

Greenbriar Development Project

**Analysis of the Effects of the
Greenbriar Development Project
on the Natomas Basin Habitat Conservation
Plan**

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EXECUTIVE SUMMARY

Introduction

This analysis of effects (“Effects Analysis”) of the Greenbriar Development Project (or “Project”) on the Natomas Basin Habitat Conservation Plan (“NBHCP”) is an evaluation of the effects of the Project on each of the 22 species of plants and animals covered by the NBHCP (“Covered Species” or “NBHCP Covered Species”), the conservation strategy of the NBHCP, the specific conservation measures in the NBHCP, and, consequently, on the attainment of the NBHCP’s goals and objectives. Within this Effects Analysis, the term “Greenbriar Development Project” is used to refer to the Project in its full scope, which includes construction of a mixed-use development on the Greenbriar Project Site, off-site infrastructure improvements, establishment of several habitat reserves, and implementation of the associated conservation measures. The term “Greenbriar Conservation Strategy” is used to refer specifically to the proposed conservation strategy, which includes the establishment of reserves and implementation of the Project’s other proposed conservation measures.

The NBHCP, approved by the U.S. Fish & Wildlife Service (“USFWS”) and the California Department of Fish and Wildlife (“CDFW”; previously California Department of Fish and Game) in 2003, establishes the overall conservation program for the development of a 17,500-acre portion of the Natomas Basin. The Greenbriar Project Site where the mixed-use development would be constructed and the Off-Site Improvement Lands where off-site infrastructure improvements would occur are located within the boundaries of the NBHCP Plan Area, but are not within the City of Sacramento or Sutter County Permit Areas, as defined by the NBHCP, where take of NBHCP Covered Species was previously authorized. As a result, the potential effects of the development on the Greenbriar Project Site and Off-Site Improvement Lands were not evaluated in the NBHCP. Because the Greenbriar Development Project would result in additional development and reserve establishment that was not addressed in the NBHCP, a project level effects analysis was prepared to evaluate its potential effects on the NBHCP Covered Species and their habitats, on the Operating Conservation Program (OCP) of the NBHCP, on the attainment of the NBHCP goals and objectives, and on the viability of the populations of Covered Species in the Natomas Basin.

Environmental Setting

The Greenbriar Project Site is zoned for development by the City of Sacramento and is located in the central portion of the Natomas Basin at the intersections of Interstate (I) 5 and State Route (SR) 99/70. I-5 forms the southern boundary of the site and SR 99/70 forms the eastern site boundary. The planned Downtown-Natomas-Airport Light Rail line (DNA Line), now known as the “Green Line to the Airport,” bisects the site in an east-to-west direction. To the north, the site is bordered by W. Elkhorn Boulevard and agricultural lands currently being used to grow rice. Developed areas within the City of Sacramento border the site to the south and east beyond the major highways. To the west, the Greenbriar Project Site is bordered by the approved Metro Air Park (MAP) development.

The Greenbriar Project Site has been in agricultural use for decades and has been used primarily to grow grass hay since 2004. Previously cultivated crops on the Greenbriar Project Site have included rice, sugar beets and wheat. The northwest section of the Greenbriar Project Site contains remnant development from a horserace track and an irrigated polo field that were in use from approximately 1980 to the early 2000s.

Overview of the Greenbriar Development Project

The Greenbriar Development Project encompasses approximately 1,118 acres and consists of the approximately 577-acre Greenbriar Project Site where a mixed-use development would occur, Off-Site Improvement Lands largely contiguous with the Greenbriar Project Site totaling approximately 12.76 acres where off-site infrastructure improvements are proposed, an on-site reserve totaling 28.3 acres, and three off-site reserves totaling 528.5 acres. As currently proposed, the overall Greenbriar Development Project would include:

- Development of 517 acres at the Greenbriar Project Site to create a residential development with commercial and retail centers, arterial and local roads, an elementary school, and neighborhood parks and other open space areas. Included in the development footprint is work that would be completed by other entities, consisting of infrastructure improvements associated with light rail and water conveyance;
- Development of approximately 12.76 acres of improvements on the Off-Site Improvement Lands for roads and other infrastructure in support of the development on the Greenbriar Project Site;

- Avoidance and enhancement of a 28.3-acre (approximately 250-foot-wide) corridor on the Greenbriar Project Site along Lone Tree Canal, referred to as the Lone Tree Canal Reserve;
- Establishment of three Off-Site Reserves totaling 528.5 acres consisting of the 235.4-acre Spangler Reserve, the 74±acre Moody Reserve, and the 219.1-acre North Nestor Reserve; and
- Dedication of a total of 1.6 acres in the northeast corner of the Greenbriar Project Site for future improvements to the SR 99/70 interchange with Elkhorn Boulevard.

The Greenbriar Development Project also includes conservation measures to avoid and minimize impacts to special-status species and their habitats including measures to reduce or offset effects on Lone Tree Canal such as installation of barriers/fencing, contouring of the east bank of the canal to allow establishment of marsh habitat along the canal corridor, designing culvert crossings to minimize obstacles to giant garter snake (GGS; *Thamnophis gigas*) movement, and other species-specific measures to avoid and minimize construction-related effects of the Project.

The proposed Greenbriar Conservation Strategy is habitat based, consistent with the NBHCP. The Greenbriar Conservation Strategy includes preservation at more than a 1:1 ratio for all lands on the Greenbriar Project Site and Off-Site Improvement Lands that would be developed by the Greenbriar Development Project except for previously developed and/or previously mitigated lands, as described further below.

Based on current design, a total of 542.3 acres of undeveloped land will be permanently converted to urban land uses by the approximately 590-acre development on the Greenbriar Project Site and the Off-Site Improvement Lands. For the calculation of permanent land conversion, a total of 40 acres were deducted from the total acreage of the Greenbriar Project Site (577 acres) to account for the 28.3 acres proposed to be dedicated as open space and wildlife habitat within the Lone Tree Canal Reserve, 10.1 acres previously disturbed/developed by MAP for installation of a sewer force main and trunk sewer improvements, and 1.6 acres of land that would be dedicated for road right-of-way for future improvements to the SR 99/70 interchange with Elkhorn Boulevard (See **Table ES-1**).

Table ES-1. Calculation of the Net Acreage of Undeveloped Land on the Greenbriar Project Site Converted to Urban Uses by the Greenbriar Development Project

Description	Acreage
Gross Acreage of Greenbriar Project Site	577.0
<i>Acres Not Converted to Urban Land Uses by the Greenbriar Development Project</i>	
Net Acreage of the Lone Tree Canal Reserve*	(28.3)
MAP Off-Site Sewer Force Main and Natomas/MAP Trunk Sewer**	(10.1)
SR 99/70 Southbound On-Ramp Right-of-Way at Elkhorn Boulevard***	(1.6)
<i>Total Acres Deducted from the Gross Site Acreage</i>	40.0
Net Acreage to be Converted on the Greenbriar Project Site	537.0

*Reserve land is not proposed to off-set impacts to portions of the Greenbriar Project Site protected as habitat through conveyance of a conservation easement or fee title, consistent with the NBHCP Chapter VI.B.1. page VI-1.

**A sewer force main and trunk sewer connection have been constructed on 10.1 acres of the Greenbriar Project Site by the MAP Property Owners Association; these impacts were identified in the MAP Habitat Conservation Plan (HCP) and were mitigated under the MAP HCP (see MAP HCP CH 1.C.2.b. on page 13).

***A total of 1.6 acres will be dedicated for future right-of-way for the Elkhorn Boulevard interchange. This area is not being disturbed as part of the proposed project and is not considered part of the Greenbriar Development Project's net acreage.

In addition, a total of 7.46 acres were deducted from the total acreage of land conversion at the Off-Site Improvement Lands (12.76 acres) to account for existing pavement and areas previously disturbed by existing utilities (See **Table ES-2**).

Table ES-2. Calculation of the Net Acreage of Undeveloped Land on the Off-Site Improvement Lands Converted to Urban Uses by the Greenbriar Development Project

Description	Acreage
Gross Acreage of Off-Site Improvement Areas	12.76
<i>Acres Not Converted to Urban Land Uses by the Greenbriar Development Project (Previously Converted)</i>	
Elkhorn Boulevard existing pavement*	(4.46)
MAP Off-Site Sewer Force Main Connection Improvements (existing previously mitigated disturbance)**	(3.0)
<i>Total Acres Deducted from the Gross Site Acreage (previously converted)</i>	7.46
Net Acreage to be Converted on the Off-Site Improvement Lands	5.3

* Reserve land is not proposed to off-set portions of the Greenbriar Project Site that have been previously developed.

**A sewer force main connection has been constructed on 3.0 acres of the Off-Site Improvement Lands by the MAP Property Owners Association; these impacts are identified in the MAP HCP and are required to be mitigated under the MAP HCP (see MAP HCP CH 1.C.2.b. on page 13).

Overview of the Proposed Greenbriar Conservation Strategy

The proposed Greenbriar Conservation Strategy includes the establishment of approximately 557 acres of On- and Off-Site Reserves (28.3-acre Lone Tree Canal Reserve on the project site and 528.5 acres of Off-Site Reserves), which preserves habitat at a 1.03:1 ratio (acreage preserved: acreage converted to urban land uses). This exceeds the NBHCP mitigation ratio of 0.5:1, in which 0.5 acre of land is restored/enhanced, protected, and managed in perpetuity for each 1.0 acre of land developed within the NBHCP Plan Area. The Greenbriar Development Project's reserves would be enhanced, preserved, and managed in perpetuity for the purpose of providing a benefit to all of the Covered Species potentially affected by the Greenbriar Development Project as well as general benefit to wildlife in the Natomas Basin. Land uses at the Project's reserves would be consistent with the intended habitat types and ratios of The Natomas Basin Conservancy (TNBC) reserve system, which targets an overall composition of 50 percent rice, 25 percent managed marsh, and 25 percent upland. Based on the current design, the Greenbriar Development Project proposes 259.4 acres of rice (46.6%), 143.8 acres of managed marsh (25.8%), and 153.9 acres of upland (27.6%). As previously stated, the Greenbriar Conservation Strategy also includes specific conservation measures to avoid and minimize impacts to special-status species and their habitats.

The Greenbriar Development Project's proposed reserves currently consist of rice and upland habitats such as alfalfa, grassland, and ruderal areas. Much of the land at the proposed reserves will be preserved and enhanced consistent with its current use. However, managed marsh will be created at the Spangler Reserve within the existing rice field infrastructure. Currently, the 160-acre southern portion of the Spangler Reserve consists of 27 individual rice cells surrounded by berms. To create managed marsh, the area encompassed by roughly 23 of those cells will be converted to a mosaic of open water, perennial bulrush marsh, and upland habitat. Other elements of the managed marsh complex will include linear water supply ditches and upland components including higher elevation uplands between the marsh habitats (high ground hibernaculae for GGS) and upland buffers to protect the managed marsh from surrounding land uses, and maintenance roads. The remaining four cells will be used to create annual grassland with interspersed seasonal wetlands. Approximately 35 acres of annual grassland with interspersed seasonal wetlands will also be created in the northern portion of the Spangler Reserve.

Summary of Findings

To evaluate the proposed Greenbriar Development Project's effects on the NBHCP, this document describes the Greenbriar Development Project's potential effects on the predicted future condition of the Natomas Basin as described in the NBHCP, and the corresponding effects

of such future conditions on habitat for Covered Species. This analysis is based largely on the 2001 land cover data that represents baseline conditions of the NBHCP, and also considered changes in land cover between 2001-2005 and again in 2015. In addition, a Geographic Information Systems (GIS) analysis was conducted in 2014-2015 in order to determine whether sufficient land was available in the Natomas Basin for implementation of the NBHCP and the Greenbriar Development Project (including the development and conservation components for each). This GIS analysis determined the acreage of land in the Natomas Basin currently available for development or conservation purposes as well as land that has already been dedicated for other uses in approved projects or plans. Interpretations of the Greenbriar Development Project's effects on the NBHCP were based on the sum of anticipated effects on the viability of populations of Covered Species using the Natomas Basin, on the effectiveness of the NBHCP's conservation strategy, and on attainment of the goals and objectives of the NBHCP.

Overall, the Greenbriar Development Project would not reduce the viability of any of the Covered Species, reduce the effectiveness of the NBHCP conservation strategy, or adversely affect attainment of the NBHCP goals and objectives. It would have this outcome because the Greenbriar Conservation Strategy includes preservation, enhancement, and management in perpetuity of reserve lands at a 1.03:1 ratio (preserved:converted), as well as the avoidance and minimization of effects on the Lone Tree Canal corridor. For the Covered Species, the increased habitat values on preserved lands offset the habitat values lost as a result of the development at the Greenbriar Project Site, and thus ensure preservation of resources in the Natomas Basin for these species. The Greenbriar Conservation Strategy ensures preservation of the Lone Tree Canal corridor, which is essential for maintaining connectivity of aquatic habitat and movement of GGS between the southern and central Natomas Basin.

The Greenbriar Development Project's effects on the viability of populations of NBHCP Covered Species, on the effectiveness of the NBHCP's conservation strategy, and on attainment of the goals and objectives of the NBHCP are summarized in the following sections of this document.

Effects on the Population Viability of the NBHCP Covered Species

The Greenbriar Development Project would have no affect on the population viability of the following ten Covered Species: California tiger salamander (*Ambystoma californiense*), western spadefoot toad (*Spea hammondi*), vernal pool tadpole shrimp (*Lepidurus packardi*), vernal pool fairy shrimp (*Branchinecta lynchi*), midvalley fairy shrimp (*Branchinecta mesovallensis*), Sacramento Orcutt grass (*Orcuttia viscida*), Colusa grass (*Neostapfia colusana*), slender Orcutt grass (*Orcuttia tenuis*), Boggs Lake hedge-hyssop (*Gratiola heterosepala*), and legenera

(*Legenere limosa*). There is no potentially suitable habitat for any of these vernal pool species on or adjacent to any of the properties associated with the Project and habitat for these species is also extremely limited in the Natomas Basin. Although six seasonal wetlands totaling 0.18 acre on the Greenbriar Project Site were determined to potentially meet the habitat requirements for vernal pool fairy shrimp, vernal pool tadpole shrimp, and midvalley fairy shrimp, protocol presence/absence surveys were conducted for these species and they were not detected. Therefore, these species are presumed absent from the Greenbriar Project Site.

The Greenbriar Development Project could potentially affect the following Covered Species: GGS, Swainson's hawk (*Buteo swainsoni*), valley elderberry longhorn beetle (VELB; *Desmocerus californicus dimorphus*), western pond turtle (*Actinemys marmorata*), tri-colored blackbird (*Agelaius tricolor*), western burrowing owl (*Athene cunicularia*), loggerhead shrike (*Lanius ludovicianus*), Aleutian Canada goose (*Branta canadensis leucopareia*), white-faced ibis (*Plegadis chihi*), bank swallow (*Riparia riparia*), Sanford's arrowhead (*Sagittaria sanfordii*), and delta tule pea (*Lathyrus jepsonii* var. *jepsonii*).

Overall, the Greenbriar Development Project would not adversely affect the population viability of any of the Covered Species (as discussed in Chapter 6), and could have beneficial effects on the population viability of several species including GGS, VELB, western pond turtle, and western burrowing owl.

Effects on the Conservation Strategy of the NBHCP

The Greenbriar Development Project would not reduce the effectiveness of the NBHCP's conservation strategy. Section IV.C.1 (pages IV 5-15) of the NBHCP describes the basis of the key components of the NBHCP's conservation strategy and how these components provide effective mitigation for 17,500 acres of urban development. These components are:

- Basis for 0.5 to 1 mitigation ratio (Section IV.C.1.a),
- Preparation of site-specific management plans (SSMPs) (Section IV.C.1.b),
- Buffers within the reserve lands (Section IV.C.1.c),
- Connectivity (Section IV.C.1.d),
- Foraging habitat (Section IV.C.1.e), and
- 2,500-acre/400-acre minimum habitat block size requirements (Section IV.C.1.f).

In describing the basis for the 0.5:1 mitigation ratio, the NBHCP states that the ratio mitigates the impacts of the incidental take authorized under the NBHCP because much of the land to be

developed does not provide habitat or provides only marginal habitat, and the TNBC-managed reserves will provide habitat of higher quality than the eliminated habitat. The Greenbriar Development Project would not alter the habitat value of land authorized for development under the NBHCP and would not adversely affect the habitat value of TNBC reserves established under the NBHCP. Therefore, the Greenbriar Development Project would not affect the efficacy of the 0.5:1 mitigation ratio of the NBHCP. Although the Greenbriar Development Project would result in the net conversion of 542.3 acres of agricultural land and open space to urban development in addition to the 17,500 acres of permitted development under the NBHCP, the Greenbriar Development Project fully mitigates that loss by preserving habitat at a 1.03:1 ratio and conserving lands of higher quality habitat than the habitat that would be lost at the Greenbriar Project Site and Off-Site Improvement Lands. In light of the Greenbriar Conservation Strategy, this conversion to urban development would result in a minimal and likely beneficial change to the conditions in which the NBHCP conservation strategy is being implemented.

The Greenbriar Project Site is not adjacent to existing TNBC reserves, and thus would not alter the effectiveness of the buffers within these reserve lands. The Greenbriar Project Site is bordered by existing and permitted urban development, highways and/or major roads on all sides. Thus, development of the Greenbriar Project Site would not detract from the effectiveness of buffers within future reserves, even if reserves were established on adjacent land to the north or southwest.

Construction and ongoing operation of the Greenbriar Development Project is not anticipated to substantially alter any Site Specific Management Plans (“SSMPs”) for existing or future TNBC reserves in the vicinity of any of the properties associated with the Greenbriar Development Project. For each of its reserves, TNBC prepares and implements a SSMP that addresses the specific resources and habitat values of each reserve site, and how these will be managed in support of the goals and objectives of the NBHCP. SSMPs for each existing TNBC reserve are currently designed to maximize the benefit to Covered Species using the resources within that individual reserve or reserve block. Thus, changes in land use outside of an existing TNBC reserve are unlikely to necessitate changes to a SSMP. Although the Greenbriar Development Project would reduce available Swainson’s hawk foraging habitat at the Greenbriar Project Site, which is in the vicinity of two existing TNBC reserves, this external factor would not alter the site-specific management of either nearby reserve. As discussed in Chapter 6, the Greenbriar Development Project would not detrimentally affect the viability of the Covered Species within or outside existing reserves. By extension, the Greenbriar Development Project would also not result in increased cost of management for the existing TNBC reserves.

The Greenbriar Development Project would not reduce and would enhance the connectivity of reserves or habitats within the Natomas Basin. The proposed on-site Lone Tree Canal Reserve and the three proposed Off-Site Reserves would improve connectivity of habitats and TNBC reserves. Potential adverse effects on Lone Tree Canal would be minimized by measures included in the Greenbriar Development Project's design and the proposed measures in the Greenbriar Environmental Impact Report (EIR). For example, the proposed Spangler Reserve is located between the existing Ruby Ranch and Atkinson reserves to the west and the Tufts and Sills reserves to the east and the North Nestor Reserve is located between the existing Lucich North and Nestor reserves. The North Nestor Reserve will be managed in rice and will maintain biological connectivity between existing TNBC reserves to the north and south. A 13.6-acre easement area has been defined along the western boundary of the North Nestor Reserve, which could be managed separately by TNBC to further the NBHCP goal of establishing a habitat reserve of 2,500 acres in the Natomas Basin. Therefore, the enhancement and preservation of habitat at these two sites would enhance and preserve connectivity between multiple existing TNBC reserves.

A comprehensive set of conservation measures is included as part of the proposed Greenbriar Conservation Strategy to both reduce the Greenbriar Development Project's effects on, and to enhance the habitat in, a 250-foot-wide corridor along the Lone Tree Canal (Lone Tree Canal Reserve), which would provide GGS habitat connectivity. These measures would prevent the Greenbriar Development Project from reducing the connectivity of canal habitats and TNBC reserves, and also would prevent the Greenbriar Development Project from subdividing the Basin's GGS population into two smaller, and thus less viable, populations.

Based on 2001 land cover maps, the Greenbriar Development Project would reduce the overall upland land cover in the Basin providing foraging habitat for Swainson's hawk by 72.4 acres, but it would permanently preserve an estimated 268 acres of upland land cover types (13.3 acres of perennial grassland at the Lone Tree Canal Reserve (26.5 acres at a 0.5:1 ratio), 74±acres at the Moody Reserve, 136.6 acres of upland components of managed marsh, ruderal, and fallowed rice fields at the Spangler Reserve, and 43.8 acres of ruderal and fallowed rice fields at the North Nestor Reserve). Because all of the habitats proposed for creation and/or preservation as part of the Greenbriar Development Project would be available to Swainson's hawks throughout the breeding season (fallow rice, grassland, ruderal) whereas much of the habitats lost are only available to Swainson's hawks for short periods around harvest (grass hay), the Greenbriar Conservation Strategy would result in an increase in available Swainson's hawk foraging habitat in the Basin over 2001 baseline conditions, except in the months of April and May (**Figure 14** [Graph B]). The net effect of the Greenbriar Development Project would be an overall loss of 55.6 acres of moderate-quality Swainson's hawk foraging habitat in the Basin during roughly a

30-day period from mid-April to mid-May, and a net gain of 61.5 acres of mostly high-quality habitat in the Basin in the months of June through September. By maintaining foraging resources during the majority of the Swainson's hawk nesting period, the Greenbriar Development Project's development would not compromise the NBHCP's OCP.

Overall, the Greenbriar Development Project would offset the adverse effects of development by establishing large blocks of preserved habitat. It would enhance and preserve approximately 557 acres of habitat in the Basin adjacent to or near existing TNBC reserves. Although the Greenbriar Development Project would develop a large block of habitat on the Greenbriar Project Site, the site is surrounded by existing major roads and urban development, and is therefore less valuable for habitat preservation. The Off-Site Reserves, however, will be contiguous or in close proximity to TNBC reserves and will provide better long-term habitat connectivity than the Greenbriar Project Site. In addition, the Greenbriar Conservation Strategy ensures preservation of the most ecologically important portion of the Greenbriar Project Site, the corridor of land along Lone Tree Canal.

A requirement of the NBHCP is that, by the end of the 50-year period, one habitat block within the reserve system will be at least 2,500 acres in size and the balance of reserve lands shall be in habitat blocks of at least 400 acres in size, unless otherwise allowed by the responsible agencies. As discussed in Chapter 5.9, the Greenbriar Development Project will not prevent TNBC from meeting the minimum habitat block size requirements of the NBHCP. In fact, a 13.6-acre easement area has been defined along the western boundary of the North Nestor Reserve, which could be managed separately by TNBC to further the NBHCP goal of establishing a habitat reserve of 2,500 acres in the Natomas Basin.

Effects on Attainment of NBHCP Goals and Objectives

An analysis of the relationship of the Greenbriar Development Project to the goals and objectives of the NBHCP was conducted as discussed in Chapter 8. For many of the same reasons that the viability of Covered Species populations and the effectiveness of the NBHCP's conservation strategy would not be reduced, the Greenbriar Development Project would not reduce the likelihood of attaining the goals and objectives of the NBHCP.

Overall Effects on the NBHCP OCP

In summary, the Greenbriar Development Project would not reduce the viability of populations of Covered Species using the Natomas Basin and would not reduce the effectiveness of the conservation strategy of the NBHCP. It also would not reduce the likelihood of attaining any of the goals and objectives of the NBHCP. Therefore, the Greenbriar Development Project would not constitute a significant departure from the NBHCP's OCP.

The focus of the NBHCP OCP is on maintaining the long-term viability of GGS and Swainson's hawk populations in the Natomas Basin while balancing the needs of these species and the other Covered Species with economic development in the Basin. The primary mechanism to accomplish this is the preservation and long-term management of high quality habitat for GGS and Swainson's hawk in the Natomas Basin, which by default benefits the other 20 Covered Species. The NBHCP established a program to allow development in the Basin while maintaining the long-term viability of the Covered Species by allowing 17,500 acres of authorized development to occur within the City of Sacramento, Sutter County, and MAP and establishing 8,750 acres of reserves to offset the impacts of the authorized development. Thus the NBHCP established a 0.5:1 mitigation ratio (area preserved: area impacted) for future authorized development. The 0.5:1 mitigation ratio was based largely on the assumption that the majority of the land developed would be low quality habitat and the reserves would be high quality habitat and would be strategically arranged to best benefit the Covered Species.

The success of the NBHCP does not require a certain amount of agricultural land remaining in the basin. For example, the Greenbriar Project Site and the Greenbriar Development Project's proposed reserves, along with other "uncommitted" agricultural acreage, was acknowledged by the NBHCP to provide foraging habitat for Swainson's hawk, but such "existing baseline foraging habitat is not considered mitigation under the NBHCP." (NBHCP, IV-13; see also *Environmental Council of Sacramento v. City of Sacramento* (2006) 142 Cal.App.4th 1018, 1038 (ECOS) [noting that "the Operating Conservation Program does not include the continuation of agriculture in the Basin as mitigation"].) Similarly, CDFW found that the impacts of development authorized by the NBHCP were fully mitigated by implementation of the NBHCP avoidance and minimization measures, as well as the "establishment, enhancement, and active management of as much as 8,750 acres of high quality reserve habitat in perpetuity designed and managed specifically for the benefit of the Covered Species." (NBHCP California Endangered Species Act Findings, p. 11.) CDFW's analysis did not mention, nor rely on, any additional "uncommitted" acreage remaining in agriculture.

For a project to constitute a significant departure from the OCP, it would have to reduce the viability of populations of Covered Species, reduce the effectiveness of the conservation strategy of the NBHCP, and/or reduce the likelihood of attaining any of the goals and objectives of the NBHCP. The Greenbriar Development Project mirrors the NBHCP approach in that it preserves higher quality habitat than the lands being developed. The Greenbriar Project Site contains low to moderate quality habitat for the majority of the Covered Species, is surrounded by other authorized development and major highways, is bisected by the Green Line to the Airport (formerly referred to as the DNA Line) that has been planned for many years, and is also zoned for development by the City of Sacramento.

The Greenbriar Conservation Strategy would establish reserves in the Basin at a slightly greater than 1:1 ratio that would provide high quality habitat for the Covered Species at approximately twice the ratio required under the NBHCP. The primary impact to Covered Species that will result from the development of the Greenbriar Project Site is loss of upland foraging habitat – the Greenbriar Project Site has been in grass hay production for nearly a decade and in various forms of agricultural production for several decades. The NBHCP OCP assumed that some of the developed parcels would impact upland foraging habitat and some would impact rice or other habitat types when establishing the NBHCP mitigation ratio. The Greenbriar Conservation Strategy is consistent with the NBHCP mitigation strategy and the Greenbriar Development Project’s reserves will be approximately 50% managed marsh, approximately 25% rice, and approximately 25% upland. These reserves will provide high quality habitat for the Covered Species and are located either in close proximity or adjacent to existing TNBC reserves. One of the reserves (Moody Reserve) provides high quality foraging habitat for Swainson’s hawk and is located in the Swainson’s Hawk Zone, which is a high priority area for preserving habitat for Swainson’s hawk in the Basin.

As described in this Effects Analysis, the Greenbriar Development Project will contribute substantially to the long-term viability of the Covered Species and will not inhibit the ability of TNBC to carry out the NBHCP’s conservation strategy or meet the goals and objectives of the NBHCP. This is primarily due to the Project Applicant’s (Greenbriar Project Owner, LP) conservation commitments to establish reserves in terms of acreage as well as site selection and composition and the Project Applicant’s commitment to preserve and enhance Lone Tree Canal on the Greenbriar Project Site, which is an important wildlife corridor connecting habitats north and south of I-5 through the Natomas Basin.

This Effects Analysis also shows that even with the implementation of the Greenbriar Development Project in conjunction with other public and private projects that have been constructed or entitled in the Basin that are not covered under the NBHCP ITPs, sufficient land exists for TNBC to implement the mitigation required by the NBHCP. This further reduces the likelihood that the Greenbriar Development Project would reduce the effectiveness of the conservation strategy of the NBHCP or reduce the likelihood of attaining any of the goals and objectives of the NBHCP.

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List of Abbreviated Terms

amsl	Above mean sea level
BKS	Betts-Kismat-Silva Tract of the TNBC reserve system
BMPs	Best management practices
CC&Rs	Covenants, Conditions, and Restrictions
CDFG	California Department of Fish and Game
CDFW	California Department of Fish and Wildlife (formerly California Department of Fish and Game)
CLUP	Comprehensive Land Use Plan
CNPS	California Native Plant Society
CNDDB	California Natural Diversity Database
CVRWQCB	Central Valley Regional Water Quality Control Board
EIR	Environmental Impact Report
DNA Line	Downtown-Natomas-Airport Light Rail Line now known as the “Green Line to the Airport.”
DWR	California Department of Water Resources
ESA	Federal Endangered Species Act of 1973
GGs	Giant garter snake
GIS	Geographic information systems
HCP	Habitat Conservation Plan
I-5	Interstate-5
I-80	Interstate-80
ITP	Incidental Take Permit
MAP	Metro Air Park
MAP HCP	Metro Air Park Habitat Conservation Plan
NBHCP	Natomas Basin Habitat Conservation Plan
NCMWC	Natomas Central Mutual Water Company
NEMDC	Natomas East Main Drainage Canal
NLIP	Natomas Levee Improvement Project
OCP	Operating Conservation Program of the NBHCP
MAP POA	Metro Air Park Property Owners’ Association
Quad	Quadrangle

RD 1000	Reclamation District 1000
RT	Sacramento Regional Transit District
SACOG	Sacramento Area Council of Governments
SAFCA	Sacramento Area Flood Control Agency
SSMP	Site-Specific Management Plan
SR	State Route
TAC	Technical Advisory Committee
TNBC	The Natomas Basin Conservancy
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VELB	Valley elderberry longhorn beetle

Definitions of Frequently Used Terms

Covered Species or NBHCP Covered Species	Special-Status Species Covered Under the NBHCP Federal Permit under Section 10(a)(1)(B) of the Federal Endangered Species Act and State Incidental Take Permit Issued Pursuant to Section 2081(b) of the California Fish and Game Code
Greenbriar Conservation Strategy	Refers to the Greenbriar Development Project’s proposed conservation strategy that includes the establishment of approximately 557 acres of On and Off-Site Reserves and implementation of other proposed avoidance and minimization measures.
Greenbriar Development Project	Refers to the Greenbriar project in its entirety, which encompasses approximately 1,118 acres and consists of the 577-acre Greenbriar Project Site where a mixed-use development would occur, Off-Site Improvement Lands largely contiguous with the Greenbriar Project Site totaling 2.76 acres where infrastructure improvements are proposed, and the proposed Conservation Strategy including establishment of approximately 557 acres of On and Off-Site Reserves as well as the implementation of other proposed avoidance and minimization measures.
Greenbriar Project Site	Refers to the 577.0-acre property where the transit-oriented mixed-density residential and retail/commercial development will occur. The Lone Tree Canal Reserve is located along the western boundary of the Greenbriar Project Site and is therefore referred to as an On-Site Reserve.
Natomas Basin or Basin	The Natomas Basin is a roughly 53,500-acre geographical area interior to the toe of the surrounding levees (shown on Figure 1). The Natomas Basin is a geographical area that is roughly bound by the Natomas Cross Canal to the north, Steelhead Creek (formerly known as the Natomas East Main Drainage Canal) to the east, the American River to the south, and the Sacramento River to the west. The Natomas Basin is located in the northern portion of Sacramento County and the southern portion of Sutter County. The Natomas Basin contains incorporated and unincorporated areas within the City of Sacramento, Sacramento County, and Sutter County.

<p>Off-site Improvement Lands</p>	<p>Refers to the location of roads and infrastructure that are located adjacent to the Greenbriar Project Site and are proposed for improvement or construction in support of development on the Greenbriar Project Site. These Off-site Improvement Lands total 12.76 acres.</p>
<p>Off-site Reserves</p>	<p>Refers to lands that are not located on the Greenbriar Project Site that will be established as habitat reserves in perpetuity to off-set impacts resulting from the development on the Greenbriar Project Site. Includes the 235.4-acre Spangler Reserve, the 74±acre Moody Reserve and the 219.1-acre North Nestor Reserve. Off-Site Reserves total 528.5 acres.</p>
<p>On-site Reserve</p>	<p>Refers to the Lone Tree Canal Reserve, which is a 250-foot-wide corridor that will be set aside for preservation along Lone Tree Canal. Includes the canal and approximately 200 feet of adjacent uplands along the east bank (approximately 31.3 total acres). Approximately 3.0 acres of the Lone Tree Canal will be permanently impacted by development on the Greenbriar Project Site. Therefore, the net acreage of the Lone Tree Canal Reserve is 28.3 acres.</p>
<p>Permit Areas</p>	<p>For the purpose of this Effects Analysis, the term “Permit Area(s)” is used to refer to those areas designated in the NBHCP Implementation Agreement as being within the 8,050 acres in the City of Sacramento and the 7,467 acres in unincorporated Sutter County where incidental take authority was granted under the NBHCP. The Sutter County Permit Area also includes 16.5 acres within unincorporated Sacramento County where off-site canal improvements are proposed for the South Sutter County Specific Plan.</p>
<p>Spangler Reserve</p>	<p>Refers to a 235.4-acre property located approximately 2.6 miles northwest of the Greenbriar Project Site that will be established as a habitat reserve in perpetuity as part of the Greenbriar Development Project.</p>
<p>Swainson’s Hawk Zone</p>	<p>This term generally refers to lands in the Natomas Basin that are not currently developed and fall within a zone extending one mile east from the Sacramento River between the Natomas Cross Canal to the north and Interstate 80 to the south.</p>

NBHCP Plan Area	The Plan Area refers to the approximately 53,500 acres of land within the inside toe of the Natomas Basin levees.
Plan Operator	USFWS-approved third party responsible for long-term management of the Greenbriar Development Project's on and off-site reserves.
Project Applicant	Refers to the property owner and project proponent, Greenbriar Project Owner, LP.
Metro Air Park	Refers to an approved development adjacent to the Greenbriar Project Site, with a separate, approved HCP.

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Chapter 1. Introduction

1.1 Introduction

The Greenbriar Development Project is comprised of a transit-oriented, mixed-density residential and retail/commercial development that would be constructed on the Greenbriar Project Site with associated infrastructure improvements on and adjacent to the site as well as a conservation strategy (referred to as the “Greenbriar Conservation Strategy”) consisting of habitat reserve establishment and implementation of species-specific avoidance and minimization measures. The Greenbriar Development Project is located within the approximately 53,500-acre Natomas Basin, but located outside of the 17,500-acre Permit Areas of the NBHCP administered by TNBC. Implementation of the proposed Greenbriar Development Project may incidentally take federal and state listed species and/or may impact/remove potentially suitable habitat of such species.

The Project Applicant is seeking a Biological Opinion/Incidental Take Statement from the U.S. Fish and Wildlife Service (USFWS) to satisfy requirements under Section 7 of the federal Endangered Species Act of 1973 (ESA) for the Project Applicant and a third party Plan Operator to obtain incidental take authorization for activities associated with the Greenbriar Development Project. The Project Applicant is also seeking an Incidental Take Permit (ITP) from CDFW under Section 2081 and/or 2080.1 of the California Fish and Game Code for the incidental take of state listed species. The Greenbriar Development Project has been designed to avoid adverse effects on the viability of the NBHCP Covered Species or on the effectiveness of the NBHCP’s conservation strategy, and to contribute to attainment of the NBHCP’s goals and objectives. This Effects Analysis has been prepared to evaluate the potential effects of the Greenbriar Development Project on the NBHCP.

1.2 Purpose of the Effects Analysis

The Greenbriar Development Project would include development at the Greenbriar Project Site and Off-Site Improvement Lands, establishment of On-Site and Off-Site Reserves, and other conservation measures to reduce impacts to Covered Species. The purpose of this Effects Analysis is to document the potential effects of the Greenbriar Development Project and evaluate the effects of the Greenbriar Development Project on the NBHCP Covered Species, on the conservation strategy of the NBHCP, and on attainment of the NBHCP’s goals and objectives. Effects of the Greenbriar Development Project on the MAP Habitat Conservation Plan (MAP HCP) were also considered. The MAP HCP was designed to support and follow the regional conservation strategy of the NBHCP; its Covered Species are a subset of those covered by the

NBHCP and its biological goals and objectives largely represent a subset of the NBHCP's goals and objectives. Thus, the results of this Effects Analysis also document the Greenbriar Development Project's potential effects on the MAP HCP's covered species and its biological goals and objectives. Potential conflicts with and relationships to specific measures of the MAP HCP are also included in this evaluation.

1.3 NBHCP Background

The NBHCP was developed to satisfy the requirements of the federal and California Endangered Species Act(s) to allow for the incidental take of threatened and endangered species. It is intended to minimize and mitigate the loss of habitat and the incidental take of 22 Covered Species that could result from urban development and management of reserves in the Natomas Basin. The NBHCP authorizes approximately 17,500 acres of development in the MAP, City of Sacramento, and Sutter County Permit Areas, and outside of these areas it preserves 8,750 acres in a reserve system surrounded by agricultural lands. At full build-out, the planned TNBC reserve system will consist of 4,375 acres of rice, 2,187 acres of created marsh, and 2,187 acres of upland habitat. In this reserve system, land will be managed to enhance its habitat values. The future condition of the Natomas Basin resulting from the NBHCP would provide fewer acres of habitat for Covered Species than existed in 2001. The USFWS has established the reserve system with high quality habitat created/managed by the NBHCP to mitigate and offset the effects of this habitat loss; habitat lost is typically of lower quality than that preserved (USFWS 2003). Consequently, most of the NBHCP's goals and objectives are related to creating a reserve system that provides high quality habitat and is likely to sustain populations of the Covered Species in the Natomas Basin for the foreseeable future. The NBHCP also includes numerous avoidance, minimization, and mitigation measures to reduce the effects of development on Covered Species and to ensure the creation and effective operation of the TNBC reserve system.

Chapter 2. Project Description

The Greenbriar Development Project includes construction of a transit-oriented mixed-density residential and retail/commercial development on the Greenbriar Project Site designed to incorporate the planned Green Line to the Airport light rail connection. The Project would also incorporate certain improvements previously included in the planned MAP development west of the Greenbriar Project Site, and associated infrastructure would be constructed on adjacent lands. These development components of the Greenbriar Development Project would occur on the 577.0-acre Greenbriar Project Site where the development is proposed and 12.76 acres of Off-site Improvement Lands where the associated infrastructure improvements are proposed. Improvements planned by other entities on the Greenbriar Project Site and Off-site Improvement Lands are also incorporated into the Project's footprint. The Greenbriar Conservation Strategy element of the Greenbriar Development Project includes the establishment of an On-Site Reserve (Lone Tree Canal Reserve) on the Greenbriar Project Site and three Off-Site Reserves (the Spangler Reserve, the Moody Reserve, and the North Nestor Reserve) in the Natomas Basin, which will be preserved in perpetuity as wildlife habitat as well as species-specific avoidance and minimization measures.

2.1. Project Purpose

The proposed plan, land uses, zoning, and public improvements for the Greenbriar Development Project would create a residential/mixed use development on the Greenbriar Project Site that provides access to alternative modes of transportation (e.g., light rail, bicycle, walking, etc.) to on-site commercial and retail centers and to off-site employment centers. The development on the Greenbriar Project Site would provide a variety of housing types along with mixed-use development to promote use of alternative modes of transportation. The development's use of a grid street pattern would provide multiple access routes to destinations on-site and off-site and would allow for narrower streets within residential neighborhoods. The primary purpose of the Greenbriar Development Project is to provide housing and retail/commercial development along the planned Green Line to the Airport light rail line. Transit-oriented development on the Greenbriar Project Site would also provide sufficient ridership to allow extension of light rail service to the Sacramento International Airport via the Green Line to the Airport.

2.2. Project Objectives

The Greenbriar Development Project has the following objectives:

- Create a transit-oriented, pedestrian-friendly residential development near the major employment centers of downtown Sacramento and MAP;
- Establish a reserve system consisting of the Lone Tree Canal Reserve, Moody Reserve, North Nestor Reserve, and Spanger Reserve to provide wildlife habitat in the Natomas Basin in perpetuity;
- Provide land for construction of a light rail stop along the proposed Green Line to the Airport light rail line and a development with densities that would support the feasibility of a light rail line;
- Develop the Greenbriar Project Site in a manner consistent with and supportive of the Sacramento Area Council of Governments' (SACOG) Blueprint plan;
- Develop a project that is consistent with the Sacramento International Airport Comprehensive Land Use Plan (CLUP) to the degree feasible;
- Design a project that promotes using various modes of transportation by locating high-density residential development within one-quarter mile of the proposed light rail station;
- Provide vertically and horizontally mixed-use neighborhoods;
- Provide neighborhood and community retail near residential development to shorten or reduce the number of vehicle trips;
- Incorporate parks and open space into the project design in a manner that provides community connectivity;
- Create a residential development with a variety of housing types;
- Provide park and recreation opportunities within walking distance of residents;
- Provide an elementary school site to serve the project's student demands;
- Encourage walking and bicycle use by designing residential areas in a grid street pattern;
- Make efficient use of development opportunity as the project site is bordered on three sides by existing or planned urban development;
- Satisfy the requirements of the City of Sacramento's Mixed Income Housing Ordinance in part by providing an age-restricted facility (senior housing, retirement community) located near transit and other services that are affordable to very-low- and/or low-income households;

- Ensure adequate, timely, and cost effective public services for the project; and
- Develop and implement the project consistent with the General Plan Update Vision and Guiding Principles adopted by the City of Sacramento.

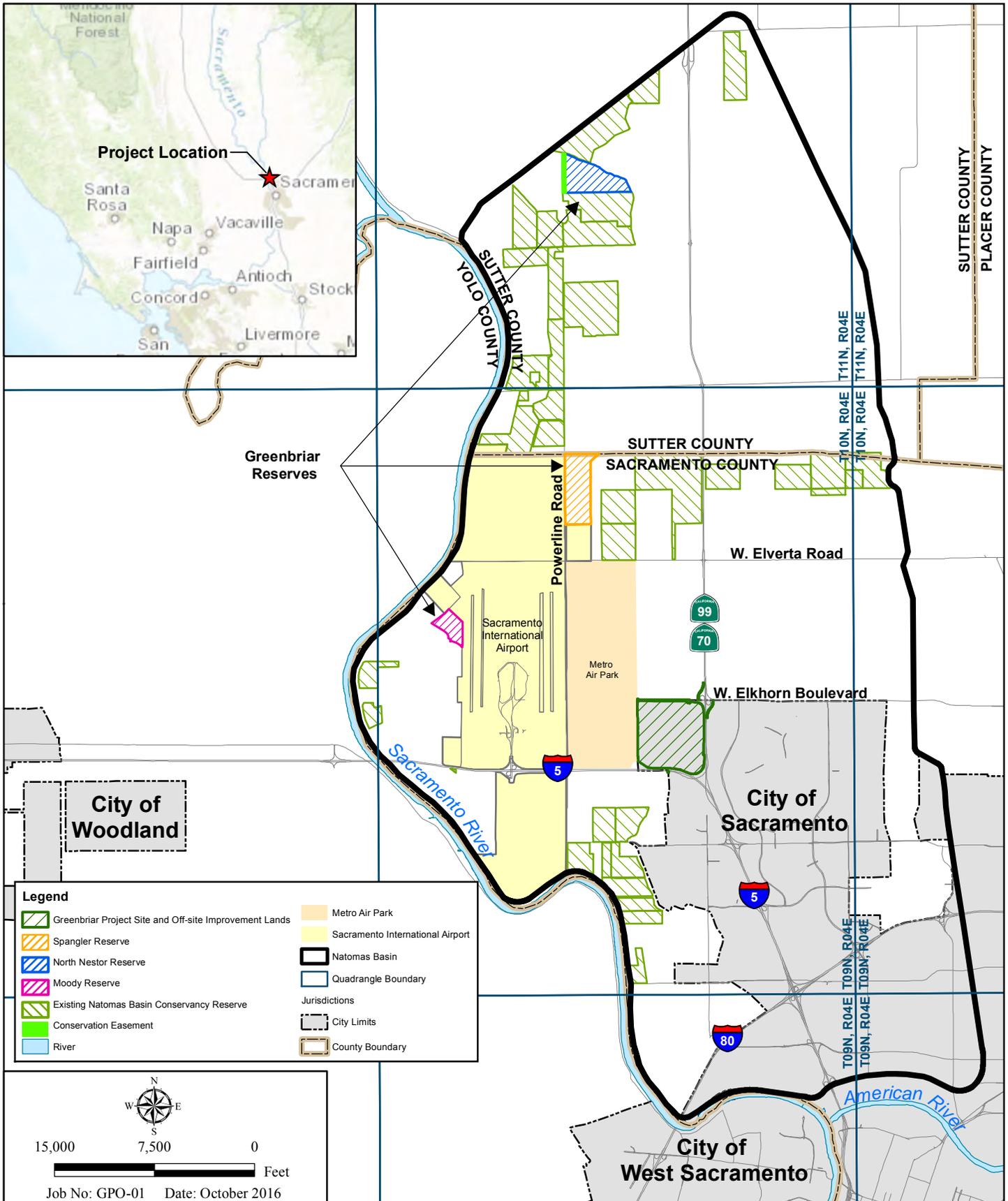
2.3. Locations of Properties Associated with the Greenbriar Development Project

Properties associated with the Greenbriar Development Project consist of the Greenbriar Project Site and Off-site Improvement Lands, the Lone Tree Canal Reserve on the Greenbriar Project Site, and three Off-site Reserves (the Spangler Reserve, the Moody Reserve, and the North Nestor Reserve). All of these properties associated with the Greenbriar Development Project are located within the Natomas Basin, a geographic basin which lies predominantly within unincorporated portions of Sacramento and Sutter Counties but also includes the northwest portion of the City of Sacramento. With the exception of the North Nestor Reserve, which is located in southern Sutter County, all of the properties are located in Sacramento County. The specific locations of each of the properties associated with the Greenbriar Development Project are presented on **Figure 1** and described in the following paragraphs.

The Greenbriar Project Site and Off-site Improvement Lands are situated in the City of Sacramento, approximately two miles east of the Sacramento River. The Greenbriar Project Site is bounded by I-5 to the south, Lone Tree Canal to the west, W. Elkhorn Boulevard to the north, and SR 99/70 to the east. The Off-site Improvement Lands are largely contiguous with the Greenbriar Project Site, and encompass a segment of W. Elkhorn Boulevard between Lone Tree Canal and the SR 99/70 interchange with Elkhorn Boulevard, the SR 99/70 southbound and northbound off-ramps at Elkhorn Boulevard, and an approximately 100-square-foot area south of I-5. The Greenbriar Project Site and Off-site Improvement Lands are located in Section 4, Township 9 North, and Section 33, Township 10 North of Range 4 East on the United States Geological Survey (USGS) 7.5-minute “Taylor Monument, CA” quadrangle (quad). The Lone Tree Canal Reserve is located along the west side of the Greenbriar Project Site and encompasses Lone Tree Canal and adjacent uplands.

The Spangler Reserve is located in unincorporated Sacramento County, approximately 2.6 miles northwest of the Greenbriar Project Site, east of Powerline Road and south of the Sacramento-Sutter County line. It is located in Sections 4 and 17, Township 10 North, Range 4 East on the USGS 7.5-minute “Taylor Monument, CA” quad.

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Regional Locator and Site Vicinity

GREENBRIAR DEVELOPMENT PROJECT
ANALYSIS OF EFFECTS ON THE NATOMAS BASIN HCP

Figure 1

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The Moody Reserve is located at 7320 Walnut Road, adjacent to the west side of the Sacramento International Airport in unincorporated Sacramento County. The Moody Reserve is situated in the west-central portion of the Natomas Basin and is located in Section 24, Township 10 North, Range 3 East on the USGS 7.5-minute “Taylor Monument, CA” quad. This site is approximately 2.6 miles northwest of the Greenbriar Project Site.

The North Nestor Reserve is located on the east side of Power Line Road, between Howsley Road and Sankey Road in unincorporated Sutter County. The North Nestor Reserve is situated in the far northwestern portion of the Natomas Basin and is located in Section 19, Township 11 North, Range 4 East on the USGS 7.5-minute “Verona, CA” quad. This site is approximately 7.2 miles north of the Greenbriar Project Site.

2.4. Elements of the Development on the Greenbriar Project Site and Off-Site Improvement Lands

2.4.1. Greenbriar Project Site

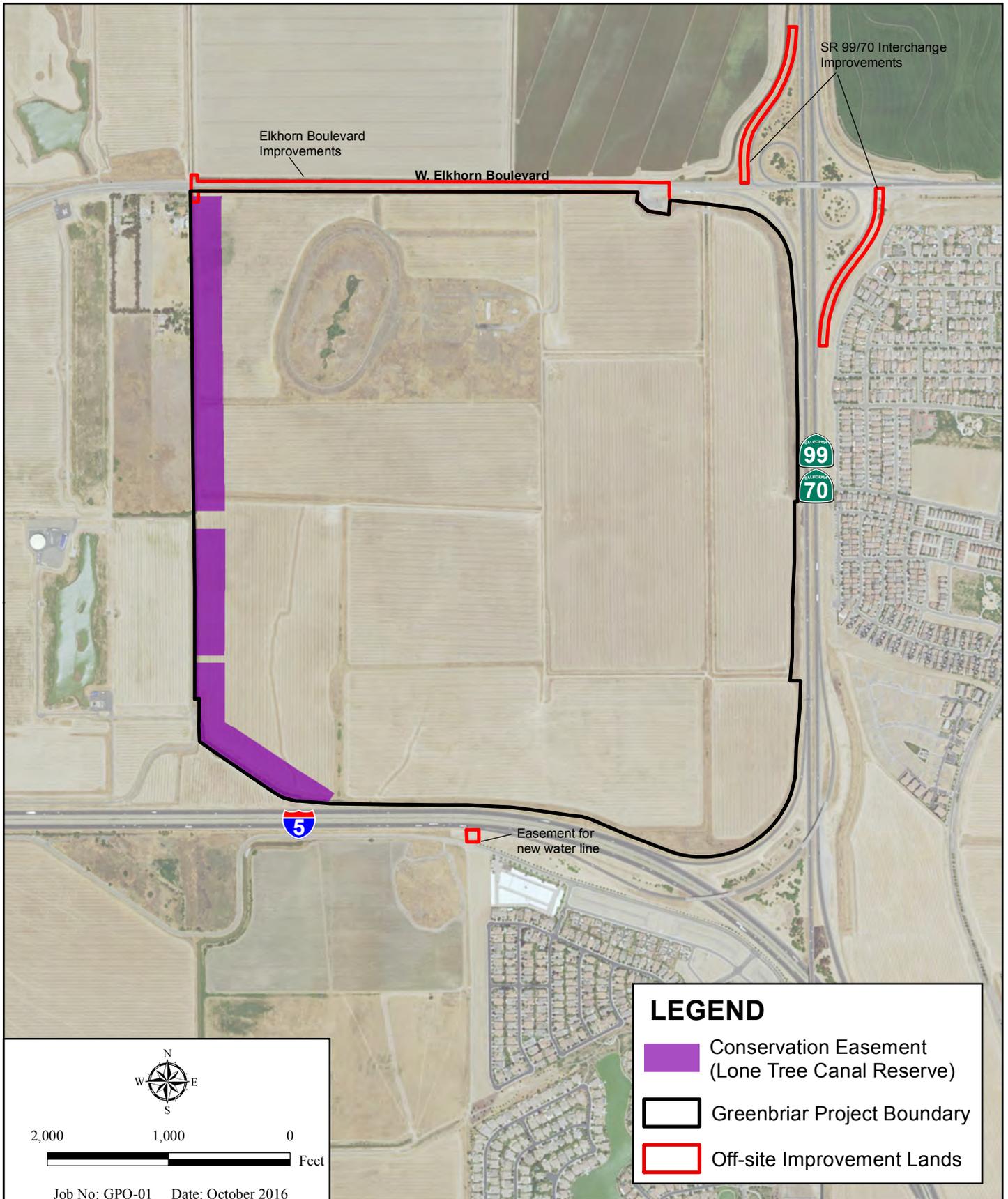
The Greenbriar Project Site encompasses 577.0 acres; of which approximately 517 acres would be used to create a transit-oriented residential development with commercial and retail centers, arterial and local roads, an elementary school, neighborhood parks, and a detention basin¹. A total of 1.6 acres in the northeast corner of the project site would be dedicated for additional SR 99/70 right-of-way for future improvements to the SR 99/70 interchange with Elkhorn Boulevard. The remaining 58.4 acres on the Greenbriar Project Site are designated for open space, and include approximately 28.3 acres² along Lone Tree Canal that will be preserved and managed for special-status species (Lone Tree Canal Reserve). **Figure 2** depicts the Greenbriar Project Site boundary and the location of the proposed conservation easement along Lone Tree Canal. Refer to **Figure 3** for the proposed design at the Greenbriar Project Site.

Single-family residences will be the primary development on the Greenbriar Project Site. Two multi-family residential developments will be constructed south of Meister Way, and one north of Meister Way near the eastern Greenbriar Project Site limit near the Green Line to the Airport light rail station. Commercial properties are proposed for construction in the northeast corner of the Greenbriar Project Site, and a smaller commercial property is proposed to be located south of Meister Way. An elementary school site is proposed near the southeast corner of the Greenbriar Project Site, near SR 99/70 and I-5.

¹Tentative Master Parcel and Tentative Subdivision Maps prepared by Wood Rodgers (July 12, 2012)

²Preliminary Project Impact Analysis Impacts prepared by Wood Rodgers (June 12, 2012)

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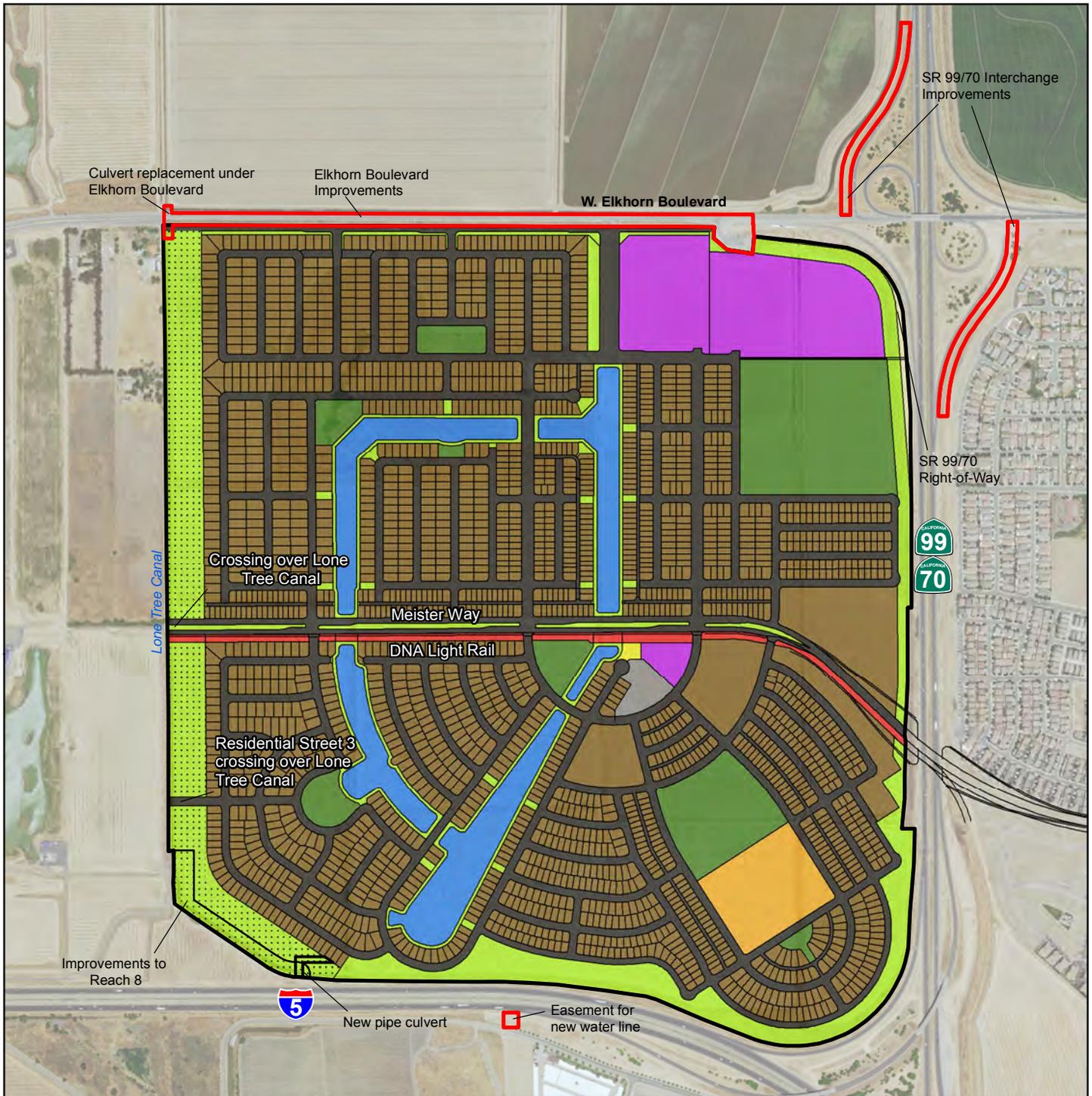


Project Boundary and Conservation Easement Location

GREENBRIAR DEVELOPMENT PROJECT
ANALYSIS OF EFFECTS ON THE NATOMAS BASIN HCP

Figure 2

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Culvert replacement under Elkhorn Boulevard

Elkhorn Boulevard Improvements

W. Elkhorn Boulevard

SR 99/70 Interchange Improvements

Lone Tree Canal

Crossing over Lone Tree Canal

Meister Way

DNA Light Rail

Residential Street 3 crossing over Lone Tree Canal

Improvements to Reach 8



New pipe culvert

Easement for new water line



SR 99/70 Right-of-Way

Legend

- Greenbriar Project Site
 - Off-site Improvement Lands
- Proposed Land Use
- | | | | |
|---|--|---|--|
| Commercial/Retail | Park | Road | School |
| DNA Light Rail | Park and Ride | SR 70/99 Right-of-Way | Utilities |
| Lake | Residential | Open Space | Lone Tree Canal Reserve |



1,000 500 0
Feet

Job No: GPO-01 Date: October 2016

Aerial: ESRI 2014

Project Design

GREENBRIAR DEVELOPMENT PROJECT
ANALYSIS OF EFFECTS ON THE NATOMAS BASIN HCP

Figure 3

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Neighborhood parks will be located throughout the Greenbriar Project Site – a community park is proposed for construction near the northeast corner of the Greenbriar Project Site.³ **Table 1** presents the acres and percentage for each proposed land use in the Greenbriar Project Site.

Table 1. Proposed Greenbriar Project Site land use by type, acres, and percent

Land use	Acres	Percent
Residential (single and multi-family)	377.3	65.4
Commercial/retail	42	7.2
Parks and school	50.8	8.8
Detention Basin	46.9	8.1
Open space	58.4	10.0
Additional SR 99/70 right-of-way	1.6	0.2
Total	577.0 acres	

Source: Digital project design provided by Wood Rodgers dated June 2012 (Wood Rodgers 2012).

The following specific elements will be incorporated into the development on the Greenbriar Project Site:

- A main entry from W. Elkhorn Boulevard will feature two travel lanes in each direction, on-street bike lanes in each direction, a landscaped median, and sidewalks on both sides of the roadway.
- Two main streets will intersect Meister Way from the north, providing connectivity to the commercial development in the northeast, W. Elkhorn Boulevard, and Meister Way. The main streets will feature one travel lane in each direction, on-street bike lanes in each direction, and one-way frontage roads in each direction (providing access to residences) separated from the travel lanes by landscaped medians.
- Residential Street 3 will cross over the Lone Tree Canal Reserve via a 54-inch culvert, providing connectivity between the MAP property, and the Greenbriar Project Site. Refer to detail K on **Figure 4** for the proposed design of Residential Street 3.
- Linear detention basins situated throughout the Greenbriar Project Site may feature pedestrian/multi-use trails and landscaping (detail L on Figure 4).

³ Tentative Master Parcel and Tentative Subdivision Maps prepared by Wood Rodgers (July 12, 2012)

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- Improvements on the Greenbriar Project Site will intersect with the Lone Tree Canal Reserve. Meister Way, the Green Line to the Airport light rail line, and Residential Street 3 will cross over Lone Tree Canal, the installation of drainage structures will occur along the canal, and the engineered building pad will extend into the reserve along the eastern boundary. Refer to Chapter 2.7.2.1, *Lone Tree Canal Reserve* for a description of Lone Tree Canal Reserve and features of the proposed project resulting in areas of disturbance to the reserve.

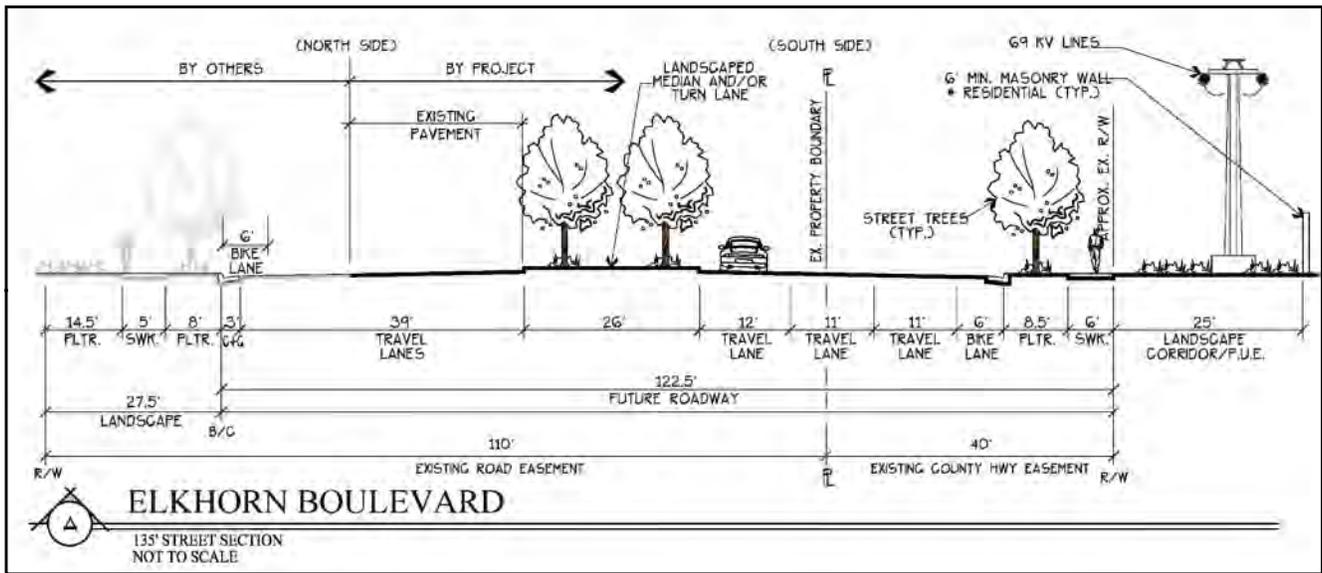
As described above, several specific elements of the Greenbriar Development Project are improvements planned by other entities that have been incorporated into the design. These and other improvements on and adjacent to the Greenbriar Project Site planned by others are identified in Chapter 2.5 *Improvements by Others*.

2.4.2. Off-site Improvement Lands

The Off-Site Improvement Lands encompass approximately 12.76 acres, and include improvements to W. Elkhorn Boulevard and the SR 99/70 interchange at W. Elkhorn Boulevard, as well as drainage and utility improvements. The off-site improvements include:

- W. Elkhorn Boulevard is proposed to be widened along its existing alignment from Lone Tree Canal to SR 99/70, to three lanes in each direction, with on-street bike lanes in each direction, a landscaped median, and sidewalks on both sides of the roadway separated from the road by a landscaped parkway. The Project would construct three new eastbound lanes with the on-street eastbound bike lane and the associated frontage improvements along the southern edge of the roadway. The Project also plans to construct the landscaped median, and incorporate the existing lanes as westbound lanes. The northernmost travel lane, and the on-street bike lane, sidewalk and landscaping along the northern edge of the roadway (comprising an approximately 31.5-foot-wide corridor) will be constructed by others (see Chapter 2.5 *Improvements by Others*). Refer to **Figure 5** for a detail of the W. Elkhorn Boulevard design, and the extent of improvements incorporated into the Greenbriar Development Project.
- The SR 99/70 southbound and northbound off-ramps at Elkhorn Boulevard will be reconstructed to include one additional lane on each ramp. The improvements will be constructed along 50-foot-wide corridors adjacent to the existing ramp, within the existing right-of-way. Construction of the off-ramps are planned by others.

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Source: Tentative subdivision map Phase 1 prepared by Wood Rodgers (July 16, 2011)



Job No: GPO-01 Date: October 2016

W. Elkhorn Boulevard Roadway Detail

GREENBRIAR DEVELOPMENT PROJECT
 ANALYSIS OF EFFECTS ON THE NATOMAS BASIN HCP

Figure 5

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- An existing 30-inch-diameter pipe culvert under W. Elkhorn Boulevard at Lone Tree Canal will be replaced with a 54-inch culvert capable of conveying 100-year storm flows. Disturbance to the north side of W. Elkhorn Boulevard falls within the Off-Site Improvement Lands. Disturbance to the south side of W. Elkhorn Boulevard is within the Lone Tree Canal Reserve on the Greenbriar Project Site.
- A 30-inch-diameter water line to supply the Greenbriar Project Site will be constructed from the southern site boundary, and will pass under I-5 to tie into the existing City of Sacramento's water line at South Bayou Road. An approximately 100-square-foot area located south of I-5 will be required.

The areas of disturbance resulting from the proposed off-site improvements are summarized in **Table 2**. These acreages are based on the *Greenbriar Project Acreage Calculations Memorandum* prepared by Wood Rodgers Inc., which is included as **Appendix A**.

Table 2. Off-site Improvements

Improvement	Description	Area (acres)
Widen West Elkhorn Boulevard (not overlapping Greenbriar Project Site)	Construct 3 new eastbound lanes with landscaped median and on-street bike lane, and incorporate existing 2 lanes as westbound lanes. Install sidewalk and landscaping along the southern edge of the roadway.	8.46
SR 99/70 and West Elkhorn Boulevard interchange improvements	Add one additional lane to SR 99/70 southbound and northbound Elkhorn Boulevard off-ramps	4.0
Drainage	Replace the existing 30-inch diameter pipe culvert under W. Elkhorn Boulevard with a 54-inch-diameter culvert.	0.1*
Utility	Install 30-inch-diameter water supply line under I-5.	0.2
Total area of disturbance		12.76

Source: *Greenbriar Project Acreage Calculations Memorandum* prepared by Wood Rodgers (Appendix A); although this memorandum was originally prepared for the draft HCP and some revisions to culvert sizes/types have occurred, the impact acreages have not substantially changed

*Represents portion of the drainage improvements located in the Off-Site Improvement Lands.

2.5. Improvements by Others

Proposed developments and infrastructure improvements that will be constructed by other entities occur on and in the vicinity of the Greenbriar Project Site; in some cases infrastructure improvements planned by others would benefit the Greenbriar Development Project as well as

other projects. The Greenbriar Development Project has incorporated planned improvements by others on the Greenbriar Project Site and Off-site Improvement Lands, and plans to construct improvements planned by others necessary to complete the Project, if not constructed prior to the Greenbriar Development Project. Planned/already completed improvements by other entities on the Greenbriar Project Site and Off-Site Improvement Lands include:

- The SR 99/70 southbound on-ramp right-of-way at Elkhorn Boulevard will be dedicated for future development by the County of Sacramento;
- The proposed Green Line to the Airport light rail line will be constructed by Sacramento Regional Transit along Meister Way through the Greenbriar Project Site. Through the Greenbriar Project Site, the Green Line to the Airport light rail line will parallel Meister Way along its southern boundary, and will share the bridge spanning the Lone Tree Canal Reserve. Refer to details E and F on **Figure 4** for the proposed design of the Green Line to the Airport light rail line;
- The MAP POA has completed the Off-Site Sewer Force Main and Natomas/MAP Trunk Sewer Connection Improvements on the Greenbriar Project Site;
- The MAP Project includes extending Meister Way from its current terminus at Lone Tree Canal, through the Greenbriar Project Site, to SR 99/70. Through the Greenbriar Project Site, Meister Way will feature one travel lane in each direction, on-street bike lanes in each direction, a landscaped median, and sidewalks on both sides of the roadway. Meister Way will cross over the Lone Tree Canal Reserve via a 54-inch culvert. Refer to details E and F on **Figure 4** for the proposed design of Meister Way;
- The MAP Project includes constructing W. Elkhorn Boulevard, along the northern Greenbriar Project Site boundary, from Lone Tree Canal to SR 99/70;
- One additional lane will be added to the SR 99/70 southbound and northbound Elkhorn Boulevard off-ramps by the County of Sacramento; and
- The MAP POA will widen W. Elkhorn Boulevard (not on the Greenbriar Project Site), and replace the existing pipe culvert under W. Elkhorn Boulevard with a 54-inch-diameter pipe culvert.

The MAP project also plans to construct improvements along Lone Tree Canal by widening and deepening reach 8 of the canal, flattening the side slopes to 2:1, and constructing two 78-inch-diameter culverts under I-5. These improvements are not part of the Greenbriar Development

Project. This action and other development associated with the MAP project (and their effects on threatened and endangered species) are covered under the MAP HCP (Thomas Reid Associates 2001).

Planned improvements identified in an approved HCP or regional plan (other than the Greenbriar Development Project) are presented in **Table 3** and are based on the *Greenbriar Project Acreage Calculations Memorandum* prepared by Wood Rodgers, Inc., which is included as **Appendix A**. These planned improvements will be constructed regardless of the Greenbriar Development Project.

Table 3. Planned Improvements by Others on the Greenbriar Project Site and Off-site Improvement Lands*

Improvement	Area (acres)
<i>Planned Project Impacts by Others on the Greenbriar Project Site</i>	
Develop SR 99/70 southbound on-ramp right-of-way at W. Elkhorn Boulevard	1.6
Construct Green Line to the Airport light rail line	6.0
MAP Off-Site Sewer Force Main and Natomas/MAP Trunk Sewer Connection Improvements (already completed)	10.1
Construct Meister Way	11.9
Widen W. Elkhorn Boulevard to six lanes and replace existing pipe culvert under W. Elkhorn Boulevard (overlap onto Greenbriar Project Site)	6.7
Total planned Improvements by Others on the Greenbriar Project Site	36.3
<i>Planned Project Impacts by Others on Off-site Improvement Lands</i>	
Add one additional lane to SR 99/70 southbound and northbound Elkhorn Boulevard off-ramps	4.0
Widen W. Elkhorn Boulevard (not on Greenbriar Project Site), and replace existing pipe culvert under W. Elkhorn Boulevard with a 54-inch-diameter pipe culvert	7.2
Total planned Improvements by Others on the Off-site Improvement Lands	11.2
Total planned Improvements	47.5

Sources: *Greenbriar Project Acreage Calculations Memorandum* prepared by Wood Rodgers (Appendix A) MAP HCP (Thomas Reid Associates 2001)

*Part or all of these improvements may be constructed by the Greenbriar Development Project depending on timing.

2.6. Project Schedule

Construction of the proposed development at the Greenbriar Project Site is scheduled to begin in 2017 and is expected to occur in at least two phases, referred to as Phase 1 and Phase 2, over a 5 to 10-year period. Phase 1 will primarily develop land north of Meister Way as well as implement construction and restoration activities within and immediately adjacent to the Lone Tree Canal Reserve. Phase 2 will primarily develop land south of Meister Way. Single-family residences will be the primary development on the Greenbriar Project Site. Two multi-family residential components will be constructed south of Meister Way, and one north of Meister Way near the eastern Greenbriar Project Site limit. Commercial properties are proposed for construction in the northeast corner of the Greenbriar Project Site, and a smaller commercial property is proposed to be located south of Meister Way. An elementary school site is proposed near the southeast corner of the Greenbriar Project Site. Neighborhood parks will be located throughout the Greenbriar Project Site – a community park is proposed for construction near the northeast corner of the Greenbriar Project Site.⁴

Timing of construction of the proposed Meister Way overpass will be determined based on Project transportation impacts identified in the Final EIR (EDAW 2007) and through the financing plan prepared for the Project, which will be prepared in consultation with the City of Sacramento. Timing for the extension of light rail service and construction of a light rail station will depend on Sacramento Regional Transit's schedule for implementation.

2.7. Greenbriar Conservation Strategy

The Greenbriar Conservation Strategy consists of two primary elements: establishment of reserves to provide habitat for Covered Species in perpetuity and implementation of specific conservation measures to reduce impacts to Covered Species. Each of these elements of the Greenbriar Conservation Strategy is discussed in this section.

2.7.1. Discussion of Proposed Reserve Land

Consistent with the NBHCP, reserve land will be dedicated for the total gross acreage of the development footprint on the Greenbriar Project Site and Off-Site Improvement Lands excluding acres that are either 1) previously developed or 2) will be protected in perpetuity as wildlife habitat through conveyance of a conservation easement or fee title. Improvements by other entities have not been excluded from the reserve land calculation because it is unknown whether these improvements will be constructed by the Project Applicant or another entity. The following paragraphs describe areas within the Greenbriar Project Site and Off-Site

⁴ Tentative Master Parcel and Tentative Subdivision Maps prepared by Wood Rodgers (July 2012)

Improvement Lands that were excluded from the calculation of land dedication and summarize the net acreage of currently undeveloped land that would be developed as a result of the Project.

2.7.1.1. GREENBRIAR PROJECT SITE

A total of three areas totaling 40 acres on the Greenbriar Project Site are excluded from the calculation of reserve land proposed for preservation in perpetuity to off-set impacts of the proposed development: the net acreage of the land being dedicated as the Lone Tree Canal Reserve (28.3 acres), a 10.1-acre area that was disturbed by the MAP POA to construct the MAP Off-Site Sewer Force Main and Natomas/MAP Trunk Sewer Connection Improvements, and a 1.6-acre area that is dedicated as future right-of-way for the Elkhorn Blvd interchange.

Additional reserve land is not necessary to off-set impacts associated with establishment of the Lone Tree Canal Reserve because it is being protected in perpetuity as wildlife habitat and open space through conveyance of a conservation easement or fee title. The 10.1-acre area that was impacted by the MAP POA, which includes a 20-foot wide easement granted to the Sacramento Regional Sanitation District, was identified as an Off-Site Infrastructure Improvement in the MAP HCP (a 100-foot-wide x 17,700-foot-long construction envelope was evaluated for the sewer infrastructure in the MAP HCP although the exact location has changed slightly). This area was disturbed and mitigated by the MAP POA. The MAP HCP states “MAP POA will oversee construction of the off-site infrastructure improvements and payment of mitigation fees which will be funded through the same Mello Roos bond (or a similar bonding mechanism) that funds the initial infrastructure improvements (MAP HCP Chapter 1.C.2.c. page 13). The 1.6-acre area dedicated for future right-of-way for the Elkhorn Blvd interchange was excluded from the calculated acreage of reserve land because it will be dedicated as right-of-way for the interchange prior to site development.

Table 4 summarizes the net acreage of development impacts on the Greenbriar Project Site that would be implemented by the Project Applicant.

Table 4. Calculation of the Net Acreage of Development Impacts on the Greenbriar Project Site Implemented by the Project Applicant

Description	Acreage
Gross Acreage of Greenbriar Project Site	577.0
<i>Land that would not be developed by the Project Applicant</i>	
Net Acreage of the Lone Tree Canal Reserve*	(28.3)
MAP Off-Site Sewer Force Main and Natomas/MAP Trunk Sewer Connection Improvements (existing previously mitigated disturbance)**	(10.1)
SR 99/70 Southbound On-Ramp Right-of-Way at Elkhorn Boulevard***	(1.6)
<i>Total</i>	<i>40.0</i>
Net Acreage of Development Impacts on the Greenbriar Project Site	537.0

*The Lone Tree Canal Reserve is being protected in perpetuity as wildlife habitat through conveyance of a conservation easement or fee title. Dedication of reserve land for this portion of the Greenbriar Project Site is not necessary consistent with the NBHCP Chapter VI.B.1. page VI-1.

**A sewer force main and trunk sewer connection have been constructed on 10.1 acres of the Greenbriar Project Site by the MAP POA; these impacts are identified in the MAP HCP and are required to be mitigated under the MAP HCP (see MAP HCP CH 1.C.2.b. on page 13).

***A total of 1.6 acres will be dedicated for future right-of-way for the Elkhorn Boulevard interchange. This area is not being disturbed as part of the proposed project and is not considered part of the project's gross impact acreage.

2.7.1.2. OFF-SITE IMPROVEMENT LANDS

Two areas on the Off-Site Improvement Lands are excluded from the calculation of reserve land proposed to off-set impacts: a 3.2-acre segment composed of existing pavement on W. Elkhorn Boulevard and a 3.0-acre segment along the south side of W. Elkhorn Boulevard that was disturbed by the MAP POA to construct the Off-Site Sewer Force Main Connection.

Table 5 summarizes the net acreage of development impacts on the Off-Site Improvement Lands that would be implemented by the Project Applicant.

Table 5. Calculation of the Net Acreage of Development Impacts on the Off-Site Improvement Lands Implemented by the Project Applicant

Description	Acreage
Gross Acreage of Off-Site Improvement Lands	12.76
<i>Land that would not be developed by the Project Applicant</i>	
Elkhorn Boulevard existing pavement*	(4.46)
MAP Off-Site Sewer Force Main Connection Improvements (existing previously mitigated disturbance)**	(3.0)
<i>Total</i>	<i>7.46</i>
Net Acreage of Development Impacts on the Off-Site Improvement Lands	5.3

*Reserve land is not proposed to off-set impacts to portions of a project site that have been previously developed.

**A sewer force main connection has been constructed on 3.0 acres of the Off-Site Improvement Lands by the MAP POA; these impacts are identified in the MAP HCP and are required to be mitigated under the MAP HCP (see MAP HCP CH 1.C.2.b. on page 13).

2.7.1.3. SUMMARY OF PROPOSED RESERVE LAND DEDICATION

The Greenbriar Conservation Strategy is habitat-based, consistent with the NBHCP. Reserve land would be preserved as wildlife habitat in perpetuity to off-set impacts to all of the land on the Greenbriar Project Site and Off-Site Improvement Lands that would be developed with the exception of previously developed land and/or land impacts previously mitigated by other entities. The project development footprint is a total of 589.76 acres, comprising the 577.0-acre Greenbriar Project Site and 12.76 acres of Off-Site Improvement Lands. Of this acreage, reserve land is not proposed for 47.46 acres as identified in **Tables 11 and 12**. Therefore, reserve land is proposed to off-set 542.3 acres of net impacts associated with the Greenbriar Development Project.

2.7.2. Reserve Establishment

On- and Off-Site Reserves will be established in perpetuity to off-set impacts to special-status species that would result from development activities on the Greenbriar Project Site and Off-site Improvement Lands. These reserves include the Lone Tree Canal Reserve on the Greenbriar Project Site, and three Off-Site Reserves: the Spangler Reserve, the Moody Reserve, and the North Nestor Reserve. Proposed activities at the reserves include creating, enhancing, and managing habitat for the Covered Species. Land use categories in the overall Off-Site Reserves will include rice, upland, and managed marsh to be consistent with the target land uses for the TNBC reserve system, which consist of roughly 50% rice, 25% managed marsh and 25% upland.

A total of approximately 557 acres of reserve land is proposed to offset development impacts to 542.3 acres of land on the Greenbriar Project Site and Off-Site Improvement Lands (1.03:1 ratio). Based on the current design, the Greenbriar Development Project proposes 259.4 acres of rice (46.6%), 143.8 acres of managed marsh (25.8%), and 153.9 acres of upland (27.6%). A summary of the proposed land use within each category (rice, managed marsh, upland) at each of the Project's reserves is provided in **Table 6**.

Table 6. Summary of the Proposed Land Use by Category (Rice, Managed Marsh, Upland) at the Greenbriar Development Project's Reserves*

	Lone Tree Canal Reserve	Spangler Reserve	Moody Reserve	North Nestor Reserve	Total Acres
Rice	--	40.3	--	219.1	259.4
Managed Marsh	1.8	142.0	--	--	143.8
Upland	26.5	53.1	74.3	--	153.9
Total acres	28.3	235.4	74.3	219.1	557.1

*Consistent with the NBHCP, a significant portion of the rice and managed marsh will be managed to provide habitat for upland-dependent species (e.g., Swainson's hawk foraging) as described in Tables 21 and 22.

2.7.2.1. LONE TREE CANAL RESERVE

The Lone Tree Canal Reserve is an approximately 250-foot-wide corridor along the western boundary of the Greenbriar Project Site that will be set aside for preservation. The Lone Tree Canal Reserve includes the entire Lone Tree Canal (top-of-bank to top-of-bank), which includes approximately 3.1 acres of waters of the U.S., and an approximately 200-to 225-foot-wide upland buffer on the east side of the canal. **Appendix B** is a schematic design of the Lone Tree Canal corridor and open space buffer, which make up the Lone Tree Canal Reserve.

Project Related Development Activities

The entire corridor designated for the Lone Tree Canal Reserve encompasses approximately 31.3 acres; however, construction activities associated with several development-related improvements on the Greenbriar Project Site and Off-site Improvement Lands will result in 3.0 acres of impacts within the Lone Tree Canal Reserve. These improvements are presented in

Table 7. Therefore, a net acreage of approximately 28.3 acres will be preserved and managed for GGS in the Lone Tree Canal Reserve.

Table 7. Improvements within the Lone Tree Canal Reserve

Improvement	Description	Area (acres)
Meister Way	Meister Way and the Green Line to the Airport light rail line will cross over the open-space buffer at the Lone Tree Canal Reserve via a 54-inch culvert.	1.6*
Residential Street 3	This residential street will cross over the open-space buffer at the Lone Tree Canal Reserve via a 54-inch culvert.	1.0**
Drainage	The existing 30-inch diameter pipe culvert under W. Elkhorn Boulevard will be replaced with a 54-inch diameter pipe culvert (overlapping the Lone Tree Canal Reserve).	0.1
	A 60-inch-diameter lake outfall pipe will be installed to drain to Lone Tree Canal and the existing culvert at I-5	0.3
	A 8-inch-diameter pipe will be installed to drain to Lone Tree Canal near the northern project boundary from detention basins proposed for construction on the Greenbriar Project Site	0.0***
Total area of disturbance		3.0

Source: *Greenbriar Project Acreage Calculations Memorandum* prepared by Wood Rodgers (Appendix A).

Note: Actual culvert sizes have changed based on hydrology studies and design refinements and are potentially subject to future revision; however, the footprint of the impact has not changed and is sufficient in size to accommodate any potential future revisions to culvert sizes and designs.

*Includes footprint of the Meister Way and Green Line to the Airport light rail line crossing plus a construction area north and south of the crossing. This acreage estimate is likely conservative because some or all of the construction area may be restored to pre-project or better conditions and would only be a temporary impact.

**Includes footprint of residential street crossing plus a construction area north and south of the crossing. This acreage estimate is likely conservative because some or all of the construction area may be restored to pre-project or better conditions and would only be a temporary impact.

***Included in construction footprint of 54-inch diameter pipe culvert installed to replace existing 30-inch diameter pipe culvert under W. Elkhorn Boulevard.

A total of 28.3 acres of Lone Tree Canal Reserve will be temporarily disturbed during habitat enhancing activities. Approximately 3.2 acres of the Lone Tree Canal Reserve will be temporarily disturbed for improvements along reach 8 of Lone Tree Canal planned by the MAP project (these improvements are not part of the Greenbriar Development Project). Refer to Chapter 2.5 *Improvements by Others* for a description of the improvements along reach 8.

An 8-inch-diameter drain pipe will be installed to drain to Lone Tree Canal near the northern project boundary, from detention basins proposed for construction on the Greenbriar Project Site. The purpose of the drain pipe is to provide supplemental flows to Lone Tree Canal in the event that additional water is required to maintain water sufficient to support GGS during its active season. The drain pipe will include a slide gate that will be physically operated as needed. The detention basin water supply will be stormwater that could be supplemented by groundwater. The drain pipe installation area is within the area that will be impacted by replacement of the existing 30-inch-diameter pipe culvert under W. Elkhorn Boulevard at Lone Tree Canal with a 54-inch culvert capable of conveying 100-year storm flows.

In addition, approximately 3.1 acres of engineered fill will be permanently placed along the eastern boundary of the Lone Tree Canal Reserve. The engineered fill will be an extension of the adjacent building pads at a 3:1 slope, with a maximum width of 25 feet at the bottom and a depth of approximately 8 to 10 feet at the eastern boundary of the reserve. Habitat disturbance due to the placement of the engineered fill will be temporary because the engineered fill will be hydro-seeded and will be established as grassland habitat upon completion of construction.

Project Related Restoration Activities

The Project Applicant will implement habitat-enhancing features by contouring the east bank of Lone Tree Canal to create a 3:1 slope, hydro-seeding the slope with native vegetation, allowing emergent vegetation to establish along the toe of the new slope, installing a snake wall and protective fencing, and by establishing the Lone Tree Canal Reserve under a conservation easement. Disturbances associated with constructing these features will be temporary, and would be expected to improve the overall habitat quality of Lone Tree Canal for GGS.

To ensure that the project maintains habitat connectivity for GGS between the southern (Fisherman's Lake) and northwestern zones of the Natomas Basin and to provide foraging habitat for Swainson's hawk, the following measures will be implemented along Lone Tree Canal at the Greenbriar Project Site:

- Approximately 28.3 acres along Lone Tree Canal shall be protected, enhanced, and managed as GGS habitat and Swainson's hawk foraging habitat (i.e., the Lone Tree Canal Reserve). This on-site habitat preservation shall protect an approximately 250-foot-wide corridor that includes Lone Tree Canal and approximately 200 feet of adjacent uplands along the east side of the canal. A 25-foot-wide setback from the Lone Tree Canal Reserve boundary has been provided on the adjacent MAP property, west of the reserve boundary. Uplands within the Lone Tree Canal Reserve will be converted to, and managed as, perennial grassland as described below. Additional

- aquatic and upland habitat for GGS shall be created along the east bank of Lone Tree Canal. This habitat shall be managed in perpetuity as high-quality habitat for GGS.
- To ensure that the project does not diminish GGS movement along Lone Tree Canal, the culverts used for the proposed roadways crossing Lone Tree Canal (Meister Way and Residential Street 3) shall be designed to allow passage by GGS.
 - Habitat within the Lone Tree Canal Reserve shall be enhanced and managed to provide cover and refugia for the GGS during the winter dormant period.
 - The east bank of the canal, which currently has a nearly vertical slope, will be recontoured to a 3:1 slope (horizontal:vertical). This will reduce the amount of maintenance required in the channel (e.g., dredging, bank repair) and facilitate the growth of freshwater marsh plants. Tule (*Schoenoplectus* sp.) as well as native sedges, rushes, and/or other emergent wetland species will be allowed to establish along the slope at the proper elevation to provide cover for the snake. The emergent wetlands along the recontoured slope will provide foraging habitat for GGS while providing cover from predators.
 - The upland areas within the Lone Tree Canal Reserve will be seeded with native perennial grasses, to provide upland habitat for the GGS for cover and to provide additional refugia during the winter dormant period. The grassland will also provide foraging habitat for Swainson's hawk.
 - A masonry and metal fencing barrier (aka "snake wall") shall be installed between the Lone Tree Canal Reserve and the adjacent development on the Greenbriar Project Site, at the boundary of the Lone Tree Canal Reserve along W. Elkhorn Boulevard, and at the Meister Way and Residential Street 3 crossings of the Lone Tree Canal Reserve. The barrier will ensure that GGS do not enter the development area and will serve to prevent humans and pets from entering the reserve. The design of the barrier will be subject to USFWS review and approval. The barrier shall be maintained on the reserve side by a USFWS-approved third party Plan Operator to ensure that vegetation and/or debris does not accumulate near the barrier and provide opportunities for wildlife and pets to climb over the barrier. On the development side, adjacent to the barrier, Covenants, Conditions, and Restrictions (CC&Rs) shall prohibit accumulation of vegetation or debris adjacent to the barrier.

Specific design requirements for the barrier include:

- Chain link fencing will be placed at either end of the corridor and at Meister Way, with locked gates permitting entry only by RD 1000 and Natomas Central Mutual

Water Company (NCMWC) for channel maintenance, and by the Plan Operator for habitat monitoring and maintenance purposes.

- Adequate height and below-ground depth to prevent snakes or burrowing mammals from providing a through-route for snakes by establishing burrows from one side to the other;
- The barrier will be constructed using extruded concrete or block construction extending a minimum of 36-inches above ground level;
- The barrier will include a cap or lip extending at least two-inches beyond the barrier's vertical edge to prevent snakes from gaining access along the barrier's top edge; and
- Signage to discourage humans from entering the Lone Tree Canal Reserve.

The following measures relate to management of the Lone Tree Canal Reserve:

- The Lone Tree Canal Reserve shall be protected in perpetuity under a conservation easement and will be managed to sustain the value of this area for GGS habitat connectivity. Compliance and biological effectiveness monitoring shall be performed and annual monitoring reports prepared. This monitoring, reporting, and adaptive management shall be performed as described in the SSMP prepared for the reserve.
- Aquatic habitat shall be maintained throughout the GGS active season in Lone Tree Canal, in perpetuity. This is the legal responsibility and obligation of the MAP Property Owners' Association (MAP POA). The MAP HCP includes provisions (Thomas Reid Associates 2001) to ensure that water levels are maintained at or above 12 inches of depth. If water is not provided to Lone Tree Canal by the MAP to meet the habitat requirements of GGS, as required by the MAP HCP, and USFWS exhausts its enforcement responsibilities, the Project Applicant shall assume the responsibility of providing water for GGS aquatic habitat throughout the section of Lone Tree Canal within the Lone Tree Canal Reserve.
- Assuming this backup water responsibility was a mitigation measure in the City of Sacramento's Draft EIR for the Greenbriar Project (EDAW 2006). However, as stated in the EIR, the project applicant shall only assume this responsibility if it has been sufficiently demonstrated to the City of Sacramento that USFWS has exhausted all reasonable means to compel MAP to comply with the relevant conditions of the MAP ITP. Specific requirements related to ensuring suitable aquatic habitat in Lone Tree Canal is present, in perpetuity, throughout the GGS active season, shall be developed through consultation with CDFW and USFWS, and included in the SSMP for the Lone Tree Canal Reserve. If needed, the 8-inch drain pipe mentioned above

would provide supplemental flows to Lone Tree Canal from the detention basins on the Greenbriar Project Site.

Table 8 is a description of the proposed habitats at the Lone Tree Canal Reserve by category of upland and managed marsh.

Table 8. Description of Proposed Habitats at the Lone Tree Canal Reserve by Category

Category	Specific Habitat	Acres
Upland	Perennial grassland between Lone Tree Canal and the development on the Greenbriar Project Site	26.5
<i>Subtotal</i>		26.5
Managed Marsh	Lone Tree Canal; open water with emergent vegetation	1.8
<i>Subtotal</i>		1.8
Total Site Acreage		28.3

2.7.2.2. OFF-SITE RESERVES

Approximately 528.5 acres of Off-Site Reserves have been identified and shall be protected, enhanced, and managed as habitat (i.e., the 235.4-acre Spangler Reserve, the 74±acre Moody Reserve, and the 219.1-acre North Nestor Reserve). The reserves will be at locations that contribute to an interconnected regional reserve system as envisioned in the NBHCP. The plan for the proposed restoration of the Off-Site Reserves is discussed below.

Spangler Reserve

The 235.4-acre Spangler Reserve is currently in rice production, and consists of rice fields with a supporting network of agricultural drains as well as upland berms along the perimeter of the rice fields and drains. The Spangler Reserve shall be protected as habitat for GGS and Swainson's hawk and will also provide habitat for other NBHCP Covered Species. The Spangler property currently is divided into a 75.3-acre northern portion and an approximately 160-acre southern portion by a drainage ditch. Upon completion of reserve establishment, approximately 40.3 acres of the northern portion of the site will remain in rice production and best management practices for rice farming will be implemented. The remaining approximately 35 acres in the northern portion will be permanently converted to upland habitat to provide foraging for Swainson's hawk and upland refugia for GGS. In order to ensure additional foraging opportunities at the Spangler Reserve for Swainson's hawk, it is envisioned that approximately 20% of the rice fields will be fallowed each year on a rotating schedule (this percentage could

vary based on water availability or other management considerations). The southern portion of the site will be used for creation of a managed marsh complex (142.0 acres) and upland habitat (18.1 acres). Approximately half of the managed marsh will be created in the first of two phases; the remaining managed marsh will be created in the second phase. In the interim period between completion of Phase 1 and commencement of Phase 2, the acreage of managed marsh planned for creation in Phase 2 will remain in rice production.

The managed marsh and upland habitat will be constructed within the existing rice field infrastructure. Currently, the 160-acre southern portion of the Spangler Reserve consists of 27 individual rice cells surrounded by berms. To create managed marsh, the interior of 23 of those cells will be converted to a mosaic of open water, perennial bulrush marsh, and upland habitat. Other elements of the managed marsh complex will include linear water supply ditches and upland components including higher elevation uplands between the marsh habitats (high ground hibernaculæ for GGS) and upland buffers to protect the managed marsh from surrounding land uses, and maintenance roads. The remaining four cells will be used to create annual grassland with interspersed seasonal wetlands.

New bypass ditches and control structures will be constructed to allow control of the water delivery to each individual cell in the managed marsh so that each cell can be maintained individually without affecting water delivery to the surrounding cells. It is anticipated that dewatering of each cell would need to occur every five to seven years in order to maintain a minimum of 20% open water in each cell for optimal GGS habitat and that up to 1/3 of the cells would be dewatered for maintenance purposes in any one year (with the exception of the four cells used for creation of seasonal wetland). Once dewatered, the cells will be disced to remove excess tules and cattails and left fallow for one season. If possible, row crops compatible with Swainson's hawk foraging will be planted within fallow cells. If planting of row crops is not feasible in a given year, the cells will be seeded with a mix of annual grasses and forbs that will attract small mammals and in turn provide foraging habitat for Swainson's hawk. The fallow cells will be returned to marsh the following season. An appropriate mix of grasses and forbs will also be planted in upland areas such as on the cell berms, in high ground areas, and along the field access roads. The conceptual design of the Spangler Reserve is included as **Appendix C**.

A preliminary assessment of the suitability of the Spangler Reserve as an Off-site Reserve was included in the *Draft Conceptual Habitat Restoration Design* prepared by Wildlands, Inc. (Wildlands 2005). Based on this assessment, the Spangler Reserve is suitable for management as a reserve due to its size, connectivity to the Natomas Basin's network of canals and drains, and its proximity to existing NBHCP reserves.

A review of the Spangler Reserve managed marsh design was conducted by GGS scientist, Mr. Eric C. Hansen, and he found the design "novel in its design, scale, and simplicity while

remaining wholly consistent with the general design elements of giant garter habitat creation.” He further stated that “through its simplicity, however, it overcomes many of the challenges experienced with habitats comprising larger, more complex management units while potentially increasing carrying capacity. As reserve land that is separate from the HCPs, the Spangler Reserve augments the 2,500-acre reserve block that the NBHCP will maintain in the northeast corner of the Natomas Basin. Implementing a novel design also provides superior opportunities to measure the species’ response to different conditions and to manage habitat adaptively. These factors are all benefits to the NBHCP and the MAP HCP and the persistence of GGS in the Natomas Basin over time.” The letters from Mr. Hansen are included as **Appendix D**. A description of the proposed habitats at the Spangler Reserve by category (rice, managed marsh, upland) is included as **Table 9**.

Table 9. Description of Proposed Habitats at the Spangler Reserve by Category*

Category	Specific Habitat	Acres
Rice	Managed rice fields consisting of individual rice cells, interior berms, and ditches/canals	40.3
Managed Marsh	Managed marsh complex with open water, bulrush marsh, and upland components	142.0
Upland	Annual grassland including created seasonal wetlands	53.1
Total Site Acreage		235.4

*Consistent with the NBHCP, a significant portion of the rice and managed marsh will be managed to provide habitat for upland-dependent species (e.g., Swainson’s hawk foraging) as described in Tables 21 and 22.

Moody Reserve

The 74±acre Moody Reserve is an agricultural parcel currently being used for alfalfa production. The entire site is classified as “upland.” No changes in land use are planned for the site. It is currently envisioned that the site would remain in agricultural production of alfalfa or other upland crops (i.e., non-rice crops) that provide high quality foraging habitat for Swainson’s hawk adjacent to high quality nesting habitat on the adjacent properties. A conservation easement will be placed on the site to preserve the property as a biological reserve in perpetuity for the benefit of Swainson’s hawk and other NBHCP Covered Species. Site management practices will be modified as needed to provide optimal habitat for Swainson’s hawk and other Covered Species such as implementing protective measures for elderberry shrubs on the site. A description of the proposed habitats at the Moody Reserve by category (upland) is included as **Table 10**.

Table 10. Summary of Proposed Habitats at the Moody Reserve by Category

Category	Specific Habitat	Acres
Upland	Agricultural fields currently being used to cultivate alfalfa	55.48
	Ruderal habitat in field margins, dirt roads, and dirt parking areas	9.36
	Great Valley valley oak riparian habitat (includes disturbed riparian)	5.4
	Non-native grassland in an uncultivated corner of the site	3.63
	Irrigation ditches used periodically to irrigate the agricultural fields	0.23
	Seasonal wetlands within the non-native grassland in an uncultivated corner of the site	0.20
Total Site Acreage		74.3

North Nestor Reserve

The 219.1-acre North Nestor Reserve is an agricultural parcel currently being used to grow rice. The entire site is composed of active rice fields. The North Nestor Reserve will be managed in rice and will maintain biological connectivity between existing TNBC reserves to the north and south. A 13.6-acre easement area has been defined along the western boundary of the North Nestor Reserve, which could be managed separately by TNBC to further the NBHCP goal of establishing a habitat reserve of 2,500 acres in the Natomas Basin. The remainder of the North Nestor Reserve's management would be modified as needed to benefit NBHCP Covered Species, such as by modifying the rice production practices to allow a percentage of the rice fields to fallow each year to provide foraging habitat for Swainson's hawk and other NBHCP Covered Species. Currently it is envisioned that approximately 20% of the rice would be left fallow on a rotational basis each year; this percentage could vary based on water availability or other management considerations. A description of the proposed habitats at the North Nestor Reserve by category (rice) is included as **Table 11**.

Table 11. Summary of Proposed Habitats at the North Nestor Reserve by Category*

Category	Specific Habitat	Acres
Rice Fields	Managed rice fields consisting of individual rice cells, interior berms, ditches/canals, access roads, and perimeter berms	219.1
Total Site Acreage		219.1

*Consistent with the NBHCP, a significant portion of the rice will be managed to provide habitat for upland-dependent species (e.g., Swainson's hawk foraging) as described in Tables 21 and 22.

Additional Off-Site Reserve Lands

Given the 1.03:1 ratio proposed, it is unlikely that any additional reserve lands would be required. However, additional off-site reserve property, if required, will be chosen using the following criteria:

- Proximity to existing preserve areas providing a mosaic of larger habitat areas to enhance existing and new reserve lands' value;
- Proximity to major water courses surrounding the Natomas Basin (e.g., the Sacramento River, Natomas Cross Canal, and American River);
- Suitability of foraging habitat for Swainson's hawk; and,
- Proximity to known Swainson's hawk nest locations.

Parcels within one mile of a major water course will be considered, regardless of their proximity to other preserve areas, for the following:

- high habitat value relative to other available parcels;
- existing water rights;
- capability of supporting appropriate agricultural land uses;
- distance from incompatible land uses (e.g., urban development); and
- hydrologic connectivity to other habitats and existing TNBC reserves.

Dedication Instrument

The project applicant will dedicate the Spangler Reserve, the Moody Reserve, and the North Nestor Reserve by granting a conservation easement, including the structure for funding each site, to a USFWS-approved third party Plan Operator. A conservation easement is "binding upon successive owners of such land, and the purpose of which is to retain land predominantly in its

natural, scenic, historical, agricultural, forested, or open-space condition.” (Civ. Code, § 815.1.) California state law recognizes that conservation easements are perpetual in duration and can be considered public uses. (Civ. Code, § 815.2; Code Civ. Proc., § 1240.055.)

Like other properties, lands upon which a conservation easement has been placed can be subject to eminent domain proceedings as a means to make such lands available for other public uses such as road expansions. A property that is already appropriated to public use may only be acquired by eminent domain to put the property to a “more necessary public use than the use to which the property is appropriated.” (Code Civ. Proc., § 1240.610.) Any public agency proposing to carry out eminent domain proceedings on a property covered by a conservation easement must provide notice and fair market value compensation to both the land owner and the conservation easement holder. (Code Civ. Proc., § 1240.055.) Compensation for the conservation easement portion must be used for the “purchase of property that replaces the natural resource characteristics the original mitigation was intended to protect, or as near as reasonably feasible.” (See Gov. Code, § 65966, subd. (j).) Thus, California law protects the habitat value of conservation properties even in the eminent domain context.

The endowment or other structure for funding the reserve sites will be calculated by estimating enhancement, management, administration, and monitoring costs. Prior to signing the dedication instrument, the project applicant and/or the USFWS-approved third party Plan Operator will submit the instrument to USFWS and CDFW for review and concurrence. Concurrence will be required before the transfer is final.

Prior to the instrument between the Project Applicant and the Plan Operator being finalized, SSMPs will be developed for each reserve. These plans will describe the following, as pertinent:

- Results of an existing conditions biological assessment;
- Prohibited and controlled activities;
- Measures to avoid take and conflicts with the Sacramento International Airport;
- Management activities including habitat management, monitoring, patrols, and rice production practices (if applicable);
- Restoration and enhancement programs; and,
- Reserve water management.

Further details on monitoring, reporting, adaptive management, and the funding mechanism for the proposed reserves will be included in the SSMPs prepared for each of the reserves.

2.7.2.3. CONSISTENCY WITH NBHCP RESERVE ACQUISITION CRITERIA

The NBHCP contains several overall acquisition/evaluation criteria to be considered when a piece of land is being evaluated for its suitability as a potential reserve. The overall acquisition criteria in the NBHCP are listed below along with an evaluation of consistency between the Greenbriar Development Project's reserves and such criteria.

The NBHCP provides for a general division of habitat types within TNBC's system of reserves as follows: 50% rice production, 25% managed marsh, and 25% upland habitat.

Approximately 557 acres of reserve land is proposed in the Greenbriar Conservation Strategy to offset impacts to 542.3 acres of land on the Greenbriar Project Site and Off-Site Improvement Areas (1.03:1 ratio). Based on the overall acreage (542.3 acres) and a ratio of 50:25:25 (rice:managed marsh:upland), the Greenbriar Conservation Strategy would need to provide 278.5 acres of rice, and 139.25 acres each of managed marsh and upland to be consistent with the NBHCP. Based on the current design, the Greenbriar Conservation Strategy proposes 259.4 acres of rice, 143.8 acres of managed marsh, and 153.9 acres of upland, roughly meeting or exceeding the NBHCP ratio in each category.

Land has legal water rights to an adequate water supply to serve the anticipated uses (wetland or upland) of the proposed reserve.

The North Nestor Reserve and the Moody Reserve would remain in their current uses. Water deliveries to these two sites are regulated by the NCMWC; it is assumed that these water deliveries would continue consistent with the existing land use.

Land use changes are proposed at the Lone Tree Canal Reserve and the Spangler Reserve. Water supply and drainage at the Spangler Reserve is currently managed as part of the local agricultural and flood control system managed by NCMWC and Reclamation District 1000 (RD 1000). The rice fields at the Spangler Reserve are periodically flooded for rice production and are expected to be flooded or saturated for the duration of the growing season (May 15 through September 15). Following crop harvest, the fields are flooded from November 15 through February 15 for weed control. NCMWC currently delivers approximately 6-7 acre-feet/year to the Spangler Reserve (pers. comm., Mike Fales), and up to a maximum delivery of 10 acre-feet/year could be delivered (pers. comm., Dee Swearingen). Project water requirements are anticipated to be within this range. RD 1000 staff indicated that a flow-through of 1 cubic foot per second, which is within the range or higher than is anticipated to be required by the proposed site design, would not pose an issue to the existing RD 1000 drainage system.

It is the legal responsibility and obligation of the MAP POA to maintain aquatic habitat in Lone Tree Canal throughout the GGS active season, in perpetuity. The MAP HCP includes provisions (Thomas Reid Associates 2001) to ensure that water levels are maintained at or above 12 inches of depth (See Chapter 2.7.2.1 *Lone Tree Canal Reserve*). In order to provide a back-up water supply, an 8-inch-diameter drain pipe will be installed to drain to Lone Tree Canal near the northern boundary of the Greenbriar Project Site, from detention basins proposed for construction. The purpose of the drain pipe is to provide supplemental flows to Lone Tree Canal in the event that additional water is required to maintain water sufficient to support GGS during its active season. The drain pipe will include a slide gate that will be physically operated as needed. The detention basin water supply will be supplemented, if needed, by groundwater.

Land is capable of supporting appropriate agricultural cultivation in conjunction with either wetland or upland habitat reserve.

The Greenbriar Development Project's proposed reserves were chosen specifically because they are already being used for agricultural cultivation consistent with the requirements of the NBHCP Covered Species and have existing agricultural uses consistent with the existing TNBC reserve system. The Moody Reserve is currently in alfalfa production (and has been for many years) and is capable of supporting continued alfalfa production. The Spangler Reserve and the North Nestor Reserve are both currently in rice production (and have been for many years) and are both capable of supporting continued rice production. The Lone Tree Canal Reserve, while not in agricultural production, represents important north/south connectivity for GGS and is thus consistent with other goals of the NBHCP.

Land is capable of either supporting or being improved to support various NBHCP Covered Species associated with the anticipated type of habitat (wetland or upland) proposed for the potential reserve.

All of the proposed reserves associated with the Greenbriar Development Project have been assessed and determined to support NBHCP Covered Species and/or their habitats in their current condition. The Lone Tree Canal Reserve provides habitat for GGS and other Covered Species dependent on canal habitats as well as upland foraging habitat for Swainson's hawk and other bird species. The Spangler Reserve and North Nestor Reserve both provide habitat for GGS and other Covered Species dependent on rice and canal habitats. The Moody Reserve provides nesting and upland foraging habitat for Swainson's hawk and other bird species. Habitat value at all of the reserve sites will be maintained and/or enhanced upon reserve establishment.

Upland or wetland specific criteria will be applied as appropriate.

Of the Greenbriar Development Project's proposed reserves, only the Spangler Reserve is proposed for substantial habitat creation. The design of the proposed managed marsh at the Spangler Reserve was developed in coordination with Mr. Eric C. Hansen, GGS scientist. Mr. Hansen found the site to be suitable to support managed marsh. In addition, he found the managed marsh design to be "wholly consistent with the general design elements of giant garter habitat creation...through its simplicity it overcomes many of the challenges experienced with habitats comprising larger, more complex management units." Mr. Hansen also found that by increasing both the number of management units (i.e. managed marsh cells) and the ability to exercise a greater degree of control over local conditions, the managed marsh design at the Spangler Reserve provides superior opportunities to measure the species' response to different conditions and to manage habitat adaptively (**Appendix D**).

Land is adequately removed from incompatible urban development or uses (i.e., situated a minimum of 800 feet from existing urban lands or lands that are designated for urban uses in an adopted general plan). Mitigation lands that do not comply with the 800-foot setback requirement may be acquired on a case-by-case basis under certain circumstances such as cases where the value of the site warrants preservation (e.g., Fisherman's Lake).

Existing urban lands is defined as "lands that are intensively or completely developed for urban, commercial, or residential uses or are adjacent to or within the immediate vicinity of intensively developed areas, such that the direct and indirect effects of such development are significantly incompatible with the objectives and purposes of the reserve system and would be likely to have significant adverse effects on the reserve viability or on Covered Species inhabiting the reserve lands."

No lands meeting the definition of "existing urban lands" in the NBHCP occur within 800 feet of any of the proposed Off-Site Reserves (North Nestor Reserve, Spangler Reserve, Moody Reserve). The North Nestor Reserve is bordered by existing TNBC reserves on the north (managed marsh) and south (rice lands) sides – the remaining lands adjacent to the site are agricultural lands in active rice production. A parcel with a homestead and agriculture-related equipment and structures occurs approximately 575 feet south of the southwestern corner of the North Nestor Reserve. Activities on the parcel are not incompatible with the objectives and purposes of the reserve system. This is evidenced by the fact that the TNBC reserve (Nestor) that is adjacent to the south side of the North Nestor Reserve directly abuts the developed parcel with no buffer. The TNBC Bennett North reserve also abuts the same developed parcel with no buffer.

The Spangler Reserve is bordered by agricultural lands in active rice production on the north and east sides, by fallow agricultural land on the south side, and Powerline Road and airport property on the west side. Although some “development” occurs adjacent to the Spangler Reserve in the form of lands in uses other than agriculture (i.e. Powerline Road and airport property), these lands are not incompatible with the objectives and purposes of the reserve system. Powerline Road is a rural two-lane farm road that experiences very low traffic volumes. A total of seven existing TNBC reserves abut Powerline Road between the Spangler Reserve and where the pavement ends on Powerline Road just north of Sankey Road. The adjacent airport property is in grass hay production and provides Swainson’s hawk foraging habitat. One TNBC reserve (Atkinson) directly abuts the airport property just west of the Spangler Reserve.

The Moody Reserve is bordered by airport property to the north and east, by Jacob’s Slough, agricultural land in alfalfa production and the Teal Bend Golf Course to the south, and Sacramento Area Flood Control Agency (SAFCA) mitigation land to the west. The closest distance between a runway/taxiway and the Moody Reserve is approximately 650 feet. This runway/taxiway parallels the eastern border of the Moody Reserve for approximately 1,800 feet. To the north of the Moody Reserve, there are no runways/taxiways within 800 feet. The developed portions of the Teal Bend Golf Course are 600+ feet away from the southern border of the Moody Reserve and are separated from the site by Jacob’s Slough and a well developed riparian corridor with 80+ foot tall trees. None of these land uses (airport lands, Teal Bend Golf Course) are incompatible with the objectives and purposes of the reserve system. This is evidenced by the fact that the Moody Reserve and adjacent riparian woodlands support nesting and foraging Swainson’s hawk, which would be the primary purpose of the reserve along with providing habitat for other upland dependant Covered Species. During a site visit by HELIX biologists in July 2015, six Swainson’s hawks were observed foraging in the Moody Reserve and perching on trees in the site.

Although the Lone Tree Canal will be within 25± feet of planned “urban land uses” along the west side (MAP) and 250± feet from “urban land uses” on the east side (Greenbriar development), it is an important north/south corridor for GGS and other Covered Species and its preservation and enhancement as proposed by the Greenbriar Development Project would support the NBHCP goal of maintaining habitat connectivity between the southern and central Basin (see *Greenbriar Development Project – Considerations Regarding Giant Garter Snake Persistence in the Natomas Basin*, letter by Eric Hansen in **Appendix D**). As stated by Mr. Hansen in his previously referenced letter, the Lone Tree Canal Reserve would provide higher quality habitat for GGS post-implementation of the Greenbriar Development Project than it does in its current condition because the site is currently in active hay production (right up to the edge of Lone Tree Canal), which is unsuitable as upland habitat for GGS. The Greenbriar

Conservation Strategy includes restoring and preserving a 250 foot upland buffer on the east side of the canal, which would provide suitable upland habitat for GGS. It is worth noting, as pointed out by Mr. Hansen, that the Greenbriar Project Site is the only available option for upland creation along Lone Tree Canal because the snake exclusion wall associated with MAP limits the creation of upland to the west of Lone Tree Canal. Similar to Fisherman's Lake, the Lone Tree Canal warrants preservation regardless of its proximity to urban land uses for the reasons stated above.

2.7.3. Conservation Measures

To avoid and minimize potential effects to Covered Species associated with construction and restoration activities, the Greenbriar Conservation Strategy includes similar conservation measures to the conservation measures included in the NBHCP. An evaluation of the applicability of the NBHCP conservation measures and their inclusion in the proposed Greenbriar Conservation Strategy is presented in **Appendix E**; the Greenbriar Development Project's proposed conservation measures are included in **Appendix F**. (These measures are also comparable to those incorporated into the MAP HCP [which has been superseded by the 2003 NBHCP].)

2.8. Construction activities

This section describes the construction activities associated with the Greenbriar Development Project which include constructing and operating the development on the Greenbriar Project Site, constructing the off-site improvements, and developing and managing the On- and Off-Site Reserves. Construction activities for improvements implemented by others are also discussed.

2.8.1. Construction and Operation of the Development on the Greenbriar Project Site

The Project includes specific activities on the Greenbriar Project Site in addition to the improvements being constructed. Operation of the development includes long-term, ongoing activities including maintenance and operation of the Greenbriar Project Site's roadways, drainage structures, and utilities.

Planned project activities on the Greenbriar Project Site include the following:

- Implementation of the mixed-use development for all phases of construction, not to exceed 577 acres.
- Establishment of the Lone Tree Canal Reserve.

- Translocation of the elderberry shrub at the Greenbriar Project Site to a USFWS-approved mitigation bank or to an On- or Off-Site Reserve.
- Construction activities including clearing and grubbing, erosion control (installing best management practices during construction), excavating and relocating soil on-site (i.e., balanced grading), backfilling and soil compacting, installing utilities (including potable water conveyance, wastewater conveyance, stormwater drainage facilities, underground electrical and natural gas facilities), and constructing the proposed residential and retail structures. Heavy construction equipment will be required, and may include: scrapers/earthmovers, wheeled dozers, water trucks, fork-lift, wheeled loaders, and motor graders.

2.8.2. Construction of Off-Site Improvements

Project activities on the Off-Site Improvement Lands include the following:

- Off-site improvements not to exceed 12.76 acres. The off-site improvements include widening W. Elkhorn Boulevard to five lanes, SR 99/70 off-ramp improvements at the Elkhorn Boulevard Interchange, and replacing existing pipe culverts along Lone Tree Canal at W. Elkhorn Boulevard.
- Construction activities including clearing and grubbing, erosion control (installing best management practices during construction), excavating and backfilling, soil compacting and grading, replacing existing pavement and installing new pavement and roadway striping, install and replacing existing pipe culverts, constructing roadway pedestrian and bicyclist facilities, and installing frontage landscaping.
- The SR 99/70 off-ramp improvements at the Elkhorn Boulevard interchange are included in the Greenbriar Development Project as part of a fair share agreement with the City of Sacramento. As part of the agreement, the Project Applicant will contribute to the interchange improvements financially; however, the interchange improvements will be constructed and mitigated for by the City of Sacramento.
- Constructing a portion of W. Elkhorn Boulevard and expanding the existing pipe culverts along Lone Tree Canal at W. Elkhorn Boulevard that are included as covered activities in the MAP HCP (refer to Chapter 2.5, *Improvements by Others*). If these improvements are constructed by the MAP project prior to construction activities associated with the Greenbriar Development Project, then the construction activities for that improvement would no longer be a project activity under the Greenbriar Development Project.

2.8.3. On- and Off-site Reserve Establishment and Management

Project activities at the Lone Tree Canal Reserve and the Off-Site Reserves include the following:

- Establishing 528.5 acres of Off-Site Reserves.
- Preservation and enhancement of the 28.3-acre Lone Tree Canal Reserve.
- Habitat enhancement/restoration activities at the On- and Off-Site Reserves, including construction of managed marsh and grassland/seasonal wetland complex at the Spangler Reserve.
- Monitoring and management activities including controlling water supply and erosion, implementing suitable agricultural methods, controlling vegetation overgrowth by grazing or mowing, controlling invasive non-native species, monitoring potential predators and implementing control measures if necessary, managing and maintaining ditches (e.g., removing debris). Management activities will be described in a SSMP for each reserve.

2.8.4. Construction and Operation of Improvements by Others

The following project activities are planned by others to be constructed on the Greenbriar Project Site and Off-site Improvement Lands:

- Constructing Meister Way through the Greenbriar Project Site.
- Widening W. Elkhorn Boulevard to five lanes, SR 99/70 off-ramp improvements at the Elkhorn Boulevard Interchange, and replacing existing pipe culverts along Lone Tree Canal at W. Elkhorn Boulevard.
- Green Line to the Airport light rail construction and maintenance. Six acres have been incorporated into the Greenbriar Project Site design for construction of the light rail project. If the development at the Greenbriar Project Site is constructed prior to the light rail, the six acres would be temporarily disturbed (e.g., clearing and grading, and used by construction equipment), but not developed.
- If the W. Elkhorn Boulevard improvements or Meister Way extension are constructed by the MAP project prior to the construction of the Greenbriar Development Project, those activities would not be included as covered activities in the Greenbriar Development Project.

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Chapter 3. Environmental Setting

This section describes the existing conditions of the various properties associated with the Greenbriar Development Project in order to provide a context and relative intensity for Project impacts. The region's climate, topography and geology, and hydrology as well as the level of human or natural disturbance is also discussed. Refer to **Figure 6** for the land use in the region.

3.1. Description of Existing Biological and Physical Conditions

3.1.1. Environmental Setting

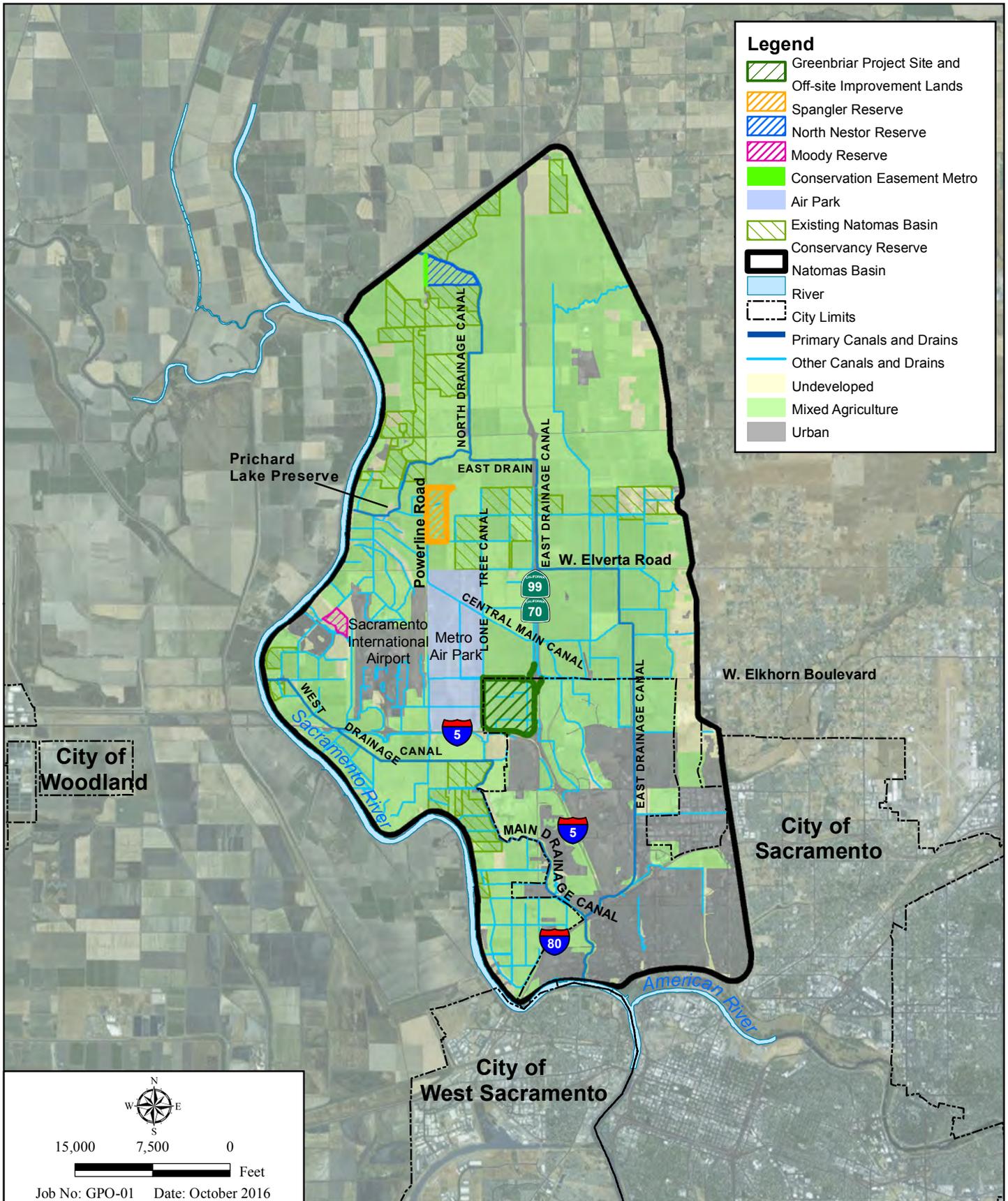
3.1.1.1. GREENBRIAR PROJECT SITE AND OFF-SITE IMPROVEMENT LANDS

Transportation land uses border the Greenbriar Project Site to the north, east, and south. W. Elkhorn Boulevard to the north is an arterial roadway. SR 99/70 to the east and I-5 to the south are major regional transportation corridors. Current land use to the west of the Greenbriar Project Site (the planned MAP development) is undeveloped land/idle cropland. A residential property is located west of the Greenbriar Project Site, south of W. Elkhorn Boulevard. Land use in the immediate vicinity includes agricultural cropland to the north and southwest and residential development to the east and southeast, separated from the Greenbriar Project Site by freeways and an arterial roadway.

The Greenbriar Project Site is primarily used for agriculture, and contains abandoned irrigation and drainage canals. Lone Tree Canal follows the western site boundary, and is maintained by RD 1000 under an existing easement. The additional irrigation and drainage canals throughout the Greenbriar Project Site are managed and maintained by NCMWC and RD 1000 under existing easements, but are currently not in use, and the easements are in the process of being abandoned. The majority of the Greenbriar Project Site is currently being dry farmed for grass hay. A portion of the property was cultivated for rice until 2004 and the remainder of the property has been used for cropland for 20 years or more. Previously cultivated crops on the Greenbriar Project Site include rice, sugar beets and wheat. The northwest section of the site contains remnant development from a horserace track and an irrigated polo field that were in use from approximately the 1980 to the early 2000s. The developed area is surrounded by undeveloped land. An existing drainage structure constructed for the MAP Project, and a 20-foot-wide utility easement granted to the Sacramento Regional Sanitation District are located in the northeast corner of the Greenbriar Project Site (approximately 10.1 acres of existing disturbance).

The Off-site Improvement Lands are developed for transportation land uses (roadways).

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Source: TNBC, DWR (1998, 2000, 2010) Aerial: ESRI 2014

Environmental Setting

GREENBRIAR DEVELOPMENT PROJECT
ANALYSIS OF EFFECTS ON THE NATOMAS BASIN HCP

Figure 6

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3.1.1.2. SPANGLER RESERVE

Land use in the vicinity of the Spangler Reserve consists primarily of active and inactive agricultural cropland (e.g., rice, grass hay) as well as habitat reserves managed by TNBC and other non-profit entities. The Spangler Reserve is within the overflight zone of the Sacramento International Airport which is located approximately 1 mile southwest of the site. Sacramento County owns the parcel adjacent to the southern boundary of the Spangler Reserve.

The Spangler Reserve is currently used for intensive agricultural production of rice. Irrigation canals and drainage ditches transect and follow the perimeter of the site, and are connected by culverts. The rice fields are laser-leveled and delineated by small levees. Access roads follow the canals/ditches, and one access road crosses longitudinally through the center of the site.

3.1.1.3. MOODY RESERVE

The Moody Reserve is located in the west central portion of the Natomas Basin approximately 0.4 mile southeast of the Sacramento River, between the Sacramento International Airport and Teal Bend Golf Course. Major land uses in the vicinity of the Moody Reserve include the Teal Bend Golf Course, fallow and active agricultural fields, and the Sacramento International Airport. The Moody Reserve occurs within the historic floodplain of the Sacramento River and supports remnant valley oak woodland and riparian habitat, which also occurs in the vicinity of the site. In addition to the Sacramento River and its riparian corridor, notable biological habitats in the vicinity of the Moody Reserve includes the recently constructed Lower GGS/Drainage canal (approximately 50 feet in width at top-of-bank) that exists along a significant portion of the southeastern boundary of the Moody Reserve; a drainage containing perennial wetlands and a mature riparian corridor (ranging from approximately 175 to 500 feet in width) that parallels the southern and eastern boundaries of the Moody Reserve; and fallow agricultural lands to the north of the Moody Reserve that contain remnant valley oak woodland/savannah with scattered valley oaks and elderberry shrubs with an understory of annual grasses.

The Moody Reserve consists primarily of alfalfa fields, which comprise the interior portion of the site. Irrigation canals and drainage ditches, which are used to periodically flood-irrigate and then subsequently drain the alfalfa fields, follow the southern, western, and northern perimeters of the site. Walnut Road is a single lane, unpaved road that demarcates the northwestern site boundary. The southeastern corner of the site contains an area that is not farmed that supports grassland, riparian, and seasonal wetland habitat associated with the riparian corridor south of the site.

3.1.1.4. NORTH NESTOR RESERVE

The North Nestor Reserve is located in the northwestern portion of the Natomas Basin in an area used primarily for agricultural production. The Natomas Cross Canal is located approximately

0.25-mile north of the site, the Sacramento River is located approximately 1.6 miles southwest of the site, and the SR 99/70 corridor is located approximately 0.8 mile east of the site. Power Line Road forms the western site boundary and North Drainage Canal forms the northern site boundary. Major land uses adjacent to the site include existing habitat reserve consisting of managed marsh at the TNBC Lucich North reserve north of the site and preserved rice lands at the TNBC Nestor reserve south of the site as well as privately-owned agricultural fields to the northeast, east, and west.

The North Nestor Reserve is currently used for agricultural production of rice. Irrigation canals and drainage ditches follow the perimeter of the site, and are connected by culverts. The rice fields are laser-leveled and delineated by small levees. Access roads follow the canals/ditches, and along the tops of the levees delineating the rice fields.

3.1.2. Climate

The climate of the Natomas Basin is Mediterranean, characterized by wet, cool winters and dry, hot summers. At the Sacramento International Airport (approximately 1 mile from the Greenbriar Project Site), mean daily maximum and minimum temperatures are 92 degrees Fahrenheit and 58 degrees Fahrenheit, respectively, in July, and 54 degrees Fahrenheit and 39 degrees Fahrenheit, respectively, in January. The mean annual precipitation is 18 inches, with over 90 percent occurring as rain from October to May. Winter storms can cause localized flooding.

3.1.3. Topography and Geology

All properties presently associated with the Greenbriar Development Project are located in the Natomas Basin area of the Sacramento Valley in northwestern Sacramento County and southern Sutter County. The Natomas Basin is located in the central portion of the Great Valley geomorphic province of California. The Great Valley is an approximately 50-mile-wide and 400-mile-long alluvial plain that lies between the mountains and foothills of the Sierra Nevada to the east and the Coast Ranges to the west. This alluvial plain was once covered by ocean. As a result, the valley is underlain by an asymmetrical depression (formed by intersecting, downward sloping folds of bedrock) in which various sedimentary deposits have accumulated in a sequence of units (known as the Great Valley Sequence) for more than 100 million years.

Formation of the Great Valley Sequence began with marine sediments from the receding ocean and was followed more recently by river deposits (alluvial deposits) washing down from the Sierra Nevada, Klamath, Cascade, and Coast Ranges. The USGS Geologic Map of the Late Cenozoic Deposits of the Sacramento Valley and Northern Sierran Foothills, California shows the area to be underlain by undivided Holocene basin deposits and the lower member of the

Riverbank Formation. The Holocene basin deposits (which occurred within the last 10,000 years) consist of fine-grained silt and clay derived from the nearby mountain ranges and deposited by the Sacramento and American Rivers. The lower member of the Riverbank Formation consists of red semi-consolidated gravel, sand, silt, and clay derived from the nearby mountain ranges and deposited by the Sacramento and American Rivers.

The topography of the Natomas Basin where the Project properties occur is relatively flat, with elevations at the Greenbriar Project Site (including Lone Tree Canal Reserve) and the Off-site Improvement Lands ranging from approximately 5 to 25 feet above mean sea level (amsl). The interior portions of the Natomas Basin are an average of approximately 20 feet amsl; elevations at the Spangler Reserve range from 20 to 25 feet amsl, elevations at the Moody Reserve range from 20 to 26 feet amsl, and elevations at the North Nestor Reserve range from 18 to 23 feet amsl.

3.1.4. Hydrology

The Natomas Basin historically contained marshland and a variety of wetlands. After the Sacramento River levee system was completed around 1915, the area was drained and converted to farmland. Subsequently, a network of channels and pumping stations were constructed in the Natomas Basin in the 1930s for flood control and irrigation. The NCMWC maintains and operates the water delivery channels throughout the Natomas Basin, and the RD 1000 maintains and operates agricultural drainage and flood control channels. Refer to **Figure 6** for the network of channels in the Natomas Basin.

3.1.4.1. GREENBRIAR PROJECT SITE AND OFF-SITE IMPROVEMENT LANDS

The Greenbriar Project Site features a network of irrigation and drainage canals following the perimeter of each agricultural field, and the western (Lone Tree Canal), southern, and eastern boundaries of the site. Irrigation canals are also located on the Off-site Improvement Lands along W. Elkhorn Boulevard. The NBHCP identifies and describes the canals following the perimeter of the site as part of a regional water drainage system, and the interior canals as part of a water delivery system. Canals on the Greenbriar Project Site were constructed to convey irrigation or drainage, and are connected to the system of canals and ditches developed and maintained by the NCMWC and RD 1000. There are also canals on the site that are maintained by the landowner. The Greenbriar Project Site was irrigated for agricultural purposes until 2003, and water was pumped through the irrigation ditches from a lift station located approximately 0.5 mile north of the site. Water delivery to the Greenbriar Project Site from the pump station has since ceased due to changes in agricultural production on the site; the ditches are largely dry except during rain events.

The Lone Tree Canal on the Greenbriar Project Site is an indirect tributary to the Sacramento River via the West Drainage Canal. In the Natomas Basin, Lone Tree Canal collects drainage flows and runoff from adjacent properties, including MAP and the Greenbriar Project Site, and flows southward, where it is conveyed under I-5 through a multi-cell concrete box culvert, to the West Drainage Canal.

3.1.4.2. SPANGLER RESERVE

Hydrology on the Spangler Reserve is currently managed as part of the local agricultural and flood control system managed by NCMWC and RD 1000. A network of irrigation canals and drainage ditches follow the perimeter of the Spangler Reserve. The Powerline Ditch is located along the western limit of the Spangler Reserve. Additionally, a drainage ditch follows the eastern site limit and another transects the northern half of the site. An irrigation canal along its southern and southwestern boundary connects to Pritchard Lake, approximately 0.6 mile west of the Spangler Reserve (see **Figure 6**). These canals and ditches contribute to the overall network of channels throughout the Natomas Basin, which are direct tributaries to the Sacramento River, located approximately 1.5 mile west of the Spangler Reserve. The agricultural fields at the Spangler Reserve are periodically flooded for rice production and are expected to be flooded or saturated for the duration of the growing season (May 15 through September 15). Following crop harvest, the fields are flooded from November 15 through February 15 for weed control.

3.1.4.3. MOODY RESERVE

Hydrology on the Moody Reserve is also currently managed as part of the local agricultural and flood control system managed by the NCMWC and the RD 1000. Irrigation canals and drainage ditches follow the southern, western, and northern perimeters of the Moody Reserve, and one small ditch bisects the western portion of the site. These canals and ditches contribute to the overall network of channels throughout the Natomas Basin, which are direct tributaries to the Sacramento River, located approximately 0.4 mile northwest of the Moody Reserve. The alfalfa fields at the Moody Reserve are periodically flooded for alfalfa production from early spring through late fall.

3.1.4.4. NORTH NESTOR RESERVE

Hydrology on the North Nestor Reserve is currently managed as part of the local agricultural and flood control system managed by the NCMWC and the RD 1000. Irrigation canals and drainage ditches follow the perimeter of the site. The North Drainage Canal comprises the northern site boundary, and connects with the Natomas Cross Canal approximately 0.13 mile northwest of the reserve site. These canals and ditches contribute to the overall network of channels throughout the Natomas Basin, which are direct tributaries to the Sacramento River, located approximately 1.6 miles southwest of the North Nestor Reserve. The agricultural fields at the North Nestor

Reserve are periodically flooded for rice production and are expected to be flooded or saturated for the duration of the growing season (May 15 through September 15). Following crop harvest, the fields are flooded from November 15 through February 15 for weed control.

3.1.5. Habitat Types

Habitat types, also referred to as vegetation or plant communities, are assemblages of plant and animal species that usually coexist in the same area. Naturally-occurring habitat types are classified based upon their dominant flora and fauna and the life form (e.g., grass/forb, shrub, tree) of the dominant species. Habitats characterized by a high level of anthropogenic disturbance are often classified by the dominant land use of the habitat.

3.1.5.1. GREENBRIAR PROJECT SITE AND OFF-SITE IMPROVEMENT LANDS

Habitat types/land uses in the Greenbriar Project Site and Off-Site Improvement Lands include grass hay, ruderal/disturbed, abandoned irrigation canal, remnant structure, seasonal wetland, scrub shrub wetland, seasonal marsh, active irrigation canal, and ditch. Each habitat type is described in detail in the following sections.

Grass Hay

The Greenbriar Project Site contains 432.84 acres in intensive agricultural production of grass hay. Typical species include oats (*Avena* sp.), barley (*Hordeum* sp.), and ryegrass (*Lolium* sp.).

Ruderal/Disturbed

A total of 116.45 acres of the Greenbriar Project Site contain ruderal/disturbed habitat located in the northwestern portion of the site, following the perimeters of the fields and canals, and within the dirt access roads. Approximately 7.21 acres of ruderal/disturbed habitat occurs on the Off-Site Improvement Lands along W. Elkhorn Boulevard, I-5, and SR 99/70.

The ruderal/disturbed habitat at the Greenbriar Project Site and the Off-Site Improvement Lands is largely characterized by areas moderately to densely vegetated with herbaceous plant species typically associated with previously disturbed, unmanaged areas. The dirt access roads are sparsely vegetated as a result of continued use. The dominant plant species associated with the ruderal/disturbed habitat on the Greenbriar Project Site and Off-Site Improvement Lands include soft brome (*Bromus hordeaceus*), wild oat (*Avena* sp.), mouse-tail grass (*Vulpia myuros*), long-beaked filaree (*Erodium botrys*), woodland geranium (*Geranium molle*), chick weed (*Stellaria media*), milk thistle (*Silybum marianum*), star thistle (*Centaurea solstitialis*), barley (*Hordeum murinum* ssp. *leporinum*), clover (*Trifolium* sp.), and shepherd's purse (*Capsella bursa-pastoris*).

Abandoned Irrigation Canal

The Greenbriar Project Site features a network of irrigation canals no longer in use. The canals on the site previously functioned for agricultural irrigation and water was deployed by a pump. The Greenbriar Project Site is no longer actively irrigated; therefore, the majority of the canals have colonized with disturbed upland vegetation. Canals still used to convey irrigation water (e.g., Lone Tree Canal) or canals directly connecting with water-holding canals exhibit hydrophytic vegetation, and are described under aquatic habitats in the following section.

Approximately 8.63 acres of abandoned irrigation canal occurs on the Greenbriar Project Site. The canals contain earthen banks and bottoms with steep sides. Culverts and head gates connecting to other canals off-site are closed, preventing water from entering the channels, and blocking aquatic habitat connectivity through the Greenbriar Project Site. This habitat features varying densities of non-native grasses and forbs including milk thistle (*Silybum marianum*), curly dock (*Rumex crispus*), and black mustard (*Brassica nigra*).

Approximately 0.01 acre of abandoned irrigation canal occurs on the Off-site Improvement Lands.

Remnant Structure

Approximately 0.27 acre of dilapidated building foundations associated with the previous horserace track and polo field remain on the Greenbriar Project Site. The foundations have become vegetated with disturbed upland species such as milk thistle, star thistle, and black mustard, and the westernmost foundation contains openings and burrows providing suitable habitat for a variety of ground dwelling animals, including western burrowing owl.

Seasonal Wetlands

Seasonal wetlands on the Greenbriar Project Site and Off-Site Improvement Lands are topographic depressions with a hydrologic regime characterized by temporary saturation or inundation capable of supporting hydrophytic plant species and hydric soils. Plant species in seasonal wetlands are adapted to withstand short periods of saturation or saturated soil conditions but will not withstand prolonged periods of inundation.

Approximately 11.49 acres of seasonal wetland occur on the Greenbriar Project Site, and approximately 0.38 acre of seasonal wetland occurs on the Off-Site Improvement Lands.

The seasonal wetlands in the grass hay fields on the Greenbriar Project Site have been significantly altered and are planted with grass for hay production. These wetlands are

characterized by seasonally saturated soils. The seasonal wetlands in the previously developed portion of the site (the northwest corner) are seasonally inundated and support hydrophytic plant species such as Italian ryegrass (*Festuca perennis*) and curly dock (*Rumex crispus*).

Scrub Shrub Wetland

The approximately 1.34-acre remnant water feature in the center of the horserace track on the Greenbriar Project Site previously contained seasonal marsh; however, it is no longer artificially irrigated, and does not support herbaceous vegetation typical of a perennial or seasonal marsh. The feature previously supported a stand of trees that were removed during the winter of 2012/2013 consistent with proposed measures to remove potential nesting habitat on the site. Sandbar willow (*Salix exigua*) and Himalayan blackberry (*Rubus armeniancus*) occur along the perimeter and encroach on the bottom of the feature. The bottom of the feature is primarily devoid of herbaceous vegetation; however, herbaceous species intermittently present in the bottom of the feature at the time of the site visit on April 17, 2012 included: bull thistle (*Cirsium vulgare*), black mustard, bristly oxtongue (*Helminthotheca echioides*), broad leaved peppergrass (*Lepidium latifolium*), and curly dock.

This feature is seasonally inundated as a result of storms, and may support annual wetland vegetation following sufficient saturation or inundation; however, no herbaceous wetland vegetation was identified at the time of the site visit in April when hydrophytic annuals were present in other wetland features or during subsequent visits in December 2012 and January 2013.

Seasonal Marsh

Seasonal marsh is wetland that is seasonally inundated or saturated, but the hydrology persists through the majority of the warm season which may support plants capable of withstanding extended periods of inundation or saturation such as perennial herbaceous plant species. Approximately 0.31 acre of seasonal marsh occurs on the Greenbriar Project Site. The seasonal marshes on the Greenbriar Project Site are primarily located near roadways or adjacent to canal berms where the topography of the right-of-way results in seasonal inundation. No seasonal marsh was identified on the Off-site Improvement Lands.

Active Irrigation Canal

Irrigation canals in the Natomas Basin are used for agricultural irrigation and drainage, and the water levels are largely managed through artificial means consistent with agricultural needs. As described earlier, the Greenbriar Project Site is no longer actively irrigated; therefore, the

irrigation canals transecting the site largely support disturbed upland vegetation and do not function as aquatic habitat.

However, the Lone Tree Canal on the Greenbriar Project Site and Off-Site Improvement Lands is actively used to convey irrigation water. The Lone Tree Canal contains 3.06 acre of active irrigation canal on the Greenbriar Project Site, and 0.06 acre on the Off-Site Improvement Lands. On all properties, the active irrigation canals support hydrophytic vegetation along the bottoms and banks, but are devoid of adjacent riparian vegetation due to the agricultural function of the features. On the Greenbriar Project Site and Off-Site Improvement Lands, Lone Tree Canal supports emergent vegetation indicative of prolonged periods of inundation, including cattails (*Typha angustifolia*, *T. latifolia*), common tule (*Schoenoplectus acutus*), and tall flatsedge (*Cyperus eragrostis*). Abandoned irrigation canals on the Greenbriar Project Site connecting directly with Lone Tree Canal exhibit wetland vegetation near their confluence with Lone Tree Canal, likely supported by groundwater seepage and stormwater ponding.

Ditch

An approximately 0.08-acre ditch located on the Off-Site Improvement Lands is a grass-lined depression that collects runoff from the southbound SR 99/70 off-ramp at W. Elkhorn Boulevard. This ditch is inundated in response to seasonal precipitation, and supports disturbed/ruderal habitat.

Table 12 summarizes the habitat types identified in the properties associated with the Greenbriar Development Project. **Figures 7a and 7b** are habitat maps for the Greenbriar Project Site and the Off-Site Improvement Lands. **Figures 8a and 8b** are habitat maps for the Spangler Reserve. **Figure 9** is the habitat map for the Moody Reserve. **Figure 10** is the habitat map for the North Nestor Reserve. Refer to **Figures 11a and 11b** for site photographs of typical habitats on the Greenbriar Project Site.

Table 12. Existing Vegetation Community/Habitat Type by Project Property

Vegetation Community/ Habitat Type	Greenbriar Project Site (acres)	Off-site Improvement Lands (acres)	Spangler Reserve (acres)	Moody Reserve (acres)	North Nestor Reserve (acres)	Total (acres)
<i>Upland</i>						
Grass hay	432.84	--	--	--	--	432.84
Alfalfa agriculture	--	--	--	55.48	--	55.48
Non-native grassland	--	--	--	3.63	--	3.63
Ruderal/ disturbed	116.45	7.21	12.1	9.36		145.12
Abandoned irrigation canal	8.63	0.01	--	--	--	8.64
Graded/paved	2.69	5.02	--	--	--	7.71
Developed/ remnant structure	0.27	--	--	--	--	0.27
<i>Aquatic</i>						
Rice agriculture	--	--	217.43	--	219.1	436.53
Seasonal wetland	11.49	0.38	--	0.20	--	12.07
Active irrigation canal	3.06	0.06	4.55	--	--	7.67
Scrub shrub wetland	1.34	--	--	--	--	1.34
Seasonal marsh	0.31	--	--	--	--	0.31
Riparian	--	--	--	5.4	--	5.4
Ditch	--	0.08	0.92	0.23	--	1.23
Total	577.0*	12.76	235.4	74.3	219.1	1,118.56*

*total may not add due to rounding

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Legend

Greenbriar Project Site Off-site Improvement Lands

Habitat Type

*Habitats based on site visits in 2012 and 2013

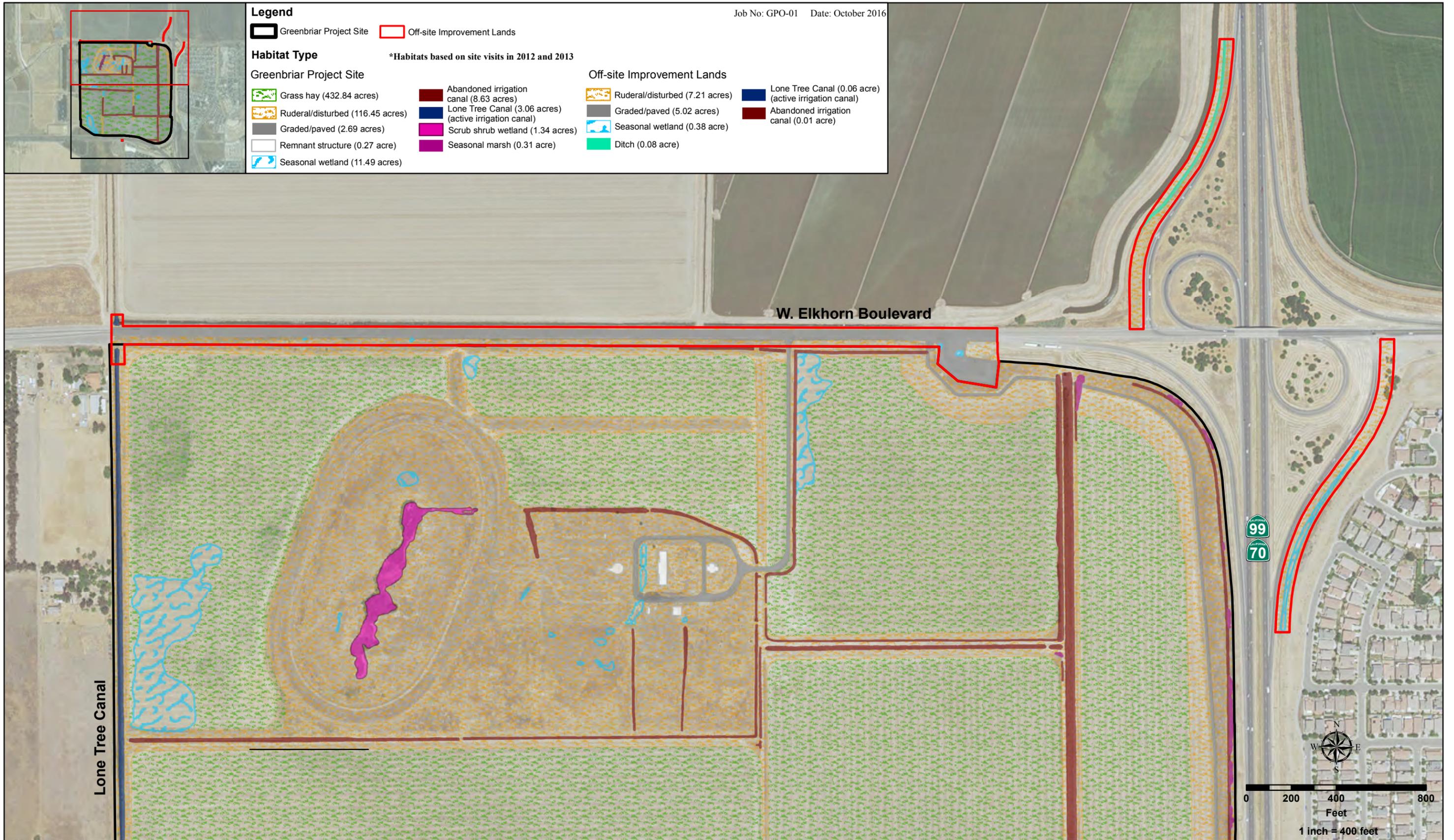
Greenbriar Project Site

- Grass hay (432.84 acres)
- Ruderal/disturbed (116.45 acres)
- Graded/paved (2.69 acres)
- Remnant structure (0.27 acre)
- Seasonal wetland (11.49 acres)

- Abandoned irrigation canal (8.63 acres)
- Lone Tree Canal (3.06 acres) (active irrigation canal)
- Scrub shrub wetland (1.34 acres)
- Seasonal marsh (0.31 acre)

Off-site Improvement Lands

- Ruderal/disturbed (7.21 acres)
- Graded/paved (5.02 acres)
- Seasonal wetland (0.38 acre)
- Ditch (0.08 acre)
- Lone Tree Canal (0.06 acre) (active irrigation canal)
- Abandoned irrigation canal (0.01 acre)



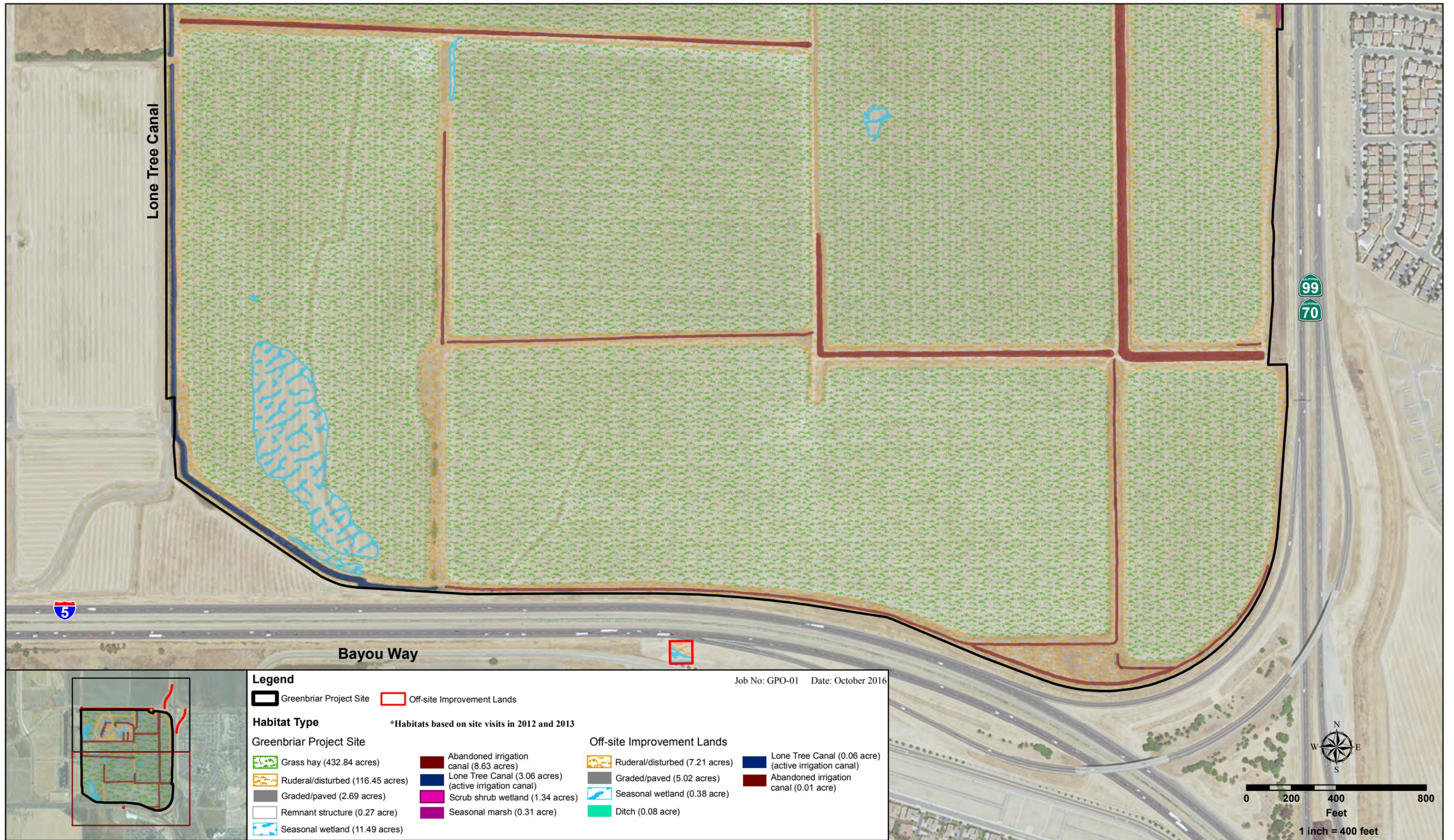
Aerial: ESRI 2014

Habitat Map: Greenbriar Project Site and Off-site Improvement Lands

GREENBRIAR DEVELOPMENT PROJECT
ANALYSIS OF EFFECTS ON THE NATOMAS BASIN HCP

Figure 7a

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Aerial: ESRI 2014

Habitat Map: Greenbriar Project Site and Off-site Improvement Lands

GREENBRIAR DEVELOPMENT PROJECT
ANALYSIS OF EFFECTS ON THE NATOMAS BASIN HCP

Figure 7b

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Aerial: ESRI 2014

Habitat Map: Spangler Reserve
 GREENBRIAR DEVELOPMENT PROJECT
 ANALYSIS OF EFFECTS ON THE NATOMAS BASIN HCP
 Figure 8a

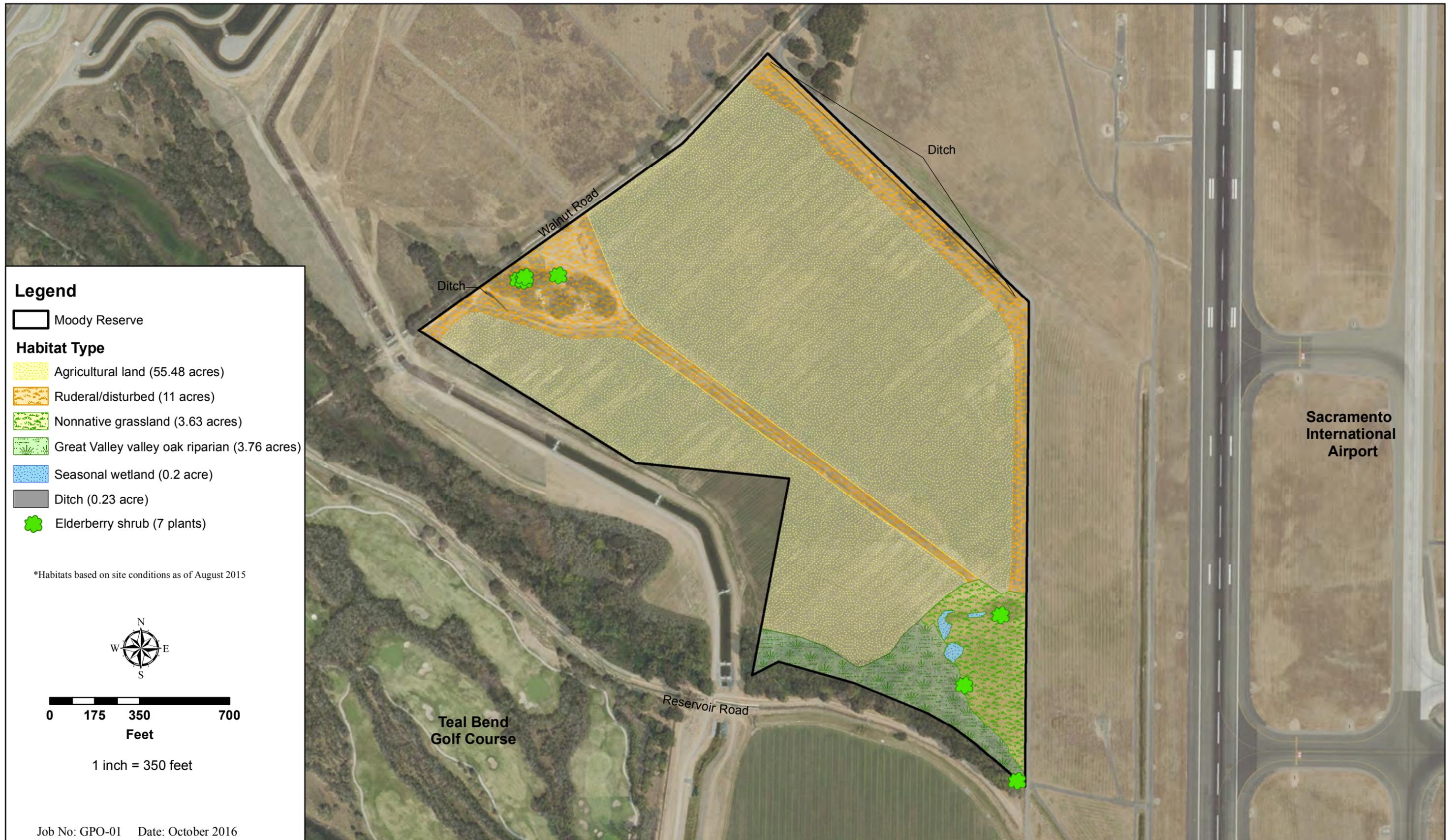
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Aerial: ESRI 2014

Habitat Map: Spangler Reserve
 GREENBRIAR DEVELOPMENT PROJECT
 ANALYSIS OF EFFECTS ON THE NATOMAS BASIN HCP
 Figure 8b

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Aerial: ESRI 2014

Habitat Map: Moody Reserve

GREENBRIAR DEVELOPMENT PROJECT
ANALYSIS OF EFFECTS ON THE NATOMAS BASIN HCP

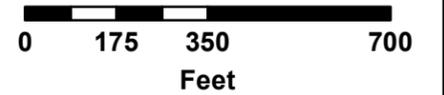
Figure 9

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Legend

-  North Nestor Reserve
-  Rice (219.1 acres)
-  Conservation Easement



Job No: GPO-01 Date: October 2016

1 inch = 350 feet

Aerial: ESRI 2014

Habitat Map: North Nestor Reserve

GREENBRIAR DEVELOPMENT PROJECT
ANALYSIS OF EFFECTS ON THE NATOMAS BASIN HCP

Figure 10

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Greenbriar Project Site: View of Lone Tree Canal near the proposed Meister Way crossing. Photo taken 02/24/15.



Greenbriar Project Site: View of an abandoned canal bordered by hay fields (recently harvested). Photo taken 05/22/14.



Greenbriar Project Site: View of ruderal/disturbed areas on the site. Photo taken 02/25/13.



Greenbriar Project Site: View of hay fields in winter. Photo taken 12/28/12.



Greenbriar Project Site: View of Lone Tree Canal from W. Elkhorn Blvd. Photo taken 10/09/13.



Greenbriar Project Site: View of abandoned ditch and hay fields. Photo taken 05/22/14

Photo Page

Greenbriar Development Project
Analysis of Effects on the Natomas Basin HCP
Figure 11a

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Moody Reserve: View of the alfalfa fields at the site. Photo taken 10/22/14.



Moody Reserve: View of the riparian habitat along the southern boundary. Photo taken 03/09/15.



North Nester Reserve: View of rice fields on the site prior to planting. Photo taken 03/06/15.



North Nester Reserve: View of a ditch along the western site boundary. Photo taken 03/06/15.



Spangler Reserve: View of rice fields on the site after harvest. Photo taken 10/09/13.



Spangler Reserve: View of a ditch that bisects the site east to west. Photo taken 10/09/13.

Photo Page

Greenbriar Development Project
Analysis of Effects on the Natomas Basin HCP
Figure 11b

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3.1.5.2. SPANGLER RESERVE

The entire Spangler Reserve is in active rice production. Current habitat types in the Spangler Reserve include rice, ruderal/disturbed, active irrigation canals, and drainage ditch. Each habitat type is described in detail in the following sections.

Rice

The majority of the Spangler Reserve (217.43 acres) is comprised of a monoculture of intensive agricultural production of rice.

Ruderal/Disturbed

Approximately 12.1 acres of the Spangler Reserve is comprised of ruderal/disturbed habitat. This habitat occurs around the edges of the rice fields, within the dirt access roads, and in equipment staging and turnaround areas throughout the Spangler Reserve. Vegetation in this habitat is sparse and consists primarily of annual grasses and forbs.

Active Irrigation Canal

Approximately 4.55 acres of active irrigation canal occurs on the Spangler Reserve. The active irrigation canals support hydrophytic vegetation along the bottoms and banks, but are devoid of adjacent riparian vegetation due to the agricultural function of the features. Active irrigation canals along the western and southern perimeter of the Spangler Reserve carry high water volumes, and do not support emergent vegetation; however, the canal that bisects the northern portion of the site and the canal along the eastern perimeter contain low water levels and support hydrophytic vegetation including *Veronica americana*, *Typha* sp., *Cyperus eragrostis*, *Polypogon* sp., *Juncus* sp., *Rumex* sp., and *Equisetum arvense*.

Drainage Ditch

An approximately 0.92-acre ditch located on the Spangler Reserve is a shallow, sparsely vegetated depression that collects runoff from Powerline Road. This ditch is inundated in response to seasonal precipitation and supports disturbed/ruderal habitat.

3.1.5.3. MOODY RESERVE

The primary existing land use of the Moody Reserve is agricultural production. Habitat types in the Moody Reserve include agricultural fields, ruderal/disturbed, non-native grassland, Great Valley valley oak riparian, irrigation ditch, and seasonal wetland. Each habitat type is described in detail in the following sections.

Agricultural Fields

The majority of the Moody Reserve is comprised of agricultural fields currently being used for the production of alfalfa (*Medicago sativa*). A total of 55.48 acres of agricultural fields occur on the site. Alfalfa production in the region involves periodic flooding of the fields for irrigation. Alfalfa may be harvested every 28 days from spring to fall, and is typically flood irrigated two or three times during the growing cycle (UCD Alfalfa Working Group 2007). At the time of the October 17, 2014 site visit, the majority of the site was being flood irrigated for alfalfa production. At the time of the survey on March 9, 2015, the fields were dry and the fields were fallow or in early spring production. Opportunistic grasses and forbs had begun to colonize the fields, including short fruit stork's bill (*Erodium brachycarpum*), bur clover (*Medicago polymorpha*), redmaids (*Calandrinia ciliata*), Bermuda grass (*Cynodon dactylon*), common cudweed (*Gnaphalium luteo-album*), telegraph weed (*Heterotheca grandiflora*), and wild oat (*Avena fatua*).

Ruderal/Disturbed

A total of 9.36 acres of ruderal/disturbed habitat occurs on the Moody Property. This habitat type is characterized by sparse weedy vegetation (ruderal) and/or areas dominated by horticultural plantings associated with prior site uses (disturbed). The ruderal and disturbed habitats are combined into one habitat type because they both largely lack native or naturalized vegetation but are not in agricultural use. The ruderal habitat type is associated with the margins of the agricultural fields, the dirt access roads, the edges of the irrigation and drainage channels, and an equipment staging area. Vegetation in this habitat ranges from sparse to dense and consists of plant species similar to the weedy species colonizing the harvested agricultural fields. Additional common species in the ruderal disturbed habitat include fiddleneck (*Amsinckia menziesii*), annual bluegrass (*Poa annua*), and wild radish (*Raphanus sativus*).

The disturbed area is composed of a variety of native and horticultural trees and shrubs including valley oak (*Quercus lobata*), weeping willow (*Salix babylonica*), Mediterranean cypress (*Cupressus sempervirens*), coast redwood (*Sequoia sempervirens*), pine (*Pinus* sp.), white mulberry (*Morus alba*), cork oak (*Quercus suber*), and citrus (*Citrus* sp.). Several elderberry shrubs (*Sambucus nigra*) occur in the disturbed area, as well as various horticultural shrubs. The groundcover within the disturbed area features various grasses and forbs, including wild oat, wild radish, miner's lettuce (*Claytonia perfoliata*), ripgut brome (*Bromus diandrus*), and common bedstraw (*Galium aparine*).

Non-native Grassland

A total of 3.63 acres of non-native grassland occurs in the southeastern portion of the Moody Reserve in an undeveloped area not being used for agricultural production. The non-native grassland is characterized primarily by ripgut brome and yellow star thistle. Additional grasses and forbs observed within this habitat include telegraph weed, Bermuda grass, annual vetch (*Vicia* sp.), wild radish, and geranium (*Geranium dissectum*). A large Gooding's willow (*Salix goodingii*) and a stand of Himalayan blackberry (*Rubus armeniancus*) and poison oak (*Toxicodendron diversilobum*) shrubs are located in the northern portion of the non-native grassland.

Great Valley Valley Oak Riparian

A total of 5.4 acres of Great Valley valley oak riparian habitat occurs on the Moody Reserve along the southern boundary of the site. Great Valley valley oak riparian is typically a medium to tall (rarely to 100 feet) broadleaved, winter-deciduous, closed canopy riparian forest dominated by valley oak. Understories include scattered Oregon ash (*Fraxinus latifolia*), Northern California walnut (*Juglans hindsii*), and California sycamore (*Platanus racemosa*), as well as young valley oak. Long-stemmed, woody vines including Clematis (*Clematis* sp.) wild grape (*Vitis* sp.) or poison oak are often conspicuous, and are more scattered throughout the shady understory (Holland 1986). On the Moody Reserve, this habitat is associated with an off-site drainage that parallels the north side of Reservoir Road. The overstory of the riparian habitat is characterized by mature valley oaks, with lesser numbers of Fremont's cottonwood (*Populus fremontii*), box elder (*Acer negundo*), and willow (*Salix* spp.). Adjacent to the non-native grassland, the riparian corridor is dominated by narrow leaved willow (*Salix exigua*) and sapling valley oaks. The understory is comprised of a variety of grasses and forbs.

Irrigation Ditch

Two irrigation ditches totaling 0.23 acre are present on the Moody Reserve: a longer concrete-lined irrigation ditch that follows the northeastern site boundary and a short irrigation ditch with soil bed and banks that occurs south of the residential dwelling. These features were constructed as part of the irrigation system for agricultural activities on the site and are fed by a NCMWC ditch north of Walnut Road. Both ditches are maintained relatively free of vegetation and water levels within the ditches are artificially managed with pumps and drains. At the time of the field survey on March 9, 2015 no water was present in either ditch; however, remnant vegetative debris observed in the longer ditch along the northeastern site boundary indicates that when water is present the ditch may provide seasonal wetland habitat. Remnant emergent vegetation in the northern channel able to be identified at the time of the survey included common tule

(*Schoenoplectus acutus*) and water speedwell (*Veronica anagallis-aquatica*). A combination of upland and moderately hydrophytic species occur along the banks and outer berms of both ditches including ripgut brome, Italian ryegrass, and horsetail (*Equisetum* sp.).

Seasonal Wetland

A total of 0.20 acre of seasonal wetland habitat comprised of three separate wetland features is present in the southeastern portion of the Moody Reserve within the non-native grassland and adjacent to the Great Valley valley oak riparian habitat. The seasonal wetlands occupy low points in the topography and are vegetated primarily with Italian ryegrass and rush. The seasonal wetlands appear to be inundated periodically via overflow from the drainage south of the Moody Reserve as well as stormwater runoff from the surrounding uplands. Based on the vegetation composition of the seasonal wetlands, they appear to be characterized primarily by prolonged saturation rather than inundation. No plant species characteristic of vernal pool habitats were observed within the seasonal wetlands.

3.1.5.4. NORTH NESTOR RESERVE

The entire North Nestor Reserve is in intensive rice production. Habitat types in the site include rice and ruderal/disturbed. Each habitat type is described in detail in the following sections.

Rice

Rice fields occupy a total of 219.1 acres on the North Nestor Reserve. No significant canals or ditches are present on the site. Irrigation and drainage for the site is primarily performed by a network of canals and ditches around the site's perimeter.

3.1.6. Wildlife

The properties associated with the Greenbriar Development Project provide suitable habitat for a variety of wildlife species commonly inhabiting agricultural land in the Natomas Basin. The larger expanses of terrestrial habitats (e.g., grass hay, alfalfa, ruderal/disturbed) on the Greenbriar Project Site and the Moody Reserve provide suitable foraging habitat for raptors such as white-tailed kite (*Elanus leucurus*), northern harrier (*Circus cyaneus*), red-tailed hawk (*Buteo jamaicensis*), Swainson's hawk, and western burrowing owl. Common grassland birds such as the western meadow lark (*Sturnella neglecta*) may use the grass hay, non-native grassland, or ruderal/disturbed habitats on these two sites for nesting, and the emergent and dense weedy vegetation along the canals/ditches provide potential nesting habitat for birds such as red-winged black bird (*Agelaius phoeniceus*). During the winter, the agricultural fields provide potential foraging habitat for migratory waterfowl, raptors, and passerines. Common mammals including coyote (*Canis latrans*), California jackrabbit (*Lepus californicus*), raccoons (*Procyon lotor*),

Botta's pocket gopher (*Thomomys bottae*), California vole (*Microtus californicus*), and mule deer (*Odocoileus hemionus*) are present on the Greenbriar Project Site and the Moody Reserve.

The rice fields at the Spangler Reserve and the North Nestor Reserve support a variety of wildlife depending on the season. In the spring and summer, the rice fields may support foraging bird species such as black-crowned night-heron (*Nycticorax nycticorax*), Canada goose (*Branta canadensis*) cinnamon teal (*Anas cyanoptera*), mallard (*Anas platyrhynchos*), gadwall (*Anas strepera*), and killdeer (*Charadrius vociferous*); in the fall and winter, the flooded rice fields provide foraging habitat for migrating or overwintering waterfowl, waders, shorebirds, and gulls. When fallow, the rice fields provide terrestrial habitat similar to non-irrigated cropland or disturbed annual grassland. Mammals including coyotes and raccoons would be expected to use the Spangler Reserve and the North Nestor Reserve.

The canals on the Greenbriar Project Site, Spangler Reserve, and North Nestor Reserve supporting permanent or seasonal aquatic habitat as well as the rice fields at the Spangler Reserve and the North Nestor Reserve provide suitable habitat for common aquatic and semi-aquatic species such as mosquitofish (*Gambusia affinis*), bullfrog (*Rana catesbeiana*), and Pacific tree frog (*Pseudacris regilla*). These areas also provide potential habitat for GGS, and western pond turtle.

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Chapter 4. Evaluation Approach

4.1. Overview

The purpose of this document is to evaluate whether construction and implementation of the Greenbriar Development Project could affect the NBHCP Covered Species, the effectiveness of the NBHCP conservation strategy including effectiveness of specific conservation measures, or the attainment of the NBHCP goals and objectives. This Effects Analysis analyzes whether, and to what extent, the Greenbriar Development Project could alter any of several population or habitat attributes of the NBHCP Covered Species. These attributes include:

- Construction-related effects on survival and reproduction;
- Zones with human-wildlife conflicts (i.e., areas adjacent to developed lands and roads);
- Acreage of habitat in the Natomas Basin;
- Quality of habitat in the Natomas Basin;
- Connectivity of habitat in Natomas Basin;
- Connectivity of existing TNBC reserves;
- Habitat value of existing TNBC reserves;
- Water availability at TNBC reserves; and,
- Opportunities to establish additional TNBC reserves.

For each of these attributes, potential alterations resulting from the Greenbriar Development Project were analyzed. The findings of this Effects Analysis of the Greenbriar Development Project's potential impacts on NBHCP Covered Species, effectiveness of the NBHCP conservation strategy including effectiveness of specific conservation measures, and NBHCP goals and objectives were based on the results of the analyses of the above attributes. Available information on the distribution and ecology of NBHCP Covered Species in the Natomas Basin, and the description of the Greenbriar Development Project, including the establishment of On- and Off-Site Reserves and the avoidance and minimization measures, were also considered.

The methodologies and the bases for the interpretations of effects on NBHCP Covered Species, the NBHCP conservation strategy, and the NBHCP's goals and objectives are described below.

4.2. Methods for Analyzing Alterations of Populations and Habitats

4.2.1. Construction-Related Effects on Survival and Reproduction

This analysis of potential construction-related effects considers the potential impacts of the planned development at the Greenbriar Project Site (including implementation of the Lone Tree Canal Reserve) and Off-Site Improvement Lands as well as any potential impacts of habitat creation/restoration at the Spangler Reserve. No construction or active restoration activities are currently anticipated at the Moody Reserve or the North Nestor Reserve; therefore, an evaluation of construction-related effects on NBHCP Covered Species at these sites is not warranted. If active restoration activities are implemented at the Moody Reserve or the North Nestor Reserve (or any currently un-identified reserve site), any effects on NBHCP Covered Species would be temporary and the same measures that are included in this document to avoid and minimize construction-related effects resulting from activities at the other properties associated with the Project would also be implemented at these reserve sites. Therefore, any potential construction-related effects on NBHCP Covered Species at the Moody Reserve or North Nestor Reserve (or any currently un-identified reserve site) would not alter the conclusions in this Effects Analysis.

The lists of NBHCP Covered Species with the potential to occur on the Greenbriar Project Site (including the Lone Tree Canal Reserve) and Off-Site Improvement Lands as well as the Spangler Reserve and/or be adversely affected by construction activities at those sites is based on an evaluation of regionally-occurring special-status species documented in the *Greenbriar Biological Resources Evaluation* (HELIX 2013a) and the *Spangler Biological Resources Evaluation* (HELIX 2013b). A summary of the methods used to compile the list of species with the potential to be affected is described below.

Lists of special-status species known to occur and/or having the potential to occur in the region were reviewed to determine their potential to occur on the Greenbriar Project Site and the Spangler Reserve or otherwise be affected by Project activities. The following resource agency lists were reviewed to compile a list of special-status species known to occur or potentially occurring in the project region:

- USFWS list of federal endangered and threatened species that occur in or may be affected by projects in the “Taylor Monument, California” USGS 7.5 minute topographic quad (USFWS 2015)

- California Native Plant Society (CNPS) list of special-status plants with reported occurrences in the “Taylor Monument, California” USGS 7.5-minute quad and the eight surrounding quads (Knights Landing, Verona, Rio Linda, Sacramento East, Pleasant Grove, Grays Bend, Davis, Sacramento West) (CNPS 2015)
- CDFW’s California Natural Diversity Database (CNDDDB) list of special-status species with reported occurrences on the “Taylor Monument, California” USGS 7.5-minute quad and within a five-mile radius of the Greenbriar Project Site (CDFW 2015)

Additionally, all wildlife and plant species covered under the NBHCP’s ITP were evaluated for their potential to occur on the Greenbriar Project Site and the Spangler Reserve or otherwise be affected by Project activities regardless of their federal or state listing status or appearance on the above-listed resource agency documentation.

The Greenbriar Biological Resources Evaluation (HELIX 2013a) and the Spangler Biological Resources Evaluation (HELIX 2013b) include a discussion of the general habitat requirements, status, the presence or absence of suitable habitat; and determination rationale for each species evaluated. Biological reconnaissance surveys were conducted of the Project’s properties to determine the existing conditions, and botanical and wildlife inventories were conducted to determine the presence of special-status species or habitats with the potential to support special-status species. Species determined to have no potential to occur on the Greenbriar Project Site, Off-Site Improvement Lands, and the Spangler Reserve or otherwise be affected by construction activities at those sites were excluded from further evaluation with respect to construction-related effects on survival and reproduction.

Construction-related activities associated with the Greenbriar Development Project would not affect five of the 15 animal species covered by the NBHCP: vernal pool tadpole shrimp, vernal pool fairy shrimp, midvalley fairy shrimp, California tiger salamander, and western spadefoot toad. Such activities also would not affect five of the seven plant species covered by the the NBHCP: Sacramento Orcutt grass, Colusa grass, slender Orcutt grass, Boggs Lake hedge-hyssop, and legenere.

However, ten of the animal species covered by the NBHCP have the potential to be affected by construction-related activities: GGS, Swainson’s hawk, VELB, western pond turtle, tri-colored blackbird, western burrowing owl, loggerhead shrike, Aleutian Canada goose, white-faced ibis, and bank swallow. Two of the plant species covered by the NBHCP have the potential to be affected by construction-related activities: Sanford’s arrowhead and delta tulle pea.

For NBHCP Covered Species likely to be or possibly affected by construction-related activities, the Greenbriar Development Project's proposed conservation measures were evaluated. The extent of potential construction-related effects would be reduced through the proposed measures. Where combinations of construction activities and affected species and habitats would be similar to those addressed by the NBHCP, this analysis considered the applicable conservation measures in the NBHCP (Chapter V) that address construction-related effects to be a complete set of appropriate avoidance and minimization measures for comparable effects potentially caused by Project activities at the Greenbriar Project Site and Off-Site Improvement Lands. Thus, a table of conservation measures in the NBHCP was compiled and any such measures pertinent to the Greenbriar Development Project were identified (pertinent conservation measures include measures for special-status species and/or biological resources that would be impacted by the Greenbriar Development Project). An evaluation of whether pertinent conservation measures from the NBHCP should be included as part of the Greenbriar Conservation Strategy was conducted based on the results of the biological studies – this evaluation is included as **Appendix E**.

The evaluation in **Appendix E** was used in evaluating the Greenbriar Development Project's effects on attainment of NBHCP goals and objectives that address the implementation of conservation measures. The analysis also considered the need for different conservation measures to address likely effects that would differ from those addressed by the NBHCP, and the potential for the Greenbriar Development Project to alter the efficacy of the NBHCP conservation measures. The Greenbriar Development Project's conservation measures related to Covered Species and habitats are included as **Appendix F**.

4.2.2. Zones with Human-Wildlife Conflicts

Conflicts between wildlife use and human activities (e.g., animal-vehicle collisions, harassment and predation by pets, degradation of water quality) normally occur in habitat areas adjacent to developed land uses and major roads. These "edge effects" diminish with distance, but the distance at which they are no longer significant is debatable.

In this document, the widths used to evaluate human-wildlife conflicts, alterations of vegetation and other habitat conditions, habitat fragmentation, and effects on existing NBHCP reserves, were based on the distances used in previous analyses related to the NBHCP or incorporated into the NBHCP itself. The effects of developed land uses on adjacent land diminish with distance. The different types of edge effects, however, extend different distances onto adjacent land; these distances can be from tens to thousands of feet, and differ not only among mechanisms but among sites as well (because of variation in site attributes such as the presence of barriers and the quantity of impervious surfaces). Thus, in a regional analysis, the use of a specific width

only indicates the area within which effects of adjacent developed land are often sufficient to alter habitats.

In the GIS-based evaluations, two widths were used, 800 feet and one mile. The 800-foot width was used in evaluating zones where increased human disturbance, predation from cats and dogs, vehicle collisions, dumping, and alterations to soils, hydrology and vegetation were likely to occur. The one-mile width was used in evaluating the effects on foraging habitat for animals with large home ranges, such as raptors. Both widths are consistent with comparable analyses supporting the NBHCP.

The Greenbriar Development Project (specifically development on the Greenbriar Project Site) could cause human-wildlife conflicts on adjacent lands by altering the acreage in the zone of potential human-wildlife conflicts (because of an altered perimeter of development compared to what was identified in the NBHCP) or by altering the intensity of human-wildlife conflicts (because of the avoidance and minimization measures implemented or a change in land cover types in this zone). The Off-Site Reserves were not considered to create zones of human-wildlife conflicts in the analysis because proposed changes in land use are minor at these sites and are not expected to significantly alter existing patterns of human-wildlife interaction on adjacent areas. However, potential effects of development in proximity to the Off-Site Reserves were considered.

Change in the extent of the 800-foot-wide human-wildlife conflict zone was calculated from the acreage in this zone around the MAP, City of Sacramento and Sutter County permit areas for urban development from the Final NBHCP (City of Sacramento et al. 2003) and around these permit areas plus a developed Greenbriar Project Site. Changes to the intensity of wildlife-human conflicts in the 800-foot wide zone were assessed by calculating changes in land cover types within these zones and by comparing the Greenbriar Development Project's avoidance and minimization measures with those in the NBHCP that address these conflicts. An increase in land cover providing higher quality habitat (or land cover more sensitive to human disturbance) would increase human-wildlife conflicts, while a decrease in such land cover types would reduce human-wildlife conflicts. Similarly, a less comprehensive or stringent set of measures would increase the intensity of conflicts, while a more comprehensive or stringent set of measures would reduce the intensity of conflicts. Any reduction in the efficacy of specific NBHCP measures addressing human-wildlife conflicts also could increase conflicts; potential effects on the efficacy of these measures were evaluated in **Appendix G**.

4.2.3. Acreage of Habitat in the Natomas Basin

The NBHCP documented baseline land cover in the Natomas Basin as of 2001. For each Covered Species, the NBHCP analyzed the habitat that was available in the Natomas Basin under baseline conditions and that would be available in the expected future condition of the Natomas Basin. The data sources and methods used to do so are described in *Natomas Basin Habitat Conservation Plan Impacts to Covered Species* (CH2M HILL 2003) that was attached to the Final NBHCP as Appendix H. The Natomas Basin covers approximately 53,500 acres. The future condition evaluated in the NBHCP was the result of developing an additional 17,500 acres of this land in the MAP, City of Sacramento, and Sutter County permit areas and establishing an 8,750-acre reserve system in the Natomas Basin outside of those permit areas.

In this analysis conducted for the Greenbriar Development Project, for each of the NBHCP Covered Species potentially affected by the project, changes in habitat acreages based on 2001 conditions were derived from the changes in the acreage of land cover types by identifying those land cover types that provide habitat for each species. Additional analyses were performed for Swainson's hawk that included assessment of changes in habitat within 1 mile of existing reserves and nests, quality of foraging habitat, and seasonal availability of foraging habitat.

The Greenbriar Development Project would alter the future conditions evaluated in the NBHCP by developing additional land above the 17,500 acres authorized and by preserving and enhancing additional land beyond the 8,750-acre reserve system established by the NBHCP. Thus, for the Greenbriar Development Project's Effects Analysis, for each Covered Species, the future condition of the Natomas Basin with the NBHCP and the Greenbriar Development Project was compared to the future condition analyzed in the NBHCP and to the 2001 NBHCP baseline. For the Greenbriar Project Site and the proposed reserve sites, these comparisons were based primarily on 2001 land cover to be consistent with and comparable to the NBHCP's effects analysis, and because 2001 conditions were used as the NBHCP baseline. These comparisons allow assessment of both the extent of future habitat under the future condition resulting from the NBHCP and under the future condition resulting from the NBHCP plus the Greenbriar Development Project. These were GIS-based analyses. The land cover GIS data layer developed for the NBHCP was the primary data source for land cover. This was the available land cover data most applicable to this analysis. In addition, publically available historical aerial photography was reviewed to evaluate land use changes on the project properties between 2001 and the present.

To assess the future condition of the Natomas Basin with the Greenbriar Development Project, several assumptions were made regarding changes in land cover. These assumptions included the following:

- All land in the MAP, City of Sacramento, Natomas North Precinct Master Plan Area, and Sutter County permit areas was assumed to be developed, or otherwise no longer providing habitat for Covered Species.
- Land at the Greenbriar Project Site was assumed to be developed, or otherwise no longer providing habitat for NBHCP Covered Species, except for an approximately 250-foot-wide corridor along the western edge of the site that would be preserved (Lone Tree Canal Reserve). Freshwater marsh would be created along the existing canal, and riparian habitat that was mapped along the canal in 2001 is expected to recover and persist following establishment of the reserve. Uplands within the reserve are currently mainly ruderal/disturbed habitat and hay fields, and will be converted to and managed as perennial grasslands.
- All other areas were treated as they were in the effects analysis for the NBHCP, except that 8,750 acres (not including the Greenbriar Development Project's proposed reserves) would be incorporated into a reserve system as prescribed in the NBHCP. The reserve system would be approximately 25 percent managed marsh, 50 percent rice and 25 percent upland land cover types. For estimating acreage changes, the managed marsh was assumed to come out of the baseline (2001) rice acreage.
- Under the future condition, land at the Greenbriar Development Project's proposed reserve sites was assigned to the land cover types and management strategies described in this Effects Analysis. Preserved land would be dedicated to a nonprofit land trust and an endowment would be provided for the enhancement, operations, maintenance, and administration of preserved land in perpetuity.

Thus, the future condition that was analyzed assumes that the Greenbriar Development Project (including the Greenbriar Conservation Strategy), all development proposed under the NBHCP and all of its associated mitigation would occur, and that current agricultural land uses are representative of future agricultural land uses. These or comparable assumptions were also made in the effects analyses supporting the NBHCP (e.g., Sections 3 and 4 of Appendix H of the NBHCP, and Section 2 of Appendix K).

Changes in the acreage of habitat for each NBHCP Covered Species potentially affected by the project were calculated based on the sum of changes in land cover types providing habitat for that species. The habitat-land cover relationships used in analyses supporting the NBHCP were also applied to these analyses for the Greenbriar Development Project. These relationships are summarized in **Table 13**.

Table 13. Species Habitat-Land Cover Relationships

SPECIES	Airport	Alfalfa	Canals	Grassland	Highways	Idle	Non-rice Crops	Oak Groves	Orchards	Other	Pasture	Seasonally Wet	Ponds	Rice	Riparian	Ruderal	Rural Residential	Tree Groves	Urban	Upland Marsh
GGs			X									X	X	X						
Swainson's hawk (nesting)								X							X			X		
Swainson's hawk (foraging)		X		X		X	X				X					X				X
Western burrowing owl		X	X	X		X					X					X				X
Loggerhead shrike		X	X	X		X	X	X	X		X	X	X			X	X	X		
Tri-colored blackbird (foraging)		X		X			X				X	X	X	X						
Aleutian Canada goose (foraging)							X				X	X	X	X						
White-faced ibis		X	X									X	X	X						
VELB															X					
Western pond turtle			X									X	X	X	X					
Sanford's arrowhead			X									X	X							
Delta tule pea			X									X	X							

4.2.4. Quality of Habitat in the Natomas Basin

Changes in habitat quality can result from changes in land cover, connectivity, adjacent land uses, and the preservation and management of land to enhance its habitat quality. In this report, changes in the acreage of land cover types providing different quality habitat and changes in the acreage of land preserved and managed to enhance habitat quality were derived from the analyses of change in habitat acreages described in the preceding section (Chapter 4.2.3, *Acreage of Habitat in the Natomas Basin*). Changes in habitat quality resulting from changes in connectivity or adjacent land uses were evaluated separately, and these evaluations are described in other sections. For Swainson's hawk, the quality and seasonal availability of foraging habitat were evaluated using the same methods employed by CH2M HILL for the NBHCP (CH2M HILL 2003).

In this analysis conducted for the Greenbriar Development Project (corresponds to the analysis conducted for the NBHCP unless otherwise noted), crops and other land cover types were categorized as high-, medium-, or low-quality Swainson's hawk foraging habitat based on the quantity of small mammal prey supported and the availability of that prey as a function of vegetation cover. This was done on the basis of previous research into Swainson's hawk habitat preferences (Estep 1989, Estep and Teresa 1992). Availability of foraging habitat was analyzed separately by considering small mammal prey to be available in croplands only at harvest. The analysis of available foraging habitat by month did not distinguish between low-, medium-, and high-quality habitat.

Alfalfa and idle cropland were considered to be high-quality habitat; sugar beet, tomato, melons, squash and cucumber, beans, wheat, pastures (clover, unspecified or mixed), and ruderal land was considered moderate-quality habitat; corn, safflower, onions and garlic, and unspecified row and field crops were considered low-quality habitat. In the present analysis, fallow rice was added to the high-quality habitat category, as it is comparable in accessibility and abundance of prey to idle cropland, and grassland and upland marsh components were added to the medium-quality habitat category, as they are comparable to pasture in terms of vegetative cover and architecture of the dominant plant species (prey accessibility) as well as prey abundance (NBHCP Appendix K).

Fallow rice was not assigned a quality ranking in Estep and Teresa (1992), therefore assigning a habitat quality to fallow rice is somewhat subjective. The habitat quality of a fallow rice field for Swainson's hawk depends on the accessibility and abundance of prey, as is true for any cover type. The accessibility and abundance of prey is dependent largely on factors that can be influenced by site management such as the vegetation structure (height, density, and spacing)

and species of vegetation present; both factors influences the accessibility of prey and species of vegetation present can influence the abundance of prey.

Fallow rice was given an informal designation of “Moderate-value” in the NBHCP (Appendix K; Section 2.3.1) because the authors theorized that although fallow rice fields provide consistently accessible prey throughout the hawk's residency period, that prey likely would not be able to achieve high abundance in the short period of time during which the rice is fallowed. However, other studies seem to indicate that fallow rice is more accurately characterized as idle cropland, which provides high quality foraging habitat for Swainson’s hawk. In a study by Estep in 2009 in Yolo County, California (Estep 2009) on the influence of vegetation structure of a variety of agricultural cover types on Swainson’s hawk foraging habitat suitability, a fallow rice field was chosen as the representative study site for the “idle cropland” cover type. Presumably the author felt that the fallow rice field was accurately characterized as idle cropland. The study reported that prey accessibility was relatively and consistently high during the Swainson’s hawk breeding season in the fallow rice field. In the discussion of prey accessibility and abundance of prey in the fallow rice field, the study further stated that previous studies have shown relatively high rodent abundance in idle fields and significant use of idle fields by foraging Swainson’s hawks (Estep 1989, Estep 2009).

In this analysis for the Greenbriar Development Project, fallow rice being created at the project’s reserves was assigned a “high quality” habitat designation because it is expected to be similar in function to idle cropland and support high densities of prey that will be accessible throughout the Swainson’s hawk breeding season. If necessary to support sufficient prey densities, the fields could be managed to allow higher concentrations of prey to develop by modifying flooding practices, period of fallowing, or potentially the introduction of certain “green food” (bent grass, chickweed, bedstraw, sorrel, plantain, and bromus) plant species during fallow periods that are tolerant of limited inundation/saturation. Meadow mice have been shown to increase their reproductive rate nearly ten-fold in the presence of persistent green food over dry grasses (NBHCP V-21), indicating that site management could significantly alter the abundance of prey in the fallow fields.

The temporal availability of prey was also analyzed. In this analysis, prey was considered inaccessible to Swainson’s hawk in cultivated fields except during harvest because of the dense (and high) cover of vegetation. In contrast, crops such as alfalfa and other land cover types (e.g., grassland) were considered to provide accessible prey for longer periods because of frequent harvests or the vegetation’s growth form. Harvest months were June for wheat, July to August for tomato and unspecified crops, August for safflower, onions, and garlic, September to October for sugar beet, and October for beans, melons, squash, and cucumber (NBHCP Appendix K).

Swainson's hawks have migrated out of the Natomas Basin by October, and thus crops harvested in October do not provide foraging habitat in the NBHCP analysis. For crops harvested during periods of two months, the total acreage of these crops was divided by two to determine the acreage of foraging habitat available during each of those months. In this analysis for the Greenbriar Development Project (as in the NBHCP), grassland, ruderal, idle cropland, fallow rice, and pastures (including alfalfa) were considered to provide habitat throughout April to September.

The area of low-, moderate-, and high-quality Swainson's hawk foraging habitat and the monthly availability of total Swainson's hawk foraging habitat in the Greenbriar Project Site and the Lone Tree Canal, Spangler, Moody, and North Nestor Reserves were compared to the 2001 baseline data (i.e., 1993 California Department of Water Resources (DWR) mapping of croplands and 2001 land cover mapping by CH2M HILL of the entire Natomas Basin) used for the analyses in the NBHCP (CH2M HILL 2003). Habitat quality and harvest months for Swainson's hawk foraging habitats in the Natomas Basin used in this analysis are presented in **Table 14**.

Table 14. Habitat Quality and Availability for Swainson's Hawk Foraging Habitat in the Greenbriar Project Sites

HABITAT	HABITAT QUALITY	AVAILABILITY
Alfalfa	High	April-Sept
Fallow Rice	High	April-Sept
Grassland	Moderate	April-Sept
Idle	High	April-Sept
Pasture	Moderate	April-Sept
Ruderal	Moderate	April-Sept
Upland Marsh Components	Moderate	April-Sept
Wheat	Moderate	April-May

Note: Data based on CH2M Hill 2003, except for fallow rice and upland marsh components, as described in methods section.

In addition to these analyses, other effects on habitat quality for Swainson's hawk and GGS also were considered. As in the NBHCP, effects on habitat within 1 mile of recently documented Swainson's hawk nests (i.e., nests documented in the last 5 years) were considered. For GGS, effects were also considered for upland land cover types that could provide habitat and that were adjacent to canals.

4.2.5. Connectivity of Habitat in the Natomas Basin

The proposed Greenbriar Development Project could affect the connectivity of habitat by eliminating or creating waterways, affecting the use of waterways by Covered Species, or by

altering the length, width, or habitat attributes of existing corridors of natural vegetation. In assessing these effects, several assumptions were made including the following:

- All of the Greenbriar Project Site would be developed, except for a 250-foot wide corridor along Lone Tree Canal.
- All canals in the developed portion of the Greenbriar Project Site would be eliminated.
- In the absence of avoidance and minimization measures, all waterways and uplands within 800 feet of the Greenbriar Project Site and proposed reserves could potentially be affected by the Greenbriar Development Project. (Ecologically significant effects caused by developed land uses were considered to not extend beyond an 800-foot wide zone adjacent to developed land cover and highways, and the basis for selecting this width is further described in Chapter 4.2.2 *Zones with Human-Wildlife Conflicts*.)
- At the proposed Off-Site Reserves (Spangler Reserve, Moody Reserve, North Nestor Reserve), waterways associated with agricultural production would remain.

Interpretations of effects on connectivity were based on general ecological literature regarding wildlife use of corridors, recent reviews of the ecology of Covered Species, and consultations with species experts. Along canals, potential changes in physical conditions (e.g., flow regime, culvert dimensions), vegetation structure and extent, human disturbance, and predation were all evaluated as factors potentially altering connectivity.

4.2.6. Connectivity of TNBC Reserves

The connectivity of TNBC reserves can be altered by altering upland corridors or waterways between existing reserves. Upland corridors are affected by narrowing their width, altering the habitat attributes of the land in them, or by altering their length. The assessment of these potential effects was based on the same assumptions and conducted in the same manner as previously described in Chapter 4.2.5 *Connectivity of Habitat in the Natomas Basin*, except that only effects on corridors between existing reserves were considered rather than effects on all lands. (Corridors were considered to not pass through urban land.) This assessment assumed that the most ecologically important upland corridors include the shortest paths between reserves.

Waterways are also important corridors connecting TNBC reserves. Thus, altering the location or habitat value of waterways could affect the connectivity of existing reserves. This effect was evaluated by identifying all waterways within 800 feet of the properties associated with the Greenbriar Development Project, and determining if they were part of the shortest path along waterways between reserves, in a corridor between reserves with multiple waterways, or

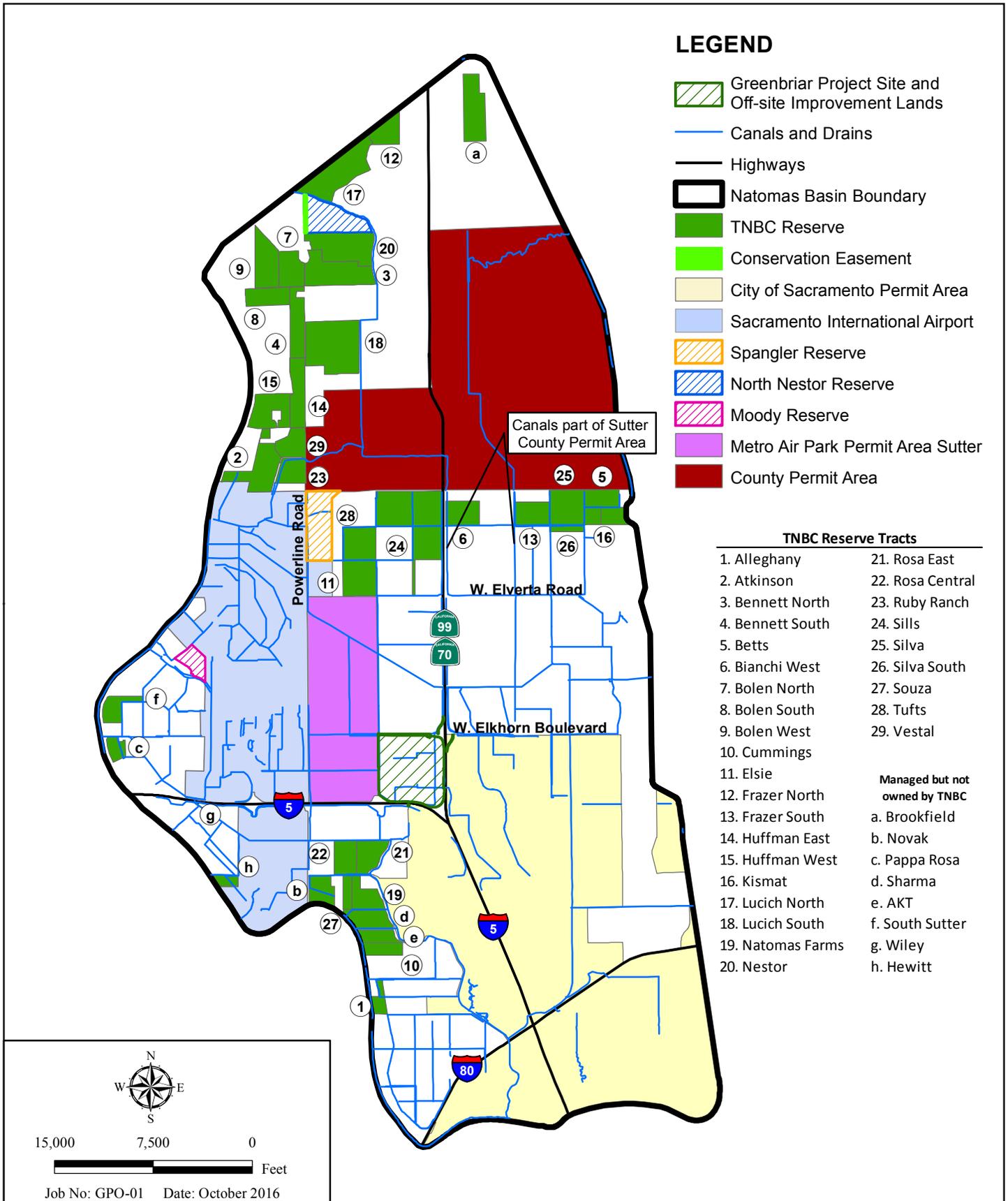
otherwise could be important for species movement between reserves (e.g., species use of the waterway has been documented). This analysis also considered the recent documentation of habitat conditions along canals by Eric Hansen (Jones & Stokes 2005). The analysis of waterways connecting TNBC reserves was based on analysis of GIS data for waterways in the Natomas Basin, and on boundaries of existing TNBC reserves, MAP, City of Sacramento, and Sutter County permit areas, and of the Greenbriar Project Site, Spangler Reserve, Moody Reserve, North Nestor Reserve, and on species distribution data and consultation with knowledgeable individuals. For this analysis, ecologically significant effects of developed land uses and roads were not considered to extend in general beyond an 800-foot zone of adjacent land; the basis for selecting this width is further described in Chapter 4.2.2 describing the evaluation of zones with human-wildlife conflicts. **Figure 12** is a map of the TNBC reserves as of 2015.

4.2.7. Habitat Value of Existing TNBC Reserves

Changes in adjacent land cover can affect existing TNBC reserves by altering foraging habitat accessible from a reserve or by altering the habitat values of reserve lands through development or preservation of adjacent lands. Thus, three analyses were performed to evaluate effects on the habitat value of existing TNBC reserves. These analyses are described below.

- The effects of the Greenbriar Development Project on foraging habitat were evaluated based on changes in land cover because of the Greenbriar Development Project within 800 feet and 1 mile of existing reserves. Most effects of developed land uses and roads were considered to not extend beyond an 800-foot wide zone of adjacent land. (The basis for selecting this width is described in Chapter 4.2.2 *Zones with Human-Wildlife Conflicts*.) Furthermore, as summarized in Chapter 6. *Potential Effects of the Greenbriar Development Project on the NBHCP Covered Species*, the territories and home ranges of some covered (and many other) species residing at the reserves are unlikely to extend more than 800 feet from reserve boundaries. However, Swainson's hawk and other raptors have much larger home ranges and territories; for these species, land within 1 mile of reserves was considered to include the most important habitat for individuals nesting on reserves. (This premise is comparable to that underlying the analysis of Swainson's hawk habitat in the Natomas Basin presented in *Natomas Basin Conservation Plan Impacts to Proposed Covered Species* [CH2M HILL 2003] and included in Appendix K of the NBHCP).

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Source: The Natomas Basin Conservancy 2016 **Location of the Natomas Basin Conservancy Reserves**

GREENBRIAR DEVELOPMENT PROJECT
ANALYSIS OF EFFECTS ON THE NATOMAS BASIN HCP

Figure 12

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- The effects of additional development on habitat values of TNBC reserves were evaluated by calculating the acreage of existing TNBC reserves within 800 feet of additional developed land cover that would result from the Greenbriar Development Project. This 800-foot criterion is the desired distance of reserves from urban land (described on page IV-16 of the NBHCP) and also includes the area that would experience ecologically significant effects caused by adjacent developed land uses and roads.
- The proximity of the proposed reserves (Lone Tree Canal Reserve, Spangler Reserve, Moody Reserve, North Nestor Reserve) to existing reserves was examined to determine if any were adjacent to existing reserves, and if they expanded the area, increased the habitat variety or reduced the perimeter-to area ratio of the reserve.

4.2.8. Water Availability at TNBC Reserves

The Greenbriar Development Project could alter water availability at TNBC reserves if it were to eliminate sections of canals that are required for water deliveries to TNBC reserves, contribute to the elimination of other canals by affecting demand for water deliveries and increase the land ownership of TNBC and its corresponding water use and ownership of stock in NCMWC.

The following assumptions were used in determining the potential effect on water availability at TNBC Reserves:

- The Lone Tree Canal will continue to carry water through the Greenbriar Project Site, in perpetuity as part of the Lone Tree Canal Reserve.
- Ditches and canals located within the development portion of the Greenbriar Project Site would be eliminated.
- Existing ditches and canals on the Off-Site Reserves will not be altered.

Because development on the Greenbriar Project Site will remove existing ditches and canals, the potential for off-site impacts to off-site canal segments to TNBC reserves was evaluated, and the potential effect on water availability to reserves was assessed. NCMWC and RD 1000 were contacted to determine whether existing waterways on other sites may be eliminated because of the Greenbriar Development Project.

The Greenbriar Development Project's effect on TNBC stock ownership in NCMWC also was considered. NCMWC is a privately held water company comprised of landowner stockholders. As TNBC acquires mitigation lands in the Natomas Basin, it increases its shares in NCMWC.

This increased ownership could result in TNBC changing operations and maintenance practices to support the goals and objectives of the NBHCP. The Greenbriar Development Project would increase TNBC ownership and thus its influence on the operations of NCMWC. The magnitude of this increase in ownership and its likely effects were assessed.

4.2.9. Opportunities to Establish Additional TNBC Reserves and Meet the Minimum Habitat Block Size Requirements

Elements of the proposed project that could affect TNBC's ability to establish additional reserves include development of the Greenbriar Project Site, establishment of the on-site Lone Tree Canal Reserve, and establishment of the Off-Site Reserves including the Spangler Reserve, the Moody Reserve, and the North Nestor Reserve. The Project Applicant will dedicate the On- and Off-Site Reserves by granting a conservation easement, including the structure for funding the sites to a USFWS-approved third party Plan Operator. The third party Plan Operator could be TNBC or another entity approved by USFWS.

The Greenbriar Development Project could affect the ability of TNBC to establish additional reserves and meet the minimum habitat block size requirements stated in the NBHCP. The Greenbriar Development Project would slightly reduce the acreage of land available to TNBC to acquire the 8,750 acres of land necessary to mitigate for the development permitted through the NBHCP. However, 7,916 acres would still be available in excess of the TNBC requirement (See **Figure 13**; 7,916 acres = 12,562 acres of developable/reserve land remaining in the Natomas Basin minus 4,646 acres of outstanding reserve land required by TNBC.) The Greenbriar Development Project would include establishment of reserves adjacent to and near existing TNBC reserves so that more interconnected reserves can be established that exceed the 400-acre minimum desired size and one swath of reserves comprising 2,500+ acres can be established. These potential effects were evaluated by estimating the acreage potentially available for NBHCP mitigation with and without the Greenbriar Development Project, and by examining the connectivity of the proposed Spangler Reserve, Moody Reserve, and the North Nestor Reserve to existing TNBC reserves. The North Nestor Reserve will be managed in rice and will maintain biological connectivity between existing TNBC reserves to the north and south. A 13.6-acre easement area has been defined along the western boundary of the North Nestor Reserve, which could be managed separately by TNBC to further the NBHCP goal of establishing a habitat reserve of 2,500 acres in the Natomas Basin.

The acreage potentially available for NBHCP reserves without the Greenbriar Development Project was estimated by subtracting the following areas from the Natomas Basin's total acreage of land: MAP lands, City of Sacramento (including the panhandle area in unincorporated Sacramento County) and Sutter County permit areas for urban development, the County-owned

airport and buffer, existing established mitigation land, land within the Natomas North Precinct Master Plan Area, and levee slopes around the perimeter of the NBHCP Plan Area (including the footprint of new levee infrastructure and mitigation lands associated with the Natomas Levee Improvement Project). In addition, land cover considered unsuitable for restoration or enhancement was subtracted from the acreage potentially available for NBHCP mitigation including the following: existing developed land outside of the City of Sacramento and Sutter County permit areas such as the Teal Bend Golf Course, I-5, SR 99/70, and other major roadways; and other commercial and residential land cover. The remaining land that was considered available for future mitigation or development consists primarily of agricultural and semi-agricultural lands or lands incidental to agriculture.

The acreage potentially available for NBHCP reserves assuming development of the Greenbriar Development Project was estimated by subtracting the following areas from the acreage potentially available without the Greenbriar Development Project: the Greenbriar Project Site (includes the Lone Tree Canal Reserve), the Spangler Reserve, the Moody Reserve, and the North Nestor Reserve. The fragmentation by the Greenbriar Development Project of a block of land that otherwise was potentially suitable for preservation also was considered. **Figure 13** is a graphic representation of the analysis of the potential effects of the Greenbriar Development Project on opportunities to establish additional TNBC reserves. This figure quantifies the remaining land in the Natomas Basin for potential development or use as reserve land.

The location of the proposed reserves associated with the Greenbriar Conservation Strategy was also examined to determine if these lands expanded existing TNBC reserves, could contribute to the expansion of TNBC reserves in the future or could be expanded into a reserve that was greater than 400 or 2,500 acres in size, or if they were isolated from TNBC reserves by developed lands or other barriers.

4.3. Basis for Interpretation of Effects on NBHCP Covered Species

For each of the potentially affected NBHCP Covered Species, the following were evaluated:

- construction-related effects on individuals using the Greenbriar Project Site or adjacent lands,
- effects of restoration activities on individuals using the Lone Tree Canal Reserve or the Spangler Reserve,
- change in habitat quantity, and
- change in habitat quality.

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Figure 13. Current Land Use Status in the Natomas Basin

(BACK COVER)

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For this evaluation, the available information on the ecology and distribution of each Covered Species was compiled, reviewed, and summarized. Interpretations of construction-related effects on individuals were based on the analysis of the likely alterations of survival and reproduction of individuals using the Greenbriar Project Site or adjacent lands. Interpretations of the potential effects of restoration activities were based on the analysis of the likely alterations of survival and reproduction of individuals using the Lone Tree Canal Reserve or the Spangler Reserve or adjacent areas during restoration activities. No changes in land use are anticipated at the Moody Reserve or the North Nestor Reserve; therefore, no impacts to Covered Species are anticipated at those sites.

Interpretations of effects on habitat availability were based on the analysis of alterations to habitat acreage that was described previously. Interpretations of change in habitat quality were based on the analyses of land cover acreages and connectivity of habitat in the Natomas Basin, and of the acreage in zones with human activity-wildlife conflicts. Changes in the acreage of preserved lands, and in the acreage of high quality habitat were also considered.

For each NBHCP Covered Species, the interpretations of effects on habitat acreage and quality (and of construction-related effects and human-wildlife conflicts) were used to evaluate the Greenbriar Development Project's overall effect on the viability of the population using the Natomas Basin. A population's viability (i.e., its likelihood of long-term persistence) is strongly influenced by population size, population demography, and environmental variability (which in turn have a strong influence on reproduction and mortality). In the Natomas Basin, fluctuations in the acreage of crop types and changes in agricultural practices cause substantial environmental variability affecting the populations that rely on agricultural habitats. By reducing the quantity or quality of habitat, patterns of urban development could reduce population size and adversely affect demography.

4.4. Basis for Interpretation of Effects on NBHCP Conservation Strategy

The previously described analyses of effects on population and habitat attributes, and on Covered Species, were used to evaluate the potential effect of the proposed Greenbriar Development Project on the effectiveness of the NBHCP's conservation strategy. This strategy is described in Section IV.C of the NBHCP, which describes six key components of the NBHCP's conservation strategy for mitigating 17,500 acres of urban development. These components are:

- Basis for 0.5 to 1 mitigation ratio (Section IV.C.1.a);
- Preparation of SSMPs (Section IV.C.1.b);

- Buffers within the reserve lands (Section IV.C.1.c);
- Connectivity (Section IV.C.1.d);
- Foraging habitat (Section IV.C.1.e); and
- 2,500-acre/400-acre minimum habitat block size requirements (Section IV.C.1.f).

Potential effects of the proposed Greenbriar Development Project on each of these components was assessed individually (using the results of the analyses described in Chapter 4.2 *Methods for Analyzing Alterations of Populations and Habitats* of this Effects Analysis); these effects were then synthesized into an overall effect of the proposed Greenbriar Development Project on the effectiveness of the NBHCP's conservation strategy.

4.5. Basis for Interpretation of Effects on NBHCP Goals and Objectives

The NBHCP's goals and objectives represent the desired outcomes from implementation of the NBHCP's conservation strategy. Nine of the NBHCP's goals and objectives could be affected by the Greenbriar Development Project. **Table 15** lists these nine goals and objectives of the NBHCP; it also identifies the population and habitat attributes potentially affected by the Greenbriar Development Project that could affect attainment of these goals and objectives. This Greenbriar Effects Analysis evaluated the effects of the proposed Greenbriar Development Project on each of these nine goals and objectives of the NBHCP. Interpretations of the Greenbriar Development Project's overall effect on the attainment of a goal or objective were based primarily on the sum of these anticipated effects.

Seven of the NBHCP's goals and objectives (NBHCP page I-16) would not be affected by the Greenbriar Development Project and are not listed in **Table 15** or discussed further:

- **Overall Goal 2.** Implement an adaptive management program that responds to changing circumstances affecting Covered Species and their habitats.
- **Overall Objective 2.** Maintain and operate flood control, irrigation and drainage facilities in a manner that minimizes take of Covered Species and promotes vegetative cover that enhances habitat values for Covered Species, consistent with the Water Agencies' legal obligations.
- **Overall Objective 4.** Within individual TNBC reserves, provide a mosaic of habitats that support both wetland and upland species, and that are configured to support species that utilize both types of habitat.

- **Overall Objective 5.** Implement monitoring programs with qualitative and/or quantitative monitoring methods to evaluate management objectives and strategies for the reserve system. TNBC shall develop each monitoring plan and shall submit the plan for review by the NBHCP Technical Advisory Committee (TAC) and approval by the Wildlife Agencies prior to implementation.
- **Overall Objective 6.** Increase the diversity and abundance of Covered Species on reserve lands.
- **Overall Objective 7.** Revise the reserve design and management based on the most current biological data.
- **Wetland Species/Habitat Goal/Objective 3.** Document population trends of Covered Species through monitoring.

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Table 15. Relationships Between Applicable NBHCP Goals and Objectives and Attributes Potentially Affected By the Greenbriar Development Project

NBHCP GOALS AND OBJECTIVES	SPECIES AND HABITAT ATTRIBUTES							
	Survival and Reproduction of Individuals Using Project Site or Adjacent Lands	Zones with Human-wildlife Conflicts	Acreeage of Habitat in Natomas Basin	Connectivity of Habitat in Natomas Basin	Connectivity of Existing TNBC Reserves	Habitat Value of Existing TNBC Reserves	Water Availability at TNBCReserves	Opportunities to Establish Additional TNBC Reserves
Overall Goal 1. <i>Establish and manage in perpetuity a biologically sound and interconnected habitat reserve system that mitigates impacts on Covered Species resulting from Covered Activities and provides habitat for existing, and new viable populations of Covered Species. (NBHCP page I-15)</i>	-	-	X	X	X	X	X	X
Overall Goal 3. <i>Preserve open space and habitat that may also benefit local, nonlisted and transitory wildlife species not identified within the NBHCP. (NBHCP page I-16)</i>	-	-	X	X	X	X	X	X
Overall Goal 4. <i>Ensure that direct impacts of Authorized Development upon Covered Species are avoided or minimized to the maximum extent practicable. (NBHCP, page I-16)</i>	X	-	-	-	-	-	-	-
Overall Objective 1. <i>Minimize conflicts between wildlife and human activities, including conflicts resulting from airplane traffic, roads and automobile traffic, predation by domestic pets, and harassment by people. (NBHCP, page I-16)</i>	X	X	-	-	-	-	-	-
Overall Objective 3. <i>Ensure connectivity between TNBC reserves to minimize habitat fragmentation and species isolation. Connections between reserves will generally take the form of common property boundaries between reserves, waterways (primarily irrigation and drainage channels) passing between reserves, and/or an interlinking network of water supply channels or canals. (NBHCP, page I-16)</i>	-	-	-	X	X	X	X	

NBHCP GOALS AND OBJECTIVES	SPECIES AND HABITAT ATTRIBUTES							
	Survival and Reproduction of Individuals Using Project Site or Adjacent Lands	Zones with Human-wildlife Conflicts	Acreage of Habitat in Natomas Basin	Connectivity of Habitat in Natomas Basin	Connectivity of Existing TNBC Reserves	Habitat Value of Existing TNBC Reserves	Water Availability at TNBC Reserves	Opportunities to Establish Additional TNBC Reserves
Wetland Species/Habitat Goal/Objective 1. <i>Acquire, enhance and create a mosaic of wetland habitats with adjacent uplands and connecting corridors to provide breeding, wintering, foraging, and cover areas for wetland species in the NBHCP Plan Area. (NBHCP, page I-17)</i>	-	-	-	X	X	X	X	X
Wetland Species/Habitat Goal/Objective 2. <i>Provide habitat to maintain, attract and sustain viable populations of the Covered Species. The habitat areas should be configured to encompass natural species migration areas, minimize species isolation, and prevent future habitat fragmentation. (NBHCP, page I-17)</i>	-	X	X	X	X	X	X	X
Upland Species/Habitat Goal/Objective 1. <i>Acquire, enhance and create a mosaic of upland habitat types for breeding, foraging, and cover for species dependent on upland habitats. (NBHCP, page I-17)</i>	-	-	X	-	-	X	-	X
Upland Species/Habitat Goal/Objective 2. <i>Ensure reserve land connectivity with travel corridors for upland-dependent species. The habitat areas should encompass grasslands, agricultural croplands, riparian habitats, and shelter and nesting habitat areas (fence rows, clusters of shrubs and small trees), as well as wetland areas to provide a year-round source of water for upland species. The upland areas should be configured to enhance natural species migration, minimize species isolation, and prevent future habitat fragmentation. (NBHCP, page I-17)</i>	-	-	-	X	X	X	-	X

¹An “X” indicates that alteration of that species or habitat attribute could directly affect attainment of that goal or objective.

Chapter 5. Greenbriar Development Project's Potential Alteration of Population and Habitat Attributes of the NBHCP Covered Species

5.1. Construction-Related Effects on Survival and Reproduction

Construction-related effects to NBHCP Covered Species resulting from implementation of the Greenbriar Development Project are expected to be limited to the Greenbriar Project Site (including the Lone Tree Canal Reserve) and Off-Site Improvement Lands, where the residential/mixed use development and off-site infrastructure would be constructed, and potentially the Spangler Reserve where restoration activities would occur. No active restoration or other construction activities are planned at the Moody Reserve or the North Nestor Reserve; therefore, no impacts to Covered Species are anticipated at these sites.

Based on CNDDDB searches, other data on the distribution of species in the Natomas Basin (primarily compliance monitoring associated with the NBHCP), and numerous biological surveys conducted by HELIX personnel, the NBHCP Covered Species that are known to use the properties associated with the Greenbriar Development Project (either currently or historically) include GGS, Swainson's hawk, western burrowing owl, loggerhead shrike, and white-faced ibis. Other NBHCP Covered Species that may occur on the properties associated with the Project, at least during certain times of the year (in the case of bird species), include VELB, western pond turtle, tri-colored blackbird, Aleutian Canada goose, and bank swallow. Two plant species covered by the NBHCP, Sanford's arrowhead and delta tulle pea, have the potential to occupy canals, ditches, and other suitable wetland habitats on the Project's properties.

For the species listed above, construction could affect their survival and/or reproduction by killing, injuring or disturbing individuals, or by eliminating habitat that those individuals depend on for food or shelter. These potential effects are summarized below and described in detail in the sections addressing potential effects for each NBHCP Covered Species.

The remainder of the NBHCP Covered Species are not expected to occur on the properties associated with the Greenbriar Development Project. These species are: California tiger salamander, western spadefoot toad, midvalley fairy shrimp, vernal pool fairy shrimp, vernal pool tadpole shrimp, Bogg's lake hedge-hyssop, Colusa grass, legenera, Sacramento Orcutt grass, and slender Orcutt grass. These NBHCP Covered Species are associated with vernal pool grasslands. Many of these species have not been documented to occur in the Natomas Basin and

habitats for these species are only present along the far eastern edge of the Basin. Although not expected to occur, vernal pool branchiopods are discussed in this section due to the presence of marginally suitable habitat on the Greenbriar Project Site, although protocol presence/absence surveys were conducted and vernal pool branchiopods were not found.

5.1.1. GGS

Suitable habitat for GGS is present on the Greenbriar Project Site (including Lone Tree Canal Reserve), the Spangler Reserve, and the North Nestor Reserve. The Moody Reserve does not provide suitable habitat for GGS, however, portions of the site are within 200 feet of suitable aquatic habitat and there is a low likelihood that GGS could enter the site. No construction activities are planned on the Moody Reserve; therefore, no impacts to GGS are anticipated at this location and it is not discussed further in this section. The Off-Site Improvement Lands do not contain suitable habitat for this species and are also not discussed further. Construction-related effects to GGS are discussed for the remaining properties associated with the Greenbriar Development Project in the following paragraphs.

Construction activities associated with development on the Greenbriar Project Site, including the Lone Tree Canal Reserve, and restoration activities on the Spangler Reserve and North Nestor Reserve could potentially affect GGS individuals and/or habitat. On the Greenbriar Project Site, Lone Tree Canal and a spur along an intersecting interior canal provide approximately 3.21 acres of aquatic habitat for GGS, and Lone Tree Canal provides an important movement/dispersal corridor between northern and southern populations of GGS in the Natomas Basin.

Approximately 32 acres of adjacent uplands within 200 feet of aquatic habitat provide marginally suitable habitat for GGS basking or hibernation. The entire Spangler Reserve and North Nestor Reserve is suitable habitat for GGS.

GGS, if present on the Greenbriar Project Site during construction, may be injured or killed by construction-related activities, including ground disturbing activities, equipment use, and construction of structures and infrastructure. The snake may also be indirectly impacted during construction as a result of increased levels of fugitive dust, sedimentation, harmful substances, or waterborne contaminants. Similarly, implementation of the restoration activities in the Lone Tree Canal Reserve and the Spangler and North Nestor reserves could impact this species if it is present, although the overall result of the restoration at these sites would be beneficial to this species.

5.1.2. Swainson's Hawk

Suitable habitat for this species is present on all of the properties associated with the Greenbriar Development Project. The Greenbriar Project Site provides foraging habitat for Swainson's

hawk but no potential nest trees are present on the site (although potential nest trees are present in proximity to the site). The Moody Reserve provides potential nesting and foraging habitat for Swainson's hawk. The North Nestor and Spangler reserves provide foraging habitat for Swainson's hawk. No construction activities are planned at the Spangler Reserve and the North Nestor Reserve that could impact Swainson's hawk and these reserves are not discussed further in this section.

Construction activities associated with the development on the Greenbriar Project Site could potentially affect Swainson's hawk during the nesting season by disturbing potential nests on or adjacent to the site and reducing foraging habitat. Development on the Greenbriar Project Site will result in a permanent loss of foraging habitat at the site.

A Swainson's hawk was observed foraging on the Greenbriar Project Site during a site visit on May 8, 2012; however, no nest trees are present on the site. Several reported occurrences of nesting Swainson's hawk occur in the CNDDDB within 1 to 5 miles of the Greenbriar Project Site within the past five years. The nearest documented occurrence of Swainson's hawk in the CNDDDB to the Greenbriar Project Site is from 1989, where a hawk was observed soaring near the southeast corner of the site. No nesting was documented in this location. However, there is a documented Swainson's hawk nest tree on the parcel adjacent to the northwestern boundary of the Greenbriar Project Site within a few hundred feet of the project boundary (Swainson's hawk Nest Site # NB 98; ICF 2012; exact location confidential).

During Swainson's hawk surveys conducted in 2013 for the biological effectiveness monitoring associated with the NBHCP, a new Swainson's hawk nest territory was discovered in the southwestern corner of the Teal Bend Golf Course near the Sacramento River (Nest Site Number NB-132; ICF 2014). This nest territory is less than one mile from the Moody Reserve. In addition, biological effectiveness monitoring for the NBHCP in combination with CNDDDB records indicate 39 documented Swainson's hawk nest sites within 5 miles of the Moody Reserve, of which 38 are considered extant (CDFW 2015). Of these extant occurrences, two are within riparian habitat adjacent to the south side of the Moody Reserve and three are within one mile of the site along the Sacramento River (ICF 2014; CDFW 2015). Swainson's hawk nest surveys had not been conducted by HELIX on the Moody Reserve in 2015 at the time of report preparation; however, an adult Swainson's hawk was observed soaring over the Moody Reserve on April 16, 2015 and is presumably nesting in riparian habitat on or in close proximity to the site.

Construction activities associated with the proposed development on the Greenbriar Project Site could cause nest disturbance to any Swainson's hawks potentially nesting within 0.25 miles, including documented nests on adjacent parcels.

5.1.3. VELB

Of the properties associated with the Greenbriar Development Project, suitable habitat for VELB is present only on the Moody Reserve. No construction activities are planned at the Moody Reserve and it is not discussed further in this section. Although no habitat for VELB is present on the Greenbriar Project Site, the site contains one elderberry shrub. For this reason, it is discussed below. The remaining properties do not provide suitable habitat for this species.

One elderberry shrub is present within the Greenbriar Project Site near W. Elkhorn Boulevard, along the northern edge of disturbed annual grassland. The lone elderberry shrub does not provide suitable habitat for VELB. The shrub is not located within riparian habitat and no VELB or species indicators (e.g., exit holes or frass) were observed. There is one CNDDDB record for VELB on the "Taylor Monument, California" USGS quad where this species was reported within riparian habitat along the Sacramento River approximately four miles west of the Greenbriar Project Site. However, there are no other elderberry shrubs within the beetles' dispersal distance of the Greenbriar Project Site and no potential for VELB to occupy the shrub on the site.

The proposed development on the Greenbriar Project Site will require removal of the elderberry shrub. As an added measure to enhance habitat for Covered Species, the elderberry shrub would be transplanted to one of the Greenbriar Development Project's reserves (likely the Moody Reserve). Transplantation of the shrub will not affect VELB because the shrub is not occupied by the beetle.

5.1.4. Western Pond Turtle

Suitable habitat for western pond turtle is present on all of the properties associated with the Greenbriar Development Project with the exception of the Off-Site Improvement Lands. No construction activities associated with the Greenbriar Development Project are planned on the Moody Reserve or the North Nestor Reserve that would impact western pond turtle); no impacts to western pond turtle are anticipated at these locations and they are not discussed further in this section. Construction-related effects to western pond turtle are discussed for the remaining properties associated with the Project in the following paragraphs.

Construction activities associated with development on the Greenbriar Project Site, including the Lone Tree Canal Reserve, and restoration activities on the Spangler Reserve could potentially

affect western pond turtle individuals and/or its habitat. Western pond turtle has not been identified on the Greenbriar Project Site or the Spangler Reserve. The CNDDDB records indicated a documented occurrence of western pond turtle west of the Sacramento River, approximately 3.5 miles northwest of the Greenbriar Project Site and approximately 1.7 mile west of the Spangler Reserve in a system of artificial ponds and irrigation canals. Western pond turtle is known to occur near the Elkhorn Pumping Station, which is located approximately 0.3 mile northwest of the Moody Reserve. On the Greenbriar Project Site, Lone Tree Canal and a portion of a connecting canal provide approximately 3.21 acres of aquatic habitat for western pond turtle, and a suitable movement/dispersal corridor. Approximately 32 acres of adjacent upland provide potentially suitable habitat for basking or hibernation. On the Spangler Reserve and Moody Reserve, irrigation canals and drainage ditches on and adjacent to these properties provide suitable habitat for this species.

Turtles present on the Greenbriar Project Site during construction may be injured or killed by construction-related activities, including ground disturbing activities, equipment use, and construction of structures and infrastructure. The turtle may also be indirectly impacted during construction as a result of increased levels of fugitive dust, sedimentation, harmful substances, or waterborne contaminants. Similarly, implementation of the restoration activities in the Lone Tree Canal Reserve and the Spangler Reserve could impact this species if it is present, although the overall result of the restoration would be beneficial to this species.

5.1.5. Tri-colored Blackbird

Foraging habitat for tri-colored blackbird is present on all of the properties associated with the Greenbriar Development Project. Suitable nesting habitat for this species is present only on the Greenbriar Project Site and the Moody Reserve. No construction or restoration activities are planned at the Moody Reserve or the North Nestor Reserve that would impact tri-colored blackbird and these sites are not discussed further in this section. The Off-Site Improvement Lands do not contain suitable habitat for this species and are also not discussed further. Construction-related effects to tri-colored blackbird are discussed for the remaining properties associated with the proposed project in the following paragraphs.

Construction activities associated with the development on the Greenbriar Project Site as well as restoration activities on the Spangler Reserve could potentially affect tri-colored blackbird individuals and/or its habitat. Tri-colored blackbird has not been observed on any of the properties associated with the Project; however, this species is known to nest in the Natomas Basin and the CNDDDB contains a reported occurrence of approximately 200 tri-colored blackbirds nesting in willow trees along an irrigation ditch that is located approximately 1.5 mile east of the Greenbriar Project Site, approximately 4.0 miles southeast of the Spangler Reserve,

and approximately 5 miles southeast of the Moody Reserve. In the Greenbriar Project Site, the emergent vegetation along Lone Tree Canal and the adjacent uplands provide potential nesting and foraging habitat for this species. Although this species has not been observed on the Greenbriar Project Site, tri-colored blackbird could potentially occupy suitable habitat there prior to commencement of construction. The Spangler Reserve provides foraging habitat for tri-colored blackbird but it is unlikely that this species would nest in the Spangler Reserve.

Potential impacts to tri-colored blackbird as a result of construction-related activities include nest disturbance and loss of foraging habitat. Disturbance associated with construction of the proposed roadway crossings over Lone Tree Canal would impact potential nesting habitat along the canal. Similarly, implementation of the restoration activities in the Lone Tree Canal Reserve could impact this species if it is present, although the overall result of the Lone Tree Canal restoration would be beneficial to this species. Other construction activities on the Greenbriar Project Site and the Spangler Reserve would result in loss or temporary disturbance of disturbed annual grassland and agricultural fields (including rice) that provide potential foraging habitat.

5.1.6. Western Burrowing Owl

Of the properties associated with the Greenbriar Development Project, suitable habitat for this species is present on the Greenbriar Project Site and Off-Site Improvement Lands and the Moody Reserve. No construction activities are planned at the Moody Reserve and it is not discussed further in this section. The Spangler Reserve and the North Nestor Reserve do not provide suitable habitat for this species and are also not discussed further in this section.

Construction activities associated with the development on the Greenbriar Project Site could potentially affect western burrowing owl individuals and/or its nesting and foraging habitat. Western burrowing owl was observed on the Greenbriar Project Site by EDAW (EDAW 2006) and again by HELIX; an owl and possible active burrow were observed in the foundation of a remnant structure on the Greenbriar Project Site on December 13, 2012. Western burrowing owl was not observed during numerous subsequent site visits conducted by HELIX to conduct biological surveys and monitoring in 2013 through 2015. The CNDDDB contains two reported occurrences of western burrowing owl within one mile of the Greenbriar Project Site, as recently as 2008. The active agricultural fields, disturbed annual grassland, and network of dry canals and ditches on the Greenbriar Project Site and portions of the Off-Site Improvement Lands provide suitable foraging and nesting habitat for this species. Although no burrows or western burrowing owls have been observed on the Greenbriar Project Site since 2012, the Greenbriar Project Site could become occupied by this species prior to commencement of construction.

Construction activities associated with the proposed development on the Greenbriar Project Site could cause nest disturbance or trap or injure owls in their burrows and could also result in loss of potential habitat.

5.1.7. Loggerhead Shrike

Foraging habitat for loggerhead shrike is present on all of the properties associated with the Greenbriar Development Project. Suitable nesting habitat for this species is present only on the Greenbriar Project Site and the Moody Reserve. No construction or restoration activities are planned on the Moody Reserve or North Nestor Reserve that would impact loggerhead shrike and they are not discussed further in this section. The Off-Site Improvement Lands do not contain suitable habitat for this species and are also not discussed further. Construction-related effects to loggerhead shrike are discussed for the remaining properties associated with the proposed project in the following paragraphs.

Construction activities associated with the development on the Greenbriar Project Site could potentially affect loggerhead shrike individuals and/or its habitat. Loggerhead shrikes were observed on the Greenbriar Project Site in 2005 by EDAW (EDAW 2006) and again in 2012 by HELIX. Individuals of the species were present on the Greenbriar Project Site during a biological survey conducted by HELIX on June 6, 2012 and an active loggerhead shrike nest was observed in the elderberry shrub on the site. The agricultural fields and disturbed annual grassland in the Greenbriar Project Site provide potential foraging habitat, and small trees and shrubs provide suitable nesting habitat for this species. Loggerhead shrike could potentially nest on the Greenbriar Project Site prior to construction.

Construction activities associated with the proposed development on the Greenbriar Project Site could cause nest disturbance and will also result in loss of potential nesting and foraging habitat. Disturbance associated with construction of the proposed development would eliminate the existing nesting and foraging habitat for this species on the Greenbriar Project Site outside of the Lone Tree Canal Reserve. Similarly, implementation of the restoration activities in the Lone Tree Canal Reserve could impact this species if it is present, although the overall result of the Lone Tree Canal restoration would be beneficial to this species.

5.1.8. Aleutian Canada Goose

All of the properties associated with the Greenbriar Development Project provide potential foraging habitat for this species, although it has not been observed in the Natomas Basin since comprehensive basin-wide avian inventories commenced in 2004 (ICF 2014). The species does not nest in California; therefore, no potential nesting habitat would be impacted by the Greenbriar Development Project. No construction or restoration activities are planned on the

Moody Reserve or the North Nestor that would impact Aleutian Canada goose and these sites are not discussed further in this section. The Off-site Improvement Lands do not contain suitable habitat for this species and are also not discussed further. Construction-related effects to this species are discussed for the remaining properties associated with the proposed project in the following paragraphs.

Construction activities associated with the development on the Greenbriar Project Site and restoration activities on the Spangler Reserve could potentially affect Aleutian Canada goose individuals and/or its foraging habitat. The active agricultural fields, disturbed annual grassland, and canals and ditches on the Greenbriar Project Site as well as the agricultural fields on the Spangler Reserve provide potentially suitable foraging habitat for this species.

Impacts to Aleutian Canada geese, although unlikely, could include permanent and temporary loss of potential foraging habitat. Permanent loss would occur within the development area of the Greenbriar Project Site. Construction of the Lone Tree Canal Reserve and restoration activities on the Spangler Reserve would temporarily impact potential foraging habitat, but habitat would be enhanced and preserved once construction is completed.

5.1.9. White Faced Ibis

All of the properties associated with the Greenbriar Development Project provide potential foraging habitat for this species; however, no nesting habitat for white faced ibis is present on the Project's properties. No construction or restoration activities are planned on the Moody Reserve or the North Nestor Reserve that would impact white faced ibis and these sites are not discussed further in this section. The Off-Site Improvement Lands do not contain suitable habitat for this species and are also not discussed further. Construction-related effects to this species are discussed for the remaining properties associated with the proposed project in the following paragraphs.

Construction activities associated with the development on the Greenbriar Project Site and restoration activities on the Spangler Reserve could potentially affect white faced ibis individuals and/or its foraging habitat. The active agricultural fields and disturbed annual grassland on the Greenbriar Project Site as well as the agricultural fields on the Spangler Reserve provide potentially suitable foraging habitat for this species.

Impacts to white faced ibis would include permanent and temporary loss of potential foraging habitat. Permanent loss would occur within the development area of the Greenbriar Project Site. Construction of the Lone Tree Canal Reserve and restoration activities on the Spangler Reserve would temporarily impact potential foraging habitat, but habitat would be enhanced and preserved once construction is completed.

The NBHCP only includes mitigation measures to prevent potential impacts to this species if found nesting on or near a project site. The Greenbriar Development Project will have no effect on white-faced ibis nesting habitat, therefore, no specific measures for this species are necessary.

5.1.10. Bank Swallow

All of the properties associated with the Greenbriar Development Project provide potential foraging habitat for this species, although no nesting colonies are known to occur in the Basin (ICF 2014). No construction or restoration activities are planned on the Moody Reserve or the North Nestor Reserve that would impact bank swallow and these sites are not discussed further in this section. The Off-Site Improvement Lands do not contain suitable habitat for this species and are also not discussed further. Construction-related effects to this species are discussed for the remaining properties associated with the proposed project in the following paragraphs.

Construction activities associated with the development on the Greenbriar Project Site and restoration activities on the Spangler Reserve could potentially affect bank swallow individuals and/or its foraging habitat. The active agricultural fields, disturbed annual grassland, and canals and ditches on the Greenbriar Project Site as well as the rice fields on the Spangler Reserve provide potentially suitable foraging habitat for this species.

Impacts to bank swallow, although unlikely, could include permanent and temporary loss of potential foraging habitat. Permanent loss would occur within the development area of the Greenbriar Project Site. Construction of the Lone Tree Canal Reserve and restoration activities on the Spangler Reserve would temporarily impact potential foraging habitat, but habitat would be enhanced and preserved once construction is completed.

The NBHCP only includes mitigation measures to prevent potential impacts to this species if found nesting on or near a project site. Based on this evaluation, no measures are necessary for bank swallow due to the lack of nesting habitat on or adjacent to the properties associated with the Greenbriar Development Project.

5.1.11. Vernal Pool Branchiopods Including Vernal Pool Fairy Shrimp, Vernal Pool Tadpole Shrimp, and Midvalley Fairy Shrimp

Of the properties associated with the Greenbriar Development Project, suitable habitat for vernal pool branchiopods is present only on the Greenbriar Project Site. The remaining properties do not provide suitable habitat for these species and are not discussed further in this section.

Six seasonal wetlands on the Greenbriar Project Site totaling approximately 0.18 acre were determined to potentially meet the habitat requirements for vernal pool branchiopods. Ground disturbing activities associated with previous and existing land uses have affected the quality of

the seasonal wetland habitats present, and they currently provide marginal habitat for vernal pool branchiopods. Dry and wet season surveys were conducted within the seasonal wetlands in 2012/2013 according to USFWS protocol and no vernal pool branchiopods were identified. The CNDDDB records indicated no documented occurrences of special-status vernal pool branchiopods within 1 mile of the site.

Special-status vernal pool branchiopods are not present within the seasonal wetlands on the Greenbriar Project Site, and no impacts to these species would occur during construction activities within the seasonal wetlands.

To avoid and minimize potential effects associated with construction activities, the Greenbriar Development Project implemented the same measures that were included in the NBHCP to avoid and minimize construction-related effects on vernal pool branchiopods (e.g., species-specific surveys during the appropriate time of the year according to USFWS protocol).

5.1.12. Sanford's Arrowhead

Of the properties associated with the Greenbriar Development Project, suitable habitat for Sanford's arrowhead is present only on the Greenbriar Project Site (including the Lone Tree Canal Reserve) and the Spangler Reserve. The Off-Site Improvement Lands as well as the Moody Reserve and the North Nestor Reserve do not provide suitable aquatic habitat for this species and are not discussed further in this section.

Construction activities associated with development on the Greenbriar Project Site and restoration activities on the Spangler Reserve could potentially affect Sanford's arrowhead individuals and/or its habitat. Although Sanford's arrowhead has not been observed within the Greenbriar Project Site or Spangler Reserve and there are no reported occurrences of this species in the CNDDDB within one mile of either site, freshwater aquatic habitats on the Greenbriar Project Site within Lone Tree Canal and segments of adjacent ditch/canal features as well as canals/ditches on the Spangler Reserve provide potentially suitable habitat for this species. Sanford's arrowhead could potentially colonize suitable habitat in the Greenbriar Project Site and Spangler Reserve prior to commencement of construction.

On the Greenbriar Project Site, disturbance associated with construction of the proposed roadway crossings over Lone Tree Canal would affect suitable habitat for Sanford's arrowhead and could result in impacts to Sanford's arrowhead if individuals of this species are present in the canal. Similarly, implementation of the restoration activities in the Lone Tree Canal Reserve and on the Spangler Reserve could impact this species if it is present, although the overall result of the project's restoration activities would be beneficial to this species.

5.1.13. Delta Tule Pea

Of the properties associated with the Greenbriar Development Project, suitable habitat for delta tule pea is only present on the Greenbriar Project Site (including the Lone Tree Canal Reserve). The Off-Site Improvement Lands as well as the Spangler Reserve, Moody Reserve and the North Nestor Reserve do not provide suitable aquatic habitat for this species and are not discussed further in this section.

Construction activities associated with development on the Greenbriar Project Site could potentially affect delta tule pea individuals and/or its habitat. Although delta tule pea has not been observed within the Greenbriar Project Site and there are no reported occurrences of this species in the CNDDDB within one mile of the site, freshwater aquatic habitats within Lone Tree Canal and segments of adjacent ditch/canal features provide potentially suitable habitat for this species. Delta tule pea could potentially colonize suitable habitat in the site prior to commencement of construction.

Disturbance associated with construction of the proposed roadway crossings over Lone Tree Canal would affect suitable habitat for delta tule pea and could result in impacts to delta tule pea if individuals of this species are present in the canal. Similarly, implementation of the restoration activities in the Lone Tree Canal Reserve could impact this species if it is present, although the overall result of the Lone Tree Canal restoration would be beneficial to this species.

5.2. Zones with Human-Wildlife Conflicts

As described in the methodology Chapter 4.2.2 *Zones with Human-Wildlife Conflicts*, areas within 800 feet of the MAP, City of Sacramento, or Sutter County permit areas, or major highways, were considered to be areas with high levels of potential human-wildlife conflicts. The Greenbriar Development Project would reduce the total area of most land cover types but would include measures to reduce effects on adjacent habitats. Overall, the Greenbriar Development Project with the proposed conservation strategy would not significantly increase human-wildlife conflicts in the Natomas Basin.

5.2.1. Future Conditions Under the NBHCP

Under the future conditions resulting from implementation of the NBHCP, a portion of the Greenbriar Project Site would be adjacent to urban development or major highways, and thus potentially experiencing high levels of human-wildlife conflicts. Urban development would be adjacent to the site along its eastern and western sides and part of its southern side. Lone Tree Canal and Lone Tree Road would be between the Greenbriar Project Site and urban development to the west. SR 99/70 would separate the site from the urban development to the east. Along the site's southern side, I-5 would be between the site and both urban development and the

agricultural or natural vegetation remaining to the southwest. Along the Greenbriar Project Site's northern boundary, W. Elkhorn Boulevard would be a six lane road between the site and agricultural or natural land cover to the north. The expansion of W. Elkhorn Boulevard was authorized by the MAP HCP, and although in this analysis it was not considered urban development or a major highway that would generate high levels of human-wildlife conflicts, it would increase levels of human-wildlife conflicts.

Under the future conditions resulting from implementation of the NBHCP, the proposed Spangler Reserve would be bordered to the north by development in Sutter County's permit area. No development would be anticipated to occur in proximity to the North Nestor Reserve under the future conditions resulting from implementation of the NBHCP. Currently, the Moody Reserve is bordered by Sacramento International Airport lands and the Teal Bend Golf Course. No new development would be anticipated to occur in proximity to the Moody Reserve under the future conditions resulting from implementation of the NBHCP.

5.2.2. Potential Effects of the Proposed Greenbriar Development Project Under Future Conditions

The proposed Greenbriar Development Project would reduce the area of habitat in zones with potentially high levels of human-wildlife conflicts. This would occur because the development on the Greenbriar Project Site would occur on portions of the site that would otherwise be in such zones, and would create smaller new zones with potentially high levels of human-wildlife conflicts. Under the future condition resulting from the NBHCP, about 230 acres of the Greenbriar Project Site would be within 800 feet of urban development or major highways. The development on the Greenbriar Project Site would eliminate most of this acreage and would create a new, but smaller, zone with potentially high levels of human-wildlife conflicts to the north (about 62 acres in size), because this undeveloped land would be within 800 feet of urban land after development of the Greenbriar Project Site. The net change would be a reduction of 137 acres in the extent of areas with high levels of human-wildlife conflicts.

Though land to the north would be adjacent to development on the Greenbriar Project Site, a six-lane road (W. Elkhorn Boulevard) would be between this land and residential development on the site. The road would isolate the development on the Greenbriar Project Site from land to the north, and thus limit human-wildlife conflicts resulting from development.

Nonetheless, the proposed Greenbriar Development Project would result in an increase in the area of rice that is within 800 feet of urban development or a major highway, and thus increase the area of GGS and white-faced ibis habitat in zones with potentially high levels of human-wildlife conflicts. The NBHCP baseline year for land cover comparison, used here as well, was 2001. In the 2001 NBHCP land cover map, the area within 800 feet of the northern border of the

Greenbriar Project Site was primarily in rice production (53 of 62 acres). This acreage was greater than the 47 acres of rice on the Greenbriar Project Site that were within 800 feet of the MAP or City of Sacramento permit areas in 2001. Thus, based on 2001 land cover for the Greenbriar Project Site, the acreage of rice in areas with high levels of human-wildlife conflicts would increase by approximately 6 acres as a result of developing the site.

At the proposed Spangler Reserve about 37 acres of rice would be within 800 feet of future development within Sutter County's permit area. However, reserve management (e.g., limiting access) would reduce human-wildlife conflicts. No change in the acreage of habitat in zones with potentially high levels of human-wildlife conflicts would occur as a result of implementing a reserve at the Moody Reserve or the North Nestor Reserve as no changes in the on-site or surrounding land use are anticipated.

Compared to the total area of land in the Natomas Basin that is within 800 feet of a major highway or of the MAP, City of Sacramento, or Sutter County permit areas, changes associated with the Greenbriar Development Project are relatively small. There are approximately 2,790 acres of land outside of the three permit areas but within 800 feet of such areas or of a major highway. Thus, the proposed Greenbriar Development Project would reduce the area of these zones by about 5 percent. Similarly, there are roughly 1,420 acres of rice and managed marsh in these zones, and the Greenbriar Development Project would increase this area by 3 percent (44 acres).

The proposed Greenbriar Development Project also could increase human-wildlife conflicts along Lone Tree Canal. Under the future condition resulting from the NBHCP, a 1.1 mile section of the Lone Tree Canal would be within 800 feet of urban development; these urban land uses and highways would be adjacent to one bank of the canal except at road crossings. Development of the Greenbriar Project Site would place urban land uses within 200 feet of the other bank of Lone Tree Canal as well. The Lone Tree Canal is an important corridor for animal movement, particularly for GGS. The Greenbriar Development Project's potential effects on this canal, and measures to reduce those effects, are discussed in detail in Chapter 5.5 *Connectivity of Habitat in the Natomas Basin*.

The Greenbriar Development Project would also implement measures to reduce human-wildlife conflicts. The Greenbriar Development Project includes all of the applicable measures incorporated into the NBHCP to avoid and minimize human-wildlife conflicts. An evaluation of the applicability of NBHCP measures and their inclusion in the Greenbriar Development Project is presented in **Appendix E**. To further reduce human-wildlife conflicts along Lone Tree Canal, the Greenbriar Development Project also would implement a comprehensive set of measures

including fencing and a barrier. These measures are described in more detail under Chapter 5.5 *Connectivity of Habitats in the Natomas Basin*.

Overall, the proposed Greenbriar Development Project would not cause a significant increase in human-wildlife conflicts in the Natomas Basin. This is in part because much of the Greenbriar Project Site is, or under NBHCP and MAP permit conditions would be, bordered by urban development, highways, and major roads under the future condition and in part because of the proposed Greenbriar Conservation Strategy.

5.3. Habitat Acreage in the Natomas Basin

The Greenbriar Development Project would preserve approximately 557 acres of habitat in the Natomas Basin for NBHCP Covered Species, but would convert potential existing habitat for NBHCP Covered Species at the Greenbriar Project Site to urban land uses. Overall, the Greenbriar Development Project would not substantially affect the habitat acreage available for NBHCP Covered Species in the basin.

5.3.1. Change in Habitat Acreage at the Proposed Greenbriar Development Project Sites

The proposed Greenbriar Development Project would alter the habitats occurring on the Greenbriar Project Site as well as some of the proposed Off-Site Reserves. Most of the Greenbriar Project Site would be converted to urban land cover (**Table 16**), however, a 28.3-acre area along the western edge, bordering the Lone Tree Canal (referred to as the Lone Tree Canal Reserve), would be conserved. This area would be preserved, enhanced by recontouring the bank and allowing the establishment of freshwater marsh along the channel (1.8 acres) with native grassland in the uplands (26.5 acres), and dedicated as a reserve.

Estimates of habitat loss depend on whether they are based on 2001, 2005, or 2015 land cover. For some species (e.g., GGS), estimates of habitat loss would be much greater if based on 2001 land cover than if based on land cover from 2005 to 2015, by which time rice was no longer being grown on the site. For other species (e.g., Swainson's hawk), estimates of habitat loss would be greater if based on 2005 or 2015 land cover when the majority of the site provided foraging habitat. For the purposes of this document's evaluation of the long-term effects on the habitat in the Natomas Basin for each of the NBHCP Covered Species, the expected future condition was compared to 2001 land cover because 2001 land cover was the baseline for the NBHCP's estimates of future habitat conditions.

Table 16. Land Cover Acreages of Greenbriar Development Project Properties

LAND COVER TYPES	GREENBRIAR PROJECT SITE ¹				SPANGLER RESERVE				MOODY RESERVE				NORTH NESTOR RESERVE				TOTAL ⁴			
	2001	2005	2015	Post-Project	2001	2005	2015	Post-Project	2001	2005	2015	Post-Project	2001	2005	2015	Post-Project	2001	2005	2015	Post-Project
Alfalfa	–	–	–	–	–	–			55.48	55.48	55.48	55.48					55.48	55.48	55.48	55.48
Canals	15.0	15.0	12.0	–	7.6	7.6	5.1										22.6	22.6	17.1	
Grassland	–	–	–	26.5 ⁵	–	–		53.1	3.63	3.63	3.63	3.63					3.63	3.63	3.63	83.23
Idle	62.5	115.1	58.0 ²	–	–												62.5	115.1	58.0 ³	
Non-rice crops	234.1	381.0	494.0 ⁴	–		–											234.1	381.0	494.0 ⁵ (Hay)	
Pasture	33.8	–	–	–	–	–											33.8	–		
Ponds and seasonally wet areas	–	1.7	13.0	43.6 ⁶	–	–		142.0 ⁷	0.43	0.43	0.43	0.43					0.43	2.13	13.43	186.03
Rice	160.0	–	–	–	217.4	217.4	217.4	40.3					219.1	219.1	219.1	219.1	596.5	436.5	436.5	259.4
Riparian	1.4	1.4	–	–					3.76	3.76	3.76	5.4					5.16	5.16	3.76	5.4
Roads and highways	30.26	30.26	12.76	12.76													30.26	30.26	12.76	12.76
Ruderal	9.2	2.0	–	–	10.4	10.4	12.1		9.36	9.36	9.36	9.36					28.96	21.76	21.46	9.36
Rural residential	43.3	43.3	–	–					1.64	1.64	1.64	–					44.94	44.94	1.64	
Tree groves	–	–	–	–																
Urban	–	–	–	506.9 ³	–	–											–	–		506.9
Total⁸	589.8	589.8	589.8	589.8	235.4	235.4	235.4	235.4	74.3	74.3	74.3	74.3	219.1	219.1	219.1	219.1	1,118.6	1,118.6	1,118.6	1,118.6

¹ The Greenbriar Project Site acreage includes the 577-acre project site, which is composed of the 31.3 gross acres (28.3 acres net) along Lone Tree Canal that would become a preserve and 545.7 acres within the development footprint, as well as the 12.76 acres of Off-Site Improvement Lands.

² Refers to the portion of the Greenbriar Project Site where the former residence and race track occurred; these areas are not in agricultural production.

³ Includes residential streets

⁴ Includes grass hay and ruderal/disturbed areas associated with grass hay field margins and dirt roads around grass hay fields.

⁵ Refers to the 26.5 acres of grassland that will be established in the Lone Tree Canal Reserve.

⁶ Includes the 41.8-acre detention basin that will be constructed on the Greenbriar Project Site and 1.8 acres of marsh that will be established in Lone Tree Canal.

⁷ Includes 142.0 acres of managed marsh proposed for creation on the site with 8.19 acres of ruderal and 5.1 acres of canal included within the managed marsh.

⁸ The total acreages may not add up due to negligible inconsistencies in rounding across habitat types.

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As outlined in greater detail in Chapter 9 (**Figure 13**), a GIS analysis of the current land uses within the Natomas Basin has been undertaken. This analysis shows that there are approximately 7,916 acres remaining in the Basin following implementation of the NBHCP, all approved growth and development, and its associated mitigation. The data presented in this figure and summarized in Chapter 9 represent the latest GIS information available.

5.3.2. Change in Habitat Acreage at Proposed Reserve Sites

The entire 235.4-acre Spangler Reserve is currently in active rice production (and has been for decades) and consists of rice fields, canals, and ruderal areas associated with access roads and berms and equipment staging areas. Habitat creation/enhancement will occur on approximately 195.1 acres of the site consisting of creation of 142 acres of managed marsh (an estimated 128.7 acres of marsh, 5.1 acres of canal, and 8.19 acres of upland components), and 53.1 acres of annual grassland with constructed wetlands. The remainder of the site would remain in rice (40.3 acres). The site manager will have the option to fallow a portion of the rice fields on a rotational basis as needed and based on the SSMP (See Chapter 2.7.2.2 *Off-Site Reserves* for further detail). Some minor modifications to ruderal habitat and canals could potentially occur, but would not significantly alter the acreage of these habitats on the site.

Land cover at the North Nestor Reserve is anticipated to remain unchanged. The North Nestor Reserve is currently in active rice production (and has been for decades), with approximately 219.1 acres of rice fields. The site is expected to remain in rice production; however, the site manager will have the option to fallow a portion of the rice fields on a rotational basis as needed and based on the SSMP (See Chapter 2.7.2.2 *Off-Site Reserves* for further detail). The North Nestor Reserve will be managed in rice and will maintain biological connectivity between existing TNBC reserves to the north and south. A 13.6-acre easement area has been defined along the western boundary of the North Nestor Reserve, which could be managed separately by TNBC to further the NBHCP goal of establishing a habitat reserve of 2,500 acres in the Natomas Basin.

The Moody Reserve is anticipated to remain unchanged. The site is comprised primarily of alfalfa fields, with some minor amounts of grassland, seasonal wetland, riparian, and ruderal.

5.3.3. Overall Change in Habitat Acreage

The changes from the proposed Greenbriar Development Project would reduce the acreage in the Basin of several natural or agricultural land cover types that provide habitat for NBHCP Covered Species, and would increase the acreage of urban, grassland, riparian, and ponds and seasonally wet areas (**Table 17**).

Table 17. Change in Land Cover Acreage Because of Natomas Basin HCP and Greenbriar Development Project

LAND COVER	NATOMAS BASIN 2001 ¹	FUTURE CONDITION RESULTING FROM NBHCP ¹	FUTURE CONDITION RESULTING FROM NBHCP PLUS PROJECT ^{1, 2, 3, 4}		
			2001 Project Site Land Cover	2005 Project Site Land Cover	2015 Project Site Land Cover
Airport	1,532	1,492	1,492	1,492	1,492
			(0)	(0)	(0)
Alfalfa	368	368	368	368	368
			(0)	(0)	(0)
Canals	1,753	1,162	1,144	1,144	1,150
			(-18)	(-18)	(-12)
Grassland	882	284	364	364	364
			(80)	(80)	(80)
Highway or major roadway	1,353	770	752	752	770
			(-18)	(-18)	(0)
Idle	1,449	422	360	307	364
			(-63)	(-115)	(-58)
Non-rice crops	16,395	9,533	9,299	9,152	9,039
			(-234)	(-381)	(-494)
Oak grove	94	77	77	77	77
			(0)	(0)	(0)
Orchard	178	165	165	165	165
			(0)	(0)	(0)
Other	460	314	314	314	314
			(0)	(0)	(0)
Pasture	660	494	460	494	494
			(-34)	(0)	(0)
Ponds and seasonally wet areas	93	2,259	2,445	2,443	2,432
			(186 ⁴)	(184 ⁴)	(173 ⁴)
Rice	22,129	11,643	11,306	11,466	11,466
			(-337)	(-177)	(-177)
Riparian	115	91	91	91	93
			(0)	(0)	(2)

LAND COVER	NATOMAS BASIN 2001 ¹	FUTURE CONDITION RESULTING FROM NBHCP ¹	FUTURE CONDITION RESULTING FROM NBHCP PLUS PROJECT ^{1, 2, 3, 4}		
			2001 Project Site Land Cover	2005 Project Site Land Cover	2015 Project Site Land Cover
Ruderal	1,882	370	350	358	358
			(-20)	(-12)	(-12)
Rural Residential	369	287	242	242	285
			(-45)	(-45)	(-2)
Tree Grove	102	44	44	44	44
			(0)	(0)	(0)
Urban	3,725	23,763	24,270	24,270	24,270
			(507)	(507)	(507)

¹ Acreage along Class II-IV canals included in acres of canals, thus reducing acreages in other categories from those given in NBHCP.

² Acreages include changes in land cover occurring at all of the properties associated with the Greenbriar Development Project (the Greenbriar Project Site including the Lone Tree Canal Reserve, the Spangler Reserve, the Moody Reserve, and the North Nestor Reserve).

³ Change in acreage from future condition of NBHCP is in parentheses.

⁴ Includes the proposed 41.8-acre lake at the Greenbriar Project Site, 1.8 acres of marsh in Lone Tree Canal Reserve, and 142.0 acres of managed marsh creation at the Spangler Reserve.

Based on 2001 land cover, these changes represent a slight reduction in habitat acreage for most species that use non-rice cropland and other upland land cover, a net loss for species using canals and rice agricultural land (due to the loss of rice habitat at the Greenbriar Project Site prior to 2005 and the conversion of rice to managed marsh at the Spangler Reserve), and a net gain in ponds and seasonally wet areas due to the creation of managed marsh at the Spangler Reserve from active rice fields. The NBHCP Covered Species that forage in non-rice crops and other upland land cover (Swainson's hawk, loggerhead shrike, tri-colored blackbird, and Aleutian Canada goose) would lose between 85 and 461 acres of habitat (See **Table 18**). Aquatic habitat for GGS would decrease by 211 acres and aquatic habitat for western pond turtle would decrease by 169 acres. Because the acreage of the managed marsh at the Spangler Reserve would be greater than the acreage of lost canal habitats, potential habitat for Sanford's arrowhead and delta tulle pea (which occur in marsh or canal habitats) would increase by 168 acres. Because vernal pool habitat will not be affected by the Greenbriar Development Project, vernal pool related covered species are not evaluated in **Table 18**.

Table 18. Change in Habitat Acreage Because of Natomas Basin HCP and Greenbriar Development Project (including reserve lands)

LAND COVER	NATOMAS BASIN 2001	FUTURE CONDITION RESULTING FROM NBHCP ^{1, 2}	FUTURE CONDITION RESULTING FROM NBHCP PLUS PROJECT ^{1, 2, 3}		
			2001 Project Site Land Cover	2005 Project Site Land Cover ⁴	2015 Project Site Land Cover
GGS ⁵	23,975	15,064	14,853	15,011	15,006
			(-211)	(-53)	(-58)
Swainson's hawk (nesting)	311	211	211	211	213
			(0)	(0)	(2)
Swainson's hawk (foraging) ⁶	21,636	12,018	11,874	11,717	11,661
			(-144)	(-301)	(-357)
Western burrowing owl (nesting and foraging)	6,994	3,647	3,693	3,727	3,727
			(46)	(80)	(80)
Loggerhead shrike	24,339	15,555	15,470	15,363	15,290
			(-85)	(-192)	(-265)
Tri-colored blackbird (foraging) ⁷	40,434	22,322	21,941	21,988	21,875
			(-381)	(-334)	(-447)
Aleutian Canada ⁷ goose	39,184	21,670	21,209	21,256	21,143
			(-461)	(-414)	(-527)
White-faced ibis ⁷	24,343	15,432	15,221	15,381	15,387
			(-211)	(-51)	(-45)
Bank Swallow	24,339	15,555	15,470	15,363	15,290
			(-85)	(-192)	(-265)
VELB ⁸	115	91	91	91	93
			(0)	(0)	(2)
Western pond turtle	24,090	15,155	14,986	15,144	15,141
			(-169)	(-11)	(-14)
Sanford's arrowhead	1,846	3,421	3,589	3,587	3,582
			(168)	(166)	(161)
Delta tule pea	1,846	3,421	3,589	3,587	3,582
			(168)	(166)	(161)

¹ Acreage along Class II-IV canals were included in acres of canals, thus reducing acreages in other land cover categories from those given in NBHCP as baseline conditions; this altered habitat estimates as well.

² Acreages include changes in land cover occurring at the proposed Spangler Reserve, and assume that land in MAP, City of Sacramento, and Sutter County permit areas would not provide habitat under future conditions.

³ Change in acreage from future condition because of NBHCP is in parentheses.

⁴ 2005 habitat acreages differ from those in the EIR because different methodologies were used; this effects analysis relied on a GIS analysis comparable to analyses of 2001 land cover, whereas the EIR used by GIS analyses and field surveys by biologists to estimate habitat acreages.

⁵ This acreage represents/includes the total acreage of canal habitat lost to maintain consistency with the 2001 and 2005 analyses. Most of the canals on the Project site no longer convey irrigation water and no longer represent suitable habitat for aquatic species including GGS, western pond turtle, Sanford's arrowhead, and Delta tule pea. Does not include the 41.8-acre detention basin on the Greenbriar Project Site because it is not anticipated to provide habitat for GGS.

⁶ Includes 127.3 acres of Swainson's hawk foraging that will be created at Spangler Reserve and North Nestor Reserve as a component of the rice and managed marsh.

⁷ Does not include the 41.8-acre detention basin at the Greenbriar Project Site as this feature is not expected to provide habitat for this species.

⁸ Although one elderberry shrub occurs on the Greenbriar Project Site it was not considered VELB habitat. Therefore, loss of the shrub was not counted as loss of habitat for the purpose of this exercise.

Based on 2015 land cover, these changes primarily represent a reduction in non-rice cropland and idle land, as the Greenbriar Project Site consists almost entirely of hay fields and idle land associated with an old farmstead that has been razed. No rice habitat will be lost at the Greenbriar Project Site based on 2015 land cover; however, 195.1 acres of rice would be converted to managed marsh or annual grassland/seasonal wetland at the Spangler Reserve. Canal habitat will be lost at the Greenbriar Project Site, but the canals no longer convey irrigation water and do not provide habitat for species using the canals (including GGS). Potential habitat for Sanford's arrowhead, and delta tule pea (which occur in marsh or canal habitats) would increase by 161 acres and potential habitat for western burrowing owl would increase by 80 acres.

The proposed Greenbriar Development Project will have no impact on mapped habitat for the following NBHCP Covered Species: California tiger salamander, western spadefoot toad, midvalley fairy shrimp, vernal pool fairy shrimp, vernal pool tadpole shrimp, Boggs Lake hedgehog, Colusa grass, legenere, Sacramento Orcutt grass, and slender Orcutt grass. Vernal pool grasslands that provide habitat for these species are not present in the Greenbriar Project Site. Although six isolated seasonal wetlands onsite meet the potential habitat requirements for vernal pool branchiopods, vernal pool branchiopods were not found in these wetlands during protocol surveys and the wetlands were not mapped as vernal pool habitat in the NBHCP. Therefore, impacts to these seasonal wetlands were not counted as loss of vernal pool branchiopod habitat for the purpose of this analysis.

This assessment indicated that land cover changes between 2001 and 2005 occurred primarily within the MAP, City of Sacramento, and Sutter County permit areas for urban development, and at TNBC reserves; the primary land cover changes outside of these areas were an increase in the acreage of rice, a substantial decrease in the acreage of non-rice crops and a corresponding increase in the acreage of fallowed and abandoned cropland. It did not indicate that fallowing of rice in anticipation of development was occurring. Although the dramatic changes in non-rice crop and idle cropland acreages affect the acreage of available habitat for just two Covered Species (western burrowing owl and Aleutian Canada goose), they do illustrate that availability of agricultural habitats can change rapidly in the Natomas Basin. The most notable changes in land cover post-2005 are associated with a decrease in rice production of 5,178 acres, or approximately 24 percent of the total rice production in the Natomas Basin as compared to 2001 land cover mapping. The acreage of several other land cover types has increased significantly including an increase in alfalfa of 933 acres, an increase in developed land of 1,351 acres, an increase of 1,288 acres of ponds, marsh, and seasonally wet areas (although some of this discrepancy is likely due to including some canal acreage into this category), and an increase of 3,915 acres of grassland.

5.4. Habitat Quality in the Natomas Basin

In addition to the changes in habitat acreage described in Chapter 5.3.3 *Habitat Acreage in the Natomas Basin*, changes in the quality of the remaining habitat would also occur. In part, changes in habitat quality result from changes in the acreage of land cover types providing lower or higher habitat quality. For example, the emergent wetland and managed marsh created by the Greenbriar Development Project along Lone Tree Canal and in the Spangler Reserve would provide higher quality habitat for some species (e.g., western pond turtle and GGS) than the canal habitats eliminated by the Greenbriar Development Project.

5.4.1. Habitat Quality Adjacent to the Greenbriar Project Site

Development on the Greenbriar Project Site has the potential to reduce habitat quality adjacent to the site. These effects could be caused by a wide variety of mechanisms that include alteration of hydrology, water quality, disturbance regimes, and vegetation structure, and the introduction of non-native species, collisions with vehicles, noise disturbance, and harassment by humans, and predation by cats, dogs, and wildlife associated with human land uses. The distance that effects on wildlife habitat extend from developed land varies with the mechanism causing the effect, the species affected, and attributes of the development and its surrounding landscape, but distances may range from less than 10 to over 1,000 feet (Forman and Alexander 1998, Paul and Meyer 2001, ELI 2003, Miller et al. 2003, Allan 2004). The most likely causes of effects on adjacent habitats because of the development on the Greenbriar Project Site are:

- Spread of non-native invasive species,
- Harm and harassment of wildlife by humans, cats, and dogs,
- Dumping of trash, and
- Increased levels of noise and nighttime light.

However, the Greenbriar Project Site is currently surrounded by roads and major highways on the north, east, and south sides and partially bordered by rural residential development on the west side. Under the future condition authorized by the NBHCP and MAP HCP, development will extend along the entire western boundary of the site as well. The only significant habitat for Covered Species adjacent to the proposed development on the Greenbriar Project Site (under future conditions) would be the rice lands across W. Elkhorn Blvd, a planned six lane road, and the Lone Tree Canal Reserve. The Project includes avoidance and minimization measures to reduce impacts to the Lone Tree Canal Reserve including construction of a “snake wall” to ensure that GGS do not enter the development area, and to prevent humans and pets from entering the reserve. Although development at the Greenbriar Project Site could reduce habitat

quality on adjacent lands, these potential impacts would be negligible due to the existing disturbances adjacent to the site.

The habitat quality of adjacent agricultural lands could be indirectly altered by changes in crop types or the cessation of agriculture. Land cover on adjacent land north of the Greenbriar Project Site could possibly change because of conflicts between rice cultivation and the residential development on the site. Aerial application of pesticides and herbicides probably is not feasible immediately adjacent to residential development, which could cause part, or all, of the adjacent parcel to be removed from rice cultivation. The North Natomas Community Plan has reduced these conflicts through a 350-foot wide buffer of open space along roads separating developed and agricultural land uses (EDAW 2005). Similarly, the MAP includes a 250-foot wide buffer along its northern and eastern borders in which developed land uses are restricted to open space, warehouses, or parking areas (USFWS 2001). The development at the Greenbriar Project Site would not contain an open space buffer along its borders between its development and adjacent land uses, and the only buffer would be W. Elkhorn Boulevard, which would be an approximately 175-foot-wide, six lane road. The Greenbriar Development Project would include notification of all prospective residents and tenants within 500 feet of existing agricultural uses describing the types of agricultural operations that could occur in proximity to their homes or businesses. Nonetheless, agricultural-residential conflicts could occur.

Under a worst-case scenario, if all agricultural use of land within 350 feet of the Greenbriar Project Site's residential development were to cease, roughly 23 acres of active agricultural land (currently in rice production) would become idle land or go into some other use. However, similar constraints to agricultural uses on the parcel would likely occur as MAP is developed. In addition, crop selection in the basin is highly variable as shown above, and the status of the rice crop on the parcel to the north could be changed with or without the Greenbriar Development Project. If the parcel to the north were to become idle or otherwise fallow, it would provide foraging habitat and upland refugia and would not have an overall detrimental effect on Covered Species.

In addition to these localized effects, development can also degrade wildlife habitat through landscape-scale effects on the distribution of habitat. These potential effects are described in sections of this report addressing effects on connectivity (Chapter 5.5), the habitat value of existing TNBC reserves (Chapter 5.7), and on Covered Species (Chapter 6).

5.4.2. Habitat Quality at Proposed Reserves

Habitat quality would be increased through preservation and management at the proposed on-site Lone Tree Canal Reserve totaling 28.3 acres net and at the proposed Off-Site Reserves, which

total approximately 528.5 acres and include the Spangler Reserve (235.4 acres), the Moody Reserve (74±acres), and the North Nestor Reserve (219.1 acres). Habitat quality would increase at these sites because:

- Habitat would be preserved in perpetuity at all reserve sites;
- Habitat would be managed for the benefit of numerous NBHCP Covered Species at all reserve sites;
- Habitat would be enhanced at the Lone Tree Canal Reserve by recontouring the banks to enhance foraging habitat and cover for GGS and reduce maintenance disturbance, and establishment of native grassland in the upland areas;
- Managed marsh and upland habitat (annual grassland with seasonal wetlands) would be created at the Spangler Reserve;
- Habitat disturbance caused by farming or canal maintenance would be limited to authorized activities at all reserve sites and would be reduced at the Lone Tree Canal Reserve; and
- Habitat would be relatively free of human intrusion at the Lone Tree Canal Reserve (USFWS 2003) and the Off-Site Reserves.

5.4.2.1. ON-SITE RESERVE

As part of the proposed development at the Greenbriar Project Site, a 250-foot-wide corridor will be preserved along Lone Tree Canal (Lone Tree Canal Reserve) that includes the canal and approximately 200 feet of adjacent uplands along the east side of the canal for a total of 28.3 acres net. This habitat shall be managed in perpetuity as high-quality habitat for GGS. The proposed design of the Lone Tree Canal Reserve is summarized below.

Uplands within the Lone Tree Canal Reserve will be converted to, and managed as, perennial grassland habitat, which will also provide habitat for Swainson's hawk. Additional aquatic habitat for GGS shall be created along the east bank of Lone Tree Canal by recontouring the bank from the existing roughly 1:1 slope to a 3:1 slope, which will provide additional habitat for freshwater marsh plants. A masonry and metal fencing barrier (aka "snake wall") shall be installed between the Lone Tree Canal Reserve and the adjacent Greenbriar development, and at the boundary of the Lone Tree Canal Reserve along W. Elkhorn Boulevard and at the Meister Way and Residential Street 3 crossings of the Lone Tree Canal Reserve, to ensure that GGS do not enter the development area, and to prevent humans and pets from entering the reserve.

5.4.2.2. OFF-SITE RESERVES

The Project Applicant has obtained three parcels that will be established as Off-Site Reserves. These three parcels are described below.

Spangler Reserve

A preliminary assessment of the suitability of the Spangler Reserve as an Off-Site Reserve was included in the *Draft Conceptual Habitat Restoration Design* prepared by Wildlands, Inc. (Wildlands 2005). Based on this assessment, the Spangler Reserve is suitable for management as a reserve due to its size, connectivity to the Natomas Basin's network of canals and drains, and its proximity to existing NBHCP reserves.

The Spangler Reserve, which is approximately 235.4 acres, shall be protected as GGS habitat and will also provide habitat for Swainson's hawk and other NBHCP Covered Species. The Spangler Reserve is currently in rice production, and consists of rice fields with a supporting network of agricultural drainages as well as upland berms along the perimeter of the rice fields and drainages. The northwestern portion of the Spangler Reserve would remain in active rice production. However, managed marsh complex and an upland complex with seasonal wetlands would be created on approximately 195.1 acres of the site consisting of 142 acres of managed marsh (an estimated 128.7 acres of managed marsh, 8.19 acres of ruderal, and 5.19 acres of canal) and 53.1 acres of annual grassland with constructed wetlands. The Spangler Reserve will provide 235.4 acres of habitat for the GGS, and will also provide foraging habitat for Swainson's hawk (in the annual grassland/seasonal wetland complex, in upland components of the managed marsh and upland ruderal habitats, in rice fields when they are fallow, and in portions of the managed marsh that are dewatered for vegetation maintenance) and other Covered Species (e.g., western pond turtle).

Moody Reserve

The 74±acre Moody Reserve will be protected primarily as Swainson's hawk foraging habitat and will also provide habitat for GGS and other NBHCP Covered Species. The Moody Reserve provides high quality foraging habitat for Swainson's hawk in alfalfa fields and associated grassland and ruderal areas and adjacent nesting habitat in oak woodland/riparian areas. The Moody Reserve contains elderberry shrubs that provide potential habitat for the VELB. The site also provides potential upland habitat for western pond turtle and foraging habitat for the majority of the avian NBHCP Covered Species.

North Nestor Reserve

The North Nestor Reserve, which is approximately 219.1 acres, shall be protected as GGS habitat and will also provide habitat for Swainson's hawk (in rice fields when they are fallow and in ruderal habitats) and other NBHCP Covered Species. The North Nestor Reserve is currently in rice production, and consists of rice fields with a supporting network of agricultural drainages as well as upland berms along the perimeter of the rice fields and drainages. The North Nestor Reserve will be managed in rice and will maintain biological connectivity between existing TNBC reserves to the north and south. A 13.6-acre easement area has been defined along the western boundary of the North Nestor Reserve, which could be managed separately by TNBC to further the NBHCP goal of establishing a habitat reserve of 2,500 acres in the Natomas Basin.

The effects of changes in the quality of habitat provided by enhanced and preserved land, are further described in the sections of this report that address potential effects on each Covered Species (see Chapter 6).

5.4.3. Habitat Quality for Swainson's Hawk Foraging

The effects of the proposed Greenbriar Development Project on the quality of Swainson's hawk foraging habitat was evaluated through two analyses: acres of foraging habitat in low-, moderate- and high-quality categories, and availability of habitat in terms of the total acres of foraging habitat available for Swainson's hawks per month. These analyses were conducted as in the NBHCP. Methods for these analyses are described in detail in Chapter 4.2.4 *Quality of Habitat in the Natomas Basin*.

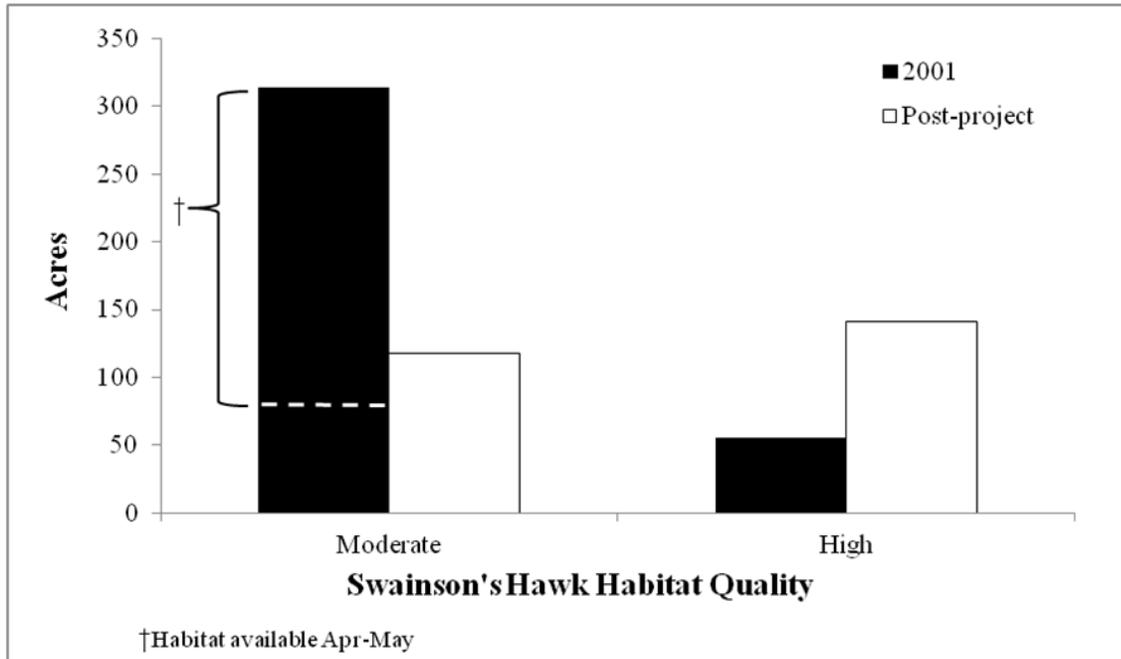
The Greenbriar Development Project would result in a net loss of moderate-quality Swainson's hawk foraging habitat acreage in the Basin but would result in a net gain of high-quality Swainson's hawk foraging habitat (**Figure 14** [Graph A]). The net gain of high-quality habitat would come from the creation of 84.7 acres of fallow rice and managed marsh habitat in the Spangler and North Nestor Reserves. The Moody Reserve would continue to provide 55.5 acres of high-quality alfalfa habitat, as it has done since 2001. Losses in moderate-quality habitat would result from the removal of 277.1 acres of wheat, pasture, and ruderal habitats from the Greenbriar Project Site and minor losses of 2.2 acres of ruderal habitat in the Spangler Reserve. These losses would be offset by creation of 26.5 acres of moderate-quality grassland habitat in the Lone Tree Canal Reserve and 95.7 acres of moderate-quality grassland and upland marsh component habitats in the Spangler Reserve. Thus the project overall would result in a net loss of 157.1 acres of moderate-quality Swainson's hawk foraging habitat based on 2001 conditions. It is worth noting that of the 277.1 acres of moderate-quality foraging habitat lost at the Greenbriar Project Site, 234.1 acres are grass hay that is suitable for Swainson's hawk foraging

only during harvest, which is assumed to take place between mid-April and mid-May in an average year. Considering only habitat available throughout the entire Swainson's hawk breeding season, the proposed Greenbriar Development Project would result in a net gain of 38.0 acres of moderate-quality Swainson's hawk foraging habitat.

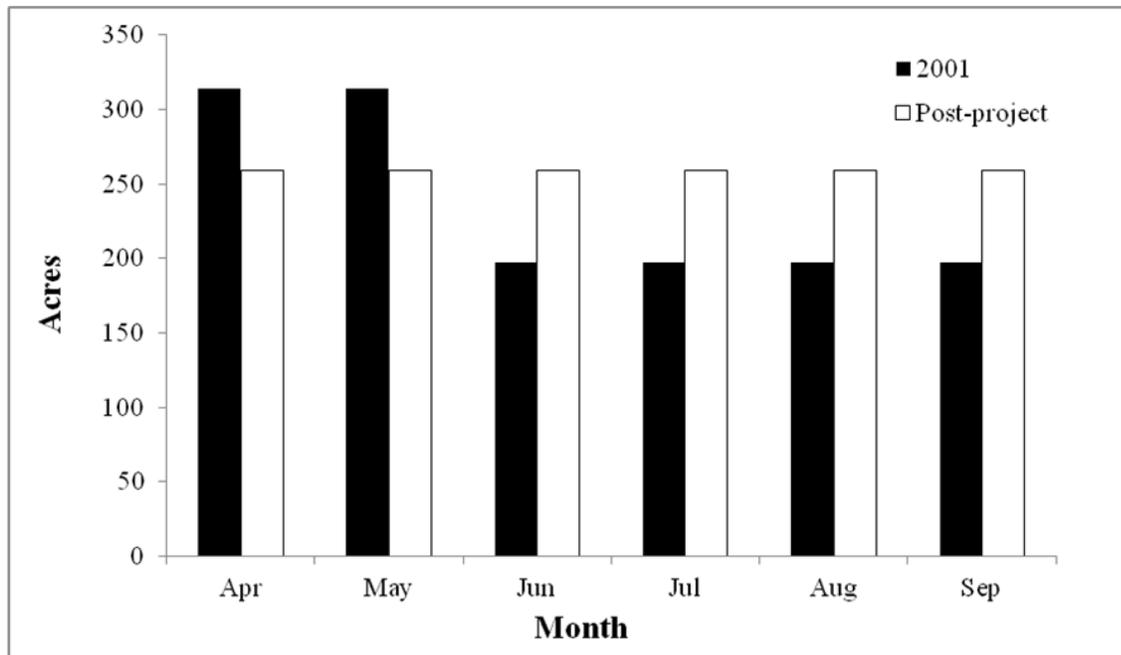
Because all of the habitats proposed for creation and/or preservation as part of the Greenbriar Development Project would be available throughout the Swainson's hawk breeding season (fallow rice, grassland, ruderal), the Greenbriar Development Project would result in an increase in available Swainson's hawk foraging habitat in the Basin over 2001 baseline conditions except in the months of April and May (**Figure 14** [Graph B]). The Lone Tree Canal, Spangler, Moody, and North Nestor Reserves would provide a total of 268 acres of Swainson's hawk foraging habitat in all months from April to September. In their 2001 baseline condition, these same sites plus the Greenbriar Project Site provided a total of 314.5 acres of Swainson's hawk foraging habitat in April and May, but only 197.5 acres of foraging habitat in June through September. This seasonal change in habitat availability is attributed to the fact that the 234.1 acres of grass hay on the Greenbriar Project Site is available to Swainson's hawks only during harvest (between mid-April and mid-May). To determine the availability of foraging habitat for Swainson's hawk in this current analysis, the 234.1 acres of grass hay on the Greenbriar Project Site were divided evenly between the months of April and May (as described in Chapter 4.2.4 *Quality of Habitat in the Natomas Basin*), resulting in a calculation of 117 acres less foraging habitat available in each month after May. In summary, the net effect of the Greenbriar Development Project based on this analysis would be an overall loss of 55.6 acres of moderate-quality Swainson's hawk foraging habitat in the Basin in the months of April and May, and a net gain of 61.5 acres of mostly high-quality habitat in the Basin in the months of June through September.

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Figure 14. Quality and Availability of Swainson's Hawk Foraging Habitat at the Greenbriar Development Project Sites



A) Total Acres of Swainson's hawk foraging habitat at the Greenbriar Project sites; quality assessed as in CH2MHill (2003).



B) Availability of Swainson's hawk foraging habitat by month at the Greenbriar Project sites; habitat availability assessed as in CH2MHill (2003).

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5.5. Connectivity of Habitat in the Natomas Basin

The proposed Greenbriar Development Project could cause effects on connectivity of habitats in the Natomas Basin by developing the Greenbriar Project Site, however, these effects would be offset by avoidance and minimization measures as well as preservation of higher quality habitat in the Basin. The Greenbriar Development Project includes measures to reduce human disturbance and predation effects resulting from the Greenbriar Development Project, and to create and enhance habitat along Lone Tree Canal, which would beneficially affect connectivity of canal and marsh habitats. Further, the Greenbriar Development Project would ensure the long-term conservation of a corridor along a segment of Lone Tree canal (Lone Tree Canal Reserve). This canal is important for maintaining connectivity of canal habitats between the southern and northern Natomas Basin, and the project provides an opportunity to preserve a corridor along the canal in perpetuity.

In addition, the proposed reserves would increase connectivity of preserved habitats for Covered Species. The Spangler Reserve and the North Nestor Reserve provide preserved rice lands between existing TNBC reserves composed of rice and managed marsh and are also surrounded by rice agriculture in private ownership. The North Nestor Reserve will be managed in rice and will maintain biological connectivity between existing TNBC reserves to the north and south. A 13.6-acre easement area has been defined along the western boundary of the North Nestor Reserve, which could be managed separately by TNBC to further the NBHCP goal of establishing a habitat reserve of 2,500 acres in the Natomas Basin. The Moody Reserve preserves high quality foraging habitat for Swainson's hawk and other covered bird species and is within one-mile of the Sacramento River, within the Swainson's Hawk Zone, and known nest sites for Swainson's hawk.

Overall, the Greenbriar Development Project is not expected to significantly reduce connectivity of habitat for covered bird species. The following sections provide a detailed description of the proposed Greenbriar Development Project's effects on connectivity at the regional and local levels, and along Lone Tree Canal. This section also evaluates the effect of the Greenbriar Development Project on the implementation of the connectivity measures in the NBHCP's conservation strategy.

5.5.1. Overview of Existing and Future Conditions

In 2001 and currently, the proposed Greenbriar Project Site provides agricultural and canal habitats, as do some adjacent lands. However, because the site is bordered to the south and east by I-5 and SR 99/70, respectively, habitats for less mobile animals, or those highly sensitive to human disturbance, are at least partially isolated from similar habitats to the east or south. Birds,

including avian Covered Species, can fly over these highways. The Greenbriar Project Site's canal habitats are connected to similar habitats to the south by a culvert under I-5 through which Lone Tree Canal flows, and the site's canal habitats are also connected to habitats north of the site by Lone Tree Canal and a culvert in the northeastern corner of the Greenbriar Project Site. These culverts may currently limit animal movement from the southern to central Natomas Basin across the site. Nonetheless, Lone Tree Canal currently provides a movement corridor and habitat for GGS. In recent years, flows in the canal have not been optimal for GGS, although the MAP HCP provides assurances that at least some water will be present in this drainage canal in the future (Thomas Reid Associates 2001). The majority of the other canals within and along the southern and eastern borders of the Greenbriar Project Site do not carry water and do not currently provide habitat for GGS. Lone Tree Canal is the primary remaining corridor for movement of GGS between the southern and central portions of the Natomas Basin (C. Aubry, pers. comm., Eric Hansen, pers. comm.). Loss of this corridor could isolate the southern portion of the Natomas Basin, dividing the current GGS population into two smaller populations, which would substantially reduce the likelihood of GGS persisting in the Natomas Basin.

The Greenbriar Project site is located within a corridor that currently provides some connectivity between the southern and central Natomas Basin. The Sacramento International Airport, MAP and City of Sacramento largely separate the southern and central Basin. Under future conditions, assuming buildout of the NBHCP and the Greenbriar Project, a western corridor, between the airport and the Sacramento River, would remain 0.4–1.6 miles wide. To the east of the Sacramento International Airport and MAP, the Lone Tree Canal Reserve, preserved as part of the Greenbriar Development Project, would remain approximately 250 feet wide running north-south along the length of the Greenbriar Project Site providing a corridor between the MAP and the City of Sacramento. The Lone Tree Canal Reserve would be an important waterway, and possibly the only waterway, connecting habitats in the southern and central Natomas basin (Jones & Stokes 2005; Eric Hansen, pers. comm.).

Under current conditions, the Spangler Reserve is surrounded by airport lands and privately owned rice lands. Under the future condition, the proposed Spangler Reserve would be outside of, but adjacent to, permit areas where development has been authorized. The northern border of the proposed Spangler Reserve would be immediately adjacent to development in the Sutter County permit area. Under current conditions, the North Nestor Reserve is bordered on the north and south by TNBC reserves and on the east and west by privately owned rice lands. It is unlikely that development would occur in the vicinity of the North Nestor Reserve because it is outside of the Sutter County Permit Area. The western extent of the Sutter County permit area terminates approximately 0.9 mile east of the North Nestor Reserve on the opposite side of SR 99/70. The Moody Reserve is surrounded currently by airport lands, privately owned

agricultural lands (non-rice), SAFCA mitigation land, and the Teal Bend Golf Course. The future conditions surrounding the Moody Reserve are unlikely to change because the privately owned agricultural lands are adjacent to the airport and unsuitable for development.

5.5.2. Connectivity of Aquatic, Wetland, and Rice Habitats within the Natomas Basin

Within the Natomas Basin, aquatic, wetland, and rice habitats are connected by a series of irrigation and drainage canals. Most of these waterways are suitable for use and movement of a variety of animals, including GGS and western pond turtle, and thus provide movement corridors for these animals between wetland and rice habitats. In the Natomas Basin, irrigation water is provided by NCMWC, a private water company. NCMWC diverts water from five locations along the Sacramento River and the Natomas Cross Canal, and distributes this water throughout the Basin through a series of canals and pump stations.

Drainage and flood control is provided by RD 1000, a public agency. RD 1000 operates the primary drainage canals within the Natomas Basin and is responsible for conveying and pumping nonurban stormwater runoff from the Basin. Runoff from agricultural lands within the Natomas Basin flows into numerous local drainage ditches that ultimately flow into the primary RD 1000 canals. RD 1000's primary system of interior drains includes the following:

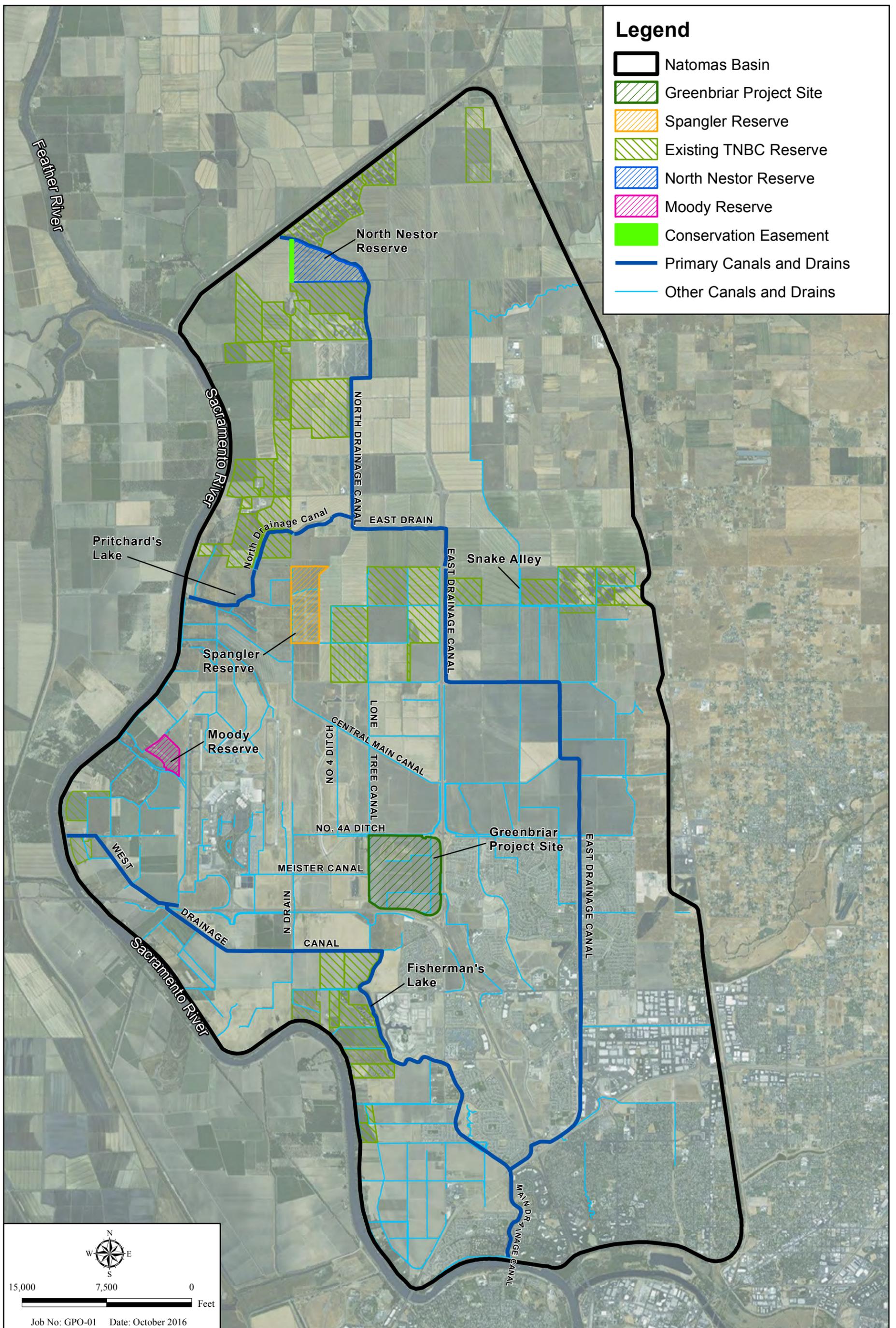
- The East Drainage Canal conveys drainage water from the northern and eastern Natomas Basin to its confluence with the Main Drainage Canal northwest of the Interstate 80 (I-80)/I-5 interchange. At its closest point, the East Drainage Canal is approximately 1.8 miles east of the Greenbriar Project Site.
- The West Drainage Canal conveys drainage water from the western Natomas Basin northwest of Sacramento International Airport to its confluence with the Main Drainage Canal. Fisherman's Lake, a natural slough, is a portion of the West Drainage Canal. The West Drainage Canal is approximately 3,000 feet (0.6 mile) south of the Greenbriar Project Site at its closest point across I-5, just before the drainage canal turns south toward Fisherman's Lake.
- The Main Drainage Canal conveys the combined flows of the East and West Drainage Canals from their confluence northwest of the I-80/I-5 interchange through South Natomas west of I-80. Drainage water from the Main Drainage Canal is pumped into the Sacramento River approximately 5 land miles to the south (downstream) of the Greenbriar Project Site.

- The North Drainage Canal is an interior canal that conveys drainage water from the Sutter County portion of the Natomas Basin northward, where it is pumped into the Natomas Cross Canal.
- The Natomas Cross Canal conveys drainage water from central portions of Sutter County westward to the Sacramento River. The Natomas Cross Canal connects with the Sacramento River approximately 7.1 miles north of the Greenbriar Project Site.
- The Natomas East Main Drainage Canal (NEMDC) conveys drainage water from Dry Creek, Arcade Creek, and a large portion of the Natomas area north of the confluence with Dry Creek. The NEMDC, also referred to as Steelhead Creek, outfalls to the Sacramento River at the northern edge of Discovery Park and near the confluence of the Sacramento River and American River approximately 5.2 miles south of the Greenbriar Project Site.

These primary drainage canals are significant corridors of aquatic habitat to which the entire drainage network is connected. **Figure 15** depicts this primary drainage system.

Although the canal network hydrologically connects aquatic and wetland habitats throughout the Natomas Basin, roads impede or block the movement of many animals through aquatic or wetland habitats. Even for animals that could attempt crossing a road surface, such as turtles and snakes, major roads are effectively impassable (Forman et al. 2003, Dodd et al. 2004, Aresco 2005). For major roads, passage is restricted to the culverts through which the canal waters flow. Culverts are themselves obstacles to animal movement; although a wide variety of animals will move through culverts, for most species, the frequency of these movements is low (Yanes 1995, Rodriguez et al. 1996, Clevenger et al. 2001, Forman et al. 2003, Ng et al. 2004). In general, the use of culverts decreases with their length and with the presence of fencing or debris pits (Yanes 1995, Rodriguez et al. 1996, Clevenger et al. 2001, Forman et al. 2003, Ng et al. 2004).

Nonetheless, regular animal crossings (including by other species of garter snake) have been documented through even long culverts that are comparable to those under I-5 (see Forman et al. 2003, Ng et al. 2004, Dodd et al. 2004). Conversely, the use of culverts increases with presence of adjacent habitat or cover, roadside fencing that “funnels” animals towards culverts, and with increased visibility through the culvert (Yanes 1995, Rodriguez et al. 1996, Clevenger et al. 2001, Forman et al. 2003, Ng et al. 2004).



Legend

- Natomas Basin
- Greenbriar Project Site
- Spangler Reserve
- Existing TNBC Reserve
- North Nestor Reserve
- Moody Reserve
- Conservation Easement
- Primary Canals and Drains
- Other Canals and Drains

Job No: GPO-01 Date: October 2016

Canals and Drainages of Natomas Basin

GREENBRIAR DEVELOPMENT PROJECT
ANALYSIS OF EFFECTS ON THE NATOMAS BASIN HCP

Figure 15

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Within the Natomas Basin, I-5 and SR 99/70 are major barriers to animal movement that are crossed by only a few long culverts. Thus, habitat south of I-5 (i.e., in the southern Natomas Basin), such as at Fisherman's Lake, is partially isolated from habitat north of I-5. Similarly, habitats west of SR 99/70 (i.e., in the northwestern Natomas Basin), such as at Pritchard Lake, are partially isolated from habitat east of SR 99/70 (i.e., in the northeastern Natomas Basin), such as Snake Alley.

In 2001 and presently, habitats east and west of SR 99/70 are linked by culverts on the V Drain, R Drain, H1 Drain, and Central Main Canal; each of these canals in turn connects to a series of drains and ditches. In 2001, aquatic habitats north and south of I-5 were linked through culverts by the West Drainage Canal, the N Drain (parallel to Powerline Road), and the Lone Tree Canal. The West Drainage Canal passes north under I-5 to the west of the airport. The N Drain and Lone Tree Canal pass north under I-5 to the west and east of MAP where each is connected to a series of ditches, drains, and canals (including Meister Canal) throughout the northwestern portion of the Basin, and to the culverts under SR 99/70 to the northeastern portion of the Basin. After it passes under I-5, the N Drain, via Powerline Ditch, also connects GGS habitats south of I-5 to those in the northwestern portion of the Basin.

However, as the development authorized by the MAP HCP and the NBHCP has occurred, and will occur, the system of canals connected to the culverts under I-5 has been changing and will continue to change. Except for the West Drainage Canal, all corridors connecting GGS habitats in the southern Natomas Basin to habitats north of I-5 pass through or drain the MAP, and thus they all will be altered under the future condition of the Natomas Basin permitted by the NBHCP. Development authorized by the MAP HCP and NBHCP will eliminate the Powerline Ditch, No. 4 and 4a ditches, and Meister Canal, eliminate water sources to the Airport East Ditch, and replace the open Central Main Canal with an underground pipe. It also will affect habitat along Lone Tree Canal by reducing the area of land draining into Lone Tree Canal, placing urban development along one side of the canal, and widening W. Elkhorn Boulevard to six lanes (Thomas Reid Associates 2001, USFWS 2002). The length of the existing 115-foot-long culvert under W. Elkhorn Boulevard would not be increased with the widened roadway, but the diameter will increase from 2.5 feet to 4.5 feet.

Thus, regardless of whether the Greenbriar Project Site is developed, under the future condition permitted by the NBHCP GGS habitat south of I-5 would be largely isolated from habitat north of I-5. Two possible corridors would remain: the West Drainage Canal and Lone Tree Canal. Both corridors could connect important habitats in the southern Natomas Basin (such as Fisherman's Lake which is along the West Drainage Canal) with those in the northwestern and northeastern portions of the Basin. Along both of these potential corridors, there will be

obstacles to GGS movement. Both waterways will pass under I-5 through long culverts (over 300 feet long). The West Drainage Canal currently has limited connection to other waterways north of I-5; in the future, it will probably remain isolated because zones of canals and drainage ditches that are currently not suitable habitat for GGS will likely continue to separate it from habitats north and east of the airport. Lone Tree Canal will pass through a culvert under W. Elkhorn Boulevard (115 feet long). Development of the MAP will also affect water flow within Lone Tree Canal, however, the MAP POA is required by the MAP HCP to maintain a minimum of 12 inches of water in the canal during the snake's active season (Thomas Reid Associates 2001).

Movement of GGS along these north-south corridors may happen rarely but is nonetheless important. This movement would allow genetic interchange between the Basin's northern and southern subpopulations of GGS, and it would allow GGS to re-establish in the southern Natomas Basin if that smaller subpopulation were to become extirpated (e.g., due to environmental fluctuations or demographic stochasticity). Thus, the opportunity for GGS to move along Lone Tree Canal will be important for the long-term viability of the GGS population in the Natomas Basin.

Under the future condition permitted by the NBHCP at the Greenbriar Project Site, water in Lone Tree Canal would flow south under W. Elkhorn Boulevard through a 115-foot-long, 2.5-foot-diameter culvert. It would then flow in a waterway 12 feet wide at the bottom and about 6 feet deep. Along this waterway, set back 25 feet from its western bank will be a 3-foot-high wall, on the other side of which will be Lone Tree Road and commercial and industrial development. Along the eastern bank would be agricultural, ruderal, or natural vegetation. This vegetation would extend for nearly a mile and if cultivated it would include waterways that irrigate and drain the area. At the southern end of the site, water from the MAP would enter the canal, and together these waters would flow into three 8-foot by 5-foot box culverts and two 6.5-foot diameter pipes, and pass under I-5.

For this section of Lone Tree Canal between the I-5 and W. Elkhorn Boulevard culverts, the Greenbriar Development Project would alter these future conditions. Water would flow through a 54-inch diameter culvert under W. Elkhorn Boulevard; there would still be a low wall and development along the western bank, and water would still enter from the MAP and then flow under I-5 through three 8-foot by 5-foot box culverts and two 6.5-foot diameter pipes. However, near the center of this section of Lone Tree Canal, there would be an additional road crossing where Meister Way and the Green Line to the Airport light rail would cross the canal and an additional road crossing where Residential Street 3 would cross the canal; both crossings will include placement of 54-inch culverts into Lone Tree Canal. Along the eastern bank would be a

strip of tules and other emergent vegetation. This strip of freshwater marsh and open water would be relatively narrow; grassland would be on its far side, and within 250 feet of the water flowing in the canal would be a barrier wall and fence separating the corridor along the canal from residential development to the east. There would also be fencing and a wall along Meister Way and Residential Street 3 where it crossed the corridor of managed vegetation along Lone Tree Canal.

The Project Applicant will implement habitat-enhancing features by contouring the east bank of the canal to create a 3:1 slope, hydro-seeding the slope with native vegetation, allowing emergent vegetation to establish along the toe of the new slope, installing a snake wall and protective fencing, and by establishing the reserve under a conservation easement. The Project Applicant will dedicate the Lone Tree Canal Reserve by granting a conservation easement, including the structure for funding the site, to a USFWS-approved third party Plan Operator. The structure for funding the sites will be calculated by estimating enhancement, management, administration, and monitoring costs. Prior to signing the dedication instrument, the Project Applicant and/or the USFWS-approved Plan Operator will submit the instrument to USFWS and CDFW for review and concurrence. Concurrence will be required before the transfer is final.

Flows within the canal would also be maintained. MAP and the Greenbriar Development Project would reduce the area draining into Lone Tree Canal. However, the MAP HCP contains assurances that sufficient water will be maintained in Lone Tree Canal to provide aquatic habitat (Thomas Reid Associates 2001). In addition, as part of the Greenbriar Development Project, an 8-inch-diameter drain pipe will be installed to drain to Lone Tree Canal near the northern project boundary, from detention basins proposed for construction on the Greenbriar Project Site. The purpose of the drain pipe is to provide supplemental flows to Lone Tree Canal in the event that additional water is required to maintain water sufficient to support GGS during its active season.

5.5.3. Potential Consequences of the Proposed Greenbriar Development Project for Future Connectivity

Development of the Greenbriar Development Project, including the creation, enhancement and preservation of habitat at the proposed reserves, could affect the connectivity of habitats at local and regional scales. At a local scale, both development and habitat enhancement/restoration alter the spatial distribution of habitat. Development reduces connectivity and the quantity of habitat accessible to individuals on nearby lands, increases the distance individuals must travel to meet their needs for food and shelter, and increases the risks individuals are exposed to during these movements. Conversely, the enhancement and creation of habitat can increase connectivity, by creating larger areas of contiguous habitat, increasing the food and shelter provided by habitat, or

by facilitating movement of individuals. The preservation and active management for habitat values also can maintain connectivity.

5.5.3.1. POTENTIAL EFFECTS ON CONNECTIVITY AT A LOCAL SCALE

The Greenbriar Development Project could affect connectivity of some habitats at a local scale, although habitat connectivity for most species using the site is currently significantly reduced by the surrounding roadways (I-5, SR 99/70, W. Elkhorn Boulevard). At this scale, development of the Greenbriar Project Site could reduce the quantity and contiguity of habitat available to individuals of some species using this site and adjacent lands. These individuals could lose part or all of the habitat in their home ranges or territories, and the remaining habitat could be split into separate pieces (i.e., fragments) that would be isolated by development, or require increased risk and energetic cost to access. This fragmentation of habitat would occur along the northern and southern borders of the Greenbriar Project Site where lands were not identified for development under the future condition resulting from the NBHCP, and it would also occur along the western border for those species still able to use the remaining corridor of land as habitat. Habitat fragmentation attributable to the Greenbriar Development Project could affect all Covered Species, except those associated with vernal pools. For example, both western burrowing owl and loggerhead shrike currently use the Greenbriar Project Site; after development of the Greenbriar Project Site, patches of habitat for these species would be smaller in size and separated by greater widths of non-habitat.

Conversely, the connectivity of habitats would be increased by the creation, enhancement, and preservation of habitat at the proposed Spangler Reserve, Moody Reserve, and North Nestor Reserve. Based on the evaluation contained in this Effects Analysis, overall, the proposed Greenbriar Development Project would not adversely affect local habitat connectivity.

5.5.3.2. POTENTIAL EFFECTS ON CONNECTIVITY AT A REGIONAL SCALE

At a regional scale, development can create barriers that isolate areas of otherwise suitable habitat or can subdivide a population into two smaller, and thus less viable, populations. Conversely, habitat creation and enhancement as a result of a conservation strategy associated with development can reduce or eliminate barriers, and can increase connectivity at a regional scale.

Development at the Greenbriar Project Site would convert this site to urban land cover except for a 250-foot-wide zone that would remain along the Lone Tree Canal. The remaining habitat along Lone Tree Canal would be crossed by Meister Way/Green Line to the Airport light rail and Residential Street 3, which would be new roads that connect the development on the Greenbriar Project Site to Lone Tree Road.

If connectivity of habitats was reduced at the Greenbriar Project Site, relatively few species would be affected. First, most species in the Natomas Basin are abundant, widely distributed and highly mobile (species observed during monitoring for TNBC support this characterization [Jones & Stokes 2005]). This conclusion is largely a consequence of the Natomas Basin being primarily an agricultural (and developed) landscape that is frequently disturbed. Secondly, I-5 (which is along the entire southern border of the site), and adjacent development to the east and west, already reduces use of the site as a movement corridor by terrestrial animals that are less mobile or are highly sensitive to human disturbance.

The preservation and enhancement of Lone Tree Canal will maintain a north/south corridor that will provide connectivity for GGS and other aquatic species. At a regional scale, the Greenbriar Conservation Strategy also could improve connectivity of wetland and rice habitats in the northern Natomas Basin through its creation and preservation of habitat at the proposed Spangler Reserve and North Nestor Reserve and upland habitats at the Moody Reserve. These sites are connected to the regional system of waterways; thus, the restoration, enhancement and preservation of habitat at these sites could facilitate the movement of Covered Species along these waterways.

The potential effects on connectivity of GGS habitat are further evaluated in the following section.

5.5.3.3. POTENTIAL EFFECTS ON CONNECTIVITY OF GGS HABITAT AT THE GREENBRIAR PROJECT SITE

The effects analysis for the connectivity of GGS habitats is based on several well-supported assumptions including:

- GGS currently use Lone Tree Canal at the Greenbriar Project Site and are likely to continue to do so under the future condition resulting from the NBHCP;
- Occasionally GGS cross through the culverts under I-5;
- The frequency of crossings under I-5 is affected by the extent that GGS use the adjacent sections of Lone Tree Canal;
- The level of GGS use is affected by the habitat features provided by Lone Tree Canal and immediately adjacent land (i.e., movement along the canal is not independent of habitat availability and condition along the canal); and
- Mitigation for other projects affecting Lone Tree Canal south of I-5 and north of W. Elkhorn Boulevard would sustain GGS habitat along those segments of Lone Tree Canal.

In the absence of effective conservation measures to maintain or improve connectivity, the proposed Greenbriar Development Project could substantially affect the use of Lone Tree Canal (and of the adjacent Greenbriar Project Site) by GGS. The Greenbriar Development Project would:

- Eliminate several dry canals and some natural vegetation within the Greenbriar Project Site;
- Create additional road crossings of Lone Tree Canal at Meister Way/Green Line to the Airport light rail and Residential Street 3;
- Create residential development within 250 feet of Lone Tree Canal; and
- Reduce the acreage draining into Lone Tree Canal (potentially reducing flow in the canal).

In the absence of the proposed Greenbriar Conservation Strategy, these changes could affect GGS use of Lone Tree Canal. Developing dry canals and other habitats outside of the hay fields at the Greenbriar Project Site would directly eliminate marginal GGS habitat that may provide prey, cover, basking sites, and refugia. Additional obstacles, increased predation, and increased human activities all could degrade the quality of remaining habitat, increase mortality and reduce GGS use of this segment of Lone Tree Canal.

To offset the effects resulting from these changes and to retain GGS habitats and the movement corridor along Lone Tree Canal, the Greenbriar Conservation Strategy would implement the following measures:

- To ensure that the Greenbriar Development Project does not diminish habitat connectivity for GGS between the southwest and northwest zones identified in the NBHCP, approximately 28.3 acres along Lone Tree Canal shall be protected and managed as GGS habitat. This on-site habitat preservation shall protect an approximately 250-foot wide corridor of GGS habitat that includes Lone Tree Canal and approximately 200-225 feet of adjacent uplands. Uplands within the linear open space/buffer area shall be managed as perennial grassland as described below. Additional aquatic habitat for GGS shall be created along the east bank of Lone Tree Canal by recontouring the bank to provide additional habitat for freshwater marsh plants. The habitat shall be managed in perpetuity as high-quality habitat for GGS.
- To ensure that the Greenbriar Development Project does not diminish GGS movement along Lone Tree Canal, the proposed road crossings of Lone Tree Canal

- (Meister Way/Green Line to the Airport light rail and Residential Street 3) shall be designed to minimize obstacles to GGS movement to the extent feasible.
- Uplands within the Lone Tree Canal linear open space/buffer area shall be created and managed to provide GGS habitat during the winter dormant period. Upland habitat with the linear open space/buffer areas shall be converted to native perennial grassland and managed, in perpetuity, as perennial grassland habitat.
 - Aquatic habitat shall be maintained throughout the GGS active season in Lone Tree Canal, in perpetuity. This is the legal responsibility and obligation of the MAP POA. The MAP HCP includes provisions under changed circumstances (Thomas Reid Associates 2001) to ensure that water levels are maintained at or above 12 inches of depth. If water is not provided to Lone Tree Canal by the MAP to meet the habitat requirements of GGS, as required by the MAP HCP, and USFWS exhausts its enforcement responsibilities, the Greenbriar Development Project shall assume the responsibility of providing suitable water to support GGS aquatic habitat throughout the section of Lone Tree Canal in the Lone Tree Canal Reserve. This responsibility was a mitigation measure in the City of Sacramento's Draft EIR for the Greenbriar Development Project (EDAW 2006). However, as stated in the EIR, the Project Applicant shall only assume this responsibility if it has been sufficiently demonstrated to the City of Sacramento that USFWS has exhausted all reasonable means to compel MAP to comply with the relevant conditions of the MAP ITP. Specific requirements related to ensuring suitable aquatic habitat in Lone Tree Canal is present, in perpetuity, throughout the GGS active season, shall be developed through consultation with CDFW and USFWS. An 8-inch-diameter drain pipe will be installed near the northern boundary of the Greenbriar Project Site to provide a source for supplemental flows to Lone Tree Canal from detention basins proposed for construction on the site. The drain pipe will include a slide gate that will be physically operated as needed. The detention basin water supply will be stormwater that could be supplemented by groundwater.
 - A masonry and metal fencing barrier shall be installed between the Lone Tree Canal Reserve and the adjacent development on the Greenbriar Project Site, and at the boundary of the Lone Tree Canal Reserve along W. Elkhorn Boulevard and at the Meister Way/Green Line to the Airport light rail and Residential Street 3 crossings of the Lone Tree Canal Reserve, to ensure that GGS do not enter the development area, and to prevent humans and pets from entering the reserve. The design of the barrier will be subject to USFWS review and approval. The barrier shall be maintained on the reserve side by a USFWS-approved Plan Operator to ensure that vegetation or

- debris does not accumulate near the barrier and provide opportunities for wildlife and pets to climb over the barrier. On the development side, adjacent to the barrier, CC&Rs shall prohibit accumulation of vegetation or debris adjacent to the barrier.
- Specific requirements associated with the barrier include:
 - Chain link fencing will be placed at either end of the corridor and at Meister Way/Green Line to the Airport light rail and Residential Street 3 crossings, with locked gates permitting entry only by RD 1000 and NCMWC for channel maintenance, and by the Plan Operator for habitat monitoring and maintenance purposes;
 - Adequate height and below-ground depth to prevent snakes or burrowing mammals from providing a through-route for snakes by establishing burrows from one side to the other crossing;
 - Constructed using extruded concrete or block construction extending a minimum of 36-inches above ground level;
 - A cap or lip extending at least two-inches beyond the barrier's vertical edge to prevent snakes from gaining access along the barrier's top edge; and
 - Signage to discourage humans and their pets from entering the area.
 - The Lone Tree Canal Reserve shall be protected in perpetuity under a conservation easement and will be managed to sustain the value of this area for GGS habitat connectivity. Compliance and biological effectiveness monitoring shall be performed and annual monitoring reports prepared. This monitoring, reporting, and adaptive management shall be performed as determined in coordination with USFWS and CDFW.

5.5.3.4. ASSESSMENT OF REQUIRED WIDTH AND OTHER SETBACK ATTRIBUTES

To date, several recommendations have been made regarding the required width of a setback to conserve canal habitat for GGS use and movement. These previous recommendations include:

- In the avoidance and minimization measures of a biological opinion for a programmatic consultation with the U.S. Army Corps of Engineers (USACE), a measure was included to avoid construction activities within 200 feet of the banks of GGS aquatic habitat (USFWS 1997). The basis given for this distance was that most GGS use of uplands was within 200 feet of aquatic habitat. This same biological opinion also included a requirement that replacement habitat must be located at least 200 feet from roadways “to reduce vehicular mortality” (USFWS 1997).

- The NBHCP includes a requirement (for which there may be exceptions) that reserves be at least 800 feet from existing or planned urban lands, because intensively developed land is “significantly incompatible with the objectives and purposes of the reserve system” and that urban lands are likely to cause significant adverse effects on reserve viability or on Covered Species occupying the reserve (City of Sacramento et al. 2003, page IV-16). The NBHCP does not include an explanation of why these effects would no longer be significant with urban land at a distance of 800 feet.
- The NBHCP includes a requirement that reserves contain a buffer (typically of natural or ruderal vegetation) 30–75 feet in width to minimize the effects of incompatible land uses. These effects are referred to as “population mortality effects”; the relationship of these effects to the width of the buffer is not described.
- Planning documents for North Natomas have included setbacks ranging from 200 to 250 feet in width between urban development and adjacent agricultural areas (Padre Associates 2005). Initially, these setbacks were intended to reduce conflicts between agriculture and development; later, open space and habitat benefits were added to their purpose.
- The Fisherman’s Lake Buffer Zone Study (Padre Associates 2005) includes a species account for GGS, a review of the USFWS, Natomas Community Plan, and NBHCP setbacks and buffers described above, and a brief evaluation of the effectiveness of the 250- and 800-foot wide buffers that were under consideration at Fisherman’s Lake. This evaluation concludes that “For GGS, all scenarios from the City of Sacramento boundary and the RD 1000 right-of-way boundary alternatives would provide adequate protection of 200 feet from the edge of the channel banks per USFWS guidelines.” Relationships between setback width and particular effects on GGS were not evaluated in this study.

Although the documents with these recommendations did not include analyses to support their recommended setback or buffer widths, based on current understanding of the ecology of GGS, a buffer width of 250 feet as proposed along Lone Tree Canal will be an adequate buffer for GGS along with the other proposed protective measures (e.g. the snake wall). The Lone Tree Canal Reserve would contain fencing, a barrier, habitat enhancement, and management measures that would minimize the effects of adjacent land uses on this habitat (See Chapter 2.7.2.1 *Lone Tree Canal Reserve*). Mr. Eric Hansen has evaluated the Lone Tree Canal Reserve design and indicated that the current proposed buffer would be sufficient to maintain connectivity for GGS through the site (see letter entitled *Greenbriar Development Project – Considerations Regarding Giant Garter Snake Persistence in the Natomas Basin* in **Appendix D**).

5.5.3.5. OVERALL EFFECT ON CONNECTIVITY OF GGS HABITATS

The proposed conservation measures would offset the Greenbriar Development Project's effects on GGS movement along Lone Tree Canal, and are in addition to the measures incorporated into the MAP HCP (for example, a smaller setback and a barrier also exist on the MAP side of Lone Tree Canal).

In addition, because existing conditions do not provide high value habitat for GGS along the entire length of Lone Tree Canal and are not optimal for movement of the snake along the canal, opportunities also exist to enhance connectivity. Management of the canal and adjacent uplands for GGS would result in an improvement over current conditions, and over the future condition resulting from the NBHCP. The Greenbriar Development Project includes measures to enhance habitat along the canal (e.g., the creation of marsh habitat along the eastern bank of the canal).

In conclusion, for GGS, significant adverse effects on connectivity between habitats in the southern and central Natomas Basin would be unlikely due to the Greenbriar Development Project, and it would not cause adverse effects on the implementation of the NBHCP's GGS conservation measures.

5.6. Connectivity of Existing TNBC Reserves

As described in the preceding section, in the absence of conservation measures proposed by the Project Applicant, connectivity of habitats between TNBC reserves in the southern (Fisherman's Lake reserve complex) and central (Central Basin reserve complex) portions of the Natomas Basin could be reduced by the development on the Greenbriar Project Site, and this reduction would be substantial for species that would not pass through the corridor remaining along Lone Tree Canal.

For species not passing through the remaining corridor along Lone Tree Canal, the connectivity of TNBC reserves would be reduced. The travel distances between reserves in the southern and central Natomas Basin, with and without passing through a corridor between the MAP and the City of Sacramento, indicate this change in reserve connectivity. For example, passing through the Greenbriar Project Site, the distance between the nearest reserve in the southern Basin (the Rosa property) and the nearest reserve in the central Basin (the Elsie property) is about 3.5 miles across uplands and 3.7 miles along canals (**Figure 12**). If development of the Greenbriar Project Site prevented a species from passing between the MAP and the City of Sacramento, these distances would become 6.7 and 8.7 miles via uplands and canals, respectively. (These distances assume that an individual that cannot pass between the MAP and the City of Sacramento also cannot pass between the MAP and the Sacramento International Airport.) Though this example

involved the southern reserve closest to the central Natomas Basin, the change in connectivity would be comparable at other reserves in the southern Natomas Basin.

However, as described in the preceding section that addressed effects on habitat connectivity, the proposed Greenbriar Development Project would include a set of measures to reduce effects on connectivity; in addition, canal and adjacent upland habitats would be enhanced along Lone Tree Canal. Therefore, significant adverse effects on the connectivity of existing TNBC reserves through Lone Tree Canal on the Greenbriar Project Site is not anticipated.

The Greenbriar Development Project's proposed Off-Site Reserves would have beneficial effects on connectivity between existing TNBC reserves. This would be due to the creation, preservation and management of habitat on the Spangler Reserve and preservation and management of habitat on the North Nestor Reserve. The Spangler Reserve would increase connectivity among the nearby TNBC reserves to the east and northwest (Sills/Tufts/Elsie and the Atkinson/Ruby Ranch reserves, respectively) and the North Nestor Reserve would increase connectivity between the adjacent TNBC reserves to the north and south (the Lucich North and Nestor reserves, respectively). The North Nestor Reserve will be managed in rice and will maintain biological connectivity between existing TNBC reserves to the north and south. A 13.6-acre easement area has been defined along the western boundary of the North Nestor Reserve, which could be managed separately by TNBC to further the NBHCP goal of establishing a habitat reserve of 2,500 acres in the Natomas Basin. The preservation and management of the Moody Reserve would also increase connectivity of Swainson's hawk foraging habitat and habitat for VELB because it is within a one-mile radius of the Sacramento River (known as the Swainson's Hawk Zone) and several SAFCA mitigation sites managed by TNBC occur in the vicinity.

5.7. Habitat Value of Existing TNBC Reserves

Overall, the proposed Greenbriar Development Project would not adversely affect the habitat value of existing TNBC reserves. Although the development of the Greenbriar Project Site would reduce the acreage of foraging habitat within 1 mile of an existing TNBC reserve, the Project's reserve lands would preserve, create, and enhance habitat adjacent to or near existing TNBC reserves. **Figure 12** shows the location of the existing TNBC reserves with respect to the properties associated with the Greenbriar Development Project.

5.7.1. Effects of Development at the Greenbriar Project Site

No existing TNBC reserves are within 800 feet of the Greenbriar Project Site and only one reserve (the Rosa property) is within a mile. Development at the Greenbriar Project Site may reduce the quantity and connectivity of foraging habitat for raptors nesting at or near this reserve,

and also could similarly affect foraging opportunities near the Souza and Natomas Farms reserves that are within one and a quarter miles of the site.

The foraging habitat available to raptors nesting at these existing reserves would be slightly reduced due to development at the Greenbriar Project Site. Of the land within one mile of TNBC's Rosa property, about 31 percent is in the MAP or City of Sacramento permit areas; the Greenbriar Project Site accounts for an additional 6 percent. Thus, habitat value for raptors nesting at this reserve would be reduced under the future condition of the Natomas Basin, and development of the Greenbriar Project Site would slightly further reduce foraging habitat for raptors. Development of the Greenbriar Project Site also could detrimentally affect the foraging habitat available for nesting raptors at TNBC's Souza and Natomas Farms reserves, though to an even lesser degree than at the Rosa property because these reserves are further from the site.

The Project Applicant has proposed conservation measures to offset these effects. The Lone Tree Canal Reserve will retain approximately 13.3 acres of Swainson's hawk foraging habitat and provide a key connectivity corridor on the Greenbriar Project Site. The proposed Off-Site Reserves (Spangler Reserve, Moody Reserve, and North Nestor Reserve) will provide a minimum of an additional 267.9 acres of foraging habitat for Swainson's hawk ranging from moderate to high quality. The habitat provided by the proposed Greenbriar Conservation Strategy is expected to offset the Greenbriar Development Project's marginal effect on Swainson's hawks and other raptors residing at or near existing TNBC reserves, though the reserves benefiting from habitat enhancements may differ from those adversely affected by the loss of foraging habitat on the Greenbriar Project Site.

5.7.2. Effects of Proposed Reserves

The Greenbriar Development Project's proposed reserves could increase the quality of habitat available to GGS at existing TNBC reserves in the Central Basin (i.e., the Tufts, Sills, Ruby, and Atkinson reserves) because one of these reserves (the Spangler Reserve) would be enhanced for GGS and could be accessible to snakes using those reserves. These existing TNBC reserves are all within two miles of the proposed Spangler Reserve where rice will be managed to enhance its habitat value for GGS and managed marsh will be created. In addition, the Lone Tree Canal Reserve will increase the quality of the GGS dispersal corridor between the TNBC reserves in the southern and northern portions of the Basin.

The Greenbriar Development Project's proposed reserves would contribute to the connectivity of existing TNBC reserves and the amount of preserved land in the proximity of TNBC reserves (thus increasing their effectiveness). The Spangler Reserve is located between the Tufts and Atkinson reserves and is also connected to them via canals and drains (**Figure 15**); thus, it would

increase their connectivity. Preservation of the North Nestor Reserve will fill the gap between the TNBC Lucich North and Nestor reserves and thereby provide a large contiguous block of preserved rice and managed marsh consisting of the Frazer North, Bennet North, Bolen North, Bolen West, Bolen South, Bennet South, Lucich South, Huffman East, Huffman West, Atkinson, Ruby Ranch, and Vestal TNBC reserves as well as private reserve lands. This will increase the quality of habitat at the existing TNBC reserves by providing GGS friendly management practices at the North Nestor Reserve and providing safer dispersal for GGS from the Frazer North and Lucich North reserves to the TNBC reserves to the south. By increasing the connectivity of existing reserves and by increasing the area of preserved land in the vicinity of existing reserves, the Greenbriar Development Project would beneficially affect the habitat value of existing TNBC reserves.

5.7.3. Overall Effect on Habitat Value of TNBC Reserves

Overall, the proposed Greenbriar Development Project would not adversely affect the habitat value of the existing TNBC reserve system, and could cause a beneficial effect by preserving, creating, and enhancing habitat on adjacent or nearby lands that would benefit wildlife residing at or using existing TNBC reserves. However, it could cause a marginal reduction in foraging habitat available to Swainson's hawks nesting at or near reserves in the southern Natomas Basin, and though its conservation strategy would provide foraging habitat for hawks nesting at TNBC reserves, these may not be the same reserves that would experience a loss of foraging habitat. The marginal reduction in foraging habitat is not expected to necessitate changes in the management of any TNBC reserves.

5.8. Water Availability at TNBC Reserves

The proposed Greenbriar Development Project would eliminate several currently unused canals on the Greenbriar Project Site, and would convert the site from predominantly agricultural to urban land cover. These changes, however, would not be anticipated to alter water availability to TNBC reserves or cause additional canals to be eliminated outside of the site (Dave Fischer, pers. comm.).

The development on the Greenbriar Project Site would alter drainage of the site, and eliminate delivery of irrigation water by canals. These changes would affect water levels in canals and drains connected to the site. Because no TNBC reserves are adjacent to the Greenbriar Project Site and the NCMWC canals on the site do not connect to any TNBC reserves downstream (See **Figure 15**), these alterations are not anticipated to alter water availability at any TNBC reserves.

All of the identified Off-Site Reserves associated with the Greenbriar Development Project are in the Natomas Basin and thus would increase the portion of the NCMWC held by shareholders

concerned with the habitat values of the canal system and with the availability of water at TNBC reserves. In the future, this may contribute to attainment of NBHCP goals and objectives, but is not anticipated to alter any specific operations by NCMWC in the near future.

5.9. Opportunities to Establish Additional TNBC Reserves and Meet the Minimum Habitat Block Size Requirements in the NBHCP

The purpose of this section is to evaluate the potential effects of the Greenbriar Development Project on the ability of TNBC to acquire the 8,750 acres of reserve land that would be required to mitigate for the 17,500 acres of development authorized by the NBHCP (0.5:1 mitigation ratio) and the ability of TNBC to compile reserve blocks sufficient to meet the minimum habitat block size requirements in the NBHCP.

The Greenbriar Development Project was not included in the 17,500 acres of development authorized under the NBHCP; therefore, its associated impacts are in excess of the 17,500 acres of development authorized by the NBHCP and the Project's reserves will be additive to the 8,750 acres of reserve land required by the NBHCP. Therefore, both the development areas (Greenbriar Project Site and Off-Site Improvement Lands) and the reserve sites (Lone Tree Canal Reserve, Spangler Reserve, Moody Reserve, and North Nestor Reserve) somewhat reduce the amount of land in the Basin available to TNBC to establish the required 8,750 acres of reserves. Although the third party Plan Operator that will be responsible for long-term management of the Greenbriar Development Project's reserve sites has not been identified and TNBC has not been excluded as a potential third party Plan Operator, for the purposes of this effects analysis the assumption has been made that the Project's reserve sites may not be managed by TNBC. This allows for a conservative analysis of the potential effects of the Greenbriar Development Project on the ability of TNBC to compile reserve blocks sufficient to meet the minimum habitat block size requirements in the NBHCP (described below).

The potential effects of the Greenbriar Development Project on the opportunity for TNBC to acquire the 8,750 acres of reserve land that would be required to mitigate for the 17,500 acres of development authorized by the NBHCP (0.5:1 mitigation ratio) and the ability of TNBC to compile reserve blocks sufficient to meet the minimum habitat block size requirements in the NBHCP are discussed in the following paragraphs.

5.9.1. Effects on Availability of Land for NBHCP Reserve Establishment

The required mitigation for the 17,500 acres of development authorized by the NBHCP consists of 8,750 acres of managed marsh, rice, and uplands. Based on the acreage of the MAP, City of Sacramento, and Sutter County permit areas for urban development, the Natomas North Precinct Master Plan Area, and of existing development outside of those areas, the Natomas Basin

contains substantially more than 8,750 acres of land potentially suitable as and potentially available for mitigation. Of the Natomas Basin's 53,537 acres, an estimated 17,784 acres is potentially available for development or mitigation after taking into account the acreage of authorized development under the NBHCP (17,500 acres; includes City of Sacramento, Sutter County, and MAP permit areas), existing development and established mitigation in the Basin including the Sacramento International Airport and the Natomas Levee Improvement Project (NLIP), the Natomas North Precinct Master Plan Area (5,699 acres), and other small infrastructure improvements (12,554 acres) (See **Figure 13**). Thus, the acreage of potentially suitable and available land is over 2 times what is required by the NBHCP for preservation. Several factors affecting the suitability of land for preservation could complicate establishment of an interconnected reserve system of this size, and may increase its cost or compromise the habitat quality of reserves. These factors include existing easements, infrastructure and buildings, availability of land for purchase, adjacent land uses and proximity to urban development, connectivity to other reserves, availability of water, suitability of soils for the establishment of managed marsh, and parcel size relative to the desired size of reserves.

The proposed Greenbriar Development Project would slightly reduce the acreage available for preservation as mitigation for development permitted by the NBHCP and could affect the feasibility of preserving land adjacent to the Greenbriar Project Site. After implementation of the Greenbriar Development Project, 1,118.56 acres would become unavailable to TNBC. These lands include: 546 acres within the development footprint at the Greenbriar Project Site, 12.76 acres of Off-Site Improvement Lands, 31.3 acres (28.3 acres net) at the proposed reserve along Lone Tree Canal, 235.4 acres at the proposed Spangler Reserve, 74± acres at the proposed Moody Reserve, and 219.1 acres at the proposed North Nestor Reserve. Thus, overall, the Greenbriar Development Project reduces the acreage of land potentially suitable and available for preservation by 1,118.56 acres, from 17,784 acres to 16,665.44 acres (by approximately 6%). Even with this reduction, the remaining acreage of land potentially suitable and available in the Basin for preservation (16,665 acres) would be approximately 2 times the 8,750 acres the NBHCP requires for the reserve system and leaves 7,916 acres available for development or mitigation over and above what is currently developed, authorized for development under the NBHCP, or required for mitigation under the NBHCP (See **Figure 13**).

This change in availability of land is not expected to result in a direct change in land prices or availability for purchase of other lands within the Basin. The market for land in the Basin is highly variable, and a change in overall land availability of this magnitude is not sufficient to cause a basin-wide change in per-acre land prices.

5.9.2. Effects of Development on the Greenbriar Project Site on TNBC Reserve Establishment

Though the NBHCP did not identify the Greenbriar Project Site as a potential reserve, the NBHCP also did not identify a complete set of potential reserve sites; therefore, most land outside of areas permitted for urban development, including the Greenbriar Project Site, could be considered a potential reserve site under the NBHCP. Development of the Greenbriar Project Site would reduce options for establishing a reserve over 400 acres in size that included parcels adjacent to the Greenbriar Project Site, and would eliminate any opportunity for a reserve that included the site.

The Greenbriar Project Site would be unsuitable for a reserve because it has several major limitations on the habitat values that it could provide. Portions of the site are immediately adjacent to major highways or in the future condition of the Basin would be adjacent to urban development, and these areas would experience high levels of human-wildlife conflicts. Nearly half of the site is, or would be under future conditions, within 800 feet of a major highway or urban development. Highways and urban development would continue to reduce the connectivity of habitats on the Greenbriar Project Site with habitats that would remain to the north and to the south.

Though most of the Greenbriar Project Site would be developed, the most important portion of the site for GGS and for connectivity between the southern and central Natomas Basin would be preserved. The site design would preserve 28.3 net acres (upon construction of road crossings) immediately adjacent to Lone Tree Canal that would establish a 250-foot wide conserved corridor. This reserve would include barriers to reduce effects of adjacent development, measures to assure water flow, restoration and enhancement of habitat, and funding for management of the site. Thus, the Greenbriar Development Project would contribute to the conservation of an ecologically important corridor along Lone Tree Canal adjacent to the MAP.

5.9.3. Effects of Proposed Reserves on NBHCP Reserve Establishment

Conservatively assuming that TNBC is not chosen as the easement holder and/or land manager for the Greenbriar Development Project's reserves, the Project would eliminate the possibility of adding the Spangler Reserve, Moody Reserve, and North Nestor Reserve to the TNBC reserve system. This would reduce the acreage of land available to TNBC by approximately 528.5 acres. Under the same scenario, establishment of these three reserve sites could affect the ability of TNBC to consolidate reserves into habitat blocks that meet the minimum habitat block size requirements stated in the NBHCP. A requirement of the NBHCP is that, by the end of the 50-year period, one habitat block within the reserve system will be at least 2,500 acres in size and

the balance of reserve lands shall be in habitat blocks of at least 400 acres in size, unless otherwise allowed by the Agencies.

The location of each of the reserve sites associated with the Greenbriar Development Project with respect to established TNBC reserves is discussed in the following paragraphs as well as the potential effect of establishing a reserve at each site on the ability of TNBC to compile reserve blocks of sufficient size to meet the minimum habitat block size requirements.

5.9.3.1. MOODY RESERVE

The 74±acre Moody Reserve is located in the central portion of the Natomas Basin along its western boundary formed by the Sacramento River. The Moody Reserve lies north of I-5 between the Sacramento International Airport and the Sacramento River. Although TNBC manages two SAFCA reserves in this area (South Sutter and Pappa Rosa), there are no TNBC reserves in this area (See **Figure 12**) and the ability for TNBC to acquire a 400 acre or larger block of land would be limited. The Moody Reserve is located approximately 2.2 miles southwest of the nearest TNBC reserve, the Elsie reserve, which along with the Tufts reserve forms the current westernmost extent of TNBC's Central Basin reserve complex that currently comprises nine existing reserves. The Moody Reserve is also approximately 2.3 miles southwest of the Atkinson reserve, which along with the Ruby Ranch reserve forms the southern boundary of the TNBC North Basin reserve complex that is currently composed of 14 existing reserves. The remaining TNBC reserves are in the Fisherman's Lake Reserve complex, which is currently composed of six existing TNBC reserves and three additional reserves owned by SAFCA and managed by TNBC. The northernmost extent of the Fisherman's Lake reserve complex is made up of the Rosa Central and Rosa East reserves and is located approximately 3.0 miles southeast of the Moody Reserve.

Due to its location and the lack of TNBC reserves in the vicinity, the Moody Reserve would not be expected to be a targeted acquisition for TNBC because it is only 74±acres and would be difficult to compile into a minimum habitat reserve block of 400+ acres. Therefore, preservation of the Moody Reserve as part of the Greenbriar Development Project is not expected to adversely affect the ability of TNBC to meet the minimum habitat block size requirements of the NBHCP.

5.9.3.2. SPANGLER RESERVE

The Spangler Reserve is located in the central portion of the Basin on the east side of the Sacramento International Airport lands. The Spangler Reserve lies approximately 800 feet west of the Elsie and Tufts reserves (See **Figure 12**), which form the westernmost extent of TNBC's Central Basin reserve complex. The southernmost TNBC reserve in the North Basin reserve complex (Ruby Ranch) is located only approximately 800 feet north of the Spangler Reserve, but

across the Sacramento/Sutter County line (Spangler is in Sacramento County and the North Basin reserve complex is in Sutter County). For this reason, it is appropriate to evaluate the Spangler Reserve with respect to the TNBC Central Basin reserve complex. The TNBC Central Basin reserve complex is currently composed of two separate blocks of reserves that together total 1,330.69 acres in size. The easternmost block of reserves in the Central Basin reserve complex is currently 478.14 acres in size and is composed of the Betts-Kismat-Silva (BKS) tract (338.65 acres) along with the Frazer South (110.37 acres) and Silva South (29.12 acres) reserves. The westernmost block of reserves in the Central Basin reserve complex (next to the Spangler Reserve) is currently 852.55 acres in size and is composed of the Bianchi West (110.16 acres), Elsie (158.03 acres), Sills (436.41 acres), and Tufts (147.95 acres) reserves. Incorporation of the Spangler Reserve into the Greenbriar Development Project would not affect the ability of TNBC to meet the minimum habitat block size requirement of 400 acres because the adjacent TNBC reserves already form an 852.55-acre block (if deemed necessary additional land could be purchased by TNBC to form a block with fewer edge effects by acquiring land to the north of Tufts or the east of Elsie/Tufts). It is unlikely that enough reserves will be established by TNBC in the Central Basin reserve complex to form a 2,500-acre block so the Spangler Reserve would not affect that goal; in addition, the requirement of the NBHCP to form one 2,500+acre block will likely be met in the North Basin reserve complex.

5.9.3.3. NORTH NESTOR RESERVE

The North Nestor Reserve is located in the northern portion of the Natomas Basin and lies between the TNBC Lucich North and Nestor reserves, which are within the TNBC North Basin reserve complex (See **Figure 12**). The TNBC North Basin reserve complex is composed of 14 individual reserves with a total size of 2,354.98 acres. Two TNBC reserves lie to the north of the North Nestor Reserve (Lucich North and Frazer North) and 12 TNBC reserves lie to the south. Therefore, the North Basin reserve complex is currently composed of one reserve block that is 360.59 acres in size and one reserve block that is 1,994.39 acres in size. The Lucich North and Frazer North reserves, which make up the 360.59-acre block, are currently disjunct from the rest of the reserves in the North Basin complex and are separated from the rest of the reserves in the North Basin complex by the North Nestor Reserve. The North Nestor Reserve will be managed in rice and will maintain biological connectivity between existing TNBC reserves to the north and south. A 13.6-acre easement area has been defined along the western boundary of the North Nestor Reserve, which could be managed separately by TNBC to further the NBHCP goal of establishing a habitat reserve of 2,500 acres in the Natomas Basin. The preservation of the North Nestor Reserve, in perpetuity, even if not acquired or managed by TNBC, would provide ample habitat function and value to the connectivity of the Natomas Basin habitat mosaic. Such connectivity benefits species, thereby contributing to the overall effectiveness of the NBHCP OCP.

A connection through the North Nestor property is not the only way for TNBC to compile a 2,500+-acre block of reserves. Properties currently being used for rice farming to the east and west of the North Nestor Reserve could be acquired by TNBC to connect Lucich North and Frazer North to the southern block of TNBC reserves in the North Basin complex and compile a 2,500+ acre habitat reserve block. Another alternative would be to acquire property next to Lucich North and Frazer North along the Natomas Cross Canal, thereby establishing a minimum 400-acre habitat reserve block in the northern portion of the North Basin complex that was disjunct and then acquire additional property to the east or west of the southern block of TNBC reserves in the North Basin complex to compile a separate 2,500-acre habitat block in the southern portion of the North Basin complex.

Numerous properties adjacent to the east side of the southern TNBC reserves in the North Basin complex are within one mile of the Sacramento River and adjacent to SAFCA mitigation sites making them ideal for establishment of TNBC reserves. Acquisition by TNBC of any number of these properties adjacent to the west side of the Bolen West, Bolen South, Bennet South, Huffman East and Huffman West reserves could result in compilation of a 2,500+ acre reserve block. For example, there is a 340-acre parcel that is bordered by Bolen South to the north, Bennet South and Huffman East to the east, and Huffman West to the south. The parcel is adjacent to a narrow strip of land that was recently sold by the same property owner to SAFCA for mitigation land along the Garden Highway levee.

Other opportunities for TNBC to acquire land and compile a contiguous 2,500-acre reserve block in the North Basin complex include parcels adjacent to the east side of the Nestor, Bennet North, and Lucich South reserves – a total of approximately 1,000 acres of rice land is available in this area bound by the existing TNBC reserves to the west, SR 99/70 to the east, and Sutter Pointe Specific Plan Area to the south.

In summary, incorporation of the North Nestor Reserve into the Greenbriar Development Project's proposed reserve sites would not prevent TNBC from compiling a minimum 2,500-acre habitat reserve block in the North Basin reserve complex or meeting the minimum 400-acre block size requirement. Rather, the 13.6-acre easement that will be established by the Project Applicant across the North Nestor Reserve and made available to TNBC, if desired, could further the NBHCP goal of compiling a minimum 2,500-acre habitat reserve block.

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Chapter 6. Potential Effects of the Greenbriar Development Project on the NBHCP Covered Species

The purpose of this chapter is to evaluate the potential effects of the Greenbriar Development Project on the 22 animal and plant species that are Covered Species under the NBHCP. Two of the animal species and five of the plant species covered by the NBHCP have no potential to occur on or be affected by development on any of the properties associated with the Greenbriar Development Project. The two animal species covered by the NBHCP with no potential to be affected by the Greenbriar Development Project are California tiger salamander and western spadefoot toad. Because these species are Covered Species under the NBHCP and have the potential to occur in the Basin currently or in the future, they are discussed briefly in this section followed by the 13 animal species with the potential to occur on the properties associated with the Greenbriar Development Project and/or be affected by development on those sites. Lastly, the seven plant species covered by the NBHCP are discussed.

6.1. Giant Garter Snake

6.1.1. Species Ecology

6.1.1.1. HABITAT ASSOCIATIONS/REQUIREMENTS

Habitat Type

GGs typically inhabit sloughs, marshes, and drainage canals characterized by slow flowing or standing water, permanent summer water, mud bottoms, earthen banks, and an abundance of preferred forage species.

During their active season (May through October), mature GGs typically spend the majority of their time in canals and sloughs (Wylie and Casazza 2000). During late spring and summer, rice fields also provide foraging habitat for this species (Brode and Hansen 1992). Use of rice, however, is concentrated around the perimeter of the fields (Wylie and Casazza 2000; Eric Hansen, pers. comm.). Rice may, however, be an important source of prey and may export prey with drain waters into connected canals. GGs avoid areas of dense riparian overstory, and use burrows, crevices, undercut banks and large rocks to hide from predators. Winter hibernaculae include small burrows and soil crevices above prevailing flood elevations; these are typically located near aquatic habitat and in grassland or ruderal vegetation. (In the Natomas Basin, most canal banks have small burrows and crevices, and thus the banks of canals that are dewatered in winter can provide hibernaculae.)

The USFWS (1997) has determined that essential habitat components consist of the following:

- Adequate water during the snake's active period (early spring through mid-fall) to provide a prey base and cover;
- Emergent, herbaceous wetland vegetation, such as cattail and bulrushes, for escape cover and foraging habitat;
- Upland habitat for basking, cover, and retreat sites; and
- Higher elevation uplands for cover and refuge from flood waters.

Land cover types designated as GGS habitat in the NBHCP include canals, ponds and seasonally wet areas and rice. Managed marsh also provides habitat. Small fish are the primary prey of this species; they will also take amphibians when available.

Home Range Size and Movement

Based on radio-telemetry studies by Wylie and Casazza (2000), the size of GGS home ranges are between 32 and 215 acres (median = 86 acres) at Elverta and Fisherman's Lake sites. For comparison, home ranges were between 5 and 213 acres (median = 39.5 acres) at Gilsizer Slough in Sutter County, and 22 and 2,070 acres (median = 128 acres) at the Colusa National Wildlife Refuge. Most GGS activity within these home ranges is concentrated along canals, sloughs, and the edge of aquatic habitats (Wylie and Casazza 2000).

GGS rely on canals and ditches as movement corridors. These corridors provide important habitat, are used during daily movements within a home range, and are necessary for GGS dispersal and the resulting exchange of individuals and alleles between subpopulations. Unvegetated canals may be used as dispersal corridors, but snakes typically do not remain in exposed canals because of increased vulnerability to predators. GGS have been reported traveling over one mile, and may move as much as two miles in a day (Hansen and Brode 1993).

The USFWS has previously considered 200 feet as the width of upland vegetation providing habitat along the borders of aquatic habitat for GGS (USFWS 1997). However, the width of uplands used by GGS varies considerably. Many summer basking and refuge areas used by this snake are immediately adjacent to canals and other aquatic habitats, and may even be located in the upper canal banks (Eric Hansen, pers. comm.). GGS have also been observed hibernating as far as 820 feet (250 m) from water, however, and any land within this distance may be important for snake survival in some cases (Hansen 1988). (Hibernaculae this distant from water, however, are most often found in areas with high winter floods.) GGS also seek refuge in upland burrows during hot summer weather (Hansen and Brode 1993), and have been documented up to 164 feet from aquatic habitat during this time (Wylie et al. 1997).

6.1.1.2. MECHANISMS OF HABITAT DEGRADATION

Increased Predation

Known predators of GGS include raccoons, skunks, opossums, foxes, hawks, egrets, herons, and bitterns (USFWS 1999a). All of the mammalian predators in this list increase in proximity to residential areas as a result of supplemental food sources and reduced coyote abundance (Crooks and Soule 1999). Domestic dogs may also prey on GGS, and cats may prey on juveniles. Although predation of GGS by cats and dogs has not been studied scientifically, the effects of cats and dogs on small animals has been documented in a variety of ecosystems, and based on current understanding, cat and dog predation on GGS is likely.

Disturbance from Human Activity

GGS are highly sensitive to human disturbance, and will abandon otherwise suitable habitat as a result of increased human activity such as fishing (Eric Hansen, pers. comm.). Human visits to areas occupied by snakes may result in lowered snake abundance even when the visits are brief in duration and no more than one person, once per day (Eric Hansen, pers. comm.). Human activities can also degrade GGS habitats by trampling vegetation, compacting soils, destabilizing banks, and crushing burrows, and can cause vehicle collisions with snakes.

Habitat Fragmentation

In a dynamic habitat such as the Natomas Basin, GGS frequently move in response to changing conditions in their rice, marsh, canal, and ditch habitats, especially during the dry summer months (Wylie and Casazza 2000). Connectivity between these areas is thus extremely important for snake survival and reproduction, as well as the genetic interchange and patch-recolonization ability necessary for the viability of the overall Basin population. Any loss or degradation of snake movement corridors may thus cause effects that far outreach the area of the directly impacted corridors.

Operation and Maintenance of Waterways

Water channels lose their habitat value for GGS when cleaned of aquatic vegetation, during low/no flow periods or when high water releases eliminate or alter basking sites, refugia, foraging areas or juvenile microhabitat (USFWS 1999a). In the Natomas Basin, canal and drain maintenance, and irrigation practices, involve periodic clearing of vegetation along waterways, and short-term, seasonal and inter-annual changes in flow in waterways. A recent habitat assessment of canals and drains throughout the Natomas Basin indicates that operation and management practices are reducing habitat quality along a substantial portion of these waterways (Jones & Stokes 2005). Water diversions may also reduce the abundance of the snakes' aquatic prey. Water diversions or changes in land use within the area served by a canal or drain watershed may alter flows or even cause a canal or drain to be abandoned.

Water Quality

Aquatic communities may be greatly affected by surrounding land use. Urban areas can exert different and in some cases stronger effects than agricultural lands (Bury 1972, Moore and Palmer 2005). Residential developments typically result in increased runoff of hydrocarbons and of chemicals used for lawns and gardens, and increased stormwater volume (and associated increases in flow depths and velocities) because of high coverage of impervious surfaces.

6.1.1.3. DISTRIBUTION

Information on CNDDDB Occurrences

The 2002 CNDDDB records cited in the NBHCP listed 168 GGS occurrences in California, 38 of which occurred in the Natomas Basin. At this time, CNDDDB lists 58 occurrences in the Natomas Basin, of which 51 are considered extant. Of the 51 GGS occurrences that are presumed extant, 13 are within one mile of the Greenbriar Project Site and 26 are within one mile of the Spangler Reserve. The CNDDDB records indicate a documented occurrence of GGS from 2007 near the southeast corner of the Greenbriar Project Site where this species was observed in a drainage canal near the intersection of I-5 and SR 99/70. In addition, there are six reported occurrences of GGS ranging between approximately 1.5 and 2.0 miles north and east of the Moody Property and there are numerous reported occurrences of GGS in canal and managed marsh adjacent to the North Nestor Reserve.

Other Information on Distribution and Abundance in Natomas Basin

A USGS Biological Resources Division study conducted from 1998 to 1999 recorded 277 individual GGS in the Natomas Basin (Wylie and Casazza 2000). At the western edge of the Greenbriar Project Site, sampling conducted during 1998 and 1999 detected at least five GGS in Lone Tree Canal; based on these results, GGS population density for the canal was estimated at 2.4 snakes per 1,000 feet of canal length (95 percent confidence interval = 2–3.7) (Wylie and Casazza 2000).

Surveys conducted in 2010 for TNBC recorded 149 GGS observations (ICF 2012). The number of GGS captured in the Natomas Basin as well as the overall capture success decreased in 2010 by approximately 31 percent and 35 percent respectively, following decreases of approximately 29 percent and 33 percent respectively, in 2009. The results of the 2010 survey were the lowest recorded in the Natomas Basin since 2004. Over a two-year period in 2009 and 2010, the numbers of GGS captured and overall capture success decreased by approximately 51 percent and 57 percent, respectively (ICF 2012). However, the report states that capture success may have been influenced by atypically cold, wet weather during the spring and the resulting late start to the rice growing season.

Monitoring data collected in 2004 for TNBC (Jones & Stokes 2005) recorded smaller snake sizes on average (corresponding to younger snakes with lower reproductive outputs) than in previous years. When combined with data from previous years, this suggested a declining trend in snake size, which would correspond to an on-going decline in population viability unless coupled with a rapidly increasing population size (which is not indicated by the monitoring data). However, there have been no significant changes or consistent trends in the size of GGS captured in the Basin since 2004 (from 2004 to 2010) (ICF 2012).

Occurrence at the Greenbriar Development Project Sites

Berryman Ecological evaluated GGS habitat in the Greenbriar Project Site in September 2006, and September 2010 (see **Appendix H** for the survey memo). The Greenbriar Project Site currently provides low quality habitat for GGS composed of 3.21 acres of aquatic habitat in Lone Tree Canal and two minor tributaries to Lone Tree Canal and 32.0 acres of low quality upland habitat within 200 feet of aquatic habitat. The upland habitat is low quality because it is in hay production and is cultivated regularly. The portion of Lone Tree Canal on the Greenbriar Project Site was classified as a ‘completely blocked’ or ‘major impairment’ GGS transit route (ICF 2012), thus limiting GGS habitat connectivity in the area. Adjacent uplands are in use as hay production, which is unsuitable upland habitat for GGS (**Appendix D**; *Greenbriar Development Project – Considerations Regarding Giant Garter Snake Persistence in the Natomas Basin* by Mr. Eric Hansen). A total of 0.06 acres of GGS habitat is present on the Off-Site Improvement Lands.

Focused surveys for GGS have not been conducted on the Greenbriar Project Site, but GGS are known to occur along Lone Tree Canal and in the immediate vicinity of the site. GGS were detected in Lone Tree Canal near West Elkhorn Boulevard in 2003. Additionally, there was one observation of an adult GGS from 1986 and another from 1987 along Lone Tree Canal (CNDDDB 2015). Sampling conducted during 1998 and 1999 detected at least five GGS in Lone Tree Canal; based on these results, GGS population density for the canal was estimated at 2.4 snakes per 1,000 feet of canal length (95 percent confidence interval = 2–3.7) (Wylie and Cassaza 2000). Because GGS have been observed in Lone Tree Canal and in the immediate vicinity of the Greenbriar Project Site, they are potentially present within suitable habitat.

The Project’s reserve sites were evaluated for suitable GGS habitat by current HELIX personnel. The Spangler Reserve provides approximately 235.4 acres of suitable GGS habitat in the form of rice fields, canals, and adjacent uplands. The North Nestor Reserve provides 219.1 acres of suitable habitat for GGS in the form of rice fields, ditches, and adjacent ruderal habitat. The Moody Reserve does not provide suitable habitat for GGS, however, portions of the site are

within 200 feet of suitable aquatic habitat and there is a low likelihood that GGS could enter the site.

6.1.2. Greenbriar Development Project Effects on Species Ecology

6.1.2.1. LONG-TERM EFFECTS ON HABITAT

Effect on Quantity of Habitat

Overall, the Greenbriar Development Project would result in an estimated loss of 210.8 acres of GGS habitat compared to 2001 conditions. Changes in GGS habitat acreages at the Greenbriar Project Site (includes the Lone Tree Canal Reserve) and the Spangler Reserve are summarized in **Table 19**. No change in land use is anticipated at the Moody Reserve or the North Nestor Reserve; therefore, these sites are not included in the table. At the Greenbriar Project Site, there would be a loss of an estimated 173.2 acres of GGS habitat from conditions at the time of the NBHCP (2001), although only 7.64 acres of this change is attributable to the Greenbriar Development Project and the remainder is due to the discontinuation of rice farming on the site in 2004 (HELIX 2013a). Approximately 142 acres of managed marsh complex (includes annual grassland/seasonal wetland within the managed marsh) will be created at the Spangler Reserve from land previously occupied by canals, rice and ruderal. This will improve the habitat quality of the site for GGS, although there will be a loss of 37.6 acres of wetted GGS habitat at that site (the entire site will still provide high quality habitat for GGS in the form of rice, managed marsh, and upland comprised of annual grassland with seasonal wetlands). The apparent loss of canal acreage is likely due to differences in mapping methods for the canals between 2001 and 2012 (e.g. how much adjacent bank was included within the canal acreage) since no canal alteration is proposed at the Spangler Reserve.

Table 19. Change in Acreage of GGS Habitat at Project Sites and in the Natomas Basin Compared to 2001 Conditions

LAND COVER TYPE PROVIDING HABITAT	FUTURE CONDITION	CHANGE AT EACH PROJECT SITE		TOTAL CHANGE	FUTURE CONDITION WITH PROJECT
		Greenbriar	Spangler		
Canals	1,162	-15.0	-2.5	-17.5	1,144.5
Ponds and seasonally wet areas	2,259	1.8*	142.0***	143.8****	2,402.8
Rice	11,643	-160.0**	-177.1	-337.1	11,305.9
TOTAL	15,064	-173.2	-37.6	-210.8	14,853.2

Note: Acreages are based on 2001 land cover mapping used to evaluate future condition resulting from the NBHCP and future land cover proposed at Project sites. No change in land use is anticipated at the Moody Reserve or the North Nestor Reserve; therefore, these sites are not included in the table.

*The 1.8 acres represents the freshwater marsh habitat that will be created/enhanced in the Lone Tree Canal Reserve. The 41.8-acre detention basin that would be created on the site is not considered in these calculations because it is not expected to provide habitat for GGS.

**No rice is being lost at the Greenbriar Project Site as a result of the Greenbriar Development Project. A total of 160 acres of rice production was present on the site in 2001, which was used as the baseline conditions for the NBHCP. Rice production was discontinued at the site in 2004 when the site was in previous ownership. Only 7.64 acres of GGS habitat in the form of canals and adjacent uplands would be lost at the Greenbriar Project Site based on current conditions.

***Represents 142 acres of managed marsh including 8.19 acres of ruderal and 5.1 acres of canals.

****Does not include 41.8-acre detention basin on the Greenbriar Project Site as this features will not provide habitat for GGS.

The Greenbriar Conservation Strategy (described in Chapter 2.7 Greenbriar Conservation Strategy) includes preservation, enhancement, and long-term management of 557 acres of reserves that would be managed for the purpose of providing a benefit to all of the NBHCP Covered Species. Of these 557 acres, all but 74 acres (the 74-acre Moody Reserve) will represent high quality habitat for GGS. As a result of the Greenbriar Development Project, a minimum of 482.8 acres of GGS habitat will be enhanced and preserved in the Basin in perpetuity consisting of 235.4 acres at the Spangler Reserve, 219.1 acres at the North Nestor Reserve, and 28.3 acres at the Lone Tree Canal Reserve (**Table 20**).

Table 20. Summary of GGS Habitat Provided by the Greenbriar Development Project’s Reserves

Greenbriar Project Reserve	Total GGS Habitat (Acres)
Lone Tree Canal Reserve	28.3
Moody Reserve	0 (negligible)
Spangler Reserve	235.4
North Nestor Reserve	219.1
Total GGS Habitat	482.8

A discussion of the accounting of GGS habitat at the Greenbriar Development Project’s reserves is included below.

Rice Fields

For the purpose of accounting for GGS habitat, the total acreage of rice agriculture in the reserves, including any temporarily fallowed portions, are considered habitat as long as individual fields/cells are not fallowed for more than one year. This is the current practice in the Basin with TNBC reserves – all rice fields are periodically fallowed (ICF 2015; Chapter 3.5 Page 3-19.)

The interior portions of fallowed rice fields are part of the overall landscape that provides habitat for GGS. All of the habitat in the rice fields has some value for GGS, even drained fields, which can be used by snakes for hibernation. GGS may overwinter in the fallow fields where they hibernate in burrows in the small berms separating the rice checks (Hansen 1998). GGS typically use the interior portions of the rice fields for about 3 to 3.5 months each year (Mid-May to early June through August). The remainder of their active season (late March through early October) they primarily utilize associated canals/ditches. Thus, their occurrence is likely anywhere within the larger mosaic of rice agriculture.

If an attempt was made to deduct GGS habitat to account for periodic fallowing of rice cells, all aquatic habitat (active flooded fields, ditches/canals) plus uplands within 200 feet would likely be considered GGS habitat in accordance with generally accepted standards of quantifying GGS habitat. It isn’t possible to come up with an exact estimate of the acreage of the rice fields that

would consist of GGS habitat (aquatic habitat and uplands within 200 feet of aquatic habitat) versus the portions of the rice fields that would not consist of GGS habitat (uplands greater than 200 feet from aquatic habitat) because the individual rice fields that would be fallowed each year are of different dimensions and are positioned differentially in the landscape, and the exact acreage of fields fallowed will vary on an annual basis.

However, if an attempt was made to estimate the acreage of fallowed rice fields greater than 200 feet from aquatic habitat for the purpose of deducting that from “GGS habitat”, none of the fallowed rice at the proposed Spangler Reserve would fall into this category. The majority of the individual rice fields at Spangler are 200 feet in width with the widest field being less than 300 feet in width. Therefore, no portion of the fallowed rice fields would be greater than 200 feet from aquatic habitat. At North Nestor the checks are arranged differently and range from 350-600 feet in width. Therefore, a small immeasurable acreage of fallowed rice at North Nestor could be greater than 200 feet from the adjacent active rice fields and perimeter ditches but the majority of this habitat would still be within 200 feet of some form of GGS aquatic habitat.

Managed Marsh

The entire managed marsh complex at the Spangler Reserve is considered GGS habitat. While fallowed portions of the managed marsh will provide foraging habitat for Swainson’s hawk, the managed marsh is being rotationally fallowed primarily for normal maintenance practices associated with constructed marsh. All managed marsh is periodically fallowed for maintenance activities, including managed marsh constructed and operated by TNBC in the Natomas Basin. One of the many advantages to the proposed managed marsh at Spangler vs. the typical managed marsh in the Basin is that small discrete cells can be individually dewatered having much less disruption to GGS habitat than is typically experienced by GGS in managed marsh lacking this design. See the following excerpts from a letter written by Eric C. Hansen, Consulting Environmental Biologist, on January 9, 2014 entitled *Greenbriar Managed Marsh Concept Design – Biological Considerations*.

While perhaps differing in scale and configuration to that of most mitigation sites constructed for giant garter snakes, the proposed mitigation design for the Spangler 235 property clearly incorporates all of the standard attributes common to occupied giant garter snake habitats. However, rather than developing these components as fewer, continuous blocks of strata distributed over the broader landscape, the scale of the design is adjusted to incorporate all requisite features within units or cells of a smaller, easily manageable scale typical of a rice-growing landscape. The result does not change the final proportion of the habitat components distributed across the total area, nor does

it compromise wetland function. It does, however, alter the distribution of the components, thus providing a greater range of heterogeneity and habitat edge or interface and increasing the proximity of the different features that giant garter snakes require throughout the day. Units are independent, but result in a series of repeating habitat strata that will function as part of the larger wetland landscape. Not only is this expected to potentially increase carrying capacity and reduce individual movement and home range (which confer greater risks to individual snakes) by meeting all life history requirements in a smaller area, but it provides a distinct advantage by providing superior opportunities to measure the species' response to different conditions as well as the precise control for adaptive management.”

Maintenance activities, such as de-silting, dredging, grading, and vegetation clearing must be performed regularly on any managed wetland in order to maintain its function. In the case of the Spangler 235 property, because each unit can be independently controlled there is more potential to isolate maintenance activities, thereby reducing the scale and magnitude of potential impacts. Because each cell can be readily bypassed, it is possible to selectively isolate and dry individual cells for maintenance while continuing to provide aquatic habitat in neighboring cells. While this approach applies to the majority of wetlands constructed and managed for giant garter snakes, the large scale of the cells or units associated with the larger units within these complexes often makes it difficult to complete maintenance activities without decommissioning large blocks of habitat, therefore impacting a larger number of snakes. Because the design proposed for the Spangler 235 property emphasizes simplicity in its topography and design, maintenance can be completed with less physical disruption and in shorter time, whereas maintenance of larger and more complex systems often require longer and more invasive procedures and therefore more impactful periods of down time.

Because the fallowing of marsh is part of the overall management regime for marsh habitats constructed for GGS, it is not appropriate to deduct fallowed marsh from the acreage of “GGS habitat.” Even if an attempt was made to estimate the acreage of fallowed marsh greater than 200 feet from aquatic habitat for the purpose of deducting that from “GGS habitat”, none of the fallowed marsh at the proposed Spangler Reserve would be expected to fall into this category. The majority of the cells intended for managed marsh construction at Spangler (15 out of 23) are approximately 200 feet in width. The widest cells (remaining 8) are approximately 400 feet in width. The upland portions will remain undisturbed (roughly 30 percent of each cell). That means that roughly 70 percent of the interior of each cell (bulrush marsh and open water components) would be dewatered for maintenance every 5-7 years for one season and up to a maximum of 1/3 of the cells would be dewatered for maintenance in any given year. Based on

the cell design, even fallowed marsh areas will fall almost entirely within 200 feet of adjacent aquatic habitat.

Seasonal Wetland Complex

Approximately 53.1 acres of the Spangler Reserve is anticipated to be managed as annual grassland/ seasonal wetland complex. This habitat will contain depressions that will be seasonally inundated with water due to natural precipitation, and therefore will support GGS habitat, while also providing foraging habitat for Swainson's hawk.

Effect on Quality of Habitat

Areas Adjacent to Developed Land or Highways

As discussed above in *Mechanisms of Habitat Degradation*, without conservation measures, snakes traveling through the Lone Tree Canal or using other canal and rice habitats near the proposed development would likely be adversely affected by the residential development through increased predation, disturbance, and degradation of aquatic habitat. (The adjacent MAP development does not include residential development.) Development of the Greenbriar Project Site also would reduce the acreage of land draining into Lone Tree Canal, and thus could lead to reduced flows in the canal. In the absence of measures to off-set these alterations, the quality of GGS habitat along Lone Tree Canal would likely be reduced. The Greenbriar Conservation Strategy does, however, include measures to reduce these effects (**Appendix F**).

The Greenbriar Development Project also could create conflicts with continued cultivation of rice on the property north of the Greenbriar Project Site. Aerial application of pesticide and herbicide probably is not feasible immediately adjacent to residential development, which could affect the viability of rice cultivation on the adjacent parcel. This issue is discussed further under *Habitat Quality in the Natomas Basin* in Chapter 5.4 of this report.

Alteration of Habitat Quality at Proposed Reserve Sites

The Lone Tree Canal Reserve would result in improved habitat for GGS due to the recontouring of the east bank of the canal and the establishment of freshwater marsh. The Spangler Reserve is currently in active rice production; 40.3 acres of the site would remain in active rice production (managed for GGS) and the remaining 195.1 acres would be converted to managed marsh and upland habitats under the proposed Greenbriar Conservation Strategy. The managed rice, marsh, and upland habitats are expected to provide higher quality habitat for GGS than current conditions. The North Nestor Reserve is currently in active rice production and would remain in active rice production but would be managed specifically to provide high quality habitat for GGS. Due to the enhancement of Lone Tree Canal, the creation of managed marsh and adjacent

uplands at the Spangler Reserve, and management of the rice fields at the Spangler Reserve and the North Nestor Reserve to benefit GGS, the Greenbriar Development Project would result in an increase in habitat quality for GGS at the reserve sites.

6.1.2.2. EFFECTS ON CONNECTIVITY

The Greenbriar Development Project's potential effects on connectivity of GGS habitat are described in detail in Chapter 5.5 *Connectivity of Habitat in the Natomas Basin*.

6.1.2.3. EFFECTS OF CONSTRUCTION-RELATED ACTIVITIES

During construction of the development at the Greenbriar Project Site as well as earthwork associated with restoration activities at the Lone Tree Canal Reserve and the Spangler Reserve, GGS could be killed or injured by vehicle strikes (Leidy 1992), crushed beneath heavy machinery, and/or entombed in or excavated from their winter retreats (Wylie and Casazza 2000). The Greenbriar Conservation Strategy includes conservation measures to avoid and minimize direct loss of GGS through construction. In combination, these measures would minimize injury and mortality to GGS as a direct result of construction-related activities. These measures (included in **Appendix F**) include pre-construction surveys, restricting all grading activity within GGS habitat (aquatic habitat and uplands within 200 feet of aquatic habitat) to a period between May 1 and October 1, dewatering between April 15 and September 30 of all irrigation ditches, canals, or other aquatic habitat within the construction area, with no ponded water remaining, for at least 15 consecutive days prior to the excavation or filling in of the dewatered habitat, worker awareness training, and biological monitoring during construction activities within 200 feet of aquatic habitat for GGS.

6.1.2.4. EFFECTS OF HUMAN-WILDLIFE CONFLICTS

As discussed above in *Mechanisms of Habitat Degradation*, without conservation measures, GGS would likely experience increased predation near the proposed residential development because of the increased abundance of domestic dogs and cats, as well as human-associated species like raccoons, skunks and opossums. Domestic cats have been recorded between 98–590 feet from homes, unattended domestic dogs between 590–1,083 feet from homes (Odell and Knight 2001), and increased abundance of native predators may extend farther. As this distance is well beyond the proposed 250-foot wide corridor between the proposed residential development and the Lone Tree Canal, absent appropriate conservation measures, the development would likely result in increased predation of snakes using the canal. The increased human population in the area would also increase the potential for human activity near the canal, which may lead to site avoidance or abandonment by snakes (Eric Hansen, pers. comm.). Increased human activity along the canal could result in increased canal maintenance including further clearing of vegetation. Snake mortality because of vehicle strikes (Leidy 1992) may also

increase on existing roads because of the increased traffic associated with the development on the Greenbriar Project Site.

The Greenbriar Conservation Strategy does, however, include measures to reduce these effects including preservation, enhancement, and management of an approximately 250-foot-wide corridor along Lone Tree Canal and installation of a barrier between the Lone Tree Canal Reserve and the development to prevent humans and pets from entering the reserve. These measures are described in **Appendix F**.

6.1.2.5. OVERALL EFFECT ON POPULATION VIABILITY

Overall, the Greenbriar Development Project would not adversely affect GGS, and its overall effect on population viability would be beneficial. The loss of habitat acreage would be offset by the increased habitat quality resulting from the preservation and enhancement of habitat.

Preservation of habitat has benefits in addition to those of habitat enhancement. In the Natomas Basin, a particularly important benefit of habitat preservation is that it ensures that the habitat will continue to exist, and it buffers total habitat availability from year to year fluctuations. For GGS, privately owned habitat in the Natomas Basin is primarily rice and associated canals, and there are no assurances that rice cultivation will continue on any particular site. Furthermore, agricultural markets will cause the total acreage of rice, and consequently of GGS habitat, to fluctuate substantially from year to year. Such environmental fluctuations strongly influence populations and reduce their viability. In contrast, preserved lands will provide habitat on a much more consistent basis, and thus reduce the magnitude of fluctuations in habitat availability.

Both habitat enhancement and preservation also can contribute to population viability by reducing anthropogenic causes of mortality. Preservation reduces human disturbance, and minimizes activities that could harm or kill snakes. Habitat enhancement and management also reduces or eliminates agricultural activities that can harm or kill snakes. In addition, the preservation and enhancement of habitat typically results in larger blocks of higher quality habitat, and this should reduce long distance movements by snakes, which would also reduce the risk of mortality associated with those movements. Dispersal and other long distance movements are dangerous for snakes, particularly where road crossings are involved [Bonnet et al. 1999, Rosen and Lowe 1994]).

The Greenbriar Development Project is also unlikely to reduce the viability of the GGS population due to adverse effects on connectivity. The Greenbriar Conservation Strategy, including enhancements to GGS habitat in Lone Tree Canal, would conserve and enhance connectivity and habitat for GGS along Lone Tree Canal, which is an important waterway connecting the southern and central Natomas Basin.

Although the Greenbriar Development Project would result in the apparent loss of 210.8 acres of GGS habitat in the Basin as compared to 2001 conditions, the majority of this habitat loss (160 acres) is attributed to former rice production at the Greenbriar Project Site. Based on 2015 conditions, only 58 acres of land potentially providing habitat would be lost for GGS a result of the project, which includes acreage due to loss of canals on the Greenbriar Project Site that no longer provide GGS habitat (See GGS discussion in Chapter 5.3.3 *Overall Change in Habitat Acreage*) and conversion of rice to upland refugia. Rice production has been discontinued at the Greenbriar Project Site for a decade; currently the site is in agricultural production of hay and does not provide habitat for GGS (**Appendix D**). Based on the site's underlying zoning and future planned use to support light rail, it is highly unlikely that the site would ever support rice agriculture again or provide habitat for GGS outside of Lone Tree Canal regardless of whether or not development occurred on the site as a result of the Greenbriar Development Project (**Appendix D**). The only viable habitat for GGS on the Greenbriar Project Site (Lone Tree Canal and adjacent uplands within 200 feet) is being preserved and enhanced.

The Greenbriar Conservation Strategy includes preservation, enhancement, and creation of 482.8 acres (235.4 acres at the Spangler Reserve, 219.1 acres at the North Nestor Reserve, and 28.3 acres at the Lone Tree Canal Reserve) of habitat for GGS. Essentially, the Greenbriar Development Project is having little to no impact on habitat for GGS based on current conditions (as explained above) while establishing a conservation program to create, enhance, and preserve in perpetuity a minimum of 482.8 acres of high quality habitat for GGS in the Basin.

6.2. Swainson's Hawk

6.2.1. Species Ecology

6.2.1.1. HABITAT ASSOCIATIONS/REQUIREMENTS

Habitat Type

Swainson's hawks are most commonly found in grasslands, low shrublands, and agricultural habitats that include large trees for nesting. Land cover types designated as Swainson's hawk nesting habitat in the NBHCP include oak groves, tree groves, and riparian. These habitats are suitable for nesting only where adjacent to adequate foraging habitat. Land cover types designated as Swainson's hawk foraging habitat in the NBHCP include alfalfa, grassland, idle, non-rice crops, pasture, and ruderal. Swainson's hawks will also nest in these foraging habitats if large trees are available; however, isolated trees may be less suitable for nesting than trees in groves or riparian areas.

Prey abundance and accessibility (for capture) are the most important features determining the suitability of hawk foraging habitat. In addition, agricultural operations (e.g., mowing, flood

irrigation) have a substantial influence on the accessibility of prey and thus create important foraging opportunities for Swainson's hawk (Estep 1989). Crops which are tall and dense enough to preclude the capture of prey (e.g., corn) do not provide suitable habitat except around field margins, but prey in these habitats are accessible during and immediately following harvest. Other crops (e.g., tomato, sugar beet) are tall and dense enough to inhibit but not to prevent the capture of prey during the growing season, and also provide valuable foraging opportunities during their harvest. Alfalfa, idle crop land, and most ruderal land and grassland have low and or open vegetation that doesn't impede prey capture, but prey abundance varies among these habitats and so does the frequency of agricultural operations (which are absent from ruderal land and grassland). Based on these considerations, we have divided crops and other foraging habitats into three categories of quality (i.e., low, moderate, and high). The basis for this classification is described in detail in Chapter 4.2.4 *Quality of Habitat in the Natomas Basin*.

Home Range Size and Movement

Although the most important foraging habitat for Swainson's hawks lies within a one-mile radius of each nest (City of Sacramento et al. 2003), Swainson's hawks have been recorded foraging up to 18.6 miles from nest sites (Estep 1989). Any habitat within this foraging distance may provide food at some time in the breeding season that is necessary for reproductive success. In a dynamic agricultural environment such as the Natomas Basin, the area required for hawk foraging depends on the time of season, crop cycle, crop type, and disking/harvest schedule, as these factors affect the abundance and availability of prey (City of Sacramento et al. 2003). Swainson's hawk foraging ranges during the breeding season have been estimated at approximately 1,000-7,000 acres (Bechard 1982, Estep 1989, Johnsgard 1990).

6.2.1.2. MECHANISMS OF HABITAT DEGRADATION

Reduction of Prey Base

The discussion of habitat suitability for Swainson's hawks above was determined by the abundance and availability of prey. Conversion of higher-suitability habitats to lower-suitability habitats would be accompanied by a reduction in prey base that may reduce nest survival or the fat reserves required by hawks for their fall migration to Central Mexico (Swainson's Hawk Technical Advisory Committee 2001), without any change in overall habitat acreage.

Changes in the hawks' rodent prey base may also result from impacts of residential development to adjacent mammalian predator communities. Crooks and Soule (1999) quantified the impacts of domestic cats on rodents and other small animals. They estimated that the average domestic cat population in moderately sized fragments (~50 acres of upland habitat bordered by 100 residences) returns about 840 rodents, 525 birds, and 595 lizards to residences each year. Assuming that cats do not bring back all prey that they kill, actual impacts to hawk prey numbers

are probably even greater. Crooks and Soule (1999) also documented increased extirpations of songbird species in habitat fragments with higher densities of cats, raccoons and opossums, all of which often increase in proximity to residential development. Although rodents are the primary prey of breeding Swainson's hawks in the Natomas Basin, songbirds also contribute to their diets.

Several studies indicate that the abundance of bird species is lower near residential development. Compared to undeveloped areas at least 2,297 feet from development, Odell and Knight (2001) demonstrated lower densities of the hawks' secondary songbird prey within 1,083 feet of sparse residential development (less than 0.4 dwelling units/acre); impacts of higher density development are expected to be greater. Similarly, Blair (1996) reported 1/3 fewer bird species in lands adjacent to residential development, when compared to habitat preserves in the same area. Increased predation on the hawks' rodent prey is likely to extend between 98–590 feet from homes because of domestic cats, 590–1,083 feet from homes because of domestic dogs, and farther because of increased populations of small wild predators such as opossums and foxes (Odell and Knight 2001).

Habitat Fragmentation and Reduced Patch Size

The contiguity of foraging habitat and its placement near nest sites may also affect hawk foraging (and subsequently breeding) success. Longer foraging flights carry higher energetic costs than foraging closer to nests, and reduce the amount of time adults are present to defend nests from predators. Similarly, there may be a threshold of required habitat area near each nest, related to the foraging ranges discussed above, such that habitat loss beyond this threshold would result in a greater impact to nest survival than habitat loss from a larger area. The diversity and abundance of Swainson's hawk prey have also been reported to decline in fragmented habitat (Crooks et al. 2001; Helzer and Jelinski 1999; Hinsley et al. 1995).

Increased Predation

Corvids (crows, magpies) and great horned owls are the most common predators of Swainson's hawk eggs and nestlings (England et al. 1997). Corvid populations typically increase near human settlement because of the supplemental food source of human refuse and additional perches provided by urban trees, street lights, and other infrastructure (Steenhof et al. 1993; Marzluff et al. 2001). This increase in predator abundance may result in increased nest predation near residential development.

Nest Disturbance

Swainson's hawk responses to nest disturbance vary with each nesting pair and the timing, regularity, and nature of the disturbance. Although some researchers have described disturbed nest sites that successfully fledge young (Estep 1989; England et al. 1995), others have recorded

nest abandonment in response to human activity, especially during nest building and incubation (Bent 1937; Stahlecker 1975). In addition to nest abandonment, significant disturbances near hawk nests may interfere with parental care and feeding of young in a way that reduces nest success.

6.2.1.3. DISTRIBUTION

Information on CNDDDB Occurrences

When information was compiled for the NBHCP in 2001, there were 892 known occurrences in California, of which 882 were considered extant. The NBHCP did not list CNDDDB occurrences for the Natomas Basin, but local surveys (described below) provided extensive data. At this time, 39 occurrences are reported in CNDDDB for the Natomas Basin, of which 38 are considered extant. Of these extant occurrences, three are within one mile of the Greenbriar Project Site. The nearest documented occurrence in CNDDDB of Swainson's hawk to the Greenbriar Project Site is from 1989, where a hawk was observed soaring near the southeast corner of the site. No nest was located. The CNDDDB records also indicated several documented occurrences of Swainson's hawk nesting between 1 mile and 5 miles of the Greenbriar Project Site within the past five years. There are no reported occurrences in CNDDDB of Swainson's hawk within one mile of the Spangler Reserve or North Nestor Reserve. Several reported occurrences occur within one mile of the Moody Reserve.

Other Information on Distribution and Abundance in Natomas Basin

Estep (1989) indicates that nesting sites and foraging activity occur throughout the Basin, depending on the availability of suitable nest trees in proximity to upland foraging areas. The most recent survey of the Natomas Basin at the time the NBHCP was prepared located 62 breeding sites in or immediately adjacent to the Basin (Swainson's Hawk Technical Advisory Committee 2001). Hawks nesting at the 35 sites adjacent to the Basin were located along the Sacramento River and may have depended on the Basin's foraging habitat for their survival and reproduction. The NBHCP asserts that the Swainson's hawk population supported by the Natomas Basin is "important to the continued viability" of the species, which has been estimated by CDFW to have declined by 94 percent from historical conditions in the state (Bloom 1980, CDFG 1989).

Basin-wide Swainson's hawk surveys are conducted annually as part of the biological effectiveness monitoring for the NBHCP. At the time of report preparation, the most recent publicly available Swainson's hawk surveys conducted for the biological effectiveness monitoring are from the 2013 survey season (ICF 2014). TNBC has documented over 100 Swainson's hawk nest sites in or adjacent to the Basin, of which approximately 50 are active in a typical year. Swainson's hawks nest primarily in the southern portion and along the far western

and northern edges of the Basin. All of these nests are within the 18.6 mile recorded foraging distance from the Greenbriar Project Site and proposed reserve sites and may be affected by changes in land cover at those sites.

TNBC has mapped five nests within one mile of the Greenbriar Project Site. The closest Swainson's hawk nest is on the parcel adjacent to the northwestern boundary of the Greenbriar Project Site within a few hundred feet of the project boundary (Swainson's hawk Nest Site # NB 98; ICF 2012). No Swainson's hawk nests have been mapped within one mile of the proposed Spangler Reserve or North Nestor Reserve. A Swainson's hawk nest territory occurs in the southwestern corner of the Teal Bend Golf Course near the Sacramento River (Nest Site Number NB-132; ICF 2014). This nest territory is less than one mile from the Moody Property. In addition, biological effectiveness monitoring for the NBHCP in combination with CNDDDB records indicate 39 documented Swainson's hawk nest sites within 5 miles of the Moody Reserve, of which 38 are considered extant (CDFW 2015). Of these extant occurrences, two are within riparian habitat adjacent to the south side of the Moody property and three are within one mile of the Moody property along the Sacramento River (ICF 2014; CDFW 2015). The CNDDDB records indicate 30 documented occurrences within 5 miles of the North Nestor Reserve, of which all are considered extant (CDFW 2015). Numerous occurrences are along the Sacramento River to the west, and the Natomas Cross Canal to the north.

6.2.1.4. OCCURRENCE AT THE GREENBRIAR DEVELOPMENT PROJECT SITES

A Swainson's hawk was observed foraging in the Greenbriar Project Site during a biological survey on May 8, 2012, however, no nests were identified within the site. The Greenbriar Project Site provides approximately 577 acres of Swainson's hawk foraging habitat but no suitable nest trees occur on the site. Therefore, no suitable nesting habitat for Swainson's hawk is present on the Greenbriar Project Site. However, trees on adjacent properties provide suitable potential nesting opportunities for Swainson's hawks using the site for foraging. Swainson's hawks are known to nest in close proximity to the segment of Lone Tree Canal on the Greenbriar Project Site, both to the west and south. There is an active Swainson's hawk nest on MAP within 700 feet (0.13 mi) west of the northwest corner of the Greenbriar Project Site and there is another active Swainson's hawk nest within 0.22 mi of the southwest corner of the Greenbriar Project Site in Caltrans ROW south of Interstate-5: both nests were confirmed in the field on May 11, 2016 by HELIX biologists.

The Spangler Reserve and the North Nestor Reserve provide foraging opportunities in upland areas, which consist of ruderal areas along the perimeter of rice fields or on berms between fields and along the banks of canals as well as in rice fields when they are fallowed. The Moody Reserve provides high quality nesting and foraging habitat for Swainson's hawk in the form of

alfalfa fields and grassland surrounded by oak woodland and riparian habitats with large trees. An adult Swainson's hawk was observed soaring over the Moody Reserve on April 16, 2015 and several Swainson's hawks were observed foraging over the site and perching in trees on the site during site visits in summer 2015.

6.2.2. Greenbriar Development Project Effects on Species

6.2.2.1. LONG-TERM EFFECTS ON HABITAT

Effect on Quantity of Habitat

The Greenbriar Development Project would not change the acreage of Swainson's hawk nesting habitat at the Greenbriar Project Site or proposed reserve sites from conditions at the time of the NBHCP (2001). Riparian woodland habitat is expected to re-establish at the Moody Reserve (1.64 acres), resulting in a net increase in nesting habitat for Swainson's hawk based on 2015 conditions.

The change in acreage of Swainson's hawk foraging habitat at the Greenbriar Project Site (includes the Lone Tree Canal Reserve), Spangler Reserve, and North Nestor Reserve compared to 2001 conditions is summarized in **Table 21**. No change in land use composition is anticipated at the Moody Reserve; therefore, this site is not included in the table. The Greenbriar Development Project would reduce the acreage of Swainson's hawk foraging habitat in the Natomas Basin from conditions at the time of the NBHCP (2001). The proposed development at the Greenbriar Project Site would result in the loss of Swainson's hawk foraging habitat by an estimated 250.6 acres and an additional 2.2 acres of ruderal habitat would be lost at the Spangler Reserve; however, restoration activities and long-term management of the Spangler Reserve and North Nestor Reserve would create Swainson's hawk foraging habitat (See **Table 22**). Therefore, the Greenbriar Development Project would result in a net loss of 72.4 acres of land in the Basin that provides Swainson's hawk foraging habitat compared to 2001 conditions.

Table 21. Change in Acreage of Swainson’s Hawk Habitat at Project Sites and in the Natomas Basin based on 2001 Conditions

LAND COVER TYPE PROVIDING HABITAT	FUTURE CONDITION	CHANGE AT EACH PROJECT SITE			TOTAL CHANGE	FUTURE CONDITION WITH PROJECT
		Greenbriar	Spangler	North Nestor		
Alfalfa	368	–	–	–	–	368
Grassland	284	26.5	53.1****	–	79.6	363.6
Idle	360	–	8.1*	43.8*	51.9	411.9
Non-rice crops	9,533	-234.1	–	–	-234.1	9,298.9
Pasture	494	-33.8	–	–	-33.8	460.2
Ruderal	370	-9.2	-2.2**	–	-11.4	358.6
Upland marsh components/ Rotationally dewatered marsh	547	–	75.4***	–	75.4	622.4
TOTAL	11,956	-250.6	134.4	43.8	-72.4	11,883.6

Note: Acreages are based on 2001 land cover mapping used to evaluate future condition resulting from the NBHCP and future land cover proposed at Project sites. No change in the acreage of Swainson’s hawk foraging habitat is anticipated at the Moody Reserve; therefore, this site is not included in the table.

*A total of 20% of the managed rice fields at the Spangler (8.1 acres) and North Nestor Reserves (43.8 acres) will be fallowed each year on a rotational basis to provide foraging habitat for Swainson’s hawk and other NBHCP Covered Species.

**Ruderal habitat is not being removed at Spangler. The 2.2-acre difference in ruderal habitat at Spangler between 2001 and future conditions is a result of different methods for quantifying vegetation communities

***This 75.4 acres is comprised of 42.6 acres of upland components of managed marsh and 32.8 acres of marsh that will be dewatered on a rotational basis for vegetation management (See Table 21).

****Refers to the annual grassland/seasonal wetland complex that will be created at the Spangler Reserve.

Table 22 is a summary of the Swainson’s hawk foraging habitat that will be provided by the Greenbriar Development Project including the change in acreage of Swainson’s hawk foraging habitat at the Spangler Reserve and the North Nestor Reserve that would occur. Descriptions of the conceptual restoration design for these two sites are included in Chapter 2.7.2.2 *Off-Site Reserves*. Habitat creation and management changes at these two sites include fallowing of the rice fields on a rotational basis, creation of upland habitat components of managed marsh, creation of annual grassland/seasonal wetland complex as well as permanent upland, and dewatering of managed marsh cells on a rotational basis for vegetation management purposes.

Table 22. Foraging Habitat Acreage for Swainson’s Hawk and other Birds at the Greenbriar Development Project’s Reserves

Reserve Site	Land Use	Specific Habitat	Total Acres	Description of Swainson’s Hawk Foraging Component/ Acres	
Lone Tree Canal	Upland	Perennial grassland	26.5	Counted as SWHA foraging at a ratio of 0.5:1	13.25
Moody	Upland	Alfalfa, grassland, ruderal, riparian	74.3	Entire site is foraging	74.3
North Nestor	Managed Rice Fields	rice cells, interior berms between cells	219.1	~20% of the rice cells will be fallowed each year to provide Swainson’s hawk foraging	43.8
Spangler	Managed Rice Fields	rice cells, interior berms between cells	40.3	~20% of the rice cells will be fallowed each year to provide Swainson’s hawk foraging	8.1
	Managed Marsh	Managed marsh consisting of open water, bulrush marsh, and high ground upland hibernaculae for GGS	142	~30% of the total acreage of the managed marsh cells will be permanent upland habitat (high ground GGS hibernaculae, interior and perimeter berms) that will provide Swainson’s hawk foraging habitat.	42.6
				70% of the total acreage of the managed marsh cells will be open water and bulrush marsh; 1/3 of the open water and bulrush marsh will be dried out in any give year and will provide Swainson’s hawk foraging habitat.	32.8*
	Upland	Annual grassland with created ephemeral wetlands	53.1	Annual grassland with interspersed ephemeral wetlands will provide green forage for small mammals and high quality Swainson’s hawk foraging habitat.	53.1
Total Site Acreage			555.3	Total Acreage of Swainson’s Hawk Foraging Habitat	267.9

*142 acres of cells with managed marsh x 0.7 x 0.33 = 32.8 acres.

The Greenbriar Conservation Strategy (described in Chapter 2.7) includes preservation, enhancement, and long-term management of 557 acres of reserve that would be managed for the purpose of providing a benefit to all of the NBHCP Covered Species. Foraging habitat for Swainson’s hawk will be provided at all of the Greenbriar Development Project’s proposed reserves by a combination of land use changes and habitat management changes. A total of 26.5 acres of grassland habitat at the Lone Tree Canal Reserve will provide foraging habitat for Swainson’s hawk (provides 13.3 acres at a 0.5:1 ratio). The entire 74±acre Moody Reserve, which is within the NBHCP Swainson’s Hawk Zone, will provide high quality upland habitat for Swainson’s hawk composed of high quality foraging habitat adjacent to suitable nest trees. The 235.4-acre Spangler Reserve will provide an estimated 136.6 acres of foraging habitat for Swainson’s hawk. The 219.1-acre North Nestor Reserve will provide a minimum of 43.8 acres of foraging habitat in portions of rice fields when they are left idle (See **Table 22**). Therefore, a total of 268 acres of Swainson’s hawk foraging habitat would be provided at the Greenbriar Development Project’s reserves (**Table 23**).

Table 23. Summary of Swainson’s Hawk Foraging Habitat/Upland Habitat Provided by the Greenbriar Development Project’s Reserves

Greenbriar Project Reserve	Swainson’s Hawk Foraging Habitat (Acres)
Lone Tree Canal Reserve	13.3
Moody Reserve	74.3
Spangler Reserve	136.6
North Nestor Reserve	43.8
Total Swainson’s Hawk Foraging/Upland Habitat	268 Acres

The Greenbriar Development Project will not occur on any lands designated as Swainson’s hawk foraging habitat mitigation in the NBHCP. The NBHCP explains that under the NBHCP and MAP HCP, a total of 4,387 acres of upland within TNBC reserves and excluded from the Sutter Industrial/Commercial reserve would “fully mitigate the impacts of the NBHCP planned development on foraging habitat.” (NBHCP, IV-13.) That acreage, according to Table IV-2 of the NBHCP, consists of 3,372 acres of undesignated upland habitat to be preserved pursuant to the NBHCP and MAP HCP mitigation ratios, as well as 1,015 acres of the Sutter County

Industrial/Commercial reserve that were to be redesignated as agricultural. (NBHCP, IV-12 to IV-13.) The 4,387 acres of foraging habitat did not include the Greenbriar Project Site or any of the Off-Site Reserves.

Effects on Quality of Habitat

Areas Adjacent to Developed Land or Highways

Although the expanded urban area that would be created by the Greenbriar Development Project would result in a net reduction of areas within 800 feet or one mile of urban development or highways, the Greenbriar Development Project would expand a gradient of urban influence into the previously unaffected area to the north of the Greenbriar Project Site and could increase the urban influence on the agricultural land to the southwest of the site. The impacts to Swainson's hawk prey in these areas that could occur as a result of proximity to development are discussed under *Mechanisms of Habitat Degradation*, above. However, the existing major roads and freeways that border the Greenbriar Project Site would function as partial barriers that limit the extent of urban influences on adjacent agricultural lands.

Altered Habitat Quality at Proposed Reserve Sites

Swainson's hawk habitat quality would be expected to increase at all of the Greenbriar Development Project's proposed reserves. Conservation of the corridor along Lone Tree Canal will improve its value as foraging habitat because it would be converted to perennial grassland with higher habitat value than the corridor's current or recent agricultural land cover. Swainson's hawk foraging habitat quality will increase at the Spangler Reserve due to creation of upland habitats (upland components of managed marsh and annual grassland/seasonal wetland complex), rotational fallowing of rice fields, and periodic dewatering of the managed marsh for vegetation management. The quality of Swainson's hawk foraging habitat will also increase at the Moody Reserve and the North Nestor Reserve due to site management to maximize foraging habitat such as improving crop management to maximize the prey base (Moody) as well as rotational fallowing of rice fields (North Nestor).

6.2.2.2. EFFECTS ON CONNECTIVITY

With the exception of the 250-foot wide proposed conservation easement along Lone Tree Canal, the Greenbriar Project Site would become urban land cover, which would reduce upland connectivity between the Swainson's hawk nests south (and west) of the site and foraging habitat to the north of the Greenbriar Project Site. This connectivity will be further reduced by development of the MAP. Although nesting hawks have the ability to fly past a developed Greenbriar Project Site to northern foraging areas, they may be less likely to use foraging habitat beyond this 546-acre urban area because of the energetic cost and additional time away from the

nest required by the flight (long foraging flights are more likely to follow lines of contiguous habitat, as hawks may scan for prey along the entire flight).

For Swainson's hawk, the consequences of this potential habitat fragmentation depend on the distribution of foraging and nesting habitat under the future condition of the Natomas Basin resulting from the NBHCP. Currently, there is relatively little foraging habitat north and east of the Greenbriar Project Site, and this habitat is already fragmented. There also is very little potential nesting habitat north and east of the Greenbriar Project Site (both foraging habitat and nesting habitat are concentrated to the south and west of the Greenbriar Project Site). Thus, changes in land cover at the Greenbriar Project Site are unlikely to cause substantial alterations of movement of Swainson's hawks across the site. Preservation and enhancement of habitat at the Moody Reserve will have a beneficial effect on connectivity of Swainson's hawk habitat by providing preserved habitat within one mile of the Sacramento River that is also adjacent to other reserve sites with Swainson's hawk foraging habitat (SAFCA mitigation site).

The potential effects of habitat fragmentation and reduced upland connectivity on Swainson's hawk prey are discussed under 6.3.1.2 *Mechanisms of Habitat Degradation*, above.

6.2.2.3. EFFECTS OF CONSTRUCTION-RELATED ACTIVITIES

Construction of the proposed development at the Greenbriar Project Site and habitat restoration and enhancement activities at the proposed reserve sites has the potential to displace and/or disturb nesting Swainson's hawks. Nest disturbance from the operation of heavy construction equipment and continued activity near nest sites could cause nest abandonment or interfere with the incubation and feeding of young in a way that reduces nesting success.

The proposed Greenbriar Conservation Strategy (included in **Appendix F**) includes conservation measures to avoid and minimize construction-related effects on Swainson's hawks such as preconstruction surveys and, if Swainson's hawks are found, the requirement that no new disturbances (e.g., heavy equipment operation associated with construction) will occur within 0.5 mile of an active nest between March 15 and September 15, or until a qualified biologist, with concurrence by CDFW, has either determined that young have fledged or that the nest is no longer occupied or that construction can commence with pre-cautions in place (would be determined in coordination with CDFW). These measures adequately reduce the impacts to Swainson's hawks that may result specifically from construction-related activities.

6.2.2.4. EFFECTS OF HUMAN-WILDLIFE CONFLICTS

Swainson's hawks returning to nest trees within 0.5 mile of the Greenbriar Project Site could be affected by human disturbance from the residential development proposed at the site resulting in nest abandonment (Bent 1937; Stahlecker 1975) or interference with incubation and feeding of

young in a way that reduces reproductive success. Predation of eggs and young chicks by crows and other corvids may also increase as a result of increased human refuse and infrastructure at the Greenbriar Project Site (Steenhof et al. 1993; Marzluff et al. 2001). Mortality because of vehicle strikes may also increase on existing roads because of the increased traffic associated with the development on the Greenbriar Project Site. Human-wildlife conflicts are unlikely to occur at the proposed reserves.

6.2.2.5. OVERALL EFFECT ON POPULATION VIABILITY

The following excerpt is from the NBHCP page IV-29 CH IV.C.4.b. *Upland Reserve Acquisition Criteria/Methodology*:

“The NBHCP’s primary strategies to mitigate impacts to the Swainson’s hawk caused by Authorized Development are to avoid development in the Swainson’s Hawk Zone (within the City of Sacramento and Sutter County) and to acquire upland habitat as Mitigation Lands inside the Swainson’s Hawk Zone.”

Preservation of the Moody Reserve, which is within the Swainson’s Hawk Zone, will greatly benefit the NBHCP strategy of preserving Swainson’s hawk populations in the Basin by establishing reserve lands within this zone. In addition, the Greenbriar Development Project will not occur on any lands designated as Swainson’s hawk foraging habitat mitigation proposed in the NBHCP.

The Greenbriar Development Project would result in an increase in Swainson’s hawk nesting habitat of approximately 2 acres but would result in the loss of 72.4 acres of foraging habitat in the Basin. Although the foraging habitat for Swainson’s hawk at the Greenbriar Project Site that is being lost is considered moderate quality, prey is inaccessible to Swainson’s hawk at the site during much of the spring and summer because of the dense (and high) cover of vegetation in hay fields (discussed in Chapter 4.2.4 *Quality of Habitat in the Natomas Basin*). The Greenbriar Conservation Strategy includes preservation, enhancement, and creation of 268 acres of Swainson’s hawk foraging habitat at the reserves that is/will be available to Swainson’s hawk throughout the nesting season, the majority of which is high quality habitat including 74 acres within the Swainson’s Hawk Zone.

Overall, based on the analysis of habitat quality and availability for Swainson’s hawk conducted for this Effects Analysis, the Greenbriar Development Project would not affect the viability of the Swainson’s hawk population in the Natomas Basin and would contribute to the overall success of Swainson’s hawk population in the Basin and the NBHCP conservation strategy (due to the preservation and enhancement of habitat at the Moody Reserve within the Swainson’s Hawk Zone). This is due largely to the fact that the availability of foraging habitat during April-

July is considered to limit the abundance and reproductive success of Swainson's hawk in the Natomas Basin (CH2M HILL 2003; USFWS 2003). The Greenbriar Development Project would reduce the acreage of foraging habitat available to Swainson's hawk for approximately a 30-day period (mid-April to mid-May) during these four months; however, the Greenbriar Development Project would result in a net increase of foraging habitat available to Swainson's hawk in the Basin during June and July as well as for the remainder of the nesting season and the habitat would be higher quality than the habitat lost. For these reasons, the Greenbriar Development Project would not be expected to reduce the number of hawks nesting in the Natomas Basin or their reproductive success overall.

6.3. Valley Elderberry Longhorn Beetle

6.3.1. Species Ecology

6.3.1.1. HABITAT ASSOCIATIONS/REQUIREMENTS

Habitat Type

The VELB is dependent on its host plant, elderberry (*Sambucus* spp.), which is a common component of riparian corridors and adjacent upland areas in the Central Valley. Small elderberry patches are also found in some oak groves and rural residential areas. The NBHCP lists riparian as the only land cover type that provides habitat for this species. Studies conducted in the American River basin demonstrate that VELB occurs most frequently and is most abundant in significant riparian zones that are well developed. Within significant riparian zones, VELB primarily occurs within the riparian corridor but can occur infrequently in non-riparian scrub habitats adjacent to the riparian corridor. Along the American River, the beetle tends to occupy woodlands dominated by exotic trees (black locust; *Robinia psuedoacacia*) and native black walnut (*Juglans californica*), and in mixed riparian forests. The beetle less commonly occupies annual grasslands and live oak woodlands. The study also showed that the beetle preferentially occupies elderberry shrubs in wooded areas with a relatively dense canopy cover over elderberry shrubs located in open and sparsely wooded areas. Of the occupied shrubs found in wooded areas, about 50 percent were under a canopy cover of 25-50 percent, while 25 percent were under canopies with 50-75 percent cover and 25 percent were under canopies with 75-100 percent cover. The study also demonstrated that the VELB appears to be capable of limited dispersal and prefers to remain within contiguous patches of high quality riparian habitat. Clusters of local aggregations of VELB along the American River Parkway were approximately 2,000 to 2,600 feet in diameter (Talley 2005 in Talley et al. 2006).

Home Range Size and Movement

Dispersal of VELB individuals is extremely limited. Many adults live their entire lives on their original host plant and do not disperse at all. Dispersing individuals typically limit travel to their

home drainages, limiting the ability of the species to colonize fragmented habitat (Collinge et al. 2001).

Mechanisms of Habitat Degradation

The primary factor in the decline of VELB has been the loss, modification, or degradation of VELB habitat by development or other activities that eliminate or reduce the health of its host plant, elderberry. Elderberry habitat is degraded by fragmentation, pesticide and herbicide use, exotic species invasion, and hydrological alteration such as flood management, channel maintenance, and increased water diversions for urban and agricultural development (USFWS 1984; Huxel 2000; Collinge et al. 2001). Non-native or invasive plant species such as giant reed (*Arundo donax*), Himalayan blackberry (*Rubus discolor*), and fig (*Ficus carica*) may also negatively affect the health and vigor of the host plant for VELB. VELB also contend with invasive species such as the Argentine ant (*Linepithema humile*) and European earwig (*Forficula auricularia*), as these species prey on VELB larva.

6.3.1.2. DISTRIBUTION

Information on CNDDDB Occurrences

When information was compiled for the NBHCP, there were 168 known occurrences of VELB in California, all of which were considered extant. At that time, several occurrences were known along the southern and western edges of the Natomas Basin, along the American and Sacramento rivers. As of 2015, two occurrences of VELB are documented in the CNDDDB in the Natomas Basin and both are considered extant. CNDDDB does not list VELB occurrences within one mile of any of the properties associated with the Greenbriar Development Project.

Other Information on Distribution and Abundance in Natomas Basin

The TNBC Biological Effectiveness Monitoring report from 2014 states that although several elderberry shrubs occur in the Natomas Basin, the VELB itself is not known to occur in the Basin (ICF 2014).

Occurrence at the Greenbriar Development Project Sites

Presence/absence surveys were conducted at the Greenbriar Project Site for VELB and/or its host plant (elderberry) in June 2012, consistent with the *Conservation Guidelines for the Valley Elderberry Longhorn Beetle* (USFWS 1999b). One elderberry shrub with one or more stems measuring one inch or greater in diameter at ground level was documented within the Greenbriar Project Site, located along the northern boundary of the site near W. Elkhorn Boulevard. Stems one inch or greater in diameter at ground level were tallied by diameter size class and thoroughly searched for beetle exit holes (external evidence of beetle presence). The shrub had 11 stems $\geq 1'' - \leq 3''$ and five stems $> 3'' - < 5''$. No beetles or exit holes were observed in the shrub. The elderberry shrub does not occur in riparian habitat and does not provide habitat for the VELB.

The elderberry shrub is a single shrub surrounded by agricultural fields and is assumed to be unoccupied by VELB based on the ecology and life history requirements of the beetle coupled with the lack of evidence of the beetle on the shrub.

Seven elderberry shrubs were observed by HELIX in winter 2015 on the Moody Reserve in the ruderal/disturbed area as well as in the riparian corridor along the southern site boundary. The elderberry shrubs at the Moody Reserve represent potential habitat for the VELB because they are located in or in close proximity to riparian habitat and are within the potential dispersal range of the VELB from other elderberry shrubs located on surrounding properties.

No elderberry shrubs are present at any of the other properties associated with the proposed project including the Spangler Reserve or the North Nestor Reserve.

6.3.2. Greenbriar Development Project Effects on Species

6.3.2.1. LONG-TERM EFFECTS ON HABITAT

Effect on Quantity of Habitat

One elderberry shrub that does not provide habitat for the VELB (and is assumed to be unoccupied by the beetle) would be removed from the Greenbriar Project Site. The elderberry shrub will likely be transplanted to one of the On- or Off-Site Reserves (e.g., Moody Reserve) where it could provide potential habitat for VELB. Transplanting the elderberry shrub to suitable habitat elsewhere and planting it in a location with other elderberry plants would result in a net increase in potential habitat for VELB. Assuming the elderberry shrub was transplanted elsewhere in the Natomas Basin, the quantity of habitat for VELB in the Basin would experience an incremental increase.

Preservation and long-term management of the Moody Reserve would have a beneficial effect on the elderberry shrubs on the site, and potentially result in an increase in the quantity of habitat for VELB (approximately 2 acres of riparian woodland), because the SSMP prepared for the site would include measures to protect and enhance habitat for VELB.

Effects on Quality of Habitat

Areas Adjacent to Developed Land or Highways

As the Greenbriar Project Site does not currently provide habitat for VELB and no elderberry shrubs will exist in or adjacent to the Greenbriar Project Site upon completion of the development, the gradient of urban influence within 800 feet of the Greenbriar Project Site will not affect the quality of VELB habitat.

Enhancement at Reserves

The quality of habitat for VELB is expected to increase due to transplanting the elderberry shrub at the Greenbriar Project Site, which is currently on the edge of a hay field and next to W. Elkhorn Boulevard, to one of the Greenbriar Development Project's reserves. The elderberry shrub would be planted in or in close proximity to a riparian area with other elderberry shrubs, which would improve the quality of the shrub for providing VELB habitat. Currently it is anticipated that the elderberry shrub would be transplanted to a suitable location on the Moody Reserve.

Preservation and management of the Moody Reserve would improve the quality of habitat for VELB at that site. The current land use practices reduce the likelihood that the VELB would occupy the elderberry shrubs in the disturbed area. With protective measures in place, the elderberry shrubs would be expected to increase in number over time and potentially create moderate to high quality habitat for VELB.

6.3.2.2. EFFECTS ON CONNECTIVITY

Because of the beetle's limited dispersal capability, habitat connectivity is critical for the colonization of unoccupied shrubs and the maintenance of genetic diversity. The elderberry shrub at the Greenbriar Project Site is not occupied by VELB and there are no other elderberry shrubs in the vicinity. Therefore, transplanting this shrub will have no effect on connectivity of habitat for VELB in the vicinity of the Greenbriar Project Site. However, transplanting the elderberry shrub from the Greenbriar Project Site to suitable habitat at an On- or Off-Site Reserve could provide increased connectivity of habitat for VELB at its future location.

Restoration, enhancement, and/or long-term management of the Moody Reserve would improve VELB habitat on the site. In turn, this would improve the connectivity of VELB habitat by providing a more contiguous stretch of woodland/riparian habitat between the SAFCA reserve to the west of the Moody Reserve (which contains riparian habitat and elderberry savannah) and suitable habitat for VELB south of the site in riparian habitat adjacent to the Teal Bend Golf Course.

Overall, the Greenbriar Development Project would have a small beneficial effect on habitat connectivity for this species.

6.3.2.3. EFFECTS OF CONSTRUCTION-RELATED ACTIVITIES

Construction-related activities at the Greenbriar Project Site would not affect this species because the elderberry shrub on the site is not occupied by VELB and does not provide habitat for VELB in its current location. In addition, the elderberry shrub will be transplanted prior to construction to one of the Greenbriar Development Project's reserves.

No impacts to elderberry shrubs are anticipated at the Moody Reserve and elderberry shrubs do not occur at any of the other properties associated with the Greenbriar Development Project.

6.3.2.4. EFFECTS OF HUMAN-WILDLIFE CONFLICTS

Human-wildlife conflicts for this species would not be affected by the Greenbriar Development Project because elderberry habitat is not currently present on the Greenbriar Project Site and would not persist on or adjacent to the Greenbriar Project Site post-transplantation of the elderberry shrub. Development does not occur in the vicinity of the elderberry shrubs at the Moody Reserve.

6.3.2.5. OVERALL EFFECT ON POPULATION VIABILITY

There is some uncertainty whether VELB occurs in the Natomas Basin. However, suitable habitat is present in the Basin and VELB could be present in the Basin currently or could disperse into the Basin or be introduced into the Basin in the future. Effects on the population viability of VELB, in lieu of specific data on number of individuals or populations present, are measured by the effects on suitable habitat. Transplantation of one elderberry shrub that is currently unoccupied by VELB and does not provide habitat for the beetle to suitable habitat at a reserve would be a very small potential benefit to suitable habitat for VELB in the Basin. Restoration, enhancement, and/or long-term management of moderate to high quality habitat for VELB in close proximity to the Sacramento River (at the Moody Reserve) would have a greater potential benefit on suitable habitat for VELB. Overall, the Greenbriar Development Project would have a beneficial effect on suitable habitat for VELB in the Natomas Basin and on the viability of current or potential future VELB populations in the Basin.

6.4. Western Pond Turtle

6.4.1. Species Ecology

6.4.1.1. HABITAT ASSOCIATIONS/REQUIREMENTS

Habitat Type

Western pond turtles are most commonly found in permanent or nearly permanent wetlands, ponds, slow-moving streams and irrigation ditches (Zeiner et al. 1988). Adjacent upland areas are also used for basking and egg-laying. Land cover types designated as pond turtle habitat in the NBHCP include canals, ponds and seasonally wet areas, rice, and riparian. Special habitat features that improve turtle abundance, survival and reproductive success are rocks, logs, open mud banks, emergent aquatic vegetation and streamside vegetation. These features provide the turtles with basking sites and cover from predators (Stebbins 1972). Although pond turtles feed primarily on aquatic invertebrates (USFWS 1992), they also feed on plants, small fish and carrion.

Home Range Size and Movement

Upland areas adjacent to aquatic habitat are essential for reproduction, and eggs may be laid as far as 1,319 feet (0.25 mi) from water (Hayes et al. 1999). Hatchling and adult turtles may winter in upland sites, and turtles may move more than one mile overland in response to desiccation of local water bodies or other forms of habitat loss or degradation.

6.4.1.2. MECHANISMS OF HABITAT DEGRADATION

Increased Predation

Hayes et al. (1999) documented predation on pond turtles by domestic dogs; unattended dogs have been recorded between 590–1,083 feet (180–330 m) from homes (Odell and Knight 2001). Absent appropriate conservation measures, these distances indicate that the development on the Greenbriar Project Site would likely result in increased predation of any pond turtles using Lone Tree Canal for movement between habitat areas to the north and south of the site. Populations of native pond turtle predators such as raccoons and opossums also typically increase in proximity to residential areas as a result of supplemental food sources and reduced coyote abundance (Crooks and Soule 1999).

Disturbance from Human Activity

Pond turtle observations have been known to decline in areas with increased human activity (Eric Hansen, pers. comm.). Human visits to areas occupied by turtles may result in lowered turtle abundance even when the visits are brief in duration and no more than one person, once per day (Eric Hansen, pers. comm.).

Habitat Fragmentation

Although pond turtles may travel less frequently than GGS, turtles occupying dynamic habitats such as the Natomas Basin may need to travel in response to changing conditions in their aquatic habitats, especially during the dry summer months. Connectivity between these areas may thus be important for turtle survival and reproduction, as well as the genetic interchange and patch-recolonization ability that may be necessary for the viability of the overall Basin population. Any loss or degradation of turtle movement corridors may thus yield effects beyond the area of the directly impacted corridors.

Operation and Maintenance of Waterways

Water channels lose their habitat value for pond turtles when cleaned of aquatic vegetation, during low/no flow periods and when high water releases eliminate or alter basking sites, refugia, foraging areas or hatchling microhabitat (Holland 1991). Water diversions or changes in land use within the area served by a canal or drain may alter flows or even cause a canal or drain to be abandoned.

Water Quality

Aquatic communities may be greatly affected by surrounding land use. Urban areas can exert different and in some cases stronger effects than agricultural lands (Bury 1972; Moore and Palmer 2005). Residential developments typically result in increased traffic and fuel runoff, runoff of chemicals used for lawns and gardens, and increased stormwater volume and currents because of high coverage of impervious surfaces. Increased exposure to contaminants has been implicated in pond turtle population declines (Bury 1972; Holland 1991).

6.4.1.3. DISTRIBUTION

Information on CNDDB Occurrences

When information was compiled for the NBHCP in 2001, there were 117 known occurrences in California, of which 116 were considered extant. At that time, CNDDDB did not list western pond turtle occurrences in the Natomas Basin. Currently, there are few reported occurrences of western pond turtle in CNDDDB for the Natomas Basin. The closest reported occurrence of this species to the Greenbriar Project Site is west of the Sacramento River, approximately 3.5 miles northwest of the Greenbriar Project Site and 1.7 mile west of the Spangler Reserve where western pond turtle was observed in a system of artificial ponds and irrigation canals. In addition, western pond turtle is known to occur near the Elkhorn Pumping Station (ICF 2014; CNDDDB 2015), which is located approximately 0.3 mile northwest of the Moody Reserve. Western pond turtle nests and juveniles were observed near the Elkhorn Pumping Plant in March and April 2009.

Other Information on Distribution and Abundance in Natomas Basin

Many Natomas Basin canals are considered suitable habitat for this species. Western pond turtles are known to occur in several areas of the Natomas Basin, including at Fisherman's Lake and near the Prichard Lake and Elkhorn pumping stations (ICF 2012). Western pond turtles have been observed on the BKS tracts in the Central Basin Reserve, on the Atkinson Tract in the North Drainage Canal, and along the Rosa tract (ICF 2012).

Occurrence at the Greenbriar Development Project Sites

The Greenbriar Project Site currently provides 3.21 acres of aquatic habitat for this species in Lone Tree Canal and two minor tributaries to Lone Tree Canal and 32.0 acres of low quality upland habitat within 200 feet of aquatic habitat. The upland habitat is low quality because it is in hay production and is cultivated regularly. The Spangler Reserve provides approximately 235.4 acres of suitable pond turtle habitat and the North Nestor Reserve provides approximately 219.1 acres of suitable pond turtle habitat. At both reserve sites, this habitat is in the form of rice fields, canals, and adjacent uplands. The irrigation and drainage canals and irrigated croplands throughout both reserve sites provide suitable foraging habitat for western pond turtle, and a

suitable movement/dispersal corridor. The access roads and berms adjacent to the canals and rice fields provide potentially suitable habitat for basking or hibernation. Limited habitat for western pond turtle occurs at the Moody Reserve in the drainage along the southern boundary as well as upland areas on the Moody Property outside of the active agricultural fields (ruderal/disturbed areas and non-native grassland). Pond turtles have not been observed at any of the properties associated with the Greenbriar Development Project but this species can be difficult to detect with visual encounter surveys and could be present in suitable habitat on any of these properties.

6.4.2. Greenbriar Development Project Effects on Species

6.4.2.1. LONG-TERM EFFECTS ON HABITAT

Effect on Quantity of Habitat

Overall, the Greenbriar Development Project would result in an estimated loss of 169 acres of western pond turtle habitat compared to 2001 conditions. Effects on the acreage of western pond turtle habitat at the Greenbriar Project Site (includes the Lone Tree Canal Reserve) and Spangler Reserve are summarized in **Table 24**. No land use changes are anticipated at the Moody Reserve or the North Nestor Reserve; therefore, these sites are not included in the table. At the Greenbriar Project Site, there would be an estimated 131.4 acres less western pond turtle habitat compared to conditions at the time of the NBHCP (2001), although only 35.21 acres of this change is attributable to the Greenbriar Development Project (the rest is due to the discontinuation of rice farming in 2004; HELIX 2013a). A total of 2.5 acres of canals would be lost at the Spangler Reserve based on 2001 conditions; however, approximately 177.1 acres of rice will be converted to managed marsh complex (along with some upland and canal habitat) which will improve the habitat quality of the site for western pond turtle. The apparent loss of canal acreage at the Spangler Reserve is likely due to differences in mapping methods for the canals between 2001 and 2012 (e.g. how much adjacent bank was included within the canal acreage) since no canal alteration is proposed at the Spangler Reserve.

Table 24. Change in Acreage of Western Pond Turtle Habitat at Project Sites and in the Natomas Basin (Compared to 2001 Conditions)

LAND COVER TYPE PROVIDING HABITAT	FUTURE CONDITION	CHANGE AT EACH PROJECT SITE		TOTAL CHANGE	FUTURE CONDITION WITH PROJECT
		Greenbriar	Spangler		
Canals	1,162	-15.0	-2.5	-17.5	1,144.5
Ponds and seasonally wet areas	2,259	43.6*	142.0	185.6	2444.6
Rice	11,643	-160.0**	-177.1	-337.1	11,305.9
Riparian	91	0	0	--	91
TOTAL	15,155	-131.4	-37.6	-169	14,986

Note: Acreages are based on 2001 land cover mapping used to evaluate future condition resulting from the NBHCP and future land cover proposed at Project sites. No change in land use is anticipated at the Moody Reserve or the North Nestor Reserve; therefore, these sites are not included in the table.

*The 43.6 acres includes the 1.8 acres of freshwater marsh habitat that will be created/enhanced in the Lone Tree Canal Reserve and the 41.8-acre detention basin that would be created on the interior of the Greenbriar Project Site because it is expected to provide habitat for western pond turtle.

**No rice is being lost at the Greenbriar Project Site as a result of the Greenbriar Development Project. A total of 160 acres of rice production was present on the site in 2001, which was used as the baseline conditions for the NBHCP. Rice production was discontinued at the site in 2004 when the site was in previous ownership (i.e., not owned by the Project Applicant). Only 7.64 acres of western pond turtle habitat in the form of canals and adjacent uplands would be lost at the Greenbriar Project Site based on current conditions.

The Greenbriar Conservation Strategy (described in Chapter 2.7) includes preservation, enhancement, and long-term management of approximately 557 acres of reserves that would be managed for the purpose of providing a benefit to all of the NBHCP Covered Species. Of these 557 acres, all but 74 acres (the 74±acre Moody Reserve) will represent high quality habitat for western pond turtle, and some portions of the Moody Reserve will also be habitat for western pond turtle (uplands adjacent to riparian and canal habitats). As a result of the Greenbriar Development Project, a minimum of 482.8 acres of western pond turtle habitat will be enhanced and preserved in the Basin in perpetuity, consisting of 235.4 acres at the Spangler Reserve, 219.1 acres at the North Nestor Reserve, and 28.3 acres at the Lone Tree Canal Reserve.

Effects on Quality of Habitat

Areas Adjacent to Developed Land or Highways

As discussed above in *Mechanisms of Habitat Degradation*, any turtles traveling through Lone Tree Canal or inhabiting other canals and wetlands downstream from the Greenbriar Project Site could be affected by the residential development through increased predation, disturbance, and degradation of aquatic habitat. (The adjacent MAP development does not include residential development.) Development of the Greenbriar Project Site also would reduce the acreage of land draining into Lone Tree Canal, and thus could lead to reduced flows in the canal. In the

absence of measures to offset this alteration, the quality of western pond turtle habitat along Lone Tree Canal could be reduced by this loss of water. However, both the MAP HCP (Thomas Reid Associates 2001) and the Greenbriar Conservation Strategy contain measures to assure the provision of water in Lone Tree Canal. The applicable measure (complete measures described in **Appendix F**) is as follows:

Aquatic habitat shall be maintained throughout the GGS active season in Lone Tree Canal, in perpetuity. This is the legal responsibility and obligation of the MAP POA. The MAP HCP includes provisions under changed circumstances (Thomas Reid Associates 2001) to ensure that water levels are maintained at or above 12 inches of depth. If water is not provided to Lone Tree Canal by the MAP to meet the habitat requirements of GGS, as required by the MAP HCP, and USFWS exhausts its enforcement responsibilities, the Greenbriar Development Project Applicant shall assume the responsibility of providing suitable GGS aquatic habitat throughout the section of Lone Tree Canal within the Lone Tree Canal Reserve. Assuming this responsibility was a mitigation measure in the City of Sacramento's EIR for the Greenbriar Development Project (EDAW 2006). However, as stated in the EIR, the Greenbriar Development Project Applicant shall only assume this responsibility if it has been sufficiently demonstrated to the City of Sacramento that USFWS has exhausted all reasonable means to compel MAP to comply with the relevant conditions of the MAP ITP. Specific requirements related to ensuring suitable aquatic habitat in Lone Tree Canal is present, in perpetuity, throughout the GGS active season, shall be developed through consultation with CDFW and USFWS, and may include mechanisms, such as installation of a well, to assure water is provided in the canal to meet habitat requirements.

As described under *Connectivity of Habitat in the Natomas Basin* (in Chapter 5.5 of this report), the Greenbriar Conservation Strategy includes measures that would substantially reduce the effects of the development on the Greenbriar Project Site on adjacent western pond turtle habitat.

Alteration of Habitat Quality at Proposed Reserve Sites

The Spangler Reserve is currently in active rice production and portions of the site would remain in active rice production under the Greenbriar Conservation Strategy; however, 142.1 acres of rice would be converted to managed marsh and upland that would provide significantly higher quality habitat for western pond turtle. The Lone Tree Canal Reserve would result in improved habitat for western pond turtle due to recontouring the banks to promote the growth of freshwater marsh plants along the east side of the canal. Although both reserve sites will preserve potential

aquatic and upland habitats for this species, no land use changes are proposed at the Moody Reserve or the North Nestor Reserve. Due to the creation/establishment of marsh habitat at the Spangler Reserve and the Lone Tree Canal Reserve and management of all of the Project's reserves to benefit western pond turtle and other NBHCP Covered Species, the Greenbriar Development Project would result in an increase in habitat quality for western pond turtle at the reserve sites.

6.4.2.2. EFFECTS ON CONNECTIVITY

The importance of habitat connectivity for this species is discussed in *Mechanisms of Habitat Degradation*, above. In the absence of effective conservation measures, the Greenbriar Development Project would reduce connectivity of western pond turtle habitat by altering adjacent uplands, reducing water flows in the canal, and increasing predation and human disturbance. However, as described under *Connectivity of Habitats in the Natomas Basin*, the Greenbriar Conservation Strategy includes measures that would substantially reduce these effects. These measures (described in **Appendix F**) include creation, enhancement and preservation of habitat (including freshwater marsh habitat along Lone Tree Canal) in the 28.3 net acre reserve along Lone Tree Canal, a barrier/fencing to reduce predation and human disturbance effects, an additional assurance that aquatic habitat would be maintained in Lone Tree Canal, and provisions for the long-term protection of this conserved area. In addition, the preservation of Lone Tree Canal on the Greenbriar Project Site would protect an important dispersal corridor for western pond turtle between suitable habitat to the north and south of the site. These measures would substantially reduce the Greenbriar Development Project's potential effects on connectivity.

6.4.2.3. EFFECTS OF CONSTRUCTION-RELATED ACTIVITIES

Construction-related activities associated with the Greenbriar Development Project could affect western pond turtle, though the Greenbriar Project Site currently provides only marginally suitable habitat. Also, construction-related degradation of water quality in Lone Tree Canal could affect turtles downstream. In addition, western pond turtles could be harmed during restoration activities at the Lone Tree Canal Reserve and the Spangler Reserve by being crushed under equipment or entombment in their winter burrows. Conservation measures proposed to avoid and minimize take of western pond turtles and GGS, as well as construction water quality best management practices (BMPs), would reduce any direct construction-related effects on this species. These measures (included in **Appendix F**) include pre-construction surveys and presence of a qualified biological monitor(s) during any dewatering of the canals to relocate any western pond turtles in the canals to suitable habitat up or downstream of the area of disturbance. GGS measures will also benefit western pond turtle, such as dewatering between April 15 and September 30 of all irrigation ditches, canals, or other aquatic habitat within the construction

area, with no ponded water remaining, for at least 15 consecutive days prior to the excavation or filling in of the dewatered habitat.

6.4.2.4. EFFECTS OF HUMAN-WILDLIFE CONFLICTS

As discussed above in *Mechanisms of Habitat Degradation*, in the absence of avoidance and minimization measures, western pond turtles (to the extent that they may be present near the Greenbriar Project Site) could experience increased predation near the residential development on the Greenbriar Project Site because of a likely increased abundance of domestic dogs and cats, as well as human-associated native predators such as raccoons, skunks and opossums. The increased human population in the area would also increase the potential for human activity near the canal, which may lead to site avoidance by western pond turtles (Eric Hansen, pers. comm.). Mortality because of vehicle strikes may also increase on existing roads because of the increased traffic that the development on the Greenbriar Project Site would produce.

However, as described under *Connectivity of Habitat in the Natomas Basin* (Chapter 5.5), the proposed Greenbriar Conservation Strategy (included in **Appendix F**) includes the following measure that would substantially reduce these effects:

A masonry and metal fencing barrier shall be installed between the Lone Tree Canal Reserve and the adjacent development on the Greenbriar Project Site, and at the boundary of the Lone Tree Canal Reserve along W. Elkhorn Boulevard and at the Meister Way/Green Line to the Airport light rail and Residential Street 3 crossings of the Lone Tree Canal Reserve, to ensure that GGS do not enter the development area, and to prevent humans and pets from entering the reserve. The design of the barrier will be subject to USFWS review and approval. The barrier shall be maintained on the reserve side by a USFWS-approved third party Plan Operator to ensure that vegetation or debris does not accumulate near the barrier and provide opportunities for wildlife and pets to climb over the barrier. On the development side, adjacent to the barrier, CC&Rs shall prohibit accumulation of vegetation or debris adjacent to the barrier.

6.4.2.5. OVERALL EFFECT ON POPULATION VIABILITY

Overall, the Greenbriar Development Project would not adversely affect western pond turtle. The loss of 129.2 acres of marginal habitat based on 2001 conditions would be more than offset by the increased habitat quality at the Project's reserves resulting from the preservation of habitat, creation of marsh, and management of rice to enhance habitats. Based on 2015 conditions, the project will result in a net increase of 25 acres of western pond turtle habitat in the Basin. The Greenbriar Conservation Strategy would conserve connectivity and habitat for western pond turtle along Lone Tree Canal and near proposed reserves in the southern and

central Basin. These beneficial effects on habitat and connectivity are expected to increase the viability of the Natomas Basin's western pond turtle population.

6.5. Tri-colored Blackbird

6.5.1. Species Ecology

6.5.1.1. HABITAT ASSOCIATIONS/REQUIREMENTS

Habitat Type

Tri-colored blackbirds nest in dense colonies that range from less than 25 individuals to over 80,000 individuals. As nesting and foraging habitat differ for this species, these habitats were analyzed separately. Common nesting substrates include tule and cattail marsh, blackberry, thistle, willow, nettle, and some grain crops (Beedy and Hayworth 1991). Because patches of dense nesting substrate do not necessarily correlate with the land cover types defined by the NBHCP, the NBHCP analyzed these patches separately as "tri-colored blackbird nesting habitat." Special habitat features that improve nesting blackbird abundance, survival and reproductive success include dense nesting substrates and proximity to concentrated insect populations large enough to sustain the colony (Grinnell and Miller 1944, DeHaven 2000).

Tri-colored blackbirds forage in grassland, pasture, silage, wetlands and flooded fields, rice, and other grain fields (Zeiner et al. 1990). Land cover types designated as tri-colored blackbird foraging habitat in the NBHCP include alfalfa, grassland, non-rice crops, pasture, and rice. As they represent a transition between cropland and grassland habitats, idle and ruderal fields may also provide marginal foraging habitat. Tri-colored blackbirds are primarily insectivorous, with grasshoppers, beetles, and weevils dominating their diet (Beedy and Hayworth 1991).

Home Range Size and Movement

Breeding tri-colored blackbirds concentrate foraging activity in proximity to nesting colonies, and may travel up to 4 miles from nesting or roosting sites to forage. The species is generally nomadic when not breeding, and may be found year-round throughout lowland California.

6.5.1.2. MECHANISMS OF HABITAT DEGRADATION

Increased Predation

The abundance of blackbird predators such as domestic cats and foxes typically increases in proximity to residential development (Crooks and Soule 1999). Although increased predation near residential development would likely be much less for vigilant, mobile flocks of foraging tri-colored blackbirds than for more stationary nesting birds such as loggerhead shrikes or western burrowing owls, predation rates would be expected to increase for all small bird species near residential development.

Nest Disturbance

Nesting colonies of tri-colored blackbirds are highly sensitive to disturbance, which may cause nest abandonment or interfere with the incubation and feeding of young in a way that reduces reproductive success (City of Sacramento et al. 2003).

Water Diversion and Runoff

Water diversions and urban runoff may degrade wetland habitat for tri-colored blackbirds nesting downstream from a diversion.

6.5.1.3. DISTRIBUTION

Information on CNDDDB Occurrences

In 2001, the NBHCP did not list state-wide or Basin-specific CNDDDB occurrences of tri-colored blackbirds, but noted that there were nine reported occurrences in Sutter County, of which seven were extant in 2001. As of 2015, there are three reported occurrences of tri-colored blackbird in CNDDDB for the Natomas Basin, of which two are presumed extant. There are no reported occurrences within one mile of the Greenbriar Project Site or the Spangler Reserve. The CNDDDB records indicated the nearest documented occurrence of this species was from 1992 with approximately 200 tri-colored blackbirds nesting in willow trees along an irrigation ditch. This occurrence is approximately 1.5 miles east of the Greenbriar Project Site, 4 miles southeast of the Spangler Reserve, and 5 miles southeast of the Moody Reserve. The CNDDDB records indicate two documented occurrences of tri-colored blackbird within 5 miles of the North Nestor Reserve, which are both from 1936 with flocks of tri-colored blackbirds nesting in cattails and tules approximately 1.75 mile west and 2.75 miles southwest of the reserve site (CDFW 2015). Both occurrences were considered extirpated by 1991.

Other Information on Distribution and Abundance in Natomas Basin

Tri-colored blackbirds are known to forage throughout the Basin, and have been observed foraging on the MAP site near the Greenbriar Project Site (Thomas Reid Associates 2001). In the Natomas Basin, tri-colored blackbird has nested on three properties owned or managed by TNBC: the BKS tract along the eastern edge of the central-Basin, the Frazer tract in the northern portion of the Basin adjacent to the Natomas Cross Canal, and the Willey Wetlands Preserve in the southern portion of the Basin south of I-5. Tri-colored blackbird has only been documented nesting on private property along the north edge of the Basin near the Frazer tract, where this species was documented nesting in 2007 (ICF 2014).

Occurrence at the Greenbriar Development Project Sites

Tri-colored blackbird has not been observed on any of the properties associated with the Greenbriar Development Project. The entire 577-acre Greenbriar Project Site provides suitable foraging habitat for this species, although it is unlikely that tri-colored blackbird would use the

patchy emergent vegetation in Lone Tree Canal for nesting. The Spangler and North Nestor reserves provide foraging opportunities in the rice fields as well as along the canals and in upland areas, which consist of ruderal areas along the perimeter of rice fields or on berms between fields and along the banks of canals. The alfalfa fields at the Moody Reserve provide foraging habitat for tri-colored blackbird.

6.5.2. Greenbriar Development Project Effects on Species

6.5.2.1. LONG-TERM EFFECTS ON HABITAT

Effect on Quantity of Habitat

The Greenbriar Development Project’s effects on the acreage of nesting habitat for tri-colored blackbirds in the Basin are summarized in **Table 24**. The Greenbriar Project Site and proposed reserve sites were not considered to support tri-colored blackbird nesting habitat in the NBHCP. The managed marsh proposed for creation at the Spangler Reserve is expected to provide suitable nesting habitat for tri-colored blackbird. An estimated 128.7 acres of the managed marsh will consist of suitable nesting habitat for tri-colored blackbird (excludes ruderal and canal/ditch components). The proposed creation of 1.8 acres of freshwater marsh habitat in the Lone Tree Canal Reserve would also provide potential nesting habitat for tri-colored blackbird. Therefore, the Greenbriar Development Project would result in a net gain of 130.5 acres of potential nesting habitat for this species in the Basin.

Table 25. Change in Acreage of Tri-colored Blackbird Nesting Habitat at Project Sites and in the Natomas Basin Based on 2001 Conditions

LAND COVER TYPE PROVIDING HABITAT ²	FUTURE CONDITION	CHANGE AT EACH PROJECT SITE		TOTAL CHANGE	FUTURE CONDITION WITH PROJECT
		Greenbriar	Spangler		
Ponds and seasonally wet areas	2,259	1.8*	128.7**	130.5	2,389.5

Note: Acreages are based on 2001 land cover mapping used to evaluate future condition resulting from the NBHCP and future land cover proposed at Project sites.

*Represents wetland habitat creation in Lone Tree Canal. The 41.8 acres of detention basin were not included in this calculation because it is not expected to provide habitat for tri-colored blackbird.

**Represents the acreage of managed marsh cells that will be created at the Spangler Reserve.

The Greenbriar Development Project’s effects on the acreage of potential foraging habitat for tri-colored blackbirds at the Greenbriar Project Site (includes Lone Tree Canal Reserve) and Spangler Reserve are summarized in **Table 25**. No change in the acreage of potential foraging habitat for tri-colored blackbird is anticipated at the Moody Reserve or the North Nestor Reserve; therefore, these sites are not included in the table (rotational fallowing of rice at North Nestor is not expected to result in a loss of foraging habitat for tri-colored blackbirds because the fallowed rice fields will be suitable foraging habitat). The proposed development at the

Greenbriar Project Site would eliminate an estimated 399.6 acres of foraging habitat. The conversion of rice to managed marsh and uplands at the Spangler Reserve would result in a net gain of 4.7 acres of tri-colored blackbird foraging habitat at that site. Therefore, the Greenbriar Development Project would reduce the acreage of tri-colored blackbird foraging habitat in the Natomas Basin by approximately 394.9 acres based on 2001 conditions.

Table 26. Change in Acreage of Tri-colored Blackbird Foraging Habitat at Project Sites and in the Natomas Basin Compared to 2001 Conditions

LAND COVER TYPE PROVIDING HABITAT	FUTURE CONDITION	CHANGE AT EACH PROJECT SITE		TOTAL CHANGE	FUTURE CONDITION WITH PROJECT
		Greenbriar	Spangler		
Alfalfa	368	–	–	–	368
Grassland	284	26.5	53.1*	79.6	363.6
Non-rice crops	9,533	-234.1	–	-234.1	9,298.9
Pasture	494	-33.8	–	-33.8	460.2
Rice	11,643	-160.0	-177.1	-337.1	11,305.9
Ponds and seasonally wet areas	2,259	1.8**	128.7***	130.5	2,389.5
TOTAL	24,581	-399.6	4.7	-394.9	24,186.1

Note: Acreages are based on 2001 land cover mapping used to evaluate future condition resulting from the NBHCP and future land cover proposed at Project sites.

*Represents creation of 18.11 acres of annual grassland/seasonal wetland complex.

**Represents wetland habitat creation in Lone Tree Canal. The 41.8 acres of detention basin were not included in this calculation because it is not expected to provide habitat for tri-colored blackbird.

***Represents 128.69 acres of managed marsh complex (See Table 9 - Description of Proposed Habitats at the Spangler Reserve by Category), excludes ruderal and ditch/canal components.

The proposed Greenbriar Conservation Strategy includes preservation, enhancement, and long-term management of approximately 557 acres of reserve that would be managed for the purpose of providing a benefit to all of the NBHCP Covered Species. Habitat for tri-colored blackbird will be provided at all of the Project’s proposed reserves including 26.5 acres of grassland habitat at the Lone Tree Canal Reserve, 59.11 acres (55.48 acres of alfalfa and 3.63 acres of grassland) at the Moody Reserve, 222.1 acres (40.3 acres of rice, 128.67 acres of managed marsh and 53.11 acres of grassland/seasonal wetland complex) at the Spangler Reserve, and 206.0 acres of rice (does not include ruderal components) at the North Nestor Reserve. Based on the proposed Greenbriar Conservation Strategy, an estimated 513.7 acres of foraging habitat would be permanently preserved for the tri-colored blackbird at the Greenbriar Development Project’s reserves (Table 27).

Table 27. Summary of Tri-Colored Blackbird Foraging Habitat Provided by the Greenbriar Development Project’s Reserves

Greenbriar Project Reserve	Tri-colored Blackbird Foraging Habitat (Acres)
Lone Tree Canal Reserve	26.5
Moody Reserve	59.11
Spangler Reserve	222.1
North Nestor Reserve	206.0
Total Tri-Colored Blackbird Foraging Habitat	513.7 Acres

Effects on Quality of Habitat

Areas Adjacent to Developed Land or Highways

Although the urban area that would be created by the development at the Greenbriar Project Site would result in a net reduction of areas within 800 feet or 1 mile of development, the development would expand a gradient of urban influence into the previously unaffected area to the north of the site and increase the urban influence in the idle field to the southwest. The potential effects in this area on tri-colored blackbirds are discussed under *Mechanisms of Habitat Degradation*, above. These effects include increased predation of foraging tri-colored blackbirds but not of nesting blackbirds. Marginal tri-colored blackbird nesting habitat occurs in the vicinity of the Greenbriar Project Site but no known tri-colored blackbird nesting colonies occur; therefore, the development at the Greenbriar Project Site would not result in nest disturbance unless new nests were established near the site.

Adverse effects on adjacent land would be limited by I-5 along the Greenbriar Project Site’s southern border and by W. Elkhorn Boulevard (which would be expanded to six lanes) along the site’s northern border, which would serve as partial barriers between development on the site and adjacent agricultural lands.

Habitat Alteration at Proposed Reserve Sites

Tri-colored blackbird habitat quality would be expected to increase at the Moody Reserve, the North Nestor Reserve, and the Spangler Reserve due to management of the sites to benefit foraging birds, reduction of human intrusion, and creation of managed marsh (Spangler Reserve). Conservation of the corridor along Lone Tree Canal may improve its value as foraging habitat because it would be converted to perennial grassland that might have higher habitat value than the corridor's recent agricultural land cover. This corridor, however, would be a relatively narrow band of potential habitat surrounded by urban development, and this setting might limit its use by tri-colored blackbird. Conservation of the seasonal wetland and riparian habitat along the southern boundary of the Moody Reserve is expected to provide potential nesting habitat for tri-colored blackbird as these habitats mature.

Overall, the reserve sites are expected to increase in quality for tri-colored blackbird habitat as a result of the Greenbriar Development Project.

6.5.2.2. EFFECTS ON CONNECTIVITY

Because tri-colored blackbirds are largely nomadic when not nesting, connectivity for this species is mostly pertinent to a 4-mile radius of foraging habitat surrounding nesting colonies. The Greenbriar Project Site is at the edge of this radius from the TNBC BKS reserve where tri-colored blackbirds have nested, and thus development at the Greenbriar Project Site would not affect connectivity of foraging habitat near this reserve (although it would reduce the habitat acreage within 4 miles of the reserve). The proposed Spangler Reserve is similarly located along the edge of this radius and would preserve foraging habitat and create additional nesting habitat within 4 miles of the TNBC BKS reserve (but would not affect connectivity). Preservation of the Moody Reserve would improve connectivity of foraging habitat within a 4-mile radius of the Willey Wetlands Preserve (managed by TNBC) where tri-colored blackbirds have nested. Similarly, preservation of the North Nestor Reserve would improve connectivity of foraging habitat within a 4-mile radius of the TNBC Frazer tract where tri-colored blackbirds have nested.

6.5.2.3. EFFECTS OF CONSTRUCTION-RELATED ACTIVITIES

Construction-related activities are unlikely to affect tri-colored blackbirds because they are not known to nest in the immediate vicinity of the Greenbriar Project Site and proposed reserve sites. Potential effects would be limited to displacement of birds foraging or roosting on the sites during the initial phases of construction when fields are graded. At most, this impact would be similar to habitat loss, as the physical flight of the birds from these areas would not cause a significant effect. However, conservation measures (included in **Appendix F**) including pre-construction surveys and avoidance of any active nests during the nesting season will be implemented.

6.5.2.4. EFFECTS OF HUMAN-WILDLIFE CONFLICTS

Because tri-colored blackbirds are not currently known to nest in the vicinity of the proposed development on the Greenbriar Project Site or the proposed reserve sites, nest disturbance by humans are not anticipated to occur as a result of the Greenbriar Development Project. Increased populations of human-associated predators may result in increased predation of foraging blackbirds near the Greenbriar Project Site post-development, as discussed in *Mechanisms of Habitat Degradation*, above.

6.5.2.5. OVERALL EFFECT ON POPULATION VIABILITY

Overall, the Greenbriar Development Project would result in a loss of 395 acres of foraging habitat for this species in the Basin based on 2001 conditions and a loss of 474 acres of foraging habitat based on 2015 conditions. The Greenbriar Development Project is not expected to have an overall effect on the population viability of tri-colored blackbird in the short term because of the limited current use of the Natomas Basin by tri-colored blackbird and the substantial quantities of foraging habitat that exist in the Basin. The Project will result in an increase in nesting habitat as well as preserved foraging habitat in the Basin. The Greenbriar Development Project would increase the quantity of nesting habitat in the Natomas Basin by 134.5 acres. Although currently, nesting habitat is more limited than foraging habitat in the Natomas Basin, under the future condition much more nesting habitat will exist, and thus the additional nesting habitat that would be provided by the Greenbriar Development Project may not affect the tri-colored blackbird population in the Basin significantly. The Greenbriar Development Project would be expected to cause a small beneficial effect on tri-colored blackbird use of the Natomas Basin in the long term.

Because the Greenbriar Development Project would have little effect on tri-colored blackbird use of the Natomas Basin, and because the Natomas Basin accounts for only a small portion of the habitat for and population of tri-colored blackbird in the Central Valley, the Greenbriar Development Project would not alter the viability of the tri-colored blackbird population using the Natomas Basin.

6.6. Western Burrowing Owl

6.6.1. Species Ecology

6.6.1.1. HABITAT ASSOCIATIONS/REQUIREMENTS

Habitat Type

Western burrowing owl typically inhabits grasslands, savannahs and other open habitats with low-lying vegetation. Land cover types designated as western burrowing owl habitat in the NBHCP include alfalfa, grassland and pasture. Western burrowing owls are also known to nest

and forage in idle agricultural fields, ruderal fields and the edges of cultivated fields, although these areas provide lower quality habitat than grasslands. The NBHCP also describes canals as potential nesting habitat for burrowing owls, although it does not include canals in the list of potential habitats for this species. Levees and upper banks of canals and ditches provide western burrowing owl nesting habitat when canal maintenance activities are limited, water levels remain below nesting burrows and the area remains relatively undisturbed. Small mammal populations (particularly California ground squirrels) are the most important feature in western burrowing owl habitat, as these mammals provide both food and nesting burrows for the owls. When natural burrows are scarce, western burrowing owls will also nest in artificial structures such as culverts. They often nest in elevated areas such as berms and levees, where they may scan adjacent lands for predators and prey. Western burrowing owls feed primarily on large insects and rodents, and will also feed opportunistically on birds, reptiles and amphibians.

Home Range Size and Movement

Although the more northern western burrowing owl populations migrate seasonally, western burrowing owls are year-round residents of the Natomas Basin. The owls often form loose colonies, with nest burrows 46–2,952 feet apart (Ross 1974; Gleason 1978). Surprisingly little data are available on home range size for this species. Published estimates vary from 0.05–1.86 square miles (Haug and Oliphant 1990).

6.6.1.2. MECHANISMS OF HABITAT DEGRADATION

Increased Predation

Ground- and burrow-nesting birds such as western burrowing owls are particularly vulnerable to predation by domestic dogs and cats. Many wild predators of western burrowing owls also increase near human habitation. In proximity to residential development, dominant carnivores such as coyotes are typically replaced by foxes, opossums, skunks, and other small predators that feed on western burrowing owls (Sheffield 1997; Wellicome 1997; Crooks and Soule 1999). Avian predators such as great-horned owls and crows may also increase in proximity to residential development, in response to introduced nesting trees, increased food supplies and increased hunting perches such as street lights and other infrastructure (Steenhof et al. 1993; Marzluff et al. 2001). This increase in predator abundance would likely result in increased predation of western burrowing owl nests and adults near residential development.

Reduction of Prey Base

Changes in the owls' prey base may result from residential development affecting adjacent mammalian predator communities. Small mammals and insects are the primary prey of burrowing owls (NatureServe 2013a). Crooks and Soule (1999) quantified the effects of domestic cats on small animals. They estimated that the average domestic cat population in

moderately sized fragments (~50 acres of upland habitat bordered by 100 residences) returns about 840 rodents, 525 birds and 595 lizards to residences each year. Assuming that cats do not bring back all prey that they kill, actual effects on prey numbers are probably even greater. Crooks and Soule (1999) documented increased extirpations of songbird species in habitat fragments with higher densities of cats, raccoons and opossums, all of which often increase in proximity to residential development.

Compared to undeveloped areas at least 2,296 feet from development, Odell and Knight (2001) demonstrated lower densities of the western burrowing owls' secondary songbird prey within 1,083 feet of sparse residential development (about 0.4 houses per acre); impacts of higher density development are expected to be greater. Similarly, Blair (1996) reported 1/3 fewer bird species in lands adjacent to residential development, when compared to habitat preserves in the same area.

Habitat Fragmentation and Reduced Patch Size

Habitat fragmentation has been implicated as a major cause of population decline in grassland birds in general, and is likely to specifically impact western burrowing owls. Helzer and Jelinski (1999) found both overall avian species richness and the presence of several common grassland species to increase with the size of habitat patches (especially when >124 acres) and decrease with the perimeter-area ratio of these patches, which reflects the proportion of habitat influenced by edge effects.

In fragments 5–250 acres in size, Crooks et al. (2001) found fragment size to be the most important factor determining extinction and colonization of songbirds. No fragments up to 247 acres in size were large enough to support the full complement of native bird species with 95 percent probability over a 100-year period. Western burrowing owls forage in larger habitat patches than the smaller birds studied by Crooks et al. (2001), and are likely to be similarly affected by fragmentation. Hinsley et al. (1995) also demonstrated the instability of bird populations in habitat fragments.

Nest Disturbance

Although western burrowing owls are tolerant of human activity outside of the breeding season, they have been shown to abandon nests if disturbed during incubation. In addition to nest abandonment, significant disturbances near owl nests may interfere with parental care and feeding of young in a way that reduces nest success.

6.6.1.3. DISTRIBUTION

Information on CNDDB Occurrences

When information was compiled for the NBHCP, there were 370 known occurrences of western burrowing owl in California, of which 300 were considered extant. At that time, three occurrences were known from the Natomas Basin, all of which were considered extant. As of 2015, 17 occurrences of western burrowing owl are documented in the CNDDB in the Natomas Basin, of which 16 are considered extant. Of these extant occurrences, one is within a mile of the Greenbriar Project Site. The CNDDB records indicated documented occurrences of active burrows and western burrowing owls observed near drainage canals adjacent to rice fields approximately 0.75-mile north of the Greenbriar Project Site near SR 99/70. There is also a reported occurrence of burrowing owl at the Sacramento International Airport approximately 0.3 mile east of the Moody Reserve where two adults and a juvenile were observed in 2006. There are no reported occurrences of burrowing owl within one mile of the Spangler Reserve or the North Nestor Reserve.

Other Information on Distribution and Abundance in Natomas Basin

No systematic surveys have been conducted to determine western burrowing owl distribution or abundance across the Natomas Basin. Western burrowing owls breed and winter in low densities in the Natomas Basin, primarily along the eastern terrace and in the southeastern portion of the Basin (ICF 2014). During biological effectiveness monitoring for the NBHCP, two nesting pairs of owls were observed near the Highline Canal that separates the Elsie and Tufts reserves, one nesting pair was observed on the Sills reserve, an individual owl was observed on the north side of the Tufts reserve, one individual western burrowing owl was regularly observed on the BKS reserve, and nine pairs of western burrowing owls were observed on non-reserve lands (ICF 2012). During surveys in 2004 and 2005, western burrowing owls were observed in the eastern Basin south of Elverta Road and in the central Basin along SR 99/70 (approximately 1.3 miles north of the Greenbriar Project Site) (Jones & Stokes 2005). Western burrowing owls have also been incidentally observed east of the Greenbriar Project Site along W. Elkhorn Boulevard and west of the Greenbriar Project Site on the Metro Air Park and Sacramento International Airport.

6.6.1.4. OCCURRENCE AT THE GREENBRIAR DEVELOPMENT PROJECT SITES

A burrowing owl was incidentally observed in a culvert on the southwestern portion of the Greenbriar Project Site in March 2005 (EDAW 2006). A number of owl pellets and whitewash were also observed, indicating extended use of the site by at least one owl for roosting and foraging over a period of time, and possible nesting. A burrowing owl was also observed by HELIX biologists next to a burrow in the foundation of a remnant structure on the Greenbriar Project Site on December 13, 2012. Western burrowing owls were not detected during several subsequent visits during winter 2012/2013 by HELIX biologists and no burrowing owls have

been detected on the site in any subsequent site visits by HELIX personnel. The active agricultural fields, disturbed annual grassland, and network of dry canals and ditches on the Greenbriar Project Site provide approximately 577 acres of suitable foraging habitat for this species. The canal banks, some culverts, and foundations of remnant structures provide potential nesting habitat.

The Spangler Reserve and the North Nestor Reserve provide foraging opportunities along the canals and in upland areas, which consist of ruderal areas along the perimeter of rice fields or on berms between fields and along the banks of canals. The Moody Reserve provides foraging and nesting habitat for burrowing owl in and around the perimeter of the alfalfa fields and grassland/ruderal habitats. Burrowing owls have not been observed on any of the Project's reserve sites.

6.6.2. Greenbriar Development Project Effects On Species

6.6.2.1. LONG-TERM EFFECTS ON HABITAT

Effect on Quantity of Habitat

The Greenbriar Development Project's effects on western burrowing owl habitat at the Greenbriar Project Site (includes Lone Tree Canal Reserve), Spangler Reserve, and the North Nestor Reserve are summarized in **Table 28**. No changes in land use are anticipated at the Moody Reserve; therefore, this site is not included in the table. The proposed development at the Greenbriar Project Site would result in the loss of an estimated 94.0 acres of western burrowing owl habitat; however, habitat will be created for burrowing owl at the Spangler Reserve and North Nestor Reserve. Therefore, the Greenbriar Development Project would increase the acreage of burrowing owl habitat in the Natomas Basin from conditions at the time of the NBHCP (2001) by an estimated 81.7 acres.

Table 21 in Chapter 6.3.2.1 *Long-term Effects on Habitat* (under Swainson's hawk) is a summary of the change in acreage of foraging habitat at the Spangler Reserve and the North Nestor Reserve that would occur. Descriptions of the conceptual restoration design for these two sites are included in Chapter 2.7.2.2 *Off-Site Reserves*. Habitat creation and management changes at these two sites include fallowing of the rice fields on a rotational basis, creation of upland habitat components of managed marsh, creation of annual grassland/seasonal wetland complex, and dewatering of managed marsh cells on a rotational basis for vegetation management purposes.

Table 28. Change in Acreage of Western Burrowing Owl Habitat at Project Sites and in the Natomas Basin based on 2001 Conditions

LAND COVER TYPE PROVIDING HABITAT	FUTURE CONDITION	CHANGE AT EACH PROJECT SITE			TOTAL CHANGE	FUTURE CONDITION WITH PROJECT
		Greenbriar	Spangler	North Nestor		
Alfalfa	368	–	–		–	368
Canals	1,162	-15.0	-2.5		-17.5	1,144.5
Grassland	284	26.5	53.1		79.6	363.6
Idle	422	-62.5	8.1 *	43.8*	-10.6	411.4
Pasture	494	-33.8	–		-33.8	460.2
Ruderal	370	-9.2	-2.2**		-11.4	358.6
Upland marsh components/ Rotationally Dewatered Marsh	547	–	75.4***		75.4	622.4
TOTAL	3,647	-94.0	131.9	43.8	81.7	3,728.7

Note: Acreages are based on 2001 land cover mapping used to evaluate future condition resulting from the NBHCP and future land cover proposed at Project sites. No change in the acreage of western burrowing owl habitat is anticipated at the Moody Reserve; therefore this site is not included in the table.

*A total of 20% of the managed rice fields at the Spangler and North Nestor Reserves will be fallowed each year on a rotational basis to provide foraging habitat for Swainson’s hawk and other NBHCP Covered Species including western burrowing owl.

**Ruderal habitat is not being removed at the Spangler Reserve. The 2.2-acre difference in ruderal habitat at the Spangler Reserve between 2001 and future conditions is a result of different methods for quantifying vegetation communities.

***This 75.4 acres is comprised of 42.6 acres of upland components of managed marsh and 32.8 acres of marsh that will be dewatered on a rotational basis for vegetation management (See Table 21).

The Greenbriar Conservation Strategy includes preservation, enhancement, and long-term management of approximately 557 acres of reserve that would be managed for the purpose of providing a benefit to all of the NBHCP Covered Species. Foraging habitat for western burrowing owl will be provided at all of the Greenbriar Development Project’s proposed reserves by a combination of land use changes and habitat management changes. A total of 26.5 acres of grassland habitat at the Lone Tree Canal Reserve will provide foraging habitat for western burrowing owl (provides 13.3 acres at a 0.5:1 ratio). The entire 74±acre Moody Reserve will provide habitat for western burrowing owl. The 235.4-acre Spangler Reserve will provide an estimated 136.6 acres of moderate quality foraging habitat for western burrowing owl. The 219.1-acre North Nestor Reserve will provide a minimum of 43.8 acres of moderate quality foraging habitat for western burrowing owl in portions of rice fields when they are left idle (See **Table 21**). Therefore, a total of 268 acres of western burrowing owl habitat would be provided at the Greenbriar Development Project’s reserves (See **Table 22**).

Effects on Quality of Habitat

Areas Adjacent to Developed Land or Highways

Although the expanded urban area that would be created at the Greenbriar Project Site would result in a net reduction of areas within 800 feet or 1 mile of development, the development at the Greenbriar Project Site would expand a gradient of urban influence into the previously unaffected area to the north of the site and could increase the urban influence in the idle field to the southwest. The potential effects on western burrowing owls and their prey in these areas are discussed under *Mechanisms of Habitat Degradation*, above. These adverse effects, however, would be limited by I-5 along the Greenbriar Project Site's southern border, and by W. Elkhorn Boulevard (which would be expanded to six lanes) that would serve as partial barriers between development on the Greenbriar Project Site and adjacent agricultural lands. The current land use to the southwest of the Greenbriar Project Site is fallow agriculture, which supports western burrowing owl habitat.

Altered Habitat Quality at Proposed Reserve Sites

Overall, the Project's reserve sites are expected to increase in quality for western burrowing owl habitat as a result of the Greenbriar Conservation Strategy. Western burrowing owl habitat quality would be expected to increase at the Moody Reserve, the North Nestor Reserve, and the Spangler Reserve due to management of these reserve sites to benefit foraging birds as well as the creation of upland at the Spangler Reserve. Also, preservation of habitat, even without enhancement measures, provides some benefits, including that it precludes land use changes that would eliminate habitat, and should reduce or eliminate uses that could cause mortality of individuals. Conservation of the corridor along Lone Tree Canal may improve its value as foraging habitat because it would be converted to perennial grassland that would have higher habitat value than the corridor's current or recent agricultural land cover. This corridor, however, would be a relatively narrow band of potential habitat surrounded by urban development, and this setting might limit its use by western burrowing owl.

6.6.2.2. EFFECTS ON CONNECTIVITY

With the exception of the 250-foot wide conservation easement proposed along Lone Tree Canal, the development at the Greenbriar Project Site would eliminate the existing contiguity of upland habitats to the north and south of the site. This connectivity is already constrained by existing freeways and W. Elkhorn Boulevard, and will be further reduced by the MAP development. Western burrowing owl survival and reproduction are likely to be higher in larger, more contiguous habitat areas. Connectivity benefits western burrowing owls by providing greater ease of locating mates, greater flexibility in year-round foraging opportunities, and safer

passages for juvenile dispersal. The potential effects of reduced connectivity on upland birds in general are discussed under *Mechanisms of Habitat Degradation*, above.

The proposed Moody Reserve would preserve additional western burrowing owl habitat contiguous to SAFCA mitigation lands in close proximity to known western burrowing owl populations. Such preservation of larger, more contiguous areas of habitat is expected to benefit western burrowing owl survival and reproduction compared to current conditions.

6.6.2.3. EFFECTS OF CONSTRUCTION-RELATED ACTIVITIES

Earth-moving activities may trap or injure western burrowing owls in their burrows, and disturbance near nests may cause nest abandonment. The Greenbriar Conservation Strategy and the NBHCP require comparable measures to avoid impacts to western burrowing owls during construction. The Greenbriar Conservation Strategy contains measures to avoid and minimize construction-related effects on western burrowing owls such as preconstruction surveys and avoidance of occupied burrows during the nesting season (included in **Appendix F**). By following these measures, the potential for injury, entrapment, and nest abandonment would be reduced. However, nests may be abandoned because of loss of the surrounding foraging habitat during construction, and western burrowing owl viability at relocation sites is not guaranteed.

6.6.2.4. EFFECTS OF HUMAN-WILDLIFE CONFLICTS

On the remaining habitat adjacent to the proposed development on the Greenbriar Project Site, human activity may cause western burrowing owl nest abandonment or interfere with the incubation and feeding of young in a way that reduces reproductive success. Increased western burrowing owl predation would also likely occur in proximity to the proposed development, as a result of the typical increase in human-associated owl predators discussed above under *Mechanisms of Habitat Degradation*. Increased predation by domestic cats is likely to extend between 98–540 feet from homes, predation by domestic dogs is likely to extend between 540–990 feet from homes, and increased predation by wild predators is likely to extend farther (Odell and Knight 2001). Mortality of western burrowing owl because of vehicle strikes may also increase on existing roads because of the increased traffic that would result from the development at the Greenbriar Project Site.

6.6.2.5. OVERALL EFFECT ON POPULATION VIABILITY

Overall, the Greenbriar Development Project is expected to result in a beneficial effect on western burrowing owl because it would result in an increase of 46 acres of habitat for this species in the Basin based on 2001 conditions and an increase in habitat of 80 acres based on 2015 conditions. The Greenbriar Development Project is unlikely to have a substantial effect on western burrowing owls using the Natomas Basin, and since the Basin accounts for a very small portion of the Central Valley's western burrowing owl population and of the habitat it occupies

(USFWS 2003), the Greenbriar Development Project would not alter the viability of the western burrowing owl population using the Natomas Basin.

6.7. Loggerhead Shrike

6.7.1. Species Ecology

6.7.1.1. HABITAT ASSOCIATIONS/REQUIREMENTS

Habitat Type

The loggerhead shrike prefers open habitats with scattered shrubs, trees, posts, or other perches. It can be found in shrublands or open woodlands with bare ground, or sparse herbaceous cover, but is often found in open cropland (Zeiner et al. 1990). Loggerhead shrikes hunt in open areas of short grasses, forbs, or bare ground, and uses thorns or barbed wire to hold prey while eating, or to store for later. Suitable breeding habitat includes shrublands or open woodlands with grass cover or bare ground; birds in the Central Valley typically use riparian edges where they generally place their nests 1 to 2 meters above ground in shrubs or trees. Due to the hunting strategy of this bird, its habitat requirements are similar during breeding and non-breeding seasons. Land cover types designated as shrike habitat in the NBHCP include alfalfa, grassland, non-rice crops, oak groves, orchard, pasture, ponds and seasonally wet areas, riparian, ruderal, rural residential, tree groves, and canals. Special habitat features that improve shrike abundance, survival, and reproductive success are hunting perches, low nesting trees and shrubs, thorny vegetation, and/or barbed wire on which to impale their prey.

Home Range Size and Movement

The mean territory size of breeding loggerhead shrikes in mainland California is 22 acres (Miller 1931). The range-wide maximum and minimum breeding territory sizes recorded are 1.7 and 44 acres. Territory size varies with habitat quality, prey abundance and availability, and density of hunting perches (Kridelbaugh 1982, Yosef and Grubb 1992). Loggerhead shrikes have been observed foraging up to a quarter mile from active nests (Brooks 1988). Shrikes are year-round residents in California, and breeding pairs disband in autumn to defend separate, adjacent, winter territories (Miller 1951, Craig 1978). As food availability decreases in winter, seasonal home ranges may increase to 128 acres (Blumton et al. 1989). Juvenile shrikes move an average of 3.4 miles from their natal territories to their fall territories.

6.7.1.2. MECHANISMS OF HABITAT DEGRADATION

Increased Predation

Domestic cats are a common predator of loggerhead shrike adults, juveniles and nests (Luukkonen 1987, Novak 1989), and would increase in abundance following the proposed development. Crooks and Soule (1999) quantified the impacts of domestic cat predation on

songbirds such as loggerhead shrikes, and estimated that the average domestic cat population in moderately sized fragments (approximately 50 acres of upland habitat bordered by 100 residences) returns about 525 birds to human residences each year. Assuming that cats do not bring back all prey that they kill, actual impacts to birds are probably even greater.

Many wild mammalian predators of shrikes also increase near human habitation. In proximity to residential development, dominant, larger carnivores such as coyotes are typically replaced by foxes, opossums, skunks, and other small predators that feed on shrikes and other songbirds. Crooks and Soule (1999) have recorded increased avian extirpation rates in habitat fragments as a result of these predator increases.

Shrike nest predators such as crows also typically increase in proximity to residential development, in response to introduced nesting trees, increased food supplies, and increased hunting perches such as street lights and other infrastructure (Steenhof et al. 1993; Marzluff et al. 2001). Predation of loggerhead shrike nests is also more intense along roads, urban edges, and other linear habitats (DeGeus 1990), presumably because of the increased use of linear rights-of-way by crows and mammalian predators (Knight et al. 1995). Shrike mortality from vehicle collisions has also been significant in some areas (Shuford et al. 2008), and may increase with increased traffic generated by the proposed residential development.

Nest Disturbance

Loggerhead shrikes will abandon nests if disturbed by humans during egg-laying or early in incubation. Shrikes are generally tolerant of human activity near nests later in the breeding season, however, and nest abandonment is not generally a significant factor in nest failure (Collister 1994).

Habitat Fragmentation

Habitat fragmentation has been implicated as a major cause of population decline in grassland birds in general, and is likely to specifically affect loggerhead shrikes. Helzer and Jelinski (1999) found both overall avian species richness and the presence of several common grassland species to increase with the size of habitat patches (especially when >50 ha) and decrease with the perimeter-area ratio of these patches, which reflects the proportion of habitat influenced by edge effects. Hinsley et al. (1995) and Crooks et al. (2001) also demonstrated the instability of upland bird populations in habitat fragments.

6.7.1.3. DISTRIBUTION

Information on CNDDDB Occurrences

Although loggerhead shrikes are known to occur in open habitats throughout California, they have not been extensively surveyed and few occurrence data are available in the state. There are no reported occurrences in CNDDDB of loggerhead shrike in the Natomas Basin (CDFW 2015).

Other Information on Distribution and Abundance in Natomas Basin

Loggerhead shrike is known to nest on the Atkinson tract in the North Basin Reserve and occasionally on non-reserve lands in the Basin (ICF 2012).

Occurrence at the Greenbriar Development Project Sites

Loggerhead shrikes were observed on the Greenbriar Project Site during surveys in 2005 and again in 2012, including an active nest in the elderberry shrub on the site. The agricultural fields and disturbed annual grassland on the Greenbriar Project Site with areas of sparsely vegetated or bare ground, and few trees, provide potential foraging and some nesting habitat for this species. A total of 577 acres of foraging habitat for this species occurs at the Greenbriar Project Site.

The Spangler Reserve and the North Nestor Reserve provide foraging opportunities along the canals and in upland areas, which consist of ruderal areas along the perimeter of rice fields or on berms between fields and along the banks of canals. Nesting habitat for loggerhead shrike is present on the Moody Reserve within low trees and shrubs in the riparian corridor in the southern portion of the site and in the ruderal/disturbed areas. The entire Moody Reserve provides high quality foraging habitat for shrike.

6.7.2. Greenbriar Development Project Effects on Species

6.7.2.1. LONG-TERM EFFECTS ON HABITAT

Effect on Quantity of Habitat

The Greenbriar Development Project's potential effects on loggerhead shrike habitat at the Greenbriar Project Site (includes Lone Tree Canal Reserve), Spangler Reserve, and North Nestor Reserve are summarized in **Table 29**. No change in land use or impacts to loggerhead shrike habitat is anticipated at the Moody Reserve; therefore, this site is not included in the table. The proposed development at the Greenbriar Project Site would result in the loss of an estimated 327.8 acres of foraging habitat for loggerhead shrike; however, foraging habitat will be created for shrike at the Spangler Reserve and the North Nestor Reserve. Based on the proposed conservation measures, the Greenbriar Development Project would reduce the acreage of loggerhead shrike habitat in the Natomas Basin from conditions at the time of the NBHCP (2001) by an estimated 138.6 acres.

Table 29. Change in Acreage of Loggerhead Strike Habitat at Projects Sites and in the Natomas Basin Compared to 2001 Conditions

LAND COVER TYPE PROVIDING HABITAT	FUTURE CONDITION	CHANGE AT EACH PROJECT SITE			TOTAL CHANGE	FUTURE CONDITION WITH PROJECT
		Greenbriar	Spangler	North Nestor		
Alfalfa	368	–	–	–	–	368
Canals	1,162	-15.0	-2.5	–	-17.5	1,144.5
Grassland	284	26.5	–	–	27	311
Idle	422	-62.5	8.1*	43.8*	-10.6	411.4
Non-rice crops	9,533	-234.1	–	–	-234.1	9,298.9
Oak groves	77	–	–	–	–	77
Orchards	165	–	–	–	–	165
Pasture	494	-33.8	–	–	-33.8	460.2
Ponds and seasonally wet areas	2,259	43.6**	142.0***	–	185.6	2,444.6
Ruderal	370	-9.2	-2.2****	–	-11.4	358.6
Rural residential	287	-43.3	–	–	-44.9*****	243.7
Tree groves	44	–	–	–	–	44
TOTAL	15,465	-327.8	145.4	43.8	-138.6	15,326

Note: Acreages are based on 2001 land cover mapping used to evaluate future condition resulting from the NBHCP and future land cover proposed at Project sites. No change in the acreage of loggerhead shrike habitat is anticipated at the Moody Reserve or the North Nestor Reserve; therefore, these sites are not included in the table.

*A total of 20% of the managed rice fields at the Spangler and North Nestor Reserves will be fallowed each year on a rotational basis to provide foraging habitat for loggerhead shrike and other NBHCP Covered Species.

**The 43.6 acres includes the 1.8 acres of freshwater marsh habitat that will be created/enhanced in the Lone Tree Canal Reserve and the 41.8-acre detention basin that would be created on the interior of the Project site because it is expected to provide habitat for loggerhead shrike.

***Includes 142 acres of managed marsh with 8.19 acres of ruderal and 5.1 acres of canal.

****Ruderal habitat is not being created at Spangler. The 2.5-acre difference in ruderal habitat at Spangler between 2001 and future conditions is a result of different methods for quantifying vegetation communities (e.g., some agricultural roads were considered ruderal that were previously categorized into other adjacent land uses).

*****Includes 1.64 acres of rural residential that would be lost at the Moody Reserve, which is not included in the table.

Table 21 in Chapter 6.3.2.1 *Long-term Effects on Habitat* (under Swainson’s hawk) is a summary of the change in acreage of foraging habitat at the Spangler Reserve and the North Nestor Reserve that would occur. Descriptions of the conceptual restoration design for these two reserve sites are included in Chapter 2.7.2.2 *Off-Site Reserves*. Habitat creation and management changes at these two reserve sites include fallowing of the rice fields on a rotational basis, creation of upland habitat components of managed marsh, creation of annual grassland/seasonal wetland complex, and dewatering of managed marsh cells on a rotational basis for vegetation management purposes.

The proposed Greenbriar Conservation Strategy includes preservation, enhancement, and long-term management of approximately 557 acres of reserve that would be managed for the purpose of providing a benefit to all of the NBHCP Covered Species. Habitat for loggerhead shrike will be provided at all of the Project’s proposed reserves by a combination of land use changes and habitat management changes. A total of 26.5 acres of grassland habitat at the Lone Tree Canal Reserve will provide foraging habitat for loggerhead shrike. The entire 74±acre Moody Reserve will provide habitat for loggerhead shrike. A total of 195.1 acres of habitat will be provided for loggerhead shrike at the Spangler Reserve (everything except the active rice fields), and 43.8 acres will be provided at the North Nestor Reserve consisting of idle rice fields. Therefore, a total of 339.4 acres of habitat would be permanently preserved for the loggerhead shrike at the Greenbriar Development Project’s reserves (**Table 30**).

Table 30. Summary of Loggerhead Shrike Foraging Habitat Provided by the Greenbriar Development Project’s Reserves

Greenbriar Project Reserve	Loggerhead Shrike Foraging Habitat (Acres)
Lone Tree Canal Reserve	26.5
Moody Reserve	74
Spangler Reserve	195.1
North Nestor Reserve	43.8
Total Loggerhead Shrike Foraging Habitat	339.4 Acres

Effects on Quality of Habitat

Areas Adjacent to Developed Land or Highways

Although the urban area that would be created by the Greenbriar Development Project would result in a net reduction of areas within 800 feet or 1 mile of development, the development at the Greenbriar Project Site would expand a gradient of urban influence into the previously unaffected area to the north of the site and could increase the urban influence in the idle field to the southwest. The potential effects on loggerhead shrikes in these areas are discussed under *Mechanisms of Habitat Degradation*, above. These adverse effects, however, would be limited by I-5 along the Greenbriar Project Site’s southern border, and by W. Elkhorn Boulevard (which would be expanded to six lanes) that would serve as partial barriers between development on the

site and adjacent agricultural lands. The current land use to the southwest of the Greenbriar Project Site is fallow agriculture, which supports loggerhead shrike habitat.

Altered Habitat Quality at Proposed Reserve Sites

Loggerhead shrike habitat quality would be expected to increase at the Moody Reserve, the North Nestor Reserve, and the Spangler Reserve due to management of these reserve sites to benefit foraging birds and creation of upland components of managed marsh at the Spangler Reserve. Conservation of the corridor along Lone Tree Canal may improve its value as foraging habitat because it would be converted to perennial grassland that might have higher habitat value than the corridor's current or recent agricultural land cover. This corridor, however, would be a relatively narrow band of potential habitat surrounded by urban development, and this setting might limit its use by loggerhead shrike.

Overall, the reserve sites are expected to increase in quality for loggerhead shrike habitat as a result of the Greenbriar Development Project.

6.7.2.2. EFFECTS ON CONNECTIVITY

With the exception of the 250-foot wide proposed conservation easement along Lone Tree Canal, development at the Greenbriar Project Site would further reduce the existing contiguity of upland habitats to the north and south of the site. This connectivity is already reduced due to the freeways and W. Elkhorn Boulevard, and will be further reduced by development at the MAP property. Shrike survival and reproduction are likely to be higher in larger, more contiguous habitat areas. Connectivity benefits shrikes by providing greater ease of locating mates, greater flexibility in year-round foraging opportunities, and safer passages for juvenile dispersal and seasonal movements. The potential effects of reduced connectivity on upland birds in general are discussed under *Mechanisms of Habitat Degradation*, above.

Except for the proposed Spangler Reserve, the amount of loggerhead shrike habitat at the proposed reserve sites is not expected to significantly change, and thus their preservation and management are unlikely to significantly increase habitat connectivity. The creation of managed marsh and long-term management of habitat at the proposed Spangler Reserve would potentially benefit shrike and locally increase connectivity of shrike habitats.

6.7.2.3. EFFECTS OF CONSTRUCTION-RELATED ACTIVITIES

Construction activities associated with the proposed development on the Greenbriar Project Site or the proposed habitat creation/restoration on the Project's reserve sites could disturb or displace loggerhead shrikes and may cause nest abandonment. The Greenbriar Conservation Strategy includes preconstruction surveys for loggerhead shrikes prior to construction (See

Appendix F). If shrikes are found, disturbance would be avoided during the nesting season to the maximum extent possible. The elderberry shrub containing the shrike nest (that was observed in 2012) would be transplanted during the dormant season of the VELB (November 1 to February 15) which is outside of the nesting season for shrike (March 1 through July 31) and is not expected to impact shrike potentially nesting in the elderberry shrub.

6.7.2.4. EFFECTS OF HUMAN-WILDLIFE CONFLICTS

On the remaining habitat adjacent to the proposed development on the Greenbriar Project Site (primarily within the Lone Tree Canal Reserve), human activity may cause shrike nest abandonment or interfere with the incubation and feeding of young in a way that reduces reproductive success. Increased shrike predation would also be likely to occur in proximity to the proposed development, as a result of the typical increase in human-associated predators discussed above under *Mechanisms of Habitat Degradation*. Human-wildlife conflicts are unlikely to occur at the proposed reserve sites.

6.7.2.5. OVERALL EFFECT ON POPULATION VIABILITY

Overall, the Greenbriar Development Project would result in a loss of 85 acres of habitat for loggerhead shrike in the Basin based on 2001 conditions and a loss of 265 acres of habitat based on 2015 conditions. The Greenbriar Development Project's effects would be small relative to the quantity of habitat that would remain in the Natomas Basin (e.g., the Greenbriar Development Project would cause the loss of less than 1 percent of habitat that would be available under the future condition), and the Project's reserves would provide 339.4 acres of habitat for shrikes. Furthermore, the Natomas Basin represents only a small portion of the habitat used by loggerhead shrikes in the Central Valley (USFWS 2003). Thus, the Greenbriar Development Project would not alter the viability of the loggerhead shrike population using the Natomas Basin.

6.8. Aleutian Canada Goose

6.8.1. Species Ecology

6.8.1.1. HABITAT ASSOCIATIONS/REQUIREMENTS

Habitat Type

Aleutian Canada geese winter in California's Central Valley. They forage primarily in pasture, corn, wheat, rice and other grain crops, wetlands, and grasslands, and typically prefer short vegetation. Wintering geese roost in large ponds and lakes, flooded fields, and rice checks. Land cover types designated as Aleutian Canada goose habitat in the NBHCP include non-rice crops, pasture, and rice. While Aleutian Canada geese feed primarily on grasses and wetland sedges during their Alaskan summer, they forage primarily on various marsh plants, algae, sedge

and grass seeds and agricultural grains while in California in fall and winter (NatureServe 2013b).

Home Range Size and Movement

Aleutian Canada geese nest in the western Aleutian Islands and migrate through coastal Oregon and northern California after the breeding season. Most wintering Aleutian Canada geese concentrate in the Modesto, Los Banos, and Colusa areas of California; the Natomas Basin may provide important foraging and roosting habitat during goose migration.

6.8.1.2. MECHANISMS OF HABITAT DEGRADATION

Because Aleutian Canada geese are particularly well-adapted to foraging in agricultural landscapes and may persist in small numbers in suburban parks, habitat loss is a greater issue for this species than habitat degradation. This species is similarly not dependent on animal prey populations or sensitive to the increases in small mammalian or corvid predators that typically occur near residential developments.

6.8.1.3. DISTRIBUTION

Information on CNDDDB Occurrences

When information was compiled for the NBHCP, there were 13 known occurrences of this species in California in the CNDDDB, all of which were considered extant. At that time, no occurrences were known from the Natomas Basin. At of 2015, CNDDDB still does not list Aleutian Canada goose occurrences within the Natomas Basin.

Other Information on Distribution and Abundance in Natomas Basin

Aleutian Canada geese have not been recorded in the Natomas Basin since comprehensive monitoring began in 2004 (ICF 2014). However, the proximity of the Basin to important wintering areas suggests that this species is likely to forage and roost in the Basin during migration.

Occurrence at the Greenbriar Development Project Sites

Aleutian Canada goose has not been documented at any of the properties associated with the Greenbriar Development Project. Based on the current land cover at the Greenbriar Project Site, the entire 577-acre site could be used by this species for foraging. The majority of the Spangler Reserve and the North Nestor Reserve also provide suitable foraging habitat for this species and Aleutian Canada goose could potentially forage at these sites. Grassland at the Moody Reserve provides potential foraging habitat for this species.

6.8.2. Greenbriar Development Project Effects on Species

6.8.2.1. LONG-TERM EFFECTS ON HABITAT

Effect on Quantity of Habitat

The Greenbriar Development Project’s effects on the acreage of potential Aleutian Canada goose foraging habitat at the Greenbriar Project Site (includes Lone Tree Canal Reserve) and Spangler Reserve compared to 2001 conditions are summarized in **Table 31**. No change in the acreage of Aleutian Canada goose habitat is anticipated at the Moody Reserve or the North Nestor Reserve; therefore, these sites are not included in the table (rotational fallowing of rice at North Nestor is not expected to result in a loss of foraging habitat for Aleutian Canada goose because the fallowed rice fields will be suitable foraging habitat). The Greenbriar Development Project would reduce the acreage of potential Aleutian Canada goose foraging habitat in the Natomas Basin from conditions at the time of the NBHCP. The proposed development at the Greenbriar Project Site would reduce foraging habitat for this species by an estimated 426.1 acres. Habitat conversion of rice to managed marsh at the Spangler Reserve would result in a loss of 35.1 acres of foraging habitat for this species. Thus, the Greenbriar Development Project as a whole would yield a loss of 461.2 acres of potential Aleutian Canada goose foraging habitat in the Basin based on 2001 conditions.

Table 31. Change in Acreage of Potential Aleutian Canada Goose Habitat at Project Sites and in the Natomas Basin Compared to 2001 Conditions

LAND COVER TYPE PROVIDING HABITAT	FUTURE CONDITION	CHANGE AT EACH PROJECT SITE		TOTAL CHANGE	FUTURE CONDITION WITH PROJECT
		Greenbriar	Spangler		
Non-rice crops	9,533	-234.1	–	-234.1	9,298.9
Pasture	494	-33.8	–	-33.8	460.2
Rice	11,643	-160.0*	-177.1	-337.1	11,305.9
Ponds and Seasonally wet areas	2,259	1.8**	142.0***	143.8	2,402.8
TOTAL	23,929	-426.1	-35.1	-461.2	23,467.8

Note: Acreages are based on 2001 land cover mapping used to evaluate future condition resulting from the NBHCP and future land cover proposed at Project sites.

*No rice is being lost at the Greenbriar Project Site as a result of the Greenbriar Development Project. A total of 160 acres of rice production was present on the site in 2001, which was used as the baseline conditions for the NBHCP. Rice production was discontinued at the site in 2004 when the site was in previous ownership.

**Represents the 1.8 acres of marsh creation in Lone Tree Canal Reserve. The 41.8-acre detention basin was not included in this calculation because it is not expected to provide habitat for Aleutian Canada geese.

***Represents 142 acres of managed marsh including 8.19 acres of ruderal and 5.1 acres of canal.

The proposed Greenbriar Conservation Strategy includes preservation, enhancement, and long-term management of approximately 557 acres of reserve that would be managed for the purpose of providing a benefit to all of the Covered Species. A total of 1.8 acres of marsh habitat will be preserved for this species at the Lone Tree Canal Reserve. A total of 40.3 acres of foraging habitat (rice fields) will be preserved for this species at the Spangler Reserve and an additional 219.1 acres of rice fields will be preserved at the North Nestor Reserve. In addition, 195.1 acres of managed marsh and grassland/seasonal wetland complex that provides potential foraging habitat for this species will be preserved at the Spangler Reserve and 3.8 acres of grassland/seasonal wetlands will be preserved at the Moody Reserve. Based on the proposed Greenbriar Conservation Strategy, an estimated 460.1 acres of foraging habitat would be permanently preserved for Aleutian Canada goose at the Greenbriar Development Project's reserves (**Table 32**).

Table 32. Summary of Aleutian Canada Goose Foraging Habitat Provided by the Greenbriar Development Project's Reserves

Greenbriar Project Reserve	Aleutian Canada Goose Foraging Habitat (Acres)
Lone Tree Canal Reserve	1.8
Moody Reserve	3.8
Spangler Reserve	235.4
North Nestor Reserve	219.1
Total Aleutian Canada Goose Foraging Habitat	460.1 Acres

Effects on Quality of Habitat

Areas Adjacent Developed Land or Highways

As discussed above under *Mechanisms of Habitat Degradation*, the predominant impacts typically associated with areas adjacent to housing developments are unlikely to adversely affect Aleutian Canada geese. This species is especially well-adapted to foraging in close proximity to humans.

Habitat Alteration at Proposed Reserve Sites

The Spangler Reserve contains 217.4 acres of Aleutian Canada goose foraging habitat (rice), of which 142 acres would be converted to managed marsh, which will also provide foraging habitat for this species.

6.8.2.2. EFFECTS ON CONNECTIVITY

Habitat connectivity is of lesser importance to foraging geese than to nesting or less mobile animals. Goose survival is likely to be higher, however, in larger, more contiguous foraging habitat where food is more abundant and the energetic costs of travel are decreased. Preservation of habitat at the Spangler Reserve could result in increased connectivity of habitat for Aleutian Canada goose due to its proximity to two TNBC reserves (Tufts and Ruby Ranch) and preservation of habitat at the North Nestor Reserve could result in increased connectivity of habitat for this species between the Lucich North and Nestor TNBC reserves.

6.8.2.3. EFFECTS OF CONSTRUCTION-RELATED ACTIVITIES

Construction-related activities are unlikely to affect Aleutian Canada geese because they do not nest in the vicinity of the Greenbriar Project Site and the Project's proposed reserve sites. Potential effects would be limited to displacement of birds foraging or roosting on the Greenbriar Project Site during the initial phases of construction when fields are graded or at the Spangler Reserve when ground-disturbing restoration activities commence. At most, this effect would be similar to temporary habitat loss. However, measures (included in **Appendix F**) will be implemented including pre-construction surveys and coordination will be conducted with CDFW if Aleutian Canada geese are identified on the Project properties.

6.8.2.4. EFFECTS OF HUMAN-WILDLIFE CONFLICTS

Because Aleutian Canada geese do not nest in the Basin, the Greenbriar Development Project would not likely result in human conflicts with this species, other than the changes in habitat. Foraging geese are less sensitive to disturbance than nesting birds. Similarly, changes in predator communities associated with residential development would be unlikely to affect large geese as significantly as smaller birds such as western burrowing owls and loggerhead shrikes.

6.8.2.5. OVERALL EFFECT ON POPULATION VIABILITY

Overall, the Greenbriar Development Project would result in a loss of 461 acres of habitat for this species in the Basin based on 2001 conditions and a loss of 527 acres based on 2015 conditions. Currently, Aleutian Canada geese do not nest in the Natomas Basin, but are expected to roost and forage in the Basin during seasonal migration to a limited extent. Although the Greenbriar Development Project would reduce the overall acreage of foraging habitat in the Natomas Basin, an effect on the population's viability is unlikely because the population's size is

not considered to be limited by the quantity of foraging habitat available during migration and the Greenbriar Development Project would not substantially alter the availability of this habitat, which is abundant in the Natomas Basin. In addition, 460.1 acres of foraging habitat for this species will be preserved at the Greenbriar Development Project's reserves.

6.9. White-faced Ibis

6.9.1. Species Ecology

6.9.1.1. HABITAT ASSOCIATIONS/REQUIREMENTS

Habitat Type

White-faced ibis breed in wetlands with dense emergent vegetation such as cattails and rushes. They forage in shallow wetlands, irrigation ditches and a variety of irrigated crops and flooded agricultural fields (Ryder and Manry 1994, Cogswell 1977). Land cover types designated as ibis habitat in the NBHCP includes alfalfa, canals, ponds and seasonally wet areas, and rice. White-faced ibis feed on aquatic and moist-soil invertebrates such as earthworms, larval insects, snails, and bivalves. Although white-faced ibis feed intensively in rice fields, rice seeds have not been noted in food samples and only trace, incidental amounts of vegetation have been recorded in ibis diets (Belknap 1957).

Home Range Size and Movement

White-faced ibis nesting colonies have ranged in size from 1.3 acres to 600 acres. Foraging distances from nesting sites vary widely and depend on the availability of food. Some colonies concentrate their foraging activity within 2–4 miles of their breeding sites (Bray 1986, Bray and Klebenow 1988), while others forage 25–30 miles from nest sites (Trost 1989). Some colony locations are used for nesting year after year, while others are used more sporadically depending on water conditions and the availability of food (Ryder 1967).

6.9.1.2. MECHANISMS OF HABITAT DEGRADATION

Water Quality and Water Diversion

White-faced ibis depend on healthy populations of aquatic invertebrate prey, which in turn may be greatly affected by surrounding land use. Urban areas can cause different and in some cases stronger effects than agricultural lands (Bury 1972, Moore and Palmer 2005). Residential developments typically result in increased runoff of hydrocarbons and of chemicals used for lawns and gardens, and increased stormwater volume (and associated increased depths and velocities) because of high coverage of impervious surfaces. Water diversions may also reduce the abundance of ibis prey. Decreased abundance of aquatic invertebrates has been shown to impact insectivorous birds in both observational field studies and controlled field experiments (Baxter et al. 2004).

6.9.1.3. DISTRIBUTION

Information on CNDDDB Occurrences

When information was compiled for the NBHCP, there were seven known breeding colonies in California, all of which were considered extant. At that time, no colonies were known in the Natomas Basin, and the nearest known nesting occurrence was in Yolo County, north of Woodland. As of 2015, CNDDDB does not list white-faced ibis occurrences in the Natomas Basin.

Other Information on Distribution and Abundance in Natomas Basin

White-faced ibis are common winter foragers in the Natomas Basin, and 10,000 to 11,000 ibis have been estimated in the Sacramento Valley as a whole (Thomas Reid Associates 2001). During biological effectiveness monitoring conducted for the NBHCP, white-faced ibis have been observed foraging, roosting, and/or nesting on 15 of the 25 tracts in the TNBC reserves system (ICF 2014). The number of ibis in the Basin has increased substantially since comprehensive monitoring began in 2004 and larger numbers of ibis appear to be staying in the Basin longer each year (ICF 2012).

Occurrence at the Greenbriar Development Project Sites

White-faced ibis has not been documented nesting on any of the properties associated with the Greenbriar Development Project. Based on the current land cover at the Greenbriar Project Site and the Lone Tree Canal Reserve, it is unlikely that white-faced ibis would use the site for foraging. The majority of the Spangler Reserve, Moody Reserve, and North Nestor Reserve provide suitable foraging habitat for this species and white-faced ibis is assumed to forage at these sites. White-faced ibis were observed foraging at the North Nestor Reserve by HELIX biologists in winter 2015.

6.9.2. Greenbriar Development Project Effects On Species

6.9.2.1. LONG-TERM EFFECTS ON HABITAT

Effect on Quantity of Habitat

The Greenbriar Project Site and proposed reserve sites were not considered to support white-faced ibis nesting habitat in the NBHCP. The freshwater marsh habitat proposed in and along Lone Tree Canal is not anticipated to provide suitable nesting habitat for white-faced ibis because of its small size and the surrounding urban development. However, the 142 acres of managed marsh at the Spangler Reserve may provide suitable nesting habitat for this species. Thus, the Greenbriar Development Project is expected to result in an increase of 142 acres of white-faced ibis nesting habitat in the Natomas Basin from conditions at the time of the NBHCP.

The Greenbriar Development Project’s effects on the acreage of white-faced ibis habitat are summarized in **Table 33**. No land use changes that would affect white-faced ibis habitat are proposed at the Moody Reserve or the North Nestor Reserve; therefore, these sites are not included in the table (rotational fallowing of rice at North Nestor is not expected to result in a loss of foraging habitat for white-faced ibis because the fallowed rice fields will be suitable foraging habitat). The Greenbriar Development Project would contribute to the loss of white-faced ibis habitat in the Natomas Basin from conditions at the time of the NBHCP (2001). Changes in land use at the Greenbriar Project Site include discontinuation of rice crops onsite in 2004 and loss of canal habitats. Changes at the Spangler Reserve include loss of canals and creation of managed marsh from rice. Overall, the Greenbriar Development Project would reduce nesting and foraging habitat by an estimated 210.8 acres compared to 2001 conditions.

Table 33. Change in Acreage of White-faces Ibis Nesting and Foraging Habitat at Project Sites and in the Natomas Basin Compared to 2001 Conditions

LAND COVER TYPE PROVIDING HABITAT	FUTURE CONDITION	CHANGE AT EACH PROJECT SITE		TOTAL CHANGE	FUTURE CONDITION WITH PROJECT
		Greenbriar	Spangler		
Alfalfa	368	–	–	–	368
Canals	1,162	-15.0	-2.5	-17.5	1,144.5
Ponds and Seasonally wet areas	2,259	1.8*	142***	143.8	2,402.8
Rice	11,643	-160.0**	-177.1	-337.1	11,305.9
TOTAL	15,432	-173.2	-37.6	-210.8	15,221.2

Note: Acreages are based on 2001 land cover mapping used to evaluate future condition resulting from the NBHCP and future land cover proposed at Project sites. No land use changes are proposed at the Moody Reserve or the North Nestor Reserve; therefore, these sites are not included in the table.

*Represents the 1.8 acres of marsh creation in Lone Tree Canal Reserve. The 41.8-acre detention basin was not included in this calculation because it is not expected to provide habitat for white-faced ibis.

**No rice is being lost at the Greenbriar Project Site as a result of the Greenbriar Development Project. A total of 160 acres of rice production was present on the site in 2001, which was used as the baseline conditions for the NBHCP. Rice production was discontinued at the site in 2004 when the site was in previous ownership. Currently, the rice production areas at the Greenbriar Project Site have been replaced with grain crops which are not considered suitable habitat for white-faced ibis in the NBHCP.

***Represents 128.69 acres of managed marsh, 8.19 acres of ruderal, and 5.1 acres of canals.

The proposed Greenbriar Conservation Strategy includes preservation, enhancement, and long-term management of approximately 557 acres of reserve that would be managed for the purpose of providing a benefit to all of the Covered Species. An estimated 182.3 acres of nesting and foraging habitat for this species (rice fields, managed marsh, and associated canals) would be preserved at the Spangler Reserve. A total of 55.91 acres of foraging habitat would be preserved at the Moody Reserve (55.48 acres of alfalfa, 0.23 acre of canal/ditch, and 0.20-acre seasonal wetland). An additional 219.1 acres of rice that provides foraging habitat for this species would

be preserved at the North Nestor Reserve. Based on the proposed measures, an estimated 457.3 acres of foraging habitat would be permanently preserved for white-faced ibis at the Greenbriar Development Project’s reserves (Table 34).

Table 34. Summary of White-Faced Ibis Foraging Habitat Provided by the Greenbriar Development Project’s Reserves

Greenbriar Project Reserve	White-Faced Ibis Foraging Habitat (Acres)
Moody Reserve	55.9
Spangler Reserve	182.3
North Nestor Reserve	219.1
Total White-Faced Ibis Foraging Habitat	457.3 Acres

Effects on Quality of Habitat

Areas Adjacent to Developed Land or Highways

Potential impacts to white-faced ibis that forage near developed areas are discussed under *Mechanisms of Habitat Degradation*, above. They are primarily associated with canal and wetland habitats, but also forage in rice, and these habitats exist near the Greenbriar Project Site.

Habitat Alteration at Proposed Reserves Sites

A total of 142 acres of rice would be converted to managed marsh habitat at the Spangler Reserve and 1.8 acres of freshwater marsh habitat would be created at the Lone Tree Canal Reserve. The conversion of rice to managed marsh will provide additional nesting opportunities for white-faced ibis. Preservation and long-term management of the Moody Reserve and North Nestor Reserve would improve the habitat quality for white-faced ibis due to improved site management and reduced human intrusion. Overall, the Project’s reserve sites are expected to increase in quality as white-faced ibis habitat as a result of the Greenbriar Development Project.

6.9.2.2. EFFECTS ON CONNECTIVITY

Habitat connectivity is of lesser importance to foraging ibis than to nesting or less mobile animals. Ibis survival is likely to be higher, however, in larger, more contiguous foraging habitat where prey is more abundant and the energetic costs of travel are decreased. Preservation, creation, and enhancement of habitat at the Spangler Reserve will result in increased connectivity

of habitat for white-faced ibis due to its proximity to two TNBC reserves (Tufts and Ruby Ranch). Preservation and enhancement/long-term management of the North Nestor Reserve will result in increased connectivity of habitat for white-faced ibis by providing connectivity in perpetuity between the Lucich North and Nestor TNBC reserves.

6.9.2.3. EFFECTS OF CONSTRUCTION-RELATED ACTIVITIES

Construction-related activities are unlikely to affect white-faced ibis because they do not nest in the vicinity of the Greenbriar Project Site and proposed reserve sites. Potential effects would be limited to displacement of birds foraging or roosting on the sites during the initial phases of construction when fields are graded. At most, this effect would be similar to habitat loss, as the physical flight of the birds from these areas would not cause a significant effect. No mitigation measures for foraging white-faced ibis are included in the NBHCP and none are necessary for the Greenbriar Development Project.

6.9.2.4. EFFECTS OF HUMAN-WILDLIFE CONFLICTS

Humans entering active colonies may cause partial or total desertion of the colony, particularly during nest-site selection, nest-building, and incubation (Ryder and Manry 1994). Because white-faced ibis do not currently nest in the vicinity of any of the Project properties, the Greenbriar Development Project is unlikely to cause human conflicts with this species. (Foraging ibis are less sensitive to disturbance than nesting birds.) Similarly, changes in predator communities associated with residential development at the Greenbriar Project Site would be unlikely to affect white-faced ibis as much as smaller birds such as burrowing owls and loggerhead shrikes.

6.9.2.5. OVERALL EFFECT ON POPULATION VIABILITY

Overall, the Greenbriar Development Project would result in a loss of 211 acres of habitat for this species in the Basin based on 2001 conditions and a loss of 45 acres of habitat for this species based on 2015 conditions. The proposed Greenbriar Development Project is not likely to affect the viability of the white-faced ibis population using the Natomas Basin. The Greenbriar Development Project would reduce the area of foraging habitat in the Natomas Basin (by 1 percent), but would offset this effect by preserving and enhancing nesting habitat (142 acres) in the Natomas Basin. The abundance of white-faced ibis in the Basin is not considered limited by the availability of foraging habitat; thus, the Greenbriar Development Project's effect on foraging habitat would not alter the population viability of white-faced ibis.

6.10. Bank Swallow

6.10.1. Species Ecology

6.10.1.1. HABITAT ASSOCIATIONS/REQUIREMENTS

Habitat Type

Bank swallows nest in colonies in vertical banks, cliffs and bluffs that are typically along streams and rivers but occasionally near roads or gravel quarries. Nesting colonies may range in size from 10 to 1,500 pairs, and average 100–200 nesting pairs. Bank swallows forage in a variety of open habitats including wetlands, open water, grasslands, agricultural fields, shrublands, and open or riparian woodlands. Aquatic and flooded habitats provide the best foraging opportunities. Land cover types designated as bank swallow habitat in the NBHCP include alfalfa, canals, grassland, non-rice crops, pasture, ponds and seasonally wet areas, rice, and riparian. Bank swallows are almost exclusively insectivorous and catch their prey while flying.

Home Range Size and Movement

Most breeding season foraging flights are within a kilometer (0.62 mile) of the nesting colony (Garrison 1999). Bank swallows are long-distance migrants and may use any available foraging habitat in the Basin during migration.

6.10.1.2. MECHANISMS OF HABITAT DEGRADATION

Bank Erosion and Water Diversion

The major contributors to bank swallow habitat degradation are flood and erosion control projects that apply riprap or reduce the slope of river banks and canals, rendering them unusable for nesting and reducing their habitat quality for roosting and foraging (Garrison et al. 1987). Diversion of water may affect bank swallows if it results in the dewatering of canals or reduction of aquatic habitat for larval insects.

Water Quality and Runoff

Aquatic communities may be greatly affected by surrounding land use. Urban areas can cause different and in some cases stronger effects than agricultural lands (Bury 1972, Moore and Palmer 2005). Residential developments typically result in increased runoff of hydrocarbons and of chemicals used for lawns and gardens, and increased stormwater volume (and associated increases in depths and velocities) because of high coverage of impervious surfaces. Decreased abundance of aquatic invertebrates has been shown to impact insectivorous birds in both observational field studies and controlled field experiments (Baxter et al. 2004).

Predation and Nest Disturbance

Although predation of most birds increases in proximity to human settlement, bank swallows are largely protected from human-associated predators because of the cliff locations of their nests.

These aerial hunters are also largely protected from human-associated predators while foraging because they spend relatively very little time foraging from perches or among vegetation. Kestrels are the primary predators of this species while foraging; snakes are most common while nesting. Bank swallows are typically tolerant of human activity near nesting colonies, if humans do not attempt to climb the nest banks (Garrison 1999).

6.10.1.3. DISTRIBUTION

Information on CNDDDB Occurrences

When information was compiled for the NBHCP, there were 171 known occurrences in California, of which 170 were considered extant. At that time, no nesting colonies were known in the Natomas Basin. As of 2015, CNDDDB still does not list bank swallow occurrences within the Natomas Basin.

Other Information on Distribution and Abundance in Natomas Basin

There is no suitable nesting habitat for bank swallow in the Natomas Basin (ICF 2012). Although no nesting colonies are known in the Basin, the area provides potential foraging habitat for migrating bank swallows.

Occurrence at the Greenbriar Development Project Sites

Bank swallow has not been documented at any of the properties associated with the Greenbriar Development Project. Based on the current land cover at the Greenbriar Project Site (including the Lone Tree Canal Reserve), the entire 577-acre site could be used by this species for foraging. The majority of the Spangler Reserve, Moody Reserve, and North Nestor Reserve provide suitable foraging habitat for this species and bank swallow is assumed to occasionally forage at these sites.

6.10.2. Greenbriar Development Project Effects on Species

6.10.2.1. LONG-TERM EFFECTS ON HABITAT

Effect on Quantity of Habitat

The Greenbriar Development Project would not affect known bank swallow nesting habitat, as bank swallow nesting colonies do not exist at the Greenbriar Project Site or proposed reserve sites, nor would nesting habitat be created, enhanced or preserved at the Project's proposed reserves.

The Greenbriar Development Project's effects on the acreage of bank swallow foraging habitat are summarized in **Table 35**. No change in the acreage of potential foraging habitat for bank swallow is anticipated at the Moody Reserve or the North Nestor Reserve; therefore, these sites are not included in the table (rotational fallowing of rice at North Nestor is not expected to result

in a loss of foraging habitat for bank swallow because the fallowed rice fields will be suitable foraging habitat). The proposed development at the Greenbriar Project Site would eliminate an estimated 376.0 acres of habitat. The conversion of rice to managed marsh and uplands at the Spangler Reserve would result in a net gain of 15.5 acres of bank swallow foraging habitat at that site. Therefore, the Greenbriar Development Project would reduce the acreage of bank swallow foraging habitat in the Natomas Basin by approximately 360.5 acres based on 2001 conditions.

Table 35. Change in Acreage of Bank Swallow Habitat at Project Site and in the Natomas Basin

LAND COVER TYPE PROVIDING HABITAT	FUTURE CONDITION	CHANGE AT EACH PROJECT SITE		TOTAL CHANGE	FUTURE CONDITION WITH PROJECT
		Greenbriar	Spangler		
Alfalfa	368	–	–	–	368
Canals	1,162	-15.0	-2.5	-17.5	1,144.5
Grassland	284	26.5	53.1	79.6	363.6
Non-rice crops	9,533	-234.1	–	-234.1	9,298.9
Pasture	494	-33.8	–	-33.8	460.2
Ponds and Seasonally wet areas	2,259	41.8*	142.0***	183.8	2,442.8
Rice	11,643	-160.0**	-177.1	-337.1	11,305.9
Riparian	91	-1.4	–	-1.4	89.6
TOTAL	25,834	-376.0	15.5	-360.5	25,473.5

Note: Acreages are based on 2001 land cover mapping used to evaluate future condition resulting from the NBHCP and future land cover proposed at Project sites.

*Represents the 41.8-acre detention basin on the Greenbriar Project Site.

**No rice is being lost at the Greenbriar Project Site as a result of the Greenbriar Development Project. A total of 160 acres of rice production was present on the site in 2001, which was used as the baseline conditions for the NBHCP. Rice production was discontinued at the site in 2004 when the site was in previous ownership.

***Represents 128.69 acres of managed marsh with 8.19 acres of ruderal and 5.1 acres of canal/ditch.

The proposed Greenbriar Conservation Strategy includes preservation, enhancement, and long-term management of approximately 557 acres of reserve that would be managed for the purpose of providing a benefit to all of the NBHCP Covered Species. Habitat for bank swallow will be provided at all of the Project’s proposed reserves including 26.5 acres of grassland habitat at the Lone Tree Canal Reserve, 59.11 acres (55.48 acres of alfalfa and 3.63 acres of grassland) at the Moody Reserve, 235.4 acres (40.3 acres of rice, 142 acres of managed marsh and 53.1 acres of grassland/seasonal wetland complex) at the Spangler Reserve, and 219.1 acres of rice at the North Nestor Reserve. Based on the proposed measures, an estimated 540.1 acres of foraging habitat would be permanently preserved for bank swallow at the Greenbriar Development Project’s reserves (**Table 36**).

Table 36. Summary of Bank Swallow Foraging Habitat Provided by the Greenbriar Development Project’s Reserves

Greenbriar Project Reserve	Bank Swallow Foraging Habitat (Acres)
Lone Tree Canal Reserve	26.5
Moody Reserve	59.11
Spangler Reserve	235.4
North Nestor Reserve	219.1
Total Bank Swallow Foraging Habitat	540.1 Acres

Effects on Quality of Habitat

Areas Adjacent to Developed Land or Highways

As discussed above under *Mechanisms of Habitat Degradation*, the predominant effects typically associated with areas adjacent to housing developments are unlikely to negatively affect bank swallow. Effects on water quality and canal management, however, could potentially affect bank swallows.

Habitat Alteration at Proposed Reserve Sites

The Spangler Reserve contains 235.4 acres of bank swallow foraging habitat (rice, managed marsh, uplands and associated canals), 177.1 acres of rice would be converted to managed marsh and uplands/seasonal wetlands that is also foraging habitat for bank swallow.

6.10.2.1. EFFECTS ON CONNECTIVITY

Because bank swallows do not nest in the Basin, connectivity is of less concern for this species than for less mobile species or species with limited foraging distances from breeding sites. Larger patches of more contiguous habitat are likely to be of greater value to migrating swallows, by providing more abundant food with the lower energetic cost of foraging in a contiguous area. Preservation of habitat at the Spangler Reserve and North Nestor Reserve will result in increased connectivity of foraging habitat for bank swallow due to the proximity of these sites to existing TNBC reserves.

6.10.2.2. EFFECTS OF CONSTRUCTION-RELATED ACTIVITIES

Construction-related activities are unlikely to affect bank swallows because they do not nest in the vicinity of the Greenbriar Project Site and proposed reserve sites. Potential effects would be limited to displacement of birds foraging or roosting on the Greenbriar Project Site during the initial phases of construction when fields are graded or at the Spangler Reserve during initiation of restoration activities. This impact is largely akin to temporary habitat loss. No mitigation measures for foraging bank swallow are included in the NBHCP and none are necessary for the Greenbriar Development Project.

6.10.2.3. EFFECTS OF HUMAN-WILDLIFE CONFLICTS

Direct human-wildlife conflicts are unlikely to be of concern for bank swallows in the Natomas Basin. Habitat quantity and quality are the primary concerns for this species.

6.10.2.4. OVERALL EFFECT ON POPULATION VIABILITY

Bank swallows do not nest in the Natomas Basin, but are expected to forage in the Basin during migration. Overall, the Greenbriar Development Project would result in a loss of 85 acres of foraging habitat for this species in the Basin based on 2001 conditions and a loss of 265 acres based on 2015 conditions. Although the Greenbriar Development Project would reduce the overall acreage of foraging habitat in the Natomas Basin, an effect on the bank swallow population's viability would not occur because the population's size is not considered to be limited by the quantity of foraging habitat available during migration and the Greenbriar Development Project would not substantially alter the availability of this habitat, which is abundant in the Natomas Basin. In addition, 540.1 acres of foraging habitat for this species will be preserved at the Greenbriar Development Project's reserves.

6.11. California Tiger Salamander

6.11.1. Species Ecology

6.11.1.1. HABITAT ASSOCIATIONS/REQUIREMENTS

Habitat Type

California tiger salamander requires two major habitat components: aquatic breeding sites and terrestrial aestivation or refuge sites. Tiger salamanders breed primarily in vernal pools and other ephemeral rainwater ponds (Loredo et al. 1996). They will occasionally breed in stockponds, reservoirs and small lakes, but fail to reproduce in water bodies that support predatory fish or bullfrogs (Stebbins 1972, Zeiner et al. 1988). The highest quality breeding habitat for tiger salamanders exists in large, contiguous vernal pool complexes in a grassland matrix with pools that last for more than 10 weeks (Jennings and Hayes 1994). California tiger salamanders spend the majority of their lives in upland habitats within one mile of aquatic

breeding areas (Center for Biological Diversity 2001). These upland habitats are essential for salamander foraging, aestivation, migration, and dispersal. Upland habitats used by migrating salamanders include grassland, pasture, and open woodlands. The NBHCP lists ponds and seasonally wet areas as the only land cover type providing tiger salamander habitat because these upland habitats will only be used by salamanders when in close proximity to aquatic breeding areas. Tiger salamanders depend on burrows of small mammals such as California ground squirrels and Botta's pocket gopher for shelter during aestivation.

Home Range Size and Movement

California tiger salamanders typically range within 2,200 feet of breeding habitat during the breeding season. During migration, however, they have been recorded as far as one mile from aquatic habitats (Center for Biological Diversity 2001).

6.11.1.2. MECHANISMS OF HABITAT DEGRADATION

Tiger salamander habitat is frequently degraded by roads, buildings, and other barriers to migration (Shaffer and Fisher 1991; Shaffer and Stanley 1992; Barry and Shaffer 1994). Erosion because of grading for nearby developments can degrade breeding wetlands by increasing sedimentation. Tiger salamanders are also sensitive to pesticides, herbicides and fertilizers associated with suburban lawn care and agriculture. Burrowing mammal control programs and the introduction of predatory bullfrogs and nonnative fishes have also contributed to declines in tiger salamander populations (Jennings and Hayes 1994).

6.11.1.3. DISTRIBUTION

Information on CNDDDB Occurrences

When information was compiled for the NBHCP, there were 465 known occurrences of California tiger salamander in California, all of which were considered extant. At that time, no occurrences were known from the Natomas Basin. As of 2015, CNDDDB still does not list California tiger salamander occurrences within the Natomas Basin.

Other Information on Distribution and Abundance in Natomas Basin

California tiger salamanders have not been recorded in the Natomas Basin (ICF 2014).

Occurrence at the Greenbriar Development Project Sites

No suitable habitat for California tiger salamander occurs at any of the properties associated with the Greenbriar Development Project and this species has not been reported at any of these sites or elsewhere in the Natomas Basin.

6.11.2. Greenbriar Development Project Effects on Species

6.11.2.1. LONG-TERM EFFECTS ON HABITAT

Effect on Quantity of Habitat

It is anticipated that the Greenbriar Development Project would have no effect on the quantity of California tiger salamander habitat in the Basin. California tiger salamander is not expected to occur on or use any of the properties associated with the Greenbriar Development Project during any portion of its life cycle. Suitable breeding or upland habitat for this species does not exist on any of the properties associated with the Project and therefore no loss of habitat would occur and no habitat is being created at any of the Project's proposed reserves. Restoration plans for the proposed reserves do not include the specific creation of California tiger salamander habitat. Although the seasonal wetlands that would be created at the Spangler Reserve could potentially meet the breeding habitat requirements for California tiger salamander, the seasonal wetlands will not be surrounded by sufficient upland habitat to support this species and there would be no potential for California tiger salamander to disperse into the reserve site.

Effects on Quality of Habitat

The Greenbriar Development Project is not expected to have any effect on the quality of California tiger salamander habitat, as salamander habitat does not exist on any of the properties associated with the Project and this species is not known to occur in the Natomas Basin.

6.11.2.2. EFFECTS OF CONSTRUCTION-RELATED ACTIVITIES

The Greenbriar Development Project would have no effect on California tiger salamanders during construction-related activities, as habitat for this species does not exist on any of the properties associated with the Project and this species is not expected to be present.

6.11.2.3. EFFECTS OF HUMAN-WILDLIFE CONFLICTS

The Greenbriar Development Project would have no effect on human-wildlife conflicts relating to California tiger salamanders, because habitat for this species does not exist on any of the properties associated with the Project and this species is not known to occur in the Basin.

6.11.2.4. OVERALL EFFECT ON POPULATION VIABILITY

California tiger salamander is not known from the vicinity of the Greenbriar Project Site or the proposed reserve sites, or adjacent lands. Potentially suitable habitat for this species does not exist at or in the vicinity of the Greenbriar Project Site and proposed reserve sites. Although this species may be found in the Basin or occupy the Basin in the future, it would not be expected to occupy any of the reserves associated with the Greenbriar Development Project. For these reasons, the Greenbriar Development Project would have no affect on the population viability of California tiger salamander.

6.12. Western Spadefoot

6.12.1. Species Ecology

6.12.1.1. HABITAT ASSOCIATIONS/REQUIREMENTS

Habitat Type

Western spadefoot (*Scaphiopus hammondi*) breed in shallow, seasonal wetlands in a matrix of grassland, chaparral or woodland habitat, and are rarely found in creeks, drainages, and ponds. Grassland vernal pools provide optimal western spadefoot habitat; these animals attach their eggs to rain pool vegetation and burrow underground after the pools become dry (Stebbins 1972). The NBHCP lists ponds and seasonally wet areas as the only land cover type that provides habitat for this species. Adults feed on insects, worms, and other invertebrates; tadpoles feed on invertebrates and algae.

Home Range Size and Movement

During the breeding season, western spadefoot rarely travel more than several meters from breeding pools (Jennings and Hayes 1994). Outside of the breeding season, data are not available on the dispersal distances, movement patterns, or colonization abilities of this species (Jennings and Hayes 1994).

6.12.1.2. MECHANISMS OF HABITAT DEGRADATION

Development activities that destroy breeding habitats for this species and the associated uplands are a major cause of habitat loss for this species. Urban runoff and pesticide/herbicide application may degrade wetland habitat for breeding western spadefoot.

6.12.1.3. DISTRIBUTION

Information on CNDDDB Occurrences

When information was compiled for the NBHCP, there were 173 known occurrences of western spadefoot in California, of which 172 were considered extant. At that time, no occurrences were known from the Natomas Basin. As of 2015, CNDDDB still does not list western spadefoot occurrences within the Natomas Basin.

Other Information on Distribution and Abundance in Natomas Basin

Western spadefoot has not been recorded in the Natomas Basin (ICF 2014).

Occurrence at the Greenbriar Development Project Sites

No suitable habitat for western spadefoot occurs on any of the properties associated with the Greenbriar Development Project.

6.12.2. Greenbriar Development Project Effects on Species

6.12.2.1. LONG-TERM EFFECTS ON HABITAT

Effect on Quantity of Habitat

It is anticipated that the Greenbriar Development Project would have no effect on the quantity of western spadefoot habitat in the Basin. Western spadefoot is not expected to occur on or use any of the properties associated with the Greenbriar Development Project during any portion of its life cycle. Suitable breeding habitat for this species does not exist on any of the properties associated with the Project and therefore no loss of habitat would occur and no habitat is being created at any of the Project's proposed reserves. Restoration plans for the proposed reserves do not include the specific creation of western spadefoot habitat. Although the seasonal wetlands that would be created at the Spangler Reserve could potentially meet the breeding habitat requirements for western spadefoot, the seasonal wetlands will not be surrounded by sufficient upland habitat to support this species and there would be no potential for western spadefoot to disperse into the site.

Effects on Quality of Habitat

The Greenbriar Development Project would have no effect on the quality of western spadefoot habitat, because habitat for this species does not currently exist on any of the properties associated with the Project. Restoration plans for the proposed reserves do not include the creation of western spadefoot habitat.

6.12.2.2. EFFECTS OF CONSTRUCTION-RELATED ACTIVITIES

The Greenbriar Development Project would have no effect on western spadefoot during construction-related activities, because habitat for this species does not exist in the vicinity of the Greenbriar Project Site or proposed reserve sites.

6.12.2.3. EFFECTS OF HUMAN-WILDLIFE CONFLICTS

The Greenbriar Development Project would have no effect on human-wildlife conflicts relating to western spadefoot, because habitat for this species does not exist in the vicinity of the Greenbriar Project Site and proposed reserve sites.

6.12.2.4. OVERALL EFFECT ON POPULATION VIABILITY

Western spadefoot is not known from the vicinity of the Greenbriar Project Site or the proposed reserve sites, or adjacent lands. Further, potentially suitable habitat for this species does not exist at or in the vicinity of the Greenbriar Project Site and proposed reserve sites. Although this species may be found in the Basin or occupy the Basin in the future, it would not be expected to occupy any of the reserves associated with the Greenbriar Development Project. For these

reasons, the Greenbriar Development Project would have no effect on the population viability of western spadefoot.

6.13. Vernal Pool Fairy Shrimp

6.13.1. Species Ecology

6.13.1.1. HABITAT ASSOCIATIONS/REQUIREMENTS

Habitat Type

Vernal pool fairy shrimp inhabit vernal pools (79 percent of observations) and other seasonal wetlands (Helm 1998). The species occupies a variety of vernal pool habitats, from small, clear, sandstone rock pools to large, turbid, alkaline, grassland valley floor pools; although they have been collected from large vernal pools, including one exceeding 25 acres, they tend to occur in smaller pools. The species is most frequently found in pools measuring less than 0.05 acre. The pools are most commonly in grass or mud bottomed swales, or are basalt flow depression pools in unplowed grasslands (USFWS 2005). The NBHCP lists ponds and seasonally wet areas as the only land cover type that provides habitat for this species.

The primary constituent elements of critical habitat for vernal pool fairy shrimp are the habitat components that provide: (i) Topographic features characterized by mounds and swales and depressions within a matrix of surrounding uplands that result in complexes of continuously, or intermittently, flowing surface water in the swales connecting the pools providing for dispersal and promoting hydroperiods of adequate length in the pools; (ii) Depressional features including isolated vernal pools with underlying restrictive soil layers that become inundated during winter rains and that continuously hold water for a minimum of 18 days, in all but the driest years; thereby providing adequate water for incubation, maturation, and reproduction. As these features are inundated on a seasonal basis, they do not promote the development of obligate wetland vegetation habitats typical of permanently flooded emergent wetlands; (iii) Sources of food, expected to be detritus occurring in the pools, contributed by overland flow from the pools' watershed, or the results of biological processes within the pools themselves, such as single-celled bacteria, algae, and dead organic matter, to provide for feeding; and (iv) Structure within the pools consisting of organic and inorganic materials, such as living and dead plants from plant species adapted to seasonally inundated environments, rocks, and other inorganic debris that may be washed, blown, or otherwise transported into the pools, that provide shelter.

Mechanisms of Dispersal

Vernal pool fairy shrimp rely on wind and motile species such as birds, mammals, and amphibians for their dispersal. Fairy shrimp eggs are transported in the stomachs of waterfowl and amphibians, and in small clumps of soil attached to mammalian hooves and hair, bird feet,

and feathers. Dispersal distances have not been measured, but will likely equate with movement distances of the egg-transporting animals. As such, connectivity of upland and aquatic habitat between vernal pools benefits shrimp dispersal by increasing the opportunities for egg transport by mammals and amphibians. Dispersal may continue between disconnected pools through avian transport.

6.13.1.2. MECHANISMS OF HABITAT DEGRADATION

Development activities that destroy wetland habitats for this species and the associated uplands are a major cause of habitat loss for this species. Urban runoff and pesticide/herbicide application may degrade wetland habitat occupied by vernal pool fairy shrimp.

6.13.1.3. DISTRIBUTION

Information on CNDDDB Occurrences

When information was compiled for the NBHCP, there were 270 known occurrences of vernal pool fairy shrimp in California, all of which were considered extant. At that time, no occurrences were known from the Natomas Basin. As of 2015, two occurrences of vernal pool fairy shrimp are known in the Natomas Basin and both are considered extant. Both occurrences are located near the eastern border of the Basin. CNDDDB does not list vernal pool fairy shrimp occurrences within one mile of any of the properties associated with the Greenbriar Development Project.

Other Information on Distribution and Abundance in Natomas Basin

There is no other information on the presence of vernal pool fairy shrimp in the Natomas Basin.

Occurrence at the Greenbriar Development Project Sites

Seasonal wetlands on the Greenbriar Project Site were evaluated for the potential to support vernal pool fairy shrimp habitat during site visits by HELIX personnel in June 2012.

Approximately 0.18 acre of potentially suitable fairy shrimp habitat was identified on the Greenbriar Project Site. Presence/absence surveys were conducted within suitable habitats on the Greenbriar Project Site according to the *Interim Survey Guidelines to Permittees for Recovery Permits under Section 10(a)(1)(A) of the Federal Endangered Species Act for the Listed Vernal Pool Branchiopods* (USFWS 1996) to determine if these species were present. Both wet and dry season surveys were completed and no branchiopods were detected on the site.

No suitable habitat for this species occurs at any of the other properties associated with the Project.

6.13.2. Greenbriar Development Project Effects on Species

6.13.2.1. LONG-TERM EFFECTS ON HABITAT

Effect on Quantity of Habitat

A total of 0.18 acre of seasonal wetlands on the Greenbriar Project Site were determined to potentially meet the habitat requirements for vernal pool fairy shrimp during biological surveys conducted in the summer of 2012. The wetlands on the Greenbriar Project Site were not mapped as habitat for vernal pool branchiopods in the NBHCP. Upon completion of dry and wet season surveys and negative findings for vernal pool branchiopods, it is believed that ground disturbing activities associated with previous and existing land uses have affected the quality of the seasonal wetland habitats present and currently they provide marginally suitable habitat for this species, at best.

Because no vernal pool branchiopods were detected within the wetlands on the Greenbriar Project Site and the wetlands were not mapped as habitat for vernal pool branchiopods in the NBHCP, impacts to these seasonal wetlands were not counted as loss of vernal pool branchiopod habitat for the purpose of this Effects Analysis. No habitat for vernal pool fairy shrimp is present on any of the other properties associated with the Project and restoration plans for the proposed reserves do not include the specific creation of vernal pool fairy shrimp habitat. Although the seasonal wetlands that would be created at the Spangler Reserve could potentially meet the habitat requirements for vernal pool fairy shrimp, it is unlikely that this species would successfully colonize the site. Therefore, the Greenbriar Development Project is expected to have no effect on the quantity of vernal pool fairy shrimp habitat in the Natomas Basin.

Effects on Quality of Habitat

The Greenbriar Development Project would have no effect on the quality of vernal pool fairy shrimp habitat in the Natomas Basin (as mapped by the NBHCP) as none exists on any of the properties associated with the Project and none would be created at the Project's On or Off-Site Reserves.

6.13.2.2. EFFECTS OF CONSTRUCTION-RELATED ACTIVITIES

No effects to vernal pool fairy shrimp are anticipated to occur as a result of construction activities because this species is not present on any of the properties associated with the Project.

6.13.2.3. EFFECTS OF HUMAN-WILDLIFE CONFLICTS

Human-wildlife conflicts for this species would not be affected by the Greenbriar Development Project because vernal pool branchiopods are not known to occur at or adjacent to the Greenbriar Project Site or the proposed reserves.

6.13.2.4. OVERALL EFFECT ON POPULATION VIABILITY

Vernal pool fairy shrimp are not believed to occur on, or in the vicinity of, any of the properties associated with the Project. Therefore, it is likely that the Greenbriar Development Project would have no effect on the population viability of vernal pool fairy shrimp. In the unlikely event that vernal pool fairy shrimp were to colonize the seasonal wetlands on the Spangler Reserve in the future, the Project could have a beneficial effect on the population viability of fairy shrimp in the Basin.

6.14. Vernal Pool Tadpole Shrimp

6.14.1. Species Ecology

6.14.1.1. HABITAT ASSOCIATIONS/REQUIREMENTS

Habitat Type

Vernal pool tadpole shrimp are found primarily in vernal pools; they inhabit other seasonal wetlands to a limited extent. They occupy vernal pools with a variety of depths and water volumes containing clear to highly turbid water and with areas ranging from 20 square feet to over 3,750,000 square feet (Helm 1998). Vernal pool tadpole shrimp occur in a wide range of vernal pool habitats across the Central Valley of California, from Shasta County to northwestern Tulare County. Isolated occurrences have also been reported in Alameda and Contra Costa Counties. Vernal pool tadpole shrimp distribution is highly fragmented (USFWS 2007).

Mechanisms of Dispersal

The life history of the tadpole shrimp is linked to the seasonal cycle of the vernal pool. After winter rainwater fills the pool, the population is reestablished from cysts that lie dormant in the dry pool sediments. Sexually mature adults have been observed in vernal pools three to four weeks after the pools had been filled. Some cysts hatch immediately and the others remain dormant in the soil to hatch during later rainy seasons (USFWS 2007). Vernal pool tadpole shrimp rely on wind and motile species such as birds, mammals, and amphibians for their dispersal. Tadpole shrimp eggs are transported in the stomachs of waterfowl and amphibians, and in small clumps of vernal pool soil attached to mammalian hooves and hair, bird feet, and feathers. Dispersal distances have not been measured, but will likely equate with movement distances of the egg-transporting animals. As such, connectivity of upland and aquatic habitat between vernal pools benefits tadpole shrimp dispersal by increasing the opportunities for egg transport by mammals and amphibians. Dispersal may continue between disconnected pools through avian transport.

6.14.1.2. MECHANISMS OF HABITAT DEGRADATION

Development activities, including residential and commercial development as well as agricultural development, that destroy wetland habitats for this species and the associated uplands are a major cause of habitat loss for this species. Urban runoff and pesticide/herbicide application may degrade wetland habitat occupied by vernal pool tadpole shrimp.

6.14.1.3. DISTRIBUTION

Information on CNDDDB Occurrences

When information was compiled for the NBHCP, there were 154 known occurrences of vernal pool tadpole shrimp in California, of which 153 were considered extant. At that time, no occurrences were known from the Natomas Basin. As of 2015, one occurrence is known in the Natomas Basin and is considered extant. This occurrence is located near the eastern border of the Basin. At this time, the CNDDDB does not list vernal pool tadpole shrimp occurrences within one mile of any of the properties associated with the Greenbriar Development Project.

Other Information on Distribution and Abundance in Natomas Basin

There is no other available information on the presence of vernal pool tadpole shrimp in the Natomas Basin.

Occurrence at the Greenbriar Development Project Sites

Seasonal wetlands on the Greenbriar Project Site were evaluated for potentially suitable vernal pool tadpole shrimp habitat during site visits by HELIX personnel in June 2012. Approximately 0.18 acre of potentially suitable tadpole shrimp habitat was identified on the Greenbriar Project Site. Presence/absence surveys were conducted within suitable habitats on the Greenbriar Project Site according to the *Interim Survey Guidelines to Permittees for Recovery Permits under Section 10(a)(1)(A) of the Federal Endangered Species Act for the Listed Vernal Pool Branchiopods* (USFWS 1996) to determine if this species was present. Both wet and dry season surveys were completed and no branchiopods were detected.

No suitable habitat for this species occurs on any of the other properties associated with the Project.

6.14.2. Greenbriar Development Project Effects On Species

6.14.2.1. LONG-TERM EFFECTS ON HABITAT

Effect on Quantity of Habitat

A total of 0.18 acre of seasonal wetlands on the Greenbriar Project Site were determined to potentially meet the habitat requirements for vernal pool tadpole shrimp during the summer of 2012. The wetlands on the Greenbriar Project Site were not mapped as habitat for vernal pool branchiopods in the NBHCP. Upon completion of dry and wet season surveys and negative

findings for vernal pool branchiopods, it is believed that ground disturbing activities associated with previous and existing land uses have affected the quality of the seasonal wetland habitats present and currently they provide only marginally suitable habitat for this species, at best.

Because no vernal pool branchiopods were detected within the wetlands on the Greenbriar Project Site and the wetlands were not mapped as habitat for vernal pool branchiopods in the NBHCP, impacts to these seasonal wetlands were not counted as loss of vernal pool branchiopod habitat for the purpose of this Effects Analysis. No habitat for vernal pool tadpole shrimp is present within or directly adjacent to any of the properties associated with the Project and restoration plans for the proposed reserves do not include the creation of vernal pool tadpole shrimp habitat. Although the seasonal wetlands that would be created at the Spangler Reserve could potentially meet the habitat requirements for vernal pool tadpole shrimp, it is unlikely that this species would successfully colonize the site. Therefore, the Greenbriar Development Project will have no effect on the quantity of vernal pool tadpole shrimp habitat in the Natomas Basin.

Effects on Quality of Habitat

The Greenbriar Development Project would have no effect on the quality of vernal pool tadpole shrimp habitat in the Natomas Basin (as mapped by the NBHCP) as none exists on any of the properties associated with the Greenbriar Development Project and none would be created at the Project's On or Off-Site Reserves.

6.14.2.2. EFFECTS OF CONSTRUCTION-RELATED ACTIVITIES

No effects to vernal pool tadpole shrimp are anticipated to occur as a result of construction activities because this species is not present on or adjacent to any of the properties associated with the Project.

6.14.2.3. EFFECTS OF HUMAN-WILDLIFE CONFLICTS

Human-wildlife conflicts for this species would not be affected by the Greenbriar Development Project because vernal pool branchiopod habitat would not persist on or adjacent to the Greenbriar Project Site post-construction and this species is not known to occur at or adjacent to the reserves.

6.14.2.4. OVERALL EFFECT ON POPULATION VIABILITY

Vernal pool tadpole shrimp are not believed to occur on, or in the vicinity of, any of the properties associated with the Project. Therefore, it is likely that the Greenbriar Development Project would have no effect on the population viability of vernal pool tadpole shrimp. In the unlikely event that vernal pool tadpole shrimp were to occupy the seasonal wetlands on the Spangler Reserve in the future, the Project could have a beneficial effect on the population viability of this species in the Basin over the long term.

6.15. Midvalley Fairy Shrimp

6.15.1. Species Ecology

6.15.1.1. HABITAT ASSOCIATIONS/REQUIREMENTS

Habitat Type

Midvalley fairy shrimp occur in vernal pools in the Central Valley of California from Sacramento County to Fresno County (Helm 1998). This species primarily occupies shallow vernal pools, but also occasionally occupies vernal swales and various artificial ephemeral wetland habitats. This species has one of the most rapid life cycles of the vernal pool branchiopods found in California and has been found inhabiting the most ephemeral of season wetland types with average depths of only 10 centimeters (Helm 1998). Midvalley fairy shrimp appear to be vernal pool obligates, as 93 percent of observations have occurred in vernal pools and the remaining 7 percent have occurred in vernal swales (Helm 1998). This species is associated with the smallest (less than 2,200 square feet) and most ephemeral (average depth of 4 inches) vernal pools (Helm 1998). The NBHCP lists ponds and seasonally wet areas as the only land cover type that provides habitat for this species.

Mechanisms of Dispersal

Midvalley fairy shrimp rely on wind and motile species such as birds, mammals, and amphibians for their dispersal. Fairy shrimp eggs are transported in the stomachs of waterfowl and amphibians, and in small clumps of vernal pool soil attached to mammalian hooves and hair, bird feet, and feathers. Dispersal distances have not been measured, but will likely equate with movement distances of the egg-transporting animals. As such, connectivity of upland and aquatic habitat between vernal pools benefits shrimp dispersal by increasing the opportunities for egg transport by mammals and amphibians. Dispersal may continue between disconnected pools through avian transport.

6.15.1.2. MECHANISMS OF HABITAT DEGRADATION

Development activities, including residential and commercial development as well as agricultural development, that destroy wetland habitats for this species and the associated uplands are a major cause of habitat loss for this species. Urban runoff and pesticide/herbicide application may degrade wetland habitat occupied by midvalley fairy shrimp.

6.15.1.3. DISTRIBUTION

Information on CNDDDB Occurrences

When information was compiled for the NBHCP, there were 14 known occurrences of midvalley fairy shrimp in California, all of which were considered extant. At that time, no occurrences

were known from the Natomas Basin. As of 2015, CNDDDB still does not list midvalley fairy shrimp occurrences within the Natomas Basin.

Other Information on Distribution and Abundance in Natomas Basin

Midvalley fairy shrimp has not been recorded in the Natomas Basin (ICF 2014).

Occurrence at the Greenbriar Development Project Sites

Seasonal wetlands on the Greenbriar Project Site were evaluated for potentially suitable vernal branchiopod habitat during site visits by HELIX personnel in June 2012. Approximately 0.18 acre of potentially suitable fairy shrimp habitat was identified on the Greenbriar Project Site. Presence/absence surveys were conducted within suitable habitats on the Greenbriar Project Site according to the *Interim Survey Guidelines to Permittees for Recovery Permits under Section 10(a)(1)(A) of the Federal Endangered Species Act for the Listed Vernal Pool Branchiopods* (USFWS 1996) to determine if this species was present. Both wet and dry season surveys were completed and no branchiopods were detected.

No suitable habitat for this species occurs on any of the other properties associated with the Project.

6.15.2. Greenbriar Development Project Effects on Species

6.15.2.1. LONG-TERM EFFECTS ON HABITAT

Effect on Quantity of Habitat

A total of 0.18 acre of seasonal wetlands on the Greenbriar Project Site were determined to potentially meet the habitat requirements for vernal pool branchiopods during the summer of 2012. The wetlands on the Greenbriar Project Site were not mapped as habitat for vernal pool branchiopods in the NBHCP. Upon completion of dry and wet season surveys and negative findings for vernal pool branchiopods, it is believed that ground disturbing activities associated with previous and existing land uses have affected the quality of the seasonal wetland habitats present and currently they provide only marginally suitable habitat for fairy shrimp, at best.

Because no vernal pool branchiopods were detected within the wetlands on the Greenbriar Project Site and the wetlands were not mapped as habitat for vernal pool branchiopods in the NBHCP, impacts to these seasonal wetlands were not counted as loss of vernal pool branchiopod habitat for the purpose of this Effects Analysis. No habitat for midvalley fairy shrimp is present within or directly adjacent to any of the other properties associated with the Project and restoration plans for the proposed reserves do not include the specific creation of fairy shrimp habitat. Although the seasonal wetlands that would be created at the Spangler Reserve could potentially meet the habitat requirements for midvalley fairy shrimp, it is unlikely that this species would successfully colonize the site. Therefore the Greenbriar Development Project is

expected to have no effect on the quantity of midvalley fairy shrimp habitat in the Natomas Basin.

Effects on Quality of Habitat

The Greenbriar Development Project would have no effect on the quality of midvalley fairy shrimp habitat in the Natomas Basin (as mapped by the NBHCP) as none exists on any of the properties associated with the Project and none would be created at the Project's On or Off-Site Reserves.

6.15.2.2. EFFECTS OF CONSTRUCTION-RELATED ACTIVITIES

No effects to midvalley fairy shrimp are anticipated to occur as a result of construction activities because this species is not present on any of the properties associated with the Project.

6.15.2.3. EFFECTS OF HUMAN-WILDLIFE CONFLICTS

Human-wildlife conflicts for this species would not be affected by the Greenbriar Development Project because vernal pool branchiopod habitat would not persist on or adjacent to the Greenbriar Project Site post-construction and this species is not known to occur at or adjacent to the reserves.

6.15.2.4. OVERALL EFFECT ON POPULATION VIABILITY

Midvalley fairy shrimp are not believed to occur on, or in the vicinity of, any of the properties associated with the Project, or elsewhere in the Natomas Basin. Therefore, it is likely that the Greenbriar Development Project would have no effect on the population viability of midvalley fairy shrimp. In the unlikely event that midvalley fairy shrimp were to occupy the seasonal wetlands on the Spangler Reserve in the future, the Project could have a beneficial effect on the population viability of this species in the Basin.

6.16. Covered Plant Species

Of the seven plant species covered by the NBHCP (**Table 37**), the Greenbriar Development Project would not affect the five vernal pool-associated species because these species are not known to occur in the vicinity of the Greenbriar Project Site or proposed reserve sites (or in the Natomas Basin), nor is suitable habitat present at or near any of the properties associated with the Project. These plant species are: Boggs Lake hedge-hyssop, Sacramento Orcutt grass, slender Orcutt grass, Colusa grass, and legenera. The other two covered plant species (delta tule pea and Sanford's arrowhead) are also not known to occur at any of the properties associated with the Project, or in the Natomas Basin, but potentially suitable habitat for these species does occur at or near some of these sites. Botanical surveys for Delta tule pea and Sanford's arrowhead were conducted in 2012 at the Greenbriar Project Site and Spangler Reserve and these

species were not observed (HELIX 2013a, b). Surveys have not been conducted for these species at the other properties associated with the Greenbriar Development Project. Because these species could potentially spread into the Greenbriar Development Project sites prior to implementation, the proposed measures (included in **Appendix F**) include a rare plant survey requirement and the applicable avoidance and minimization measures from the NBHCP for these species.

The Greenbriar Development Project would eliminate approximately 15 acres of canal at the Greenbriar Project Site, of which approximately 3.21 acres currently represents suitable habitat for these aquatic plants. Because these species are not known to occur in the Natomas Basin, the Greenbriar Development Project likely would not alter the viability of any of their populations.

Table 37. Primary Habitats and Distribution of Plant Species Covered by the NBHCP

Species	Growth Form	Primary Habitat(s)	Distribution
Delta tule pea (<i>Lathyrus jepsonii</i> var. <i>jepsonii</i>)	Biennial-perennial, herbaceous vine	Riparian scrub, marsh (primarily tidal, fresh or brackish)	Alameda, Contra Costa, Napa, Sacramento, San Joaquin, and Solano counties; not known from the Natomas Basin
Sanford's arrowhead (<i>Sagittaria sanfordii</i>)	Perennial, rhizomatous aquatic with emergent leaves	Marsh and other shallow freshwater habitats	Butte, Del Norte, Fresno, Kern, Merced, Orange, Sacramento, Shasta, San Joaquin, and Tehama counties; not known from the Natomas Basin
Bogg's Lake hedge hyssop (<i>Gratiola heterosepala</i>)	Small semi-aquatic annual, up to 4 inches in height	Vernal pools and swallow lake margins	Fresno, Lake, Lassen, Madera, Merced, Modoc, Placer, Sacramento, San Joaquin, Shasta, Siskiyou, Solano, and Tehama counties; not known from the Natomas Basin
Sacramento Orcutt grass (<i>Orcuttia viscida</i>)	Annual herb	Vernal pools (generally larger, deeper pools)	Sacramento County; not known from the Natomas Basin
Slender Orcutt grass (<i>Orcuttia tenuis</i>)	Annual herb	Vernal pools (generally larger, deeper pools)	Butte, Lake, Lassen, Modoc, Plumas, Sacramento, Shasta, Siskiyou, and Tehama counties; not known from the Natomas Basin
Legenere (<i>Legenere limosa</i>)	Annual herb	Vernal pools and swales, seasonal marshes, artificial ponds, floodplains of intermittent streams, and other seasonally inundated habitats	Lake, Napa, Placer, Sacramento, San Joaquin, San Mateo, Santa Clara, Shasta, Solano, Sonoma, Stanislaus, Tehama, and Yuba counties; not known from the Natomas Basin
Colusa grass <i>Neostapfia colusana</i>	Annual herb	Occurs in large deep pools with substrates of adobe mud but also in smaller pools.	Colusa, Glenn, Merced, Solano, Stanislaus, and Yolo counties; not known from the Natomas Basin

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Chapter 7. Potential Effects of the Greenbriar Development Project on the Conservation Strategy of the NBHCP

Based on the analyses presented in Chapter 5 (Alteration of Population and Habitat Attributes by the Project) and Chapter 6 (Potential Effects of the Project on Covered Species), this section summarizes the effect of the Greenbriar Development Project on the conservation strategy of the NBHCP that is described in section IV.C of the NBHCP. Overall, the Greenbriar Development Project would not reduce the effectiveness of the NBHCP's conservation strategy because it would not alter the basis of this conservation strategy. The Natomas Basin is approximately 53,500 acres in total size. The NBHCP allows for Authorized Development to occur on 17,500 of these acres within the Natomas Basin. As provided by the NBHCP, all Authorized Development will provide mitigation fees to set aside and manage as reserves 0.5 acres of land for every acre of land developed. Therefore, the NBHCP provides for establishment of 8,750 acres of reserve land. Because the acreage of land in the Natomas Basin that is potentially available and suitable for preservation substantially exceeds the 8,750 acres that is required for preservation by the NBHCP (**Figure 13**; takes the conservative approach and assumes all TNBC reserves would be in the Basin and none would be in Area B); the Greenbriar Development Project would not preclude or increase the cost of preservation of sufficient land to attain the NBHCP's goals and objectives.

In Section IV.C.1 (pages IV 5-15), the NBHCP describes the basis of the key components of the NBHCP's conservation strategy and how these components provide effective mitigation for 17,500 acres of urban development. These components are:

- Basis for 0.5 to 1 mitigation ratio (Section IV.C.1.a);
- Preparation of SSMPs (Section IV.C.1.b);
- Buffers within the reserve lands (Section IV.C.1.c);
- Connectivity (Section IV.C.1.d);
- Foraging habitat (Section IV.C.1.e); and
- 2,500-acre/400-acre minimum habitat block size requirements (Section IV.C.1.f).

The effects of the Greenbriar Development Project on each of these components of the NBHCP conservation strategy is described in the following sections, and then these effects are

synthesized, along with the effects of the Project on the population viability of the Covered Species (see chapters 5 and 6) as the overall effect of the Greenbriar Development Project on the effectiveness of the NBHCP's conservation strategy.

7.1. Basis for 0.5 to 1 Mitigation Ratio

On pages IV-6 and IV-7, the NBHCP describes eight key considerations for determining that the 0.5:1 mitigation ratio (area preserved: area impacted) mitigates the impacts of incidental take authorized under the NBHCP's ITP. These eight key considerations are summarized below.

- Overall, reserves will provide greater habitat value than the agricultural land that will be converted to urban development. (This consideration overlaps with other considerations.)
- Much of the land to be developed is either of limited value as habitat or serves as habitat to a limited number of species.
- For several wetland and vernal pool-associated species, reserves will provide opportunities for reintroduction into the Basin.
- Reserves would provide habitat for migratory bird species that have limited habitat in the Basin.
- Reserves would be managed to minimize take related to agricultural and land management activities.
- Reserves would provide permanent habitat for Covered Species.
- Reserves would be monitored and adaptively managed.
- Reserves would be consolidated into large blocks of habitat.

Because the Greenbriar Development Project would not alter the habitat value of land authorized for development under the NBHCP, and would not adversely affect the habitat value of TNBC reserves established under the NBHCP, the Greenbriar Development Project would not affect this basis for the 0.5:1 mitigation ratio for the 17,500 acres of urban development authorized by the NBHCP. Similarly, the Greenbriar Development Project would not adversely affect the monitoring and management of reserves, or opportunities to consolidate reserves into large blocks of habitat. (The Greenbriar Development Project's effects on the habitat quality of existing reserves, water availability at TNBC reserves, and opportunities to establish additional TNBC reserves are evaluated in Chapters 5.7, 5.8, and 5.9, respectively.) Although not explicitly stated in section IV of the NBHCP, the 0.5:1 mitigation ratio is related to other elements of the conservation strategy (e.g., maintenance of habitat connectivity). With its

proposed conservation strategy, the Greenbriar Development Project would not adversely affect these other elements of the NBHCP conservation strategy, and thus the Greenbriar Development Project would not affect the basis of the NBHCP 0.5:1 mitigation ratio.

The Greenbriar Development Project, as proposed, would be developing agricultural land (primarily in hay production) that at present (2016) largely lacks habitat for GGS but provides some low quality habitat for the species and provides only low to moderate quality habitat for a few of the avian NBHCP Covered Species (including Swainson's hawk). Therefore, the Greenbriar Development Project is consistent with the first two key considerations in developing the 0.5 to 1 mitigation strategy, in that it involves development of lands with limited habitat value and preservation of reserves with greater habitat value than the lands being developed. Furthermore, the Greenbriar Development Project will provide reserve land consistent with considerations 4 through 8, in that reserves will be monitored and managed to minimize take, provide permanent habitat for NBHCP Covered Species, including migratory bird species, and would not detract from TNBC's ability to consolidate large blocks of habitat (consideration 3 is not relevant to the Greenbriar Development Project because there are no vernal pool species on the Greenbriar Project Site). Even though the Greenbriar Development Project is consistent with these criteria, the Greenbriar Conservation Strategy includes providing reserve land at a 1.03:1 ratio (developed: preserved), or approximately double the 0.5:1 ratio utilized in the NBHCP.

7.2. Preparation of SSMPs

For each reserve, TNBC prepares and implements a SSMP that addresses the specific resources and habitat values of each reserve site, and how these will be managed in support of the goals and objectives of the NBHCP. SSMPs for each existing TNBC reserve are currently designed to maximize the benefit to NBHCP Covered Species using the resources within that individual reserve or reserve block. Thus, changes in land use outside of an existing TNBC reserve are unlikely to necessitate changes to an SSMP.

The potential effects of the Greenbriar Development Project that could affect reserve management include altering connectivity, adjacent land uses, water availability, or affecting opportunities to establish additional reserves. These effects are evaluated in Chapters 5.6, 5.7, 5.8, and 5.9, respectively. In brief, the Greenbriar Development Project would not alter connectivity or water availability, or affect opportunities to establish additional reserves. The Greenbriar Development Project would change adjacent land uses of existing and future reserves but the effect would be beneficial overall (e.g., the Greenbriar Development Project's proposed reserves would be in close proximity and/or adjacent to existing TNBC reserves and would provide larger blocks of habitat). Therefore, although the Greenbriar Development Project would reduce available Swainson's hawk foraging habitat at the Greenbriar Project Site, which is

in the vicinity of two existing TNBC reserves, this external factor would not alter the site-specific management of either nearby reserve. The Greenbriar Development Project would not detrimentally affect the viability of the NBHCP Covered Species within or outside existing reserves. By extension, the Greenbriar Development Project would also not result in the need for adaptive management or increased cost of management for the existing reserves.

7.3. Buffers within Reserve Lands

Buffers are often incorporated into TNBC reserves to minimize the effects of incompatible adjoining land uses. These buffers consist of a 30-70-foot-wide strip of native or ruderal vegetation along the edge of the reserve.

Development at the Greenbriar Development Project site would not alter the need for or effectiveness of reserve buffers at existing TNBC reserves because the Greenbriar Project Site is not adjacent to an existing reserve. (Potential effects of the Project on human-wildlife conflicts and reserve habitat values are evaluated in Chapters 5.2 and 5.7, respectively.) Also, because under the future condition of the Natomas Basin resulting from the NBHCP, the Greenbriar Project Site would already be bordered by urban development, highways or major roads on all sides, development of the Greenbriar Project Site could cause only very limited effects on the effectiveness of buffers within future reserves, even if reserves were established on adjacent land to the north or southwest (i.e., adjacent land that was not identified for development under the future condition of the Natomas Basin as portrayed in the NBHCP).

The proposed Spangler Reserve and Moody Reserve also would not alter the need for or effectiveness of reserve buffers at existing reserves because these two reserve sites are not directly adjacent to existing TNBC reserves. The North Nestor Reserve could have a beneficial effect by reducing or eliminating the need for buffers at the TNBC Lucich North and Nestor reserves along shared borders.

7.4. Connectivity

The conservation strategy of the NBHCP emphasizes the need for maintaining connectivity of reserves and the importance of existing canals and drains for providing that connectivity; however, the NBHCP would not preserve or enhance habitat along canals, although it does contemplate future needs to preserve habitat along canals in some instances. The NBHCP states (on page IV-8) that elimination of drains or canals would primarily be related to urban development, and thus would be unlikely to affect reserves. Nonetheless, the NBHCP acknowledges (on page IV-9) that once reserves are established and key connectivity corridors have been identified, changes in water delivery and drainage along these waterways could occur,

and thus these changes must be considered by TNBC and measures taken to ensure connectivity. Suggested measures include Memoranda of Understanding, easements, or purchase of land.

Lone Tree Canal is a key connectivity corridor between existing reserves (Jones & Stokes 2005). The Greenbriar Development Project includes enhancing and preserving habitat within a 250-foot wide corridor along Lone Tree Canal, installing a barrier/fencing to keep snakes out of adjacent development on the Greenbriar Project Site and to exclude humans and domestic/feral animals from the Lone Tree Canal corridor, providing an additional assurance for water flow in the canal, and re-contouring the east bank of the canal to allow for the establishment of freshwater marsh habitat along the canal. (Both the potential effects and the conservation measures that reduce or eliminate them are described in greater detail in Chapter 5.5 *Connectivity of Habitat in the Basin* and 5.6 *Connectivity of Existing TNBC Reserves*). These measures would ensure that connectivity would be maintained along this section of Lone Tree Canal, and are comparable to the measures contemplated in the NBHCP (on page IV-9) for ensuring connectivity of canals.

The Project's proposed reserves would also have a beneficial effect on connectivity of TNBC reserves by enhancing and preserving habitat in between existing and future reserves. The proposed Spangler Reserve is located between the existing Ruby Ranch and Atkinson reserves to the west and the Tufts and Sills reserves to the east. The North Nestor Reserve is located between the Lucich North and Nestor reserves. A 13.6-acre easement area has been defined along the western boundary of the North Nestor Reserve, which could be managed separately by TNBC to link the reserves and further the NBHCP goal of establishing a habitat reserve of 2,500 acres in the Natomas Basin. Therefore, the enhancement and preservation of habitat at these two sites would enhance and preserve connectivity between multiple TNBC reserves.

7.5. Foraging Habitat

The Greenbriar Development Project would include adequate provisions to maintain foraging habitat values, and thus would not compromise the effectiveness of the NBHCP OCP. The effects on habitat acreage and quality in the Natomas Basin are evaluated in Chapters 5.3 and 5.4, respectively. (In addition, effects on habitat values of existing reserves are evaluated in Chapter 5.7.) The Greenbriar Development Project would offset the loss of Swainson's hawk foraging habitat at the Greenbriar Project Site by preservation of foraging habitat at the On- and Off-Site Reserves. The effects of the Greenbriar Development Project on foraging habitat would not alter the viability of any of the populations of NBHCP Covered Species (as described for each species in Chapter 6 *Potential Effects of the Greenbriar Project on Covered Species*).

7.6. Minimum Habitat Block Size Requirements

A requirement of the NBHCP is that, by the end of the 50-year period, one habitat block within the TNBC reserve system will be at least 2,500 acres in size and the balance of reserve lands shall be in habitat blocks of at least 400 acres in size. The NBHCP (on page IV-14) provides four bases for this size requirement. These bases are:

- Large blocks minimize the “perimeter effect”;
- Large blocks promote biodiversity by allowing multiple species and niches to occupy the site;
- The benefit to genetic diversity of dispersing interconnected reserves throughout the Natomas Basin; and
- The 400-acre reserve size is considered the minimum size to allow persistence of Covered Species.

No aspect of the Greenbriar Development Project would alter any of these bases for the minimum habitat block size requirements of the NBHCP. The Greenbriar Development Project’s potential affect on opportunities to establish additional TNBC reserves and to form reserves in compliance with the minimum block sizes was evaluated in Chapter 5.9 *Opportunities to Establish Additional TNBC Reserves and Meet the Minimum Habitat Block Size Requirements in the NBHCP*. In brief, implementation of the Greenbriar Development Project would not prevent TNBC from establishing 8,750 acres of reserves in the Natomas Basin or meeting the minimum habitat block size requirements stated in the NBHCP. In addition, the Greenbriar Development Project would create reserves that would be beneficial for the NBHCP Covered Species and contribute to the success of the TNBC reserves by providing wildlife and habitat values in proximity to existing TNBC reserves. Overall, the proposed Greenbriar Development Project would not substantially reduce opportunities for establishing additional reserves for the NBHCP because sufficient suitable land is available to provide reserves both for the NBHCP and for the Greenbriar Development Project. The proposed project also would not prevent TNBC from compiling reserves into the minimum habitat block size requirements stated in the NBHCP. In fact, a 13.6-acre easement area has been defined along the western boundary of the North Nestor Reserve, which could be managed separately by TNBC to further the NBHCP goal of establishing a habitat reserve of 2,500 acres in the Natomas Basin.

Interestingly, the Greenbriar Development Project does illustrate the benefits of smaller reserves in some instances to preserve connectivity. The Greenbriar Development Project includes enhancement and preservation of land along Lone Tree Canal to maintain connectivity for the

GGS. This land would be partially isolated by major roads and both existing and proposed development, and would not become part of a larger habitat block in the future, but would still provide an important and useable corridor for GGS (See *Greenbriar Development Project – Considerations Regarding Giant Garter Snake Persistence in the Natomas Basin-Prepared by Mr. Eric C. Hansen* in **Appendix D**). In general, corridors along canals and drains near roads and development will be more difficult to incorporate into larger blocks of habitat because of the potentially adverse effects of roads and development on reserves. Yet, it is in precisely these locations that preserving and managing corridors would be most beneficial or even necessary. Though it acknowledges that evidence may be discovered in support of smaller reserves, the NBHCP does not address the effects of preserving such corridors on the attainment of its minimum habitat block size requirements.

Overall, the Greenbriar Development Project would beneficially affect the establishment of large blocks of preserved habitat. It would enhance and preserve approximately 557 acres of additional habitat, at least 454.5 acres of which would be adjacent to or near existing TNBC reserves (the 235.4-acre Spangler Reserve and the 219.1-acre North Nestor Reserve). Under the future condition of the Natomas Basin as defined in the NBHCP, the Greenbriar Project Site would be surrounded by major roads and urban development, and the Greenbriar Conservation Strategy would preserve and actively manage the most ecologically important portion of the site, which is the corridor of land along Lone Tree Canal.

7.7. Effectiveness of the Conservation Strategy of the NBHCP

As described in the preceding sections, the Greenbriar Development Project would not adversely affect the key components of the NBHCP's conservation strategy. Therefore, the Greenbriar Development Project would not reduce the effectiveness of the conservation strategy, and thus no changes in the NBHCP conservation strategy would be necessitated by the Greenbriar Development Project.

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Chapter 8. Potential Effects of the Greenbriar Development Project on the NBHCP's Goals and Objectives

This chapter summarizes the effects of the Greenbriar Development Project on attainment of each applicable goal and objective in the NBHCP. These effects were analyzed in the preceding sections of this report that addressed effects on NBHCP Covered Species, habitat acreage, human-wildlife conflicts, connectivity, habitat values at TNBC reserves, water availability at TNBC reserves, and the opportunity to establish additional reserves.

Nine of the NBHCP's goals and objectives could be affected by the Greenbriar Development Project and are discussed individually below. The following seven NBHCP's goals and objectives (NBHCP page I-16) would not be affected by the Greenbriar Development Project and are not discussed in detail:

- **Overall Goal 2.** Implement an adaptive management program that responds to changing circumstances affecting Covered Species and their habitats.
- **Overall Objective 2.** Maintain and operate flood control, irrigation and drainage facilities in a manner that minimizes take of Covered Species and promotes vegetative cover that enhances habitat values for Covered Species consistent with the Water Agencies' legal obligations.
- **Overall Objective 4.** Within individual TNBC reserves, provide a mosaic of habitats that support both wetland and upland species, and that are configured to support species that utilize both types of habitat.
- **Overall Objective 5.** Implement monitoring programs with qualitative and/or quantitative monitoring methods to evaluate management objectives and strategies for the reserve system. TNBC shall develop each monitoring plan and shall submit the plan for review by the NBHCP TAC and approval by USFWS and CDFW prior to implementation.
- **Overall Objective 6.** Increase the diversity and abundance of Covered Species on reserve lands.
- **Overall Objective 7.** Revise the reserve design and management based on the most current biological data.

- **Wetland Species/Habitat Goal/Objective 3.** Document population trends of Covered Species through monitoring.

Interpretations of the Greenbriar Development Project's effects on the NBHCP in the preceding chapters were based primarily on the sum of the anticipated effects on the TNBC reserve system, and on the sum of anticipated effects on the viability of populations of NBHCP Covered Species using the Natomas Basin. An overall negative effect on the existing reserve system would have been considered adverse to the attainment of the NBHCP's goals and objectives. The Greenbriar Development Project would not have an overall negative effect on the existing reserve system.

Effects that would preclude attainment of a goal or objective, reduce the viability of an NBHCP Covered Species or otherwise necessitate a change in the NBHCP's conservation strategy would have been considered substantial effects that would conflict with the NBHCP. Overall, the Greenbriar Development Project would not conflict with attainment of the goals and objectives of the NBHCP, and the Greenbriar Development Project could provide an overall benefit towards the attainment of several goals. (For example, the Greenbriar Development Project would preserve approximately 557 acres of land and this preserved land would contribute to the connectivity and quality of habitat preserved through the NBHCP). In the following sections, the Greenbriar Development Project's effects are assessed for each potentially affected goal and objective of the NBHCP. These assessments, in turn, are based on the analyses presented in Chapters 4 through 7 of this document.

8.1. Overall Goals

8.1.1. Overall Goal 1

“Establish and manage in perpetuity a biologically sound and interconnected habitat reserve system that mitigates impacts on Covered Species resulting from Covered Activities and provides habitat for existing, and new viable populations of Covered Species” (NBHCP, p. I-15).

The following factors relate to attainment of this goal:

- Acreage of habitat in the Natomas Basin;
- Quality of habitat in the Natomas Basin;
- Connectivity of habitat in the Natomas Basin;
- Connectivity of TNBC reserves;
- Habitat value of TNBC reserves;
- Water availability at TNBC reserves; and,

- Opportunities to establish additional TNBC reserves.

The Greenbriar Development Project could affect the attainment of this goal through all of these mechanisms, except for water availability at TNBC reserves (which the Greenbriar Development Project would not affect – see Discussion in 5.8 *Water Availability at TNBC Reserves*). The Greenbriar Development Project’s potential beneficial effects would include increased habitat quality resulting from the preservation, creation, and enhancement of habitats, increased connectivity of habitats between existing TNBC reserves, increased habitat value of existing TNBC reserves, and increased connectivity of habitat in the Natomas Basin. The Greenbriar Development Project’s potential adverse effects would include a reduction in the overall acreage of upland and wetland habitats in the Natomas Basin, reduced foraging habitat values within a mile of an existing TNBC reserve, fragmented upland habitats in the vicinity of the Greenbriar Project Site, and degraded habitat quality of adjacent agricultural lands to the north and southwest of the Greenbriar Project Site.

The Greenbriar Development Project’s potential adverse effects would be offset by incorporating measures to ensure that connectivity along Lone Tree Canal is sustained (as described in Chapters 5.4, 5.5, 6.1, and 6.2.) and preserving and enhancing 528.5 acres of Off-Site Reserves. These measures also would cause additional beneficial effects (as described in Chapters 5.6, 5.7, and 5.8), because the preserved and enhanced foraging habitat would not only off-set effects on foraging habitat and on TNBC reserves, but also could increase connectivity of habitat and of TNBC reserves. Similarly, by ensuring that connectivity along Lone Tree Canal would be maintained, the Greenbriar Development Project would conserve an important corridor connecting reserves and habitats of the southern and central Natomas Basin.

As described in Chapter 5.9 *Opportunities to Establish Additional TNBC Reserves and Meet the Minimum Habitat Block Size Requirements in the NBHCP*, the Greenbriar Development Project would not substantially effect the establishment and management of reserves for the NBHCP or the attainment of minimum habitat block size requirements. Because the acreage of land in the Natomas Basin that is potentially available and suitable for preservation substantially exceeds the 8,750 acres that will be preserved by the NBHCP, the Greenbriar Development Project would not preclude the preservation of sufficient land to attain the NBHCP’s goals and objectives. It would provide 557 acres of additional reserve lands, with much of this acreage adjacent to or near existing reserves, which would increase the connectivity of habitats and the resources available to NBHCP Covered Species using reserves established by the NBHCP; in addition, it would conserve an important corridor of canal habitat along Lone Tree Canal.

Although the Greenbriar Development Project would result in the loss of upland and wetland habitats, the preservation and enhancement of habitat by the Greenbriar Development Project would adequately offset its impacts on upland and wetland habitats for NBHCP Covered Species. Effects on the acreage and quality of habitats are summarized below, and a detailed assessment of these effects is presented in Chapters 5.3 and 5.4. (These effects are also evaluated separately for each Covered Species in Chapter 6 *Potential Effects of the Greenbriar Development Project on Covered Species.*)

For wetland land cover (i.e., rice, canal, and ponds and seasonally wet areas), the loss of habitat resulting from the Greenbriar Development Project would be offset by preservation of rice and canal, and the creation of managed marsh and seasonal wetland habitat at the Greenbriar Development Project's proposed reserves. Permanent loss of wetland land cover resulting from the Greenbriar Development Project as compared to 2001 conditions includes the loss of 160 acres of rice and 17.5 acres of canal habitats (primarily as a result of development at the Greenbriar Project Site). Although it would not constitute a loss of wetland land cover, a total of 177.1 acres of rice at the Spangler Reserve would be converted to managed marsh and annual grassland with interspersed seasonal wetlands. Wetland land cover permanently created/preserved by the Greenbriar Development Project includes 40.3 acres of rice and associated canal habitat at the Spangler Reserve, 219.1 acres of rice at the North Nestor Reserve, 1.8 acres of freshwater marsh habitat at the Lone Tree Canal Reserve, and 142 acres of managed marsh at the Spangler Reserve. In addition, 53.1 acres of annual grassland with interspersed seasonal wetlands will be created at the Spangler Reserve. Therefore, the permanent loss of wetland habitats (i.e., those provided by land cover mapped as rice, canal, and ponds and seasonally wet areas based on 2001 conditions) is more than offset by the preservation, creation, and management of similar habitats. These effects are described in detail in Chapters 5.3-5.4 and 6.1-6.2. The Greenbriar Development Project would also conserve an important corridor of canal and adjacent upland habitat at the Greenbriar Project Site (Lone Tree Canal Reserve).

For upland land cover (i.e., upland components of managed marsh, alfalfa, grassland, idle, non-rice crop, pasture, and ruderal), the loss of habitat resulting from the Greenbriar Development Project also would be offset by creation/preservation of habitat at the Project's proposed reserves. Permanent loss of upland land cover resulting from the Greenbriar Development Project as compared to 2001 conditions involves the loss of 377.8 acres of various upland land cover types such as idle, rural residential, grass hay, ruderal, and roads and highways (primarily as a result of development at the Greenbriar Project Site). A total of 268 acres of upland land cover types would be created/preserved or provided due to rotational fallowing of rice and managed marsh (See **Table 22**) including 13.3 acres at the Lone Tree Canal Reserve, 74.3 acres at the Moody Reserve, 136.6 acres at the Spangler Reserve, and 43.8 acres at the North Nestor

Reserve. For the NBHCP Covered Species associated with uplands (foraging birds) the habitat values provided by this upland habitat would fully offset the habitat values of the upland acreage lost as a result of the Greenbriar Development Project. (The analysis of the foraging habitat value lost at the Greenbriar Project Site and of the value gained at the Project's proposed reserve sites is summarized in Chapter 5.4 *Habitat Quality in the Natomas Basin*.)

On the basis of the Greenbriar Development Project's establishment of reserves that provide habitat for NBHCP Covered Species and off-set the Greenbriar Development Project's impacts to those species, implementing the proposed Greenbriar Development Project would improve the connectivity of the NBHCP reserve system and provide habitat for viable populations of NBHCP Covered Species. For these reasons, the Greenbriar Development Project would not adversely affect attainment of this goal.

8.1.2. Overall Goal 3

"Preserve open space and habitat that may also benefit local, non-listed and transitory wildlife species not identified within the NBHCP" (NBHCP, page I-16).

The following factors relate to attainment of this goal:

- Acreage of habitat in the Natomas Basin;
- Quality of habitat in the Natomas Basin;
- Connectivity of habitat in the Natomas Basin;
- Connectivity of TNBC reserves;
- Habitat value of existing TNBC reserves;
- Water availability at TNBC reserves; and,
- Opportunities to establish additional TNBC reserves.

The Greenbriar Development Project furthers this goal by preserving 557 acres of habitat in the Natomas Basin, and does not detract from TNBC's ability to establish reserves under the NBHCP. By preserving, enhancing, and creating habitat, the Greenbriar Development Project would increase the quality of habitats, increase the connectivity of habitats and TNBC reserves, and create additional preserved land adjacent to existing TNBC reserves.

The Greenbriar Development Project's adverse effects would be offset by incorporating measures to ensure that connectivity along Lone Tree Canal is sustained (including additional requirements for fencing and barriers), and preserving and enhancing 528.5 acres of land at three

Off-site Reserves, two of which are adjacent or in close proximity to existing TNBC reserves. Additional preserve land provided by the Greenbriar Development Project also could increase connectivity of habitat and of TNBC reserves. Similarly, by ensuring that connectivity along Lone Tree Canal would not be reduced, the Greenbriar Development Project would conserve an important corridor connecting TNBC reserves in the southern and central Natomas Basin.

As described in Chapters 5.6-5.9, the Greenbriar Development Project would have an overall beneficial effect on the establishment and management of reserves for the NBHCP. Because the acreage of land in the Natomas Basin that is potentially available and suitable for preservation substantially exceeds the 8,750 acres that will be preserved by the NBHCP, the Greenbriar Development Project would not preclude the preservation of sufficient land to attain the NBHCP's goals and objectives. It would provide reserve lands adjacent to or near existing reserves, increasing the connectivity of habitats and the resources available to wildlife species using reserves established by the NBHCP; in addition, it would conserve an important corridor of canal habitat along Lone Tree Canal. The Greenbriar Development Project also would increase opportunities to establish new reserves, particularly to create larger reserves by preserving additional land adjacent to existing TNBC reserves.

Because the Greenbriar Development Project would not reduce the likelihood that the NBHCP would be able to preserve sufficient habitat for non-listed species to attain this goal, the Greenbriar Development Project would not adversely affect the attainment of this goal.

8.1.3. Overall Goal 4

“Ensure that direct impacts of Authorized Development upon Covered Species are avoided or minimized to the maximum extent practicable” (NBHCP, page I-16).

The following factor relates to attainment of this goal:

- Construction-related effects on the survival or reproduction of NBHCP Covered Species.

Development of the Greenbriar Project Site and Off-Site Improvement Lands could affect GGS, Swainson's hawk, western burrowing owl, loggerhead shrike, and other NBHCP Covered Species including VELB, western pond turtle, tri-colored blackbird, white-faced ibis, bank swallow, Aleutian Canada goose, Sanford's arrowhead, and Delta tule pea. These potential effects (which are described in detail in Chapter 6 *Potential Effects of the Greenbriar Development Project on the NBHCP Covered Species*) would be comparable to the construction-related effects that could be caused by development permitted by the NBHCP.

The Greenbriar Conservation Strategy would substantially reduce these effects because it includes all of the applicable avoidance and minimization measures that were included in the NBHCP to avoid and minimize construction-related effects, which are a comprehensive set of effective measures for reducing these effects. (An assessment of the applicability of these measures is **Appendix E**.) In addition, the Greenbriar Conservation Strategy would include several more stringent avoidance and minimization measures. Therefore, the Greenbriar Development Project would not adversely affect attainment of this goal because it would implement a comprehensive set of measures to avoid and minimize effects on NBHCP Covered Species. The Greenbriar Development Project also would not alter the effectiveness of any NBHCP conservation measures for avoiding and minimizing the effects of development authorized by the NBHCP (see **Appendix G**).

8.2. Overall Objectives

8.2.1. Overall Objective 1

“Minimize conflicts between wildlife and human activities, including conflicts resulting from airplane traffic, roads and automobile traffic, predation by domestic pets, and harassment by people” (NBHCP, page I-16).

The following factors relate to attainment of this goal:

- Construction-related effects on the survival or reproduction of NBHCP Covered Species; and
- Altering the area, types of habitats, or level of conflicts in zones with high levels of human-wildlife conflicts.

Without the proposed measures, the Greenbriar Development Project would reduce the overall area of zones with high levels of human-wildlife conflicts, but it would increase the area of rice habitat and the level of conflicts within such zones, and it would cause construction-related effects in these zones (Chapter 5.2 *Zones with Human-Wildlife Conflicts* provides a detailed description of effects on zones with high levels of human-wildlife conflicts). These human-wildlife conflicts and construction-related effects would be comparable to those resulting from the development authorized by the NBHCP.

The Greenbriar Development Project includes avoidance and minimization measures that would address these potential effects. These measures include all of the applicable measures that were included in the NBHCP to avoid and minimize construction-related effects and to reduce human-wildlife conflicts. (An assessment of the applicability of these measures is included as

Appendix E.) As described in Chapter 5.1 *Construction-Related Effects on Survival and Reproduction*, these measures represent a comprehensive set of effective measures for avoiding and minimizing the Greenbriar Development Project’s effects. In addition, the Greenbriar Development Project also incorporates additional measures (e.g., fencing and barriers) to reduce human-wildlife conflicts along Lone Tree Canal.

Therefore, the Greenbriar Development Project would not adversely affect attainment of this objective because it would implement a comprehensive set of measures that would minimize potential human-wildlife conflicts of the Greenbriar Development Project. The Greenbriar Development Project also would not alter the effectiveness of any NBHCP conservation measures for minimizing human-wildlife conflicts (**Appendix G**).

8.2.2. Overall Objective 3

“Ensure connectivity between TNBC reserves to minimize habitat fragmentation and species isolation. Connections between reserves will generally take the form of common property boundaries between reserves, waterways (primarily irrigation and drainage channels) passing between reserves, and/or an interlinking network of water supply channels or canals” (NBHCP, page I-16).

The Greenbriar Development Project could potentially affect attainment of this goal by affecting:

- Connectivity of habitat in the Natomas Basin;
- Connectivity of TNBC reserves;
- Habitat value of TNBC reserves; and,
- Water availability at TNBC reserves.

The Greenbriar Development Project would increase the connectivity of habitats and TNBC reserves due to preservation and enhancement of habitat at the Greenbriar Development Project’s proposed reserves, two of which (Spangler Reserve and North Nestor Reserve) are adjacent or in close proximity to existing TNBC reserves. A 13.6-acre easement area has been defined along the western boundary of the North Nestor Reserve, which could be managed separately by TNBC to link the reserves and further the NBHCP goal of establishing a habitat reserve of 2,500 acres in the Natomas Basin.

The Greenbriar Development Project includes preserving and enhancing a corridor of upland habitat along Lone Tree Canal and incorporating additional measures to ensure that aquatic connectivity along Lone Tree Canal is sustained. By ensuring that upland and aquatic habitat connectivity along Lone Tree Canal will not be reduced, the Greenbriar Development Project

would conserve a portion of an important corridor connecting reserves and habitats of the southern and central Natomas Basin (See **Appendix D - Greenbriar Development Project – Considerations Regarding Giant Garter Snake Persistence in the Natomas Basin** Prepared by Mr. Eric C. Hansen). Therefore, the Greenbriar Development Project would not adversely affect attainment of this objective.

8.3. Wetland Species/Habitat Goals and Objectives

8.3.1. Wetland Species/Habitat Goal/Objective 1

“Acquire, enhance and create a mosaic of wetland habitats with adjacent uplands and connecting corridors to provide breeding, wintering, foraging, and cover areas for wetland species in the NBHCP Plan Area” (NBHCP, page I-17).

The following factors relate to attainment of this goal:

- Acreage of habitat in the Natomas Basin;
- Quality of habitat in the Natomas Basin;
- Connectivity of habitat in the Natomas Basin;
- Connectivity of TNBC reserves;
- Habitat value of TNBC reserves;
- Water availability at TNBC reserves; and,
- Opportunities to establish additional TNBC reserves.

By acquiring, enhancing, and preserving 557 acres of reserve land, the Greenbriar Development Project would increase the area of preserved and managed wetland land (rice, canals, and managed marsh) in the Natomas Basin, which would increase the connectivity of habitats and create additional opportunities to create larger reserves. Preservation and enhancement of Lone Tree Canal would preserve an important north/south corridor through the Basin (see Hansen letter in **Appendix D**). Thus, the Greenbriar Development Project will not interfere with attainment of this goal.

8.3.2. Wetland Species/Habitat Goal/Objective 2

“Provide habitat to maintain, attract and sustain viable populations of the Covered Species. The habitat areas should be configured to encompass natural species migration areas, minimize species isolation, and prevent future habitat fragmentation” (NBHCP, page I-17).

The following factors relate to attainment of this goal:

- Acreage of habitat in the Natomas Basin;
- Quality of habitat in the Natomas Basin;
- Connectivity of habitat in the Natomas Basin; and
- Connectivity of TNBC reserves.

Based on the analyses presented in Chapter 5 *Alteration of Habitat and Population Attributes by the Proposed Greenbriar Development Project*, the Greenbriar Development Project would cause a net increase in the acreage of wetland (non-rice) habitats in the Basin, improve the habitat quality of some wetlands (e.g., the freshwater marsh habitat at Lone Tree Canal and the managed marsh at the Spangler Reserve) in the Basin, improve connectivity of habitat and TNBC reserves, and increase opportunities to establish additional reserves.

The Greenbriar Development Project, along with discontinuation of rice crops in 2004, would eliminate 160 acres of rice and 15 acres of canal habitats compared to 2001 conditions and convert an additional 177.1 acres of rice to managed marsh and grassland/seasonal wetlands. However, the Greenbriar Development Project would preserve/create 182.3 acres of rice, canal, and managed marsh habitats at the Spangler Reserve, preserve 219.1 acres of rice and canal/ditch habitats at the North Nestor Reserve, preserve 0.20 acres of seasonal wetlands at the Moody Reserve, and preserve/create 1.8 acres of freshwater marsh habitat at Lone Tree Canal Reserve.

Therefore, the loss of wetland (i.e., land cover mapped as rice, canal, and ponds and seasonally wet areas under the NBHCP baseline [2001] conditions) is more than offset by the preservation/creation and management of the rice, canal, and managed marsh at the Greenbriar Development Project's reserves. Because the Greenbriar Development Project would increase the acreage of land preserved in the Natomas Basin, it would provide opportunities to increase the connectivity of TNBC reserves (which are described in Chapters 5.6 and 5.9). The Greenbriar Development Project would also conserve and enhance Lone Tree Canal, an important corridor of canal and adjacent upland habitat at the Greenbriar Project Site (as described in Chapter 5.5 *Connectivity of Habitat in the Natomas Basin*).

Consequently, as described in Chapter 6 *Potential Effects of the Greenbriar Development Project on the NBHCP Covered Species*, the Greenbriar Development Project would benefit the viability of NBHCP Covered Species using wetland land cover (i.e., rice, canal, or ponds and seasonally wet areas). Because the Greenbriar Development Project would increase the viability of NBHCP Covered Species using these aquatic habitats, and creates additional reserves that contribute to efforts to sustain viable populations and prevent fragmentation of habitat, the Greenbriar Development Project would be beneficial to this goal/objective overall.

8.4. Upland Species/Habitat Goals and Objectives

8.4.1. Upland Species/Habitat Goal/Objective 1

“Acquire, enhance and create a mosaic of upland habitat types for breeding, foraging, and cover for species dependent on upland habitats” (NBHCP, page I-17).

The following factors relate to attainment of this goal:

- Acreage of upland habitat in the Natomas Basin;
- Quality of upland habitat in the Natomas Basin;
- Habitat value of existing TNBC reserves; and,
- Opportunities to establish additional TNBC reserves.

The Greenbriar Development Project’s effects on the attainment of this goal/objective would include the preservation and enhancement of upland habitats that increase habitat quality and contribute to the connectivity of upland habitats within one mile of the Sacramento River. The Greenbriar Development Project’s effects also would include reduced acreage of upland habitats in the Natomas Basin and slightly reduced foraging habitat within a mile of an existing TNBC reserve. Chapters 5 *Alteration of Population and Habitat Attributes by the Greenbriar Development Project* and 6 *Potential Effects of the Greenbriar Development Project on Covered Species* provide detailed assessments of these effects.

Through a combination of habitat creation and land management changes, the Greenbriar Development Project would preserve/create approximately 268 acres of upland habitat that provides foraging habitat for Swainson’s hawk and other NBHCP Covered Species (See **Table 22**). Based on 2001 conditions, the Greenbriar Development Project would result in a net loss of approximately 72.4 of Swainson’s hawk foraging habitat in the Basin (See **Table 20**; this number differs from the loss of upland land cover because not all upland land cover provides foraging habitat for Swainson’s hawk), primarily due to loss of foraging habitat at the Greenbriar Project Site. Based on conditions at the time of report preparation, the majority of the habitat that would be lost at the Greenbriar Project Site is of low to marginal quality for Swainson’s hawk and most of the other NBHCP Covered Species in the Basin utilizing upland habitats due to the existing site uses. In addition, the Greenbriar Project Site is bordered by proposed development and major highways on three sides, reducing its long-term habitat value. The preserved land at the Off-Site Reserves would be of moderate to high quality and the upland habitat along the Lone Tree Canal Reserve would also be of higher quality for Swainson’s hawk (grassland is high value Swainson’s hawk foraging and grass hay is moderate quality) and other

upland species including GGS (See **Appendix D**) post-Greenbriar Development Project than under current conditions.

Overall, the Greenbriar Development Project would not interfere with the ability of the NBHCP to meet this goal/objective. Because the acreage of upland habitat in the Natomas Basin that is potentially available and suitable for preservation is substantially more than the acreage of upland habitat that would be preserved and enhanced by the NBHCP (See **Figure 13**; 7,916 acres of land is available in the Basin over and above the 8,750 acres required for the NBHCP reserves), the Greenbriar Development Project would not preclude the preservation of sufficient land to attain the NBHCP's goals and objectives. The Greenbriar Development Project would, however, increase habitat quality of existing TNBC reserves (by protecting/enhancing a movement corridor along Lone Tree Canal for Covered Species and establishing reserves adjacent or in close proximity to existing TNBC reserves), which would aid the attainment of this goal/objective.

8.4.2. Upland Species/Habitat Goal/Objective 2

“Ensure reserve land connectivity with travel corridors for upland-dependent species. The habitat areas should encompass grasslands, agricultural croplands, riparian habitats, and shelter and nesting habitat areas (fence rows, clusters of shrubs and small trees), as well as wetland areas to provide a year-round source of water for upland species. The upland areas should be configured to enhance natural species migration, minimize species isolation, and prevent future habitat fragmentation” (NBHCP, page I-17).

The following factors relate to attainment of this goal:

- Connectivity of upland habitat in the Natomas Basin;
- Connectivity of existing TNBC reserves;
- Habitat value of existing TNBC reserves; and,
- Opportunities to establish additional TNBC reserves.

Beneficial effects of the Greenbriar Development Project on this goal/objective would include the preservation and enhancement of upland habitats that would contribute to the connectivity of habitats and existing TNBC reserves. Potential adverse effects would include slightly reduced foraging habitat within a mile of an existing TNBC reserve, fragmented and reduced connectivity of upland habitats in the vicinity of the Greenbriar Project Site, and a slight reduction in land available in the Natomas Basin to establish reserves. Chapters 5.5-5.7 and 5.9 provide a detailed assessment of these effects.

The Greenbriar Development Project would preserve 268 acres of upland habitat in the Basin (See **Table 22**), and would increase connectivity of habitat and of TNBC reserves. The Greenbriar Development Project's proposed Spangler Reserve, North Nestor Reserve, and Lone Tree Canal Reserve would contribute to travel corridors connecting reserve lands. The proposed Spangler Reserve would contain upland habitats as a component of the managed marsh as well as the edges of fields and berms, and this site is within 800 feet of an existing reserve and would connect to habitat on buffer lands surrounding Sacramento International Airport to the south.

The proposed reserve on the Greenbriar Project Site, along Lone Tree Canal, would contain grassland, marsh, and canal habitats managed to sustain connectivity of habitat for GGS. This would also provide some benefit as a travel corridor for upland species; however, the partial isolation of the site by W. Elkhorn Boulevard to the north and I-5 to the south, as under existing conditions, would limit this benefit for upland terrestrial species.

Based on the assessments presented in Chapter 6 *Potential Effects of the Greenbriar Development Project on Covered Species*, a slight reduction in connectivity of upland habitats at the Greenbriar Project Site would be unlikely to alter the viability of the populations of NBHCP Covered Species using upland habitats in the Natomas Basin. Of the NBHCP Covered Species, Swainson's hawk, western burrowing owl, and loggerhead shrike are highly mobile animals that could fly over or around the site. Development at the Greenbriar Project Site would somewhat reduce and fragment upland habitats beyond the fragmentation already caused by freeways and W. Elkhorn Boulevard. However, habitat would be enhanced and preserved along Lone Tree Canal and at the Project's proposed reserves, and the proposed Moody Reserve would enhance and preserve additional upland habitat within one mile of the Sacramento River in the Swainson's Hawk Zone. This enhanced and preserved land would improve connectivity of upland habitats, and could increase the survival or reproduction of individuals using those reserve sites. Also, burrowing owls and loggerhead shrikes using the Natomas Basin are part of large populations, a reduction of connectivity at the Greenbriar Project Site would affect a very small portion of their range and numbers, and their loss of habitat would be off-set by habitat preservation, creation, and enhancement at the proposed reserve sites. Thus, the Greenbriar Development Project is unlikely to alter the viability of populations of NBHCP-covered upland species using the Natomas Basin.

Overall, the Greenbriar Development Project would not alter the viability of any NBHCP Covered Species using upland habitats, and would not necessitate any changes in or increase the cost of the conservation strategy of the NBHCP.

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Chapter 9. Cumulative Effects

The NBHCP was developed to satisfy the requirements of the Federal and California endangered species acts for the incidental take of threatened and endangered species associated with 17,500 acres of development. It is intended to minimize and mitigate the loss of habitat and the incidental take of covered species that could result from such urban development and management of 8,750 acres of related reserves in the Natomas Basin. The Greenbriar Project Site and Off-Site Improvement Lands are located within the Natomas Basin, but are not within an area permitted for development under the NBHCP and the potential effects of development on these sites was not evaluated in the NBHCP. Because the Greenbriar Development Project would result in additional development that was not addressed in the NBHCP, this Effects Analysis is required to evaluate the Project's potential effects on special-status species and habitats, on the NBHCP OCP, the attainment of the NBHCP goals and objectives, and the viability of populations of NBHCP Covered Species.

In addition to the proposed Greenbriar Development Project, several infrastructure projects have been completed within the Natomas Basin that are outside of the NBHCP permit area and would impact additional land in excess of the 17,500 acres. While this Effects Analysis is neither a California Environmental Quality Act document nor a National Environmental Policy Act document, for purposes of providing regional context, this chapter provides information regarding known projects that have been constructed or entitled within the boundaries of the Natomas Basin but outside of the 17,500-acre NBHCP permit area.

9.1. Cumulative Context

The cumulative context for this analysis is the Natomas Basin. In order to determine whether sufficient land was available in the Natomas Basin for implementation of the Greenbriar Development Project, HELIX conducted a GIS analysis to determine the acreage of land in the Basin currently available for development or mitigation purposes as well as land that has already been dedicated for other uses in approved projects or plans. **Figure 13** is a graphic depiction of this GIS analysis. Land identified as currently unavailable as mitigation or already dedicated to other uses includes the following:

- the total acreage of development in the Natomas Basin authorized under the NBHCP and its associated ITPs,
- the acreage of mitigation land required under the NBHCP to offset the authorized development (0.5:1 ratio),

- the acreage of existing development in the Natomas Basin at the time of 1997 NBHCP approval,
- the Natomas North Precinct Master Plan,
- the total acreage of the Sacramento International Airport plus County-owned buffer land,
- the total acreage of the NLIP footprint and its associated mitigation,
- other existing mitigation reserves in the Basin, and
- the SR 99 interchange improvements at Riego Rd and Elverta Road.

The Natomas Basin is an estimated 53,537 acres in size. The NBHCP authorized 17,500 acres of development consisting of 8,050 acres within the City of Sacramento, 7,467 acres within Sutter County, and 1,983 acres within MAP. In order to mitigate for 17,500 acres of impact at a 0.5:1 ratio, the NBHCP must establish 8,750 acres of reserves over the life of the plan. The GIS analysis assumed establishment of all 8,750 acres within the Natomas Basin. As of March 17, 2015, TNBC has acquired 4,104 acres of mitigation land in the Basin.

Per the NBHCP, a total of 5,716 acres of existing development in the Basin (outside of the Sacramento International Airport) was noted at the time of the NBHCP. The Sacramento International Airport and surrounding buffer land consisted of an additional 5,565 acres (NBHCP Page III-10) for a total of 11,281 acres of existing development. A total of 933 acres of development has occurred in the Basin as a result of the NLIP and its associated mitigation (does not include land associated with the NLIP that is within the County-owned airport buffer because airport lands are accounted for separately in the GIS analysis) – this project was not included in the development authorized under the NBHCP. In addition, two interchange improvement projects on SR 99 totaling 238 acres (SR-99 interchange improvements at Riego Rd (113 acres) and Elverta Rd (125 acres) were subtracted from the total acreage available in the Basin along with 102 acres of other mitigation reserves not owned or managed by TNBC. Therefore, a total of 44,503 acres of land in the Basin is already developed, related to implementation of the NBHCP, or included in an approved land use plan (MAP, Sacramento International Airport).

The Natomas North Precinct Master Plan is a ±5,699.3-acre mixed-use project located in the Natomas Basin within the Natomas community of unincorporated northwestern Sacramento County, south of Sutter County and southwest of Placer County, east of SR 99, and north of the City of Sacramento. The proposed project includes a broad range of residential land uses, as well as commercial and employment land uses and schools, parks and open space to support the residential land uses. Although the Natomas North Precinct Master Plan is not an approved project, this acreage was also deducted from the land available for development/mitigation in the Natomas Basin. Although this document is not a California Environmental Quality Act (CEQA)

analysis, it is worth noting that the Natomas North Precinct Master Plan is part of a larger prior proposed project that was included in the cumulative analysis for the project (Greenbriar 2006 Draft EIR (DEIR, p. 7-8.). The project evaluated in the Draft EIR included a development area of 10,000 acres with higher densities than the development currently assumed for the North Precinct (5,699.3 acres); therefore, the analysis of cumulative impacts in the Draft EIR can be considered a “worst-case” scenario. No update to the cumulative analysis is required based on additional planning efforts that have continued for the Natomas Joint Vision area since 2006 since the development impacts currently being considered will be within the envelope of those considered by the Draft EIR. (CEQA Guidelines, § 15164.)

The Greenbriar Development Project, including the Greenbriar Project Site (includes Lone Tree Canal Reserve), Off-Site Improvement Lands, and the Off-Site Reserves (Moody Reserve, Spangler Reserve, and North Nestor Reserve) totals approximately 1,118 acres in size. When added to the 44,503 acres otherwise dedicated, even with implementation of the Greenbriar Development Project an additional 7,916 acres of land is left over and above what is needed to implement the NBHCP and its reserve system. **Table 38** is a summary of land availability for development/mitigation in the Natomas Basin.

Table 38. Summary of Land Availability for Development/Mitigation in the Natomas Basin

Total Acreage of the Natomas Basin	53,537 ¹
Acreage of Authorized Development in the Natomas Basin under the NBHCP ² and its Associated ITPs	-17,500 ³
Acreage of Mitigation Land Required Under the NBHCP to Offset 17,500 acres of Authorized Development (0.5:1 ratio)	-8,750 ⁴
Acreage of existing development in the Natomas Basin in 1997 when the original NBHCP was adopted	-5,716 ⁵
Natomas North Precinct Master Plan Area	-5,699 ⁶
Sacramento International Airport plus County-Owned Buffer	-5,565 ⁷
NLIP Footprint and Associated Mitigation (Not Included in the Authorized Development under the NBHCP)	-933 ⁸
Other Existing Mitigation Reserves in the Basin	-102 ⁹
SR-99 Interchange Improvements (Riego Rd/Elverta Rd)	-238 ¹⁰
Greenbriar Development Project	-1,118 ¹¹
Remaining Land Potentially Available For Development/Mitigation in Natomas Basin	7,916

¹ = Total acreage of the Natomas Basin as stated in the NBHCP and measured as the area interior to the toe of the levees surrounding the Basin (City of Sacramento et al. 2003; page I-1).

² = All references to the NBHCP in this table refer to the 2003 NBHCP referenced here unless otherwise noted:

City of Sacramento, Sutter County, and TNBC (2003). Final Natomas Basin Habitat Conservation Plan. Prepared for USFWS and CDFW.

³ = Comprised of 8,050 acres within the City of Sacramento, 7,467 acres within Sutter County, and 1,983 acres within MAP.

⁴ = The 4,104 acres of mitigation land that TNBC has already acquired in the Basin as of March 17, 2015 is included in this total. Note: Twenty percent of the required 8,750 acres of mitigation land (i.e., 1,750 acres) may occur in "Area B", which is defined in the NBHCP as approximately 60,000 acres located in Sutter County north of the Natomas Cross Canal (see Inset on Figure 13).

⁵ = The total acreage of existing development in the Basin at the time of 1997 NBHCP approval was 7,267 acres as stated in the NBHCP page IV-1. The acreage of existing development attributed to the Sacramento International Airport in the NBHCP (1,551 acres) was subtracted from this total because the airport and surrounding buffer are accounted for separately in the table. See NBHCP Table III-4 on page III-7.

⁶ = Total proposed acreage (5,699.3 acres) from the Natomas North Precinct Master Plan Area Notice of Preparation (April 28, 2016)

⁷ = The total acreage of land under the control of the Sacramento County Department of Airports at the time of the 2003 NBHCP (NBHCP page III-10).

⁸ = Does not include mitigation land associated with the NLIP that is within the County-Owned airport buffer because airport lands are accounted for separately in the table.

⁹ = As determined from remotely sensed data interpretation (i.e., aerial photography); ownership/management entity unknown.

¹⁰ = SR-99 Interchange Improvements are for Riego Rd (113 acres) and Elverta Rd (125 acres).

¹¹ = Total acreage of all land associated with the Greenbriar Development Project, including the 577.0-acre Greenbriar Project Site, 12.76 acres of Off-site Improvement Lands, the 235.4-acre Spangler Reserve, the 74-acre Moody Reserve, and the 219.1-acre North Nestor Reserve.

9.2. Projects Contributing to Cumulative Impacts

Projects in the Natomas Basin outside of those permit areas covered by the NBHCP are described below.

9.2.1. Sacramento International Airport Master Plan

The airport is in the process of developing a draft Airport Master Plan. The current Master Plan, approved by the Sacramento County Board of Supervisors in 2007, sets forth a program for improvements to existing facilities and development of new airport facilities over a 20-year planning period. The Master Plan evaluated alternatives for meeting projected aviation demand over the 20-year period, and encompassed all airport functions, including the airfield, terminal and related passenger services, cargo, general aviation, airport support, and access.

The 2007 Master Plan included expanded development of the airport in three phases, and included improvements such as Terminal B and a new air traffic control tower (See 2007 Master Plan EIR, Table PD-2.) The 2007 Master Plan EIR identified potential impacts to biological resources that could result from implementing phases 1 and 2 of the Master Plan. Such impacts to wetlands were estimated to be approximately 7.5 acres, largely due to drainage ditch modifications (Airport Master Plan Final EIR (2007), p. 11-25.) The EIR also contemplated potential impacts to approximately 3.83 acres of suitable habitat and 2.15 acres of marginal habitat for GGS due to placing portions of canals and ditches into culverts, although the Airport Master Plan is not expected to impact dispersal corridors for GGS (*Id.* at pp. 11-34 to 11-35). Construction of new parking facilities and commercial development under phases one and two was estimated to impact approximately 190 acres of Swainson's hawk foraging habitat (*Id.* at p. 11-39). The EIR also provided mitigation to reduce those impacts to a less than significant level (*Id.* at pp. 11-25 to 11-26, 11-34 to 11-35, 11-39 to 11-40.).

9.2.2. Sacramento Area Flood Control Agency: Natomas Levee Improvement Project

To assess the risk of levee failure and to identify potential remedies, SAFCA commissioned the Natomas Levee Evaluation Study in 2005. This study indicated that the risk of flooding at the 100-year level was greater than previously assumed. A variety of remedies were proposed for identified problems. Most of these remedies involved levee improvement and bank protection techniques, including construction of cutoff walls within existing levees, and placement of toe rock and revegetation of banks at locations along existing levees that pose erosion problems.

SAFCA, along with local, state, and federal agencies, began developing the NLIP with a goal of securing 100-year flood protection for the Basin as soon as possible, and 200-year protection as a longer-term goal. This process culminated in multiple studies and environmental analyses to

support necessary improvements to the levee system. The majority of the improvements have already been constructed, while others are waiting for federal funding before they can be completed. The environmental analysis for each piece of the NLIP has included evaluation and mitigation of the effects on species within the basin, including GGS and Swainson's hawk. Mitigation is being implemented for each piece of the NLIP to offset adverse impacts to GGS and Swainson's hawk, including loss of habitat, through a combination of preservation and enhancement of existing habitat and creation of new habitat within the Basin.

9.2.3. Downtown Sacramento-North Natomas-Airport Light Rail Line

Since the early 1990s, the Sacramento Regional Transit District (RT) has been considering a light rail line (referred to herein as the "DNA Line" or "Green Line to the Airport") that would connect downtown Sacramento, North Natomas, and the Sacramento International Airport (SACOG 2000). The route proposed for this rail line would pass through areas permitted for development in North Natomas, cross the Greenbriar Project Site, the MAP, and then run along I-5, and enter the Sacramento International Airport. This project would affect only a small area of habitat for Covered Species because most of this route is within existing development, areas permitted for development by the NBHCP, or the likely footprint of other proposed projects such as the Greenbriar Development Project.

RT certified a Programmatic EIR for the Green Line to the Airport light rail (formerly known as the DNA Line) in 2008. That document evaluated potential habitat impacts of the Green Line to the Airport light rail line. Most of the route is within the City of Sacramento's NBHCP Permit Area or MAP HCP area, and as such, could be mitigated under those HCPs. Construction of the Green Line to the Airport light rail line within the airport boundary would likely impact already disturbed areas. The 2008 Programmatic EIR estimated that the Greenbriar Development Project portion of the Green Line to the Airport light rail route would impact approximately 7.4 acres of agricultural land that provides some foraging habitat value, but this impact was deemed less than significant (DNA Corridor Draft Programmatic EIR, p. 4.14-13.). Engineering for the Greenbriar Development Project showed the disturbance on the Greenbriar Project Site associated with the Green Line to the Airport light rail ROW is approximately 6 acres (Wood Rodgers 2012). That 6 acres of impact is proposed to be off-set as part of the Greenbriar Conservation Strategy as discussed in Chapter 2.7 *Greenbriar Conservation Strategy*.

9.2.4. SR 99 at Elverta Road Interchange Project

The SR 99 at Elverta Road Interchange Project was completed in October 2013. The interchange replaced an at-grade signalized intersection. The project involved construction of a new interchange with ramp meters and High Occupancy Vehicle by-pass lanes on all freeway on-ramps, widening and reconstructing approximately 1 mile of Elverta Road, removal of a traffic

signal at the intersection of SR 99 and Elverta Road, two new traffic signals at the intersections of the highway off-ramps and Elverta Road, addition of bicycle lanes and sidewalks, relocation of existing drainage canals, and addition of drought tolerant landscaping in the four quadrants of the interchange. The project footprint was approximately 125 acres in size.

9.2.5. SR 99 at Riego Road Interchange Project

The SR 99 at Riego Road Interchange Project was completed in December 2014. The project replaced the existing signalized intersection with a full-service eight-lane overcrossing interchange. The intersection is approximately 10 miles north of downtown Sacramento in the southern portion of Sutter County. The project footprint was approximately 113 acres. This interchange is within the Sutter Pointe Specific Plan Area but was implemented by the California Department of Transportation and Sacramento County Department of Transportation, entities that are not signatories to the NBHCP.

9.2.6. Natomas North Precinct Master Plan

The Natomas North Precinct Master Plan Area in Sacramento County is a portion of an area formerly known as the Natomas Joint Vision Area. The Joint Vision Area has been discussed by landowners and developers in the Sacramento region since the early 1990's. A Memorandum of Understanding in 2002 between the City and County of Sacramento outlined a "roadmap" for future development and revenue sharing, but resulted in no actual development. There is currently an application on file with the County for an approximately 5,699-acre area—the available documents show that the applicants are seeking to amend the Urban Services Boundary and Urban Policy Area to include this 5,699-acre area. The County released a Notice of Preparation of an Environmental Impact Report (NOP) for this Master Plan Area on April 28, 2016, but the NOP does not describe any potential conservation strategy, except to acknowledge that the Plan Area had been considered an area for potential mitigation under the NBHCP.

Given that the 577-acre Greenbriar Project Site has been more than a decade in the permitting process, a development of the magnitude of the Natomas North Precinct Master Plan Area will certainly take several decades to come to fruition, if at all. Future development of the Natomas North Precinct Master Plan Area is speculative, at best (See *Environmental Council of Sacramento v. City of Sacramento* (2006) 142 Cal.App.4th 1018, 1030-1034 [describing the amorphous and speculative nature of potential development of the Joint Vision Area]).

In any event, the Natomas North Precinct Master Plan Area, if some or all of it is ever developed, would be subject to extensive CEQA review and consideration by the City and County, Sacramento County Local Agency Formation Commission, and regulatory agencies including CDFW and USFWS. Those processes will necessarily include analysis of the impact

of any such development on species and habitat within the Natomas Basin, as well as that development's potential effects on the OCP of the NBHCP. The agencies would also most likely require preparation of a new HCP for the Natomas North Precinct Master Plan Area. While further discussion of the Natomas North Precinct Master Plan Area for purposes of this Effects Analysis would be too speculative to be of any analytical value, **Figure 13** nonetheless conservatively shows the Natomas North Precinct Master Plan Area as being deducted from the acreage of land potentially available for development or mitigation in the Natomas Basin.

9.3. Cumulative Effects Of Proposed And Potential Projects

Projects in the Natomas Basin outside of those areas permitted for development by the NBHCP or that were implemented by entities other than the City of Sacramento, Sutter County, and MAP are depicted on **Figure 13**. These projects were deducted from the acreage of land potentially available for development or mitigation in the Natomas Basin.

The required mitigation for the 17,500 acres of development authorized by the NBHCP consists of 8,750 acres of managed marsh, rice, and uplands. Based on the acreage of the MAP, City of Sacramento, and Sutter County permit areas for urban development, and of existing development outside of those areas, the Natomas North Precinct Master Plan Area, the Natomas Basin contains substantially more than 8,750 acres of land potentially suitable as and potentially available for mitigation. Of the Natomas Basin's 53,537 acres, an estimated 17,784 acres is potentially available for development or mitigation after taking into account the acreage of authorized development under the NBHCP (17,500 acres; includes City of Sacramento, Sutter County, and MAP permit areas) and existing development and established mitigation in the Basin including the Sacramento International Airport and the NLIP (12,316 acres), the Natomas North Precinct Master Plan Area (5,699 acres), and other small infrastructure improvements (**See Figure 13**). Thus, under 2015 conditions, the acreage of potentially suitable and available land is almost three times what is required by the NBHCP for preservation. Regardless of whether the Greenbriar Project Site is developed, numerous factors affect the suitability and cost of land available for preservation under the NBHCP. These factors include existing easements, infrastructure and buildings, availability of land for purchase, adjacent land uses and proximity to urban development, connectivity to other reserves, availability of water, suitability of soils for the establishment of managed marsh, and parcel size relative to the desired size of reserves.

The proposed Greenbriar Development Project would slightly reduce the acreage otherwise available for preservation as mitigation for development permitted by the NBHCP and affect the feasibility of preserving land adjacent to the Greenbriar Project Site. Because of the Greenbriar Development Project, a total of 1,118.56 acres of land in the Basin would become unsuitable for preservation or unavailable. These lands include: 546 acres within the development footprint at

the Greenbriar Project Site, 12.76 acres of Off-Site Improvement Lands, 31.3 acres (28.3 net acres) at the proposed reserve along Lone Tree Canal, 235.4 acres at the proposed Spangler Reserve, 74± acres at the proposed Moody Reserve, and 219.1 acres at the proposed North Nestor Reserve. Thus, overall, the Greenbriar Development Project reduces the acreage of land potentially suitable and available for preservation from 17,784 acres to 16,665.44 acres. Even with this reduction, the remaining acreage of land potentially suitable and available for preservation (16,665 acres) would be approximately 2 times the 8,750 acres the NBHCP requires for the reserve system and leaves approximately 7,916 acres available for development or mitigation over and above what is currently developed, authorized for development under the NBHCP, or required for mitigation under the NBHCP (**See Figure 13**).

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10.2. Personal Communications

- Aubry, Craig. U.S. Fish and Wildlife Service, Sacramento, CA. November 4, 2005 email correspondence with Amanda Olekszulyn regarding Greenbriar Project.
- Dave Fischer, NCMWC, personal communication with Leo Edson, EDAW.
- Dee Swearingen, NCMWC. Conversations in December 2013 with HELIX staff.
- Eric Hansen, private consultant, Natomas, CA. October 20, 2005 written comments on a preliminary draft of the biology section for the Greenbriar Project DEIR provided to Leo Edson, EDAW.
- Mike Fales, Spangler Lessee Farmer. Meeting with Robert Edgerton, HELIX, on May 13, 2013 regarding current rice farming practices at the Spangler property.

Appendix A
Greenbriar Project Acreage Calculations
Memorandum prepared by Wood Rodgers



DRAFT MEMORANDUM

Date: June 12, 2012

To: Robert Edgerton
HDR

From: Mark Rodgers P.E.
Wood Rodgers Inc.

Re: **Greenbriar
HCP Acreage Calculations**

Introduction and Purpose

The purpose of this Memorandum and attachments is to identify the Habitat Conservation Plan (HCP) disturbance areas associated with the Greenbriar Project. These areas can be generally categorized as follows:

1. Greenbriar Project On-site and Off-site Impacts (**Exhibit A**)
2. Other External Project Impacts (**Exhibit B**)

Exhibit A –Greenbriar Project Impacts

Exhibit A identifies the total on-site and off-site acreage that may be impacted as a result of project development. On-site acreage includes the area within the project boundary. Off-site acreage includes the areas outside the project boundary. Note that the north project boundary is the southerly limit of existing right-of-way (R/W) for Elkhorn Blvd.

Exhibit A, Part I -On-Site Impacts:

On-site impacts have been estimated based on the total project site area less areas proposed for preservation, areas to remain undisturbed, and areas previously disturbed by others.

Exhibit A, Part IA references the on-site area proposed for preservation (the Lone Tree Canal Buffer). This is an approximate 250-foot wide corridor along the western boundary of the Project. Encroachments into the buffer include drainage culvert and outfall facilities, roadway and light rail corridor connections and adjacent construction limits. Exhibit A, Part IA includes the overall acreage of the Lone Tree Canal Buffer at 31.3 acres. After determination of the encroachments totaling 3.0 acres, the remaining undisturbed area is 28.3 acres.

Exhibit A, Part 1B references the other on-site avoidance or previously disturbed areas.

The on-site area to remain undisturbed consists of the dedication of R/W associated with the future reconstruction of the SB on-ramp for the Elkhorn / SR99 Interchange. On-site areas previously disturbed by others include the construction of twin 16" sewer force mains and a 36" Gravity outfall system by Metro Air Park (MAP). The total for Exhibit A, Part IB is 11.7 acres.

The **Exhibit A Part I Summary** reflects a total on-site acreage of 577.0 acres less the Lone Tree Canal Buffer at 28.3 acres; and less the avoidance / previously disturbed areas at 11.7 acres; totaling 537.0 acres.

Exhibit A, Part II -Off-Site Impacts:

Off-Site impacts have been estimated based on proposed infrastructure (roadway, sewer, water and drainage improvements) needed for project buildout. Off-site impacts have been separated into a determination of the Elkhorn Blvd impacts and other off-site impacts.

Exhibit A, Part IIA includes impacts to the existing Elkhorn Blvd R/W. The overall impacted area within the existing R/W has been estimated at 7.2 acres. Within this area, 3.2 acres has been deducted for existing pavement, and 3.0 acres has been deducted for the area directly south of the existing pavement that was disturbed as part of the MAP twin sewer force main construction. This results in a net 1.0 acre impact within the existing Elkhorn Blvd R/W.

Exhibit A, Part IIB includes all other off-site impacts as a result of proposed improvements. These include the northbound and southbound off-ramps at the SR 99 / Elkhorn Interchange, the Lone Tree canal Elkhorn Blvd culvert construction, and an area located south of Interstate 5 (I-5) needed to bore and jack a 30" connection north into the project site. These areas total 4.3 acres.

The **Exhibit A Part II Summary** reflects a total off-site area of 5.3 acres.

The **Exhibit A Project HCP Summary** includes 537.0 acres on-site and 5.3 acres off-site for a grand total of 542.3 acres impacted with project development.

Exhibit B –Greenbriar External Project Impacts

External project impacts have been estimated based on proposed infrastructure shared with other HCP programs that have similar Greenbriar Project infrastructure requirements. Exhibit B identifies the total on-site and off-site acreage that may also be impacted as a result of other projects and their corresponding HCP(s) or future mitigation plans. Exhibit B areas can generally be considered overlapping HCP areas with the Exhibit A Greenbriar HCP areas. Exhibit B information has been developed to provide a basis for determination of 1) ultimate responsible party(s), and / or 2) potential adjusted Greenbriar HCP requirements dependent on the constructing entity. On-site acreage includes the area within the project boundary. Off-site acreage includes the areas outside the project boundary. Note that the north project boundary is the southerly limit of existing right-of-way (R/W) for Elkhorn Blvd.

The detailed information for Exhibit B includes the acreage of external project impact; adjusted acreage to exclude external project impact overlap; a determination of whether the improvements have been completed (land that has been previously disturbed); and the reference information. Note that the majority of external project impacts are related to the Metro Air Park (MAP) project and corresponding HCP. Other projects include the North Natomas Public Facilities Financing Plan (NNPFFP) and corresponding HCP, potentially an Elkhorn Interchange Project Report (PR) and Environmental Analysis, and potentially a Sacramento Regional Transit Downtown Natomas Airport (DNA) Line environmental analysis.

Note that some of the impacted areas identified in Exhibit B have been included in Exhibit A based on avoidance or previous disturbance from construction.

Exhibit B, Part I -On-Site External Project Impacts:

The on-site external project impacts include the Elkhorn Interchange Southbound On-ramp expansion, MAP Sewer Force Mains and Gravity Trunk Sewer, Meister Way roadway improvements, the proposed regional Transit LRT DNA corridor and Transit Station, and MAP proposed improvements to the Lone Tree Canal and culvert expansion under I-5. The adjusted total external project impacts for the on-site areas total 36.3 acres.

Exhibit B, Part II -Off-Site External Project Impacts:

Exhibit B, Part IIA references the off-site Elkhorn Blvd widening. This section identifies the MAP related acreages and impacts based on the MAP Finance Plan and MAP HCP EIS. Also included are the MAP Sewer Force Main areas and the area of the existing pavement section. After adjusting for overlap, the estimated total acreage is 7.2 acres.

Exhibit B, Part IIB references other off-site external project impacts. This section identifies the northbound and southbound off-ramps at the SR 99 / Elkhorn Interchange included in the MAP and NNPFFP Finance Plans. The estimated total acreage is 4.0 acres.

The **Exhibit B Summary** totals Exhibit B Part I (on-site) at 36.3 acres and Exhibit B Part II (off-site) at 11.2 acres off-site for a total of 47.5 acres potentially impacted by external projects.

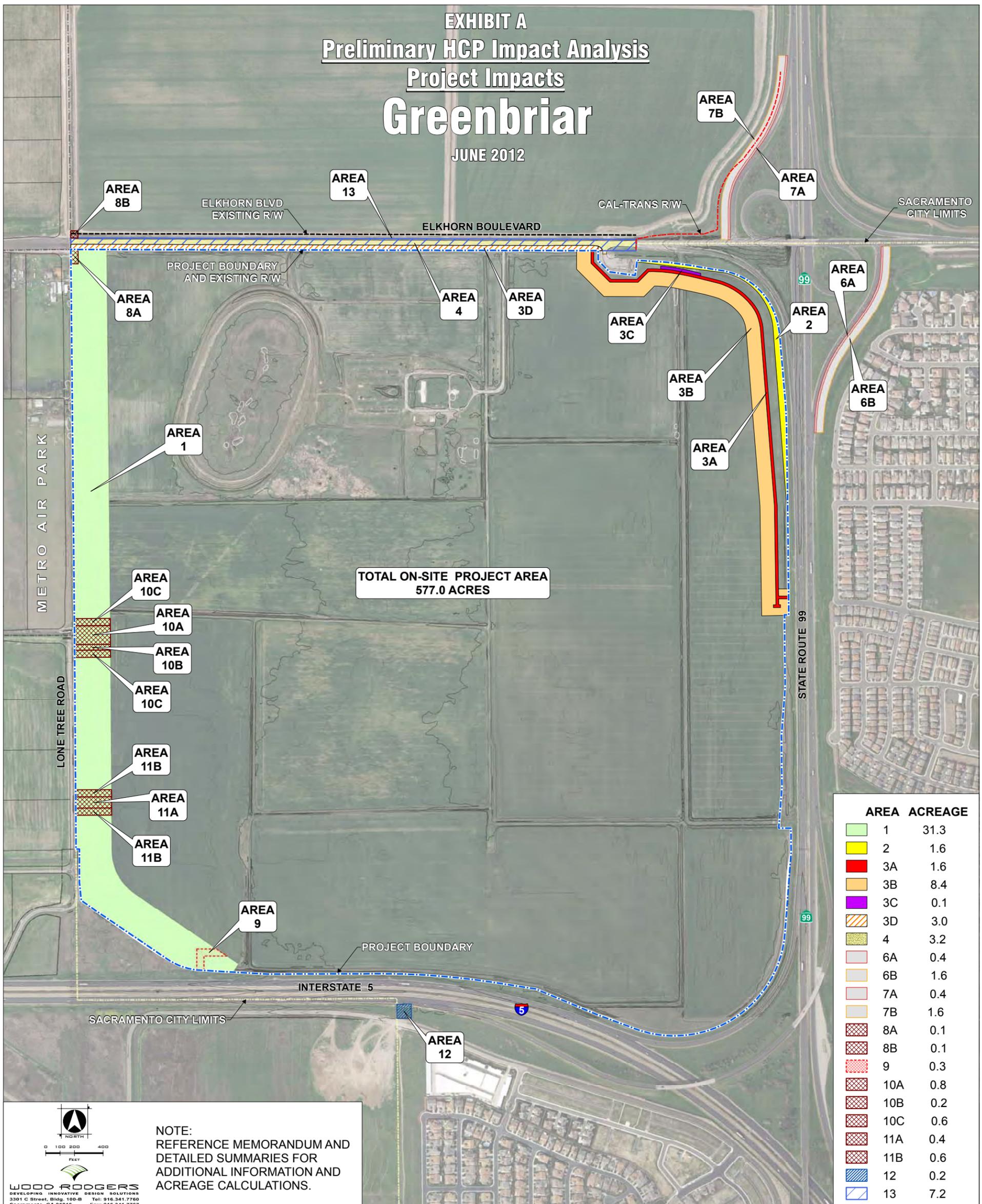
Attachments:

1. Exhibit A Project Impacts Map
2. Exhibit A Project Impact Summary
3. Exhibit A Project Impact Detailed Description
4. Exhibit B External Projects Impact Map
5. Exhibit B External Projects Impact Summary
6. Exhibit B External Projects Impact Detailed Description

References:

1. Metro Air Park Public Facilities Master Plan (Volumes 1 & 2), Final Report, Revision 1 dated March 2, 2004, prepared by Stantec Consulting Inc.
2. Final Environmental Impact Statement, Metro Air Park Project dated July 2001, prepared by the US Fish and Wildlife Service
3. Project Study Report, On State Route 99 Between the I-5 / SR 99 Interchange and Elverta Road Intersection in the County of Sacramento dated July 16, 1999, prepared by Dokken Engineering
4. North Natomas Final Nexus Study and Financing Plan, 2008 Update, approved by the City of Sacramento May 26, 2009, prepared by Economic and Planning Systems Inc.
5. Greenbriar Entitlement Submittal Package to the City of Sacramento for Tentative Map(s), Subdivision Modification, General Plan Amendment, PUD Schematic Plan and Guidelines and Development Agreement prepared by Wood Rodgers Inc.
6. Draft Report, Greenbriar Public Facilities Financing Plan, dated August 14, 2007, prepared by Economic and Planning Systems Inc.

EXHIBIT A
Preliminary HCP Impact Analysis
Project Impacts
Greenbriar
 JUNE 2012



NOTE:
 REFERENCE MEMORANDUM AND
 DETAILED SUMMARIES FOR
 ADDITIONAL INFORMATION AND
 ACREAGE CALCULATIONS.

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Exhibit A
Greenbriar
Project HCP Summary
June 12, 2012
Draft

Description	Acreage
Part I -On-Site Impacts	
Total On-Site Area	577.0
Subtotal Part IA. On-Site Lone Tree Canal Buffer	(28.3)
Subtotal Part IB Other On-Site Avoidance / Disturbed Areas	(11.7)
Subtotal On-Site Impacts	537.0
<hr/>	
Part II -Off-Site Impacts	
Subtotal Part IIA. Off-Site Elkhorn Blvd Improvements	1.0
Subtotal Part IIB Other Off-Site Impacts	4.3
Subtotal Off-Site Impacts	5.3
<hr/>	
Grand Total Impacted Acreage	542.3
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Area Number	Description	Acreage	Identify Acreage Avoidance (-) Impact (+)	Notes
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Part I -Greenbriar On-Site Areas - Project HCP Impact and Avoidance Areas

Part IA. On-Site Lone Tree Canal Buffer -Determine Net Reduction in Impact

Area 1	Total Area -Lone Tree Canal Buffer	(31.3)	Deduct for Avoidance	Area identified as a open space preserve area based on current Tentative Maps.Area is approximately 250-feet wide.
Area 8A	Construct Twin 60-inch Culverts (Elkhorn Blvd at the Lone tree Canal)	0.1	Add for Impact within Buffer	Replace existing 48-inch culvert with Twin 60"ulverts capable of passing 100-year flows of 407 cfs.
Area 9	Construction of the 48-inch RCP Detention Basin / Lake Outfall Pipe to exist Lone Tree Canal and Culvert at I-5.	0.3	Add for Impact within Buffer	Encroachment into the Lone Tree Canal Buffer for construction of the outfall pipe. Assumed 50-foot wide x approx 250-foot long area.
Area 10A	Meister Way Roadway Crossing	0.8	Add for Impact within Buffer	Meister Way Roadway Crossing. Future 106-foot R/W with 12.5-foot PUE's. Total 131-foot wide encroachment.
Area 10B	Future LRT Corridor	0.2	Add for Impact within Buffer	Future 50-foot LRT Corridor
Area 10C	Construction Limits for Meister Way and LRT Crossing	0.6	Add for Impact within Buffer	Assume 50-foot wide construction limit area needed north and south of the Meister Way / LRT alignments.
Area 11A	Future Roadway Crossing. Future 53-foot R/W with 12.5-foot PUE's.	0.4	Add for Impact within Buffer	Future 53-foot R/W with 12.5-foot PUE's. Total 78-foot encroachment.
Area 11B	Construction Limits for Future Roadway Crossing	0.6	Add for Impact within Buffer	Assume 50-foot wide construction limit area needed north and south of the roadway alignment.
Subtotal Part IA. On-Site Lone Tree Canal Buffer		(28.3)		



Area Number	Description	Acreage	Identify Acreage Avoidance (-) Impact (+)	Notes
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Part IB. Other On-Site Avoidance or Previously Disturbed Areas -Determine Net Reduction in Impact

Area 2	SR 99 SB On-Ramp R/W at Elkhorn Blvd.	(1.6)	Deduct for Avoidance	Area identified as future dedicated R/W for the Elkhorn Blvd Interchange expansion based on the Project Study Report (PSR) dated July 16, 1999. Determined through a preliminary calculation of the future toe of slope for the on-ramp. Assume that Grenbriar will not disturb this area.
Area 3A	Metro Air Park Off-Site Sewer Force Main and Natomas / Metro Air Park Trunk Sewer Connection Improvement Plans (Permanent Easement)	(1.6)	Deduct for Previously Disturbed	20-foot wide easement granted to the Sacramento Regional Sanitation District. Contains twin, 16" Force mains and a 36" Gravity outfall under SR 99.
Area 3B	Metro Air Park Off-Site Sewer Force Main and Natomas / Metro Air Park Trunk Sewer Connection Improvement Plans (Limits of Construction)	(8.4)	Deduct for Previously Disturbed	Limit of construction as identified on the Metro Air Park Off-Site Sewer Force Main Improvement Plans, Sheet 13. Also reference USFW Final EIS, Table 3, pages 2.5 and 2.6. and narrative, page 3.11.
Area 3C	Metro Air Park Off-Site Sewer Force Main Improvement Plans (Limits of Construction)	(0.1)	Deduct for Previously Disturbed	Additional limit of construction added based on sewer access road and culvert replacement as identified on the Metro Air Park Off-Site Sewer Force Main Improvement Plans, Sheet 10A.
Subtotal Part IB Other On-Site Avoidance / Disturbed Areas		(11.7)		
Total Part I -Total for On-Site Avoidance / Disturbed Areas		(40.0)		

Part II -Greenbriar Off-Site Areas -Project HCP Impacts -Determine Additional Impacts

Part IIA Off-Site Elkhorn Blvd Impacts

Area 13	Elkhorn Blvd Widening (Proposed Greenbriar 5-lane Improvements).	7.2	Add for Impact	Based on Proposed widening that constructs 3-new EB lanes and frontage improvements. Existing 2-lane section to be improved as WB lanes. Work to avoid the existing Elkhorn Blvd Canal located within the existing R/W. Total area of disturbance includes the southerly 80-foot wide corridor north of the existing PL (R/W).
Area 4	Elkhorn Blvd Existing Pavement Section	(3.2)	Deduct for Existing Pavement	Existing pavement section based on aerial topographic survey performed in 2005.
Area 3D	Metro Air Park Off-Site Sewer Force Main Connection Improvement Plans (Limits of Construction incl Pipe locations within the Existing R/W)	(3.0)	Deduct for Previously Disturbed	Assumed limits of construction as identified on the Metro Air Park Off-Site Sewer Force Main Improvement Plans, Sheets 3 through 9. Also reference Typical Section 3 on Sheet 4. Area consists of the remaining area between the existing south EP and the existing R/W.
Subtotal Part IIA. Off-Site Elkhorn Blvd Improvements		1.0		



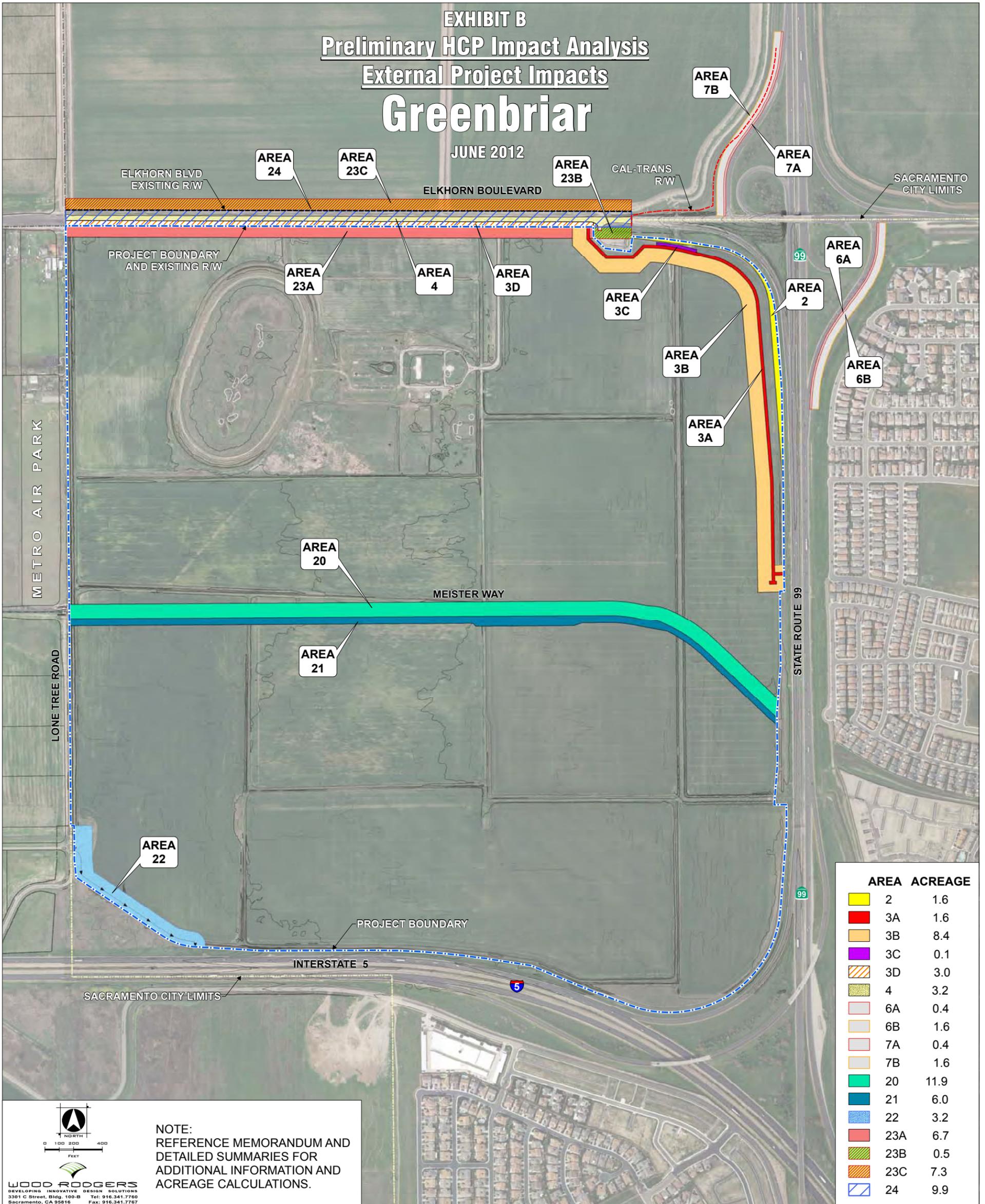
Area Number	Description	Acreage	Identify Acreage Avoidance (-) Impact (+)	Notes
Part IIB Other Off-Site Impacts				
Area 6A	Widen SR 99 NB Off-ramp at Elkhorn Blvd (Permanent Pavement Section) and install Signal.	0.4	Add for Impact	Assume 12-foot lane added to existing pavement.
Area 6B	Widen SR 99 NB Off-ramp at Elkhorn Blvd (Construction Area Limits) and install Signal.	1.6	Add for Impact	Assume a 50-foot wide area is needed for off-ramp construction.
Area 7A	Widen SR 99 SB Off-ramp at Elkhorn Blvd (Permanent Pavement Area).	0.4	Add for Impact	Assume 12-foot lane added to existing pavement.
Area 7B	Widen SR 99 SB Off-ramp at Elkhorn Blvd (Construction Area Limits).	1.6	Add for Impact	Assume a 50-foot wide area is needed for off-ramp construction.
Area 8B	Construct Twin 60-inch Culverts (Elkhorn Blvd at the Lone tree Canal)	0.1	Add for Impact	Replace existing 48-inch culvert with Twin 60" culverts capable of passing 100-year flows of 407 cfs.
Area 12	Off-Site 30" Water T-Main Extension (Greenbriar Off-site Impact).	0.2	Add for Impact	Water T-Main Extension proposed by the City of Sacramento for future cross connection to County of Sacramento MAP water system. Assume a 100' x 100' area will be needed for a bore / receiving pit and construction limits on the south side of Interstate 5.
Subtotal Part IIB Other Off-Site Impacts		4.3		
Total Part II -Total for Off-Site Areas -Additional Impacts		5.3		

Notes:

- HCP impacts to the following off-site locations have been excluded:
 - SR 99 and Elverta Road Intersection Improvements.**
 -The County of Sacramento has completed design, and construction bid award for a full interchange facility. Therefore no intersection widening will be necessary.
 - Widening of the future Interstate 5 MAP Interchange after construction to add additional lanes to the northbound off-ramp and the southbound loop on-ramp.**
 -It has been assumed that the future initial phase interchange construction will have satisfied any potential additional HCP impacts.
 - 24-inch Waterline connection west to the intersection of Elkhorn Blvd and East Commerce Way.**
 -Construction off-site will be in existing freeway buffer areas east of SR99 already compensated for under the North Natomas HCP Program.

EXHIBIT B
 Preliminary HCP Impact Analysis
 External Project Impacts
Greenbriar

JUNE 2012



AREA	ACREAGE
2	1.6
3A	1.6
3B	8.4
3C	0.1
3D	3.0
4	3.2
6A	0.4
6B	1.6
7A	0.4
7B	1.6
20	11.9
21	6.0
22	3.2
23A	6.7
23B	0.5
23C	7.3
24	9.9

NOTE:
 REFERENCE MEMORANDUM AND
 DETAILED SUMMARIES FOR
 ADDITIONAL INFORMATION AND
 ACREAGE CALCULATIONS.

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 Sacramento, CA 95816 Fax: 916.341.7767

**Exhibit B
Greenbriar
Project HCP Summary -External Project Impacts
June 12, 2012
Draft**

Description	Acreage
On-Site Impacts	
Total Part I On-Site Acreage -Ext. Project Impacts	36.3
Subtotal On-Site Impacts	36.3
<hr/>	
Off-Site Impacts	
Total for Part IIA Off-Site Elkhorn Blvd Impacts	7.2
Total Part IIB -Other Off-site Impacts	4.0
Subtotal Off-Site Impacts	11.2
<hr/>	
Grand Total Impacted Acreage	47.5
<hr/>	



Area Number	Description	Acreage	Adjusted Acreage to Exclude Overlap	Improvements Completed	North Natomas Public Facilities Finance Plan (PFFP) 2008	Metro Air Park Finance Plan 2004 / 2006	USFW Final Metro Air Park HCP EIS 2001	Notes
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Part I Greenbriar On-Site Areas -External Projects HCP Impacts

Area 2	SR 99 SB On-Ramp R/W at Elkhorn Blvd.	1.6	1.6	No	Yes See PFFP, Table B-1, Page B-3	Yes See FP Proj. SR99-2	No	Area identified as future dedicated R/W for the Elkhorn Blvd Interchange expansion based on the Project Study Report (PSR) dated July 16, 1999. Determined through a preliminary calculation of the future toe of slope for the on-ramp. Assume that Greenbriar will not disturb this area.
Area 3A	Metro Air Park Off-Site Sewer Force Main and Natomas / Metro Air Park Trunk Sewer Connection Improvement Plans (Permanent Easement)	1.6	1.6	Yes	No	Yes See FP Proj. SWR-2	Yes	20-foot wide easement granted to the Sacramento Regional Sanitation District. Contains twin, 16" Force mains and a 36" Gravity outfall under SR 99.
Area 3B	Metro Air Park Off-Site Sewer Force Main and Natomas / Metro Air Park Trunk Sewer Connection Improvement Plans (Limits of Construction)	8.4	8.4	Yes	No	Yes See FP Proj. SWR-2	Yes	Limit of construction as identified on the Metro Air Park Off-Site Sewer Force Main Improvement Plans, Sheet 13. Also reference USFW Final EIS, Table 3, pages 2.5 and 2.6. and narrative, page 3.11.
Area 3C	Metro Air Park Off-Site Sewer Force Main Improvement Plans (Limits of Construction)	0.1	0.1	Yes	No	No		Additional limit of construction added based on sewer access road and culvert replacement as identified on the Metro Air Park Off-Site Sewer Force Main Improvement Plans, Sheet 10A.
Area 20	Meister Way (West Project Boundary to East Project Bndry)	11.9	11.9	No	Yes See PFFP, Table B-1, Page B-3	Yes See FP Proj. MW-2 and MW-3	Yes	Per USFW Final EIS, Table 3, pages 2.5 & 2.6 and narrative, page 3.11. Included within the NNPPFP as it pretains to the future overcrossing of SR 99
Area 21	Proposed Light Rail Transit Corridor and Station	6.0	6.0					50-foot wide LRT Corridor proposed by Sacramento Regional Transit.
Area 22	Metro Air Park Lone Tree Canal (Reach 8) Widening and Construction of 2-each 78-inch Culverts Under Interstate 5.	3.2	0.0	No	No	Yes See FP Proj.RD1000-7	Yes	Per USFW Final EIS, Table 3, pages 2.5 & 2.6 and narrative, page 3.11. Note that Area is within the proposed 250' Lone Tree Buffer, therefore the adjusted acreage is 0.



Area Number	Description	Acreage	Adjusted Acreage to Exclude Overlap	Improvements Completed	North Natomas Public Facilities Finance Plan (PFFP) 2008	Metro Air Park Finance Plan 2004 / 2006	USFW Final Metro Air Park HCP EIS 2001	Notes
Area 23A	On-Site Elkhorn Blvd Construction Impacts (Permanent 6-lane Improvements)	6.7	6.7	No	No	Yes See FP Proj. EB-3 and EB-6	Yes	Per USFW Final EIS, Table 3, pages 2.5 & 2.6 and narrative, page 3.12. Per Table 3, 14.7 ac total impacts. Per the Narrative 7-acres on-site south of Elkhorn is affected. Based on 3,939 lf of Elkhorn from Lone Tree Road to SR 99, area is 81' wide along Elkhorn.
Total Part I On-Site Acreage -Ext. Project Impacts		N/A	36.3					
Part II -Greenbriar Off-Site Areas -External Projects HCP Impacts								
Part IIA Off-Site Elkhorn Blvd Impacts								
Area 24	Elkhorn Blvd Widening (Permanent 6-lane Improvements)	9.9	9.9	No	No	Yes See FP Proj. EB-3 and EB-6	No	Based on constructing improvements within the existing 110' R/W. Note that the Sacramento County standard 6-lane cross-section is 108' R/W. The existing 110' R/W includes the Elkhorn Blvd Canal that will ultimately need to be relocated to north of the existing R/W for the expansion from 4 to 6-lanes.
Area 4	Elkhorn Blvd Existing Pavement Section	3.2	(3.2)	Yes	No	No	No	Existing pavement section based on aerial topographic survey performed in 2005. Acreage included in Area 24.
Area 3D	Metro Air Park Off-Site Sewer Force Main Connection Improvement Plans (Limits of Construction incl Pipe locations within the Existing R/W)	3.0	0.0	Yes	No	Yes See FP Proj. SWR-2	Yes	Assumed limits of construction as identified on the Metro Air Park Off-Site Sewer Force Main Improvement Plans, Sheets 3 through 9. Also reference Typical Section 3 on Sheet 4. Area consists of the remaining area between the existing south EP and the existing R/W (snake fence). Acreage included in Area 24.



Area Number	Description	Acreage	Adjusted Acreage to Exclude Overlap	Improvements Completed	North Natomas Public Facilities Finance Plan (PFFP) 2008	Metro Air Park Finance Plan 2004 / 2006	USFW Final Metro Air Park HCP EIS 2001	Notes
Area 23B	Elkhorn Blvd Construction Impacts (Permanent 6-lane Improvements)	0.5	0.5	No	No	Yes See FP Proj. EB-3 and EB-6	Yes	Per USFW Final EIS, Table 3, pages 2.5 & 2.6 and narrative, page 3.12. Per Table 3, 14.7 ac total impacts. Per the Narrative 7-acres off-site south is affected. This is west of on-site Area 23A.
Area 23C	Elkhorn Blvd Construction Impacts (Permanent 6-lane Improvements)	7.3	0.0	No	No	Yes See FP Proj. EB-3 and EB-6	Yes	Per USFW Final EIS, Table 3, pages 2.5 & 2.6 and narrative, page 3.12. Per Table 3, 14.7 ac total impacts. Per the Narrative 7-acres off-site north is affected. This area will not be impacted by Greenbriar in construction of a 5-lane expansion of Elkhorn (3-eastbound and 2-westbound lanes). Adjust acreage to 0.
Total for Part IIA Off-Site Elkhorn Blvd Impacts		N/A	7.2					
Part IIB -Other Off-Site Impacts								
Area 6A	Widen SR 99 NB Off-ramp at Elkhorn Blvd. (Permenant additional Pavement Section)	0.4	0.4	No	Yes See PFFP, Table B-1, Page B-3,	Yes See FP Proj. SR99-1.2 & SR99-2	No	Unknown whether off-ramp widening will require additional payment of HCP Fees. Note that per the USFW Final EIS, page 4.24, Impacts and Mitigations regarding the Elkhorn Interchange Improvements has been identified as a cumulative impact and impacted off-site acreages have not been included in the MAP HCP. Need to check the potential preparation of a separate EIS for the Elkhorn Interchange by the County of Sacramento. It is also possible that the NB Off-Ramp has been included in the North Natomas EIS and HCP.
Area 6B	Widen SR 99 NB Off-ramp at Elkhorn Blvd (Construction Area Limits).	1.6	1.6					Assume a 50-foot wide area is needed for off-ramp construction.



Area Number	Description	Acreage	Adjusted Acreage to Exclude Overlap	Improvements Completed	North Natomas Public Facilities Finance Plan (PFFP) 2008	Metro Air Park Finance Plan 2004 / 2006	USFW Final Metro Air Park HCP EIS 2001	Notes
Area 7A	Widen SR 99 SB Off-ramp at Elkhorn Blvd (Permenant Pavement Area).	0.4	0.4	No	Yes See PFFP, Table B-1, Page B-3	Yes See FP Proj. SR99-1.2 & SR99-2	No	Unknown whether off-ramp widening will require additional payment of HCP Fees. Note that per the USFW Final EIS, page 4.24, Impacts and Mitigations regarding the Elkhorn Interchange Improvements has been identified as a cumulative impact and impacted off-site acreages have not been included in the MAP HCP. Need to check the potential preparation of a separate EIS for the Elkhorn Interchange by the County of Sacramento. It is also possible that the NB Off-Ramp has been included in the North Natomas EIS and HCP.
Area 7B	Widen SR 99 SB Off-ramp at Elkhorn Blvd (Construction Area Limits).	1.6	1.6					Assume a 50-foot wide area is needed for off-ramp construction.
Total Part IIB -Other Off-site Impacts		N/A	4.0					
Total for Part II Greenbriar Off-Site Areas -Ext. Projects		N/A	11.2					
Grand Total Greenbriar Ext. Projects HCP Impacts			47.5					

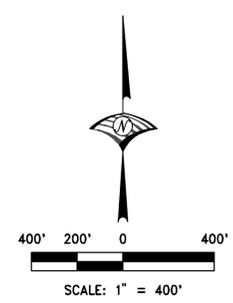
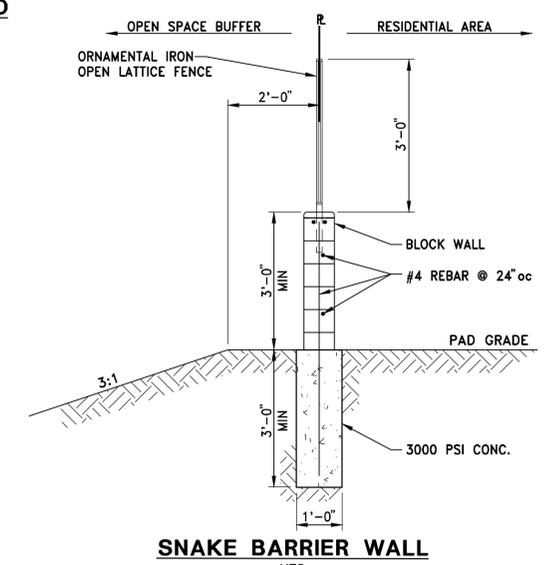
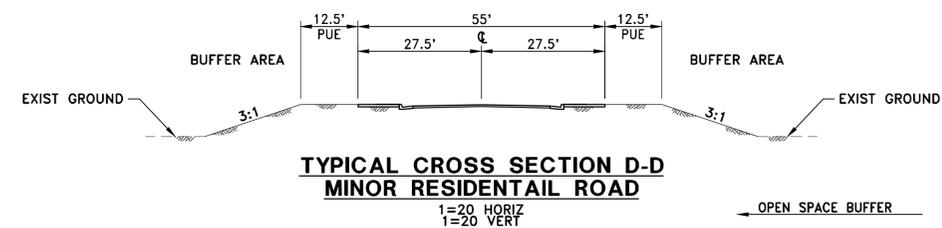
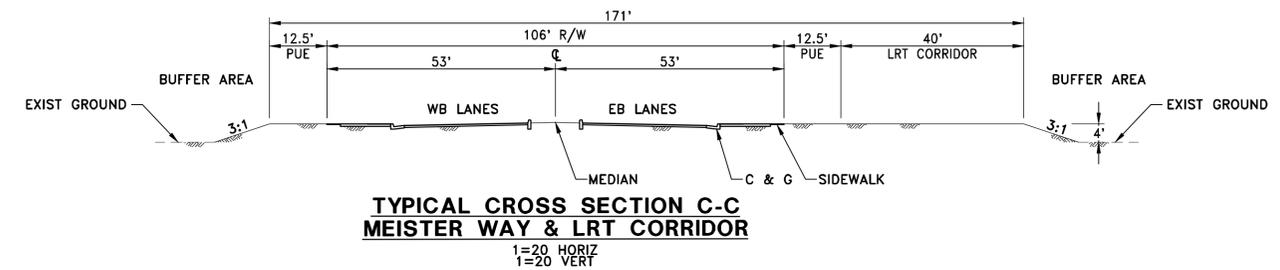
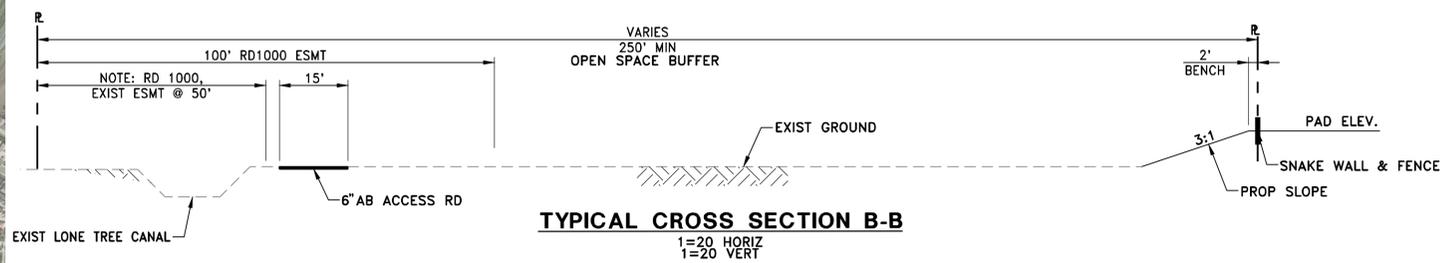
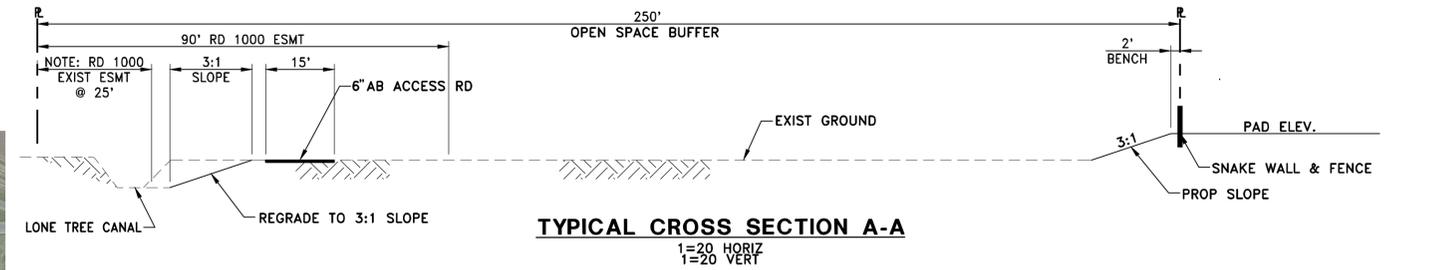
Appendix B
Greenbriar Open Space Buffer Schematic Design
Prepared by Wood Rodgers January 27, 2014

OPEN SPACE BUFFER SCHEMATIC DESIGN FOR

GREENBRIAR

CITY OF SACRAMENTO, CALIFORNIA

EXHIBIT A
WR MEMORANDUM
DATED JANUARY 27, 2014



LEGEND

- 13.7 SPOT ELEVATION
- 29 LOT NUMBER
- P=18.8 PAD ELEVATION
- 12" D DRAIN LINE AND SIZE
- PROPERTY LINE
- - - EXIST SLOPE
- - - PROP SLOPE

REVISIONS			
NO.	DESCRIPTION	DATE	BY

BENCH MARK	ELEV. 18.742 ft. (NGVD29)
DESCRIPTION:	Benchmark No. 256-J4b, Ramset placed in light base NW corner Macon Dr., Van Eyck Way and Bankside Way.
SCALE	HORIZ. = VERT. =

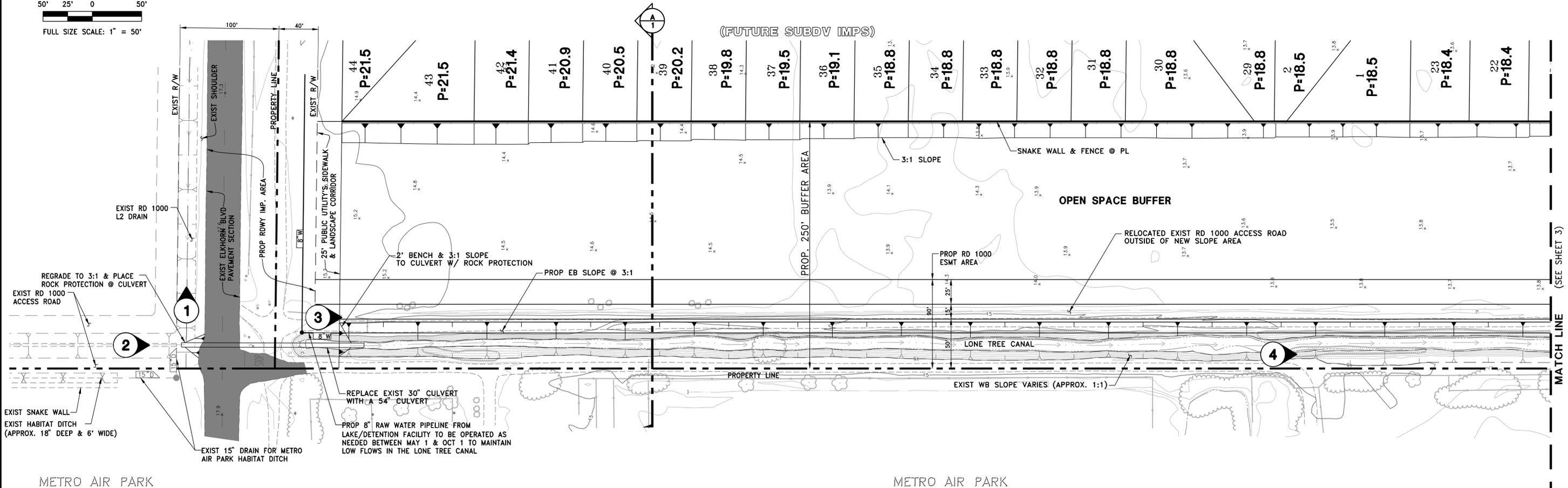
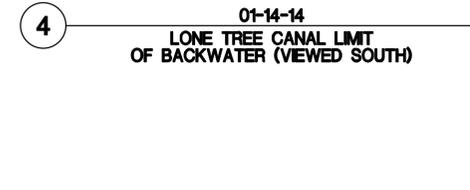
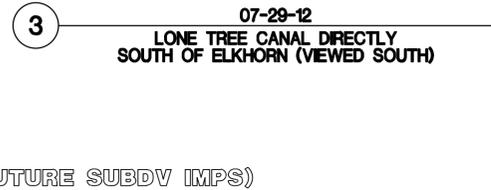
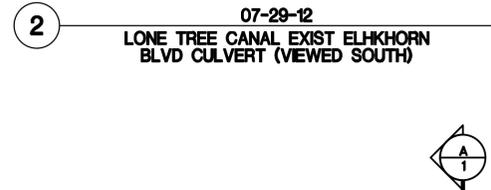
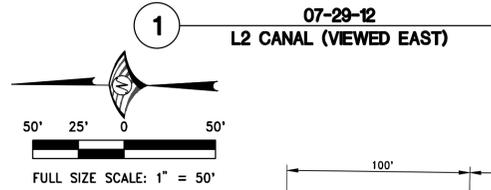
CITY OF SACRAMENTO DEPARTMENT OF PUBLIC WORKS			
DRAWN BY: J. MENDOZA	DESIGNED BY: M. RODGERS	CHECKED BY: S. BALBIERZ	DATE: January 27, 2014
DATE: January 27, 2014	R.C.E. 41540 DATE 01/27/14	R.C.E. 65913 DATE 01/27/14	

WOOD RODGERS
DEVELOPING INNOVATIVE DESIGN SOLUTIONS

3301 C St. Bldg. 100-B Tel 916.341.7760
Sacramento, CA 95816 Fax 916.341.7767

GREENBRIAR		CPCXX-XXXX P: N/A X	SHEET 1 OF 5
OPEN SPACE BUFFER SCHEMATIC DESIGN			

J:\000-3\116-Greenbriar-Farms-Integral\08-Integral-0A\Civil\Exhibits\Open Space Buffer Schematic Design\EXH-SNAKEWALL COVER SHEET.dwg 1/27/2014 4:42 PM Jose Mendoza



NO.	REVISIONS DESCRIPTION	DATE	BY

BENCH MARK ELEV. 18.742 ft.(NGVD29)
DESCRIPTION:
Benchmark No. 256-J4b,
Ramset placed in light base NW corner
Macon Dr., Van Eyck Way and Bankside Way.

CITY OF SACRAMENTO
DEPARTMENT OF PUBLIC WORKS

SCALE
HORIZ. = _____
VERT. = _____

DRAWN BY: J. MENDOZA
DATE: January 27, 2014

DESIGNED BY: M. RODGERS
R.C.E. 41540 DATE 01/27/14

CHECKED BY: S. BALBIERZ
R.C.E. 65913 DATE 01/27/14

WOOD RODGERS
DEVELOPING INNOVATIVE DESIGN SOLUTIONS
3301 C St. Bldg. 100-B
Sacramento, CA 95816
Tel 916.341.7760
Fax 916.341.7767

GREENBRIAR

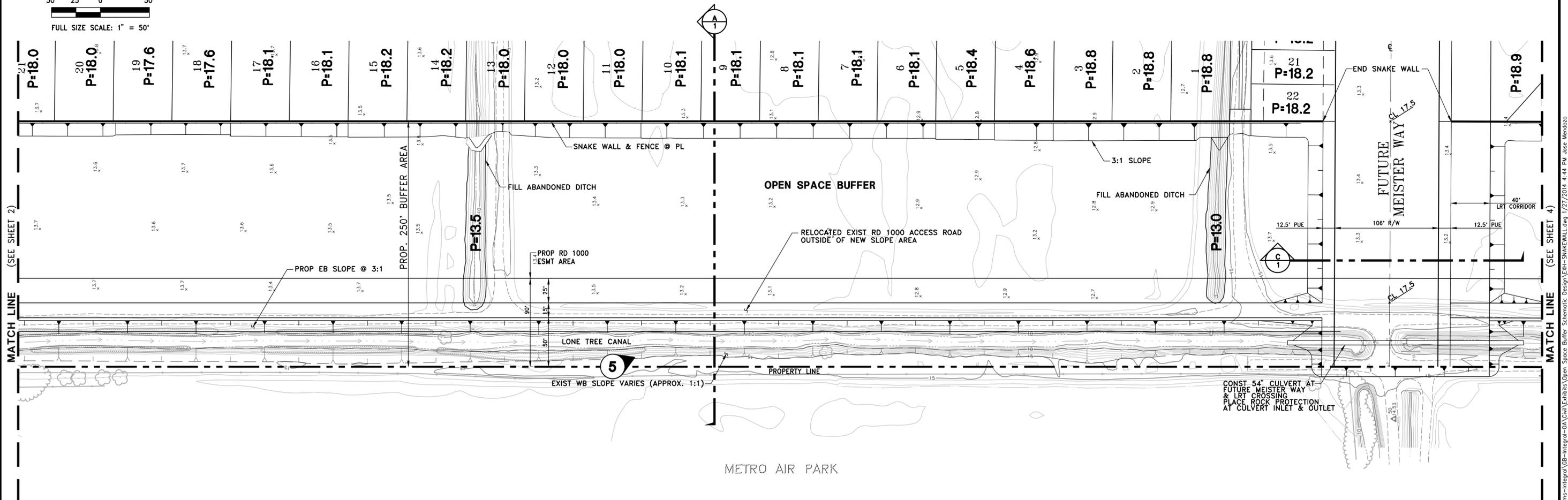
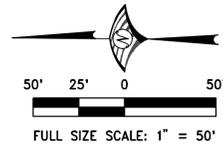
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5 01-14-14
LONE TREE CANAL
W/ BACKWATER (VIEWED SOUTH)



NO.	REVISIONS DESCRIPTION	DATE	BY

BENCH MARK ELEV. 18.742 ft.(NGVD29)
DESCRIPTION:
Benchmark No. 256-J4b,
Ramset placed in light base NW corner
Macon Dr., Van Eyck Way and Bankside Way.

CITY OF SACRAMENTO
DEPARTMENT OF PUBLIC WORKS

SCALE
HORIZ. =
VERT. =

DRAWN BY: J. MENDOZA
DATE: January 27, 2014

DESIGNED BY: M. RODGERS
R.C.E. 41540 DATE 01/27/14

CHECKED BY: S. BALBIERZ
R.C.E. 65913 DATE 01/27/14

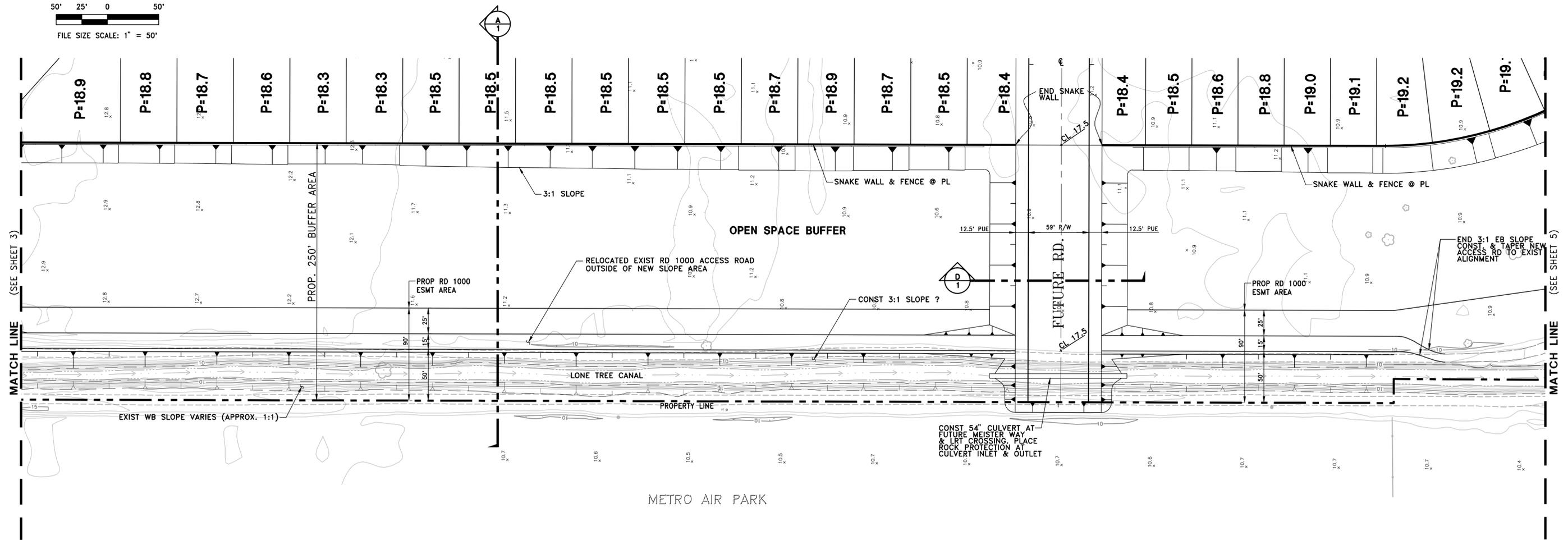
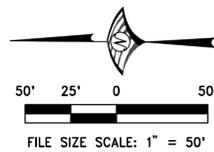
WOOD RODGERS
DEVELOPING INNOVATIVE DESIGN SOLUTIONS

3301 C St. Bldg. 100-B
Sacramento, CA 95816

Tel 916.341.7760
Fax 916.341.7767

GREENBRIAR		CPCXX-XXXX	P: N/A	X	SHEET
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NO.	REVISIONS DESCRIPTION	DATE	BY

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 DESCRIPTION:
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SCALE
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 VERT. =

CITY OF SACRAMENTO
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DRAWN BY: J. MENDOZA
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GREENBRIAR

OPEN SPACE BUFFER SCHEMATIC DESIGN

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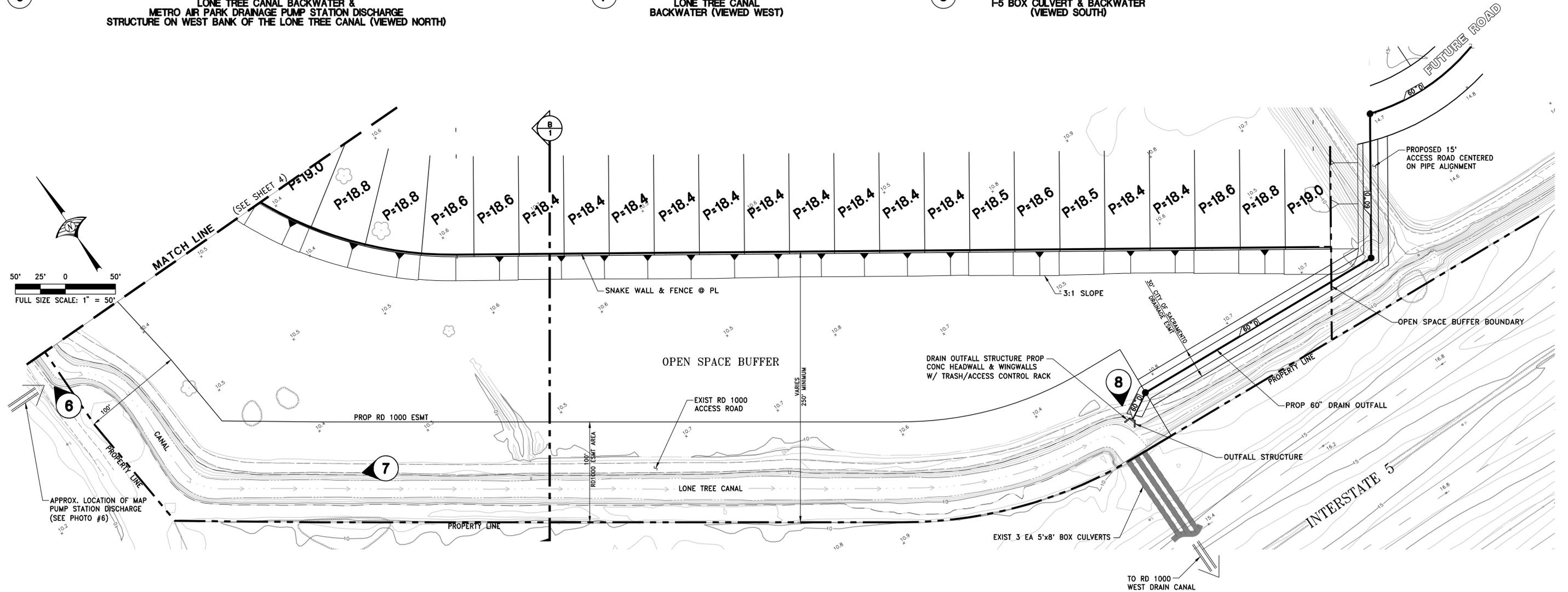
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6 07-29-12
LONE TREE CANAL BACKWATER & METRO AIR PARK DRAINAGE PUMP STATION DISCHARGE STRUCTURE ON WEST BANK OF THE LONE TREE CANAL (VIEWED NORTH)

7 07-29-12
LONE TREE CANAL BACKWATER (VIEWED WEST)

8 07-29-12
I-5 BOX CULVERT & BACKWATER (VIEWED SOUTH)



NO.	REVISIONS DESCRIPTION	DATE	BY

BENCH MARK ELEV. 18.742 ft. (NGVD29)
DESCRIPTION:
Benchmark No. 256-J4b,
Ramset placed in light base NW corner
Macon Dr., Van Eyck Way and Bankside Way.

SCALE
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CITY OF SACRAMENTO
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DRAWN BY: J. MENDOZA
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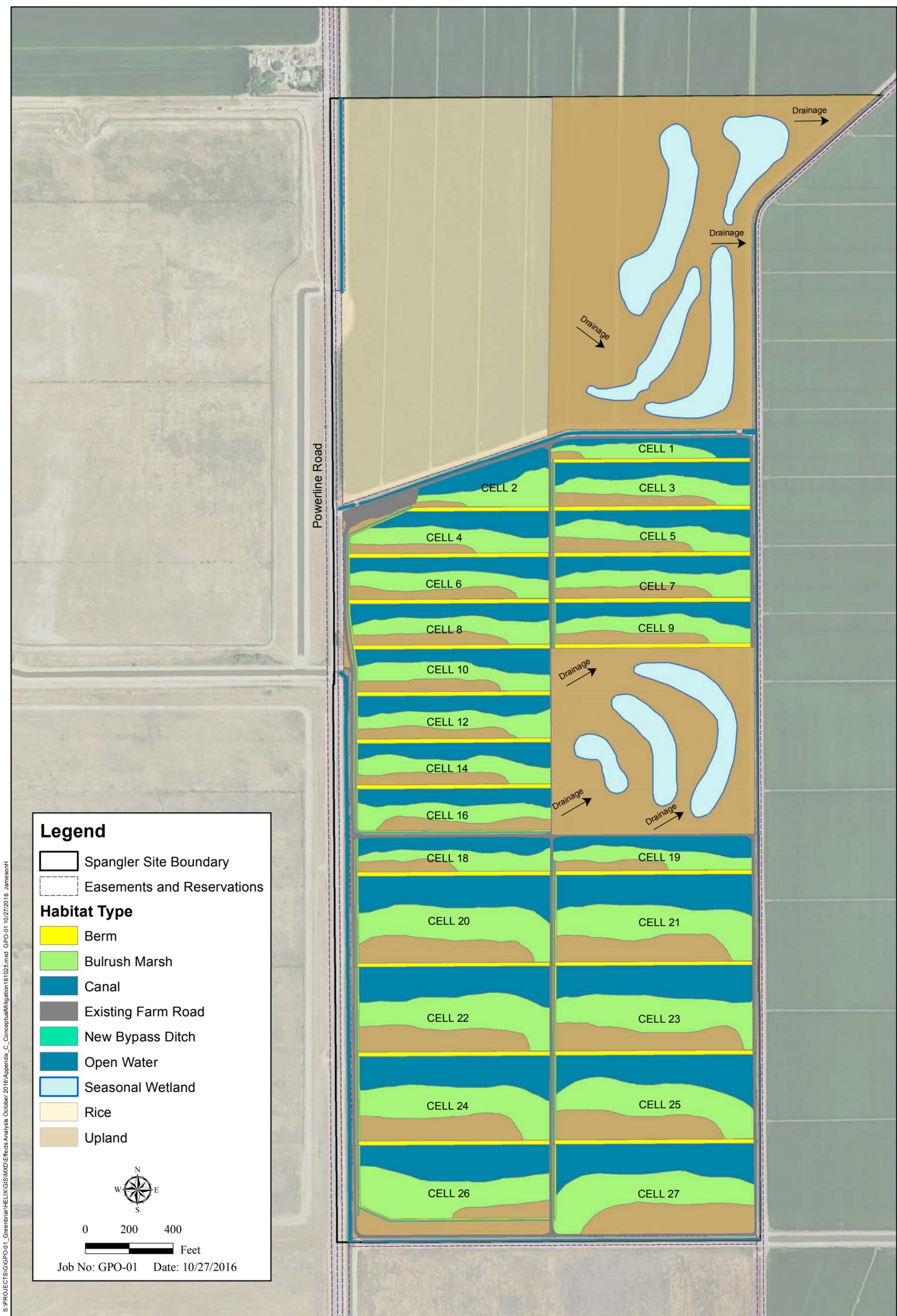
GREENBRIAR
OPEN SPACE BUFFER SCHEMATIC DESIGN

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Appendix C

Conceptual Design for the Spangler Reserve



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Spangler Reserve Conceptual Mitigation Design

GREENBRIAR DEVELOPMENT PROJECT
ANALYSIS OF EFFECTS ON THE NATOMA BASIN HCP
Appendix C

Appendix D

Letters by Mr. Eric C. Hansen Regarding Implications of the Greenbriar Development Project on GGS

Greenbriar Development Project – Considerations Regarding Giant Garter Snake Persistence in the Natomas Basin-Prepared by Mr. Eric C. Hansen

Greenbriar Managed Marsh Concept Design – Biological Considerations-Prepared by Mr. Eric C. Hansen

Eric C. Hansen
Consulting Environmental Biologist

4200 N. Freeway Blvd., Suite 4
Sacramento, CA
95834



Phone 916-921-8281
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Mobile 916-214-7848

Date: March 8, 2015

To: Maya Thompson Kepner
American West Conservation, LLC
5955 Granite Lake Drive, Suite 130
Granite Bay, CA 95746

Re: Greenbriar Development Project – Considerations Regarding Giant Garter Snake Persistence in the Natomas Basin

Dear Ms. Thompson Kepner,

Per your request, I am providing this letter as a brief commentary on the Greenbriar Development Project (and one of the project's identified mitigation sites-Spangler 235) in relation to giant garter snake conservation in the Natomas Basin (Sacramento County and Sutter County, California). Based on a February 10, 2014 site visit and on subsequent input provided by HELIX Environmental Planning, Inc., this letter responds to the request by the resource agencies to provide a written description of the biological rationale explaining how the Greenbriar Development Project (Greenbriar Site) is likely to affect the long-term conservation of the giant garter snake in the Natomas Basin and how it is expected to relate to the performance of the Natomas Basin Habitat Conservation Plan (NBHCP) and Metro Air Park Habitat Conservation Plan. Details of this letter include a discussion on past and current suitability of habitat on the Greenbriar Site, land use on the Greenbriar Site into the foreseeable future, and the effects of the completed Project on regional landscape connectivity and movement. Comments on the biological merit of giant garter snake mitigation design concepts on the Spangler 235 property are detailed in a separate letter dated January 9, 2014, which is submitted with this letter for reference. ¹

Land use on the Greenbriar Site has changed dramatically over the last 10 years. According to a desktop analysis of available aerial photography, the Greenbriar Site has historically been in agricultural production; mainly in use for rice and hay. Substantial portions of the site appear to have been used for rice production for decades. Rice production occurred at the Greenbriar Site through at least the winter of 2003/2004. We estimate that roughly 300 acres of the site (the southern half) was in rice production; the northern portion of the site contained a residence, outbuildings, a horse race track, and

¹ *Greenbriar Managed Marsh Concept Design – Biological Considerations*. Letter provided to Maya Thompson Kepner, American West Conservation, LLC. January 9, 2014.

hay fields. By 2005, nearly the entire site appears to have been converted to hay production, with none occurring since. All rice operations had ceased and all structures had been demolished or removed. Since 2005, the entire Greenbriar Site has been in continuous hay production with the exception of some fallow areas where the foundations of the old structures remain. As confirmed by site visits in winter 2015, the site is currently in active hay production, which is unsuitable as upland for giant garter snakes.

Because of the transition away from rice production habitat suitability on the Greenbriar Site is very low; restricted almost exclusively to the Lone Tree Canal and the limited upland associated with its crowns and shoulders. Giant garter snakes were identified within Lone Tree Canal in 2006 (Hansen 2006), are known to occupy Lone Tree Canal adjacent to the Metro Air Park property to the north (ICF International 2011). Although spring and summer water deliveries within Lone Tree Canal are often sporadic, this feature retains favorable characteristics and provides a potential corridor connecting giant garter snake sub-populations from north to south. As described, development on the Greenbriar Site would not affect the Lone Tree Canal, and an open-space buffer zone between the canal and adjacent development would provide upland habitat that is currently absent due to regular tilling associated with agricultural use.

A return to rice and the wetland benefits associated with its production is unlikely. The Greenbriar Site was zoned for urban land uses and annexed into the City of Sacramento in 2008. The Greenbriar Site is also directly along the planned route of the Regional Transit Green Line to the Sacramento International Airport. Even if the Greenbriar Development Project did not go forward as currently planned, because the site is designated for urban land uses and is along a planned transit corridor, some form of urban development would most likely occur onsite. Agricultural land uses, including rice, are incompatible with the City's underlying land use designation and zoning for the site. Regulatory and economic factors make it highly unlikely the current owner or any future owner would re-initiate rice cultivation on this property.

The disposition of the site and the low likelihood of returning to rice production suggest that, with the exception of Lone Tree Canal as a potential movement corridor, the Greenbriar Site makes no contribution to the persistence of giant garter snakes in the Natomas Basin or to the performance of the HCPs. As proposed, the project would not impact the Lone Tree Canal or affect its function as a movement corridor, but would instead provide an open space corridor with the upland value that is currently missing. It is also worth noting that the snake exclusion wall associated with Metro Air Park limits the creation of upland to the west of Lone Tree Canal, leaving the Greenbriar Site the only available option for upland creation. The potential securing of upland habitat along the Lone Tree Canal provides a potential contribution to the HCPs by supporting the goal of maintaining habitat connectivity.

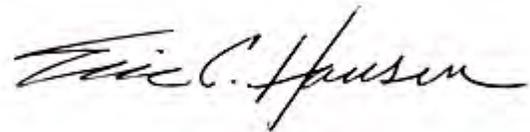
In addition to the open-space buffer, a completed Greenbriar Development Project would provide perpetually-maintained mitigation lands that are not associated with the mitigation acreage required by the HCPs. One of the project's identified mitigation sites,

Spangler 235, is novel in its design, scale, and simplicity while remaining wholly consistent with the general design elements of giant garter habitat creation. Through its simplicity, however, it overcomes many of the challenges experienced with habitats comprising larger, more complex management units while potentially increasing carrying capacity. As mitigation that is separate from the HCPs, the Spangler 235 property augments the 2,500-acre reserve block that the NBHCP will maintain in the NE corner of the Natomas Basin. Implementing a novel design also provides superior opportunities to measure the species' response to different conditions and to manage habitat adaptively. These factors are all benefits to the HCPs and the persistence of giant garter snakes in the Natomas Basin over time.

In closing, while the Greenbriar Site likely supported giant garter snakes when grown in active rice, shifts in land use and zoning over the last 10 years have rendered the property unsuitable, and it is unlikely that this scenario will change. Construction of the full project would result in no perceivable harm to Lone Tree Canal and the potential connectivity it provides, but would in fact provide an upland habitat value greater than that present today. Given the current baseline, the Greenbriar Site provides little or no value as habitat for giant garter snakes, is not likely to in the future, and is unlikely to affect the existing HCPs in any way other than by augmenting existing conservation lands in the Natomas Basin.

Please contact me with any questions or concerns. I will gladly expand on any of these topics at your request.

Sincerely,

A handwritten signature in black ink that reads "Eric C. Hansen". The signature is written in a cursive, flowing style.

Eric C. Hansen
Consulting Environmental Biologist

References:

Hansen, E.C. 2006. Results of Giant Garter Snake (*Thamnophis gigas*) Surveys at the Greenbriar Property: Sacramento County, CA. Technical memorandum provided to Phil Serna, Serna Consulting, LLC. October 18, 2006.

ICF International. 2011. Biological Effectiveness Monitoring for the Natomas Basin Habitat Conservation Plan Area 2010 Annual Survey Results (Agency Version). Prepared for the Natomas Basin Conservancy. April 2011.

Eric C. Hansen
Consulting Environmental Biologist

4200 N. Freeway Blvd., Suite 4
Sacramento, CA
95834



Phone 916-921-8281
Fax 916-921-8278
Mobile 916-214-7848

Date: January 9, 2014

To: Maya Thompson Kepner
American West Conservation, LLC
5955 Granite Lake Drive, Suite 130
Granite Bay, CA 95746

Re: Greenbriar Managed Marsh Concept Design – Biological Considerations

Dear Ms. Thompson Kepner,

I am providing this letter as a commentary on the biological merit of giant garter snake mitigation design concepts for the Greenbriar Development Project (and one of the project's identified mitigation sites-Spangler 235) in Sacramento County, California. Based upon the design concepts for the Spangler 235 property presented by Mr. Jeffery Little of Sycamore Environmental Consultants, Inc. to the resource agencies on November 12, 2013, this letter responds to the request by the resource agencies to provide a written description of the biological rationale explaining how the proposed design is likely to accommodate the life history requirements of the giant garter snake (breeding, feeding, sheltering) and improve or facilitate perpetual management of the habitat.

The rationale is simple in that all requisite habitat elements will be provided in essentially the same proportions that are applied on other occupied GGS restoration sites, but at a different scale resulting from an increased number of smaller, repeating units instead of fewer, large units. This repeating pattern will increase habitat heterogeneity and edge, thereby potentially increasing the habitat's carrying capacity. It will also provide the capacity to manage units individually and with greater accuracy, thereby providing more precise control for adaptive management. Finally, because each unit can be independently controlled, there is more potential to isolate maintenance activities, thereby reducing the scale and magnitude of the impacts associated with the de-silting, dredging, grading, and vegetation clearing that must be performed on any managed wetland in order to maintain its function.

As proposed, the Spangler 235 property would utilize the topography and drainage patterns of the existing rice fields to form the units or cells of the constructed wetlands, each of which would include all of the strata associated with functional giant garter snake habitats. Ranging in size from approximately 2 to 9 acres, each cell would comprise a mosaic of open, perennial water; dense, emergent vegetation; vegetated,

seasonal wetland with variable bottom topography; and vegetated upland with varying slope and aspect. This will be accomplished by deepening one side of the former rice cell to create open, perennial water bounded by dense, emergent macrophytes such as bulrush (*Schoenoplectus* spp.) to provide cover and to maintain reservoirs of food such as small fish and amphibians during the snake's active season. Much like a natural wetland, the channel bottom will slope gradually along one side to create shallow, seasonal wetlands characterized by varied vegetation density and water depth and will terminate in a deeper channel with a steeper slope on the opposing side. This will provide warm, productive cover that, much like rice fields, are valuable as nursery habitat for newborn giant garter snakes. Both intervening berms and spoils generated by excavating deeper areas will provide upland habitat (e.g., bankside burrows, holes, and crevices) to provide short-term refuge areas during the active season as well as high ground or upland habitat above the annual high water mark to provide cover and refuge from high water during the dormant winter period. Water delivery will be maintained through the existing conveyance and drainage infrastructure, which will connect the property to other rice fields, including those maintained as giant garter snake habitat by the Natomas Basin Conservancy (i.e., Sills and Elsie tracts).

The smaller scale of the units on the Spangler 235 property is expected to confer many advantages, including, but not limited to, simplicity of design, simplicity of maintenance, and reduced impacts associated with maintenance activities, such as the disruption of breeding, feeding, and sheltering. While perhaps differing in scale and configuration to that of most mitigation sites constructed for giant garter snakes, the proposed mitigation design for the Spangler 235 property clearly incorporates all of the standard attributes common to occupied giant garter snake habitats. However, rather than developing these components as fewer, continuous blocks of strata distributed over the broader landscape, the scale of the design is adjusted to incorporate all requisite features within units or cells of a smaller, easily manageable scale typical of a rice-growing landscape. The result does not change the final proportion of the habitat components distributed across the total area, nor does it compromise wetland function. It does, however, alter the distribution of the components, thus providing a greater range of heterogeneity and habitat edge or interface and increasing the proximity of the different features that giant garter snakes require throughout the day. Units are independent, but result in a series of repeating habitat strata that will function as part of the larger wetland landscape. Not only is this expected to potentially increase carrying capacity and reduce individual movement and home range (which confer greater risks to individual snakes) by meeting all life history requirements in a smaller area, but it provides a distinct advantage by providing superior opportunities to measure the species' response to different conditions as well as the precise control for adaptive management.

While any good restoration design seeks to increase edge and heterogeneity, this is generally accomplished by adding sinuosity to channels and complexity to design, and, as a result, complexity to maintenance and management. Maintenance activities, such as de-silting, dredging, grading, and vegetation clearing must be performed regularly on any managed wetland in order to maintain its function. Large, complex management units can experience impeded flows, rapid sedimentation, and frequent maintenance

activities occurring on a large spatial and temporal scale, resulting in adverse impacts to giant garter snakes either by removing foraging habitat and refuge or through direct mortality or injury. The degree of impact is driven by factors such as the extent and nature of the activity, the timing of the activity, and the ability for snakes to seek alternative resources and to avoid danger. In the case of the Spangler 235 property, because each unit can be independently controlled there is more potential to isolate maintenance activities, thereby reducing the scale and magnitude of potential impacts. Because each cell can be readily bypassed, it is possible to selectively isolate and dry individual cells for maintenance while continuing to provide aquatic habitat in neighboring cells. While this approach applies to the majority of wetlands constructed and managed for giant garter snakes, the large scale of the cells or units associated with the larger units within these complexes often makes it difficult to complete maintenance activities without decommissioning large blocks of habitat, therefore impacting a larger number of snakes. Because the design proposed for the Spangler 235 property emphasizes simplicity in its topography and design, maintenance can be completed with less physical disruption and in shorter time, whereas maintenance of larger and more complex systems often require longer and more invasive procedures and therefore more impactful periods of down time.

In closing, while the approach to the Spangler 235 design is novel in its scale and simplicity, it remains wholly consistent with the general design elements of giant garter habitat creation. Through its simplicity, however, it overcomes many of the challenges experienced with habitats comprising larger, more complex management units. Finally, by increasing both the number of management units and the ability to exercise a greater degree of control over local conditions, the design provides superior opportunities to measure the species' response to different conditions and to manage habitat adaptively.

Please contact me with any questions or concerns. I will gladly expand on any of these topics at your request.

Sincerely,

A handwritten signature in black ink that reads "Eric C. Hansen". The signature is written in a cursive style with a large, sweeping initial "E".

Eric C. Hansen
Consulting Environmental Biologist

Appendix E

Assessment of Avoidance and Minimization by the Greenbriar Development Project

Appendix E - Assessment of Avoidance and Minimization by the Greenbriar Development Project

For this assessment, the avoidance and minimization measures in the NBHCP were considered a comprehensive set of effective measures to avoid and minimize the construction-related effects and human-wildlife conflicts potentially resulting from the NBHCP. Development at the Greenbriar Project Site is comparable to the development permitted by the NBHCP, and the construction-related effects and human-wildlife conflicts potentially caused by development at the Greenbriar Project Site are the same as those potentially caused by the development permitted by the NBHCP.

Therefore, for comparable effects potentially caused by the proposed Greenbriar Development Project, incorporation of the applicable measures from the NBHCP was considered to be avoidance and minimization to the maximum extent practicable. The NBHCP's avoidance and minimization measures related to development were reviewed to determine the measures that were applicable to the Greenbriar Development Project, and if the measure or a comparable measure was incorporated into the Greenbriar Conservation Strategy. All applicable measures (or comparable but more detailed or more stringent measures) were incorporated into the Greenbriar Conservation Strategy. The results of this assessment are summarized in **Table E-1**.

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Table E-1. Inclusion of NBHCP Measures to Reduce Construction-Related Effects and Human-Wildlife Conflicts in the Greenbriar Conservation Strategy

	Natomas Basin HCP Measure	Applicability	Inclusion	Rationale
1.	Pre-construction Surveys (p V-1) shall be conducted not less than 30 days or more than 6 months prior to commencement of construction activities, to determine the status and presence of, and likely impacts to, all Covered Species on the site. Pre-construction surveys for an individual species may be completed up to one year in advance if the sole period for reliable detection of that species is between May 1 and December 31.	Applicable	Included	Biological surveys have been conducted at the Greenbriar Project Site, Moody Reserve, Spangler Reserve, and North Nestor Reserve to determine the Covered Species with the potential to occur on these sites or be impacted by implementation of the Project (HELIX 2013). Pre-construction survey measures have been included in the avoidance and minimization measures proposed in the Project's EIR, where applicable, for each species with the potential to occur the properties associated with the Project.
2.	Preservation of the Area Adjacent to Fisherman's Lake (p V-2): Pursuant to the Settlement Agreement, the City has agreed to initiate a North Natomas Community Plan amendment to potentially widen the agricultural buffer along the City side of Fisherman's lake to 800 feet wide.	N/A		This measure is specific to locations outside of the Project.
3.	General Measures to Minimize Take (p V-3)			
	A. Tree Preservation: Valley oaks and other large trees should be preserved whenever possible. Preserve and restore stands of riparian trees used by Swainson's hawks and other animals for nesting, particularly adjacent to Fisherman's Lake.	Applicable	Included	This measure is not applicable to construction of the Greenbriar development because there are no valley oaks or other large trees or riparian trees on the Greenbriar Project Site. However, valley oaks and other riparian trees on the Moody Reserve will be preserved and potentially restored according to the SSMP.
	B. Native Plants: Improve the wildlife value of landscaped parks, buffers, and developed areas by planting trees and shrubs which are native to the Natomas Basin and therefore are used by native animals.	Applicable	Included	Native plants will be used in landscaped parks, buffers, and developed areas to the extent feasible.
	C. Protect Raptor Nests: Avoid the raptor nesting season when scheduling construction near nests.	Applicable	Included	Mitigation Measures 6.12-11 includes measures to avoid disturbance of bird nests during the nesting season.

	Natomas Basin HCP Measure	Applicability	Inclusion	Rationale
	D. Protected Plant/Animal Species, also referred to as “Special Status Species”: Search for protected plant species during flowering season prior to construction and protected animal species during the appropriate season.	Applicable	Included	Comparable and more specific measures have been included in the proposed project for each species with potential to occur on-site (e.g., MM 6.12-1, 6.12.-2, 6.12-4, 6.12-5, 6.12-6, 6.12-7, 6.12-9, 6.12-10, and 6.12-11).
4.	Measures to Minimize Take of Vernal Pool Species (p V-3)			
	A. General Biological Survey and Information Required (p V-4): In the event a biological reconnaissance survey or the pre-construction survey identifies that vernal pool resources are on-site, a vernal pool species specific biological assessment must be provided during the appropriate season (as established by USFWS) to determine the type and abundance of species present.	Applicable	Included	There are no vernal pools any of the properties associated with the Project. However, potentially suitable habitat for vernal pool branchiopods is present in six seasonal wetlands on the Greenbriar Project Site. Presence/absence surveys were conducted according to USFWS protocols and these species were not detected.
	i. Where site investigations indicate vernal pool species may occur, the developer shall notify the Land Use Agency regarding the potential for impacts to vernal pool species.	Applicable	Included	The Land Use Agency (City of Sacramento) has been notified of the presence of potential habitat for vernal pool species and the results of negative surveys.
	ii. USFWS and CDFW shall identify specific measures required to avoid, minimize and mitigate impacts to vernal pool species to be implemented prior to disturbance and in accordance with adopted standards or established guidelines.	N/A		No special-status vernal pool species are present on any of the properties associated with the Project.
	iii. The requirement by USFWS to preserve a vernal pool within development would be based on an intact vernal pool with minimal disturbance where the presence of one or more of the following species is recorded: slender orcutt grass, Sacramento orcutt grass, Colusa grass, or vernal pool tadpole shrimp. No preservation requirement shall be made unless the vernal pool is a suitable site for TNBC Mitigation Lands.	N/A		No vernal pools meeting these criteria occur on any of the properties associated with the Project.

	Natomas Basin HCP Measure	Applicability	Inclusion	Rationale
	iv. Such vernal pool areas, including any required buffer land dedication, shall apply toward the Land Acquisition Fee component of the development project's NBHCP mitigation obligation.	N/A		No vernal pools meeting these criteria occur on any of the properties associated with the Project.
	B. Mitigation Strategies (p. V-5)			
	i. Avoidance and Preservation On-Site to Minimize Impacts: In the event USFWS requires on-site preservation in accordance with Section A.iii above, on-site mitigation shall be required. In the event USFWS does not require on-site mitigation, a developer or private land owner may still propose to dedicate fee title or conservation easement for that portion of the property with vernal pool resources and an associated 250-foot buffer surrounding the vernal pool resource to the TNBC. If the dedication is accepted, a reduction in the Land Acquisition Fee portion of the habitat Mitigation Fee shall be granted the developer for the portion (calculated on an acreage basis) of the site permanently preserved by easement or dedication. However, habitat Mitigation Fees, in full, must be paid on the remaining developable acreage on the site, and all fees other than Land Acquisition Fees shall be paid for all acres on the site. Additional conditions to preserve the biological integrity of the site (such as reasonable drainage conditions) may be imposed by the Land Use Agency in consultation with TNBC and the TAC.	N/A		No vernal pools meeting the criteria for on-site preservation are present on any of the properties associated with the Project.
	ii. Construction Period Avoidance and Relocation of Vernal Pool Resources (p. V-6).			

	Natomas Basin HCP Measure	Applicability	Inclusion	Rationale
	a. No grading, development or modification of the vernal pool site or the buffer area extending 250 feet around the perimeter of the vernal pool site may occur during the vernal pool “wet” season as identified by USFWS. Protective fencing shall be established around the perimeter of the vernal pool site and the buffer area during the vernal pool wet season.	N/A No undisturbed vernal pools occur.		No vernal pools meeting the criteria for on-site preservation are present on any of the properties associated with the Project.
	b. In consultation with TNBC and the TAC, soils and cysts from the vernal pool may be relocated as soon as practicable during the dry season to a suitable TNBC or other reserve site provided the relocation/recreation site is approved by TNBC, and the USFWS.	N/A No undisturbed vernal pools occur.		No vernal pools meeting the criteria for on-site preservation are present on any of the properties associated with the Project.
	iii. Payment Into a USFWS Approved Conservation Bank (p. V-6). In the event all of the above approaches are not appropriate for the site, the Land Use Agency shall require the developer to purchase credits from a USFWS-approved mitigation bank in accordance with the following mitigation ratios: 2:1 for preservation in mitigation banks, 1:1 for creation in mitigation banks, 3:1 for preservation in acres outside of mitigation banks, 2:1 for creation in acres outside of mitigation banks.	N/A TBD; pending results of surveys.		No vernal pools meeting the criteria for on-site preservation are present on any of the properties associated with the Project.

	Natomas Basin HCP Measure	Applicability	Inclusion	Rationale
5.	Measures to Reduce Take for Individual Species (p. V-7)			
	A. Measures to Reduce Take of GGS (p. V-7)			
	i. Within the Natomas Basin, all construction activity involving disturbance of habitat, such as site preparation and initial grading, is restricted to the period between May 1 and September 30. This is the active period for the GGS and direct mortality is lessened, because snakes are expected to actively move and avoid danger.	Applicable	Included	A comparable measure has been included in the Greenbriar Conservation Strategy (e.g., MM 6.12-1).
	ii. Pre-construction surveys for GGS, as well as other NBHCP Covered Species, must be completed for all development projects by a qualified biologist approved by USFWS. If any GGS habitat is found within a specific site, the following additional measures shall be implemented to minimize disturbance of habitat and harassment of GGS, unless such project is specifically exempted by USFWS.	Applicable	Included	A comparable measure has been included in the Greenbriar Conservation Strategy (e.g., MM 6.12-1).
	iii. Between April 15 and September 30, all irrigation ditches, canals, or other aquatic habitat should be completely dewatered, with no puddled water remaining, for at least 15 consecutive days prior to the excavation or filling in of the dewatered habitat. Ensure dewatered habitat does not continue to support GGS prey, which could detain or attract snakes. If a site cannot be completely dewatered, netting and salvage of prey items may be necessary.	Applicable	Included	A comparable measure has been included in the Greenbriar Conservation Strategy (e.g., MM 6.12-1).

	Natomas Basin HCP Measure	Applicability	Inclusion	Rationale
	iv. For sites that contain GGS habitat, no more than 24- hours prior to start of construction activities (site preparation and/or grading), the project area shall be surveyed for the presence of GGS. If construction activities stop on the project site for a period of two weeks or more, a new GGS survey shall be completed no more than 24-hours prior to the re-start of construction activities.	Applicable	Included	A comparable measure has been included in the Greenbriar Conservation Strategy (e.g., MM 6.12-1).
	v. Confine clearing to the minimal area necessary to facilitate construction activities. Flag and designate avoided GGS habitat within or adjacent to the project as Environmentally Sensitive Areas. This area shall be avoided by all construction personnel.	Applicable	Included	A comparable measure has been included in the Greenbriar Conservation Strategy (e.g., MM 6.12-1).
	vi. Construction personnel completing site preparation and grading operations shall receive USFWS approved environmental awareness training. This training instructs workers on how to identify GGS and their habitats, and what to do if a GGS is encountered during construction activities. During this training an on-site biological monitor shall be designated.	Applicable	Included	A comparable measure has been included in the Greenbriar Conservation Strategy (e.g., MM 6.12-1).
	vii. If a live GGS is found during construction activities, immediately notify the USFWS and the project's biological monitor. The biological monitor, or his/her assignee, shall do the following:	Applicable	Included	A comparable measure has been included in the Greenbriar Conservation Strategy (e.g., MM 6.12-1).

	Natomas Basin HCP Measure	Applicability	Inclusion	Rationale
	<p>a. Stop construction in the vicinity of the snake. Monitor the snake and allow the snake to leave on its own. The monitor shall remain in the area for the remainder of the work day to make sure the snake is not harmed or if it leaves the site, does not return. Escape routes for GGS should be determined in advance of construction and snakes should always be allowed to leave on their own. If a GGS does not leave on its own within one working day, further consultation with USFWS is required.</p>	Applicable	Included	A comparable measure has been included in the Greenbriar Conservation Strategy (e.g., MM 6.12-1).
	<p>viii. Upon locating dead, injured or sick threatened or endangered wildlife species, the Permittees or their designated agents must notify within one working day the Service's Division of Law Enforcement and Sacramento Fish and Wildlife Office. Written notification to both offices must be made within 3 calendar days and must include the date, time, and location of the finding of a specimen and any other pertinent information.</p>	Applicable	Included	A comparable measure has been included in the Greenbriar Conservation Strategy (e.g., MM 6.12-1).
	<p>ix. Fill or construction debris may be used by GGS as an over-wintering site. Therefore, upon completion of construction activities remove any temporary fill and/or construction debris from the site. If this material is situated near undisturbed GGS habitat and it is to be removed between October 1 and April 30, it shall be inspected by a qualified biologist to assure that GGS are not using it as hibernaculae.</p>	Applicable	Included	A comparable measure has been included in the Greenbriar Conservation Strategy (e.g., MM 6.12-1).

	Natomas Basin HCP Measure	Applicability	Inclusion	Rationale
	x. No plastic, monofilament, jute, or similar erosion control matting that could entangle snakes will be placed on a project site when working within 200 feet of snake aquatic or rice habitat. Possible substitutions include coconut coir matting, tactified hydroseeding compounds, or other material approved by the Wildlife Agencies.	Applicable	Included	A comparable measure has been included in the Greenbriar Conservation Strategy (e.g., MM 6.12-1).
	xi. Fences will be constructed along the shared boundary of urban development and the North Drainage Canal and the East Drainage Canal within Sutter County's Permit Area.	N/A		This measure is specific to locations outside the Project area.
	a. 100 feet will be provided from fence-to-fence and access to the canals shall be limited by gates.	N/A		This measure is specific to locations outside the Project area.
	b. A snake deterrent will be placed along the fences on the North Drainage Canal and the East Drainage Canal (i.e., fence construction that restricts snake movement or an appropriate vegetative barrier either inside or outside of the boundary fence). The design of the deterrent shall be subject to approval by the Wildlife Agencies.	N/A		This measure is specific to locations outside the Project area.
	c. The specific fence/snake barrier design adjacent to a given development will be determined within Sutter County's review of the proposed development and the fence/barrier shall be installed immediately after site grading is completed.	N/A		This measure is specific to locations outside the Project area.

	Natomas Basin HCP Measure	Applicability	Inclusion	Rationale
	xii. At the time of urban development along the North and East Drainage Canals, Sutter County shall consult with the Wildlife Agencies to determine design strategies that would enhance conditions for GGS movement through the North and East Drainage Canals. Possible strategies may include expanded buffer areas and modified canal cross sections if such measures are, in the determination of Sutter and the Water Agencies, found to be feasible.	N/A		This measure is specific to locations outside the Project area.
	B. Measures to Reduce Take of Swainson's Hawk (V-9)			
	i. Measures to Reduce Cumulative Impacts to Foraging Habitat (V-9): Sutter County and the City of Sacramento will not grant development approvals within the one-mile wide Swainson's Hawk Zone adjacent to the Sacramento River.	N/A		Although the Moody Reserve is within the one-mile wide Swainson's Hawk Zone, no development is proposed at that site. The Greenbriar Project Site is not located within this zone.
	ii. Measures to Reduce Nest Disturbance (V-10)			
	a. Pre-construction surveys shall be completed by the respective developer to determine whether any Swainson's hawk nest trees will be removed on-site, or active Swainson's hawk nest sites occur on or within ½ mile of the development site.	Applicable	Included	A comparable measure has been included in the Greenbriar Conservation Strategy (e.g., MM 6.12-2).
	b. If breeding Swainson's hawks (i.e. exhibiting nest building or nesting	Applicable	Included	A comparable measure has been included in the Greenbriar Conservation Strategy (e.g., MM 6.12-2).

	Natomas Basin HCP Measure	Applicability	Inclusion	Rationale
	behavior) are identified, no new disturbances (e.g., heavy equipment operation associated with construction) will occur within ½ mile of an active nest between March 15 and September 15, or until a qualified biologist, with concurrence by CDFW, has determined that young have fledged or that the nest is no longer occupied. Routine disturbances such as agricultural activities, commuter traffic, and routine facility maintenance activities within ½ mile of an active nest are not restricted.			
	1) Where disturbance of a Swainson's hawk nest cannot be avoided, the nest tree may be destroyed during the non-nesting season. For purposes of this provision the Swainson's hawk nesting season is defined as March 15 to September 15. If a nest tree (any tree that has an active nest in the year the impact is to occur) must be removed, tree removal shall only occur between September 15 and February 1.	Applicable	Included	A comparable measure has been included in the Greenbriar Conservation Strategy (e.g., MM 6.12-2).
	2) If a Swainson's hawk nest tree is to be removed and fledglings are present, the tree may not be removed until September 15 or until CDFW has determined that the young have fledged.	Applicable	Included	A comparable measure has been included in the Greenbriar Conservation Strategy (e.g., MM 6.12-2).
	3) If construction or other project related activities which may	Applicable	Included	A comparable measure has been included in the Greenbriar Conservation Strategy (e.g., MM 6.12-2).

	Natomas Basin HCP Measure	Applicability	Inclusion	Rationale
	disturb nesting birds are proposed within the 1/4 mile buffer zone, intensive monitoring (funded by the project sponsor) by a CDFW approved raptor biologist will be required. Exact implementation of this measure will be based on specific information at the project site.			
	iii. Measures to Prevent the Loss of Nest Trees			
	a. Valley oaks, tree groves, riparian habitat and other large trees will be preserved wherever possible, particularly near Fisherman's Lake and elsewhere where large oak groves, tree groves and riparian habitat have been identified.	Applicable	Included	This measure is not applicable to the Greenbriar development because there are no suitable trees on the Greenbriar Project Site. However, suitable trees on the Moody Reserve will be preserved and potentially restored according to the SSMP.
	b. The raptor nesting season shall be avoided when scheduling construction near nests in accordance with applicable guidelines published by the Wildlife Agencies or through consultation with the Wildlife Agencies.	Applicable	Included	A comparable measure has been included in Greenbriar Conservation Strategy (See MM 6.12-11).
	iv. Measures to Mitigate the Loss of Nest Trees (V-11)			
	a. Fifteen trees (five gallon container size) must be planted, maintained and monitored within the habitat reserves for every Swainson's hawk nesting tree anticipated to be impacted by Authorized Development.	N/A		There are no Swainson's hawk nesting trees on the Greenbriar Project Site; therefore, none will be impacted by development at the site.

	Natomas Basin HCP Measure	Applicability	Inclusion	Rationale
	<p>1) The Land Use Agency Permittee approving a project that impacts an existing Swainson's hawk nest tree shall provide funding sufficient for monitoring survival success of trees for a period of 5 years. For every tree lost during this time period, a replacement tree must be planted immediately upon the detection of failure. Trees planted to replace trees lost shall be monitored for an additional 5-year period to ensure survival until the end of the monitoring period. A 100% success rate shall be achieved.</p>	N/A		<p>There are no Swainson's hawk nesting trees on the Greenbriar Project Site; therefore, none will be impacted by development at the site.</p>
	<p>All necessary planting requirements and maintenance to ensure success shall be provided. Trees must be irrigated for a minimum of the first 5 years after planting, and then gradually weaned off the irrigation in an approximate 2-year period. If larger stock is planted, the number of years of irrigation must be increased accordingly. In addition, 10 years after planting, a survey of the trees shall be completed to assure 100% establishment success.</p>	N/A		<p>There are no Swainson's hawk nesting trees on the Greenbriar Project Site; therefore, none will be impacted by development at the site.</p>

	Natomas Basin HCP Measure	Applicability	Inclusion	Rationale
	<p>2) Of the replacement trees planted, a variety of native tree species will be planted to provide trees with differing growth rates, maturation, and life span. This will ensure that nesting habitat will be available quickly (5-10 years in the case of cottonwoods and willows), and in the long term (i.e., valley oaks, black walnut and sycamores). Trees shall be sited on reserves in proximity to hawk foraging areas. Trees planted shall be planted in clumps of 3 trees each. Planting stock shall be a minimum of 5-gallon container stock for oak and walnut species.</p>	N/A		<p>There are no Swainson's hawk nesting trees on the Greenbriar Project Site; therefore, none will be impacted by development at the site.</p>
	<p>3) In order to reduce temporal impacts resulting from the loss of mature nest trees, the City of Sacramento will fund mitigation planting within 14 months of permit of the NBHCP and ITP's, to be reimbursed by private developers at the time of approval of their development projects that impact mature nest trees.</p>	N/A		<p>There are no Swainson's hawk nesting trees on the Greenbriar Project Site; therefore, none will be impacted by development at the site.</p>

	Natomas Basin HCP Measure	Applicability	Inclusion	Rationale
	<p>4) For each additional nesting tree removed by Land Use Agencies' Covered Activities, the Land Use Agency shall fund and provide for the planting of 15 native sapling trees of suitable species with differing growth rates at suitable locations on TNBC preserves. Funding for such plantings shall be provided by the applicable Permittee within 30 days of approving a Covered Activity that will impact a Swainson's hawk nesting tree.</p>	N/A		<p>There are no Swainson's hawk nesting trees on the Greenbriar Project Site; therefore, none will be impacted by development at the site.</p>
	<p>C. Measures to Reduce Take of VELB (p. V-13): developers must comply with conservation practices for VELB set forth in the conditions of the "<i>USFWS Compensation Guidelines for the Valley Elderberry Longhorn Beetle</i>," dated 1999. This policy assumes that any elderberry bushes found within the range of the species are likely to provide beetle habitat, and any destruction or loss of such elderberry shrub habitat must be mitigated according to the Guidelines. The principle conditions of the Guidelines are summarized below.</p>	Applicable	Included	<p>A survey for VELB was conducted at the Greenbriar Project Site in accordance with the USFWS 1999 Guidelines. One elderberry shrub was found at the site; however, it does not provide habitat for VELB.</p>
	<p>i. Any direct or indirect impacts to VELB habitat will be avoided whenever possible. To the maximum extent practicable, projects will be designed to avoid stands of elderberry bushes and to avoid isolation of the plants from other nearby populations. Pre- construction surveys at the construction impact site will be conducted to assess the appropriate amount of mitigation.</p>	Applicable	Included	<p>A survey for VELB was conducted at the Greenbriar Project Site in accordance with the USFWS 1999 Guidelines. One elderberry shrub was found at the site; however, it does not provide habitat for VELB.</p>

	Natomas Basin HCP Measure	Applicability	Inclusion	Rationale
	ii. If elderberry plants cannot be avoided, they shall be transplanted during the dormant season (November 1 to February 15) to an area protected in perpetuity and approved by the USFWS.	Applicable	Included	A comparable measure has been included in the Greenbriar Conservation Strategy (See MM 6.12-8).
	iii. Replacement seedling plants will be provided at a ratio between 2:1 and 5:1 depending on the extent of beetle utilization of the plants moved or lost. A 1,800-square-foot area will be provided for each transplanted elderberry shrub or every five elderberry seedling plants.	Applicable	Included	A comparable measure has been included in the Greenbriar Conservation Strategy (See MM 6.12-8) to provide adequate space for the elderberry shrub transplanted from the Greenbriar Project Site. No replacement seedlings are proposed as the elderberry shrub being transplanted from the Greenbriar Project Site is not occupied by the VELB and does not represent suitable habitat for the beetle.
	iv. Annual monitoring of VELB habitat will be provided in the planted mitigation sites for a ten year period.	N/A		No annual monitoring of VELB habitat is proposed as the elderberry shrub being transplanted from the Greenbriar Project Site is not occupied by the VELB and does not represent suitable habitat for the beetle.
	v. Replacement elderberry shrubs will meet a 60% survival rate by the end of the ten year period and the 60% survival rate shall be required for the term of the applicable permit.	N/A		No replacement plantings are proposed as the elderberry shrub being transplanted from the Greenbriar Project Site is not occupied by the VELB and does not represent suitable habitat for the beetle.
	D. Measures to Reduce Take on Tricolored Blackbird (V-13)			
	i. A pre-construction survey is required for potential nesting habitat and presence of nesting tricolored blackbirds.	Applicable	Included	A comparable measure has been included in the Greenbriar Conservation Strategy (See MM 6.12-9).
	ii. If surveys determine tricolored blackbirds are present, the following measures shall be implemented in accordance with the Migratory Bird Treaty Act, to avoid disturbance to occupied nesting colonies during the nesting season. A boundary shall be marked by brightly colored construction fencing that establishes a boundary 500 feet from the active colony. No disturbance associated with Authorized	Applicable	Included	A comparable measure has been included in the Greenbriar Conservation Strategy (See MM 6.12-9).

	Natomas Basin HCP Measure	Applicability	Inclusion	Rationale
	Development shall occur within the 500 foot fenced area during the nesting season to July 1, or while birds are present. A qualified biologist, with concurrence of USFWS, must determine young have fledged and nest sites are no longer active before the nest site may be disturbed.			
	E. Measures to Reduce Take on Aleutian Canada Goose (V-14)			
	i. A pre-construction survey for Aleutian Canada geese will be required. If present, the developer must consult with USFWS and CDFW to determine appropriate measures to avoid and minimize take that are appropriate for the use and activity of the species, since this species is a seasonal visitor to the Basin.	Applicable	Included	A comparable measure has been included in the Greenbriar Conservation Strategy (See MM 6.12-10).
	F. Measures to Reduce Take on White-faced Ibis (V-14)			
	i. Prior to approval of an Urban Development Permit, a pre- construction survey will be required.	N/A		Suitable white-faced ibis nesting habitat does not exist on site.
	ii. If surveys determine the presence of active nest sites of White- faced ibis, disturbance by Authorized Development within 1/4 mile of nests will be avoided within the nesting season of May 15 through August 31 or until a qualified biologist, with concurrence of Wildlife Agencies, has determined that young have fledged or that the nest is no longer occupied.	N/A		Suitable white-faced ibis nesting habitat does not exist on site.
	G. Measures to Reduce Take on Loggerhead Shrike (V-14)			

	Natomas Basin HCP Measure	Applicability	Inclusion	Rationale
	i. Prior to approval of an Urban Development Permit, a pre- construction survey will be required.	Applicable	Included	A comparable measure has been included in the Greenbriar Conservation Strategy (See MM 6.12-7).
	ii. If surveys identify an active loggerhead shrike nest that will be impacted by Authorized Development, the developer shall install brightly colored construction fencing that establishes a boundary 100 feet from the active nest. No disturbance associated with Authorized Development shall occur within the 100 foot fenced area during the nesting season of March 1 through July 31. A qualified biologist, with concurrence of USFWS must determine young have fledged or that the nest is no longer occupied prior to disturbance of the nest site.	Applicable	Included	A comparable measure has been included in the Greenbriar Conservation Strategy (See MM 6.12-7).
	H. Measures to Reduce Take Burrowing Owl (V-15)			
	i. Prior to the initiation of grading or earth disturbing activities, the applicant/developer shall hire a CDFW approved qualified biologist to perform a pre-construction survey of the site to determine if any burrowing owls are using the site. The preconstruction survey shall be submitted to the Land Use Agency with jurisdiction over the site prior to commencement of construction and a mitigation program shall be developed and agreed to by the Land Use Agency and developer prior to initiation of any physical disturbance on the site.	Applicable	Included	A comparable measure has been included in the Greenbriar Conservation Strategy (See MM 6.12-5).
	ii. Occupied burrows shall not be disturbed during nesting season (February 1 through August 31) unless a qualified biologist approved by the CDFW verifies through noninvasive measures that either: 1) the birds have not begun egg-laying and incubation; or 2) that juveniles from	Applicable	Included	A comparable measure has been included in the Greenbriar Conservation Strategy (See MM 6.12-5).

	Natomas Basin HCP Measure	Applicability	Inclusion	Rationale
	the occupied burrows are foraging independently and capable of survival.			
	iii. If nest sites are found, the USFWS and CDFW shall be contacted regarding suitable mitigation measures, which may include a 300 foot buffer from the nest site during the breeding season (February 1 - August 31), or a relocation effort for the burrowing owls if the birds have not begun egg-laying and incubation or the juveniles from the occupied burrows are foraging independently and are capable of independent survival. If on-site avoidance is required, the location of the buffer zone will be determined by a qualified biologist. The developer shall mark the limit of the buffer with yellow caution tape, stakes, or temporary fencing. The buffer will be maintained throughout the construction period.	Applicable	Included	A comparable measure has been included in the Greenbriar Conservation Strategy (See MM 6.12-5).
	iv. If relocation of owls is approved by USFWS and CDFW, the developer shall hire a qualified biologist to prepare a plan to include: (a) the location of the nest and owls proposed for relocation; (b) the location of the relocation site; (c) the number of owls involved and the time of year when the relocation is proposed to take place; (d) the name and credentials of the biologist who will be retained to supervise the relocation; (e) the proposed method of capture and transport for the owls to the new site; (f) a description of the site preparations at the relocation site (e.g., enhancement of existing burrows, creation of artificial burrows, one-time or long-term vegetation control, etc.); and (g) a description of efforts and funding support proposed to monitor the relocation. Relocation options may include passive relocation to an area of the site not subject to disturbance	Applicable	Included	A comparable measure has been included in the Greenbriar Conservation Strategy (See MM 6.12-5).

	Natomas Basin HCP Measure	Applicability	Inclusion	Rationale
	through one way doors on burrow openings, or construction of artificial burrows.			
	v. Where on-site avoidance is not possible, disturbance and/or destruction of burrows shall be offset through development of suitable habitat on TNBC upland reserves. Such habitat shall include creation of new burrows with adequate foraging area (a minimum of 6.5 acres) or 300 feet radii around the newly created burrows. Additional habitat design and mitigation measures are described in the CDFW's October 17, 1995, <i>Staff Report on Burrowing Owl Mitigation</i> .	Applicable	Included	A comparable measure has been included in the Greenbriar Conservation Strategy (See MM 6.12-5).
	I. Measures to Reduce Take of Bank Swallow (V-16)			
	i. Disturbance to bank swallows nesting colonies will be avoided within the nesting season of May 1 through August 31 (or until a qualified biologist, with concurrence of USFWS and CDFW, has determined that young have fledged or that the nest is no longer occupied) during all Authorized Development activities conducted in the Permit Areas.	N/A		Suitable bank swallow nesting habitat does not exist on any of the properties associated with the Greenbriar Development Project.
	ii. If surveys identify an active bank swallow nesting colony that will be impacted by Authorized Development, the developer shall install brightly colored construction fencing that establishes a boundary 250 feet from the active nesting colony. No disturbance associated with Authorized Development shall occur within the 250-foot fenced area during the nesting season of May 1 through August 31. Additionally, disturbance within ½ mile upstream or downstream of the colony will be avoided if the colony is located upon a natural waterway.	N/A		Suitable bank swallow nesting habitat does not exist on any of the properties associated with the Greenbriar Development Project.

	Natomas Basin HCP Measure	Applicability	Inclusion	Rationale
	J. Measures to Reduce Take on Northwestern Pond Turtle (V-16)			
	i. Take of the northwestern pond turtle as a result of habitat destruction during construction activities, including the removal of irrigation ditches and drains, and during ditch and drain maintenance, will be minimized by the dewatering requirement described above for GGS (see Section 5.a.(3)).	Applicable	Included	A comparable and more stringent measure has been included in the Greenbriar Conservation Strategy (See MM 6.12-6).
	K. Measures to Reduce Take on California Tiger Salamander (V-16)			
	i. Prior to approval of an Urban Development Permit, the involved Land Use Agency shall require a pre-construction survey. If a future survey determines the presence of California tiger salamander, the Land Use Agency shall require the developer to consult with USFWS and CDFW to determine appropriate measures to avoid and minimize take of individuals.	N/A		Suitable California tiger salamander habitat does not exist on any of the properties associated with the Greenbriar Development Project.
	L. Measures to Reduce Take on Western Spadefoot (V-16)			
	i. Prior to approval of an Urban Development Permit, the involved Land Use Agency shall require a pre-construction survey. If such survey determines western spadefoot toad are present, the Land Use Agency shall require the developer to consult with CDFW and USFWS to determine appropriate measures to avoid and minimize take of individuals.	N/A		Suitable western spadefoot toad habitat does not exist on any of the properties associated with the Greenbriar Development Project.
	M. Measures to Reduce Take of Vernal Pool Fairy Shrimp, Vernal Pool Tadpole Shrimp, and Midvalley Fairy Shrimp (V-17)			

	Natomas Basin HCP Measure	Applicability	Inclusion	Rationale
	i. Prior to approval of an Urban Development Permit, the involved Land Use Agency shall require a pre-construction survey. If such survey determines these species are present, the Land Use Agency shall require the developer to consult with USFWS to determine measures to avoid and minimize take of individuals. Procedures for reviewing projects that could affect vernal pools and vernal pool species are discussed under Section V.A.4 above.	Applicable	Included	In compliance with this measure, USFWS protocol surveys for covered vernal pool branchiopods were completed for the Greenbriar Project Site and no branchiopods were found.
	N. Measures to Reduce Take Delta on Tule Pea (V-17)			
	i. If Delta tule pea plants are identified through a pre-construction survey, the involved Land Use Agency shall provide notice to USFWS, CDFW and the CNPS to transplant the individuals.	Applicable	Included	A comparable measure has been included in the Greenbriar Conservation Strategy (See MM 6.12-4).
	O. Measures to Reduce Take on Sanford's Arrowhead (V-17)			
	i. If Sanford's arrowhead plants are identified through a pre-construction survey, the involved Land Use Agency shall provide notice to USFWS, CDFW and the CNPS. Under such circumstances, the development proponent shall allow the transplantation of plants prior to site disturbance.	Applicable	Included	A comparable measure has been included in the Greenbriar Conservation Strategy (See MM 6.12-4).
	P. Measures to Reduce Take on Boggs Lake Hedge-Hyssop, Sacramento orcutt Grass, Slender orcutt Grass, Colusa Grass, and Legenere (V- 17)	N/A		Suitable habitat for these species does not exist on any of the properties associated with the Greenbriar Development Project.
	i. Prior to approval of an Urban Development Permit, the involved Land Use Agency shall require a pre-construction survey. If such survey determines these species are present, the Land	N/A		Suitable habitat for these species does not exist on any of the properties associated with the Greenbriar Development Project.

	Natomas Basin HCP Measure	Applicability	Inclusion	Rationale
	Use Agency shall require the developer to consult with USFWS to determine appropriate measures to avoid and minimize loss of individuals. If Authorized Development is proposed for areas containing vernal pools, the applicant will be required to complete additional review, permitting and mitigation as described under Section V.A.4.			

Appendix F

Greenbriar Conservation Measures Related to Biological Resources

Appendix F - Greenbriar Development Project Conservation Measures

The Greenbriar Conservation Strategy (discussed in Chapter 2.7) consists of two primary elements: establishment of reserves and implementation of specific conservation measures to reduce impacts to Covered Species and habitats. Specific conservation measures are not necessary for the following species as they would not be affected by the project: white-faced ibis, bank swallow, California tiger salamander, western spadefoot, vernal pool fairy shrimp, vernal pool tadpole shrimp, midvalley fairy shrimp, Boggs Lake hedge hyssop, Sacramento orcutt grass, slender orcutt grass, Colusa grass, and legenera. Species with and without specific conservation measures will benefit from the habitat enhancement and preservation element of the Greenbriar Conservation Strategy, which includes establishing the Lone Tree Canal Reserve, the Moody Reserve, the Spangler Reserve, and the North Nestor Reserve for the benefit of all of the Covered Species.

The proposed conservation measures for the Greenbriar Development Project pertaining to special-status species and habitats are presented below.

6.12-1: GGS Conservation Measures

General Measure

- a. The Project Applicant shall obtain appropriate authorization for incidental take of GGS from USFWS and CDFW.

Habitat Creation, Preservation, and Management in the Lone Tree Canal Linear Open Space/ Buffer Area

- b. To ensure that development of the Greenbriar Project Site does not diminish habitat connectivity for GGS between the southwest and northwest zones in the Basin identified in the NBHCP, approximately 28.3 acres along Lone Tree Canal shall be protected and managed as GGS habitat. This on-site habitat preservation shall protect an approximately 250-foot wide corridor of GGS habitat that includes the canal and approximately 200-225 feet of adjacent uplands. Uplands within the linear open space/buffer area shall be managed as perennial grassland as described below. Additional aquatic habitat for GGS shall be created along the east bank of Lone Tree Canal by recontouring the bank to facilitate the growth of freshwater marsh plants.
- c. To ensure that the Project does not preclude GGS movement along Lone Tree Canal, all new road crossings of Lone Tree Canal shall be designed to minimize obstacles to GGS movement.

- d. Upland habitat within the Lone Tree Canal Reserve shall be created and managed to provide refugia for GGS during the winter dormant period. Upland habitat within the linear open space/buffer areas shall be converted to native grassland and managed, in perpetuity, as grassland habitat.
- e. Aquatic habitat shall be maintained throughout the GGS active season in Lone Tree Canal, in perpetuity. This is the legal responsibility and obligation of the MAP POA. The MAP HCP includes provisions for maintaining water in the canal such that the basic habitat requirements of the GGS are met. The MAP HCP also provides a road map, through “Changed Circumstances”, to address procedures to follow if water is not being maintained in the canal to meet these requirements. As described in the MAP HCP, the MAP is legally obligated to assure these requirements are met, and financial and procedural mechanisms are included in the MAP HCP to enforce this. It is, therefore, assumed that MAP will provide water to Lone Tree Canal, as required by the MAP HCP and ITP, in perpetuity. It is also assumed that USFWS will use all reasonable means available to it, to enforce this MAP HCP requirement. If water is not provided to Lone Tree Canal by the MAP to meet the habitat requirements of GGS as required by the MAP HCP and USFWS exhausts its enforcement responsibilities, the Project Applicant shall assume the responsibility of providing suitable GGS aquatic habitat throughout the section of Lone Tree Canal in the Lone Tree Canal Reserve. However, as stated herein, the Project Applicant shall only assume this responsibility if it has been sufficiently demonstrated to the City of Sacramento that USFWS has exhausted all reasonable means to compel MAP to comply with the relevant conditions of the MAP ITP.
- f. An 8-inch-diameter drain pipe will be installed to drain to Lone Tree Canal near the northern boundary of the Greenbriar Project Site from detention basins proposed for construction on the Greenbriar Project Site. The purpose of the drain pipe is to provide supplemental flows to Lone Tree Canal in the event that additional water is required to maintain water sufficient to support GGS during its active season. The drain pipe will include a slide gate that will be physically operated as needed. The water supply will be stormwater and/or groundwater from pumps installed as part of the project.
- g. A masonry and metal fencing barrier shall be installed between the GGS habitat linear open space/buffer area and the adjacent development on the Greenbriar Project Site to ensure that GGS do not enter the development area, and to prohibit humans and pets from entering the GGS habitat. The design of this barrier shall be subject to USFWS and CDFW review and approval. The entire length of the barrier shall be maintained on the preserve side by a nonprofit land trust to ensure that vegetation or debris does not accumulate near the barrier and provide opportunities for wildlife and pets to climb over the barrier. On the development side, CC&Rs shall prohibit accumulation of vegetation

or debris adjacent to the barrier. Chain link fencing shall be placed at both ends of the corridor, with locked gates permitting entry only by RD 1000 and NCMWC for channel maintenance, and by the preserve manager for habitat monitoring and maintenance purposes.

- h. Specific requirements associated with the barrier shall be developed through consultation with USFWS and CDFW, and may include the following and/or other specifications that CDFW and USFWS consider to be equally or more effective:
- Adequate height and below-ground depth to prevent snakes or burrowing mammals from providing a through-route for snakes by establishing burrows from one side to the other crossing;
 - Constructed using extruded concrete or block construction extending a minimum of 36-inches above ground level;
 - Maintenance to repair the barrier and to prevent the establishment of vegetation or collection of debris that could provide snakes with a climbing surface allowing them to breach the barrier;
 - A cap or lip extending at least two-inches beyond the barrier's vertical edge to prevent snakes from gaining access along the barrier's top edge; and,
 - Signage to discourage humans and their pets from entering the area.
- i. The Lone Tree Canal Reserve shall be protected in perpetuity under a conservation easement and will be managed to sustain the value of this area for GGS habitat connectivity. Compliance and biological effectiveness monitoring shall be performed and annual monitoring reports prepared. This monitoring, reporting, and adaptive management shall be performed as described in the SSMP prepared for the project in coordination with USFWS and CDFW.

On-site Avoidance and Minimization Measures

- j. The measures described below shall be implemented to avoid and minimize take of GGS during construction activities, including construction of managed marsh habitat:
- All grading activity within GGS habitat (aquatic habitat and uplands within 200 feet of aquatic habitat) shall be restricted to a period between May 1 and September 30. Because this is during the snakes' active stage, it would allow GGS to actively move away from danger and thereby reduce chances of GGS

mortality. Additionally, this restriction is timed to avoid grading during the snakes' breeding, dispersal, fall foraging and over-wintering periods, when they are most vulnerable to disturbance. If grading cannot be scheduled between May 1 and September 30, the Project Applicant shall contact the USFWS to determine whether additional measures are necessary to avoid and/or minimize take of GGS. Grading shall only occur during the period between October 1 and April 30 upon written USFWS approval.

- A qualified biologist with experience identifying GGS shall survey the construction area for GGS no more than 24 hours prior to the start of any construction activities resulting in ground disturbance or vegetation removal. If construction activities stop for a period of two weeks or more, a new GGS survey shall be completed no more than 24 hours prior to the re-start of construction activities.
- Between April 15 and September 30, all irrigation ditches, canals, or other aquatic habitat within the construction area shall be completely dewatered, with no ponded water remaining, for at least 15 consecutive days prior to the excavation or filling in of the dewatered habitat. The purpose of dewatering the aquatic habitat prior to ground disturbing activities in the aquatic habitat is to compel GGS to leave the area on their own. A qualified biological monitor shall ensure that dewatered habitat does not continue to support GGS prey, which could attract snakes into the area. Netting and salvage of prey may be necessary if a site cannot be completely dewatered.
- To minimize habitat disturbance during construction of the urban development, the Lone Tree Canal Reserve shall be bordered on the outer edge with exclusionary fencing to prevent GGS from entering the construction area (a permanent barrier will be installed with improvements at the Lone Tree Canal Reserve).
- Clearing and grading shall be confined to the minimum area necessary to facilitate construction activities as determined by a qualified biologist. Habitat that will be avoided shall be cordoned off, clearly flagged, and designated as an "Environmentally Sensitive Area" by a qualified biologist. To prevent GGS from entering the development area during construction, the exclusionary fencing protecting the Lone Tree Canal Reserve shall be erected during the GGS active season (May 1 and October 1) preceding construction when GGS are less likely to occupy upland retreats on the Greenbriar Project Site, and shall remain intact for the duration of construction. The development area side of the exclusion fence

shall be routinely monitored for any GGS that may have potentially been stranded by the fence, not finding their way through the fence into the canal. Snakes encountered should be relocated to the nearest suitable habitat off-site by a qualified biologist.

- All construction personnel shall receive worker environmental awareness training from a qualified biologist prior to commencing any construction-related activities. This training shall instruct workers on how to identify the GGS and its habitat, and what to do if a GGS is encountered during construction activities.
- A qualified biological monitor shall be present during grading activities within 200 feet of aquatic GGS habitat to ensure that construction activities do not encroach into unauthorized areas. If a live GGS is found during construction activities, the biological monitor shall immediately notify USFWS. The biological monitor shall have the authority to stop construction in the vicinity of the snake. The snake shall be monitored and given a chance to leave the area on its own. If the snake does not leave on its own within 1 working day, the biological monitor shall consult with the USFWS to determine any necessary additional measures. Any GGS mortality shall also be reported by the biological monitor within 1 working day to USFWS. Any project-related activity that results in GGS mortality shall cease so that this activity can be modified to the extent practicable to avoid future mortality.
- Upon completion of construction activities, construction debris shall be completely removed from the site. If this material is situated near existing GGS aquatic habitat, and it is to be removed between October 1 and April 30, it shall be inspected by a qualified biologist prior to removal to assure that GGS are not using it for hibernaculae or temporary refuge.
- No plastic, monofilament, jute, or similar erosion control matting that could entangle snakes shall be placed when working within 200 feet of snake aquatic or rice habitat. Possible substitutions include coconut coir matting, tactified hydroseeding compounds, or other material approved by CDFW and USFWS.
- Upon locating dead, injured or sick threatened or endangered wildlife species (Federal), the USFWS's Division of Law Enforcement and the Sacramento Fish and Wildlife Office will be notified within one working day. Written notification to both offices must be made within 3 calendar days and must include the date, time, and location of the finding of a specimen and any other pertinent information.

6.12-2: Swainson's Hawk Conservation Measures

- a. Surveys shall be conducted by a qualified biologist on and adjacent to the Greenbriar Project Site, Spangler Reserve, and any other properties associated with the Greenbriar Development Project where construction or restoration activities resulting in ground disturbance or mechanized land clearing would occur. The surveys shall be conducted consistent with the *Recommended Timing and Methodology for Swainson's Hawk Nesting Surveys in California's Central Valley* (SHTAC 2000) in the calendar year that construction is scheduled to commence.
- b. If breeding Swainson's hawks (i.e. exhibiting nest building or nesting behavior) are identified, no new disturbances (e.g., heavy equipment operation associated with construction) will occur within 0.5 mile of an active nest between March 15 and September 15, or until a qualified biologist, with concurrence by CDFW, has either determined that young have fledged or that the nest is no longer occupied, or that construction can commence with pre-cautions in place (would be determined in coordination with CDFW). Routine disturbances such as agricultural activities, commuter traffic, and routine facility maintenance activities within 0.5 mile of an active nest are not restricted.
- c. Where disturbance of a Swainson's hawk nest cannot be avoided, the nest tree may be destroyed during the non- nesting season. For purposes of this provision, the Swainson's hawk nesting season is defined as March 15 to September 15. If a nest tree (any tree that has an active nest in the year the impact is to occur) must be removed, tree removal shall only occur between September 15 and February 1.
- d. If a Swainson's hawk nest tree is to be removed and fledglings are present, the tree may not be removed until September 15 or until a qualified biologist in coordination with CDFW has determined that the young have fledged and are no longer dependent upon the nest tree.
- e. If construction or other project related activities which may disturb nesting birds are proposed within a 1/4 mile buffer zone of an active nest, intensive monitoring (funded by the Project Applicant) by a qualified biologist will be required. Exact implementation of this measure will be based on specific information at the construction area.

6.12-3: Waters of the U.S. and Waters of the State Conservation Measures

- a. Prior to Project approval, the Project Applicant shall obtain a verified wetland delineation from the USACE. Based on the results of the verified delineation, the Project Applicant shall commit to replace, restore, or enhance on a “no net loss” basis, in accordance with the USACE and the Central Valley Regional Water Quality Control Board (CVRWQCB), as appropriate for each agency’s jurisdiction, the acreage of all waters of the U.S. and wetland habitats, including “isolated” wetlands that would be removed with implementation of the Project. Wetland restoration, enhancement, and/or replacement shall be at a location and by methods acceptable to the USACE, CDFW, and CVRWQCB, as determined during the Section 404, Section 1600, and Section 401 permitting processes.
- b. The Project Applicant shall prepare and submit a habitat mitigation and monitoring plan to the USACE for the creation of jurisdictional waters at a mitigation ratio no less than 1:1 acres of created waters of the U.S., including wetlands, to each acre filled. The mitigation plans shall demonstrate how the USACE criteria for jurisdictional waters will be met through implementation. Wetland mitigation achieved through reserve establishment to benefit Covered Species can satisfy this measure if conducted in such a way that it meets both habitat function and the USACE criteria for creation of waters of the U.S. The wetland creation section of the habitat mitigation and monitoring plan shall include the following:
 - target areas for creation,
 - a complete biological assessment of the existing resources on the target areas,
 - specific creation and restoration plans for each target area,
 - performance standards for success that will illustrate that the compensation ratios are met, and
 - a monitoring plan including schedule and annual report format.
- c. The Project Applicant shall secure the following permits and regulatory approvals, as necessary, and implement all permit conditions before implementation of any construction activities associated with the Project:
 - Authorization for the fill of jurisdictional waters of the U.S. shall be secured prior to placing any fill in jurisdictional wetlands from the USACE through the Clean Water Act (CWA) Section 404 permitting process. Timing for compliance with

the specific conditions of the 404 permit shall be per conditions specified by the USACE as part of permit issuance. It is expected that the Project would require an individual permit because wetland impacts would total more than 0.5 acre. In its final stage and once approved by the USACE, the mitigation plan is expected to detail proposed wetland restoration, enhancement, and/or replacement activities that would ensure no net loss of jurisdictional wetlands function and values in the project vicinity. As required by Section 404, approval and implementation of the wetland mitigation and monitoring plan shall ensure no net loss of jurisdictional waters of the U.S., including jurisdictional wetlands. Mitigation for impacts to “isolated” wetlands shall be included in the same mitigation plan. All mitigation requirements identified through this process shall be implemented before construction begins in any areas containing wetland features.

- Prior to construction in any areas containing wetland features, the project applicant shall obtain water quality certification pursuant to Section 401 of the CWA for the project. Any measures required as part of the issuance of water quality certification shall be implemented.
 - The Project Applicant shall obtain a Streambed Alteration Agreement under Section 1600 et seq. of the California Fish & Game Code for impacts to Waters of the State as defined under Section 1602 of the California Fish & Game Code.
- d. The Project Applicant shall file a report of waste discharge with the CVRWQCB for activities affecting “isolated” waters of the state, if applicable.

6.12-4: Delta Tule Pea and Sanford’s Arrowhead Conservation Measures

- a. Before the initiation of any ground-disturbing or vegetation-clearing activities within suitable habitat, the Project Applicant shall retain a qualified botanist to conduct focused surveys for Delta tule pea and Sanford’s arrowhead. The botanist shall conduct surveys for these special-status plant species at the appropriate time of year when the target species would be in flower, and therefore, clearly identifiable. Surveys shall be conducted following the approved CDFW protocol for surveying for special-status plant species. If no special-status plants are found during focused surveys, the botanist shall document the findings in a letter report to USFWS and CDFW and no further measures shall be required.
- b. If special-status plant populations are found, the Project Applicant shall consult with CDFW to determine the appropriate mitigation measures for any population that may be affected by the Project.

- c. Special-status plants will be avoided if they occur outside of the construction limits. Fencing and signage will be placed around any avoided special-status plant(s) identifying the plant location(s) as an environmentally sensitive area that must be protected during construction. Appropriate BMPs will be implemented to protect the plants from fugitive dust, sedimentation, harmful substances, or contaminated runoff from the construction area that could harm the plants.
- d. Mitigation measures may include creation of off-site populations on project mitigation sites, through seed collection or transplanting, preserving and enhancing existing populations, or restoring or creating suitable habitat in sufficient quantities to compensate for the impact.

6.12-5: Western Burrowing Owl Conservation Measures

- a. In the calendar year that construction is scheduled to commence, surveys will be conducted by a qualified biologist to determine presence/absence of western burrowing owls and/or occupied burrows in the Greenbriar Project Site and accessible areas within 500 feet according to the CDFW's *Staff Report on Burrowing Owls* (CDFW 2012). Winter survey(s) shall be conducted between December 1 and January 31 and nesting survey(s) shall be conducted between April 15 and July 15. Pre-construction surveys shall also be conducted within 30 days prior to construction to ensure that no additional western burrowing owls have established territories since the initial surveys. If no western burrowing owls are found during any of the surveys, a letter report documenting survey methods and findings shall be submitted to CDFW, and no further mitigation will be necessary.
- b. Occupied burrows shall not be disturbed during the nesting season (February 1 through August 31) unless a qualified biologist verifies through non-invasive measures that either: 1) the birds have not begun egg-laying and incubation; or 2) that juveniles from the occupied burrows are foraging independently and are capable of independent survival.
- c. If nest sites are found, the USFWS and CDFW shall be contacted regarding suitable mitigation measures, which may include a 300 foot buffer from the nest site during the breeding season (February 1 - August 31), or a relocation effort for the burrowing owls if the birds have not begun egg-laying and incubation or the juveniles from the occupied burrows are foraging independently and are capable of independent survival. If on-site avoidance is required, the location of the buffer zone will be determined by a qualified biologist. The developer shall mark the limit of the buffer zone with yellow caution tape,

stakes, or temporary fencing. The buffer will be maintained throughout the construction period.

- d. If relocation of the owls is approved for the site by CDFW, the developer shall hire a qualified biologist to prepare a plan for relocating the owls to a suitable site. The relocation plan must include: (a) the location of the nest and owls proposed for relocation; (b) the location of the proposed relocation-site; (c) the number of owls involved and the time of year when the relocation is proposed to take place; (d) the name and credentials of the biologist who will be retained to supervise the relocation; (e) the proposed method of capture and transport for the owls to the new site; (f) a description of the site preparations at the relocation-site (e.g., enhancement of existing burrows, creation of artificial burrows, one-time or long-term vegetation control, etc.); and (g) a description of efforts and funding support proposed to monitor the relocation. Relocation options may include passive relocation to another area of the site not subject to disturbance through one way doors on burrow openings, or construction of artificial burrows in accordance CDFW guidelines.
- e. Where on-site avoidance is not possible, disturbance and/or destruction of burrows shall be offset through development of suitable habitat on the Project's reserves. Such habitat shall include creation of new burrows with adequate foraging area (a minimum of 6.5 acres or 300 feet radii) around the newly created burrows. This habitat (created burrows and associated foraging habitat) will be protected and managed in perpetuity as burrowing owl habitat according to guidelines established in the Site Specific Management Plan for the reserve. Management activities in the burrowing owl habitats on the reserve shall include but are not limited to 1) vegetation management (grazing, mowing, burning), management of ground squirrels and other fossorial mammals, semi-annual and annual artificial burrow cleaning and maintenance (if applicable), control of non-native weeds and wildlife potentially detrimental to burrowing owls, and trash removal.

6.12-6: Western Pond Turtle Conservation Measures

- a. All construction personnel shall receive worker environmental awareness training from a qualified biologist prior to commencing any construction-related activities. This training shall instruct workers on how to identify the western pond turtle and its habitat, and what to do if a western pond turtle is encountered during construction activities.
- b. A pre-construction survey will be conducted for nesting pond turtle by a qualified biologist. If nesting areas for pond turtles are identified within the survey limits, a buffer area of 300 feet shall be established between the nesting site and the aquatic habitat (e.g.

canal or ditch) located near the nesting site. The buffer shall be indicated by temporary fencing if construction has or will begin before the nesting period has ended (the period from egg laying to emergence of hatchlings is normally April to November). Any western pond turtles observed in the survey limits will be reported to the CNDDDB.

- c. A qualified biological monitor(s) will be present during any dewatering of the canals to relocate any western pond turtles in the canals to suitable habitat up or downstream of the area of disturbance. Prior to dewatering, CDFW will be notified of the intent to conduct western pond turtle monitoring and potential relocation. If western pond turtle is encountered in the construction area during dewatering activities, work shall be halted until the individual has left the work area on its own or been relocated by a qualified biologist.
- d. Additionally, as stated in the avoidance and minimization measures for GGS, between April 15 and September 30, all irrigation ditches, canals, or other aquatic habitat within the construction area shall be completely dewatered, with no ponded water remaining, for at least 15 consecutive days prior to the excavation or filling in of the dewatered habitat. The purpose of dewatering the aquatic habitat prior to filling is to compel turtles to leave the area on their own. A qualified biological monitor shall ensure that dewatered habitat does not continue to support suitable prey which could attract turtles into the area. Netting and salvage of prey may be necessary if a site cannot be completely dewatered.

6.12-7: Loggerhead Shrike Conservation Measures

On-site Avoidance and Minimization Measures

- a. If construction begins during the breeding season for loggerhead shrikes (March 1 to July 31), pre-construction surveys for loggerhead shrike shall be conducted by a qualified biologist on the Greenbriar Project Site, Spangler Reserve, and any other proposed construction/restoration areas (involving ground disturbance or vegetation removal) as well as on publicly accessible land within 500 feet of those sites (and on private land if permission is granted by the land owner). The pre-construction surveys will be conducted by a qualified biologist within two weeks prior to commencement of construction to determine presence/absence of nesting loggerhead shrike. If surveys determine loggerhead shrikes are present, the following measures shall be implemented to avoid disturbance to occupied nests during the nesting season:
 - A boundary shall be marked by brightly colored construction fencing that establishes a buffer zone a minimum of 100 feet from the active nest. No project-related disturbance shall occur within the fenced, 100-foot buffer during the

nesting season (March 31 to July 31) or until the young have fledged and are no longer dependent on the nest as determined by a qualified biologist.

6.12-8: VELB Conservation Measures

- a. The elderberry shrub on the Greenbriar Project Site will be transplanted when the plant is dormant, approximately November through the first two weeks in February, after it has lost its leaves. The following transplanting procedure shall be followed:
 - The plant will be cut back 3 to 6 feet from the ground or to 50 percent of its height (whichever is taller) by removing branches and stems above this height. The trunk and all stems measuring 1 inch or greater in diameter at ground level will be replanted. Any leaves remaining on the plant will be removed.
 - A hole will be excavated of adequate size to receive the transplant.
 - The plant will be excavated using a Vermeer™ spade, backhoe, front end loader, or other suitable equipment, taking as much of the root ball as possible, and will be replanted immediately at the designated location. The plant will only be moved by the root ball. The root ball will be secured with wire and wrapped with damp burlap. The burlap will be dampened as necessary to keep the root ball wet. Care will be taken to ensure that the soil is not dislodged from around the roots of the transplant. Soil at the transplant site will be moistened prior to transplant if the soil at the site does not contain adequate moisture.
 - The planting area will be at least 1,800 square feet for the elderberry transplant. The root ball will be planted so that its top is level with the existing ground. Soil will be compacted sufficiently so that settlement does not occur. As many as five additional elderberry plantings (cuttings or seedlings) and up to five associated native species plantings may also be planted within the 1,800 square foot area with the transplant. The transplant and each new planting will have its own watering basin measuring at least three feet in diameter. Watering basins should have a continuous berm measuring approximately eight inches wide at the base and six inches high.
 - The soil in the planting location will be saturated with water. Fertilizers or other supplements will not be used, as the effects of these compounds on the beetle are unknown.

6.12-9: Tri-colored Blackbird Conservation Measures

- a. If construction begins during the nesting season for tri-colored blackbirds (May 15 to July 31), pre-construction surveys will be conducted by a qualified biologist within two weeks prior to commencement of construction to determine presence/absence of tri-colored blackbird nests within the Greenbriar Project Site, Spangler Reserve, and any other proposed construction/restoration areas (involving ground disturbance or vegetation removal) as well as on publicly accessible land within 500 feet of those sites (and on private land if permission is granted by the land owner). If surveys determine tri-colored blackbirds are present, the following measures shall be implemented to avoid disturbance to occupied nesting colonies during the nesting season:
 - A boundary shall be marked by brightly colored construction fencing that establishes a buffer zone a minimum of 500 feet from the active colony. No project-related disturbance shall occur within the 500 foot fenced buffer area during the nesting season to July 31, or while birds are present.
 - A qualified biologist must determine the young tri-colored blackbirds have fledged and nest sites are no longer active before the nest site may be disturbed.
- b. If construction commences outside of the nesting season (August 1 to May 14), no avoidance and minimization measures are necessary.

6.12-10: Aleutian Canada Goose Conservation Measures

Precautionary measures will be implemented consistent with measures included in the NBHCP to avoid potential impacts to foraging Aleutian Canada geese if they are present during ground disturbance or vegetation disturbance/removal associated with construction or restoration activities on the Greenbriar Project Site, Spangler Reserve, or any other properties associated with the Greenbriar Development Project.

- a. A pre-construction survey for Aleutian Canada geese shall be conducted within two weeks prior to beginning construction if construction is scheduled to commence during the time of year that this species would be present in the Basin (October 1 through May 15). If Aleutian Canada geese are identified, CDFW should be consulted regarding the appropriate avoidance and minimization measures to avoid impacts to this species. Such measures shall be appropriate for the use (e.g. foraging, roosting, etc.) and activity of the species, since this species is a seasonal visitor to the Basin. Measures may include postponing the start of construction until the birds have left on their own accord, or implementing deterrents to encourage the birds to leave the site on their own accord.

6.12-11: General Nesting Bird Conservation Measures

- a. The following avoidance and minimization measures shall be implemented prior to site disturbance to avoid impacts to nesting raptors and other birds on the project sites or immediately adjacent properties. This is a general nesting bird protection measure. Specific measures for special-status bird species are listed individually.
- In order to avoid impacts to nesting birds, a nesting survey shall be conducted within the Greenbriar Project Site, Spangler Reserve, and/or any other sites as needed prior to commencing with earth-moving or construction work if this work would occur during the typical nesting season (between February 1 and August 31).
 - The nesting survey shall include examination of all areas on or within 300 feet of the entire site, not just trees slated for removal, since ground vibrations and noise from earth-moving equipment can disturb nesting birds and potentially result in nest abandonment. Areas within 300 feet of the site shall be surveyed on foot if accessible or from within the site or publicly accessible areas by scanning the surrounding land with the aid of binoculars.
 - If nesting birds are identified during the surveys, CDFW shall be notified to determine the appropriate buffer, orange construction fence shall be installed to establish a 300-foot radius around the nest unless a qualified biologist determines that a lesser distance will adequately protect the nest (refer to discussion below for more detail). If the tree or nest is located off the site, then the buffer shall be demarcated per the above where the buffer intersects the site.
 - The size of the non-disturbance buffer may be altered if a qualified biologist conducts behavioral observations and determines the nesting birds are well acclimated to disturbance. If this occurs, the biologist shall prescribe a modified buffer that allows sufficient room to prevent undue disturbance/harassment to the nesting birds. If the buffer is reduced, the qualified biologist shall remain on site to monitor the behavior of the nesting birds during construction in order to ensure that the reduced buffer does not result in take of eggs or nestlings.
 - No construction or earth-moving activity shall occur within the established buffer until it is determined by a qualified biologist that the young have fledged (are no longer dependent on the nest or the adults for feeding) and have attained sufficient flight skills to avoid project construction zones. This typically occurs by August 31. This date may be earlier or later, and shall be determined by a

qualified biologist. If a qualified biologist is not hired to monitor the nesting raptors then the full 300-foot buffer(s) shall be maintained in place from February 1 through the month of August. The buffer may be removed and work may proceed as otherwise planned within the buffer on September 1.

Appendix G

Assessment of Avoidance and Minimization of Construction-Related Effects and Human-Wildlife Conflicts

Appendix G - Assessment of Avoidance and Minimization of Construction-Related Effects and Human-Wildlife Conflicts

This Effects Analysis evaluates the overall effect of the proposed Greenbriar Development Project on the viability of species covered by the NBHCP, on the effectiveness of the NBHCP conservation strategy, and on the attainment of the goals and objectives of the NBHCP.

The NBHCP includes goals and objectives that address avoidance and minimization of direct impacts and of human wildlife conflicts. These are listed below.

Overall Goal 4. Ensure that direct impacts of Authorized Development upon Covered Species are avoided or minimized to the maximum extent practicable. (NBHCP, page I-16)

Overall Objective 1. Minimize conflicts between wildlife and human activities, including conflicts resulting from airplane traffic, roads and automobile traffic, predation by domestic pets, and harassment by people. (NBHCP, page I-16).

To attain this goal and this objective, the NBHCP includes a set of avoidance and minimization measures to be implemented where applicable. The following section evaluates the potential for the Greenbriar Development Project to reduce the effectiveness or impact the implementation of such measures in the NBHCP.

EFFECTIVENESS OF NBHCP MEASURES WITH THE PROPOSED GREENBRIAR DEVELOPMENT PROJECT

For each of the NBHCP's land use agency's conservation measures, the potential for the Greenbriar Development Project to reduce the measure's effectiveness as a means of avoiding or minimizing construction-related effects or human-wildlife conflicts was evaluated. The Greenbriar Development Project would not alter the effectiveness of any of these measures. Most of these NBHCP measures are seasonal avoidance or exclusion zone measures based on the ecology of the species and the nature of construction activities. Because no individual construction project alters this basis, there are few means by which one construction project could affect the effectiveness of these measures. For example, the effectiveness of pre-construction surveys for a particular species is largely unaffected by the extent or location of development. Similarly, the effectiveness of requiring that developers consult with the USFWS regarding NBHCP Covered Species observed during pre-construction surveys also is unaffected by development on other sites. Similarly, the ability to apply these measures to a development project in general would not be altered by the effects of another development project.

It is possible, however, that by fragmenting habitat, a development project can create barriers to animal movement to and from a future development site. In this instance, the effectiveness

measures that reduce construction-caused mortality by allowing animals to leave construction sites would likely be reduced because animals may no longer be able to move to habitat outside of the construction site. For example, NBHCP land use agency conservation measure 5.a. *Measures to Reduce Take of GGS* is intended in part to increase the movement of GGS off of construction sites (NBHCP page V-7). If a construction site is isolated from other GGS habitat, these measures would be ineffective. The Greenbriar Development Project is not more likely to cause this set of circumstances than are projects permitted by the NBHCP. The Greenbriar Project Site is isolated from the development authorized by the NBHCP by I-5 and SR 99/70, and development of the Greenbriar Project Site therefore would not reduce the connectivity of areas authorized for development by the NBHCP to habitat in the remainder of the Natomas Basin.

The assessment of all of the land use agency's conservation measures (measures that relate to project's approved by the City of Sacramento and Sutter County) in the NBHCP is summarized below.

MEASURES FOR PRE-CONSTRUCTION SURVEYS

The effectiveness of pre-construction surveys is based on each species' ecology and on the attributes of the site being surveyed and the biologist's conduct of the survey. The Greenbriar Development Project would not affect this basis of the effectiveness of pre-construction surveys, nor would it affect the ability to implement pre-construction surveys for development authorized by the NBHCP.

MEASURE FOR PRESERVATION OF THE AREA ADJACENT TO FISHERMAN'S LAKE

This measure consists of the City of Sacramento agreeing to initiate a North Natomas Community Plan amendment to potentially widen the agricultural buffer along the City side of Fisherman's lake to 800 feet wide. None of the properties associated with the Greenbriar Development Project are in or adjacent to this zone. The Greenbriar Development Project also would not otherwise affect the City's initiation of an amendment to potentially widen an agricultural buffer at this site.

GENERAL MEASURES TO MINIMIZE TAKE

The NBHCP includes four general measures to minimize take. These measures are to 1) protect large trees, 2) incorporate native plants into buffers, developed areas and parks, 3) schedule construction activities to avoid the raptor nesting season, and 4) conduct pre-construction surveys at an appropriate time of year. The Greenbriar Development Project would not affect the ability to implement these measures, but development at the Greenbriar Project Site might affect the habitat value of protected trees or native vegetation incorporated into landscaping.

In general, additional development could affect the value for wildlife of preserved trees and natural vegetation incorporated into landscaping by increasing the isolation of these features from natural or agricultural vegetation that provides habitat. To do so, additional development would have to reduce connectivity between the preserved tree or native vegetation inside a developed area and habitat outside of the developed area. Because I-5 and SR 99/70 already separate the Greenbriar Project Site from the development authorized by the NBHCP in the City of Sacramento, this potential effect would be limited to possible consequences for Swainson's hawks nesting in a preserved tree within the City of Sacramento adjacent to the Greenbriar Project Site. While this effect is conceivable, no Swainson's hawk nests are known within 1 mile to the east of the site, and a future nest in this portion of the City of Sacramento is unlikely and would have limited access to foraging habitat even if the Greenbriar Project Site remains undeveloped.

MEASURES TO MINIMIZE TAKE OF VERNAL POOL SPECIES

Seasonal wetlands occur on the Greenbriar Project Site that provide marginal habitat for covered vernal pool branchiopods. However, vernal pool branchiopods were not detected during USFWS protocol surveys on the Greenbriar Project Site, the Greenbriar Development Project would not affect vernal pool habitat, is not near vernal pool habitat, and would not affect the ability to implement the measures in the NBHCP. Therefore, the Greenbriar Development Project would not alter the effectiveness of measures for minimizing the take of vernal pool-associated species or alter the effectiveness of these measures.

MEASURES TO REDUCE TAKE FOR INDIVIDUAL SPECIES

MEASURES TO REDUCE TAKE OF GGS

The NBHCP includes twelve measures to reduce take of GGS by construction activities. Construction of the proposed Greenbriar Development Project will not reduce the effectiveness of these measures at sites authorized for development by the NBHCP. These measures include a seasonal restriction on site preparation and grading, pre-construction surveys, dewatering of canals prior to excavation, minimization of grading, construction monitoring, a restriction on the use of materials that could entangle GGS, and measures for fences and barriers along the North Drainage Canal and the East Drainage Canal to restrict the movement of GGS into adjacent development.

The effectiveness of seasonal restrictions, preconstruction surveys and of restrictions on materials that could entangle snakes are based on the ecology of GGS, site attributes, how the survey is conducted, and the nature of construction activities. Individual construction projects, including construction at the Greenbriar Project Site, would not alter this basis, or otherwise affect the effectiveness of these measures.

Measures such as dewatering of canals or halting development when a construction monitor locates a GGS on-site would not be affected by other development projects. On the other hand, if another development project were to fragment habitat and thus reduce the ability of a snake to move from a construction site to suitable habitat off-site, then the effectiveness of these measures would be reduced. Development at the Greenbriar Project Site is not likely to cause this situation for development projects authorized by the NBHCP. The Greenbriar Project Site is isolated from the development authorized by the NBHCP by I-5 and SR 99/70, and development of the Greenbriar Project Site therefore would not reduce the connectivity of areas authorized for development by the NBHCP to habitat in the remainder of the Natomas Basin. Thus, the effectiveness of these measures would not be reduced.

The Greenbriar Project Site is not adjacent to the North Drainage Canal or the East Drainage Canal. Therefore, it is unlikely to affect the effectiveness of measures for fences and barriers along these waterways.

MEASURES TO REDUCE TAKE OF SWAINSON'S HAWK

The NBHCP includes a measure to reduce cumulative effects on Swainson's hawk foraging habitat, five measures to reduce disturbance of nest trees, and seven measures to prevent or mitigate the loss of nest trees.

The measure to reduce cumulative effects established a 1 mile-wide Swainson's Hawk Zone along the Sacramento River within which there would be no development. This zone was established because Swainson's hawk nests are concentrated along the Sacramento River. The Moody Reserve would be beneficial for the implementation of this measure because it is within the Swainson's Hawk Zone and would preserve important foraging habitat. The remainder of the properties associated with the Greenbriar Development Project are not in or adjacent to this zone, and thus would not alter its effectiveness.

The measures to reduce disturbance of nest trees are based on the ecology of Swainson's hawk and the nature of construction activities; this basis would not be altered by the Greenbriar Development Project. The Greenbriar Development Project also would not affect the ability to implement these measures.

MEASURES TO REDUCE TAKE OF VELB

These measures include the avoidance of VELB habitat, and measures for the transplanting of elderberry bushes and for the planting and monitoring of elderberry bushes. The Greenbriar Development Project would not affect the ability of projects authorized by the NBHCP to avoid, transplant, plant, or monitor elderberry bushes, nor would it affect the effectiveness of those measures for reducing the take of VELB.

MEASURES TO REDUCE TAKE OF TRI-COLORED BLACKBIRD

Measures for pre-construction surveys and exclusion zones around nesting colonies are included in the NBHCP as measures to reduce the take of tri-colored blackbird. The Greenbriar Development Project would not affect the ability to conduct pre-construction surveys or establish exclusion zones at construction sites in areas that were authorized for development by the NBHCP.

MEASURES TO REDUCE TAKE OF ALEUTIAN CANADA GOOSE

Measures for pre-construction surveys and consultation with USFWS and CDFW (if Aleutian Canada goose is present) are included in the NBHCP as measures to reduce the take of Aleutian Canada goose. The Greenbriar Development Project would not affect the ability to conduct pre-construction surveys at construction sites in areas that were authorized for development by the NBHCP or to consult with USFWS or CDFW if Aleutian Canada goose is present.

MEASURES TO REDUCE TAKE OF WHITE-FACED IBIS

Measures for pre-construction surveys and a seasonal restriction on construction activities within one quarter mile of active nests were included in the NBHCP. The Greenbriar Development Project would not affect the ability to conduct pre-construction surveys at construction sites in areas that were authorized for development by the NBHCP or to seasonally restrict construction at sites authorized for development by the NBHCP.

MEASURES TO REDUCE TAKE OF LOGGERHEAD SHRIKE

Measures for pre-construction surveys and exclusion zones around active nests are included in the NBHCP as measures to reduce the take of loggerhead shrike. The Greenbriar Development Project would not affect the ability to conduct pre-construction surveys or establish exclusion zones at construction sites in areas that were authorized for development by the NBHCP.

MEASURES TO REDUCE TAKE OF WESTERN BURROWING OWL

Several measures to reduce the take of western burrowing owls are included in the NBHCP. These measures include pre-construction surveys, establishment of exclusion zones, seasonal restrictions on the disturbance of occupied nests, relocation of owls, and mitigation for disturbed nests. The Greenbriar Development Project would not affect the ability to conduct preconstruction surveys, restrict activities, or establish exclusion zones at construction sites in areas that were authorized for development by the NBHCP. The Greenbriar Development Project also would not affect the feasibility or potential benefits of relocating owls or of

mitigating effects on western burrowing owls. Therefore, the Greenbriar Development Project would not affect the effectiveness of measures for reducing the take of western burrowing owl.

MEASURES TO REDUCE TAKE OF BANK SWALLOW

Pre-construction surveys and establishment of an exclusion zone (if a bank swallow colony is present) are included in the NBHCP as measures to reduce the take of bank swallow. No bank swallow habitat is present on any of the properties associated with the Greenbriar Development Project. The Greenbriar Development Project would not affect the ability to conduct pre-construction surveys or establish exclusion zones at construction sites in areas that were authorized for development by the NBHCP.

MEASURES TO REDUCE TAKE OF WESTERN POND TURTLE

The only measure included in the NBHCP to reduce take of western pond turtle is the canal dewatering requirement that was included for GGS. The Greenbriar Development Project would not affect the dewatering of canals in areas authorized for development by the NBHCP, or the ability of animals to move from dewatered canals to suitable habitat off-site. The Greenbriar Project Site is only directly connected to areas authorized for development through the Lone Tree Canal crossing of I-5, and the ability of turtles to use this crossing and to move up Lone Tree Canal would not be reduced by development at the Greenbriar Project Site.

MEASURES TO REDUCE TAKE OF CALIFORNIA TIGER SALAMANDER

No California tiger salamander habitat is present on or adjacent to any of the properties associated with the Project. The Greenbriar Development Project would not affect California tiger salamander habitat, is not near California tiger salamander habitat, and would not affect the ability to implement the measures in the NBHCP. Therefore, the Greenbriar Development Project would not alter the effectiveness of measures for minimizing the take of California tiger salamander.

MEASURES TO REDUCE TAKE OF WESTERN SPADEFOOT TOAD

No western spadefoot toad habitat is present on any of the properties associated with the Project. The Greenbriar Development Project would not affect western spadefoot toad habitat, is not near western spadefoot toad habitat, and would not affect the ability to implement the measures in the NBHCP. Therefore, the Greenbriar Development Project would not alter the ability to implement measures for minimizing the take of western spadefoot toad.

MEASURES TO REDUCE TAKE OF VERNAL POOL FAIRY SHRIMP, VERNAL POOL TADPOLE SHRIMP, AND MIDVALLEY FAIRY SHRIMP

Several measures to reduce the take of covered vernal pool branchiopods are included in the NBHCP. These measures include a species-specific biological assessment, avoidance and minimization measures, preservation of intact undisturbed vernal pools that contain slender orcutt grass, Sacramento orcutt grass, Colusa grass, or vernal pool tadpole shrimp, and potentially compensatory mitigation. The Greenbriar Development Project would not affect vernal pools and would not affect the ability to implement the measures in the NBHCP. The Greenbriar Development Project would not alter the effectiveness of measures for minimizing the take of vernal pool fairy shrimp, vernal pool tadpole shrimp, and midvalley fairy shrimp associated with development authorized by the NBHCP.

MEASURES TO REDUCE TAKE OF DELTA TULE PEA

The NBHCP includes a pre-construction survey and the opportunity to transplant any Delta tulle pea located during the survey as measures to reduce take of Delta tulle pea. The Greenbriar Development Project would not affect the ability to conduct pre-construction surveys of sites authorized for development by the NBHCP, or to transplant Delta tulle pea to suitable habitat elsewhere. Therefore, the Greenbriar Development Project would not affect the effectiveness of these measures at reducing take of Delta tulle pea.

MEASURES TO REDUCE TAKE OF SANFORD'S ARROWHEAD

The NBHCP includes a pre-construction survey and the opportunity to transplant any individuals located during the survey as measures to reduce take of Sanford's arrowhead. The Greenbriar Development Project would not affect the ability to conduct pre-construction surveys of sites authorized for development by the NBHCP, or to transplant Sanford's arrowhead to suitable habitat elsewhere. Therefore, the Greenbriar Development Project would not affect the effectiveness of these measures at reducing take of Sanford's arrowhead.

MEASURES TO REDUCE TAKE OF BOGGS LAKE HEDGE-HYSSOP, SACRAMENTO ORCUTT GRASS, SLENDER ORCUTT GRASS, COLUSA GRASS, AND LEGENERE

The Greenbriar Development Project would not affect habitat for these vernal pool-associated plant species, is not near vernal pool habitat, and would not affect the ability to implement the measures in the NBHCP for minimizing the take of these species. Therefore, the Greenbriar Development Project would not alter the effectiveness of these measures.

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**Appendix H
Giant Garter Snake Habitat, Greenbriar Property,
Sacramento. Prepared by Berryman Ecological**



BERRYMAN
Ecological

PO Box 28, Weimar, CA 95736

Ellen@BerrymanEcological.com (530) 878-3660

October 4, 2010

Mark Enes
AKT Development Corporation
7700 College Town Road
Sacramento, CA 95826

Re: Giant Garter Snake Habitat, Greenbriar Property, Sacramento,

Dear Mr. Enes:

Berryman Ecological conducted an assessment on the Greenbriar site in 2010 to re-evaluate the location and extent of existing habitat for the state and federally listed giant garter snake (*Thamnophis gigas*). This letter report provides background information related to the habitat assessment, and describes the assessment methods and results.

BACKGROUND

The Greenbriar site consists of approximately 577 acres of land in Sacramento County, California (**Figure 1**). The site is currently in agricultural use, with dry farmed wheat. A portion of this site was in rice cultivation until 2002: with repeated flooding during rice farming, the site supported aquatic habitat for the giant garter snake. The site has not been flood irrigated since 2002. A site assessment conducted by Berryman Ecological in 2006 revealed that some of the ditches and a pond associated with an abandoned racetrack on the site still supported aquatic habitat for giant garter snake, but based on the presence of stands of dying hydrophytic vegetation, it appeared that the site was becoming progressively drier. The site was therefore re-evaluated in 2010 to assess whether the extent of giant garter snake habitat had changed since the 2006 assessment.

METHODS

A field assessment was conducted on September 1 and 2, 2010, to update mapping conducted in 2006. The methods used for mapping giant garter snake habitat were the same for both the 2010 and the 2006 assessment. Features evaluated to identify giant garter snake habitat included all ditches/canals and wetlands appearing on the February 2006 wetland delineation and the August 2006 supplemental delineation prepared by Foothill Associates. The features on the site were assessed for the presence of the following:

- Sufficient standing or slow moving water to supply cover and food such as small fish and amphibians during the snake's active season;
- Emergent, aquatic vegetation;
- Vegetated banks that provide sufficient basking sites; and
- Subterranean retreats (burrows, holes, or crevices/cracks) on banks and in adjacent uplands.

Though the features were evaluated for all of the four criteria, the primary factor in determining suitability was the presence/absence of sufficient water. Features that lacked standing or slow moving water late in the season (early September 2005) but possessed aquatic vegetation indicative of prolonged inundation, were considered to provide marginal habitat for giant garter snake. This marginal habitat provides aquatic habitat for only a portion of the snake's active season. Those features that lacked water or emergent, aquatic vegetation were considered unsuitable for GGS.

RESULTS

As a result of the 2010 survey, 3.21 acres of suitable aquatic habitat and 32 acres of adjacent upland habitat within 200 feet of aquatic habitat were mapped on the Greenbriar site (**Figure 2**). As of September, 2010, the existing aquatic habitat consists of Lone Tree Canal (**Figures 3 and 4**), a spur running easterward from Lone Tree Canal where it enters the culvert under Interstate 5 (**Figure 5**), and a section of a drainage ditch perpendicular to Lone Tree Canal (**Figure 6 and 7**). Features that had been mapped as giant garter snake aquatic habitat during the 2006 assessment and no longer appear to hold water for sufficient duration to provide aquatic habitat include the Old Racetrack Pond (**Figures 8 and 9**), the eastern channel (**Figures 10 and 11**), Ditch 2 (**Figure 12 and 13**), and Ditch 3 (**Figure 14**).

With the proposed Greenbriar project, 0.18 acre of aquatic habitat and 5.00 acre of adjacent upland would be permanently impacted (**Figure 2**). Additionally, approximately 0.18 acre of aquatic habitat and 2.00 acres of adjacent upland habitat would be temporarily impacted through installation of infrastructure.

HABITAT VALUE

Lone Tree Canal and the "spur" running eastward from the canal's Interstate 5 undercrossing provide good quality aquatic habitat for giant garter snake. Giant garter snakes could move into adjacent upland habitat from this aquatic habitat during the period from late March through early October. In October, giant garter snakes may establish themselves in soil cracks or burrows for hibernation, although snakes would not likely be able to persist beyond fall ground preparation (disking, landplaning) for wheat farming.

The extent to which giant garter snakes use the irrigation ditches onsite depends on the duration of irrigation. Wheat requires little if any irrigation: if it is irrigated, this would typically take place in April and sometimes the first week in May, and involve flooding the fields once or twice from head ditches for a period of 12-24 hours per set. This extent of irrigation would

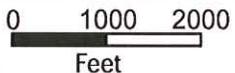
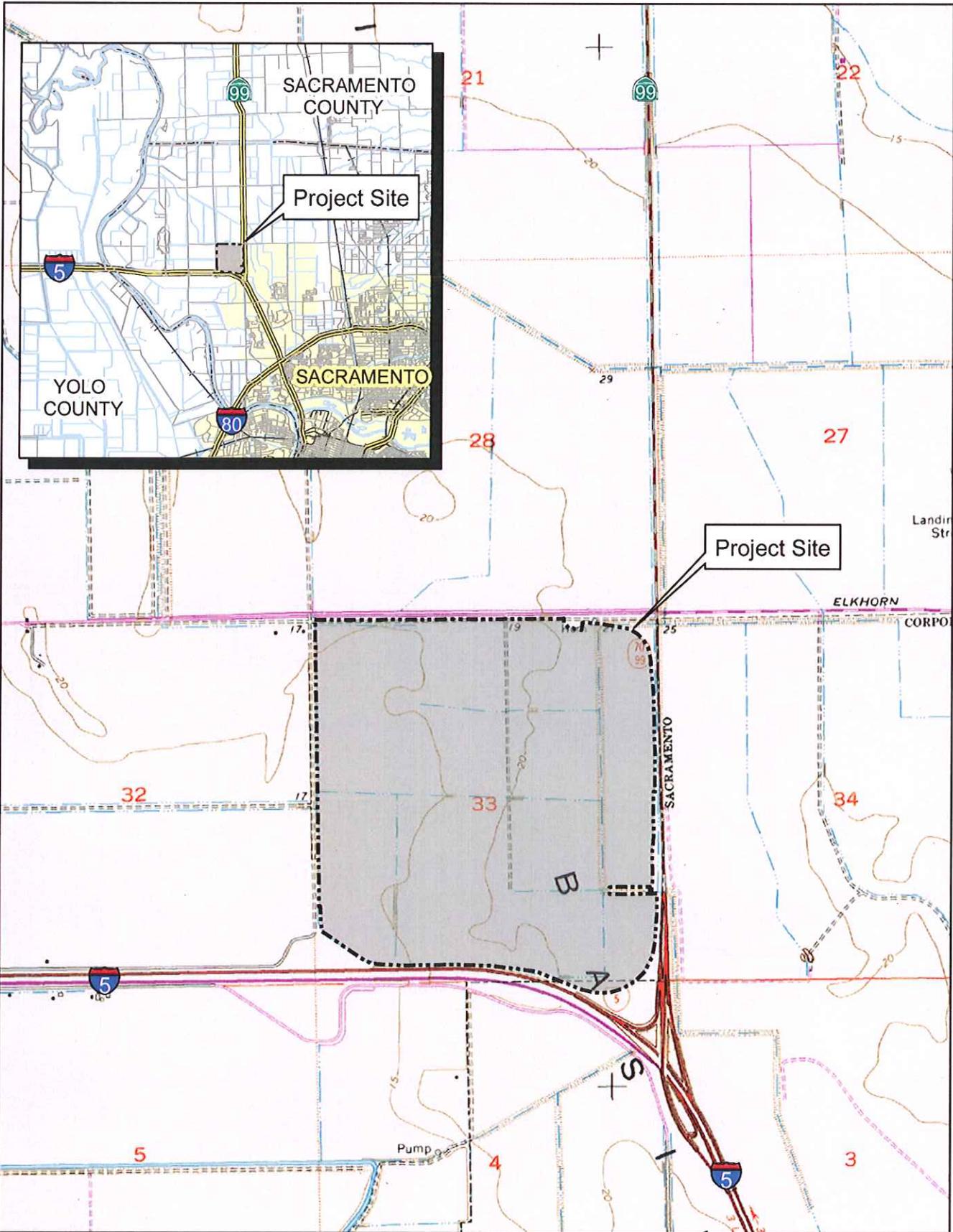
not be sufficient for an aquatic prey base to establish, and is therefore unlikely to attract giant garter snakes: if any snakes were to move into the irrigation ditches from the adjacent canals, it would likely be for only a very brief period during the irrigation. The one exception would be the segment of drainage ditch perpendicular to Lone Tree Canal that was found to support aquatic habitat during the most recent field investigation. The source of water in this segment is unclear, and it is uncertain whether this aquatic habitat persists from year to year.

Although aquatic habitat is present along the periphery of the property, the interior wheat fields provide very little if any habitat value for the snakes. Giant garter snakes may move into these fields (most likely within 200 feet of aquatic habitat), but annual disking or land-leveling prevents the establishment of an abundance of rodent burrows for giant garter snake refuge. The soil cracks may provide temporary refuge for these snakes, but snakes are unlikely to persist in these areas due to ground preparation, disking, and harvesting activities.

This concludes the letter report assessing giant garter snake habitat for the Greenbriar property. If you have any questions, please feel free to contact me at (530) 878-3660.

Sincerely,


Ellen Berryman
Berryman Ecological

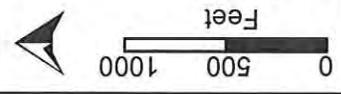


Site and Vicinity

Figure 1

Date: 06/23/05
 Rev: 1
 Tech: ARMB

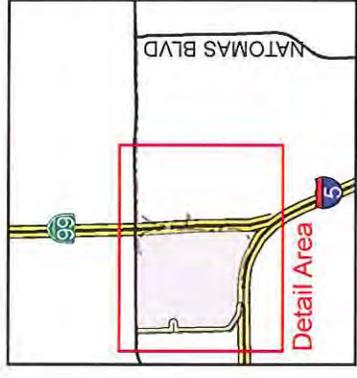
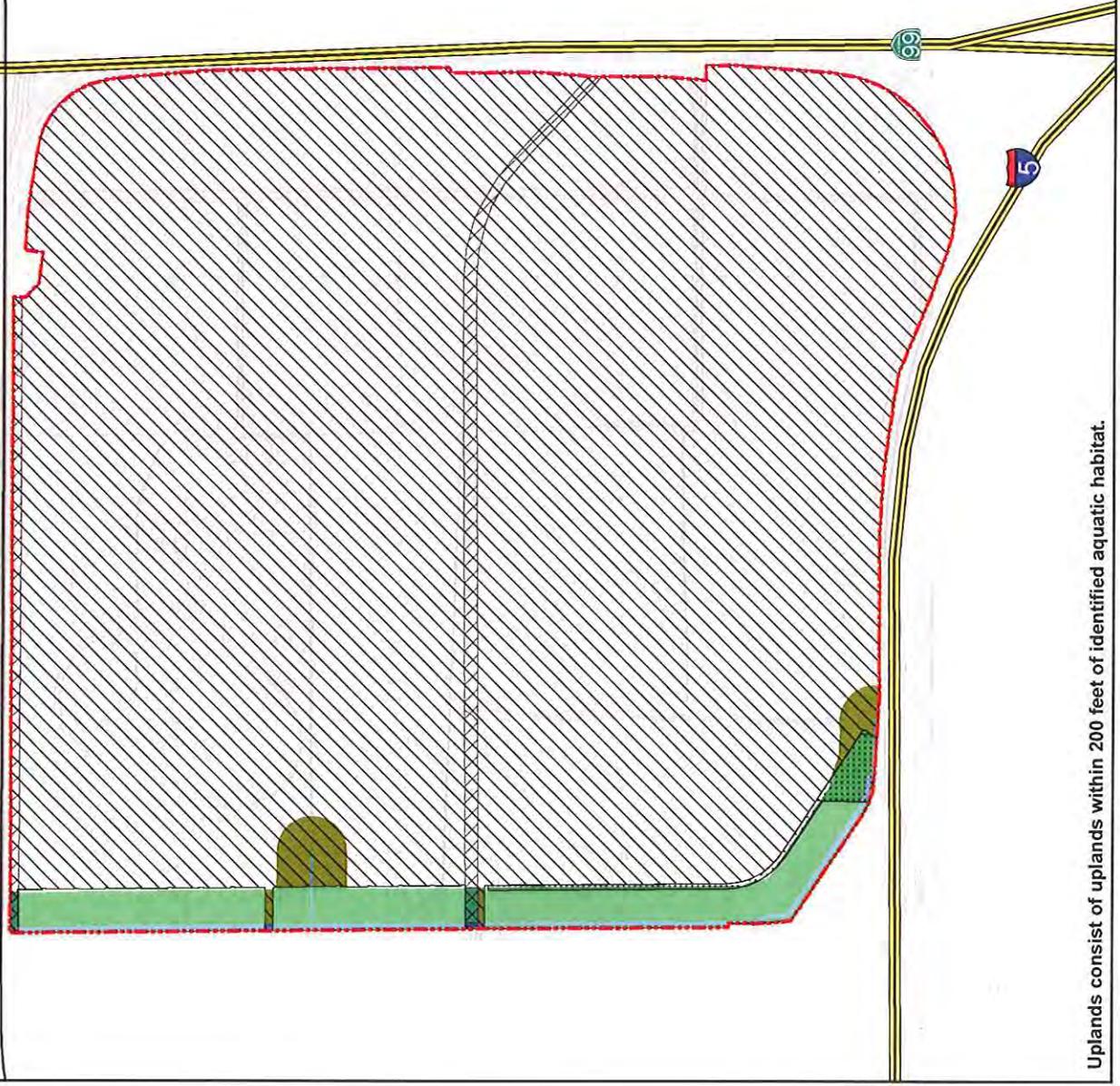
Source: Taylor Monument USGS DRG provided by Maptech.



GGs Habitat Impacts
Greenbriar

Date: 09/05/2010
Tech: ARMB/JCN

ELKHORN BLVD



Project Site	
Areas of Temporary Disturbance	
Permitted Under MAP HCP	
Development Area	
Giant Garter Snake Habitat	
Type	Acreage
Temporary Impacts	
Aquatic	0.18
Upland	2.00
Permanent Impacts	
Aquatic	0.18
Upland	5.00
MAP HCP	
Aquatic	0.04
Upland	1.00
Open Space	
Aquatic	
Upland	

Uplands consist of uplands within 200 feet of identified aquatic habitat.

Source: Digital base data provided by Wood Rodgers, Wetland delineation data provided by Foothill Associates, GGS habitat survey provided by Howe Biological Consulting.



Figure 3: Lone Tree Canal and Interstate 5



Figure 4: Lone Tree Canal



Figure 5: Lone Tree Canal spur (east of I-5 culvert)



Figure 6: Ditch #1 with aquatic habitat



Figure 7: Ditch #1 with aquatic habitat

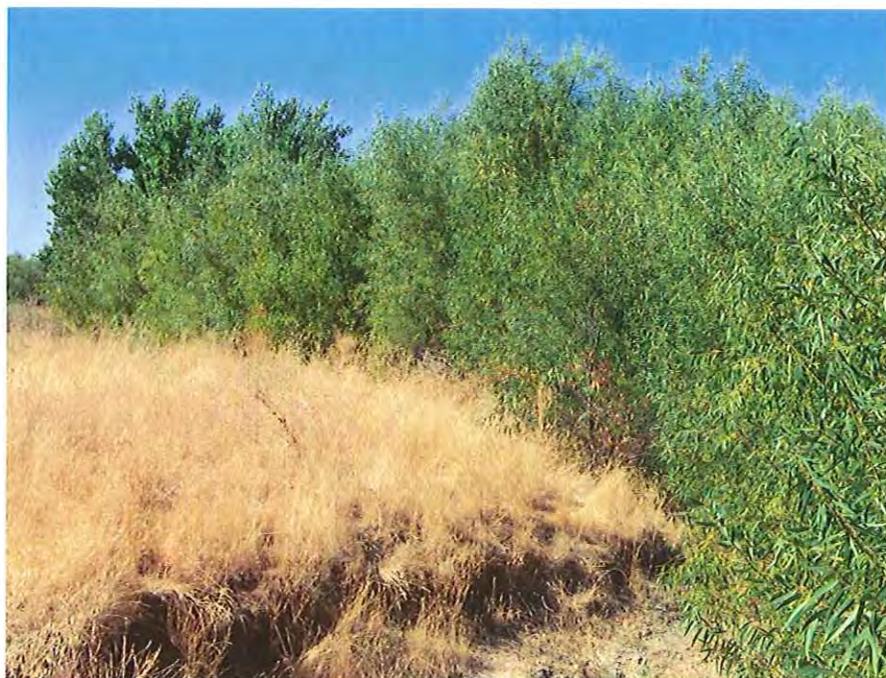


Figure 8: Old Racetrack Pond. No aquatic habitat



Figure 9: Old Racetrack Pond. No aquatic habitat



Figure 10: Eastern channel. No aquatic habitat.



Figure 11: Eastern channel. No aquatic habitat



Figure 12: Ditch #2. No aquatic habitat



Figure 13: Ditch #2. No aquatic habitat.



Figure 14: Ditch #3. No aquatic habitat.