Monitoring of the golden-cheeked warbler (*Dendroica chrysoparia)* In western Travis County, Texas: 2005 Field Season



Photo: The Nature Conservancy, Ft. Hood, 1998

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INTRODUCTION

In the United States and Canada, 448 native bird species breed in terrestrial habitats (Rich et al. 2004). About 200 of those terrestrial species, commonly known as neotropical migrants, breed in North America, and then migrate south to winter in Mexico, Central America, South America, and the Caribbean (Sibley 2001). A majority of neotropical migratory bird species face population declines due to a wide array of threats including, but not limited to, habitat loss, degradation, and fragmentation (Rich et al. 2004). Partners in Flight, the U.S. Fish and Wildlife Service (USFWS), and many other cooperating agencies are actively developing recovery and conservation plans, acquiring critical habitat, and educating the general public about bird conservation issues in order to slow or prevent further population declines.

In 1990, the USFWS listed the golden-cheeked warbler (*Dendroica chrysoparia*), a neotropical migrant, as federally endangered due to loss and fragmentation of habitat due to suburban development, reservoir construction, and agricultural use (U.S. Fish and Wildlife Service 1990, Ladd and Gass 1999). The golden-cheeked warbler breeds only in Travis County and 24 other counties in central Texas where suitable oak-juniper (*Quercus spp.-Juniperus ashei*) woodlands and forest are present (Ladd and Gass 1999, Pulich 1976). During the last two decades in Travis County, development has expanded westward from the city of Austin at a rapid pace, accelerating the loss and fragmentation of golden-cheeked warbler breeding habitat. In 1996, the Balcones Canyonlands Conservation Plan was approved by the USFWS to facilitate local recovery of the warbler and seven other endangered species (Balcones Canyonlands Preserve 1999). A main objective of the plan is to protect 30,428 acres of endangered species habitat in western Travis County. This preserve system, the Balcones Canyonlands Preserve (BCP), is managed and owned by various governmental and private entities, including Travis County. Travis County actively manages 3,943 acres within the BCP as well as an additional 819 acres at Steiner Ranch. Steiner Ranch has not yet been included in the acreage requirement set by the USFWS since it is located outside the original preserve acquisition boundary.

In 1996, Travis County began monitoring the golden-cheeked warbler on the BCP and other county-managed properties, and surveys have since been conducted annually with an emphasis on newly acquired preserve property (Travis County Natural Resources 1996; 1997; 1998; 1999; 2000; 2001; 2002; 2003; 2004). In 2005, Travis County Natural Resources monitored golden-cheeked warblers on thirteen tracts covering 1,954 acres (791 hectares) (**Figure 1; Table 1**). Territory mapping of entire preserve tracts was conducted on

four newly acquired preserve properties: Canyon Vista, Medway Ranch, Nootsie, and Ribelin, as well as on three previously acquired preserve properties: Steiner Ranch Tract 4 (Vireo Management Area (VMA)) and Tract 5 (Northeast (NE)), Greenshores, and Grandview Hills-North. On each tract, data were collected on four bird population parameters: male abundance, species distribution, territory density, and territory location (see methods section for an explanation of survey methodology). Also, presence/absence surveys for the warbler were conducted on the Franzetti (newly acquired in 2005) and Cuevas tracts. Golden-cheeked warbler presence/absence surveys were not conducted on any of the county's parklands in 2005.

In addition to these surveys, territory and productivity data were collected on three annually monitored, permanent 100-acre (40.4 ha) study plots at Bunten, Hamilton Pool Preserve (hereafter Hamilton Pool), and Lake Perspectives. On these plots, data were collected on territory density and location, pairing success, breeding success, and productivity.

METHODS

STUDY SITES

The Jollyville Unit Preserve (1,926 ac) is located in northwest Travis County (**Figure 1**) in the Cypress Creek macrosite (Balcones Canyonlands Preserve 1999). Steiner Ranch Preserve (819 ac) is located off RM 620 (**Figure 1**) in the North Lake Austin macrosite (Balcones Canyonlands Preserve 1999). Detailed physical descriptions of these units within the BCP can be found in the Jollyville Unit, Romberg, and Steiner Ranch Land Management Plans (Balcones Canyonlands Preserve 1999).

Hamilton Pool Preserve (232 ac) is located in far southwestern Travis County near the Hays County boundary in the Pedernales macrosite off of RM 3238 (Hamilton Pool Road) (**Figure 1**) (Balcones Canyonlands Preserve 1999). River and creek terrain supports mixed, evergreen-deciduous woodland dominated by *J. ashei*, *Quercus buckleyi*, and *Ulmus crassifolia* (Carr 1996), which provides habitat for the golden-cheeked warbler. A detailed description can be found in the Hamilton Pool Preserve Land Management Plan (Balcones Canyonlands Preserve 1999).

The Greenshores (52 ac) and Franzetti (58 ac) tracts are located in the North Lake Austin macrosite (**Figure 1**). Greenshores is located near the Oak Shores and Pearce Roads off of City Park Road, south of RM 2222 while the Franzetti tract is located directly off of City Park Road. Conner's creek and several side tributaries dissect Greenshores and drain

southward toward Lake Austin, a reservoir on the Colorado River. It is comprised of gently sloping uplands dominated by mature oak-juniper woodlands, and it gives way to a steep, mesic canyon. Franzetti is a long linear tract comprised of an oak-juniper woodland, a creek, canyons and plateaus.

Medway Ranch tract is located in the South Lake Austin macrosite (**Figure 1**). This 344-acre tract is located between Lake Austin on the east and RM 620 on the west, located on Pecan Drive and Murfin Road. A major drainage as well as two smaller drainages flows through the tract toward Lake Austin. Due to historic clearing for ranch land uses, much of the tract has semi-open savannahs with post oaks (*Quercus stellata*) and little habitat for the warbler except for along the drainages, which provides the best habitat for the golden-cheeked warbler.

The Ribelin tract is located within the Bull Creek macrosite and on the Jollyville Plateau (**Figure 1**). This 319-acre tract is located off of RM 2222 and McNeil Drive, which is the primary access point. The tract is located adjacent to the City of Austin's Ivanhoe Tract and the Upper Bull Creek Unit. The tract contains a short section of Bull Creek, and the topography includes upland plateaus that give way to irregular, steep slopes and ravines. Primary soils on this tract are found in the Tarrant series (Soil Conservation Service 1974). Closed canopy oak-juniper woodlands cover the majority of the canyons and slopes. Humans have heavily impacted the lands comprising the Ribelin tract. There are several ranch roads, a substantial power line corridor (which makes up the south boundary of the property line), man-made clearings, old dumps, and fences found throughout the tract. In recent history, the land was utilized for cattle and livestock ranching.

The Canyon Vista tract is 237 acres with 236 acres owned outright by Travis County and 1 acre owned by Round Rock ISD as a conservation easement. The tract is located off of Spicewood Springs road. Topography includes upland plateaus that give way to irregular, steep slopes and ravines. Vegetation ranges from open juniper brakes on uplands and shallow slopes to closed canopy oak-juniper woodlands on steeper, mesic slopes. Brackett series soils predominate on rolling uplands and gentle slopes while Tarrant series soils occur on steep slopes and in canyons (Soil Conservation Service 1974). Humans have heavily impacted the lands by constructing several ranch roads, recreational trails, and man-made clearings. Old dumps and fences are found intermittently throughout the tract. Dense residential areas border the preserve, and large tracts of privately owned land are found along the southern boundary.

TRACT TERRITORY MAPPING

Data Collection

Territory mapping of golden-cheeked warblers was conducted from 24 March to 22 June 2005 on the following Travis County preserve tracts: Canyon Vista, Grandview Hills-North, Greenshores, Medway Ranch, Nootsie, Ribelin, and Steiner Ranch (tracts 4 and 5) (**Figure 1**). Territory mapping was used to estimate territory density and male abundance as well as species distribution and territory location for each tract. All observations (both visual and auditory) of male, female, and juvenile warblers were plotted on hard-copy digital orthophoto maps with a resolution of 2' (scale 1:5,000 or less). For each observation, the following demographic data were recorded: sex, age, presence of a mate, and number of fledglings observed. Song type and counter singing was also noted. Avian locations were later recorded in an ArcView 3.2 (ESRI, Inc., Redlands, California) database using the NAD 1983 Texas State Plane Coordinate System. Spatial and demographic data were also entered into the database via an ArcView 3.2 script.

All potential warbler habitat at each site was surveyed repeatedly throughout the breeding season. Total survey hours varied according to tract size and terrain (**Table 1**). Due to limitations inherent to territory mapping methods including, but not limited to, differences in observer ability and the stability of exclusive territories of the target species, results of all surveys should be interpreted as indices, rather than complete counts (Verner 1985).

Mapping methods generally followed IBCC guidelines (1970), and improvements on this method were incorporated to increase accuracy in assigning observations to specific territories or clusters (Verner 1985, Bibbey 1992). Field observations (e.g., bird behavior, phenology) and general knowledge of the species (e.g., territory size, habitat requirements) were also relied upon to help differentiate individual males and delineate their territories. Any male that could be differentiated from surrounding males was given a unique number for further tracking. Females or fledglings associating with a unique male were given the same unique number. Also, Bibbey's consecutive flush method (1992) was modified to allow no more than five sequential movements attempted at one time in order to minimize influencing bird behavior.

Observations of warblers that could not be differentiated from surrounding individuals with any confidence were designated as "unknown." Playback tapes of warbler vocalizations were not used to elicit warbler responses. Systematic nest searching was not conducted during this field season. However, incidental observations of any warbler nests were noted and mapped

onto the hard-copy digital orthophoto maps. All observations of brown-headed cowbirds (*Molothrus ater*) and any signs of nest parasitism were also noted. During the rare observed occurrence, brown-headed cowbird fledglings were to be safely dispatched if being tended by a warbler.

Data analysis

Abundance was calculated as the sum of all individual male warblers detected at a given survey site, including those observed outside of tract boundaries. Species distribution comprises all locations where warblers were observed. This includes males, females, and fledglings and may include multiple sightings of the same individual.

An individual male was considered to have established a breeding territory if one or more of the following conditions were observed: 1) a male was observed with a female; 2) a nest was located for an individual male; 3) a male was observed with fledglings; and/or 4) a male was observed at least three times (on different days with at least one week between observations) using the same general location. Males that only used areas outside of tract boundaries were not included in the territory analysis.

In calculating territory type and number, territories that fell entirely within the tract boundaries were considered "full" territories. Territories that fell at least partially outside the tract were considered "edge" territories. In order to avoid an upward bias in calculating territory number, Verner (1985) suggested counting each edge territory as half (0.5) of a territory (referred to as modified territories hereafter). In the results section, a "low" estimate (full territories only), "high" estimate (full and edge territories weighted the same, i.e. 1.00), and the modified estimate based on Verner's (1985) method (number of full territories + 0.5 [number of edge territories]) are presented. For each of the surveyed tracts, territory density is calculated as the number of modified territories divided by the number of acres and hectares for a tract.

PRESENCE/ABSENCE SURVEY

Presence/absence surveys were conducted on Cuevas and Franzetti preserve tracts. Presence/absence surveys followed U.S. Fish and Wildlife Service minimum procedures for golden-cheeked warbler and black-capped vireo presence/absence surveys (USFWS 1994).

100-ACRE PRIME PLOT

Data collection

In 2005, territory mapping was conducted on three 100-acre permanent plots on the following preserves: Bunten, Lake Perspectives, and Hamilton Pool, all of which are classified as "prime" sites, i.e., more than 75% of the plot contains excellent warbler habitat (Balcones Canyonlands Preserve 1999). The 100-acre plots were surveyed following the same procedure as the abovementioned territory mapping with some exceptions. Territory mapping was conducted between 31 March and 30 June 2005. Surveys started one half hour after sunrise on days when the temperature was > 55° F, wind velocity was < 15 mph, and precipitation was light to none. The study plots were visited a total of ten times distributed evenly throughout the season, with each survey totaling six hours. No playback tapes were used to elicit warbler responses or systematic nest searching undertaken. However, incidental observations of any warbler nests were noted and mapped onto the hard-copy digital orthophoto maps. Two or three different observers alternately monitored each 100-acre plot during the survey period. For further information, a general study protocol for 100-acre plots is outlined in the BCP Land Management Plan (Balcones Canyonlands Preserve 1999).

All territories, including edge territories, were monitored repeatedly to collect pairing, breeding, and productivity data. Pairing status of male warblers was determined by observing a male associating with a female, locating a nest for that male, and/or observing a male tending at least one fledgling. Observations of fledglings tended by a parent and the greatest number of fledglings observed at any one time provided data for breeding success and productivity.

Data analysis.

Abundance was calculated as the sum of all individual male warblers detected at a given survey site, including those observed outside of tract boundaries. Species distribution comprises all locations where warblers were observed. This includes males, females, and fledglings and may include multiple sightings of the same individual.

An individual male was considered to have established a breeding territory if one or more of the following conditions was observed: 1) a male was observed with a female; 2) a nest was located for an individual male; 3) a male was observed with fledglings; and/or 4) a male was observed at least three times (on different days with at least one week between observations) using the same general location. Males that only used areas outside of tract boundaries were not included in the territory analysis.

In calculating territory type and number for 100-acre prime plots, the tract territory mapping methodology was utilized. Territory density is calculated as the number of modified territories per 100 acres, and then, for easier interpretation, is calculated per 100 hectares (247.1 acres).

To calculate pairing success, breeding success, and productivity, only full territory totals for each tract were used. Full territories were the territories that only fell within the plot boundaries. Pairing success rate was calculated as the number of males determined to have paired with a female divided by the number of full territories (Anders 2000). To determine breeding success rate, full territories with at least one fledgling observed with either the male or female parent was tallied, and then divided by the total number of full territories for the plot (Koloszar and Becker 2000).

Productivity was measured two ways for the 100-acre study plots:

1) Productivity for paired full territories = $\frac{\text{\# of fledglings*}}{\text{\# of paired full territories}}$

2) Productivity for all full territories = $\frac{\text{\# of fledglings*}}{\text{total \# of full territories}}$

*Sum of the highest number of fledglings observed at any one time

RESULTS AND DISCUSSION

During field season 2005, golden-cheeked surveys were conducted between 24 March and 30 June 2005 on 1,954 acres, and the amount of time spent surveying was 581.25 hours total (**Table 1**). A total of 2,631 observations of warblers were recorded on the surveyed properties. This total includes observations of 2,418 males, 179 females, and 34 warblers for which sex was not determined.

Table 1. List of Travis County Balcones Canyonlands Preserve (BCP) tracts surveyed for golden-cheeked warblers (*Dendroica chrysoparia*) during the 2005 field season. Also included are tract acreages, survey dates and total survey hours for each tract.

Tract	Acreage Surveyed	Survey Dates	Total Survey Hours
100-acre prime plots			
Bunten	100	3/31 - 6/21/05	60
Hamilton Pool	100	3/31 - 6/21/05	60
Lake Perspectives	100	3/31 - 6/30/05	60
Territory Mapping			
Canyon Vista	229	3/30 - 6/14/05	90.25
Grandview Hills-North	175	3/31 - 6/16/05	48.5
Greenshores	52	3/25 - 6/22/05	12
Medway Ranch	348	3/22 - 5/05/05	13.5
Nootsie	127	3/29 - 6/07/05	82.75
Ribelin	310	3/24 - 6/13/05	118.25
Steiner Ranch			18.5
Tract 4 (VMA)	127	3/29 - 5/18/05	
Tract 5 (NE)	101	3/29 - 5/18/05	
Presence/Absence			
Cuevas	142	3/24 - 4/22/05	16.5
Franzetti	58	5/03, 5/18	1
Total	**1,954**	**3/24 - 6/30/05**	**581.25**

TRACT TERRITORY MAPPING

Overall, 1,469 acres were mapped for golden-cheeked warbler territories for 383.75 hours during the 2005 field season (**Table 1**). The total abundance on all tracts surveyed was 160. Abundance was greatest on the Ribelin tract (56), and Medway Ranch (3) had the least abundance (**Table 2**). The Ribelin tract also had the greatest number of modified territories (37.5), however the Nootsie tract had the greatest territory density overall (0.13/ac; 0.31/ha) but only 16 modified territories (**Table 2**). Ribelin (0.12/ac; 0.30/ha), Canyon Vista (0.08/ac; 0.21/ha), and Greenshores (0.06/ac; 0.15/ha) had higher territory densities then Grandview Hills-North (0.05/ac; 0.13/ha), the combined tracts of Steiner Ranch (0.02/ac; 0.06/ha), and Medway Ranch (0.004/ac; 0.01/ha), which had the lowest territory densities (**Table 2**).

Table 2. Results of the golden-cheeked warbler (*Dendroica chrysoparia*) territory mapping on Travis County-managed Balcones Canyonlands Preserve tracts surveyed during the 2005 field season. Golden-cheeked warbler male abundance, territory number (full, full and edge, and modified territory number[a]), and territory density per acre and hectare are summarized. See methods section for definition of full and edge territory.

Preserve tract (ac)	Abundance	No. of Full Territories	No. of Full & Edge Territories	Modified Number of Territories[a]	Territory Density (ac)[b]	Territory Density (ha)[b]
Canyon Vista (229)	31	18	20	19	0.08	0.21
Grandview Hills-North (175)	19	7	11	9	0.05	0.13
Greenshores (52)	10	2	5	3.5	0.06	0.15
Medway Ranch (348)	3	1	2	1.5	0.004	0.01
Nootsie (127)	26	11	21	16	0.13	0.31
Ribelin (310)	56	26	49	37.5	0.12	0.30
Steiner Ranch, total (819)						
Tract 4, VMA (126)	1	0	1	0.5	0.004	0.01
Tract 5, NE (101)	14	4	6	5	0.05	0.12
Combined Tract 4 & 5 (227)	15	4	7	5.5	0.02	0.06

[a] Number of full territories + 0.5 (number of edge territories) (Verner 1985)
[b] Calculated using the modified number of territories

Figures 2 through 8 illustrate territory distribution and abundance for each of the properties surveyed. Territorial male observations indicate only the general location of a territory relative to other territories and to tract features and are not meant to represent actual territorial boundaries or territory sizes.

Additional observations

Warbler nests were not systematically searched for during the territory mapping surveys, however one active nest was located in a mature Ashe juniper on the Nootsie tract. The nest was located while a male and female were feeding hatchlings. A successful nest attempt was confirmed when multiple observers recorded at least 2 fledglings in the area being fed by parents.

On 25 March 2005, a damaging hailstorm moved through western Travis County and into downtown Austin. There were many reports of broken and cracked windshields and dented car bodies. Damage was also reported to trees in the area. We observed 3" to 6" juniper branch tips underneath many trees especially in the North Lake Austin macrosite area. Additionally, reports were made of dead birds being found in parking lots. This weather system possibly affected the golden-cheeked warbler as well as other neotropical migrants since it occurred during spring migration and the early breeding season.

Construction noise and activities effected surveyors' ability to assess warbler populations on Steiner Ranch and Greenshores. Also, road noise from RM 620 made warbler detections difficult on Steiner Ranch and Nootsie. Most of the surveyed tracts have a substantial feral hog issue, which is being addressed through hog trapping by approved local trappers. Trespassers walking their pets or mountain biking were encountered frequently on Canyon Vista. Incidents were reported to BCP ranger staff, and trespassers were educated about the BCP mission and goals. Canyon Vista fencing will be completed by the spring of 2006, which may decrease trespassing incidents.

PRESENCE/ABSENCE SURVEYS

During the 2005 field season, 200 acres were surveyed for the presence of golden-cheeked warblers on the Cuevas and Franzetti preserve tracts (**Table 1**). Sixty golden-cheeked warbler detections (male and female) were recorded on the Cuevas tract between 24 March and 22 April 2005 (**Table 1**; **Figure 12**). Three females were observed while surveying Cuevas. The Franzetti tract was surveyed for a minimum of one hour on two days, 3 May and 18 May 2005 (**Table 1**). Seven male detections were recorded on the Franzetti tract, however no females were observed (**Figure 13**). No fledglings were detected at either tract.

Franzetti will be surveyed for warbler territories during the 2006 field season, and the Cuevas data from this year and past surveys will be used to determine the best area for potential black-capped vireo (*Vireo atricapillus*) habitat restoration.

100-ACRE PRIME PLOTS

Territory Density

In the 2005 field season on the 100-acre prime plots, an average of 13 territories were established per 100 acres which can be interpreted as an average of 32.4 territories per 100 hectares (**Table 3**). Thirty-six males were detected during the 100-acre plot surveys on Bunten, and 13 and 18 males were detected on the Hamilton Pool and Lake Perspectives study plots, respectively (**Table 3**). The Bunten 100-acre plot had 22.5 modified territories, which was much greater than the number of modified territories on Hamilton Pool (7) or Lake Perspectives (9.5) (**Table 3**). On the Bunten study plot, 15 territories fell entirely within plot boundaries and 15 were edge territories. Seven territories were located entirely within the study plot boundary on Lake Perspectives, with 5 additional territories straddling the boundary. Finally, at Hamilton Pool, 5 out of 9 territories fell entirely within the boundary of the study plot.

Based on Verner's (1985) method for calculating territory number, territory density was highest at Bunten with 56 territories per 100 hectares (male/1.8 ha). Territory density at Lake Perspectives was less than Bunten (24 territories per 100 hectares or one male per 4.2 ha), but Hamilton Pool had the least number of territories overall (17.3/100ha or one male/5.8 ha) (**Table 3**).

Table 3. Results of the golden-cheeked warbler (*Dendroica chrysoparia*) territory mapping on Bunten, Lake Perspectives, and Hamilton Pool 100-acre study plots on the Travis County-managed Balcones Canyonlands Preserve. Results include abundance, number of territories (full, full and edge, and modified), and territory density per 100 hectares.

Study Plot	Abundance	No. of full territories	No. of full and edge territories	Modified number of territories[a]	Territory density per 100ha[b]
Bunten	36	15	30	22.5	56
Hamilton Pool	13	5	9	7	17.3
Lake Perspectives	18	7	12	9.5	24
Average				**13.0**	**32.4**

[a] Number of full territories + 0.5 (number of edge territories) (Verner 1985)
[b] Based on calculation of the modified territory number listed in column 4

Figures 9 through 11 illustrate territory distribution and abundance for each of the 100-acre prime study plots surveyed. Territorial male observations indicate only the general location of a territory relative to other territories and to tract features and are not meant to represent actual territorial boundaries or territory sizes.

Differences in territory density between prime plots may be attributed to site-specific characteristics, although other, untested covariates may have affected densities (e.g., age structure of the local population, inter-specific competition). Although both Bunten and Lake Perspectives contain excellent warbler habitat, there are differences between plots with regard to the ratios of excellent to marginal habitat, as well as, the amount of edge on the plot boundaries (See Campbell 1995 for descriptions of *excellent* and *marginal* warbler habitat). The Bunten study plot comprises 100% excellent warbler habitat. Lake Perspectives, on the other hand, contains areas of marginal habitat and about 75% excellent warbler habitat. Perhaps more importantly, however, the Bunten study plot is situated entirely within a much larger block of continuous excellent warbler habitat, while Lake Perspectives is bounded to the east by Bullick Hollow Road and to the southeast by open uplands unsuitable for breeding golden-cheeked warblers. Studies have indicated that densities of forest-dwelling migrant songbirds tend to be higher on larger blocks of continuous habitat and this may be a function of decreasing edge effects (Biological Advisory Team 1990; Friesen et al. 1995; Wahl 1990).

Hamilton Pool study plot had the lowest warbler territory density. Only 50% of the study plot contains excellent warbler habitat; the remaining percent is marginal to poor breeding habitat. In 1996, Hamilton Pool was designated a prime plot in the Balcones Canyonlands Preserve Handbook (Balcones Canyonlands Preserve 1999) and has been surveyed as such over the years. However, it does not fit the criteria for prime plots (i.e., >75% of the plot must contain excellent warbler habitat) as outlined in the handbook. However, since the Hamilton Pool study plot is officially designated as a prime plot, it will continue to be surveyed and analyzed as prime for the sake of consistency.

Pairing Success, Breeding Success, and Productivity

For all three 100-acre study plots, the average pairing success was 81%. The highest pairing rate occurred at Hamilton Pool with one female or at least one observed fledglings for every full territory. At Bunten, 73% of all males were determined to have paired with females, and at Lake Perspectives, 71% of all males were paired.

The breeding success rate for all three plots ranged from 0.66 to 1.00 with an average of 79% successfully raising a brood; Hamilton Pool had fledglings in every full territory on the plot. A total of 48 fledglings were observed in 20 broods across all three 100-acre study plots. Each successfully paired territory averaged 2.27 fledglings (range: 1.80 to 2.80), while each full territory averaged 1.74 fledglings (range: 1.57, 1.86) (**Table 4**).

Table 4. Golden-cheeked warbler pairing success rate; breeding success rate; and productivity per successful pair and full territory for the three Travis County 100-acre prime plots, Bunten, Hamilton Pool, and Lake Perspectives. Data collected during the 2005 field season on the Balcones Canyonlands Preserve in western Travis County, Texas. See methods section for a description of calculations.

100-acre Prime Study Plot	No. of full territories	No. of territories w/ female	No. of territories producing ≥ 1	Pairing success rate	Breeding success rate	Productivity per successful pair	Productivity per full territory
Bunten	15	11	10	0.73	0.66	2.80	1.86
Hamilton Pool	5	5	5	1.00	1.00	1.80	1.80
Lake Perspectives	7	5	5	0.71	0.71	2.20	1.57
Average				**0.81**	**0.79**	**2.27**	**1.74**

Additional observations

Two nests were discovered during surveys on the Hamilton Pool 100-acre plot on 26 April and 6 May. One of the nests was located in a live oak (*Quercus fusiformis*) and the other was located in a cedar elm (*Ulmus crassifolia*). Both broods were successfully completed with 2 fledglings each. No nests were found on the Bunten or Lake Perspectives study plots.

Please see the tract territory mapping discussion for information about weather issues. Surveyors had some difficulty detecting warblers on the north-west facing slopes in the Bunten plot due to construction noise from a ridge across FM 2769. No other issues were encountered or reported.

A 100-acre transitional plot will be put into place by the 2006 field season at Medway in order to monitor habitat succession and improvement. Ribelin will become the location of a fourth 100-acre prime plot by the start of the 2006 survey season. The plot will most likely be situated in the eastern portion of tract.

Brown-headed Cowbird Parasitism

A female golden-cheeked warbler was observed feeding a juvenile cowbird on the Ribelin tract on 2 June. A second unconfirmed sighting also occurred on Ribelin earlier in May, where a male golden-cheeked warbler may have been tending to a cowbird young. No other incidents, including discovering cowbird eggs in host nests, were noted during the 2005 field season. For a summary of brown-headed cowbird parasitism for 2005 see the "2005 Summary of Wildlife Management Activities on Travis County Tracts of the BCP" (Travis County Natural Resources 2005).

RECOMMENDATIONS

- Natural Resources staff will continue to make cowbird trapping at Hamilton Pool Preserve a high priority. The success of cowbird trapping may be critical to golden-cheeked warbler survival on Hamilton Pool Preserve. Cowbird parasitism affects not only golden-cheeked warblers but also other neotropical migrant species for which Hamilton Pool provides habitat, such as northern parula (*Parula americana*), black-and-white warbler (*Mniotilta varia*), and painted bunting (*Passarina ciris*).

- Abundance of cowbirds presents a similar problem for both golden-cheeked warblers and other migrant songbirds on Steiner Ranch Preserve. Although productivity data have not been gathered systematically at Steiner Ranch, it is probable that warbler productivity rates are very low, as they were at Hamilton Pool Preserve in 2002 prior to effective cowbird trapping. Cowbird trapping is problematic at Steiner Ranch due to accessibility, as well as its distance from other trap locations and preserves. Efforts may be made to hire Natural Resources interns as early as February so that they can learn to maintain cowbird traps independently for the majority of trapping season.

- It is also recommended that Travis County Natural Resources continue to add additional 100-acre study plots with the goal of adding one (transitional or prime) per year until 2009. A transitional 100-acre plot and a prime 100-acre plot will be set up in Medway and Ribelin, respectively, by the beginning of the 2006 field season. Because they provide systematic data to measure population and productivity trends, 100-acre study plots are critical to the BCP golden-cheeked warbler-monitoring program. The accuracy of the monitoring program increases with the number of plots surveyed.

- After field season 2006, there will be five years of data for Hamilton Pool and Lake Perspectives and four years of data for Bunten. Staff will conduct a statistical analysis on the data set, most likely using a repeated measures analysis of variance (ANOVA).

- Habitat enhancement will be performed in areas with a high density of juniper saplings to encourage hardwood regeneration. Golden-cheeked warbler monitoring will continue in areas restored for black-capped vireo habitat to evaluate their response to management activities.

- Natural Resources staff will plan and implement a golden-cheeked warbler color-banding program on either the Hamilton Pool or Lake Perspectives 100-acre prime plot by the year 2008. Color-bands will supplement and enhance the productivity and distribution data as well as provide information about site-recruitment and fidelity.

DATA MANAGEMENT

Information regarding data sets compiled for field season 2005 is provided below. All data sets are currently stored in the Travis County Natural Resources office, 1010 Lavaca Street, Austin, Texas.

Excel File Names:

Allcombined-2005.xls
Bunten-2005.xls
CanyonVista-2005.xls
Cuevas-2005.xls
Franzetti-2005.xls
GrandviewHillsN-2005.xls
Greenshores-2005.xls
HamiltonPool-2005.xls
LakePerspectives-2005.xls
Medway-2005.xls
Nootsie-2005.xls
Ribelin-2005.xls
SteinerRanch-2005.xls

Description: Golden-cheeked warbler location Excel databases for 2005 field season
Software: Microsoft Windows NT, Excel 2000
Archive Location: T:\Park_NR\NatRes\Common\Gcwa\GCWA-2005\2005 GCWA Excel files

ArcView 3.2 Shapefile Names:

gcwa-bunten-05.shp
gcwa-cynvista-05.shp
gcwa-cuevas-05.shp
gcwa-franzetti-05.shp
gcwa-greenshores-05.shp
gcwa-gvhn-05.shp
gcwa-hamiltonpool-05.shp
gcwa-lakeperspectives-05.shp
gcwa-medway-05.shp
gcwa-nootsie-05.shp
gcwa-ribelin-05.shp
gcwa-steinerranch-05.shp

Description: Golden-cheeked warbler geospatial files for 2005 field season
Software: ArcView 3.2
Archive Location: T:\Park_NR\NatRes\Common\Gcwa\GCWA-2005\2005 ArcView Shapefiles

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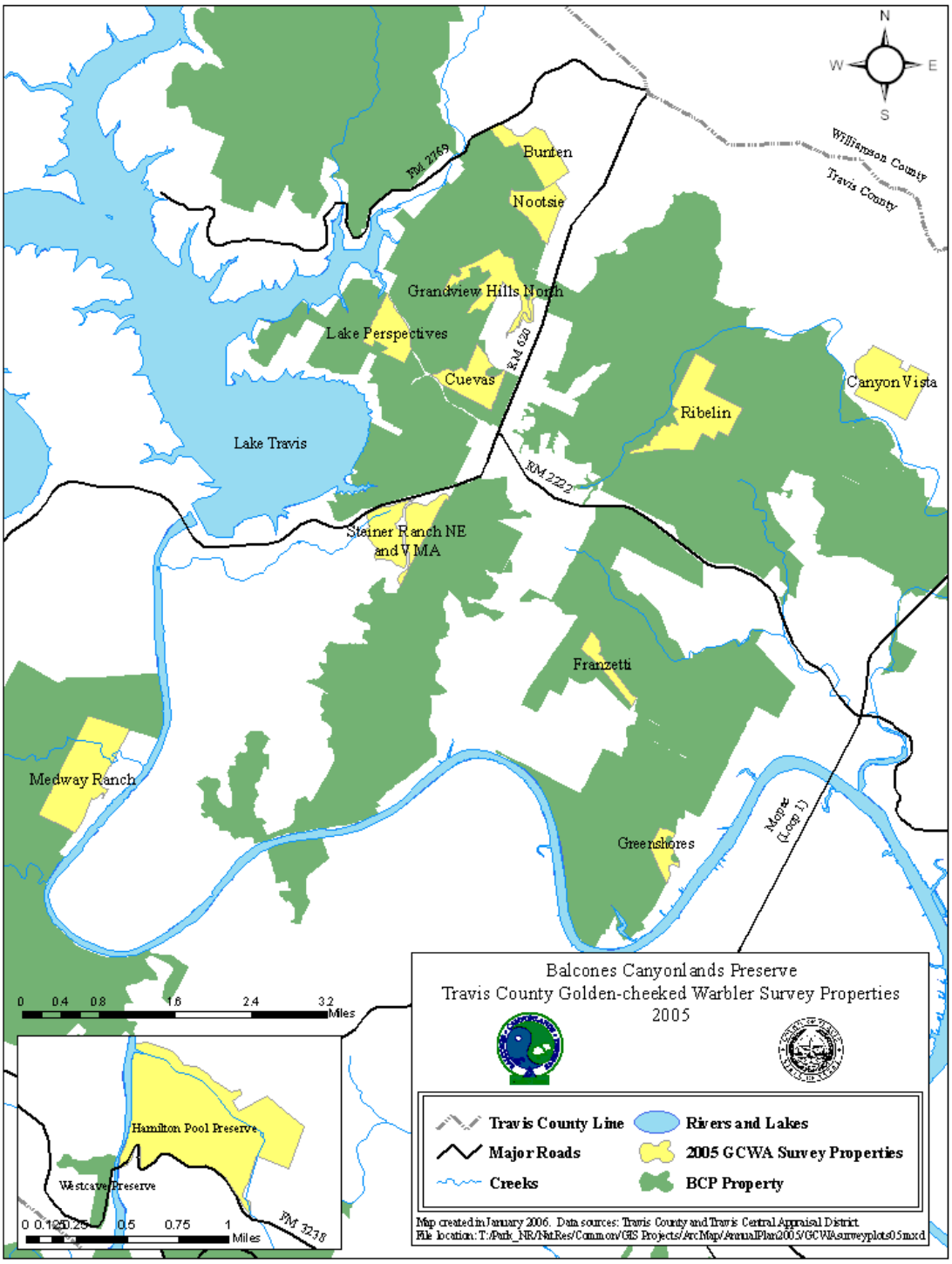


Figure 1. Location of Travis County-managed Balcones Canyonlands Preserve tracts surveyed for golden-cheeked warblers (*Dendroica chrysoparia*) in 2005.

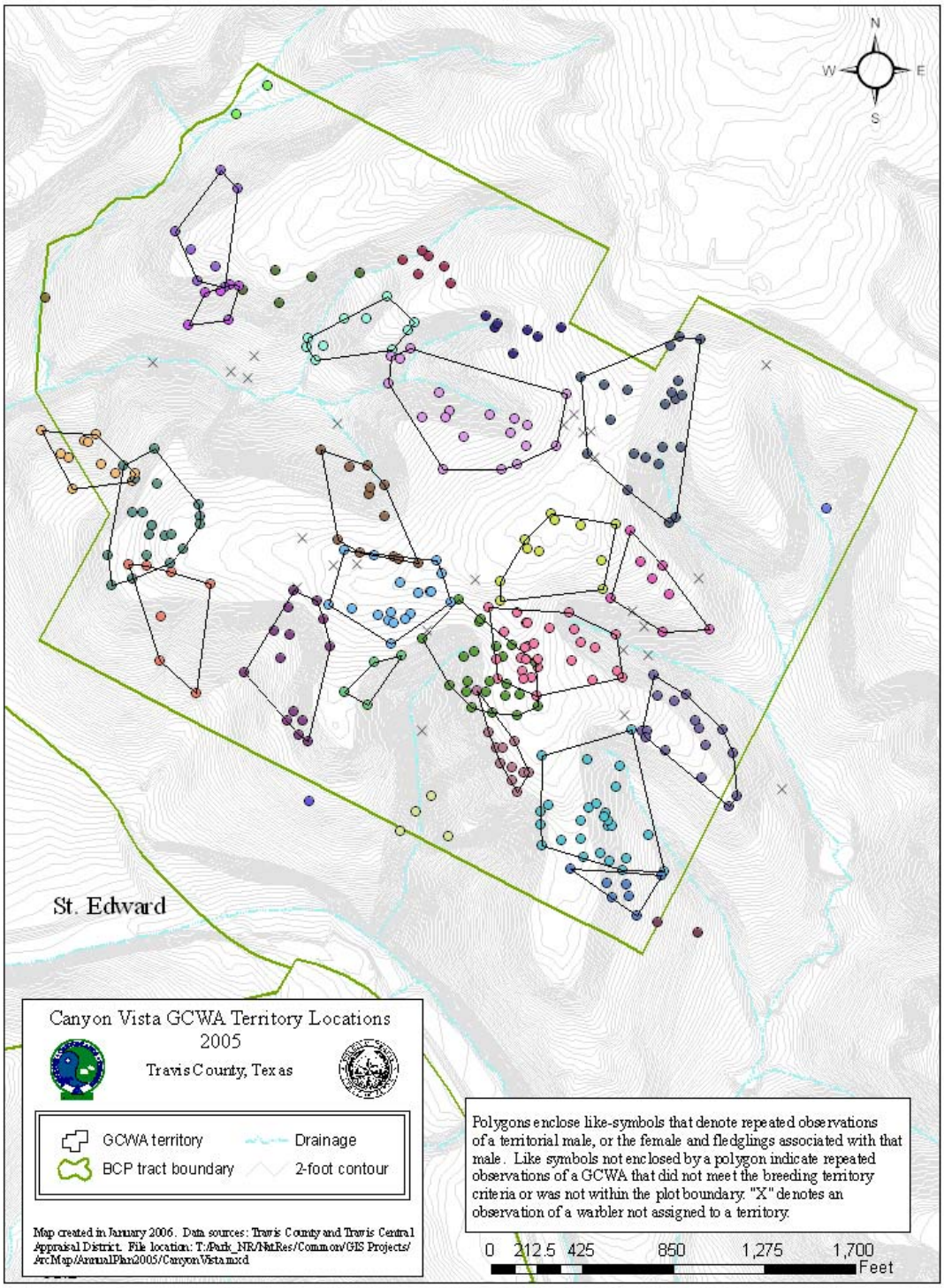


Figure 2. 2005 golden-cheeked warbler (*Dendroica chrysoparia*) (GCWA) territory locations on the Canyon Vista tract within the Balcones Canyonlands Preserve in western Travis County, Texas.

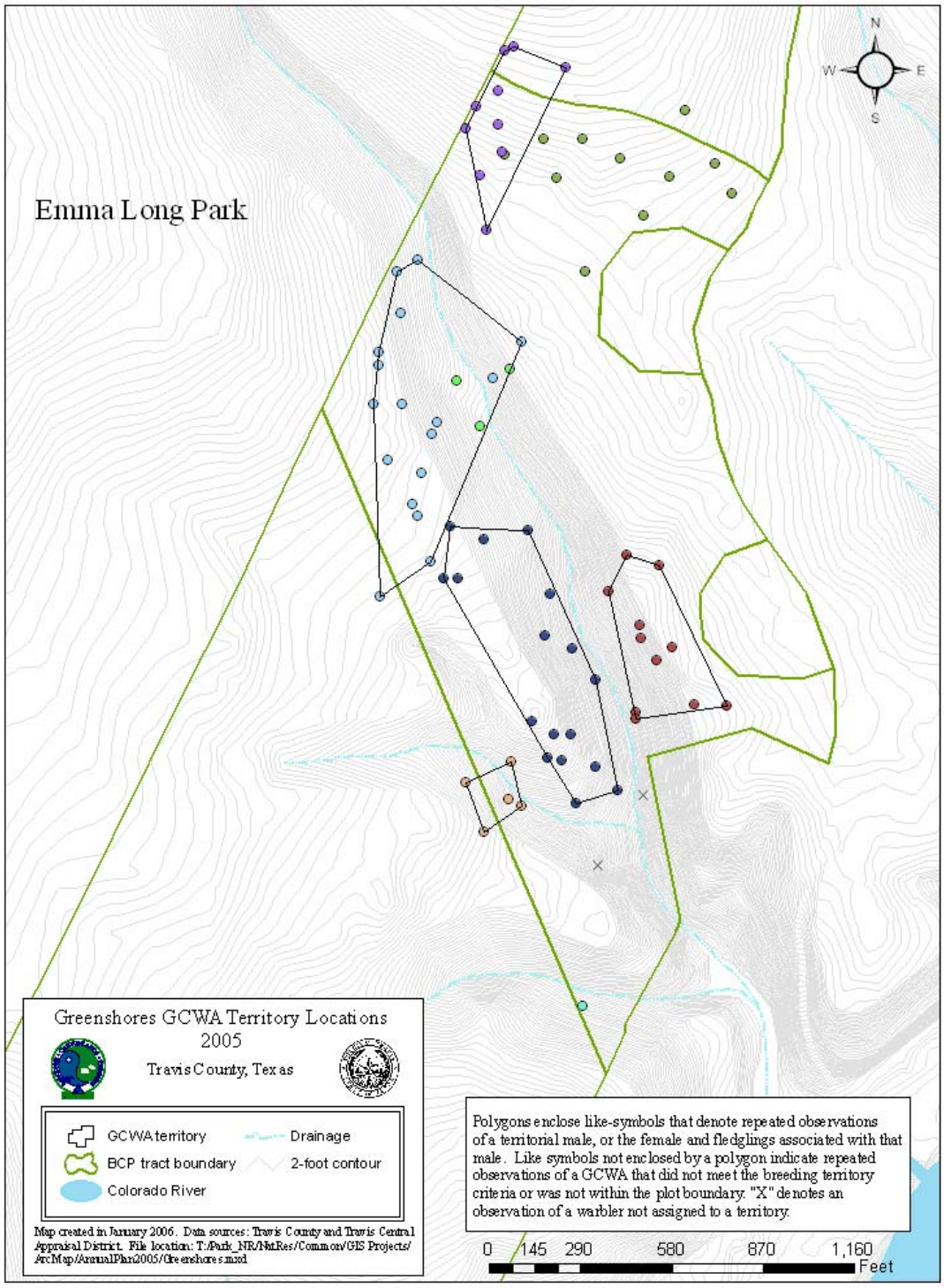


Figure 3. 2005 golden-cheeked warbler (*Dendroica chrysoparia*) (GCWA) territory locations on the Greenshores tract within the Balcones Canyonlands Preserve in western Travis County, Texas.

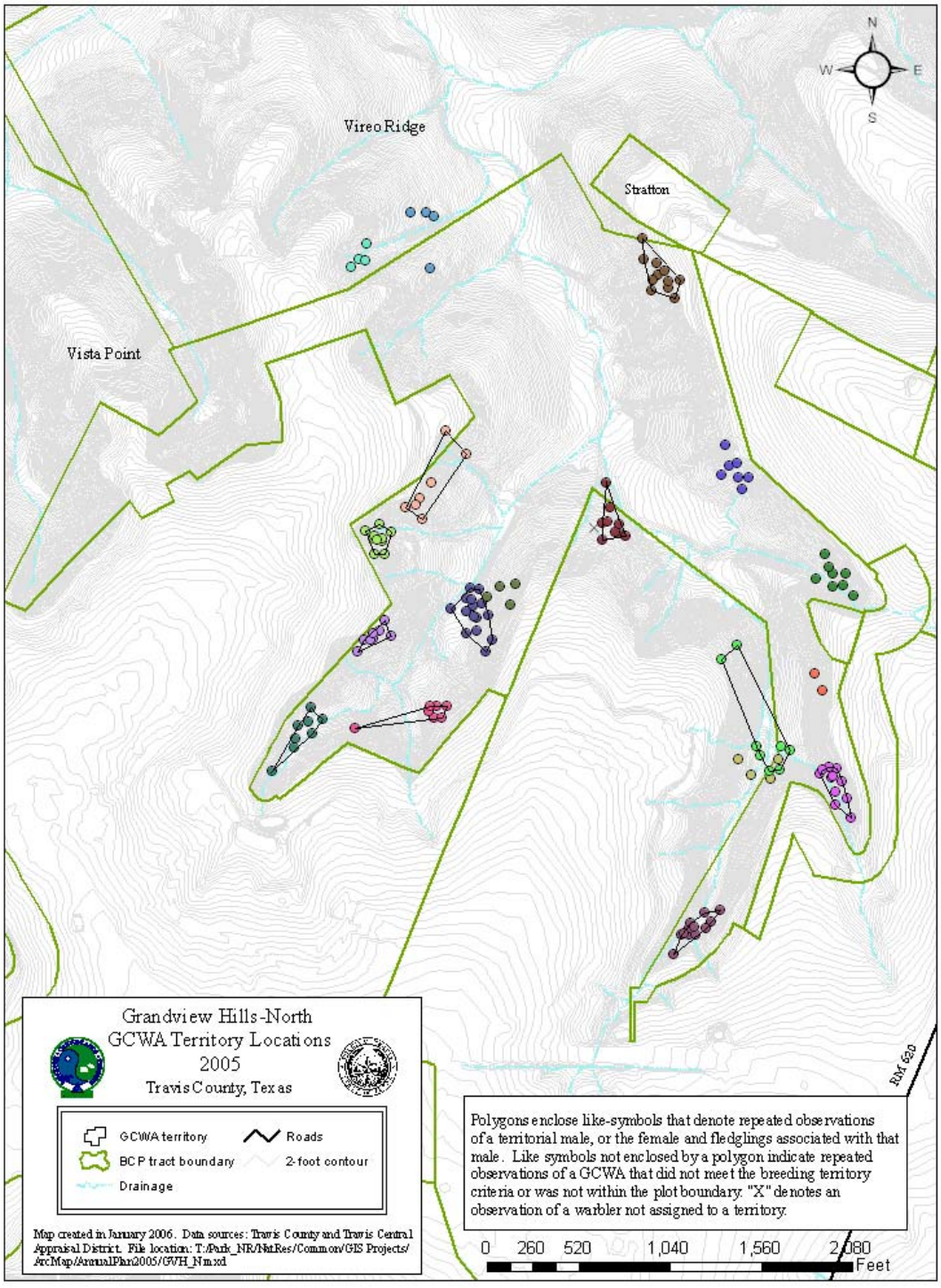


Figure 4. 2005 golden-cheeked warbler (*Dendroica chrysoparia*) (GCWA) territory locations on the Grandview Hills-North tract within the Balcones Canyonlands Preserve in western Travis County, Texas.

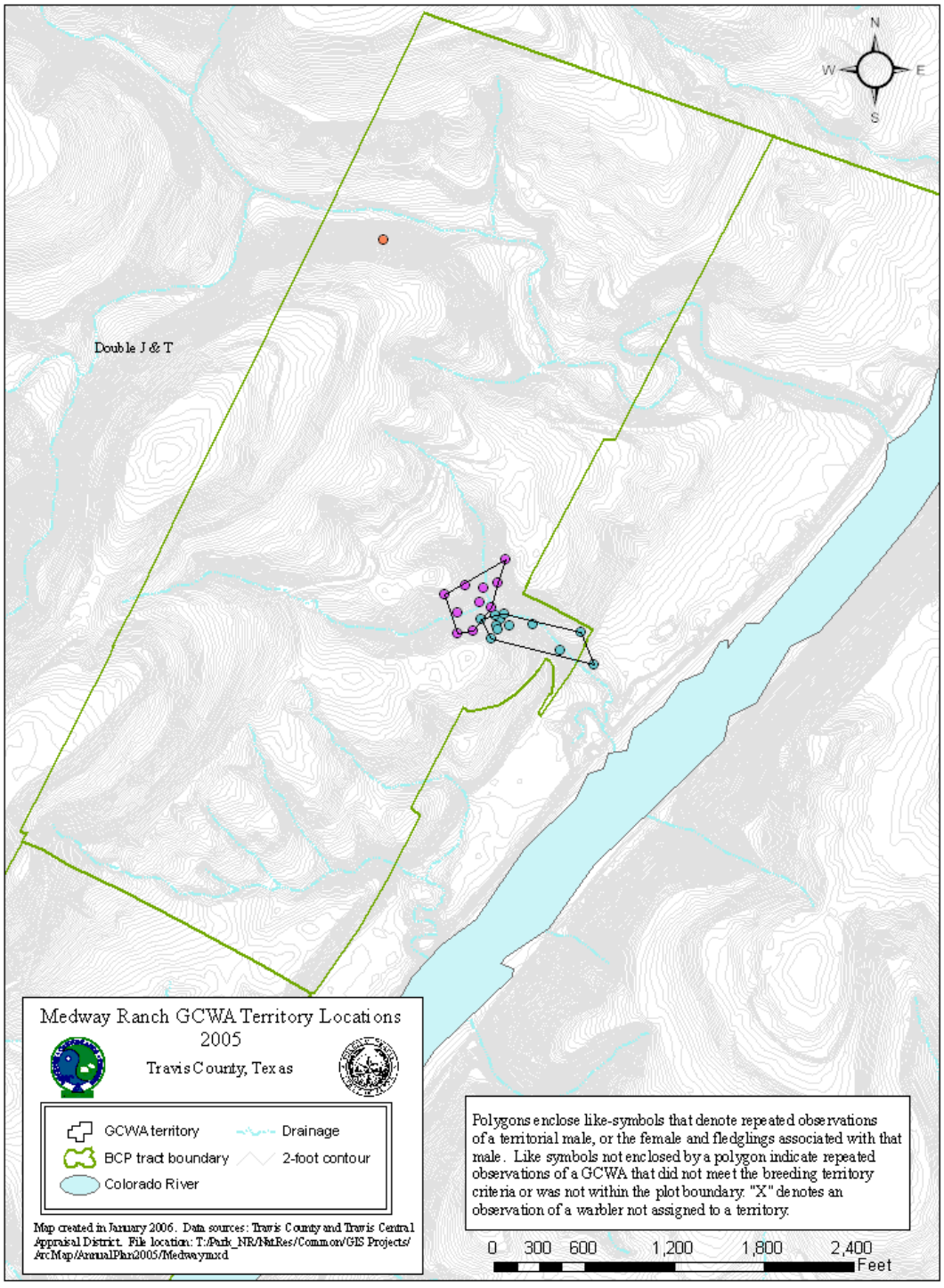


Figure 5. 2005 golden-cheeked warbler (*Dendroica chrysoparia*) (GCWA) territory locations on the Medway Ranch tract within the Balcones Canyonlands Preserve in western Travis County, Texas.

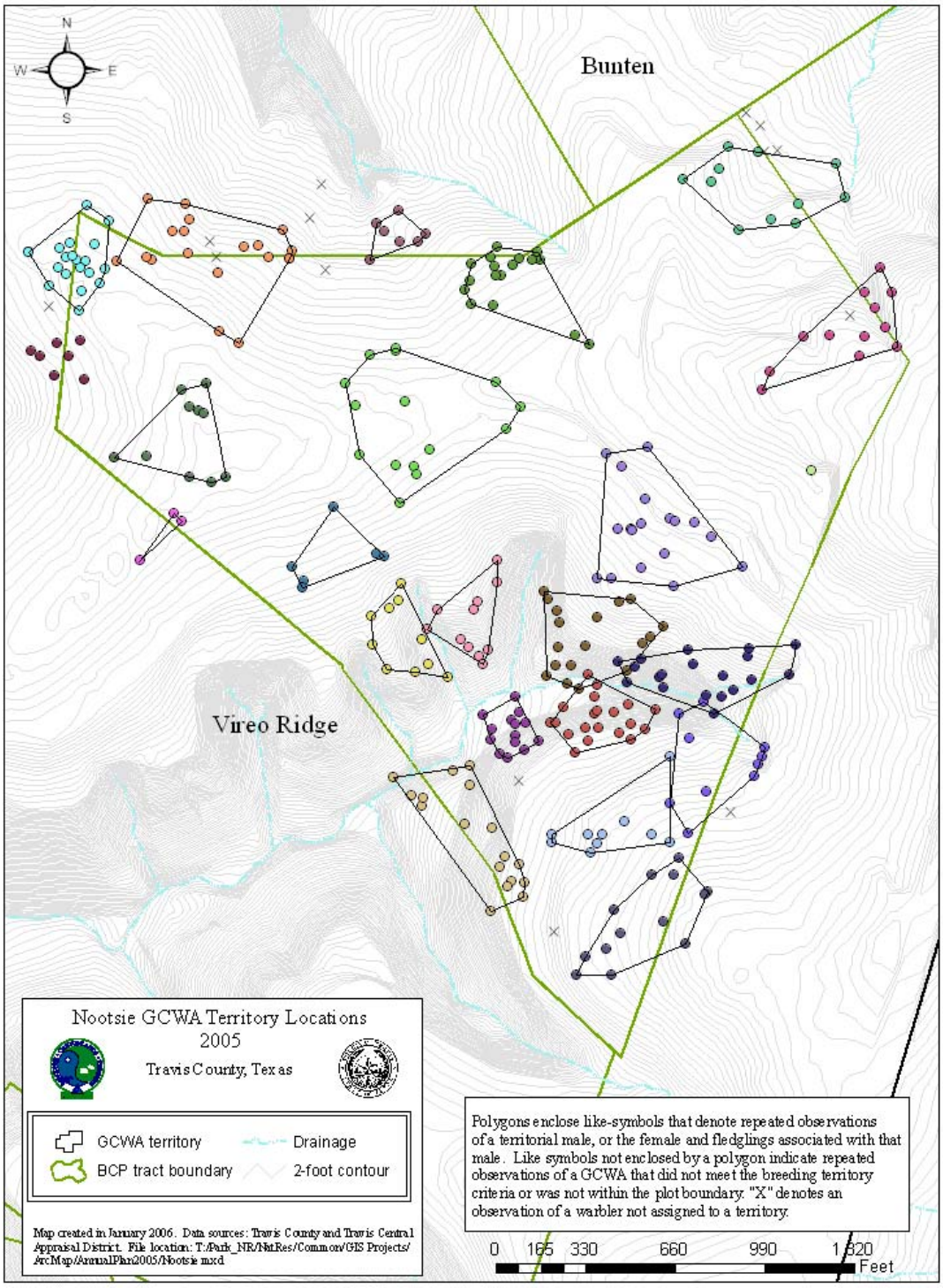


Figure 6. 2005 golden-cheeked warbler (*Dendroica chrysoparia*) (GCWA) territory locations on the Nootsie tract within the Balcones Canyonlands Preserve in western Travis County, Texas.

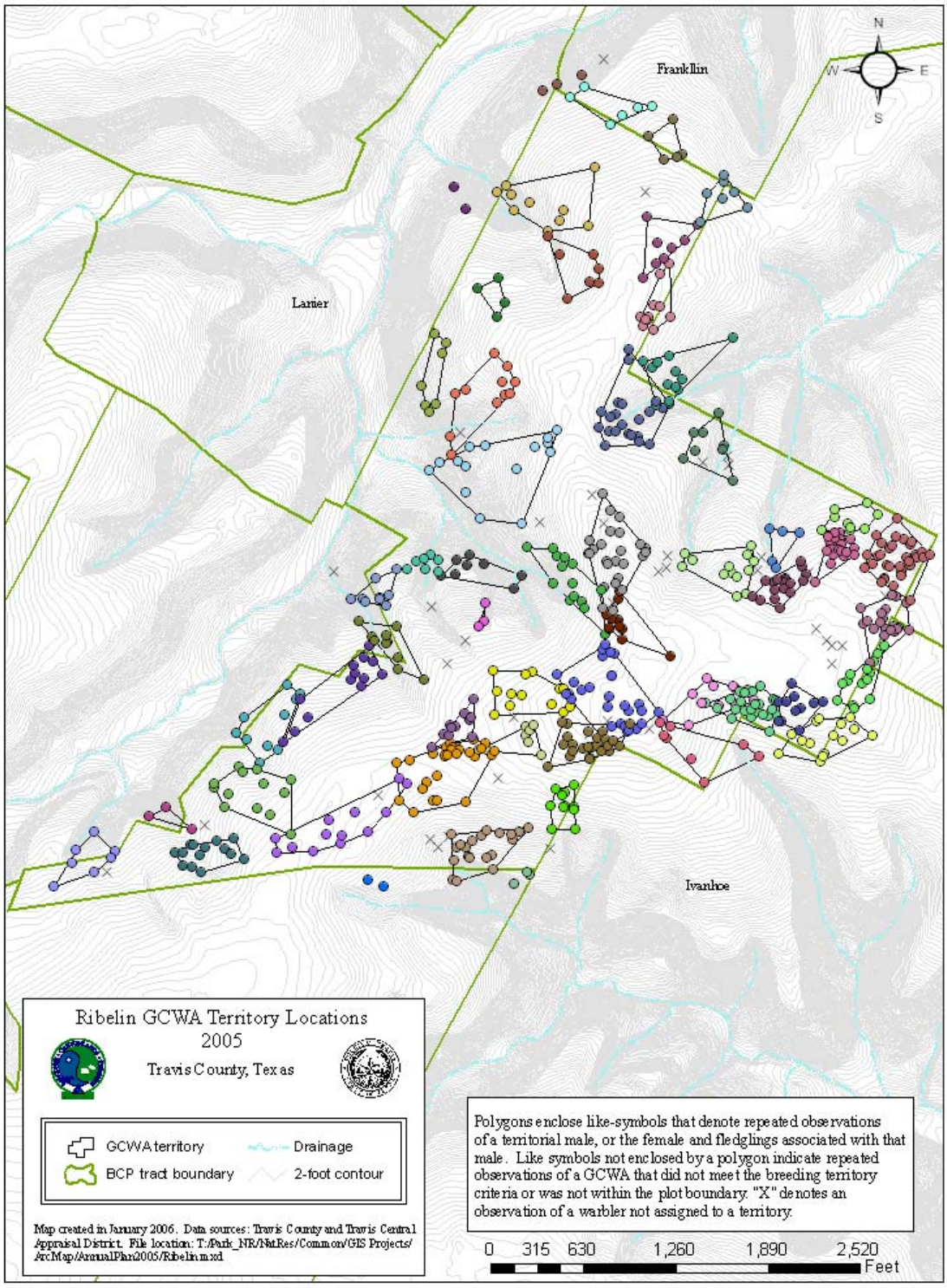


Figure 7. 2005 golden-cheeked warbler (*Dendroica chrysoparia*) (GCWA) territory locations on the Ribelin tract within the Balcones Canyonlands Preserve in western Travis County, Texas.

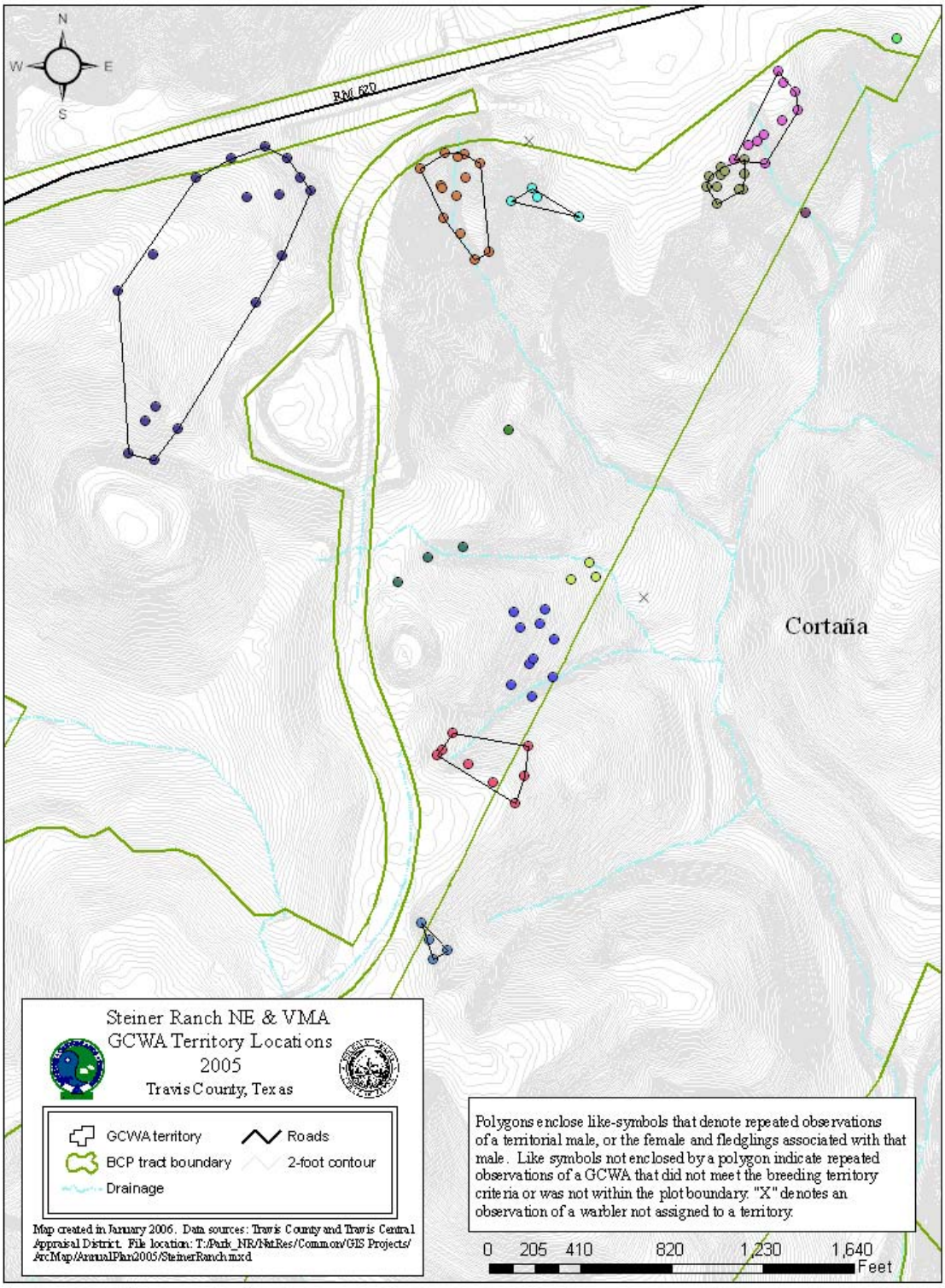


Figure 8. 2005 golden-cheeked warbler (*Dendroica chrysoparia*) (GCWA) territory locations on the Steiner Ranch tracts 4 and 5 (VMA and NE, respectively) within the Balcones Canyonlands Preserve in western Travis County, Texas.

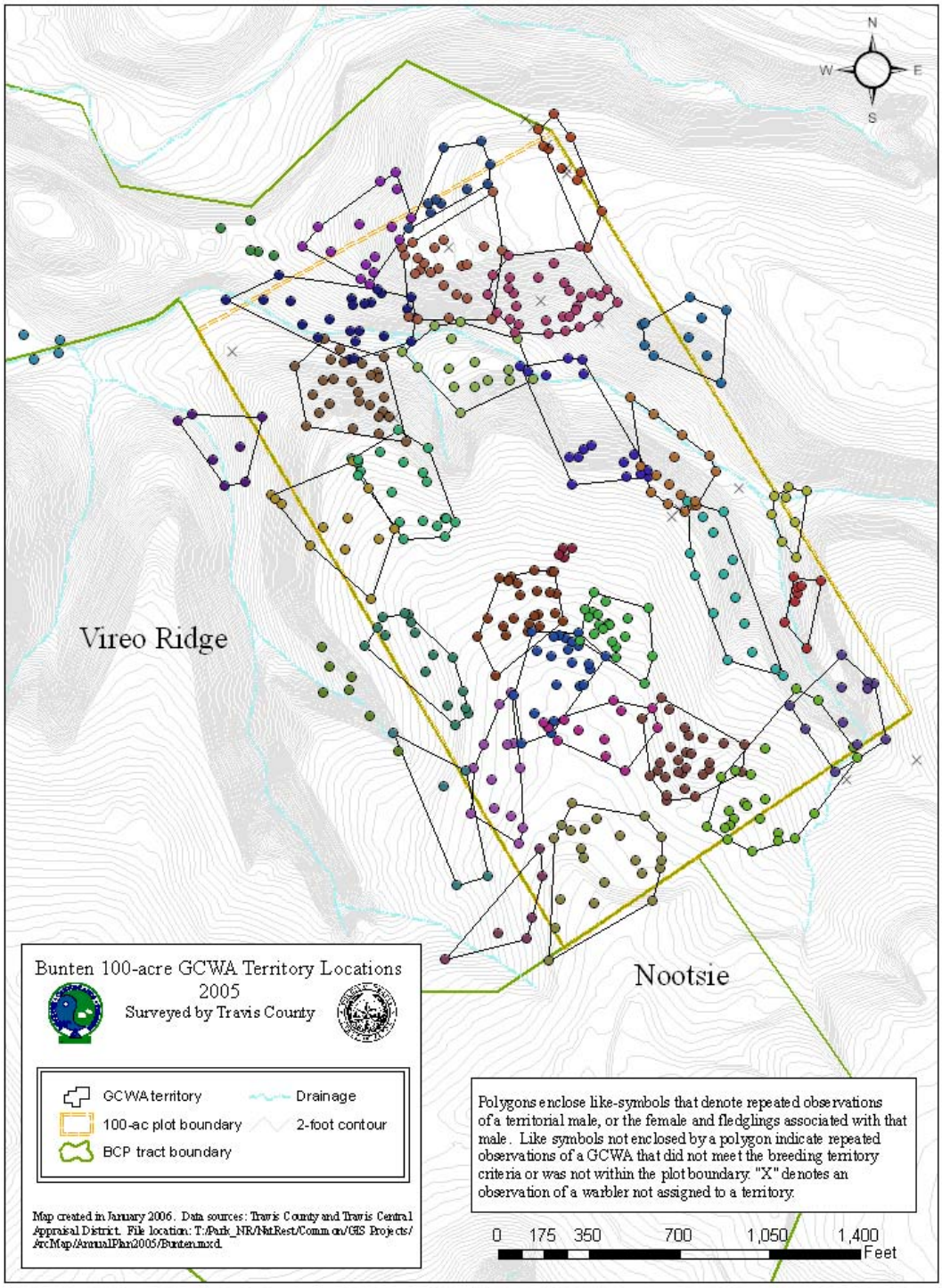


Figure 9. 2005 golden-cheeked warbler (*Dendroica chrysoparia*) (GCWA) territory locations on the Bunten 100-acre study plot within the Balcones Canyonlands Preserve in western Travis County, Texas.

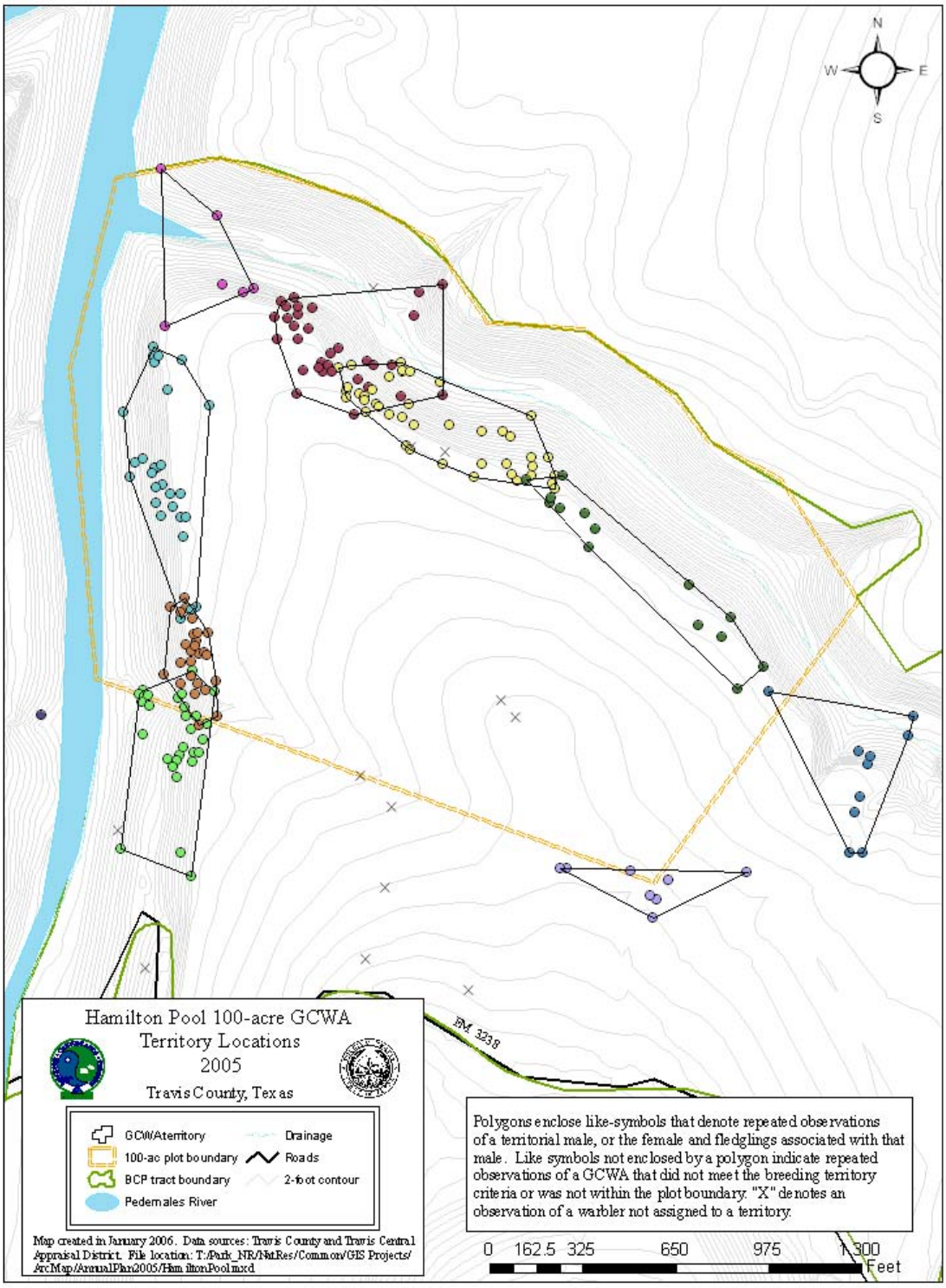


Figure 10. 2005 golden-cheeked warbler (*Dendroica chrysoparia*) (GCWA) territory locations on the Hamilton Pool 100-acre study plot within the Balcones Canyonlands Preserve in western Travis County, Texas.

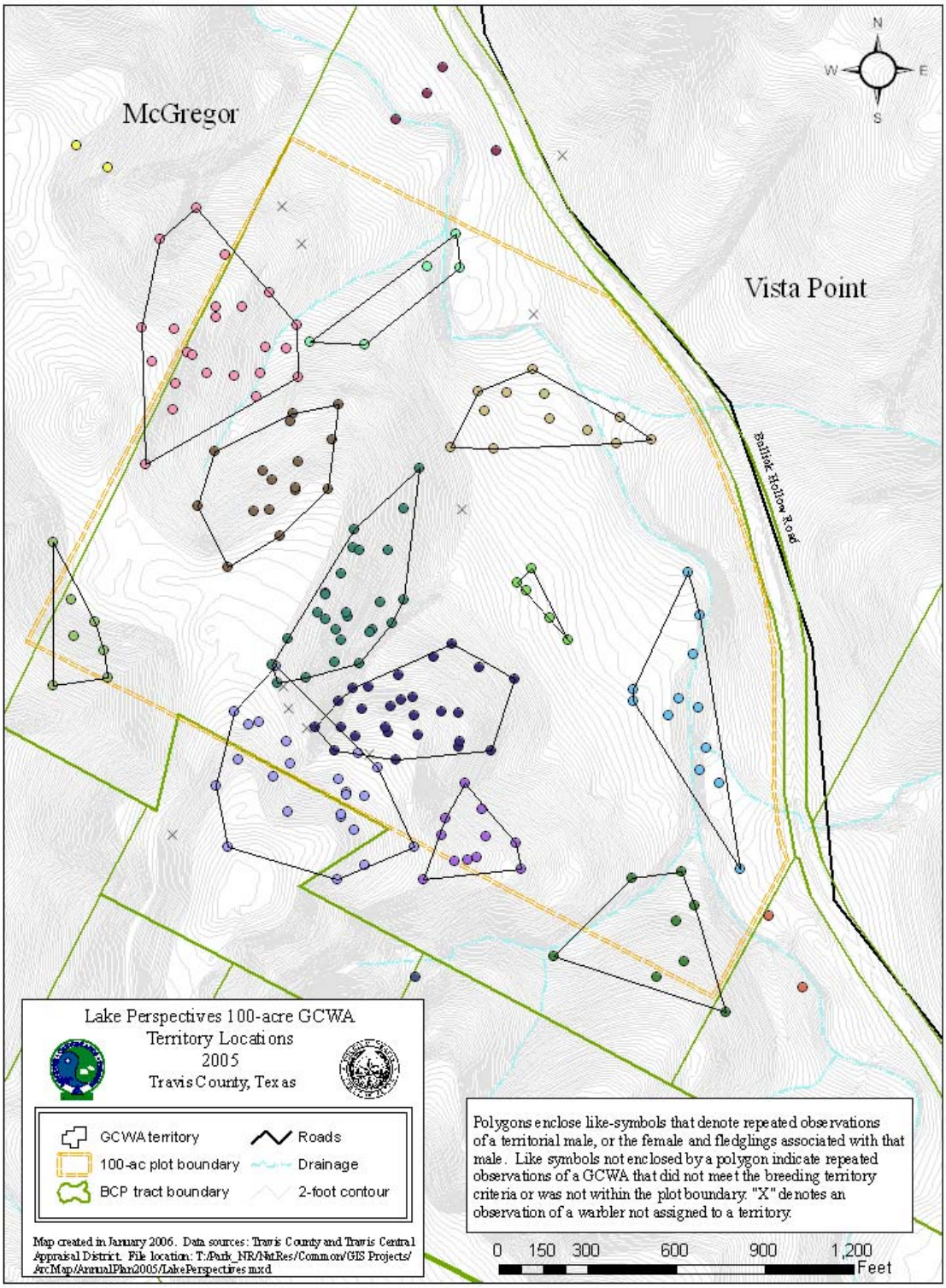


Figure 11. 2005 golden-cheeked warbler (*Dendroica chrysoparia*) (GCWA) territory locations on the Lake Perspectives 100-acre study plot within the Balcones Canyonlands Preserve in western Travis County, Texas.

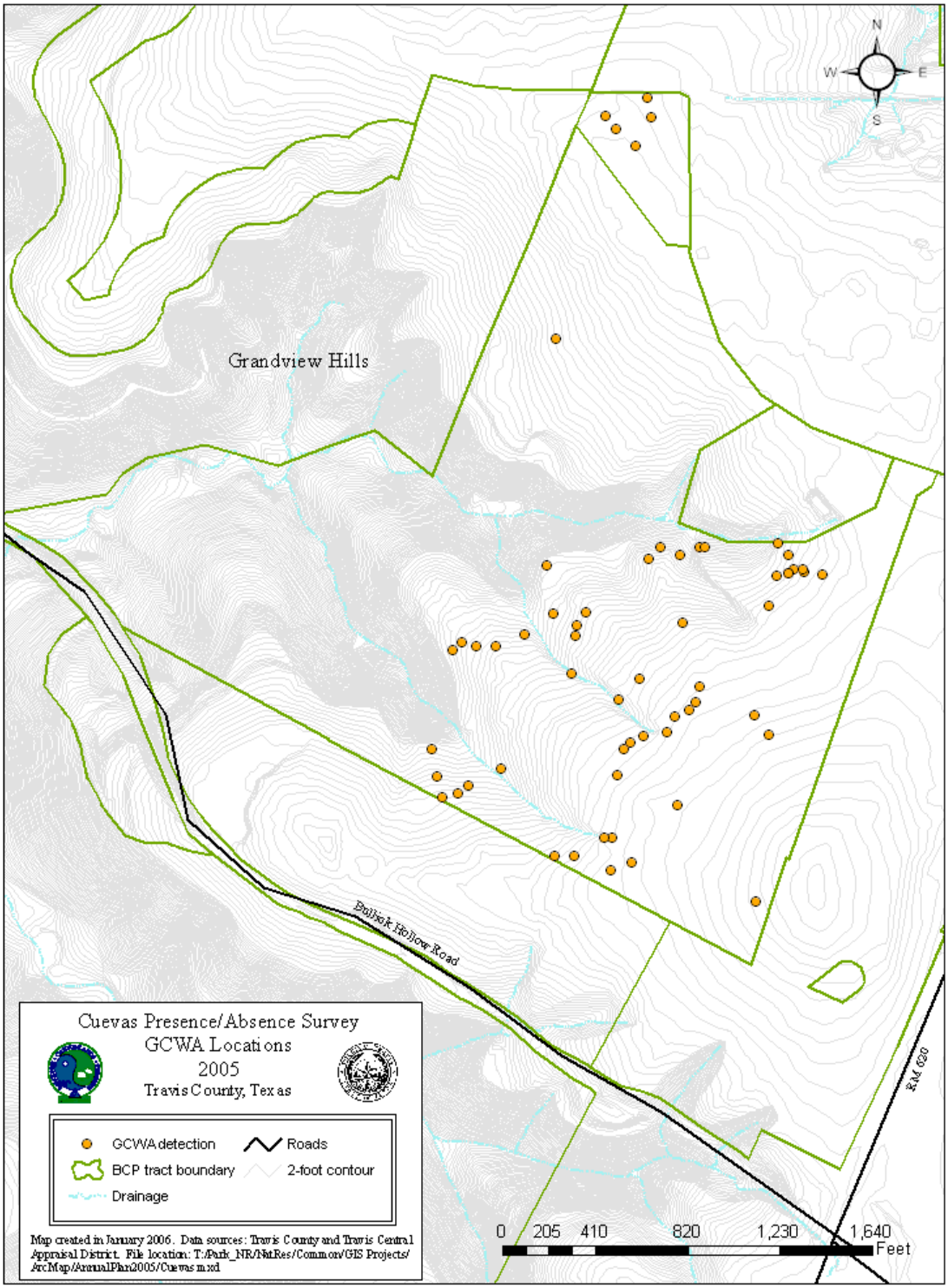


Figure 12. 2005 golden-cheeked warbler (*Dendroica chrysoparia*) (GCWA) detections during presence/absence surveys on the Cuevas tract within the Balcones Canyonlands Preserve in western Travis County, Texas.

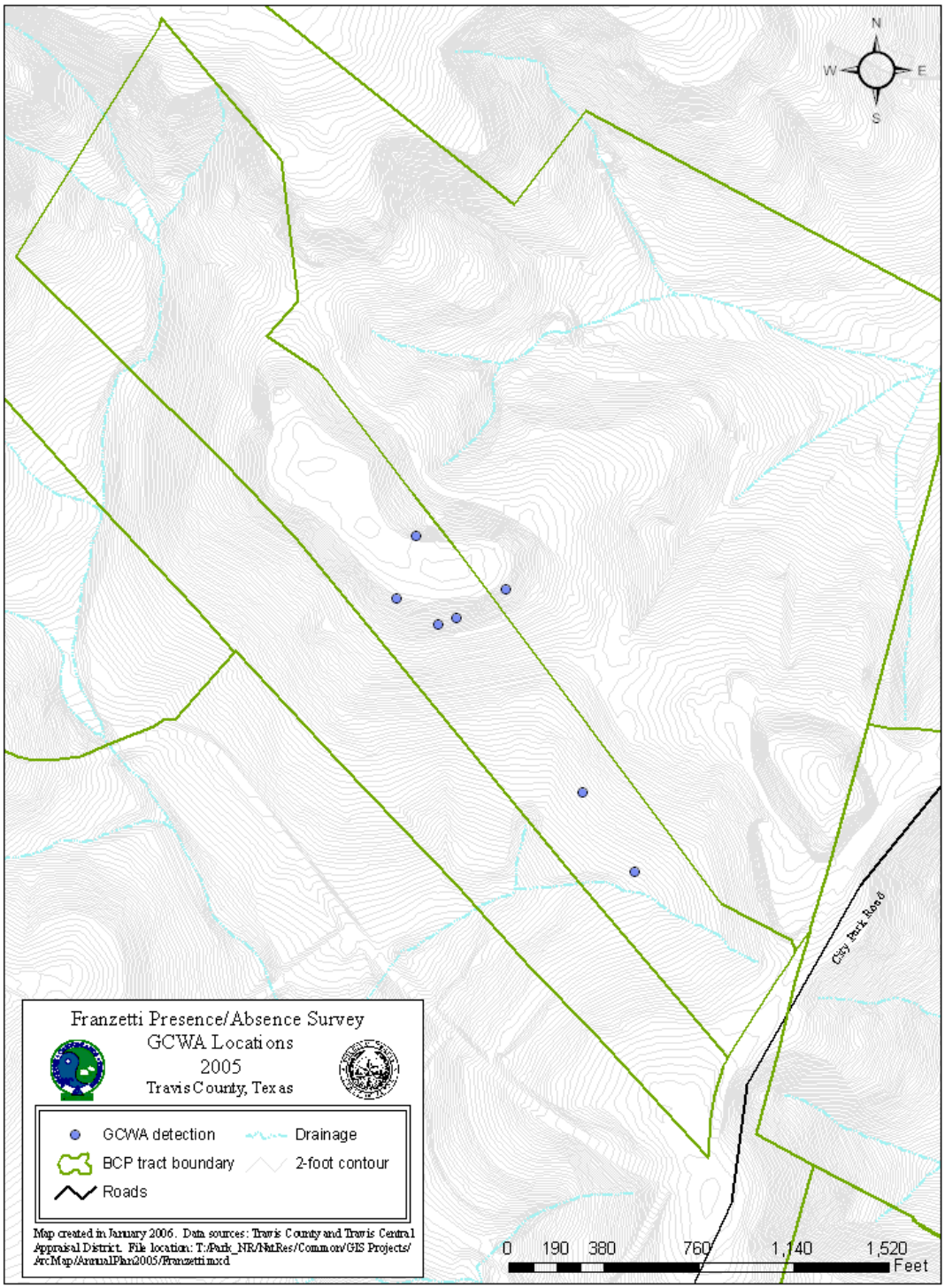


Figure 13. 2005 golden-cheeked warbler (*Dendroica chrysoparia*) (GCWA) detections during presence/absence surveys on the Franzetti tract within the Balcones Canyonlands Preserve in western Travis County, Texas.