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RIPIARIAN RESTORATION AND WETLAND CREATION AT SOLANO COMMUNITY COLLEGE

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Abstract: The California Department of Transportation (Caltrans) conducted mitigation work to establish and protect native wetland and riparian habitat on approximately 0.5 hectare (1.3 acres) adjacent to Dan Wilson Creek. Dan Wilson Creek is located in the Solano Community College property just off of Suisun Valley Road in Fairfield, California. This work mitigates for impacts to 0.07 hectare (0.17 acre) of wetland habitat and 0.05 hectare (0.13 acre) of riparian habitat resulting from the Solano Interstate Route 80 Widening Project located between Interstate 680 and State Route 12 East. Caltrans began construction on the I-80 Widening Project in the fall of 2003. Mitigation work coincided with the widening of Interstate 80 over Dan Wilson Creek that occurred during the summer of 2004.

Approximately 0.16 hectare (0.40 acre) of the land contoured, graded, and planted at the mitigation site will provide riparian habitat and 0.20 hectare (0.50 acre) will provide wetland habitat after the five-year monitoring period to meet the mitigation goals established by Caltrans, the California Department of Fish and Game, and the U.S. Army Corps of Engineers.

Caltrans biologists obtained a photographic record of the mitigation site in June 2004 before it was graded and contoured. These biologists will obtain photographic records of the same location(s) annually during the five-year monitoring period to monitor the progress of the mitigation project.

Caltrans biologists will conduct spring and summer plant surveys to detect early and late-season species and will map the extent of the vegetation cover using a Global Positioning System (GPS). Caltrans biologists will use a minimum of 20 vegetation sample plots, each measuring 3 x 3 meters (10 x 10 feet), to estimate plant coverage and dominance and will collect information on wildlife observed at the mitigation site on an opportunistic basis.

The majority of plants installed at the mitigation site have been successful as of June 2005. Approximately 90% of the plants installed in the upland and upland-riparian zones of the mitigation site showed signs of growth. Approximately 488 (91%) of the 535 planted arroyo willows were found in the mitigation area, with 313 (64%) of the counted willows showing signs of growth. Some of the installed wetland plants, including common tule (*Scirpus acutus* var. *occidentalis*), have established and spread throughout the wetland zone.

Animal species identified by Caltrans biologists in the area before the mitigation work began were again observed in the area after the work. Some of the aquatic species have migrated into the newly developed wetland from Dan Wilson Creek. The number of bird species observed in the area increased after the mitigation work. Birds commonly observed in freshwater pond habitats are using the wetland.

Introduction

Caltrans conducted mitigation work to establish and protect native wetland and riparian habitat on approximately 0.5 hectare (1.3 acres) adjacent to Dan Wilson Creek (figure 1). Dan Wilson Creek is located in the Solano Community College (College) property just off of Suisun Valley Road in Fairfield and eventually drains into Suisun Marsh and Grizzly Bay. This work mitigates for impacts to 0.07 hectare (0.17 acre) of wetland habitat and 0.05 hectare (0.13 acre) of riparian habitat resulting from the Solano Interstate Route 80 (I-80) Widening Project located between Interstate 680 (I-680) and State Route 12 East (figure 1). Caltrans began construction on the I-80 Widening Project in the fall of 2003. Mitigation work coincided with the widening of the I-80 bridge over Dan Wilson Creek that occurred during the summer of 2004.

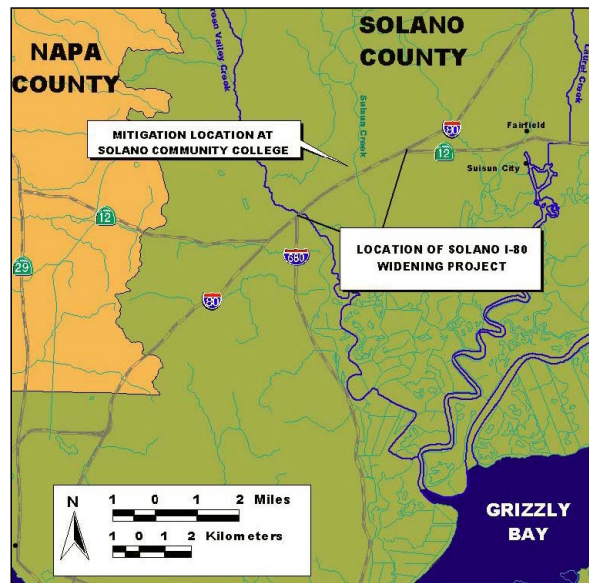


Figure 1. Project Location Map. Location of the Solano I-80 Widening Project and mitigation site at Solano Community College.

The goal of the mitigation project is to convert a flood-control channel with marginal riparian habitat into a high-quality riparian corridor and seasonal-wetland area. This project serves as in-kind mitigation for impacts to riparian and seasonal wetland habitat that occurred as a result of the I-80 Widening Project. The mitigation area is located on and adjacent to Dan Wilson Creek at the eastern end of Solano Community College and bounded by a paved road and the college's athletic facilities (figure 2).

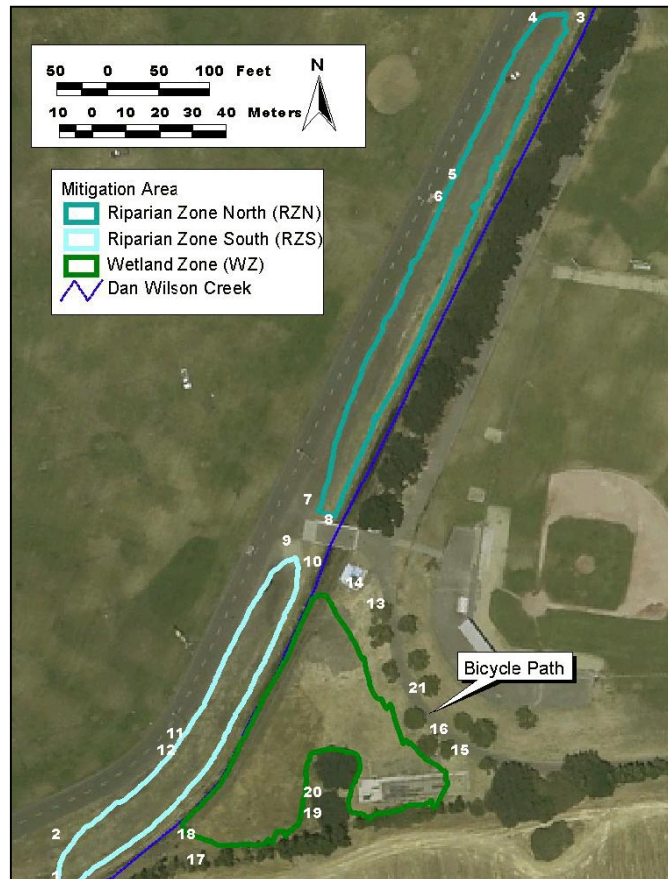


Figure 2. Aerial map of Solano Community College. The aerial image shows the areas where mitigation work has occurred (Riparian Zone South, Riparian Zone North, and Mitigation Zone). The numbers in white represent approximate points in each section where ground photos were taken. Photo courtesy of Caltrans Digital Highway Inventory Photography Program. Copyright 2003, Department of Transportation.

The successful project will result in a high-quality riparian corridor and seasonal-wetland area. Success is primarily dependent on establishment of the planted riparian and hydrophytic vegetation. Success criteria will include long-term channel morphological stability without extreme changes in the flow regime of the creek, adequate hydrology of the wetland from the adjacent creek, and establishment of a self-sustaining wetland and riparian corridor.

Objectives

The objective of this study is to monitor the Solano Community College mitigation site over the span of five years. Biologists will monitor the plants at randomly sampled quadrats to determine plant success and will collect data on wildlife usage of the site on an opportunistic basis.

The California Department of Fish and Game (CDFG) and U.S. Army Corps of Engineers (USACE) are concerned with the success of the mitigation plantings and plant establishment in the created wetland and riparian corridor. They expect approximately 0.16 hectare (0.40 acre) of the land contoured, graded, and planted at the mitigation site to provide riparian habitat, and 0.20 hectare (0.50 acre) to provide wetland habitat after the five-year monitoring period. They also expect a 70% success rate for all plantings in both areas after five years. Other parameters that Caltrans may assess during the monitoring period include hydrology, sedimentation, and water quality. Caltrans will conduct these surveys in the area approximately four times per year.

Methods

The mitigation work began during the summer of 2004 (between June 15 and October 15). Caltrans graded and contoured the site. A landscape contractor (American Civil Constructors) planted the site with the native riparian and wetland plant species during the summer and fall of 2004. Before installing plants in the mitigation area, the

landscape contractor hydroseeded the area with a native seed mix of legume species (including Spanish clover (*Lotus purshianus*), sky lupine (*Lupinus nanus*), and arroyo lupine (*Lupinus succulentus*) and non-legume species (including meadow barley (*Hordeum brachyantherum*), three week's fescue (*Vulpia microstachys*), California brome (*Bromus carinatus*), molate red fescue (*Festuca rubra*), California poppy (*Eschscholzia californica*), purple needlegrass (*Nassella pulchra*), and creeping wildrye (*Leymus triticoides*) to prevent erosion of the graded and contoured slopes.

Caltrans biologists will conduct spring and summer plant surveys to detect early and late-season species and will map the extent of the vegetation cover using a GPS. Annual reports submitted to CDFG and USACE will include the initial number of planted species in the riparian areas (riparian zone south (RZS) and riparian zone north (RZN)) and an estimate of how many of those plantings survived each year. Caltrans biologists will survey a minimum of nine random vegetation sample plots measuring approximately 3 x 3 meters (10 x 10 feet) in each riparian and wetland zone to estimate plant coverage and dominance.

Analysis

A grid with 3 x 3 meter (10 x 10 feet)-quadrats was placed over an aerial photo of the site to obtain the sample plots. The riparian zones were subdivided into three zones each. The wetland zone (WZ) was subdivided into four zones to provide an equal representation across the different elevations. The upper zone contains mostly upland plants, the middle zone represents a transition between upland and riparian (streamside) plants, the lower zone of the riparian zone contains riparian vegetation, and the wetland zone contains wetland (hydrophytic or aquatic) plants. The weir separating the wetland zone from Dan Wilson Creek contains both wetland plants and riparian vegetation. Caltrans biologists randomly selected a minimum of two quadrats from each subdivision prior to the first plant surveys.

Caltrans biologists will monitor these quadrats for the percent cover change of vegetation over the five-year monitoring period. During the first three years of monitoring, known as the plant-establishment period (PEP), the landscape contractor will monitor all of the plantings and will replace dead or dying plants. CDFG and USACE success criteria for the mitigation site are 90% plant survival after the PEP, 80% plant survival after year four, and 70% plant survival after year five.

Results

During the pre-mitigation and post-mitigation surveys, Caltrans biologists surveyed the dominant plants within the three mitigation areas (RZS, RZN, and WZ) as well as wildlife in or near the mitigation areas. Caltrans biologists obtained photographic records of each mitigation area at specific points (figure 2). Figures 3, 4, and 5 are representative of the photographic records taken at the site. Caltrans biologists delineated the three mitigation areas using GPS for later determination of plant coverage after the PEP.

Caltrans Biologists Michael Galloway, Hal Durio, David Amme, Karen Taylor, and Tami Schane conducted post-mitigation surveys of the project area between July 27, 2004, and February 14, 2005. Caltrans Biologists Michael Galloway, Hal Durio, and Tami Schane conducted post-mitigation plant surveys of the project area on May 12 and May 24, 2005.

Riparian zone south

Caltrans left an unplanted area measuring approximately 0.01 hectare (0.02 acre) at the southern end of the RZS to allow the Solano County Water Agency access to Dan Wilson Creek for flood-control maintenance activities. The landscape contractor planted the remaining 0.11 hectare (0.28 acre) with native vegetation (figure 3). The RZS was subdivided into three zones representing a native upland area at the upper elevations, an upland/riparian transition zone at the middle elevations, and a riparian zone adjacent to Dan Wilson Creek (table 1). The upper third of RZS was planted with native upland species, the middle third consists of an upland/riparian transition zone, and the lower third of the RZS adjacent to Dan Wilson Creek was planted with arroyo willow (*Salix lasiolepis*).



Point 1



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Figure 3. Riparian Zone South. Photos taken before mitigation work on the left (June 9, 2004) and after mitigation work on the right (June 10, 2005).

Table 1. Final plant list for the Solano Community College Mitigation Site

Scientific Name	Common Name	Quantity	Installation Period	Location Installed ¹
<i>Aesculus californica</i>	California buckeye	277	August 2004	Upland, Upland/Riparian
<i>Alnus rhombifolia</i>	White alder	169	August 2004	Upland/ Riparian
<i>Artemisia douglasiana</i>	Mugwort	337	November 2004	Upland/ Riparian
<i>Baccharis pilularis</i>	Coyote bush	289	August 2004	Upland
<i>Baccharis salicifolia</i>	Mule fat	337	August 2004	Upland/ Riparian
<i>Cercis occidentalis</i>	California redbud	75	August 2004	Upland
<i>Cyperus eragrostis</i> var. <i>eragrostis</i>	Common nut grass	199	August 2004	Wetland
<i>Eleocharis macrostachya</i>	Spike rush	249	August 2004	Wetland
<i>Fraxinus latifolia</i>	Oregon ash	241	August 2004	Upland
<i>Heteromeles arbutifolia</i>	Toyon	289	August 2004	Upland
<i>Juncus balticus</i>	Baltic rush	100	August 2004	Wetland
<i>Juncus phaeocephalus</i>	Brownhead rush	134	August 2004	Wetland
<i>Juncus xiphioides</i>	Iris-leaved rush	100	August 2004	Wetland
<i>Platanus racemosa</i>	California sycamore	108	August 2004	Upland/ Riparian
<i>Populus fremontii</i>	Fremont poplar	84	August 2004	Upland/ Riparian
<i>Quercus agrifolia</i>	Coast live oak	145	August 2004	Upland
<i>Quercus lobata</i>	Valley oak	9	August 2004	Upland
<i>Rhamnus californica</i>	California coffeeberry	211	August 2004	Upland/ Riparian
<i>Salix lasiolepis</i>	Arroyo willow	535	September 2004	Riparian, Wetland
<i>Scirpus acutus</i> var. <i>occidentalis</i>	Common tule	169	August 2004	Wetland
<i>Scripus americana</i>	Three-square bulrush	6	September 2004	Wetland
<i>Symphoricarpos albus laevigatus</i>	Creeping snowberry	675	August 2004	Upland/ Riparian

During the plant surveys, the biologists conducted random plant sampling of the upland and upland/riparian transition zones of RZS. Approximately 60 plants were observed in the sampled areas. Of the plants, 54 (90%) showed budding, leafing, or other signs of growth. One of the six plants that did not show any signs of growth was identified as a California sycamore (*Platanus racemosa*).

Caltrans biologists counted 150 arroyo willow in the riparian zone of RZS. Approximately 56 (37%) of the arroyo willow in the area showed budding, leafing, or other signs of growth.

Riparian zone north

The landscape contractor planted approximately 0.15 hectare (0.38 acre) of the RZN similarly to the RZS (figure 4). The RZN was also subdivided into three zones representing a native upland area at the upper elevations, an upland/riparian transition zone at the middle elevations, and a riparian zone adjacent to Dan Wilson Creek (table 1).

During the plant surveys, the biologists conducted random plant sampling of the upland and upland/riparian transition zones of RZN. Approximately 83 plants were observed in the sampled areas. Of the plants, 75 (90%) showed budding, leafing, or other signs of growth. Three of the eight plants that did not show any signs of growth were identified as toyon (*Heteromeles arbutifolia*).

Caltrans biologists counted 190 arroyo willow in the riparian zone of RZN. Approximately 155 (82%) of the arroyo willow in the area showed budding, leafing, or other signs of growth.



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Figure 4. Riparian Zone North. Photos taken before mitigation work on the left (June 9, 2004) and after mitigation work on the right (June 10, 2005).

Wetland zone

Caltrans was not able to plant approximately 0.11 hectare (0.28 acre) of the WZ at the lowest elevations. This area ponded immediately following contour excavation because the groundwater table was shallower than expected (figure 5). Caltrans anticipates that the wetland vegetation planted at lower elevations will spread into the unplanted, ponded area. The landscape contractor planted the upper and middle elevations of the remaining 0.13 hectare (0.32 acre) of the WZ similarly to the riparian zones, with an upland area along the upper elevations and an upland/riparian transition zone

along the middle elevations. The landscape contractor also planted the lower elevations of the WZ with hydrophytic plants (table 1). The landscape contractor planted the weir that separates Dan Wilson Creek from the WZ with these hydrophytic species at the lower elevations and arroyo willow at the higher elevations.

During the plant surveys, Caltrans biologists conducted random plant sampling of the upland and upland/riparian transition zones of the WZ. Approximately 108 plants were observed in the sampled areas. Of the plants, 98 (91%) showed budding, leafing, or other signs of growth. Two of the 10 plants that did not show any signs of growth were identified as toyon.

Caltrans biologists counted 148 arroyo willow in the riparian zone of the WZ. Approximately 102 (69%) of the arroyo willow in the area showed budding, leafing, or other signs of growth.

The planted wetland vegetation is competing with species recruiting into the ponded area of the WZ. Water bent (*Agrostis viridis*), perennial rye grass (*Lolium perenne*), cattail (*Typha* sp.), and hairy willow herb (*Epilobium ciliatum*) have recruited from the creek and established in the ponded area of the WZ. Percentage cover of the planted wetland vegetation in the sampled quadrats varies from 0% to 80%. The most dominant planted-wetland species are common tule (*Scirpus acutus* var. *occidentalis*), common nut grass (*Cyperus eragrostis* var. *eragrostis*), brownhead rush (*Juncus phaeocephalus*), and iris-leaf rush (*Juncus xiphioides*).



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Figure 5. Wetland Zone. Photos taken before mitigation work on the left (June 9, 2004) and after mitigation work on the right (June 10, 2005).

Biologists recorded wildlife observed at the mitigation site on an opportunistic basis. Table 2 lists the wildlife species observed at the mitigation site after the site had been graded and contoured (July 27, 2004).

Table 2. Wildlife observed at the Solano Community College Mitigation Project after the grading and contouring Work on July 27, 2004

Scientific Name	Common Name	Date First Observed	Zone Observed
Birds			
<i>Agelaius phoeniceus</i>	Red-winged blackbird	October 7, 2004*	DWC
<i>Anas platyrhynchos</i>	Mallard	February 14, 2005	WZ
<i>Buteo jamaicensis</i>	Red-tailed hawk	February 14, 2005	WZ
<i>Buteo lineatus</i>	Red-shouldered hawk	December 14, 2004	WZ
<i>Ceryle alcyon</i>	Belted kingfisher	September 8, 2004*	WZ
<i>Charadrius vociferus</i>	Killdeer	July 27, 2004	WZ
<i>Corvus corax</i>	Common raven	November 9, 2004*	RZN
<i>Egretta thula</i>	Snowy egret	October 7, 2004	WZ
<i>Gallinago gallinago</i>	Common snipe	November 9, 2004	WZ
<i>Mergus serrator</i>	Red-breasted merganser	January 11, 2005	WZ
<i>Sayornis nigricans</i>	Black phoebe	November 9, 2004	WZ
<i>Tachycineta bicolor</i>	Tree swallow	May 24, 2005	WZ
<i>Tringa flavipes</i>	Lesser yellowlegs	September 8, 2004	WZ
<i>Zonotrichia atricapilla</i>	Golden-crowned sparrow	January 11, 2005*	WZ
Invertebrates			
<i>Damselfly</i> sp.	Damselflies	July 27, 2004*	WZ
<i>Odonata</i> Order	Dragonflies	July 27, 2004*	WZ
<i>Procambarus</i> sp.	Crayfish	September 30, 2004	WZ
Amphibians			
<i>Hyla regilla</i>	Pacific treefrogs	February 14, 2005	WZ
<i>Rana catesbeiana</i>	Bullfrogs	September 23, 2004*	WZ, DWC
Fish			
<i>Gambusia affinis</i>	Mosquitofish	July 27, 2004*	WZ, DWC
Reptiles			
<i>Sceloporus occidentalis</i>	Western fence lizards	July 27, 2004*	DWC
Mammals			
<i>Ondatra zibethicus</i>	Muskrat	December 14, 2004	WZ

An asterisk (*) indicates animal species observed at the mitigation site before and after the grading and contouring work.

The Napa-Solano Mosquito Abatement District provides annual stocks of mosquitofish (*Gambusia affinis*) to Dan Wilson Creek at Solano Community College to control mosquitoes in the area. Caltrans Biologist Michael Galloway contacted the Napa-Solano Mosquito Abatement District to request that they place mosquitofish into the WZ as well. During grading and contouring of the site, it appeared that additional mosquitofish had been placed into Dan Wilson Creek and the WZ.

Conclusions

Approximately 0.16 hectare (0.4 acre) of the land contoured, graded, and planted at the mitigation site will provide riparian habitat, and 0.20 hectare (0.5 acre) will provide wetland habitat after the five-year monitoring period to meet the mitigation goals established by Caltrans, the California Department of Fish and Game, and the U.S. Army Corps of Engineers.

During the three-year plant-establishment period (PEP), the landscape contractor will maintain all plants that are installed at the mitigation site by replacing any dead or dying plants before the end of the PEP. The majority of plants that were installed in the upland and upland-riparian zones of the mitigation site were successful after one year, with approximately 90% of the plants showing signs of growth. The unsuccessful plants that could be identified were either California sycamore or toyon. The landscape contractor will determine whether the same species of plant will be used as a replacement or if the dead or dying plants should be replaced with another plant in the planting table. The landscape contractor will replace the dead or dying plants in fall 2005.

Caltrans biologists found 488 (91%) of the 535 arroyo willows installed by the landscape contractor in the mitigation area, with 313 (64%) of the counted willows showing signs of growth. The southern end of the site has the highest concentration of unsuccessful willow plantings. This may be indicative of the lack of shading or wind protection at the southern end of the mitigation area, which may lead to a drying-out of the willows, a difference in the soils, a difference in the elevation of the willow plantings, or the method of installation. The Caltrans biologists and the landscape contractor will further monitor the growth of the willows in the area to determine if additional willows need to be planted at a later time.

The majority of wetland plants in the mitigation site are successful. Some plants, including common tule, have established and spread throughout the wetland zone. Some existing plants identified near the mitigation site, such as cattail, have recruited into the WZ. The success of the plants installed in the wetland combined with the recruitment of hydrophytic plants into the WZ defines this area as a wetland. The landscape contractor will determine whether the plants that have recruited into the area should be removed to maintain plant diversity of the area.

Animal species identified by Caltrans biologists in the area before the mitigation work began were again observed in the area after the work. Most of the animals found in Dan Wilson Creek are either exotic species or, in the case of mosquitofish, were placed into the creek as a vector-control measure. Caltrans biologists identified many of these species in the WZ after Caltrans finished the grading and contouring of the area. Some of these species have migrated from Dan Wilson Creek into the newly developed WZ.

The number of bird species observed in the area increased after the mitigation work. Birds commonly observed in freshwater pond habitats, including the common snipe (*Gallinago gallinago*), snowy egret (*Egretta thula*), black phoebe (*Sayornis nigricans*), killdeer (*Charadrius vociferus*), and lesser yellowlegs (*Tringa favipes*), are using the WZ.

Acknowledgments: This project would not have been possible without the assistance and the land provided by the Solano Community College. We would like to thank everyone involved at the college for all of their help. We would also like to thank the Solano County Water Agency for their input on the restoration work. We would especially like to thank all the field biologists at Caltrans who helped gather data for this study. Thanks to Fred Botti, retired California Department of Fish and Game biologist, who suggested this site at the college as a possible restoration area. This project is dedicated to the memory of Kirby McClellan, Caltrans biologist, who did most of the biological work on the Solano Interstate Route 80 Widening Project and was responsible for getting the ball rolling on this mitigation project.

Biographical Sketches: Michael Galloway is currently employed as a biologist for Caltrans. He graduated from San Francisco State University in 2001 with an M.A. degree in marine biology. His master's thesis focused on Pacific harbor seal (*Phoca vitulina richardii*) haul-out behavior at a haul-out site in the San Francisco Bay. He is currently monitoring several Caltrans restoration projects in the San Francisco Bay area, including this project, and the Triangle Marsh Restoration Project in Corte Madera, California.

Chuck Morton is a district branch chief for the California Department of Transportation in the Oakland office. His area of responsibility encompasses Marin, Sonoma, Napa, Solano, and Contra Costa Counties and includes over 700 miles of roadway. He holds a B.S. in biology and marine science and a M.S. in environmental planning.