Travis County FY2021
Jollyville Plateau Salamander (*Eurycea tonkawae*)
Monitoring Report



Photo: Jollyville Plateau salamander by Piers Hendrie

Travis County
Department of Transportation and Natural Resources
Natural Resources and Environmental Quality Division

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Background

On May 2, 1996, the City of Austin and Travis County were jointly issued a U.S. Fish and Wildlife Service (USFWS) regional permit referred to as the Balcones Canyonlands Conservation Plan (BCCP). This permit allows “incidental take” of eight locally occurring endangered species in compliance with Section 10(a)1(b) of the Endangered Species Act (USFWS 1996a). The thirty-year permit covers approximately 561,000 acres in western Travis County, Texas identified in the Habitat Conservation Plan (HCP) and Final Environmental Impact Statement (USFWS 1996b). The permit also covers incidental take of 27 species of concern should any become listed as threatened or endangered during the life of the permit.

The Jollyville Plateau salamander (*Eurycea tonkawae*; hereafter JPS) occurs within the Balcones Canyonlands Preserve (BCP) and the overall management of Travis County preserve lands benefits the conservation of this species. Although the BCCP 10(a) permit does not cover “take” of this species or require mitigation, the BCCP partners have pledged to protect the species wherever it is located within the BCP.

On September 19, 2013, the U.S. Fish and Wildlife Service listed the JPS as threatened (USFWS 2012 and 2013) under the Endangered Species Act and designated 32 units of critical habitat (totaling 4,331 acres) in portions of Travis and Williamson Counties (Figure 1). The most significant threat is degradation of aquatic habitats, primarily in the form of reduced water quality and alteration of natural flow regimes due to extremely rapid human population growth and urbanization within this small range (USFWS 2013). About half of the total stream catchment area for the range of the JPS has been developed and studies show urbanization has a strong negative effect on density and relative abundance of JPS throughout its range (Bendik *et al.* 2014)

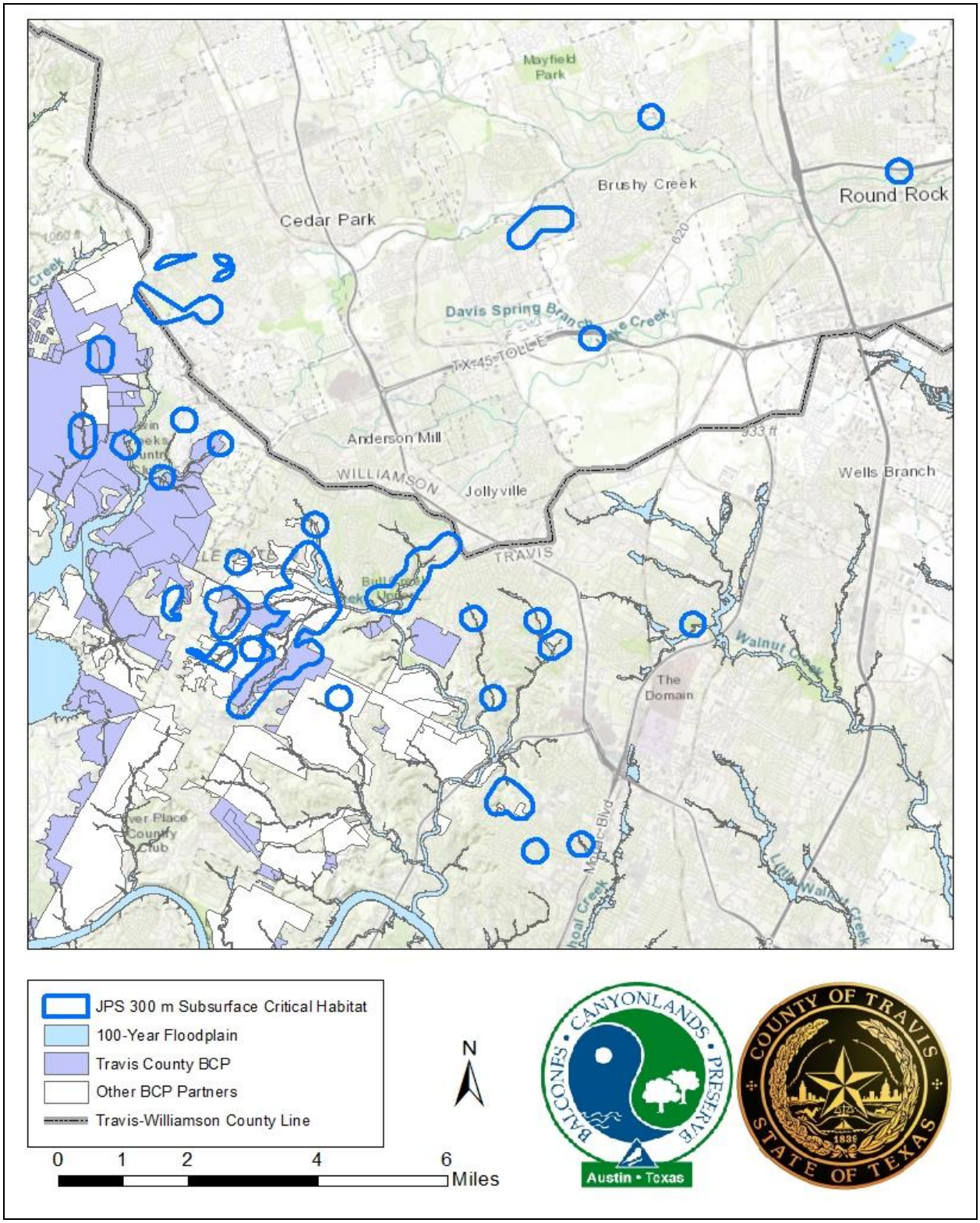

Figure 1. Critical Habitat Units designated for the Jollyville Plateau salamander in northwestern Travis and southern Williamson Counties. Surface critical habitat includes the locality buffered by 80 m of stream habitat upstream and downstream. Subsurface critical habitat includes a 984-foot (300 m) radius surrounding each spring.

Life History

The Jollyville Plateau salamander is an aquatic, neotenic salamander that is endemic to the highly urbanized area of northwestern Travis and southern Williamson counties. As a perennibrachiate, these salamanders are restricted to karst-associated habitats such as surface springs, corresponding streams, and subsurface groundwater habitats. It is a member of the Plethodontidae, a large family in the order Caudata that is characterized by the absence of lungs.

JPS found in surface springs and streams have well developed eyes, a wide head, and dark greenish-brown body. Some cave dwelling JPS exhibit reduced eyes, a flattened head, and loss of color (Chippendale *et al.* 2000). Chippendale *et al.* (2000) suggested that there might be two lineages with a taxonomic split corresponding to major geologic and topographic features: the "plateau" clade which occupies Bull, Walnut, Shoal, Brushy, South Brushy, and southeast Lake Travis watersheds, and the "peripheral" clade which is found in the Buttercup and northern Lake Travis watersheds. This finding was later confirmed with an "*E. tonkawae* (east)" group occupying Bull, Walnut, Shoal, and Brushy watersheds while an "*E. tonkawae* (west)" group occupies the Buttercup watershed as well as the Cypress and Long Hollow subwatersheds of the larger Lake Travis watershed (Devitt *et al.* 2019). This taxonomic research also shows evidence of admixture contact of these eastern and western groups at SAS Canyon and Kretschmarr Cave. These sites occur along the divide separating Cypress and Bull drainages.

The eggs of JPS are rarely found on the surface, so it is possible that they are deposited underground (O'Donnell *et al.* 2005). The skin on the ventral side of the body is translucent so that eggs are visible in gravid female individuals which are often found on the surface.

It appears from the presence of juveniles on the surface in all seasons that they reproduce year-round (Bendik 2011a, Hillis *et al*. 2001). However, juvenile abundance often increases in the spring and summer suggesting higher reproduction in the winter and early spring (Bowles *et al*. 2006). At hatching, JPS measure about 15 mm total length and reach reproductive maturity at 45-70 mm total length within six months to a year.

Their diet consists of small invertebrates, including fly larvae, amphipods, ostracods, copepods, water mites, snails, aquatic beetles, and damselfly, caddisfly, mayfly, and stonefly larvae. (COA 2001, Bendik 2011b). If flatworms are present in JPS habitat, they may be part of the diet as flatworms are a primary food source of the Barton Springs salamander (Gillespie 2013). Their underground diet is likely more restricted to stygobitic invertebrates such as amphipods and isopods.

Predators of JPS may include centrarchid fish (sunfish and bass), crayfish, and large insects such as dragonfly nymphs and giant waterbugs (Bowles *et al.* 2006, Cole 1995). Adult cannibalism on juveniles has also been observed in the field and in captivity but is not thought to be a significant source of predation (B. Sissel, personal observation).

Surface habitat of the JPS consists of spring outlets, associated stream reaches, and in small hillside seeps. They can generally be found in the interstitial spaces underneath or between rocks, in vegetation or in leaf litter where they are hidden from predators. Like other Central Texas *Eurycea*, JPS also inhabit underground refugia including subterranean streams and wet caves. Northwestern Travis and southern Williamson Counties encompass the nine watersheds containing known JPS localities: Brushy, Bull, Buttercup, Lake Creek, Lake Travis, Shoal, South Brushy, Walnut, and West Bull (Figure 2).

The narrow distribution of JPS has been explained by certain habitat requirements such as reliability of flow, minimal substrate siltation and calcium carbonate deposition, and availability of subsurface refugia (Dowling 1956, Rudolph 1978, Sweet 1982, Chippendale *et al.* 1993, Tumilson and Cline 1997, Bendik *et al.* 2016). Another requirement for survival and reproduction is well oxygenated groundwater with a narrow temperature range (Davis *et al.* 2001, Bowles *et al.* 2006, Bendik *et al.* 2016). Groundwater at JPS sites flow from the Northern Segment of the Edwards Aquifer and the Trinity Aquifer to local alluvial springs (Cole 1995). Groundwater in the Jollyville Plateau was characterized using water level monitoring, groundwater tracing, water chemistry and tritium dating. Results imply that the Jollyville Plateau Edwards Aquifer contains vadose zone conduits that transmit recharge water to springs and creeks with limited connection to the water table (Johns 2013).

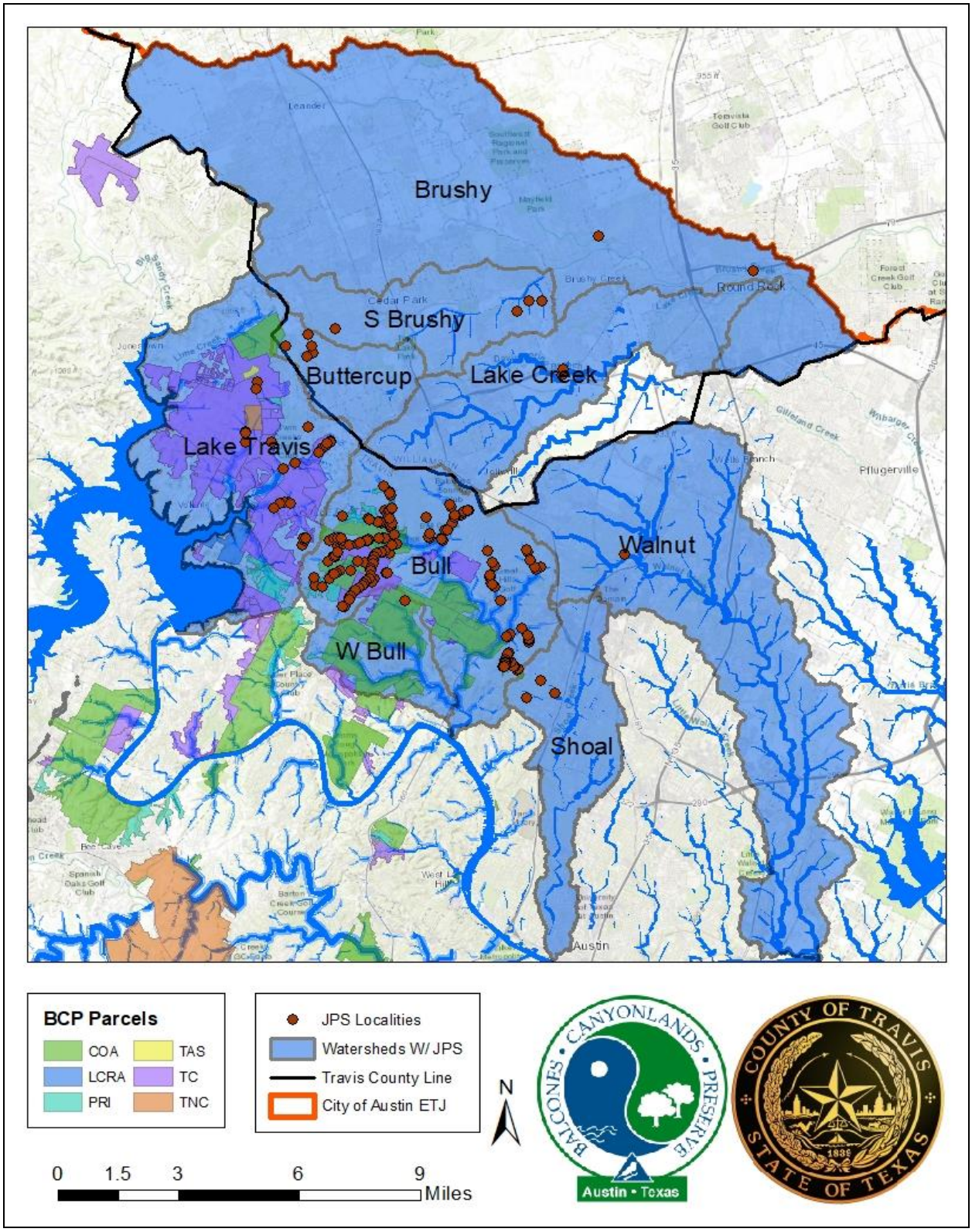

Figure 2. Nine watersheds containing JPS localities in Williamson and Travis Counties, Texas. Lake Travis Watershed is shown as subdivided to a smaller catchment area that incorporates all known JPS localities.

In Travis County, most known JPS localities are found within the Bull Creek and Cypress Creek catchments. Most ecological research (Bowles *et al.* 2006, Bendik and Glusenkamp 2013, Bendik *et al.* 2013, Bendik *et al.* 2014, Gabor *et al.* 2016, Bendik 2017) focused on abundant populations at obvious springs, lending to conservation decisions based on those specific sites. After federal listing, a geographic study demonstrated that occupancy and movement of JPS in the Bull Creek drainage differed from previous assumptions and therefore challenged the current notion of conservation planning for the species (Bendik *et al.* 2016). For this reason, in 2016, a working group comprised of biologists from the City of Austin, Travis County and Texas Parks and Wildlife Department decided to focus conservation research on creek and tributary segments in terms of occupancy to further understand broader spatial distribution and habitat requirements. The working group did, however, decide to continue monitoring two specific populations at Upper Ribelin and Lower Ribelin using capture-recapture methods.

Survey Methods

Occupancy surveys were conducted following protocol established in Bendik *et al.* 2016. Sites were surveyed for JPS occupancy in March and April 2021. Sites in the Old Lampasas and Furtado tributaries to Bull Creek were spaced 70 m apart while sites in the Tributary 3 to Bull Creek, Bull Creek and West Bull Creek main stems were spaced 140 m apart. The differences in spacing were according to stream length. Stream reaches for FY21 surveys were chosen by the working group. Two of the five drainages flowed through the BCP while the other three flow through urban areas. Three surveys were conducted at each site.

Capture-recapture surveys were conducted by exhaustively searching all cover objects on the surface of the stream (e.g., rock cover, leaf litter, and woody debris), capturing each salamander if possible, and counting each salamander not captured. Salamanders that were captured were then photographed on a grid so they could later be measured using Image J software and photo-matched following Bendik *et al.* 2014. Salamanders that were not captured were only counted if they traveled behind the observer and size (< 1 inch, 1-2 inches, ≥ 2 inches) was visually estimated. This was done as a drive survey, whereby observers would begin downstream removing cover objects to create an open “line” perpendicular to the bank that moved upstream until all cover objects were searched. To avoid double-counts, only salamanders that were

chased (or captured and moved) downstream below the observer line were tallied. It was not possible to search the subsurface habitat for salamanders.

FY2021 Survey Sites and Results

Travis County and City of Austin staff conducted occupancy surveys on the Bull Creek and West Bull Creek watersheds (Figure 3). The BCP relevant reaches are the main stem of Bull Creek and West Bull Creek. As this report represents the BCP, only the results from these reaches are reported. These reaches traversed the Beard Trust, Lanier, Kent Butler, Franklin, Ribelin, and Sam Hamilton East tracts of the BCP. A more thorough analysis of occupancy will be available in a future internal report.

Main stem Bull Creek yielded 15 occupied sties out of 24 sites surveyed. This reach is by far the most occupied section of reaches surveyed since 2013. After factoring in detection probability, estimated occupancy is 0.87 ± 0.11 (SE). Six of the occupied sites were recorded outside of the 80-meter surface critical habitat.

West Bull Creek yielded no occupied sites (Figure 5). This came as a surprise due to their being a known locality (Ivanhoe Spring 2) in the watershed. The watershed also has relatively low conductivity compared with urban sites. Further investigation is needed to understand if this is due to chance, surveying error, or hydrogeology of the groundwater in the watershed.

Travis County Natural Resources and City of Austin staff preformed capture-recapture surveys at two sites during FY2021: Lower Ribelin and Upper Ribelin. Table 1 lists the number of salamanders observed for these surveys. On average, 74 percent of the salamanders observed could be caught and photographed. These photos will be used to attempt to identify individuals between surveys and estimate population trends over time. The photos were taken on a grid for measuring and determining growth rates.

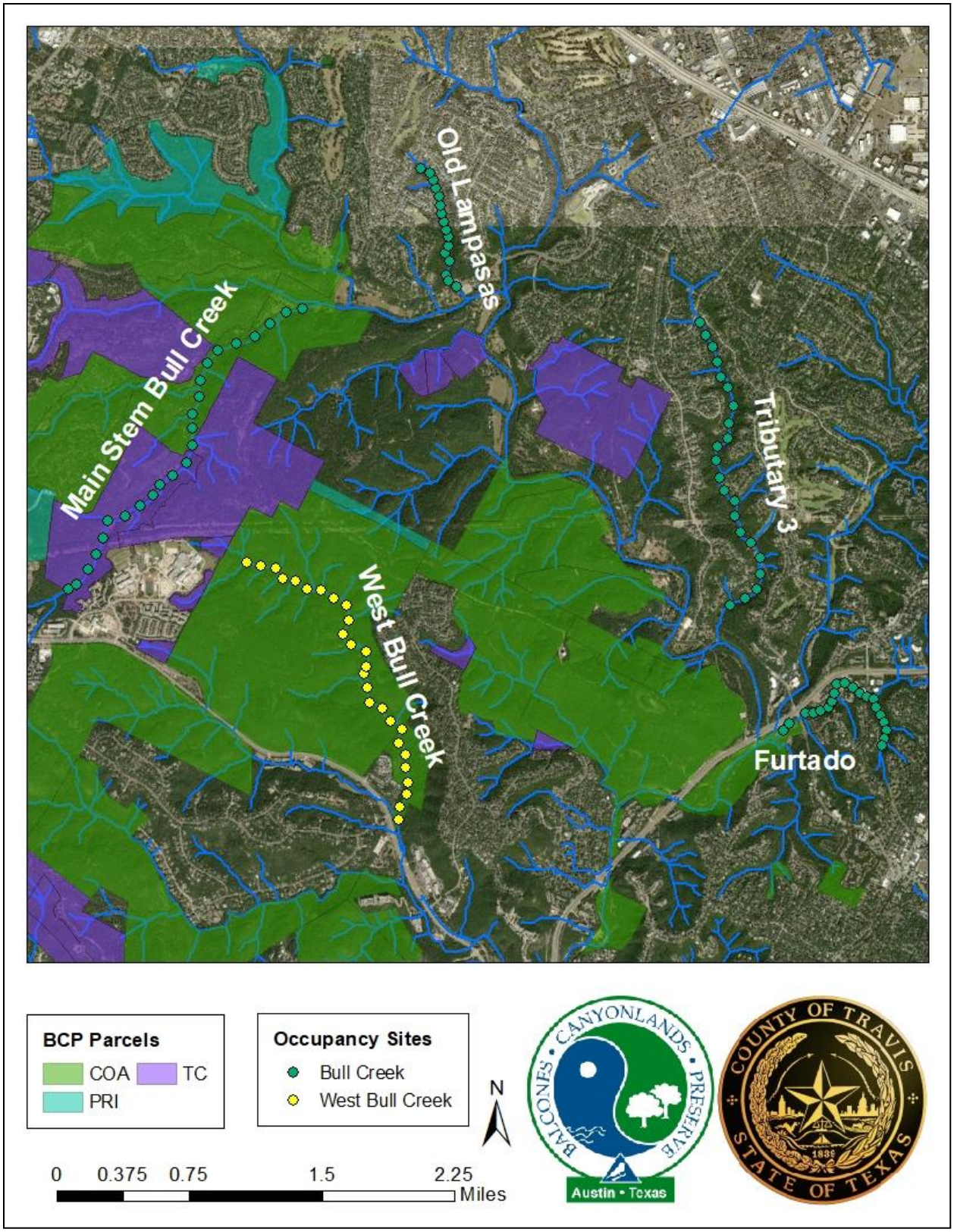

Figure 3. Five creeks where occupancy surveys were conducted in FY2021.

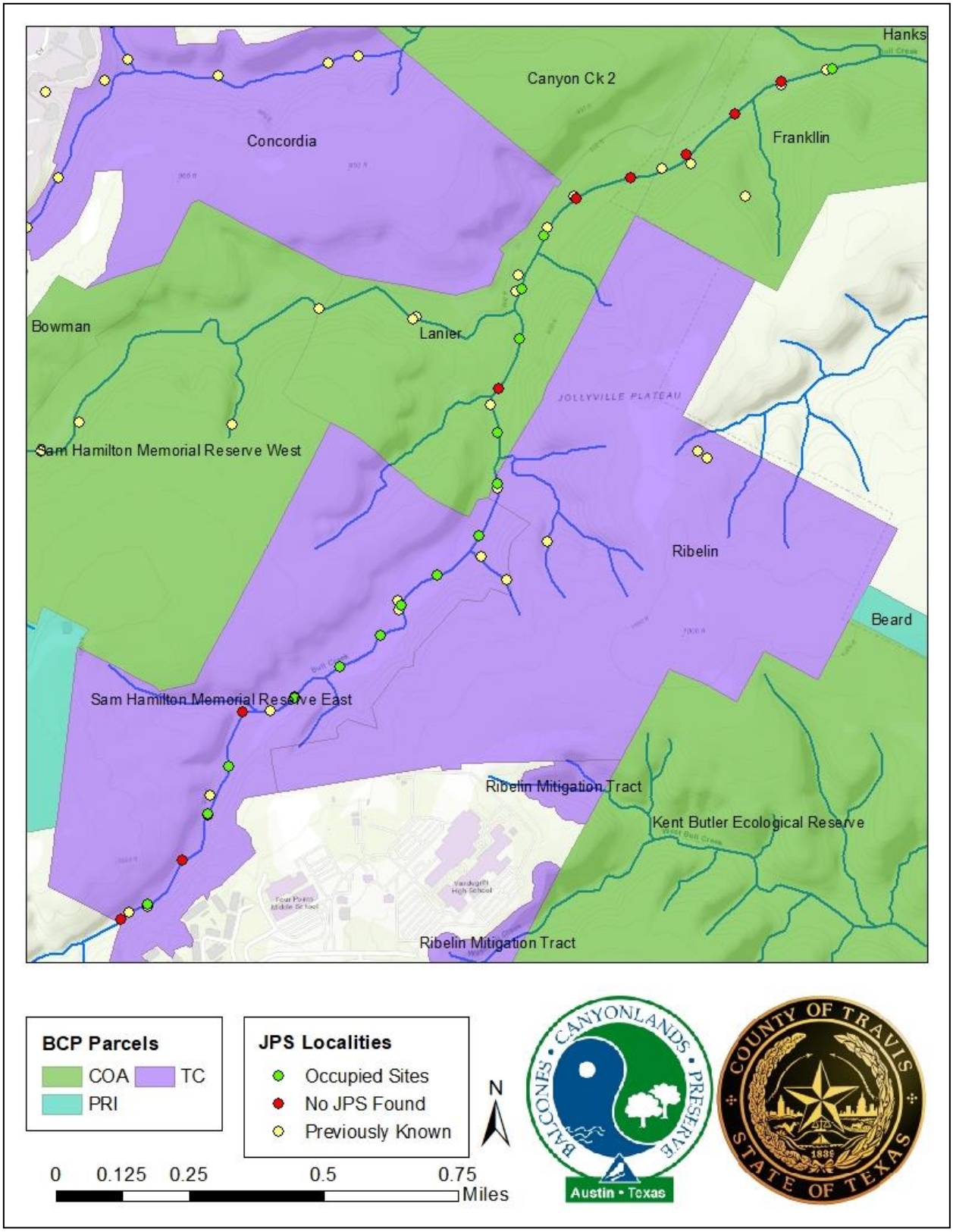

Figure 4. Mainstem Bull Creek occupancy surveys also showing previously known localities.

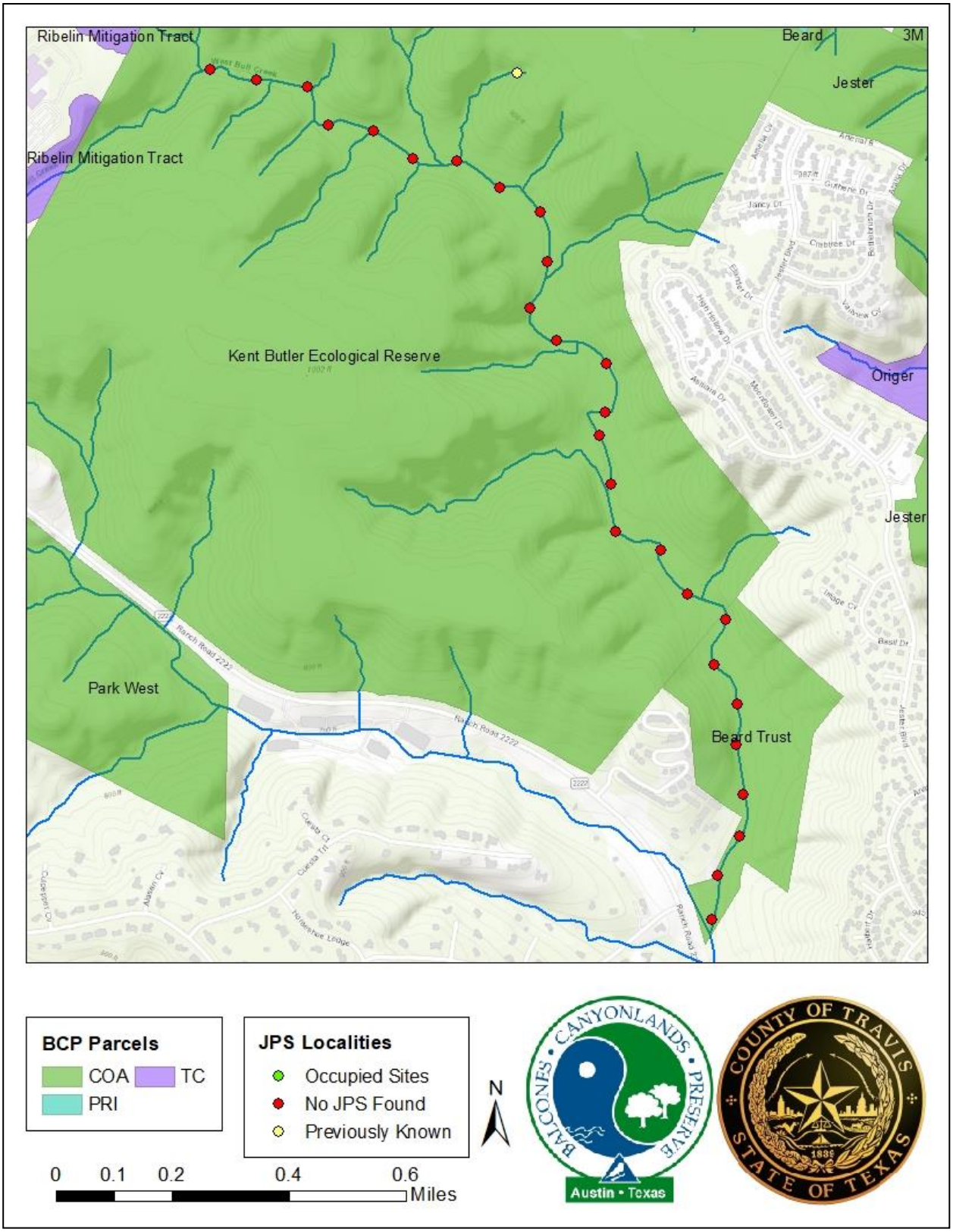

Figure 5. West Bull Creek occupancy surveys also showing previously known localities.

Table 1. Results of JPS surveys at three BCP sites in 2021.

Site	Date	# Salamanders
Lower Ribelin	08/06/2021	72
Upper Ribelin	08/06/2021	113

Threats

Amphibians are sensitive indicators of environmental degradation (Barinaga 1990, Blaustein *et al.* 1994, Hartwell and Ollivier 1998). Amphibians with restricted ranges in or near expanding metro areas face great risk of extinction. Of the thirteen *Eurycea* salamanders in central Texas, seven are threatened by or entirely surrounded by development (Diaz *et al.* 2020). Most known localities are at risk from urbanization due to their localized recharge areas (Chippendale *et al.* 2000, Chippendale and Price 2005, USFWS 2012). Prior research has shown that salamander densities are reduced in urbanized stream catchments (Orser and Shure 1972, Willson and Dorcas 2003). Urbanization correlates with changes to natural flow regime and degradation of surface and groundwater (Diaz *et al.* 2020). These manipulations to habitat quality may be the largest threat facing JPS and must be considered in conservation efforts (Bowles *et al.* 2006, Diaz *et al.* 2020).

The City of Austin's human population grew 277% from 1970 to 2017 (COA 2017). Bowles *et al.* (2006) found lower JPS density in developed tributaries compared to springs in undeveloped watersheds. Developed tributaries had higher concentrations of chloride, magnesium, nitrate-nitrogen, potassium, sodium, and sulfate (Bowles *et al.* 2006). Four of nine JPS sites monitored by the City of Austin from 1996 to 2007 showed statistically significant declines in salamander abundance over ten years (O'Donnell *et al.* 2006). Analysis of count data from 1996 to 2011 reveal that JPS populations declined in areas with the largest increases in residential development over a 15-year period and furthermore, densities of JPS are negatively correlated with residential development across its range (Bendik *et al*. 2014, Bendik *et al.* 2016).

Future Conservation Efforts

To address the conservation of JPS, Travis County will continue to manage and acquire land to protect endangered species, which will benefit JPS and general water quality. All streams within Travis County BCP tracts will be protected and if found to host JPS, will be managed to protect the species. Travis County will also collaborate

in research efforts to elucidate many of the unknowns regarding JPS life history, habitat preferences, potential threats, and the mechanics of the northern segment of the Edwards Aquifer. New occupancy studies or surveys of prior sites from dry years will be conducted in FY2022 to better understand occupancy and distribution in drainages where knowledge is lacking. After discovery of additional populations, staff will return on a systematic basis to verify JPS presence at these sites.

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