Petition to delist the Bone Cave harvestman (*Texella reyesi*) in accordance with Section 4 of the Endangered Species Act of 1973

PETITION TO DELIST THE BONE CAVE HARVESTMAN (*TEXELLA REYESI*) IN ACCORDANCE WITH SECTION 4 OF THE ENDANGERED SPECIES ACT OF 1973

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EXECUTIVE SUMMARY

The federally endangered Bone Cave harvestman (*Texella reyesi*) is a terrestrial karst invertebrate that occurs in caves and voids north of the Colorado River in Travis and Williamson counties, Texas. The U.S. Fish and Wildlife Service (USFWS) listed *T. reyesi* as endangered in 1988 on the basis of only five to six known localities that occurred in a rapidly developing area. Little was known about the species at the time, but the USFWS deemed listing was warranted to respond to immediate development threats. The current body of information on *T. reyesi* documents a much broader range of known localities than known at the time of listing and resilience to the human activities that USFWS deemed to be threats to the species.

Status of the Species

- An increase in known localities from five or six at the time of listing to 172 today.
- Significant conservation is in place with at least 94 known localities (55 percent of the total known localities) currently protected in preserves, parks, or other open spaces.
- Regulatory protections are afforded to most caves in Travis and Williamson counties via state laws and regulations and local ordinances.
- Biologists continue to discover new, occupied localities and this trend is likely to continue as more areas are explored and more caves are discovered.

Review of Endangered Species Act Listing Factors

- Development activities on the surface may not result in the significant loss or degradation of habitat for *T. reyesi* as originally thought. Several examples of continued species persistence in developed areas include: Inner Space Caverns, Sun City caves, Three-Mile Cave, Four-Mile Cave, and Weldon Cave.
- Inner Space Caverns demonstrates that the species can persist in caves with frequent human visitation and may be more tolerant of related habitat modifications than originally believed.
- Recent studies suggest that fire ants may not present as significant or as lasting of a threat to the species as originally believed.
- The regulatory landscape includes a number of measures contributing to the conservation of the species outside of the protections afforded by the Endangered Species Act of 1973, as amended.
- The use of small voids or "mesocaverns" within the geologic formations known to support occupied caves mitigates the potential threat of climate change.

This petition provides several examples of other delisting actions by the USFWS in recent years, highlighting the rationale behind these prior actions and identifying similarities with the circumstances of *T. reyesi*. These provide historical evidence that the USFWS has delisted species on the basis of the original data in the listing rule being in error, as a result of new information demonstrating that the true range and population of the species is more expansive than previously known, and on the basis of species recovery, even if the criteria in published recovery plans were not fully met.

The Petitioners believe that delisting *T. reyesi* is warranted on the basis of both 1) significant conservation efforts achieving recovery, 2) significant increases in the number of known localities and the size of the species' range, and 2) new information and analysis indicating the existence and/or magnitude of previously identified threats do not support a conclusion that the species is at risk of extinction now or in the foreseeable future.

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We, the Petitioners, respectfully submit this petition to delist the federally endangered Bone Cave harvestman *(Texella reyesi)* to the U.S. Fish and Wildlife Service (USFWS) for consideration pursuant to Section 4 of the Endangered Species Act (ESA) of 1973, as amended.

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1.0 PETITIONED ACTION

The Petitioners respectfully submit this petition to delist the federally endangered Bone Cave harvestman *(Texella reyesi)* to the U.S. Fish and Wildlife Service (USFWS) for consideration pursuant to Section 4 of the Endangered Species Act (ESA) of 1973, as amended.

Since the 1988 listing, under the name *Texella reddelli,* a substantial amount of new scientific and commercial information has become available that demonstrates that *T. reyesi* is not at risk of extinction now or in the foreseeable future and that the protections of the ESA were not and are not warranted. The Petitioners request that the Secretary of the Interior (Secretary), acting by and through the USFWS, evaluate this petition to delist the *T. reyesi* on the basis of the best available scientific and commercial data pursuant to Section 4 of the ESA.

Several of the Petitioners believe that species inappropriately receiving the protections of the ESA cause significant economic harm to landowners who are prevented from using their land and to local governments who need to provide necessary community services. Others believe that the objectives of the ESA are best served by focusing limited conservation resources on species that truly warrant the protections of the ESA. All Petitioners believe that *T. reyesi* should no longer be listed as threatened or endangered under the ESA.

Pursuant to ESA section 4(b)(3)(A), the question USFWS must determine at this stage is "whether the petition presents substantial scientific or commercial information indicating that the petitioned action may be warranted." This is a relatively low-threshold burden of proof. For the purposes of this decision, "'substantial information' is that amount of information that would lead a reasonable person to believe that the measure proposed in the petition may be warranted." 50 CFR 424.14(b)(1).

2.0 BONE CAVE HARVESTMAN SPECIES OVERVIEW

In the 25 years since the final rule listing *T. reyesi* as endangered in 1988, there has been much progress toward developing a scientific basis for understanding the biology and ecology of troglobitic species in Texas. Much of the available scientific data have been developed through monitoring activities associated with preserve management and project reviews related to ESA Section 10 permits and Section 7 consultations. While much of this research is site specific, it provides the basis for the current scientific and commercial data on, and understanding of, *T. reyesi.*

T. reyesi is a pale orange harvestman with absent retina. The species was identified by Ubick and Briggs (1992:211) as extremely polymorphic, particularly in its troglomorphic characteristics. For example, *T. reyesi* may have well developed cornea or the cornea may be reduced or absent altogether. Ubick and Briggs (1992:211) identified that the species is more troglomorphic in the northern reaches of its distribution. In other words, in the southern part of the range individuals have partial corneas, while in the north morphological evidence of any remnants of eye development is completely absent.

3.0 BONE CAVE HARVESTMAN REGULATORY HISTORY

The USFWS first listed *T. reyesi* as endangered under the ESA in 1988 under the name Bee Creek Cave harvestman (*T. reddelli*) (53 Fed. Reg. 36029). In 1993, the USFWS recognized *T. reyesi* as a separate species and published a final rule extending the endangered listing to this new species (56 Fed. Reg. 43818). This section is provided as a historical and regulatory overview of these and subsequent actions describing USFWS accepted data pertaining to *T. reyesi.* The justification for delisting, including an assessment of the current status, range, and distribution of the species, is provided in Section 5.0 of this Petition.

3.1 FINAL LISTING RULE (1988)

On September 6, 1988, the USFWS published a final rule to list as endangered five species of karst invertebrates known to occur only in Travis and Williamson counties, Texas (53 Fed. Reg. 36029). This final rule, which became effective on the date of publication, extended the protection of the ESA to the Tooth Cave pseudoscorpion *(Microcreagris texana)*, the Tooth Cave spider *(Leptoneta myopica)*, the Bee Creek Cave harvestman *(Texella reddelli)*, the Tooth Cave ground beetle *(Rhadine persephone)*, and the Kretschmarr Cave mold beetle (*Texamaurops reddelli)*.

Pursuant to the listing factors identified in the ESA, the USFWS provided the following justifications for the listing of these species as endangered (which now also pertain to *T. reyesi*) (53 Fed. Reg. 36031):

- **Listing Factor A (the present or threatened destruction, modification, or curtailment of its habitat or range):** "The primary threat to the five species comes from the potential loss of habitat owing to ongoing developmental activities." At that time, the USFWS assessment was directly related to "a major residential, commercial, and industrial development" that affected the entire known range of several of the species and a large portion of the habitat of the species we know today as *T. reyesi*. The USFWS described the potential threats from development activities as including collapsing or filling in caves during construction; the alteration of drainage patterns to caves (either increasing or decreasing water flow); increasing the flow of sediment, pesticides, fertilizers, and general urban run-off into caves; and increased human visitation and vandalism.

- **Listing Factor B (overutilization for commercial, recreational, scientific, or educational purposes):** The USFWS determined that "no threat from overutilization of these species is known to exist" at the time of listing; however, collection for scientific or educational purposes could become a threat if localities become generally known.

- **Listing Factor C (disease or predation):** The USFWS determined that increased human population increases the "problems of predation by, and competition with, exotic (non-native) species," including sowbugs, cockroaches, and fire ants.

- **Listing Factor D (the inadequacy of existing regulatory mechanisms):** The USFWS determined that these species were threatened by a lack of existing regulatory protections, based on a finding that "there are currently no laws that protect any of these species or that directly address protection of their habitat."

- **Listing Factor E (other natural or manmade factors affecting its continued existence):** USFWS discussed the limitations placed on these species by a lack of mobility from one habitat to another and stated "moisture regimes, food supply, and other factors may also limit subsurface migrations." The USFWS identified changes to inner-cave climate from surface alterations and vandalism of caves as potential threats.

In support of the 1988 final listing rule, the USFWS relied on only seven referenced data sources to substantiate the listing of the five species. Of these sources, only one source was less than ten years old at the time of the final rule, and only the Goodnight & Goodnight paper (1967) had any reference specific to *T. reddelli*. In the final rule, *T. reddelli* was confirmed from only five caves and believed to exist, but not confirmed, in a sixth. The known range of the species extended a distance of approximately 21 miles along the edge of the Edwards Plateau (75 square miles). The USFWS decision to list *T. reddelli* (later identified as *T. reyesi; see* Section 3.2) was based on very limited information about the species (including basic taxonomy) and was prompted by concerns about potential adverse effects of development activities at a time when the link between such activities and actual effects on the species was largely unknown.

3.2 TAXONOMIC SPLIT AND TECHNICAL CORRECTION (1993)

In response to a published taxonomic study by Ubick and Briggs in 1992, the USFWS determined in 1993 that *T. reddelli* was actually two distinct species (56 Fed. Reg. 43818). The newly identified species, *T. reyesi*, was afforded the same protections under the ESA as *T. reddelli*. In this final rule (identified as a "technical correction"), the USFWS states that "both of these species continue to face the same general threats identified in the original listing of the Bee Creek Cave harvestman [*T. reddelli*]" (56 Fed. Reg. 43819). The USFWS acknowledged that by "including newly discovered localities" of the *T. reyesi* the known range of the species expanded from 21 miles to 31 miles along the edge of the Edwards Plateau. However, the USFWS did not elaborate on the number or significance of these newly discovered localities.

Ubick and Briggs (1992:207; 211) identified 24 known *T. reyesi* locations and four *T. reddelli* locations. Of the caves in the original listing, only one of those locations (Bee Creek Cave) ultimately contained *T. reddelli* and the other four or five localities (Tooth Cave, McDonald Cave, Weldon Cave, Bone Cave, and potentially in Root Cave) contained the species now known as *T. reyesi*. The 1993 technical correction does not include an analysis of the ESA listing factors specifically applicable to *T. reyesi* nor the expanded range and distribution information. In its decision to list this newly identified species as endangered with extinction, the USFWS did not assess any new scientific or commercial data on the species beyond the taxonomic revision.

In the 1993 final rule, the omission of any assessment of available substantive scientific data beyond Ubick and Briggs (1992) was an oversight of substantial significance to the actual appropriateness of the listing. At the time the final rule was published, progress was well underway toward developing the 1994 Endangered Karst Invertebrates (Travis and Williamson counties, Texas) Recovery Plan (1994 Recovery Plan). The 1994 Recovery Plan (which addresses *T. reyesi* and six other listed karst invertebrates) includes an extensive nine-page list of references, including 32 publications and reports that are of relevance to *T. reyesi*. None of these sources were explicitly considered in the determination to extend the protections of the ESA to *T. reyesi*. This means that at the time of the 1993 technical correction, a substantial body of new information was available to the USFWS that was not considered or analyzed in the final listing rule for *T. reyesi*, indicating that the decision was not fully supported by the application of the best available scientific data available at the time.

3.3 PETITION TO DELIST AND NEGATIVE 90-DAY FINDING (1994)

On June 7, 1993, a petition to delist seven Texas karst invertebrates, including *T. reddelli,* (and later clarified to include *T. reyesi)* was submitted to the USFWS. In 1994, the USFWS issued a 90-day finding on that petition and determined that the petition, submitted by Judge John C. Doerfler of Williamson County, did not present substantial scientific data to support the delisting of any of the seven species identified.

In its 90-day finding, the USFWS determined that *T. reyesi* "is currently known from about 69 locations (60 confirmed, 9 tentative)" in Travis and Williamson counties (59 Fed. Reg. 11755). Of these localities, nine were protected at the time of the negative 90-day finding, including "three [that] are TSNL (Texas System of Natural Laboratories) caves, two [that] are in City of Austin preserves, two [that] are in City of Georgetown preserves, and two [that] were acquired as mitigation for a development project" (59 Fed. Reg. 11755). The 90-day finding includes multiple references to a review of the petition conducted by James Reddell (foremost expert on Texas cave fauna, Interim Curator of Entomology at the Texas Memorial Museum) entitled "Response to the Petition to Delist Seven Endangered Karst Invertebrates."

In the 90-day finding, the USFWS provided an assessment of the five listing factors previously identified in the ESA in reaching their finding. The USFWS maintained that "the primary threat to these species

comes from loss of habitat due to development activities" (59 Fed. Reg. 11756). The finding defers to the 1988 final rule for a specific discussion of the potential impacts of development activities. While the 90-day finding acknowledges that the known localities of *T. reyesi* have increased in the six years between 1988 and 1994, the USFWS concludes that "the degree of threat of habitat destruction or modification remains significant, and may have increased, throughout the range of each species" (59 Fed. Reg. 11756). USFWS provides this generalization without citing any scientific or commercial data to support the assertion, and without providing any specific examples of karst invertebrate habitat actually being lost to development activities. The USFWS did not cite any census data specific to *T. reyesi* populations that would have provided a quantitative basis for the continued support of the agency's original assertions.

Interestingly, the 1994 delisting petition included a list of known occupied caves that had been impacted by development activities yet continued to support the presence of listed species. The USFWS was not swayed by these data. However, the USFWS "agrees with the Petitioners that there is little quantitative data available on the direct effects" of these activities (59 Fed. Reg. 11756). It is important to note that the finding does not *disagree* with the list of examples presented in the petition. Rather, the USFWS states its surmise that "in most cases, not enough time has elapsed since the disturbance to detect an effect on the karst invertebrates." The USFWS seemingly makes the assumption that population declines will occur over time, but implies that if an adequate amount of time can be shown to have passed since the onset of these activities without recordable decline in the species at these sites, it could be concluded that these threats are not as severe as anticipated in the 1988 final rule and subsequent findings (59 Fed. Reg. 11756).

In the 90-day finding, the USFWS re-emphasized the threat presented by red imported fire ants (RIFA). The USFWS references Porter and Savignano (1990) to support the statement that "overall arthropod diversity drops" where RIFA are present (59 Fed. Reg. 11757). The USFWS also references a list developed by James Reddell and included in his review of the petition identifying nine cave-dwelling species known to have been preyed on by RIFA, none of which are *T. reyesi*. The USFWS concluded that controlling RIFA is a challenging yet necessary component to ensuring the continued viability of cave-dwelling species.

In the 90-day finding, the USFWS briefly discusses existing regulatory mechanisms relevant to the petitioned species and concludes that they were not sufficient to protect the species. The USFWS concluded that the known preserves identified in the petition did not include the entire extent of the drainage basins supplying moisture to the caves or did not have protections afforded in perpetuity. The USFWS did not identify any concerns relating to other natural or manmade factors specific to *T. reyesi*, but did identify a loss of genetic diversity as a concern for some of the other species included in the finding. The USFWS concluded that "these species continue to require the protection of the Act because of their extremely small, vulnerable, and limited habitats located within an area that is experiencing continued pressures from economic and population growth" (59 Fed. Reg. 11758). However, an "extremely small, vulnerable, and limited" habitat or range is not one of the listing factors identified in the ESA. It is the burden of the USFWS to identify how the listing factors threaten the species with extinction in the foreseeable future, and simply identifying that economic and population growth is likely to continue does not accomplish that task without specific examples of declining populations due to these activities.

Moreover, in his review of the delisting petition, James Reddell specifically states that "an argument could perhaps be made that because of its greater range *Texella reyesi* is not endangered" (Reddell 1993:11). This statement is completely ignored in the USFWS discussion on Reddell's response to the petition.

3.4 ENDANGERED KARST INVERTEBRATES RECOVERY PLAN (1994)

Section 4(f)(1) of the ESA requires that the Secretary "develop and implement plans... for the conservation and survival of endangered and threatened species listed" pursuant with the ESA, "unless he finds that such a plan will not promote the conservation of the species." Consistent with these definitions, the goal of recovery plans is to achieve a level of conservation for a listed species that removes the need for protection under the ESA. Section 4(f)(1)(B)(ii) states that recovery plans shall, to the maximum extent practicable, set "objective, measurable criteria which, when met, would result in a determination, in accordance with the provisions of [the ESA], that the species be removed from the list."

The status of *T. reyesi* was addressed in the 1994 Recovery Plan approved by the USFWS. At the time of the 1994 Recovery Plan, *T. reyesi* was confirmed in 60 caves with an additional nine pending confirmation and a geographic range including 135 square miles. This significant increase in known localities and range from the time of the 1988 listing (from 6 to 60–69 caves and 75 to 135 square miles) is consistent with the range and distribution known and discussed by the USFWS in its 90-Day Finding response to the 1993 delisting petition and in James Reddell's response to the delisting petition.

Since the 1994 Recovery Plan addresses seven invertebrate species, much of the analysis is general in nature in an attempt to encompass all the species represented in the Plan. Referring to all of the included species, the USFWS summarizes that "no population estimates are currently available for any of the species due to their secretive habits, rarity, and inaccessibility" (USFWS 1994:27).

Other than general taxonomic descriptions, the species-specific biological information and data relating to threats to the species that are provided for *T. reyesi* pertain solely to monitoring data gathered from Lakeline Cave and Temples of Thor Cave and is not representative of the status of the complete population. In evaluating the listing factors in relation to *T. reyesi*, the USFWS states that four known occupied caves had been filled, one of which was later reopened. The USFWS describes other related threats to the covered species including the alteration of drainage patterns, the alteration of surface plant and animal communities, contamination, human visitation and vandalism, the invasion of fire ants, and mining activities. While the USFWS provides examples of *T. reyesi*-occupied caves that occur in the vicinity of these threats, they do not provide data on any measurable negative impacts to *T. reyesi* resulting from this proximity. Nor does the USFWS consider in the listing factor analysis the beneficial conservation actions implemented for the species.

Karst Fauna Regions, Karst Zones, and Karst Fauna Areas

The 1994 Recovery Plan is heavily dependent upon the Karst Fauna Region (KFR) hypothesis developed by George Veni and Associates in 1992 (Veni and Associates 1992). The KFR principle was developed through a study conducted with ESA Section 6 funding to assess "geologic controls on cave development and distribution of karst fauna in the vicinity of Travis and Williamson counties" (USFWS 1994:67). The result was the delineation of 11 distinct areas named "karst fauna regions" within Travis, Williamson, Hays, and Burnet counties based on "geologic continuity, hydrology, and the distribution of 38 rare troglobites" (USFWS 1994:67). When the 1994 Recovery Plan was developed, *T. reyesi* was known from six KFRs: the North Williamson County, Georgetown, McNeil/Round Rock (originally identified as two distinct KFRs, but considered as one in the 1994 Recovery Plan), Cedar Park, Jollyville Plateau, and Central Austin KFRs.

In addition to delineating the KFRs, Veni and Associates (1992) identified zones in Travis and Williamson counties that estimated the relative likelihood that listed karst invertebrate species were present in each zone. These "Karst Zones" are described as follows in the 1994 Recovery Plan:

> Zone 1: Areas in the Edwards Group limestones that are known to contain listed species;

Zone 2: Areas that may contain listed species or other endemic fauna;
Zone 3: Areas that probably do not contain any listed species or their habitat; and
Zone 4: Areas of non-cavernous rock and thus do not contain caves or other karst features.

The 1994 Recovery Plan identifies the known distribution of each of the included species by occupied cave. This effectively demonstrates that the known range of *T. reyesi* far exceeded the known range for the other six species addressed in the recovery plan (Table 1). This distribution information further demonstrates the significant increase in known localities, from the five confirmed localities in 1988 to the 69 confirmed and pending localities known at the time the 1994 Recovery Plan was approved. Despite the acknowledgment of these new data, including the fact that *T. reyesi* occurs in six of the eight KFRs, there was no discussion on how the information may warrant unique consideration in determining appropriate recovery criteria for *T. reyesi*.

Table 1. Endangered karst invertebrate locations as of 1994 in Travis and Williamson Counties as Identified by William Elliot and James Reddell for Inclusion in the 1994 Recovery Plan (USFWS 1994:29)

Karst Invertebrate Species	Occupied Localities Travis County	Occupied Localities Williamson County	Total
Texella reyesi	19	50	69
Texella reddelli	7	0	7
Tartarocreagris texana	4	0	4
Neoleptoneta myopica	4	0	4
Rhadine persephone	12	15	27
Texamaurops reddelli	4	0	4
Batrisodes texanus	0	5	5

The 1994 Recovery Plan bases the downlisting criteria for the Travis and Williamson counties karst invertebrates on the permanent protection of Karst Fauna Areas (KFAs) within each of the KFRs where a species is known to occur. The 1994 Recovery Plan states that KFAs should be selected on the "ability to ensure long-term protection, current level of habitat disturbance, past and present land use, presence of other rare or candidate species, ease of protection (landowner cooperation), and, where applicable, importance to the regional groundwater system" (USFWS 1994:80). At the time the 1994 Recovery Plan was written, there was no specific design for the size and configuration of a KFA. The 1994 Recovery Plan instead provided that those specific determinations should be site-specific, but should include an area large enough to "maintain the integrity of the karst ecosystem on which each species depends" (USFWS 1994:82).

The 1994 Recovery Plan recommends that downlisting of any of the listed karst invertebrates be considered when three KFAs within each KFR where the species is known to occur (if opportunities for at least three exist) are protected in perpetuity (USFWS 1994:76). However, where opportunities for three KFAs per KFR are not known to exist, the USFWS indicates that two protected KFAs (or even only one, if it is the only one available) could be sufficient for downlisting, provided that at least two KFAs for that species are protected range wide (USFWS 1994:77). Given that *T. reyesi* clearly has the most known localities of the species included in the 1994 Recovery Plan, occurring across six KFRs and at 172 known localities, this species would require more protected KFAs (18 total) than the other species in order to warrant downlisting under the recovery guidelines (USFWS 1994:79), even though the 1994 Recovery Plan indicates that a lesser standard could be sufficient for protection of the species.

Requiring the species with the most known localities and widest distribution to also have the most formally protected KFAs provides a level of conservation that exceeds what is necessary to ensure the perpetual protection of the species, particularly when compared to the recovery guidelines provided for the rarest of the species. The 1994 Recovery Plan does not provide any biological evidence why having more than two KFAs for a more abundant species is necessary for the species' long-term survival, when the USFWS does not require this level of conservation for species that are considered to be rarer. Nor does the USFWS provide evidence regarding how the determination of three KFAs within each KFR is necessary to contribute to long-term recovery. Rather, it seems logical that if rare species with only two known localities can be feasibly protected to the point of downlisting when those two localities are protected, then the dozens of protected localities for *T. reyesi* that are distributed across six KFRs should also warrant downlisting consideration.

Implications of the Bexar County Recovery Plan Minority Report

In 2009, during the drafting of the Bexar County Karst Invertebrate Recovery Plan, the use of KFRs was chosen as the preferred method for assessing the recovery of related karst invertebrates in the greater San Antonio area. A minority report was provided to the USFWS by Dr. Kemble White, who served as a member of the Recovery Team that outlined scientifically supported counter arguments to the use of KFRs in the Bexar County Recovery Plan. The minority report cited a body of peer-reviewed literature that was not included for consideration by the Bexar County Recovery Team. In summation, this literature shows that actual species distribution is not represented by the KFR hypothesis and encourages the USFWS to consider alternative methods for determining appropriate distribution for recovery. While White does not argue that distinct regions cannot be delineated to measure recovery, he clarifies that "they are likely different for each species group" rather than uniform as described through the KFRs (White 2009:3).

According to White (2001; 2006; 2009) the weakness behind the KFR concept in the Bexar County system is based on insufficient sampling efforts to substantiate the KFR delineation, boundaries being developed without definitive taxonomic evidence to support those boundaries, a complete failure to consider alternative ways to define species boundaries, and biased data in the endemism index. White argues that given the normal trajectory of a significant increase in available species data following a listing action by the USFWS, and that a "great majority of useful data have been generated and published since the nine Bexar County karst invertebrates were listed," those data should be applied to revise or discard the existing KFR concept in Bexar County (White 2009:5). This is based on scientific literature that shows that "the KFR hypothesis has been retested, both directly and indirectly, and the new data consistently demonstrate that the KFR concept does not explain the biogeographical origins or distribution of the Bexar County troglobites" (White 2009:5). The Petitioners encourages the USFWS to consider the peer-reviewed data regarding the use of KFRs in determining recovery that is referenced in this petition.

While most of the available literature on this subject involves research specific to Bexar County, the same logic can be applied to the KFRs used in Williamson and Travis counties. This is supported by the consideration of the Bexar County Karst Invertebrate Recovery Plan in the 5-Year Status Review for *T. reyesi* completed by USFWS in 2009. Peer-reviewed literature that refutes the relevance and scientific application of the current KFRs must be considered in this petition. This literature demonstrates that within the body of best available scientific and commercial data there are supported arguments against the use of KFRs as the primary tool for measuring species recovery. Given this documented uncertainty, if the data demonstrate a significant increase in a species' range and this increase is accompanied by a sustaining number of protected populations and a reduction of the impacts resulting from potential threats, that species should be delisted regardless of the distribution of those protected localities. This is

consistent with the regulatory definition of recovery as described in the ESA and outlined in listing decisions approved by the USFWS (some examples are provided in Section 4 of this petition).

Challenges Associated with Multi-Species Recovery Plans

The 1994 Recovery Plan is a multi-species plan that includes little species-specific information pertaining to *T. reyesi*. While the USFWS regularly develops multi-species recovery plans in an effort to achieve high efficiency and more cohesive strategies to address threats to species, there are several studies that have determined that the current protocol for developing multi-species plans, especially the monitoring and adaptive management component of these plans, is not in the best interest of the individual species or in meeting the conservation objective of the ESA for individual species (Boersma et al. 2001; Clark et al. 2002).

A study conducted in 2001 by Boersma et al., "found that species from single-species plans were four times more likely to be improving in status than species from multi-species plans" (Clark et al. 2002:656). Clark et al. (2002) subsequently developed a statistical method for evaluating multi-species and single-species plans to test the findings of Boersma et al. (2001). The Clark study overwhelmingly confirmed the work of Boersma et al., concluding that "by nearly all measures in this and other papers analyzing the recovery plan project database, single-species recovery plans provide a better foundation for recovery efforts than multi-species plans" (Clark et al. 2002:660). In an effort to identify why there exists such a significant difference in the success rate, the Clark study identified two primary potential causes: (1) the effectiveness of the plans is directly related to the biological nature of the species and (2) by lumping multiple species into one plan, there is no attention focused to individual species' needs and therefore the recovery goals may not be equally appropriate or beneficial to each species in the plan.

Clark assesses that "the extent of species-specific biological understanding is greater in single-species than multi-species plans," which is supported by the idea that "the USFWS has lumped species into multi-species plans simply because it had insufficient information about the individual listed species to draft adequate single-species plans" (Clark et al. 2002:660).

Given these assumptions, it is reasonable to assume that the 1994 Recovery Plan does not include a complete consideration of the unique biological needs of *T. reyesi*. Evidence indicates that a species benefits from being considered independently and not as part of a multi-species effort. There has been a significant increase in the available information relating to *T. reyesi* since the development of the 1994 Recovery Plan that indicates that the levels of recovery applied generally for all seven species does not translate into appropriate recovery guidelines for *T. reyesi*.

The introductory section of the 1994 Recovery Plan includes a disclaimer that concludes "approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery tasks" (USFWS 1994:i). This disclaimer explicitly acknowledges that should a preferred method for evaluating recovery or new analysis of the listing factors utilizing new available scientific data become available, downlisting/delisting should be considered regardless of progress towards achieving the specific conservation objectives outlined in the 1994 Recovery Plan.

3.5 5-YEAR STATUS REVIEW (2009)

Fifteen years after the release of the 1994 Recovery Plan, the USFWS completed a 5-year status review (Five-Year Review) of *T. reyesi* in 2009 and, remarkably, in spite of new data documenting the increased number of protected locations for the species, arbitrarily determined that no change in listing status was warranted. The Five-Year Review does not evaluate any of the ESA listing factors and provides no analysis of new scientific or commercial data in relation to those factors. While it does confirm that there were 168 known occupied caves containing *T. reyesi* distributed across all KFRs, a substantial increase

over those known at the time of the 1994 Recovery Plan, it does not evaluate the implications of these additional known localities on the species' risk of extinction.

While the Five-Year Review does incorporate several new references into its works cited, the resources provided are primarily related to various Section 10 consultations that have occurred relative to the species, primarily in Travis County. It is likely that the resources included in the Five-Year Review could have yielded an assessment of the species' status in relation to the listing criteria, but the USFWS made no effort to do so in their assessment. As a result, the Five-Year Review is ultimately a listing of known cave locations that fails to provide any scientific or quantitative assessment of the species' status in relation to the listing criteria, even though abundant data were available.

Inadequate Consideration of Protected or Stable Sites

In the Five-Year Review, the USFWS exclusively based its evaluation of species status on the progress (or not) towards attaining the recovery criteria outlined in the 1994 Recovery Plan, which are based on the acquisition and management of a certain number of KFAs. It acknowledges that while there was one KFA for *T. reyesi* recognized by the USFWS (Priscilla's Well KFA), an additional 28 areas were potentially eligible as KFAs. These tracts were not recognized by the USFWS as KFAs at the time of the Five-Year Review due to a lack of information regarding surface/subsurface drainage basins, insufficient protected acreages around features, and/or lack of commitments for ongoing management activities. The Five-Year Review provides an overview of each of these 28 opportunities and the known information that may warrant their consideration as a KFA. Caves identified as having KFA potential in the Five-Year Review are identified in Appendix A and section 5.2.4 of this petition. These 29 approved, potential, or de facto KFAs are locations where the effective threats to the species are sufficiently low as to warrant consideration as "recovery quality" conservation areas. The number of these essentially stable sites is in excess of the number of protected sites deemed necessary for the species in the 1994 Recovery Plan and are distributed across five of the KFRs known to include *T. reyesi*.

Inappropriate Reliance on a Narrow Set of Data

The Five-Year Review states that the USFWS "mostly relied on information summarized and cited in Balcones Canyonlands Preserve (BCP) Annual Report and the BCP cave assessment" (USFWS 2009:1). Other predominant references include the draft Bexar County Karst Invertebrate Recovery Plan and the 1994 Recovery Plan. The stated reliance on these information sources is problematic since a strong majority of the known occupied caves for *T. reyesi* are located in Williamson County and not represented in the BCP reports which cover Travis County. Further, there are no known locations of *T. reyesi* in Bexar County, which represents an altogether different karst system inhabited by an altogether different group of karst invertebrate species. The 1994 Recovery Plan, as described above, includes very little species-specific information about *T. reyesi* and relies on a recovery framework (the KFR and KFA constructs) that may not accurately reflect the conservation needs of the species.

Climate Change

The Five-Year Review briefly considers the potential threat of climate change in its analysis. Climate change is not addressed as a direct threat in either the 1988 or 1993 listing rules for *T. reyesi* and its discussion in the status review is minimal. The USFWS states that "to date, these changes do not appear to have had a negative impact on *T[exella] reyesi*" (USFWS 2009:18). The USFWS acknowledges that potential impacts of climate change are unknown and that they "lack sufficient certainty to know how climate change will affect this species" (USFWS 2009:18). Since the discussion on climate change is speculative and completely lacks supportive data, it is not a substantive argument for continued listing.

3.6 ESA SECTION 7 AND SECTION 10 CONSULTATIONS

The USFWS has issued or completed several ESA Section 10 incidental take permits and Section 7 consultations that address *T. reyesi*. Some (but certainly not all) of these actions include:

- Four Points Property Section 10 Permit (PRT-808694)
- Grandview Hills Property Section 10 Permit (PRT-815447)
- Comanche Canyon Ranch Section 10 Permit (TE-004683-0)
- Sultan and Kahn Section 10 Permit (TE-035525-0)
- Russell Park Estates Section 10 Permit (TE-051567-1)
- Simon Lakeline Mall Section 10 Permit (TE-762988)
- Williamson County Regional Habitat Conservation Plan Section 10 Permit (TE-181840-0)
- Balcones Canyonlands Conservation Plan Section 10 Permit (PRT-788841)
- Hart Triangle (GDF Realty Investments) Section 10 Permit (TE-027690-0)
- Shadow Canyon (San Gabriel Harvard Limited Partnership) Section 10 Permit (TE-116313-0)
- State Highway 195 in Williamson County Section 7 Consultation (21450-2006-F-0132)
- Brushy Creek MUD Section 7 Consultation (2-15-F-2002-0453)

Each of these consultations resulted in the establishment of mitigation preserve land that includes the protection in perpetuity of known *T. reyesi* localities. These represent part of the at least 8,413 acres of protected lands with 94 *T. reyesi* occupied caves discussed further in Section 5.2.4 and Appendix B of this petition.

4.0 DELISTING CRITERIA, PROCESS, AND HISTORICAL PRECEDENTS

Delisting a species from the protections of the ESA may occur as a result of achieving recovery, species extinction, or new analysis that otherwise indicates that the original listing was in error. Since 1967, 59 species have been delisted (51 domestic and 8 foreign species). Of these, 18 were delisted because the original data were found to be in error, 31 have been recovered, and 10 have gone extinct (USFWS 2013a; NOAA 2013).

4.1 RECOVERY AND RELATIONSHIP TO RECOVERY PLANS

The Policy and Guidelines for Planning and Coordinating Recovery issued by the USFWS in 1990 defines recovery as "the process by which the decline of an endangered or threatened species is arrested or reversed, and threats to its survival are neutralized, so that its long-term survival in nature can be ensured. The goal of this process is the maintenance of secure, self-sustaining wild populations of the species" (USFWS 1990:1). While there is a regulatory basis for the development of recovery plans, there is no requirement that recovery plans be implemented. **It is also important to recognize that neither the ESA nor the USFWS regulation establishes that recovery plans act as the sole determinant of a species' progress towards achieving recovery.**

For example, in its final rule to delist the Lake Erie water snake in 2011, the USFWS states that "recovery plans are intended to provide guidance to the USFWS, States, and other partners… they are not regulatory documents and cannot substitute for the determinations and promulgation of regulations required under 4(a)(1) of the Act" (76 Fed. Reg. 50681). In regard to implementation of recovery plans, the USFWS identifies that "there are many paths to accomplishing recovery of a species, and recovery may be achieved without all criteria being fully met" (76 Fed. Reg. 50681). Moreover, "the determination to remove a species from the Federal List of Endangered and Threatened Wildlife is ultimately based on an

analysis of whether a species is no longer endangered or threatened" (76 Fed. Reg. 50681). Therefore, a species may be delisted on the basis of recovery even if the specific recovery criteria identified in the species' recovery plan have not been met.

Other examples of species that have been delisted on the basis of recovery not necessarily defined by strict adherence to published recovery plan criteria include the following:

- **Columbian White-tailed Deer (*Odocoileus virginianus leucurus*), Douglas County distinct population segment) (68 Fed. Reg. 43647)** - In 2003, the Douglas County distinct population segment of the Columbian white-tailed deer (distinguished in the 1983 revision to the recovery plan) was delisted due to recovery. Prior to listing, the species had declined by 1970 to just two known populations representing approximately 400–500 individuals. Largely as a result of conservation efforts and regulations on hunting, by 2002, the species increased to over 6,000 known individuals (68 Fed. Reg. 43651). This represents a population increase of 1,417.5% (based on a starting value of 400 known individuals). Despite this population increase, there remained only two known populations of the species at the time of delisting, and the range of the delisted population segment included only one county in Oregon. The basis for delisting the distinct population segment was the establishment of secure habitats. The recovery plan "did not define secure habitat to include only publically owned lands; rather, it provided further guidance on secure habitat by stating that local entities, including planning commissions, county parks departments, and farm bureaus could secure habitat through zoning ordinances, land-use planning, parks and greenbelts, agreements, memoranda of understanding, and other local jurisdictions" (68 Fed. Reg. 43651). They additionally encouraged conservation organizations to contribute through "easements, leases, acquisitions, donations, or trusts" (68 Fed. Reg. 43651).

- **Robbins' Cinquefoil (*Potentilla robbinsiana*) (67 Fed. Reg. 54968)** - In 2002, the Robbins' Cinquefoil was delisted due to recovery. This determination was based on the application of protective conservation actions and the addition of new viable populations. At the time of the listing in 1980, there was only one known population of the species that had been transected by development associated with the Appalachian Trail. Within that population, approximately 2,000 individual plants were known to occur. By the time the species was delisted, more than 14,000 individual plants were known to occur at two naturally occurring localities and two transplanted localities (67 Fed. Reg. 54968). This represents a known population increase of 600%. While the recovery plan initially called for four new transplant sites, it was later determined that only two of these sites needed to be viable. In response to comments received relating to the separation from the objectives outlined in the recovery plan, the USFWS iterated that "the objectives identified during the recovery planning process provide a guide for measuring the success of recovery, but are not intended to be absolute prerequisites, and should not preclude a reclassification or delisting action if such action is otherwise warranted" (67 Fed. Reg. 54972).

- **Aleutian Canada goose (*Branta canadensis leucopareia*) (66 Fed. Reg. 15643)** - In 2001, the Aleutian Canada goose was delisted due to recovery. In 1975, 790 individuals of the species were known to exist. By 1989, the population had increased to 5,800 known individuals (an increase of 634%). As a result of that increase, the species was down-listed to threatened. In 2000, there were 36,978 known individuals (an increase of an additional 537%) and the species was delisted (66 Fed. Reg. 15643). This represents a cumulative population increase of 4,580% from the time of listing. The species was determined to be recovered due to the discovery of new localities, the introduction of captive-bred individuals that led to an expanded range, and the elimination of threats like hunting by establishing closed hunting areas.

These are just a handful of examples where species have been delisted on the basis of recovery. In these cases, the USFWS determined that the threat of extinction and decline of the species had been reversed.

In many cases, the conditions considered for recovery were different from those outlined in the initial recovery planning process as new scientific information became available. In all cases, some forms of perpetual protective measures were implemented in support of continued species security.

As described in detail in Section 5.2.4 of this petition and consistent with these examples, a substantial level of conservation has been achieved for *T. reyesi*. These efforts have been accomplished through the establishment of permanent preserves dedicated to the protection and management of the species and more generally through the implementation of local and state regulations that minimize adverse effects on *T. reyesi* habitat across the range of the species. When coupled with the knowledge of a significantly expanded range and known distribution of the species and evidence that the threats to the species may not be as severe as originally assumed, these conservation measures sufficiently assure the continued survival of the species and avert the risk of extinction in the foreseeable future.

4.2 EXTINCTION

To date, 10 species have been delisting under the ESA due to extinction. While this is a warranted justification for the removal of a species from the protections of the ESA, it is not relevant to the *T. reyesi* and therefore not discussed further in this petition.

4.3 ORIGINAL DATA IN ERROR

The third acceptable criteria for delisting are instances where the original data used to support the listing is determined to be in error. In such cases, **delisting may be warranted if the analysis of new information or a reanalysis of the original information indicate that the existence or magnitude of threats to the species, or both, do not support a conclusion that the species is at risk of extinction now or in the foreseeable future.** Examples of species that have been delisted on the basis of an erroneous listing include:

- **Pine Barrens treefrog *(Hyla andersonii)* (48 Fed. Reg. 52740)** - In 1983, the Florida population of the Pine Barrens treefrog was delisted due to a finding that the original data were in error. The USFWS stated "recent evidence indicates that the species is much more widely distributed than originally known" (48 Fed. Reg. 52740). At the time of the listing, there were only seven known localities of this species in Florida and the predominant threat was cited as "the present or threatened modification, or curtailment of its habitat or range" (48 Fed. Reg. 52741). By 1979, several more populations were identified, and by 1980 there were over 150 confirmed occupied locations for the species (an increase of at least 2,042%). The final rule noted that while the overall distribution of the species was relatively limited, the likelihood of discovering more known localities in consideration with the additional new sites discovered indicated that "the Florida population is relatively secure for the immediate future" (48 Fed. Reg. 52741).

- **Rydberg Milk-Vetch (*Astragalus perianus)* (54 Fed. Reg. 37911)** - In 1989, the Rydberg Milk-Vetch was delisted on the basis of erroneous data. At the time when this species was listed, there was only one known locality. The subsequent delisting was based on the discovery of 11 additional localities over nine years of research (an increase of 1,100%). This delisting was supported by the existence of regulatory mechanisms that minimized the impacts of the threats identified in the initial listing factors.

- **McKittrick pennyroyal *(Hedeoma apiculatum)* (58 Fed. Reg. 49244)** - In 1993, the McKittrick pennyroyal was delisted because of "the number of newly discovered populations and the remote and inaccessible nature of the habitat" (58 Fed. Reg. 49244). This species was at the time of listing and continues to be only known from two counties, one each in Texas and New Mexico. At the time of listing, there were 7 known localities of the species. At the time of delisting, there

were 36 known populations of the species (an increase of 414%) (58 Fed. Reg. 49245). The USFWS determined that since this plant species occurs in hard-to-reach habitats, it is likely that its distribution is even broader than the confirmed locations, and that its natural preferred habitat limits the likelihood of human-related impacts.

- **Utah (Desert) Valvata snail *(Valvata utahensis)* (75 Fed. Reg 52272)** – In 2010, the Utah Valvata snail was delisted on the basis of new information. At the time of listing in 1992, the species was believed to occur in only "a few springs and mainstream Snake River sites" at, isolated points along the Snake River. The species was delisted after data showed that the species range extended an additional 122 miles beyond the initially identified range (an increase in the known range of 118.5%). The USFWS determined that due to the increased range of the species, the listing factors would not contribute to the likelihood of the species being threatened with extinction in the foreseeable future. Among the threats discussed, impacts to its habitat from agricultural and industrial purposes were excluded as threats because "the species persists in these varied mainstem Snake River systems, including impounded reservoir habitats" (75 Fed. Reg. 52280). **This distinction is critical because despite the continued presence of previously perceived threats, the proven ability of the species to continue to thrive in those conditions supported delisting.**

Since listing in 1998, a significant amount of new scientific and commercial information has become available that demonstrates *T. reyesi* occurs in significantly more locations than originally believed. Given the vastly increased number of known localities occupied by the species, many of which are protected, the perceived threats believed to apply to the species are not of a magnitude or intensity that is likely to cause the extinction of the species now or in the foreseeable future. The circumstances of *T. reyesi* are similar to those in the examples above, where the consideration of new populations or occupied sites prompted the USFWS to delist. Like the Utah Valvata snail, *T. reyesi* has also demonstrated the ability to persist and thrive in conditions where the USFWS assessment of threats should indicate a decline or extirpation (*see* section 5.2.1 for examples). This new information supports the conclusion that the protections of the ESA are no longer warranted for *T. reyesi* since the existence or magnitude of threats to the species, or both, do not support a conclusion that the species is at risk of extinction now or in the foreseeable future.

5.0 JUSTIFICATION FOR THE PETITIONED ACTION

Herein, the Petitioners present and analyze the credible scientific or commercial information that would lead a scientifically accurate species status review to conclude that delisting of *T. reyesi* may be warranted. The following assessment shows that *T. reyesi* is not at risk of extinction in the foreseeable future and therefore should be delisted.

5.1 DISTRIBUTION AND RANGE

The known distribution and range of *T. reyesi* has increased substantially since the time of the 1988 listing. At the time of listing, *T. reddelli* was known to occur in five or six caves (Tooth Cave, Bee Creek Cave, McDonald Cave, Weldon Cave, Bone Cave, and possibly Root Cave; of these, all but Bee Creek Cave were later confirmed to contain *T. reyesi*) with a range that included approximately 75 square miles (21–31 linear miles). By the release of the 1994 Recovery Plan, the USFWS recognized 60 caves with confirmed occupancy by *T. reyesi*, and nine additional caves believed to be occupied by *T. reyesi* pending taxonomic confirmation. These caves represented a range of 135 square miles, an increase of 60 square miles. By 2009 when the Five-Year Review was completed, the USFWS recognized 168 known localities for *T. reyesi* with an approximate range of 190 square miles (Figure 1).

One cave, the Barker Ranch Cave No. 1 has been identified by the USFWS as being occupied with *T. reyesi*. However, for the purpose of this petition and the scientific record for the species, this cave should not be considered a *T. reyesi* site location. Given the distribution of other occupied *T. reyesi* caves, Barker Ranch Cave No. 1 is a clear outlier, being found 16.5 miles farther south than any other known occupied cave. Further, and most importantly, the specimen was likely misidentified. The identification was based on the collection of a single juvenile specimen collected in 2000 (Ubick and Briggs 2004:108). Ubick and Briggs specifically state in their report that records of females and juveniles are only tentatively identified to species. Without DNA verification, which Ubick and Briggs did not perform, it is not possible to determine that a juvenile specimen is in fact *T. reyesi*. Given these factors, it is extremely unlikely that this specimen is *T. reyesi*. It is more likely that this juvenile belongs to the species *Texella mulaiki* which Ubick and Briggs identify as being the predominate species in southern Travis County in the vicinity where this juvenile specimen was collected. While further investigation is certainly warranted at this site, the Barker Ranch Cave No. 1 record for *T. reyesi* should be considered in error and is excluded from the analysis of the species' current status in this petition.

Nevertheless, the current body of scientific and commercial information indicates that *T. reyesi* is widely distributed across a range that is now known to encompass approximately 148 square miles, 5 KFRs, and at least 172 known localities (167 confirmed in the Five-Year Review, excluding Barker Ranch Cave No. 1, and including an additional five sites verified by ZARA in 2010). Therefore, the known distribution of *T. reyesi* (as measured by the number of known occupied localities) has expanded by approximately 3,340% over a period of 25 years. The discovery of new localities has occurred at an average rate of approximately 7.59 new sites per year (based on 167 new localities discovered between 1988 and 2010). This increase in range and known localities is depicted in Table 2 and Figure 1.

Table 2. *T. reyesi* Known Localities and Range Over Time.

Year and Source Document	Known Occupied Caves	Known *T. reyesi* Range
1988 (Final Rule)	5-6	75 square miles
1994 (1994 Recovery Plan)	60-69	135 square miles
2009 (Five-Year Review)	168	190 square miles
2014 (Delisting Petition)	172	148 square miles

Appendix C includes a comprehensive list of known occupied caves with *T. reyesi* as of the 2009 Five-Year Review or that have been subsequently confirmed to contain the species. Most of these currently known localities are shown in Figure 1. However, the precise locations of some occupied localities are no longer known or are not publicly available and are either not included on Figure 1 or are shown as only approximate locations.

This increase in known distribution clearly represents an expansion of our understanding of the species range rather than a true expansion of the *T. reyesi* population. Consequently, we now know that the analysis of threats in the 1988 final listing rule was based on extremely limited information that was premised on an erroneous understanding of the species' range as being restricted to no more than five or six locations distributed across approximately 75 square miles along the edge of the Edwards Plateau (the only known occurrences of the species at that time, one of which was actually *T. reddelli*).

The significant increase in known localities of *T. reyesi* is a consequence of increased survey effort over areas of potential habitat. The full extent of potential habitat for *T. reyesi* where the species has a possibility for occurrence may be approximated by the area of Karst Zones 1 and 2 delineated by Veni (1992, as updated in 2007). These karst zones encompass approximately 125 square miles across the

known range of the species and it is extremely likely that within this area, more caves will be discovered. Further, this area supports extensive mesocavernous space (interstitial space) likely occupied by the species in areas not accessible to biologists. The USFWS provided a 100-acre buffer around occupied caves in the critical habitat designation for karst invertebrates in Bexar County to account for "subsurface karst deposits, the cave footprint, surface and subsurface drainage areas, a cave cricket foraging area, and, where possible, at least 100 acres (40 ha) of undisturbed or restorable vegetation" (77 Fed. Reg. 8461). This represents an area designed to include mesocavernous space under the ground that is not included in the cave footprint itself and therefore, should be included in calculations of available habitat. Given the use of mesocavernous space in regulatory considerations, these areas must be considered in the evaluation of occupied habitat.

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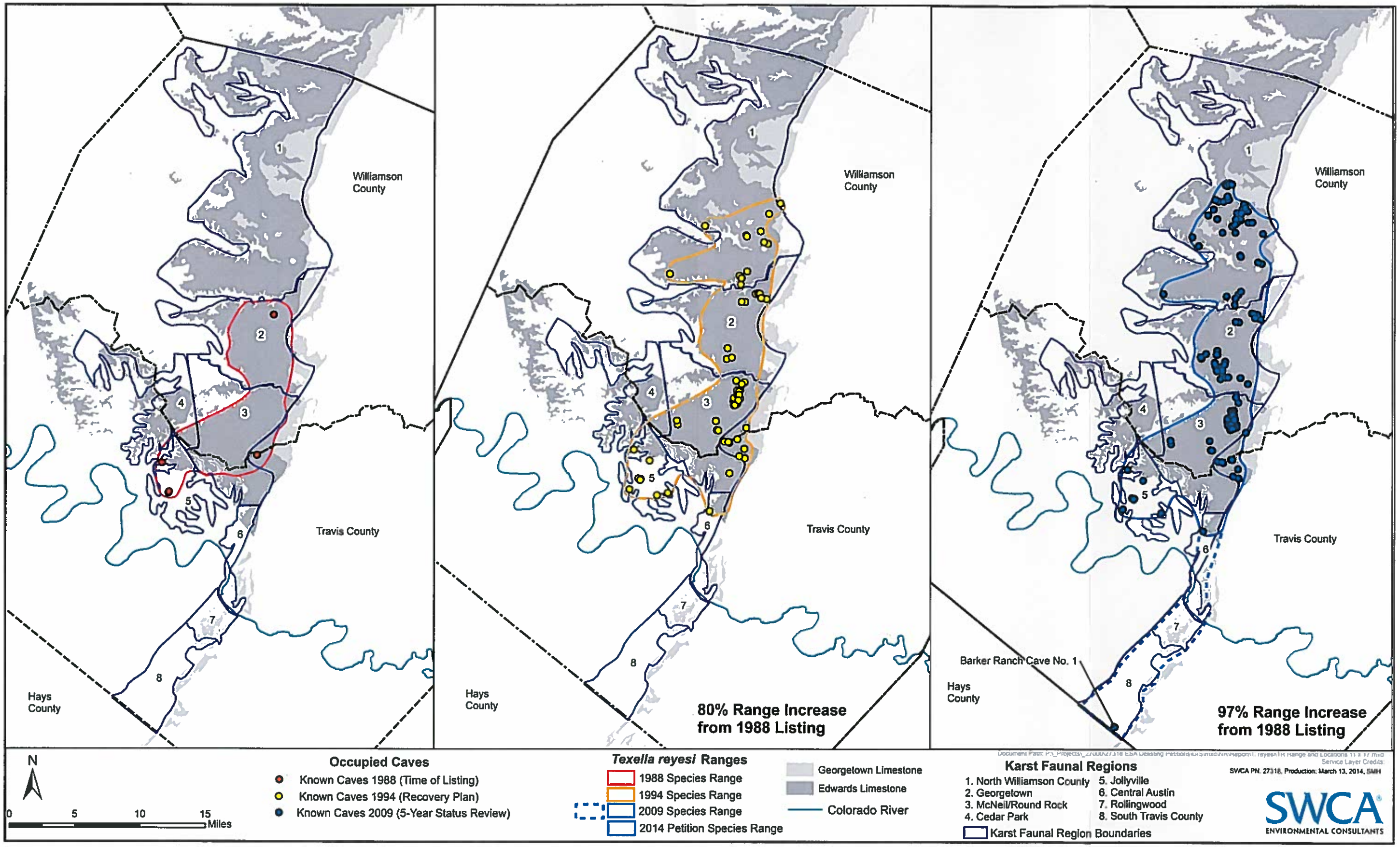

Figure 1. *T. reyesi* known localities and distribution over time.

Therefore, a review of the best available scientific and commercial data indicates that *T. reyesi* is not restricted to a small number of isolated caves as purported in the 1988 listing rule, but is instead a relatively wide-ranging occupant of karst habitats across at least 148 square miles of Travis and Williamson counties. The species has been and continues to be found in new locations across areas of potential habitat as more survey work is conducted, both within known caves subject to additional survey effort and within newly discovered caves across its range. While much of this distribution and range information is acknowledged by the USFWS in various publications, the USFWS has failed to quantify and address the implications of this increasing body of information in any status review completed subsequent to the final listing rule. The heavy reliance of the USFWS on this "extremely limited" range and distribution to justify the final listing rule substitutes surmise and opinion for scientific data.

The Petitioners believe that the new distribution and range information available since the time of listing warrants a complete reevaluation of the relevance of the listing factors and the magnitude of the threats to the species to reach an appropriately informed decision about whether or not the continued protection of the ESA is necessary to prevent the extinction of *T. reyesi*.

5.2 Analysis of Listing Factors

As previously discussed, known populations of *T. reyesi* have increased from five confirmed locations to at least 172 known locations—an increase of 3,340 percent. This increase in known population is comparable in extent to delisting examples described earlier for several other species. However, when conducting the 2009 Five-Year Review of *T. reyesi*, the USFWS completely failed to evaluate these new scientific and commercial data in light of the listing factors.

Analysis Framework and Examples

The ESA does not identify a minimum population or range size that must be achieved and maintained to warrant delisting. A listing or delisting determination is to be based entirely on the risk of species extinction from any one or a combination of the five factors provided in the ESA. This distinction is critical because even in cases where there is only one known locality for a given species, if that locality is not subject to any of the five listing factors, listing under the ESA is not warranted. For example, in 2005, the USFWS made the determination not to list the greater and lesser Adams cave beetles (*Pseudanopthalus cataryctos)* after a Candidate Conservation Agreement with Assurances (CCAA) (TE-088168-0) was approved by the USFWS that effectively eliminated all concerns that may have been realized pursuant with the listing factors. This determination was made despite the two beetles only having one known locality and the CCAA only including 1 acre of land.

The CCAA, approved by USFWS, states that "contributions to this CCAA are expected to alleviate these threats by controlling the identifiable, potential sources of those threats" (Southern Conservation Corp. 2005:3). The USFWS determined that "these conservation efforts will reduce or eliminate the threats to the survival of the two beetle species, precluding the need for listing them under the ESA" (MacKenzie 2005). In this case, the USFWS determined that because the species were protected under a conservation agreement, none of the listing factors were considered likely to result in extinction for the species in the foreseeable future despite there being only one known occurrence of the two species. This example shows how species that do not meet any of the listing factors must be delisted regardless of the known range of the species.

In 2006, the USFWS made the controversial decision not to list the Cerulean warbler. While conservation groups lead by the Southern Environmental Law Center and the National Audubon Society cited concerns that habitat had been lost and modified enough to warrant listing, the USFWS ultimately determined that listing was not necessary because "the species is unlikely to be in danger of extinction in the foreseeable future" (Parham 2006). This determination acknowledged that the population of the species is declining,

however similarly determined that the rate of decline was slow enough that the species population would ultimately "number in the tens of thousands 100 years [from the time of the ruling]" (Parham 2006).

The example of the Cerulean warbler and others enforces the application of the definitions and terms outlined in the ESA. "It is the Act's definitions of endangered (i.e., "in danger of extinction throughout all or a significant portion of its range") and threatened (i.e. "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range") that provide the applicable standards for determining whether a species has "recovered" (Goble 2010:72). Critical to note is that the Cerulean warbler was shown to be declining but deemed not warranted for listing. In contrast, the known localities for *T. reyesi* have increased substantially without any indication of species decline, which should similarly support a determination that the protections of the ESA are not warranted. If the listing factors do not indicate that a species is likely to be threatened with extinction in the foreseeable future, the species should not be listed.

Listing Factor Analysis

Since the Five-Year Review failed to adequately address the listing factors, the Petitioners provide the following analysis of the listing factors as they apply to the *T. reyesi* based on the best currently available scientific and commercial data. This analysis conclusively shows that the listing factors when discussed in the specific context of *T. reyesi* do not warrant the continued listing of the species. Previous actions by the USFWS, such as the decisions not to list the Adams Cave beetle and Cerulean warbler, support the petitioned action as consistent with the application of the ESA and similar consideration should be afforded *T. reyesi.*

5.2.1 Listing Factor A: The present or threatened destruction, modification, or curtailment of habitat or range

The 1988 Final Rule states that "the primary threat to the five species comes from potential loss of habitat owning to ongoing development activities" (53 Fed. Reg. 36031). In listing this threat, the final rule provides no evidence supporting this claim. While there has been minimal scientific research on the actual impacts of development on cave habitats, there are many examples where *T. reyesi* has continued to persist alongside development activities. There is no evidence that development activities have led to a significant reduction in the population size or distribution of *T. reyesi* across all or a significant portion of its range. In fact, despite development, the number of known localities of the species has steadily increased since listing. This refutes the USFWS assertion that development, particularly given the number and distribution of currently protected *T. reyesi* localities, is a threat to the continued existence of the species.

There are at least five well-studied examples of occupied caves that have remained occupied despite occurring near areas with typical development. The caves include Inner Space Caverns, Sun City (multiple caves), Weldon Cave, Three-Mile Cave, and Four-Mile Cave. In these instances, biologists have observed that development has not resulted in a decrease in *T. reyesi* abundance, and in some instances, it appears that human activities may have had a positive impact on population numbers. At the very least, these examples show that in lieu of peer-reviewed scientific studies demonstrating significant negative effects of development on cave habitats and occupancy by *T. reyesi*, there is ample documentation that the extreme caution recommended by the USWFS is not warranted. It is critical to note that these examples represent only a few of the known caves that occur in and around developed areas and support the ability of *T. reyesi* to persist despite proximity to these activities.

- *Inner Space Caverns:* Inner Space Caverns in Williamson County was discovered in 1963 during construction of Interstate 35 when a core drilling team for the Texas Highway Department drilled

through 40-feet of limestone to discover the cave. In 1966 the cave was opened to visitors and currently receives approximately 100,000 visitors annually for guided tours throughout various reaches of the cave. The cave has been equipped with walkways, electrical lighting, and other conveniences for visitors.

In 2007, biologists surveyed the cave for troglobitic species (SWCA 2007, unpublished data). From previous surveys (Reddell and Finch 1963, Elliott and Reddell 1989 and 1991, Chandler 1992, Gertsch 1992, Ubick and Briggs 1992) it was known that at least ten troglobites were found in the cave, including *T. reyesi*. Given the assumptions identified by the USFWS in its final rule, the discovery, modification, and commercialization of Inner Space Caverns should have resulted in the extirpation of *T. reyesi* from this location. Contrarily, surveys conducted in 2007 showed a continued presence of *T. reyesi* at the site and SWCA Environmental Consultants (SWCA) biologists noted that the species appeared to be more abundant in the "developed" parts of the caves where there has been artificial lighting, walkways, and a constant flow of tourist traffic for more than forty years.

While no formal survey effort has occurred at Inner Space since 2007, SWCA-permitted biologists have observed *T. reyesi* occupying a light fixture control box in the cave during every visit these biologists have made to the cave (at least annually), with the most recent observation occurring in the spring of 2013 (Dr. Kemble White, personal communication 2014). **Therefore, there is no evidence that 40 years of access to, and modification of, the cave environment presents a direct threat to the species in the cave.**

While the Petitioners do not intend to imply that all caves should be developed and/or used for commercial activities, it should be acknowledged that human presence in and around a cave alone does not necessarily result in discernible threats to the species. Inner Space Caverns provides a strong example since this cave has experienced extensive development—it is located under a road, under train tracks, the inside of the cave has been paved, it receives significant human visitation, it has electrical lines that have been installed throughout to power lights, etc., and biologists continue to identify *T. reyesi* on every visit to the cave.

- *Sun City:* In 1995, development began on a residential subdivision known as Sun City, Texas. Development activities at Sun City were expected to last for twenty years and include 5,600 acres. The development is currently on-schedule with its construction goals. The Sun City property includes 95 caves, of which 26 are known to contain federally listed species. All of the caves on the property have been inspected for karst fauna. *T. reyesi* occurs in at least 25 of these caves. In 1995, the USFWS approved a management plan for a complex preserve system on the property that includes regular management, monitoring, and biological inspections. No Incidental Take Permit was provided by the USFWS for the development. Rather, the preserve management system supported the use of an avoidance plan that facilitated a no-take determination from the USFWS. Eleven caves have been monitored regularly since 1995 and data through 2000 are currently available to the Petitioners. In 2000, after five years of development activity, an additional survey of all the caves was conducted.

  Interestingly, the 2000 survey found that one cave located in the center of the golf course with extensive development all around (Kiva Cave No. 1) showed a "slight (but probably not statistically significant) increase in fauna" and has consistently been the most dependable cave for *T. reyesi* surveys (Reddell 2000:3; Dr. Kemble White, personal communication 2014). Another cave in a developed area (Holler Hole Cave) showed some minor signs of decline that were attributed to a prolonged period of drought and the presence of Ashe juniper above the cave. The remaining caves are outside of the developed areas of the property, and have shown variability in the amount of fauna detected throughout the years of monitoring. Ultimately, monitoring reports

indicate that there has not been any substantial negative change in the populations of cave fauna across the entire property since the monitoring began, despite an increase in nearby development activities. "The conclusion to be drawn from these studies is that the fauna of the caves has not been adversely affected by construction or other activities on Sun City. Biodiversity in many cases has increased and in none is there any indication that is has decreased" (Reddell 2000:4). This clearly supports the no-take determination made by the USFWS prior to the project beginning.

Looking toward the future, Reddell additionally determined that "there is no reason to believe that development of Sun City will lead to harm to the cave fauna" (Reddell 2000:4). While more recent survey data is not publically available, biologists working in Sun City continue to regularly observe *T. reyesi* during annual surveys on the property (Dr. Kemble White, personal communication 2014).

- *Weldon Cave:* At the time of the 1988 listing, concern was expressed over Weldon Cave, a known occupied cave for *T. reddelli* (and later identified as a *T. reyesi* occupied site), that due to a recent road extension and neighboring residential development, the cave "may no longer exist" (53 Fed. Reg. 36031). Despite these identified threats in 1988, in 2009 when developing the Five-Year Review, USFWS identified Weldon Cave as a high potential KFA site. This was the only example of potential development related impacts to the *T. reddelli* presented in the final rule and after 25 years, these threats have not been realized and Weldon Cave remains a viable cave for the species. This cave alone provides ample evidence that the threats leading to listing were seriously overstated at the time.

- *Three-Mile Cave and Four-Mile Cave:* Both of these caves are located under State Highway 29 west of Georgetown in Williamson County, and both were confirmed as occupied by *T. reyesi* through survey efforts conducted by SWCA in 2008 and 2009 respectively. The entrances to both of these caves are in close proximity to the highway, and the features themselves extend below the highway in both cases. Four-Mile Cave was inaccessible prior to 2009 survey efforts as the entrance had been blocked off with large boulders, likely to deter vandalism and trespassing. The interior walls of the cave have been covered in historic graffiti (estimated to be from the 1890s, 1920s, and 1950s) showing that prior to the entrance being blocked off it was frequented by human visitors. Despite this confirmed historical use and close proximity to the five-lane highway (the entrance is within the drainage ditch of the east bound lanes of the highway), the cave remains occupied by *T. reyesi* (Dr. Kemble White, personal communication 2014).

The initial determination provided in the 1988 final rule for the species provided an extremely limited and unsupported case for the impacts caused by development. The one example that was provided in 1988 has been disproven. If one considers the current evidence regarding this listing factor, there are several examples that show the species' ability to coexist with development. The 26 years since the initial listing have offered several opportunities for there to be quantifiable evidence to show the impacts of development, and no strong negative correlations have been confirmed. Examples like Inner Space Caverns, Sun City, and Weldon Cave are only a few showing that impacts of development are likely not as significant to the species as was anticipated in the 1988 final rule.

The lack of legitimate threats is further supported by the use of mesocavernous space by the species. *T. reyesi* is consistently found in the dark parts of caves. According to Ubick and Briggs (1992:211), "in all instances they have been found only in the more remote parts of the caves, [and] none have been found in twilight, with the exception of the single juvenile from Comanche Trail Cave." This supports the results of surveys conducted in Sun City that have shown that the species seems likely to retreat deeper into caves under dry surface conditions such as the presence of drought and excessive drying vegetation (like juniper). It is likely that this behavior has limited the amount of available scientific data on the species as

much of the available *T. reyesi* habitat is not accessible to biologists. While *T. reyesi* has been documented as occurring at 172 localities, the true extent of the habitat for this species is likely to include much of the 125 square miles of Karst Zones 1 and 2 mapped within the range of the species.

This use of mesocavernous spaces by karst invertebrates was not considered at the time of the 1988 listing. At that time, it was believed that each of the species listed occurred in "small, shallow, dry caves" (53 Fed. Reg. 36029). The final rule additionally described the occupied caves as "isolated islands" indicating that they were "separated from one another when stream channels cut through the overlying limestone to lower rock layers" (53 Fed. Reg. 36030). While this continues to be a growing area of study, there is evidence that supports the characterization of mesocavernous spaces as occupied habitat. This concept is supported in the Five-Year Review by the USFWS claim that "troglobitic habitat includes caves and mesocavernous voids in karst limestone (USFWS 2009:2).

Monitoring activities on the Sun City Preserve have "demonstrated that opening of previously filled caves leads to an increase in population size for troglobitic species" (Reddell 2000:4). Monitoring activities also indicate that at any given cave, *T. reyesi* may not always be identified during a survey. Sun City surveys indicated that in some cases, "one or more species may be extremely abundant on one date but rare or absent on another. At the same time, other species on the same dates may be rare or absent." (Reddell 2000:4). With this in mind, it is critical to note that simply because one survey does not produce any specimens of *T. reyesi*, a negative survey result does not preclude that cave from being occupied habitat. Research at Sun City found that it was less likely that *T. reyesi* would be detected in caves during dry seasons or periods of drought. Reddell posits that *T. reyesi* retreats deeper into the caves and/or utilizes the mesocavernous spaces where the habitat maintains more moisture. This trait not only complicates routine surveys for the species, but mitigates many potential threats to the species since they are able to retreat to other habitats as climactic and surface conditions warrant.

USFWS karst invertebrate collection protocols were developed specifically with this behavior in mind. According to existing karst invertebrate survey requirements, "notable differences in species abundance have been observed within as little as a week within caves that cannot be accounted for by rainfall or other surface condition" (USFWS 2011:11). For this reason, survey protocols include multiple survey efforts (a minimum of 3 as of 2011) to determine presence/absence.

The documented use of mesocavernous space by *T. reyesi* is significant because the full range and extent of these underground habitats cannot be fully known by scientists. Further, these areas are significant in relation to species survival because they are geologically protected from development and other activities that may occur on the surface or near the humanly accessible openings of occupied caves. Given the approximately 125 square miles of potential underground mesocavernous space within Zones 1 and 2 of the species' range, it is extremely likely the species is able to retreat into these mesocavernous spaces to avoid unfavorable conditions and continue to thrive (Veni and Associates 1992; USFWS 2009). This is further supported by the presence of *T. reyesi* in caves that were previously unoccupied or sealed (for example, caves previously discussed in Sun City).

5.2.2 Listing Factor B: Overutilization for commercial, recreational, scientific, or educational purposes

Overutilization was not considered a significant threat at the time of listing and there is no evidence that a current threat of this sort exists. Rather, the continued presence of the species in well-documented caves (such as Inner Space Caverns which is subject to extensive use for commercial purposes with an arguably positive benefit to the species) supports the premise that overutilization is not a current or potential threat to the species.

5.2.3 Listing Factor C: Disease or predation

In Texas, no endangered species have been known to become extinct because of red imported fire ants (RIFA) (Drees 2002). Without significant evidence, RIFA have been generally considered a major threat to endangered karst invertebrates in Bexar, Travis, and Williamson counties. Long-term impacts of RIFA on karst invertebrates or their habitat have never been quantified or scientifically tested, instead, they have simply been assumed to have a major impact. The literature related to the interaction of RIFA and karst invertebrates is based solely on anecdotal evidence, professional opinion, unpublished technical reports, and other non-peer-reviewed literature of questionable reproducibility.

Short-term impacts on RIFA on some invertebrate communities have however been reported. In response to the delisting petition in 1993, the USFWS cited a 1990 study showing the disruption of above ground arthropod communities by RIFA that was conducted during the initial invasion of RIFA in Travis County, Texas by Porter and Savignano. Porter and Savignano (1990) demonstrated that RIFA dramatically reduce arthropod abundance and species richness soon after infestation of RIFA to an area. They found that native ant species richness was 70 percent less in infested areas and overall arthropod species richness was 40 percent less in infested areas than un-infested areas. While the results of this study would seem to indicate that RIFA do have a negative impact on the species, a subsequent study by Morrison in 2002 revisited the Porter and Savignano (1990) study area 12 years later and replicated their study. Morrison (2002) found that arthropod communities had rebounded to pre-RIFA-invasion levels and that all measures of native ant and other arthropod species' diversity had returned to pre-invasion levels. RIFA were still the most abundance ant species, but not nearly as abundant as during the initial RIFA infestation. He concluded that the impacts to arthropod communities by RIFA might be greatest during and shortly after the initial RIFA invasion but long-term impacts are likely not as significant as once believed. This subsequent study is not acknowledged by the USFWS in any of their evaluation of the status of *T. reyesi*, but represents new scientific information, including refutation of previous conclusions regarding the susceptibility of *T. reyesi* to RIFA infestations.

RIFA have been in found in parts of Bexar and Bell counties since about 1960, Comal County since about 1976, and Travis, Williamson, and Hays counties since about 1980. All of these counties contain caves with karst invertebrate species. No doubt RIFA, along with other native species occasionally forage on *Ceuthophilus* cave crickets, and on rare occasions, karst invertebrates. Despite this, as previously discussed, Morrison found that surface arthropods communities in Travis County are able to successfully rebound after the initial infestation. Moreover, after approximately 45 years of infestation of RIFA in Bexar County, karst invertebrates are still present in Bexar County karst preserves.

A biological study of karst features on Sun City, Texas in 2000 conducted by James Reddell observed that RIFA had invaded every cave on the property, however Reddell determined that "no direct predation has been observed on either *T. reyesi* or the Coffin Cave mold beetle (*Batrisoides texanus*), but ants have been observed feeding on cave cricket nymphs and both species of troglobitic millipede" (Reddell 2000:8). Despite RIFA being present, there has not been a decline in the known populations of *T. reyesi* on the property.

In 2006, SWCA conducted an investigation in an attempt to describe cave cricket, RIFA, and other species interactions at potential food sources around caves within six of the seven La Cantera preserves. This was based on the assumption that even if RIFA do not actively feed on the troglobitic *Cicurina* species in Bexar County, they may still be threatened through competition created between RIFA and the cricket food source. To conduct this study, freeze-killed crickets (*Acheta domestica*), Texas persimmon (*Diospyros texana*) fruit, store-bought spinach, native organic matter, and water bait stations were used to observe forage preferences of cave crickets and other species.

Arthropods observed foraging around cave entrances at bait stations are listed from most common to least common and included big-headed ants (*Pheidole dentata*), carpenter ants (*Camponotus castaneus*) (ant identification confirmed by Texas A&M), cave crickets (*Ceuthophilus* spp. mostly *secretus*), daddy long-legs (*Leiobunum townsendii*), RIFA, and various beetle species. Freeze-killed crickets were favored by big-headed ants, carpenter ants, daddy long-legs, cave crickets, and RIFA. Texas persimmon fruit was the next most favored food item and was primarily favored by big-headed ants, carpenter ants, cave crickets, and various beetles. Big-headed ants were usually the first to arrive at bait stations.

At bait stations, competition between cave crickets and daddy long-legs was sometimes observed, especially when daddy long-legs emerged first from a cave and "beat" cave crickets to bait stations. Competition was also observed between big-headed ants and carpenter ants. No major competition between RIFA and other arthropods was observed; though, this was likely due to low RIFA numbers and would have very likely been observed if RIFA numbers were higher. Interestingly, RIFA were only observed at freeze-killed cricket bait stations on the largest 75-acre preserve; though, RIFA were outnumbered by big-headed ants.

Competition was commonly observed between native big-headed ants and cave crickets. If freeze-killed crickets were placed at stations too early in the evening before the cave cricket emergence, big-headed ants would remove all of the freeze-killed crickets and leave nothing for cave crickets or other animals. If no big-headed ants were foraging at freeze-killed cricket bait stations, cave crickets would "casually" graze at the stations. When big-headed ants arrived at bait stations occupied by cave crickets, cave crickets would be "chased off". If the cave cricket was large enough, it would often leave with a freeze-killed cricket in its mandibles when it was chased off. When big-headed ants were occupying freeze-killed cricket bait stations before cave crickets (as was the case most of the time), larger cave crickets would sometimes jump in and "steal" a freeze-killed cricket (sometimes unsuccessful) and immediately jump away from the big-headed ant infested bait station. Smaller cave crickets, though often attempted to grab a freeze-killed cricket, were often not large enough to grab a freeze-killed cricket and were "chased off" by big-headed ants. What these observations indicate is 1) many organisms, including native species, compete with cave crickets, 2) cave crickets can cope with competition by leaving with or "stealing" food items from competitors, and 3) availability of food sources for cave crickets, such as dead and dying arthropods and other high protein food sources, is dependent on the availability of food sources at the time of the cave cricket emergence—food items available too early may be foraged upon by diurnal or crepuscular species and not available for cave crickets.

In San Antonio, SWCA has been actively managing the La Cantera cave preserves since their protection in 2001. One management objective has involved regular monitoring of RIFA and bi-annual biological surveys of cave fauna at each cave on the preserve. For the 2012 La Cantera Preserve Annual Report (submitted to the USFWS), SWCA (2013) conducted an evaluation of over ten years of collected scientific data, not finding any correlation between the rate of occurrence of RIFA and the populations of cave crickets or federally listed *Cicurina* spiders identified during surveys, refuting arguments that RIFA is a significant threat.

In summary, predation or competition by RIFA has not been shown to have a lasting negative impact on populations of *T. reyesi* or the ability of the species to persist in areas that also contain RIFA. Therefore, this purported threat is not of significant magnitude to push the species towards extinction in the foreseeable future.

5.2.4 Listing Factor D: The inadequacy of existing regulatory mechanisms

In 2003, the USFWS published in the Federal Register its final Policy for Evaluation of Conservation Efforts When Making Listing Decisions, the "PECE Policy" (68 Fed. Reg. 15100, March 28, 2003). The PECE Policy is the USFWS guide on how to evaluate formalized conservation efforts (e.g., conservation

agreements, conservation plans, management plans, and similar documents approved by Federal agencies, state and local agencies, businesses, organizations, or individuals) when deciding whether or not to list a species. As defined by the PECE Policy, "conservation efforts" are "specific actions, activities, or programs designed to eliminate or reduce threats or otherwise improve the status of a species. [They] may involve restoration, enhancement, maintenance, or protection of habitat; reduction of mortality or injury, or other beneficial actions" (68 Fed. Reg. 15113).

Existing Preserves and Protected Habitats

A desktop review of existing public and private preserve lands, lands protected via Section 10 and Section 7 consultations, and other relevant land management activities identified approximately 94 occupied caves for the *T. reyesi* that are currently under some form of protection from land development and/or receive regular management. This represents more than one-half of all known occupied localities of the species recognized by the USFWS, and includes protected caves throughout the entire known range of the species. Among these protected caves are three additional KFAs recognized and approved by the USFWS since the Five-Year Review of *T. reyesi*. The four currently recognized KFAs that fully protect *T. reyesi* are the Twin Springs Preserve, Cobbs Cavern Preserve, Priscilla's Well Preserve, and Karankawa KFA.

In addition to the four accepted KFAs, there are 28 de facto KFAs acknowledged by the USFWS in the Five-Year Review. These caves have the potential to meet the minimum geographic requirements for a KFA but may not have the required management structure. Some meet both criteria but have yet to be formally accepted as KFAs.

- Polaris Cave
- Shaman Cave
- Pow Wow Cave
- Red Crevice Cave
- Temples of Thor Cave
- Thor Cave
- Jensen Cave
- Lobo's Lair
- Wolf's Rattlesnake Cave
- Round Rock Breathing Cave
- Steam Cave
- Fence-line Sink
- Blessed Virgin Cave
- Raccoon Lounge Cave
- WS-54
- WS-71a
- WS-65310
- Chaos Cave
- Rockfall Cave
- Weldon Cave
- Gallifer Cave
- Tooth Cave
- McDonald Cave
- Stovepipe Cave
- MWA Cave
- Eluvial Cave
- Jollyville Plateau Cave
- Beard Ranch Cave

The significant number of permanently protected *T. reyesi* localities indicates that the species is not likely to return to a vulnerable status following delisting.

The current KFAs have been recognized through regulatory action by the USFWS. For example, in the 2011 Biological Opinion for State Highway 195 in Williamson County (Consultation No. 21450-2006-F-0132) incidental take of six *T. reyesi* occupied caves was authorized following the determination that no jeopardy of the species would occur. This decision depended upon the existence of previously preserved caves, specifically within the North Williamson County KFR. The USFWS determined that "if Cobbs Cavern is purchased and preserved, there will be three KFAs within this KFR, meeting recovery criterion 1 for this species" (Mowad 2011). At the time, the acquisition of Cobbs Cavern was underway and has since been finalized. This conclusion by the USFWS confirms that the presence of preserved areas eliminates the threat of jeopardy to the species.

Including the approved KFAs and the recognized de facto KFAs, there are at least 94 occupied caves spanning the entire range of the species that are currently afforded protection. It is likely that more known localities are protected through efforts not identified in the initial desktop review. Caves identified during the desktop review with protections and management activities are indicated in Figure 2 and described in Appendix A. These are not exhaustive lists, as more caves with undisclosed locations and management activities likely exist across the region.

City of Austin Regulations

The City of Austin has in place regulatory programs/mechanisms for protection of water quality, recharge features, and karst areas which have the benefit of providing protection of suitable habitat for karst invertebrates, including *T. reyesi*. These protections cover approximately 63,344 acres (approximately 67 percent) of currently known *T. reyesi* range.

Pursuant with Section 1.3.0 of the City of Austin Environmental Criteria Manual, an environmental assessment and City developed Critical Environmental Feature Worksheet is required any time proposed development activities occur near a karst feature. These activities require the identification of proposed protective measures for the feature, including proposed setbacks from the feature. Caves are defined by the Manual as "underground voids large enough for an adult to enter" and a standard setback of a 150- to 300-foot radius around the feature is required. Further, any activities must preserve all natural characteristics of the feature. The same regulations apply to sinkhole and recharge features.

To ensure compliance with these regulations, "all work must stop if a void in the rock substrate is discovered which is; one square foot in total area; blows air from within the substrate and/or consistently receives water during any rain event" for the completion of a geological assessment (P-1). These measures offer protection to karst features and *T. reyesi* habitat throughout the City of Austin in both known occupied and presumably unoccupied caves, and this protection will still be enforced regardless of the listing status of *T. reyesi*. The use of buffer zones protects the cave habitats from exposure to contaminants and disruption from direct development activities.

The City of Austin further expanded this ordinance in 2008 through the Void and Water Flow Mitigation Rule (adopted April 22, 2008) requiring that a licensed geologist be present at least once per day during all trenching operations and to inspect sites for sensitive features prior to any backfilling. In the event a feature is discovered, prior to any work proceeding, mitigation must be proposed and approved by the City of Austin through a permitting process. Void mitigation was adopted by the City of Austin to "preserve the hydrologic function of the void, maintain recharge paths to springs, creeks and wells, isolate the void from potential contaminants, maintain the structural integrity of the void and adjacent utilities and buildings, and to protect the Edwards Aquifer" (Pope 2009). These efforts offer protection and mitigation for all void spaces meeting the specifications and therefore afford protection to the mesocavernous spaces that may potentially be occupied by *T. reyesi* as well as open caves.

Section 1.3.4 requires that a Pollution Attenuation Plan be completed for all industrial development projects "not enclosed in building" (Section 1.3.4). The City of Austin requires the Pollution Attenuation Plan in addition to other state and federal permitting requirements (such as the TPDES permit and other related TCEQ permits). This provides an extra level of review to ensure that implemented procedures are conducted in the most environmentally sustainable way.

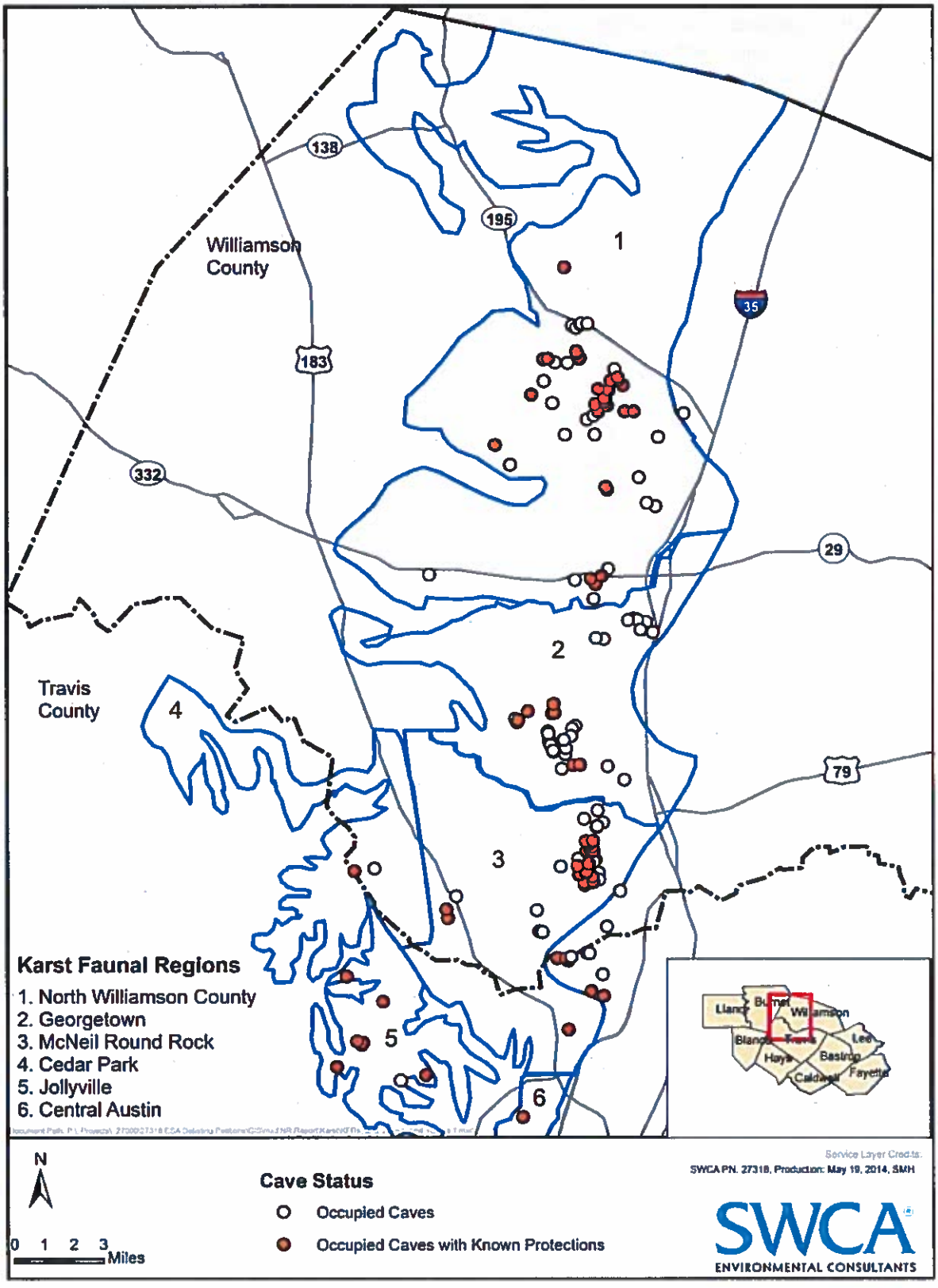

Figure 2. Occupied *T. reyesi* caves with known protection and/or management activities.

Collectively, these measures reduce potential impacts to *T. reyesi* that may arise from pollution run-off into sensitive features in and around the City of Austin. The City of Austin also has an active Stormwater Management Plan that establishes criteria for the use of best management practices (BMPs) to minimize stormwater run-off into sensitive features. These measures reduce potential impacts to *T. reyesi* that may arise from pollution run-off into sensitive features in and around the City of Austin and provide regional protection to the species that extends beyond known occupied sites.

City of Georgetown Water Quality Management Plan

On December 20, 2013, the City of Georgetown adopted Resolution No. 122013-C adopting a Water Quality Management Plan (the "Management Plan") for the City. The goal of the Management Plan is specifically to protect the Georgetown Salamander and its habitat, but the benefits will extend to *T. reyesi* through measures across the City that will improve water quality. These measures include public education, illicit discharge detection and elimination, construction site stormwater runoff control, post-construction stormwater management in new development and re-development, and pollution prevention and good housekeeping for municipal operations. This plan provides further detail on how the City will comply with its MS4 permit, thereby reducing threats from the ongoing effects of urbanization and hazardous materials spills. This program also reduces sediment discharges and water quality.

These measures, like the City of Austin regulations, encourage the use of best management practices focused on preventing harmful materials from reaching known and potential *T. reyesi* habitat. The measures of the Management Plan afford protections to approximately 10,223 acres within the known range of *T. reyesi*.

Texas Commission on Environmental Quality Regulations

The Texas Commission on Environmental Quality's (TCEQ) Edwards Aquifer Rules (the "Edwards Rules") were enacted to prevent water quality degradation within the Edwards Aquifer and, thereby, to benefit public health, aquatic and terrestrial life, and the Texas economy. The stated purpose of the Edwards Rules is:

> that the existing quality of groundwater not be degraded, consistent with the protection of public health and welfare, the propagation and protection of *terrestrial* and aquatic life, the *protection of the environment*, the operation of existing industries, and the maintenance and enhancement of the long-term health of the state.

30 TAC § 213.1(1) (emphasis added). This set of rules includes a number of specific measures that significantly reduce threats to *T. reyesi* related to urbanization and construction activities; pollution of karst habitats from pesticides, fertilizers, and hazardous materials; and physical modification of surface habitats. Since the surface-connected caves and mesocavernous spaces that provide habitat for *T. reyesi* are also considered significant recharge features to the Edwards Aquifer, the conservation measures required by the Edwards Rules also directly benefit *T. reyesi*. The Edwards Aquifer Rules were significantly modified in 1999 to increase the protections afforded through these regulations. These amended rules reflect new conservation measures that have been implemented since *T. reyesi* was listed.

Among other things, the Edwards Rules require that for any construction-related activity occurring over the Edwards Aquifer, detailed studies and reports must be made and submitted, and certain BMPs be implemented. The BMPs under the Edwards Rules are specific measures designed to prevent pollution of surface and groundwater, maintain flow to naturally-occurring sensitive features, and provide erosion and sediment control. The BMPs include measures such as storm water detention ponds, grassy swales, buffers, and setbacks. The benefits to the *T. reyesi* from implementation of the Edwards Aquifer Rules

include the development and implementation of Edwards Aquifer Protection Plans (such as water pollution prevention plans, sewage collection system plans, and underground and aboveground storage tank facility plans), wastewater treatment and disposal system permits, optional enhanced measures for water quality protection, revised BMPs for quarry operations, measures for plugging abandoned wells and borings, prohibitions on certain types of activities over the recharge zone, and Contributing Zone plans. Each program is administered and enforced by the TCEQ and includes requirements for monitoring and reporting necessary to ensure that measures are implemented as required by the rules, with schedules and defined standards for implementation.

TCEQ's Texas Pollution Discharge Elimination System (TPDES) permitting program is designed to minimize sedimentation and contamination in surface waters by regulating stormwater runoff from construction sites. TPDES is authorized by the EPA as part of its National Pollution Discharge Elimination System (NPDES) for regulating point source pollution to waters of the United States. To be covered under the TPDES Construction General Permit, anyone disturbing 1 acre or more of land or part of a larger common plan of development that will disturb 1 acre or more of land must prepare and implement a Stormwater Pollution Prevention Plan (SWPPP) before discharging stormwater to any surface water in the State of Texas. The plan must describe the intended sequence of major activities that disturb soils for major portions of the site, estimate the total area of the site and the total area of the site that is expected to be disturbed, and describe which BMPs will be used to minimize pollution in runoff before, during, and after construction.

Development and implementation of a site-specific SWPPP minimizes the potentially adverse effects of surface runoff from construction. These plans significantly reduce the amount of sedimentation and related pollutants carried in stormwater runoff and thereby significantly reduce threats to the *T. reyesi* related to urbanization, hazardous materials spills, and construction activities. TCEQ assures the implementation and effectiveness of this program by required regular inspections for proper application of BMPs, personnel training for those working on construction sites, record keeping, and formal certification of BMPs implemented on-site.

Under the TPDES permitting program, TCEQ also administers EPA's Municipal Stormwater Program. Phase I of this program, begun in 1990, requires Municipal Separate Storm Sewer Systems (MS4s) in medium and large cities (or certain counties with populations of 100,000 or more) to obtain NPDES permit coverage for their stormwater discharges. Phase II, begun in 1999, requires regulated small MS4s in urbanized areas, as well as small MS4s outside the urbanized areas that are designated by TCEQ, to obtain NPDES permit coverage for their stormwater discharges. Each regulated MS4 is required to develop and implement a Stormwater Management Program (SWMP) to reduce the contamination of stormwater runoff and prohibit illicit discharges. Each SWMP must address six minimum control measures: public education; public involvement; illicit discharge elimination; construction sites; post construction pollution; and pollution prevention for municipal operations. The SWMP describes in detail which BMPs will be implemented to meet permit requirements.

The MS4 program reduces threats to *T. reyesi* from the ongoing effects of urbanization and hazardous materials spills by helping to ensure that stormwater runoff is relatively free from pollutants, including sediment from post-construction developments, illicit discharges of hazardous materials from individuals or businesses, and operations of municipal properties. This program also reduces physical threats to surface habitats in the form of reduced sediment discharges. The TCEQ has the authority to issue significant penalties (up to $27,500 per day) for non-compliance with MS4 permits.

Endangered Species Act

At least nine caves known to be occupied by the *T. reyesi* will continue to be afforded protections under the ESA, including all currently recognized KFAs, due to the presence of other listed species within the

same cave. In these instances, even if delisted, *T. reyesi* will benefit from the protections of the other listed species present in that locality. Caves that will continue to be afforded protection from the ESA after a delisting are included in Table 3.

Table 3. Caves Occupied by *T. reyesi* and Other Federally Listed Species

Species known to occupy along with *T. reyesi*	Occupied Caves
Tooth Cave Ground Beetle *(Rhadine persephone)*	Hide-Away Cave
	Lakeline Cave
	Raccoon Cave
	Testudo Tube Cave
Coffin Cave Mold Beetle *(Batrisodes texanus)*	Cobbs Cavern Cave
	Inner Space Caverns
	Off-Campus Cave
	On-Campus Cave
	Red Crevice Cave
	Deliverance Cave No. 2*
	Dragonfly Cave*
	Electro-Mag Cave*
	Hourglass Cave*
	Karankawa Cave*
	Medicine Man Cave*
	Pricilla's Well Cave*
	Rattlesnake Inn Cave*
	Shaman Cave*
	Unearthed Cave*
	Viper Cave*

*These sites are likely to be classified as occupied by *Batrisodes cryptotexanus* pending a taxonomic revision of *B. texanus*. If renamed, it is likely that the new species will remain protected under the ESA.

5.2.5 Listing Factor E: Other natural or manmade factors affecting its continued existence

While climate change was not listed as a threat in the Final Rule in 1998 or 1993, it is introduced as a potential threat in the Five-Year Review, although the USFWS acknowledges a lack of evidence showing a direct correlation to species impacts.

While it has been assumed that caves are less susceptible to changes occurring on the surface of the earth, some more recent data suggests that climactic changes on the surface may have an impact on cave ecosystems. Ultimately, while climate change may introduce changes to the climate of caves that could potentially impact *T. reyesi*, given the unique layout and nature of all caves, it is not possible to quantify those impacts or the effect of regional climate changes on them. Studies do suggest that cave conditions become less responsive to surface conditions the further one travels away from the cave entrance. For *T. reyesi*, this would indicate that by traveling to further depths within a cave, it would be possible to avoid the impacts of climate change. The known use of mesocavernous spaces by *T. reyesi* indicates that this is a probable natural protective mechanism for the species. Additionally, given examples like the Inner Space Caverns where the cave climate was changed considerably by the introduction of artificial entrances, light stations, and human visitation (all contributors of increased cave temperature and modified cave climate), it appears that *T. reyesi* is able to adapt to changing climactic conditions within a cave.

6.0 STATUS OF THE SPECIES

Since 1988, the known localities of the *T. reyesi* have increased from five to 172 known caves, and additional caves are regularly being discovered. For example, in 2010 biologists working with Travis County discovered five previously unknown occupied caves within the BCP preserve in Travis County: Cortana Cave, Geode Cave, F-12 Cave, IV-3 Cave, and Pond Party Pit Cave (Travis County, et. al. 2012:6, ZARA 2010:9). These additional five caves are not included in the 168 caves identified by the USFWS Five-Year Review as they were discovered after that review was complete. It is highly likely that more occupied caves will be discovered as research continues throughout Travis and Williamson counties. A timeline of the regulatory history and population milestones that support this petition is identified in Figure 3.

With each new *T. reyesi* locality found and protected, the species baseline is increased and the magnitude of the potential threats to the species is reduced. **The perceived imminent threat of development that was relevant to a known population of only five caves at the time of listing is no longer relevant given the expanded range and distribution of the species, and the known protected localities.** Even if natural or man-induced events caused the destruction of several *T. reyesi* caves, the number of protected preserve caves and the likely occupied habitat present in mesocaverns and other undiscovered void spaces would continue to support the species.

Based on the prior actions taken by the USFWS, *T. reyesi* benefits from a level of recovery comparable to that achieved for other species in previous delisting actions. In many cases, the recovery level for *T. reyesi* exceeds the acceptable recovery criteria approved by the USFWS. While known localities alone may not constitute recovery, the added benefit of extensive preserves and other regulatory actions that offer at least some protection to the species across its range further supports delisting. How the status of *T. reyesi* compares to six other species that have been delisted is represented in Table 4.

1988 Final Rule listing *Texella reddelli* (5–6 known localities)

Lakeline Mall Habitat Conservation Plan (HCP) 1991

Petition to delist seven Karst invertebrates submitted to the USFWS by Judge John C. Doerfler 1993

1993 Technical Correction: *Texella reyesi* federally listed (range 21–31 miles)

90-Day Finding determined that the Petition to Delist was not warranted (69 known localities) 1994

1994 Endangered Karst Invertebrate Recovery Plan (60–69 known localities)

1995 Four Points HCP

Balcones Canyonlands Preserve HCP (resulted in the protection of 24 occupied caves to-date) 1996

1999 Grandview Hills HCP

Comanche Canyon Ranch HCP 2000

2001 Sultan & Kahn HCP (resulted in the protection of 4 occupied caves to-date)

Russel Park HCP (resulted in the protection of 1 occupied cave to-date) 2002

2004 Brushy Creek MUD Section 7 Consultation (resulted in the protection of 15 occupied caves to-date)

Williamson County HCP (involved in the protection of approximately 40 occupied caves to-date) 2008

2009 5-Year Status Review (168 known localities)

Five previously unknown localities identified by Zara Environmental 2010

2014

Petition to Delist *Texella reyesi* submitted to USFWS by petitioners identified here-in

Figure 3. Timeline of regulatory actions for *Texella reyesi*.

Table 4. Comparison of *T. reyesi* to Six Prior Delisting Actions by the USFWS.

Species	Known Status at Listing	Known Status at Delisting	Reason for Delisting	Percent Increase
Pine Barrens treefrog *(Hyla andersonii)*	7 localities	150 localities	New Information	150%
Rydberg Milk-Vetch (*Astragalus perianus)*	1 locality	11 localities	New Information	1,106%
McKittrick pennyroyal *(Hedeoma apiculatum)*	7 localities	36 localities	New information	414%
Columbian White-tailed Deer (*Odocoileus virginianus leucurus,*	400-500 individuals	6,000 individuals	Designation of secure habitat zones	1,417.5%
Aleutian Canada goose (*Branta canadensis leucopareia*)	790 individuals	36,978 individuals	Increased number of individuals, threats not as severe as originally believed	4,580.75%
Robbins' Cinquefoil (Potentilla robbinsiana)	2,000 individuals	4,000 individuals	Increased number of individuals, threats not as severe as originally believed	600%
Bone Cave Harvestman *(Texella reyesi)*	5-6 localities (one *T. reddelli* and not *T. reyesi* , so actually 4-5)	Currently 172 localities; not currently delisted.	Potentially, increased number of localities, threats not as severe as originally believed, new information	3,340%

The 1994 Recovery Plan begins with a disclaimer that "recovery plans delineate the reasonable actions that are believed to be required to recover and/or protect listed species" and "approved recovery plans are subject to modification as dictated by new findings, changes in species' status, and the completion of recovery tasks" (USFWS 1994:i). These statements by the USFWS acknowledge that while recovery plans may be effective guidance tools, they are still subject to the requirements of the ESA regarding the use of the best available scientific and commercial data, and the application of the listing factors identified in Section 4(a)(1) of the ESA.

The recovery criteria identified in the 1994 Recovery Plan may be appropriate for some of the seven species included in that plan; however, the application of available scientific and commercial data indicates that those recovery criteria may be superfluous with respect to reasonably assuring the continued existence of *T. reyesi*. The establishment of USFWS-approved KFAs may require an unnecessary time and financial commitment given that the existing distribution of the species already represents a high number of protected populations, an increasing number of known localities, and a lack of significant evidence that the listing factors warrant keeping *T. reyesi* listed. While there are currently only four approved KFAs for *T. reyesi*—which is less than the minimum number of KFAs identified in the 1994 Recovery Plan, current scientific data strongly supports that the species will not become threatened with extinction in the foreseeable future.

It is not consistent with the objectives of the ESA to keep *T. reyesi* listed simply because it does not meet the specific criteria outlined in the 1994 Recovery Plan. Doing so perpetuates the trend that species included in multi-species plans are four times less likely to be improving in status *administratively* regardless of their status *biologically.* It is in the best interest of the USFWS to delist species that are

biologically recovered so that available resources can be better used to contribute to the recovery and study of species that are actually threatened with extinction.

Another standard for measuring species status is provided by the NatureServe Conservation Status guidelines (NatureServe 2014). Generally a species with five or fewer known localities is considered critically imperiled under the system; effectively justifying the listing action in 1988 when the known distribution of the species included only five to six known localities. NatureServe further classifies species as "imperiled," "vulnerable," "apparently secure," and "secure." NatureServe currently lists *T. reyesi* as imperiled. This determination is dependent upon data available only up to 1994 and cites only 64 known localities. We know now that the species has nearly three times as many known localities today. This increase in range clearly qualifies the species for reevaluation as "apparently secure," or, indeed "secure." Species with over 100 locations that may be uncommon are generally considered "apparently secure" under the NatureServe conservation status guidelines, which would make this the appropriate status for *T. reyesi.*

7.0 CONCLUSION

The listing of *T. reyesi* in 1988 was based on a woefully incomplete scientific understanding of the species that precluded a truly informed analysis of the threats to the species and the relevance of the ESA listing factors. In the 26 years since the species was originally listed, the available scientific and commercial data has been significantly expanded and clearly supports delisting of *T. reyesi*.

The likelihood of *T. reyesi* becoming threatened or endangered with extinction in the *foreseeable future* has been disproven due to:

1) the substantial increase in known localities since the time of listing,

2) the likelihood of identifying more occupied caves as research progresses,

3) the 94 known localities with some sort of protective measures, and

4) current regulatory water quality protection measures that provide both direct and indirect benefit to all known localities.

If the USFWS can accept that a species in decline is not threatened with extinction, it is logical to rule that a species with secure populations and showing a steady increase in known localities over time is not threatened with extinction in the foreseeable future. This being the case, it is the obligation of the USFWS, pursuant with the terms provided in the ESA, to delist the species.

Although the Petitioners believe the case for delisting *T. reyesi* presented in this petition is compelling, compelling support for delisting is not necessary in order to require the USFWS to make a positive 90-Day finding that the petitioned action may be warranted. Indeed, it is not even necessary that a petition present the bare minimum of evidence necessary to support a decision to implement the petitioned action. Therefore, USFWS could not legally deny this or any other petition on the basis that it fails to present the scientific evidence and analysis needed to justify a decision to implement the petitioned action. Rather, pursuant to ESA section 4(b)(3)(A), the question USFWS must determine at this stage is "whether the petition presents substantial scientific or commercial information indicating that the petitioned action may be warranted." This is a relatively low-threshold burden of proof. As USFWS has explained, for the purposes of this decision, "'substantial information' is that amount of information that would lead a reasonable person to believe that the measure proposed in the petition may be warranted" (50 CFR 424.14(b)(1)). Given the information and analysis presented in this petition, no reasonable person could believe otherwise—the delisting of *T. reyesi* unquestionably *may* be warranted. Hence, even if USFWS believes the petition has not presented sufficient support for that action, USFWS must open a status

review of the species in connection with the required process for making a 12-month finding under ESA section 4(b)(3)(B).

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