits. On the fourth visit, observation of a male GCWA was made in two separate locations within the Permit Area. At the time, it was not known whether those observations represented one male that moved between the two areas or two different birds. A coordinated survey was performed on the fifth visit, with people stationed simultaneously in each of the two locations where a GCWA was detected during the fourth visit in an effort to see if birds could be heard singing in both places at the same time. Only one of the surveyors encountered a GCWA in the Permit Area during the fifth visit. This result caused SWCA to conclude it was most likely that one bird was responsible for all GCWA observations made in the Permit Area over the last

two days of the survey as it seemed to SWCA that the arrival of two GCWAs on a property that late in the year was much less likely than the arrival of just one bird.

Male GCWAs sing frequently early in the breeding season as they establish territory boundaries and seek to attract mates (Pulich 1976). Consequently, the males are easily found at this time of year and the failure to detect a GCWA in the Permit Area during the first three survey visits (15, 21, and 26 March) suggests that the GCWA detected during the fourth and fifth visits was not present in the Permit Area earlier in the spring. Because male GCWAs typically return to their breeding grounds in the first half of March, the bird detected in the Permit Area either had to be unusually late in its return to Texas, or it had returned to the region earlier in the spring but had first spent time elsewhere attempting to establish a territory. It also seems reasonable that a bird newly arriving in a patch of woodland, whether arriving from the wintering grounds or after having left some other patch of woodland in the region, would explore that patch to evaluate food availability, determine whether other GCWAs were present, and to improve his chances of being heard by a female GCWA. Exploratory behavior would explain why one male GCWA could have been detected in two different places during the fourth survey visit.

Locations of GCWA observations made in the Permit Area in the spring of 2013 are depicted on Fig. 4. Both locations where GCWA observations were made in 2013 support woodland developed along ephemeral drainages. Woodland present along the drainages is somewhat taller and contains higher densities of deciduous trees than woodlands present in upland areas. No GCWAs were detected off-site during the survey, other than the on-site bird observed to barely cross the Permit Area boundary as shown on Fig. 4.

A complete survey for GCWA was conducted again by SWCA in the spring of 2014 across approximately 246 acres of woodland in the northeastern portion of the Balcones Quarry property. This survey was also conducted according to Service presence/absence survey protocols. Survey visits in 2014 were made on 19 and 26 March and 1, 8, and 15 April. No GCWAs were detected on the property during the first survey visit, but then one male GCWA was observed during the second, third, and fourth visits. This male was not re-located during the fifth visit and no GCWAs were detected during a sixth visit to the property made with a representative of the Service on 17 May 2014.

It is unclear why the 2014 bird could not be re-found after the fourth visit. It is possible that the bird abandoned the property owing to failure to attract a mate or that it had been killed by a predator. It would be highly unusual if it had remained present on the property but just stopped singing. Locations of GCWA observations made in the Permit Area in 2014 are also shown on Fig. 4. As shown on Fig. 4, in 2014 all GCWA observations were made in the northeastern portion of the Permit Area, which is generally the same area as one of the two areas where a GCWA was observed in 2013.

Given the presence of one GCWA in the Balcones Quarry Northeast Area in 2014 and what was most likely one in 2013, and the fact that GCWA territories are usually less than 21 acres in size, it was apparent that not all 246 acres of surveyed woodland on the property were providing habitat for the species. At the same time, the limits of GCWA habitat on the property were not clearly discernible on digital aerial photography.

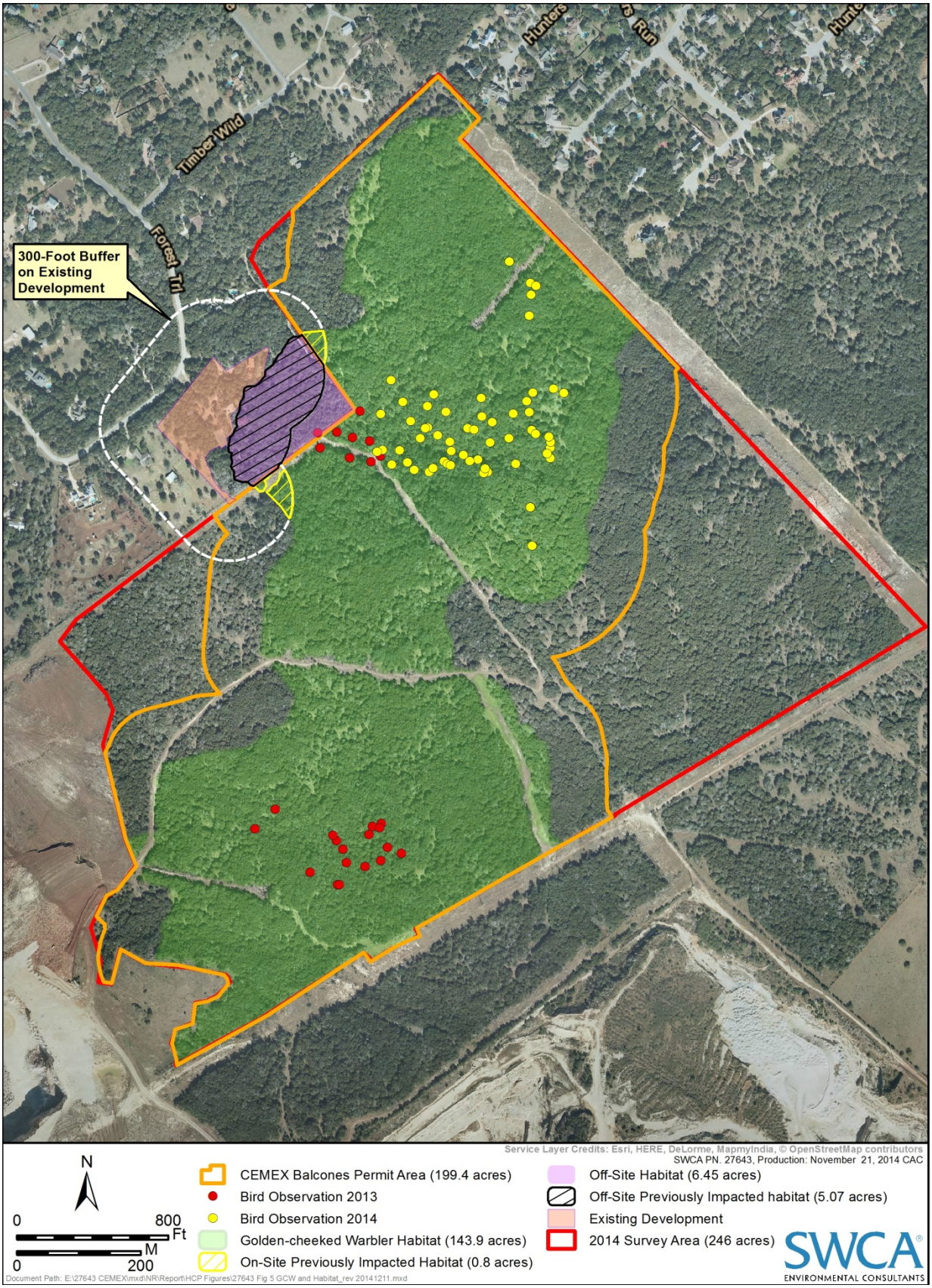


**Figure 4. Locations of 2013 and 2014 Golden-cheeked Warbler Observations and Distribution of Golden-cheeked Warbler Habitat in the Permit Area**

As a first step in delineating GCWA habitat on the property, SWCA biologists used GPS devices to map the locations of all broad-leafed hardwood trees occurring in the 246-acre area that had been surveyed for GCWAs. This was done because, based on known habits of GCWAs, SWCA believed it highly probable that GCWA usage of woodland on the property was tied to the distribution of hardwood trees. Trees were recorded as plateau live oak or other broad-leafed hardwood, nearly all of which proved to be cedar elm trees, along with a small number of Texas sugarberry (*Celtis laevigata*) trees. Geographic Information System (GIS) software was then used to produce contour maps of the density of plateau live oak trees and the density of other broad-leafed hardwood trees in the 246-acre surveyed area. Those densities were then compared against the distribution of GCWA observations made during the 2013 and 2014 surveys.

The distribution of GCWA observations in the 246-acre surveyed area did not correlate to the distribution of plateau live oak trees, but did correlate rather neatly with the distribution of the other broad-leafed hardwoods. The contour of the lowest density of other broad-leafed hardwood trees that encompassed all GCWA observations made in the 246-acre surveyed area and the woodland set between the two sets of GCWA observations made in 2013 was then used by SWCA to define the limits of GCWA habitat on the property. At the request of the Service, this delineation was then expanded to include all woodland in the northeastern portion of the Balcones Quarry property that occurred within 300 feet of the GCWA observations made during the 2013 and 2014 surveys. GCWA habitat delineated using these methods totals approximately 143.9 acres; its distribution in the Permit Area is depicted in green on Fig. 4. A more complete discussion of the methods used in the GCWA habitat delineation is provided in Appendix B. Through inference and based on review of aerial photography and observations made from the Balcones Quarry property fenceline, the delineation of GCWA habitat was extended to approximately 6.45 acres of directly adjacent off-site woodland to the north of the Balcones Quarry property as indicated in purple on Fig. 4.

CEMEX then defined its Permit Area as the delineated GCWA habitat set inside a 300-foot wide buffer of non-habitat woodland (where such woodland occurred) to attain its final 199.4-acre size. This was done to ensure that any activities performed outside the Permit Area would occur more than 300 feet away from GCWA habitat. This decision was based on consistent use of 300 feet by the Service in section 10(a)(1)(B) incidental take permit negotiations and Section 7 consultations as the distance out to which woodland clearing activities should be considered to have potential to indirectly affect GCWAs and their habitat.

### 3.5.2 Evaluation Species

The list of Evaluation Species was compiled through review of county-by-county lists of listed species produced by the USFWS (2013a) and Texas Parks and Wildlife Department (2012). Five Evaluation Species are examined in this HCP and include: two songbirds, the black-capped vireo (*Vireo atricapilla*) and Sprague's pipit (*Anthus spraguei*); a flowering plant, bracted twistflower (*Streptanthus bracteatus*); and two freshwater mussels, the Texas fatmucket (*Lampsilis breacteata*) and golden orb (*Quadrula aurea*). The black-capped vireo is federally listed as endangered. Sprague's pipit, bracted twistflower, and the two mussels are candidates for federal listing as threatened or endangered.

#### *3.5.2.1 Black-capped Vireo*

The black-capped vireo is a small migratory songbird that was listed as endangered in 1987 (USFWS 1991). In Texas, the species breeds primarily in the Cross Timbers, Edwards Plateau, and the Trans Pecos regions of the state; black-capped vireos also breed in a few localities in central Oklahoma, and in the states of Coahuila, Nuevo Leon, and Tamaulipas, Mexico (USFWS 1991, Farquhar and Gonzalez 2005). This species winters on the Pacific slope of Mexico, mostly from southern Sonora south to Guerrero.

Most black-capped vireos arrive on their breeding grounds in Texas in late March or early April. Males generally establish territories that range in size from 1 to 10 acres, with an average territory size of 2 to 4 acres (Graber 1957, Tazik and Cornelius 1989). The species may nest more than once in the same year, with migration to the wintering grounds generally occurring in September (USFWS 1991).

Typical breeding habitat for the black-capped vireo consists of relatively dense deciduous shrublands with vegetation cover down to ground level. Larger trees may be present in areas occupied by black-capped vireos, although the canopy layer is typically open. Areas occupied by black-capped vireos often contain a greater diversity of shrub species than do nearby areas where the species is absent. Shrublands occupied by vireos usually develop on limestone substrates and are dominated by oak (*Quercus* spp.) or sumac (*Rhus* spp.). However, the species can also occur on sandy substrates or wherever suitable dense shrubby vegetation is present. No critical habitat has been designated for the black-capped vireo.

Primary threats to the black-capped vireo include direct destruction of breeding habitat, loss or deterioration of breeding habitat through natural processes, low reproductive success, and indirect effects of land use on breeding grounds (USFWS 1991). Low reproductive success has been attributed to high rates of nest parasitism by brown-headed cowbirds (*Molothrus ater*) and nest predation by red imported fire ants (*Solenopsis invicta*), Texas rat snakes (*Elaphe obsoleta lindheimeri*), and other species. Habitat loss occurs through clearing of land for ranching or other agricultural practices, browsing of low-level vegetation by goats and other domestic animals, and clearing for residential developments, road construction, placement of utilities, and other land use projects.

The status of the black-capped vireo in Comal County is uncertain. Like the GCWA, its expected range in the Comal County is restricted to the Edwards Plateau, or that portion of the county lying west of the Balcones Escarpment. Most lands within its potential range in Comal County are privately held and have not been surveyed for the species. No black-capped vireos are known to occur in Comal County (Maresh 2005, Wilkins et al. 2006, McFarland et al. 2012), and potentially suitable habitat for the species appears to be comparatively limited in extent.

No suitable black-capped vireo habitat is present in the Permit Area. Woody vegetation communities present in the Permit Area are limited to woodlands bearing very low densities of shrubs in the understory. No black-capped vireos were detected in the Permit Area incidental to the GCWA survey performed in the springs of 2013 and 2014, and the regular occurrence of this species in the Permit Area is not expected. Consequently, this species will not be discussed further in this HCP.

#### *3.5.2.2 Sprague's Pipit*

The Sprague's pipit is a small, ground-dwelling songbird. The species is migratory and primarily inhabits shortgrass grasslands during both the breeding and winter seasons. On 15 September 2010, the Service determined the Sprague's pipit warrants protection under the ESA but listing was precluded by the need to address other listing actions of a higher priority. Sprague's pipit was designated by the Service as a candidate for listing until a listing proposal is introduced (USFWS 2010). The primary threat to the species is the loss of habitat primarily resulting from the conversion of grassland to agricultural lands and fire suppression (USFWS 2010).

Sprague's pipits breed in the northern Great Plains region of North America (Sibley 2000). The species is an uncommon migrant and a rare to local winter resident throughout central Texas (Lockwood and Freeman 2014). The species winters in the Coastal Prairies from Galveston County south to the Lower Rio Grande Valley; Post Oak Savannahs and Blackland Prairies from Williamson and Brazos Counties south through eastern Comal County to the Texas Brush Country; and agricultural areas in Hudspeth County, north-central Texas, and northwestern Edwards Plateau (Lockwood and Freeman 2014).

Although the wintering and migration ecology of the Sprague's pipit is not fully known, migrants and winter residents seem to prefer shortgrass grasslands and pastures with a heavy dependence on native prairies (USFWS 2010). During migration, Sprague's pipits are likely to occur in grasslands and pastures, but can occur in most any grassy habitat of appropriate height, including roadsides and clearings within woodlands (P. Sunby/SWCA, pers. obs.). Sprague's pipits arrive in their wintering grounds starting in mid-September and may be present until late April (Lockwood and Freeman 2014).

Sprague's pipits are most likely to occur in Comal County to the east of the Balcones Escarpment. Lands east of the escarpment are contained within the Oaks and Prairies ecoregion (Lockwood and Freeman 2014), and can be expected to support grasslands and pastures suitable for use by the species. Woody vegetation communities dominate lands west of the Balcones Escarpment, as they do in the Permit Area. The occurrence of Sprague's pipit west of the escarpment and in the Permit Area is not impossible, as migrant pipits forced down by inclement weather could occur nearly anywhere. However, the Permit Area does not provide the type of shortgrass grassland habitat needed for occupation by wintering Sprague's pipits, so the regular occurrence of the species in the Permit Area is not expected. Consequently, Sprague's pipit will not be discussed further in this HCP.

#### *3.5.2.3 Texas Fatmucket and Golden Orb*

In 2011, the Service determined that listing the Texas fatmucket and golden orb as threatened or endangered was warranted but precluded by higher priority listing actions (USFWS 2011). The current status of these two freshwater mussels is poorly known, although populations are believed to have declined greatly from historical levels as a result of degradation of water quality, habitat loss, over-harvesting, and competition from invasive exotic species (USFWS 2011). Currently, both species are known from only a handful of localities; however, Texas watercourses have not been comprehensively surveyed, and populations likely exist in

undocumented locations. Neither species has potential to occur in the Permit Area owing to absence of permanent bodies of water.

The Texas fatmucket occurs in moderately sized rivers, typically in shallow water but across a variety of substrates, and appears intolerant of impounded water (USFWS 2011). This species historically occurred in the Colorado, Guadalupe, and San Antonio river systems and largely on the Edwards Plateau (Howells et al. 1996, USFWS 2011). Texas fatmucket is believed extirpated from the San Antonio River watershed and mainstem of the Colorado River (USFWS 2011). The species is currently known to occur in the Guadalupe River system and several tributaries of the Colorado River, including the South Concho River, Spring Creek, Llano River, Pedernales River, Onion Creek, Jim Ned Creek, Elm Creek, and the San Saba River (USFWS 2011). It is believed that Texas fatmucket was never widely distributed in the Guadalupe River system (USFWS 2011). Currently, Texas fatmucket is known to occur in the Guadalupe system only in the mainstem of the river in Kerr County, although it may also occur in the North Fork of the Guadalupe River, also in Kerr County (USFWS 2011). All known locations of Texas fatmucket are situated hydrologically up-gradient of the Permit Area and so do not have potential to be impacted by any activities occurring on the Balcones Quarry property. Consequently, Texas fatmucket will not be discussed further in this HCP.

The golden orb historically occurred in the Colorado, Frio, Guadalupe, Nueces, and San Antonio river systems (Howells et al. 1996, USFWS 2011). The species is believed to have been extirpated from the Colorado, Frio, and Nueces watersheds and is currently known only from the Guadalupe River, the lower San Marcos River, the lower San Antonio River, and Lake Corpus Christi (USFWS 2011). Despite its occurrence in Lake Corpus Christi, this species is believed to be relatively intolerant of impounded water and typically occurs in firm substrates of mud, sand, and gravel within moderately sized rivers (USFWS 2011). Within the Guadalupe River, golden orb is only known with certainty to occur above Comal County in the upper reach in Kerr County, and below Comal County in a central/lower reach from Gonzales County downstream to Victoria County (USFWS 2011).

Surface water runoff from the Permit Area is captured by off-site quarry pits and so cannot travel to the downstream reach of the Guadalupe River from Gonzales County to Victoria County that is known to support the golden orb. Groundwater leaving the Permit Area is expected to contribute to flow in the San Marcos River and the Guadalupe River after being emitted as spring flow at San Marcos Springs and Comal Springs. Thus, groundwater leaving the Permit Area has potential to reach riverine sites occupied by the golden orb.

Water reaching the Edwards Aquifer as a result of infiltration through the Permit Area is expected to be naturally treated through a combination of filtering, dilution, settling, and chemical dissolution (Eckhardt 2013). Consequently, the Proposed Covered Activities are not expected to result in any significant adverse impact on the quality of water issuing from San Marcos Springs or Comal Springs or, by correlation, to the quality of water in any downstream reaches of river that support populations of the golden orb. The Proposed Covered Activities are, therefore, not expected to adversely impact habitats occupied by the golden orb and this species will not be discussed further in this HCP.

#### *3.5.2.4 Bracted Twistflower*

Bracted twistflower is an annual, herbaceous wildflower that was designated as a candidate for listing as threatened or endangered in 1990 (USFWS 1990b). This plant usually occurs on steep slopes or in canyons in clearings within or on the edges of rich, deciduous oak/Ashe juniper woodland that possesses a well-developed shrubby understory (Poole et al. 2007). Soils where this species occurs typically consist of thin, gravelly clays or clay loams overlying limestone; soil series known to support bracted twistflower include Brackett, Speck, and Tarrant (Poole et al. 2007). Bracted twistflower blooms in the latter part of April or early May.

Bracted twistflower is endemic to central Texas, where it occurs in the canyonlands formed along the eastern and southern margins of the Edwards Plateau. It historically occurred in Comal County but no populations are currently known to occur in the region (Poole et al. 2007). Extant populations are known to occur in Bexar County to the south and Travis County to the north (Poole et al. 2007).

Woodlands in the Permit Area do not appear suitable for bracted twistflower because they are comparatively xeric and possess very low densities of shrubs. Soils in the Permit Area are mapped within the Rumple-Comfort series, which also is not associated with occurrence of the species. No surveys for bracted twistflower have been performed in the Permit Area because woodlands and soils appear inappropriate for the species, and because the species is not known to occur in Comal County. Bracted twistflower is not expected to occur in the Permit Area and it will not be discussed further in this HCP.

# 4.0 PROPOSED ACTION

Approximately 143.9 acres of potential GCWA habitat have been delineated in the Permit Area, with an additional adjacent 6.45 acres of habitat present off-site. This habitat supported one male GCWA in 2014 and likely also supported one male GCWA in 2013. This low rate of occupation indicates that woodland in the Permit Area is of exceedingly low quality with regard to its ability to provide habitat for the GCWA. CEMEX seeks incidental take authorization for the harm to GCWA expected to result from the displacement of one GCWA from its territory contained within the 143.9 acres of potential habitat in the Permit Area. This level of impact will not reduce the likelihood of the survival and recovery of the GCWA in the wild. CEMEX will mitigate for the loss of this very low quality GCWA habitat as described in Section 6.0.

## 4.1 PROPOSED COVERED ACTIVITIES

The Proposed Covered Activities consist of the clearing of all woodland within the Permit Area and the progressive quarrying of limestone from the Permit Area as part of continuing operation of the Balcones Quarry that began mining operations in 1969. The Permit Area was acquired by CEMEX's predecessor in 1965 and its interior roads were constructed shortly thereafter. It is believed that the Permit Area did not contain any habitat suitable for the GCWA at the time of its acquisition for mining, but that some woodland has developed habitat characteristics for the species over time in absence of active juniper control and as a consequence of natural woodland succession.

CEMEX has maintained a perimeter berm along the west and northwest sides of the Balcones Quarry property for safety purposes and visual screening. As part of the Proposed Covered Activities, CEMEX would complete the perimeter berm by first widening an existing approximately 70-foot wide cleared lane along the north edge of the Permit Area to a width of approximately 100 to 140 feet. A linear earthen and rock berm would then be constructed along the property boundary to shield quarry operations from adjacent landowners. The berm would have trapezoidal cross-section and a height of approximately 20 to 40 feet.

Quarrying operations are on-going west of the Permit Area. Under the Proposed Covered Activities, these operations would gradually progress eastward. All woodland would be cleared from the Permit Area in the first non-breeding season (1 September through end of February) following Permit issuance. All woody vegetation would be removed using mechanical methods. No herbicides would be applied to vegetation on the CEMEX property. Woody vegetation removed from the Permit Area would be used or disposed of on the Balcones Quarry property.

The surface mining method used at this site is considered open pit mining. Mining begins with stripping a sufficient amount of overburden, or off-spec material, to access the mineral deposit from which the production sequence can begin. Once the clearing of the vegetation and removal of overburden are completed, activities within the Permit Area will consist of blasting limestone rock away from a quarry face and loading the shot rock into haul trucks by front-end loaders.

It is expected that soil and upper rock layers would be removed from the ground shortly after the vegetation is cleared, leaving no time for development of vegetation possibly suitable for use by black-capped vireos in the disturbed areas. Soil and loose rock removed from areas to be

quarried would be used on-site. Middle and lower layers of rock would then be progressively removed over time from west to east. Under the Proposed Covered Activities, the Permit Area would ultimately be quarried in full within the limits of the perimeter berm down to approximately 200 feet deep and approximately 25 feet above the high level of the local water table.

Based on known reserves and current and forecasted future production rates, it is expected that quarrying in the Permit Area will end in or before the year 2036. Upon completion of quarrying activities, the pit created in the Permit Area would be stabilized. Boundary fences and the perimeter road and berm would be maintained by CEMEX following completion of quarrying in the Permit Area for safety reasons.

Under the Proposed Covered Activities, CEMEX would incorporate the following measures to minimize and mitigate impacts to the GCWA:

- While GCWAs are not known to nest in the Permit Area, all clearing of woody vegetation would be performed during the period of 1 September through 29 February to avoid the potential for that clearing to result in the destruction of active GCWA nests or the harm or harassment of adult or juvenile birds; and
- CEMEX would purchase 147.44 acres worth of mitigation credit from a Service-approved GCWA conservation bank to compensate for expected impacts to GCWA habitat (see Section 5.1.2), or would acquire and preserve a minimum of 147.44 acres of GCWA habitat through fee simple title or establishment of a conservation easement (see Section 6.3).

Apart from the seasonally restricted clearing of woody vegetation, quarrying activities performed under the Proposed Covered Activities would be performed year-round.

## 4.2 REQUESTED PERMIT DURATION

It is expected that clearing of woodland from the Permit Area would occur in the first non-breeding season following permit issuance and that quarrying activity in the Permit Area may end sometime in or before 2036, depending on aggregate production requirements. CEMEX is seeking a renewable Permit from the Service with a term of 15 years from the date of issuance. The requested Permit term is considerably longer than the amount of time expected to be needed to implement the conservation program and complete the clearing of woodland from the Permit Area, all of which is expected to require no more than a few months. The longer duration is requested to safeguard against changes in the economic market and the possibility that clearing of the woodland from the Permit Area would be postponed. In the event that woodland clearing activities have not been conducted before the expiration of the Permit, CEMEX may request a renewal to extend the duration of the Permit. To request a Permit renewal, CEMEX must:

1. Have complied with the terms and conditions of the original Permit, including reporting requirements;
2. File a written request for a Permit renewal with the USFWS at least 30 days prior to the Permit expiration date that references the Permit number;

3. Certify that all statements and information presented in the original Permit application are still correct or include a list of changes; and
4. Provide specific information concerning the amount of incidental take that has occurred under the original Permit and the amount of incidental take that remains unused.

If CEMEX files such a request at least 30 days prior to the Permit expiration date, then the Permit will remain valid while the request is being processed. If CEMEX fails to file a request at least 30 days prior to Permit expiration, then the Permit will become invalid on the original expiration date.

# 5.0 ANALYSIS OF THE IMPACTS LIKELY TO RESULT FROM THE TAKING

## 5.1 SPECIES EFFECTS AND IMPACTS ANALYSIS

The GCWA is the only Covered Species in this HCP. As discussed in Section 3.5.1, one male GCWA was present in the Permit Area in 2014, and what was believed most likely to be one (but may have been two) male GCWA was also present in the Permit Area in 2013. No female or juvenile GCWAs were observed in the Permit Area in either year of survey.

### 5.1.1 Direct Impacts to Golden-cheeked Warblers and their Habitat

No direct impacts to GCWAs are expected as a result of the Proposed Covered Activities. All clearing of woodland in the Permit Area would be conducted during the times of year when GCWAs are not present in Texas (1 September through end of February), so no potential would exist for vegetation clearing activities to destroy occupied GCWA nests or harm recently fledged but still relatively immobile young.

Quarrying activities would occur in cleared areas, and largely down in a quarry pit where GCWAs would not be expected to visit. Consequently, while quarrying activities would be performed year-round, they would have no potential to result in direct impacts to GCWAs.

Approximately 143.9 acres of potential GCWA habitat were delineated in the Permit Area. The Proposed Covered Activities would result in the loss of all 143.9 acres of potential GCWA habitat in the Permit Area. The very low rate of GCWA occurrence demonstrates that GCWA habitat quality in the Permit Area is extremely low. Approximately 0.8 acres of the GCWA habitat delineated on the Balcones Quarry property occurs within 300 feet of existing development (see Fig. 4). As such, half (0.4 acre) of the GCWA habitat viability in this 0.8-acre area is considered to already have been lost based on consistent use of 300 feet by the Service in section 10(a)(1)(B) incidental take permit negotiations and Section 7 consultations as the distance out to which woodland clearing activities should be considered to have potential to indirectly affect GCWAs and their habitat. Therefore, this area will not be considered fully taken by CEMEX's activities resulting in a total of 143.5 acres of on-site impact.

### 5.1.2 Indirect Impacts to Golden-cheeked Warblers and their Habitat

Based on the results of the 2013 and 2014 surveys, it is expected that loss of woodland from the Permit Area would result in the displacement of no more than one male GCWA. If the bird present in 2014 was not re-located after the fourth survey visit because it had abandoned the property or been killed by a predator, then the clearing of woodland from the Permit Area, if it were to occur prior to the 2015 breeding season, might not adversely impact any GCWAs that previously used habitat on the property and no actual take of GCWAs would be expected to occur. Under such a scenario, the loss of habitat from the Permit Area could still indirectly affect GCWAs as a species by reducing the total amount of habitat available for their use. No evidence suggests GCWAs breed in the Permit Area, so the result of loss of habitat under this scenario might be a minor reduction in the amount of woodland available to unpaired or *floating* males.

However, if the GCWA remained present on the property in 2014 and just happened to be missed during the fifth survey visit and again on the 17 May visit made with a Service representative, then it is likely the bird would return to the woodlands of the Permit Area in the spring of 2015. The clearing of woodland from the Permit Area under this scenario would cause the displacement of a GCWA from its territory, with the expected response being that the bird would seek to establish a territory elsewhere in the region. Given that some number of adult GCWA must die each year as a result of natural causes (e.g., predation, disease, effects of old age), the displaced bird might be able to establish a territory in habitat vacated as a result of natural attrition of the population. If so, the loss of woodland from the Permit Area might not necessarily harm the displaced GCWA, but it would reduce the total amount of woodland habitat available to be used by the species.

On the other hand, if the displaced bird was not able to re-fill a vacated territory and instead had to try to squeeze itself into habitat already occupied by other GCWAs, then its attempt to establish a territory outside of the Permit Area could lead to increased competition for space and resources between GCWAs, and increased number of territorial conflicts. This could result in short-term decreased fitness in one or more GCWAs until the territorial conflicts were resolved.

Because the number of GCWAs involved in any of the scenarios described above is very small, the loss of woodland from the Permit Area as a result of the Proposed Activities is expected to result in a minor impact to the GCWA population of Comal County.

Vegetation clearing and the noise and activity associated with quarrying operations are not expected to create potential to indirectly impact any GCWAs on lands adjacent to the Permit Area. Golden-cheeked warblers occupy both the interior and edges of woodland, although some studies (e.g., Peak 2007) have shown that GCWAs experience decreased nesting success and increased predation rates closer to the edges of woodland than they do within the interior of woodlands. As such, concern exists that vegetation clearing that results in creation of new woodland edges can cause deleterious effects on GCWAs. Clearing of woodland can also result in loss of viability of habitat by decreasing habitat patch sizes.

No woodland would remain in the Balcones Quarry Northeastern Area once the clearing activity was performed. Approximately 6.45 acres of woodland inferred to be GCWA habitat is present to the north of the Balcones Quarry property (purple on Figure 4). Following the clearing of the Balcones Quarry property, this woodland would be rendered far too small and isolated to be capable of supporting a GCWA in a mostly open landscape such as that which would be created under the Proposed Alternative (Magness et al. 2006). Consequently, the viability of this off-site habitat is expected to be lost as a result of the Proposed Activities. Approximately 5.07 acres of the 6.45 acres of off-site habitat occurs within 300 feet of the existing residential development (see Fig. 4). As such, half (2.56 acres) of the GCWA habitat viability in this 5.07-acre area is considered to already have been lost.[2] Add the other half to the remaining 1.38 acres (6.45 - 5.07 = 1.38) and the result is 3.94 acres of off-site impacts. Therefore, the number of acres of on-site

[2] This is based on consistent use of 300 feet by the Service in section 10(a)(1)(B) incidental take permit negotiations and Section 7 consultations as the distance out to which woodland clearing activities should be considered to have potential to indirectly affect GCWAs and their habitat.

GCWA habitat impact (143.5) plus 3.94 acres of off-site impact results in a total impact acreage of 147.44 acres.

A fairly extensive patch of semi-open to closed canopy woodland is present to the east of the Balcones Quarry property. It is separated from the woodland of the Permit Area by an approximately 160- to 170-foot wide open swath that runs along the east side of the Balcones Quarry property (see Fig. 4). To our knowledge, the status of the GCWA in the woodland to the east of the Balcones Property is undetermined, although SWCA did not detect any GCWAs in this woodland while conducting the 2013 or 2014 surveys. The SWCA biologists regularly walked the cleared swath while conducting the GCWA survey on the Balcones Quarry property and would have easily been able to hear a GCWA singing to the east if it was within a few hundred feet of the western edge of that patch of woodland.

Owing to the presence of the cleared swath, the clearing of woodland as part of the Proposed Covered Activities would not create any new edge along the woodland to the east, nor would it reduce the size of that patch of woodland. All quarrying activity would be separated from the woodland to the east by a minimum distance of 160 to 170 feet, and noise from the activities would be buffered both by the perimeter berm and by the wall of the quarry pit. Given this buffering and the results of a study that demonstrated that road construction noise does not appear to affect the behavior or reproductive success of GCWAs (Lackey et al. 2011), the Proposed Covered Activities are not expected to indirectly affect any GCWAs that might be present in off-site woodland to the east.

# 6.0 CONSERVATION PROGRAM

Applicants for a Permit must demonstrate to the Service that they will "minimize and mitigate the impacts of the taking to the maximum extent practicable" (16 USC 1539). When determining whether or not an applicant has met this criterion, the Service typically considers both the adequacy of the proposed measures and whether or not the proposed measures are the maximum that can be practically implemented by the applicant (USFWS and NMFS 1996). These measures are described below in Sections 6.3 and 6.4. This HCP complies with the Five Point Policy of the Service, which requires integration of the following five components into an HCP: 1) biological goals and objectives; 2) adaptive management; 3) monitoring; 4) permit duration; and 5) public participation. The expected impact of the Proposed Covered Activities on the GCWA is described in Section 5.1. Impacts expected to result from the Proposed Alternative will not reduce the likelihood of the survival and recovery of the GCWA.

## 6.1 BIOLOGICAL GOALS

The biological goal of this HCP is to mitigate for the loss of GCWA habitat in the Permit Area, all of which is considered to be of very low quality, to the maximum extent practicable and commensurate with the level of impact to the species by securing higher quality GCWA habitat with long-term conservation value to the species elsewhere.

## 6.2 BIOLOGICAL OBJECTIVES

The biological objective of this HCP is to avoid directly taking any GCWAs by conducting vegetation clearing activities during the fall or winter when the species is not present on its breeding grounds.

## 6.3 MINIMIZATION MEASURES

CEMEX will not clear any woody vegetation from woodland currently present in the Permit Area during the GCWA breeding season, defined as 1 March through 31 August, to avoid directly taking GCWAs that may be using habitat in the Permit Area. Exception to this restriction will be made only if a breeding season survey performed according to USFWS presence/absence survey protocols first demonstrates that no GCWAs are present within 300 feet of the desired activity, or if the clearing would be restricted to shrubby vegetation occurring in areas previously rendered unsuitable for further use by GCWAs under the authorizations provided for by the Permit.

## 6.4 MITIGATION MEASURES

Prior to the removal of any native woodland from the Permit Area, CEMEX proposes to mitigate for the proposed taking through the conservation of 147.44 acres of GCWA habitat. This number was derived from the number of acres of GCWA habitat delineated in the Permit Area (143.9) as adjusted for existing disturbance (minus half of 0.8 acre) for a total of 143.5 acres, plus 3.9 acres, which is the number of acres of off-site habitat (6.45) expected to be rendered inviable for further use by the species as adjusted for existing disturbance (minus half of 5.07 acres). To accomplish this, CEMEX will purchase 147.44 acres of GCWA conservation credits from a

Service-approved third-party conservation bank with a service area that includes the Permit Area, purchase credits from the Comal County Regional Habitat Conservation Plan, or preserve a minimum of 147.44 acres of GCWA habitat through fee simple title acquisition or establishment of a conservation easement. If preserving habitat, the 147.44 acres would be contiguous with a minimum of 352.56 additional acres of preserved habitat to ensure the total size of the preserved area was at least 500 acres. The number of mitigation acres represents one acre of mitigation for each of the maximum number of acres of potential habitat believed possibly utilized by GCWAs in the Permit Area and that would be lost under the Proposed Covered Activities. In addition, if preserving habitat, CEMEX would establish a conservation trust fund in an amount approved by the Service to provide for operation and maintenance of the preserved habitat in perpetuity.

GCWA conservation banks have been approved by the Service to provide mitigation for projects that occur within their service areas. The Service's standards for conservation banks ensure that the quality of this off-site mitigation is high and provides long-term value to the target species (see USFWS 2013c). Thus, the proposed mitigation would contribute to the permanent conservation of GCWAs across hundreds of acres of higher quality GCWA habitat considered less susceptible to damage that could be induced by climate change. It is also expected that 147.44 acres of GCWA habitat on an approved conservation bank, because of its higher quality, should support many more GCWAs than the number (~1) expected to be displaced under the Proposed Alternative. For example, the Festina Lente property contains approximately 1,139 acres of GCWA habitat and the number of GCWA territories occurring on the property is estimated to range from 57 to 101 (SWCA 2012). Therefore, on average, 147.44 acres of habitat on the Festina Lente property can be expected to support from 7 to 13 GCWA territories. By purchasing credits from a third-party conservation bank, CEMEX would fulfill its proposed mitigation without further involvement.

In response to inquiries made by SWCA on behalf of CEMEX, the Bandera Corridor Conservation Bank and Festina Lente Conservation Bank, both operating in Bandera County and approved by the USFWS in 2011 and 2014, respectively, confirmed that the Permit Area is located within their approved service areas and that they have sufficient credits available for purchase. CEMEX is not obligated to purchase conservation credits from any particular bank. Other conservation banks that may be able, with Service approval, to supply the necessary credits include the Hickory Pass Ranch Conservation Bank or Clearwater Conservation Bank, both located in Burnet County. Other banks may also become available prior to Permit issuance and could also provide a source of GCWA conservation credits for CEMEX.

Alternatively, CEMEX would preserve at least 147.44 acres of GCWA habitat through fee simple title acquisition or establishment of a conservation easement. Habitat preserved in this manner would be part of a block of woodland covering at least 500 acres in compliance with the current Service mitigation guidance for the GCWA and in accordance with Service requirements that GCWA conservation banks at a minimum be this size (USFWS 2013c). Service approval would be required for any property preserved under this method. For habitat preserved through fee simple title acquisition or conservation easement, CEMEX would establish and endow a Service-approved operation and management (O&M) plan for the preserve and retain a Service-approved third-party to implement the O&M plan. In the case of acquired land, CEMEX might donate the land to a Service-approved third-party manager while retaining rights to the

mitigation credit needed to compensate for GCWA take authorized under its Permit, and in accordance with Service mitigation lands guidance (USFWS 2013c).

The proposed mitigation measures meet the "maximum extent practicable" standard because providing for the preservation of 147.44 acres of golden-cheeked warbler habitat would provide a substantial benefit to the GCWA in comparison to maintenance of very low quality GCWA habitat in the Permit Area. Providing for the preservation of 147.44 acres of mitigation to compensate for the displacement of one GCWA, a species with territories that are typically less than 21 acres in size, is considered the maximum that can reasonably be required of CEMEX, and exceeds the amount of mitigation required of many applicants that have sought to displace a similar number of GCWAs.

## 6.5 MONITORING PLAN

All GCWA habitat is expected to be removed from the Permit Area in the first non-breeding season following Permit issuance. Therefore, monitoring for the presence of the GCWA in the Permit Area following permit issuance is not warranted and not provided for in this HCP.

### 6.5.1 Compliance Monitoring

CEMEX will notify the Service in writing to the Austin Ecological Services Field Office of the initiation of Proposed Covered Activities at least 10 business days prior to the start of work. With the notification, CEMEX will acknowledge that the vegetation clearing will not occur during the period of 1 March through 31 August. At this same time, CEMEX will provide the USFWS with proof that purchase of the 147.44 acres of conservation credits as proposed in Section 6.4 has been completed, if that mitigation option is followed.

CEMEX will then provide the Austin Ecological Services Field Office of the Service with one or more annual reports that document the extent of quarrying activity in the Permit Area performed in the year of record starting with the year of Permit issuance. Annual reports will be submitted no later than 15 December each year. Annual reports would no longer be submitted to the Service once all potential GCWA habitat was cleared from the Permit Area as documented in the final annual report.

### 6.5.2 Effectiveness Monitoring

CEMEX will document in its annual reports and notifications that the clearing of woodland from the Permit Area occurred outside of the GCWA breeding season (1 March – 31 August) and that 147.44 acres of conservation credits were purchased prior to that clearing, if that mitigation option is followed. In that event, this will be considered the extent of effectiveness monitoring needed under this HCP.

If CEMEX instead preserves at least 147.44 acres of GCWA habitat through fee simple title acquisition or establishment of a conservation easement as mitigation, then CEMEX would provide the Austin Ecological Services Office of the Service with annual reports on management activities performed in the GCWA preserve pursuant to the Service-approved O&M Plan.

### 6.5.3 Validation Monitoring

The Proposed Covered Activities would result in the full and permanent removal of GCWA habitat from the Permit Area. As identified in Section 5.1, this is expected to result in full and permanent displacement of GCWAs from the Permit Area. No validation monitoring is considered necessary to verify this assumption.

Other than the GCWA whose territory is largely if not completely contained on the Balcones Quarry Northeast Property, no GCWAs are known to occur on lands adjacent to the Permit Area. It is conceivable the species may occur in woodland to the east of the Balcones Quarry property despite none being detected in this area during the 2013 and 2014 surveys. It is assumed that the Proposed Covered Activities will not indirectly impact GCWAs should they occur to the east of the property, in part because the clearing of woodland from the Permit Area would not introduce edge habitat to, or reduce the size of, the patch of woodland to the east. Even if GCWAs do occur on the property to the east, CEMEX does not own it and cannot access it in an attempt to study whether or not the Proposed Covered Activities are influencing GCWA behavior or nesting success. Therefore, validation monitoring is not possible in that regard and is not proposed as part of this HCP.

## 6.6 ADAPTIVE MANAGEMENT PLAN

According to Service policy [see 65 CFR 35242 (1 June 2000)], adaptive management is defined as a formal, structured approach to dealing with uncertainty in natural resources management, using the experience of management and the results of research as an on-going feedback loop for continuous improvement. Adaptive approaches to management recognize that the answers to all management questions are not known and that the information necessary to formulate answers is often unavailable. Adaptive management also includes, by definition, a commitment to change management practices when determined appropriate.

The Proposed Covered Activities would result in full removal of GCWA habitat from the Permit Area, with compensation for loss of habitat most likely to be provided through purchase of credits from a Service-approved GCWA conservation bank. Consequently, provision for on-site adaptive management by CEMEX is not applicable to this HCP. It is expected that any need for adaptive management on land contained within a GCWA conservation bank from which credits are purchased by CEMEX will be addressed by the bank owner pursuant to its Conservation Bank Agreement with the Service. Similarly, need for adaptive management would be required under any O&M plan prepared for GCWA habitat preserved by CEMEX through fee simple title acquisition or establishment of a conservation easement.

# 7.0 CHANGED AND UNFORSEEN CIRCUMSTANCES

## 7.1 Changed Circumstances

Under the No Surprises Rule (63 FR 8859, codified at 50 CFR 17.22 and 17.32), the Service assures incidental take permittees that, so long as an approved HCP is being properly implemented, no additional land use restrictions or financial compensation will be required of the permittee with respect to the covered species (in this case, the GCWA). These assurances hold even if unforeseen circumstances arise after the Permit is issued, indicating that additional mitigation might be warranted. To the extent that changed circumstances are provided for in the HCP, the permittee must implement the appropriate measures in response to the changed circumstances if and when they occur. The No Surprises Rule defines "changed circumstances" as "circumstances affecting a species or geographic area covered by a conservation plan that can reasonably be anticipated by plan developers and the Service and that can be planned for (e.g., the listing of new species, or a fire or other natural catastrophic event in areas prone to such events)."

CEMEX and the USFWS agree that a changed circumstance will have occurred if, at the time CEMEX wishes to begin implementation of the Proposed Covered Activities, GCWA conservation credits from a Service-approved conservation bank with a service area covering the Permit Area are not available for purchase; Comal County, as part of their Regional Habitat Conservation Plan (RHCP), does not have credits available; and no GCWA habitat suitable for preservation through fee simple title or conservation easement as described in Section 6.4 is available within GCWA Recovery Region 6. CEMEX will notify the Service in writing if it finds that this circumstance has occurred and will request additional coordination with the Service to obtain authorization for another appropriate form of mitigation. Such alternate mitigation may include, but is not necessarily limited to, the following options:

- purchase of 147.44 GCWA conservation credits from a Service-approved conservation bank that might not include the Permit Area in its service area; or

- permanent protection of 147.44 acres of GCWA habitat that is part of a larger block of permanently protected GCWA habitat of at least 500 acres located within another GCWA Recovery Region, and in accordance with current Service policy and guidance for the protection of mitigation lands for GCWAs.

The Service will consider alternate forms of mitigation if no conservation bank GCWA credits can be purchased from any bank rangewide including the Comal County RHCP and, if consistent with the scope and intent of the original mitigation proposal, approval for an alternate form of mitigation will not be unreasonably withheld. CEMEX believes that these alternative mitigation options would fulfill the requirement to minimize and mitigate the impacts of the requested taking to the maximum extent practicable.

If additional conservation or mitigation measures are deemed necessary to respond to changed circumstances and such measures were not provided for in this HCP, the Service will not require any conservation or mitigation measures in addition to those provided for in this HCP without the consent of CEMEX, provided that this HCP is being properly implemented.

In the event that changed circumstances are deemed to have occurred on land contained within a conservation bank from which CEMEX has purchased mitigation credit, the bank owner will have the responsibility to address those changed circumstances pursuant to its Conservation Bank Agreement with the Service. Similarly, any O&M plan established for land preserved by CEMEX in lieu of purchase of conservation credits would include provision for addressing changed circumstances.

## 7.2 Unforeseen Circumstances

"Unforeseen circumstances" are changes in circumstances affecting a species or geographic area covered by an HCP that could not reasonably have been anticipated by plan developers and the Service at the time of the conservation plan's negotiation and development, and that result in a substantial and adverse change in the status of any covered species. The Service will have the burden of demonstrating that unforeseen circumstances exist and must base the determination on the best scientific and commercial data available. The Service shall notify CEMEX in writing of any unforeseen circumstances the Service believes to exist.

The No Surprises Rule states that the Service may require additional conservation measures of an incidental take permittee as a result of unforeseen circumstances "only if such measures are limited to modifications within conserved habitat areas, if any, or to the conservation plan's operating conservation program for the affected species, and maintain the original terms of the conservation plan to the maximum extent possible" (50 CFR 17.32). The Service shall not require the commitment of additional land, water, or financial resources by the permittee without the consent of the permittee, or impose additional restrictions on the use of land, water, or other natural resource otherwise available for use by the permittee under the original terms of the ITP. No Surprises assurances apply only to the species adequately covered by an HCP (i.e., the GCWA), and only to those permittees who are in full compliance with the terms of their plan, permit, and other supporting documents, as applicable.

# 8.0 FUNDING ASSURANCES

CEMEX must assure the Service that adequate funding is available to implement the HCP as one of the criteria for ITP issuance. This is particularly important under circumstances in which species impacts may occur prior to implementation of the conservation efforts. However, CEMEX commits to purchase conservation credits (or causing an appropriate presence to be established) as described in Section 6.4 before clearing any native woodland from the Permit Area. Therefore, in no case will the authorized incidental take precede implementation of the mitigation action. This approach eliminates the potential for an authorized GCWA impact to go unmitigated if funding does not occur. As such, the importance of demonstrating the availability of specific funding is lessened.

The total cost to fulfill the mitigation requirements includes purchase of 147.44 conservation credits for the GCWA from a conservation bank, purchase of 147.44 conservation credits from the Comal County RHCP, or preservation of at least 147.44 acres of GCWA habitat that are part of a minimum 500 acre GCWA preserve through fee simple title acquisition or establishment of a conservation easement. Cost of fulfilling this requirement is dependent upon the final per credit price charged by the chosen conservation bank, local land cost, or negotiated cost of a conservation easement. If preserving habitat through fee simple title acquisition or establishment of a conservation easement, CEMEX will gain Service approval of the funding structure for preservation, operation, and maintenance of the conserved land in perpetuity prior to the removal of any woodland from the Permit Area. Such funding assurance was not developed for inclusion in this HCP because of the high probability that mitigation will be provided through purchase of conservation credits from a conservation bank.

CEMEX accepts as a term and condition of the proposed Permit the purchase of 147.44 GCWA conservation credits or preservation of a minimum of 147.44 acres of GCWA habitat through fee simple title acquisition or establishment of a conservation easement prior to the clearing of woodland from the Permit Area. As such, CEMEX provides the necessary financial assurances that funding will available to implement the proposed conservation program. CEMEX will provide the Service with proof of purchase of the conservation credits or proof of establishment of a conservation easement or fee simple title acquisition of land prior to the removal of any woodland from the Permit Area.

# 9.0 ALTERNATIVES TO THE TAKING

Section 10(a)(2)(A)(iii) of the ESA requires a permit applicant to identify in an HCP what alternative actions to the proposed taking it considered and the reasons why those actions are not being utilized. Section 4.0 describes the Proposed Action, which is expected to result in the loss of 147.44 acres of GCWA habitat and concomitant harm to one GCWA through displacement. Alternatives to the proposed taking considered by CEMEX and the reasons why those actions are not being utilized are discussed below.

## 9.1 REDUCED QUARRYING ALTERNATIVE

The only alternative to the proposed taking available to CEMEX would be to not harm the GCWA by causing its displacement from the Balcones Quarry property. To that end, CEMEX examined how it could quarry limestone from the Balcones Quarry Northeastern Area without the risk of causing take of GCWAs. In order to do so, quarrying in that portion of the Balcones Quarry property would need to be configured to avoid woodlands known to be used by GCWAs and retain a patch of woodland large enough to be capable of supporting at least one GCWA territory in perpetuity, and some consideration might have to be made with regard to timing of blasting. Based on the results of several studies of minimum patch size requirements of the GCWA (Arnold et al. 1996, Coldren 1998, Magness et al. 2006, Morrison et al. 2010, Butcher et al. 2010) and input from SWCA, it was estimated that at least 125 contiguous acres of woodland would need to be retained in the Balcones Quarry Northeast Area in order for there to remain a reasonably high probability of GCWAs continuing to utilize woodland on the property if the remainder of the property was quarried. Based on this estimate, under this alternative, it is expected CEMEX would at a minimum avoid quarrying the 143.9-acre area identified as supporting GCWA habitat.

This alternative is not being utilized for several reasons. One reason is because abandoning long-held plans to quarry the 143.9 acres would cause significant economic hardship to CEMEX. The property containing the Permit Area was purchased for the purpose of quarrying prior to the GCWA being listed as endangered and at a time when the property very likely did not support habitat for the species. Not quarrying the Balcones Quarry Northeast Area in full would result in a substantial amount of lost revenue, a portion of which was expected by CEMEX to offset the cost of acquiring and holding the property.

A second reason was that quarrying what would be about half of the Balcones Quarry Northeast Area could affect the long-range plans for CEMEX and its Balcones Quarry. CEMEX has holdings to the west of its active quarry pit that are part of its existing operation and that it intends to mine in the future. However, the mining of that western property requires resolution of several issues, one of which is also gaining authorization from the Service to allow the removal of GCWA habitat.[3] It was believed possible that if 143.9 acres of the Northeast Area were set

[3] The western property is separated from the Northeast Area that is the subject of this HCP by the active mine and process areas. The western property was not included in this HCP largely for three reasons: 1) The two areas are not adjacent properties and are separated by disturbed areas that include mining and processing; 2) CEMEX is seeking authorization to clear trees in advance of mining in its Northeast Area as expeditiously as possible to ensure that aggregate production can continue without interruption and potential delays; and 3) since timing is not an issue for the western property, CEMEX is hoping to gain authorization to mine the western property through participation

aside, CEMEX could deplete its mineral reserves in the reduced area before it was able to commence operations on its property to the west, resulting in a shutdown of production at the Balcones Quarry. A production shutdown would cause CEMEX to suffer severe economic loss and would require the layoff of approximately ±90 employees. CEMEX found this alternative unacceptable owing to the risk it could cause a production shutdown.

A third reason is that CEMEX believes the conservation benefit it is able to provide to the GCWA through mitigation provided under the Proposed Action greatly outweighs any benefit the species might receive from its avoidance of 143.9 acres of woodland in the northeastern portion of its Balcones Quarry property. The Permit Area supports very low quality GCWA habitat that may never support more than one GCWA territory per year, may not be used by the species for breeding, and would not be managed by CEMEX for the benefit of the GCWA. CEMEX is proposing to purchase 147.44 acres worth of credit from a GCWA conservation bank as part of the Proposed Action. Not only would the conserved habitat be managed in perpetuity for the benefit of the GCWA, but because a conservation bank would be conserving habitat of much higher quality than that present in the Permit Area, the habitat conserved through purchase of conservation credit should also annually support several more GCWA territories than could be expected to occur in the Permit Area. As identified in Section 6.4, 147.44 acres of habitat on the Festina Lente Conservation Bank can be expected to support 7 to 13 pairs of GCWAs.

## 9.2 QUARRY AN ALTERNATE PROPERTY

CEMEX identified but quickly dismissed the possibility of moving quarry operations onto a different property as an alternative to the Proposed Action. It requires several years to determine available limestone reserves and to acquire a property and receive all permits and approvals needed to conduct a quarry operation on that property. This alternative was rejected by CEMEX because it would cause a multi-year production shutdown at the Balcones Quarry while CEMEX worked to identify a suitable alternate property and obtain all needed approvals to begin mining that property.

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in the Comal County RHCP rather than through acquisition of an individual permit from the Service since the County RHCP may be available at a later time.

## 10.0 LITERATURE CITED


Alldredge, M.W., J.S. Hatfield, D.D. Diamond, and C.D. True. 2002. Population viability analysis of the golden-cheeked warbler. U.S. Fish and Wildlife Service, Austin, Texas.

Arnold, K., C. Coldren, and M. Fink. 1996. The interaction between avian predators and golden-cheeked warblers in Travis County, Texas. Sponsored by the Texas Department of Transportation. Research report 1983-2, study number 7-1983, Texas Transportation Institute, Texas A&M University, College Station, Texas.

Baer Engineering and Environmental Consulting, Inc. 2009. City of Austin results of presence/absence surveys for the golden-cheeked warbler on selected properties. Prepared for the City of Austin, Wildland Conservation Division of the Water and Wastewater Utility. Baer Engineering and Environmental Consulting, Inc., Austin, Texas. Baer Project No. 092019-8i.010.

Baer Engineering and Environmental Consulting, Inc. 2010. Results of presence/absence surveys for the golden-cheeked warbler and black-capped vireo on selected properties. Prepared for the City of Austin, Wildland Conservation Division of the Water and Wastewater Utility. Baer Engineering and Environmental Consulting, Inc., Austin, Texas. Baer Project No. 092061-8i.010.

Barker, R.A. and A.F. Ardis. 1996. Hydrogeologic framework of the Edwards-Trinity aquifer system, west-central Texas. U.S. Geological Survey professional paper 1421-B.

Barrett, M.E. and B.J. Eck. 2012. Best management practices for quarry operations, complying with the Edwards Aquifer Rules. Texas Commission on Environmental Quality, Field Operations Support Division, Austin, Texas. TCEQ Publication RG-500.

Batte, C.D. 1984. Soil Survey of Comal and Hays Counties, Texas. U.S. Department of Agriculture Soil Conservation Service, in cooperation with the Texas Agricultural Experiment Station. Washington, D.C.

Brune, G.M. 2002. Springs of Texas, Volume 1. Texas A&M University Press, College Station. 566 p.

Butcher, J.A., M.L. Morrison, D. Ransom, Jr., R.D. Slack, and RN. Wilkins. 2010. Evidence of a minimum patch size threshold of reproductive success in an endangered songbird. Journal of Wildlife Management 74(1):133-139.

Campbell, L. 2003. Endangered and Threatened Animals of Texas – Their Life History and Management. Texas Parks and Wildlife Department, Austin. 129 pp.

City of Austin, Travis County, and U.S. Forest Service. 2012. 2012 Annual report: golden-cheeked warbler (*Setophaga chrysoparia*) monitoring program, Balcones Canyonlands Preserve. Accessed July 2013 at http://www.co.travis.tx.us/TNR/bccp/BCCP_Reports/2012_annual_report/Single_File/AppendixF_COA_Warbler.pdf.

Coldren, C.L. 1998. The effect of habitat fragmentation on the golden-cheeked warbler. Ph.D. dissertation. Texas A&M University, College Station, Texas.

Collins, E.W. 2000. Geologic map of the New Braunfels, Texas, 30 x 60 minute quadrangle. University of Texas at Austin, Bureau of Economic Geology. Miscellaneous map no. 39.

Diamond, D.D. 2007. Range-wide modeling of golden-cheeked warbler habitat. Missouri Resource Assessment Partnership. Unpublished report prepared for the Texas Parks and Wildlife Department, Wildlife Diversity Program, Austin.

Dixon, J.R. 2013. Amphibians and Reptiles of Texas, with Keys, Taxonomic Synopses, Bibliography, and Distribution Maps. Texas A&M University Press, College Station. 447 p.

Eckhardt, G. 2013. Edwards Water Quality. The Edwards Aquifer Website. Accessed December 2013 at http://www.edwardsaquifer.net/geology.html#quality.

Edwards Aquifer Authority (EAA). 2007. Hydrologic Data Report for 2006. San Antonio, Texas. Report No. 07-01.

Edwards Aquifer Authority (EAA). 2012. Hydrologic Data Report for 2011. San Antonio, Texas. Report No. 12-04.

Engels, T.M. 1995. Conservation biology of the golden-cheeked warbler. Ph.D. dissertation, University of Texas, Austin, Texas.

Ettel, T. 2000. Surveys for the federally endangered golden-cheeked warbler (*Dendroica chrysoparia*) on Proposition 2 tracts for the City of Austin, Texas. Unpublished report prepared for the City of Austin, Wildland Conservation Division of the Water and Wastewater Utility. The Nature Conservancy of Texas, Austin.

Farquhar, C.C., and J.I. Gonzalez. 2005. Breeding habitat, distribution and population status of the black-capped vireo in northern Mexico. Draft final Section 6 Report, WER 65, Grant No. E-17, submitted to the Texas Parks and Wildlife Department and USFWS, Austin.

Gluesenkamp, A. 2011. Typhlomolge tail tips tell tall tales: population studies of *Eurycea rathbuni*. Presentation given at EuryceAlliance meeting at San Marcos, Texas, 10 June 2011.

Golden-cheeked Warbler Recovery Team. 1998. Golden-cheeked Warbler Recovery Team April 2 – 3, 1998 meeting minutes: responses to USFWS's questions. U.S. Fish and Wildlife Service Ecological Services Office, Austin, Texas.

Graber, J.W. 1957. A bioecological study of the black-capped vireo (*Vireo atricapilla*). Ph.D. dissertation, University of Oklahoma, Norman.

Green, R.T., F.P. Bertetti, N.M. Franklin, A.P. Morris, D.A. Ferrill, and R.V. Klar. 2006. Evaluation of the Edwards Aquifer in Kinney and Uvalde Counties, Texas. Report prepared for the Edwards Aquifer Authority. June 19, 2006.

Griffith, G., S. Bryce, J. Omernik, and A. Rogers. 2007. Ecoregions of Texas. Report prepared for the Texas Commission on Environmental Quality, Austin.

Guyton & Associates. 1979. Geohydrology of Comal, San Marcos, and Hueco Springs. Texas Department of Water Resources, Austin. Report No. 234.

Hicks & Company. 2010. Black-capped vireo and golden-cheeked warbler habitat assessment and survey. Prepared for the City of Austin, Wildland Conservation Division of the Water and Wastewater Utility. Hicks & Company, Austin, Texas.

Howells, R.G, R.W. Neck, and H.D. Murray. 1996. Freshwater mussels of Texas. Texas Parks and Wildlife Press. Austin, Texas. 218 pp.

Kroll, J.C. 1980. Habitat requirements of the golden-cheeked warbler: management implications. Journal of Range Management 33:60-65.

Kuniansky, E.L. and A. Ardis. 2004. Hydrogeology and ground-water flow in the Edwards-Trinity aquifer system, west-central Texas: Regional aquifer-system analysis—Edwards-Trinity. U.S. Geological Survey professional paper 1421-C.

Kutac, E.A. and S.C. Caran. 1994. Birds and Other Wildlife of South-Central Texas. University of Texas Press, Austin. 203 p.

Lackey, M.A., M.L. Morrison, Z.G. Loman, N. Fisher, S.L. Farrell, B.A. Collier, and R.N. Wilkins. 2011. Effects of road construction noise on the endangered golden-cheeked warbler. Wildlife Society Bulletin 35(1):15–19.

Lockwood, M.W. and B. Freeman. 2014. The TOS Handbook of Texas Birds, Second Edition. Texas A&M University Press, College Station. 403 p.

Loomis-Austin, Inc. 2008. Mapping potential golden-cheeked warbler breeding habitat using remotely sensed forest canopy cover data. Unpublished report prepared for the County of Hays. Loomis-Austin, Inc., Austin, Texas. LAI Project No. 051001.

Maas-Barleigh, D.S. 1997. Summary of the 1995 and 1996 field seasons: effects of habitat fragmentation on golden-cheeked warblers (*Dendroica chrysoparia*). University of Oklahoma, Norman, Oklahoma.

Maclay, R.W. and L.F. Land. 1988. Simulation of Flow in the Edwards Aquifer, San Antonio Region, Texas, and Refinement of Storage and Flow Concepts. U.S. Geological Survey Water-Supply Paper 2336.

Magness, D.R., R.N. Wilkins, and S.J. Hejl. 2006. Quantitative relationships among golden-cheeked warbler occurrence and landscape size, composition, and structure. Wildlife Bulletin 34:473–479.

Maresh, J.P. 2005. Project 61: Census and monitoring of black-capped vireo in Texas. Draft final Section 6 report, WER 61, Grant No. E-15, submitted to the Texas Parks and Wildlife Department and USFWS, Austin, Texas.

Marshall, M.E., M.L. Morrison, and R.N. Wilkins. 2013. Tree species composition and food availability affect productivity of an endangered species: the golden-cheeked warbler. The Condor 115(4): 882-892.

McFarland, T.M., H.A. Mathewson, J.E. Groce, M.L. Morrison, and R.N. Wilkins. 2013. A range-wide survey of the endangered black-capped vireo in Texas. Southeastern Naturalist 12(1):41-60.

Morrison, M.L., R.N. Wilkins, B.A. Collier, J. Groce, H. Mathewson, T. McFarland, A. Snelgrove, T. Snelgrove, and K. Skow. 2010. Golden-cheeked warbler population distribution and abundance. Texas A&M Institute of Renewable Natural Resources, College Station, Texas, USA.

Moses, E. 1996. Golden-cheeked warbler (*Dendroica chrysoparia*) habitat fragmentation in Travis County, Texas: a remote sensing and geographical information system analysis of habitat extent, pattern and condition. Master's thesis, Texas A&M University. College Station, Texas.

Ogden, A.E., R.A. Quick, and S.R. Rothermel. 1986. Hydrochemistry of the Comal, Hueco, and San Marcos Springs, Edwards Aquifer, Texas. In: The Balcones Escarpment - Geology, Hydrology, Ecology, and Social Development in Central Texas. Abbott, P.L. and C.M. Woodruff, Jr., eds. Published for Geological Society of America Annual Meeting, San Antonio, Texas (9-14 November 1986). p. 115-130.

Peak, R.G. 2003. Population trends of the golden-cheeked warbler on Fort Hood, Texas 1992–2003. In: Endangered species monitoring and management at Fort Hood, Texas: 2003 annual report. The Nature Conservancy, Fort Hood Project, Fort Hood, Texas, USA.

Peak, R.G. 2007. Forest edges negatively affect golden-cheeked warbler nest survival. The Condor 109:628-637.

Poole, J.M., W.R. Carr, D. M. Price, and J.R. Singhurst. 2007. Rare Plants of Texas. Texas A&M University Press, College Station, Texas.

Pulich, W.M. 1976. The Golden-cheeked Warbler: A Bioecological Study. Texas Parks and Wildlife Department, Austin. 172 p.

Rappole, J.H., D.I. King, and W.C. Barrow, Jr. 1999. Winter ecology of the endangered golden-cheeked warbler (*Dendroica chrysoparia*). Condor 101:762-770.

Rappole, J.H., D.I. King, and P. Leimgruber. 2000. Winter habitat and distribution of the endangered golden-cheeked warbler (*Dendroica chrysoparia*). Animal Conservation 2:45-59.

RECON Environmental Inc., Hicks & Company, Zara Environmental LLC, and BIO-WEST. 2012. Edwards Aquifer Recovery Implementation Program Habitat Conservation Plan. Prepared for the Edwards Aquifer Recovery Implementation Program. Available on-line at: http://www.eahcp.org/files/uploads/Final%20HCP%20November%202012.pdf. Accessed December 2013.

Sanford, W.E. and D.L. Selnick. 2013. Estimation of evapotranspiration across the conterminous United States using a regression with climate and land-cover data. Journal of the American Water Resources Association 49(1):217-230.

Sibley, D.A. 2000. National Audubon Society The Sibley Guide to Birds. Alfred A. Knopf, Inc. New York, New York. 544 p.

Spearing, D. 1991. Roadside Geology of Texas. Mountain Press Publishing Company, Missoula, Montana. 418 p.

SWCA Environmental Consultants (SWCA). 2002. Results of presence/absence surveys for the golden-cheeked warbler on selected properties owned by the City of Austin, Travis and Hays counties, Texas. Report submitted to the City of Austin Water and Wastewater Utility. SWCA Environmental Consultants, Austin, Texas. SWCA project no. 5990.

SWCA Environmental Consultants (SWCA). 2003. Results of surveys for the golden-cheeked warbler on selected properties owned by the City of Austin, Travis and Hays counties, Texas. Report submitted to the City of Austin Water and Wastewater Utility, Wildland Conservation Division. SWCA Environmental Consultants, Austin, Texas. SWCA project no. 6845.SWCA Environmental Consultants (SWCA). 2013. Results of surveys for the golden-cheeked warbler and black-capped vireo on City of Austin Water Quality Protection Lands, Travis and Hays counties, Texas. Report submitted to the City of Austin Water and Wastewater Utility. SWCA Environmental Consultants, Austin, Texas. SWCA project no. 25530.

SWCA Environmental Consultants (SWCA). 2012. Baseline Natural Resource Assessment of Festina Lente Ranch, Bandera County, Texas. Prepared for the U.S. Fish and Wildlife Service on behalf of EBX-GCW Conservation, LLC. SWCA Environmental Consultants, Austin, Texas. SWCA project no. 16829.

SWCA Environmental Consultants, Smith, Robertson, Elliott, Glen, Klein & Bell, L.L.P., Prime Strategies, Inc., Texas Perspectives, Inc., and Capital Market Research, Inc. 2013. Final Comal County Regional Habitat Conservation Plan. Prepared for Comal County, Texas, and the Comal County Commissioners Court. SWCA project no. 12659.

Tazik, D.J. and J.D. Cornelius. 1989. The black-capped vireo on the lands of Fort Hood, Texas. Preliminary status report, Directorate of Engineering and Housing, Fort Hood, Texas.

Terrell, E.E., W.H.P. Emery, and H.E. Beaty. 1978. Observations of *Zizania texana* (Texas wildrice), an endangered species. Bulletin of the Torrey Botanical Club 105(1):50-57.

Texas Parks and Wildlife Department (TPWD). 2012. Annotated county list of rare species for Comal County. Available at http://www.tpwd.state.tx.us/gis/ris/es/ES_Reports.aspx?county=Comal. Accessed November 2013.

Texas Water Development Board. 2012. Precipitation and Lake Evaporation. Accessed November 2013 at https://www.twdb.state.tx.us/surfacewater/conditions/evaporation/index.asp.

U.S. Climate Data. 2013. Climate of New Braunfels, Texas. Accessed November 2013 at http://www.usclimatedata.com/climate.php?location=USTX0950.

U.S. Department of Agriculture. 2010. Texas goats and mohair historical estimates. National Agricultural Statistics Service, Texas Field Office. Accessed November 2013 at http://www.nass.usda.gov/Statistics_by_State/Texas/Publications/Historic_Estimates/he_goats.pdf.

U.S. Environmental Protection Agency (EPA). 2009. A framework for categorizing the relative vulnerability of threatened and endangered species to climate change. National Center for Environmental Assessment, Washington, D.C; EPA/600/R-09/011. Available from the National Technical Information Service, Springfield, VA, and online at http://www.epa.gove/ncea.

U.S. Fish and Wildlife Service (USFWS). 1978. Endangered and threatened wildlife and plants; determination that 11 plant taxa are endangered species and 2 plant taxa are threatened species. Federal Register (26 April 1978) 43:17910-17916.

U.S. Fish and Wildlife Service (USFWS). 1980. Endangered and threatened wildlife and plants; listing of the San Marcos salamander as threatened, the San Marcos gambusia as endangered, and the listing of critical habitat for Texas wild rice, San Marcos salamander, San Marcos gambusia, and fountain darter. Federal Register (14 July 1980) 45:47355-47364.

U.S. Fish and Wildlife Service (USFWS). 1990a. Endangered and threatened wildlife and plants; final rule to list the golden-cheeked warbler as endangered. Federal Register (27 December 1990) 55:53153-53160.

U.S. Fish and Wildlife Service (USFWS). 1990b. Endangered and threatened wildlife and plants; review of plant taxa for listing as endangered or threatened species. Federal Register (21 February 1990) 55:6184-6229.

U.S. Fish and Wildlife Service (USFWS). 1991. Black-capped vireo Recovery Plan. Albuquerque, New Mexico.

U.S. Fish and Wildlife Service (USFWS). 1992. Golden-cheeked warbler (*Dendroica chrysoparia*) Recovery Plan. Austin, Texas.

U.S. Fish and Wildlife Service. 1995. San Marcos/Comal (Revised) Recovery Plan. Albuquerque, N.M. pp. x + 93 with 28 pages of appendices.

U.S. Fish and Wildlife Service (USFWS). 1996. Golden-cheeked warbler population and habitat viability assessment report. Compiled and edited by Carol Beardmore, Jeff Hatfield, and Jim Lewis in conjunction with workshop participants. Report of an Aug. 21-24, 1996 workshop arranged by the U.S. Fish and Wildlife Service in partial fulfillment of U.S. National Biological Service Grant No. 80333-1423. Austin, Texas.

U.S. Fish and Wildlife Service (USFWS). 1997. Endangered and threatened wildlife and plants; final rule to list three aquatic invertebrates in Comal and Hays counties, TX, as endangered. Federal Register (18 December 1997) 62:66295-66304.

U.S. Fish and Wildlife Service (USFWS). 2004. Biological opinion for consultation no. 2-12-05-F-021 [Effect of Natural Resource Conservation Service activities associated with implementation of 2002 Farm Bill conservation programs on federally listed species]. December 17, 2004. Arlington, Texas.

U.S. Fish and Wildlife Service (USFWS). 2010. Endangered and threatened wildlife and plants; 12-month finding on a petition to list Sprague's pipit as endangered or threatened throughout its range. Federal Register (15 September 2010) 75:56028-56050.

U.S. Fish and Wildlife Service (USFWS). 2011. Endangered and threatened wildlife and plants; 12-month finding on a petition to list Texas fatmucket, golden orb, smooth pimpleback, Texas pimpleback, and Texas fawnsfoot at threatened or endangered. Federal Register (6 October 2011) 76:62166-62212.

U.S. Fish and Wildlife Service (USFWS). 2012. Biological opinion for consultation no. 02ETAU00-2012-F-0149 [Effect of DCP Midstream Sand Hills petroleum pipeline]. September 10, 2012. Austin, Texas.

U.S. Fish and Wildlife Service (USFWS). 2013a. Endangered Species List (On-line). Viewed November 2013 at http://www.fws.gov/southwest/es/ES_Lists_Main.cfm.

U.S. Fish and Wildlife Service (USFWS). 2013b. Endangered and threatened wildlife and plants: revised critical habitat for the Comal Springs dryopid beetle, Comal Springs riffle beetle, and Peck's cave amphipod. Federal Register (23 October 2013) 78:63100-63127.

U.S. Fish and Wildlife Service (USFWS). 2013c. Guidelines for the establishment, management, and operations of golden-cheeked warbler and black-capped vireo mitigation lands. U.S. Fish and Wildlife Service, Southwest Region.

U.S. Fish and Wildlife Service (USFWS). 2014. Final Environmental Impact Statement and Record of Decision on Comal County's Regional Habitat Conservation Plan for Comal County, Texas. Federal Register (17 January 2014) 79:3221-3223.

U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS). 1996. Habitat conservation planning handbook. USFWS and NMFS, Washington, DC. November 1996.

U.S. Geological Survey (USGS). 1995. Water resources data Texas water year 1994.Volume 3. USGS water-data report TX-94-3.

Van Auken, O.W. 1988. Woody vegetation of the southeastern escarpment and plateau. In: Amos, B.B. and F.R. Gehlbach (eds.). Edwards Plateau vegetation: Plant ecological studies in central Texas. Baylor University Press, Waco, Texas. pp. 43-55.

Wahl, R., D.D. Diamond, and D. Shaw. 1990. The golden-cheeked warbler: a status review, unpublished report submitted to Ecological Services, U.S. Fish and Wildlife Service, Ft. Worth, Texas. 80pp.

Wahl, K. L., and T.L. Wahl. 1995. Determining the flow of Comal Springs at New Braunfels, Texas. Texas Water '95, American Society of Civil Engineers, August 16-17, 1995, San Antonio, Texas. pp. 77-86.

Wilkins, N., R.A. Powell, A.A.T. Conkey, and A.G. Snelgrove. 2006. Population status and threat analysis for the black-capped vireo. Department of Wildlife and Fisheries Sciences, Texas A&M University. Prepared for the USFWS, Region 2.

**Appendix A.** Hydrology of the Permit Area

The CEMEX Balcones Northeast Area (Permit Area) is located within the recharge zone for the Edwards Aquifer. A recharge zone is that surface area where precipitation and stream flow are able to infiltrate the bedrock to become groundwater. Groundwater can be held within subterranean void space to create a pooled aquifer, it can travel down-gradient to be discharged back at the surface as spring flow, or, as in the case of water of the Edwards Aquifer, it can do a combination of both. The recharge zone is also referred to as the *unconfined zone* of an aquifer. The *confined zone* of an aquifer consists of that section which is completely buried beneath the surface.

The Edwards Aquifer is divided into distinct hydrological segments. The Permit Area is located within the recharge zone for the San Antonio Segment of the Edwards Aquifer (SASEA). The recharge zone for the SASEA extends for approximately 180 miles between groundwater divides in Kinney County to the west and Hays County to the northeast (Edwards Aquifer Authority [EAA] 2012). The recharge zone for the SASEA covers approximately 1,250 square miles or 800,000 acres (EAA 2012).

Recharge to the SASEA results primarily from stream flow loss and direct infiltration of precipitation within the recharge zone. Water can enter the aquifer through open connections with surface features (caves, fissures, exposed faults, etc.) and via diffuse ground infiltration. The SASEA also receives contribution from hydrologically connected aquifers such as the Trinity Aquifer, with the amount of this contribution dependent upon water levels within the respective aquifers. It has been estimated that contribution from adjacent aquifers ranges from approximately 5,000 to greater than 100,000 acre-feet per year (EAA 2007, Kuniansky and Ardis 2004, Barker and Ardis 1996).

Water within the SASEA discharges at many springs located along the breadth of the southern and eastern edges of the recharge zone. Primary discharges at the lower, northeastern end of the SASEA include Comal Springs and Hueco Springs in Comal County and San Marcos Springs in Hays County.

Several faults cross the recharge zone for the SASEA. The planes of most of these faults strike to the northeast. Water entering the aquifer in the western part of the recharge zone generally travels westward toward Bexar County, although flow is impeded by displacement along the faults (Maclay and Land 1988). Groundwater chemistry and well data indicate that water in the western section of the SASEA pools up behind natural high points in Kinney and Uvalde counties, with the high point in Uvalde County referred to as the Knippa Gap (Green et al. 2006).

The direction of groundwater flow in the unconfined zone of the SASEA can differ from the direction of flow in the confined zone. In Medina and Bexar counties, the direction of groundwater travel in the unconfined zone has a southerly component; upon reaching the confined zone, groundwater then travels northeastward along pathways directed by the northeast-trending faults (Kuniansky and Ardis 2004, Maclay and Land 1988).

Median annual recharge to the SASEA from 1934 through 2011 was approximately 559,400 acre-feet, with an estimated low of 43,700 acre-feet in the drought year of 1956 and an estimated high of 2,486,000 acre-feet in 1992 (EAA 2012). Because of drought, total recharge in 2011 was

an estimated 112,000 acre-feet (EAA 2012). However, annual recharge to the aquifer during the period of 2001 through 2011 averaged approximately 889,600 acre-feet due in large part to exceptionally high recharge levels in 2004 and 2007 (EAA 2012).

Including withdrawals from wells, total discharge from the SASEA in 2011 was 692,900 acre-feet of water (EAA 2012). Total water discharged from the SASEA from 2001 through 2011 averaged 872,700 acre-feet per year (EAA 2012). Consequently, while substantially more water left the SASEA in 2011 than entered it (-580,900 acre-feet), recharge exceeded discharge by an average of approximately 16,900 acre-feet per year over the period of 2001 through 2011.

Comal Springs is the largest spring system in Texas (USFWS 1995). The springs are located at an elevation of approximately 623 feet above mean sea level (msl) on the north side of the City of New Braunfels (USFWS 1995). Water from the springs enters Landa Lake and from there flows into both the old and new channels of the Comal River. Approximately 95% of the time, all flow in the Comal River is the result of discharge from Comal Springs (Wahl and Wahl 1995). The Comal River joins the Guadalupe River as it flows through New Braunfels.

Discharge at Comal Springs is of a relatively constant temperature and generally considered to be of high quality in terms of supporting aquatic life (USFWS 1995). Discharge at the springs in 2011 was measured at 164,010 acre-feet, representing approximately 61.8% of the 265,217 acre-feet of water discharged from all the primary springs of the SASEA that year (EAA 2012). From 1928 through 1989, annual discharge at Comal Springs averaged 205,746 acre-feet (USFWS 1995). Despite being the largest spring system in Texas, Comal Springs stopped flowing for about five months during severe drought in 1956 (USFWS 1995).

The unconfined zone of the SASEA in Comal County between the Bexar County line and Comal Springs is almost completely separated from the confined zone by the Comal Springs fault (Maclay and Land 1988). Based on faulting patterns, water well data, water chemistry studies, and limited dye tracing studies, it is believed that the primary recharge area for Comal Springs is located southwest of the Cibolo Creek basin more than 60 miles away from the springs to the southwest, with this water traveling to Comal Springs through the confined zone (USFWS 1995, Maclay and Land 1988, Ogden et al. 1986, Guyton & Associates 1979). Because of the separation between the confined and unconfined zones of the SASEA in Comal County, local recharge is believed to provide for little flow at Comal Springs except immediately following large rainfall events or when aquifer levels are high (USFWS 1995, Ogden et al. 1986, Guyton & Associates 1979).

Hueco Springs is located close to the west bank of the Guadalupe River approximately 4 miles north of the center of New Braunfels. Water issued from Hueco Springs flows into the Guadalupe River. Annual discharge from Hueco Springs in the drought year of 2011 was measured at 10,674 acre-feet (EAA 2012). Mean annual flow at Hueco Springs from 1945 through 1973 was 26,000 acre-feet (Guyton & Associates 1979). This long-term average represents approximately 4.6% of the median annual recharge to the SASEA measured across the larger 1934-2011 period.

The recharge area for Hueco Springs is believed to be relatively small and segmented from the main body of the confined SASEA because water temperature, turbidity, and flow rate at Hueco

Springs all fluctuate in response to rainfall events, and because the springs will stop flowing during extended periods of dry weather (Brune 2002, Ogden et al. 1986). Hueco Springs is believed to primarily receive recharge from shallower, local groundwater systems in the Dry Comal Creek and Guadalupe River basins to the northwest of the Hueco Springs fault (Brune 2002, Maclay and Land 1988).

San Marcos Springs are located at an elevation of approximately 620 feet above msl in the City of San Marcos and represent the second-largest spring system in Texas (USFWS 1995). Water from the springs flow into Spring Lake and form the headwaters of the San Marcos River. The San Marcos River ultimately joins the Guadalupe River in Gonzales County. Discharge from San Marcos Springs in 2011 was measured at 84,960 acre-feet (EAA 2012). From May 1956 through October 1994, annual flow at San Marcos Springs averaged approximately 123,158 acre-feet (U.S. Geological Survey 1995). San Marcos Springs did not stop flowing during the 1956 drought, but flow was greatly reduced during this period (USFWS 1995). Like the water discharged from Comal Springs, water discharging from San Marcos Springs is of nearly constant temperature (USFWS 1995).

Much of the water discharging at San Marcos Springs also appears to be derived from the same general region that provides recharge for Comal Springs, reaching San Marcos Springs by flowing through the confined zone beyond the Comal Springs system (USFWS 1995). However, San Marcos Springs is also known to receive water originating at a number of more localized areas (including the Blanco River basin, Guadalupe River basin, and the Sink, Purgatory, and York creek basins) and from areas in east-central Hays County, and likely also receives recharge from that portion of the recharge zone in Comal County situated between the Hueco Springs and Comal Springs faults (USFWS 1995, Maclay and Land 1988, Guyton & Associates 1979).

The Permit Area is located approximately 3 miles west-southwest of Comal Springs, approximately 4.5 miles southwest of Hueco Springs, and approximately 20 miles southwest of San Marcos Springs. The Permit Area is located on the recharge or unconfined zone of the SASEA between the Hueco Springs and Comal Springs faults. Consequently, based on the above, water infiltrating the ground in the Permit Area is expected under normal conditions to travel toward San Marcos Springs, but under certain flow regimes it may also be capable of contributing to discharge at Comal Springs. A similar expected flowpath for groundwater traveling between the Hueco Springs and Comal Springs faults was depicted in the EARIP by RECON et al. (2012). For the sake of this HCP, it is presumed that most of the recharge occurring in the Permit Area reaches San Marcos Springs and some minority portion of it reaches Comal Springs, but it is not possible to quantify the respective amounts of contribution.

Given the relatively small size of the property, water infiltrating the ground in the Permit Area must constitute a very small component of discharge at San Marcos Springs or Comal Springs. To illustrate, average precipitation in New Braunfels is approximately 3 feet or 0.9 m (U.S. Climate Data 2013, Texas Water Development Board 2012). The Permit Area is approximately 199.4 acres in size. Accordingly, on average, approximately 776.1 acre-feet of water fall onto the Permit Area per year (199.4 acres x 3 feet = 776.1 acre-feet). If all of this water made it underground and reached San Marcos Springs or Comal Springs, it would represent

approximately 0.63% or 0.37% of the average annual discharge at those springs, respectively, or approximately 0.24% of their combined average annual discharge.

However, the Permit Area has historically been wooded and approximately 70 to 79% of rainfall in Comal County is lost to evapotranspiration (Sanford and Selnick 2013). Ignoring water lost to surface water runoff because runoff from the property is captured by quarry pits contained within the SASEA recharge zone, the low end of this range suggests that approximately 232.8 acre-feet of the water (776.1 x 0.30 = 232.8) is about the maximum amount of recharge that could have been expected to be provided by the Permit Area when it was completely vegetated. This amount represents approximately 0.19% and 0.11% of the average annual discharge at San Marcos Springs and Comal Springs, respectively, or approximately 0.07% of their combined average annual discharge.

**Appendix B.** Golden-cheeked Warbler Habitat Delineation Methods

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# MEMORANDUM

To: Tanya Sommer / U.S. Fish and Wildlife Service
Christina Williams / U.S. Fish and Wildlife Service

From: Paul Sunby, SWCA Environmental Consultants

Date: August 18, 2014

Re: Delineation of Golden-cheeked Warbler Habitat in the CEMEX Balcones Quarry Northeast Area / Modified in Response to Service Comments

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SWCA Environmental Consultants (SWCA) on behalf of CEMEX Construction Materials South, LLC (CEMEX) submitted to the U.S. Fish and Wildlife Service (Service) on 29 July 2014 a delineation of golden-cheeked warbler (*Setophaga chrysoparia*) habitat in the CEMEX Balcones Quarry Northeast Area. The Service provided comments on the habitat delineation to SWCA on 15 August 2014. This memorandum provides the golden-cheeked warbler habitat delineation for the Balcones Quarry Northeast Area as modified from that submitted on 29 July in response to Service comments.

As background, CEMEX submitted a draft habitat conservation plan (HCP) to the Service in April 2014 regarding the CEMEX Balcones Quarry, Comal County, Texas, where continued operation of the quarry in the Balcones Quarry Northeast Area is expected to cause loss of woodland known to be utilized by the federally listed endangered golden-cheeked warbler. One male golden-cheeked warbler was found in the Balcones Quarry Northeast Area during a survey performed in the spring of 2014. In 2013, golden-cheeked warbler observations were made in two separate parts of the property. It was believed most likely these observations represented one male traveling between the two locations. To guard against the less likely possibility that two warblers were present on the property in 2013, the draft HCP proposed to mitigate for displacement of up to two golden-cheeked warblers through purchase of 42 acres worth of mitigation credits from a Service-approved golden-cheeked warbler conservation bank. Forty-two acres was considered the maximum area likely to be used by two warblers on the Balcones property. For comparison, the warbler in 2014 was observed across an approximately 15-acre area, and the two areas where observations were made in 2013 totaled approximately 6 acres.

In a meeting between the Service and CEMEX and its representatives on 15 July 2014, the Service requested a delineation of the limits of golden-cheeked warbler habitat in the Balcones Quarry Northeast Area. The 29 July submittal was made in response to that request. This memorandum describes the methods used to delineate habitat on the property as provided in the 29 July submittal and provides the results of the delineation as modified based on the 15 August Service comments.

Golden-cheeked warbler habitat consists of woodland composed of a mixture of Ashe juniper (*Juniperus ashei*) and broad-leaf hardwood trees, typically live oak (*Quercus fusiformis*), deciduous oaks, and other deciduous species such as elm, walnut, cherry, and ash. Deciduous trees are an

important component of golden-cheeked warbler habitat, with the bird occurring in greatest densities where Texas oak (*Quercus buckleyi*) and other deciduous oaks are comparatively abundant.

As a first step in delineating golden-cheeked warbler habitat in the Balcones Quarry Northeast Area, SWCA mapped the locations of all broad-leaf hardwood trees occurring on the property. This mapping was performed during the period of 16-21 July by a team of two biologists that walked transects back and forth across the property. The biologists used GPS devices to record the location of each target tree. Each biologist was provided with two GPS devices, one dedicated to mapping live oak trees and the other dedicated to mapping deciduous hardwoods. For the sake of speed, the biologists did not record tree size parameters or tree species – the location of each tree was simply recorded with the push of one button on the appropriate GPS device. Please know that nearly all deciduous hardwoods occurring on the property were observed to be cedar elms (*Ulmus crassifolia*), with a few Texas sugarberry (*Celtis laevigata*) trees also found. No deciduous oak trees were observed on the property. The results of the tree survey are depicted in Figure 1, along with locations of the 2014 and 2013 golden-cheeked warbler observations. As shown on Figure 1, live oak trees greatly outnumber deciduous broad-leaf hardwoods.

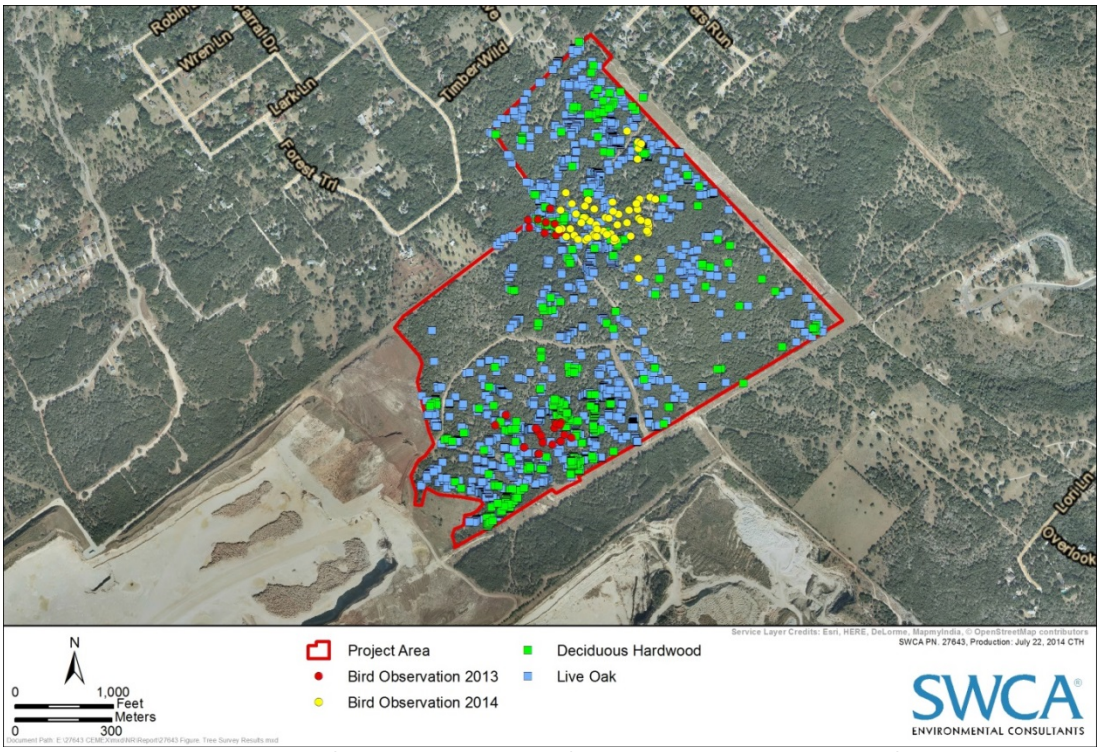


Figure 1. Balcones Quarry Northeast Area tree survey results.

As a second step in the habitat delineation, SWCA used Geographic Information System (GIS) software to establish a grid of points across the Balcones Quarry Northeast Property, using a spacing of 82 feet (25 m). This point grid is shown on Figure 2. GIS software was then used to count the number of broad-leaf hardwood trees occurring within a set radius of each of the grid points. Separate counts were made for live oak trees, deciduous trees, and total broad-leaf hardwoods (live oak and deciduous trees combined).

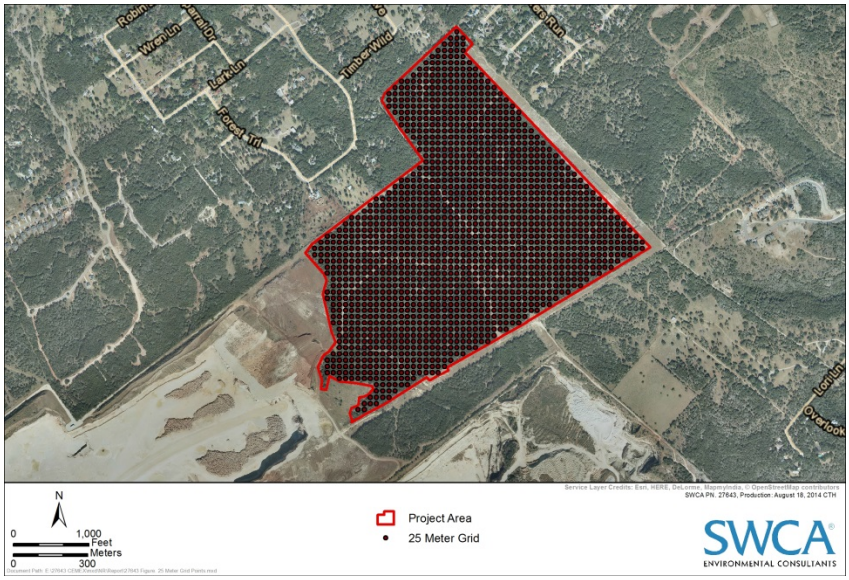


Figure 2. Point grid established in the Balcones Quarry Northeast Area.

We chose the 82-foot spacing for the grid points based on experience performing these types of analyses. A wider spacing can provide unsatisfactorily coarse results, and a narrower spacing can result in the creation of so many sample points that computer processing time becomes onerous. The number of trees occurring within the set radius (the radii used are identified later in this memorandum) of each point was used to create raster datasets that were then used to create maps of tree density. It was immediately apparent that because live oak trees so greatly outnumber the deciduous hardwoods, the mapping of total broad-leaf hardwood tree density provided results essentially identical to those achieved from the mapping of live oak tree density. Consequently, further analysis of the combined live oak/deciduous total broad-leaf hardwood tree density was discontinued.

The mapping of live oak density in the Balcones Quarry Northeast Area is shown on Figure 3, along with locations of golden-cheeked warbler observations made on the property in 2013 and 2014. This figure shows live oak density based on the number of trees occurring within 200 feet of each of the grid points. No strong correlation exists between live oak density and locations of golden-cheeked warbler observations. In fact, most warbler observations on the property have been made outside of areas with the greatest live oak density.

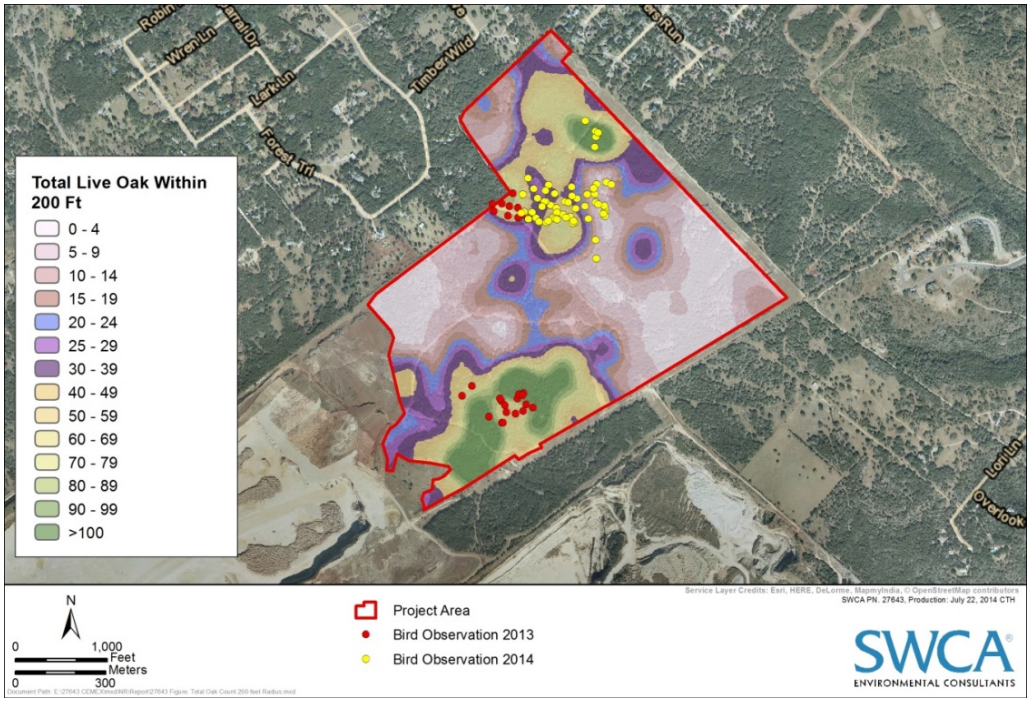


Figure 3. Live oak density in the Balcones Quarry Northeast Area.

In contrast, locations of warbler observations correlate well with deciduous hardwood tree density. Deciduous hardwood tree density as determined based on tree counts using 200-foot radius circles is shown on Figure 4. As seen on this figure, most warbler observations made on the property have occurred in areas where there are 6 or more deciduous trees per 200-foot radius circle. A 200-foot radius circle encompasses approximately 2.88 acres; thus, 6 trees per 200-foot radius circle is a density of 2.08 deciduous hardwood trees per acre. Figure 5 shows locations of golden-cheeked warbler observations compared against actual locations of deciduous trees on the property.

Golden-cheeked warblers require a certain amount of deciduous tree foliage in their territories (Pulich 1976, USFWS 1992). As a result, warbler territory size (as reflected by warbler density) varies with deciduous tree density (Wahl et al. 1990). Intuitively, territories can be smaller where deciduous trees occur in higher densities, and must be larger where deciduous trees are more widely spaced in order for the territories to contain the necessary amount of deciduous foliage. Using 200-foot radius circles for data analysis identifies tree density at a localized (2.88-acre) scale. We considered this scale necessary and appropriate for searching for correlation between bird use and tree type. However, it is too fine of a scale for habitat mapping on the Balcones Quarry Northeast Area because warbler territories on the property are much larger than 2.88 acres, as evidenced by observation of the 2014 bird across an approximately 15-acre area. Any warbler in the Balcones Quarry Northeast Area needs to be concerned about deciduous tree numbers across a larger area.

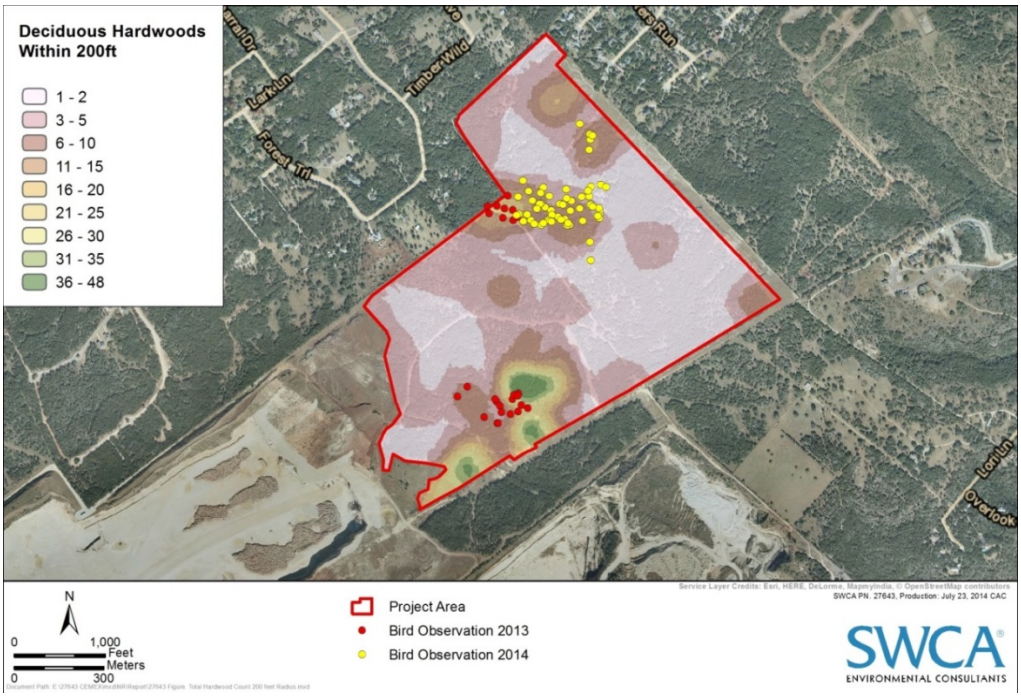


Figure 4. Deciduous hardwood tree density in the Balcones Quarry Northeast Area.

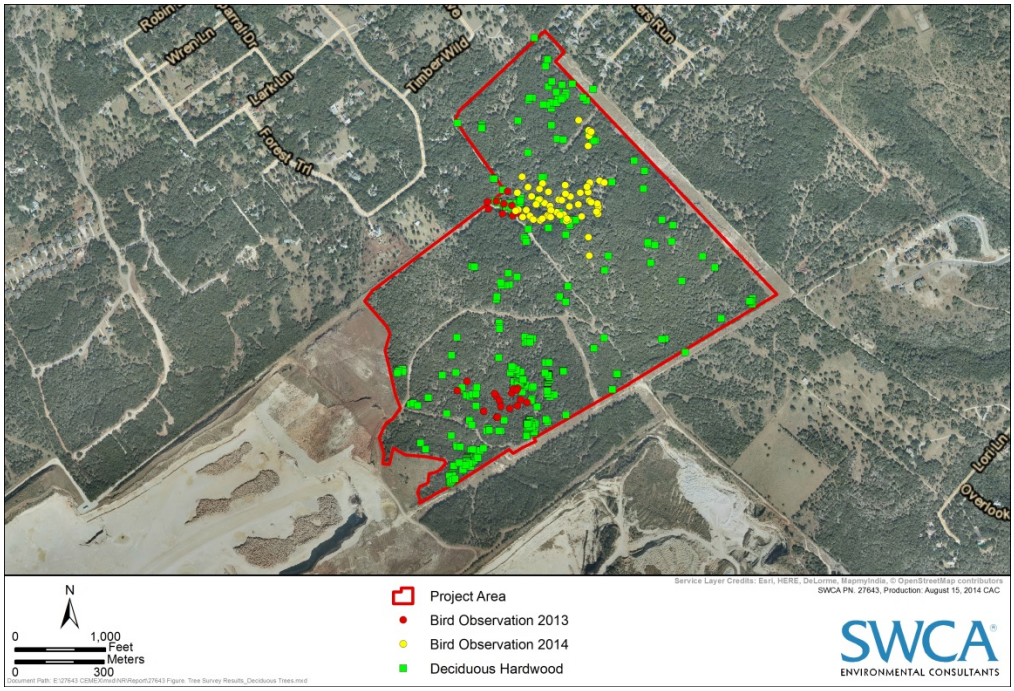


Figure 5. Locations of golden-cheeked warbler observations and deciduous trees.

Consequently, after observing the correlation between deciduous tree density and warbler occurrence as shown in Figure 4, we re-mapped hardwood tree density on the property using a 526.6-foot radius circle (a 526.6-foot radius circle encompasses 20 acres) to see how warbler occurrence correlated to tree density mapped at that scale. This result is depicted on Figure 6. We used 20 acres for this analysis because it was the round number nearest the upper end of reported warbler territory sizes (Kroll 1980, Pulich 1976) and nearest the acreage that appears to be used by warblers in the Balcones Quarry Northeast Area (again, the bird in 2014 was observed across an area in excess of 15 acres).

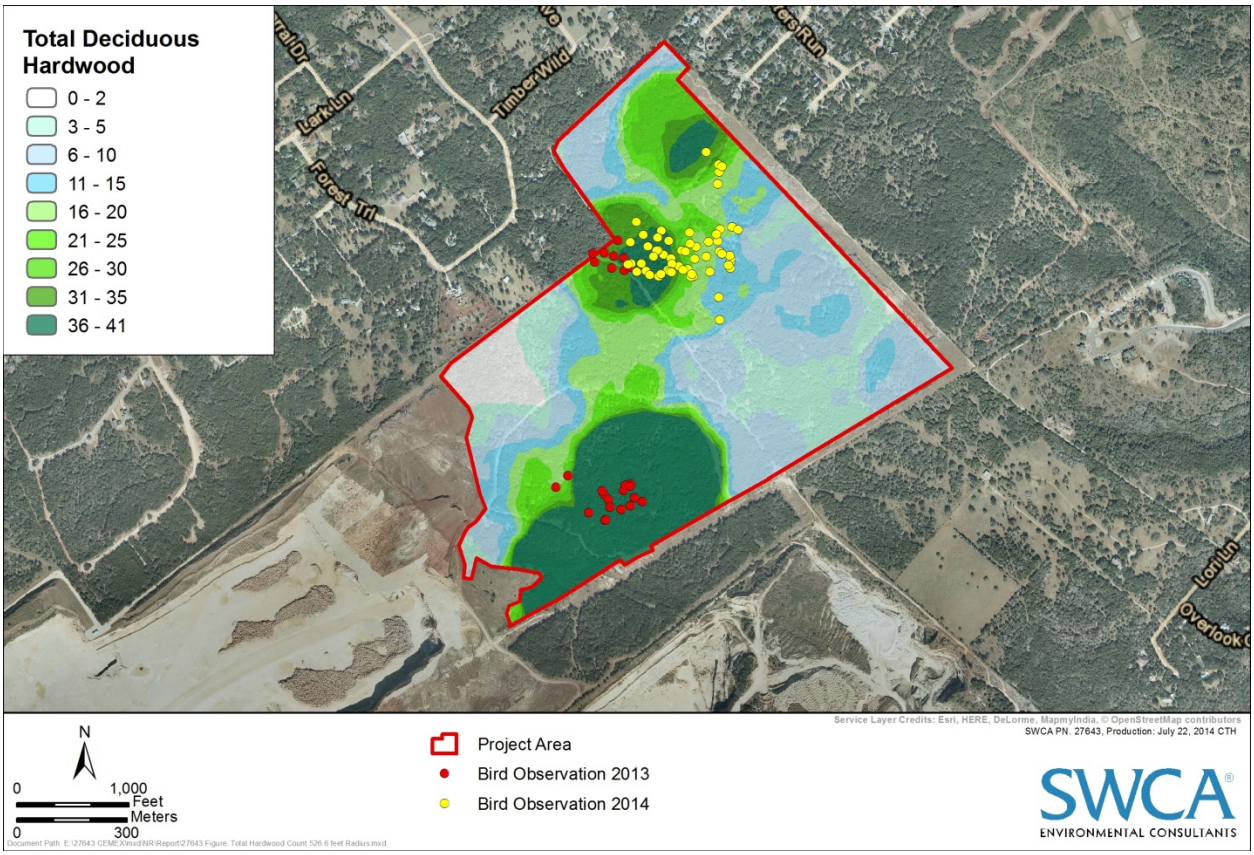


Figure 6. Hardwood tree density in the Balcones Quarry Northeast Area measured using 526.6-foot radius circles.

As shown on Figure 5, all golden-cheeked warbler observations made on the property in 2013 and 2014 occurred in areas where on average there were 11 or more deciduous trees per 20 acres, or 0.55 deciduous trees per acre. Woodland in the Balcones Quarry Northeast Area with a density of at least 11 deciduous trees per 20 acres forms a strip across the property extending generally southwest-northeast. In 2013, warbler observations were made on both ends of this strip, with the strip also providing the corridor for shortest distance of movement between these two areas.

In the case of the Balcones Quarry Northeast Area, SWCA believes it appropriate to delineate as golden-cheeked warbler habitat all woodland where the average density of deciduous trees is at least 11 trees per 20 acres. Delineation in this manner uses deciduous tree density based on a scale believed to be important to the warblers that utilize the Balcones Quarry Northeast Area, encompasses all locations where golden-cheeked warblers were observed during surveys, encompasses the corridor likely to have been used by the 2013 warbler for travel between the two areas where it was observed, and excludes all woodland of lower deciduous tree density classes where golden-cheeked warblers have never been observed. This area totals approximately 139.0 acres and represents the area that was delineated as warbler habitat as submitted to the Service on 29 July.[4]

Based on a request made in the 15 August comments on the 29 July submittal, we have herein modified the habitat delineation to also identify as habitat all woodland regardless of character that occurs within 300 feet of locations where a golden-cheeked warbler was observed during the 2013 and 2014 surveys. Adding this woodland to the habitat delineation increases the total amount of warbler habitat delineated in the Balcones Quarry Northeast Area to 143.9 acres.

A map of golden-cheeked warbler habitat in the Balcones Quarry Northeast Area derived as described above is provided in Figure 7 below. As can be seen on Figure 7, the delineated golden-cheeked warbler habitat ends to the north at property boundaries abutting residential development, and ends to the south at the edge of a cleared transmission line easement. Thus, the 143.9 acres comprise a discrete patch of golden-cheeked warbler habitat. Pursuant to the golden-cheeked warbler mitigation framework contained in the Incidental Take Permit recently issued for the Comal County Regional HCP and commensurate with the small number of birds and very low quality of habitat occurring on the property, we believe a 1:1 mitigation to impact ratio is adequate for this patch of habitat.

Please do not hesitate to contact me regarding any of the information contained in this memorandum.

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[4] We believe it important to note that environmental conditions specific to the Balcones Quarry Northeast Area (e.g., geology, soils, moisture availability, etc.) are responsible for the character of woodland it supports, and woodland character is in turn responsible for how the property is used by golden-cheeked warblers. Therefore, while we consider the use of a minimum density of 11 deciduous trees per 20 acres appropriate to define the limits of golden-cheeked warbler habitat in the Balcones Quarry Northeast Area, we do not believe this minimum deciduous tree density would accurately delineate the limit of warbler habitat across the range of the species owing to local and regional variability in geology, soils, woodland tree species composition, etc.

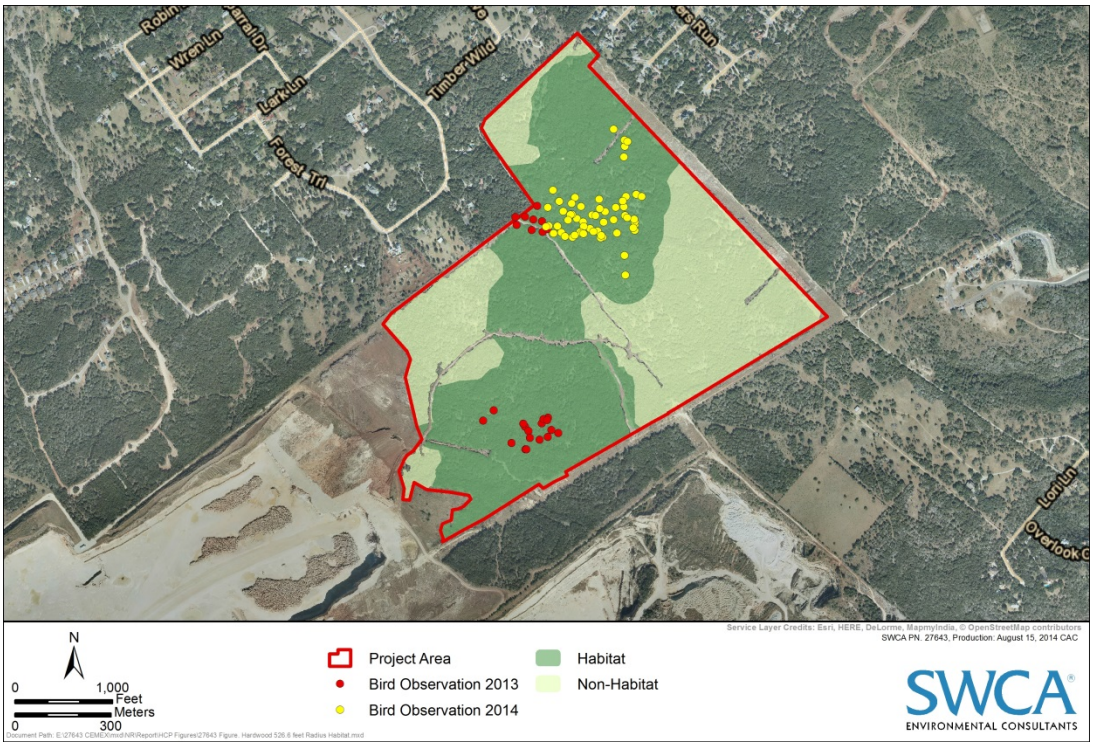


Figure 7. Golden-cheeked warbler habitat in the Balcones Quarry Northeast Area.

## Literature Cited

Kroll, J.C. 1980. Habitat requirements of the golden-cheeked warbler: management implications. Journal of Range Management 33:60-65.

Pulich, W.M. 1976. The Golden-cheeked Warbler: A Bioecological Study. Texas Parks and Wildlife Department, Austin. 172 p.

U.S. Fish and Wildlife Service (USFWS). 1992. Golden-cheeked warbler (*Dendroica chrysoparia*) Recovery Plan. Austin, Texas.

Wahl, R., D.D. Diamond, and D. Shaw. 1990. The golden-cheeked warbler: a status review, unpublished report submitted to Ecological Services, U.S. Fish and Wildlife Service, Ft. Worth, Texas. 80pp.