ENVIRONMENTAL ASSESSMENT
FOR THE SAN ANTONIO WATER SYSTEM
MICRON AND WRIP HABITAT CONSERVATION PLAN

Prepared by

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CHAPTER 1. PURPOSE AND NEED

1.1 Purpose and Need

The U.S. Fish and Wildlife Service (Service) is evaluating whether or not to issue a section 10(a)(1)(B) Incidental Take Permit (ITP) under the federal Endangered Species Act of 1973, as amended (ESA) for potential take of five endangered karst invertebrate species that could result from two proposed water pipeline projects to be constructed by San Antonio Water System (SAWS, Applicant). The two pipeline projects include portions of SAWS's Water Resources Integration Program (WRIP) and portions of their Micron to Anderson Pump Station Phase 2 Project (Micron Pipeline) (together, the Proposed Projects). The Proposed Projects cross areas mapped as known or potentially suitable habitat for federally listed karst invertebrate species in Bexar County, Texas. Therefore, the boring and trenching activities associated with the Proposed Projects have the potential to impact the following federally listed species: Madla's Cave meshweaver (*Cicurina madla*), Robber Baron Cave meshweaver (*Cicurina baronia*), Braken Bat Cave meshweaver (*Cicurina venii*), and two species of ground beetles with no common names (*Rhadine infernalis* and *Rhadine exilis*). Additionally, the Applicant proposes to include an unlisted blind spider with no common name (*Cicurina loftini*). Collectively all six species are referred to as the Covered Species.

SAWS is seeking an ITP from the Service to authorize incidental take that could occur as a result of the Proposed Projects. SAWS has prepared Micron and WRIP Habitat Conservation Plan (HCP) that describes SAWS's proposed approach for achieving compliance with the ESA related to the Covered Species. The HCP describes the conservation measures proposed by SAWS to benefit Covered Species in the vicinity of the Proposed Projects and supports an application to the Service for an ITP, in accordance with section 10(a)(1)(B) of the ESA.

This environmental assessment (EA) examines the impact that approval of the HCP and issuance of an ITP (Proposed Federal Action) is expected to have on the human environment.

1.2 Regulatory Framework

1.2.1 National Environmental Policy Act (NEPA)

The issuance of an ITP is a federal action subject to the requirements of the National Environmental Policy Act (NEPA) (42 United States Code (USC) 4321–4327). NEPA requires federal agencies to: 1) study proposed federal actions to determine if they would result in significant impacts to the human environment, and 2) review the alternatives available for the project and consider the impact of those alternatives on the environment (42 USC 4332(c)). NEPA regulations require that federal agencies identify and assess all "reasonable alternatives to proposed actions that will avoid or minimize adverse effects of these actions upon the quality of the human environment" (Code of Federal Regulations (CFR) Title 40 Part 1500.2). The U.S. Department of the Interior defines "Reasonable Alternatives" as alternatives that are technically and economically practical or feasible and meet the purpose and need of the proposed action (43 CFR 46.100). The scope of NEPA requires that the agency consider the impacts of the action on the "human environment," including a variety of resources such as water, air quality, cultural, and historic resources.

In complying with NEPA, a federal agency often first examines the potential impacts of the federal action through preparation of an EA. If the proposed action is expected to cause significant environmental impact, then examination of the project must be elevated to the level of an environmental impact statement (EIS).

1.2.2 Endangered Species Act

Section 9 of the ESA prohibits the take of any federally listed endangered wildlife species (16 USC 1538(a)). The ESA defines "take" as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or

collect, or to attempt to engage in any such conduct" (16 USC 1532(19)). "Harm" is not defined in the statute, but the Service's regulations define it as "an act which actually kills or injures wildlife and may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns including breeding, feeding or sheltering" (50 CFR 17.3 (2005)). Section 10(a)(1)(B) of the ESA (16 USC 1539(a)(1)(B)) authorizes the Service to issue a permit allowing take that is "incidental to, and not the purpose of, the carrying out of an otherwise lawful activity."

For the Service to issue an ITP, the ESA requires the following:

1) The taking would be incidental;
2) the applicant would, to the maximum extent practicable, minimize and mitigate the impacts of such taking;
3) the applicant would ensure that adequate funding for the conservation plan and procedures to deal with unforeseen circumstances would be provided;
4) the taking would not appreciably reduce the likelihood of survival and recovery of the species in the wild; and
5) the measures required under Section 10(a)(2)(A)(iv), if any, are met, and such other assurances that may be required by the HCP would be implemented.

As a condition of receiving an ITP, an applicant must prepare and submit to the Service for approval an HCP containing the mandatory elements of Section 10(a)(2)(A). An HCP must specify the following:

1) The impact that will likely result from the taking;
2) the steps the applicant will take to minimize and mitigate the impacts, and the funding available to implement those steps;
3) what alternative actions to such taking were considered and the reasons the alternatives were not chosen; and
4) other measures that the Secretary of the Interior may require as being necessary or appropriate for purposes of the conservation plan (16 USC 1539(a)(2)(A)).

Section 7(a)(2) of the ESA requires that each federal agency shall consult with the Secretary of the Interior to ensure that any actions authorized, funded, or carried out by such agency are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat (16 USC 1536(a)(2)). The regulations define "jeopardize" as engaging in an action that would reasonably be expected, directly or indirectly, to appreciably reduce the likelihood of the survival and recovery of the species in the wild (50 CFR 402.02). Issuance of an ITP is an action for which the mandate of consultation applies (Service and National Marine Fisheries Service (NMFS) 1996).

1.3 Decisions Needed

Under provisions of the ESA, the Service must determine whether implementation of SAWS's Micron and WRIP HCP meets the issuance criteria identified in section 10(a)(2)(B) of the ESA.

For purposes of better organizing and scoping the necessary environmental effects analysis, the Service is required to consider connected actions, cumulative actions, and similar actions (40 CFR 1508.25). In this case, the Proposed Federal Action is approval of the HCP and issuance of an ITP to SAWS to authorize take of certain listed species that may result from the Proposed Projects.

CHAPTER 2. ALTERNATIVES INCLUDING THE PROPOSED ACTION

This EA examines the potential impacts of the Proposed Federal Action to determine if environmental impacts may be significant (42 USC 4332(C)). In this case, the Proposed Federal Action is approval of the HCP and issuance of the ITP to SAWS to authorize take of the Covered Species that may result from the Covered Activities.

NEPA regulations require, among other things, that federal agencies examine all reasonable alternatives to the Proposed Federal Action, including a "No Action" alternative (40 CFR 1502.14).

With respect to this EA, we identified three alternatives for consideration:

- Alternative A (No Action) – No Section 10(a)(1)(B) Permit is Issued
- Alternative B (Preferred Alternative) – Issuance of a Section 10(a)(1)(B) Incidental Take Permit with the Implementation of SAWS's Micron and WRIP HCP
- Alternative C – Issuance of a Section 10(a)(1)(B) Incidental Take Permit with the Implementation of a Reduced Take/Reduced Mitigation Micron and WRIP HCP

These three alternatives are discussed below and are analyzed in chapters 3 and 4 of this EA. Section 2.5 reviews alternatives that were considered but eliminated from detailed analysis, along with an explanation of why these alternatives were dismissed from consideration.

2.1 Background

SAWS was established in 1992 to create a single, public utility responsible for water, wastewater, stormwater and reuse water for the City of San Antonio, Texas. SAWS holds one Certificate of Convenience and Necessity (CCN) to provide potable water service issued by the Texas Commission of Environmental Quality (TCEQ). According to the Texas Water Code, "continuous and adequate service" to a certificated area is required. SAWS must anticipate population growth within its certified area and determine how to manage per capita consumption effectively. As the regional population continues to increase, SAWS must anticipate local water needs and ensure that adequate supporting infrastructure and supply are available to accommodate that growth.

Historically, SAWS has been dependent upon the Edwards Aquifer to meet customer demands. In 2007, Texas Senate Bill 3 amended the Edwards Aquifer Authority Act to include provisions that capped withdrawals under regular pumping permits from the Edwards Aquifer. The bill additionally made permitted withdrawals subject to critical period reductions in times of drought to minimize impacts to spring flows in the Comal and San Marcos river systems. SAWS aquifer withdrawal is subject to these critical period reductions, which affects the amount of Edwards Aquifer water available to meet customer demand. These reductions require additional diligence on behalf of SAWS to ensure that alternative water sources are available to offset mandated aquifer withdrawals during times of drought. SAWS has voluntarily participated in the Edwards Aquifer Recovery Implementation Program (EARIP)[1] which ultimately developed the Edwards Aquifer HCP (EAHCP)[2] and obtained an approved ITP (TE63663A) from the Service on March 18, 2013. The EAHCP utilizes a series of spring flow protection programs designed to maintain minimum spring flows necessary to achieve the biological objectives for the Edwards Aquifer.

[1] The EARIP is a consensus-based stakeholder process designed to address ESA compliance related to the Edwards Aquifer at a regional level. The EARIP is the collective efforts of five entities representing: the Edwards Aquifer Authority (EAA), City of New Braunfels, City of San Marcos, City of San Antonio (Through SAWS), and Texas State University – San Marcos.
[2] The goal of the EAHCP is to protect federally listed aquifer species from harm during severe droughts.

The SAWS 2012 Water Management Plan[3] identified the Proposed Projects as being critical to the continued ability of SAWS to meet the increasing demand for its services caused by population growth and urban expansion, and to address conservation measures associated with the EAHCP.

2.2 ALTERNATIVE A – No Action, No Section 10(a)(1)(B) Permit is Issued

Under the No Action Alternative, the Service would not issue a section 10(a)(1)(B) ITP to SAWS for the Proposed Projects. Therefore, SAWS would not construct the Proposed Projects, and would also not implement the mitigation described in the HCP, which would result in the protection of a 57.6 acre perpetual preserve supporting endangered karst species.

2.3 ALTERNATIVE B (Preferred Alternative) – SAWS's Micron and WRIP HCP

2.3.1 Micron Pipeline Project

SAWS identifies the proposed Micron Pipeline as a critical component of its distribution system, since it provides key infrastructure to provide continuous and adequate water delivery service to the western portion of San Antonio and Bexar County, Texas. Once completed, the Micron Pipeline will be an approximately 5.5-mile-long, 48-inch-diameter steel water transmission main that would connect the existing SAWS Micron Pump Station and the existing SAWS Anderson Pump Station (Figure 1). This pipeline will carry potable, chlorine-treated Edwards Aquifer water between the two stations allowing for efficient and direct movement of water necessary to meet the needs of SAWS customers in the Anderson Pump Station service area.

Portions of the Micron Pipeline are already complete (Figure 1). SAWS initially determined that the Micron Pipeline did not need incidental take coverage under the ESA, and, therefore, initiated construction on November 15, 2011. On September 18, 2012, following the discovery of endangered *Cicurina venii* within the right-of-way (ROW) for State Highway (SH) 151, the Texas Department of Transportation withdrew ROW permissions from SAWS until further site evaluation was conducted (see Section 1.4 of the HCP for further details). Prior to stopping construction, approximately 856 feet of boring and steel casing under SH 151 and a portion of Loop 1604 had been completed. However, due to the demobilization, 160 feet of boring and steel casing remains to be completed under Loop 1604. None of the surface trenching has been completed and bore pits were filled in to stabilize the area while construction is on hold.

Completion of the Micron Pipeline would require approximately 1.4 acres of land. All construction would occur within a 45-foot-wide easement, consisting of 20 feet of permanent easement and 25 feet of temporary construction easement. The project design would implement erosion and sedimentation controls, including silt control fencing, rock berms, and stabilized construction entrances.

2.3.2 Water Resources Integration Program Project (WRIP)

SAWS identifies the proposed WRIP Project as a critical component of the Water Management Plan for its ability to help SAWS meet increasing water demands while lessening its dependence upon the Edwards Aquifer. The WRIP project meets the needs of providing continuous and adequate service within SAWS's service area and achieving goals outlined in the EAHCP, namely recharge of the Aquifer Storage and Recovery Facility (ASR) for water storage.

[3] The 2012 Water Management Plan is a tool used by SAWS to plan how to conserve current aquifer water supplies effectively and how to supplement future aquifer water supplies with alternative water sources as part of SAWS's goal of reducing overall Edwards Aquifer use, especially during times of severe drought.

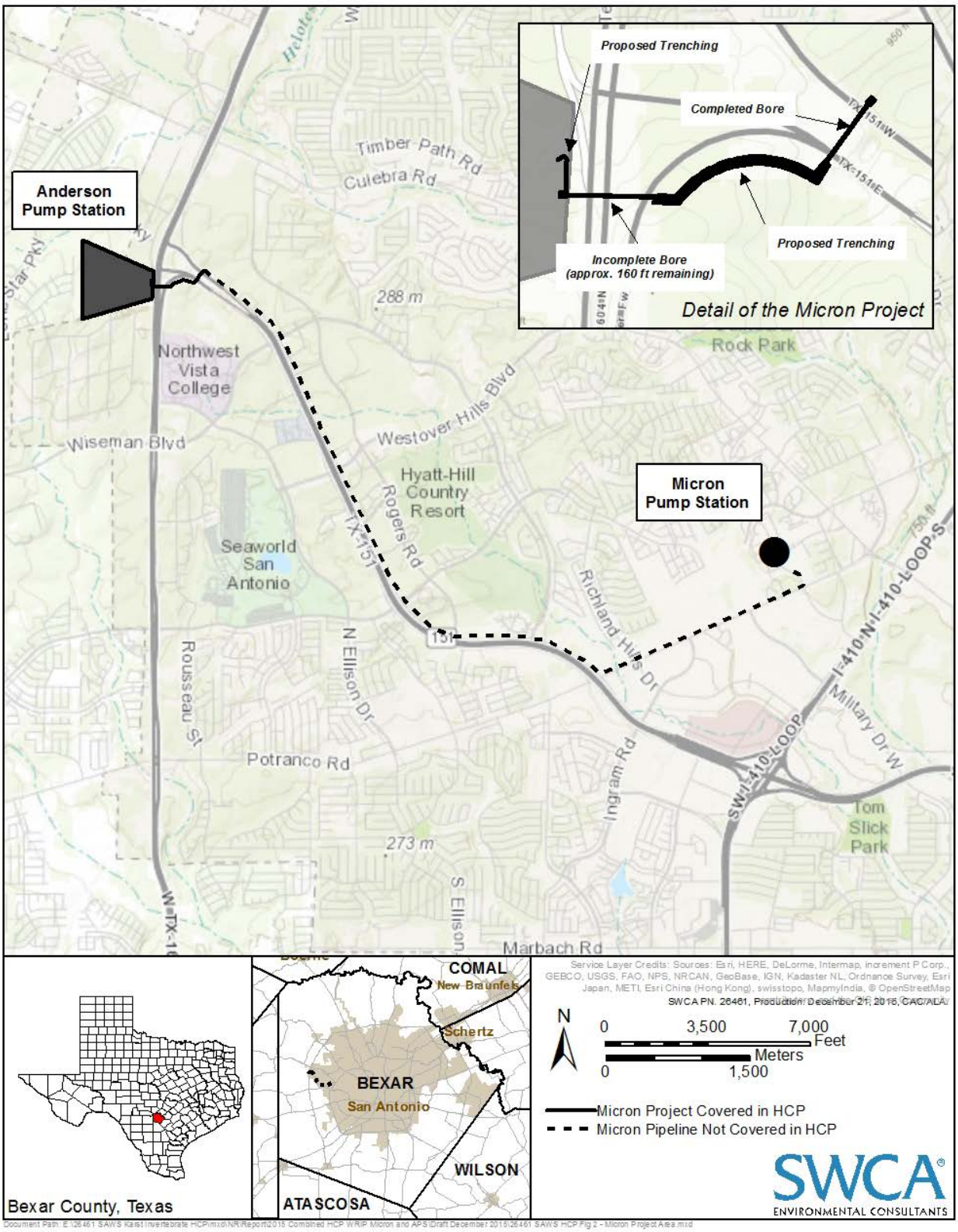

Figure 1. Location of the Micron Pipeline and the Micron Pipeline Phase 2 Project Area.

The WRIP Project would allow for the expanded use of four alternative water supply sources that would lessen SAWS's pumping demand on the Edwards Aquifer. The alternative water supplies include the Local Carrizo Project, the Expanded Carrizo Project, the Brackish Groundwater Desalination Project, and the ASR Program. Together, these four alternative water supply sources have the ability to provide up to 34% of the water needed by SAWS customers during a potential drought period.

At completion, the WRIP would be a 45-mile-long, 48-inch-diameter up to 60-inch-diameter steel water transmission main that would convey up to 75 million gallons of potable water per day between the Twin Oaks ASR facility in southern Bexar County and SAWS's pump stations in western Bexar County (Figure 2). The WRIP would transport water in two directions; the direction of flow would depend on the availability of various water sources at any given time. Once in operation, potable, chlorine-treated water would move through the pipeline at all times distributing water to customers in western Bexar County or reverse flows from the western pump stations to store water into the ASR facility for recovery at a later date.

SAWS would construct the WRIP in two phases (WRIP and WRIP Phase 2), each with independent utility from one another. The WRIP portion is that segment between the Twin Oaks ASR and the Old Pearsall Road Pump Station, which is outside of karst habitat. Therefore, this HCP does not consider this portion of the pipeline. Phase 2 of the WRIP Project, which is between the Old Pearsall Road Pump Station and the Anderson Pump Station, would occur within karst zones having the potential to support endangered karst species. Therefore, this phase is included in SAWS's HCP and application for an ITP. P (Figure 2).

Phase 2 is a 16.4-mile-long pipeline between the new Old Pearsall Road Pump Station and the existing Anderson Pump Station near the intersection of Loop 1604 and SH 151 within an 80-foot-wide permanent easement. The pipeline would be installed through open-cut trenching to depths of 10 to 20 feet, except at sensitive locations (e.g. stream crossings, public roadways) where the pipeline would be bored or tunneled. A portion of the pipeline would be constructed within previously excavated and disturbed ROW. The total extent of the easement acquired for Phase 2 covers approximately 159.0 acres.

2.3.3 Covered Activities

Activities associated with the construction of the Proposed Projects would generally include vegetation disturbance; excavation; temporary placement of excavated material; permanent placement of pipe, casings, and stabilizing materials; backfilling of excavated trenches; and restoration of surface conditions. Specifically, the Covered Activities associated with the Proposed Projects would include:

- Vegetation removal or disturbance for the Proposed Projects only to the extent necessary to allow for construction activities within easements.
- Excavation of open-cut trenches to a typical maximum width of 7 feet and to depths of between 10 and 20 feet. Exact trench measurements are contingent upon the substrate type at the surface (soil, concrete, or asphalt).
- Excavation of bore pits for machinery access to tunneled segments of the proposed pipelines. Each bore pit would be generally 25 by 40 feet wide at the surface and dug to a depth of 10 to 40 feet. Exact pit measurements are subject to contractor discretion based on site conditions. Excavation by bore, jack, or tunnel through the subsurface beneath streams, roads, or other sensitive resources approximately 5 to 35 feet below the surface grade. Such excavation could include the use of water for coolant/lubrication of the pipe or casing materials being tunneled. Excavated material would be removed and disposed of offsite in a manner that does not cause take and in accordance with all applicable laws.

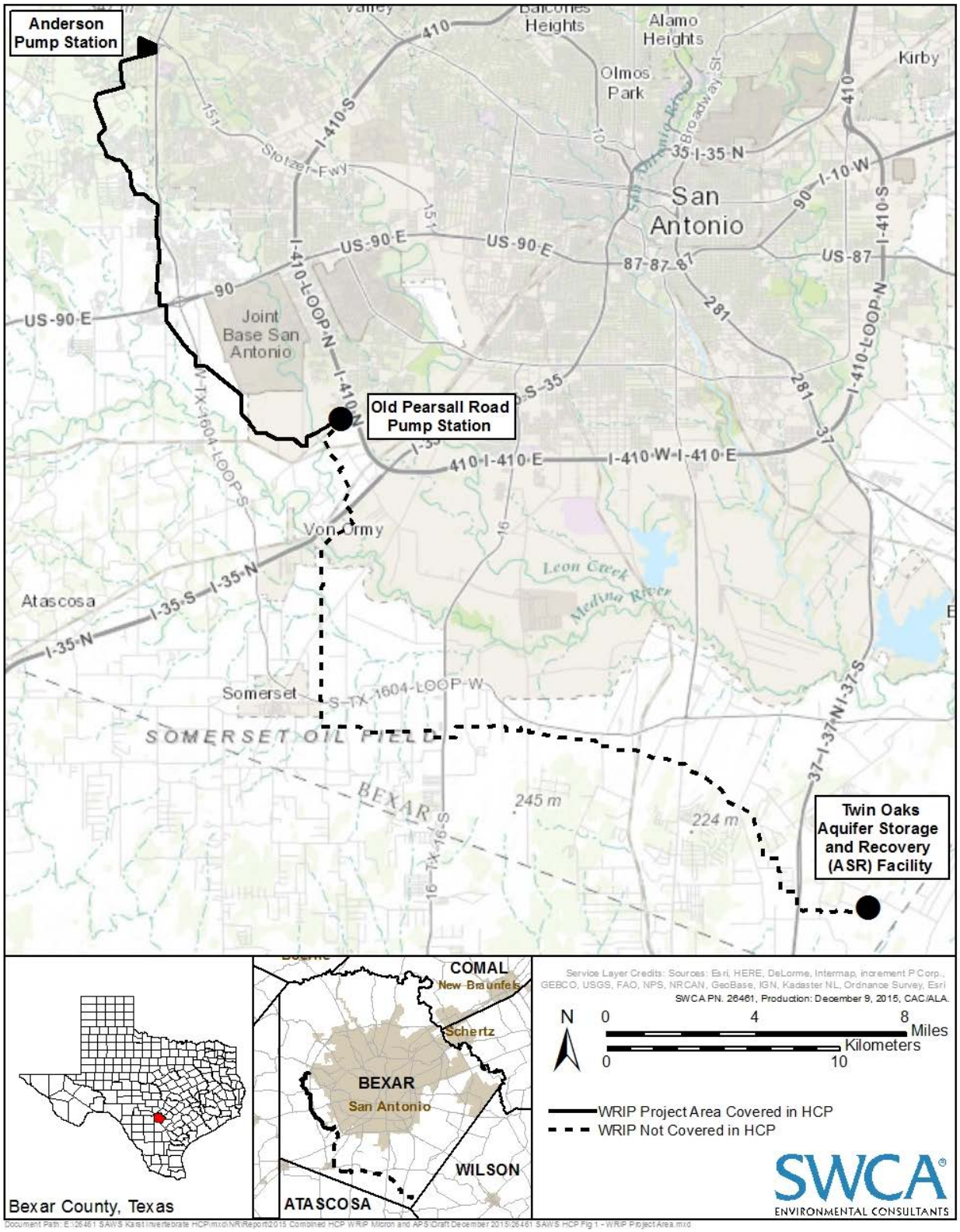

Figure 2. Location of the WRIP and the WRIP Phase 2 Project Area.

- Temporary placement and storage of excavated material or clean fill material within Proposed Projects construction easements.
- Application of water during construction to control dust within active construction areas.
- Bank stabilization to control erosion and sedimentation prior to boring activities at stream crossings.
- Permanent placement of sand or gravel pipe bedding and subgrade fill, filter fabrics, flowable fill, mortar, or grout, as specified by construction plans to encase and stabilize the pipe.
- Restoration of disturbed areas as quickly as possible to their original or better condition. This will include replacement of temporarily stored topsoil and revegetation by seeding with native plant seeds and the utilization of a licensed arborist for any replanting of tree species.
- Pipeline cleaning and hydrostatic pressure and leakage testing on all pipeline installed.
- Movement of vehicles and heavy construction equipment within the Project Areas.

2.3.4 HCP Plan Area and Mitigation

The HCP Plan Area includes the unconstructed portion of Phase 2 of the Micron Pipeline and Phase 2 of the WRIP (Figure 3). The HCP Plan Area also includes 57.6 acres of undeveloped land within the existing SAWS Anderson Pump Station (Figure 4). The Anderson Pump Station is the terminus for both of the Proposed Projects and is located at the southwest corner of Loop 1604 and SH 151 intersection. The included acreage is designated as a karst preserve (herein referred to as the APS Karst Preserve) in the HCP to provide mitigation for the Covered Species.

In total, the HCP Plan Area encompasses approximately 219.0 acres: 159.0 acres associated with Phase 2 of the WRIP Project, 1.4 acres associated with Phase 2 of the Micron Pipeline Project, and 57.6 acres associated with the proposed APS Karst Preserve.

2.3.5 Avoidance and Minimization

The SAWS Micron and WRIP HCP establishes the Proposed Projects' biological goals and objectives intended to avoid, minimize, and mitigate the potential taking of Covered Species. The biological goals and objectives include:

1) avoiding reasonably certain takings of Covered Species by routing the Proposed Projects through areas with no demonstrated occupancy by the Covered Species and employing construction methods (where practicable) that reduce the amount of excavation needed to install the pipelines;
2) minimizing potential impacts on Covered Species by using best management practices to reduce construction phase effects; and
3) mitigating for potential impacts by permanently dedicating and managing the 57.6-acre APS Karst Preserve within an undeveloped portion of the Anderson Pump Station property for the benefit of the Covered Species.

The Proposed Projects also avoid areas designated as critical habitat for listed karst invertebrates, and investigations to-date have not documented the presence of voids with habitat characteristics or the presence of individuals.

Best management practices implemented during construction to minimize potential impacts would include the application of erosion and sedimentation controls, spill prevention plans, and site restoration measures designed to minimize impacts to the surface and subsurface environment during and after construction. Additionally, preservation measures would be applied to minimize impacts to the existing tree canopy in accordance with the City of San Antonio Tree Ordinance.

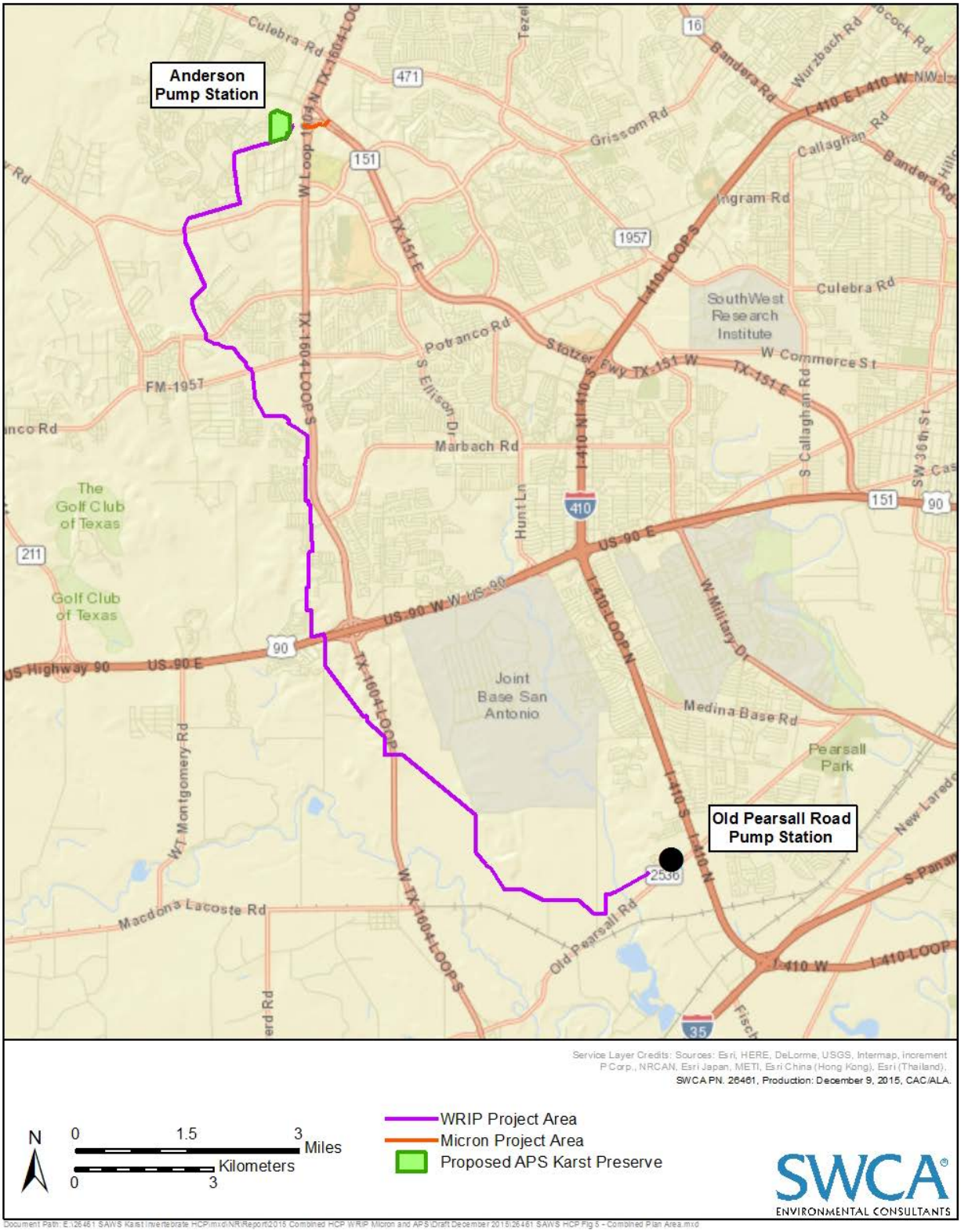

Figure 3. SAWS Micron and WRIP HCP Plan Area.

Figure 4. SAWS Anderson Pump Station and the proposed APS Karst Preserve.

2.4 ALTERNATIVE C – Reduced Take/Reduced Mitigation SAWS Micron and WRIP HCP

Alternative C is similar to Alternative B in that it would involve the issuance of a section 10(a)(1)(B) ITP to SAWS to authorize incidental take of the Covered Species that may result from the Covered Activities. However, Alternative C would implement a "Reduced Take/Reduced Mitigation" HCP developed by SAWS.

SAWS would apply the same method to quantify an amount of potential take for the Covered Species as with the Preferred Alternative. However the estimate would be reduced to only those disturbances within mapped Karst Zone 1 (known to contain listed karst invertebrate species) and Karst Zone 2 (has a high probability of containing habitat suitable for listed karst invertebrate species). Under this alternative, potential take of Covered Species occurring in Karst Zone 3 would no longer be included in the permit coverage or HCP since Karst Zone 3 "probably do[es] not contain listed karst invertebrate species" (Veni 2002).

Authorization of take under this alternative would cover 45.3 acres that crosses over mapped Karst Zone 2. While currently delineated as Karst Zone 2, the Service considers the area around Loop 1604 and SH 151 as Karst Zone 1, due to the presence of listed species. However, because maps have not been updated to reflect this, there is no defined way to assign acreage to this Karst Zone 1 area. Of the proposed take authorization, Alterative C would allocate 43.9 acres to the WRIP Phase 2 Pipeline and 1.4 acres to the Micron Phase 2 Pipeline.

The "Reduced Take/Reduced Mitigation" HCP would have the same biological goals and objectives for the Proposed Projects and would still address measures to avoid and minimize the potential taking of the Covered Species. However, Alternative C would reduce the HCP Plan Area to only the surface and subsurface disturbances within Karst Zone 2 and would reduce the proposed APS Karst Preserve area to 40 acres, which would meet the minimum recommended size requirements established by the Service for a medium-quality preserve (Service 2012a). The smaller APS Karst Preserve would still include the cluster of occupied karst features (SWCA 2013, 2014a).

2.5 Alternatives Eliminated from Further Analysis

NEPA requires the identification and assessment of reasonable alternatives that will avoid or minimize the effects of proposed actions upon the quality of the human environment (40 CFR 1500.2(e)). The range of reasonable alternatives for this EA is limited to those that address the Proposed Federal Action and fulfill the purpose and need for the action. Therefore, we eliminated several alternatives from further evaluation in the EA in accordance with these standards. Table 1 presents the alternatives and briefly discusses the reasons why they were eliminated from further consideration.

Table 1. Alternatives Eliminated from Further Analysis

Alternatives Considered	Reason for Eliminating from Further Analysis
Issuance of a Separate Individual Section 10(a)(1)(B) Incidental Take Permit for each of the Proposed Projects	Individual section 10(a)(1)(B) permits for each of the Proposed Projects was considered. However, this approach was deemed impractical because seeking two individual permits would greatly increase the amount of work required by the Service and SAWS to achieve the same results expected to be gained by covering both Proposed Projects under one permit. Therefore, this alternative would not serve as a reasonable alternative for the Proposed Federal Action.
Issuance of a Section 10(a)(1)(B) Incidental Take Permit with Habitat Mitigation Lands Not Currently Owned by SAWS	Although this alternative would likely meet the purpose and need for the Proposed Federal Action it would not be practical since SAWS currently owns a sufficient amount of land with existing karst habitat that is identical to the karst habitats that could potentially be impacted by the Proposed Projects. Therefore, identifying alternate mitigation lands is not warranted.

Alternatives Considered	Reason for Eliminating from Further Analysis
Issuance of a Section 10(a)(1)(B) Incidental Take Permit with Additional Mitigation	Development of an additional alternative providing mitigation above and beyond proposed Alternatives B and C was considered during preparation of the EA. This alternative would meet the Proposed Project purpose and need, but the USFWS Habitat Conservation Planning Handbook (USFWS 2016) states that mitigation should be commensurate with the impacts of taking. The Applicant has committed to avoiding most potential takings of Covered Species by routing the Proposed Projects through areas with no demonstrated occupancy by the Covered Species and employing construction methods (where practicable) that reduce the amount of excavation needed to install the pipelines, as well as minimizing potential impacts on Covered Species by using best management practices to reduce construction phase effects. The Applicant will also mitigate for potential impacts by permanently dedicating and managing the 57.6-acre APS Karst Preserve within an undeveloped portion of the Anderson Pump Station property for the benefit of the Covered Species. SAWS fully offsets the impacts of its requested takings by providing mitigation that permanently protects and manages known, demonstrated habitat for listed karst invertebrates as compensation for potential (not demonstrated) impacts to listed karst invertebrates associated with the Covered Activities. In this respect, the proposed mitigation provides a tangible net benefit to the conservation of the listed karst invertebrates. Furthermore, SAWS does not own any other lands known to be suitable for the conservation of listed karst invertebrates, nor is SAWS aware of any other opportunities to acquire such lands from other parties. Therefore, additional mitigation is neither warranted nor practicable within the timeframes of these projects, and this alternative was not carried forward for analysis.
Altering the Routes of the Proposed Projects	All alternative routes result in the crossing of karst zones that could potentially support listed karst species, due to the need to connect to the Anderson Pump Station. Additionally, alternative routes would avoid and minimize project impacts identical to the alternatives analyzed. Therefore, no alternative routes are analyzed.

2.6 Comparison of Alternatives

Table 2 summarizes the major elements of the three alternatives being carried forward for further evaluation in this EA.

Table 2. Comparison of the Selected Alternatives Carried Forward for Further Analysis

Major Elements of the Selected Alternatives	Alternative A No Action, No Incidental Take Permit (ITP) Issued	Alternative B (Preferred Alternative) Issue an ITP and Implement a Micron and WRIP Habitat Conservation Plan (HCP)	Alternative C Issue an ITP and Implement a Reduced Take SAWS Micron and WRIP HCP
Authorizes the Incidental Take of Covered Species	No. In absence of an authorized ITP, any take of the Covered Species from the Proposed Projects would violate the Endangered Species Act (ESA).	Yes. Issuance of an ITP under this alternative would authorize any potential incidental take of the Covered Species within Karst Zones 1, 2 and 3.	Yes. Issuance of an ITP under this alternative would authorize any potential incidental take of the Covered Species within Karst Zones 1 and 2.

Major Elements of the Selected Alternatives	Alternative A No Action, No Incidental Take Permit (ITP) Issued	Alternative B (Preferred Alternative) Issue an ITP and Implement a Micron and WRIP Habitat Conservation Plan (HCP)	Alternative C Issue an ITP and Implement a Reduced Take SAWS Micron and WRIP HCP
Projects Proposed for ITP Coverage	None. There would be no Proposed Projects covered by this alternative.	2 SAWS Projects. Micron Pipeline (Phase 2) and WRIP (Phase 2).	2 SAWS Projects. Micron Pipeline (Phase 2) and WRIP (Phase 2).
Habitat of Concern	Karst Invertebrate Habitat. Karst Zones 1, 2, and 3.	Karst Invertebrate Habitat. Karst Zones 1, 2, and 3.	Karst Invertebrate Habitat. Karst Zones 1 and 2.
Species Covered	None. No federally listed species would be covered under this alternative.	Five listed endangered species and one non-listed species to include: • Madla's Cave meshweaver (*C. madla*) • Robber Baron Cave meshweaver (*C. baronia*) • Braken Bat Cave meshweaver (*C. venii*) • ground beetle (*R. infernalis)* • ground beetle (*R. exilis)* • blind spider (*C. loftini*)	Same as for Alternative B.
HCP Plan Area	None. Without this issuance of an ITP there would be no area.	219.0 acres. (1.4 acres for Micron Phase 159.0 acres for WRIP Phase 2, and 57.6 acres at the Anderson Pump Station)	200.4 acres. (1.4 acres for Micron Phase 159.0 acres for WRIP Phase 2, and 40 acres at the Anderson Pump Station)
Estimated Take	Without a 10(a)(1)(B) permit an estimate of take would not be established.	67.8 acres over Karst Zones 1, 2 and 3(1.4 acres for Micron Phase 2, and 66.4 acres for WRIP Phase 2).	45.3 acres over Karst Zones 1 and 2 (1.4 acres for Micron Phase 2, and 43.9 acres for WRIP Phase 2).
Proposed Conservation Measures	None.	A 57.6-acre Karst Preserve would be established at the Anderson Pump Station.	A 40-acre Karst Preserve would be established at the Anderson Pump Station.
Mitigation/ Conservation Funding	None.	SAWS has allocated funds for the Proposed Projects to implement minimization and mitigation measures for the Covered Species. SAWS also owns the land for the proposed 57.6-acre Karst Preserve at the Anderson Pump Station and would provide all funds to continue to manage and monitor the preserve in perpetuity.	SAWS has allocated funds for the Proposed Projects to implement minimization and mitigation measures for the Covered Species. SAWS also owns the land for the proposed 40-acre Karst Preserve at the Anderson Pump Station and would provide all funds to continue to manage and monitor the preserve in perpetuity.

Major Elements of the Selected Alternatives	Alternative A No Action, No Incidental Take Permit (ITP) Issued	Alternative B (Preferred Alternative) Issue an ITP and Implement a Micron and WRIP Habitat Conservation Plan (HCP)	Alternative C Issue an ITP and Implement a Reduced Take SAWS Micron and WRIP HCP
Meets the Purpose and Need of the Proposed Federal Action	No. Under this alternative the Service would not issue an ITP and SAWS would not have the regulatory assurance that project activities would not violate the ESA.	Yes. Under this alternative the Service would issue an ITP and ensure that Covered Species are protected to the greatest extent possible. SAWS would have the regulatory assurance to avoid possible violations of the ESA for the Proposed Projects for Karst Zones 1, 2 and 3.	Yes. Under this alternative the Service would issue an ITP and ensure that Covered Species are protected to the greatest extent possible. SAWS would have the regulatory assurance to avoid possible violations of the ESA for the Proposed Projects for Karst Zones 1 and 2.
Project Impacts Mitigated to the Maximum Extent Practicable	N/A.	Yes.	Yes.

CHAPTER 3. AFFECTED ENVIRONMENT

3.1 Introduction

The affected environment describes the current environmental conditions for resources by the alternatives, including the No Action Alternative, within a Permit Study Area. If a specific environmental resource would not be affected by the Proposed Federal Action, then it does not need to be described in detail.

3.1.1 Regional Environmental Setting

The Permit Study Area is situated in far western Bexar County, Texas, and is included on the Culebra Hill and Macdona, Texas, U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle maps. Topography in the Permit Study Area is generally characterized by gentle, rolling hills and drainages, with slopes becoming more gradual towards the south. Elevation across the Permit Study Area ranges from approximately 1,000 feet above mean sea level (amsl) in the northern region to approximately 600 feet amsl in the southern region. Surface flows across the Permit Study Area generally drain south towards Potranca and Medio creeks, both tributaries of the Medina River. Much of the Permit Study Area is rural south of U.S. Highway 90 (US 90). North of US 90, the Permit Study Area crosses through the suburban areas expanding west in Bexar County.

Average long-term annual rainfall in the Permit Study Area is around 29 inches per year with a variation of +/- 20 inches per year dependent on precipitation and drought conditions (National Oceanic and Atmospheric Administration [NOAA] 2015). Winters are generally mild and summers are hot.

3.1.2 Resources Not Considered for Detailed Analysis

Table 3 lists the resources that have been dismissed from further discussion and analysis in this EA, and includes a brief explanation why each resource listed has been eliminated from further review.

Table 3. Resources Eliminated from Further Review

Resource	Reason for Dismissing from Further Discussion and Analysis
Air Quality, Climate and Climate Change, Visual and Aesthetic Qualities, Geology (excluding karst habitat features), and Traffic and Transportation**	All of these resources could be temporarily affected during construction activities. However, effects would be infrequent and restricted to site-specific locations. Implementation of erosion control measures, best management practices, and post-construction revegetation efforts would further minimize project-related impacts. Therefore, potential impacts of the Proposed Federal Action would not rise above the insignificant level for these resources. **An impact analysis for the Covered Species and associated geology providing karst habitat for the Cover Species is analyzed further under Section 3.3 Geologic Karst Resources*
Land Use	Routing and siting for the Proposed Projects would be consistent with the requirements set for public infrastructure projects to avoid conflicts with land uses (e.g., following property lines, rights-of-way, and existing utility easements). SAWS would need to comply with the applicable Texas Commission on Environmental Quality (TCEQ) siting rules regardless of the Proposed Federal Action. The land proposed for the Habitat Conservation Plan (HCP) preserve is part of the Anderson Pump Station property owned by San Antonio Water System (SAWS) and is currently undeveloped with no planned land use identified other than for use as a spoil fill site. Establishment of the HCP preserve would alter SAWS's future use of this undeveloped area of the Anderson Pump Station; however, SAWS is currently using other SAWS-owned property for this purpose and would likely acquire other property in the future to meet this need. Therefore, land use impacts would not rise above a negligible level for the proposed HCP preserve.

Resource	Reason for Dismissing from Further Discussion and Analysis
Noise Impacts to Humans*	Adjacent residents could be temporarily affected by noise during construction activities. However, construction noise levels of 55-85 dBA are comparable to other noise levels currently experienced by local residents. For comparison, traffic noise from state highway Loop 1604 – which is located within 0.5 miles of the Proposed Projects for roughly 55% of their alignment – can reach almost 80 dBA. Therefore, residents may not experience noticeably greater noise levels or only experience them for a brief duration, since effects would be restricted to site-specific locations and noise impacts would cease when construction is complete. ** Noise effects to wildlife are addressed in Section 4.5.2.*
Prime and Unique Agricultural Lands	The Proposed Federal Action is limited to the authorization of take that may result from removal of or direct/indirect impacts to potential Covered Species habitat. For the six Covered Species, this habitat consists of subterranean cave-bearing geologic formations of the Culebra Anticline Karst Fauna Region (KFR) with stable temperature and high humidity, which does not qualify as prime or unique agricultural lands.
Surface Water Resources, including Floodplains	The Proposed Federal Action is limited to the authorization of take that may result from removal of or direct/indirect impacts to potential Covered Species habitat (e.g., cave-bearing geologic formations of the Culebra Anticline KFR) which occurs at subterranean levels well below any surface water resources such as streams/creeks, wetlands, and/or floodplain areas. Moreover, should the Proposed Projects involve regulated impacts to surface water resources, SAWS would be required to obtain a Section 404 Clean Water Act permit and comply with TCEQ water quality requirements. Any potential surface water impacts would be analyzed in accordance with the Clean Water Act during the appropriate permit application processes. Similarly, the Federal Emergency Management Agency regulates construction within designated floodplains and SAWS would be required to coordinate with the local floodplain manager and permit project activities accordingly. For this reason, any potential impacts of the Proposed Federal Action would not rise above the insignificant level for this resource.
Ground Water Resources	The Permit Study Area is not located over the Contributing or Recharge Zones of Edwards Aquifer or other ground water source. Construction of the WRIP would allow SAWS to pump and store water in ASRs (Aquifer Storage and Recovery, per terms and conditions for the implementation and administration of the ASR Program identified as a Conservation Measure in Chapter 5 of the *Edwards Aquifer Habitat Conservation Plan (Recon Environmental 2012)*. However, this issue is considered beyond the scope of this EA. Analysis of effects to the Edwards Aquifer is provided in the *Final Environmental Impact Statement Edwards Aquifer Recovery Implementation Program Habitat Conservation Plan* (USFWS 2012c).
Forestry and Mineral Resources	The Permit Study Area does not contain forestry resources and avoids any existing areas of mineral extraction (e.g., quarries, oil and gas) by following existing utility easements, rights-of-way, and property lines.
Ecologically Critical Areas, Wild and Scenic Rivers, or Other Unique Natural Resources,	The Permit Study Area does not contain any designated ecologically critical areas, wild or scenic rivers, or other unique natural resources of concern.
Coastal Management Zones and Coastal Resources	The Permit Study Area is not located within a coastal zone or coastal barrier and does not contain coastal resources.

Resource	Reason for Dismissing from Further Discussion and Analysis
Important Scientific, Archaeological, and Other Cultural Resources, Including Historic Properties Listed or Eligible for the National Register of Historic Places	Background investigations were conducted for the Proposed Projects to determine the likelihood for archaeological, cultural, and/or historic resources to be present. It was determined from these investigations that the Proposed Projects would have no adverse effect on cultural resources eligible for formal designation and that no additional archaeological investigations would be warranted. Concurrence from the Texas Historical Commission for the WRIP Project was received in July 2012. For this reason, any potential impacts of the Proposed Federal Action would not rise above the insignificant level for this resource.
Sustainability, Energy Efficiency, and Greenhouse Gas Reductions	The sustainability, energy, and greenhouse gas emission requirements of for the Proposed Projects should generally be consistent with such requirements set for public infrastructure projects. There would be no change in the energy requirements for the Proposed Projects as a result of the Proposed Federal Action and SAWS would need to comply with the applicable TCEQ energy requirements and construct in accordance with American Water Works Association (AWWA) standards. Therefore it is not anticipated that future energy consumption or potential energy saving measures associated with the Proposed Projects would vary considerably from those of other similar undertakings within the county or state. For this reason, any potential impacts of the Proposed Federal Action would not rise above the insignificant level for this resource.
Depletable Resource Requirements and Conservation Potential	The only resources known to be subject to depletion as a result of the Proposed Federal Action are karst invertebrate habitat and potentially listed karst invertebrates. These resources are addressed in detail in the karst geology (section 3.3) and Covered Species (section 3.2.4) sections of this EA.
Hazards and Hazardous Materials	The planned routing and siting of the Proposed Projects would follow existing utility easements, rights-of-way, and property lines clear of hazards and hazardous materials. SAWS would evaluate any new easements or land acquisitions for hazards or hazardous materials through a Phase I Environmental Site Assessment and address any issues identified accordingly. For this reason, any potential impacts of the Proposed Federal Action would not rise above the insignificant level for this resource.
Public Health and Safety	Covered activities would occur within existing utility easements, rights-of-way, and property lines. Additionally, SAWS would need to comply with the applicable TCEQ health and safety requirements and construct the Proposed Projects in accordance with American Water Works Association standards. For this reason, any potential impacts of the Proposed Federal Action would not rise above the insignificant level for this resource.

<table>
<tr><th>Resource</th><th>Reason for Dismissing from Further Discussion and Analysis</th></tr>
<tr><td>Socioeconomic Resources, Environmental Justice, and Limited English Proficiency</td><td>Demographic information available through the EPA's Environmental Justice Screening and Mapping Tool is provided in the below table (EPA 2016). The table compares average demographic results for the census blocks affected by the Proposed Projects versus Bexar County, Texas. Although the Proposed Projects would occur in a predominately minority area, this demographic setting is consistent with the distribution of minority and low-income residents across the County. Therefore, any effects to the affected minority or low-income population from Proposed Projects actions would not be disproportionately greater (more severe) than those experienced by the population as a whole. Further, the Proposed Projects would not result in significant effects to air, noise or water pollution, hazardous waste, aesthetic values, community values and economic vitality, traffic, or public safety issues that may be of concern to local minority or low-income residents. Implementation of best management practices would also reduce any temporary construction-related effects. Long-term, the construction of the pipelines and facilities to provide water service to the community would provide a benefit to all affected residents.
<table>
<tr><th></th><th>Affected Census Blocks</th><th>Bexar County</th></tr>
<tr><td>Minority Population (% of total population)</td><td>80%</td><td>70%</td></tr>
<tr><td>Low Income Population (% of total population)</td><td>38%</td><td>40%</td></tr>
<tr><td>Linguistically Isolated Population (% of total population)</td><td>4%</td><td>7%</td></tr>
</table>
Additionally, while population and development growth are projected for the Permit Study Area, it is understood that growth and development would proceed in spite of the Proposed Projects and the Proposed Federal Action. Therefore, any potential impacts of the Proposed Federal Action would not measurably contribute to changing socioeconomic conditions or cause impacts to rise above the insignificant level for this resource.</td></tr>
<tr><td>Utilities and Infrastructure</td><td>Proposed Projects would be cohesive with the existing utilities and infrastructure. Furthermore, SAWS would need to comply with the applicable TCEQ requirements and AWWA standards for the Proposed Projects regardless of the Proposed Federal Action. For this reason, any potential impacts of the Proposed Federal Action would not rise above the insignificant level for this resource.</td></tr>
<tr><td>Golden-cheeked Warbler</td><td>In 2011, biologists identified potential golden-cheeked warbler habitat in two parcels east and west of the Micron project (Baer Engineering 2011). However, based on the results of the GCWA habitat assessment, a review of the proposed project, the project location, and consultation with USFWS, it was determined that the proposed project is not likely to result in incidental take of the GCWA, nor will the project result in a loss of suitable habitat for the endangered songbird. (Baer Engineering 2011). The included portions of the WRIP do not contain suitable golden-cheeked warbler habitat.</td></tr>
</table>

3.2 Biological Resources

The following subsections summarize the available technical information on the existing biological resources of the Permit Study Area. Included in these discussions are sections on vegetation, wildlife (including migratory birds), Covered Species, and state special status species. In general, the vegetation communities and wildlife species found within the Permit Study Area reflect the area's highly developed and urbanized nature.

3.2.1 Vegetation

The vegetation of a region is based upon soil conditions, geography, and prevailing climate patterns. Vegetation communities are collections of flora species within a specific geographical area based upon soil type, topography, local climate, and pattern of disturbance. Vegetation communities greatly influence wildlife species by providing shelter, food resources, and travel corridors.

The Permit Study Area is located entirely within the Texas Blackland Prairie, a Level III ecoregion (Griffith et al. 2004). Texas Blackland Prairie is a disjunct ecological region distinguished from surrounding regions by its fine-textured clayey soils and native vegetation dominated by prairie species. Since much of the Permit Study Area has been converted to urban and industrial uses or contains cropland, the majority of the Permit Study Area no longer exhibits characteristics typical of the Blackland Prairie ecoregion (Figure 5).

Most of the undeveloped lands in the vicinity of the Permit Study Area are vegetated with open herbaceous cover or shrublands, although patches of moderately dense woodland cover occur in the northern part of the Permit Study Area. Plowed fields, rangeland, and old fields are also found adjacent to the Proposed Projects.

Approximately 98 acres of the Permit Study Area is mapped by the Texas Parks and Wildlife Department (TPWD) as occurring in the Mesquite-Live Oak-Bluewood Parks vegetation type, with the remaining 56 acres of vegetation falling within the Crops type. Trees associated with the mesquite woodland include hackberry (*Celtis* sp.), cedar elm (*Ulmus crassifolia*) and Texas persimmon (*Diospyros texana*). Shrubs common in this woodland include bee-brush (*Aloysia gratissima*), desert hackberry (*Celtis pallida*), brasil (*Condalia hookeri*), littleleaf sumac (*Rhus microphylla*), agarita (*Berberis trifoliolata*), Spanish dagger (*Yucca treculeana*), pencil cactus (*Opuntia leptocaulis*), and prickly pear (*Opuntia lindheimeri*).

The northern portion of the Permit Study Area supports semi-open to moderately dense live oak/Ashe juniper woodland on hilltops and moderately dense live oak woodland in drainages and low lying areas. Woodlands located on hilltops are separated by numerous grassy breaks. Cedar elm, Texas persimmon, and net-leaf hackberry (*Celtis reticulata*) occur as isolated individuals or in very low densities. Canopy closure ranges from 30 to 50 percent. Shrub layer species primarily occur along woodland margins in low to very low densities. Shrub layer species include elbow bush (*Forestiera pubescens*), agarita, evergreen sumac, cat claw acacia (*Acacia roemeriana*), condalia (*Condalia hookeri*), Texas kidneywood (*Eysenhardtia texana*), Texas mountain laurel (*Sophora secundiflora*), mesquite, Arkansas yucca (*Yucca arkansana*), twist leaf yucca (*Yucca rupicola*), and prickly pear (*Opuntia lindheimeri*). Bee-brush occurs in more heavily grazed areas.

3.2.2 General Wildlife

The Permit Study Area lies within the Balconian Biotic Province, as delineated by Blair (1950), with the exception of approximately 0.3 mile of the WRIP Phase 2 segment that lies within the Tamaulipan Biotic Province.

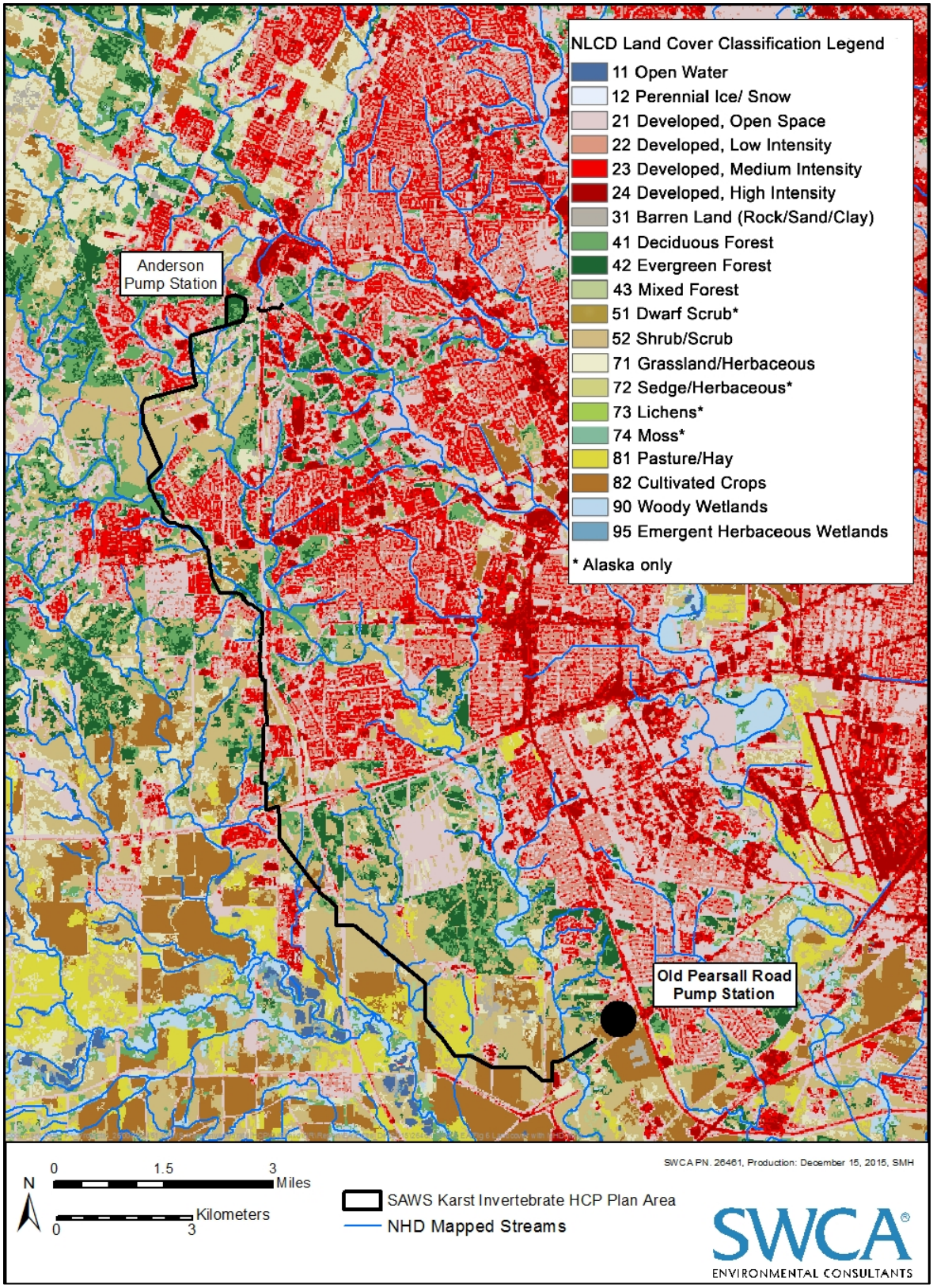

Figure 5. Land use and land cover in the vicinity of the Permit Study Area.

The Balconian Biotic Province supports a mix of vertebrate species that are also found in eastern forests, grasslands of the Great Plains, southwestern deserts, and the thornscrub of South Texas and northeastern Mexico. As described by Blair (1950), no mammal, reptile, frog, or toad species are endemic to the Balconian Biotic Province. Review of range maps provided in Sibley (2000) indicates that the province also has no endemic species of birds. Because of its unique karstic limestone geology, the Balconian Biotic Province does, however, claim endemic salamander and fish fauna (Blair 1950; Thomas et al. 2007).

Terrestrial wildlife habitats within the Permit Study Area generally correspond to the vegetation types described above. No perennial aquatic habitats occur within the Permit Study Area, but seasonal or intermittent pools or stream flow are utilized by water birds, amphibians, some snakes, and a variety of arthropods, and provide a source of drinking water for many non-aquatic species.

The following sections discuss common or typical wildlife species that are known or likely to occur within the Permit Study Area.

3.2.2.1 Fish

Although some stream channels may hold water seasonally, or intermittently (Figure 5), there are no perennial waters located within the Permit Study Area. Therefore, no fish would be expected to occur within the Permit Study Area.

3.2.2.2 Amphibians and Reptiles

As there are no perennial waters located within the Permit Study Area, no frog or aquatic turtle species would be expected to occur. Toads, which are better adapted to terrestrial conditions, are expected to occur widely throughout a variety of upland and lowland habitats in the Permit Study Area. Blair (1950) also indicates that 16 species of lizard have been known to occur in the Balconian Biotic Province. In general, lizards are expected to occur most commonly in open or semi-open areas where ground cover includes patches of bare ground.

Common native species of reptiles and amphibians that would be expected to occur within the Permit Study Area include the Gulf Coast toad (*Bufo valliceps)*, Texas earless lizard (*Cophosaurus texanus*), ground skink (*Scincella lateralis*), Texas rat snake (*Elaphe obsoleta*), Texas patchnose snake (*Salvadora grahamiae*), green anole (*Anolis carolinensis*), and flathead snake (*Tantilla gracilis*) (Kutac and Caran 1994). Although non-native, the Mediterranean gecko (*Hemidactylus turcicus turcicus*) also may occur within the Permit Study Area. One lizard of the Permit Study Area, the Texas horned lizard (*Phrynosoma cornutum*), has disappeared or become extremely uncommon across much of its former range in the state. This species is discussed in more detail below under State Special Status Species.

3.2.2.3 Birds

The Permit Study Area occurs within a landscape supporting a diverse avifauna that includes many permanent resident species, as well as migratory species that typically are present in the region only during the breeding or non-breeding seasons. Many other bird species that breed and winter outside of the Permit Study Area can occur regularly in the region during the spring and fall migration periods. The Permit Study Area lies within the Central Flyway, used by many species of migratory birds as they travel to and from their wintering grounds in Texas, Mexico, or Central or South America (TPWD 2016).
In May 2010, biologists with Baer Engineering and Environmental Consulting, Inc. (Baer Engineering) observed barn swallow (*Hirundo rustica*), black vulture *(Coragyps atratus)*, black-crested titmouse *(Baeolophus atratus)*, brown-headed cowbird (*Molothrus ater*), Carolina chickadee (*Poecile carolinensis*), Carolina wren (*Thryothorus ludovicianus*), cedar waxwing (*Bombycilla cedrorum*), common grackle (*Quiscalus quiscula*), crested caracara (*Caracara cheriway*), the house finch (*Carpodacus mexicanus*), killdeer (*Charadrius vociferus*), lesser goldfinch (*Carduelis psaltria)*, mourning

dove (*Zenaida macroura*), northern cardinal (*Cardinalis cardinalis*), northern mockingbird (*Mimus polyglottos*), painted bunting (*Passerina ciris*), red-tailed hawk (*Buteo jamaicensis*), vesper sparrow (*Pooecetes gramineus*), white-eyed vireo (*Vireo griseus*), and white-winged dove (*Zenaida asiatica*) within Phase 2 of the Micron Pipeline (Baer Engineering 2011).

While SAWS has not conducted specific migratory bird surveys for Phase 2 of the WRIP, due to the project's close proximity to Micron and shared habitat types, it is likely that similar migratory birds would be present.

3.2.2.4 Mammals

At least 184 species of mammals are expected to occur in the wild in Texas (Schmidly 2004), with 66 native species likely occurring regularly in the Balconian Biotic Province based on range maps and county records produced by Schmidly (2004). Several introduced species of free-roaming hooved mammals likely also occur in the province on occasion.

Mammals that may be found within the Permit Study Area would be typical of developed urban areas and mesquite woodland habitats in south-central Texas. These include opossum (*Didelphis virginiana*), armadillo (*Dasypus novemcinctus*), fox squirrel (*Sciurus niger*), coyote (*Canis latrans)*, raccoon (*Procyon lotor*), and white-tailed deer (*Odocoileus virginiana*).

3.2.3 Endangered Species

3.2.3.1 Golden-Cheeked Warbler

The golden-cheeked warbler was emergency listed as endangered on May 4, 1990, with a final rule listing the species on December 27, 1990. In 2011, biologists identified potential GCWA habitat in two parcels east and west of the Micron project (Baer Engineering 2011). However, based on the results of the GCWA habitat assessment, a review of the proposed project, the project location, and consultation with the Service, it was determined that the Micron project is not likely to result in incidental take of the GCWA, nor will the project result in a loss of suitable habitat for the endangered songbird (Baer Engineering 2011). The included portions of the WRIP do not contain suitable GCWA habitat.

3.2.3.2 Karst Invertebrates

There are three federally listed endangered eyeless spiders: Madla's Cave meshweaver, Robber Baron Cave meshweaver, Braken Bat Cave meshweaver; two endangered species of ground beetles with no common names (*Rhadine infernalis* and *Rhadine exilis*); and one unlisted blind Cicurina spider with no common name (*Cicurina loftini*) that occur within the Permit Study Area. These endangered species were listed on December 26, 2000. Critical habitat was designated February 14, 2012; however, no designated critical habitat for these species occurs within the Project Area.

All of these species are obligate cave-dwellers (troglobites) known only from subsurface voids formed in the Edwards Formation, Glen Rose Formation, Pecan Gap, and Austin Chalk limestones in northern and western Bexar County. A number of anatomical and physiologic adaptations to cave life characterize troglobites, including loss of pigment and sclerotization, reduction or loss of eyes, elongation of appendages, lengthened life span, modified fecundity, and metabolic adaptation to nutrient poor habitat conditions. The cave environment is relatively monotonous compared to surface invertebrate habitats and is characterized by stable temperatures close to the mean surface temperature, constant near-saturation humidity, low evaporation rates, and the absence of photosynthetic nutrient production (Service 2011). Due to the lack of light for photosynthesis, most cave communities lack primary producers. Instead there is a reliance on nutrient input from the surface ecosystem. These types of cave communities are essentially decomposer communities (Culver 1982). Nutrients are introduced into the subsurface in the form of plant detritus washed in by floodwater, microorganisms that enter the cave under their own

power, and the eggs and waste of species such as cave crickets (*Ceuthophilus* spp.) that move freely in and out of caves (Service 2003).

Most threats to the species alter the stable physical environment of the cave, alter nutrient input, or introduce substances and/or organisms that have the potential to affect karst invertebrates adversely. Key identified threats include:

- Fill-in or collapse of cave entrances during development activities, which can alter the physical cave environment as well as impede or eliminate nutrient input.
- Chemical contamination from ground water and/or surface drainage, including pesticides, fertilizers, sewage, hazardous material spills, various pipeline leaks, storage tanker leaks, landfills, and urban run-off or trash dumping.
- Changes to surface drainage via alterations in topography, impervious cover, etc. which could lead to drying of karst features and changes in nutrient inputs.
- Loss or alteration of surface biological communities which can potentially adversely affect karst invertebrates by altering nutrient inputs, alter the stable physical environment of the cave, or introduce potentially harmful organisms.
- Removal of surface vegetation, which could lead to fluctuations in cave temperatures and moisture regimes that are outside the normal range of variability for the system.
- Soil disturbance resulting in an increased density of red imported fire ants and alteration of the cave's physical environment through increased sedimentation.
- Creation of new cave entrances from excavation, which could alter cave moisture regimes, increase sedimentation, and change water drainage patterns. Excavation could also destroy caves entirely.

Population estimates are unavailable for any of the Covered Species due to lack of adequate estimation techniques, their cryptic behavior, taxonomic issues, and difficulty accessing cave and karst habitat. The following describes the known distribution by species.

Madla's Cave Meshweaver (*Cicurina madla*)
Cicurina madla was first collected in 1963 from a cave in the Helotes Karst Fauna Region (KFR) and described by Gertsch (1992) in 1992. The species has now been collected from at least 22 caves in the four Bexar County KFRs associated with the Edwards Limestone formation (Government Canyon KFR, Stone Oak KFR, Helotes KFR, and the UTSA KFR) (Service 2012b). However, based on the findings of Paquin and Ledford (2012), *C. madla* could also occur in the Culebra Anticline KFR at the TxDOT SH 151 project.

Robber Baron Cave Meshweaver (*Cicurina baronia*)
The first collection of *Cicurina baronia* was obtained from the Robber Baron Cave in Bexar County in 1969 and described by Gertsch (1992) in 1992. Today, only two caves are known to contain *C. baronia* and both are located in the Alamo Heights KFR (Service 2012b). Cokendolpher (2012) did not identify any of the spiders collected from TxDOT SH 151/Loop 1604 project site as *C. baronia*. However, there has been some scientific suggestion that the species is synonymous to *C. loftini*, which was collected at the TxDOT SH 151/Loop 1604 project site (Cokendolpher 2012, Paquin and Ledford 2012).

Braken Bat Cave Meshweaver (*C. venii*)
The type locality for *C. venii* is the Braken Bat Cave in the Culebra Anticline KFR (Service 2012b). Gertsch (1992) collected a single, damaged specimen of an adult female, later named *C. venii*, from this cave in 1980. No other specimens of *C. venii* have ever been collected at this site and the current status of *C. venii* at the Braken Bat Cave is unknown because the main entrance of the cave was sealed with

concrete (Paquin and Dupérré 2009). Recently, Cokendolpher (2012) assigned the name of *C. venii* to an adult female *Cicurina* specimen collected at the TxDOT SH 151/Loop 1604 project site, which if accurate, would be the second known locality for *C. venii* and the first time since 1980 that the species was observed. Zara Environmental LLC (Zara) (2015) reported the collection of immature *Cicurina* specimens found at the Clandestine Cupola Cave, which may be either *C. venii* or *C. loftini*.

Ground Beetle with no Common Name (*Rhadine infernalis*)
Rhadine infernalis is a ground beetle similar to *R. exilis* but with a more robust body (Service 2000). Barr and Lawrence (1960) first collected *Rhadine infernalis* in 1959 and described the species as *Agonum infernalis* in 1960. Barr reassigned the species to *Rhadine* in 1974. *Rhadine infernalis* has been reported from at least 39 caves in the Culebra Anticline, Government Canyon, Helotes, Stone Oak and UTSA KFRs (Service 2012b).

Ground Beetle with no Common Name (*Rhadine exilis*)
Rhadine exilis is a ground beetle with a very slender body that readily distinguishes it in the field from *R. infernalis* (Service 2000). Barr and Lawrence (1960) first collected *R. exilis* in 1959 from a cave in the Helotes KFR and was described as a new species in 1960 (Barr and Lawrence 1960). The species was first assigned the name *Agonum exile*, but was formally reclassified in 1974 as *Rhadine exilis* (Barr and Lawrence 1960). Today, *Rhadine exilis* is known to occupy at least 53 caves across the Government Canyon, Helotes, Stone Oak, and UTSA KFRs (Service 2012b). Recent collections of a slender, eyeless *Rhadine* beetle have been identified from the Culebra Anticline as *R. exilis* (James Reddell, University of Texas at Austin, pers. comm. to Cyndee Watson, Service's Austin Office), and additional specimens were collected at the proposed APS Karst Preserve and identified as *R. exilis* (James Reddell, pers. comm. to Amanda Aurora, SWCA).

Spider with no Common Name (*Cicurina loftini*)
Cicurina loftini was first collected from Caracol Creek Coon Cave in the Culebra Anticline KFR in 1993 (Paquin and Dupérré 2009) and was first described as a species by James Cokendolpher (2004) in 2004. *Cicurina loftini* has been confirmed from at least one other Bexar County cave (SBC Cave) (Paquin and Dupérré 2009). Zara (2010) tentatively confirm that an immature specimen discovered in Clandestine Cupola Cave may be *C. loftini* or *C. venii*. All three of these caves are within the Culebra Anticline KFR. Cokendolpher (2012) also assigned the name of *C. loftini* to two specimens (male and female) collected from the TxDOT SH 151 project site, but Paquin and Ledford (2012) suggest that *C. loftini* should be considered synonymous with *C. baronia.*

3.2.4 State Special Status Species
As of October 2015, there were 15 state-listed species (that are not currently federally listed or candidate species) that may occur in Bexar County (Table 4; TPWD 2015a). State-listed species are those species that are threatened or endangered with extirpation within the legal boundary of the State of Texas.

Table 4. State-listed Species that may occur in Bexar County

Common Name (*Scientific Name*)	State Status	Habitat Requirements
Cascade Caverns salamander (*Eurycea latitans*)	T	Springs and caves in Medina River, Guadalupe River, and Cibolo Creek watersheds within Edwards Aquifer area.
Comal blind salamander (*Eurycea tridentifera*)	T	Springs and waters of caves in Bexar and Comal Counties.
white faced ibis (*Plegadis chihi*)	T	Freshwater marshes, sloughs, irrigated rice fields, brackish and saltwater marshes; nests in marshes, in low trees.

Common Name (*Scientific Name*)	State Status	Habitat Requirements
American Peregrine falcon (*Falco peregrinus anatum*)	T	Nests in tall cliff eyries; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.
Peregrine falcon (*Falco peregrinus*)	T	Both subspecies migrate across the state from more northern breeding areas in United States and Canada to winter along coast and farther south.
wood stork (*Mycteria americana*)	T	Prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt water.
zone-tailed hawk (*Buteo albonotatus*)	T	Open deciduous or pine-oak woodland, mesa or mountain country, often near watercourses, and wooded canyons and tree-lined rivers along middle-slopes of desert mountains.
toothless blindcat (*Trogloglanis pattersoni*)	T	San Antonio Pool of the Edwards Aquifer.
widemouth blindcat (*Satan eurystomus*)	T	San Antonio Pool of the Edwards Aquifer.
black bear (*Ursus americanus*)	T	Desert lowlands and high elevation forests and woodlands.
false spike mussel (*Quincuncina mitchelli*)	T	Medium to large rivers; substrates varying from mud through mixtures of sand, gravel and cobble; Rio Grande, Brazos, Colorado, and Guadalupe (historic) river basins
Texas horned lizard (*Phrynosoma cornutum*)	T	Open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees.
Texas indigo snake (*Drymarchon melanurus erebennus*)	T	South of the Guadalupe River and Balcones Escarpment; thorn bush-chaparral woodlands of south Texas, especially dense riparian corridors; suburban areas and irrigated croplands.
Texas tortoise (*Gopherus berlandieri*)	T	Open brush with grass understory.
timber/canebrake rattlesnake (*Crotalus horridus*)	T	Swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland, limestone bluffs.

T – threatened

Based on TPWD's Natural Diversity Database, no state-listed species are known to occur within 1.5 miles of the Micron project limits (Baer Engineering 2011). During field surveys and an assessment of the WRIP Phase 2 project, biologists observed no state-listed species (Chiang, Patel & Yerbey 2005; Hicks and Company 2012). However, Hicks and Company (2012) determined in a 2012 EA that potential habitat for the Texas horned lizard, Texas indigo snake (*Drymarchon melanurus erebennus*), Texas tortoise (*Gopherus berlandieri*), and timber/canebrake rattlesnake (*Crotalus horridus*) is present. Since the direct take of these species is prohibited by Texas State law (Section 68.015 of the Texas Parks and Wildlife Code), these species are carried forward for analysis in the EA. "Take" is defined in Section 1.101(5) of the Texas Parks and Wildlife Code as: "collect, hook, hunt, net, shoot, or snare, by any means or device, includ[ing] an attempt to take or to pursue in order to take."

3.2.4.1 Texas Horned Lizard

The Texas horned lizard is listed as threatened in the State of Texas. This species is primarily found in desert or semi-arid climates where it prefers loose sand or loamy soil types (TPWD 2015b). These species are docile and have a long history of being captured for use as pets in the State of Texas, but this practice is now banned with the listing. One major threat to this species is the invasion of red imported fire ants, which outcompete their primary food source, harvester ants, and result in increased use of pesticides, which decrease food sources for the lizard.

3.2.4.2 Texas Indigo Snake

The Texas indigo snake is listed as threated in the State of Texas. These snakes have wide forage ranges and prefer areas with light vegetation nearby permanent water sources (Herps of Texas 2015). Threats to the species include habitat fragmentation and changes in land use, such as new development, that restrict their foraging range.

3.2.4.3 Texas Tortoise

The Texas tortoise was state listed as threatened in 1977. This species feeds on common prickly pear and other succulent species within their range (TPWD 2015c). These species are at risk due to exploitation for use as pets, low reproductive rates (breeding age is 15 years old, clutches average three eggs, and most juveniles do not survive to adulthood), and habitat modification (TPWD 2015c).

3.2.4.4 Timber/Canebrake Rattlesnake

The timber/canebrake rattlesnake is listed as threatened in the State of Texas. Reaching a length of 36 to 40 inches, this species is the second largest species of venomous snakes in the state (TPWD 2015d). These snakes' preferred habitat includes permanent water sources in woodlands or thickets with fallen tree branches or other forms of protective cover. Major threats to the species include the destruction of habitat and death caused by human intervention or automobiles (TPWD 2015d).

3.3 Geologic Karst Resources

In 1993 (revised in 2002), the Service commissioned a study that delineated five geographic zones according to their potential to provide suitable habitat for karst invertebrates (Veni 2002). Veni (2002) based the zones on lithology, distribution of known caves and cave fauna, and geologic controls on cave development. Special attention was paid to cavern development in the Edwards Group, Upper Glen Rose, Pecan Gap Chalk, and Austin Chalk geologic formations. Veni (2002) delineated the zones as follows:

- Zone 1: Areas known to contain endangered karst invertebrate species.
- Zone 2: Areas having a high probability of containing habitat suitable for endangered karst invertebrate species.
- Zone 3: Areas that probably do not contain endangered karst invertebrate species.
- Zone 4: Areas that require further research but are generally equivalent to Zone 3, although they may include sections that could be classified as Zone 2 or Zone 5 as more information becomes available.
- Zone 5: Areas that do not contain endangered karst invertebrate species.

Mapped karst zones within the Permit Study Area are summarized in Table 5 and Figure 6. The Service notes that the area of Karst Zone 2 around SH 151 should be considered equivalent to Karst Zone 1, since listed species have been confirmed to occur in that area (Christina Williams, Service's Austin Office, pers. comm.). However, because the zone maps have not been updated, there is no way to accurately assess the number of Zone 1 acres impacted. Therefore, they will be calculated as Zone 2. Table 5 also provides the acreage of karst zones within Culebra Anticline KFR for comparative purposes.

Table 5. Mapped Karst Zones Associated with the Permit Study Area and Culebra Anticline KFR

Karst Zone *	Permit Study Area (acres)	Culebra Anticline KFR (acres)
Karst Zone 1	0	3,857.2
Karst Zone 2	102.9	13,015.8
Karst Zone 3	22.5	0
Karst Zone 4	0	0
Karst Zone 5	24.8	0

* Veni 2002

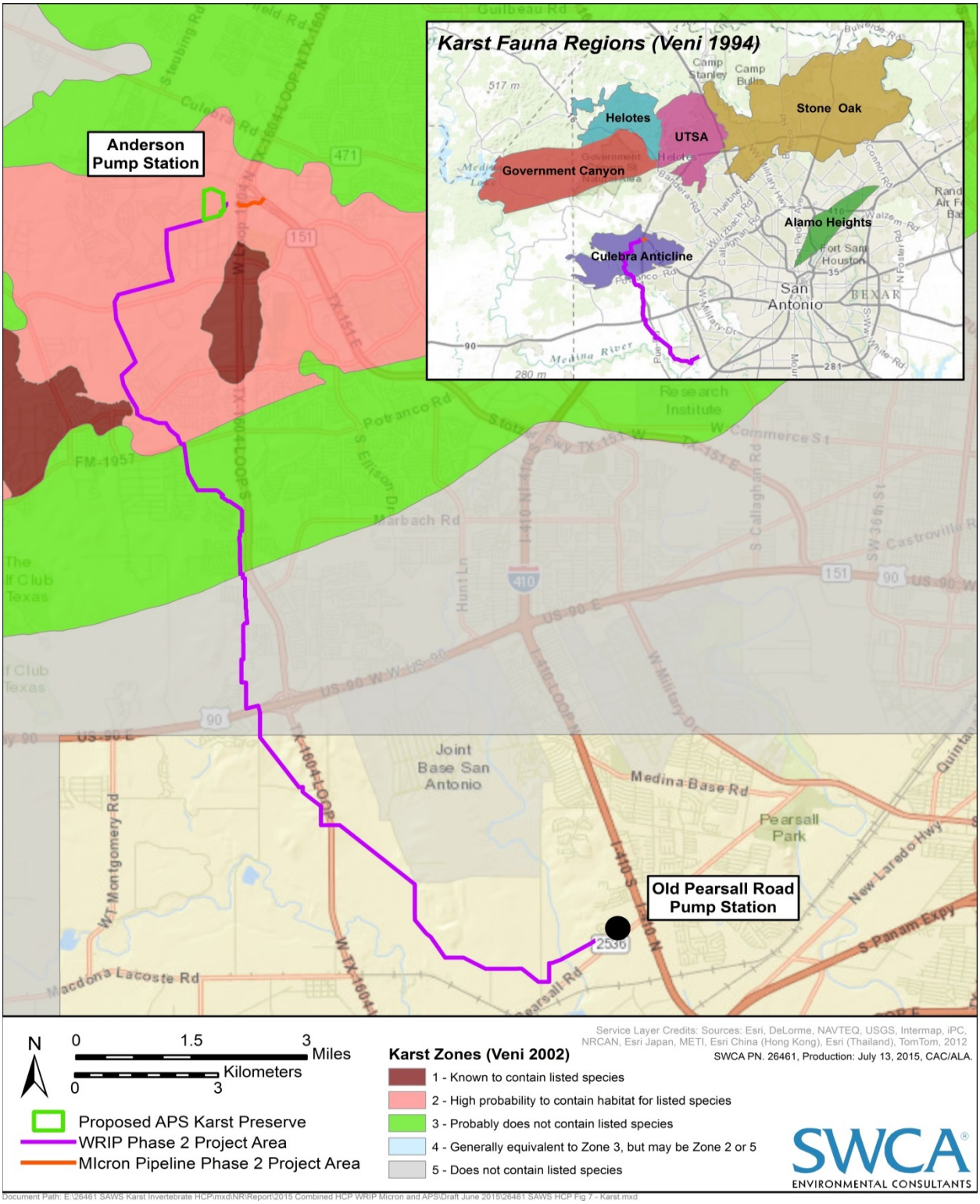

Figure 6. Karst zones and fauna regions crossed by the Proposed Projects.

Veni (1994) hypothesized that certain geologic and geographic features such as stream valleys and faults form barriers to karst invertebrate dispersal and distribution. On the basis of this hypothesis, Veni (1994) delineated six KFRs within Bexar County, including the Stone Oak, UTSA, Helotes, Government Canyon, Culebra Anticline, and Alamo Heights KFRs (see Figure 6).

As shown in Figure 6, both Proposed Projects occur fully or partially within the Culebra Anticline KFR; no part of either project occurs in any other KFR. The Culebra Anticline is located on the southern edge of the Balcones Fault Zone and is a northeast- to southwest-trending asymmetrical fold in the bedrock that plunges to the southwest. The fold extends from Loop 410 in San Antonio west to the Medina River. The Austin Chalk on the Culebra Anticline is up to 200 feet thick and is locally fractured and jointed. Most known caves in this area follow the crest of the Culebra Anticline.

3.3.1 Known Karst Features

3.3.1.1 WRIP

The WRIP Phase 2 Project Area has been evaluated twice for the presence of caves or other karst features that may be exposed at the surface. In 2005, SWCA professional geologists completed the first karst feature survey of this area, identifying three potential karst features that warranted further investigation to determine their potential to provide habitat for listed karst invertebrates. Following excavation, SWCA found that each feature was of non-karst origin and concluded that none of these features provided suitable habitat for listed karst invertebrates (SWCA 2005).

In 2014, SWCA completed another karst feature survey of the WRIP Phase 2 Project Area to update the findings of the 2005 survey. The 2014 karst feature survey reported only one additional potential karst feature—a “closed depression with loose, scattered rocks”—within the WRIP Phase 2 Project Area that, upon excavation, did not exhibit potential habitat for listed karst invertebrates (SWCA 2014b). Therefore, after two complete karst feature surveys, performed in accordance with Service protocols effective at the time, no features are known to occur within the WRIP Phase 2 Project Area that would indicate the presence of potential habitat for listed karst invertebrates. However, the findings of these investigations are limited to potential karst features that have expression at the ground surface; void spaces without surface expression were not detectable by surface surveys.

SAWS followed USFWS protocols, which rely first on surface investigations to determine if additional investigation is warranted. SAWS exceeded the level of effort specified by USFWS for these surface surveys by conducting surveys in 2005 and again in 2014, both of which failed to discover karst features with the characteristics of potential karst invertebrate habitat. Therefore, after two complete karst feature surveys, performed in accordance with USFWS protocols effective at the time, no features are known to occur within the WRIP Phase 2 Project Area that would indicate the presence of potential habitat for listed karst invertebrates. SAWS determined that additional investigation with ground-penetrating radar (GPR) was not warranted, and certainly not required, to bolster these negative findings.

3.3.1.2 Micron

The Micron Pipeline Phase 2 Project Area has been investigated multiple times for the presence of karst features that could provide habitat for listed karst invertebrates. In 2011, Baer Engineering (2011) conducted a karst feature survey of the Project Area and the adjacent lands within 250 feet and found no karst features that would indicate the presence of potential habitat for listed karst invertebrates. However, Baer Engineering (2011) reported that karst features containing karst invertebrate fauna occurred within 500 feet of the Micron Pipeline Phase 2 Project area, including Clandestine Cupola Cave that contains either the non-listed, blind spider *C. loftini* or *C. venii* (Zara 2010). Baer Engineering (2011) noted that the Micron Pipeline Phase 2 Project Area does not occur within the likely surface or subsurface drainage basins for Clandestine Cupola Cave, as delineated by Zara (2011).

Following the discovery of the occupied karst features at the TxDOT SH 151/Loop 1604 project site, Pape-Dawson Engineers conducted another karst feature survey, in accordance with Service protocols, of the Micron Pipeline Phase 2 Project Area and similarly reported finding no karst features with expression at the surface (Pape-Dawson Engineers 2012).

Finally, SAWS commissioned a study of the Micron Pipeline Phase 2 Project Area using GPR in an attempt identify any subsurface voids within the Project Area that may lack surface expression. Baer Engineering (2012) completed this GPR study in 2012 and did not detect the presence of large voids (i.e., those greater than 1 or 2 feet in diameter) within the Micron Pipeline Phase 2 Project Area. However, Baer Engineering (2012) also reported finding "reflections likely indicating fractures, fracture-filled weather zones, bedding planes, or other features such as alternating lithologic units" that indicated a higher likelihood of potential void development.

3.3.1.3 APS Karst Preserve

SWCA conducted detailed investigations of the APS Karst Preserve in 2013 and 2014 to search for karst features that may provide habitat for the Covered Species. SWCA identified 68 potential karst features within the surveyed area (see Figure 11 in the HCP). Of the 68 potential karst features, 18 appeared to be true karst features and the remaining 50 features appeared to be anthropogenic (caused by humans) in origin or were formed by non-karst processes such as animal burrowing or tree roots.

Of the 18 true karst features identified within the APS Karst Preserve, SWCA determined that 2 features contained karst invertebrates, 6 features likely contain suitable habitat, 4 features do not contain habitat, and the 6 remaining features are unknown. The two features confirmed to contain species are features S-19 (*Cicurina* sp.) and S-29 (*Cicurina* sp. and *R. exilis*); both possess significant void space, small conduits, organic matter, and cave crickets. Additionally, features S-10, S-17, S-21, S-58, S-61, and S-62 likely contain suitable karst invertebrate habitat, since these features have small conduits and voids and in some cases cave crickets, but are humanly inaccessible.

CHAPTER 4. ENVIRONMENTAL CONSEQUENCES

4.1 Introduction

This chapter analyzes the resources that would be affected under the No Action Alternative (Alternative A), as well as the two considered "action alternatives" (Alternatives B and C). The following sections include discussions of direct and indirect effects and their significance, as well as measures to mitigate for environmental impacts.

4.2 Impact Framework

For the purpose of this EA, the Service developed an impact framework for the measurement of potential effects of the Proposed Federal Action. The impact framework evaluates the vulnerability of the resource and its probability for potential impacts to occur against any identified impact thresholds established for the resource, i.e., the point in which an impact can be determined (Table 6). The vulnerability of a resource represents its susceptibility to potential impacts. The more vulnerable a resource is to potential impacts, the higher the chance for impacts to occur. The probability (i.e., likelihood) represents the possibility that the potential impact would occur at some point as a result of the Proposed Federal Action. The probability of potential impacts to a given resource can be assessed either qualitatively or quantitatively, or in some cases both.

Table 6. Impact Probability vs. Resource Vulnerability

Vulnerability \ Probability	Rare	Unlikely	Possible	Likely	Certain
Very Low	Negligible	Negligible	Incidental	Incidental	Minor
Low	Negligible	Negligible	Minor	Minor	Moderate
Medium	Incidental	Minor	Moderate	Moderate	Significant
High	Incidental	Minor	Moderate	Significant	Significant
Very High	Minor	Moderate	Moderate	Significant	Significant

After evaluating a resource's vulnerability against the probability of impacts, the Service assigned potential affects to a level of impact ranging from negligible to significant (Table 7).

The purpose of establishing this impact framework is three-fold: 1) to provide a uniform method for assessing project affects over a variety of resources and regions of influences; 2) to provide a clear and concise means to categorize potential project affects based on the level of impacts to each respective resource; and 3) to assist in determining if an EIS is warranted.

Table 7. Impact Classification

Impact Classification	Level of Affect	Definition
Negligible	Non-existent to Low	Effects on the evaluated resource are so small that they are generally easy and quick to correct or return back to normal with little time or effort.
Incidental	Low	Effects on the evaluated resource may occur as a measurable small consequence (unpredicted or assumed) that is generally easy and quick to correct or return back to normal with little time or effort.
Minor	Low to Medium	Effects on the evaluated resource are minimal, short-term, and fall well below the identified threshold(s) for the resource. *Applied mitigation measures may reduce minor effects to a negligible impact.
Moderate	Medium	Effects on the evaluated resource are reasonable short-term impacts (less than 5 years) that fall below the identified threshold(s) for the resource and would recover within a moderate amount of effort or time. *Applied mitigation measures may reduce moderate effects to a minor or negligible impact.

Significant	High to Extreme	Effects on the evaluated resource would exceed the identified threshold(s) for the resources and would be foreseeably long-term and potentially catastrophic. Recovery would require excessive amounts of effort and time. *Applied mitigation measures may reduce significant project to a moderate or minor impact.

4.3 Thresholds of Significance

Thresholds of significance are used to determine when a significant impact would occur to a particular resource. Thresholds are most often based on legal regulatory standards. However, when a regulatory threshold or other applicable standard does not exist for a particular environmental resource, then a threshold can be developed from applicable studies, surveys, reports, or other associated data.

Thresholds may be qualitative or quantitative measurements, or consist of a set of criteria to evaluate against. Some environmental resources require quantitative numerical standards to assess potential impacts while other environmental resources are difficult to quantify numerically and instead require qualitative descriptions to assess potential impacts. Additionally, a threshold may vary with its setting. For example, biological impacts may not be significant within a populated downtown urban setting but may be potentially significant along an undeveloped riparian corridor.

To establish the thresholds of significance used in this EA for the environmental resources carried forward for further review (see Section 3.1.2), we conducted a review of federal, state, and local policies, ordinances, regulations, and planning documents to determine what adopted regulatory standards are in place for the Permit Study Area. We then developed thresholds of significance for any remaining environmental resources that did not have a regulatory standard currently in place; these thresholds are based on the best available studies and documentation available for that particular environmental resource. Table 8 provides a summary of the thresholds of significance utilized in this EA.

Table 8. Summary of Environmental Resource Thresholds

Environmental Resource	Regulatory Source(s)	Threshold(s) of Significance
Biological Resources	• Endangered Species Act • EO 13112, Invasive Species • San Antonio Tree Preservation Ordinance (Unified Development Code, Section 35-523) • Texas Parks and Wildlife Department regulations	• Result in the take of federal or state protected species. • Result in adverse effects to existing vegetation communities or local and regional wildlife resources. • Result in impacts to significant or heritage trees, as defined by the San Antonio Tree Ordinance, including the take of a heritage tree, impacts within the root protection zone, and removal of canopy below the amount required by ordinance. • Result in the introduction of invasive species which could cause adverse environmental effects. • Adverse modification of critical habitat, as defined in the ESA implementing regulations.
Geology – Karst Features	• U.S. Geological Survey • Natural Resources Conservation Service • San Antonio LID (low-impact development) Guidance	• Removal of top soils, resulting in incapacity to support native vegetation. • Increase the potential for erosion and sediment impacts to karst features. • Results in adverse effects to Karst Zones 1-3

4.4 Biological Resources – Vegetation

4.4.1 Alternative A – No Action

The Permit Study Area occurs in a historically agricultural and currently urbanizing landscape. Therefore, vegetation community impacts under the No Action alternative would be negligible, since the area is expected to continue to convert from agricultural to urbanized. The No Action Alternative would not result in the preservation of the 57.6-acre karst preserve. As such, Alternative A would not protect vegetation communities associated with this preserve from future loss or disturbance from on-site activities or adjacent land development.

4.4.2 Alternative B (Preferred Alternative) – SAWS's Micron and WRIP HCP

Alternative B (Preferred Alternative) would include removal of vegetation, which would be limited to the minimum area necessary for the construction, operation, and maintenance of the facilities. Nevertheless, Covered Activities would result in the clearing or disturbance of approximately 98 acres of Mesquite-Live Oak-Bluewood Parks vegetation community within the 45- to 80-foot easement during construction. This represents less than 1% of the vegetation within the surrounding subwatersheds.

However, proposed mitigation for impacts to the Covered Species would protect 57.6 acres of Mesquite-Live Oak-Bluewood Parks vegetation community. Alternative B would prohibit future development and land use conversions in the preserve and monitoring would evaluate and maintain the vegetation communities over the long term. Therefore, although the intent of the proposed mitigation is to protect Covered Species, vegetation communities associated with the preserve would also experience an indirect benefit.

While there will be a net loss of 40.4 acres of Mesquite-Live Oak-Bluewood Parks vegetation, such impacts would be considered minor as there would be limited alteration to vegetation composition, abundance, and diversity due to linear nature of the project on the affected vegetation relative to the larger landscape. Additionally, SAWS would re-seed disturbed areas with native plant seeds and would use a certified arborist for any replanting of tree species. SAWS would also comply with Tree Protection Plans required by the City of San Antonio for preservation or mitigation of significant or heritage trees. Design drawings for Micron Pipeline Phase 2 indicate that tree canopy removal for this project would be limited to 0.69 acre, preserving 30.27% of the total tree canopy. Estimations for tree canopy removal associated with the WRIP Pipeline Phase 2 have not been completed to-date, but will need to be submitted and approved by the City of San Antonio prior to construction.

Vegetation adjacent to the easement could experience a reduction in productivity due to foliar coating by dust (causing a reduction in photosynthesis). However, this impact would typically be limited to the heaviest period of construction and would be minimized by structural dust control procedures, including wetting of disturbed areas and covering of soil spoil areas as needed or required.

4.4.3 Alternative C –Reduced Take SAWS Micron and WRIP HCP

Alternative C would result in the same construction impacts to vegetation as described for Alternative B. However, Alternative C would protect approximately 31% less Mesquite-Live Oak-Bluewood Parks vegetation community (40 vs. 57.6 acres) as an offset for impacts to Covered Species, when compared to Alternative B.

4.5 Biological Resources – General Wildlife

4.5.1 Alternative A – No Action

Under the No Action alternative, wildlife communities utilizing the Permit Study Area would be likely to experience gradual changes due to increasing land development in the surrounding region. These changes would likely be beneficial to some species and negative to others. As agricultural land converts to residential and currently undeveloped lots in existing adjacent residential subdivisions become built-out,

species that are sensitive to urban activity would be expected to be replaced by more urban tolerant species. However, wildlife species, other than the karst invertebrates, likely to be using the Permit Study Area are not known to be particularly unique or sensitive and are commonly found to some extent in both rural and urban environments. Furthermore, for those species typically requiring larger areas or less human activity to thrive, the local and regional landscape offers similar habitats that could support displaced animals.

4.5.2 Alternative B (Preferred Alternative) – SAWS's Micron and WRIP HCP

Potential wildlife impacts are primarily associated with the alteration and removal of vegetation during construction and maintenance of the Proposed Projects. As discussed in the preceding section on vegetation impacts, Covered Activities would result in the removal or fragmentation of up to approximately 106 acres of vegetation (excluding cropland) which provide shelter, breeding, and foraging habitat for woodland, grassland, and shrubland species. In particular, the creation of new edge habitat could adversely impact species that rely on woodland features, although other species that use more open habitats could benefit from the generation of new edge environment.

Project-induced temporary increases in human activity (e.g., increased noise and movement during construction) could cause some wildlife to avoid the construction area or otherwise alter behavior patterns (e.g., stay underground more than they would normally) for the duration of the activity. SAWS estimates that construction of the Proposed Projects would take approximately 9 to 18 months, for the covered portions of the Micron Pipeline and WRIP, respectively. Wildlife can be negatively impacted by human-produced noise, including changes in vigor and productivity, especially if disturbed during critical times of year such as breeding and wintering (Knight and Cole 1995; Gabrielsen and Smith 1995).

Proposed Project construction activity would include the use of heavy equipment and vehicle traffic, which produce a typical range of sound from 55–85 dBA at 50 feet from the noise source (Table 9). In comparison, quiet outdoor settings and suburbs can be as low as 40-50 dBA, while vehicle and truck traffic on highways (such as highway Loop 1604) can generate 70-80 dBA, and a jet takeoff may reach 100 dBA or higher.

Table 9. Standard Noise Levels of Commonly Used Construction Equipment

Equipment	**Typical Sound Level** (dBA)			
	50 feet *	**500 feet ****	**1,500 feet ****	**3,000 feet ****
Backhoe	78–80	59	50	44
Front end loader	79–80	59	50	44
Grader	85	64	55	49
Pickup truck	55–75	54	45	39
Dozer	82–85	64	58	52
Dump truck	76–84	63	54	48
Tractor	84	63	54	48

* Data from Federal Highway Administration (2006).

** Estimated noise levels at distances away from the equipment item (beyond 50 feet) are conservative because the only attenuating mechanism considered was divergence of the sound waves in open air. In general, this mechanism results in a 6-dBA decrease in the sound level with every doubling of distance from the source.

Although the majority (55%) of the Proposed Projects alignment would occur in areas of higher ambient noise (due to close [within 0.5 mile] proximity to vehicle noise sources from Loop 1604), a smaller portion of the alignments would occur in areas of lower ambient noise levels (such as suburbs with a typical sound level of 50 dBA). For these quieter areas, the introduction of new construction noise could increase noise levels experienced by wildlife. However, this noise would be produced sporadically and temporarily, and all noise sources would only impact species that are in the range (0.25 to 0.5 mile) of the produced sound. Noise impacts would cease when construction ends. Due to the presence of similar habitat that occurs in the Project Area (see Figure 5, Section 3.2.2), many species displaced due to human noise and activity would likely be able to use equivalent suitable habitat available on adjacent lands. As Section 4.4.2 notes, proposed vegetation clearing represents less than 1% of that habitat type available within the surrounding subwatersheds.

Vehicle and equipment operation could also result in mortality of smaller-bodied or slow-moving species—such as rodents, reptiles or amphibians—taking shelter in an area cleared or excavated or in the path of moving vehicles. The Applicant has committed to routing the Proposed Projects through areas with no demonstrated occupancy by the Covered Species and employing construction methods (where practicable) that reduce the amount of excavation needed to install the pipelines, as well as minimizing potential impacts on Covered Species by using best management practices to reduce construction phase effects. These BMPs could also benefit other non-covered wildlife species by potentially reducing mortality risk from construction activity. Impacts to these species would be considered minor or negligible as the impacts would be site-specific, temporary in nature, and would not be expected to affect the species on a broader population landscape level, since the species most likely to be affected are common to the region (see Section 3.2.2.2 and 3.2.2.4)..

Overall, construction would not likely result in substantial reductions in wildlife populations in the region because of the relatively small amount of habitat (<1%) affected within the broader landscape and the low potential for direct mortality within the Permit Study Area. Sufficient habitat would remain functional to maintain viability of existing wildlife populations. Implementation of best management practices and post-construction site restoration would also reduce potential project impacts to wildlife habitat.

Additionally, wildlife benefits would occur with implementation of the APS Karst Preserve. The APS Karst Preserve would perpetually preserve and manage 57.6 acres of vegetation capable of providing shelter, breeding, and foraging habitat for a variety of wildlife species. Although the mitigation measure only seeks to offset take of Covered Species, other wildlife species present in the same location would also be protected from future development and habitat loss.

4.5.3 Alternative C –Reduced Take SAWS Micron and WRIP HCP

Alternative C would result in the same construction and maintenance impacts to wildlife as described for Alternative B. However, Alternative C would protect approximately 31% less wildlife habitat (40 vs. 57.6 acres) as an offset for impacts to Covered Species, when compared to Alternative B.

4.6 Biological Resources – Endangered Species

4.6.1 Alternative A – No Action

Under the No Action Alternative, endangered species would not be impacted by the Proposed Projects, because they would not be implemented. The continued expansion of adjacent development within the Permit Study Area could impact endangered karst invertebrates; however, this will likely be minor, due to the minimal acreage that would be impacted compared to the remaining acreage of Karst Zones in the Culebra Anticline Region. Additionally, the expected implementation of the recently issued Southern Edwards Plateau ITP to Bexar County and the City of San Antonio would likely increase compliance with the ESA through their expedited permitting process.

4.6.2 Alternative B (Preferred Alternative) – SAWS's Micron and WRIP HCP

SAWS estimates that approximately 67.8 acres of potential Covered Species habitat would be disturbed as a result of the Proposed Projects. Limited and incomplete population data preclude a direct evaluation of the loss of individuals of these endangered species and the decrease in local population numbers. However, this take represents only 0.4% of the total acreage of potential karst invertebrate habitat in Culebra Anticline KFR. Furthermore, a portion of the requested take authorization occurs over Karst Zone 3 that only has a low probability of providing habitat for Covered Species.

Post-construction restoration activities would ensure that local topography and drainage—which can influence the subsurface cave environment—would not be altered long term. Denudation of the surface plant community and soil disturbances associated with the Covered Activities would be temporary in nature, since the disturbed areas associated with the Proposed Projects would be restored as quickly as possible to original or better conditions by replacing topsoil and revegetating with native plants.

Covered Activities would convert approximately 13.3 acres of forested and woodland vegetation to open herbaceous vegetation over parts of the Proposed Projects that occur over Karst Zones 1, 2, or 3; although, this effect would be minimized by the currently patchy nature of the exiting woodlands and the implementation of required Tree Protection Plans. Clearing would be limited to narrow linear corridors (45 to 80 feet wide) that already occur in a woodland-grassland mosaic with extensive areas of existing development. Therefore, vegetation conversion would not be expected to alter surface biological communities in such a way that would significantly change the overall type or quality of nutrient input to the subsurface, alter the stable physical environment of the cave, or introduce potentially harmful organisms. For these reasons, it is unlikely that any changes to vegetation communities within the Permit Study Area would have significant or even measurable effects on the Covered Species.

Covered Activities would also excavate approximately 6.7 acres of potential karst invertebrate habitat within Karst Zones 1, 2, and 3, at depths of approximately 10 to 40 feet below the surface. It is possible that the excavated areas could contain habitat suitable for karst invertebrates and, if present, that one or more of the Covered Species could occupy some of this habitat.

Excavation activities could indirectly affect individual karst invertebrates in adjacent habitat through changes to the cave environment, including alteration of the moisture regime, temperature increases and fluctuations, sedimentation, and more direct access by surface fauna. The reach of any such effects into adjacent habitats is unknown and would likely depend on the particular size, shape, preexisting climate, and other characteristics of the feature. Following pipeline installation, all excavated areas would be backfilled, which would cut off direct exposure to the surface and could help restore subsurface climate conditions.

Little is known of the effects on karst invertebrates that could be potentially displaced into other connected karst voids where stable conditions are still present. There is no evidence that temporary opening of karst voids (over days or even weeks) significantly disrupts essential behaviors of karst invertebrates to an extent that could result in actual death or injury. Karst fauna surveys conducted according to Service protocols commonly return observations of the presence of karst invertebrates from features with (similar to the Covered Activities) new or expanded connections to the surface environment. Therefore, it is possible but not certain whether individuals of the Covered Species, if they are present, would suffer significant adverse effects over the duration of the construction period.

To mitigate potential Covered Species take, under Alternative B (Preferred Alternative) SAWS would fund and maintain, in perpetuity, a 57.6-acre karst preserve on SAWS-owned property. This karst preserve would comply with Service acreage recommendations for a medium-quality Karst Fauna Area and would be expected to protect Covered Species habitat with known occupied species, which could lead

to increased species survival. The mitigation project would offset take from the permanent protection of occupied karst invertebrate habitat.

It is possible that Service-approved management activities, such as in-cave monitoring, associated with the proposed APS Karst Preserve could incidentally take one or more of the Covered Species. However, any such incidental takings would be associated with beneficial conservation activities associated with the APS Karst Preserve and would be covered by separate ESA section 10(a)(1)(A) enhancement of survival permits held by the biologists conducting such work. Therefore, no adverse impacts to the Covered Species would be anticipated from proposed mitigation measures. As previously noted, this alternative would provide additional Covered Species benefits when compared to the No Action Alternative.

4.6.3 Alternative C –Reduced Take SAWS Micron and WRIP HCP

Alternative C would result in the same direct and indirect effects associated with the Proposed Projects' construction as described for the No Action Alternative.

To mitigate potential Covered Species take, SAWS would fund and maintain, in perpetuity, a 40-acre karst preserve on SAWS-owned property. As with Alternative B, this karst preserve would comply with Service acreage recommendations for a medium-quality Karst Fauna Area and would be expected to protect Covered Species habitat with known occupied species, which could lead to increased species survival. The mitigation project would offset expected take.

Any incidental take of Covered Species during preserve operations would be addressed through ESA section 10(a)(1)(A) enhancement of survival permits (as discussed in Alternative B). Therefore, no adverse impacts to the Covered Species would be anticipated from proposed mitigation measures. As previously noted, this alternative would provide additional species benefits when compared to the No Action Alternative, although species benefits would be reduced compared to Alternative B.

4.7 Biological Resources – State Special Status Species

4.7.1 Alternative A – No Action

Potential habitat exists in the Permit Study Area for four state-threatened reptiles: the Texas horned lizard, indigo snake, Texas tortoise, and timber/canebrake rattlesnake; therefore, the Proposed Projects could impact these reptiles through injury, death, disturbance, or loss and degradation of habitat. Impacts to these species would be considered minor or negligible as the impacts would be localized, and would not affect the species on a broader population landscape level. The following sections provide additional analysis by species.

4.7.1.1 <u>Texas Horned Lizard</u>

Texas horned lizards occur in areas where vegetation is sparse, therefore, the clearing of pipeline easements in up to 96 acres of shrub or woody areas could create new habitat for the species. Repeated vehicle/equipment travel along the ROW easement could also create open habitat for foraging and basking. These actions would have localized, beneficial impacts on habitat availability and quality but could also increase the potential for equipment and vehicles traveling within the easements to kill or injure Texas horned lizards during the times of year when the species is active.

Texas horned lizards are comparatively slow moving and, because of their small size and coloration, they can be difficult to see. They also hibernate during cold weather periods and burrow into soil or hide under rocks when inactive. For this reason, some potential exists for Texas horned lizards to be injured or killed by the construction of the pipelines, if any members of the species happened to take shelter in an area cleared or excavated. Because Texas horned lizards are expected to be rare in the Permit Study Area (TPWD reports that the species is mostly gone from the eastern side of Texas), the potential for this type

of direct impact is extremely low and, as a result, the Proposed Projects would be expected to have a minor effect on the species.

4.7.1.2 Texas Indigo Snake

Potential impacts to the Texas indigo snake are primarily associated with the alteration or removal of habitat during construction and maintenance of the Proposed Projects. Surface disturbance associated with the Proposed Projects could remove or degrade up to 5 acres of existing habitat for the species, although post-construction restoration efforts could provide new vegetative cover over the long term. Additionally, construction would not likely result in substantial reductions in wildlife populations because of the relatively small amount of habitat (<0.1%) affected within the broader landscape.

The Texas indigo snake is active during daylight and dens in underground burrows; as such, potential exists for the species to be injured or killed by vehicle and equipment movement or pipeline construction. However, according to Werler and Dixon (2000) the Texas indigo snake occurred in Bexar County as late as the 1950's, but no longer occurs in the county. Therefore, the anticipated potential for species mortality is extremely low and, as a result, the Proposed Projects would be expected to have a minor effect on the species.

4.7.1.3 Texas Tortoise

Because Texas tortoises are found in scrub and brushlands (Herps of Texas 2016), surface disturbance in up to 96 acres of shrub or woody areas associated with the Proposed Projects could reduce habitat quality and availability for the species, although post-construction revegetation outside of the permanent easement could re-establish some suitable habitat over the long term.

As with other described species, the Texas tortoise is slow moving and resides in underground burrows. For this reason, potential exists for Texas tortoises to be injured or killed by vehicle traffic or during pipeline construction if any members of the species take shelter in an area being cleared or excavated. Potential also exists for a Texas tortoise to fall into a trench and not be able to climb out (e.g., if trenches are left open during breaks in construction). Because this species is expected to be rare in the Permit Study Area due to severe population decline, the potential for this type of direct impact is extremely low and, as a result, the Proposed Projects would be expected to have a minor effect on the species.

4.7.1.4 Timber/Canebrake Rattlesnake

Since timber rattlesnakes use open, rocky locations for basking, clearing of pipeline easements and repeated vehicles or equipment travel along the easements could result in some localized beneficial impacts to the species from the creation of up to 115 acres of new habitat. However, these actions could also increase the potential for equipment and vehicles traveling within the easements to kill or injure the timber rattlesnake during the times of year when the species is active. Timber rattlesnakes are inactive during cold weather periods in underground dens and limestone crevices. For this reason, some potential exists for the timber rattlesnake to be injured or killed during pipeline construction if any members of the species happened to be present in an area cleared or excavated. However, there are no known records of canebrake rattlesnakes in Bexar County (Werler and Dixon 2000). Therefore, the anticipated potential for species mortality is extremely low and, as a result, the Proposed Projects would be expected to have a minor effect on the species.

4.7.2 Alternative B (Preferred Alternative) – SAWS's Micron and WRIP HCP

Because the Proposed Projects would be cleared and maintained in a similar fashion under all alternatives, pipeline construction and operation impacts to all state-listed species under Alternative B (Preferred Alternative) are similar to those expected under the No Action Alternative. As part of Alternative B, the APS Karst Preserve would preserve an additional 57.6 acres of wildlife habitat as mitigation for Covered Species impacts. Although the mitigation measure only seeks to offset take of Covered Species, any state-

listed species or their potential habitat present in the same location would also be protected from future development. Therefore, Alternative B (Preferred Alternative) could provide additional indirect long-term benefit to the species, as compared to the No Action Alternative.

4.7.3 Alternative C –Reduced Take SAWS Micron and WRIP HCP

Because the Proposed Projects would be cleared and maintained in a similar fashion under all alternatives, pipeline construction and operation impacts to all state-listed species under Alternative C are similar to those expected under the No Action Alternative. Under this alternative, however, proposed mitigation would protect approximately 31% less habitat (40 vs. 57.6 acres) as an offset for impacts to Covered Species, when compared to Alternative B (Preferred Alternative). Therefore, indirect benefits to state-listed species would be reduced.

4.8 Geologic Karst Features

4.8.1 Alternative A – No Action

Under the No Action Alternative, the Proposed Projects would cross a total of 67.8 acres of land in mapped Karst Zones 2 and 3 (Table 10). However, the 67.8 acres of estimated impacts represents only 0.4% of total Zone 1–3 acreage within the Culebra Anticline KFR.

Table 10. Surface/Subsurface Disturbance and Estimated Impacts within Karst Zones 1–3.

Proposed Projects	Total Surface /Subsurface Disturbance (acres)	Disturbance within Karst Zones (acres)			Total Estimated Impacts within Karst Zones (acres)
		Zone 1	Zone 2	Zone 3	
WRIP Phase 2	159.0	0	43.9	22.5	66.4
Micron Pipeline	1.4	0	1.4	0	1.4
Total Area	**160.4**	**0**	**45.3**	**22.5**	**67.8**

Trenching and boring or tunneling methods, where applicable, could minimize the potential for disruption of any unknown karst habitat or, in the case of boring or tunneling, help maintain the microclimate of any voids encountered at depth by avoiding the creation of an extensive surface connection.

Best management practices implemented during construction (see Section 1.3.3) would further minimize potential impacts to the surface and subsurface environment. Given these minimization measures, along with the limited extent of impact, the Proposed Projects would be expected to only have minor effects to overall karst resources.

Based on previous field studies for the WRIP and Micron pipelines (see Section 3.3.1), the Project Areas do not include any karst features with surface expression and the presence of occupied karst invertebrate habitat in the subsurface is also not known to occur.

4.8.2 Alternative B (Preferred Alternative) – SAWS's Micron and WRIP HCP

Alternative B (Preferred Alternative) would result in similar construction impacts to karst resources as described for the No Action, but would gain additional benefits associated with the implementation of the APS Karst Preserve. The karst preserve would perpetually preserve and manage 57.6 acres of land overlaying designated Karst Zone 2 within the Culebra Anticline KFR. This alternative would protect two features known to contain suitable or documented habitat for karst invertebrates, six features likely to contain suitable habitat, and six other features present on the APS Karst Preserve where the presence of suitable karst invertebrate habitat remains unknown.

Since the size of the proposed APS Karst Preserve would exceed the total surface area of disturbance over Karst Zones 1 or 2 for the WRIP and Micron pipelines, this alternative would sufficiently offset impacts to karst resources from the Proposed Projects' construction.

4.8.3 Alternative C –Reduced Take SAWS Micron and WRIP HCP

Alternative C would result in the same construction impacts to karst resources as described for Alternative B. Alternative C would similarly protect karst features of the APS Karst Preserve and sufficiently offset disturbance from Proposed Projects activities. However, Alternative C would preserve approximately 31% less karst resources (40 vs. 57.6 acres) as an offset for impacts to Covered Species, when compared to Alternative B.

4.9 Summary of Potential Impacts

Table 11 summarizes the potential environmental effects resulting from the three evaluated alternatives in terms of the affected resources presented in Chapter 3 and analyzed further in this chapter (40 CFR 1502.14).

Table 11. Summary of Potential Effects from Proposed Projects

Resources	No Action Alternative (Alternative A)	Alternative B	Alternative C
Vegetation	Clearing or disturbance of approximately 98 acres of Mesquite-Live Oak-Bluewood Parks vegetation community and 56 acres of cropland.	Same construction impacts as Alternative A. Protection of 57.6 acres of Mesquite-Live Oak-Bluewood Parks vegetation community within the Anderson Pump Station (APS) Karst Preserve.	Same construction impacts as Alternative A. Protection of 40 acres of Mesquite-Live Oak-Bluewood Parks vegetation community within the APS Karst Preserve.
General Wildlife	Clearing or disturbance of approximately 106 acres of potential wildlife habitat. Wildlife avoidance or behavioral changes due to project-induced temporary increases in human activity. Potential mortality from vehicle or equipment strikes.	Same construction impacts as Alternative A. Protection of 57.6 acres of potential wildlife habitat within the APS Karst Preserve.	Same construction impacts as Alternative A. Protection of 40 acres of potential wildlife habitat within the APS Karst Preserve.

Resources	No Action Alternative (Alternative A)	Alternative B	Alternative C
Covered Species	Estimated take of 67.8 acres of Karst Zone 1–3 habitat. Conversion of 13.3 acres of forested and woodland vegetation to open herbaceous vegetation over Karst Zones 1, 2, or 3. Excavation of 6.7 acres of potential karst invertebrate habitat within Karst Zones 1, 2, and 3. Potential displacement, injury or mortality of Covered Species individuals from excavation. Indirect impacts to covered Species through changes to the cave environment, including alteration of the moisture regime, temperature increases and fluctuations, sedimentation, and more direct access by surface fauna.	Same construction impacts as Alternative A. Protection of 57.6 acres of suitable Karst Zone 2 habitat for Covered Species within the APS Karst Preserve.	Same construction impacts as Alternative A. Protection of 40 acres of suitable Karst Zone 2 habitat for Covered Species within the APS Karst Preserve.
State-listed Species	Clearing or disturbance of potential habitat (may benefit or adversely affect, depending on species). Potential for reptiles to fall into open trenches or excavations. Potential mortality from vehicle or equipment strikes.	Same construction impacts as Alternative A. Protection of 57.6 acres of potential habitat within the APS Karst Preserve.	Same construction impacts as Alternative A. Protection of 40 acres of potential habitat within the APS Karst Preserve.
Karst Resources	Disturbance of 67.8 acres of land in Karst Zones 1, 2, and 3. Disturbance of 0.4% of the Culebra Anticline Karst Fauna Region. No anticipated impacts to any known karst features with surface expression.	Same construction impacts as Alternative A. Protection of 57.6 acres of Karst Zone 2 lands within the APS Karst Preserve. Protection of two features known to contain suitable or documented habitat for karst invertebrates, six features likely to contain suitable habitat, and six other features where the presence of suitable karst invertebrate habitat remains unknown.	Same construction impacts as Alternative A. Protection of 40 acres of Karst Zone 2 lands within the APS Karst Preserve. Protection of two features known to contain suitable or documented habitat for karst invertebrates, six features likely to contain suitable habitat, and six other features where the presence of suitable karst invertebrate habitat remains unknown.

CHAPTER 5. CUMULATIVE EFFECTS

5.1 Introduction

As required under NEPA, this section considers "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR 1508.7). "Reasonably foreseeable future actions" are defined in these regulations as actions that are not speculative—they have been approved, are included in short- to medium-term planning and budget documents prepared by government agencies or other entities, or are likely given trends. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7). Later sections of this chapter provide a discussion of unavoidable impacts and irretrievable commitment of resources.

5.2 Reasonably Foreseeable Actions

The Proposed Federal Action would issue an ITP under section 10(a) of the ESA that would authorize take of the Covered Species associated with the disturbance of up to 67.8 acres of karst invertebrate habitat over a period of 15 years. As such, this cumulative analysis examines likely trends and projects that would occur within the same timeframe. The cumulative analysis area differs by resource to encompass all areas where an impact on the resource could result from the incremental impact of the Proposed Federal Action when added to other past, present, and reasonably foreseeable future actions. See Section 5.3 for a discussion of analysis areas by resource.

Table 12 provides a list of reasonably foreseeable actions within the Culebra Anticline KFR or subwatersheds that encompass the Permit Study Area. This list demonstrates some of the types of development activities predicted to occur during the ITP. Other non-transportation related projects, such as private development, are also likely to occur during the 15-year ITP. The Southern Edwards Plateau HCP EIS also provides an analysis of these cumulative impacts for the region (Service 2014).

Table 12. Reasonably Foreseeable Actions in the Culebra Anticline KFR

Project Name	Agency	Location/Limits	Scope
SH 211	Public Works	From Farm-to-Market Road (FM) 1957 (Potranco Road) to FM 471 (Culebra Road)	The proposed project would construct a new two-lane roadway connecting the existing sections of State Highway (SH) 211 from FM 471 (Culebra Road) to FM 1957 (Potranco Road). The purpose of the proposed project is to improve connectivity and mobility, and provide residents a through alternative between FM 1957 and FM 471. The total length of the project is 7.6 miles.
Talley Rd – FM 1957 (Potranco Road) to Wiseman Blvd.	Public Works	From FM 1957 (Potranco Road) to Wiseman Boulevard	Roadway expansion from two to four lanes with curbs, sidewalks, bike lanes, turn lanes and drainage improvements. Some right-of-way (ROW) acquisition will be required.
FM 1957 (Potranco Road)	Public Works	Loop 1604 to just west of SH 211	Construction will provide for enhanced connection between two western relief routes of SH 211 and Loop 1604. The proposed improvements will expand the existing two-lane rural roadway section to an urban roadway section consisting of two 11-foot lanes, and two 14-foot shared-use lanes, continuous left turn lane or 10-foot raised center median within an 80-foot ROW (minimum).

Project Name	Agency	Location/Limits	Scope
FM 471 (Culebra Rd)	Public Works	From FM 1560 to Old FM 471	The construction will complete the capacity gap that currently exists on FM 471 from FM 1560 to Old FM 471. The proposed improvements will widen Culebra Road from its existing two-lane configuration to a four-lane divided roadway with anticipated bicycle and pedestrian amenities.
WT Montgomery Road Phase I	Public Works	IH 90 West to Lucas Creek bridge.	The main purpose of the project is to provide drainage improvements and road reconstruction to the WT Montgomery Road.
Elm Forest at Turtle Cross Street MR 31	Bexar County Flood Control	Outside city limits, Medina River Watershed Unnamed Tributary 14 in Medio Creek	This project is intended to replace the low water crossing at the entrance to this subdivision. It is also intended to provide more capacity at several inadequate drainage outfalls to Medio Creek for several of the subdivision streets.
Grosenbacher Road South of Madrona MR 30	Bexar County Flood Control	Outside city limits, Medina River Watershed, Unnamed Tributary 13 in Potranca Creek	This project consists of improvements to two low water crossings along Grosenbacher Road to alleviate flooding of upstream and downstream residences.
FM 1957 (Potranco Road)	Texas Department of Transportation (TXDOT)	Begin at Loop 1604, end at FM 3487	Add raised concrete medians along FM 1957 corridor.
Loop 1604	TXDOT	Begin Culebra/WTX1604-end Bandera/WTX1604, FM 471 (Culebra Road) to SH 16 (Bandera Road) Bexar County	Expanding Loop 1604 to an expressway section. Improving intersection/interchange operations by adding overpasses at Braun Road, New Guilbeau Road, and Shaenfield Road (Project Length 4.7 miles) Expand Loop 1604 from a four-lane divided facility to a four-lane expressway. Provide continuous frontage roads. Proposed improvements will be constructed within existing ROW and easements.
Loop 1604 from US 90 to FM 1957 (Potranco Road)	TXDOT	Loop 1604 from US 90 to FM 1957 (Potranco Road)	The proposed improvements are needed due to high traffic and congestion. The proposed project would expand Loop 1604 to a four-lane expressway (non-toll lanes). Proposed improvements include construction of: • Southbound main lanes and frontage road • Entrance and exit ramps • Direct connector (flyover) from southbound Loop 1604 to eastbound US 90 • Grade separations at US 90, Marbach Road and Dove Canyon
Loop 1604 to IH 410	TXDOT	US 90 between LP 1604 and IH 410	Convert two-way operation frontage roads to one-way operation. Operational improvements between entrance and exit ramps on US 90 main lanes. Intersection improvements at Loop 1604.

5.3 Cumulative Impact Analysis

5.3.1 Biological Resources

5.3.1.1 Vegetation and General Wildlife

The analysis area for vegetation and general wildlife encompasses the subwatershed boundaries that overlap vegetated portions of the Permit Study Area, because actions within this area have the greatest potential to influence local vegetation composition, as well as wildlife abundance and distribution. The reader is referred to Chapter 3, Sections 3.2.1 and 3.2.2, for a description of the vegetation communities and general wildlife typical of the Permit Study Area. Past and present actions have contributed to the direct loss of vegetation as well as injury, mortality, loss of habitat, habitat fragmentation, avoidance, and displacement of general wildlife species. Most of the obvious adverse impacts to vegetation and general wildlife species in the last decade have resulted from population growth and urban/suburban/extra-urban development.

Future growth in development and urbanization, as indicated by projected population increases in Bexar County (U.S. Census Bureau 2000), are trends that have the potential for future adverse effects to the vegetation and wildlife resources addressed in this EA. In parts of the cumulative analysis area where the human population and development is anticipated to increase, many wildlife populations are likely to decline, as habitat needed for shelter, breeding, foraging, and to support prey species is lost or altered. Increased levels of development will also likely increase the number of collision risks to avian and terrestrial species present within the Permit Study Area. However, some species, such as raccoons, birds, and squirrels, could benefit from an increase in human development.

Cumulative Impact Determination. The Proposed Projects, when considered in conjunction with other reasonably foreseeable projects, would not result in significant cumulative effects to plant and general wildlife communities. This is due in part to the limited scale of vegetation removal or degradation compared to the total vegetated land available within the surrounding subwatersheds. Additionally, the same amount of population growth and land development, and the same cumulative impacts, are expected to occur in the area of analysis whether or not an ITP is issued for the Proposed Projects. Therefore, the act of issuing an ITP in and of itself would not contribute to the previously described potential adverse cumulative impacts. Implementation of the mitigation measures in either the Proposed HCP (Alternative B) or the Reduced Take HCP (Alternative C) could, in fact, reduce adverse impacts on plant and wildlife communities, although any reduction would be negligible in terms of measurable impact.

5.3.1.2 Covered Species

The analysis area for Covered Species encompasses the Culebra Anticline KFR, because ongoing actions in this KFR have the potential to result in take of Covered Species.

Over the next 15 years and beyond, the projected population growth, land development, and associated impacts to lands with demonstrated or potential occupancy by listed karst invertebrate species in the Culebra Anticline KFR could result in adverse impacts to one or more Covered Species. Troglobitic species are particularly vulnerable to the impacts of development, including construction activities, chemical contamination introduced into caves from groundwater and/or surface drainages, destruction of surface habitat, and red imported fire ants that may feed on dead troglobites, cave crickets, and other species within caves (Service 2000).

To date, there is one HCP/ITP issued for Covered Species that includes, but extends beyond, the Culebra Anticline KFR (Table 13). Unauthorized clearing of karst invertebrate habitat has likely occurred in the past; however, the location and extent of such clearing is unknown and is not included in the analysis.

Table 13. Incidental Take Permits Issued or In Progress by the U.S. Fish and Wildlife Service for Covered Species in the Culebra Anticline KFR

Applicant	Description and Status	Location	Species in Habitat Conservation Plan	Estimated Take of Covered Species	Mitigation Measures for Covered Species
Bexar County and City of San Antonio	Southern Edwards Plateau Habitat Conservation Plan	Kerr, Bandera, Medina, Kendall, Blanco, Comal, and Bexar counties, City of San Antonio	Golden-cheeked warbler, black-capped vireo, covered karst invertebrates	21,086 acres of Karst Zone 1-4 lands	Acquisition of approximately 1,000 acres of karst preserves and funding for other types of karst conservation measures.

Cumulative Impact Determination. The issuance of an ITP for the Proposed Projects would contribute an additional 67.8 acres (0.3%) to potential take associated with other projects. Therefore, the Proposed Projects would affect only a very small fraction (<1%) of the total amount of potential karst invertebrate habitat in the Culebra Anticline KFR, and would not, when considered with other reasonably foreseeably projects, result in significant cumulative adverse impacts to the species. Implementation of either the HCP or Reduced Take HCP, along with other authorized plans, would help increase compliance with ESA and heighten enforcement by the Service of non-compliance, leading to an anticipated overall reduction in cumulative adverse impacts on Covered Species.

5.3.1.3 State Special Status Species

The analysis area for state special status wildlife species encompasses the subwatershed boundaries that overlap the Permit Study Area, because actions within this area have the greatest potential to influence species abundance and distribution.

The state-listed species addressed in this EA include four reptiles: the Texas horned lizard, indigo snake, Texas tortoise, and timber/canebrake rattlesnake. Changes in land use within the subwatersheds over time could influence the distribution and abundance of suitable habitat for these species. In addition to loss, fragmentation, or disruption of habitat for these species, other threats that currently exist and are expected to continue into the future include highway mortality and illegal collection for the pet trade. The cumulative impact of these threats is expected to increase in those areas experiencing human population growth. However, laws and regulations currently in place that prevent take would reduce the potential for cumulative adverse impacts to these species.

Cumulative Impact Determination. Construction of the Proposed Projects under any of the three alternatives would contribute to on-going species habitat loss or fragmentation and create a periodic, increased risk of mortality or injury from vehicle or equipment strikes. However, the same amount of population growth and land development, and the same cumulative impacts, are expected to occur in the area of analysis whether or not an ITP is issued for the Proposed Projects. The act of issuing an ITP in and of itself would not contribute to the potential adverse cumulative impacts described above. Implementation of the mitigation measures in either the Proposed HCP or the Reduced Take HCP could, in fact, reduce adverse impacts for these species, although any reduction would be negligible in terms of measurable impact. Therefore, the Proposed Projects, when considered in conjunction with other reasonably foreseeable projects, would not result in significant cumulative effects to state-listed species.

5.3.2 Geologic Karst Resources

The analysis area for karst resources encompasses the Culebra Anticline KFR, because ongoing actions in this KFR have the potential to result in disturbance or loss of karst resources.

Over the next 15 years, any population growth and concomitant development of Karst Zone 1–3 lands within the KFR could result in permanent, localized disturbance or loss of karst resources. Such disturbances could be expected from grading and excavation for new roads, trenching for the installation of underground utilities, and the clearing of land for construction of houses, commercial buildings, and parking lots.

Cumulative Impact Determination. Construction of the Proposed Projects under any of the three alternatives would contribute to on-going, potential disturbance or loss of karst resources. However, only 0.4% of the Culebra Anticline KFR would be impacted by Covered Activities and implementation of the mitigation measures in either the Proposed HCP or the Reduced Take HCP would result in preservation of 57.6 or 40 acres, respectively, of Zone 2 karst lands. Any other development occurring within the KFR would require baseline geologic studies prior to construction, which could lead to additional permitting or regulatory requirements (depending on study findings). Therefore, the Proposed Projects, when considered in conjunction with other reasonably foreseeable projects, would not result in significant cumulative effects to karst resources.

5.4 Unavoidable Adverse Impacts

Unavoidable adverse impacts are those effects that would occur following implementation of all recommended mitigation measures. These effects do not have to be avoided by the planning agency, but they must be disclosed and discussed (40 CFR 1500.2(e)). It is not always possible to avoid adverse impacts from implementation of an alternative.

Impacts expected under all alternatives include the clearing of vegetation, excavation of karst resources, including potential endangered species habitat, and impacts to karst feature drainage areas. However, these impacts could be minimized or offset through the use of best management practices, site restoration, and mitigation following construction. Therefore, the Proposed Projects would not result in significant, unavoidable adverse effects.

5.5 Irreversible and Irretrievable Commitment of Resources

NEPA regulations at 40 CFR 1502.16 require that the discussion of environmental consequences include "any irreversible or irretrievable commitments of resources which would be involved in the proposal should it be implemented." An irreversible commitment of resources may be defined as the loss of future options. It applies primarily to non-renewable resources, such as minerals or cultural resources, and to those factors that are renewable only over long time spans, such as soil productivity. Irretrievable commitments represent the loss of production, harvest, or use of renewable resources. These opportunities are foregone for the period of the Proposed Action or its alternatives, during which other resource utilization cannot be realized.

Under all alternatives, proposed impacts to Covered Species habitat could result in irreversible potential habitat loss for karst invertebrate species. However, under both HCP action alternatives, mitigation lands would help preserve blocks of Zone 2 karst habitat for these species. The commitment and funding by SAWS for acquisition and permanent management for the mitigation property would be an irreversible commitment.

5.6 Short-Term Use of the Environment versus Long-Term Productivity

NEPA requires consideration of the relationship between short-term uses of the human environment and the maintenance and enhancement of long-term productivity (40 CFR 1502.16). Short-term uses are generally those that determine the present quality of life for the public. The quality of life for future generations depends on long-term productivity and the ability of the environment to support that productivity on a sustainable basis.

Short-term environmental losses would be considered minor as the pipeline corridors would result in disturbance of about 115 acres of undeveloped land. In most locations, SAWS would return disturbed areas to pre-project or similar conditions. All three alternatives could result in a long-term decrease in habitat for the Covered Species because of human development; however, both HCP action alternatives would be expected to conserve suitable habitat for these species in the long term through the acquisition and management of suitable species habitat in perpetuity.

CHAPTER 6. SERVICE DETERMINATION OF A PREFERRED ALTERNATIVE

Section 1502.14(e) of CEQ regulations require identification of "the agency's preferred alternative if one or more exists, in the draft statement." The "agency's preferred alternative" is the alternative which the agency believes would fulfill its statutory mission and responsibilities, giving consideration to economic, environmental, technical and other factors.

After careful consideration of the goals and objectives identified in Chapter 1, "Purpose and Need" of this EA, the Service has identified Alternative B (Preferred Alternative) — SAWS's Micron and WRIP HCP—as its Preferred Alternative. Of the two construction alternatives (B and C), Alternative B (Preferred Alternative) would provide the greatest mitigation, in the form of a dedicated karst preserve, which would directly offset impacts to Covered Species and their habitat, as well as indirectly benefit other vegetation communities and wildlife that may reside in the protected area. Alternative B (Preferred Alternative) would also ensure species' needs are met through minimizing and mitigating potential project impacts to the maximum extent practicable.

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