Final
Habitat Conservation Plan

LCRA Transmission Services Corporation Competitive Renewable Energy Zone Transmission Lines

Prepared for:

LCRA Transmission Services Corporation

Prepared by:

SWCA Environmental Consultants

April 2012

SWCA Project Number 15959-062-AUS

LCRA TRANSMISSION SERVICES CORPORATION
COMPETITIVE RENEWABLE ENERGY ZONE TRANSMISSION LINES
FINAL HABITAT CONSERVATION PLAN

Prepared for

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TABLE OF CONTENTS

EXECUTIVE SUMMARY V
1.0 INTRODUCTION AND PROJECT OVERVIEW 1
1.1 PURPOSE AND NEED FOR ACTION 3
1.2 PROJECT SUMMARY 3
1.2.1 Summary Project Description 3
1.2.2 Regulatory Context 5
1.2.2.1 Endangered Species Act 5
1.2.2.2 National Environmental Policy Act 6
1.2.2.3 Public Utility Commission of Texas Substantive Rules 8
1.2.2.4 Bald and Golden Eagle Protection Act 9
1.2.2.5 Migratory Bird Treaty Act 9
2.0 ENVIRONMENTAL SETTING 10
2.1 REGIONAL GEOLOGY AND TOPOGRAPHY 10
2.2 HYDROLOGY AND WATER RESOURCES 12
2.3 VEGETATION 12
2.4 LISTED, PROPOSED, CANDIDATE, AND OTHER PROTECTED SPECIES 13
2.4.1 Covered Species 13
2.4.1.1 Golden-cheeked Warbler 14
2.4.1.2 Black-capped Vireo 20
2.4.2 Evaluation Species 26
2.4.2.1 Bald Eagle 26
2.4.2.2 Least Tern 27
2.4.2.3 Whooping Crane 28
2.4.2.4 Sprague's Pipit 34
2.4.2.5 Ocelot 35
2.4.2.6 Freshwater Mussels 36
2.4.2.7 Tobusch Fishhook Cactus 36
2.5 PUBLIC LANDS 37
3.0 PROJECT ALTERNATIVES 38
3.1 REVIEW OF PUC/CCN PROCESS 38
3.2 PROPOSED ALTERNATIVE 40
3.2.1 General Transmission Line Construction Methods 44
3.2.2 Construction Schedules 46
3.2.3 Maintenance and Repair 47
3.2.4 Maintenance Schedules 48
3.3 NO ACTION ALTERNATIVE 48
3.4 MAXIMUM TAKE AVOIDANCE 48
3.5 INDIVIDUAL PERMITS 49
3.6 SUMMARY OF PUBLIC INVOLVEMENT AND AGENCY COORDINATION 50
4.0 IMPACT ASSESSMENT 53
4.1 GOLDEN-CHEEKED WARBLER 53
4.1.1 Direct Impacts to Golden-cheeked Warblers 53
4.1.1.1 Collision Risk 55
4.1.2 Habitat Impacts 57

4.1.2.1 Habitat Delineation Methodology ... 57
4.1.2.2 Direct Habitat Impacts ... 58
4.1.2.3 Indirect Habitat Impacts ... 59
4.1.2.4 Total Direct and Indirect Habitat Impacts ... 60
4.1.3 Other Indirect Impacts to Golden-cheeked Warblers ... 62
4.1.4 Cumulative Effects ... 62
4.2 BLACK-CAPPED VIREO ... 65
4.2.1 Direct Impacts to Black-capped Vireos ... 65
4.2.1.1 Collision Risk ... 67
4.2.2 Habitat Impacts ... 68
4.2.2.1 Habitat Delineation Methodology ... 68
4.2.2.2 Direct Habitat Impacts ... 69
4.2.2.3 Indirect Habitat Impacts ... 72
4.2.2.4 Total Direct and Indirect Habitat Impacts ... 72
4.2.3 Cumulative Effects ... 73
4.3 FINAL PRECONSTRUCTION IMPACT ASSESSMENT ... 75
4.4 BALD EAGLE ... 76
4.4.1 Direct Impacts ... 76
4.4.1.1 Habitat Impacts ... 77
4.4.1.2 Electrocution ... 77
4.4.1.3 Collision Risk ... 77
4.4.2 Indirect Impacts ... 78
4.4.3 Cumulative Effects ... 79
4.5 LEAST TERN ... 79
4.5.1 Direct Impacts ... 79
4.5.2 Indirect Impacts ... 80
4.5.3 Cumulative Effects ... 80
4.6 WHOOPING CRANE ... 80
4.6.1 Methodology ... 81
4.6.2 Direct Impacts ... 84
4.6.2.1 Habitat Impacts ... 84
4.6.2.2 Collision Risk ... 84
4.6.3 Indirect Impacts ... 85
4.6.4 Cumulative Effects ... 86
4.7 SPRAGUE'S PIPIT ... 87
4.7.1 Direct Impacts ... 87
4.7.1.1 Habitat Impacts ... 87
4.7.1.2. Collision Impacts ... 87
4.7.2 Indirect Impacts ... 88
4.7.3 Cumulative Effects ... 89
4.8 FRESHWATER MUSSELS ... 89
4.8.1 Cumulative Effects ... 91
4.9 TOBUSCH FISHHOOK CACTUS ... 91
4.9.1 Direct Impacts ... 91
4.9.2 Indirect Impacts ... 93
4.9.3 Cumulative Effects ... 94

4.10 CLIMATE CHANGE 94
5.0 PROPOSED HABITAT CONSERVATION PLAN 95
5.1 ASSESSMENT OF TAKE 95
5.2 BIOLOGICAL GOALS AND OBJECTIVES 101
5.3 IMPACT MINIMIZATION MEASURES 102
5.3.1 General Impact Avoidance and Minimization Measures 102
5.3.2 Golden-cheeked Warbler 102
5.3.3 Black-capped Vireo 103
5.3.4 Bald Eagle 104
5.3.5 Least Tern 106
5.3.6 Whooping Crane 106
5.3.7 Tobusch Fishhook Cactus 106
5.4 MITIGATION MEASURES 107
5.4.1 Final Preconstruction Impact Assessment 107
5.4.2 Golden-cheeked Warbler 108
5.4.3 Black-capped Vireo 111
5.5 MONITORING 113
5.6 IMPLEMENTATION 114
5.6.1 HCP Administration 114
5.6.2 Reporting and Compliance 114
5.6.3 Funding 115
5.6.4 Adaptive Management 115
5.6.5 “No Surprises” Assurances 116
5.6.5.1 Changed Circumstances Provided for in the Plan 117
5.6.5.2 Changed Circumstances Not Provided For In The Plan 123
5.6.5.3 Unforeseen Circumstances 124
5.6.5.4 Effect of Unforeseen Circumstances on Permit 125
5.6.5.5 Notice of Unforeseen Circumstances 125
5.6.6 Amendment Procedure 125
5.6.6.1 Minor Amendments to the HCP 125
5.6.6.2 All Other Amendments 125
5.6.7 Permit Duration 125
5.6.7.1 Renewal and Extension 125
6.0 PUBLIC AND AGENCY PARTICIPATION 126
7.0 OTHER CONDITIONS THAT MAY BE REQUIRED BY THE SERVICE 126
8.0 CONCLUSION 127
9.0 LITERATURE CITED 128

LIST OF FIGURES

Figure 1. Project Location Overview Map 4
Figure 2. Seven-county Study Area for the Priority Projects 11
Figure 3. Golden-cheeked Warbler Recovery Regions and Potential Habitat 18
Figure 4. Black-capped Vireo Distribution and Recovery Regions 24
Figure 5. Whooping Crane Corridor and Observations 33
Figure 6. Twin Buttes–Big Hill Approved Route 41
Figure 7. Big Hill–Kendall Approved Route 43

LIST OF TABLES

Table E.1 Summary of Golden-cheeked Warbler Habitat Impacts vi
Table E.2. Black-capped Vireo Habitat Impacts vi
Table E.3. Golden-cheeked Warbler Habitat Impacts and Mitigation Credit Requirements vii
Table E.4. Black-capped Vireo Habitat Impacts and Mitigation Credit Requirements vii
Table 1. Acres of Potential Golden-cheeked Warbler Habitat as Identified by Loomis-Austin, Inc. (2008), Diamond (2007) and Morrison et al. (2010) by Recovery Region 17
Table 2. Acres of Potential Golden-cheeked Warbler Habitat by County as Identified by Diamond (2007) 17
Table 3. Known Male Black-capped Vireo Population by Recovery Region 23
Table 4. Known Male Black-capped Vireo Population and Amount of Potentially Suitable Vireo Habitat by County 23
Table 5. Public Lands Within the Study Area 37
Table 6. Maintenance and Repair Activities that May be Performed in CREZ Transmission Line ROW 47
Table 7. Summary of Public Participation for the LCRA TSC CREZ Transmission Lines 50
Table 8. Federal and State Agencies and Governmental Councils Solicited by PBS&J on behalf of LCRA TSC for Comment on the CREZ Transmission Line Projects 52
Table 9. Summary of Golden-cheeked Warbler Habitat Impacts under the Proposed Alternative 61
Table 10. Black-capped Vireo Habitat Impacts under the Proposed Alternative 73
Table 11. Proposed Ranking System for Identifying Risk of Priority Projects to Whooping Cranes 82
Table 12. Golden-cheeked Warbler Habitat Impacts and Mitigation Credit Requirements under the Proposed Alternative. 110
Table 13. Black-capped Vireo Habitat Impacts and Mitigation Credit Requirements under the Proposed Alternative. 112
Table 14. Survey Prescriptions for the Clearing of Covered Species Habitat During the Breeding Season 119

EXECUTIVE SUMMARY

LCRA Transmission Services Corporation (LCRA TSC) is planning to construct two new 345-kilovolt (kV) overhead electric transmission lines in central Texas. The two lines, Twin Buttes–Big Hill and Big Hill–Kendall, are referred to collectively herein as the "Priority Projects." They will be constructed by LCRA TSC pursuant to orders of the Public Utility Commission of Texas (PUC) as part of the State of Texas Competitive Renewable Energy Zone Program (CREZ).

The construction of the Priority Projects and their associated access roads may cause the loss and disturbance of habitat used by two federally listed species: golden-cheeked warbler (*Setophaga chrysoparia*) and black-capped vireo (*Vireo atricapilla*), hereafter referred to as the "Covered Species." Consequently, LCRA TSC has decided it would be prudent to apply to the U.S. Fish and Wildlife Service (USFWS or Service) for a Section 10(a)(1)(B) permit (Permit) to authorize the incidental take of the golden-cheeked warbler and black-capped vireo resulting from construction, operation, maintenance, and repair (both routine and emergency) of the Priority Projects. These activities are hereafter referred to collectively as the "Covered Activities." This Habitat Conservation Plan (HCP) has been prepared in support of that Permit application, with the Permit being valid for 30 years.

In addition to the Covered Species, this HCP also evaluates the potential of the Priority Projects to affect "Evaluation Species." Evaluation Species are federally listed, candidate, proposed, recently delisted, and petitioned species evaluated in this HCP. LCRA TSC does not anticipate the need for incidental take coverage for any Evaluation Species at this time because Covered Activities are not anticipated to cause take of Evaluation Species. Thus, the Evaluation Species will not be covered by the Permit.

Breeding habitat for the golden-cheeked warbler is crossed by the Big Hill–Kendall route but not by the Twin Buttes–Big Hill route. Both transmission line routes cross breeding habitat for the black-capped vireo.

Direct impacts to Covered Species habitat will result primarily from clearing for transmission line right-of way (ROW) and new access roads. Indirect impacts in this HCP are assumed to include all Covered Species habitat within 300 feet of the edge of cleared habitat. The location and extent of the ROW is known, except for minor route adjustments that may have to be made due to conditions encountered in the field. Because the route and width of ROW is known for both Priority Projects, an estimate of the potential upper limit of direct and indirect impacts resulting from clearing of that ROW could be calculated using aerial photography and field surveys. The precise location and extent of new access roads, however, is not known. To cover the potential impacts to Covered Species that cannot be quantified at this time (including potential habitat impacts resulting from access road construction outside of the ROW and potential direct impacts resulting from emergency activities conducted within breeding season), the initial estimates of habitat impacts have been increased by a contingency factor of 10 percent.

The estimated potential upper limit of impacts to golden-cheeked warbler, shown in Table E.1, total **1,146.0 acres** (463.8 ha). The estimated potential upper limit of impacts to black-capped vireo, shown in Table E.2, total **2,446.5 acres** (990.5 ha).

Table E.1 Summary of Golden-cheeked Warbler Habitat Impacts

Priority Project	Direct Habitat Impacts		Indirect Habitat Impacts		Total Habitat Impacts in Acres (ha)
	Direct Habitat Impact in Acres (ha)	Direct Plus Contingency Factor (10%)	Indirect Habitat Impact in Acres (ha)	Indirect Plus Contingency Factor (10%)	
Big Hill–Kendall	**270.9 (109.6)**	**298.0 (120.6)**	**770.9 (312.0)**	**848.0 (343.2)**	**1,146.0 (463.8)**

Table E.2. Black-capped Vireo Habitat Impacts

Priority Project	Direct Habitat Impacts		Indirect Habitat Impacts		Total Habitat Impacts in Acres (ha)
	Direct Habitat Impact in Acres (ha)	Direct Plus Contingency Factor (10%)	Indirect Habitat Impact in Acres (ha)	Indirect Plus Contingency Factor (10%)	
Twin Buttes – Big Hill	27.5 (11.1)	30.3 (12.2)	143.9 (58.2)	158.3 (64.0)	188.6 (76.2)
Big Hill–Kendall	467.4 (189.2)	514.1 (208.1)	1,585.3 (641.5)	1,743.8 (705.7)	2,257.9 (913.8)
Total	**494.9 (200.3)**	**544.4 (220.3)**	**1,729.2 (699.8)**	**1,902.1 (769.7)**	**2,446.5 (990.5)**

LCRA will mitigate for potential impacts to golden-cheeked warbler and black-capped vireo habitat by either purchasing mitigation credits from a Service-approved habitat mitigation bank, providing funding to an entity or conservation program for conservation of the species, or a combination thereof. The selected option(s) will be approved by the Service and will be reasonably expected to be sufficient to fund the preservation of Covered Species habitat in perpetuity in an amount equal to that attributed to being impacted by the Covered Activities.

As shown in Table E.3, the mitigation ratio for potential impacts to golden-cheeked warbler habitat will be 3:1 for direct habitat impacts and 0.5:1 for indirect habitat impacts. A total of **1,318.0 conservation credits** will be required to mitigate for potential impacts to golden-cheeked warbler habitat. As shown in Table E.4, a total of **2,584.3 conservation credits** will be required to mitigate for potential impacts to black-capped vireo habitat.

Table E.3. Golden-cheeked Warbler Habitat Impacts and Mitigation Credit Requirements

Priority Project	Direct Habitat Impacts and Mitigation			Indirect Habitat Impacts and Mitigation			Total Credits to be Acquired
	Direct Habitat Impacts Plus Contingency Factor (10%) in Acres (ha)	Mitigation Ratio	Credits to be Acquired	Indirect Habitat Impacts Plus Contingency Factor (10%) in Acres (ha)	Mitigation Ratio	Credits to be Acquired	
Big Hill–Kendall	**298.0 (120.6)**	**3:1**	**894.0**	**848.0 (343.2)**	**0.5:1**	**424.0**	**1,318.0**

Table E.4. Black-capped Vireo Habitat Impacts and Mitigation Credit Requirements

Priority Project	Direct Habitat Impacts and Mitigation			Indirect Habitat Impacts and Mitigation			Total Credits to be Acquired
	Direct Habitat Impacts Plus Contingency Factor (10%) in Acres (ha)	Mitigation Ratio	Credits to be Acquired	Indirect Habitat Impacts Plus Contingency Factor (10%) in Acres (ha)	Mitigation Ratio	Credits to be Acquired	
Twin Buttes–Big Hill	30.3 (12.2)	3:1	90.9	158.3 (64.0)	0.5:1	79.2	170.1
Big Hill–Kendall	514.1 (208.1)	3:1	1,542.3	1,743.8 (705.7)	0.5:1	871.9	2,414.2
Total	**544.4 (220.3)**		**1,633.2**	**1,902.1 (769.7)**		**951.1**	**2,584.3**

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1.0 INTRODUCTION AND PROJECT OVERVIEW

Pursuant to §39.904(g) of the Public Utility Regulatory Act of Texas (PURA), the Public Utility Commission of Texas (PUC) established Competitive Renewable Energy Zones (CREZ) in the western and Panhandle regions of Texas. The purpose of these zones was to provide an organized and cost-effective means of delivering electricity produced by wind generation facilities in those regions to end-use consumers in Texas through the construction of new electric transmission lines and associated facilities. The LCRA Transmission Services Corporation (LCRA TSC), a Texas non-profit corporation, is one of several transmission service providers that was formally required by the PUC to construct these new transmission lines through a Final Order issued on 30 March 2009 (PUC Docket No. 35665, Interchange Item 1324) and an Order on Rehearing issued on 15 May 2009 (PUC Docket No. 35665, Interchange Item 1340).[1]

Two transmission lines to be constructed by LCRA TSC are considered to be priority projects by the PUC. These two transmission lines are the Twin Buttes–Big Hill (formerly known as McCamey D) single-circuit, double-circuit capable 345-kV line and the Big Hill–Kendall double-circuit 345-kV line and are hereinafter referred to as the "Priority Projects." The PUC is requiring LCRA TSC to have these Priority Projects built and operational by the fall of 2013. In order to meet this mandate, LCRA TSC is expecting to commence construction on each of the Priority Projects no later than September 2011. The Priority Projects are described briefly in Section 1.3 and in more detail in Section 3.2 of this habitat conservation plan ("HCP").

The construction of the Priority Projects and their associated access roads may cause the loss and disturbance of habitat used by two species listed as endangered and protected under the Endangered Species Act of 1973, as amended (ESA). Consequently, LCRA TSC has decided it would be prudent to apply to the U.S. Fish and Wildlife Service (USFWS or Service) for a Section 10(a)(1)(B) permit (Permit) to authorize the incidental take of certain federally listed species resulting from construction, operation, maintenance, and repair (both routine and emergency) of the Priority Projects. These activities are hereafter referred to collectively as the "Covered Activities." This HCP has been prepared in support of that Permit application.

An ESA 10(a)(1)(B) permit is a tool by which a non-federal entity may voluntarily obtain authorization to take listed spcies in connection with otherwise lawful activities such as utility line construction. Among other things, an HCP specifies conservation measures that will be implemented to minimize and mitigate to the maximum extent practicable a specified level of incidental take of listed species. "Incidental take" is defined by the ESA and relevant regulations as take of any federally listed wildlife species that is incidental to, but not the purpose of, otherwise lawful activities (ESA Section 10(a)(1)(B)).

Two groups of species are addressed in this HCP, "Covered Species" and "Evaluation Species." Covered Species are those for which incidental take authorization is being sought. The Covered Species addressed in this HCP are the endangered golden-cheeked warbler (*Setophaga chrysoparia*) and black-capped vireo (*Vireo atricapilla*). Both bird species are known to breed in the region in which the Priority Projects will be built.

[1] Documents officially filed with the PUC are assigned docket and item numbers and posted on the PUC's Interchange Website at http://www.puc.state.tx.us/interchange/index.cfm.

Evaluation Species will not be covered by the Permit. Evaluation species fall into three general categories. One category includes federally listed, proposed, and candidate species and some state-listed species that are known or considered to have potential to occur in at least a portion of the region in which the Priority Projects will be constructed, but are not considered at risk of being taken by the Covered Activities. These species include bald eagle (*Haliaeetus leucocephalus*); least tern (*Sterna antillarum*); whooping crane (*Grus americana*); Sprague's pipit (*Anthus spragueii*); and several freshwater mussels: the golden orb (*Quadrula aurea*), false spike (*Q. mitchelli*), Texas pimpleback (*Q. petrina*), Texas fatmucket (*Lampsilis bracteata*), and Texas fawnsfoot (*Truncilla macrodon*).

Another category includes federally listed or candidate species named on lists of rare species produced by the Service or Texas Parks and Wildlife Department (TPWD) for the counties in which the transmission lines may be built, but that are believed not to occur in the areas where the transmission lines will be constructed and so also are not considered at risk of being impacted by the Covered Activities. This category includes only the ocelot (*Leopardus pardalis*).

The third category consists of listed plant species that may or may not occur in areas where transmission lines will be constructed. Plant species are not included as Covered Species. The take of listed plants is not prohibited under the ESA with respect to non-federally funded or authorized actions occurring on private lands in accordance with state law. Listed plants will, however, be considered in the intra-USFWS Section 7 consultation conducted in connection with the Service's issuance of the Permit for the Covered Species. This category contains one species, the Tobusch fishhook cactus (*Sclerocactus brevihamatus* subsp. *tobuschii*). As described later in this document, LCRA TSC will implement measures to minimize potential for construction of the transmission lines to adversely affect this listed plant species.

In this HCP, potential incidental take of the golden-cheeked warbler and black-capped vireo is expressed as the number of acres of known and potential habitat that will be directly and indirectly impacted by Covered Activities as quantifying the number of individual golden-cheeked warblers and black-capped vireos is impracticable. This approach is supported by case law (*Oregon Natural Resources Council v. Allen*, 476 F.3d 1031, 1037 (9th Cir. 2007) and *Ariz. Cattle Growers' Ass'n v. U.S. Fish and Wildlife Service*, 273 F.3d 1229, 1249-50 (9th Cir. 2001)) where quantifying the actual number of species members taken is not practicable. Thus use of habitat as a proxy for impacts to individual members of the golden-cheeked warbler and black-capped vireo is described in greater detail in Section 5.1 of this document.

In Texas, at least one other electric utility (Oncor) has developed an HCP to protect endangered species and streamline ESA compliance for the installation, operation, routine maintenance, and repair of CREZ electric transmission and distribution.

1.1 PURPOSE AND NEED FOR ACTION

The State of Texas, through CREZ, is ensuring that sufficient transmission infrastructure exists to deliver electricity generated by west Texas wind power facilities and to support the energy needs of Texans and the state's goal for renewable energy development. LCRA TSC is charged with constructing the Priority Projects on routes selected through the PUC's Certificate of Convenience and Necessity (CCN) contested case process. All other permitting, including under the ESA, for the selected routes is carried out subsequent to and independent from the CCN process. Therefore, the need exists subsequent to the PUC process for LCRA TSC to ensure it is able to perform the Covered Activities in compliance with the provisions of the ESA.

The primary purposes of this HCP are to ensure compliance with the ESA and its implementing regulations by satisfying issuance criteria for the desired Permit, and contribute to the conservation of the Covered Species. Pursuant to the ESA and Service regulations and guidance, this HCP describes the following:

- The amount of listed species habitat that may be directly and indirectly impacted by the Covered Activities;
- The amount of incidental take of golden-cheeked warbler and black-capped vireo requested to be authorized by the requested Permit;
- The conservation measures that will be implemented to minimize and mitigate to the maximum extent practicable the impacts of the authorized taking of the Covered Species;
- The measures that will be implemented to avoid and minimize potential impacts to the Evaluation Species;
- The biological goals and objectives of the HCP;
- How the proposed elements of the HCP would be funded;
- Adaptive management measures and how the HCP would accommodate changed and unforeseen circumstances;
- Proposed monitoring programs;
- Public participation in development of the HCP; and
- Permit duration.

1.2 PROJECT SUMMARY

1.2.1 Summary Project Description

The two Priority Projects will be constructed by LCRA TSC in accordance with the March 2009 PUC Final Order. Both projects will be new, bundled conductor, 345-kV transmission lines, strung primarily on double-circuit capable lattice or pole structures as determined by the PUC. The Priority Projects will be located in central Texas and are referred to as the Twin Buttes–Big Hill and Big Hill–Kendall transmission lines (Figure 1).

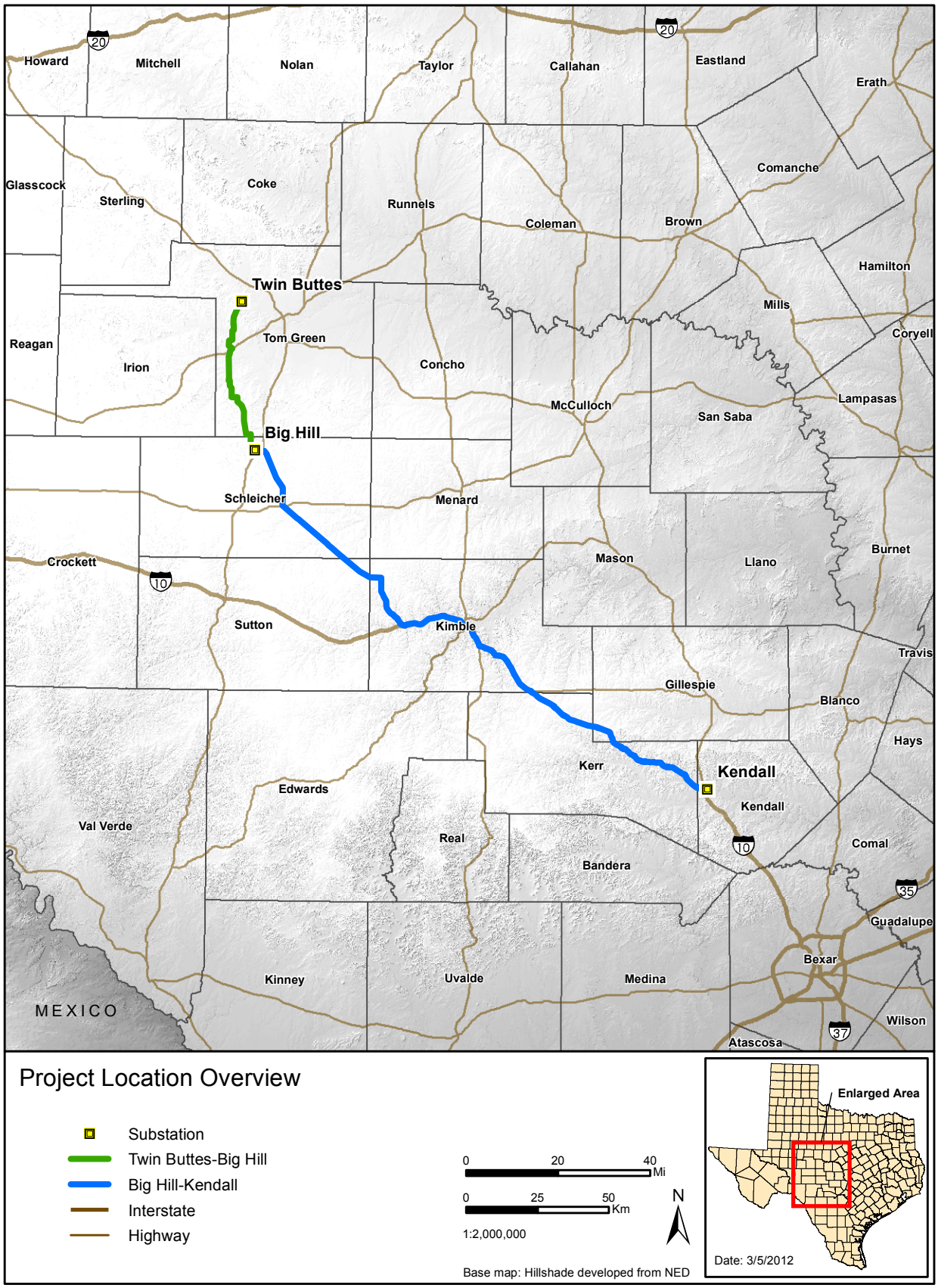

Figure 1. Project location overview map.

The Twin Buttes–Big Hill transmission line will connect the existing Twin Buttes Substation, located approximately 9 miles (14.5 km) northwest of the City of San Angelo in northwestern Tom Green County, to the Big Hill Substation, now under construction in north-central Schleicher County. The Twin Buttes–Big Hill transmission line will cross portions of western Tom Green and north-central Schleicher Counties and will be approximately 38 miles (61.0 km) long. The northern-most approximately 7 miles (11 km) of the route for this line lie directly adjacent to an existing overhead transmission line.

The Big Hill–Kendall transmission line will connect the Big Hill Substation to the existing Kendall Substation, located near the City of Comfort in northwestern Kendall County. This transmission line will be approximately 140 miles (225 km) long and will be located in portions of Schleicher, Sutton, Kimble, Kerr, Gillespie, and Kendall Counties.

The PUC-approved transmission line alignment for each of the Priority Projects is depicted on Figure 1. Also shown on Figure 1 are the locations of the Twin Buttes, Big Hill, and Kendall Substations. The total area encompassed by these two corridors, and all access roads constructed for the Priority Projects (the locations of which have yet to be identified) is hereafter referred to in this HCP as the "Permit Area."

The Priority Projects will be built within easements acquired by LCRA TSC from individual property owners whose property is crossed by the lines. An easement gives a utility the right to use privately owned land for a specific purpose—in this case, to construct, operate, and maintain the new electric transmission lines—while the landowner retains ownership of the property and rights to continue certain activities in the easement once the lines are constructed. For purposes of this HCP, easements for the transmission lines proposed by LCRA TSC for these projects are considered to be 160 feet (48.8 m) wide. The exact width of easement needed in any particular area depends on topography, structure placement, and other engineering considerations.

1.2.2 Regulatory Context

1.2.2.1 Endangered Species Act

Section 9 of the ESA prohibits the "take" of any federally listed endangered wildlife species (16 USC 1538(a)). By definition, the Service has extended the take prohibition to most species listed as threatened. 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."

Section 10(a)(2)(A) of the ESA provides that in order to obtain an incidental take permit, the applicant must submit a conservation plan that identifies or satisfies several substantive criteria: (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 taking were considered and the reasons the alternatives were not chosen; and (4) other measures that the Service may require as necessary or appropriate for purposes of the conservation plan (16 USC 1539(a)(2)(A)). The Service's ESA implementing regulations also give permittees "no surprises" assurances, which provide certainty as to their future obligations under an HCP (50 CFR 17.22, 17.32, 63 FR 8859). The Service's Habitat Conservation Planning Handbook ("HCP Handbook") provides overall guidance on the elements of an HCP.

Section 7(a)(2) of the ESA requires that each federal agency must consult with the Service to ensure that agency actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat (16 USC 1536(a)(2)). "Jeopardize" is defined by the regulations 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 incidental take permit is considered an action for which the mandate of consultation applies (HCP Handbook at 1–6). With respect to the issuance of incidental take permits, the Service functions as both the "action" agency and the "resource" agency, so that the Service is actually consulting "with itself." According to the HCP Handbook, the consultation must include consideration of direct and indirect effects on the species, as well as the impacts of the proposed project on listed plants and critical habitat, if any (HCP Handbook at 3-17 through 3-19).

1.2.2.2 National Environmental Policy Act

The Service considers issuance of an incidental take permit a federal action subject to the requirements of the National Environmental Policy Act (NEPA) (42 USC 4321–4327). NEPA requires federal agencies to (1) study proposed projects to determine if they will result in significant environmental impacts; and (2) review the alternatives available for the project and consider the impact of the alternatives on the environment (42 USC 4332(c)). The scope of NEPA is broader than the ESA in that it requires that the agency consider the impacts of the action on the "human environment," including a variety of resources such as water, air quality, and cultural and historic resources. In the context of an HCP and incidental take permit, the scope of the NEPA analysis covers the direct, indirect, and cumulative effects of the proposed incidental take and the mitigation and minimization measures proposed in the HCP (HCP Handbook at 5-1).

As defined by NEPA regulations, indirect impacts are those effects "caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern in land use, population density or growth rate…" (40 CFR 1508.8). In accordance with NEPA regulations, therefore, it is appropriate to consider the degree to which the Covered Activities and any connected actions are likely to induce other growth and development that may have further effects on the resources under consideration in this HCP. If the Service considers the construction of the Priority Projects to be a connected action to the issuance of the Section 10(a) Permit, then the Service should also consider the degree to which such construction will induce other growth and development. The paragraphs below set forth the relevant tests for causation.

ESA regulations provide that assessment of a federal proposed action must consider the effects caused by that action, but do not provide guidance on the nature of causal inquiry to be conducted. ESA case law concerning indirect effects and causation is rare, and little guidance has issued from the courts over the past 15 years. Older ESA cases that addressed causation did not directly address what the test of causation should be or how it should be applied to complex factual situations of the type considered in this EA. (See, e.g., *National Wildlife Federation v. Coleman*, 529 F.2d 359 [5th Circuit], cert. denied, 429 U.S. 979 (1976) and *Riverside Irrigation District v. Andrews*, 758 F.2d 508 [10th Cir. 1985]).

Regulatory language that defines indirect impacts and incorporates the concept of causation under the ESA is the same framework used under NEPA. In both cases, the causal test is established only by the phrase "indirect effects are caused by the action" (40 CFR 1508.8[b] and 50 CFR 402.02). NEPA and the ESA, thus, appear to have the same test for causation. Under NEPA, judicial opinions have provided significant guidance on how to conduct causal analysis. These decisions address complex fact patterns comparable to the issues addressed in this section.

The Ninth Circuit has held that an effect is caused by the action if the action is an "indispensible prerequisite" or an "essential catalyst" to the effect (*City of Davis v. Coleman*, 521 F.2d 661, 674 (9th Cir. 1975). However, it is not enough that the actions might be related or that each "might benefit from the other's presence." *Sylvester v. U.S. Army Corps of Engineers*, 884 F.2d 394 (9th Cir. 1989). Similarly, it is not enough if a proposed action "may induce limited additional development" when the "existing development necessitated the [action]" (*City of Carmel-by-the-Sea v. DOT*, 123 F.3d 1142 (9th Cir. 1997). In *City of Carmel-by-the-Sea*, the Ninth Circuit upheld an analysis that stated that the proposed project "had the potential to facilitate growth" but would not ultimately do so because of the development constraints imposed by local authorities. Similarly, in a case involving an airport expansion project designed to address existing levels of air traffic, the Ninth Circuit rejected the argument that airport expansion removed a constraint to growth because without the project, growth could not occur safely. The Ninth Circuit stated, "the fact that it might also facilitate further growth is insufficient to constitute a growth-inducing impact…" *Morongo Band of Mission Indians v. Federal Avian Administration*, 161 F.3d 569 (9th Cir. 1998).

In a fairly recent example of the application of the causal analysis to a complex fact pattern, the court in Border Power Plant Working Group v. Dept. of Energy, (2003 WL 21037927 [S.D. Cal.]) followed the analysis established by *Sylvester v. U.S. Army Corps of Engineers, City of Carmel-by-the-Sea v. DOT*, and *Morongo Band of Mission Indians v. FAA*. The court found that authorization of a power transmission line on the U.S./Mexico border did not require analysis of emissions from a Mexican power plant that could use the new line to transmit power to the U.S. The court held that the turbines in the plant dedicated to production of power for Mexico were not causally linked to the new transmission line "in a way that makes the BPP line a necessary prerequisite or essentially catalyst to their operation." The court also noted that 'because the line of causation is too attenuated between these turbines and the federal action permitting the BPP line, the Ninth Circuit authority makes clear that the emissions of the non-export turbines were not effects of the BPP line and that the federal defendants, therefore, were under no NEPA obligation to analyze their emissions as effects of the action." The court also found that because the turbine in the plant that was dedicated to the export of power had an alternate route, the BPP

line could not be considered the but-for cause of the export turbine's operation and effects from the operation of the turbine were, therefore, not indirect effects of the BPP line.

Based on existing judicial guidance, relevant factors in the causal analysis concerning growth-inducement include whether the action is the sole cause, whether the action has a useful purpose other than serving new growth, whether the action is intended to induce growth or to address existing levels of demand, and whether growth is being regulated at the local level. The test embraced by the courts demonstrates a pragmatic approach that recognizes a stopping point must exist in any causal analysis.

The Service has considered this issue previously with respect to electric and water transmission facilities (e.g., *Final Environmental Assessment/Habitat Conservation Plan for Issuance of an Endangered Species Act Section 10(a)(1)(B) Permit for Incidental Take of the Houston Toad (Bufo houstonensis) by Aqua Water Supply Corporation, Lower Colorado River Authority, Bluebonnet Electric Cooperative, Inc., and Austin Energy During the Routine Maintenance and Repair of Facilities and Installation of New Facilities in Portions of Bastrop and Lee Counties, Texas, Permit No. TE-078366-0*) and has concluded that infrastructure of this nature typically responds to rather than induces growth. This is likely to be particularly the case with respect to the Priority Projects, which do not provide distribution of electricity to consumers, but function as a component of the high voltage transmission grid. Nor can it be demonstrated that the construction of the Priority Projects induces or causes the construction of wind energy facilities, as, with or without the Priority Projects, the construction or not of any such facilities is speculative in light of numerous other factors, not the least of which is market demand and the existence or not of federal and/or state governmental financial support.

The HCP Handbook describes the Service's procedures for complying with NEPA with respect to HCPs. Most HCPs require preparation of an Environmental Assessment (EA) to comply with NEPA. The Service will review LCRA TSC's Permit application and HCP pursuant to the EA.

1.2.2.3 Public Utility Commission of Texas Substantive Rules

The PUC regulates the construction of electric transmission lines in the State of Texas under Texas Administrative Code, Title 16, Part II, Chapter 25, which establishes substantive rule requirements for electric service providers. Specifically, transmission line routing must be conducted in accordance with PUC §25.101, and factors outlined in PURA, which indicate that electric lines should be routed to the extent reasonable to moderate the impact on the affected community and landowners unless grid reliability and security dictate otherwise. Specific routing factors considered under the PUC Substantive Rules, PURA §37.056(c), and PUC's interpretation of those statutory provisions and rules are:

- whether the routes utilize existing compatible rights-of-way, including the use of vacant positions on existing multiple-circuit transmission lines;
- whether the routes parallel existing compatible rights-of-way;
- whether the routes parallel property lines or other natural or cultural features;
- whether the routes conform with the policy of prudent avoidance;

- the presence of habitable structures in proximity to the line;[2]
- the engineering constraints on constructing the line; and,
- the cost to construct the line.

1.2.2.4 Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (BGEPA) of 1940 (16 USC 668) prohibits taking, possession, and commerce of bald eagles and golden eagles (*Aquila chrysaetos*) or any part, nest, or eggs without a permit issued by the Secretary of the Interior. "Take" is defined as pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb." "Disturb" is defined in 50 CFR 22.3 as the act of agitating or bothering a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, the following: 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or shelter behavior. Furthermore, "disturb" also includes impacts that result from human-induced alterations occurring near a nest site, which was used previously by eagles, during a time when eagles are absent from the area, and if, when the eagle returns, these alterations agitate or bother an eagle to the extent that it interferes with or interrupts normal breeding, feeding, or sheltering habits, and causes injury, death, or nest abandonment.

The golden eagle was never listed as threatened or endangered under the ESA, and on 8 August 2007, the Service removed the bald eagle from the List of Threatened and Endangered Wildlife due to the species' recovery (72 FR 37345). As a result, neither species is protected from "take" under the ESA, but the BGEPA provides protection for bald and golden eagles. The Service concluded that a mechanism should be available to authorize take of bald and golden eagles pursuant to the BGEPA (74 FR 46836). On 10 November 2009, the Service authorized limited take of bald and golden eagles under the BGEPA for cases where the take to be authorized is associated with otherwise lawful activities (74 FR 46836). LCRA TSC does not intend to apply for authorization from the Service for the incidental take of bald or golden eagles pursuant to the BGEPA because such take is not anticipated to result from the construction and maintenance of the Priority Projects.

1.2.2.5 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) of 1918 (16 USC 703-712) prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior. Pursuant to Service guidance, the Permit will also constitute a Special Purpose Permit under 50 CFR 21.27 for the take of golden-cheeked warbler and black-capped vireo in the amount and/or number and subject to the terms and conditions specified herein. Any such take will not be in violation of the MBTA.

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[2] For purposes of notice for CCN proceedings for transmission lines greater than 230 kV, an applicant must provide notice to persons from whom an easement would be required and any landowners who have habitable structures on their property within 500 feet (152 m) of a route centerline. For purposes of consideration of habitable structures as part of the routing criteria, the PUC has not determined a particular distance (i.e., "proximity") that would cause structures to be considered. Applicants will report information indicating habitable structure proximity based on PUC application requirements and notice rules which differ for above and below 230 kV.

2.0 ENVIRONMENTAL SETTING

The general physical and vegetative characteristics of the region in which the Priority Projects will be built are described below. As explained in Section 1.3.1 of this HCP, the "Permit Area" includes the rights-of-way of the PUC-approved Priority Projects, plus an area within 300 feet of either side of those rights-of-way. This HCP also describes a "Study Area" that is much broader in scope than the Permit Area (see Figure 2). The Study Area encompasses both Priority Projects and includes Tom Green, Schleicher, Sutton, Kimble, Kerr, Kendall, and Gillespie Counties. It is anticipated that the Study Area described in this HCP will be coextensive with the "study area" to be utilized by the Service in connection with its review of this subject under NEPA. Cities occurring within the Study Area include San Angelo (Tom Green County), Sonora (Sutton County), Junction (Kimble County), Kerrville (Kerr County), and Comfort (Kendall County).

2.1 REGIONAL GEOLOGY AND TOPOGRAPHY

The Study Area encompasses a large portion of central Texas, with the vast majority of the area lying on the Edwards Plateau. The Edwards Plateau is largely composed of flat-lying sedimentary rocks, mostly Lower Cretaceous marine carbonates, which were elevated en masse during or prior to the Miocene epoch (Spearing 1991). The Glen Rose and Edwards formations, both composed of Lower Cretaceous carbonate deposits, are the dominant geologic units of the Edwards Plateau (Bureau of Economic Geology, 1976a, 1981a, 1981b, 1983). The predominant carbonate geology has resulted in widespread presence of karstic topography in the region.

Since the Miocene, stream erosion along the southern and eastern margins of the Edwards Plateau have created rugged topography through a system of canyons, hills, and ridges known as the Balcones Canyonlands or, more commonly, the Hill Country (Spearing 1991). Such topography is present in the southern and eastern portions of the Study Area. The western half of the plateau remains relatively flat, with mostly rolling to gently rolling topography. This more gentle topography occurs in the northwestern portion of the Study Area.

A belt of mountains formed of Precambrian igneous and metamorphic rocks and Paleozoic sedimentary rocks once occurred across what is now central Texas. This mountain range had been eroded away prior to the Cretaceous and the roots of it were covered by carbonate sediments while the entire region was inundated by seawater during the Cretaceous period (Spearing 1991). Erosion occurring since the Edwards Plateau was elevated and sea level withdrew eastward has resulted in the extensive exposure of Precambrian igneous and metamorphic rocks and Paleozoic sedimentary rocks in what is known as the Llano Uplift region of the Edwards Plateau. Portions of Gillespie County outside of the Permit Area lie within the Llano Uplift region. Topography in this region is mostly rolling to gently rolling, but it is punctuated by steep ridges and hills where more erosion-resistant Precambrian igneous/metamorphic or Paleozoic carbonate rocks occur (Griffith et al. 2004).

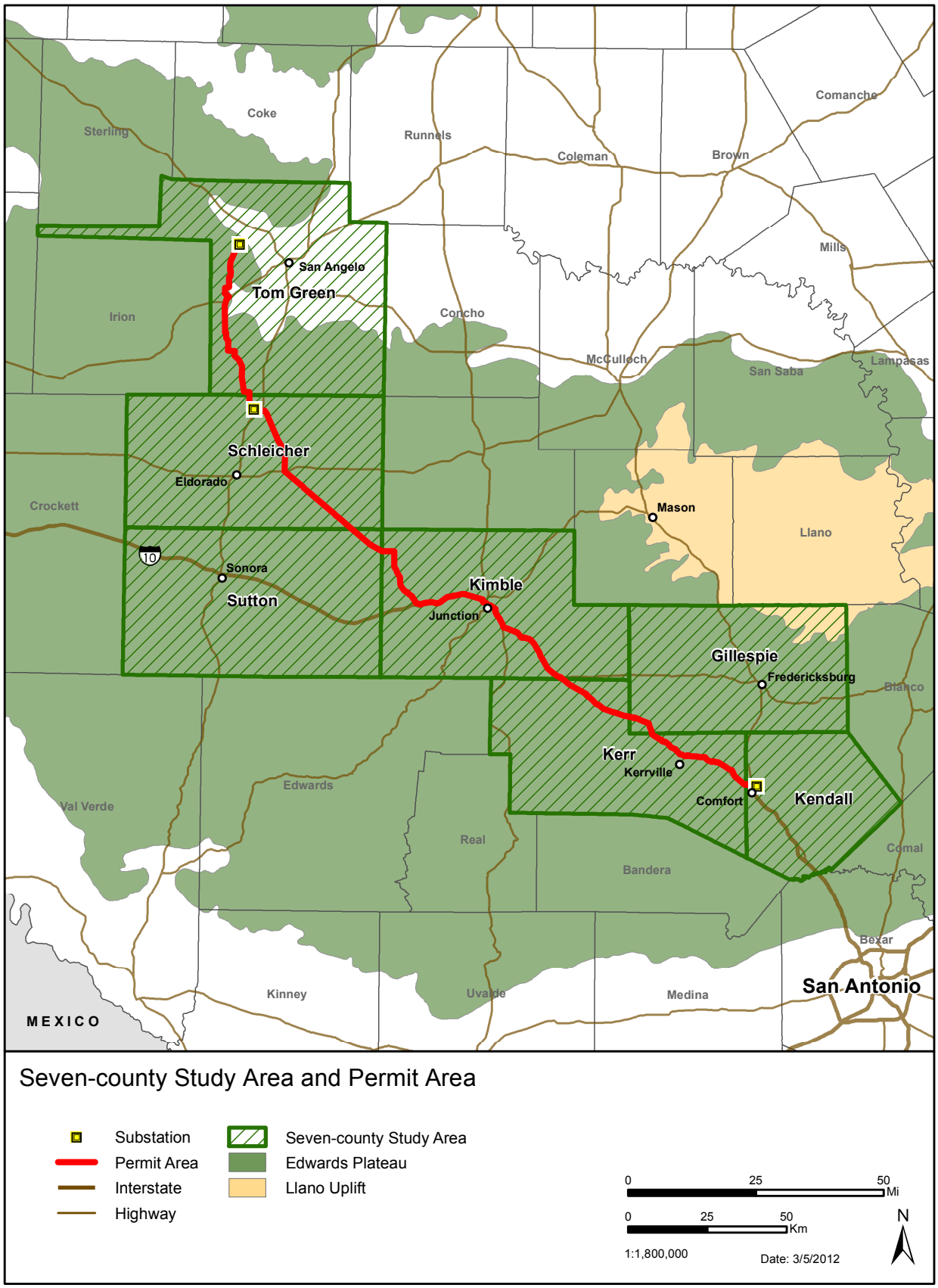

Figure 2. Seven-county Study Area and Permit Area for the Priority Projects.

2.2 HYDROLOGY AND WATER RESOURCES

The Study Area has no natural lakes. It is drained by rivers and creeks, many of which regionally have been dammed to create reservoirs. The northwestern and central portions of the Study Area lie within the Colorado River watershed, while the portion in Kerr and Kendall Counties lies within the Guadalupe River watershed (Texas Water Development Board 2009). Watercourses crossed by the Twin Buttes–Big Hill alignment include the Middle Concho River, Spring Creek, Dove Creek, Burks Creek, and Bois D'Arc Draw. The approved Big Hill–Kendall alignment crosses the South Concho River, North Valley Prong and Middle Valley Prong of the San Saba River, North Llano River, and Llano River. At the Kendall Substation, the Big Hill–Kendall alignment comes within a mile of the Guadalupe River.

Three reservoirs have been created in Tom Green County on forks of the Concho River: Lake Nasworthy, O.C. Fisher Lake, and Twin Buttes Reservoir. All occur in the vicinity of the Twin Buttes–Big Hill route but none is crossed by it. Numerous municipal ponds and private stock ponds of varying size have also been constructed along creeks within the Study Area.

The karstic carbonate rocks of the Edwards Plateau have resulted in presence of local and regional-scale groundwater systems. These systems are typically composed of a recharge zone, where porous rock exposed at the surface allows precipitation or stream flow to infiltrate the bedrock, and an underground network of conduits, caverns, and other void space that either holds water to create an aquifer, or allows the water to travel down-gradient to be discharged back at the surface at a spring. Most of the Study Area that is underlain by the Edwards Formation typically accepts recharge that feeds local spring systems. The portion of the Study Area in Kerr and Kendall, and southwestern Gillespie Counties lies within the contributing zone for the Edwards Aquifer (Edwards Aquifer Authority undated).[3]

2.3 VEGETATION

The distribution of vegetation communities in the Study Area is controlled by a variety of factors, including geology, soils, slope, aspect, water availability, and land use. In general, the carbonate rocks of the Edwards Plateau form shallow, rocky soils that are unsuitable for tilling and that support woodlands often dominated by oak (*Quercus* spp.), Ashe juniper (*Juniperus ashei*), and/or mesquite (*Prosopis glandulosa*). Paleozoic sedimentary rocks of the Llano Uplift region also generally support oak-juniper woodlands.

In contrast, the igneous and metamorphic rocks of the Llano Uplift region typically form shallow to deep, sandy soils that usually support scrubby woodlands dominated by mesquite and other thorny or spiny species, along with some Ashe juniper and oak, often post oak (*Q. stellata*). Areas with deeper soils in the Llano Uplift region commonly have been converted to pastureland. Pasturelands and small crop fields also occur throughout the Study Area in areas with deeper alluvial soils, such as on floodplains or along some creek bottoms.

Vegetation within the northwestern portion of the Study Area in Tom Green and northern Schleicher Counties has been mapped by TPWD largely as Mesquite-Juniper Shrub, Mesquite-

[3] A "contributing zone" is a watershed area that conveys surface water runoff to a recharge zone, where it can then infiltrate the ground.

Juniper-Live Oak Brush, and Live Oak-Ashe Juniper Parks (McMahan et al. 1984). According to McMahan et al. (1984), areas characterized as "Shrub" generally contain woody plants less than 9 feet (2.7 m) tall and less than 30 percent woody canopy cover, areas characterized as "Brush" also mostly contain woody plants less than 9 feet tall, but the plants are closely spaced. Areas described as "Parks" contain woody plants that are 9 or more feet tall and have woody canopy cover ranging from 11 to 70 percent, and areas described as "Woods" contain woody plants that are mostly 9 to 30 feet (2.7 to 9.1 m) tall, and with canopy cover ranging from 71 to 100 percent.

Eastern Schleicher, Sutton, Kimble, northwestern Kerr, and western Gillespie Counties have been mapped by TPWD as largely supporting Live Oak-Ashe Juniper and Live Oak-Mesquite-Ashe Juniper Parks. Eastern Kerr County and Kendall County are also mapped by TPWD as supporting these last two vegetation types, but also mixed with expanses of Live Oak-Ashe Juniper Woods.

The Middle Concho River, Spring Creek, and Dove Creek support strands of woodland composed variously of pecan (*Carya illinoinensis*), hackberry, mesquite, American elm (*Ulmus americana*), and western soapberry (*Sapindus saponaria* var. *drummondii*) trees. Riparian woodlands occurring along ephemeral tributaries consist mostly of pecan, mesquite, and plateau live oak trees. Understory species occurring in riparian areas include mesquite, Roosevelt weed (*Baccharis neglecta*), Mexican buckeye (*Ungnadia speciosa*), common sunflower (*Helianthus annuus*), giant ragweed (*Ambrosia trifida*), switchgrass (*Panicum virgatum*), and Johnsongrass (*Sorghum halepense*).

2.4 LISTED, PROPOSED, CANDIDATE, AND OTHER PROTECTED SPECIES

2.4.1 Covered Species

As noted above, this HCP covers two species for incidental take: the golden-cheeked warbler and black-capped vireo. Among other things, this HCP covers the potential for impacts to potentially suitable habitat for the Covered Species to cause take of the Covered Species.[4] It is important to note that the ESA does not prohibit impacts to potential habitat for listed species. Rather, the ESA prohibits take of a member of a listed species. Thus, just because a particular parcel of property contains vegetation identified as potential habitat for listed species does not mean that habitat is necessarily occupied by a given species. It is also important to note that potential habitat for listed species—or, for that matter, habitat occupied by listed species – is not "critical habitat" as that term is defined by the ESA. In order for listed species habitat to be considered "critical habitat" within the regulatory context, the Service must go through a formal rulemaking process, including allowing opportunity for public review and comment. No critical habitat has been designated for either of the Covered Species.

[4] Although the ESA does not define "take" to include habitat modification, Service regulations have defined "take" and, specifically, the term "harm" to include significant habitat modification that results in death or injury to a member of a listed species by significantly impairing essential behavioral patterns such as breeding, feeding, or sheltering.

2.4.1.1 Golden-cheeked Warbler

The golden-cheeked warbler is a small migratory songbird. It was listed as endangered in 1990 because of imminent and continuous destruction of breeding habitat (55 FR 53153). The breeding range of the golden-cheeked warbler is largely restricted to the Edwards Plateau and Cross Timbers regions of central and north-central Texas. Most birds arrive on their breeding grounds in early to mid-March. Breeding habitat typically consists of relatively dense and mature woodland composed of a combination of Ashe juniper and broad-leafed hardwood tree species, especially oaks such as Texas oak (*Q. buckleyi*) and plateau live oak (*Q. fusiformis*). Other hardwood tree species often found in golden-cheeked warbler breeding habitat include shin oak (*Q. sinuata*), Lacey oak (*Q. glaucoides*), post oak, escarpment black cherry (*Prunus serotina* var. *eximia*), walnut (*Juglans* spp.), Texas ash (*Fraxinus texensis*), and cedar elm (*Ulmus crassifolia*). No critical habitat has been designated for the golden-cheeked warbler.

Golden-cheeked warblers generally begin their migration south in July or early August and winter in the highlands of southern Mexico and northern Central America (USFWS 1992a). Research by Rappole et al. (1999, 2000) indicates that golden-cheeked warblers on their wintering grounds prefer oak or oak/pine woodlands occurring at elevations between approximately 3,600 to 7,900 feet (1,097 to 2,408 m).

The greatest threat to the continued existence of the golden-cheeked warbler is habitat loss resulting from urbanization and clearing associated with agricultural practices (USFWS 1992). At the time of its listing as endangered, human agricultural activities during the middle 20th century had eliminated a considerable amount of golden-cheeked warbler habitat within the range of the species. The Service (USFWS 1992) estimated the golden-cheeked warbler population as of 1990 to be approximately 13,800 territories based largely on the work of Wahl et al. (1990). This estimate was based on availability of suitable habitat as assessed through examination of satellite imagery taken in the 1970s and early 1980s (Wahl et al. 1990).

Habitat loss has continued since the warbler was listed as endangered as suburban developments spread into golden-cheeked warbler habitat along the Balcones Escarpment, especially in a growth corridor from Austin to San Antonio. At the same time, grazing and browsing pressure by goats has been reduced greatly in rural areas. The number of goats clipped annually for mohair in Texas, an industry centered on the Edwards Plateau, dropped from an average of more than 4,000,000 in the early 1960s to approximately 1,500,000 in the 1970s. This number held fairly steady through the 1980s and early 1990s, but then dropped again once a federal subsidy on mohair production ended in 1994. The number of goats clipped annually for mohair in Texas averaged approximately 300,000 in the early 2000s, and approximately 151,000 over the last five years (U.S. Department of Agriculture 2010).

The decline in number of goats on the rural landscape of the Edwards Plateau over the past 50 years, and consequent reduction in browsing pressure appears to have allowed Ashe juniper/oak woodland to develop on many lands that were formerly kept cleared of trees and brush to facilitate goat production. Through interpretation of 2001 satellite imagery, Loomis-Austin, Inc. (LAI, 2008) estimated that approximately 4,149,478 acres (1,679,951 ha) of golden-cheeked warbler habitat occurred across the breeding range of the species, and Diamond (2007) estimated that approximately 4,378,400 acres (1,772,632 ha) of habitat were present rangewide.

Recently, Morrison et al. (2010) performed their own mapping of the distribution of golden-cheeked warbler habitat through assessment of 2007 and 2008 Landsat 5 imagery and ground truthing at 1,000 points spread randomly across the range of the warbler. This mapping resulted in the identification of approximately 4,148,138 acres (1,679,408 ha) of potential golden-cheeked warbler habitat across the range of the species encompassed in 63,616 discrete patches. This number is similar to that identified by LAI (2007) and Diamond (2007). Field surveys were then conducted in 287 of those patches in the spring of 2009 to determine rates of warbler occupancy in the mapped potential habitat. Morrison et al. (2010) found that rates of golden-cheeked warbler occupancy increased as patch size increased, and that density of warbler occupation generally increased across the breeding range from north to south. Based on the results of the field surveys, Morrison et al. (2010) estimated the 2009 population of singing male golden-cheeked warblers to be approximately 220,615. This number is almost 1,500 percent greater than the 1992 Service estimate of 13,800 males in 1990.

Since the time that the golden-cheeked warbler was listed as endangered, several conservation actions have occurred or have been initiated that have resulted in, or are expected to result in, the preservation of substantial amounts of golden-cheeked warbler habitat. These include the Balcones Canyonlands National Wildlife Refuge (BCNWR) in Burnet, Travis, and Williamson Counties, the Balcones Canyonlands Preserve (BCP) in Travis County, the Williamson County Regional Habitat Conservation Plan, the pending Hays County and Comal County Regional Habitat Conservation Plans, the conceptual Southern Edwards Plateau Regional Habitat Conservation Plan, the Hickory Pass Ranch Conservation Bank in Burnet County, and acquisition of the Morton Tract by Comal County. The Nature Conservancy and other private conservation organizations also hold lands that protect golden-cheeked warbler habitat, and habitat has been preserved in many additional private property conservation easements.

The U.S. Environmental Protection Agency (EPA) recently identified the golden-cheeked warbler as highly vulnerable to climate change (EPA 2009). This designation was based on modeling that included, among others, factors such as population size, historic trends in population and range size, estimated physiological vulnerability to temperature and precipitation change, and likely extent of habitat loss due to climate change. Data used by the model concerning trends in warbler population and range was almost two decades old and may no longer reflect current conditions. The model also did not contemplate what seems to us to be real potential for golden-cheeked warblers to shift their breeding season to earlier in the year in order to avoid any climate-change induced hotter summer seasons.[5] Nonetheless, we agree that golden-cheeked warblers are likely more vulnerable to climate-change related impacts than many other species given that their breeding range is comparatively restricted in extent.

In our experience, the Service has, in Section 7 consultations and in Section 10(a)(1)(B) permit negotiations with other applicants, traditionally considered the noise and activity associated with construction projects as having potential to disturb golden-cheeked warblers. Known regular occurrence of golden-cheeked warblers on heavily visited state parks and active military reservations such as Fort Hood and Camp Bullis, as well as our own observations of golden-

[5] Golden-cheeked warblers already migrate south from their breeding grounds one to two months earlier than most other migratory bird species that breed within their range. The reason for this is not known for certain, but likely is related to the decreased availability of insect prey caused by the hot, dry summers typical of central Texas.

cheeked warblers occurring directly adjacent to home construction sites and heavily traveled roads suggest strongly to us that golden-cheeked warblers acclimate readily to human activity and sources of anthropogenic noise.

This position is supported by a recent three-year study on the effects of road construction activity and noise on golden-cheeked warblers performed by Texas A&M University (Lackey et al. 2011). This study examined warbler behavior and productivity in habitat subjected to traffic noise, habitat subjected to traffic and construction noise, and, as quiet control sites, in habitat remotely situated from traffic and construction noise. The study also introduced noise to control sites through playback of recorded construction noise. Results of the study indicate that "construction noise does not appear to affect behavior, reproductive success, or vocalization characteristics of golden-cheeked warblers" (Lackey et al. 2011).

The Golden-cheeked Warbler Recovery Plan was issued in 1992 (USFWS 1992). The Recovery Plan divided the range of the species into eight recovery regions and identified a goal of protecting a viable breeding population in each of the regions as a criterion of recovery. Location of the Permit Area relative to the golden-cheeked recovery regions is shown on Figure 3.

"Viable population" is not defined in the Recovery Plan, although it was suggested that a viable population of golden-cheeked warblers could range from 500 pairs to a few thousand individuals. More recently, the Service has indicated a viable population of golden-cheeked warblers may need to be as large as 3,000 pairs of golden-cheeked warblers (USFWS 1996a, Alldredge et al. 2002). If the Morrison et al. (2010) population estimate is accurate, then the golden-cheeked warbler population rangewide appears to be well above the minimum viability threshold.

Figure 3 also depicts the counties considered by the Service to be occupied by golden-cheeked warblers, and the distribution of potential golden-cheeked warbler habitat as modeled by Loomis-Austin, Inc. (LAI) using circa 2001 satellite imagery (Loomis-Austin, Inc. 2008). As indicated on Figure 3, the Permit Area falls into portions of golden-cheeked warbler Recovery Regions 6 and 7. Also as indicated by Figure 3, golden-cheeked warblers are expected to have potential to occur in all of the counties that may be crossed by portions of the Priority Projects except for Tom Green, Schleicher, and Sutton.

The Service has re-formed a Golden-cheeked Warbler Recovery Team to address recovery of the species and consider information gained from more recent golden-cheeked warbler studies. The work of this team is expected to result in issuance by the Service of a revised Recovery Plan for the species. Prior to its disbanding, the original Recovery Team recommended revising the number of recovery regions from eight to six, while retaining the original recovery criterion of protection of eight viable warbler populations (Golden-cheeked Warbler Recovery Team 1998). It is unknown whether the new Recovery Team will adopt this recommendation, or how, if at all, the recovery goals of the 1992 Recovery Plan could change in a revised plan.

The amount of potential golden-cheeked warbler habitat present in each of the original recovery regions crossed by the Priority Projects as identified by LAI (2008) is presented in Table 1. LAI subdivided the potential habitat identified by its model into three categories: potential habitat not likely to be occupied, potential habitat that may be occupied, and potential habitat likely to be occupied. Table 1 provides both the total amount of potential golden-cheeked warbler habitat

identified in each recovery region by LAI, and the amount of habitat identified as likely to be occupied.

Also included in Table 1 is the amount of potential golden-cheeked warbler habitat identified in the recovery regions as modeled by Diamond (2007) and Morrison et al. (2010), and the amount of potential habitat present rangewide as modeled by LAI, Diamond, and Morrison et al. (2010). Diamond acreages were obtained from Diamond Model C, which used forest/woodland cover as identified in the USGS National Land Cover Dataset as adjusted to account for patch size and edge effects. While all models were based on interpretation of satellite imagery, as the numbers in Table 1 indicate, per recovery region acreage totals of potential habitat differ quite a bit between the models even though their respective rangewide totals are fairly similar.

Table 2 provides the amount of potential golden-cheeked warbler habitat identified by Diamond (2007) by county in the Study Area. County-by-county totals of potential habitat were not provided by LAI (2008) or Morrison et al. (2010).

Table 1. Acres of Potential Golden-cheeked Warbler Habitat as Identified by Loomis-Austin, Inc. (2008), Diamond (2007) and Morrison et al. (2010) by Recovery Region

	Potential Golden-cheeked Warbler Habitat (Ac.)			
	Loomis-Austin, Inc.		Diamond	Morrison et al.
Recovery Region	Total	Likely to be Occupied		
6	689,259	242,625	769,581	389,436
7	460,728	137,534	481,190	695,726
Rangewide Total	**4,149,478**	**1,164,563**	**4,378,400**	**4,148,138**

Table 2. Acres of Potential Golden-cheeked Warbler Habitat by County as Identified by Diamond (2007)

	Recovery Region					
County	3	4	5	6	7	Total
Gillespie	---	92,510	---	91,208	---	183,718
Kendall	---	---	---	138,646	---	138,646
Kerr	---	---	---	138,005	110,786	248,791
Kimble	---	---	---	---	169,935	169,935
Total						**741,090**

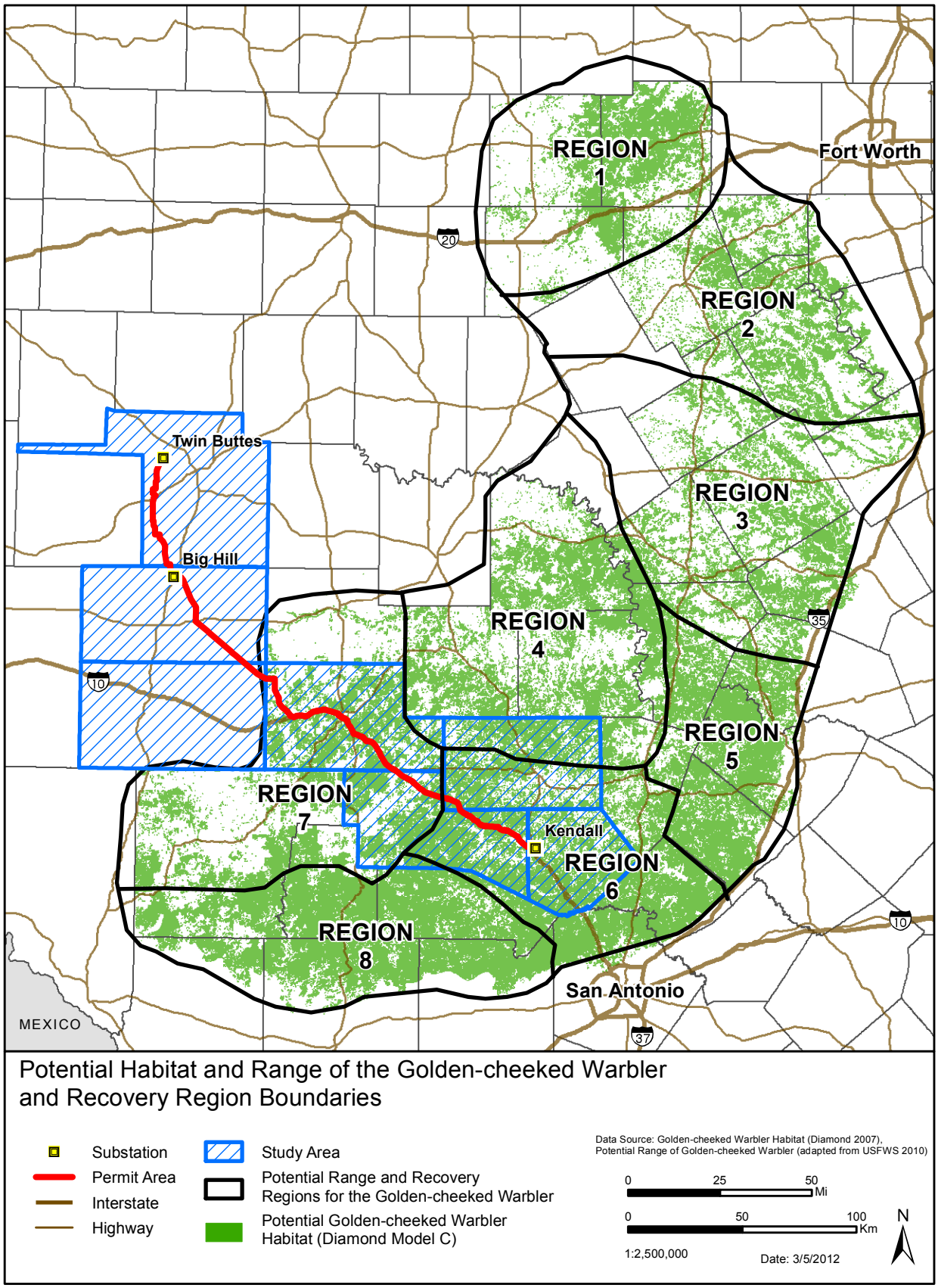

Figure 3. Golden-cheeked Warbler recovery regions and potential habitat.

Golden-cheeked warbler research indicates that occupancy and productivity are significantly lower in "small" patches of habitat than in larger ones (Maas-Barleigh 1997, Coldren 1998). During their 2009 survey of 287 patches of potential habitat, Morrison et al. (2010) detected golden-cheeked warblers in 4 of the 33 patches (12.1 percent) that were less than 24.7 acres (10 ha) in size. Occupancy rates were found to be 37.6 percent in patches that ranged from 24.7 to 123.5 acres (50 ha), 67.7 percent for patches ranging from 247 to 1,235 acres (100 to 500 ha), and 93.3 percent for patches in excess of 2,470 acres (1,000 ha) (Morrison et al. 2010). Some of this increase is likely attributable to the fact that as patch size increases, so does the chance that the patch will contain some suitable golden-cheeked warbler habitat.

Populations of golden-cheeked warblers also appear to be less stable in small habitat patches surrounded by development (Coldren 1998, Engels 1995, Arnold et al. 1996, Moses 1996). Some studies indicate that the abundance of the golden-cheeked warbler is reduced within 656 to 1,640 feet (200 to 500 m) of an urban edge (Engels 1995, Arnold et al. 1996, Coldren 1998). Coldren (1998) reported that warbler occupancy declined with increasing residential development and roadway width. Additional information on the status of the species can be found in the Golden-cheeked Warbler Recovery Plan (USFWS 1992).

Currently, three large golden-cheeked warbler breeding populations receive some degree of protection. These include those golden-cheeked warblers breeding at Fort Hood Military Reservation in Coryell and Bell Counties, those on BCP lands in Travis County, and those on the BCNWR in Burnet, Travis, and Williamson Counties. At Fort Hood, golden-cheeked warbler detections along point count routes almost doubled from 1992 to 2003 (Peak 2003). Based on extrapolation from golden-cheeked warbler densities in established study areas, the total golden-cheeked warbler population on Fort Hood in 2003 was estimated to be approximately 4,514 pairs (Peak 2003, USFWS 2005). The golden-cheeked warbler population at the BCNWR is estimated to range from 800 to 1,000 males (C. Sexton, USFWS, pers. comm. to SWCA Environmental Consultants [SWCA], 2007). Lands contained in the BCP are believed to support "hundreds" more (J. Kuhl, Travis County, pers. comm. to SWCA, 2007). The BCNWR and BCP are relatively close together, being separated by a distance of approximately 5 miles (8 km).

Smaller populations of golden-cheeked warblers receiving some form of protection occur on Possum Kingdom State Park (SP) in Palo Pinto County, Dinosaur Valley SP in Somervell County, Meridian SP in Bosque County, Colorado Bend SP in Lampasas and San Saba Counties, Hickory Pass Ranch and Canyon of the Eagles in Burnet County, U.S. Army Corps of Engineers' land at Lake Georgetown in Williamson County, Pedernales Falls SP in Blanco County, Guadalupe River SP/Honey Creek State Natural Area in Comal County, Government Canyon State Natural Area (SNA), Camp Bullis Military Reservation, and in the Indian Springs/Cibolo Canyon areas in Bexar County, Lost Maples SNA in Bandera County, Garner SP in Uvalde County, Kerr Wildlife Management Area (WMA) in Kerr County, and Kickapoo Caverns SP in Edwards and Kinney Counties.

Review of the TPWD Natural Diversity Database (NDD) indicates that the agency has few records of the species from the counties in the Study Area apart from those occurring in the aforementioned localities (TPWD 2010a). It is the experience of SWCA that golden-cheeked warblers are virtually always present at the appropriate season in woodlands within their breeding range that appear to provide optimal habitat for the species and that are situated in rural

and primarily wooded landscapes (P. Sunby/SWCA pers. obs.).[6] Occurrence of golden-cheeked warblers appears to be less certain in woodlands of lower habitat suitability and in smaller patches of woodland, especially when those patches are set within landscapes that primarily contain open range and pasture lands or contain higher levels of development. As discussed below, these general observations are supported by the findings of Magness et al. (2006).

Magness et al. (2006) developed a method for predicting presence or absence of golden-cheeked warblers in a given landscape and found that the birds occurred in a habitat patch only when landscape composition within a 1,312-foot (400-m) radius exceeded 40 percent woodland, and that the likelihood of occupancy was greater than 50 percent only when landscape composition exceeded 80 percent woodland. While they could not rule out a relationship between habitat fragmentation and overall habitat quality as measured by nesting success and recruitment, Magness et al. (2006) did conclude that common measures of habitat fragmentation, including edge density, mean-nearest neighbor, and distance between woodland patches, were poor predictors of species occurrence across all spatial scales.

2.4.1.2 Black-capped Vireo

The black-capped vireo is a small migratory songbird that was listed as endangered in 1987 (52 FR 37420). In Texas, the species breeds primarily in the Cross Timbers, Edwards Plateau, and the Trans Pecos regions of the state; black-capped vireos also breed in a few localities in central Oklahoma, and in the states of Coahuila, Nuevo Leon, and Tamaulipas, Mexico (USFWS 1991, Farquhar and Gonzalez 2005). This species winters on the Pacific slope of Mexico, mostly from southern Sonora south to Guerrero.

Most black-capped vireos arrive on their breeding grounds in Texas in late March or early April. Males generally establish territories that range in size from 1 to 10 acres (0.4 to 4.0 ha), with an average territory size of 2 to 4 acres (0.8 to 1.6 ha) (Graber 1957, Tazik and Cornelius 1989). The species may nest more than once in the same year, with migration to the wintering grounds generally occurring in September (USFWS 1991).

Typical breeding habitat for the black-capped vireo consists of relatively dense deciduous shrublands with vegetation cover down to ground level. Larger trees may be present in areas occupied by black-capped vireos, although the canopy layer is typically open. Areas occupied by black-capped vireos often contain a greater diversity of shrub species than do nearby areas where the species is absent. Shrublands occupied by vireos usually develop on limestone substrates and are dominated by oak (*Quercus* spp.) or sumac (*Rhus* spp.). However, the species can also occur on sandy substrates or wherever suitable dense shrubby vegetation is present. No critical habitat has been designated for the black-capped vireo.

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[6] Golden-cheeked warbler productivity per unit area is the best measure of habitat quality. Density of occupation of woodland by golden-cheeked warblers likely provides an adequate surrogate and one that is more readily determined. However, survey data are not always available, so it is sometimes necessary to rely on visual inspection of woodland to evaluate its suitability as golden-cheeked warbler habitat. In this case, the term “optimal” habitat refers to woodland that has a tall and nearly closed canopy and is composed of a combination of mature Ashe juniper trees and a variety of hardwood trees, especially oak (*Quercus* spp.), and with those hardwoods present in relative abundance. In our experience, golden-cheeked warblers occur in their highest densities in such woodland.

Primary threats to the black-capped vireo include direct destruction of breeding habitat, loss or deterioration of breeding habitat through natural processes, low reproductive success, and indirect effects of land use on breeding grounds (USFWS 1991). Low reproductive success has been attributed to high rates of nest parasitism by brown-headed cowbirds (*Molothrus ater*) and nest predation by red imported fire ants (*Solenopsis invicta*), Texas rat snakes (*Elaphe obsoleta lindheimeri*), and other species. Habitat loss occurs through clearing of land for ranching or other agricultural practices, browsing of low-level vegetation by goats and other domestic animals, and clearing for residential developments, road construction, placement of utilities, and other land use projects.

It is believed that black-capped vireo habitat, at least in the eastern portion of the species' range, developed historically in response to wildfire. Suppression of wildfire likely causes potentially suitable black-capped vireo habitat to develop at rates below those of historical times. Impacts to wintering habitat are thought to be relatively understudied (Grzybowski et al.1994). A recent study by Powell and Slack (2006) found that clearing of brush for grazing and/or other agricultural purposes was common throughout the Mexico winter range, but did not conclude that such disturbance "could be considered a serious problem for the species." This study also indicated that the species is more of a habitat generalist on the wintering grounds than it is during the breeding season.

The total black-capped vireo population is unknown. Much of the range of the species in Texas and Mexico lies on privately held lands that have not been surveyed. Black-capped vireo habitat is difficult to identify from satellite imagery or aerial photography because the shrubs that make up their habitat are difficult to discern from that distance, making it infeasible to first estimate extent of potential habitat and then apply an assumed occupation rate to reach a reasonable population estimate. However, as discussed below, the population of the black-capped vireo in Oklahoma and Texas is larger than was thought at the time of listing. Similarly, the Mexican population may be greater and is distributed more widely than was known at the time of listing. This is likely a result of increased survey effort, increases in local populations, or a combination of both.

The Black-capped Vireo Recovery Plan was issued in 1991 (USFWS 1991). The Recovery Plan divided the Texas range of the species into six recovery regions, and identified goals of protecting all existing populations and presence of a viable breeding population in four of the six Texas recovery regions as criteria for downlisting the species to threatened. Reorganization of the Texas range into four recovery regions was recommended in 1996 (USFWS 1996b). As this reorganization has not been formally adopted, the originally designated recovery regions are used in discussions of black-capped vireo in this HCP.

At the time the Recovery Plan was written, the total number of male black-capped vireos known to occur in Oklahoma and Texas was on the order of 1,000 (USFWS 1991). By 1995, the number of male black-capped vireos known to occur in Oklahoma and Texas was around 1,800 (USFWS 1996b). The known population of male black-capped vireos rangewide was reported as 6,269 by Wilkins et al. (2006) in a population status report prepared for the Service, with 6,010 of those occurring in Texas and Oklahoma. This number was derived using 2003 black-capped vireo population data from Fort Hood. Replacing the Fort Hood numbers provided in Wilkins et al.

(2006) with an extrapolated 2005 population estimate from Fort Hood (Cimprich 2005) yields a possible population ranging from 9,256 to 12,683 males.[7]

In 1995, approximately 170 vireo territories were known to occur in Oklahoma, with 150 of these occurring in Comanche County on the Wichita Mountains National Wildlife Refuge (WMNWR) and adjacent Fort Sill, and the remaining 20 territories occurring in Blaine (n = 17) and Cleveland (n = 3) Counties (USFWS 1996b). Wilkins et al. (2006) identified the known male black-capped vireo population in Oklahoma as 2,495, with 2,119 of those birds occurring on the WMNWR, 355 birds occurring on Fort Sill, 17 birds occurring in Blaine County, and 4 birds occurring in Cleveland County. The number of birds listed for Blaine County was based on 2003 survey data; an estimated 11 to 12 territories were present in Blaine County as of 2006 (J. Grzybowski, University of Central Oklahoma, pers. comm. to SWCA, 2006). The number of black-capped vireos occurring at the WMNWR has continued to increase, and as of 2010 its vireo population exceeded 4,000 pairs and possibly was as great as 6,000 pairs (Grzybowski et al. 2010).

The black-capped vireo population in Mexico is poorly known and was considered limited to Coahuila as of 1995 (USFWS 1996b), although previously the species had been documented in Nuevo Leon, San Luis Potosi, and Tamaulipas (Phillips 1911; Davis in Graber 1961; Marshall et al. 1984, 1985). Surveys by Farquhar and Gonzalez (2005) indicated presence of high densities of black-capped vireos in northern Coahuila. Studies from 2001 through 2005 confirmed presence of black-capped vireos in Nuevo Leon and Tamaulipas, and it was considered promising that the species was also in San Luis Potosi (Farquhar and Gonzalez 2005). Approximately 33 black-capped vireo territories were detected at two locations in Nuevo Leon in 2002 (Farquhar et al. 2003). Up to 99 male vireos were documented in subsequent years at another site in Nuevo Leon, although extrapolation of those detections into a regional population estimate was not possible (Farquhar and Gonzalez 2005). Farquhar and Gonzalez (2005) also reported on the presence of black-capped vireo in southwestern Tamaulipas.

While some of the increase in known population of black-capped vireo from 1995 to 2005 probably reflects improved knowledge of the status of the black-capped vireo rather than true increases in population (e.g., the Mexican populations), the numbers of black-capped vireos on Fort Hood and WMNWR/Fort Sill in 1995 were estimated to be 300 and 150 males, respectively (USFWS 1996b). Thus, the black-capped vireo populations on Fort Hood and at WMNWR/Fort Sill appear to have each increased more than 1,500 percent over the last decade.

Location of the Permit and Study Areas relative to the range of the black-capped vireo in Texas and the Texas black-capped vireo recovery regions is shown on Figure 4. As indicated on this figure, all counties within the Study Area lie within the breeding range of the black-capped vireo, with most of both the Permit and Study Areas falling into Recovery Region 3 and a smaller portion lying in Recovery Region 4.

Table 3 provides the known male vireo population of each of these regions as reported by the Service (2004a), Wilkins et al. (2006), and Maresh (2005). The great difference between the

[7] The 2003 black-capped vireo population on Fort Hood was reported as 1,847 males (Cimprich 2003). The 2005 population was estimated to range from 4,834 to 8,261 males (Cimprich 2005).

numbers of black-capped vireos present in Recovery Region 2 as identified by the Service (2004a) and Wilkins et al. (2006) and those as identified by Maresh (2005) results from USFWS and Wilkins et al. having used 2003 population data from Fort Hood that were limited to known number of black-capped vireos, and Maresh having used a 2005 population estimate that was extrapolated up from known black-capped vireo numbers based on a delineation of perceived available habitat.

Table 4 provides the known male black-capped vireo population for the counties comprising the Study Area as reported in these same three sources, as well as the amount of potentially suitable vireo habitat identified by USFWS (2004a) as occurring in each of these counties. The total amount of potentially suitable black-capped vireo habitat present in Texas as identified by USFWS (2004a) was 1,450,438 acres (587,222 ha). USFWS (2004a) indicates that estimates of the extent of black-capped vireo habitat present in each Texas county were based on extrapolation of data collected along public roadside transects and, for Dallas County only, review of aerial photography.

Table 3. Known Male Black-capped Vireo Population by Recovery Region

Recovery Region	Reported Black-capped Vireo Population		
	USFWS (2004a)	Wilkins et al. (2006)	Maresh (2005)
3	1,084	1,019	647[1]
4	31	148	27

[1] Maresh (2005) omitted the Kerr County population in his total for Recovery Region 3, which was reported as 435 by USFWS 2004 and 436 by Wilkins et al. (2006).

Table 4. Known Male Black-capped Vireo Population and Amount of Potentially Suitable Vireo Habitat by County

County	Reported Black-capped Vireo Population			Potentially Suitable Habitat (Ac.)[1]
	USFWS (2004a)	Wilkins et al. (2006)	Maresh (2005)	
Recovery Region 3				
Gillespie	0	0	0	58,826
Kendall	0	0	0	4,945
Kerr	435	436	n/a[3]	53,074
Kimble	35	35	35	36,001
Schleicher	0	0	0	1,397
Sutton	1	1	1	46,498
Recovery Region 4				
Tom Green	6	6	4	17,851

[1] Source: USFWS (2004a)

[2] USFWS (2004a) reported a population occurring at the BCNWR in Burnet, Travis, and Williamson Counties as an undifferentiated "at least 100 pairs." It is assumed here that 57 of those pairs were in Burnet County based on that number of pairs being identified by Wilkins et al. (2006) and Maresh (2005) on the NWR in Burnet County based on a 2002 citation. USFWS (2004a) also reported 23 pairs occurring at another Burnet County location.

[3] Maresh (2005) omitted the Kerr County population from his report.

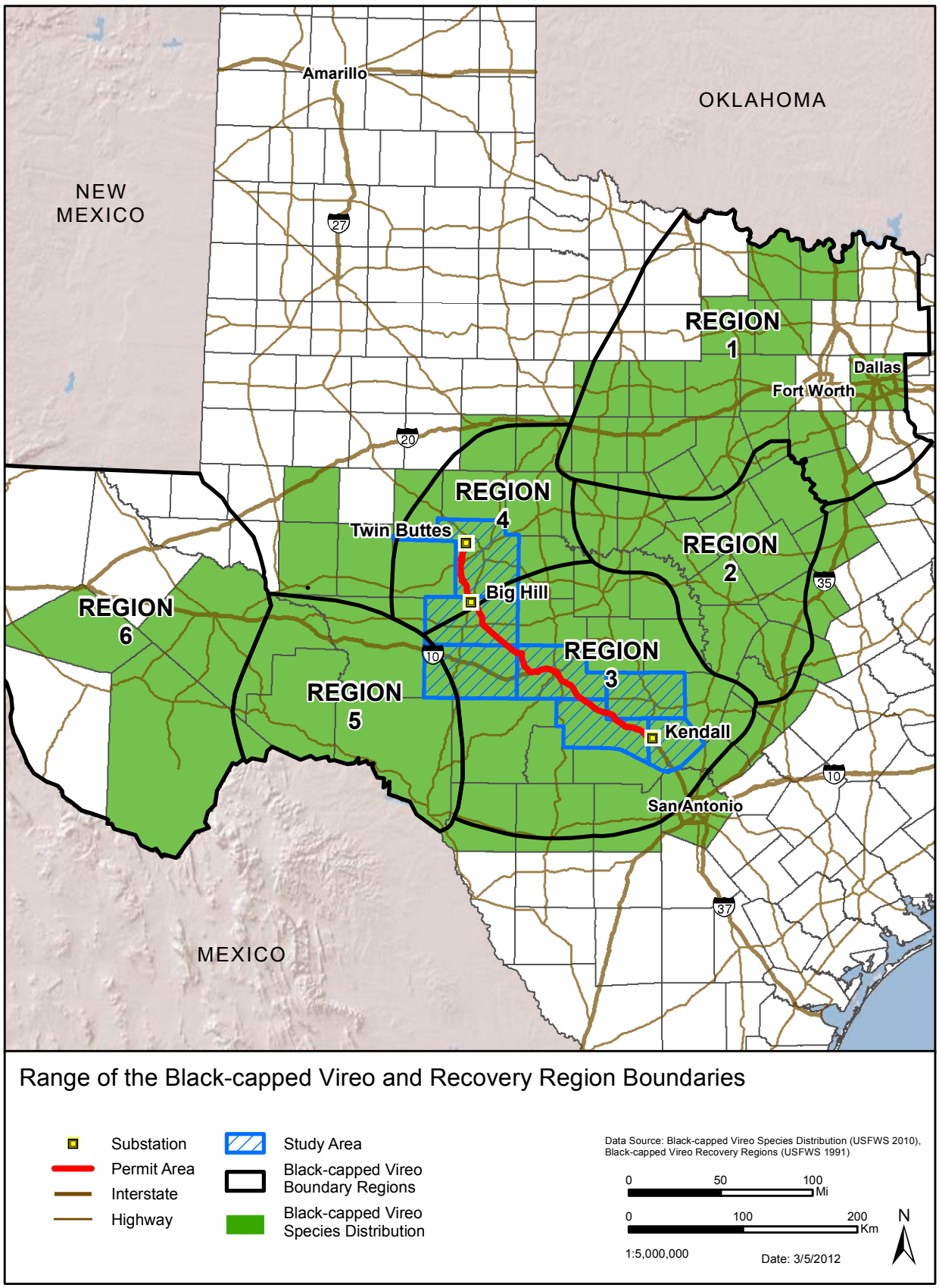

Figure 4. Black-capped vireo distribution and recovery regions.

Black-capped vireo habitat usually is distributed patchily because its existence is often the result of a local event, such as a wildfire or the specific land use practices of a particular land owner. Consequently, we question whether extrapolating from data collected along public roads can accurately portray the amount of potentially suitable vireo habitat present at a countywide scale. Nonetheless, the acreages presented in Table 4 likely do provide a general sense of the "order of magnitude" amount of potentially suitable vireo habitat present in each county.

It should be remembered that the actual number of black-capped vireos occurring in each of these counties is very likely different from the known vireo population in each county as identified in Table 4. Texas contains a vast amount of private land that rarely is visited by people who would submit records of black-capped vireo observations to the Service or TPWD. Consequently, it is assumed that in almost all cases, the actual black-capped vireo population of each county exceeds that given for the county in Table 4.

Three black-capped vireo breeding populations of 100 pairs or more receive some degree of protection. These include those vireos breeding at Fort Hood Military Reservation in Coryell and Bell Counties, those on the BCNWR in Burnet, Travis, and Williamson Counties, and those at Kerr WMA, Kerr County. The Kerr WMA population was identified as 358 males in Wilkins et al. (2006). Also based on Wilkins et al. (2006), black-capped vireo populations ranging from 10 to 100 pairs that receive some form of protection occur at Colorado Bend SP in Lampasas and San Saba Counties, the LCRA Canyon of the Eagles property in Burnet County, the BCP in Travis County, Camp Bullis Military Reservation and the City of San Antonio Rancho Diana property in Bexar County, Walter Buck WMA in Kimble County, Mason Mountain WMA in Mason County, Kickapoo Caverns SP in Edwards and Kinney Counties, Big Bend National Park in Brewster County, and Devils River SNA in Val Verde County, as well as on some privately managed properties scattered across the Texas range of the species. Small numbers of black-capped vireos, perhaps less than 10 pairs each, also occur at Hill Country and Lost Maples SNAs in Bandera County, South Llano River SP, Kimble County, and on U.S. Army Corps of Engineers land at Lake Georgetown, Williamson County (Wilkins et al. 2006 and P. Sunby/SWCA pers. obs.).

A 5-year status review of the black-capped vireo summarizing the work of Wilkins et al. (2006) was produced by the Service in 2007. Based on known increases in populations in Texas and Oklahoma, improved knowledge of the status of the species in Mexico, success of conservation measures, and changes in magnitude of threats to the species, the Service has recommended that the black-capped vireo be downlisted to threatened (USFWS 2007a).

Review of the TPWD NDD indicates the agency has many records of black-capped vireo from the Study Area, although the NDD has none from Schleicher or Kendall Counties, and possibly none from Gillespie County (TPWD 2010a).[8] Based on information provided to LCRA TSC, it is understood that a TPWD biologist recorded two black-capped vireos on a private property in southeastern Schleicher County in response to a landowner request for technical guidance (TPWD 2009a). Most of the NDD vireo records occur in the general region that will be crossed by the Big Hill–Kendall transmission line.

[8] Many records held in the TPWD are presented only as very large circles, so that exact location of the record is not provided. Two records of black-capped vireo in the NDD straddle the Kerr-Gillespie county line.

2.4.2 Evaluation Species

2.4.2.1 Bald Eagle

The bald eagle is a very large and familiar bird of prey that was listed as endangered in 1967 (32 FR 4001) and downlisted to threatened in 1995 (60 FR 35999). Successful recovery efforts led to its removal from the federal list of threatened and endangered species on 9 July 2007 (72 FR 37345). At the time of its listing, numbers of bald eagles in the lower 48 states had been severely reduced, first through persecution in the nineteenth century and then as a result of an extended period of very low reproductive success in the mid twentieth century caused by high levels of organochlorine pesticides in the environment, especially dichloro-diphenyl-trichloroethane (DDT) (64 FR 36453). The banning of the use of DDT combined with earlier prohibitions on persecution (e.g., the BGEPA) and subsequent habitat protection and other management efforts allowed bald eagles to increase greatly in number and reoccupy much of their former range. As an example, the number of active bald eagle nests known in Texas increased from 13 in 1982 to 156 in 2005 (Ortego et al. 2009).

Bald eagles are typically associated with aquatic habitats. Fish can comprise a large portion of their diet, but bald eagles are opportunistic and in Texas will take waterfowl, mammals, and turtles, as well as eat carrion (Campbell 2003, Ortego et al. 2009). In Texas, nesting birds occur mostly in the eastern half of the state, where they typically occur along major rivers or the shores of reservoirs and nest in tall trees (Campbell 2003). The typical bald eagle nesting period in Texas is October through July (Campbell 2003). For the past several years, pairs of bald eagles have been breeding in central Texas along rivers at scattered locations on the Edwards Plateau. Central Texas counties in which bald eagles are nesting, or have nested, since 2002 include Bell, Burnet, Edwards, Kimble, Llano, Mason, and San Saba (Ortego et al. 2009, B. Ortego/TPWD pers. comm. to SWCA on 27 January 2010).

The Service in its National Bald Eagle Management Guidelines recommends that transmission lines not be placed within 660 feet (201 m) of a bald eagle nest (USFWS 2007b). This setback is voluntary and not mandated by law. In Texas, TPWD tracks bald eagle nest location information, rather than the Service, and has prepared its own set of management guidelines for the species. These guidelines, which like those of the Service are voluntary and not mandated by law, recommend that certain primary and secondary habitat management measures be invoked within 1.3 miles (2.1 km) of a bald eagle nest (Campbell 2003). Among the TPWD guidelines, it is recommended that no transmission lines be placed within 750 to 1,500 feet (229 to 457 m) of a bald eagle nest.

A pair of bald eagles found nesting in Dallam County in 2004 provided the first nesting record for the Panhandle region of the state since 1916 (Lockwood and Freeman 2004, Ortego et al. 2009). According to Ortego et al. (2009), this pair continues to nest in Dallam County and feeds primarily upon black-tailed prairie dogs (*Cynomys ludovicianus*). Some bald eagles on the coastal plain in south Texas have used large transmission line towers for nesting in lieu of trees (Ortego et al. 2009).

Bald eagles are distributed in Texas more widely during migration and the winter months. While most do occur in association with aquatic habitats, at these times of year bald eagles will also

occur in grassland habitats in the Trans Pecos and Panhandle regions of the state (Campbell 2003). Several bald eagles typically winter on Lake Buchanan, Burnet and Llano Counties (Campbell 2003). The LCRA Canyon of the Eagles preserve on the northeast shore of Lake Buchanan provides protected roost sites and hunting areas for the bald eagles that winter in this area.

Although the bald eagle has been federally delisted, it is protected by the BGEPA and listed by the State of Texas as a threatened species. A distinction between federal and state protections afforded listed species is that species listed by the State of Texas are not protected against incidental take. Also under state law, habitat modification is not a regulated activity.

Threats to bald eagles in Texas include use of lead shot for hunting, loss of habitat to human development, and human disturbance (Ortego et al. 2009). Lead shot can be ingested by bald eagles, where it then can cause death or reduce reproductive success. Bald eagles mostly nest in areas secluded from human disturbance, so new residential development along the shores of reservoirs has potential to cause bald eagles to abandon nest sites and eliminate habitat that could otherwise be used by bald eagles to further expand their population. Boating and other aquatic recreational activities also create potential to disturb nesting bald eagles.

2.4.2.2 Least Tern

Least terns are small, highly aerial, aquatic birds that feed mostly on small fish, but also invertebrates and insects, which they capture by plucking them from the surface of the water or by making shallow plunge-dives (Thompson et al. 1997). These birds utilize shallow-water habitats and occur both coastally, where they nest on sandy beaches, and inland along some major rivers, where they will nest on sand bars, mud flats, dredged spoil deposits, graveled rooftops, and parking lots (Thompson et al. 1997).

Least terns that bred inland along major rivers were described as a separate subspecies known as interior least tern (*S. antillarum athalassos*). Interior populations of least tern were listed by USFWS as endangered in 1985, largely owing to concerns over loss of riverine breeding habitat to reservoir and channelization projects and disturbance to nesting habitat caused by recreational use of sand bars (50 FR 21784). No critical habitat has been designated for interior populations of least tern. Because of uncertainty regarding the validity of the *S. a. athalassos* taxon (as discussed below), the Service listed the “interior population” of least tern as endangered, rather than the interior subspecies (50 FR 21784). The endangered designation applies to those least terns that breed at least 50 miles inland from a coastline

Questions of the validity of the sub-specific status of interior least tern had already been raised when a least tern chick banded on the Texas coast was later found breeding as an adult in Kansas, suggesting free genetic interchange between coastal and inland populations (Boyd and Thompson 1985). A study performed on least terns from four coastal and inland sites in Texas found no genetic difference between coastal and “interior” least terns, causing Thompson et al. (1992) to recommend reassessing subspecies within the *S. antillarum* taxon. More recently, a study by Draheim (2006) of mitochondrial and microsatellite DNA between coastal, interior, and California (*S. a. browni*) least terns found no support for these three “subspecies,” also causing

the author to recommend reassessment of least tern taxonomy. To date, the American Ornithologists' Union has not revised the taxonomy of the least tern.

Least terns are known to breed in Texas at sites along the Canadian River, Red River, Prairie Dog Town Fork of the Red River, and the Rio Grande, various sites in north-central Texas in the Trinity River basin, and on the margins of reservoirs in the vicinity of the City of San Angelo, Tom Green County (Campbell 2003, Lockwood and Freeman 2004, Kasner et al. 2005). On their breeding grounds, least terns typically forage comparatively near, and spend their nights at, their breeding colony (Thompson et al. 1997, USFWS 1990a).

Kasner et al. (2005) indicated that 10 pairs of terns bred at O.C. Fisher Reservoir in Tom Green County in 1999, and that the species was again observed during the breeding season in 2002 at that reservoir and at Twin Buttes Reservoir. The LCRA Twin Buttes Substation, which will be the northern terminus of the Twin Buttes–Big Hill transmission line, lies approximately 6 miles (10 km) northwest of O.C. Fisher Reservoir and 9.5 miles (15.2 km) north-northwest of Twin Buttes Reservoir. The Twin Buttes–Big Hill transmission line route runs approximately 6 miles west of O.C. Fisher Reservoir and 2.75 miles (4.5 km) west of Twin Buttes Reservoir.

Least terns are considered uncommon to rare migrants across the eastern two-thirds of Texas, becoming increasingly rare to the west (Lockwood and Freeman 2004). As indicated, it is known that least terns breed in Tom Green County. It is considered that the birds have potential to occur as migrants throughout the remainder of the Study Area, albeit largely on an uncommon and infrequent basis. It is believed that migrant least terns mostly follow the courses of major rivers while traversing the state, although records of migrant least terns occurring in Texas well away from major river corridors do exist (Thompson et al. 1997).

The least terns that breed in Tom Green County may largely follow the Colorado River corridor when traveling to and from the Gulf Coast, although it seems plausible they could also partially follow the Rio Grande or Guadalupe River corridor and travel overland in part to/from Tom Green County.

2.4.2.3 Whooping Crane

The whooping crane was listed as endangered in 1970. Whooping cranes are the rarest of the 15 species of cranes in the world and are found only in North America. One natural wild population of whooping cranes exists. Members of this population nest within and directly adjacent to Wood Buffalo National Park (WBNP) in the Northwest Territories and Alberta provinces of Canada, and winter mainly in and adjacent to Aransas National Wildlife Refuge (ANWR) along the central Texas coast in Aransas, Calhoun, and Refugio Counties (Canadian Wildlife Service and USFWS 2007). The two areas are separated by approximately 2,400 miles (3,800 km). Whooping cranes largely travel through the Great Plains while migrating between the two areas.

In the spring of 2008, the wild whooping crane flock consisted of 266 birds. A total of 270 cranes, 232 adults and 38 juveniles, returned to ANWR in the fall/winter of 2008. Drought conditions and consequent scarcity of food caused above-average mortality on the wintering grounds in the winter of 2008–2009; the number of cranes believed to have survived the winter was 247 (225 adults and 22 juveniles) as of 21 April 2009 (Stehn 2009a).

Production of young was below average in the 2009 breeding season, leading to the fledging of 22 young (Stehn 2009b). Censuses conducted in the winter of 2009–2010 indicated that as of 9 March 2010 the flock was estimated to contain 263 birds, of which 242 were adults and 21 were juveniles (Stehn 2010). The most recent censuses, conducted during the winter of 2010-2011, indicated that the flock consisted of 283 birds at the start of the season, but the over-winter mortality of three adults and one juvenile caused the number to drop to 279 (231 adults and 41 juveniles) by the time the birds started migrating back north (Stehn 2011).

Approximately 136 whooping cranes occur in free-flying nonessential populations. Twenty-nine of these birds are resident in Florida and 107 migrate between summering areas in Wisconsin and wintering grounds in Florida (Stehn 2009b). Another approximately 152 whooping cranes exist in captivity at various locations in the United States and Canada (Stehn 2009b).

Breeding sites in and directly adjacent to WBNP lie within poorly drained areas that contain marly pothole wetlands interspersed with low ridges that support various evergreen trees and deciduous shrubs. The birds begin to arrive at their wintering grounds in mid-October, with most birds arriving from late October through mid-November (Canadian Wildlife Service and USFWS 2007).

Wintering whooping cranes primarily utilize coastal marshes and salt flats in and within the vicinity of the ANWR. The current population makes use of approximately 22,500 acres (9,100 ha) of such habitat on ANWR and adjacent privately owned land (Canadian Wildlife Service and USFWS 2007). Marshes used by the cranes are dominated by salt grass (*Distichlis spicata*), saltwort (*Batis maritima*), smooth cordgrass (*Spartina alterniflora*), glasswort (*Salicornia* spp.), and sea-oxeye (*Borrichia frutescens*), with Gulf cordgrass (*Spartina spartinae*) dominating inland margins (Canadian Wildlife Service and USFWS 2007). This habitat is similar to coastal habitats present along the western Gulf Coast from southwest Louisiana into northeast Mexico, or what was believed by Allen (1952) to be the primary historical wintering range of the species. High fidelity to ancestral wintering areas likely prevents whooping cranes from spreading into presumably suitable and unoccupied wintering habitat elsewhere along the Gulf Coast.

Autumn migration usually begins in mid-September, with the birds typically traveling for two days to northwest Saskatchewan/northeast Alberta, where they stage for two to four weeks before completing their journey to Texas in as little as one more week (Canadian Wildlife Service and USFWS 2007). Spring migration generally begins in late March, with some birds remaining on the wintering grounds into early May. Spring migration is typically completed in two to four weeks; no time is spent staging on the way northward (Canadian Wildlife Service and USFWS 2007).

Whooping cranes use a variety of habitats during migration, including croplands for feeding and wetlands for roosting (Howe 1987 and 1989, Lingle 1987, Lingle et al. 1991). Austin and Richert (2001) reviewed 1,014 whooping crane site evaluation records made during the period of 1977 through 1999. Site evaluations differ from standard observation records, which typically consist of not much more than date and location of observation, in that they contain much more detail regarding the physical characteristics of the site where the cranes were observed. Data collected for site evaluation records include, among others, wetland type and size, substrate type, water depth at roost or feeding sites, visibility, vegetation, distance to nearest disturbance, and land

cover. This review revealed that whooping cranes roost predominantly in palustrine (i.e., marshes, swamps, bogs) or riverine wetland systems, with these types of wetlands accounting for 91.5 percent of roost sites recorded (Austin and Richert 2001). Remaining roost sites were mostly lacustrine (i.e., lake or lakeshore) wetlands (7.8 percent of occurrences) or flooded cropland (2.8 percent). Studies of whooping cranes in migration in the U.S. indicate that 75 percent of wetlands used for roosting are less than 10 acres (4 ha) in size and 40 percent are less than 1.24 acres (0.50 ha), and that roosting sites generally occur within 0.62 mile (1 km) of feeding areas (USFWS 2009b, Howe 1987 and 1989). Studies cited by USFWS (2007c) suggest landscapes characterized as "wetland mosaics" provide the most suitable stopover habitat.

Approximately 97.9 percent of the riverine roosts reviewed by Austin and Richert (2001) were recorded in Nebraska. Outside of Nebraska, more than 75 percent of whooping cranes roosts were recorded in palustrine wetlands. Most palustrine roost sites were adjacent to cropland or grassland; less than 8 percent of palustrine roost site were reported as occurring adjacent to woodland (Austin and Richert 2001). When using riverine habitat, whooping cranes roost on submerged sandbars in wide unobstructed channels that are isolated from human disturbance and, presumably, comparatively secure from predation (Armbruster 1990). The width of rivers used for roosting by whooping cranes in the records reviewed by Austin and Richert (2001) ranged from approximately 249 to 1,500 feet (76 to 457 m).

Whooping cranes typically migrate singly or in groups of two to five birds (Canadian Wildlife Service and U.S. Fish and Wildlife Service 2007). Large groups of up to 20 to 30 cranes will sometimes aggregate at the same stopover location and may then commence a migration flight together (USFWS 2009b, Canadian Wildlife Service and U.S. Fish and Wildlife Service 2007). Cranes migrate primarily during daylight hours, relying heavily on tailwinds and thermal currents to aid their flight. They stop nightly to roost in shallow wetlands and may feed in those wetlands the next morning before continuing their migration, or fly out from the wetlands to feed in agricultural fields. If winds change or weather otherwise becomes unsuitable for travel, whooping cranes may remain at a stopover location until winds are again favorable for flight (USFWS 2009b).

Migrant whooping cranes observed at feeding sites have primarily been recorded in upland cropfields, including row crop stubble, small grain stubble, and green crops such as winter wheat (*Triticum aestivum*) and alfalfa (*Medicago sativa*) (Austin and Richert 2001), Whooping cranes have also been observed feeding in palustrine wetlands, seasonally flooded habitats, permanent water, pastures, and meadows (Austin and Richert 2001).

Most of the whooping crane observations reviewed by Austin and Richert (2001) occurred less than 0.5 mile (0.8 km) from human disturbance, with 32.5 percent of observations occurring less than 0.25 mile (0.4 km) from such disturbance. Approximately 58.5 percent of whooping crane observations were recorded more than 2,640 feet (805 m) away from utility lines. Approximately 22.4 percent of observations were recorded 1,320 to 2,640 feet (402 to 805 m) from utility lines, 16.3 percent were recorded 300 to 1,320 feet (91 to 402 m) away from utility lines, and 2.5 percent were recorded less than 300 feet from utility lines (Austin and Richert 2001). While this distribution may demonstrate some avoidance by whooping cranes of utility lines, it likely is mostly an artifact of the general scarcity of utility lines in habitats used by whooping cranes (i.e., any randomly chosen point in whooping crane habitat is more likely to be located farther from,

rather than nearer to, a utility line) and the fact that utility lines are often placed along roadsides, which could be actively avoided by the birds.

In 1978, critical habitat for the whooping crane was designated at nine sites in seven U.S. states. Two of the sites were in Colorado, two were in Kansas, and one site each was in Idaho, Nebraska, New Mexico, Oklahoma, and Texas. Critical habitat designations in Colorado, Idaho, and New Mexico pertained to a small population of whooping cranes being raised by sandhill cranes (*Grus canadensis*); these designations were removed in 1997 when these birds were designated as a nonessential experimental population (this population is no longer extant).

The remaining five originally designated sites retain their status as critical habitat for the whooping crane. These sites include the Cheyenne Bottoms State Waterfowl Management Area and Quivira National Wildlife Refuge (NWR) in Kansas, the Platte River bottoms between Lexington and Dehman, Nebraska, the Salt Plains NWR in Oklahoma, and the ANWR and vicinity in Texas. Critical habitat in the Great Plains provides traditional and important stopover habitat for migrating whooping cranes, while critical habitat at the ANWR and vicinity in Texas encompasses most of the wintering habitat occupied by the wild population.

The International Recovery Plan identifies the following as current threats to the whooping crane: human settlement/development, insufficient freshwater inflows, shooting, disturbance, disease/parasites, predation, life history (i.e., low production rates), food availability/sibling aggression, climatic factors, loss of genetic diversity, red tide, chemical spills, collisions with power lines, fences, and other structures, collisions with aircraft, and pesticides (Canadian Wildlife Service and USFWS 2007). Some of these threats (e.g., disease/parasites and pesticides) are considered to be relatively minor because they rarely lead to mortality. Others (e.g., shooting and collisions) are rather important because, given the small size of the wild population, loss of even a few adults of breeding age can negatively affect recovery efforts.

On 29 March 2010, the Service initiated a 5-year status review of the whooping crane (75 FR 15454). This review will utilize the most recent scientific information available regarding the species biology, habitat conditions, existing conservation measures, threats, and any other pertinent facts to determine whether the whooping crane warrants downlisting to threatened or removal from the list of threatened and endangered species altogether. Section 4(c)(2)(A) of the ESA requires that the Service conduct 5-year status reviews of all listed species. It is not expected this review will result in a recommendation to downlist or delist the whooping crane.

The vast majority (60 to 80 percent) of whooping crane mortalities occur during migration. Between 1950 and 1986, only 1.4 percent of whooping crane mortalities occurred on the wintering grounds (Canadian Wildlife Service and USFWS 2007). Whooping cranes are faced with various natural obstacles and problems during their annual migration. Snow and hail storms, low temperatures, and drought can present navigational handicaps and reduce food availability. Migrating cranes are also exposed to a variety of physical hazards such as collision with obstructions such as power lines, predation, disease, and illegal shootings. At least 12 whooping cranes were shot by hunters during the period of 1989 through 2005 (Canadian Wildlife Service and USFWS 2007). The advent of rural electrification brought power lines, and collisions are known to have accounted for the death or serious injury of 45 whooping cranes since 1956 (USFWS 2007c).

Stehn and Wassenich (2008) provide the circumstances of each of the 45 whooping crane/power line collisions. Of the 45 collisions, 9 (20 percent) were incurred within the wild population, with the remaining 36 incurred in the no longer extant Rocky Mountain flock (n = 13), the non-migratory Florida flock (n = 20), and the flock that migrates between Wisconsin and Florida (n = 3). Seventeen of the 45 collisions (37.8 percent) were with transmission lines and 23 (51.1 percent) were with distribution lines; the type of line involved in the other 5 collisions was not recorded.[9]

Of the nine collisions involving birds from the wild population, one was with a transmission line and eight were with distribution lines. Three of the nine collisions occurred in Texas, including the transmission line collision. The transmission line collision did not result in death of the crane; the bird was rehabilitated, unable to be released in the wild, and incorporated into a captive-breeding program (Stehn and Wassenich 2008).

The wild population migrates during both spring and fall through a relatively narrow corridor between ANWR and WBNP. The migration corridor basically follows a straight line through the Great Plains, with the cranes traveling through Alberta, Saskatchewan, extreme eastern Montana, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas (Canadian Wildlife Service and USFWS 2007). The primary migration corridor is approximately 200 miles (320 km) wide, although cranes can be pushed east or west by unfavorable winds. Location of the Study and Permit Areas relative to the primary whooping crane migration corridor is depicted on Figure 5.

Figure 5 also depicts all confirmed whooping crane observations made in Texas, as reported to the Service through the spring of 2009 (USFWS 2009a).[10] The large majority of crane observations in Texas have occurred in areas that historically supported prairies and have since largely been converted to agriculture. These include the Blackland Prairies of central Texas and the High Plains in the northwest part of the state.

The 200-mile-wide migration corridor depicted on Figure 5 was drawn based on all U.S. whooping crane observations rather than through examination of observations on a state-by-state basis. As an artifact of this methodology, 27 of the 123 Texas crane observations (21.95 percent) pictured on Figure 5 fall outside the corridor described as encompassing 95.16 percent of all national sightings. This suggests that a larger percentage of whooping cranes travel through northwest Texas than suggested by the limits of the 200-mile-wide corridor. It also appears, therefore, that whooping cranes may have somewhat greater potential to fly over the Study Area than is suggested simply by the delineated limits of the migration corridor. However, as indicated on Figure 5, no sightings of cranes have been made in the region that would be crossed by the Priority Projects. This is not surprising because the Study Area lies largely on the Edwards Plateau, which is characterized by wooded hills and rocky streams and so contains comparatively little appropriate stopover habitat.

[9] Transmission lines are the large overhead, high voltage lines of the type contemplated in this HCP. Distribution lines are much smaller, low voltage lines that usually stand within 18 to 25 feet (5.5 to 7.6 m) of the ground.

[10] It is estimated that approximately 96 percent of whooping crane stopovers are unobserved/unreported (USFWS 2009b).

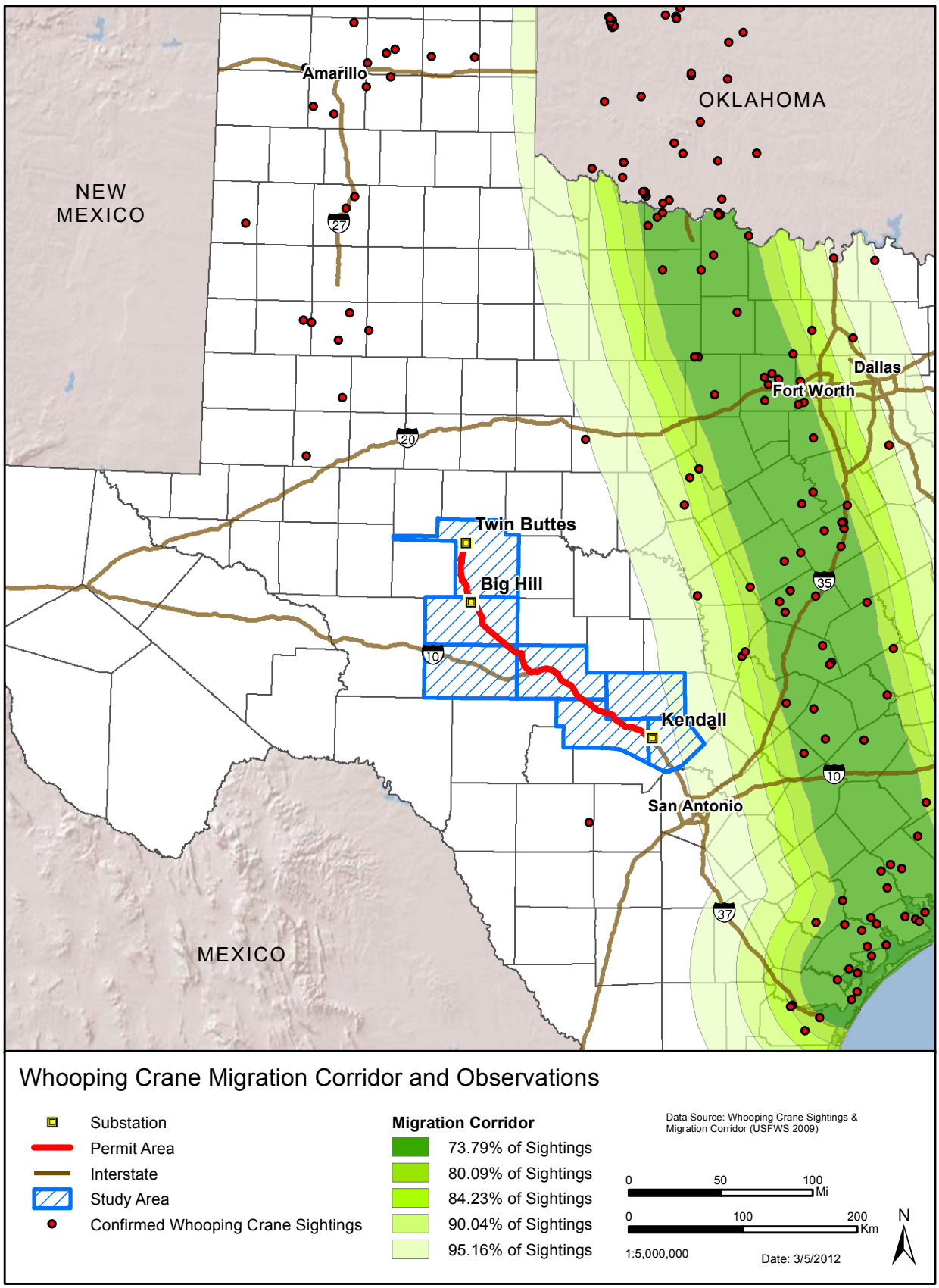

Figure 5. Whooping crane corridor and observations.

Based on the above, it is considered possible that whooping cranes could occur almost anywhere within the Study Area during migratory periods, although the potential for such occurrence appears to be extremely low throughout and decrease from east to west. It is also believed that whooping cranes are much more likely to occur in the Study Area flying high overhead than they are to occur on the ground because the Study Area largely contains rocky and hilly upland habitats that are unsuitable for use by the species. Some potential does exist, however, for individuals of the species to very occasionally stopover within the Study Area. Habitats that likely provide the most attractive stopover sites within the Study Area include the margins of large reservoirs, any large stock tanks with marshy edges, any croplands occurring in the floodplains of the Colorado, Guadalupe, or other large rivers, and any other extensive croplands or managed pastures, especially if containing or lying near a large stock pond.

2.4.2.4 Sprague's Pipit

The Sprague's pipit is a small, ground-dwelling songbird that primarily inhabits shortgrass grasslands. On 15 September 2010 the Service determined the Sprague's pipit warrants protection under the ESA but listing was precluded by the need to address other listing actions of a higher priority. Sprague's pipit was designated by the Service as a candidate for listing until a listing proposal is introduced (75 FR 56028). The primary threat to the species is the loss of habitat primarily resulting from the conversion of grassland to agricultural lands and fire suppression (75 FR 56028).

Sprague's pipits breed in the northern Great Plains region of North America (Sibley 2000). The species is an uncommon migrant and a rare to local winter resident throughout central Texas (Lockwood and Freeman 2004). The species winters in the Coastal Prairies from Galveston County south to the Lower Rio Grande Valley; Post Oak Savannahs and Blackland Prairies from Williamson and Brazos Counties south through the Texas Brush Country; and agricultural areas in Hudspeth County, north-central Texas, and northwestern Edwards Plateau (Lockwood and Freeman 2004).

Although the wintering and migration ecology of the Sprague's pipit is poorly known, migrants and winter residents seem to prefer shortgrass grasslands and pastures with a heavy dependence on native prairies (75 FR 56028). During migration, Sprague's pipits seem mostly likely to occur in grasslands and pastures, but can occur in most any grassy habitat of appropriate height, including roadsides and clearings within woodlands (P. Sunby/SWCA, pers. obs.). Sprague's pipits arrive in their wintering grounds in early October and are present until mid-April (Lockwood and Freeman 2004).

Migrant Sprague's pipits have potential to occur in appropriate habitat throughout the Study Area. Tom Green County, Schleicher County, Sutton County, and the northwestern part of Kimble County have been identified as being within the wintering range of this species (Lockwood and Freeman 2004). Accordingly, Sprague's pipits may winter in grassland habitats along the length of the Twin Buttes–Big Hill route and in the western portion of the Big Hill–Kendall route. The potential for the Covered Activities to impact Sprague's pipit is discussed in Section 4.7.

2.4.2.5 Ocelot

The ocelot is a medium-sized, generally nocturnal cat that was listed as endangered in 1982 because of extensive habitat destruction and past predator-control operations in Texas (47 FR 31670). While the species occurs in Texas, its range lies largely in Mexico and Central and South America (Hall 1981, Tewes and Schmidly 1987, USFWS 1990b, Navarro-Lopez 1993). Ocelot is included as an evaluation species in this HCP because it appears on the TPWD Annotated List of Rare Species for Sutton County (TPWD 2010b). TPWD includes ocelot on its annotated list for Sutton County because the county lies near the northwestern boundary of the historic range of the species in Texas as mapped in the Schmidly (2004) edition of *The Mammals of Texas* (C. Brancel/TPWD, pers. comm. to SWCA on 22 January 2010).

The USFWS ocelot recovery plan identifies the entire Study Area as outside of the current or potential range of the species (USFWS 1990b). The potential range of the species is mapped by USFWS (1990) as limited to south Texas, and ending to the north nearest the Study Area in southern Kinney and Uvalde and northern Frio and Atascosa Counties. The northern limit of the mapped potential range lies approximately 65 to 80 miles (104 to 128 km) south of the southern limits of the Study Area. Delineation of the potential range of ocelot in Texas by USFWS (1990) was presumably based in part on historical records of the species, including a record held by TPWD of an ocelot killed on a roadway in 1989 in Kinney County. The two most recent records in the TPWD NDD for ocelot in the state outside of the southern tip of Texas are both from Maverick County; both were sight records from 1993 (TPWD 2010c). Both observations were reported approximately 110 miles southwest of the Study Area.

Known occurrence of ocelot in Texas is currently limited to two breeding aggregations in the southern portion of the state. One aggregation is in Cameron County in and around Laguna Atascosa National Wildlife Refuge. The other is a smaller group of ocelots in northern Willacy County on the privately owned Yturria Ranch (Laack 1991, Navarro-Lopez 1985, Shindle 1995, Tewes and Everett 1986). Both aggregations occur 240 miles (384 km) or more from the Study Area.

Ocelots prefer thick thornscrub communities in south Texas, and will apparently also utilize oak/mesquite forests (Navarro-Lopez 1985, Tewes 1986, Laack 1991, Shindle 1995, Horne 1998). Suitable habitats in south Texas seem to contain the following: a minimum structural density of greater than 85 percent vertical cover; a canopy height of over 6 feet (2 m); canopy coverage of almost 100 percent; silty and/or clayey loam soils; at least 8 out of 45 appropriate woody species; and, a minimum area of 98 acres (40 ha) per brush stand or 74 acres (30 ha) for two or more proximate brush stands (Tewes and Everett 1986; Shindle and Tewes 1998; Harveson et al. 2004).

Given the distance of the Study Area from known ocelot populations and its location outside of the potential range of the species as mapped by the Service, this species is not expected to occur regularly in the region. Consequently, construction of the Priority Projects is not considered capable of adversely affecting the ocelot, and this species will not be addressed further in this HCP.

2.4.2.6 Freshwater Mussels

The five previously identified freshwater mussels—golden orb, false spike, Texas pimpleback, Texas fatmucket and Texas fawnsfoot—were listed as threatened by the State of Texas in November 2009 (TPWD 2009b). The Service is currently reviewing the status of all five of these species to determine whether they warrant federal listing as threatened or endangered (TPWD 2009b). The current status of each of these species is poorly known, although the populations of all are believed to have declined greatly from historical levels as a result of degradation of water quality, habitat loss, over-harvesting, and competition from invasive exotic species (TPWD 2009b),

These five mussels are all riverine species that occurred historically within the watersheds of the Colorado and/or Guadalupe Rivers (Howells et al. 1996). Currently, these species are known from only a few localities; however, Texas watercourses have not been comprehensively surveyed, and populations likely exist in undocumented locations. The golden orb is currently known only from the upper and central Guadalupe River and one of its tributaries, the San Marcos River. The false spike is currently known only from the San Marcos River; the Texas pimpleback from the lower Concho, upper San Saba, and upper San Marcos Rivers; the Texas fatmucket from the upper Guadalupe River, upper San Saba River, Llano River, and Live Oak Creek (a tributary of the Pedernales River); and the Texas fawnsfoot from the upper Colorado River (Howells et al. 1996, USFWS 2009c, NatureServe 2010). Two of these mussel species (the golden orb and Texas fatmucket) occur within a State of Texas freshwater mussel sanctuary in the vicinity of the Permit Area. This sanctuary, one of 18 in the state, is on the Guadalupe River in the City of Kerrville. It extends from the Upper Guadalupe River Authority Dam (Kerrville Ponding Dam) downstream to Flat Rock Dam (31 TAC 57.157**)**. One other freshwater mussel sanctuary, a reach of Live Oak Creek in Gillespie County, occurs within the Study Area.

The five mussels are evaluated in this HCP because the proposed transmission lines will either cross watercourses in which these species occur or may have occurred historically, or will cross lands within the watersheds in which these species occur or historically occurred. The potential for the Covered Activities to impact these species is discussed in Section 4.8.

2.4.2.7 Tobusch Fishhook Cactus

The Tobusch fishhook cactus is a small, inconspicuous cactus that was listed as endangered by the Service in 1979 (44 FR 64736). At the time the cactus was listed, it was considered a distinct species, albeit closely related to a similar-looking fishhook cactus, *Ancistrocactus brevihamatus*. Taxonomy of these two cacti has since been revised and the two are now considered subspecies of *Sclerocactus brevihamatus*, with the former *A. brevihamatus* now known as shorthook fishhook cactus (*Sclerocactus brevihamatus* subsp. *brevihamatus*).

Tobusch fishhook cacti are usually solitary, somewhat hemispherical, and typically range from 1 to 6 inches (3 to 15 cm) tall (Poole et al. 2007). The plants can be very difficult to find when not in bloom; the primary blooming period is February and March. Flowers are yellow to greenish-yellow. The cacti grow on shallow, moderately alkaline, clay or clay loam soils developed over limestone (Poole et al. 2007). The plants typically occur on flat to gently sloping hilltops, but may also occur on more level areas on steeper rocky slopes and in rocky floodplains (Poole et al.

2007, USFWS 1987a). Vegetation where the cacti occur is typically open, with openings set within oak/juniper woodlands. Limestone on which the species occurs is usually the Edwards Formation or its stratigraphic equivalent (TPWD 1996).

The known range of this cactus is limited to the western Edwards Plateau of Texas, where it is known to occur in parts of Bandera, Edwards, Kerr, Kimble, Kinney, Real, Uvalde, and Val Verde Counties (Poole et al. 2007). Known locations for this species approach the Kerr/Gillespie and Kimble/Menard county lines (TPWD 2010a), so it seems possible that the cactus could also occur in Gillespie and Menard Counties. Potential exists for this cactus to occur along sections of the Big Hill–Kendall transmission line, but not the Twin Buttes–Big Hill transmission line.

Threats to this cactus were identified in its recovery plan as real estate development, cattle damage, natural habitat modification, and collection by cactus fanciers (USFWS 1987a). Poole et al. (2007) state that the cactus is a preferred host plant for a particular undescribed species of weevil (*Gerstaeckeria* sp.), and that the larvae of this weevil, which feed upon the cactus, have seriously reduced some of the largest known cactus populations in a matter of a few years.

A 5-year status review of Tobusch fishhook cactus was recently produced by the Service. This report indicates that 3,129 individual cacti were known to occur on lands managed by TPWD as of 2008 (USFWS 2010a). While the report indicates that the previously identified threats to the species remain, based on greater known range and a larger and currently stable population, the Service has recommended that the cactus be downlisted to threatened (USFWS 2010a).

2.5 PUBLIC LANDS

A list of State Parks, State Wildlife Management Areas, and substantial municipal parks occurring within the Study Area is provided in Table 5. Table 5 also identifies any federally listed threatened or endangered species known to occur on those lands.

Table 5. Public Lands Within the Study Area

Property	Location (County)	Distance from Permit Area	Endangered Species Present[1]		
			GCW[2]	BCV[3]	TFC[4]
State Parks					
South Llano River	Kimble	4 mi (6 km)	X	X	
State Wildlife Management Areas					
Kerr	Kerr	10 mi (16 km)	X	X	X
Old Tunnel	Kendall	15 mi (24 km)	X		
Walter Buck	Kimble	4 mi	X	X	X
Municipal Parks					
Kerrville-Schreiner[5]	Kerr	6 mi (10 km)			

[1] GCW = Golden-cheeked warbler, BCV = black-capped vireo, TFC = Tobusch fishhook cactus

[2] Sources: Campbell (2003), LCRA (2010a), TPWD (2007a, 2007c)

[3] Sources: Campbell (2003), Wilkins et al. (2006), TPWD (2007)

[4] Source: TPWD (2009c), USFWS (2010a)

[5] Several websites of unknown reliability mention both golden-cheeked warbler and black-capped vireo as occurring at Kerrville-Schreiner Park. No TPWD websites indicate either species occurs at this former State Park, now owned by the City of Kerrville, and their regular occurrence there is not expected.

3.0 PROJECT ALTERNATIVES

Section 10(a)(2)(A)(iii) of the ESA requires a permit applicant to identify in an HCP what alternative actions to the proposed taking were considered and the reasons why those actions are not being utilized. As discussed in Section 3.1, numerous alternative routes were identified for each of the Priority Projects and submitted to the PUC. Factors considered by the PUC in determining the best route to connect the end points of each line are also identified in Section 3.1. Once a route has been selected by the PUC, LCRA TSC has no authority to build anywhere but within that route. Notably, it seems highly probable that constructing either of the Priority Projects along any of the alternative routes would have resulted in impacts to listed species and their habitats. In other words, no configuration for any of the Priority Projects can be certain to completely avoid impacts to listed species habitat. Section 3.2 describes the proposed alternative; other alternatives considered by LCRA TSC are described in Sections 3.3, 3.4, and 3.5.

3.1 REVIEW OF PUC/CCN PROCESS

As discussed in Section 1.3.2.3, the PUC regulates the construction of electric transmission lines in the State of Texas under Texas Administrative Code, Title 16, Part II, Chapter 25. Construction of a new electric transmission line by LCRA TSC or any electrical utility must first be approved by PUC, with such approval typically given only if need for the line is demonstrated adequately and if routing for the line was conducted in accordance with PUC Substantive Rules (PUC §25.101), and factors outlined in PURA. With respect to CREZ transmission lines, including the Twin Buttes–Big Hill and Big Hill–Kendall projects, the PUC blanketly determined that need exists and directed their construction.

As established by the Texas Administrative Code, the PUC controls which entities can provide transmission utility service through the issuance of certificates of convenience and necessity (CCNs). A utility wanting to build a transmission line first applies to the PUC for a CCN.[11] An application to obtain a CCN must describe the proposed transmission line, the need for the line, and the impact that building the line would have on the environment and the affected community. Acquisition of a CCN from the PUC is a prerequisite to gaining PUC approval of a transmission line project.

Typically, a utility seeking to build a transmission line between two points will conduct a routing analysis that compares several alternate routes the line could travel to connect those points. The comparative routing analysis is preceded by a document known as an environmental assessment of a study area identified for purposes of routing between points. Routes are formulated considering environmental and other constraints within that area. The alternatives are then compared based on a series of measures identified in the environmental assessment to estimate the impact that construction of a transmission line along each route would likely have on the environment and the affected community.[12]

[11] Municipally owned utilities are not required to obtain a CCN prior to constructing transmission lines.

[12] These environmental assessments are not prepared in compliance with the National Environmental Policy Act as no federal agencies are directly involved in the PUC's authorization of transmission line construction.

In addition, the utility also reviews other routing criteria contained in the statute and the PUC's Substantive Rules that also inform the utility's decision on the routes that will be submitted for PUC review. The utility submits this environmental assessment and routing analysis to the PUC as part of its CCN application package, and in that package identifies its preferred route for the transmission line. As described by the PUC (2009), the commission then decides whether to approve the application for a CCN based on the submitted information, input from landowners and other members of the public, and consideration of the following factors identified in the PUC's rules as well as other additional and more general factors laid out in PURA:

- the effect of approving the application on the applicant and any other utilities serving the proximate area;
- whether the routes utilize existing compatible rights-of-way, including the use of vacant positions on existing multiple-circuit transmission lines;
- whether the routes parallel existing compatible rights-of-way;
- whether the routes parallel property lines or other natural or cultural features;
- whether the routes conform with the policy of prudent avoidance;
- presence of habitable structures in proximity to the line;
- the engineering constraints on constructing the line; and,
- the cost to construct the line.

If the PUC approves the application for a CCN, it then decides the route for the transmission line, with the final route not necessarily being the route identified as preferred by the utility in its application package. Once the final route is chosen by the PUC, the utility must construct the line along that route, with exceptions being that, under a highly restrictive set of guidelines, the utility can shift small portions of a route if such shifts do not engender cost increases or introduce other impacts. In the case of the Priority Projects, while LCRA TSC is building the lines in response to an initiative of the State of Texas rather than in response to identified need within its own service area, it still had to obtain a CCN for each Priority Project from the PUC.

Initially, the PUC assigned LCRA TSC four CREZ priority transmission line projects: Twin Buttes–Big Hill (formerly McCamey D), Big Hill (formerly McCamey D)–Kendall, Kendall–Gillespie, and Gillespie–Newton. Between 28 October 2009 and 28 July 2010, LCRA TSC submitted CCN applications to the PUC for the four projects. The applications for two of the projects, Twin Buttes–Big Hill and Big Hill–Kendall (the Priority Projects), were approved by the PUC and final routes identified in Orders dated 9 July 2010 (Docket No. 37778, Interchange Item 528) and 24 January 2011 (Docket No. 38354, Interchange Item 3625), respectively.

On 1 December 2010, the PUC issued an Order removing both the Gillespie–Newton and Kendall–Gillespie projects from the CREZ transmission plan and replaced them with cost-effective alternatives (Docket No. 38577, Item Interchange 137). Because the replacement projects consist of upgrading existing 138-kV transmission lines and are expected to occur within existing cleared right-of-way (ROW), no impacts to listed species or their habitat is expected to occur. Thus, LCRA TSC is not requesting coverage of activities associated with the replacement projects in the Permit and does not address those activities in this HCP.

3.2 PROPOSED ALTERNATIVE

The proposed alternative consists of construction, operation, maintenance, and repair of the Priority Projects. Both Priority Projects will be new, bundled conductor, 345-kV transmission lines, strung primarily on double-circuit capable lattice or pole structures as determined by the PUC. These structures will mostly range from 120 to 180 feet (36.6 to 54.9 m) tall and will be spaced at an average frequency of four to six structures per mile. All structures will space conductor lines sufficiently to prevent simultaneous contact with lines by raptors in order to avoid potential for electrocution.

Transmission lines will be designed to meet or exceed the electrical clearances specified by the National Electrical Safety Code (NESC) and with an appropriate clearance distance to vegetation based on North American Electric Reliability Corporation (NERC) Standard FAC-003-1. Transmission lines are traditionally constructed with naturally reflective materials that dull and darken over time due to oxidation. The proposed 345-kV transmission lines will be built using large-diameter, bundled (i.e., two lines per phase spaced 18 inches or 46 cm apart) conductors (wires carrying electrical current) in lower positions and using smaller-diameter shield wires in the uppermost (i.e., highest) position. Because these lines will be built within a region known to be occupied by endangered bird species, as discussed in later sections, LCRA TSC proposes to mark shield wires in selected locations (e.g., river crossings) to reduce avian collision risk.

Each Priority Project is described below; descriptions were adapted from LCRA (2010b). Typical methods that will be used to construct these transmission lines are described in Section 3.2.1. Construction schedules are provided in Section 3.2.2. Expected maintenance and repair activities are described in Section 3.2.3 and maintenance schedules are described in Section 3.2.4. Methods used to construct, operate, maintain, and repair the Priority Projects will adhere to measures intended to result in avoiding impacts to listed species not covered by this HCP and minimizing impacts to Covered Species to the maximum extent practicable. These measures are identified by species in Sections 4.0 and 5.0.

Twin Buttes–Big Hill Transmission Line

The Twin Buttes–Big Hill transmission line will connect the existing Twin Buttes Substation, located in northwestern Tom Green County, to the Big Hill Substation, located in northern Schleicher County, north-northeast of the City of Eldorado. This transmission line will be located in portions of Tom Green and Schleicher Counties (Figure 6).

Length of the Twin Buttes–Big Hill transmission line will be approximately 38 miles. The northernmost approximately 6.8 miles of the route for this line lies directly adjacent to an overhead transmission line. In this northernmost reach, the ROW will be 160 feet (48.8 m) wide. The rest of the Twin Buttes–Big Hill transmission line corridor will be 140 feet wide, with the exception of one 1,200-foot (366-m) section near a private airstrip that will be 200 feet (61 m) wide. In this HCP, for purposes of calculating impacts to Covered Species habitat and ensuring that incidental take is not underestimated, a ROW width of 160 feet is assumed for the entire line.[13]

[13] No habitat for Covered Species is present along the section of ROW that would be 200 feet wide.

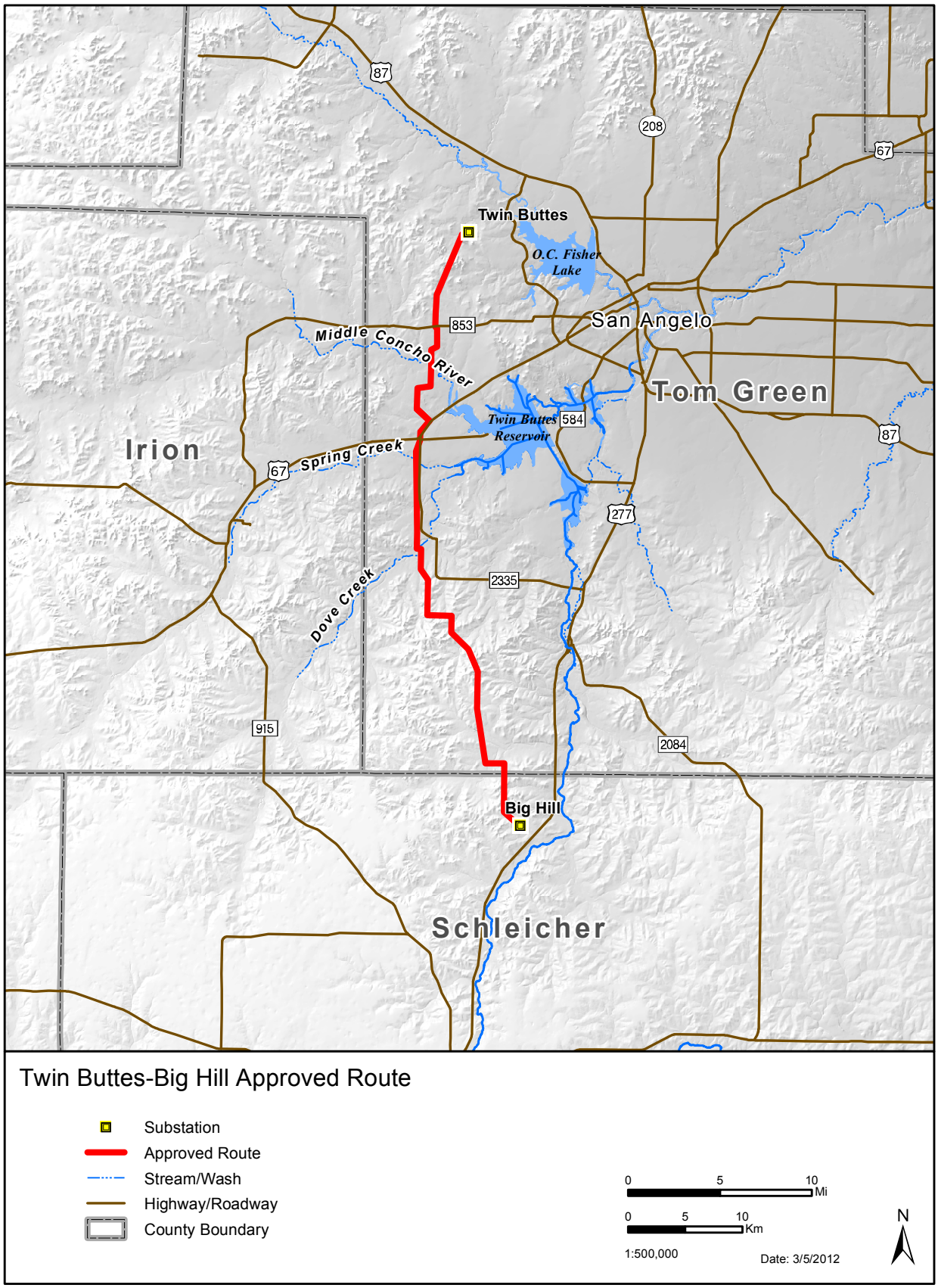

Figure 6. Twin Buttes-Big Hill approved route.

The transmission line will be a single-circuit, double-circuit capable 345-kV line. LCRA TSC will initially install one 345-kV circuit on the transmission line, and install a second 345-kV circuit when necessary.

As indicated on Figure 6, the transmission line will travel largely in a north-south direction to the west and southwest of the City of San Angelo and will cross westernmost Tom Green County and a portion of north-central Schleicher County. Approximately 6.2 miles (9.9 km) of the central portion of the selected route runs along and approximately 400 to 1,300 feet (122 to 396 m) west of F.M. 2335 and U.S. Highway 67. The remainder of the alignment travels largely across private lands except where it crosses public roadways. This transmission line will also cross the Middle Concho River, Spring Creek, and Dove Creek. The route lies approximately 6 miles (10 km) west of O.C. Fisher Reservoir and approximately 2.75 miles (4.5 km) west of Twin Buttes Reservoir.

Big Hill–Kendall Transmission Line

The Big Hill–Kendall transmission line will be an approximately 140-mile-long, double-circuit 345-kV line connecting the Big Hill Substation to the LCRA TSC Kendall Substation (Figure 7). LCRA TSC will install both circuits on this transmission line as it is constructed. Except for one short reach at the town of Junction, the ROW will be 140 feet wide. At Junction, the ROW will be 200 feet wide because of adjustments that must be made due to the proximity of the Kimble County Airport. As with the Twin Buttes–Big Hill project, for purposes of calculating impacts to Covered Species habitat and ensuring that incidental take is not underestimated, an ROW width of 160 feet is assumed for the entire line.

The Kendall Substation is located on Flat Rock Creek Road to the northeast of the community of Comfort in western Kendall County, approximately one mile (1.6 km) north of the Guadalupe River. The transmission line will cross through portions of Schleicher, Sutton, Kimble, Kerr, Kendall, and Gillespie Counties. As indicated on Figure 7, the Big Hill–Kendall alignment proceeds south, southeast out of the Big Hill Substation diagonally across Schleicher County, and passes through the northeastern corner of Sutton County into Kimble County.

At Rural Road 1674 (R.R. 1674) in western Kimble County, the route turns southward and parallels that road until intersecting Interstate Highway 10 (I-10). It then turns southeastward and parallels I-10 approximately 80 miles across Kimble and Kerr Counties (barely clipping the southwestern corner of Gillespie County), passing through the communities of Junction and Kerrville before reaching Comfort, Texas, just over the Kendall County line. Near Comfort, the route leaves I-10 and traverses approximately 2 miles cross-country to the Kendall Substation. This transmission line will cross the South Concho River, North Valley Prong and Middle Valley Prong of the San Saba River, North Llano River, and South Llano River.

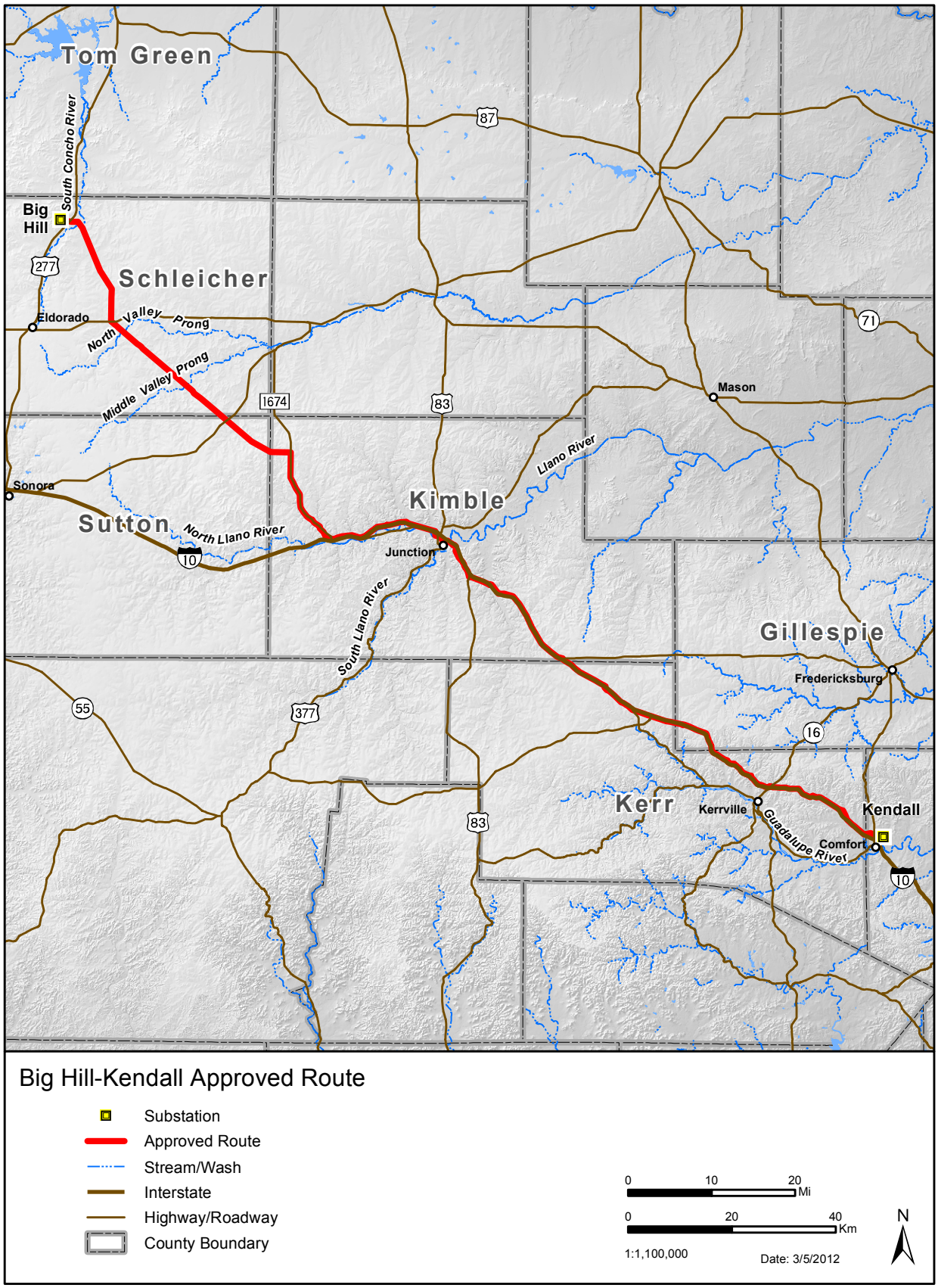

Figure 7. Big Hill-Kendall approved route.

3.2.1 General Transmission Line Construction Methods

Transmission lines are typically constructed in a four-step process: ROW preparation; structure erection; conductor and shield (static) wire installation; and cleanup. A general description of each of these steps is provided below. Information in this section was adapted from PBS&J (2009).

Relevant to all construction steps, water used for construction purposes is typically not taken directly from local streams or other bodies of water. If water from local streams is used, such use is limited to volumes that do not cause ecological harm or decrease local aesthetics.

ROW Preparation

LCRA TSC typically clears a transmission line ROW of trees and brush only to the extent needed to provide access and ensure safe operation of the line. Methods used for vegetation clearing are devised to take into account soil stability, prevention of silt deposition in watercourses, and practical measures for the protection of natural vegetation and adjacent resources (e.g., wildlife habitat). For the Priority Projects, a flail mower or similar equipment may be used to clear ROW instead of bulldozers with dirt blades, where such use would preserve the cover crop of grass, low- growing brush, and similar vegetation. Vegetation is typically removed in a straight path.

Grading of the ROW is typically not performed except if needed at structure locations, temporary storage areas, or set-up sites. However, LCRA TSC almost always establishes temporary storage areas and set-up sites outside of ROW in previously disturbed areas (e.g., vacant lots) suitable for such purpose. The establishment and use of temporary storage areas and set-up sites outside of the transmission line ROW are not included as Covered Activities.

Removal of vegetation and grading of construction areas is performed in a manner that minimizes potential for erosion and conforms to local topography. Vegetation is also removed in a manner that diminishes impacts to flora and fauna during the construction process. No vegetation is removed from a ROW until after a Stormwater Pollution Prevention Plan (SWPPP) has been prepared and a Notice of Intent has been submitted to the Texas Commission on Environmental Quality. To the extent these areas occur within the ROW, potential impacts to endangered species habitat resulting from grading activities will have been assessed as part of ROW clearing calculations discussed in Section 4.0. No grading will be performed in endangered species habitat outside of the ROW. Lay-down areas for the Twin Buttes–Big Hill have been identified and do not occur within potential habitat for listed species. Previously disturbed areas such as substations and parking lots are typically selected for lay-down areas, so it is expected that lay-down areas for the Big Hill–Kendall project will similarly occur outside of habitat for listed species.

The ROW provides the primary vehicular access to a transmission line alignment during construction operations. Because new ROW may cross lands where no roads existed previously, creating new ROW often involves installation or repair of fences and installation of gates. In areas with rugged topography or at stream and river crossings, limited ingress and egress through private property is often negotiated to reduce construction-related impacts. Such ingress and

egress may require the construction of new access roads, but can include the use of private roads. Newly constructed access roads are typically 20 feet (6 m) in width, except in curves, where clearing to 24 feet (7 m) in width, and up to 30 feet (9 m) in severe cases, can be necessary to allow large trucks and equipment to negotiate the roads. Smaller creeks and ephemeral tributaries are usually able to be crossed by vehicles. Temporary culverts may be used during the construction process to cross creeks and tributaries. For creeks in which culverts are not used, crossing may be facilitated through addition of clean rock or cobble to the creek bottom to ensure stability in wet weather.

During the construction phase, a two-track road typically develops from vehicle use in flatter portions of the ROW, while an access road may be constructed in more rugged areas. Constructed roads are provided with erosion-control measures, such as side drainage ditches and culverts in accordance with the SWPPP. Roads are stabilized if constructed on steep slopes. These roads are rarely maintained after construction ends, but are used for accessing the line for maintenance purposes, and may also be used by landowners and their assigns (e.g., hunters). If used with some regularity, these roads persist through time. If not, these roads typically revegetate naturally.

Structure Erection

Transmission line structures are provided with concrete foundations. Structure locations are first staked or otherwise marked, and soil testing is then performed to inform foundation design. Foundations are installed by construction crews. After the concrete has cured, crews erect the structures and install conductor and shield wire suspension assemblies. Equipment used to erect structures typically includes trucks and cranes. Conductor suspension assemblies include porcelain and/or polymer insulators. Shield wire provides lightning protection. Each structure is also grounded, either through use of an external ground rod or counterpoise. In some areas, structures are provided with avian-perch deterrents above suspension assemblies.

If any previously unassessed archeological materials are uncovered while installing foundations (or clearing vegetation for the ROW), construction is halted in the immediate area of the discovery and LCRA's Archeological Services are contacted promptly. Construction in the area will then not resume until the materials have been evaluated by an LCRA archeologist and measures have been taken to protect the materials commensurate with their significance.

Conductor and Shield Wire Installation

Conductors and shield wires are installed via a tensioning system. Tensioning systems typically use ropes threaded through stringing blocks or dollies for each conductor and shield wire. Conductor and shield wires are pulled by the ropes and held tight by a tensioner to prevent the wires from being damaged by contact with the ground and other objects.

During the stringing process, guard structures (temporary wood pole structures) are installed where the transmission line crosses roads or over other overhead utility lines, or any other areas where an additional margin of safety is deemed prudent during wire installation. After the wire is tensioned to the required sag, the wire is taken out of the stringing blocks and attached to the suspension assembly.

Cleanup

Cleanup operations are performed concurrent with, and after completion of, the transmission line construction process. Such operations involve removal of debris, stabilization of disturbed areas, and restoration of any items damaged during construction.

Construction equipment, materials, and supplies are dismantled as needed and removed from the ROW when construction is complete. Construction waste, with the possible exception of cut vegetation, is removed prior to completion of the project. Cut vegetation may be mulched, in which case it may be spread out over the ROW. Mulch may also be given to the landowner or to a local nursery as a product for beneficial use, or picked up and taken to a landfill. Cut vegetation is not typically burned, although burning may be used to dispose of vegetation if no other practical alternative exists. In no case is mulch ever left in piles where it could smother vegetation or be susceptible to fire.

Any soil excavated during construction and not used is evenly backfilled onto a cleared area and spread to conform to local terrain, or is removed from the site. Any soil replaced adjacent to water crossings is placed on a slope less than the normal angle of repose for that soil type.

During this phase, any temporary roads are removed and original contours are restored and revegetated as required by the SWPPP. If natural revegetation is considered incapable of providing ground cover in a reasonable length of time, seeding, sprigging, or hydro- seeding may be used in restored areas to encourage growth of ecologically desirable grasses and other vegetation. If site-specific factors make it unusually difficult to establish a protective vegetative cover, other restoration procedures, such as the use of gravel, rocks, or concrete, may be used to prevent erosion.

Unless otherwise agreed to or requested by the landowner, each affected landowner's property is returned to original contours and grades, except to the extent necessary to establish and maintain appropriate ROW and access to the transmission line.

3.2.2 Construction Schedules

The PUC is requiring LCRA TSC to have the two Priority Projects built and operational by the winter of 2013. In order to meet this mandate, LCRA TSC originally planned to commence construction of the Priority Projects no later than September 2011.

Typically, LCRA TSC clears the entire length of a ROW for new transmission line prior to erecting the structures and stringing the conductor and shield wire. However, for transmission lines of the length contemplated in this HCP, it is possible that erection of structures along one segment of the line could occur concurrently with clearing of ROW along a different segment. It is planned that clearing of the ROW more than 300 feet away from known or potential habitat for the Covered Species will commence upon Permit issuance. Clearing of the ROW within 300 feet of known or potential habitat for the golden-cheeked warbler and black-capped vireo will, to the extent practicable, be completed during the fall and winter of 2012–2013 while members of those species are on their wintering grounds. In the event that clearing cannot practicably be avoided in the Covered Species' breeding seasons, LCRA TSC will coordinate any clearing activity with the Service in order to minimize impacts.

Priority Project line structures are planned to be erected following clearing of the ROW, with conductors and shield wires strung thereafter. These activities are expected to continue into late 2013, with complete facilities testing in the winter of 2013 prior to becoming fully operational that same season.

3.2.3 Maintenance and Repair

LCRA TSC performs periodic inspection of transmission line ROW, structures, and line in order to provide a safe and reliable transmission line. Inspections are typically performed by driving the ROW, although aerial inspections are also sometimes performed. Inspections include searches for soil erosion problems and fallen timber, and observation of the condition of vegetation. As an erosion- control measure, native shrubs, forbs, or grasses may be planted where deemed necessary.

The primary ROW maintenance activity is the removal of trees and other woody vegetation that poses a potential danger to the conductors or structures, or prohibits access. Native vegetation, particularly that of value to wildlife, that does not impair access or endanger the safe operation and maintenance of the transmission line is typically allowed to grow in selected parts of the ROW. Herbicides are not typically used for vegetation maintenance purposes. However, if used, only EPA approved herbicides will be used and they will be applied in accordance with Recommended Protection Measures for Pesticide Applications in Region 2 of the U.S. Fish and Wildlife Service (White 2004) as described below to minimize effects on desirable indigenous plant life.

Herbicides will only be applied to woody vegetation that is a potential threat to the reliability of the transmission line. Applicators using mechanized equipment in ROW corridors will use either liquid streams or relatively coarse sprays to minimize spray drift into species habitat. Herbicides will not be used when rainfall is likely to occur within 24 hours after treatment. All use of herbicides will be done in compliance with the herbicide label requirements for dilution, application, disposing of rinse water, and disposing of empty containers. Herbicides or herbicide rinsate will not be disposed of in or near any water bodies (White 2004).

A list of all maintenance and repair activities that could be performed in Priority Project ROW is provided in Table 6. It is intended that any adverse effects to the Covered Species arising from performance of any of the activities identified in Table 6 would be authorized by the requested Permit. To minimize potential impacts, routine maintenance activities that have the potential to affect the Covered Species will, to the extent practicable, be performed outside of the species' breeding season. Should it be necessary for any such activities to occur during the breeding season, LCRA would apply the conditions for emergency activities, as outlined in Section 5.6.5.1.

Table 6. Maintenance and Repair Activities that May be Performed in CREZ Transmission Line ROW

Manual clearing of vegetation	Gate repair	Structure replacement
Application of herbicides	Line replacement	Insulator repair/replacement
Access road repair	Line tensioning	Installation of bird diverters
Fence repair	Structure repair	Mowing / shredding

Access roads and service roads, where practical, are maintained with native grass cover. Where grading is necessary, access and service roads are graded to the proper slope to prevent or reduce soil erosion.

As indicated in Table 6, it may be necessary for LCRA TSC to replace transmission line structures during the life of the Permit. Any non-emergency replacement of structures that are located within 300 feet (91.5 m) of Covered Species habitat will be performed outside of the breeding seasons for the respective species.

Substation maintenance is typically performed on routine and as-needed bases. Except for any work that may be needed to repair access roads, substation maintenance typically occurs within the fence that surrounds a substation.

3.2.4 Maintenance Schedules

Maintenance inspection intervals for the Priority Projects will be established by LCRA TSC. Typically, ROW inspections are performed at a frequency of once every three years. Routine maintenance activities will be endeavored to be performed when access roads are firm or dry. The planned maintenance schedule is expected to preclude black-capped vireo habitat from developing within previously wooded and cleared ROW.

3.3 NO ACTION ALTERNATIVE

An alternative considered by LCRA TSC was a “no action” alternative, meaning it would not seek the Permit from the Service to authorize the disturbance and/or removal of listed species habitat and take of listed species during construction, maintenance, and repair of the Priority Projects. LCRA TSC does not have the authority to construct the transmission lines along any alignments other than those ordered by the PUC. Therefore, in considering the No Action alternative, LCRA TSC first examined whether it was possible to construct transmission lines along the routes selected by the PUC without violating Section 9 of the ESA. Since potential Covered Species habitat occurs along the alignments for both Priority Projects, LCRA TSC determined that by minimizing clearing of potential habitat and conducting all clearing *and construction* outside of the breeding seasons of the Covered Species, it would reduce the risk of “take” of the Covered Species to the point that seeking a voluntary permit under the ESA would not be warranted. There are numerous existing transmission lines crossing habitat for the Covered Species which are not covered under any ESA permit.

This alternative was rejected because it would result in increased costs, increased safety and reliability concerns (due to the uncleared rights-of-way), and no conservation benefit for the Covered Species.

3.4 MAXIMUM TAKE AVOIDANCE

One of the alternatives considered by LCRA TSC was employing measures under a Section 10(a) Permit to avoid potential impacts to the Covered Species to the greatest extent practical. While alternative route selection might be one way to minimize impacts to the Covered Species, neither the LCRA TSC nor the Service have the authority to select alternative routes, as that action is solely within the legal authority and discretion of the PUC. Moreover, in the case of the

Priority Projects, no routes considered by the PUC would have completely avoided Covered Species habitat. Therefore, the Maximum Take Avoidance alternative would involve LCRA TSC's implementation of the following measures:

- Restrict all clearing and construction to times when the Covered Species are not present on their breeding grounds to avoid the potential for such activities to directly impact the birds or their eggs and nests;
- Avoid to the maximum extent practicable clearing of ROW in all Covered Species habitat; and
- String conduit via helicopter to minimize the amount of Covered Species habitat that would need to be cleared within the ROW to allow vehicle access.

Placing tower structures in areas of potential habitat, however, could not be avoided in all cases because some patches of potential habitat are too broad to be spanned between any two structures of the height that must be used for the Priority Projects. In addition, the reduced level of habitat impacts under this alternative would also result in a concomitant reduction in mitigation for the Covered Species and in increased costs and greater safety and reliability concerns for LCRA TSC. Increased costs would result from the need for acquisition of additional off-easement ROW access. Additional cost might also be incurred through the use of taller structures to enable the spanning of more modestly sized patches of habitat. Minimizing the clearing of woody vegetation within the ROW would increase the chance that vegetation could interfere with the transmission lines, increase the chance of wildfire being sparked by the lines, and reduce the ability of LCRA TSC to access structures for maintenance and repair purposes. For these reasons, LCRA TSC rejected this alternative.

Another conceivable method of minimizing Covered Species impacts would be boring underneath habitat and placing the lines underground. This, however, is enormously impractical and expensive and would require significant clearing and other ground disruption, and does not, therefore, qualify as a reasonable or feasible alternative.

3.5 INDIVIDUAL PERMITS

LCRA TSC considered applying for an individual Section 10(a)(1)(B) permit for each of the Priority Projects included in this HCP. This alternative held the benefit of perhaps precluding the delay of gaining Service approval for one of the Priority Projects if gaining approval for the other project proved problematic. However, this approach is inefficient. While not necessarily doubling the effort it would take to obtain one permit covering both projects, seeking two individual permits would greatly increase the amount of work required by the Service and LCRA TSC to achieve the same results expected to be gained by covering both projects under one permit. Preparation of habitat conservation plans that must accompany any application for an incidental take permit is an expensive endeavor, requiring many hours of biological and legal review and drafting, and Service resources to review such plans are limited. While information contained in separate habitat conservation plans would likely be similar, the Service would still be required to review thoroughly each habitat conservation plan. After coordination with the Service regarding this alternative, it was rejected on the basis of inefficiency.

3.6 SUMMARY OF PUBLIC INVOLVEMENT AND AGENCY COORDINATION

As described in Section 3.1, above, LCRA TSC was initially tasked by the PUC in 2009 to construct four CREZ priority transmission lines (Twin Buttes–Big Hill [formerly McCamey D], Big Hill [formerly McCamey D]–Kendall, Kendall–Gillespie, and Gillespie–Newton). The latter two projects have since been removed from the CREZ Program and are not included in this HCP. They were, however, still under consideration during the initial HCP planning process. Thus, the public involvement and agency coordination efforts reported in this section include references to those two transmission lines as well as to the Priority Projects.

Since the time LCRA TSC was charged with the task of building the four projects, it has issued press releases, published notices in various newspapers, and held many open houses regarding the projects. The press releases, notices, and open houses served to solicit public input as part of the transmission line routing analyses, and acted as community outreach intended to educate the public with regard to the purpose of, and need for, the projects. A summary of public involvement performed to date for the four transmission lines is provided in Table 7. Additional public meetings regarding the Section 10(a)(1)(B) permitting process were held in April 2010 in various municipalities within the Study Area.

During the routing analyses for the four original CREZ projects, LCRA TSC representatives also contacted appropriate federal and State resource agencies and governmental entities to solicit their opinions regarding sensitive issues in areas that may be crossed by the transmission lines. LCRA TSC also sent solicitation letters to various municipalities, River Authorities, Farm Bureaus, and other organizations located within the Study Area. Table 8 identifies the federal and state agencies and governmental councils contacted during the routing analyses. LCRA TSC first met with the Service on 7 August 2009 to introduce the Priority Projects and discuss potential for their construction to take listed species.

Table 7. Summary of Public Participation for the LCRA TSC CREZ Transmission Lines

Event	Date	Location	Subject/Purpose
All Four Transmission Lines			
Meeting	22 Sept 08	Llano	Discuss CREZ and CREZ projects at Llano County Commissioners' Court
Meeting	1 Oct 08	Blanco	Discuss CREZ and CREZ projects with Pedernales River Panel
Meeting	16 Oct 08	Abilene	Discuss CREZ and CREZ projects at Assoc. of West Texas Counties Conference
Meeting	12 Nov 08	Boerne	Discuss CREZ and CREZ projects with Kendall County Farm Bureau
Meeting	12 Dec 08	Llano	Discuss CREZ and CREZ projects with Llano River Panel
Open House	5 Feb 09	Harper	Discuss CREZ and CREZ projects with Pedernales River Panel
Meeting	23 Mar 09	Kerrville	Discuss CREZ and CREZ projects at Kerr County Commissioners' Court
Open House	23 Mar 09	Whiskey Ridge	Discuss CREZ and CREZ projects
Meeting	24 Mar 09	Lampasas	Discuss CREZ and CREZ projects at LCRA/San Saba/Llano Regional Council mtg
Press Release	1 April 09	n/a	General info. on all four transmission lines

Table 7. Summary of Public Participation for the LCRA TSC CREZ Transmission Lines

Event	Date	Location	Subject/Purpose
Meeting	14 Apr 09	Buchanan Dam	Discuss CREZ projects with Texas Farm Bureau
Meeting	8 May 09	Fredericksburg	Discuss CREZ projects with Mayor of Fredericksburg, City Manager, and Director of Utilities
Press Release	21 May 09	n/a	Solicit public input on routes
Meeting	21 May 09	Round Mountain	Discuss CREZ projects at LCRA Pedernales Regional Council mtg
Meeting	26 May 09	Fredericksburg	Discuss CREZ projects at Texas Farm Bureau mtg
Press Release	17 Sept 09	n/a	Announce request to extend CCN application deadline to allow for the study of additional transmission line routes
Press Release	24 Sept 09	n/a	Announce extended CCN application deadline to allow for the study of additional transmission line routes
Twin Buttes–Big Hill, Big Hill–Kendall			
Meeting	10 Mar 09	Junction	Discuss CREZ projects at Kimble County Commissioners' Court
Meeting	23 Mar 09	Kerrville	Discuss CREZ and CREZ projects with City of Kerrville
Meeting	26 Mar 09	Menard	Discuss of CREZ projects with Menard County Judge
Open House	4 May 09	San Angelo	Provide information and gather public input
Open House	5 May 09	Christoval	Provide information and gather public input
Open House	7 May 09	Junction	Provide information and gather public input
Open House	11 May 09	Harper	Provide information and gather public input
Meeting	12 May 09	Junction	Discuss 7 May open house and answer questions from Kimble County Judge and County Commissioners, and general public at Kimble County Commissioners' Court
Open House	12 May 09	Comfort	Provide information and gather public input
Open House	14 May 09	Kerrville	Provide information and gather public input
Meeting	15 May 09	Austin	Discuss CREZ projects with Rural County Judges' Association
Meeting	27 May 09	Kerrville	Discuss CREZ projects with Tierra Linda Home Owners' Association
Meeting	8 Jun 09	Junction	Presentation and Q&A session at Junction City Council mtg
Meeting	Jun 09	Junction	Discuss CREZ projects at Kimble County Farm Bureau mtg
Press Release	15 Jan 10	n/a	Announce filing of CCN application for the Twin Buttes–Big Hill transmission line
Press Release	1 Jul 10	n/a	Announce PUC-selected route for the Twin Buttes–Big Hill transmission line
Kendall–Gillespie, Gillespie–Newton			
Open House	21 Feb 09	Settlers Ridge	Discuss LCRA TSC CREZ public involvement process
Open House	5 Mar 09	Settlers Ridge	Discuss LCRA TSC CREZ projects
Meetings	13 Apr 09	Fredericksburg	Discuss CREZ and CREZ projects with Gillespie County Commissioners and Gillespie County Judge
Open House	4 May 09	Lampasas	Provide information and gather public input
Open House	5 May 09	Burnet	Provide information and gather public input
Open House	7 May 09	Llano	Provide information and gather public input
Open House	11 May 09	Fredericksburg	Provide information and gather public input
Open House	12 May 09	Comfort	Provide information and gather public input
Press Release	28 Oct 09	n/a	Announce filing of CCN application for the Gillespie–Newton transmission line

Table 7. Summary of Public Participation for the LCRA TSC CREZ Transmission Lines

Event	Date	Location	Subject/Purpose
Press Release	16 Jun 10	n/a	Announce suspension of further development of the Gillespie–Newton transmission line
Big Hill–Kendall, Kendall–Gillespie			
Open House	15 Feb 10	Junction	Provide information and gather public input
Open House	16 Feb 10	Menard	Provide information and gather public input
Open House	17 Feb 10	Mason	Provide information and gather public input
Open House	18 Feb 10	Fredericksburg	Provide information and gather public input
Open House	22 Feb 10	Eldorado	Provide information and gather public input
Open House	23 Feb 10	Kerrville	Provide information and gather public input
Open House	24 Feb 10	Sonora	Provide information and gather public input
Press Release	28 Jul 10	n/a	Announce filing of CCN application for the McCamey D (Big Hill)–Kendall–Gillespie transmission line
Press Release	24 Aug 10	n/a	Request for public input regarding the McCamey D (Big Hill)–Kendall–Gillespie transmission line
Meeting	1 Sep 10	Austin	State Office of Administrative Hearings (SOAH) hearing for the McCamey D (Big Hill)–Kendall–Gillespie transmission line
Press Release	15 Sep 10	n/a	Announce three settlement conferences (Eldorado, Junction, Fredericksburg) for the McCamey D (Big Hill)–Kendall–Gillespie transmission line
Press Release	20 Jan 11	n/a	Announce PUC-selected route for the McCamey D (Big Hill)–Kendall–Gillespie transmission line. Also announce decision that the Kendall–Gillespie transmission line is no longer needed; replaced by upgrade of existing facilities

Table 8. Federal and State Agencies and Governmental Councils Solicited by PBS&J on behalf of LCRA TSC for Comment on the CREZ Transmission Line Projects

Agency/Entity	Twin Buttes–Big Hill	Big Hill–Kendall	Kendall–Gillespie[1]	Gillespie–Newton
Alamo Area Council of Governments	X	X	X	X
Capital Area Council of Governments			X	X
Central Texas Council of Governments			X	X
Federal Aviation Administration	X	X	X	X
Federal Emergency Management Agency	X	X	X	X
Natural Resources Conservation Service	X	X	X	X
Texas Commission on Environmental Quality	X	X	X	X
Texas Department of Transportation	X	X	X	X
Texas Historical Commission	X	X	X	X
Texas Parks and Wildlife Department	X	X	X	X
Texas Water Development Board	X	X	X	X
U.S. Army Corps of Engineers	X	X	X	X
U.S. Environmental Protection Agency	X	X	X	X
U.S. Fish and Wildlife Service	X	X	X	X
Concho Valley Council of Governments	X	X	X	X

Table 8. Federal and State Agencies and Governmental Councils Solicited by PBS&J on behalf of LCRA TSC for Comment on the CREZ Transmission Line Projects

Agency/Entity	Twin Buttes–Big Hill	Big Hill–Kendall	Kendall–Gillespie[1]	Gillespie–Newton
Texas Department of Transportation, Department of Aviation	X	X	X	
City of San Angelo, District Engineer	X	X	X	
City of San Antonio, District Engineer	X	X	X	
City of Austin, District Engineer	X	X	X	

4.0 IMPACT ASSESSMENT

The potential for construction, maintenance, and repair of the Priority Projects to impact the Covered and Evaluation Species is discussed below. A discussion of how these species could be affected by climate change is presented in Section 4.11 following the individual species accounts.

4.1 GOLDEN-CHEEKED WARBLER

As previously indicated, the entire Twin Buttes–Big Hill transmission line alignment lies outside of the range of the golden-cheeked warbler. Therefore no direct or indirect impacts to this species will result from the building of this line and its associated access roads.

The golden-cheeked warbler breeding range does, however, extend across much of the alignment for the Big Hill–Kendall project. Potential exists for construction of this transmission line to result in the removal of some potential golden-cheeked warbler habitat as part of ROW clearing. The precise amount of potential golden-cheeked warbler habitat that will need to be cleared for the Big Hill–Kendall project is unknown at this time because the ultimate need for some clearing is not determined until a final design has been prepared. For example, discovery of an impassable rock ledge during the ROW preparation phase could preclude expected access through the ROW and instead create need for a short loop of access road to be cleared through adjacent golden-cheeked warbler habitat. Given the assessment of expected impact based on known location of the Big Hill–Kendall transmission line alignment, the Priority Projects could result in the direct impact of up to 298.0 acres (120.6 ha) of potential golden-cheeked warbler habitat and indirectly impact up to an additional approximately 848.0 acres (343.2 ha) of potential habitat, for a total impact to habitat of 1,146.0 acres (463.8 ha).

The potential for golden-cheeked warblers to be affected by the Big Hill–Kendall transmission line project is discussed below.

4.1.1 Direct Impacts to Golden-cheeked Warblers

Few, if any, direct impacts to golden-cheeked warblers are expected during the construction and maintenance phases of the Big Hill–Kendall project. The clearing of all known and potential golden-cheeked warbler habitat (to be identified as described in Section 4.1.2) will be conducted during the times of year when golden-cheeked warblers are not present on their breeding grounds

(1 September through end of February). In the event that a clearing activity cannot be avoided during the golden-cheeked warbler breeding season, LCRA TSC will coordinate that clearing activity with the Service to avoid or minimize the potential for vegetation clearing activities to destroy occupied nests or harm recently fledged but still relatively immobile young (see Changed Circumstances Section 5.6.5.1).

Clearing of woody vegetation in or within 300 feet of known or potential golden-cheeked warbler habitat as part of routine ROW and access road maintenance activities will also be scheduled to occur during the period of 1 September through the end of February. If an emergency situation were to demand removal of woody vegetation within known or potential golden-cheeked warbler habitat during the period of 1 March through 31 August, LCRA TSC will not remove that vegetation without first having a qualified biologist search for, and verify absence of, active golden-cheeked warbler nests in that vegetation, unless the severity of the emergency did not permit such a search to be conducted (e.g., an outage at the top of a structure could create need for immediate removal of tree limbs to allow an emergency repair crew to travel the ROW and reach the structure). In general, the transmission line ROW and access roads are expected to be maintained in an accessible condition so it is not expected that any emergency clearing of woody vegetation will ever result in direct loss of golden-cheeked warblers. The emergency clearing of habitat would be considered to be one of the Covered Activities for which mitigation is provided in advance and authorized by the Permit (see Section 5.4 for a discussion of mitigation coverage for emergency and other unanticipated activities). However, the need to clear golden-cheeked warbler habitat in the breeding season as a result of an emergency without prior notification to the Service is treated as a Changed Circumstance (see Section 5.6.5.1)

The stringing of conductor and shield wires could potentially harm or destroy golden-cheeked warbler nests if that stringing took place during the golden-cheeked warbler nesting season and in areas where occupied habitat was present along the centerline of a ROW. During a stringing operation, slack conductor or shield wire can sag down into the tops of trees. If a warbler nest were present beneath a sagging line, it could be knocked from the tree or have its contents crushed. The likelihood of such an event occurring seems to be extremely low both because most potential warbler habitat is expected to be cleared from beneath the centerlines of the ROW and because it is highly improbable that an active warbler nest would happen to be present at the exact point where a line sags into a tree.

LCRA TSC will seek to avoid altogether the potential for such direct loss to occur by stringing conductor and shield wire across any uncleared warbler habitat during the time of year in which warblers are not expected to be present (1 September through the end of February). However, depending on the timing of permitting, weather, etc., construction schedules may not allow for all stringing of conductor and shield wire across warbler habitat outside of the breeding period (1 March–31 August). If stringing of line must occur during that period and across known or potential golden-cheeked warbler habitat, LCRA TSC will inform its work crews of the danger that the stringing operation could pose to golden-cheeked warblers and require the crews to take all steps possible to avoid having line sag into the tops of trees. This will include keeping lines taut between structures through use of a land-based tensioning system. Helicopters will not be used to string line across known or potential golden-cheeked warbler habitat during the period of 1 March through 31 August in order to avoid the potential for overtly disturbing golden-cheeked warblers.

In addition, where stringing of the line must occur during the golden-cheeked warbler breeding season and across known or potential warbler habitat, to the extent practicable, LCRA TSC will employ the use of a biological monitor in the field who will establish the status of golden-cheeked warblers in the vicinity of the work area to the extent allowed by site access and coordinate with the Service in order to minimize the likelihood of direct impacts to active nests. The use of such monitors may not be possible in all cases because of the possibility that the stringing of line could be occurring concurrently at multiple locations, thus overwhelming the ability of LCRA TSC to supply a sufficient number of monitors. It is expected that the use of tensioning systems reduces to near zero the potential for active warbler nests to be damaged during the stringing process, and LCRA TSC believes that retaining golden-cheeked warbler habitat in the ROW wherever possible is preferable in the long-term to clearing that habitat up-front in order to avoid the potential for damage to nests to occur during the very brief period of time in which the stringing of line would occur.

Transmission lines pose a collision risk for many avian species (Faanes 1987, Manville 2005). Hence, completion of the proposed projects will create the risk of post-construction direct loss of golden-cheeked warblers through collision with the transmission lines, although we believe that risk to be very low. The potential for collision mortality to occur as a result of the Big Hill–Kendall project is discussed below.

4.1.1.1 Collision Risk

Construction of the proposed Big Hill–Kendall transmission line within the breeding range of the golden-cheeked warbler may create a collision risk for the species, although the magnitude of that risk is likely small. Collisions risks associated with this project represent a very small percentage increase in the number of collision risks on the landscape in the region. Existing collision risks include transmission lines, distribution lines, guyed and un-guyed radio and television towers, cellular phone towers, and windows in homes and other buildings.

We are not aware of any records of golden-cheeked warblers having collided with transmission lines. Important to this discussion, and later discussions concerning the potential indirect impact of transmission line construction, is that golden-cheeked warblers regularly occur directly adjacent to transmission line ROW and routinely cross their cleared ROW. SWCA has observed warblers exhibiting this behavior along many ROWs in several different counties over its nearly 20-year history of conducting surveys for the species (P. Sunby/SWCA pers. obs). Consequently, assuming that some sections of these transmission lines cross patches of golden-cheeked warbler habitat, it is expected that golden-cheeked warblers will continue to occur in woodlands adjacent to the cleared ROW following construction and, thus, in immediate proximity to the overhead transmission lines.

Based on SWCA observations of golden-cheeked warblers, the birds typically fly below or only slightly above the tops of trees when moving from tree to tree through their territories. Trees in habitats used by golden-cheeked warblers average 18 to 22 feet (5.5 to 6.6 m) tall and are usually less than 30 feet (9.1 m) tall, although deciduous trees (e.g., cedar elm), if present along creeks, can sometimes reach heights of 50 to 60 feet (15.2 to 18.3 m) on the east side of their breeding range (Ladd and Gass 1999, P. Sunby/SWCA pers. obs.). As indicated, the proposed transmission line wires will be a minimum of 35 feet above ground and more than 24 feet above

the top of any uncleared woody vegetation in a ROW. Thus, the wires will be above the height at which golden-cheeked warblers typically fly when in their habitat. The lowest lines, or those that will be closest to tree canopy and the zone in which warblers typically travel, will be conductors. Conductors for 345-kV transmission lines have a diameter of approximately one inch (2.5 cm). Golden-cheeked warblers are diurnal, do not perform aerial displays, and are not expected to fly well above tree height at times when visibility conditions are extremely poor (Ladd and Gass 1999). Rather, given the response of migrating songbirds to fog, if heavy fog or some other event creates extremely poor visibility conditions, it is expected the birds would stay low and fly through the trees to maintain points of reference (Shackelford et al. 2005). It is also expected that the birds would fly through trees to escape any predator that might actively pursue them (e.g., a sharp-shinned hawk [*Accipiter striatus*]) rather than fly up and away from trees (Ladd and Gass 1999). Consequently, the wires are expected to be visible to golden-cheeked warblers at those times when birds can be expected to be flying above canopy height, and the birds are not expected to be flying in the general vicinity of wires when under duress and perhaps being more susceptible to being distracted and vulnerable to collision. Therefore, in general, the transmission line is not expected to pose a significant collision risk for the species.

The risk of collision would seem to be somewhat greater in rugged topography, where wires could be crossing a canyon between structures built on the tops of adjacent ridges. In such a situation, the low point of the transmission line between the structures could be hundreds of feet above the bottom of the canyon, but still at an elevation equal to that of the tree canopy present on the upper slopes of the ridges supporting the structures. If a golden-cheeked warbler were to fly across the canyon from ridge to ridge, it could intersect the zone occupied by the conductor and shield wires. However, the visibility of the wires would minimize the potential for warblers to collide with those wires. Risk of collision would also seem to be somewhat greater for warblers that occupy woodlands adjacent to transmission line ROW for a few seconds each spring and summer as they passed through the elevation zone occupied by the transmission lines upon arrival from, and departure for, their wintering grounds. Such flights can be expected to occur at night, when visibility conditions are not good.

The risk posed by the transmission lines to warblers crossing canyons and to warblers as they first arrive from, and depart for, their wintering grounds, while real, appears to be of comparatively low magnitude. Brown and Drewien (1995) conducted a study of the effectiveness of different types of power line markers on reducing avian collision mortality. The study was conducted over three spring and three fall migration periods and involved both transmission and distribution lines. A total of 597 mortalities were found along the power lines during the study, with approximately 84 percent of those mortalities attributable to collision (the other 16 percent were attributable to other causes such as collision with fences, predation, lead poisoning, shooting, etc.). Of the 597 mortalities, 39 (6.5 percent) were identified as passerine birds. The bulk (89.9 percent) of the mortality was comprised of larger birds such as ducks, geese, sandhill cranes, American coots (*Fulica americana*), raptors, owls, and gamebirds. The study area was relatively flat and primarily contained agricultural fields so it is not a particularly good surrogate for the Priority Project Study Area. However, the results of the study match those of other studies (e.g., Janss and Ferrer 1998), which generally suggest that larger, less mobile birds are at greater risk of collision with transmission lines than are smaller, more agile birds.

Ultimately, whether or not golden-cheeked warblers would ever collide with the proposed transmission lines is unknown. While construction of the Big Hill–Kendall project would create a marginal collision risk for golden-cheeked warblers that would not exist in absence of the projects, that risk is considered to be very low given that the wires will be placed at heights well above those at which golden-cheeked warblers typically travel. Consequently, while the possibility cannot be ruled out conclusively that golden-cheeked warbler collision mortality could occur, it is considered unlikely that significant mortality would occur as a result of any of the Covered Activities. As such, few, if any, direct impacts to golden-cheeked warblers are expected to result from the Priority Projects.

4.1.2 Habitat Impacts

Table 1 (p. 17) shows that modeling performed by Morrison et al. (2010), LAI (2008), and Diamond (2007) identified from 4,148,138 to 4,378,400 acres of potential golden-cheeked warbler habitat across the breeding range of the species. As these numbers suggest, known or potential habitat for the golden-cheeked warbler is nearly pervasive on the Edwards Plateau and, as a practical manner, potential habitat for the golden-cheeked warbler is expected to be impossible to avoid completely in an economically feasible fashion for transmission lines of the length contemplated in this HCP.

No impacts to warbler habitat are expected as a result of construction of the Twin Buttes–Big Hill transmission line as its route lies outside of the breeding range of the species. However, much of the Big Hill–Kendall transmission line and associated access roads will be constructed within the range of the golden-cheeked warbler. The clearing of ROW and access roads for this line is expected to result in the loss of some golden-cheeked warbler habitat. In general, the clearing of golden-cheeked warbler habitat can adversely affect the species by reducing in size, or eliminating completely, patches of woodland occupied by the species, increasing susceptibility of the species to predation and nest parasitism by brown-headed cowbirds, and altering microclimatic conditions within habitat patches by opening them up to sun and wind, thereby potentially altering woodland species composition or prey availability. Not all of these threats are of equal concern, with outright loss of habitat considered to be most important. Potential to alter microclimatic conditions is considered of minor concern since most woodlands occupied by golden-cheeked warblers do not have a completely closed canopy and already contain natural or constructed clearings and breaks and, so, are subject to exposure to sun and wind.

LCRA TSC will mitigate for impacts to golden-cheeked warbler habitat as described in Section 5.4.1. Sections 4.1.2.1 through 4.1.2.3 describe the methods that will be used to delineate potential golden-cheeked warbler habitat and quantify in acres the direct and indirect impacts to that habitat expected to result from construction of the Priority Projects, specifically the Big Hill–Kendall transmission line. The number of acres of habitat expected to be directly and indirectly impacted will then be used to identify appropriate levels of mitigation.

4.1.2.1 Habitat Delineation Methodology

Golden-cheeked warbler habitat in the Permit Area was identified initially based on habitat modeling performed by LAI (2008). The LAI model identifies potential golden-cheeked warbler

habitat at a 30-m (98-foot) pixel resolution.[14] Geographic Information System (GIS) software was used to overlay the selected route centerline and the habitat model on recent aerial photography so that the habitat as modeled by Loomis-Austin could be refined. The boundaries of areas identified as habitat in the model were smoothed to follow actual limits of woodland. Any areas identified as habitat seen to have been cleared since the modeling was performed were removed from the habitat delineation. Conversely, any areas not identified in the model as potential golden-cheeked warbler habitat that appeared to LCRA TSC to be suitable for the species were added to the delineation. This delineation was performed out to a distance of 1,600 feet (488 m) from either side of the ROW.

The Big Hill–Kendall transmission line route was visited by SWCA in March and April 2011 to field truth the initial warbler habitat delineation. The final warbler habitat delineation was completed based on the results of the field assessments. Any woodland identified initially as warbler habitat was removed from the delineation after the field verifications if the woodland was found to actually not meet the definition of golden-cheeked warbler habitat as described by the TPWD in Campbell (2003). Any woodland was added to the delineation if not previously delineated but found to match the TPWD habitat definition. As Campbell (2003) provides a broad and general description of golden-cheeked warbler habitat, the final golden-cheeked warbler habitat delineation is believed to overestimate the amount of occupied warbler habitat actually present along the transmission line route.

4.1.2.2 Direct Habitat Impacts

Upon completion of the final habitat delineation, GIS software was used to draw the projected maximum 160-foot ROW limits onto the golden-cheeked warbler habitat delineation. All woodland identified as potential golden-cheeked warbler habitat that occurs within the limits of the 160-foot-wide ROW was initially considered as being directly impacted (removed) by construction. This method is anticipated to result in an estimate of maximum potential impact because it is expected that the majority of the cleared ROW will be narrower than the 160-foot width assumed in the analysis, and that the ROW will not be cleared to its full width along its entire length. It is especially likely that clearing of the ROW will not be necessary (or perhaps even possible) on some steep canyon slopes that also happen to support potential golden-cheeked warbler habitat.

Based on this methodology, the maximum amount of golden-cheeked warbler habitat that would be directly impacted by clearing of the ROW for the Big Hill–Kendall transmission line is approximately 270.9 acres (109.6 ha). LCRA TSC will seek to minimize direct warbler habitat impacts in the design phase by avoiding habitat and reducing cleared ROW widths where practicable. Typically, the final construction plans for a transmission line are determined

[14] This model used 2001 satellite imagery of Central Texas woodland cover to identify potential golden-cheeked warbler habitat. Essentially all woodland within the range of the golden-cheeked warbler was identified as potential habitat in this model. In addition, because of the 30-m resolution of the satellite imagery, the model also captures and identifies as potential habitat some areas that are not wooded. Because it is known that not all woodland in Central Texas supports the golden-cheeked warbler and that the model identifies some obvious non-habitat as habitat, the model provides a very liberal delineation of potential habitat. The model was chosen for use here because it allows for a very conservative estimate of expected project-related impacts.

following the preliminary design after project engineers are able to physically inspect the ground to view topographic and vegetative conditions at each site selected provisionally for a transmission structure. It is at this time that need for any access roads outside of the ROW will be identified.

Once the construction plans for the Big Hill–Kendall line have been finalized, the actual number of acres of known and potential golden-cheeked warbler habitat that would be directly impacted by clearing of the ROW and access roads for that line will be determined using the final habitat delineation. It is expected that considerations such as patch size and patch configuration will be taken into account in making determinations of direct habitat impact. These numbers will then be submitted to the Service for its concurrence.

4.1.2.3 Indirect Habitat Impacts

Golden-cheeked warblers occupy both the "interior" and "edges" of woodland, although some studies (e.g., Peak 2007) have shown that golden-cheeked warblers experience decreased nesting success and increased predation rates closer to the edges of woodland than they do within the interior of woodlands. Consequently, the clearing of woodland for the transmission line ROW and associated access roads could create new woodland edges that result in deleterious effects on golden-cheeked warblers. Clearing of woodland could also result in loss of viability of habitat by decreasing habitat patch sizes. For example, depending on the size of a patch of woodland, the clearing of a 160-foot-wide ROW through the center of the patch could render the woodland remaining on either side of the ROW too small to further support golden-cheeked warblers. Because access roads would be much narrower (mostly 20 to 24 feet in width), any clearing of habitat for these features is not expected to result in deleterious reductions in overall habitat patch sizes.

To account for the potential for clearing of transmission line ROW and associated access roads to indirectly affect the viability of adjacent warbler habitat through the introduction of new habitat edges and reduction in habitat patch sizes, all golden-cheeked warbler habitat occurring within 300 feet of newly created habitat edges will be considered to lose some of its viability to indirect impacts resulting from the clearing of ROW and access roads. To account for this loss in viability, the LCRA TSC will provide compensatory mitigation at a ratio of 0.5 acre of mitigation to each acre of habitat thus indirectly affected. This methodology has been consistently applied by the Service in other Section 10(a)(1)(B) permits issued for the golden-cheeked warbler since the species was listed as endangered.

Using the final habitat delineation, GIS software was used to simulate the removal of golden-cheeked warbler habitat from within the projected limits of the ROW (the direct habitat impact) and then to identify the amount of golden-cheeked warbler habitat that would occur within 300 feet of the edge of the ROW to quantify the amount of warbler habitat that would potentially be subject to indirect loss of habitat viability as a result of the ROW clearing. Because in some cases the edge of the transmission line ROW would lie within 300 feet of warbler habitat but clearing for the ROW would not result in the removal of any of that habitat (and, hence, not result in the creation of any new habitat edges), this methodology results in an estimate of maximum potential impactto golden-cheeked warbler habitat that would be subject to indirect impacts as a result of clearing of the Big Hill–Kendall transmission line ROW. Nonetheless,

based on this methodology, the total amount of potential golden-cheeked warbler habitat occurring within 300 feet of the edge of ROW, representing the maximum amount of potential habitat that could be indirectly impacted by clearing of the ROW for the Big Hill–Kendall transmission line, is approximately 770.9 acres.

LCRA TSC will seek to minimize indirect warbler habitat impacts in the design phase by avoiding the clearing of habitat where practicable. Because quantification of indirect impact is based simply on the amount of habitat present within 300 feet of a cleared edge, reducing the width of ROW clearing would have little effect on the amount of habitat considered to be indirectly impacted.

Once the construction plans for the Big Hill–Kendall transmission line have been finalized, the actual number of acres of known and potential golden-cheeked warbler habitat expected to be indirectly affected by clearing of the ROW and associated access roads for that line will be determined using the methodologies described above. Based on known distribution of golden-cheeked warbler habitat along the Big Hill–Kendall transmission line alignment, occurrence of the alignment (within the range of the golden-cheeked warbler) almost wholly adjacent to highways, constraints imposed by topography, and common presence of existing ranch roads on properties that would be crossed by the transmission line, it is expected that few, if any, access road will need to be constructed for any substantial length through golden-cheeked warbler habitat at distances greater than 300 feet from the edge of the transmission line ROW. As a result, it is further expected that most golden-cheeked warbler habitat identified as occurring within 300 feet of edges created by clearing for access roads will also occur within 300 feet of edges created by ROW clearing. Thus, clearing for access roads is not expected to newly expose much golden-cheeked warbler habitat to potential edge effects that was not already exposed to the potential for such indirect impacts as a result of clearing for the ROW.

Existing ranch roads are anticipated to be used in most instances as off-easement ROW access roads. Where the clearing for those roads has caused an open gap in woodland canopy to be present in excess of 16 feet (4.9 m) in width, but the gap needs to be widened to 20 feet or more to make the road passable by the equipment needed to construct the transmission line, indirect impact will be assessed only to that golden-cheeked warbler habitat that is made to newly occur within 300 feet of the road edge. This is because the widening of the road will not create a new habitat edge, it will only shift the location of that edge relative to the adjacent habitat, and because road use is not known to disturb golden-cheeked warblers (Lackey et al. 2011). For example, if a 5-foot (1.5 m) wide swath of warbler habitat along a 300-foot long road had to be removed to widen that road, in addition to the 5-foot by 300-foot direct habitat impact caused by the clearing, an indirect habitat impact would be assessed to that 5-foot swath of habitat that previously occurred 300 to 305 feet (91.5 to 93.0 m) from the old edge of the road, but that would now occur from 295 to 300 feet (89.9 to 91.5 m) away from the new edge.

4.1.2.4 Total Direct and Indirect Habitat Impacts

To account for direct and indirect habitat impacts expected to be caused by the construction of access roads, as well as other potential sources of take that cannot be quantified at this time (e.g., clearing of habitat that may be necessitated by an emergency maintenance activity), LCRA TSC has added a 10 percent contingency to the amount of habitat expected to be directly and

indirectly impacted through clearing of the Big Hill–Kendall transmission line ROW. The resultant total of direct and indirect impacts to the golden-cheeked warbler habitat is summarized in Table 9. As shown in Table 9, the direct impact to golden-cheeked warbler habitat is estimated to total 298.0 acres, and the indirect impact is estimated to total 848.0 acres. The total direct and indirect impact to golden-cheeked warbler habitat is hereinafter referred to as "Maximum Authorized GCWA Habitat Impacts."

As indicated in Table 9, based on the preliminary assessment performed for the Big Hill–Kendall project as identified above, the Maximum Authorized GCWA Habitat Impacts is 1,146.0 acres. This represents approximately 0.028 percent and 0.026 percent, respectively, of the potential golden-cheeked warbler habitat identified by LAI (2008) and Diamond (2007) across the range of the golden-cheeked warbler. It also represents approximately 0.100 percent and 0.092 percent, respectively, of the habitat as identified by LAI (2008) and Diamond (2007) present in the golden-cheeked warbler recovery regions (Recovery Regions 6 and 7) that encompass the Study Area. In addition, it also represents approximately 0.133 percent of the potential golden-cheeked warbler habitat as identified by Diamond (2007) in the counties that encompass the Study Area. It is important to note that it is expected that the habitat indirectly affected (848.0 acres) would remain extant on the landscape. This represents approximately 74 percent (848.0 / 1,146.0 = 0.7399) of the habitat represented in the Maximum Authorized GCWA Habitat Impacts.

Table 9. Summary of Golden-cheeked Warbler Habitat Impacts under the Proposed Alternative

Direct Habitat Impacts		Indirect Habitat Impacts		Total Habitat Impacts in Acres (ha)
Direct Habitat Impact in Acres (ha)	Direct Plus Contingency Factor (10%)[1]	Indirect Habitat Impact in Acres (ha)	Indirect Plus Contingency Factor (10%)	
270.9 (109.6)	**298.0 (120.6)**	**770.9 (312.0)**	**848.0 (343.2)**	**1,146.0 (463.8)**

The total habitat impact will be spread across dozens of miles of transmission line, so the amount of habitat impact in any particular area will be relatively small. Depending on the amount of habitat available in a particular area, the level to which it was occupied, and the degree to which the habitat was already subjected to indirect effects as a result of having been crossed by roads and utility ROW, this amount of clearing could cause nothing more than shifts in local golden-cheeked warbler territory boundaries. In smaller habitat patches, this amount of clearing could conceivably be sufficient to result in the displacement of golden-cheeked warblers from the affected patches.

LCRA TSC will mitigate for the total number of acres of known and potential golden-cheeked warbler habitat expected to be directly and indirectly impacted by transmission line construction as described in Section 5.4.1.

4.1.3 Other Indirect Impacts to Golden-cheeked Warblers

In our experience, the Service has, in Section 7 consultations and in Section 10(a)(1)(B) permit negotiations with other applicants, traditionally considered the noise and activity associated with construction projects as having potential to disturb golden-cheeked warblers. Such disturbance is also then typically considered by the Service to have potential to result in take through the Section 9 prohibitions on harassment and harm. As discussed in Section 2.4.1.1., the known regular occurrence of golden-cheeked warblers on heavily visited state parks and active military reservations such as Fort Hood and Camp Bullis, and the results of a recent three-year study by Lackey et al. (2011) on the effects of road construction activity and noise on golden-cheeked warblers, suggest strongly to us that golden-cheeked warblers acclimate readily to human activity and sources of anthropogenic noise.

Further indication that golden-cheeked warblers acclimate to anthropogenic noise and human activity was observed during the habitat assessments performed along the Big Hill–Kendall transmission line alignment by SWCA in the spring of 2011. During these assessments, SWCA observed two different golden-cheeked warblers in woodland set between the east- and west-bound travel lanes of I-10. One of these birds, seen near the City of Junction in Kimble County, was considered likely to have its entire territory contained within the median of I-10. The other bird, in Kerr County, was observed to cross into the I-10 median from the north, crossing an approximately 250-foot (76.2 m) gap that contains a frontage road and the west-bound travel lanes of I-10, the latter of which are traversed by regular, loud automobile and truck traffic traveling at speeds up to 80 miles per hour (128 kph).

Based on the information provided above, if construction of the Big Hill–Kendall transmission line must occur in proximity to golden-cheeked warbler habitat during the breeding season for the species, we believe it is extremely unlikely that the noise and activity generated by such construction would cause disturbances to golden-cheeked warblers at levels great enough to result in take of individual birds. However, for the purposes of this HCP and identifying the amount of golden-cheeked warbler habitat expected to be indirectly impacted as identified in Sections 4.1.2.3 and 4.1.2.4, all golden-cheeked warbler habitat occurring within 300 feet of the projected edge of transmission line ROW was identified as indirectly impacted as a result of the Proposed Alternative. However, because it is known that in some cases the clearing of ROW may not result in the direct disturbance of golden-cheeked warbler habitat that occurs within 300 feet of the edge of ROW, and because construction activities performed within 300 feet of warbler habitat may be performed fully outside of the warbler breeding season, the actual amount of habitat identified as indirectly impacted is expected to be less than that identified in Sections 4.1.2.3 and 4.1.2.4 when final determinations of direct and indirect habitat impact are calculated and submitted to the Service for its concurrence. Final pre-construction impact assessments are described in Section 4.3.

4.1.4 Cumulative Effects

Service regulations define “cumulative effects” under the ESA as “those effects of future State or private activities, not involving federal activities, that are reasonably certain to occur within the

action area of the Federal action subject to consultation[15]" (50 CFR 402.02). For purposes of ESA Section 7 consultation, effects are defined as "the direct and indirect effects of an action *on the species or critical habitat*, together with the effects of other activities that are interrelated or interdependent with the action, that will be added to the environmental baseline" (50 CFR 402.02; emphasis added). Conversely, under the National Environmental Policy Act (NEPA), "cumulative impacts" are "the impact *on the environment* that 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; emphasis added). Thus, the cumulative effects analysis for ESA purposes differs from the NEPA cumulative impacts analysis in at least two ways: (1) Unlike the NEPA analysis, the ESA analysis looks only at future actions that are reasonably certain to occur (as opposed to past and future actions); and (2) unlike the NEPA analysis, the ESA analysis looks only at those actions carried out by non-federal entities. Below, we analyze potential cumulative effects under the ESA.

When evaluating cumulative effects, the Service will look only to those cumulative effects that are reasonably certain to occur *within the relevant action area*. Service regulations define "action area" as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR 402.02). In other words, the action area is the area in which direct and indirect effects of the issuance of an incidental take permit to LCRA TSC are felt. For purposes of this HCP, we believe the appropriate action area encompasses the ROW for each of the two Priority Projects, the footprint of all related facilities, plus an area that would include all indirect effects where those routes cross or are adjacent to potential Covered Species habitat. This is consistent with other ESA Section 7 consultations on transmission lines. For example, in consultations on both the CPS Energy Cagnon–Kendall transmission line and the LCRA TSC's Medina Lake transmission line the Service defined the action area as the ROW plus 300 feet on either side of the ROW to the extent within potential habitat.

With regard to the golden-cheeked warbler, to account for indirect impacts, potential habitat was delineated out to a minimum distance of 300 feet from the edge of a 160-foot-wide ROW and will be delineated out to a minimum distance of 300 feet from the cleared edges of access roads. Therefore, we consider the action area for this species to be limited to those lands which lie within 380 feet (116 m) of either side of the ROW centerline of the Big Hill–Kendall project and within 300 feet of the cleared edges of its access roads.

One project expected to occur at least partially within this action area is the construction of two series compensation stations along the Big Hill–Kendall transmission line. Series compensation stations compensate for drops in voltage that occur inherently when large currents are

[15] The Service's Consultation Handbook states that "the concept of cumulative effects is frequently misunderstood as it relates to determining likely jeopardy or adverse modification…The reasonably certain to occur clause is a key factor in assessing and applying cumulative effects…Indicators of actions 'reasonably certain to occur' may include, but are not limited to: approval by State, tribal or local agencies or governments that granting authority for the action is initiation of contracts. The more State, tribal or local administrative discretion remaining to be exercised before a proposed non-Federal action can proceed, the less there is a reasonable certainty the project will be authorized. Speculative non-Federal actions that may never be implemented are not factored into the 'cumulative effects' analysis" (Handbook at 4-30).

transmitted over long distances. The two stations will be sited and constructed by AEP-ETT (American Electric Power – Electric Transmission of Texas), with each appearing generally similar to a substation. At this time, LCRA TSC has no knowledge of the actual footprints, locations, or scheduling of construction of these series compensation stations. However, it is expected that one would be constructed west of the City of Junction and the other east of Junction, and that each station would result in the disturbance of approximately 50 acres of land. While locations for these stations are not known to LCRA TSC, it can be expected that they will be constructed where land is reasonably flat. Very little potential golden-cheeked warbler habitat occurs along the Big Hill–Kendall transmission line route to the west of the City of Junction, and land where potential habitat does occur in that direction is not reasonably flat. Therefore, it seems most likely that construction of the western series compensation station will result in few, if any, impacts to golden-cheeked warbler habitat. Potential golden-cheeked warbler habitat occurs more extensively to the east of the City of Junction, although still mostly in areas where land is not particularly flat. There is greater potential for construction of the eastern series compensation station to result in direct or indirect impacts to golden-cheeked warbler habitat, but the extent to which this will happen, if it happens at all, is unknown at this time.

Except for a short segment of alignment that runs between the Kendall Substation and U.S. Highway 87 in Kendall County, all of the Big Hill–Kendall alignment that traverses potential golden-cheeked-warbler habitat runs close to I-10 and R.R. 1674. Any construction or maintenance work associated with these roadways would be federally funded or state-funded projects. Other than the roadways, most of the land use bordering the transmission line is rural; therefore, non-federal and non-state activities reasonably expected to occur within the action area would be related to livestock grazing and farming, and land may be cleared for these purposes. Some land clearing and/or construction activities for other purposes (e.g., commercial and residential structures and maintenance of county roads that cross or parallel I-10) are likely to occur in the action area within and adjacent to the communities of Junction, Kerrville, and Segovia, and, possibly, along R.R. 1674.

Many of the counties in the Study Area have increasing human populations and, based on recent history, it can be expected that growth in many of these counties will continue. This suggests that some limited commercial and residential construction and installation of other utilities would occur in the future in the action area, regardless of the route. Golden-cheeked warbler habitat is relatively widespread across the central and eastern portions of the Study Area and its presence may conflict with the locations of some desired projects.

The amount of potential golden-cheeked warbler habitat present within 300 feet of the edge of the approved Big Hill–Kendall ROW is estimated to total approximately 770.9 acres. Another 77.1 acres of indirect impact is provided for through the 10 percent contingency to be caused by construction of access roads, for a total of 848.0 acres of warbler habitat estimated to occur in the action area outside of areas assumed to be cleared for the transmission line ROW and access roads. It is not possible to estimate how much of that habitat may be affected as a result of future non-federal activities other than the Priority Projects; however, it is unlikely to be a substantial amount because very little of the approved Big Hill–Kendall route (or any alternative route) traverses fast-growing urban and suburban areas. Even if the entire 848.0 acres of potential habitat outside the ROW were lost, which is highly unlikely and not expected, that amount combined with the 298.0 acres of potential habitat that may be directly lost within the Priority

Project ROW and to construction of access roads (see Table 9) would equal a very small percentage of the total amount of golden-cheeked warbler habitat in the state. The total amount of potential habitat estimated to be within the action area, 1,146 acres, is only approximately 0.028 percent of the 4,148,138 acres of golden-cheeked warbler breeding habitat estimated to be in Texas by Morrison et al. (2010).

Moreover, the loss of habitat attributable to the Priority Project combined with reasonably foreseeable activities in the action area would be spread across dozens of miles of transmission line. Local effects are expected to be minor and not cause a significant change in the number of golden-cheeked warblers occurring in the region. As such, habitat impacts are not expected to preclude recovery of this species.

It is also assumed that future development projects in the action area would be conducted in compliance with all applicable local, state, and federal environmental regulations. It is therefore expected that the Service would have the opportunity to examine the effects that such clearing could have on the golden-cheeked warbler at the time those projects occurred.

4.2 BLACK-CAPPED VIREO

The breeding range of the black-capped vireo extends across the entire Study Area (USFWS 1991). Therefore, potential exists for black-capped vireo habitat to occur on suitable geology across the Study Area and for construction of the Priority Projects to result in the loss of some vireo habitat as part of ROW clearing. As for the golden-cheeked warbler, prior to route selection, preliminary review of possible transmission line routes was performed to identify how much black-capped vireo habitat might occur along those routes and be impacted by the Covered Activities. Upon route selection, the potential for impacts was further assessed through field inspection of most of the Twin Buttes–Big Hill route in early September and early October 2010 and most of the Big Hill–Kendall route in March and April 2011. Supplemental assessments were performed along the Twin Buttes–Big Hill alignment in April 2011 and both alignments in November 2011. As a result of these efforts, it has been determined that the Priority Projects could result in the direct impact of up to 544.4 acres (220.3 ha) of potential black-capped vireo habitat and indirectly impact up to an additional approximately 1,902.1 acres (769.7 ha) of potential habitat, for a total impact to habitat of 2,446.5 acres (990.0 ha). The potential for direct and indirect impacts to the black-capped vireo and its habitat is discussed in detail in the following sections.

4.2.1 Direct Impacts to Black-capped Vireos

Few, if any, direct impacts to black-capped vireo are expected to occur during the construction and maintenance phases of the Priority Projects. Clearing of all known and potential black-capped vireo habitat (to be identified as described in Section 4.2.2) during the construction phase of the projects will be conducted during the times of year when vireos are not present on their breeding grounds (1 October through end of February). This will avoid the potential for clearing activities to destroy occupied nests or harm recently fledged but still relatively immobile young.

Clearing of woody vegetation in or within 300 feet of known or potential black-capped vireo habitat as part of routine ROW maintenance activities will also be scheduled to occur during the

period of 1 October through the end of February. If an emergency situation were to demand the cutting of woody vegetation within known or potential black-capped vireo habitat when black-capped vireos may be present, 1 March–30 September, LCRA TSC will not remove that vegetation without first having a qualified biologist search for, and verify absence of, active black-capped vireo nests in that vegetation, unless the severity of the emergency did not permit such a search to be conducted. Such clearing would be considered to be one of the Covered Activities for which mitigation is provided in advance and authorized by the Permit (see Section 5.4 for a discussion of mitigation coverage for emergency and other unanticipated activities). However, the need to clear black-capped vireo habitat in the breeding season as a result of an emergency without prior notification to the Service is treated as a Changed Circumstance (see Section 5.6.5.1).

LCRA TSC owns and operates many hundreds of miles of transmission lines and has done so for decades. Because of this experience, it knows that emergency situations and the need for non-routine, non-emergency clearing of vegetation are both rare events. Given that black-capped vireo habitat is distributed irregularly along the ROW for the Priority Projects, there is only an extremely small chance that emergency work or non-routine, non-emergency clearing would occur in potential black-capped vireo habitat during the nesting season (1 March–30 September). Consequently, as noted above, few, if any, direct impacts to black-capped vireo are anticipated as a result of these activities. In general, the transmission line ROW are expected to be maintained in an accessible condition so it is not expected that any emergency clearing of woody vegetation would ever result in direct loss of black-capped vireos.

As discussed for the golden-cheeked warbler, the stringing of conductor and shield wires could potentially harm or destroy black-capped vireo nests if that stringing was performed during the black-capped vireo nesting season and in areas where occupied habitat was present along the centerline of a ROW. LCRA TSC will seek to avoid altogether the potential for such direct loss to occur by stringing conductor and shield wire across any uncleared black-capped vireo habitat during the time of year in which vireos are not expected to be present (1 October through the end of February). However, depending on the timing of permitting, weather, etc., construction schedules may not allow for all stringing of conductor and shield wire across vireo habitat outside of the breeding period (1 March–30 September). If stringing of line must occur during that period and across known or potential black-capped vireo habitat, LCRA TSC will inform its work crews of the importance of avoiding line sag into the tops of trees and shrubs during stringing operations and will take care to avoid that circumstance by requiring use of a tensioning system when stringing line across vireo habitat to prevent line sag. Helicopters will not be used to string line across known or potential black-capped vireo habitat during the period of 1 March through 30 September in order to avoid the potential for overtly disturbing black-capped vireos.

Where stringing of the line must occur when black-capped vireos may be present (1 March–30 September) and will occur within potential or known black-capped vireo habitat, LCRA TSC will place a biological monitor in the field and coordinate with the Service in order to minimize the risk of direct impacts to black-capped vireos. As discussed for the golden-cheeked warbler, the use of monitors may not always be possible because the number of concurrent stringing activities could overwhelm the ability of LCRA TSC to provide qualified monitors. The stated risk could absolutely be avoided altogether by clearing all potential black-capped vireo habitat

from the ROW, but the long-standing benefit that minimization of clearing would have on black-capped vireos and other wildlife is believed to far outweigh the risk that the stringing of line could pose to nesting vireos over the course of what is likely to be one day in any particular area.

As also discussed for golden-cheeked warblers, transmission lines pose a collision hazard for many avian species. Hence, completion of the proposed projects could conceivably create the risk of post-construction direct loss of black-capped vireos through collision with the transmission lines, although we believe that risk to be very low. The potential for collision mortality to occur as a result of the Priority Projects is discussed below.

4.2.1.1 Collision Risk

Construction of the Priority Projects within the breeding range of the black-capped vireo may create a collision risk for the species, although the magnitude of that risk is likely small. The Priority Projects would represent a very small percentage increase in the number of collision risks on the landscape in the Study Area. Existing collision risks include transmission lines, distribution lines, guyed and un-guyed radio and television towers, cellular phone towers, and windows in homes and other buildings.

There are no documented records of black-capped vireos having collided with transmission lines. However, there are documented records of black-capped vireos regularly occurring within and directly adjacent to transmission line ROW. SWCA has observed vireos occurring along many transmission lines in several different counties over its nearly 20-year history of conducting surveys for the species (P. Sunby/SWCA pers. obs.). Consequently, assuming that some sections of these transmission lines cross patches of black-capped vireo habitat, it is expected that black-capped vireos will continue to occur in shrublands within and adjacent to the ROW following construction and, thus, in immediate proximity to the overhead transmission lines.

Based on our observations of black-capped vireos and published descriptions of their behavior (e.g., Grzybowski 1995), the birds typically fly below or only slightly above the tops of trees and shrubs when moving through their territories. Trees and shrubs in habitats used by black-capped vireos are usually less than 15 feet (4.6 m) tall, although some trees can sometimes reach heights of 25 feet (7.6 m) or so (P. Sunby/SWCA pers. obs.). As discussed for the golden-cheeked warbler, in most areas the transmission lines would be a minimum of 35 feet above ground. Thus, the transmission lines would be well above the height at which black-capped vireos typically fly when in their habitat and so, in general, the transmission lines are not expected to pose a significant collision risk for the species.

Unlike golden-cheeked warblers, it seems highly unlikely that black-capped vireos would fly across a canyon from ridge to ridge. Consequently, the only time black-capped vireos appear likely to pass through the elevation zone that would be occupied by the transmission lines would be upon arrival from, and departure for, their wintering grounds. Like golden-cheeked warblers, black-capped vireos are nocturnal migrants, so visibility would not be good when the birds could be expected to be passing through the transmission line zone. Nonetheless, the collision risk posed by the transmission lines to black-capped vireos as they first arrive from, and depart for, their wintering grounds, appears to be of comparatively low magnitude for the same reasons discussed for the golden-cheeked warbler.

Ultimately, whether or not black-capped vireos would ever collide with the proposed transmission lines is unknown. While construction of the Priority Projects would create a collision risk for black-capped vireos that would not exist in absence of the projects, that risk is considered to be very low given that the lines will be placed at heights well above those at which black-capped vireos typically occur and their exposure to the elevation zone of those lines is likely limited to no more than a matter of seconds each year. Consequently, while the possibility cannot be ruled out conclusively that black-capped vireo collisions could occur, collision mortality is not expected to result from any of the Covered Activities. As such, few, if any, direct impacts to black-capped vireos are expected to result from the Priority Projects.

4.2.2 Habitat Impacts

Sections 4.2.2.1 through 4.2.2.3, below, describe the methods used to delineate black-capped vireo habitat and quantify in acres the direct and indirect impacts to black-capped vireo habitat expected to result from construction of the proposed transmission lines. The number of acres of habitat expected to be directly and indirectly affected (reported in Sections 4.2.2.2 and 4.2.2.3, below) will then be used to identify appropriate levels of mitigation. LCRA TSC will mitigate for impacts to black-capped vireo habitat as described in Section 5.4.2.

4.2.2.1 Habitat Delineation Methodology

Unlike golden-cheeked warbler habitat, black-capped vireo habitat is generally difficult to identify on standard aerial photographs. This is because the shrubs utilized by the species are not always visible on aerial photography, and because, even when shrubs are visible, it is not possible to accurately gauge shrub heights or identify shrub species composition.

Nonetheless, potential black-capped vireo habitat present along each of the Priority Project routes was identified initially through review of aerial photography. Identified potential habitat was then cross-checked through review of geologic maps. Distribution of black-capped vireo habitat correlates strongly with outcrop of carbonate rocks, especially the Edwards Formation and its stratigraphic equivalents. During the field reconnaissance performed to date, much of the vegetation identified conservatively through review of aerial photography as “potential” habitat that did not occur on carbonate substrates was eliminated from the delineation of black-capped vireo habitat. It was eliminated because it was found not to support the shrub species preferred by the black-capped vireo, or did not support shrubs in the densities required by the bird. It should be noted that the absence of carbonate formation does not indicate the absence of the species, or habitat for the species, and that all sections of transmission line ROW will ultimately be assessed in the field for presence of black-capped vireo habitat regardless of surface geology.

Ultimately, a final habitat delineation will be reached through the completion of field visits once access to all lands crossed by the selected routes is obtained. Any vegetation identified provisionally as potential black-capped vireo habitat will be removed from the final delineation after the field verifications if the vegetation is found to actually not meet the definition of black-capped vireo habitat as described by the TPWD in Campbell (2003). Exception will be made for seemingly suitable vegetation developed on non-carbonate substrate because the TPWD definition of habitat includes the statement that black-capped vireo habitat occurs on “rocky limestone soils” (Campbell 2003). Conversely, vegetation observed in the field will be added to

the final delineation if it meets the TPWD definition of habitat but was missed in the remote delineation of "potential" black-capped vireo habitat. To date, field verifications have largely resulted in the subtraction of habitat from the initial delineation, with very little habitat having to have been added. Vireo habitat that has been added to the initial delineation has occurred on the uppermost slopes of canyons as narrow shrubby fringes to golden-cheeked warbler habitat formed on the canyon slopes.

As with golden-cheeked warblers, the Service typically has considered clearing for development projects as having the ability to indirectly affect black-capped vireo habitat out to a distance of 300 feet from the edge of clearing. The refined delineation of potential black-capped vireo habitat will be extended out to a distance of at least 300 feet from either side of the transmission line ROW and any access road alignments. Assuming a 160-foot-wide ROW, this delineation will extend a minimum of 380 feet from either side of ROW centerline.

4.2.2.2 Direct Habitat Impacts

Similar to what was done to identify direct impacts to golden-cheeked warbler habitat, GIS software was used to draw the projected 160-foot ROW limits onto the black-capped vireo habitat delineation. All delineated potential black-capped vireo habitat present within the limits of the ROW was identified provisionally as expected to be directly impacted (removed) by construction. This method is expected to have resulted in an estimate of maximum potential impact because, as discussed for the golden-cheeked warbler, it is expected that the majority of the ROW will be narrower than the 160-foot width assumed in the analysis, the ROW will not likely be cleared to its full width along its entire length, and because some of the vegetation currently identified as potential black-capped vireo habitat will be proven not to be habitat once it is able to be viewed in the field.

Twin Buttes–Big Hill Transmission Line

Based on a preliminary review of aerial photography and assumption that all ROW will be cleared to a width of 160 feet, LCRA TSC estimated that, excluding impacts resulting from clearing for access roads, 195 to 310 acres (79 to 126 ha) of potential black-capped vireo habitat could be directly impacted along the Twin Buttes–Big Hill transmission line. This number was considered highly probable to reflect an estimate of maximum potential impact of black-capped vireo habitat along this route because nearly all wooded communities that appeared on the aerial photography to be somewhat open and shrubby were generously identified by LCRA TSC as potential black-capped vireo habitat.

Field assessment of the Twin Buttes–Big Hill route by SWCA in September and October 2010 and April and November 2011 allowed for direct viewing of all of the final alignment. From this assessment, it was revealed that, as expected, much of the vegetation that was preliminarily identified as potential black-capped vireo habitat from review of aerial photography was actually unsuitable for use by the species as it instead consisted of open oak woodland lacking understory foliage, juniper scrub, or scrub dominated heavily by mesquite. Mesquite is not identified as a component of black-capped vireo habitat by TPWD (Campbell 2003). It is the experience of SWCA that mesquite scrub in Texas is occupied by Bell's vireos (*Vireo bellii*) rather than black-

capped vireos, and several Bell's vireos were in fact heard singing in mesquite scrub along the Twin Buttes–Big Hill route during the SWCA field inspection (P. Sunby/SWCA pers. obs.).

SWCA identified four patches of potential black-capped vireo habitat along the Twin Buttes–Big Hill transmission line route as a result of its 2010 field investigations. One of these patches occurs on a limestone ridge and consists of scrubby woodland composed of a mix of juniper, Vasey oak (*Quercus pungens*), agarita (*Berberis trifoliolata*), sumac, acacia (*Acacia* spp.), Texas redbud (*Cercis canadensis* var. *texensis*), mountain laurel, lotebush (*Zizyphus obtusifolia*), prickly pear, and soapweed yucca (*Yucca glauca*). Another occurs on alluvial deposits derived from limestone and consists of moderately dense scrub composed mostly of juniper, agarita, acacia, mesquite, lotebush, and wolfberry (*Lycium berlandieri*). The other two occur on limestone hillsides and consist of low, semi-open woodland composed mostly of small juniper trees, but that also contain low densities of Texas persimmon and agarita shrubs and moderately sized Vasey oak trees.

Following adoption by LCRA TSC of a re-route of a segment of the Twin Buttes–Big Hill transmission line alignment, several other patches of potential vireo habitat were delineated along this transmission line route in April 2011 through review of aerial photography because the sections of properties crossed by the rerouted segment had not been inspected directly during the earlier field investigations. These patches of potential habitat were inspected in the field in April and November 2011 and proved to be unsuitable habitat in the form of juniper or mesquite scrub.

Based on the SWCA field assessment and conservative habitat assessments made through review of aerial photography, it is expected that construction of the Twin Buttes–Big Hill transmission line in a ROW cleared to a width of 160 feet could result in the direct impact of up to approximately 27.5 acres (11.1 ha) of potential black-capped vireo habitat. While the actual level of direct habitat impact is expected to be less than 27.5 acres, whatever the actual number ends up being, it is worth noting that it will be well below the minimum 195 acres of possible direct impact that was originally estimated through preliminary review of aerial photography.

Big Hill–Kendall Transmission Line

Field assessments conducted in March, April, and November 2011 allowed SWCA to inspect most of the alignment for the Big Hill–Kendall transmission line. All sections of the alignment occurring in Kendall, Gillespie, and Kerr Counties were able to be inspected, as well as those sections occurring in Kimble County that follow I-10 and R.R. 1674. A short section of the alignment that crosses private property in Kimble County was not able to be viewed.

Ten to twelve black-capped vireos were detected along the Big Hill–Kendall transmission line alignment by SWCA during the March and April 2011 field visits. Vireos were detected in Gillespie, Kerr, Kimble, and Sutton Counties; no vireos were detected in Kendall or Schleicher Counties. Most of the vireos detected during the field visits were encountered along the margins of I-10 or its frontage roads and along the edges of R.R. 1674.

Black-capped vireos were detected along the Big Hill–Kendall alignment in a variety of vegetation communities, although all communities in which vireos were detected were developed on carbonate substrates, included some oak vegetation, and possessed low to high densities of

shrub-layer foliage. Vireos were detected in communities with woody vegetation consisting of little more than live oak and Ashe juniper, as well as more diverse communities composed of juniper, live oak, and a variety of shrub species such as Texas persimmon, agarita, shin oak, Vasey oak, evergreen sumac (*Rhus virens*), flameleaf sumac (*Rhus lanceolata*), lotebush, Texas kidneywood (*Eysenhardtia texana*), and/or elbowbush (*Forestiera pubescens*). The structure of communities in which black-capped vireos were observed ranged from relatively open oak or oak/juniper woodlands with light to moderate shrub development, to dense shrubland.

Because of the variety of vegetation communities in which black-capped vireos were detected along the Big Hill–Kendall alignment, SWCA was liberal in its delineation of potential black-capped vireo habitat along this route. Any vegetation community in which a black-capped vireo was detected was delineated as vireo habitat, and any communities that contained oak and possessed a shrub cover of at least 15 percent were delineated as potential vireo habitat. Exception to this was made where shrub cover was exclusively composed of juniper. Some denser shrubland communities that lacked oak were also identified as potential black-capped vireo habitat because the structure of the vegetation matched that of known black-capped vireo habitat. However, no black-capped vireos were detected in non-oak-bearing communities, with such communities consistently found to be occupied by Bell's vireos.

Based on the results of the field investigations and, as described above, interpretation of aerial photography for those properties that could not be accessed directly, a total of 467.4 acres (189.2 ha) of known and potential black-capped vireo habitat was delineated within the 160-foot-wide ROW for the Big Hill–Kendall transmission line route. This acreage represents the total direct impact to black-capped vireo habitat that could result from the clearing of ROW for this Priority Project.

Based on the experience that not all vegetation identified as potential black-capped vireo habitat through review of aerial photography proves to be so once it is inspected in the field, it is expected that once all properties crossed by the Big Hill–Kendall transmission line route are able to be inspected in the field that the actual amount of known and potential black-capped vireo habitat occurring within the 160-foot-wide ROW for this project will be found to be less than 467.4 acres. However, using the liberally estimated 467.4 acres for the Big Hill–Kendall line and the 27.5 acres of direct impact identified for the Twin Buttes–Big Hill line, the estimated total maximum direct impact to known and potential black-capped vireo habitat resulting from the clearing of ROW for the two Priority Projects is approximately 494.9 acres (200.4 ha).

LCRA TSC will seek to minimize habitat impacts by reducing cleared ROW widths where practicable, and avoiding the need to clear the ROW altogether if allowed by especially steep topography. Once the project engineers are able to inspect the ground to view topographic and vegetative conditions and construction plans for a transmission line are finalized, the actual number of acres of known and potential black-capped vireo habitat expected to be directly impacted by each Priority Project will be determined using the final habitat delineation and the methodology described above. These numbers will then be submitted to the Service for its concurrence.

4.2.2.3 Indirect Habitat Impacts

Because black-capped vireos occur in shorter and more open vegetation than do golden-cheeked warblers, black-capped vireo habitat has less potential to be indirectly affected by vegetation clearing activities than does warbler habitat. For example, clearing through warbler habitat can create openings that expose previously shaded and protected interior woodland to sunlight and wind. This can lead to increases in sub-canopy foliage volume and changes in woodland micro-climate. Clearing in woodland also creates habitat edges that can provide avenues of use for predators and an avian nest parasite, the brown-headed cowbird. Because black-capped vireo habitat is relatively short and usually open to semi-open, it typically is fully subject to the effects of sunlight and wind and, thus, is physically unaffected by adjacent clearing. For these same reasons, vireo habitat also is generally accessible to predators and brown-headed cowbirds.

Despite these biological differences, as with the golden-cheeked warbler, the Service typically considers vegetation clearing activities associated with development projects as having the potential to indirectly affect black-capped vireo habitat out to a distance of 300 feet from the cleared edge, with those indirect effects typically considered to cause a 50 percent reduction in habitat viability. Therefore, as discussed for the golden-cheeked warbler, indirect habitat impacts will be assessed in known and potential black-capped vireo habitat out to a distance of 300 feet from the cleared edges of the transmission line ROW.

To compute indirect impacts, GIS software will be used to simulate the removal of black-capped vireo habitat from within the projected limits within the ROW (the direct habitat impact). GIS software will then again be used to identify the amount of known and potential black-capped vireo habitat occurring within 300 feet of the cleared edges of the ROW. Based on the initial delineations of known and potential black-capped vireo habitat derived from the results of the field inspections and review of aerial photography, the maximum amount of habitat that would be indirectly affected as a result of clearing of the Twin Buttes–Big Hill transmission line ROW is 143.9 acres (58.3 ha). The maximum amount of habitat that would be indirectly affected as a result of clearing of the Big Hill–Kendall transmission line ROW is 1,585.3 acres (641.8 ha). Together, these total 1,729.2 acres (700.1 ha).

Once the construction plans for a transmission line project have been finalized, the actual number of acres of known and potential black-capped vireo habitat expected to be directly and indirectly impacted by clearing of the ROW for that line will be determined using the methodologies described above. This number will also then be submitted to the Service. Clearing for access roads will be assessed direct and indirect habitat impacts as appropriate using these same methodologies.

4.2.2.4 Total Direct and Indirect Habitat Impacts

Similar to what was done for the golden-cheeked warbler, to account for direct and indirect impacts to black-capped vireo habitat expected to be caused by the construction of access roads, as well as other potential sources of take that cannot be quantified at this time, LCRA TSC has added a 10 percent contingency to the amount of vireo habitat expected to be directly and indirectly impacted through clearing of the transmission line ROW. The resultant total of direct and indirect impacts to black-capped vireo habitat is summarized in Table 10.

As shown in Table 10, the direct impact to black-capped vireo habitat is estimated to total 544.4 acres, and the indirect impact is estimated to total 1,902.1 acres. The total direct and indirect impact to black-capped vireo habitat is hereinafter referred to as "Maximum Authorized BCVI Habitat Impacts."

As indicated in Table 10, based on the preliminary assessments performed for the Twin Buttes–Big Hill and Big Hill–Kendall projects as identified above, the Maximum Authorized BCVI Habitat Impacts is 2,446.5 acres. It is noteworthy that the habitat indirectly affected would remain extant on the landscape. This amounts to almost 78 percent (1,902.1 / 2,446.5 = 0.777) of the habitat represented in the Maximum Authorized BCVI Habitat Impacts.

Black-capped vireo habitat impacts will be spread across scores of miles of transmission line, so the amount of habitat impact in any particular area will be relatively small. It also is likely that much of the ROW will be narrower than 160 feet, and that the ROW will not be cleared to its maximum width where the lines cross black-capped vireo habitat because this vegetation is relatively short and presents reduced safety and reliability issues compared to forested habitat. Depending on the amount of habitat available in a particular area and the level to which it was occupied, the identified amount of clearing could cause nothing more than shifts in local black-capped vireo territory boundaries. In smaller habitat patches, this amount of clearing could be sufficient to result in the displacement of black-capped vireos from the affected patches. LCRA TSC will mitigate for the total number of acres of known and potential black-capped vireo habitat expected to be directly and indirectly impacted by the Priority Projects as described in Section 5.4.2.

Table 10. Black-capped Vireo Habitat Impacts under the Proposed Alternative

Priority Project	Direct Habitat Impacts		Indirect Habitat Impacts		Total Habitat Impacts in Acres (ha)
	Direct Habitat Impact in Acres (ha)	Direct Plus Contingency Factor (10%)[1]	Indirect Habitat Impact in Acres (ha)	Indirect Plus Contingency Factor (10%)	
Twin Buttes – Big Hill	27.5 (11.1)	30.3 (12.2)	143.9 (58.2)	158.3 (64.0)	188.6 (76.2)
Big Hill–Kendall	467.4 (189.2)	514.1 (208.1)	1,585.3 (641.5)	1,743.8 (705.7)	2,257.9 (913.8)
Total	**494.9 (200.3)**	**544.4 (220.3)**	**1,729.2 (699.8)**	**1,902.1 (769.7)**	**2,446.5 (990.5)**

[1] To cover the potential impacts to black-capped vireo that cannot be quantified at this time (e.g., potential habitat impacts resulting from access road construction outside of the ROW and potential direct impacts resulting from emergency activities conducted within breeding season), estimates of habitat impacts based on aerial photography and field surveys have been increased by a contingency factor of 10%.

4.2.3 Cumulative Effects

As set forth in Section 4.1.3, the action area for analysis of cumulative effects is the area in which direct and indirect impacts of the issuance of an incidental take permit are felt. LCRA TSC believes an appropriate action area for the black-capped vireo should extend 300 feet beyond the edge of ROW, or 380 feet to either side of alignment centerline (assuming a 160-foot-wide ROW). This is because 300 feet is the distance out to which the potential for indirect habitat impacts to occur will be examined. The action area for the Priority Projects also includes all lands within 300 feet of access roads needed for the projects, although the location of those roads has yet to be identified.

As discussed for the golden-cheeked warbler, one project expected to occur at least partially within this action area is the construction of two series compensation stations along the Big Hill–Kendall transmission line. The two stations will be sited and constructed by AEP-ETT (American Electric Power – Electric Transmission of Texas). At this time, LCRA TSC has no knowledge of the actual footprints, locations, or scheduling of construction of these series compensation stations. However, it is expected that one would be constructed west of the City of Junction and the other east of Junction, and that each station would result in the disturbance of approximately 50 acres of land. While locations for these stations are not known to LCRA TSC, it can be expected that they will be constructed where land is reasonably flat. Potential exists for construction of each of these series compensation stations to directly and/or indirectly impact habitat for the black-capped vireo because potential habitat for the species is distributed rather widely on both sides of the City of Junction and some of it is developed in areas that are reasonably flat. As with the golden-cheeked warbler, the extent to which construction of the two series compensation stations would result in direct or indirect impacts to black-capped vireo habitat, if such impacts happen at all, is unknown at this time.

Most of the land traversed by the Twin Buttes–Big Hill and Big Hill–Kendall projects is rural; therefore, it is likely that land clearing and other agricultural practices will be performed at some point in portions of the action area. Segments of the Priority Project routes parallel roads and existing transmission lines, so construction and maintenance activities associated with such facilities may also occur in the action area. Portions of the action area might also be used for residential or commercial construction and installation of utilities.

The presence of black-capped vireo habitat in a particular area is often the result of vegetation responding to a disturbance such as wildfire or cutting or blading of woodland. In the eastern portion of the Study Area, which receives more rainfall than does the western portion, black-capped vireo habitat that develops in response to disturbance typically succeeds over the course of several years into taller woodland that then becomes unsuitable for the species (Wilkins et al. 2006). In the western portion of the Study Area, shrubby vegetation suitable for vireos can persist for longer periods of time. But, throughout the Study Area the status of black-capped vireo habitat is dynamic, with the amount of habitat available to the species constantly increasing or decreasing locally in response to land use practices and vegetative succession.

Any loss of black-capped vireo habitat resulting from the direct and indirect impacts of the Priority Projects will in the short term reduce the amount of viable black-capped vireo habitat present in the action area. Habitat in the action area could then be further reduced by other non-federal actions occurring in the same area. Black-capped vireo habitat is expected to be relatively widespread across the Study Area and its presence may conflict with the locations of some desired projects. In general, it is assumed that future development projects will be conducted in compliance with all applicable local, state, and federal environmental regulations.

Potential black-capped vireo habitat occurring within 300 feet of the edge of the approved Priority Project ROW is estimated to total approximately 1,729.2 acres. Another 172.9 acres of vireo habitat may be affected based on addition of the 10 percent contingency factor (e.g., to cover indirect impacts of access road clearing). It is not possible to estimate how much of this total 1,902.1 acres of potential vireo habitat may be affected as a result of future non-federal activities other than the Priority Projects; however, it is unlikely to be a substantial amount

because very little of the approved routes (or any alternative route) traverse fast-growing urban and suburban areas. Even if the entire 1902.1 acres of potential habitat outside the ROW and access roads were lost, which is highly unlikely and not expected, that amount combined with the maximum 544.4 acres of potential habitat that may be directly lost to clearing of the Priority Project ROWs and access roads would equal a very small percentage of the total amount of black-capped vireo habitat in the state. The total amount of potential habitat estimated to be directly and indirectly affected within the action area, 2,446.5 acres, is only 0.17 percent of the 1,450,438 acres of black-capped vireo breeding habitat in Texas (USFWS 2004).

4.3 FINAL PRECONSTRUCTION IMPACT ASSESSMENT

The assessment of impacts under this HCP is conservative in favor of the Covered Species in several ways. For example, the assessment of the presence of black-capped vireo habitat includes very conservative assumptions where access along the project routes has not yet been obtained. Specifically, all vegetation communities present on inaccessible properties that through review of aerial photography appeared to support shrubby or scrubby vegetation were identified as potential black-capped vireo habitat, even in cases where the digital photo signature of that vegetation was identical to that exhibited by vegetation present on nearby accessible properties that was already known not to constitute potential vireo habitat. In the case of both the golden-cheeked warbler and black-capped vireo, all potential habitat occurring within 300 feet of the ROW was identified as potentially being indirectly impacted by the Proposed Alternative, even in cases where the potential habitat occurred on the opposite side of a highway from the ROW. With regard to vegetation that was able to be inspected directly, vegetation not strictly meeting the TPWD definition of black-capped vireo habitat (e.g., not occurring on a carbonate substrate) was also included in the delineation of potential habitat if it possessed the compositional and structural elements of vegetation communities in which SWCA had in the past observed to be utilized by black-capped vireos on the southern and western Edwards Plateau. In addition, it is anticipated that the final design of the projects will incorporate further avoidance of habitat and result in further reductions of the impact assessments stated in this HCP.

For these reasons, the impact assessments set forth in this HCP are properly considered outer bounds. Prior to clearing for each of the Priority Projects, LCRA will prepare and deliver to the Service a final Covered Species impact assessment, taking into account the results of habitat assessments made on the ground, including properties that could not be accessed at the time of development of this HCP, determining actual direct and indirect habitat impacts on the basis of final design, and recalculating mitigation. Mitigation will be recalculated by applying the methodology contained in this HCP to the final impact assessment. Upon Service approval of such habitat, impact, and mitigation assessments, and in any event prior to the initiation of clearing for a Priority Project, LCRA TSC will furnish the required mitigation for that Priority Project. It is anticipated that the final impacts will be less than the conservative impacts estimated in this HCP and that mitigation will remain in the same proportions to impacts as required under this HCP. In no event will LCRA TSC exceed the maximum take threshold established under this HCP.

4.4 BALD EAGLE

As discussed in Section 2.4.2.1, bald eagles are known to nest in Kimble County and have potential to occur nearly anywhere within the Study Area during migration. The potential for the Covered Activities to adversely affect the bald eagle is discussed below.

4.4.1 Direct Impacts

LCRA TSC will coordinate with TPWD to determine whether any bald eagles are known to nest within 1.3 miles of the approved transmission line alignments. Because some possibility, however small, exists that bald eagles could be nesting in the vicinity of the alignments unbeknownst to TPWD, LCRA TSC will also search for bald eagle nests within its easements for these projects within 1.3 miles of any large river or lake that has potential to support nesting eagles, whether or not these water bodies are crossed by the transmission line alignments. No portion of the Twin Buttes–Big Hill transmission line route lies within 1.3 miles of a water body likely to attract nesting by bald eagles. No bald eagle nests were observed by SWCA during its September and October 2010 inspections of this route; in fact, very few trees large enough to be used for nesting or roosting by bald eagles even occur along the Twin Buttes–Big Hill route. The Big Hill–Kendall transmission line route crosses the Llano and North Llano Rivers, with these rivers considered to have potential to attract nesting by bald eagles. However, the route crosses these two rivers very close to I-10 and the City of Junction, which makes it unlikely that bald eagles could be nesting along either river in the vicinity of the Big Hill–Kendall alignment without such nesting being known to TPWD. Other rivers crossed by this route are comparatively small and are unlikely to support nesting bald eagles. No bald eagles or bald eagle nests were observed by SWCA during its March, April, and November 2011 inspections of this route.

ROW clearing activities are likely to be performed during the first half of the bald eagle nesting season in Texas (October through July) because of the need to perform these activities outside of the golden-cheeked warbler and black-capped vireo nesting seasons. Coordination with TPWD and the search for eagle nests will be performed to ensure that ROW clearing activities do not result in the removal of active or inactive bald eagle nests. Consequently, no physical harm to bald eagles is expected to result from clearing of the transmission line ROW. To the extent allowed by construction schedules and presence/absence of habitat for golden-cheeked warblers and black-capped vireos, LCRA TSC will endeavor to perform Covered Activities slated to occur within 660 feet of any active or presumed active bald eagle nests during the time of year in which bald eagles are not expected to be nesting (August and September), or at other times of year when eagles are not nesting if the status of nesting activity is able to be determined from the LCRA TSC easement.

As the non-nesting period for bald eagles is potentially very limited, it seems highly probable that if a transmission line alignment lies within 660 feet of an active bald eagle nest, some ROW clearing activities and/or transmission line construction activities would need to occur while eagles were nesting. Consequently, potential exists for Covered Activities to result in disturbance to nesting bald eagles. Again, however, this potential appears to be very limited as it is much more probable that no bald eagle nests will occur in proximity to any of the ROW. If a bald eagle

nest is discovered within 2.0 (3.2 km) miles of a proposed transmission line, LCRA TSC will coordinate an appropriate response with the Service.

The Covered Activities are not expected to result in undue harassment of any non-nesting bald eagles that may occur in areas where those activities were performed. Non-nesting eagles, because they are fully mobile and not necessarily tied to any fixed point like a nest, should be fully capable of avoiding any activities they perceive as potentially disturbing.

4.4.1.1 Habitat Impacts

Bald eagles in the Study Area primarily hunt in aquatic habitats, although they could hunt in nearly any open habitat available. The Covered Activities will largely be restricted to upland habitats. Structure construction will result in the temporary loss of a very small amount of vegetation (a few hundred square feet) at each structure site, but this amount of loss is considered to be insignificant with regard to influencing the amount of prey available to eagles. Consequently, no direct loss of bald eagle habitat is expected from any of the Covered Activities.

4.4.1.2 Electrocution

Birds have been documented to suffer electrocution from contact with electrical lines since power lines first appeared on the landscape in the early 1900s (Avian Power Line Interaction Committee [APLIC] 2006). Through the years, studies have found a wide variety of types of birds killed through electrocution, with 90 percent of mortalities in the western United States being golden eagles (APLIC 2006). Electrocutions usually result when a bird completes a circuit by simultaneously touching conductor and shield wires, or by touching a conductor while still in contact with a grounded structure.

Risk of electrocution varies with body size of the bird and is greater when birds are wet because dry feathers provide good insulation (APLIC 2006). Golden eagles are a common victim of electrocution because their wide wingspan allows them to inadvertently touch a broader range of line and structure configurations than can smaller birds (APLIC 2006). Bald eagles, which are similarly large, are also susceptible to electrocution. The National Wildlife Health Laboratory (1985) as cited in APLIC (2006) found that 9.1 percent of 1,429 dead bald eagles examined over the period of 1963 through 1984 had died of electrocution. Many other studies cited in APLIC (2006) indicate that electrocution can account for 12 to 17 percent of bald eagle mortality across the United States where power lines and structures are not safe-guarded against the possibility of raptor electrocution.

As identified in Section 3.3, both Priority Projects will be designed to maintain spacing between lines sufficient to prevent bald eagles from simultaneously touching conductor and shield wires. This will prevent any bald eagles that may roost on structures or fly through the lines from being electrocuted. Therefore, the Covered Activities are not expected to result in the electrocution of any bald eagles.

4.4.1.3 Collision Risk

As mentioned, bald eagles are known in parts of Texas to nest on transmission line structures (Ortego et al. 2009). It therefore is expected that bald eagles will not avoid transmission line

structures and could occasionally be flying in the immediate proximity of the transmission lines. Like electrocution, collision with power lines is a known source of mortality for bald eagles (Olendorff and Lehman 1986, USFWS 1990c).

The Priority Projects would represent a very small percentage increase in the number of collision risks on the landscape in the Study Area. Existing collision risks include transmission lines, distribution lines, guyed and un-guyed radio and television towers, cellular phone towers, and, to some extent, even aircraft. To increase visibility of the transmission lines to bald eagles and decrease the potential that bald eagle collisions would occur, LCRA TSC will mark certain sections of the transmission lines with traditional marker balls, spiral vibration dampeners, or air flow spoilers. These markers will be installed on the shield wires with spacing dependent on the type of marker used. Markers will be placed on all sections of transmission line occurring within 1.3 miles of known bald eagle nests, and on the lines at all crossings of major rivers as rivers may preferentially be followed by migrating eagles or eagles making local movements. River crossings where transmission lines would be marked will include, but will not necessarily be limited to the Llano River and North Llano River. Markers placed at river crossings would extend from the river centerline out to a distance of 300 feet (91 m) beyond each river bank as measured perpendicular to the river bank, not as measured along the length of the alignment. These markers would be inspected and replaced as necessary as part of routine maintenance activities.

Marking the Priority Projects as described is expected to reduce the potential for bald eagle collision mortality to occur. However, the potential for collision mortality to occur cannot be reduced absolutely to zero. Collision with transmission lines was not identified as a threat to the species in Texas by Campbell (2003) or by Ortego et al. (2009). Thus, while construction of the Priority Projects would create a collision risk for eagles that would not exist in absence of the projects, that risk is considered to be very low considering that few bald eagles occur in the Study Area and reduced further by the proposed marking of the transmission lines. Consequently, while the possibility cannot be ruled out conclusively that bald eagle collision could occur, collision mortality is very unlikely to result from any of the Covered Activities.

4.4.2 Indirect Impacts

No indirect impacts to bald eagles are expected as a result of completion of either Priority Project. As evidenced by their nesting on transmission line structures (Ortego et al. 2009), and as their previously discussed collision and electrocution history attest, bald eagles are tolerant of, and accept the presence of, transmission lines. Consequently, the Priority Projects are not expected to cause bald eagles to abandon any habitats that they might currently be using for hunting, nesting, or roosting in absence of those facilities, or dissuade eagles from using any areas in the future for any of these same activities. Clearing of woody vegetation from the transmission line ROW is not expected to decrease the amount of habitat available for eagles to use for hunting because the species typically hunts in aquatic and other open habitats (Campbell 2003). Any increase in the amount of open habitat available to eagles to use for hunting that may result from the clearing of ROW is expected to result in neutral or negligibly beneficial effects on the species.

4.4.3 Cumulative Effects

The action area for the bald eagle is considered to consist of those lands occurring within 1.3 miles of the Priority Projects based on TPWD guidelines that recommend certain primary and secondary habitat management guidelines be adhered to within 1.3 miles of a bald eagle nest (Campbell 2003).

It seems likely that land clearing and other agricultural practices will be performed at some point in portions of the action area, as might some road construction and maintenance projects. Portions of the action area might also be used for residential or commercial construction and installation of utilities.

Construction of the Priority Projects would contribute to the level of human disturbance on the landscape in the action area, although bald eagles are not expected to draw away from transmission lines or their structures. Consequently, construction of the Priority Projects is not expected to contribute to the level of human disturbance on the landscape that could influence where bald eagles would be willing to nest or to limit the number of bald eagles that could ultimately utilize the action area.

Some segments of the Priority Projects follow existing transmission line corridors; consequently, construction of the Priority Projects would contribute to the total number of collision hazards for bald eagles in the action area. However, because LCRA TSC would mark the Priority Project transmission lines to increase their visibility in areas where bald eagles would be most likely to occur, the potential for bald eagles to collide with any of the transmission lines is considered to be very small. Thus, contribution of the Priority Projects to existing collision hazards within the action area is not considered to be significant.

4.5 LEAST TERN

4.5.1 Direct Impacts

Least terns are not known nor expected to breed in proximity to any of the routes considered for the Priority Projects. Least terns are known to breed at reservoirs in the vicinity of the City of San Angelo, Tom Green County (Kasner et al. 2005). These reservoirs lie 2.75 miles or more east of the route selected for the Twin Buttes–Big Hill transmission line. Least terns are expected to remain at these reservoirs during the breeding season (Thompson et al. 1997, USFWS 1990a) and so are not expected to make overland forays west to lands crossed by the Twin Buttes–Big Hill transmission line. The route(s) taken by these birds as they travel between the reservoirs and their wintering areas is not known with certainty, but it can reasonably be expected that they first travel southeastward to the Gulf of Mexico before continuing southward. These birds could follow the Colorado River corridor to the Gulf of Mexico, or travel part of the way overland and then follow the Guadalupe River or Rio Grande corridor to the coast. It is not expected that least terns would approach the San Angelo region reservoirs from the west, or depart them traveling in that direction. Therefore, the transmission line that would occur closest to these breeding reservoirs (Twin Buttes–Big Hill) is not considered to create a significant collision risk for this species.

The Big Hill–Kendall route crosses lands with potential to be traversed by the terns that travel to and from the reservoirs near San Angelo. Theoretically, this transmission line would also cross lands with potential to be traversed by migrating least terns that nest outside of Tom Green County but inland to the west or northwest of the Study Area.

In general, it is expected that least terns when migrating over land would be flying at heights greater than those of the proposed transmission lines because flying well above ground provides greater protection from predators, and potentially stronger tail winds, reduced air density, and less exposure to turbulence, all resulting in more efficient use of energy (Leichti et al. 2000). Consequently, least terns flying over land can usually be expected to have a very low risk of colliding with any of the proposed transmission lines.

It is possible that least terns could be flying closer to the ground if following river corridors because rivers would present opportunities for the birds to hunt for food while moving up or down river, and islands and banks would provide the terns with ability to stop and rest. Least terns migrate during daylight hours (Thompson et al. 1997). Terns also are agile birds and have shown ability to successfully avoid transmission lines (Henderson et al. 1996). Lines used in the Priority Projects will be of comparatively large diameter because they will be carrying 345-kV of electricity. The comparatively large diameter of the lines coupled with their being strung along lattice or pole structures are expected to make the lines generally visible to, and avoidable by, least terns, with ability to see and avoid transmission lines promoted by their diurnal habits.

Because migrating least terns would be flying above line height elsewhere in the Study Area, it is considered that the Covered Activities would create a negligible risk of collision for least terns. Consequently, no direct impacts to least tern are expected as a result of the Covered Activities and LCRA TSC is not seeking take authorization for this species.

4.5.2 Indirect Impacts

No indirect impacts to least tern are expected as a result of the Covered Activities. This species is not known to breed in proximity to any area where the Covered Activities may occur. Consequently, none of the Covered Activities has potential to alter least tern habitat conditions or otherwise cause detrimental effects to least terns that would be realized later in time or at distance from where any of the Covered Activities would occur.

4.5.3 Cumulative Effects

The Priority Projects would result in an incrementally small increase in the number of collision risks on the landscape for least terns. No direct or indirect impacts to least terns or their habitat are expected as a result of the Covered Activities. Therefore, the Covered Activities are also not expected to contribute to cumulative effects on this species.

4.6 WHOOPING CRANE

As discussed in Section 2.4.2.3, the Priority Projects corridors lie in a region that could occasionally be traversed by whooping cranes. Given that transmission lines are known to pose a collision risk to whooping cranes, LCRA TSC has for this HCP developed a methodology for assessing the risk that construction of the Priority Projects could pose to whooping cranes. This

methodology was reviewed as a draft by Tom Stehn/USFWS Whooping Crane Coordinator and then modified based on his comments. Mr. Stehn also reviewed the impact discussions provided here in Section 4.6. The final methodology is described below. Any section of transmission line identified through these methods as occurring in an area where whooping cranes would be considered to have a reasonable chance of occurring on or low to the ground would be marked by LCRA TSC to make them more visible and to decrease the chance that collision mortality would occur.

4.6.1 Methodology

Assessment of the risk that construction of the Priority Projects could pose to whooping cranes will be performed along all segments of the Priority Projects corridors, although they do not lie within the 200-mile-wide migration corridor as delineated by the Service. This is because the pattern of whooping crane observations recorded in Texas as shown on Figure 5 suggests that cranes can be expected to occasionally fly west of the Service-delineated migration corridor.

The assessment of risk will be performed by characterizing landscape-level ground cover and identifying potential stopover roost sites within 2 miles (3.2 km) of each of the transmission line routes. The study distance of 2 miles was chosen based on Service recommendations on how to appropriately evaluate the potential effects of construction of wind power generation facilities and transmission lines on whooping cranes (USFWS 2009b) and comments on the draft methodology received from the USFWS Whooping Crane Coordinator.

Landscape characterizations and identification of potential stopover sites will be performed through use of publicly available information. This information is expected to include, but will not necessarily be limited to, digital aerial photography, National Wetland Inventory (NWI) and National Hydrographic Dataset (NHD) mapping, U.S. Geological Survey (USGS) digital land cover data and topographic mapping, and regional records of whooping crane observations held by the Service and Texas Parks and Wildlife Department. The NWI and NHD data will be used in conjunction with review of aerial photography to identify wetlands and waterbodies with potential to provide roosting habitat for whooping cranes during migration stopovers within 2 miles of each alignment alternative.

The USGS land cover data and topographic mapping will then be used, again in conjunction with review of aerial photography, to assess the likelihood that whooping cranes would actually use those stopover sites. In general, it will be considered that whooping cranes are less likely to use potential stopover sites where the local landscape is hillier and more wooded, and more likely to use sites where the local landscape is dominated by agricultural cover and has less topographic relief. However, potential for whooping cranes to occur on the ground in any particular area will not be ruled out based on any particular type of topography or vegetative cover.

Locations of potential roost sites occurring within 2 miles of an alignment will then be compared against position of the alignment centerline and other landscape features to determine the risk that construction and subsequent presence of the transmission line is likely to pose to migrating whooping cranes. Consideration will be given to distance of the alignment centerline to the potential roosting site, the type of land cover present between the potential roosting site and the

alignment, the type of land cover opposite the alignment from the potential roosting site, and the trend of the alignment centerline compared to the expected direction cranes would be traveling.

This evaluation will allow gauging how likely it would be that a whooping crane using the roost site would be inclined to fly towards or past the transmission line, either when making local movements to feed or when departing a site to continue migration. Migrating cranes would generally be expected to be moving north-south or northwest-southeast through the region that would be crossed by the Priority Projects. Thus, risk of collision for departing cranes would be considered greater where transmission lines would be trending east-west or southwest-northeast than where transmission lines would be trending north-south or northwest-southeast. Based on comments received from the USFWS Whooping Crane Coordinator, alignment of the line will be considered to have no bearing with regard to crane movement upon first arrival at a site because the birds may descend from migration height and then make local movements unaligned with migration direction in order to inspect various potential roost sites.

Table 11 identifies a ranking system that will be used to identify the level of risk that construction of any particular point of transmission line would pose to migrating whooping cranes. Five risk factors will be evaluated for each line segment; each factor will be given a score of zero (risk factor absent) or 1 or 2 (risk factor present). The cumulative score will be tabulated to derive a total level of risk that will then range from 0 (lowest) to 6 (highest). How this ranking system will be used is discussed in Section 4.6.2.2.

Table 11. Proposed Ranking System for Identifying Risk of Priority Projects to Whooping Cranes

Risk Factor	Score	
	No	Yes
Centerline within 1 mile of a suitable stopover site	0	2
Centerline more than 1 mile but within 2 miles of a suitable stopover site	0	1
Centerline in an area gauged as likely to be used by whooping cranes (as based on review of USGS land cover and topographic data)	0	1
Centerline passes between a suitable stopover site and a potential feeding area separated by ≤ 2 mile.	0	1
Centerline has an azimuth bearing of 15º to 105º, or 195º to 285º.	0	1

As used in Table 11, a “suitable stopover site” means a site suitable to be used by whooping cranes for roosting overnight. To be identified as a suitable stopover site, a site will need to consist of a lake, pond, stock tank, or palustrine wetland that is at least 0.25 acre (0.10 ha) in size, or a perennial stream with a braided channel that is at least 249 feet wide. The Service (2009b) indicates that more than 40 percent of whooping crane roost sites are less than 1.24 acres (0.50 ha) in size. Austin and Richert (2001) discuss roost site sizes in terms of size classes, with the smallest class discussed being < 0.40 ha (1 acre). Neither of these sources, nor the Whooping Crane International Recovery Plan (Canadian Wildlife Service and USFWS 2007), identifies the smallest roost site known to have been used by whooping cranes. We chose 0.25 acre as our minimum size for a suitable roost site because at that size, a pond or tank, if circular, would have a diameter of approximately 118 feet (36 m). That size appears to be much smaller than any that would be used for roosting by cranes. The minimum stream width of 249 feet is equal to the narrowest river reported having been used for roosting among records reviewed by Austin and

Richert (2001). This width suggests whooping cranes prefer to have at least 125 feet (half of 249 feet) of visibility when roosting, which in turn suggests that using 118 feet as a minimum roost diameter will identify all suitable roost sites as ponds or stock tanks of this size can only guarantee visibility out to the pond radius, or 59 feet (18 m). In addition, for any pond, stock tank, or palustrine wetland to be identified as a suitable stopover site, it will need to be situated in, or be at least partially bordered by, cropland or grassland vegetation. Any pond, stock tank, or palustrine wetland completely encircled by woodland will not be considered as a suitable roosting site.

Lakes with wooded edges will be considered to have potential to be used for roosting because of the possibility that, during any particular migration period, low water levels could expose a broad shoreline flat suitable for use by cranes. Further, for any area to be identified as a suitable stopover site, it will need to be located at least 300 feet (91 m) from a public road or building. Austin and Richert (2001) indicate that at least 32.5 percent of whooping crane observations occur less than 0.25 mile (0.4 km) from human disturbance, but do not provide the closest distance to human disturbance that a whooping crane has been observed. We chose 300 feet for use in this case because the whooping crane data reviewed by Austin and Richert (2001) indicated that approximately 97.5 percent of crane observations occurred more than 300 feet away from utility lines, thus suggesting the birds generally prefer to stay at least that far away from human disturbance.

Areas “gauged as likely to be used by whooping cranes” will be those that appear to have potential to be used as feeding areas. These will include any palustrine wetland of at least 0.25 acre in size as mapped in NWI or NHD wetland datasets that is set in open habitat, and any cropfield (excluding cotton fields if known) and, based on findings in Austin and Richert (2001), short grass pasture that is at least 6.5 acres (2.6 ha) in size. Austin and Richert (2001) indicate that 89.3 percent of whooping crane records from feeding sites were obtained in areas where visibility was 300 feet (91 m) or more. A circle with a radius of 300 feet covers an area of 6.5 acres. Thus, use of 6.5 acres as the minimum size for feeding areas would exclude fields and pastures that would not allow cranes to keep at least 300 feet of visibility between them and adjacent human disturbances or non-suitable habitats such as woodland.

Azimuth bearings of the transmission line alignment identified in Table 11 were identified based on comment by the USFWS Whooping Crane Coordinator that whooping cranes generally migrate at a bearing of 330º. The identified azimuth bearings will cause any alignment bearing that is within 45º of being perpendicular to the preferred crane migration direction to receive a rank of 1 for this factor under assumption that whooping cranes departing a stopover site would be at greater risk of colliding with transmission lines that cross their path than they would with lines that run parallel or sub-parallel to their path. It is acknowledged that cranes moving between feeding and roosting areas, and cranes that were evaluating the comparative suitability of multiple roost site options, would have potential to be traveling in any direction.

4.6.2 Direct Impacts

4.6.2.1 Habitat Impacts

As expected given the location of the Study Area outside the 200-mile-wide migration corridor for the species, no traditional stopover locations known to be used on a consistent and regular basis by migrating whooping cranes occur within the Study Area. Potential stopover sites within the region are expected to be used on an extremely rare, unpredictable, and opportunistic basis by whooping cranes, and, given the location of the Study Area relative to the whooping crane migration corridor, nearly all physically appropriate sites will likely never receive stopover use by whooping cranes despite their suitability for that purpose. Consequently, none of the Covered Activities is expected to result in the loss of any important stopover habitat or any habitat that is used regularly by the species.

Transmission line structures are most often placed on topographic high points, which generally are not likely to coincide with areas with potential to be used by whooping cranes, and generally would not be placed in low-lying wet areas that could provide roosting habitat. In sections of transmission line that cross an extensive amount of cropland and pasture, structure construction will result in the loss of a small amount of vegetation that could potentially have been used for foraging by whooping cranes at some future time. However, as the base of each structure would cover only a few hundred square feet and structures would be placed many hundreds of feet apart, the amount of vegetation lost to structure construction is expected to be inconsequential with regard to the ability of a particular area to support migratory whooping cranes. Consequently, the Covered Activities are not expected to result in the direct loss of any habitat of importance to whooping cranes.

4.6.2.2 Collision Risk

As discussed in Section 2.4.2.3, collision with power lines has been responsible for the death or serious injury of at least 45 whooping cranes since 1956. Of these, only 9 collisions involved birds from the wild population and 8 of those 9 involved collision with distribution lines rather than transmission lines (Stehn and Wassenich 2008). According to the Edison Electric Institute, the U.S. transmission grid includes more than 200,000 miles (320,000 km) of transmission lines of 230-kV capacity or greater (Edison Electric Institute 2010). Add in distribution lines, and the wild population of whooping cranes must cross dozens, if not hundreds, of power lines twice a year during their migrations to and from ANWR. That collision with a transmission line has been recorded only once since 1956 within the wild population suggests these birds may be better at seeing and avoiding these types of lines than they are distribution lines. We wonder whether this has to do, in part, with the transmission line structures, which obviously are not natural features and so probably draw the attention of the cranes. Distribution lines are typically strung between wooden poles, which the birds may be apt to mistake for trees. The diameter of a transmission line is also greater than that of a distribution line, so transmission lines too should be more visible to the birds than are distribution lines. Studies of avian collisions with transmission lines indicate that most collisions are with the smaller-diameter shield wires rather than the larger-diameter conductors (Faanes 1987, Stein and Wassenich 2008), indicating wire diameter affects visibility.

Identification of the relative probability that collision mortality would actually occur as the result of construction of a particular transmission line requires examination of the location of that transmission line relative to the whooping crane migration corridor and consideration of local physiographic factors that could influence whether cranes could be expected to be flying through an area crossed by a transmission line at the height of that line.

As indicated on Figure 5, the Priority Projects corridors lie outside of the 200-mile-wide whooping crane migration corridor. Thus, while we believe whooping cranes have some potential to fly through the Study Area for the Priority Projects, it is highly unlikely that whooping cranes fly through the that area on a regular basis. In general, the rocky and hilly terrain of the Study Area suggests that whooping cranes are far more likely to fly over the Study Area than they are to stop to rest within it. This suggests that, overall, the Priority Projects would pose a very low risk of collision for whooping cranes.

The methodology described in Section 4.6.1 was developed so that LCRA TSC could identify the relative collision risk that presence of the proposed transmission lines would pose to flying whooping cranes. LCRA TSC will mark all sections of transmission line where the level of risk is ranked as 4 or greater to increase their visibility to migrating whooping cranes and decrease the risk of crane/line collision. Transmission lines will be marked using traditional marker balls, spiral vibration dampeners, or air flow spoilers. Markers will be placed on the shield wire with a spacing dependent on the type of marker used. These markers will be inspected and replaced as necessary as part of routine maintenance.

That one whooping crane of the wild population has been recorded as colliding with a transmission line since 1956 despite their traversing what must be dozens of transmission lines twice a year during their migrations indicates that the risk of a whooping crane colliding with a transmission line at any point in time is quite low. The proposed marking of the Priority Projects to increase their visibility is expected to decrease even further the risk of whooping cranes colliding with these particular lines. With passage of time, it seems that the potential for a whooping crane of the wild population to again collide with a transmission line increases, although where and when such a collision might occur cannot be known. Given the proposed marking of the transmission lines and the very low rate at which collision with transmission lines has occurred within the wild population, LCRA TSC does not believe that construction of the Priority Projects would create a reasonable nor foreseeable collision risk to whooping cranes.

4.6.3 Indirect Impacts

Because the two Priority Projects would be constructed hundreds of miles away from the wintering and breeding areas of the whooping crane and outside the 200-mile-wide whooping crane migration corridor, the Covered Activities have extremely limited ability to indirectly affect whooping cranes. Theoretically, the presence of transmission line structures in a particular area that supports suitable stopover habitat could cause whooping cranes to avoid that habitat, thereby reducing the amount of stopover habitat available to migrating cranes. The degree to which whooping cranes avoid transmission line structures is not known with certainty. Of the whooping crane records reviewed by Austin and Richert (2001), approximately 58.5 percent of the records were of birds that occurred more than 0.5 mile from utility lines, and approximately 80.9 percent of birds occurred more than 0.25 mile away from utility lines. However, we wonder

whether these numbers are not an artifact of the general scarcity of utility lines in habitats used by whooping cranes and the fact that utility lines are often placed along roadsides, which could be actively avoided by the birds.

The Study Area does not contain any stopover habitat known to be utilized on a regular and consistent basis by whooping cranes. Therefore, the Covered Activities are not expected to cause any regularly utilized stopover habitat to become unsuitable for future use by the species through the creation of features the birds would avoid. The Study Area, being situated in the mostly hilly and rocky Hill Country, also contains very little habitat that can be considered especially suitable for whooping crane stopovers as croplands are scarce and, so, potential feeding areas are few. On the other hand, lakes, ponds, and stock tanks suitable for roosting are expected to be comparatively common and widespread. Thus, while construction of the transmission lines might cause whooping cranes to avoid particular stock tanks that in absence of the lines might have provided suitable roost sites, the Covered Activities are not expected to prevent whooping cranes from finding suitable roost sites as they migrate to and from ANWR. Therefore, no significant indirect impacts to whooping cranes are expected from the Covered Activities.

4.6.4 Cumulative Effects

In evaluating cumulative effects, the action area for whooping crane is defined as those lands occurring within 2 miles of the Priority Projects based on identification of this distance as that which may be traveled by whooping cranes between roosting and feeding areas. Given the predominantly rural nature of the region, it seem likely that land clearing and other agricultural practices will be performed at some point in portions of the action area, as might some road construction and maintenance projects. Portions of the action area might also be used for residential or commercial construction and installation of utilities.

Because the Study Area largely contains rocky and hilly terrain that mostly does not provide suitable feeding areas for whooping cranes, any development or construction projects occurring in the action area are not likely to result in loss of habitats that could be used by migrating whooping cranes for feeding. If such development were to occur close to a potential roosting site, it could preclude future use of that site for roosting by whooping cranes. However, such preclusion would then seem to serve to even further decrease the risk of collision by whooping cranes with the Priority Project transmission lines occurring within 2 miles of that site.

The Covered Activities are not expected to cause the loss of stopover habitat or harm to whooping cranes through collision. The Covered Activities might cause whooping cranes to avoid particular sites that could provide suitable roost habitat, although they also might not. It is believed that potential roost sites such as ponds and stock tanks are widespread in the action area. The degree to which the ability of such sites to host roosting whooping cranes is being lost to encroaching development and to the breaching of dams by landowners is not known. The action area is largely rural, so the rate at which suitable roost sites is lost within the action area is likely quite low. It is also possible that new potential roost sites are created on occasion as landowners build new stock ponds. Nearly all potential roost sites for whooping cranes within the action area (ponds and stock tanks) are not naturally occurring, and the continued existence of many of these sites is subject to change as land ownership and land uses change.

If the Covered Activities were to cause some potential roost sites to become unattractive to whooping cranes, that loss could contribute to an overall reduction of potential roost sites in the action area resulting from a combination of encroachment by development and draining of tanks, if such loss was not offset by creation of new stock tanks. Given that the Priority Projects are unlikely to cause many, if any, potential roost sites to become unattractive to whooping cranes and because potential roost sites within the action area are expected to be widespread, any loss of suitability of roost sites is not expected to result in a significant cumulative impact on this species.

Construction of the Priority Projects would contribute to the total number of collision risks for whooping cranes present within the action area, although it is important to reiterate that the Priority Projects would be constructed outside of the 200-mile-wide whooping crane migration corridor. The action area contains existing collision risks. Any future installation of other transmission or distribution lines in the action area would further increase the number of collision risks in that area. However, because of the proposed line marking, whooping cranes are not expected to collide with either Priority Project transmission line, so this contribution to collision risks within the action area is not considered to be significant.

4.7 SPRAGUE'S PIPIT

4.7.1 Direct Impacts

4.7.1.1 Habitat Impacts

Roughly the western half of the Study Area lies within the wintering range for Sprague's pipit as mapped by Lockwood and Freeman (2004), and the entire Study Area lies within the migratory corridor of this species. Sprague's pipits occur in areas that support short grass, such as grasslands and pastures. No clearing of ROW would be necessary wherever the transmission lines crossed such short grass areas, so no loss of potential Sprague's pipit habitat is expected from construction of the Priority Projects.

Where transmission lines are constructed across wooded communities, ROW clearing would be expected to result in the replacement of woody vegetation with grassy or herbaceous vegetation. This would not be expected to increase the amount of wintering habitat available to Sprague's pipits because the birds typically winter in more extensive areas of grassland, but it could increase the amount of habitat potentially available to migrating pipits. As most Sprague's pipits are likely to use more extensive areas of grassland even during migration, and Sprague's pipits may avoid transmission line structures as discussed in Section 4.8.2, any increase in grassland available to Sprague's pipits as a result of clearing of ROW for the Priority Projects is likely to be of negligible benefit to the species.

4.7.1.2. Collision Impacts

Construction of the Priority Projects would create a collision risk for Sprague's pipit wherever they crossed potentially suitable Sprague's pipit habitat because the underlying habitat could attract flying pipits towards the transmission lines. The Service in its 12-Month Finding to list Sprague's pipit as endangered or threatened did not identify collision with transmission lines as a threat to the species (75 FR 56028). However, while it cannot be concluded that construction of

the Priority Projects would not cause the occasional Sprague's pipit transmission line collision mortality, it also is considered highly probable that construction of the Priority Projects would not result in the collision loss of Sprague's pipits at a level or frequency great enough to significantly affect the species at the population level.

While collision with transmission lines does not appear to be a serious threat to Sprague's pipits, it does not mean that it would be impossible for one or more Sprague's pipits ultimately to collide with the transmission lines of the Priority Projects. However, given the relatively low probability of collision and the fact that any collisions likely would not occur at a level or frequency great enough to affect the Sprague's pipit as a species—or even local population level—LCRA TSC has elected not to include the Sprague's pipit as a Covered Species at this time.

4.7.2 Indirect Impacts

In its 12-Month Finding to list Sprague's pipit as endangered or threatened, the Service provided a rather extensive discussion on the presumed effects of development and habitat fragmentation on Sprague's pipits on their breeding grounds (75 FR 56028). This discussion cited studies that suggested Sprague's pipits on their breeding grounds avoid roads and other non-grassland features such as trees, oil wells, and human-made structures. No discussion is made in the 12-Month Finding of how sensitive Sprague's pipits may be on their wintering grounds to non-grassland features, apart from their avoiding grasslands that have been invaded by brush (75 FR 56028). Sprague's pipits certainly do not avoid roads during non-breeding periods, as mowed grassy roadsides within grassland areas afford some of the best opportunities to observe this species during migration, and migrant individuals do not strictly avoid trees as they have been flushed from Texas Hill Country woodland clearings (P. Sunby/SWCA, pers. obs.).

If Sprague's pipits avoid human-made structures during migration and when on their wintering grounds, then it could be expected that the Priority Projects, where constructed in suitable Sprague's pipit habitat, could render that habitat unsuitable for further use by the species within some distance of each structure location. What that distance might be is not known with certainty. The Service used 750 feet (229 m) as the distance that Sprague's pipits would be expected to withdraw from human-made structures on their breeding grounds.

Very little suitable habitat for Sprague's pipits was observed by SWCA along the routes for the Twin Buttes–Big Hill and Big Hill–Kendall transmission lines. What grassland communities are present along the routes for these transmission lines are generally unsuitable for use by Sprague's pipits because the grass is too tall and shrubs are often present in at least low densities. Consequently, while construction of the Priority Projects may result in the presence on the landscape of some structures that may render adjacent grassland habitat unavailable for further use by Sprague's pipits, the loss of that habitat is not expected to be of material consequence to the species because that habitat is expected to represent only a tiny percentage of all habitat available to wintering and migrant Sprague's pipits.

4.7.3 Cumulative Effects

In evaluating cumulative effects, the action area for Sprague's pipit is defined as those lands occurring within 750 feet of the Priority Projects. This distance was chosen because it is the distance identified by the Service in its 12-Month Finding as that out to which the birds would avoid human-made structures when on their breeding grounds. As discussed for other species, because the region is predominantly rural, it seems likely that land clearing and other agricultural practices will be performed at some point in portions of the action area, as might some road construction and maintenance projects. Portions of the action area might also be used for residential or commercial construction and installation of utilities. Clearing of land for agricultural purposes, if performed in valley bottoms to create pasture, could increase the amount of potentially suitable wintering or stopover habitat available to Sprague's pipits. If Sprague's pipits do not avoid human-made structures when migrating or wintering to the same extent that they do when on their breeding grounds, then any increase in available habitat within the action area could be of benefit to the species. However, because most of the Study Area contains upland, woody habitats, it is likely that any increase in the amount of available habitat would be comparatively small and any benefits to Sprague's pipit derived from that increase would be nominal.

Because the Priority Projects would largely be constructed in lightly developed or rural areas, it appears that potential wintering and stopover habitat for Sprague's pipits within the action area would more likely in the future continue to be used for agricultural purposes than be developed, with development more likely to occur in non-arable areas. However, residential or commercial development, if it were to occur in an agricultural area, could reduce the amount of wintering or stopover habitat available to Sprague's pipits. Loss of wintering habitat was identified by the Service as a threat to the species in its 12-Month Finding to list Sprague's pipit as endangered or threatened. Losses are mostly attributed to conversion of grasslands to croplands, overgrazing, and invasion of grasslands by woody species (75 FR 56028). Again, the Study Area does not contain much appropriate habitat for Sprague's pipits and most of the Study Area lies outside of the wintering range of the species, so loss of any habitat within the action area, either directly through development, indirectly through construction of structures that the birds then avoid, or through some other means, is not expected to have a significant effect on Sprague's pipit.

The Priority Projects may result in a negligible increase in the overall risk of Sprague's pipit collision with human-made structures across the landscape. Collision with transmission lines, in general, does not appear to be a serious threat to Sprague's pipit, and the Priority Projects, specifically, are not expected to create a serious risk of collision for Sprague's pipits. Consequently, the Covered Activities are expected to have a negligible contribution to the cumulative loss of this species off of its breeding grounds.

4.8 FRESHWATER MUSSELS

The five freshwater mussels evaluated in this HCP—golden orb, false spike, Texas pimpleback, Texas fatmucket, and Texas fawnsfoot—have potential to occur in some of the creeks and rivers that may be crossed by the Priority Projects, or in creeks and rivers fed in part by runoff from lands that may be crossed by segments of the Priority Projects. Texas pimpleback is known to occur in the Concho River (TPWD 2009b). The Concho River is not crossed by either of the

Priority Projects; however, the Twin Buttes–Big Hill route crosses three of its tributaries, Spring Creek, Dove Creek, and the Middle Concho River (now dry), and the Big Hill–Kendall route crosses the upper ephemeral reach of the South Concho River.

LCRA TSC will conduct construction activities in compliance with a SWPPP approved by the Texas Commission on Environmental Quality (TCEQ). Erosion and sedimentation control measures will be emplaced at structure sites during the erection process, thereby greatly limiting the amount of sediment that could escape a structure site during this temporary activity. Clearing for ROW is mostly performed by flail mowers or some other type of equipment that does not result in disturbance to the soil, so this activity is not expected to allow significant amounts of sediment to be carried from the ROW during the clearing phase. Some soil from the ROW and cleared access roads may be carried from construction areas, especially if it rains heavily during the construction phase, but runoff from construction areas would in nearly all cases be filtered by adjacent vegetative cover. Natural revegetation of ROW by grasses and forbs can be expected to stabilize any disturbed soils in the ROW.

LCRA TSC will employ several measures at all crossings of perennial streams in an effort to avoid adversely affecting any native species of freshwater mussel. These measures include:

1) Placement of all transmission line structures outside of the channels of perennial streams;
2) Use of silt fences around all structure construction sites located within 300 feet of stream crossings to control loss of sediment from those sites;
3) Use of rock berms during the construction period to slow surface water runoff from the ROW and constructed access roads in cases where ditches, gullies, or other paths of concentrated surface water runoff cross the ROW or access roads within 300 feet of the channel of a perennial stream;
4) Revegetation at structure construction sites, and any other places where soil is disturbed within the ROW or along access roads constructed by LCRA TSC, within 300 feet of the channels of perennial streams. Revegetation would be performed through seeding, using a mix certified by the U.S. Department of Agriculture and approved by the involved landowner. LCRA TSC uses mixes composed solely of seeds of native plant species wherever possible. Mulching, matting, and grading may be used as required by local topographic conditions. Unless otherwise directed by the landowner, supplemental watering will be provided to seeded areas for a period of one month after application of seed or until completion of the site preparation project, whichever is longer;
5) Prohibition on the placement of rip-rap or other fill material in the beds of perennial streams;
6) Prohibition on the storage of vehicles, mechanical equipment, fuel, oil, or any other potential sources of oil, grease, or chemical pollutants within 300 feet of perennial streams; and
7) Restriction on the application of herbicides to woody vegetation that is a potential threat to transmission line reliability. Applicators using mechanized equipment in ROW corridors will use either liquid streams or relatively coarse sprays to minimize spray drift. Herbicides will not be used when rainfall is likely to occur within 24 hours after

treatment. Any use will comply with the herbicide label requirements for dilution, application, disposal of rinse water, and disposal of empty containers. No herbicides or herbicide rinsate will be disposed of near any perennial streams or other water bodies. All use will follow herbicide toxicity guidance in *Recommended Protection Measures for Pesticide Applications in Region 2 of the U.S. Fish and Wildlife Service* (White 2004).

Despite the measures identified above, construction phase activities will create some potential for surface water runoff from construction areas to carry sediment loads above those that might be expected in absence of construction, regardless of how small that increase might be. However, because activities with potential to disturb soils would be very limited in extent, construction sites would be afforded protections against erosion through a TCEQ-approved SWPPP, construction effects would be temporary, because surface water runoff from construction areas can nearly always be expected to receive filtration treatment by adjacent vegetative cover, and because transmission lines would span all perennial creeks and rivers, the Covered Activities are expected to have a negligible effect on the quality or quantity of water within creeks and rivers that support, or may support, any native freshwater mussels. Consequently, no native freshwater mussel species are expected to be adversely impacted by the Covered Activities.

4.8.1 Cumulative Effects

Because the Priority Projects are not expected to result in direct or indirect impacts to any of the five species of freshwater mussel, neither the ESA nor NEPA requires an analysis of cumulative effects on these species.

4.9 TOBUSCH FISHHOOK CACTUS

4.9.1 Direct Impacts

LCRA TSC will delineate areas within the Big Hill–Kendall transmission line easement that have potential to support Tobusch fishhook cactus. This delineation will be based on known range of the species and performed using a combination of aerial photography and geologic maps. The delineation will then be presented to the Service for its review and approval.

A preliminary estimate of the length of transmission line that could be constructed across potential Tobusch fishhook cactus was performed by SWCA in the early stage of development of this HCP. Developing this estimate required the use of some assumptions because of uncertainty concerning the northern and eastern limits of the range of this species. To perform this estimate, SWCA considered all exposures of Edwards Formation limestone crossed by the approved Big Hill–Kendall route in Kimble, Kerr, and Gillespie Counties as having potential to support Tobusch fishhook cactus. Based on this assumption and the surface geology of the Study Area as mapped by the University of Texas (Bureau of Economic Geology 1976a, 1976b, 1981a, 1981b, 1983), approximately 64.1 miles (102.6 km) of the Big Hill–Kendall transmission line route crosses potential Tobusch fishhook cactus habitat.

Multiplying this distance by the maximum 160-foot ROW width suggests that the amount of potential Tobusch fishhook cactus habitat that could be cleared for the Big Hill–Kendall transmission line is approximately 1,243 acres (503 ha). It is expected that this acreage greatly

overestimates the amount of Tobusch fishhook cactus habitat that would actually be cleared for the Big Hill–Kendall transmission line for the following reasons: 1) The area assumed to be the geographic range of the species for this exercise likely exceeds the true range of the cactus to the north and east; 2) It is a near certainty that even within its true range the Tobusch fishhook cactus does not fully occupy all areas underlain by the Edwards Formation because not all lands underlain by the Edwards support vegetation communities suitable for occurrence of the cactus; and 3) The cactus occurs in clearings within woodlands, so if the species does occur within the selected ROW, it is possible that no clearing would need to be performed in areas where cacti are located.

LCRA TSC will incorporate BMPs into the construction and maintenance methodologies used within the Service-approved areas identified as potentially supporting Tobusch fishhook cactus in order to minimize the potential for the Covered Activities to result in direct impacts to this species. These BMPs will include the following:

- Identification of potential habitat for Tobusch fishhook cactus. LCRA TSC will delineate potential cactus habitat within the ROW for the Big Hill–Kendall transmission line alignment.
- Pre-construction surveys by a biologist familiar with the species for the cactus within 150 feet (46 m) of structure locations. Erecting a structure typically results in complete disturbance of the ground at the structure foundation site and heavy vehicle/equipment use within 150 feet of the foundation site. Surveys will be performed during the blooming period for the cactus (February and March) as allowed by the construction schedule. Any Tobusch fishhook cactus found within 150 feet of a structure location will be protected behind construction fencing where possible. If use of fencing is not possible, locations of the cactus will be marked with survey pin flags so that equipment operators can see and avoid them. All equipment operators will be educated to recognize Tobusch fishhook cacti and be informed of the importance of avoiding flagged areas.
- Pre-construction surveys for the cactus within the Big Hill–Kendall ROW during the blooming period for the cactus on any federally or state-owned land identified as potential habitat that would be crossed by the transmission line. Any Tobusch fishhook cactus found within the ROW on federally or state-owned land would be avoided when performing the Covered Activities. State-owned lands crossed by the transmission line are anticipated to be largely, if not exclusively, limited to highway ROW readily accessible to the public. Consequently, LCRA TSC would not mark any cacti found in highway ROW or protect them behind construction fencing in order to prevent their being noticed and subsequently collected. LCRA TSC would instead employ a construction monitor to guard the plants and ensure their avoidance during the time transmission line construction activities were being performed in that specific area.
- Use of flail mowers or similar equipment during construction and maintenance activities to clear vegetation in ROW within delineated potential habitat. Flail mowers cut vegetation above ground level. Cutting vegetation above ground level as opposed to blading it will avoid soil disturbance and minimize the potential for destroying any Tobusch fishhook cactus that may be present.

- Avoidance of the spreading of mulch in potential habitat areas. LCRA TSC will not spread mulch resulting from the clearing of ROW within areas identified as potential Tobusch fishhook cactus habitat. This will prevent mulch from smothering or shading out any cacti that may be present in the ROW.
- Prohibition on use of herbicides. No herbicides will be used as part of ROW maintenance activities within areas identified as potential Tobusch fishhook cactus habitat.

Despite implementation of the above BMPs, it is considered possible that the Covered Activities could result in the direct loss of individual Tobusch fishhook cactus on private lands. Cacti may be crushed by vehicles traveling the ROW between structure locations, and the location of some cacti relative to structure locations could preclude their avoidance. The number of cacti that could be directly disturbed on private lands as a result of the Covered Activities cannot be quantified at this time. The direct disturbance of Tobusch fishhook cactus on private lands is not prohibited by Section 9 of the ESA.

4.9.2 Indirect Impacts

The possible indirect effects of the Covered Activities on Tobusch fishhook cactus could be positive and negative. The clearing of woody vegetation within the ROW will decrease the amount of shaded ground and possibly increase habitat suitability for the cactus. This could allow the species to colonize previously unoccupied areas and increase the size of local populations. Given the scale of expected levels of disturbance, any improvements to local habitat conditions are expected to be minor. However, because ROWs are expected to be maintained in an open condition, habitat conditions within ROW should remain suitable for Tobusch fishhook cactus for as long at ROWs are maintained. Vegetation clearing is not expected to adversely alter habitat microclimatic conditions for the species as these cacti occur in open, sun-lit areas. As indicated previously, no mulch will be spread in areas identified as potential cactus habitat, so the Covered Activities will not result in a decrease in the amount of area available for this species to occupy.

If any cacti are destroyed during performance of the Covered Activities, this would result in an overall decrease in local populations. The presence of fewer cacti in a particular area could increase the risk of that local population from being eradicated by weevils or through some other natural process. The severity of that risk would depend on the number of cacti occurring in a particular area.

For the same reason that direct impacts to this species cannot be quantified, the indirect effect of the Covered Activities on Tobusch fishhook cactus also cannot be quantified. If no cacti are directly harmed by the Covered Activities, then indirect impacts may be limited to positive improvement of habitat conditions. If some cacti are destroyed by Covered Activities, then some negative impacts to local populations may be realized, although potential would still exist for improvement in local habitat conditions.

4.9.3 Cumulative Effects

Given that Tobusch fishhook cactus are unlikely to be indirectly affected by the Priority Projects, and there are unlikely to be any future non-federal activities occurring within the ROWs which would adversely affect the cactus, there are no anticipated cumulative effects.

4.10 CLIMATE CHANGE

Nearly all plant and animal species can be expected to be affected by significant climate change. Depending on the species and how broad or restricted its geographic range is, the effects of climate change on that species could be positive or negative, with some species having potential to be adversely affected in some portion of their range and positively affected in others. For example, the southern extent of the range of a species of the northern hemisphere could become inhospitable for that species if the planet were to become warmer, but the species may then become able to expand its range northward such that the total population ultimately suffered no net loss of individuals. Conversely, a species with a very limited range could find itself poorly adapted to habitat conditions altered through climate change and might not be able to evolve adaptations to that altered habitat in time to avoid going extinct.

Humans have some ability to assist the survival of some species, especially habitat generalists, in the face of climate change. For example, they could transplant plants into more suitable habitats, store seed in seed banks for later propagation, and capture animals in one area and release them in more suitable habitat elsewhere. Humans, however, have much less ability to assist in the survival of species that are habitat specialists because it can be difficult to replicate or "manufacture" habitats outside of the natural range of those species. Habitat specialists that find their habitats disappearing in the face of climate change instead of expanding would seem to be vulnerable to extinction.

Many of the species that end up on the federal list of threatened and endangered species are habitat specialists that become imperiled by loss of habitat. If a habitat generalist appears to become threatened with extinction, it usually is not because of loss of habitat, but because of some other factor, such as over-collection, persecution, exposure to pesticides, etc. It therefore is typically easier to effect recovery of populations of habitat generalists, as illustrated by the comparatively recent delisting of brown pelican (*Pelecanus occidentalis*), bald eagle, and peregrine falcon (*Falco peregrinus*). All three of these species are habitat generalists whose populations in North America rebounded once the use of organochlorine pesticides such as DDT was banned.

Of the Covered Species addressed in this HCP, it has been mentioned previously that the EPA has identified the golden-cheeked warbler as highly vulnerable to climate change (EPA 2009). The black-capped vireo appears to us to be less vulnerable to climate change because it is adapted to very warm temperatures and uses ephemeral habitats. Grzybowski (1995) describes this species as breeding in some of the hottest areas in North America. Use of ephemeral habitat appears to have made the birds adept at finding emerging habitats, so it seems they would be capable of following their habitat if it shifted location across the landscape in response to changes in temperature and moisture regimes.

5.0 PROPOSED HABITAT CONSERVATION PLAN

LCRA TSC is voluntarily seeking authorization from the Service for the incidental take of the golden-cheeked warbler and black-capped vireo while performing the Covered Activities for the Priority Projects. The Section 10(a)(1)(B) incidental take permit was applied for and would be used at the discretion of LCRA TSC. The LCRA TSC retains the right to withdraw from the permit at any time prior to the occurrence of any take authorized by that permit.

Sections 5.2 through 5.6 of this chapter present LCRA TSC's habitat conservation plan (HCP). This HCP complies with the Five Point Policy of the Service, which requires integration of the following five components into an HCP: 1) biological goals and objectives; 2) adaptive management; 3) monitoring; 4) permit duration; and 5) public participation. The expected impact of the proposed Covered Activities on the Covered Species is described in Section 5.1 immediately below.

5.1 ASSESSMENT OF TAKE

This HCP identifies a habitat-based approach to identification of potential impacts to the golden-cheeked warbler and black-capped vireo. Using habitat as a proxy for take of individual golden-cheeked warblers and black-capped vireos, as well as for designing mitigation measures, is consistent with longstanding Service practice with respect to both birds. Indeed, this approach has been utilized in *all* incidental take permits and ESA Section 7 consultations the agency has issued and conducted with respect to the two species.

This approach is inevitable given the nature of the potential impact of the Covered Activities on the species. It is highly unlikely that any activity carried out in connection with the Priority Projects will ever have a direct impact on any warblers or vireos, such as by proximately and detectably wounding or killing a specific identifiable bird. Rather, all of the potential impacts anticipated as a consequence of the Priority Projects are indirect causal events flowing from the effects the Covered Activities may have on habitat of the two species. In other words, the only expected take of golden-cheeked warblers and black-capped vireos flows from the possibility that the Priority Projects may eliminate or degrade the quality of golden-cheeked warbler and black-capped vireo habitat in such a way as to significantly impair the ability of unidentified golden-cheeked warbler and black-capped vireo individuals to breed, feed, and seek shelter in the future. Likewise, on the flip side, habitat quality is the only viable metric for evaluating the effectiveness of mitigation designed to improve conditions for the species. For example, neither of the recovery plans for the species specifies taking measures with respect to specific warblers or vireos; rather, both recovery plans focus on improving habitat. Given that it is habitat impacts that lead to the concern that some individuals of the two species may suffer actual death or injury, and given that habitat enhancement is how conditions for the species are improved, it is appropriate to use habitat impacts as the metric of take and mitigation in this HCP.

As has been the case for every previous incidental take authorization issued for these two species, there is no other practicable way to quantify take or mitigation. While surveys for the golden-cheeked warbler and black-capped vireo provide valuable information for determining the extent of occupation of a given area, they do not provide a precise mechanism for predicting the number of golden-cheeked warblers or vireos that may actually be "taken" by a proposed

action. The effectiveness of bird surveys in counting the number of birds in an area can be somewhat limited. For example, males of these species are far more easily observed than females or fledglings during surveys, due to their frequent vocalizations. Moreover, the acreage of habitat impacted or protected by a particular action is a relatively stable metric of take and mitigation, compared to the number, size, and location of individual bird territories on a property that may vary from year to year. In addition, the impacts of a given activity may not be fully felt in a single season and may be spread over several or even many years, during which utilization of a given area, or perceived utilization, may vary quite significantly for reasons unrelated to the activity in question. This variability is influenced by species preferences or environmental factors that may include natural year-to-year variations in the precise habitat utilized by individual birds, variations in individual bird behavior that influence detectability, variations in the ability of surveyors to detect and accurately map individual birds, and survey methodology. Therefore, estimates of take and mitigation based on impacts to territories as delineated by surveys in any given year are highly variable. For these reasons, it is not possible to predict the precise number of golden-cheeked warblers or vireos that may, over time, be "taken" or "preserved" as a result of the activities covered by or the mitigation measures to be taken pursuant to the HCP. Therefore, take and mitigation in this document are not characterized by a precise bird count, but by the loss or preservation of habitat for the Covered Species, the relative quality of which is determined primarily by an assessment of vegetative characteristics that may influence occupancy and utility of habitat.

In addition to being a scientific necessity, this approach is consistent with the case law addressing the legality of using habitat as a proxy for take of species individuals. Courts have recognized that as a general matter "Congress wanted incidental take impact to be stated in number of animals, where practical, not in terms of habitat markers." *Miccosukke Tribe of Indians of Florida v. U.S.*, 566 F.3d 1257 [11th Cir. 2009]. But courts have also explained that "while Congress indicated its preference for a numerical value, it anticipated situations in which impact could not be contemplated in terms of a precise number…In the absence of a specific numerical value, however, the Fish and Wildlife Service must establish that no such numerical value could be practically obtained." *Arizona Cattle Growers' Association v. U.S. Fish and Wildlife Service*, 273 F.3d 1229, 1249-50 [9th Cir. 2001]; see also *Oregon Natural Resources Council v. Allen*, 476 F.3d 1031, 1037 [9th Cir. 2007] (the Service must explain why it was unable numerically to quantify the level of take of northern spotted owls). These criteria are satisfied here, where there is no scientifically credible method for counting warblers or vireos lost or gained in the future as a result of the impact and mitigation activities associated with the Permit.

As described in Sections 4.1.2 and 4.2.2, the methodologies used to delineate the golden-cheeked warbler and black-capped vireo habitat expected to be impacted by the Covered Activities are based on very general habitat models. Consequently, it is expected that the amount of potential habitat identified as being affected along each transmission line route will in all cases exceed the amount of habitat affected that is actually occupied by the species.

All potential impacts to the Covered Species are *expected* to be indirect through the loss and disturbance of habitat; however, a slight possibility exists that some direct impact could occur (for example, if a tower collapsed or construction activities had to be performed when the species were present in the area, and a bird or occupied nest were inadvertently harmed as a result). The

collision of a golden-cheeked warbler or black-capped vireo with a transmission line is another example of an event that is unlikely to occur but is not impossible. In this HCP, the amount of potential impact to the Covered Species based on calculated habitat impacts is an estimate of maximum potential impact (see Sections 4.1 and 4.2, above) and then further increased through application of an additional 10 percent contingency. This estimate of maximum potential impact will result in a sufficient amount of permitted incidental take to cover any direct impacts to the species should such impacts occur.

LCRA TSC will follow the methodologies described in Sections 4.1 and 4.2 to identify the amount of known and potential golden-cheeked warbler and black-capped vireo habitat expected to be affected by construction of those lines. Through a combination of direct and indirect effects, the Priority Projects could impact up to but no more than the Maximum Authorized GCWA Habitat Impacts and Maximum Authorized BCVI Habitat Impacts.

Impacts to golden-cheeked warbler and black-capped vireo habitat would occur in linear swaths and so would be spread across many miles. As a result, the level of habitat impact in any particular area would be relatively small. With regard to the golden-cheeked warbler, clearing of habitat for transmission line ROW in most cases is not expected to cause displacement of golden-cheeked warblers from the patches of habitat being affected, although it could cause reconfiguration of territory boundaries. Clearing in smaller patches of habitat could eliminate the continued viability of those patches. No evidence suggests that golden-cheeked warblers avoid transmission lines or their supporting structures, so presence of these facilities is not expected to cause birds to abandon habitat adjacent to ROW. As noted previously in this document, SWCA has observed golden-cheeked warblers directly adjacent to transmission line ROW and routinely crossing cleared ROW in several different counties over its 20-year history of conducting surveys for the species (P. Sunby/SWCA pers. obs).

Black-capped vireos will occur in smaller patches of habitat than will golden-cheeked warblers. Therefore, clearing of ROW for the transmission lines through black-capped vireo habitat may hold greater potential to eliminate the viability of habitat patches. However, at the same time, black-capped vireo habitat is also shorter than warbler habitat (consisting of shrubs rather than trees), and so it does not pose the same threat to the safety and reliability of transmission lines as does forested habitat. Therefore, LCRA TSC may not need to clear as much vegetation from the transmission line ROWs where it traverses vireo habitat than it might in areas where the ROW traverses warbler habitat to ensure safe operation of the transmission line. This may lessen the potential impact on vireo habitat patch viability in and adjacent to the ROW.

The above discussions notwithstanding, the Service during its review of the draft HCP requested that an attempt be made to estimate the number of golden-cheeked warblers and black-capped vireos expected to be taken as a result of authorization of the Permit. This is not easily done for a variety of reasons, including lack of knowledge of the number of warblers and vireos occurring in the patches of habitat crossed by the alignments for the Priority Projects and imperfect knowledge of how the birds will respond to construction of transmission lines.

SWCA through the use of GIS software and digital aerial photography examined how clearing of the ROW for the Big Hill–Kendall transmission line would alter the size and shape of each patch of woodland identified as potential habitat for the golden-cheeked warbler. For each patch,

SWCA then predicted subjectively the number of golden-cheeked warblers it believed would be displaced from that patch as a result of clearing for construction of the Priority Project, with that number based both on the expected change in size and shape of the habitat patch and the perceived likelihood that the patch is actually occupied by golden-cheeked warblers. As has been discussed, the delineation of potential warbler habitat was by necessity liberal owing to a lack of species-specific survey data. In essence, a wide net was cast to ensure that no golden-cheeked warbler habitat was missed in the delineation, but with the inevitable result that marginal quality woodlands not actually used by golden-cheeked warblers were also captured in the delineation. While development of this HCP necessitated the use of such a methodology, habitat quality must be considered when the aim is to estimate the number of golden-cheeked warblers that would be impacted by a particular project as accurately as possible. Through its review as described above, SWCA estimated that no more than 18 pairs of golden-cheeked warblers are likely to be displaced as a result of construction of the Big Hill–Kendall transmission line.

A number for golden-cheeked warblers that might be taken as a result of construction of the Big Hill–Kendall transmission line could also be derived by taking the number of acres of golden-cheeked warbler habitat identified as being impacted by construction of the Big Hill–Kendall transmission line and dividing it by the size of the average golden-cheeked warbler territory. This method is not subjective, but it is weakened by imperfect knowledge of the status of golden-cheeked warbler in woodlands identified as potential habitat and the size of the average golden-cheeked warbler territory in woodlands crossed by the alignment for the Big Hill–Kendall transmission line. More importantly, because of the linear nature of the Priority Projects, this method also fails to account for the fact that habitat impacts are accrued across distance, so that acreage of impact equal in size to one golden-cheeked warbler territory is actually gained through small amounts of impact totaled across multiple warbler territories and, probably, intervening unoccupied woodland. In addition, this method also requires the assumption that, as a result of edge effects, golden-cheeked warblers would be displaced from woodlands occurring adjacent to a grassy transmission line ROW, but in order to be available for displacement, they would have to occur in woodlands located adjacent to an interstate highway.

SWCA initially identified potential golden-cheeked warbler habitat in the Study Area as having high, medium, or low quality based on measures such as avearge woodland canopy height, percent canopy closure, and proportion of deciduous oak trees to total number of trees in the woodland. At the request of the Service, the HCP ultimately treated all woodland equally with regard to its potential to provide habitat for golden-cheeked warblers owing to subjectivity in assignation of relative habitat quality. However, woodlands crossed by the Big Hill–Kendall transmission line alignment are not equal with regard to their ability to support golden-cheeked warblers and do range in quality from very low (woodland with few deciduous trees, low canopy height, and a relatively open canopy) to relatively high (woodland with moderate to high densities of deciduous trees, and a taller and closed canopy). Density of occupation by golden-cheeked warblers is directly proportional to habitat quality (Pulich 1976). Pulich (1976) found that, on average, golden-cheeked warblers occurred in woodlands at an average density of one pair for every 85 acres of marginal habitat, every 50 acres of average habitat, and every 20 acres of excellent habitat.

Using the original SWCA habitat delineation, it was expected that construction of the Big Hill–Kendall transmission line would result in the direct loss of approximately 78.9 acres (31.9 ha) of high quality golden-cheeked warbler habitat, 119.1 acres (48.2 ha) of medium quality habitat, and 72.9 acres (29.5 ha) of low quality habitat. It was also expected that clearing for and construction of the transmission line would indirectly impact approximately 207.9 acres (84.1 ha) of high quality habitat, 359.7 acres (145.6 ha) of medium quality habitat, and 203.3 acres (82.3 ha) of low quality habitat. A 10 percent contingency was then added to these numbers to account for possible impacts resulting from construction of access roads and performance of emergency activities. Dividing the resulting habitat impact totals by the density rates identified by Pulich and then rounding up yields an estimate of 31 pairs of golden-cheeked warblers being displaced by construction of the Big Hill–Kendall transmission line, with assumption that warblers would abandon all habitat identified as indirectly affected as a result of project construction. If assumption is made that golden-cheeked warblers would be displaced only from habitat areas that would be directly impacted by construction, then the number of golden-cheeked warblers that might be displaced as a result of construction of the Big Hill–Kendall transmission line as identified by this methodology is 9 pairs.

Based on the above, construction of the Big Hill–Kendall transmission line may cause the displacement of 9 to 31 golden-cheeked warbler territories. LCRA TSC believes it is much more likely that the actual number of warbler pairs that would be displaced as a result of construction of the transmission line would be in the 9 to 18 end of this range because of the belief that golden-cheeked warblers are not likely to abandon habitat occurring adjacent to the transmission line ROW because the species is known to occur elsewhere adjacent to its transmission line ROW and warblers were found by SWCA to occur in woodlands in the Permit Area that occur adjacent to I-10.

With regard to the number of black-capped vireos that would be displaced as a result of construction of the Priority Projects, it is pertinent that black-capped vireo territories on average are smaller than the territories of golden-cheeked warblers. Consequently, the clearing of the transmission line ROW as proposed across a black-capped vireo territory would result in a greater percentage loss of habitat used by that bird than would clearing across a golden-cheeked warbler territory and, thus, clearing across a vireo territory would create greater potential to displace its occupants. Similar to golden-cheeked warblers however, black-capped vireos are known to occur directly adjacent to transmission line and road ROW, and so LCRA TSC does not believe that clearing for the Priority Projects would result in the displacement of black-capped vireos from habitat occurring adjacent to the cleared ROW beyond any displacement that could result from reductions in habitat patch size.

Similar to what it did for golden-cheeked warblers, SWCA through the use of GIS software and digital aerial photography examined how clearing of the ROW for the Twin Buttes–Big Hill and Big Hill–Kendall transmission lines would alter the size and shape of each patch of shrubland or shrubby woodland that had been identified as potential habitat for the black-capped vireo. For each patch, SWCA then predicted subjectively the number of black-capped vireos it believed would be displaced from that patch as a result of clearing for construction of the respective Priority Project, with that number based both on the expected change in size and shape of the habitat patch and the perceived likelihood that the patch is actually occupied by black-capped vireos.

As was done for golden-cheeked warblers, the perceived quality of the potential habitat was taken into account when assessing the likelihood that a particular patch of vegetation is occupied by black-capped vireos. Similar to the habitat delineation performed for the golden-cheeked warbler, the delineation of potential black-capped vireo habitat was by necessity liberal owing to a lack of species-specific survey data and was believed to have resulted in the delineation of much vegetation as potential black-capped vireo habitat that does not actually support black-capped vireos on a regular basis. Again, development of this HCP necessitated the use of such a liberal methodology, but habitat quality and likelihood of occurrence must be considered when the aim is to estimate the number of black-capped vireos that would be impacted by a particular project as accurately as possible. Through its review as described above, SWCA estimated that no black-capped vireos are likely to be displaced as a result of construction of the Twin Buttes–Big Hill transmission line, because SWCA does not believe that any black-capped vireos actually occur in any of the patches of vegetation identified as potential vireo habitat along the alignment for that project. In contrast, black-capped vireos are known to occur portions of the Big Hill–Kendall transmission line alignment. SWCA estimated subjectively that no more than 61 pairs of black-capped vireos are likely to be displaced as a result of construction of the Big Hill–Kendall transmission line.

A number for black-capped vireos displaced as a result of transmission line construction could also be reached by dividing the amount of vireo habitat expected to be impacted by the average black-capped vireo territory size. As discussed above for the golden-cheeked warbler, this methodology contains some inherent drawbacks, including imperfect knowledge of the status of the black-capped vireo in patches of vegetation identified as potential habitat for the species, lack of knowledge of the average black-capped vireo territory size in those patches that are occupied, and failure to account for the fact that habitat impacts are accrued across distance, so that acreage of impact equal in size to one vireo territory may actually be gained through small amounts of impact totaled across multiple vireo territories and, probably, patches of vegetation that do not actually support black-capped vireos.

Unlike what was originally done for the golden-cheeked warbler, SWCA did not ever differentiate black-capped vireo habitat in its delineation based on perceived differences in habitat quality. Thus, using the black-capped vireo habitat impact numbers identified in Table 10 and the average black-capped vireo territory size of 1 to 10 acres (0.4 to 4 ha) as identified by Graber (1957), the number of pairs of black-capped vireos displaced as a result of construction of the Twin Buttes–Big Hill transmission line could be considered to range from 19 to 189, with assumption that vireos would abandon all habitat identified as indirectly affected as a result of project construction. These numbers contrast sharply with the estimate of zero made by SWCA. With this same methodology, the number of pairs of black-capped vireos displaced as a result of construction of the Big Hill–Kendall transmission line could be considered to range from 226 to 2,258. The high end of this range appears highly bloated to LCRA TSC, with the reason being the described drawbacks and assumptions inherent to this methodology.

If assumption is made that black-capped vireos would be displaced only from habitat areas that would be directly impacted by construction, then the number of pairs of black-capped vireos that could be considered to be displaced as a result of construction of the Twin Buttes–Big Hill transmission line would be 3 to 30 under this methodology. The number of pairs of vireos that could be considered to be displaced as a result of direct habitat impacts associated with

construction of the Big Hill–Kendall transmission would be 52 to 514 pairs. The low ends of these ranges are reasonably close to the SWCA estimates, while the high ends are obviously much greater. The reason for these discrepancies is again believed by LCRA TSC to be the drawbacks and assumptions inherent to this methodology.

Based on the above, construction of the Twin Buttes–Big Hill transmission line is believed likely to cause the displacement of no more than 3 pairs of black-capped vireos, although based on the SWCA estimate, LCRA TSC believes the true number may be zero. LCRA TSC considers it possible that construction of the Big Hill–Kendall transmission line could cause the displacement of 52 to 61 pairs of black-capped vireos. This is a range derived from the low-end estimate resulting from simple division of acreage of direct habitat impact by average territory size and the subjective estimate made by SWCA. LCRA TSC cannot accept the higher end estimates derived by dividing total habitat impact acreage by an average territory size of 1 acre, and believes it worth noting that application of an average vireo territory size of 1 acre to the total amount of potential black-capped vireo habitat identified by the Service (USFWS 2004) as being extant in Texas in 2004 would suggest the black-capped vireo population in Texas at that time was what sounds to LCRA TSC to be a preposterous 1,450,438 pairs.

It is important to again note that the majority of habitat (848.0 acres for golden-cheeked warbler and 1,902.1 acres for black-capped vireo) authorized to be affected through permit issuance will actually remain intact and is only expected to be indirectly affected by the Covered Activities, with members of both species expected to continue to use this habitat. For both species, because impacts to habitat at the local scale would be limited to narrow linear corridors, and because birds of both species are expected to continue to utilize habitats adjacent to the ROW, the proposed clearing is not expected to result in a significant loss of habitat viability or significant change of bird numbers at the population level. Therefore, the impacts associated with constructing and maintaining the Priority Projects would not preclude recovery of the species.

5.2 BIOLOGICAL GOALS AND OBJECTIVES

As defined by the Service, biological goals should be commensurate with the scope of the proposed action to ensure that they are consistent with conservation actions needed. Biological goals are the broad guiding principles for the operating conservation program and provide the rationale behind the minimization and mitigation strategies. Specific biological objectives are the measurable targets for achieving the biological goals (USFWS 2000).

The primary goals of this HCP are, to the maximum extent practicable, to minimize potential impacts to the golden-cheeked warbler and black-capped vireo during performance of the Covered Activities, and to provide permanent compensatory mitigation for impacts to the warbler and vireo in the form of off-site habitat preservation and management. In addition, it is also the goal of this HCP to incorporate and implement measures that will serve to avoid and minimize the potential for the Covered Activities to result in impacts to the Evaluation Species, and that will reduce the risk of collision with transmission lines by avian species to a level that is acceptably low and does not appear to create imminent risk of harm.

The specific objective of this HCP is to cause the preservation and management of golden-cheeked warbler and black-capped vireo habitat in perpetuity in order to compensate for any

Project-related impacts to the species. As described below, measures have been identified and will be enacted to minimize the potential for the Covered Activities to result in direct impacts to any federally listed species.

5.3 IMPACT MINIMIZATION MEASURES

LCRA TSC has identified several general and species-specific measures intended to minimize the impacts of the proposed taking on the Covered Species associated with the Covered Activities. General impact minimization measures that will be incorporated into the two Priority Projects are identified below, followed by species-specific measures.

5.3.1 General Impact Avoidance and Minimization Measures

- Clearing of woody vegetation from the transmission line ROW and access roads will be performed to the extent possible during the fall and winter months to minimize the potential for that clearing to disturb nesting birds.
- LCRA TSC will mark those sections of transmission line that cross major rivers and may therefore be preferentially used as movement corridors by bald eagles, least terns, and other avian species with traditional marker balls, spiral vibration dampeners, or air flow spoilers. These markers will be installed on the shield wires with spacing dependent on the type of marker used. Markers placed at river crossings would extend from the river centerline out to a distance of 300 feet beyond each river bank. Markers will be inspected and replaced as necessary as part of routine maintenance activities.
- Use of herbicides will be limited to woody vegetation that is a potential threat to the reliability of the transmission line. Applicators using mechanized equipment in ROW corridors will use either liquid streams or relatively coarse sprays to minimize spray drift outside of the ROW. Herbicides will not be used when rainfall is likely to occur within 24 hours after treatment. Any use will comply with the herbicide label requirements for dilution, application, disposing of rinse water, and disposing of empty containers.

5.3.2 Golden-cheeked Warbler

- All clearing of woodland identified as known or potential golden-cheeked warbler habitat will occur during the period of 1 September through 29 February in order to avoid the potential of felling a tree containing an active warbler nest or harassing adult or free-flying juvenile birds. Exceptions to this prohibition will be made only in cases of Changed Circumstances (see Section 5.6.5.1) or where presence/absence surveys conducted according to Service protocols establish that no golden-cheeked warblers or black-capped vireos are present within 300 feet of the desired clearing activity. Construction activities (as opposed to clearing) within 300 feet of golden-cheeked warbler habitat may be conducted during the golden-cheeked warbler breeding season (1 March through 31 August), as long as those activities promptly follow permitted clearing and/or were initiated before 1 March, therefore being a continuous activity that began before initiation of the breeding season.

- LCRA TSC will seek to minimize the clearing of woodland identified as known or potential golden-cheeked warbler habitat to that necessary for the construction and safe and reliable operation of the proposed transmission lines.
- If stringing of transmission line (conductor and shield wires) must occur during the period of 1 March through 31 August in an area where woodland identified as known or potential golden-cheeked warbler habitat was not cleared from the ROW, a land-based tensioning system will be used to keep lines from sagging into treetops and potentially harming golden-cheeked warbler nests.
- All non-emergency maintenance activities, including clearing of vegetation from any ROW, planned to be performed within 300 feet of areas identified as known or potential golden-cheeked warbler habitat will be performed during the period of 1 September through 29 February to avoid potential to disturb golden-cheeked warblers. This prohibition does not apply to simply driving a ROW or to any activities that do not involve disturbance to woody vegetation or creation of loud noise.
- If an emergency requires removal of woody vegetation from an area identified as known or potential golden-cheeked warbler habitat during the period of 1 March through 31 August, LCRA TSC will coordinate with the Service regarding the need to perform the vegetation removal. LCRA TSC will not remove any woody vegetation from the ROW during the breeding season in an emergency situation without first having a qualified biologist search for, and verify absence of, active golden-cheeked warbler nests in the vegetation needing removal, unless the severity of the emergency (e.g., downed line or tower, etc.) does not allow for such a search to be conducted. If a severe emergency demands removal of woody vegetation from a ROW before coordination with the Service can be performed, as described in Section 5.6.5.1 (Changed Circumstances), LCRA TSC will submit a written or verbal report to the Service describing the location and magnitude of the clearing activity and nature of the emergency within 48 hours of completion of the activity.

5.3.3 Black-capped Vireo

- All clearing of woody vegetation identified as known or potential black-capped vireo habitat will occur during the period of 1 October through the end of February in order to avoid the potential of cutting a shrub or tree containing an active vireo nest or harassing adult or free-flying juvenile birds. Exceptions to this prohibition will be made only in cases of Changed Circumstances (see Section 5.6.5.1) or where presence/absence surveys conducted according to Service protocols establish that no black-capped vireos or golden-cheeked warblers are present within 300 feet of the desired clearing activity. Construction activities (as opposed to clearing) within 300 feet of black-capped vireo habitat may be conducted during the black-capped vireo breeding season (1 March through 30 September), as long as those activities promptly follow permitted clearing and/or were initiated before 1 March, therefore being a continuous activity that began before initiation of the breeding season.
- LCRA TSC will seek to minimize the clearing of vegetation identified as known or potential black-capped vireo habitat to that necessary for the construction and safe and reliable operation of the proposed transmission lines.

- All non-emergency maintenance activities, including clearing of vegetation from any ROW, planned to be performed within 300 feet of areas identified as known or potential black-capped vireo habitat will be performed during the period of 1 October through the end of February to avoid potential to disturb black-capped vireos. This prohibition does not apply to simply driving a ROW or to any activities that do not involve disturbance to woody vegetation or creation of loud noise.
- If an emergency requires removal of woody vegetation from an area identified as known or potential black-capped vireo habitat during the period of 1 March through 30 September, LCRA TSC will coordinate with the Service regarding the need to perform the vegetation removal. LCRA TSC will not remove any woody vegetation from the ROW during the breeding season in an emergency situation without first having a qualified biologist search for, and verify absence of, active black-capped vireo nests in the vegetation needing removal, unless the severity of the emergency (e.g., downed line or tower, etc.) does not allow for such a search to be conducted. If a severe emergency demands removal of woody vegetation from a ROW before coordination with the Service can be performed, as described in Section 5.6.5.1 (Changed Circumstances), LCRA TSC will submit a written or verbal report to the Service describing the location and magnitude of the clearing activity and nature of the emergency within 48 hours of completion of the activity. The need for emergency removal of black-capped vireo habitat is expected to arise rarely, if ever at all, because of regular ROW maintenance activities. Consequently, it is expected that the assessment of any impacts to vireo habitat resulting from this type of activity will not cause LCRA TSC to exceed its Maximum Authorized BCVI Habitat Impacts

5.3.4 Bald Eagle

- LCRA TSC will coordinate with the TPWD to determine whether any bald eagles are known to nest within 1.3 miles of Priority Project alignments. Because the possibility exists that some pairs of bald eagles could be nesting in the vicinity of a transmission line route unbeknownst to TPWD, LCRA TSC will also search for bald eagle nests within its easements for these projects within 1.3 miles of any large river or lake that has potential to support nesting eagles, whether or not these water bodies are crossed by the transmission line alignments. Coordination with TPWD and the search for eagle nests will be performed to ensure that ROW clearing activities do not result in the removal of active or inactive bald eagle nests. If any bald eagle nests are discovered by LCRA TSC during its surveys, the nest locations and status (active/inactive) will be reported within 48 hours of discovery to the Service and TPWD.
- To avoid potential for electrocution, both Priority Projects will be designed to maintain spacing between lines sufficient to prevent bald eagles and other raptors from simultaneously touching two or more lines.
- In addition to the General Measure marking of transmission lines at major river crossings, LCRA TSC will mark all segments of transmission line that occur within 1.3 miles of active bald eagle nest locations using similar methodology. Markings will be added to lines through the life of the transmission lines within 1.3 miles of any active bald eagle nests discovered subsequent to original construction for as long as bald eagles are

protected under the BGEPA and/or retain status as a state-listed species. Line markers will be inspected and replaced as necessary as part of routine maintenance activities.

- Pursuant to Service recommendations to site transmission lines at least 660 feet from bald eagle nests, if a bald eagle nest is found to occur within 660 feet of the edge of ROW for a transmission line route, LCRA TSC will evaluate its ability to locally reroute the line to maintain a setback from the nest of at least this distance. Local rerouting is allowed by the PUC only under a highly restrictive set of guidelines, and only if the shift does not engender cost increases or introduce other impacts not previously contemplated.
- LCRA TSC will notify all personnel performing Covered Activities within 1.3 miles of a bald eagle nest of their proximity to that nest. These same personnel will also be provided with training on how to identify bald eagles and will be instructed to avoid the nest and conduct their work as quickly and quietly as possible in order to minimize the time that eagles will be exposed to their presence.
- If any bald eagle nests are found to occur within 660 feet of the edge of ROW and construction of the involved transmission line will be performed during the time of year that the bald eagles are actively nesting, LCRA TSC will deploy a biological monitor to watch the eagles while construction activities (ROW clearing, structure erection, stringing of line, and cleanup) are performed. To ensure that no harassment to eagles occurs, the biological monitor will be empowered and required to halt construction if a bald eagle is seen to approach an activity that could present a hazard to the bird, or if construction activities appear to be preventing the eagles from regularly attending the nest. In order for the latter determination to be made, the monitor will be deployed at least two days prior to the commencement of construction activities so that general eagle activity patterns can be established.

No impacts to bald eagles or significant impacts to their habitat are anticipated. However, because of the possibility that eagles are nesting in currently unknown locations, it is considered possible that a transmission line route could pass nearer to an active bald eagle nest than is recommended by the Service or TPWD. Should this occur, LCRA TSC would endeavor to perform construction activities in proximity to any bald eagle nests during the times of year in which eagles are absent; however, LCRA TSC cannot be certain that project schedules and need to also avoid certain activities during the golden-cheeked warbler and black-capped vireo breeding seasons would completely allow for this. Consequently, while LCRA TSC would prefer to construct its transmission lines at appropriate distances from eagle nests and at times of year that would avoid potential for eagles to be present during construction, LCRA TSC recognizes this may not be possible. Design of the transmission lines will preclude bald eagle electrocutions, and the risk of collision with transmission lines by eagles is considered to be very low because of the proposed marking of lines at major river crossings. While performance of the Covered Activities may create some limited potential to result in harassment of a small but unquantifiable number of nesting bald eagles, and construction of the transmission lines creates a potential for collision with the lines by eagles, this potential appears sufficiently small that LCRA TSC has elected not to include bald eagle as a Covered Species at this time. In the unlikely event that a bald eagle nest is found to occur within 660 feet of the edge of a Priority Project ROW and clearing or construction activities in the proximate

section of ROW must occur during the eagle nesting season, LCRA TSC will coordinate with the Service to identify the preferred methods for completing the necessary activities.

5.3.5 Least Tern

- Because least terns are expected to occur in the Study Area only as transients and their occurrence is expected to coincide largely with the corridors of major rivers, no impact avoidance and minimization measures are proposed for this species beyond the General Measure marking of transmission lines at major river crossings.

5.3.6 Whooping Crane

- Using the methodologies described in Section 4.6.1 and risk factors identified in Table 11, LCRA TSC will mark those segments of the shield lines for the Twin Buttes–Big Hill and Big Hill–Kendall transmission lines that have a collision risk factor of 4 or greater. Transmission lines will be marked using traditional marker balls, spiral vibration dampeners, or air flow spoilers. Markers will be placed on the shield wire with a spacing dependent on the type of marker used. These markers will be inspected and replaced as necessary as part of routine maintenance.

5.3.7 Tobusch Fishhook Cactus

- LCRA TSC will perform surveys for Tobusch fishhook cactus within 150 feet of sites chosen for location of transmission line structures in areas identified as potentially suitable habitat for the species through the methodology described in Section 4.11.1.
- Any Tobusch fishhook cactus found within 150 feet of a structure location will be protected behind construction fencing where possible. If use of fencing is not possible, locations of the cactus will be marked with survey pin flags so that equipment operators can see and avoid them. All equipment operators will be educated to recognize Tobusch fishhook cacti and be informed of the importance of avoiding flagged areas.
- LCRA TSC will conduct pre-construction surveys for the cactus within its ROW on any federally or state-owned land identified as potential habitat that would be crossed by the Big Hill–Kendall transmission line. Any Tobusch fishhook cactus found within the Big Hill–Kendall easement on federally or state-owned land will be avoided when performing the Covered Activities. State-owned lands crossed by the transmission line are anticipated to be largely, if not exclusively, limited to highway ROW readily accessible to the public. Consequently, LCRA TSC will not mark any cacti found in highway ROW or protect them behind construction fencing in order to prevent their being noticed and subsequently collected. LCRA TSC would instead employ a construction monitor to guard the plants and ensure their avoidance during the time transmission line construction activities were being performed in that specific area.
- LCRA TSC will use a flail mower or similar equipment to clear vegetation from the ROW within areas identified as potential Tobusch fishhook cactus habitat. Flail mowers cut vegetation above ground level. Cutting vegetation above ground level will avoid soil

disturbance and minimize the potential for clearing of the ROW to destroy any Tobusch fishhook cactus that may be present in an area.

- LCRA TSC will not spread any mulch resulting from the clearing of ROW within areas identified as potential Tobusch fishhook cactus habitat. This will prevent mulch from smothering or shading out any cacti that may be present in the ROW.
- LCRA TSC will not use herbicides as part of ROW maintenance activities within areas identified as potential Tobusch fishhook cactus habitat.

5.4 MITIGATION MEASURES

As described in Sections 4.1.2 and 4.2.2, LCRA anticipates that the Covered Activities will result in the clearing and impairment of potential habitat for the Covered Species. The amount of habitat for these species expected to be lost has conservatively been identified as the Maximum Authorized Golden-cheeked Warbler Habitat Impacts and Maximum Authorized Black-capped Vireo Habitat Impacts.

LCRA TSC will mitigate for the expected loss of golden-cheeked warbler and black-capped vireo habitat to the maximum extent practicable through one or more methods identified through coordination with the Service and, probably, private conservation entities. The methods considered for each species are described below. In addition to mitigating for expected loss of habitat, LCRA TSC is proposing to acquire a “bank” of mitigation credits that would be held in reserve to compensate for unanticipated direct impacts should they occur (for example, if a tower collapsed onto habitat or construction activities had to be performed when one or both species were present in the area, and a bird or occupied nest were inadvertently harmed as a result, or in the unlikely event that a golden-cheeked warbler or black-capped vireo were to collide with a transmission line. These credits would be allocated on a case-by-case basis in coordination with the Service, with expectation that mitigation for actual loss of birds would be provided at a ratio of 4.5:1 for either species. All events that could result in the unanticipated direct impact of habitat for Covered Species are expected to occur rarely if at all. The “bank” of mitigation credits to be allocated in the event they are needed to compensate for unanticipated direct impacts will be established through the previously described (see Sections 4.1.2.3 and 4.2.2.3) application of a 10 percent contingency to the number of acres of habitat expected to be directly and indirectly impacted as a result of clearing of the Priority Project ROWs. As discussed, these contingency credits would also be used to compensate for habitat directly and indirectly impacted by construction of access roads.

No compensatory mitigation is proposed for bald eagle, least tern, whooping crane, or any other Evaluation Species because LCRA TSC does not expect the Covered Activities to result in any take of these species pursuant to applicable Federal law, and take authorization is not needed for Tobusch fishhook cactus because any loss of that species will occur solely on private lands.

5.4.1 Final Preconstruction Impact Assessment

The assessment of impacts under this HCP is conservative in favor of the Covered Species in several ways. For example, the assessment of the presence of BCVI habitat includes very conservative assumptions where access has not yet been obtained. Specifically, all vegetation

communities present on inaccessible properties that through review of aerial photography appeared to support shrubby or scrubby vegetation were identified as potential black-capped vireo habitat, even in cases where the digital photo signature of that vegetation was identical to that exhibited by vegetation present on nearby accessible properties that was already known not to constitute potential vireo habitat. With regard to vegetation that was able to be inspected directly, vegetation not strictly meeting the TPWD definition of black-capped vireo habitat (e.g., not occurring on a carbonate substrate) was also included in the delineation of potential habitat if it possessed the compositional and structural elements of vegetation communities in which SWCA had in the past observed to be utilized by black-capped vireos on the southern and western Edwards Plateau. In addition, it is anticipated that the final design of the projects will incorporate further avoidance of habitat and result in further reductions of the impact assessments stated in this HCP.

For these reasons, the impact assessments set forth in this HCP are properly considered outer bounds. Prior to clearing for each of the Priority Projects, LCRA will prepare and deliver to the Service a final Covered Species impact assessment, taking into account the results of habitat assessments made on the ground, including properties that could not be accessed at the time of development of this HCP, determining actual direct and indirect habitat impacts on the basis of final design, and recalculating mitigation. Mitigation will be recalculated by applying the methodology contained in this HCP to the final impact assessment. Upon Service approval of such habitat, impact, and mitigation assessments, and in any event prior to the initiation of clearing for a Priority Project, LCRA TSC will furnish the required mitigation for that Priority Project prior to impacts. It is anticipated that the final impacts will be less than the conservative impacts estimated in this HCP and that mitigation will remain in the same proportions to impacts as required under this HCP. In no event will LCRA TSC exceed the maximum take threshold established under this HCP.

5.4.2 Golden-cheeked Warbler

The Permit Area is located within golden-cheeked warbler Recovery Regions 6 and 7. It is expected that the Covered Activities will cause the loss or impairment of at least a small amount of known or potential golden-cheeked warbler habitat in both recovery regions. Because of the linear nature of the Priority Projects, the total impact to golden-cheeked warbler habitat is expected to be diffused across a very large area, with impacts in any particular area expected to be comparatively small and minor.

While impacts to golden-cheeked warbler habitat are expected to be diffuse, LCRA TSC is proposing to compensate for habitat impacts by concentrating its mitigation efforts into the funding of preservation and perpetual management of one or more large blocks of golden-cheeked warbler habitat. LCRA TSC could endeavor to fund the preservation and management of many smaller patches of golden-cheeked warbler habitat spread across all recovery regions in which habitat impacts ultimately occurred. However, such an approach could potentially provide less effective mitigation than would concentrating efforts into one or more large blocks of habitat because smaller patches of preserved habitat would hold inherently greater risk of proving incapable of supporting golden-cheeked warblers in perpetuity.

Should future events cause golden-cheeked warbler habitat preserved through the actions of LCRA TSC and others to become the only habitat available to the species, it could be expected that the preserved patches of habitat would be relatively isolated from each other. This could cause the birds residing in those patches to have very little interaction with birds residing in other patches, with the effect that each preserve would then be supporting its own population of golden-cheeked warblers. Small populations are at greater risk of extinction from stochastic events and changes in environmental conditions than are larger populations (Goodman 1987, Shaffer 1989). Golden-cheeked warbler research also indicates that occupancy and productivity are significantly lower in "small" patches of habitat than in larger ones (Maas-Barleigh 1997, Coldren 1998). Populations of golden-cheeked warblers also appear to be less stable in small habitat patches surrounded by development (Coldren 1998, Engels 1995, Arnold et al. 1996, Moses 1996), with potential for development one of the reasons that preserved patches of habitat could become the only habitat available to golden-cheeked warblers in the future.

LCRA TSC will mitigate for expected impacts to golden-cheeked warbler habitat by either purchasing mitigation credits from a Service-approved golden-cheeked warbler habitat mitigation bank, providing funding to an entity or conservation program for conservation of the species, or a combination thereof. To date, LCRA TSC has solicited mitigation credit price quotations from the Service-approved Hickory Pass Conservation Bank in Burnet County, the Service-approved Bandera Corridor Conservation Bank in Bandera County, and two conservation banks that anticipate being approved by the Service in the near future, the Clearwater Ranch Conservation Bank in Burnet County and the Festina Lente Conservation Bank in Bandera County. The selected mitigation option(s) will be approved by the Service and will be reasonably expected to be sufficient to fund the preservation of golden-cheeked habitat in perpetuity in an amount equal to that attributed to being impacted by the Covered Activities. Pursuant to a request by the Service, any mitigation provided other than purchase of mitigation credits from a Service-approved mitigation bank will be dedicated to conservation actions in golden-cheeked warbler Recovery Region 6. Possible methods of providing mitigation include, but are not necessarily limited to:

- Purchase of golden-cheeked warbler mitigation credits from a Service-approved golden-cheeked warbler habitat mitigation bank prior to the occurrence of any take authorized under the Permit.
- Provision of funds to The Nature Conservancy of Texas to be used for preservation of golden-cheeked warbler habitat prior to the occurrence of any take authorized under the Permit.
- Provision of funds to the University of Texas Ladybird Johnson Wildflower Center for use in programs dedicated to preservation of golden-cheeked warbler habitat and to be used prior to the occurrence of any take authorized under the Permit.
- Provision of funds to another appropriate conservation entity to be used for preservation of golden-cheeked warbler habitat. Such funds would be required to be used prior to the occurrence of any take authorized under the Permit.

As described in Section 5.6.3, mitigation funding is assured prior to the occurrence of any authorized take. If mitigation is performed through provision of funding to a conservation entity,

LCRA TSC will form and lead a committee that will identify an appropriate use of that funding. It is expected that the committee at a minimum will be composed of at least one representative each from LCRA TSC, the Service, and the conservation entity chosen to receive the funding. In the event that the committee cannot reach an agreement on the best use of the available funding, the Service will have final authority to select how the funding is ultimately used.

As identified above, it is expected that the Permit would be issued to LCRA TSC under the condition that Covered Activities would not be authorized until mitigation is provided to compensate for the expected impacts to endangered species. If a golden-cheeked warbler habitat mitigation bank is available to LCRA TSC at the time that mitigation is needed to be provided, LCRA TSC would purchase the necessary mitigation credits based on a mitigation-to-direct impact ratio of 3:1. The mitigation ratio for indirect effects would be 0.5:1 for golden-cheeked warbler habitat. The number of mitigation credits that would be acquired by LCRA TSC to compensate for impacts to golden-cheeked warbler habitat expected from the clearing of ROW as adjusted through application of a 10 percent contingency to identify the Maximum Authorized GCWA Habitat Impacts is summarized in Table 12.

Table 12. Golden-cheeked Warbler Habitat Impacts and Mitigation Credit Requirements under the Proposed Alternative.

Priority Project	Direct Habitat Impacts and Mitigation			Indirect Habitat Impacts and Mitigation			Total Credits to be Acquired
	Direct Habitat Impacts Plus Contingency Factor (10%)[1] in Acres (ha)	Mitigation Ratio	Credits to be Acquired	Indirect Habitat Impacts Plus Contingency Factor (10%) in Acres (ha)	Mitigation Ratio	Credits to be Acquired	
Big Hill – Kendall	**298.0 (120.6)**	**3:1**	**894.0**	**848.0 (343.2)**	**0.5:1**	**424.0**	**1,318.0**

[1] To cover the potential impacts to golden-cheeked warbler that cannot be quantified at this time (e.g., potential habitat impacts resulting from access road construction outside of the ROW and potential direct impacts resulting from emergency activities conducted within breeding season), estimates of habitat impacts based on aerial photography and field surveys have been increased by a contingency factor of 10 %.

The per acre cost of mitigation credit obtained from the conservation bank would include costs associated with land preservation and operation and management of the bank in perpetuity. Thus, under this scenario, LCRA TSC would provide for the preservation and third-party management in perpetuity of golden-cheeked warbler habitat and would not itself own, or engender direct management responsibility of, any golden-cheeked warbler habitat. If LCRA TSC elects to provide for preservation and third-party management of golden-cheeked warbler habitat, then LCRA TSC will require that third party to implement a management plan that has been accepted by the Service. Under this latter scenario, funding provided by LCRA TSC would be sufficient to provide for operation and management (O&M) of golden-cheeked warbler habitat in perpetuity. The amount of funding dedicated to O&M under such a scenario would be developed after identification of the property to be acquired so that its specific operation and management needs would be known. The specific O&M amount would be identified based on implementation of standard golden-cheeked warbler habitat management techniques and in coordination with the management provider, and would be subject to approval by the Service.

If mitigation is provided through the provision of funds to The Nature Conservancy of Texas, University of Texas Ladybird Johnson Wildflower Center, or some other appropriate conservation entity, LCRA TSC also would be providing for the preservation and third-party management in perpetuity of golden-cheeked warbler habitat. In such a case, LCRA TSC would not itself own or engender direct management responsibility of any golden-cheeked warbler habitat.

5.4.3 Black-capped Vireo

The Permit and Study Areas are located in black-capped vireo Recovery Regions 3 and 4. It is possible, although not certain, that the Covered Activities will cause the loss or impairment of black-capped vireo habitat in each of these regions. As discussed for the golden-cheeked warbler, because of the linear nature of the Priority Projects, the total impact to black-capped vireo habitat is expected to be diffused across a very large area, with impacts in any particular area expected to be comparatively small and minor.

Also for the same reasons as discussed for the golden-cheeked warbler, while impacts to vireo habitat are expected to be diffuse, LCRA TSC is proposing, to the extent possible, to compensate for habitat impacts by concentrating its mitigation efforts into the funding of preservation and perpetual management of one or more large blocks of black-capped vireo habitat.

LCRA will mitigate for expected impacts to black-capped vireo habitat by either purchasing mitigation credits from a Service-approved black-capped vireo habitat mitigation bank, providing funding to an entity or conservation program for conservation of the species, or a combination thereof. The selected option(s) will be approved by the Service and will be reasonably expected to be sufficient to fund the preservation of black-capped vireo habitat in perpetuity in an amount equal to that attributed to being impacted by the Covered Activities. Possible methods of providing mitigation include, but are not necessarily limited to:

- Purchase of black-capped vireo mitigation credits from a Service-approved black-capped vireo habitat mitigation bank prior to the occurrence of any take authorized under the Permit.
- Provision of funds to The Nature Conservancy of Texas to be used for preservation of black-capped vireo habitat prior to the occurrence of any take authorized under the Permit.
- Provision of funds to the University of Texas Ladybird Johnson Wildflower Center for use in programs dedicated to preservation of black-capped vireo and to be used prior to the occurrence of any take authorized under the Permit.
- Provision of funds to another appropriate conservation entity to be used for preservation of black-capped vireo habitat. Such funds would be required to be used prior to the occurrence of any take authorized under the Permit.

As described in Section 5.6.3, mitigation funding is assured prior to the occurrence of any authorized take. If mitigation is performed through provision of funding to a conservation entity, LCRA TSC will form and lead a committee that will identify an appropriate use of that funding. It is expected that the committee at a minimum will be composed of at least one representative

each from LCRA TSC, the Service, and the conservation entity chosen to receive the funding. As identified in Section 5.4.2 above, the Service would retain final authority to select the use of mitigation funds in the event the committee cannot reach a consensus in that regard.

If available to LCRA TSC at the time that mitigation is needed to be provided, LCRA TSC would purchase from a mitigation bank three acre's worth of black-capped vireo habitat mitigation credit for each acre of black-capped vireo habitat identified through the methodologies described in Section 4.2.2 as being directly impacted by the Covered Activities associated with the Priority Projects, and 0.5 acre's worth of credit for each acre of vireo habitat identified through those methodologies as being indirectly impacted. The number of mitigation credits that would be acquired by LCRA TSC to compensate for impacts to black-capped vireo habitat expected from the clearing of ROW as adjusted through application of a 10 percent contingency to identify the Maximum Authorized BCVI Habitat Impacts is summarized in Table 13.

Table 13. Black-capped Vireo Habitat Impacts and Mitigation Credit Requirements under the Proposed Alternative.

Priority Project	Direct Habitat Impacts and Mitigation			Indirect Habitat Impacts and Mitigation			Total Credits to be Acquired
	Direct Habitat Impacts Plus Contingency Factor (10%)[1] in Acres (ha)	Mitigation Ratio	Credits to be Acquired	Indirect Habitat Impacts Plus Contingency Factor (10%) in Acres (ha)	Mitigation Ratio	Credits to be Acquired	
Twin Buttes–Big Hill	30.3 (12.2)	3:1	90.9	158.3 (64.0)	0.5:1	79.2	170.1
Big Hill–Kendall	514.1 (208.1)	3:1	1,542.3	1,743.8 (705.7)	0.5:1	871.9	2,414.2
Total	**544.4 (220.3)**		**1,633.2**	**1,902.1 (769.7)**		**951.1**	**2,584.3**

[1] To cover the potential impacts to black-capped vireo that cannot be quantified at this time (e.g., potential habitat impacts resulting from access road construction outside of the ROW and potential direct impacts resulting from emergency activities conducted within breeding season), estimates of habitat impacts based on aerial photography and field surveys have been increased by a contingency factor of 10%.

The per acre cost of mitigation credit obtained from the conservation bank would include costs associated with land preservation and operation and management of the bank in perpetuity. Thus, under this scenario, LCRA TSC, with Service coordination and approval, would provide for the preservation and third-party management in perpetuity of black-capped vireo habitat. Should LCRA TSC elect to provide for the preservation and third-party management of black-capped vireo habitat, then LCRA TSC will require that third party to implement a management plan that has been accepted by the Service. As described for the golden-cheeked warbler, O&M funding provided by LCRA TSC would be sufficient to provide for third-party management of preserved black-capped vireo habitat in perpetuity. The amount of O&M funding dedicated under such a scenario would be developed after identification of the property to be acquired so that its specific operation and management needs would be known. The specific O&M amount would be identified based on implementation of standard black-capped vireo habitat management techniques and in coordination with the management provider, and subject to approval by the Service.

If mitigation is provided through the provision of funds to The Nature Conservancy of Texas, University of Texas Ladybird Johnson Wildflower Center, or some other appropriate conservation entity, LCRA TSC also would be providing for the preservation and third-party management in perpetuity of black-capped vireo habitat. In such a case, LCRA TSC would not itself own or engender direct management responsibility of any black-capped vireo habitat.

5.5 MONITORING

Monitoring of lands incorporated into conservation banks from which LCRA TSC may acquire mitigation credits will be the responsibility of the conservation bank manager(s). Monitoring of any lands preserved for the benefit of the golden-cheeked warbler and black-capped vireo through any other funding provided by LCRA TSC will be the responsibility of the third parties endowed by LCRA TSC for that purpose.

No monitoring of Priority Project ROW for golden-cheeked warblers or black-capped vireos is proposed. Assessment of take for these two species is based on acreage of habitat lost to direct and indirect impacts. The amount of known and potential golden-cheeked warbler and black-capped vireo habitat expected to be lost directly to the Covered Activities will be identified with comparatively great precision prior to the clearing of any of this habitat. As described, indirect impacts will be assessed based on assumption that clearing for new ROW will result in a loss of up to 50 percent of the viability of adjacent habitat. Monitoring surveys cannot be performed to determine whether clearing for the ROW actually does result in this assumed loss of viability because LCRA TSC will not have access to lands outside of its ROW and because baseline pre-construction data will not be available to compare against any later survey results. As discussed, based on widespread observation of golden-cheeked warblers in woodlands directly adjacent to transmission line ROW, it is fully expected that golden-cheeked warblers will continue to utilize woodlands adjacent to the ROW where those woodlands are of sufficient size to support the birds.

No bald eagle nests are known to occur within several miles of the Priority Projects, and it is not likely that a nest will be established in the area before or during the project construction phase. However, if any bald eagle nests are found to occur within 660 feet of the edge of ROW and construction of the involved transmission line will be performed during the time of year that the bald eagles are actively nesting, LCRA TSC will deploy a biological monitor to watch the eagles while construction activities (ROW clearing, structure erection, stringing of line, and cleanup) are performed. To ensure that no harassment to eagles occurs, the biological monitor will be empowered and required to halt construction if a bald eagle is seen to approach an activity that could present a hazard to the bird, or if construction activities appear to be preventing the eagles from regularly attending the nest. In order for the latter determination to be made, the monitor will be deployed at least two days prior to the commencement of construction activities so that general eagle activity patterns can be established.

A biological monitor will also be deployed if any construction activities will occur on state- or federally owned land and in an area where Tobusch fishhook cactus are known to occur. The monitor will protect the cactus against damage from construction equipment and activities. The monitor will be used in lieu of marking cactus locations for avoidance in order to prevent their locations from being revealed to the general public and creating risk of collection.

LCRA TSC will inspect the markers installed on the shield wires of the transmission lines at major river crossings and for the benefit of increasing their visibility to whooping cranes or bald eagles on an annual basis for the first three years following their installation. Any markers found to have been significantly damaged, lost, or otherwise removed will be replaced promptly. The results of the first three years of marker monitoring will be used to guide subsequent monitoring rates. If no markers are found to have been damaged or lost during the first three years, these markers will be inspected thereafter every third year. For example, if markers are installed in 2013, they will be inspected in 2014, 2015, and 2016. If no markers are damaged or lost during that time, they would then be inspected again in 2019, 2022, etc.

If fewer than 5 percent of markers are found to need replacement after the first three years, then the markers would be inspected subsequently every other year. So, following the example above, inspections after 2016 would occur in 2018, 2020, etc. If more than 5 percent of the markers are found to need replacement after the first three years, the markers will continue to be inspected on an annual basis.

5.6 IMPLEMENTATION

5.6.1 HCP Administration

LCRA TSC will identify to the Service one of its employees who will act as the Primary Contact for issues regarding the Permit and implementation of the HCP. This person will be responsible for: 1) preparation and submittal of annual reports to the Service (see Section 5.6.2); 2) holding records concerning acquisition of mitigation credits and properties; 3) tracking construction progress; 4) computing actual direct habitat impacts through post-construction inspections and recalculating as necessary the assessed direct and indirect habitat impacts for the golden-cheeked warbler and black-capped vireo; 5) identifying any Changed Circumstances and notifying the Service of same (see Section 5.6.5); 6) tracking transmission line marker inspection schedules and scheduling same; 7) reporting to the Service any dead or injured listed species found within Priority Project ROW; and 8) reporting to the Service any emergency repairs made that may have had an effect on one or more Covered Species.

5.6.2 Reporting and Compliance

LCRA TSC shall submit an Annual Report of operational activities to the Service by 1 December of each year that the Permit is in effect. During the construction phase, the reports will include a summary of construction activities by transmission line, identify the amount of known and potential golden-cheeked warbler and black-capped vireo habitat cleared that year for each transmission line, identify locations where markers were installed to increase visibility of transmission lines, identify the results of any surveys performed for Tobusch fishhook cactus, identify whether any Covered or Evaluation Species were detected in or from the ROW, access roads, and substations of the Priority Projects, and identify the mitigation actions performed that year and expected to be performed the following year.

Post-construction annual reports will include this same information except for the summary of construction activities. Post-construction reports will also provide a summary of maintenance activities performed that year, including any inspection and replacement of transmission line

markers. These reports will also identify any mitigation credit deducted from LCRA TSC's mitigation credit bank that year as a result of need to compensate for unanticipated direct impacts, and the amount of credit remaining in the bank at the end of that year. The amount of any credit deducted from the bank over the reporting year would be identified through prior coordination with the Service.

Written annual reports of the year's activities will be submitted by 1 December of each year to the USFWS Ecological Services Office, 10711 Burnet Road, Suite 200, Austin, Texas 78758-4460; and to the USFWS Regional Office, Endangered Species Division - Section 10 Permits, Room 6064, PO Box 1306, Albuquerque, New Mexico 87103.

5.6.3 Funding

Mitigation funding is assured prior to the occurrence of any authorized take. The Applicant is financially capable of ensuring proper planning, management, and completion of the mitigation proposal described in this HCP. Compensatory mitigation for the covered species, or a guarantee of such payment (i.e., stand-by letter of credit), will be provided in full before any clearing of woody vegetation occurs within 300 feet of areas identified as known or potential habitat for these species. Such funds, if provided to a conservation entity, would be required to be used for acquisition of habitat prior to the occurrence of any take authorized under the Permit.

Funding for the acquisition of mitigation credits, implementation of conservation measures, as well as the installation, inspection, and monitoring of transmission line markers has been included in LCRA TSC's engineering, construction, and maintenance budgets for the Priority Projects. LCRA TSC identified and provided these mitigation costs in the applications for CCN to the PUC, which assures the necessary allocation of funds for these measures. For the purposes of estimating habitat mitigation, LCRA TSC performed a high-level assessment of the maximum potential mitigation associated with direct and indirect habitat effects and applied maximum per credit costs for mitigation. For estimating implementation of conservation measures, including installation of line markers, LCRA TSC calculated the necessary material and labor costs. LCRA TSC's mitigation cost estimates provide a worst-case scenario of the maximum potential mitigation associated with direct and indirect habitat effects, which ensures that the actual amounts of potential habitat affected within the project area will not exceed what was estimated. These projects are funded through the rates paid by consumers of electricity provided by LCRA TSC. Expenditures such as mitigation costs, which are ordered by the PUC or are necessary to construct the line, are eligible for cost recovery.

5.6.4 Adaptive Management

According to Service policy [see 65 CFR 35242 (1 June 2000)], adaptive management is defined as a formal, structured approach to dealing with uncertainty in natural resources management, using the experience of management and the results of research as an on-going feedback loop for continuous improvement. Adaptive approaches to management recognize that the answers to all management questions are not known and that the information necessary to formulate answers is often unavailable. Adaptive management also includes, by definition, a commitment to change management practices when determined appropriate.

The primary reason for using adaptive management in HCPs is to allow for changes in the mitigation strategies that may be necessary to reach the long-term goals (or biological objectives) of the HCP. Under adaptive management, the mitigation activities of the HCP can be monitored and analyzed to determine if they are producing the required results. If the desired results are not being achieved, then adjustments in the mitigation strategy can be considered.

As discussed, the Covered Activities are expected to result in the direct loss and indirect impairment of habitat for the golden-cheeked warbler and black-capped vireo, and create the potential for golden-cheeked warblers and black-capped vireos to be harassed by noise and human activity during the transmission line construction phase (but only where such activity followed as a continuous activity the clearing of vegetation performed outside the breeding season) and when emergency maintenance or repair activities must be performed adjacent to occupied habitat during the breeding season (routine maintenance would be conducted outside of the breeding season).

The effect of the clearing of potential Covered Species habitat to individuals of the two species is not quantifiable. The proposed mitigation was designed to compensate for the measured impacts to Covered Species habitat and possible harassment of individuals of these species during performance of the Covered Activities. Consequently, as long as potential Covered Species habitat is not cleared outside of the boundaries of areas cleared during the construction phase as verified by the post-construction inspections, and routine maintenance is performed outside of the species' breeding season, then the amount of mitigation provided will be considered to have adequately compensated for the assessed level of presumed take and no adaptive management measures will be considered necessary. It is expected that provisions for adaptive management would be required by the Service to be incorporated into the management plans developed for any conservation banks from which LCRA TSC could acquire mitigation credit. Similar provisions would be incorporated in the management plan for any property acquired as mitigation for impacts to the Covered Species resulting from construction and maintenance of the Priority Projects.

5.6.5 "No Surprises" Assurances

Under the "No Surprises" rule (63 FR 8859, codified at 50 CFR 17.22, 17.32), the Service provides participants in an approved HCP that is being properly implemented the assurance that the Service will not impose additional mitigation requirements in the event that unforeseen circumstances occur over time that negatively impact the species. Unforeseen circumstances means changes in circumstances affecting a species or geographic area covered by an HCP that could not reasonably have been anticipated by the Applicant and the Service at the time of permit negotiation and issuance, and that result in a substantial and adverse change in the status of the covered species.

On the other hand, the No Surprises rule also recognizes that the Applicant and the Service can reasonably anticipate that some circumstances affecting a species or geographic area covered by an HCP may change and such change can be planned for (e.g., the listing of new species, or a fire or other natural catastrophic event in areas prone to such events). To the extent such changed circumstances are provided for in the HCP, an Applicant must implement the appropriate measures in response to the changed circumstances. This section specifies the changed

circumstances anticipated by LCRA TSC and provided for in the HCP and explains the assurances provided to LCRA TSC with respect to unforeseen circumstances.

5.6.5.1 Changed Circumstances Provided for in the Plan

It is recognized by the Service and LCRA TSC that many changes in human conditions and attitudes, development pressures, environmental conditions, and scientific understanding of ecological systems, among many other circumstances, could and very likely will occur over a 30-year permit period. To address this situation, a long-term incidental take permit should contain a procedure by which the parties will deal with the changes in circumstances affecting a species or geographic area covered by the permit that can reasonably be anticipated by the Applicant and the Service.

The changed circumstances that can reasonably be anticipated by the Service and the Applicant and that are planned for herein are: 1) Covered Species habitat must be cleared during the breeding season; 2) a species covered by the HCP becomes delisted because it is considered recovered; 3) the bald eagle is relisted or any other species becomes newly listed; 4) bald eagles are discovered nesting in proximity to a transmission line after construction; and 5) an emergency requires LCRA TSC to clear Covered Species habitat without providing prior notification to the Service. The procedures this HCP has established to provide for these anticipated changed circumstances are presented below:

- *Covered Species habitat must be cleared during the breeding season*

  While LCRA TSC intends to perform all clearing of known and potential habitat for the Covered Species during those times of year when the respective species are not present on their breeding grounds, it is foreseen that not all such clearing may actually be able to be performed during the non-breeding season owing to the tight project schedules and possibility for delays to be caused by extended periods of wet weather, problems with contractors or equipment, etc. In the event that the clearing of potential Covered Species habitat must be performed during the breeding season for the respective species, LCRA TSC will first provide the Service with a pre-clearing notification of its need to perform the clearing activity. This notification will include a map that identifies the location of the proposed clearing activity, a determination of the amount of potential habitat that would be cleared, identification of the planned clearing dates, and a description of the surveys (as identified below) that will be implemented to identify the status of the Covered Species in the area planned to be cleared.

  Known or potential Covered Species habitat will not be cleared during the breeding season until after it has been inspected or surveyed by qualified biologists permitted by the Service to conduct surveys for the species at issue, and has been verified to be absent of active golden-cheeked warbler and black-capped vireo nests and any of their poorly flying fledged young. It is expected that, in most cases, the need for clearing would arise from an inability to complete a particular clearing activity prior to the end of February. The level of effort of pre-clearing inspection will depend on the time of year, the initiation date of the clearing activity, and the expected completion date of the clearing as identified below. Variation in approach is appropriate because, while the “breeding season” of the golden-cheeked warbler has been defined in this HCP as 1 March through

30 August, most warblers actually return to Texas during the second or third week of March, have completed all nesting activities by the end of June, and typically have departed for their wintering grounds by early August. Similarly, while the "breeding season" of the black-capped vireo has been defined in this HCP to be 1 March through 30 September, most vireos do not arrive in Texas until late March or early April and typically do not have eggs in a nest after early August. Thus, the potential for the clearing of known or potential habitat to actually result in the destruction of active golden-cheeked warbler or black-capped vireo nests varies considerably across the breeding seasons defined in this HCP.

Table 14 identifies the level of effort that will be employed for breeding season pre-clearing habitat inspections based on the timing and duration of the expected clearing activity. The types of survey prescribed in Table 14 are defined below. All surveys would be performed between sunrise and noon and on days that are suitable for bird detection. Surveys would not be performed in heavy rain, or when other species of birds are not singing.

Daily Monitoring: A daily inspection performed early in the breeding season aimed at verifying the Covered Species have not yet returned from their wintering grounds. Daily monitoring would be performed in the known or potential habitat expected to be cleared that same day. Daily monitoring surveys would be conducted with a level of effort of one hour of survey time for every half-mile of ROW surveyed. This equates to a slow walking speed of one-half mile per hour, as well as one hour of survey time for every 9.7 acres of ROW (2,640 linear feet of ROW x 160-foot ROW width = 422,400 ft^2 or approximately 9.7 acres). Any known or potential habitat shown by Daily Monitoring to be absent of the Covered Species would be able to be cleared by LCRA TSC that same day. If any Covered Species are detected in a patch of habitat prior to 15 March and clearing in that patch will be completed prior to 15 March, that clearing may be performed after the absence of nests from the ROW or access road alignment is verified through an Intensive Survey as defined below.

Initial Survey: A survey designed to gather information on the status and distribution of Covered Species in a patch of habitat that would be completed earlier than it is possible to complete a standard Service-protocol presence/absence survey. An Initial Survey would be conducted over five consecutive days with a level of effort of one hour of survey time for every 25 acres of survey area.[16] For Initial Surveys, the survey area is defined as all potential habitat occurring in and within 300 feet of the edges of the transmission line ROW, although the surveyor will be required to remain within the limits of the ROW while performing the survey.[17] For the golden-cheeked warbler and black-capped vireo, Initial Surveys would be performed in cases where the clearing activity was expected to be completed before 4 April or before 30 April, respectively,

[16] This level of effort is similar to that prescribed in the golden-cheeked warbler and black-capped vireo presence/absence survey protocols of the Service, except that Service protocols stipulate no more than one field visit every five days. In this particular case, it is desired for the survey to be completed as quickly as possible in the hope that the results can guide the completion of vegetation clearing before the warblers or vireos start their nesting activities.

[17] An average person can in almost all cases easily hear a singing golden-cheeked warbler or black-capped vireo that is located within 300 feet of his or her position.

which are the dates before which it is not possible to complete surveys for the species according to standard Service presence/absence survey protocols. Initial Surveys would be started immediately following the first discovery of a golden-cheeked warbler or a black-capped vireo in a patch of habitat during Daily Monitoring surveys.

Table 14. Survey Prescriptions for the Clearing of Covered Species Habitat During the Breeding Season.

Covered Species	Clearing Start Date	Clearing End Date	Daily Monitoring	Initial Survey	Update Survey	Presence/ Absence Survey	Intensive Survey	Nest Monitoring
Golden-cheeked Warbler	Before 1 March	Before 15 March[1]	X	X			X	
	Before 4 April	On or before 4 April[2]	X	X	X		X	X
	5 April to 21 July	After 5 April[3]				X	X	X
	On or after 22 July[4]	n/a					X	
Black-capped Vireo	Before 1 March	Before 15 March[1]	X					
	Before 30 April	After 15 March but before 30 April[5]	X	X	X		X	
	30 April to 30 Sept.	n/a				X	X	

[1] No golden-cheeked warblers or black-capped vireos have ever been found to have eggs in a nest on or before 15 March. Clearing between 1 and 15 March will not create potential for destruction of eggs or young.

[2] It is not possible to complete a standard Service-protocol presence/absence survey before 5 April. The surveys prescribed as shown would be performed in lieu of presence/absence surveys.

[3] Any clearing performed on or after 5 April will be supported by Service-protocol presence/absence surveys.

[4] The latest that golden-cheeked warbler eggs have been observed in a nest is 27 June (Pulich 1976). By 22 July, all golden-cheeked warblers will be fully capable of flying to avoid vegetation-clearing activities.

[5] It is not possible to complete a standard Service-protocol presence/absence survey before 30 April. The surveys prescribed as shown would be performed in lieu of presence/absence surveys.

For both species, the Initial Survey would be performed across the full extent of the patch of habitat hoped to be cleared during the breeding season, even if the clearing would be performed incrementally over more than one day. No clearing of vegetation would occur in a patch of habitat once an Initial Survey was begun until the survey was complete, unless an Intensive Survey (as defined below) is also performed to verify absence of nests from the area desired to be cleared. Known or potential habitat found to occur more than 300 feet away from Covered Species observations made during the Initial Survey would be able to be cleared by LCRA TSC within five days of completion of the Initial Survey.

Update Survey: A one-day survey performed to update the results of an Initial Survey if the clearing of habitat shown by an Initial Survey to lie more than 300 feet away from any Covered Species was not cleared by LCRA TSC within five days of completion of the Initial Survey. The purpose of this survey would be to determine whether any Covered Species were now utilizing areas where they previously not shown to occur. Update Surveys would be performed once every five days after completion of the Initial Survey, until a total of five Update Surveys had been completed. These surveys would be performed with a level of effort of one hour of survey time for every 25 acres of survey area, with the survey area as defined for the Initial Survey. Known or potential habitat found to continue to occur more than 300 feet away from observations of Covered Species would be able to be cleared by LCRA TSC.

Presence/Absence Survey: A survey conducted according to Service presence/absence survey protocols for the respective Covered Species. This survey would be used where a clearing activity in known or potential golden-cheeked warbler habitat was planned to be initiated after 4 April (Service protocols preclude a warbler presence/absence survey from being completed before 4 April) and where a clearing activity in known or potential black-capped vireo habitat was planned to be initiated after 30 April (Service protocols preclude a vireo presence/absence survey from being completed before 30 April). As with Initial Surveys, known or potential habitat found to occur more than 300 feet away from Covered Species observations made during a Presence/Absence Survey would be able to be cleared by LCRA TSC during the breeding season following completion of the Presence/Absence Survey. No Update Surveys would be performed subsequent to completion of Presence/Absence Surveys.

Intensive Survey: An intensive survey of known or potential habitat occurring within 300 feet of observations of the Covered Species made during Daily Monitoring, an Initial Survey, Update Survey, or Presence/Absence Survey, or made in known or potential habitat in cases where no Initial Survey or Presence/Absence Survey was able to be performed.[18] The purpose of this survey would be to systematically search the area planned for clearing that day to ensure it did not contain any active nests or comparatively immobile fledged young of the Covered Species, or active nests or immobile young of any other bird species protected by the MBTA. This survey would be performed by a pair of qualified biologists that together would search the habitat to be cleared at a rate no greater than 4.9 acres per hour, which equates to one-quarter mile of 160-foot wide ROW per hour. Known or potential habitat verified by an Intensive Survey to be absent of active bird nests and absent of fledglings that lack adult flying skills could be cleared by LCRA TSC only that same day. No clearing of habitat occurring within 300 feet of active nests of the Covered Species or comparatively immobile fledglings of the Covered Species discovered during Intensive Surveys would be allowed until after Nest Monitoring was performed as described below, or, in the case of fledglings, until after another Intensive Survey indicated the birds had gained increased flying ability or moved out of the area to be cleared.

[18] It is possible that the need to clear vegetation in a particular area does not become known until it is too late in the year to be able to complete presence/absence surveys according to Service protocols.

Nest Monitoring: The irregular monitoring of nests to determine nest success and date of fledging. The level of effort of nest monitoring would be at the discretion of LCRA TSC, but would need to be sufficient to prove nest failure or confidently establish fledging dates. Because golden-cheeked warblers typically nest only once per season if their first nesting attempt is successful (Ladd and Gass 1999), woodland in a golden-cheeked warbler territory could be cleared by LCRA TSC starting 21 days after the fledging date. This 21-day date is based on Pulich (1976), who indicated that by the third week out of the nest, warbler young can fly as well as their parents. Thus, 21 days after fledging it would be expected that any juvenile birds would readily be able to avoid vegetation clearing activities. Because golden-cheeked warblers will attempt a second nesting if their first attempt fails, Intensive Surveys would be required to verify absence of nests from known or potential golden-cheeked warbler habitat once a nest was found to have failed, with Nest Monitoring employed again if a second nest is found in a particular territory. If Nest Monitoring fails to prove a particular pair of golden-cheeked warblers has fledged its young, that territory will be assumed to be occupied by actively nesting warblers through 30 June. After 30 June, golden-cheeked warbler habitat could be cleared upon completion of an Intensive Survey with negative results as described above.

Black-capped vireos will attempt to nest up to six times per breeding season depending on the success of prior nesting attempts and will re-initiate nesting within days of nest failure (USFWS 1991, Grzybowski 1995). These factors suggest that the irregular monitoring of black-capped vireo nests is likely to be ineffective. Consequently, Nest Monitoring will not be used for the black-capped vireo and only Intensive Surveys as described above will be used to identify known and potential black-capped vireo habitat able to be cleared during the breeding season.

Verbal or e-mail reports of the results of all surveys performed in support of clearing of Covered Species habitat during the breeding season will be provided daily to the Service, unless the Service requests otherwise. The Service will retain the right to prohibit the clearing of Covered Species habitat during the breeding season based on its review of the pre-clearing notification and results of the field surveys. Because of the above-described survey protocol, clearing during the breeding season would not result in an increase in the amount of take of golden-cheeked warblers or black-capped vireos over and above that expected if the clearing of habitat occurred solely outside the breeding season. LCRA TSC will have already provided mitigation for the loss of all habitat removed from the Priority Project ROW; consequently, LCRA TSC will not provide any additional mitigation in the event habitat must be cleared during the breeding season.

- *One or more Covered Species becomes delisted during the tenure of the permit*

  If one or both of the Covered Species is delisted during the tenure of the Permit, it is expected that such delisting would be made partly in response to mitigation actions performed through funding provided by LCRA TSC. Consequently, LCRA TSC would not seek any mitigation funding refund and operation and maintenance of any established preserves would continue. However, delisting would remove the potential for project-related incidental take to occur, so maintenance activities involving the clearing of vegetation within LCRA TSC ROW would subsequently be performed without being subject to the breeding season prohibitions emplaced previously for the delisted species.

LCRA TSC would continue to perform ROW clearing activities with respect to potential for that clearing to cause violation of the MBTA.

- *The bald eagle becomes relisted or any other species is newly listed*

  If the bald eagle is relisted or any other species is newly listed, LCRA TSC will continue to operate the HCP in the manner established in this document. In the event that any species not addressed in this HCP is listed pursuant to the ESA, LCRA TSC will evaluate the degree to which the species has potential to be taken by the Covered Activities and the degree to which the HCP, as it is being implemented, is providing conservation benefits to the species and what additional measures, if any, LCRA TSC could implement through the HCP to provide conservation benefits for the species. Depending on this evaluation, LCRA TSC will decide whether to seek coverage of the species under an amendment to the HCP.

- *Bald eagles are found nesting in proximity to a transmission line after construction*

  Because the bald eagle population is increasing, it is foreseeable that one or more pairs of bald eagles could eventually be found to be nesting in proximity to the Big Hill to Kendall transmission line. If, following construction, an active bald eagle nest is found to occur within 1.3 miles of this transmission line, LCRA TSC will mark all sections of the transmission line that lie within 1.3 miles of the eagle nest site that were not marked previously during the construction process as described in this HCP. The transmission line will be marked using traditional marker balls, spiral vibration dampeners, or air flow spoilers. Markers will be placed on the shield wire with a spacing dependent on the type of marker used. These markers will subsequently be inspected and replaced as necessary as part of routine maintenance.

  If a pair of bald eagles builds a nest on a Priority Project transmission line structure, LCRA TSC will promptly notify the Service upon discovery of the nest. If not already marked, LCRA TSC would then mark all sections of the transmission line within 1.3 miles of the nest site as described above. This marking would be performed following the conclusion of the breeding season in which the nest was discovered and before commencement of the next breeding season.

- *An emergency requires LCRA TSC to clear Covered Species habitat without providing prior notification to the Service*

  It is foreseen that an emergency situation could arise that requires LCRA TSC to clear Covered Species habitat from its ROW during the breeding season. As the location and magnitude of any such clearing cannot be known prior to the occurrence of an emergency, as discussed in Sections 4.1.2.4 and 4.2.2.4, LCRA TSC has added a 10 percent contingency to the amount of Covered Species habitat expected to be directly and indirectly impacted through clearing of the transmission line ROW to account for direct and indirect habitat impacts expected to be caused by the clearing of habitat in response to emergencies and other potential sources of take that cannot be quantified at this time (e.g., clearing for access roads). As described in Sections 4.1.1 and 4.2.1, for emergency situations requiring expeditious but not immediate removal of Covered Species habitat

during the breeding season, LCRA TSC will have a qualified biologist search the habitat needing to be cleared to verify that no active nests of the Covered Species are present in the area.

For emergencies that demand the immediate removal of Covered Species habitat, LCRA TSC will submit to the Service a report on the clearing of habitat within 48 hours of performance of the activity. The report will identify for Service concurrence the number of acres of habitat that were cleared directly, and the number of acres of habitat expected to be indirectly impacted by the clearing activity. This quantification would follow the methodologies described in Sections 4.1.2.2, 4.1.2.3, 4.2.2.2, and 4.2.2.3 of this HCP.

Any clearing of habitat performed during an emergency would be considered to have been authorized previously by the 10 percent contingency added to the amount of habitat expected to be directly and indirectly impacted through the clearing of the transmission line ROW. It will be the responsibility of the Primary Contact (see Section 5.6.1) through the duration of the Permit to keep an accounting of the amount of habitat directly and indirectly impacted as a result of the construction of access roads and clearing performed as a result of emergencies. The amount of contingency mitigation available to cover clearing of habitat in response to emergencies will be known once the transmission line access roads are constructed. Over the duration of the Permit, if the rate at which clearing is performed in response to emergencies begins to suggest that the need for this type of clearing will eventually cause the impacts from clearing to exceed the compensation provided by the mitigation contingency, LCRA TSC will seek an amendment to its Permit (see Section 5.6.6.2) to authorize additional take as a result of clearing for emergency activities and to acquire additional mitigation.

The only types of emergencies considered herein for which the clearing of Covered Species habitat by LCRA TSC would be considered a Changed Circumstance are those that create immediate risk to the safety and reliability of the transmission lines or to the safety of humans and their property.

5.6.5.2 Changed Circumstances Not Provided For In The Plan

If additional conservation and mitigation measures are deemed necessary to respond to changed circumstances and such measures were not provided for in Section 5.6.5.1, the Service will not require any conservation and mitigation measures in addition to those provided for in the HCP without the consent of the LCRA TSC, provided the HCP is being properly implemented.

It is possible that a maintenance vehicle traveling a transmission line ROW ignites a wildfire through contact between the catalytic converter of the vehicle and the underlying grass. It is also possible that a transmission line breaks, or otherwise sparks, and ignites a wildfire. In either event, such a wildfire could spread and destroy habitat for the golden-cheeked warbler or black-capped vireo outside of the ROW for the Priority Projects. LCRA TSC is not seeking to cover such habitat fire damage under its Permit. LCRA TSC will to the extent allowed by its control of land damaged by fire, allow any habitat for the Covered Species that is damaged by fire to re-generate in burned areas. LCRA TSC will promptly report to the Service any fires generated by performance of the Covered Activities.

It is conceivable, though unlikely, that LCRA TSC vegetation clearing activities will allow oak wilt to spread from its ROW. LCRA TSC is not seeking to cover damage to Covered Species habitat from oak wilt under its Permit. LCRA TSC gains easements but does not own the land contained within its transmission line ROW. As a result, even if LCRA TSC wanted to, it does not have the requisite property rights to employ the larger-scale measures that are typically employed to stop the spread of oak wilt, such as, trenching, vibratory plowing or chemical root disruption. LCRA TSC will adhere to its corporate Oak Wilt Prevention Policy when undertaking any covered activities that have potential to impact oak trees.

Addressing any changes in circumstance that might occur on lands preserved in response to the mitigation provided by LCRA TSC will be the responsibility of the preserve owners. It is expected that changed circumstances in preserve areas will be addressed through the preserve agreements and their respective management plans.

5.6.5.3 Unforeseen Circumstances

Unforeseen circumstances mean changes in circumstances affecting a species or geographic area covered by an HCP that could not reasonably have been anticipated by the Applicant and the Service at the time of permit negotiation and issuance, and that result in a substantial and adverse change in the status of the covered species. Under the No Surprises rule, with respect to a properly implemented HCP, the LCRA TSC will not be required to commit additional land, water, money, or financial compensation, or additional restrictions on land, water, or other natural resources to respond to such unforeseen circumstances beyond the level otherwise agreed upon for the species covered by this HCP without the consent of the LCRA TSC. Changes in circumstances not provided for in Section 5.6.5.1 are considered unforeseen circumstances for purposes of this HCP.

No Surprises assurances apply to the listed species that are “adequately covered” under this HCP. Species are considered to be “adequately covered” if the HCP satisfied the permit issuance criteria contained in Section 10(a)(2)(B) of the Act with respect to that species. The species considered adequately covered under this HCP and, therefore, covered by the Service’s No Surprises policy assurances, are the golden-cheeked warbler and black-capped vireo.

In the event that unforeseen circumstances occur during the term of the permit and the Service concludes that the golden-cheeked warbler or black-capped vireo is being harmed as a result, the Service may require additional measures of LCRA TSC where the operating conservation plan is being properly implemented only if such measures are limited to modifications within the ROW of the Priority Projects and associated substation footprints, or to the conservation plan’s operating conservation program for the affected species, and maintain the original terms of the HCP to the maximum extent possible. Additional conservation and mitigation measures will not involve the commitment of additional land, water, money, or financial compensation, or additional restrictions on land, water, or other natural resources otherwise available to LCRA TSC under the original terms of the HCP without the consent of LCRA TSC.

5.6.5.4 Effect of Unforeseen Circumstances on Permit

Except as provided above, notwithstanding the occurrence of unforeseen circumstances, as long as LCRA TSC continues to properly implement the provisions of the HCP and any additional measures required by the Service in accordance with Section 8.0 hereof, the Permit will remain in full force and effect.

5.6.5.5 Notice of Unforeseen Circumstances

The Service will have the burden of demonstrating that unforeseen circumstances exist, using the best scientific and commercial data available. The Service shall notify LCRA TSC in writing of any unforeseen circumstances the Service believes to exist.

5.6.6 Amendment Procedure

It is necessary to establish a procedure whereby the Permit can be amended. However, it is important that the cumulative effect of any amendments will not jeopardize any endangered species or other rare species. Amendments must be evaluated based on their effect on the habitat as a whole. The Service must be consulted on all proposed amendments to operational plans for the Priority Projects that may affect any federally listed species. The types of proposed amendments and the applicable amendment procedures are described below.

5.6.6.1 Minor Amendments to the HCP

Minor amendments involve routine administrative revisions, changes to operation and maintenance schedules, or minor changes in project operations that do not diminish the level or means of mitigation or increase anticipated rates of take. Such minor amendments do not materially alter the terms of the LCRA TSC Permit. Upon the written request of the LCRA TSC, the Service is authorized to approve minor amendments to the HCP.

5.6.6.2 All Other Amendments

Other amendments may be considered major amendments to the Section 10(a)(1)(B) permit, which require additional steps be taken under both NEPA and the ESA.

5.6.7 Permit Duration

This HCP is written in anticipation of issuance of a 10(a)(1)(B) permit valid for 30 years covering the construction, operation, maintenance, and repair phases of the Covered Activities. The HCP will take effect when the Permit is issued, with take authorizations not valid until mitigation is provided in full for the Covered Species.

5.6.7.1 Renewal and Extension

The Permit and HCP may be renewed or extended, and amended if necessary, beyond its initial 30-year term with the approval of the Service. A written request will be submitted to the agency

that will certify that the original information provided is still current and conditions unchanged or provide a description of relevant changes to the implementation of the HCP that will take place. Such a request shall be made within at least 180 days of the conclusion of the 30-year term, and the permit and HCP shall remain valid while the renewal or extension is being processed. The permit may not be renewed for a level of take beyond that authorized by the original permit.

No additional mitigation will be provided by the Applicant in the event the Permit is renewed or extended. It is expected the identified mitigation will provide for the preservation and management in perpetuity of golden-cheeked warbler and black-capped vireo habitat, which over time is expected to result in the protection and production of golden-cheeked warblers and black-capped vireos in a number far greater than those that would be impacted by the Covered Activities over the life of the project.

6.0 PUBLIC AND AGENCY PARTICIPATION

LCRA TSC has been actively pursuing public and agency input on the Priority Projects, including meeting with concerned groups, individuals, public officials, and agencies, to properly coordinate this proposed action with all potentially concerned entities. Public scoping meetings for the NEPA analysis were held in the cities of San Angelo, Comfort, Junction, Lampasas, and Fredericksburg during the last two weeks of April 2010.

In addition to those agencies and entities identified in Tables 6 and 7 as having been subject to LCRA TSC coordination, the following agencies, organizations, and individuals have been or will be consulted or coordinated with during the process of addressing endangered species concerns for the Priority Projects:

PBS&J (now Atkins North America, Inc.), Austin TX
SWCA Environmental Consultants, Austin, TX
Texas Parks and Wildlife Department, Austin, TX
USFWS, Albuquerque, NM
USFWS, Austin, TX

This document was originally prepared by SWCA Environmental Consultants and Smith, Robertson, Elliott, Glen, Klein & Bell, LLP, on behalf of LCRA TSC, and developed with the advice of the Service.

7.0 OTHER CONDITIONS THAT MAY BE REQUIRED BY THE SERVICE

a) Upon locating a dead, injured, or sick golden-cheeked warbler, black-capped vireo, bald eagle, or any other endangered or threatened species, LCRA TSC is required to contact the Service's Law Enforcement Office in Georgetown, Texas, at (512) 863-5972 or in San Antonio, Texas, at (210) 681-8419 for care and disposition instructions. Extreme care should be taken in handling sick or injured individuals to ensure effective and proper treatment. Care should also be taken in handling dead specimens to preserve biological materials in the best possible state for analysis of cause of death. In conjunction with the care of sick or injured endangered/threatened species, or preservation of biological materials from a dead specimen, LCRA TSC and its contractor/subcontractor have the responsibility to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

b) If during the tenure of this Permit the Covered Activities are altered such that there may be an increase in the anticipated take of any of the Covered Species, LCRA TSC is required to contact the Service and obtain authorization and/or amendment of the permit before commencing any construction or other activities that might result in take beyond that described in the HCP.

c) The authorization granted by the Permit will be subject to full and complete compliance with, and implementation of, the HCP, and all specific conditions contained in the Permit. The Permit terms and conditions shall supersede and take precedence over any inconsistent provisions in the HCP or other Permit documents.

d) Acceptance of the Permit serves as evidence that LCRA TSC understands and agrees to abide by the terms of the Permit and all applicable Sections of Title 50 Code of Federal Regulations Parts 13 and 17, pertinent to issued permits.

   The golden-cheeked warbler and black-capped vireo are subject to the protections of the Migratory Bird Treaty Act of 1918, as amended, 16 USC ss. 703-712. In accordance with Appendix 5 to the Service's Habitat Conservation Planning Handbook, LCRA TSC requests that the Service include the following language in the Permit: "This permit also constitutes a Special Purpose Permit under 50 CFR s. 21.27 for the take of the golden-cheeked warbler (*Setophaga chrysoparia*) and black-capped vireo (*Vireo atricapilla*) in the amount and/or number and subject to the terms and conditions specified herein. Any such take will not be in violation of the Migratory Bird Treaty Act of 1918, as amended (16 USC ss. 703-712)."

8.0 CONCLUSION

LCRA TSC looks forward to working with the Service throughout the approval and long-term implementation of the HCP for the Priority Projects. LCRA TSC is committed to minimizing and mitigating for the impacts of the taking to the Covered Species to the maximum extent practicable, and to avoid and minimize impacts to Evaluation Species as evaluated and determined through the HCP process.

9.0 LITERATURE CITED

Allen, R. P. 1952. The whooping crane. National Audubon Society Resource Report 3. 246 pp.

Alldredge, M.W., J.S. Hatfield, D.D. Diamond, and C.D. True. 2002. Population viability analysis of the golden-cheeked warbler. U.S. Fish and Wildlife Service, Austin, Texas.

Armbruster, M. J. 1990. Characterization of habitat used by whooping cranes during migration. Biological Report 90(4): 1-16.

Arnold, K., C. Coldren, and M. Fink. 1996. The interaction between avian predators and golden-cheeked warblers in Travis County, Texas. Sponsored by the Texas Department of Transportation. Research report 1983-2, study number 7-1983, Texas Transportation Institute, Texas A&M University, College Station, Texas.

Austin, J.E., and A.L. Richert. 2001. A Comprehensive Review of Observational and Site Evaluation Data of Migrant Whooping Cranes in the United States, 1943-1999. U.S. Geological Survey, Northern Prairie Wildlife Research Center, Jamestown, ND. Northern Prairie Wildlife Research Center.

Avian Power Line Interaction Committee. 2006. Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006. Edison Electric Institute, APLIC, and the California Energy Commission. Washington, D.C. and Sacramento, CA.

Benson, R.H. 1990. Habitat area requirements of the golden-cheeked warbler on the Edwards Plateau. Prepared for the Texas Parks and Wildlife Department, Austin, Texas. Bioacoustics Laboratory, Department of Engineering Technology, Texas A&M University, College Station, Texas.

Boyd, R.L. and B.C. Thompson. 1985. Evidence for Reproductive Mixing of Least Tern Populations. Journal of Field Ornithology (56) 405-406.

Brown, W.M. and R.C. Drewien. 1995. Evaluation of two power line markers to reduce crane and waterfowl collision mortality. Wildlife Society Bulletin 23(2): 217-227.

Bureau of Economic Geology. 1976a. Geologic Atlas of Texas, San Angelo Sheet. University of Texas at Austin.

Bureau of Economic Geology. 1976b. Geologic Atlas of Texas, Brownwood Sheet. University of Texas at Austin.

Bureau of Economic Geology. 1981a. Geologic Atlas of Texas, Llano Sheet. University of Texas at Austin.

Bureau of Economic Geology. 1981b. Geologic Atlas of Texas, Sonora Sheet. University of Texas at Austin.

Bureau of Economic Geology. 1983. Geologic Atlas of Texas, San Antonio Sheet. University of Texas at Austin.

Campbell, L. 2003. Endangered and Threatened Animals of Texas – Their Life History and Management. Texas Parks and Wildlife Department, Austin. 129 pp.

Canadian Wildlife Service and USFWS. 2007. International Recovery Plan for the Whooping Crane. Ottawa: Recovery of Nationally Endangered Wildlife, and USFWS, Albuquerque, New Mexico. 162 pp.

Cimprich, D.A. 2003. The distribution of the black-capped vireo and its habitat on Fort Hood, Texas: the results of an installation-wide search. In: Endangered species monitoring and management at Fort Hood, Texas: 2003 annual report. The Nature Conservancy, Fort Hood Project, Fort Hood, Texas.

Cimprich, D.A. 2005. Monitoring of the black-capped vireo during 2005 on Fort Hood, Texas. In: Endangered species monitoring and management at Fort Hood, Texas: 2005 annual report. The Nature Conservancy, Fort Hood Project, Fort Hood, Texas.

Coldren, C.L. 1998. The effect of habitat fragmentation on the golden-cheeked warbler. Ph.D. Dissertation. Texas A&M University, College Station, Texas.

Diamond, D.D. 2007. Range-wide Modeling of Golden-cheeked Warbler Habitat. Missouri Resource Assessment Partnership. Unpublished report prepared for the Texas Parks and Wildlife Department, Wildlife Diversity Program, Austin.

Draheim, H.M. 2006. Phylogeography and Population Genetic Structure of Least Terns (*Sterna antillarum*). Master's Thesis, Oregon State University.

Eckrich, G. 2010. Fort Hood (Coryell Co.) Whooping Cranes and Pectoral Sandpiper, 3/19/10 (On-line). Report posted to the Texbirds e-mail listserve on 19 March 2010. Available at http://listserv.nethelps.com/main/wa.exe?A2=ind1003&L=texbirds&P=R19349&I=-3.

Edison Electric Institute. 2010. Electricity Transmission (On-line). Accessed on 18 April 2010 at http://www.eei.org/ourissues/ElectricityTransmission/Pages/default.aspx.

Edwards Aquifer Authority. Undated. Map of the Edwards Aquifer System (On-line). Retrieved 27 January 2010 from http://www.edwardsaquifer.org/images/EAA_system.JPG.

Engels, T.M. 1995. Conservation biology of the golden-cheeked warbler. Ph.D. Dissertation, University of Texas, Austin, Texas

Faanes, C.A. 1987. Bird Behavior and Mortality in Relation to Power Lines in Prairie Habitats. General Technical Report No. 7. USFWS, Department of the Interior. 24 p.

Farquhar, C.C., J.I. Gonzalez, M.A. Guerrero, O. Ballesteros. 2003. Breeding habitat, distribution, and population status of the Black-capped Vireo in Northern Mexico. Interim Report, Section 6 Grant No. E-17. Wildlife Diversity Program, Texas Parks and Wildlife Department, Austin, Texas.

Farquhar, C.C., and J.I. Gonzalez. 2005. Breeding habitat, distribution and population status of the black-capped vireo in northern Mexico. Draft final Section 6 Report, WER 65, Grant No. E-17, submitted to the Texas Parks and Wildlife Department and USFWS, Austin.

Golden-cheeked Warbler Recovery Team. 1998. Golden-cheeked Warbler Recovery Team April 2 – 3, 1998 Meeting Minutes: Responses to USFWS's Questions. U.S. Fish and Wildlife Service Ecological Services Office, Austin, Texas.

Goodman, D. 1987. The demography of chance extinction. Pages 11-34 in M. E. Soule, editor. Viable populations for conservation. Cambridge University Press, Cambridge, England.

Graber, J.W. 1957. A bioecological study of the black-capped vireo (*Vireo atricapilla*). Ph.D. dissertation, University of Oklahoma, Norman.

Graber, J.W. 1961. Distribution, habitat requirements, and life history of the black-capped vireo (*Vireo atricapillus*). Ecological Monographs 31:313–336.

Griffith, G.E., S.A. Bryce, J.M. Omernik, J.A. Comstock, A.C. Roger, B. Harrison, S.L. Hatch, and D. Bezanson. 2004. Ecoregions of Texas (color poster with map, descriptive text, and photographs). Reston, Virginia, U.S. Geological Survey (map scale 1:2,500,00).

Grzybowski, J.A. 1995. Black-capped Vireo (Vireo atricapillus). In The Birds of North America, No. 181 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, and The American Ornithologists' Union, Washington, D.C.

Grzybowski, J.A., D.J. Tazik, and G.D. Schnell. 1994. Regional analysis of black-capped vireo breeding habitats. Condor 96:512–544.

Hall, E. R. 1981. The Mammals of North America. Vol. II. John Wiley and Sons., New York.

Harveson, P. M., M. E. Tewes, G. L. Anderson, and L. L. Laack. 2004. Habitat use by ocelots in south Texas: implications for restoration. Wildlife Society Bulletin 32(3):948–954.

Henderson, I.G., R.H.W. Langston, and N.A. Clark. 1996. The response of common terns *Sterna hirundo* to power lines: An assessment of risk in relation to breeding commitment, age and wind speed. Biological Conservation 77(2-3):185-192.

Horne, J. S. 1998. Habitat partitioning of sympatric ocelot and bobcat in southern Texas. M.S. thesis, Texas A&M University, Kingsville.

Howe, M.A. 1987. Habitat use by migrating whooping cranes in the Aransas-Wood Buffalo corridor., in J. C. Lewis and J. W. Ziewitz, eds. *Proceedings 1985 Crane Workshop,* Pages 303-31 1. Platte River Whooping Crane Habitat Maintenance Trust and US. Fish and Wildlife Service, Grand Island, Nebraska.

Howe, M.A. 1989. Migration of radio-marked whooping cranes from the Aransas-Wood Buffalo population: patterns of habitat use, behavior, and survival. U.S. Fish Wildlife Service, Fish and Wildlife Technical Report 21. 33 pp.

Howells, R.G, R.W. Neck, and H.D. Murray. 1996. Freshwater mussels of Texas. Texas Parks and Wildlife Press. Austin, Texas. 218 pp.

Janss, G.F.E. and M. Ferrer. 1998. Rate of bird collision with power lines: effects of conductor-marking and static-wire marking. Journal of Field Ornithology 69(1): 8-17.

Kasner, A.C., T.C. Maxwell, and R.D. Slack. 2005. Breeding distributions of selected Charadriiforms (Charadriiformes: Charadriidae, Scolopacidae, Laridae) in interior Texas. Texas Journal of Science 57:1-16.

Laack, L.L. 1991. Ecology of the ocelot (*Felis pardalis*) in South Texas. M.S. thesis, Texas A&M University, Kingsville.

Lackey, M.A., M.L. Morrison, Z.G. Loman, N. Fisher, S.L. Farrell, B.A. Collier, and R.N. Wilkins. 2011. Effects of road construction noise on the endangered golden-cheeked warbler. Wildlife Society Bulletin 35(1):15–19.

Liechti, F., M. Klaassen, and B. Bruderer. 2000. Predicting migratory flight altitudes by physiological migration models. The Auk 107:205-214.

Lingle, G.R. 1987. Status of whooping crane migration habitat within the Great Plains of North America. in J. C. Lewis and J. Zewitz, eds., Proceedings 1985. Crane Workshop, Pages 331-340. Platte River Whooping Crane Habitat Maintenance Trust and U.S. Fish and Wildlife Service, Grand Island, Nebraska.

Lingle, G.A., Wingfield, and J.W. Ziewitz. 1991. The migration ecology of whooping cranes in Nebraska, U.S.A. in J. Hams, ed., Proceedings 1987 International Crane Workshop, Pages 395-401. International Crane Foundation, Baraboo, Wisconsin. Longley, W. H. 1970. Sandhill cranes at the Carlos Avery Wildlife Area. The Loon 4:124-128.

Lockwood, M.W. and B. Freeman. 2004. The TOS Handbook of Texas Birds. Texas A&M University Press, College Station. 261 pp.

Loomis-Austin, Inc. 2008. Mapping Potential Golden-cheeked Warbler Breeding Habitat Using Remotely Sensed Forest Canopy Cover Data. Unpublished report prepared for the County of Hays. Loomis-Austin, Inc., Austin, Texas. LAI Project No. 051001.

Lower Colorado River Authority (LCRA). 2010a. Canyon of the Eagles Nature Park (On-line). Accessed on 11 February 2010 at http://www.lcra.org/parks/developed_parks/canyon.html.

Lower Colorado River Authority (LCRA). 2010b. LCRA and CREZ (On-line). Accessed 17 February 2010 at http://www.lcra.org/energy/trans/crez/index.html.

Maas-Barleigh, D.S. 1997. Summary of the 1995 and 1996 field seasons: effects of habitat fragmentation on golden-cheeked warblers (*Dendroica chrysoparia*). University of Oklahoma, Norman, Oklahoma.

Magness, D.R., R.N. Wilkins, and S.J. Hejl. 2006. Quantitative relationships among golden-cheeked warbler occurrence and landscape size, composition, and structure. Wildlife Bulletin 34:473–479.

Manville, A.M. 2005. Bird Strikes and Electrocutions at Power Lines, Communication Towers, and Wind Turbines: State of the Art and State of the Science – Next Steps Toward Mitigation. General Technical Report PSW-GTR-191. U.S. Department of Agriculture Forest Service.

Maresh, J.P. 2005. Project 61: Census and monitoring of black-capped vireo in Texas. Draft final Section 6 report, WER 61, Grant No. E-15, submitted to the Texas Parks and Wildlife Department and USFWS, Austin, Texas.

Marshall, J.T., Jr., R.B. Clapp, and J.A. Grzybowski. 1984. Interim status report: *Vireo atricapillus* Woodhouse. Black-capped Vireo. Museum Section, National Museum of Natural History, Washington, D.C.

Marshall, J.T., Jr., R.B. Clapp, and J.A. Grzybowski. 1985. Status Report: *Vireo atricapillus* Woodhouse. Prepared for USFWS, Office of Endangered Species, Albuquerque, New Mexico.

McMahan, C.A., R.G. Frye, and K.L. Brown. 1984. The Vegetation Types of Texas Including Cropland. Texas Parks and Wildlife Department, Austin. Available for download at http://www.tpwd.state.tx.us/publications/pwdpubs/pwd_bn_w7000_0120/download_book/.

Morrison, M.L., R.N. Wilkins, B.A. Collier, J. Groce, H. Mathewson, T. McFarland, A. Snelgrove, T. Snelgrove, and K. Skow. 2010. Golden-cheeked warbler population distribution and abundance. Texas A&M Institute of Renewable Natural Resources, College Station, Texas, USA.

Moses, E. 1996. Golden-cheeked warbler (*Dendroica chrysoparia*) habitat fragmentation in Travis County, Texas: a remote sensing and geographical information system analysis of habitat extent, pattern and condition. Master's thesis, Texas A&M University. College Station, Texas.

National Wildlife Health Laboratory. 1985. Bald eagle mortality from lead poisoning and other causes. U.S. Geological Survey National Wildlife Health Laboratory. Unpublished report. Madison, Wisconsin.

NatureServe. 2010. NatureServe Explorer: An online encyclopedia of life [web application]. Version 1.8. NatureServe, Arlington, Virginia (On-line). Accessed 9 October 2010 at http://www.natureserve.org.

Navarro-Lopez, D. 1985. Status and distribution of the ocelot in South Texas. M.S. thesis, Texas A&I University, Kingsville.

Navarro-Lopez, L. D., J. H. Rappole, and M. E. Tewes. 1993. Distribution of the endangered ocelot (*Felis pardalis*) in Texas and northeastern Mexico. Pages 157–169 *in* R.A. Medellin, and G. Ceballos (eds.). Avances en el Estudio de los Mamiferos de Mexico. Publicaciones Especiales, Vol. 1. Asociacion Mexicana de Mastozoologia, A.C. Mexico, D.F.

Olendorff, R.R. and R.N. Lehman. 1986. Raptor collisions with utility lines: an analysis using subjective field observations. Final report. U.S. Bureau of Land Management, prepared for Pacific Gas and Electric Company, San Ramon, California. 73 pp.

Ortego, B., C. Gregory, D. Mabie, M. Mitchell, and D. Schmidt. 2009. Texas Bald Eagles. Bulletin of the Texas Ornithological Society 42(1-2):2009.

PBS&J. 2009. Environmental Assessment and Alternative Route Analysis for the Proposed Gillespie to Newton 345-kV Transmission Line Project, Gillespie, Llano, San Saba, Burnet, and Lampasas Counties, Texas. Prepared for LCRA TSC, Austin, TX. PBS&J Job No. 100006977.

PBS&J. 2010. Environmental Assessment and Alternative Route Analysis for the Proposed McCamey D to Kendall to Gillespie 345-kV CREZ Transmission Line Project in Schleicher, Sutton, Menard, Kimble, Mason, Gillespie, Kerr, and Kendall Counties, Texas. Prepared for LCRA TSC, Austin, TX. PBS&J Job No. 100006924.

Peak, R.G. 2003. Population trends of the golden-cheeked warbler on Fort Hood, Texas 1992–2003. In: Endangered species monitoring and management at Fort Hood, Texas: 2003 annual report. The Nature Conservancy, Fort Hood Project, Fort Hood, Texas, USA.

Peak, R.G. 2007. Forest edges negatively affect golden-cheeked warbler nest survival. The Condor 109:628-637.

Phillips, J.C. 1911. A year's collecting in the state of Tamaulipas, Mexico. Auk 28:67–89.

Poole, J.M., W.R. Carr, D. M. Price, and J.R. Singhurst. 2007. Rare plants of Texas. Texas A&M University Press, College Station, Texas.

Powell, R.A., and R.D. Slack. 2006. Draft final report: ecology, habitat use, threats and geographic distribution of the black-capped vireo (*Vireo atricapilla*) on the winter range. Section 6 Grand No. E-33, Interagency Cooperation Contract No. 111166, Texas A & M University, College Station, Texas 77843.

Public Utility Commission of Texas (PUC). 2009a. Commission Staff's Petition for Selection of Entities Responsible for Transmission Improvements Necessary to Deliver Renewable Energy from Competitive Renewable Energy Zones. 15 May 2009. Docket No. 35665. Item 1340. 68pp.

Public Utility Commission of Texas (PUC). 2009b. Landowners and Transmission Line Cases at the PUC Competitive Renewable Energy Zone (CREZ) Projects. Brochure produced by the PUC, Austin, Texas. Retrieved on-line on 17 February 2010 from http://www.puc.state.tx.us/electric/forms/CCN/CREZ-Brochure8x11.doc.

Rappole, J.H., D.I. King, and W.C. Barrow, Jr. 1999. Winter ecology of the endangered golden-cheeked warbler (*Dendroica chrysoparia*). Condor 101:762-770.

Rappole, J.H., D.I. King, and P. Leimgruber. 2000. Winter habitat and distribution of the endangered golden-cheeked warbler (*Dendroica chrysoparia*). Animal Conservation 2:45-59.

Shackelford, C.E., E.R. Rozenberg, W.C. Hunter, and M.W. Hunter. 2005. Migration and the migratory birds of Texas: who they are and where they are going. Texas Parks and Wildlife PWD BK W7000-511 (11/05). Booklet, 34pp.

Schmidly, D.J. 2004. The Mammals of Texas, Revised Edition. University of Texas Press, Austin. 501 p.

Shaffer, M. 1987. Minimum viable populations: Coping with uncertainty. Pages 69-86 in M. E. Soule, editor. Viable populations for conservation. Cambridge University Press, Cambridge, England.

Shindle, D.B. 1995. Habitat use of ocelots in the Tamaulipan Biotic Province. M.S. thesis, Texas A&M University-Kingsville.

Shindle, D. B., and M. E. Tewes. 1998. Woody species composition of habitats used by ocelots (*Leopardus pardalis*) in the Tamaulipan Biotic Province. Southwestern Naturalist 43:273–279.

Sibley, D.A. 2000. National Audubon Society The Sibley Guide to Birds. Alfred A. Knopf, Inc. New York, New York. 544 p.

Spearing, D. 1991. Roadside Geology of Texas. Mountain Press Publishing Company, Missoula, Montana. 418 p.

Stehn, T. 2009a. Whooping Crane Census Flight Report, 21 April 2009 (On-line). Posted to the Texbirds e-mail listserve on 22 April 2009 by P.W. Beasley. Available at http://listserv.nethelps.com/main/wa.exe?S1=texbirds&D=1&H=0&O=D&T=0.

Stehn, T. 2009b. Whooping Crane Update, 5 October 2009 (On-line). Viewed 4 November 2009 at http://www.birdrockport.com/tom_stehn_whooping_crane_report.htm.

Stehn, T. 2010. Whooping Crane Census Flight Report, 9 March 2010 (On-line). Posted to the Texbirds e-mail listserve on 12 March 2010 by P.W. Beasley. Available at http://listserv.nethelps.com/main/wa.exe?A2=ind1003&L=texbirds&P=R11343&I=-3.

Stehn, T. 2011. Whooping Crane Census Flight Report, 1 March 2011 (On-line). Available at http:// http://www.ccbirding.com/twc/.

Stehn, T.V. and T. Wassenich. 2008. Whooping crane collisions with power lines: an issue paper. Proceedings of the North American Crane Workshop 10:25-36.

Tazik, D.J. and J.D. Cornelius. 1989. The black-capped vireo on the lands of Fort Hood, Texas. Preliminary status report, Directorate of Engineering and Housing, Fort Hood, Texas.

Tewes, M. E. 1986. Ecological and behavioral correlates of ocelot spatial patterns. Ph.D. dissertation, University of Idaho, Moscow, Idaho.

Tewes, M.E., and D.D. Everett. 1986. Status and distribution of the endangered ocelot and jaguarundi in Texas. Pp. 147–158 *in* Cats of the world: biology, conservation, and management. Edited by S.D. Miller and D.D. Everett. Caesar Kleberg Wildlife Research Institute, Texas A&I University, Kingsville.

Tewes, M.E. and D.J. Schmidly. 1987. The neotropical felids: jaguar, ocelot, margay, and jaguarundi. Pages 697-712 in M. Novak, J.A. Baker, M.E. Obbard, and B. Malloch eds., Wild Furbearer Management and Conservation in North America. Ministry of Natural Resources, Ontario.

Texas Parks and Wildlife Department (TPWD). 1974. An Analysis of Texas Waterways (On-line). Accessed at http://www.tpwd.state.tx.us/publications/pwdpubs/pwd_rp_t3200_1047/index.phtml. on 10 February 2010.

Texas Parks and Wildlife Department (TPWD). 1996. Tobusch fishhook cactus fact sheet (On-line). Accessed on 19 January 2010 at http://tpwd.state.tx.us/publications/pwdpubs/media/pwd_lf_w7000_0019b.pdf.

Texas Parks and Wildlife Department (TPWD). 2007a. Birds of South Llano River State Park and Walter Buck Wildlife Management Area – A Field Checklist. Texas Parks and Wildlife Department Natural Resource Program, Austin.

Texas Parks and Wildlife Department (TPWD). 2007b. Birds of Old Tunnel Wildlife Management Area. Texas Parks and Wildlife Department, Austin.

Texas Parks and Wildlife Department (TPWD). 2009a. Response to request by James Huffman for technical guidance concerning development projects. Letter report from Mary H. Humphrey, Game Biologist dated 24 July 2009. Texas Parks and Wildlife Department, Sonora, Texas.

Texas Parks and Wildlife Department (TPWD). 2009b. News Release: 15 Texas Freshwater Mussels Placed on State Threatened List (5 November 2009). Retrieved from the Internet on 15 April 2010 from http://www.tpwd.state.tx.us/newsmedia/releases/index.phtml?req=20091105c&print=true

Texas Parks and Wildlife Department (TPWD). 2009c. Kerr WMA Management Program (On-line). Accessed 12 March 2010 at http://www.tpwd.state.tx.us/huntwild/hunt/wma/find_a_wma/list/?id=12&section=management_program.

Texas Parks and Wildlife Department (TPWD). 2010a. Texas Natural Diversity Database. 22 January 2010 review of records for Burnet, Irion, Gillespie, Kendall, Kerr, Kimble, Lampasas, Llano, Mason, Menard, San Saba, Schleicher, Sutton, and Tom Green Counties held in the Texas Parks and Wildlife Natural Diversity Database, Austin, Texas.

Texas Parks and Wildlife Department (TPWD). 2010b. Annotated county list of rare species for Sutton County. Available at http://gis2.tpwd.state.tx.us/ReportServer$GIS_EPASDE_SQL/Pages/ReportViewer.aspx?%2fReport+Project2%2fReport5&rs:Command=Render&county=Sutton. Accessed on 19 January 2010 2009.

Texas Parks and Wildlife Department (TPWD). 2010c. Texas ocelot records. 22 January 2010 review of records held in the Texas Parks and Wildlife Natural Diversity Database, Austin, Texas.

Texas Water Development Board. 2009. Major River Basins in Texas. On-line map retrieved 27 January 2010 from http://www.twdb.state.tx.us/mapping/maps/pdf/mrb_8X11.pdf.

Thompson, B.C., M.E. Schmidt, S.W. Calhoun, D.C. Morizot, and R.D.Slack. 1992. Subspecific Status of Least Tern Populations in Texas: North American Implications. Wilson Bulletin (104) 244-262.

Thompson, B.C., J.A. Jackson, J. Burger, L.A. Hill, E.M. Kirsch and J.L. Atwood. 1997. Least Tern (*Sterna antillarum*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/290.

U.S. Department of Agriculture. 2010. Texas goats and mohair historical estimates. National Agricultural Statistics Service, Texas Field Office. Accessed 15 September 2010 at http://www.nass.usda.gov/Statistics_by_State/Texas/Publications/Historic_Estimates/he_goats.pdf

U.S. Environmental Protection Agency (EPA). 2009. A freamework for categorizing the relative vulnerability of threatened and endangered species to climate change. National Center for Environmental Assessment, Washington, D.C; EPA/600/R-09/011. Available from the National Technical Information Service, Springfield, VA, and online at http://www.epa.gove/ncea.

U.S. Fish and Wildlife Service (USFWS). 1987a. Tobusch fishhook cactus (*Ancistrocactus tobuschii*) recovery plan. U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 40 pp.

U.S. Fish and Wildlife Service (USFWS). 1990a. Recovery plan for the interior population of the least tern (*Sterna antillarum*). U.S. Fish and Wildlife Service, Twin Cities, Minnesota. 90 pp.

U.S. Fish and Wildlife Service (USFWS). 1990b. Listed cats of Texas and Arizona recovery plan (with emphasis on the ocelot). U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 131 pp.

U.S. Fish and Wildlife Service (USFWS). 1990c. Chesapeake Bay Region bald eagle recovery plan: first revision. U.S. Fish and Wildlife Service, Newton Corner, Massachusetts. 80 pp.

U.S. Fish and Wildlife Service (USFWS). 1991. Black-capped vireo recovery plan. Albuquerque, New Mexico.

U.S. Fish and Wildlife Service (USFWS). 1992. Golden-cheeked warbler (*Dendroica chrysoparia*) recovery plan. Austin, Texas.

U.S. Fish and Wildlife Service (USFWS). 1996a. Golden-cheeked warbler population and habitat viability assessment report. Compiled and edited by Carol Beardmore, Jeff Hatfield, and Jim Lewis in conjunction with workshop participants. Report of an Aug. 21-24, 1996 workshop arranged by the U.S. Fish and Wildlife Service in partial fulfillment of U.S. National Biological Service Grant No. 80333-1423. Austin, Texas.

U.S. Fish and Wildlife Service (USFWS). 1996b. Black-capped vireo population and habitat viability assessment report. Compiled and edited by Carol Beardmore, Jeff Hatfield, and Jim Lewis in conjunction with workshop participants. Report of a September 18–21, 1995 workshop arranged by the USFWS in partial fulfillment of U.S. National Biological Service Grant NO. 80333-1423. Austin, Texas.

U.S. Fish and Wildlife Service (USFWS). 2000. Addendum to the HCP Handbook, Executive Summary (On-line). Accessed 18 April 2010 at http://www.fws.gov/endangered/pdfs/HCP/Executive_Summary.pdf.

U.S. Fish and Wildlife Service (USFWS). 2004. Biological opinion for consultation no. 2-12-05-F-021 [Effect of Natural Resource Conservation Service activities associated with implementation of 2002 Farm Bill conservation programs on federally listed species]. December 17, 2004. Arlington, Texas.

U.S. Fish and Wildlife Service (USFWS). 2005. Biological Opinion on the U.S. Department of Army's ongoing activities and proposed revision of the Endangered Species Management Plan (ESMP) at Fort Hood Military Installation in Bell and Coryell Counties, Texas, and its effects on the federally listed black-capped vireo (*Vireo atricapilla*) (black-capped vireo) and golden-cheeked warbler (*Dendroica chrysoparia*) (golden-cheeked warbler). Consultation #2-12-04F-478. Letter to Mr. Roderick A. Chisholm, Director of Public Works, Department of the Army. Fort Hood, Texas.

U.S. Fish and Wildlife Service (USFWS). 2007a. Black-capped Vireo (*Vireo atricapilla*) 5-Year Review: Summary and Evaluation. June 19, 2007. Arlington, Texas.

U.S. Fish and Wildlife Service (USFWS). 2007b. National Bald Eagle Management Guidelines. U.S. Fish and Wildlife Service, Washington, D.C. Retrieved from the Internet on 7 April 2010 at http://www.fws.gov/migratorybirds/CurrentBirdIssues/Management/BaldEagle/NationalBaldEagleManagementGuidelines.pdf .

U.S. Fish and Wildlife Service (USFWS). 2007c. Comment letter from Allan M. Strand to Crouch Environmental Services, Inc. dated 21 June 2007. U.S. Fish and Wildlife Service, Corpus Christi Ecological Services Field Office. Consultation 21410-2007-I-0234.

U.S. Fish and Wildlife Service (USFWS). 2009a. Confirmed United States Whooping Crane Sightings Through Spring 2009. GIS shapefile dataset provided via e-mail to SWCA Environmental Consultants by the U.S. Fish and Wildlife Service, Grand Island, Nebraska.

U.S. Fish and Wildlife Service (USFWS). 2009b. Whooping Cranes and Wind Development – An Issue Paper. U.S. Fish and Wildlife Service, Regions 2 and 6.

U.S. Fish and Wildlife Service (USFWS). 2009c. Endangered and threatened wildlife and plants: 90-day finding on petitions to list nine species of mussels from Texas as threatened or endangered with critical habitat. Federal Register (15 December 2009) 74:66260-66271.

U.S. Fish and Wildlife Service (USFWS). 2010a. Tobusch Fishhook Cactus (*Sclerocactus brevihamatus ssp. tobuschii*) 5-Year Review: Summary and Evaluation. January 5, 2010. Austin, Texas. Accessed On-line on 12 March 2010 at http://www.fws.gov/southwest/es/Documents/R2ES/Tobusch_Fishhook_Cactus_5-Year_Review.pdf.

U.S. Fish and Wildlife Service (USFWS). 2010b. Endangered Species List (On-line). Viewed 11 February 2010 at http://www.fws.gov/southwest/es/EndangeredSpecies/lists/ListSpecies.cfm.

Wahl, R., D.D. Diamond, and D. Shaw. 1990. The Golden-cheeked warbler: a status review, unpublished report submitted to Ecological Services, U.S. Fish and Wildlife Service, Ft. Worth, Texas. 80pp.

White, J.A. 2004. Recommended Protection Measures for Pesticide Applications in Region 2 of the U.S. Fish and Wildlife Service. April 2004 Working Draft Document. Region 2 Environmental Contaminants Program. Austin, Texas.

Wilkins, N., R.A. Powell, A.A.T. Conkey, and A.G. Snelgrove. 2006. Population Status and Threat Analysis for the Black-capped Vireo. Department of Wildlife and Fisheries Sciences, Texas A&M University. Prepared for the USFWS, Region 2.