APPENDIX E

HABITAT IMPACT ANALYSES

- GOLDEN-CHEEKED WARBLER
- BLACK-CAPPED VIREO
- LISTED KARST INVERTEBRATES

SEP-HCP GCW Impacts Analysis
GCW Habitat Model C2010
Land Development v. Dec. 17, 2010

October 13, 2011

County	Sector	Total Area	Model C2010 GCW Habitat (Rank 3 and 4)	% GCW Habitat	New Development 2010 - 2040	GCW Habitat Loss 2010 - 2040	Ave Annual GCW Habitat Loss 2010 - 2040	Expanded Enrollment Area	% of Sector Within Expanded Enrollment Area	Model C2010 GCW Habitat (Rank 3 and 4) Within Expanded Enrollment Area	% GCW Habitat Within Expanded Enrollment Area	New Development 2010 - 2040 Within Expanded Enrollment Area	GCW Habitat Loss (2010 - 2040) Within Expanded Enrollment Area	Initial Enrollment Area	% of Sector Within Initial Enrollment Area	Model C2010 GCW Habitat (Rank 3 and 4) Within Initial Enrollment Area	% GCW Habitat Within Initial Enrollment Area	New Development 2010 - 2040 Within Initial Enrollment Area	GCW Habitat Loss (2010 - 2040) Within Initial Enrollment Area
Bandera	ZCBC	136,914	21,623	16%	3,780	605	19.5	2,093	2%	269	13%	58	7	-	0%	-	0%	-	-
Bandera	ZEBC1	60,791	17,371	29%	1,261	366	11.8	40,884	67%	13,191	32%	848	274	-	0%	-	0%	-	-
Bandera	ZEBC2	7,230	1,775	25%	925	232	7.5	7,230	100%	1,771	24%	925	227	-	0%	-	0%	-	-
Bandera	ZWBC	305,384	124,983	41%	2,988	1,225	39.5	-	0%	-	-	-	-	-	0%	-	0%	-	-
Bexar	FN	37,318	4,625	12%	14,920	1,791	57.8	37,318	100%	4,606	12%	14,920	1,842	37,318	100%	4,605	12%	14,920	1,841
Bexar	FNE	37,017	13,499	36%	13,630	4,907	158.3	37,017	100%	13,465	36%	13,630	4,958	37,017	100%	13,487	36%	13,630	4,966
Bexar	FNW	92,020	38,482	42%	18,357	7,710	248.7	92,020	100%	38,480	42%	18,357	7,676	92,020	100%	38,459	42%	18,357	7,672
Bexar	FW	34,869	53	0%	22,445	-	-	34,869	100%	53	0%	22,445	34	34,869	100%	53	0%	22,445	34
Bexar	NC	22,795	1,267	6%	3,875	233	7.5	22,795	100%	1,266	6%	3,875	215	22,795	100%	1,265	6%	3,875	215
Bexar	NE	28,714	278	1%	3,443	34	1.1	28,714	100%	278	1%	3,443	33	28,714	100%	278	1%	3,443	33
Bexar	NW	30,871	814	3%	6,907	208	6.7	30,871	100%	814	3%	6,907	182	30,871	100%	814	3%	6,907	182
Bexar	W	16,497	-	0%	1,684	-	-	16,497	100%	-	0%	1,684	-	16,497	100%	-	0%	1,684	-
Blanco	ZNBC	319,165	28,946	9%	423	39	1.3	-	0%	-	-	-	-	-	0%	-	0%	-	-
Blanco	ZSBC	137,424	17,584	13%	971	127	4.1	-	0%	-	-	-	-	-	0%	-	0%	-	-
Comal	FNCC	80,616	24,199	30%	10,457	3,137	101.2	-	0%	-	-	-	-	-	0%	-	0%	-	-
Comal	ECC3	82,408	33,433	41%	10,769	4,416	142.5	-	0%	-	-	-	-	-	0%	-	0%	-	-
Comal	NCC3	34,901	9,079	26%	3,937	1,024	33.0	-	0%	-	-	-	-	-	0%	-	0%	-	-
Comal	SCC	49,837	20,289	41%	19,849	8,137	262.5	-	0%	-	-	-	-	-	0%	-	0%	-	-
Comal	WCC5	105,297	28,752	27%	23,888	6,449	208.0	-	0%	-	-	-	-	-	0%	-	0%	-	-
Comal	ZNB	14,614	56	0%	4,347	-	-	-	0%	-	-	-	-	-	0%	-	0%	-	-
Kendall	ZEKC	80,651	12,696	16%	7,057	1,129	36.4	43,750	54%	7,144	16%	3,828	625	2,241	3%	228	10%	196	20
Kendall	ZNKC	261,236	28,894	11%	5,881	647	20.9	544	0.2%	278	51%	12	6	-	0%	-	0%	-	-
Kendall	ZWKC	82,402	23,679	29%	5,642	1,637	52.8	8,616	10%	3,029	35%	590	207	-	0%	-	0%	-	-
Kerr	KCC	20,058	2,443	12%	4,751	570	18.4	-	0%	-	-	-	-	-	0%	-	0%	-	-
Kerr	KCNE	86,381	9,757	11%	3,704	407	13.1	-	0%	-	-	-	-	-	0%	-	0%	-	-
Kerr	KCSC	34,719	4,590	13%	649	84	2.7	-	0%	-	-	-	-	-	0%	-	0%	-	-
Kerr	KCSE	83,108	13,960	17%	918	156	5.0	-	0%	-	-	-	-	-	0%	-	0%	-	-
Kerr	KCW	484,574	83,235	17%	2,051	348	11.2		0%	-	-	-	-	-	0%	-	0%	-	-
Medina	ZDMC	55,951	-	0%	2,034	-	-	-	0%	-	-	-	-	-	0%	-	0%	-	-
Medina	ZEMC1	129,731	23,681	18%	25,505	4,590	148.1	102,892	79%	23,675	23%	20,228	4,654	38,375	30%	16,349	43%	7,544	3,214
Medina	ZHMC	113,228	-	0%	922	-	-	-	0%	-	-	-	-	-	0%	-	0%	-	-
Medina	ZNCMC	199,783	48,737	24%	2,440	585	18.9	17,860	9%	4,968	28%	218	61	-	0%	-	0%	-	-
Medina	ZNMC	71,502	-	0%	5,636	-	-	4,209	6%	-	-	332	-	-	0%	-	0%	-	-
Medina	ZWMC	283,693	19,890	7%	5,106	357	11.5	-	0%	-	-	-	-	-	0%	-	0%	-	-
SEP SECTORS		**3,621,699**	**658,670**	**18%**	**241,152**	**51,150**	**1,650**	**528,179**	**15%**	**113,288**	**21%**	**112,300**	**21,002**	**340,717**	**9%**	**75,539**	22%	**93,001**	**18,178**

COUNTY SECTOR SUMMARIES

Bandera	510,319	165,752	32%	8,955	2,428	78.3
Bexar	300,101	59,018	20%	85,260	14,883	480.1
Blanco	456,589	46,530	10%	1,395	166	5.4
Comal	367,673	115,808	31%	73,247	23,163	747.2
Kendall	424,289	65,269	15%	18,580	3,413	110.1
Kerr	708,840	113,985	16%	12,074	1,565	50.4
Medina	853,888	92,308	11%	41,642	5,532	178.5

SEP-HCP BCV Impacts Analysis

BCV Habitat per Wilkins et al. (2006)

Land Development - Dec. 17, 2010 version

October 13, 2011

County	Total County Area	BCV Habitat Estimate (Wilkins et al. 2006)	% BCV Habitat	New Development 2010 - 2040 (Dec. 17, 2010)	BCV Habitat Loss 2010 - 2040	Ave Annual BCV Habitat Loss 2010 - 2040	Expanded Enrollment Area	% of County Within Expanded Enrollment Area	BCV Habitat Estimate Within Expanded Enrollment Area	% of Expanded Enrollment Area as BCV Habitat	New Development 2010 - 2040 Within Expanded Enrollment Area	BCV Habitat Loss (2010 - 2040) Within Expanded Enrollment Area	Initial Enrollment Area	% of County Within Initial Enrollment Area	BCV Habitat Estimate Within Initial Enrollment Area	% of Initial Enrollment Area as BCV Habitat	New Development 2010 - 2040 Within Initial Enrollment Area	BCV Habitat Loss (2010 - 2040) Within Initial Enrollment Area
Bandera	510,109	7,599	1%	8,955	133	4.3	50,207	10%	748	1%	881	13	-	0%	-	0%	-	-
Bexar*	300,101	17,856	6%	85,260	5,073	163.6	300,101	100%	17,856	6%	85,260	5,073	300,101	100%	17,856	6%	85,260	5,073
Blanco	456,500	2,275	0%	1,395	7	0.2	-	0%	-	0%	-	-	-	0%	-	0%	-	-
Comal	367,819	3,591	1%	73,247	715	23.1	-	0%	-	0%	-	-	-	0%	-	0%	-	-
Kendall	423,972	4,945	1%	18,580	217	7.0	52,910	12%	617	1%	2,319	27	2,250	1%	26	1%	99	1
Kerr	708,103	53,074	7%	12,074	905	29.2	-	0%	-	0%	-	-	-	0%	-	0%	-	-
Medina	855,078	62,292	7%	41,642	3,034	97.9	124,961	15%	9,103	7%	6,086	443	38,396	4%	2,797	7%	1,870	136
SEP-HCP PLAN AREA	**3,621,682**	**151,632**	4%	**241,152**	**10,084**	**325**	**528,179**	**15%**	**28,324**	**5%**	**94,546**	**5,556**	**340,747**	9%	**20,679**	6%	**87,229**	**5,210**

* Includes only the portions of Bexar County within a SEP-HCP Sector and excludes Camp Bullis. Estimates of potential BCV habitat from Wilkins et al. (2006) are adjusted proportionately.

Assumptions and Methodology for the Karst Invertebrates Take and Impact Analysis

IMPACTS ANALYSIS STUDY AREA

The impacts analysis for the Covered Karst Invertebrates includes 12 of the 35 SEP-HCP sectors where potential karst habitat occurs, as indicated by mapped Karst Zones 1 through 4.

Sector boundaries were based on U.S. Census Bureau census tract boundaries, and SEP-HCP sectors included one or more adjacent census tracts. Sectors boundaries were used to compile and analyze population and land development projections for the SEP-HCP Plan Area.

BEXAR COUNTY KARST ZONES

Veni (1994, 2002) delineated and defined five Karst Zones associated with the endangered Bexar County karst invertebrates based on geologic maps, studies of karst development, and information on the distribution of karst species. The Karst Zones are categorized by the likelihood of finding a karst feature contains one or more of the endangered karst invertebrate species. For the purposes of the SEP-HCP, Karst Zones 1 through 4 are considered to be potential habitat for the endangered karst invertebrates. The five Karst Zones are categorized as follows:

Karst Zone 1: Areas known to contain endangered karst invertebrate species

Karst Zone 2: Areas that may contain one or more endangered karst invertebrate species due to the high probability of suitable habitat, but the areas have not been extensively surveyed.

Karst Zone 3: Areas that probably do not contain endangered karst invertebrates due to the lack of suitable habitat.

Karst Zone 4: Areas that require further research. This zone is assumed to be equivalent to Zone 3, but may also include portions similar to Zone 2 or Zone 5.

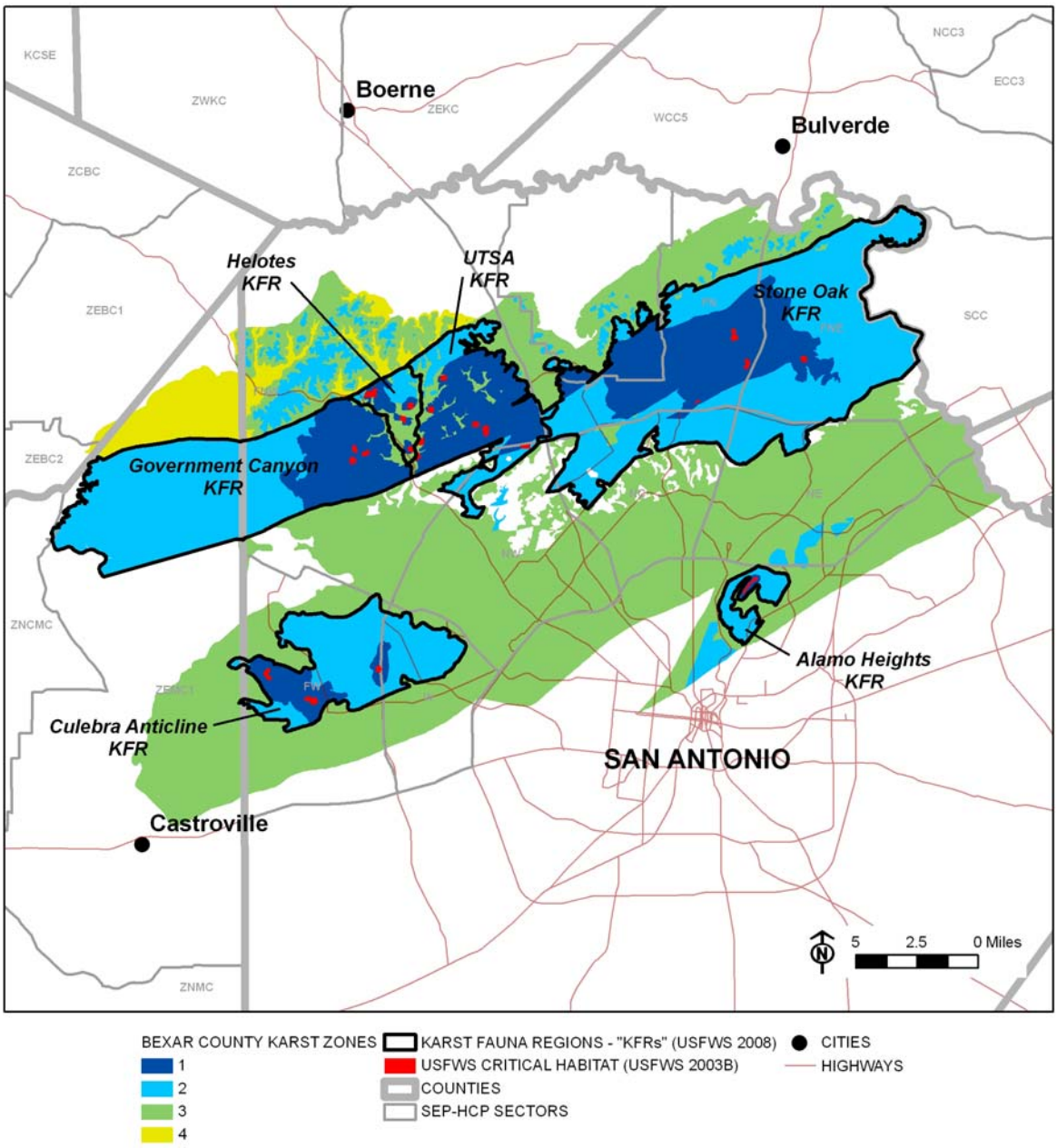
Karst Zone 5: Areas with units of rock that do not contain the endangered karst invertebrate species.

The Bexar County Karst Zones are shown in Figure 1. The acreage of each Karst Zone within each SEP-HCP sector is listed in Table 1.

KARST FAUNA REGIONS AND KFR GROUPS

To facilitate recovery of the endangered Bexar County karst invertebrates, Veni (1994, 2009) delineated six Karst Fauna Regions (or KFRs) primarily within Bexar and Medina counties based on hydrogeologic barriers and/or other presumed restrictions to the migration of troglobitic species over evolutionary time. The six KFRs for the endangered Bexar County karst invertebrates are the Alamo Heights KFR, Culebra Anticline KFR, Government Canyon KFR, Helotes KFR, Stone Oak KFR, and University of Texas at San Antonio (UTSA) KFR. The Covered Karst Invertebrates do not occur within the Alamo Heights KFR; therefore, the Alamo Heights KFR has been excluded from further analysis.

FIGURE 1. Karst Zones and Karst Fauna Regions for the Endangered Bexar County Karst Invertebrates.



The KFR boundaries shown in the Bexar County Karst Invertebrates Recovery Plan (USFWS 2011) do not include the entire extent of potential habitat associated with these species. Nor do the KFR boundaries conform to the SEP-HCP boundaries. Therefore, an impacts analysis by KFR was not practical. To facilitate a complete analysis, the SEP-HCP sectors were grouped into clusters associated with one or more KFR ("KFR Groups") as shown in Table 1. The NW KFR Group includes those sectors associated with the Government Canyon, Helotes, and UTSA KFRs.

TABLE X. Acreage Totals for the SEP-HCP Karst Permit Area, Sectors, KFR Groups, KFR Areas, and Karst Zones.

County	Sector	KFR Group	Sector Area (Acres)	Karst Zones 1 and 2		Karst Zones 3 and 4	
				Habitat Acres	Percent Habitat	Habitat Acres	Percent Habitat
Bandera	ZEBC1	NW Group	60,791	-	0%	315	1%
Bandera	ZEBC2	NW Group	7,230	-	0%	129	2%
Bexar	FN	Stone Oak	37,318	19,101	51%	9,142	24%
Bexar	FNE	Stone Oak	37,017	25,808	70%	8,062	22%
Bexar	FNW	NW Group	92,020	34,470	37%	31,824	35%
Bexar	FW	Culebra Anticline	34,869	11,844	34%	14,354	41%
Bexar	NC	Stone Oak	22,795	7,455	33%	12,506	55%
Bexar	NE	Stone Oak	28,714	4,184	15%	24,100	84%
Bexar	NW	NW Group	30,871	2,048	7%	24,296	79%
Bexar	W	Culebra Anticline	16,497	4,883	30%	6,925	42%
Medina	ZEMC1	NW Group	129,731	20,124	16%	24,358	19%
Medina	ZNCMC	NW Group	199,783	37	0%	-	0%
PLAN AREA TOTAL			**697,636**	**129,953**	**19%**	**156,012**	**22%**

DEVELOPMENT PROJECTIONS AND HABITAT IMPACTS

For this analysis, potential impacts to karst habitat are measured in terms of the acres of Karst Zones 1 through 4 that may be affected by projected new land development and re-development activities over the next 30 years. The SEP-HCP land use analysis was based on population projections, housing characteristics and trends, land use data, and other market factors. Annual estimates of redevelopment activities were calculated as 0.5 percent of all developed lands present within a sector at the beginning of each decade.

It is assumed that impacts to potential karst habitat (i.e., areas identified as Karst Zones 1 through 4) from future development and redevelopment activities would occur in proportion to the extent of Karst Zones 1 and 2 and Karst Zones 3 and 4 in a sector. For example, if 25 percent of a SEP-HCP sector was mapped as potential karst habitat, then 25 percent of the extent of future development in that sector would be assumed to impact potential karst habitat.

Table 2 summarizes the amount of development activity and associated karst habitat impacts for each of the applicable SEP-HCP sectors.

TABLE 2. Development Projections and Karst Zone Impacts (in Acres) for the Karst Permit Area Between 2010 and 2040.

Sector	KFR Group	New Development	Redevelopment	Total Development	Karst Zone 1 Impacts	Karst Zone 2 Impacts	Karst Zone 3 Impacts	Karst Zone 4 Impacts	Total Karst Zone Impacts
ZEBC1	NW Group	1,261	1,444	2,705	-	-	-	14	14
ZEBC2	NW Group	924	531	1,455	-	-	-	26	26
FN	Stone Oak	14,920	4,216	19,136	5,687	4,107	4,688	-	14,482
FNE	Stone Oak	13,630	4,358	17,988	2,151	10,390	3,918	-	16,459
FNW	NW Group	18,357	7,859	26,216	5,796	4,025	7,712	1,355	18,887
FW	Culebra Anticline	22,445	4,345	26,790	2,698	6,402	11,028	-	20,128
NC	Stone Oak	3,875	3,125	7,000	41	2,248	3,840	-	6,129
NE	Stone Oak	3,444	3,226	6,670	-	972	5,598	-	6,570
NW	NW Group	6,906	4,149	11,055	57	677	8,700	-	9,434
W	Culebra Anticline	1,684	1,786	3,470	73	954	1,457	-	2,484
ZEMC1	NW Group	25,505	6,042	31,547	-	4,894	3,929	1,994	10,817
ZNCMC	NW Group	2,441	3,985	6,426	-	1	-	-	1
PLAN AREA TOTAL		**115,392**	**45,065**	**160,457**	**16,503**	**34,669**	**50,870**	**3,389**	**105,431**

SPECIES-OCCUPIED CAVE ESTIMATES

Detailed karst feature surveys and karst faunal surveys conducted on Camp Bullis were used to extrapolate an estimate of the total number of caves that may be occupied by one or more of the endangered karst invertebrates in the vicinity of the NW and Stone Oak KFR Groups. Similar, although less rigorous, data compiled by the Texas Speleological Society on the number/distribution of karst features and species-occupied caves were used to estimate the total number of species-occupied caves that might occur in the vicinity of the Culebra Anticline Group. Due to limited data, Zara Environmental provided a professional opinion on the estimated density of species-occupied caves that might occur within Karst Zones 3 and 4 in any KFR group.

Estimated cave densities, as provided by Zara Environmental, are summarized in Table 3.

TABLE 3. Estimated Density of Species-occupied Caves.

	Karst Zones 1 and 2	Karst Zones 3 and 4
Camp Bullis Estimates (applies to the NW and Stone Oak KFR Groups)	3.28 caves per square mile	0.02 caves per square mile
Texas Speleological Society Estimates (applies to the Culebra Anticline Group)	2.22 caves per square mile	0.02 caves per square mile

Table 4 estimates the number of species-occupied caves that could be directly or indirectly impacted by future development and redevelopment activities over potential karst zone habitat during the next 30 years.

This analysis assumes that the number of caves that may be impacted by future development will occur in proportion to the extent of such activities in a sector. For example, if 25 percent of a sector is projected to be subject to development activities, then 25 percent of the estimated caves in that sector are assumed to be affected by those activities. Many caves located in SEP-HCP sectors with existing development may already be fully or partially taken.

Since the requested level of incidental take of karst habitat represents approximately 20 percent of the total extent of the anticipated future impacts, it is assumed that the number of species-occupied caves that might be impacted by SEP-HCP participants would also represent approximately 20 percent of the total number of impacted caves. Table 4 summarizes the number of species-occupied caves that might be directly or indirectly impacted by incidental take authorized through the SEP-HCP.

TABLE 4. Estimated Number of Caves Occupied by the Covered Karst Invertebrates.

Sector	KFR Group	Estimated Number of Species Caves - Zones 1 and 2	Estimated Number of Species Caves - Zones 3 and 4	Estimated Number of Species Caves Affected by Development	Affected Caves as % of Total Estimated Caves	Estimated Number of Species Caves Impacted by Requested Incidental Take	Authorized Take Caves as % of Total Estimated Caves
ZEBC1	NW Group	-	-	0	0%	0	0%
ZEBC2	NW Group	-	-	0	0%	0	0%
FN	Stone Oak	97	-	50	52%	10	10%
FNE	Stone Oak	132	-	64	49%	13	10%
FNW	NW Group	176	1	50	28%	10	6%
FW	Culebra Anticline	41	-	32	79%	6	16%
NC	Stone Oak	38	-	12	31%	2	6%
NE	Stone Oak	21	1	5	23%	1	5%
NW	NW Group	10	1	4	37%	1	7%
W	Culebra Anticline	17	-	4	21%	1	4%
ZEMC1	NW Group	103	1	25	24%	5	5%
ZNCMC	NW Group	-	-	0	0%	0	0%
PLAN AREA TOTAL		**635**	**4**	**247**	**39%**	**49**	**8%**

REFERENCES

Veni, G. 1994. Geologic controls on cave development and the distribution of endemic cave fauna in the San Antonio, Texas, region. Report prepared for Texas Parks and Wildlife Department and U.S. Fish and Wildlife Service, Austin, Texas. 112 pp.

Veni, G. 2002. Delineation of hydrogeologic areas and zones for the management and recovery of endangered karst invertebrate species in Bexar County, Texas. Report prepared for the U.S. Fish and Wildlife Service. 75 pp.

Veni, G. 2009. Karst landscape evolution: impacts on speciation, biogeography, and protection of rare and endangered species. Proceedings of the 15th Annual International Congress of Speleology. (2): 771-776.