



Agnes Street

Santa Cruz County

City of Santa Cruz

Hagemann Gulch

Arana Creek

Upper Harbor Dry Boat Storage Area

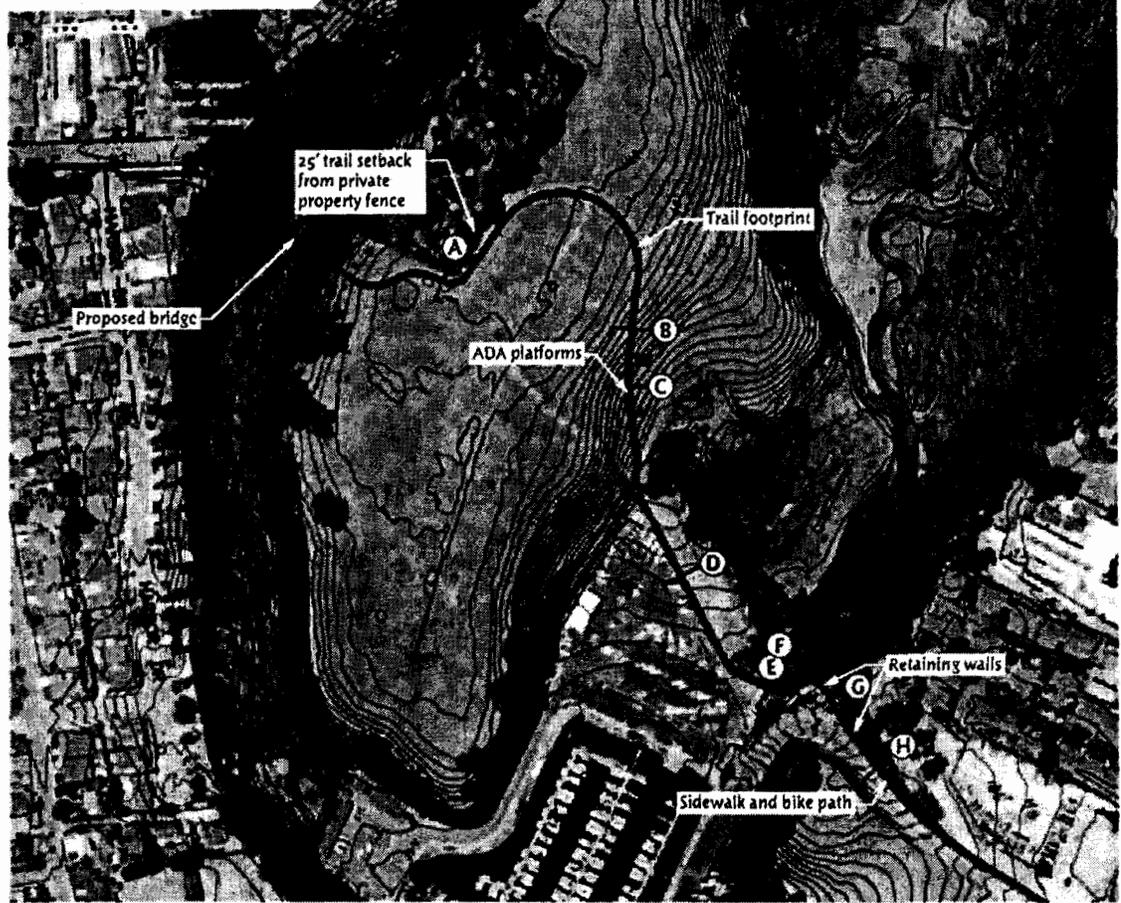
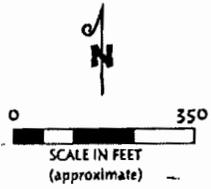
Exhibit B
3-11-074
Page 1 of 1

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36°59'26.15" N 121°59'49.32" W, elev. 10 ft

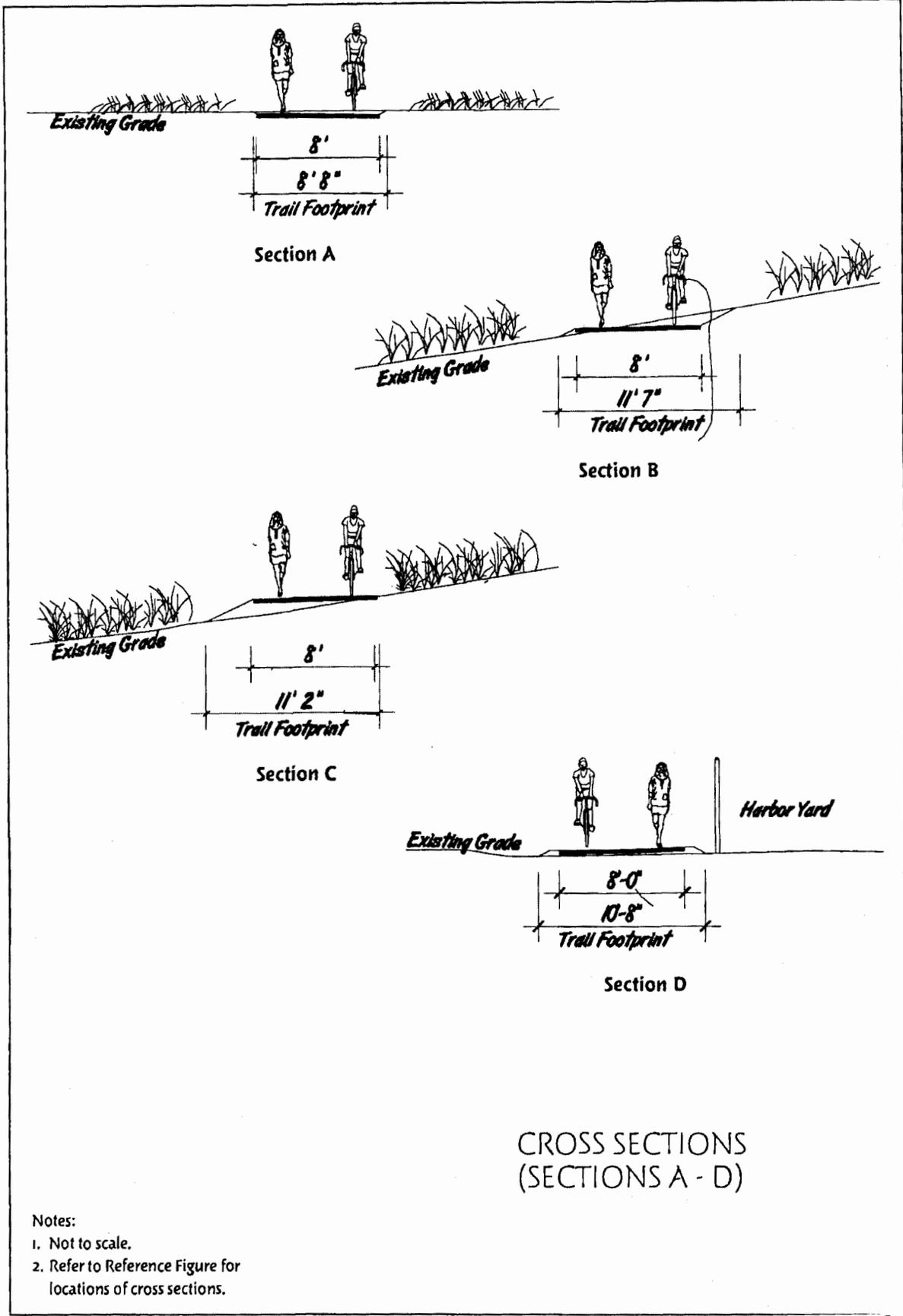
Elev. alt. 5716 ft

Ⓐ — Cross section location
(refer to following figures
for cross sections)



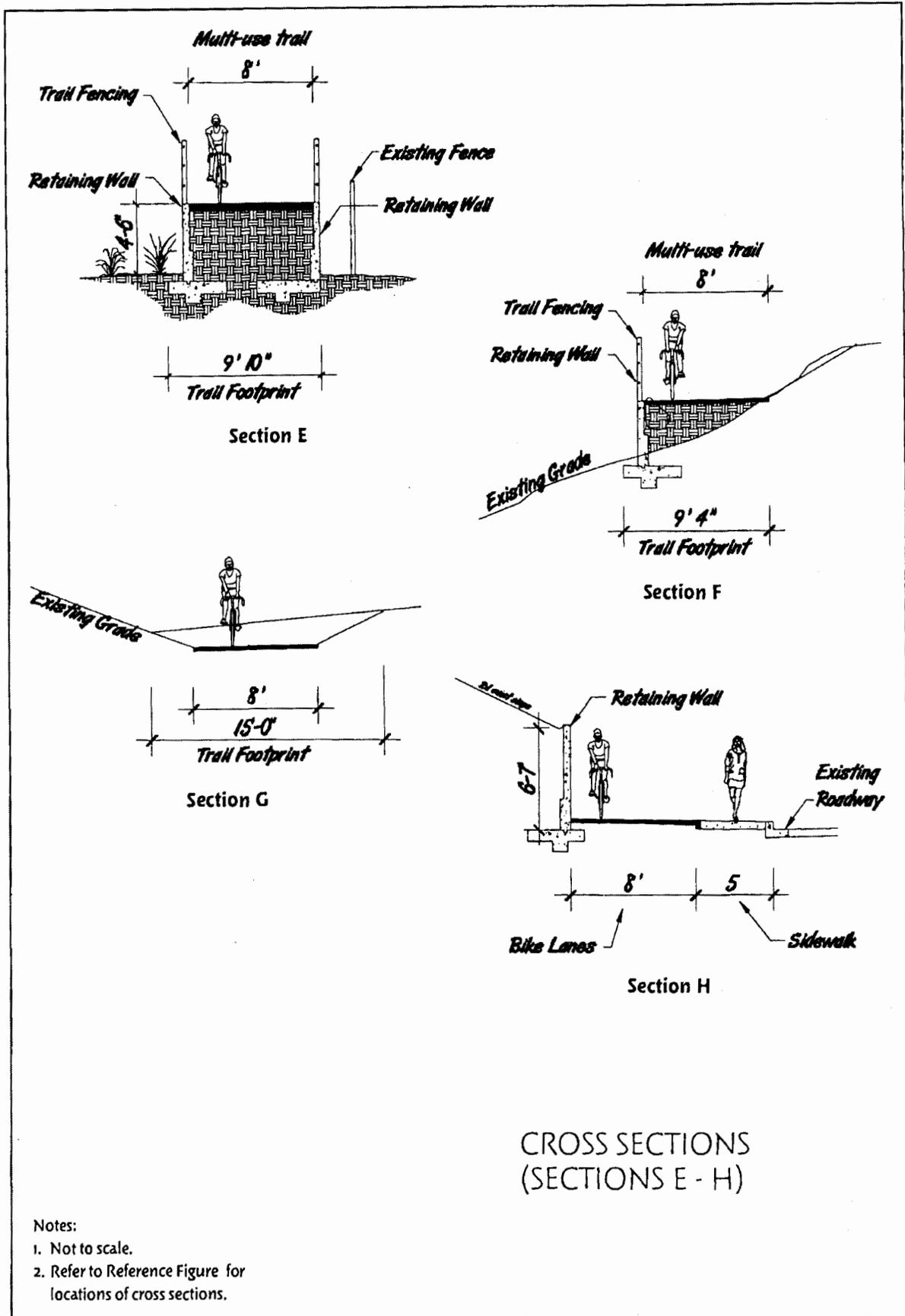
Source: RRM Design Group

Arana Gulch
CROSS SECTION REFERENCE
Canyon and Creek View Trails



CROSS SECTIONS
 (SECTIONS A - D)

- Notes:
1. Not to scale.
 2. Refer to Reference Figure for locations of cross sections.



CROSS SECTIONS
 (SECTIONS E - H)

Notes:

1. Not to scale.
2. Refer to Reference Figure for locations of cross sections.



A) View of Upper Harbor and site from Frederick Park



B) View of Central Meadow from just south of Agnes Street



C) View of Upper Harbor and site from Mello Lane

Arana Gulch
VIEWS OF SITE

Source: A. Skewes-Cox



A) Existing view within Port District property (behind dry storage area), looking south



B) Visual simulation of proposed paved multi-use trail and retaining wall (Creek View Trail)

Arana Gulch

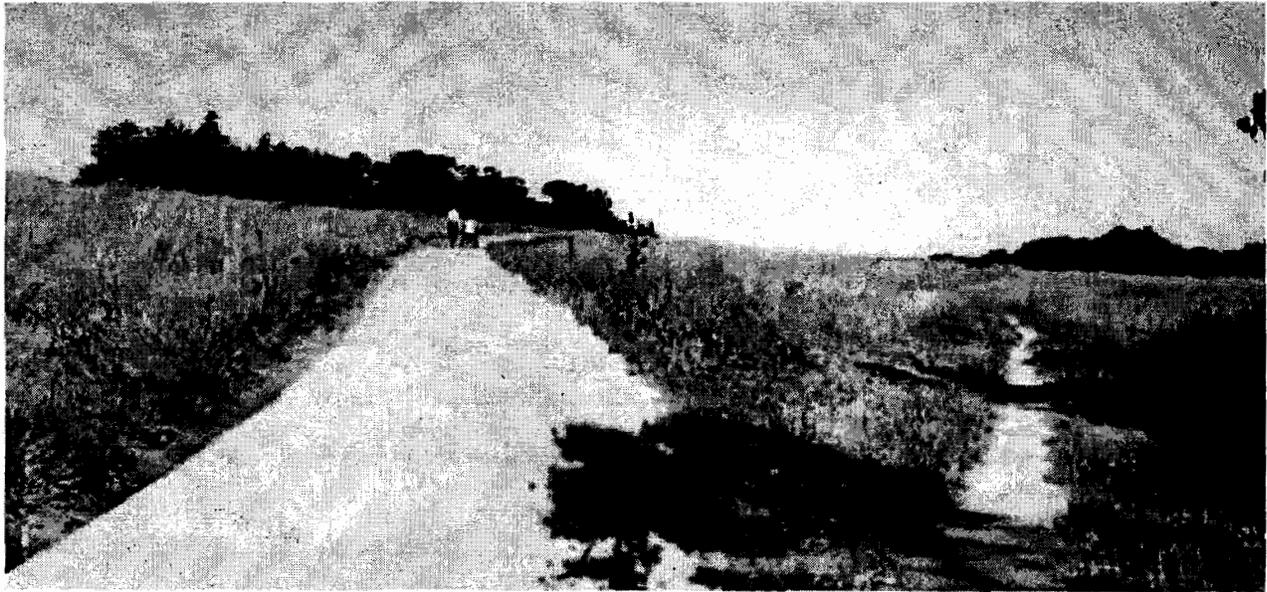
VISUAL SIMULATION OF SOUTH- EAST END OF CREEK VIEW TRAIL

(Viewpoint 4)

Source: Environmental Vision



A) Existing view looking north from Upper Harbor entrance to Arana Gulch



B) Visual simulation of proposed paved multi-use trail (Creek View Trail)

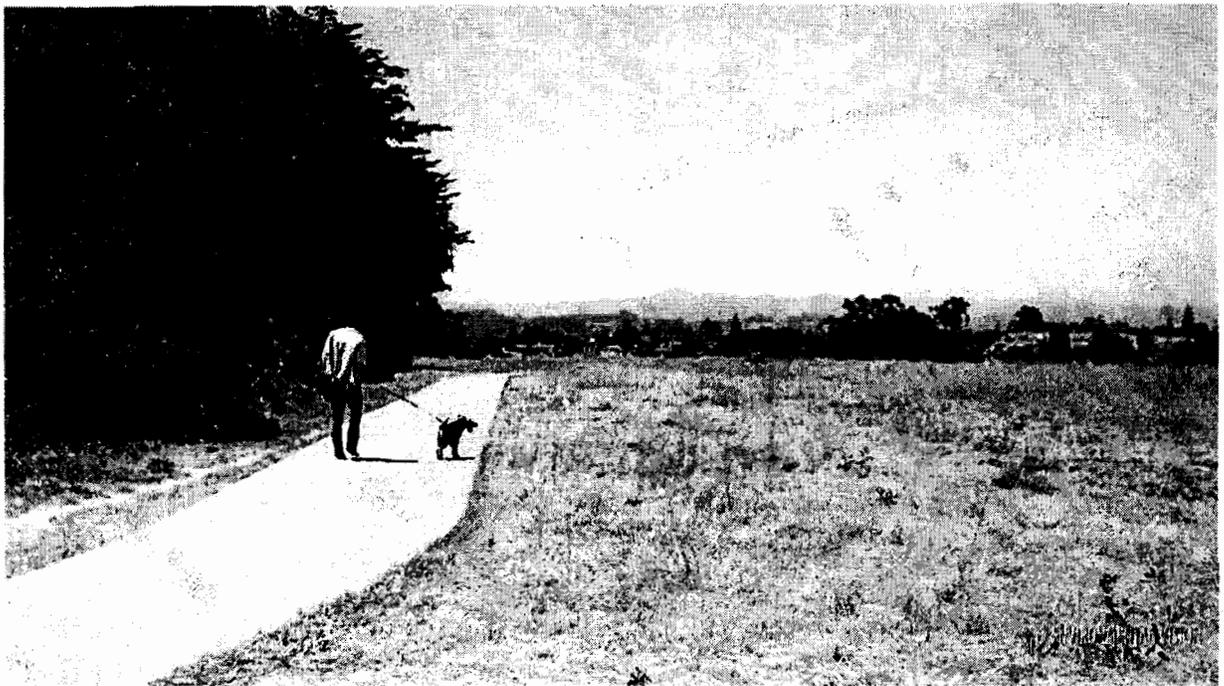
Arana Gulch
VISUAL SIMULATION OF
PROPOSED CREEK VIEW TRAIL
(Viewpoint 2)

Source: Environmental Vision

CCC Exhibit D
(page 3 of 5 pages)



A) Existing view looking north from central meadow area



B) Visual simulation of proposed multi-use trail (Canyon Trail)

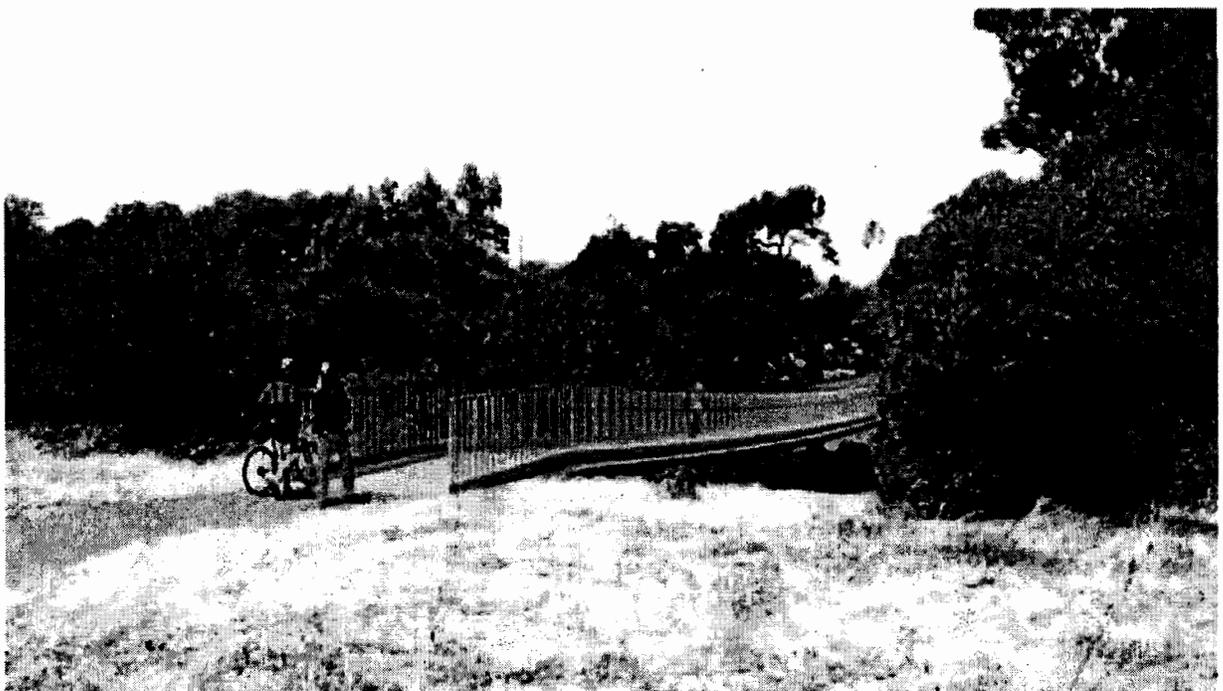
Source: Environmental Vision

Arana Gulch
VISUAL SIMULATION OF
PROPOSED CANYON TRAIL
(Visual Simulation)

CCC Exhibit D
(page 4 of 5 pages)



A) Existing view looking west toward Hagemann Gulch



B) Visual simulation of proposed bridge across Hagemann Gulch

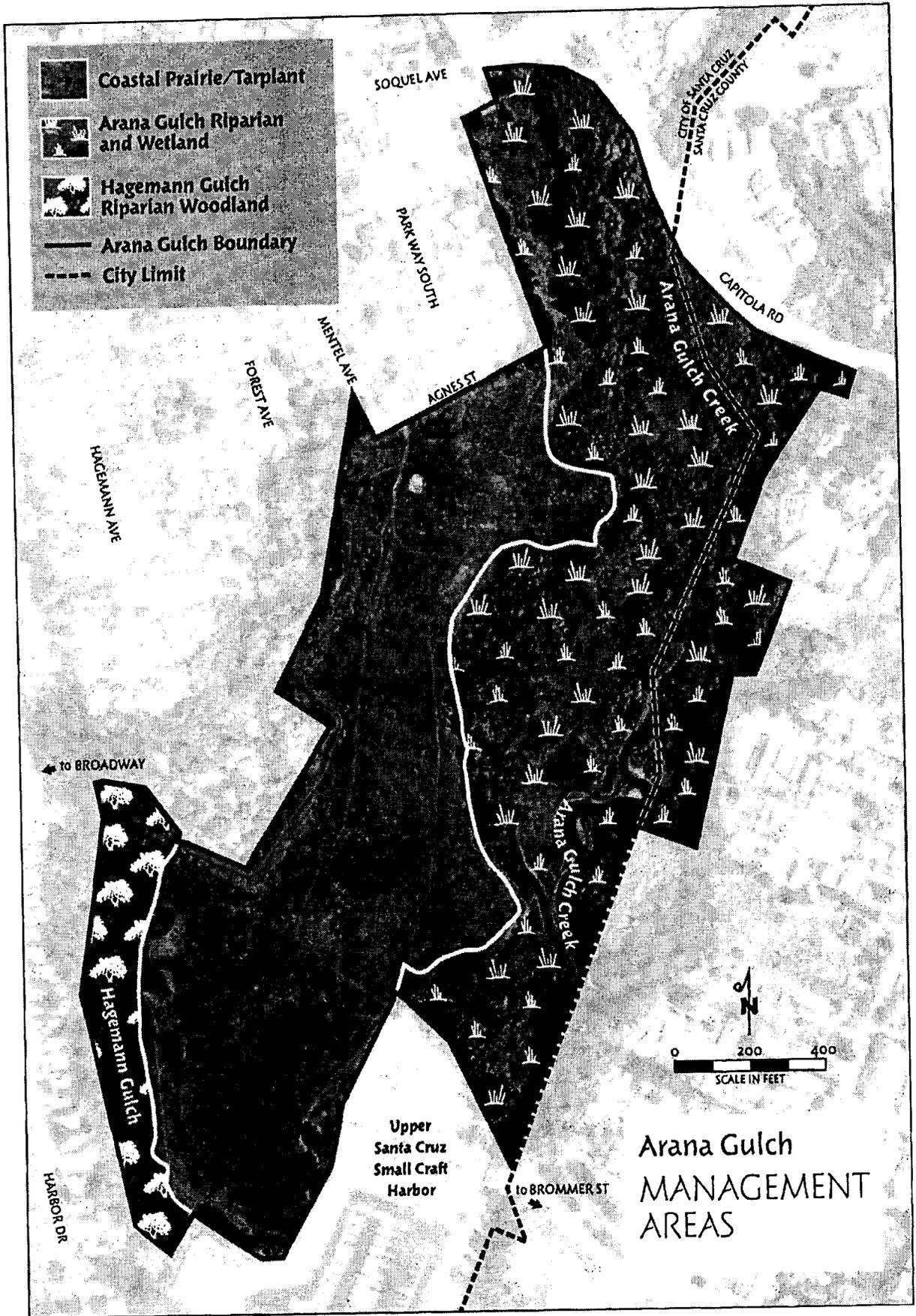
Arana Gulch

VISUAL SIMULATION OF PROPOSED HAGEMANN GULCH BRIDGE

(Viewpoint 1)

Source: Environmental Vision

CCC Exhibit D
(page 5 of 5 pages)



Chapter IV MITIGATION MONITORING PROGRAM



This Mitigation Monitoring Program (see Table IV-1) has been prepared to comply with the requirements of State law (Public Resources Code Section 21081.6). State law requires the adoption of a mitigation monitoring program when mitigation measures are required to avoid significant impacts. The monitoring program is intended to ensure compliance during implementation of the project.

This Mitigation Monitoring Program has been formulated based upon the findings of the DEIR and the comments received on the DEIR and addressed herein. This Mitigation Monitoring Program identifies mitigation measures recommended in the EIR to avoid or reduce identified impacts, and specifies the agencies responsible for implementation and monitoring.

The first column identifies the mitigation measure. The second column "Party Responsible for Implementation" refers to the agency responsible for ensuring that the mitigation measure has been implemented. The third column "Agency Responsible for Monitoring" refers to the agency that will be responsible for keeping monitoring records as proof that mitigation measures were implemented. The fourth column entitled "Monitoring Timing" identifies when and/or for how long the monitoring shall occur. The fifth column "Monitoring Compliance Record" allows the monitoring agency to document the monitoring and is left blank until monitoring begins.

The two agencies primarily responsible for monitoring will be the City Parks and Recreation Department (CPRD) and the City Public Works Department (CPWD) as noted in Table IV-1.

Table IV-1: Mitigation Monitoring and Reporting Program

Mitigation Measures	Party Responsible for Implementation ^a	Agency Responsible for Monitoring	Monitoring Timing	Monitoring Compliance Record (Name/Date) ^b
4.1 Land Use and Planning				
<i>There are no significant land use and planning impacts.</i>				
4.2 Biological Resources				
BIO-1(a): All construction activities and equipment staging shall occur outside the riparian scrub and woodland habitat. The outside edge of the habitat shall be marked in the field by a qualified botanist. Prior to construction, 5-foot-high temporary construction mesh fencing and signs shall be installed. The location and integrity of the fencing shall be field-checked by a botanist prior to grading operations and periodically during the construction period.	CPWD and CPRD	CPRD	During construction.	
A construction staging area that avoids any sensitive habitat shall be clearly identified prior to construction. For example, staging for the western portion of the Hagemann Gulch bridge should occur on City-owned property to the west of Hagemann Gulch that does not include sensitive habitat. Staging for the eastern portion of the Hagemann Gulch bridge should occur outside of the riparian corridor, oak woodland, historic mapped tarplant areas, and native grassland areas. The City shall work with the Port District to identify possible staging areas in disturbed areas of Port District property adjacent to Arana Gulch that could be used temporarily during construction.	CPWD and CPRD	CPWD and CPRD	During construction.	
BIO-1(b): Construction activities adjacent to Hagemann Gulch shall utilize standard best management practices (BMPs) to minimize effects on the nearby creek channel. BMPs shall include erosion control measures to minimize sedimentation and turbidity in the aquatic habitat. Areas disturbed by construction shall be revegetated with an erosion control seed mix.	CPRD	CPRD	During construction.	
BIO-1(c): If riparian habitat is inadvertently affected during construction, the City shall implement a 2:1 on-site habitat replacement program in the fall/winter following the completion of site construction work. A qualified botanist shall determine an appropriate degraded area within Arana Gulch for restoration as riparian habitat.	CPWD and CPRD	CPWD and CPRD	During construction.	
BIO-1(d): Any tree trimming shall comply with the City's Heritage Tree Ordinance. If any activity would disturb riparian habitat, the City shall comply with Section 1607 of the Fish and Game Code and applicable permits shall be obtained prior to construction.	CPWD and CPWD	CPRD	During construction.	
The combination of the above measures would reduce this impact to less than significant.				

Table IV-1 *continued*

Mitigation Measures	Party Responsible for Implementation ^a	Agency Responsible for Monitoring	Monitoring Timing	Monitoring Compliance Record (Name/Date) ^b
<p>BIO-2(a): Following preparation of detailed design for the Creek View Trail, the trail alignment and the small seasonal wetlands at the southern end of Arana Gulch that are in the vicinity of the trail alignment should be staked to verify if the trail alignment would have a direct impact on seasonal wetlands. To the maximum extent feasible, the final Creek View Trail alignment should avoid direct impacts to these scattered seasonal wetland areas. If the paved, multi-use trail cannot be realigned to avoid direct wetland impacts due to the need to maintain an ADA-compliant gradient, the City shall ensure completion of a jurisdictional delineation of the wetlands that could be directly impacted, with verification by the U.S. Army Corps of Engineers (Corps). If the wetland is determined to be a jurisdictional seasonal wetland area within the Arana Gulch property shall be replaced within Arana Gulch at a 2:1 ratio, or at a ratio determined necessary by the regulatory agency, or agencies. This effort shall be under the guidance of a qualified botanist.</p> <p>BIO-2(b): Prior to construction, temporary plastic mesh fencing shall be installed along the Creek View Trail alignment to exclude the seasonal wetland areas and to provide a 20- to 30-foot buffer zone where feasible. During construction, this temporary fencing shall be monitored by City staff or a qualified botanist during construction to ensure that no indirect impacts on seasonal wetland areas occur. No soils, materials or construction materials shall be located within the buffer zone.</p> <p>BIO-2(c): If the buffer zone is disturbed, the buffer zone near wetlands shall be revegetated with site-appropriate native vegetation. A qualified botanist shall determine the appropriate revegetation plantings.</p> <p>BIO-2(d): The seasonal wetlands shall be monitored for indirect impacts from trail users and management options addressed in the Arana Gulch Master Plan shall be implemented.</p> <p>BIO-2(e): Mitigation Measure HYDROLOGY-2, which addresses maintenance of flow conditions in the vicinity of paved trails, shall be implemented.</p> <p>The combination of the above measures would reduce this impact to less than significant.</p> <p>BIO-3(a): Prior to construction, temporary plastic mesh fencing shall be placed along the trail alignment to limit construction-related impacts to the maximum extent possible. During construction, the fencing placement shall be monitored by City staff, or a qualified botanist, to ensure that no indirect impacts on wetlands occur. No soils, materials or construction equipment shall be stored within this fenced trail corridor. All staging and equipment storage shall be within the developed area of the Upper Harbor.</p> <p>BIO-3(b): After construction of the trail, native species shall be planted within the 100-foot wetland buffer zone to further enhance the restoration efforts previously undertaken for the Upper Harbor dry storage area project.</p>	<p>CPWD and CPRD</p>	<p>CPRD</p>	<p>Before construction.</p>	<p>see last two pages of this document for revised Mitigation Measure BIO-2(a)</p>
	<p>CPRD</p>	<p>CPRD</p>	<p>Prior to construction.</p>	
	<p>CPRD</p>	<p>CPRD</p>	<p>Immediately after construction.</p>	
	<p>CPRD</p>	<p>CPRD</p>	<p>Ongoing</p>	
	<p>CPWD</p>	<p>CPRD</p>	<p>Prior to construction.</p>	
	<p>CPWD and CPRD</p>	<p>CPWD and CPRD</p>	<p>Prior to construction.</p>	
	<p>CPRD</p>	<p>CPRD</p>	<p>Immediately after construction.</p>	

Table IV-1 continued

Mitigation Measures	Party Responsible for Implementations ^a	Agency Responsible for Monitoring	Monitoring Timing	Monitoring Compliance Record (Name/Date) ^b
<p>BIO-3(c): After construction, permanent fencing shall be installed along the entire length of the Creek View Trail within the Port District property and extending along the north side of the trail. This fencing shall either be black, vinyl-coated chain link fencing (approximately 4 feet high), wood frame fencing with small wire mesh to prevent dogs from entering the wetland buffer zone, or other type of fencing acceptable to the Port District that prevents trail users and dogs from entering the buffer zone but that also maintains visibility of the creek. Solid fencing is not recommended because of graffiti and security concerns.</p>	CPWD	CPWD	At completion of trail on Port District property.	
<p>BIO-3(d): An interpretive display shall be posted along the trail route to highlight the significance of wetland and riparian habitats and to discourage inappropriate behavior that could damage such resources.</p>	CPRD	CPRD	Upon completion of Master Plan.	
<p>BIO-3(e): Mitigation Measure HYDROLOGY-2, which addresses maintenance of flow conditions in the vicinity of the paved trails, shall be implemented.</p>	CPWD	CPRD	Prior to trail construction.	
<p>The combination of the above measures would reduce this impact to less than significant.</p>	CPRD and CPWD	CPRD	Prior to and during construction.	
<p>BIO-4(a): To the maximum extent feasible, all trail segments shall be aligned to avoid the mapped historic extent of the four Santa Cruz tarplant areas. Prior to construction, staging areas shall be identified that are outside historic tarplant areas, as addressed in Mitigation Measure BIO-1(a). All trail alignments shall have a fenced construction corridor to minimize disturbance to habitat outside this corridor and the corridor width shall be the minimum necessary to allow trail construction. The fencing shall be maintained through the construction phase and periodically monitored to ensure protection of tarplant habitat.</p>	CPRD	CPRD	Ongoing.	
<p>BIO-4(b): The Santa Cruz Tarplant Management Program (BMP Ecosystems, 2005) shall be fully implemented. This management program would incorporate the following elements:</p> <ol style="list-style-type: none"> (1) Active management practices and techniques, including, but not limited to, the following: <ul style="list-style-type: none"> ▪ Mowing with removal of cut material ▪ Prescribed burning. ▪ Soil disturbance. ▪ Removal of invasive non-native plant species. (2) Continued experimental research directed toward refining understanding of the management regime that maximizes long-term success of tarplant. (3) Ongoing monitoring on an annual basis to determine the success of management measures, to monitor the overall well-being of tarplant colonies on the site, and to identify potential threats to tarplant persistence on the site. (4) Revision of the management prescriptions and remedial actions as appropriate to enhance long-term viability of tarplant on the site. 	CPRD	CPRD	Ongoing.	

Table IV-1 continued

Mitigation Measures	Party Responsible for Implementation ^a	Agency Responsible for Monitoring	Monitoring Timing	Monitoring Compliance Record (Name/Date) ^b
<p>BIO-4(c): For any trail alignments that would cross the historic mapped tarplant areas, soil shall be mechanically scraped under the approval of a qualified botanist and with the approval of the Adaptive Management Working Group (AMWG) for the Santa Cruz tarplant. Redistribution of scraped soil material shall also be under the approval of a qualified botanist and the AMWG as identified in the Santa Cruz Tarplant Adaptive Management Program.</p>	CPRD	CPRD	Ongoing	
<p>BIO-4(d): Trail maintenance and management actions, such as repair of pavement or mowing of the grass edge, shall be conducted in a manner conducive to the management of the tarplant population. Maintenance actions shall be coordinated with the City Parks and Recreation Department and shall comply with the Santa Cruz Tarplant Adaptive Management Program.</p>	CPRD	CPRD	Ongoing	
<p>BIO-4(e): If annual monitoring indicates that substantial adverse indirect impacts on the tarplant are occurring due to human use of the area, fencing shall be erected as necessary to discourage unauthorized human encroachment into the tarplant colonies. If tarplant areas do not demonstrate evidence of adverse impacts, permanent fencing should be avoided to allow for greater flexibility for mowing and other management practices.</p> <p>The combination of the above measures would reduce this impact, but the impact would remain significant and unavoidable because it cannot be fully ensured that all tarplant habitat would be protected.</p>	CPRD	CPRD	Ongoing	
<p>BIO-5(a): At strategic points along the multi-use trails, interpretive signs shall be posted to inform users when they are passing through a sensitive habitat or area of significant wildlife use. Descriptions of the habitats and their importance may be presented to increase pedestrians' understanding and respect for the resources of Arana Gulch. Guidelines regarding trail use shall be posted.</p>	CPRD	CPRD	Upon adoption of Master Plan.	
<p>BIO-5(b): Annual monitoring of sensitive resources shall be conducted for a 5-year period following construction and operation of the multi-use and pedestrian trails. If there is evidence of adverse effects on sensitive resources, permanent fencing of affected habitats such as the wetlands and riparian areas shall be considered and implemented, as necessary.</p> <p>The combination of the above measures would reduce this impact to less than significant.</p>	CPRD	CPRD	Five years after construction.	
<p>BIO-6: The trail alignments shall attempt to avoid clumps of native grasses to the greatest extent feasible. Materials excavated during trail construction should not be side-cast onto adjacent native grasses. Areas temporarily disturbed by trail construction shall be reseeded with native grasses and native herbaceous plant species (locally-obtained seed). Seeding shall occur in the fall following construction.</p>	CPRD	CPRD	During construction and after Fall season construction.	

Table IV-1 continued

Mitigation Measures	Party Responsible for Implementation ^a	Agency Responsible for Monitoring	Monitoring Timing	Monitoring Compliance Record (Name/Date) ^b
<p>BIO-7: Focused surveys for the California red-legged frog (CRLF) shall be conducted in the season immediately prior to construction activities. Surveys shall be conducted in accordance with current USFWS protocol (USFWS, 2005f). If CRLF are encountered during pre-construction surveys, during the inspection conducted immediately prior to ground-moving activities, or during project activities, all work on the site and adjacent staging area parcels shall cease. The USFWS and CDFG shall be notified immediately to determine whether additional avoidance measures or further action should be implemented to prevent possible take of this species. Depending on the results of the pre-construction surveys, the following measures shall be implemented to avoid impacts on the species:</p> <ul style="list-style-type: none"> ▪ Initial construction activities (including grading and vegetation removal) shall occur during dry weather, during the day, and preferably before newly metamorphosed frogs disperse and when CRLF are less likely to be moving around. Initial ground-disturbing activities shall occur between May 15 and October 15. ▪ The riparian habitat shall be inspected by a USFWS-approved biologist before any clearing of vegetation, to avoid killing, injuring or harming individual frogs, if present, during these activities. <p>A USFWS-approved biologist shall meet with the construction crew at the onset of construction to (1) provide CRLF life history information and habitat descriptions, (2) provide education regarding the workers' need to examine the ground before and during debris and vegetation removal and during initial ground disturbance activities, and (3) provide education about the need to halt activities and avoid handling or moving any CRLF or other special-status wildlife if encountered in the work area.</p>	<p>CPRD</p>	<p>CPRD</p>	<p>Prior to and during construction.</p>	
<p>BIO-8(a): Before construction begins, nest and roost surveys shall be conducted by a qualified wildlife biologist during the period from March through July. These surveys shall be conducted for special-status birds, and all birds (and their nests) protected under the Migratory Bird Treaty Act (MBTA).</p> <p>Surveys shall include the multi-use trail/bridge site and a 300-foot-wide buffer to examine nearby tree stands and structures for nesting special-status avian species. If an active nest is found, the City Parks and Recreation Department shall consult with the appropriate resource agencies (CDFG, USFWS) to determine appropriate construction buffers or other avoidance measures. If nesting birds are not found, no further action would be necessary.</p>	<p>CPRD</p>	<p>CPRD</p>	<p>Prior to construction.</p>	
<p>BIO-8(b): As suggested in the Santa Cruz Harbor Wetland Consultation (Habitat Restoration Group, 1992), a temporary 300-foot-wide buffer zone from a heron nest tree shall be maintained during May through July, if/when young are present.</p>	<p>CPWD</p>	<p>CPWD</p>	<p>As applicable.</p>	
<p>BIO-8(c): A yellow warbler nest survey shall be conducted in the riparian scrub prior to construction. If nests are found within 300 feet of the multi-use trail/bridge site, construction shall be delayed from April through July, or until the young have fledged.</p>	<p>CPRD</p>	<p>CPRD</p>	<p>Prior to construction.</p>	

Table IV-1 *continued*

Mitigation Measures	Party Responsible for Implementation ^a	Agency Responsible for Monitoring	Monitoring Timing	Monitoring Compliance Record (Name/Date) ^b
<p>BIO-8(d): While no lighting is proposed at this time, any future lighting should be limited. Any trail lighting shall consist of low-intensity lights, no higher than 3 feet off the ground, that would focus light on the trail and minimize lighting of natural areas adjacent to the trail and bridge.</p>	<p>CPWD and CPRD</p>	<p>CPRD</p>	<p>As applicable after construction.</p>	
<p>The combination of the above measures would reduce this impact to less than significant.</p> <p>BIO-9: The following measures are recommended to avoid impacts to roosting bats:</p> <ul style="list-style-type: none"> ▪ Conduct surveys in late April or early May when bats are establishing maternity colonies but before females give birth. If roosting bats are found at this time, they should be excluded from establishing maternity colonies. ▪ Protect maternity colonies that have young not yet able to fly (pre-volant). The project biologist must confirm there are no pre-volant young present before a colony is displaced. It is assumed that after September 1 colonies have no pre-volant young. ▪ For any trees that could provide roosting space for bats, the trees shall be thoroughly evaluated prior to trimming to determine if a colony is present. Visual inspection, trapping, and acoustic surveys may be utilized as initial techniques. ▪ If a tree is not an active roost site, it may be immediately trimmed. If the tree is not trimmed within four days, the night surveys shall be redone. ▪ If a tree is an active roost site, the CDFG shall be contacted immediately and the bat species identified if possible. Active roost trees may still be trimmed after consultation. ▪ Removal of any native riparian tree, if necessary, shall be preceded by a thorough visual inspection to reduce the risk of displacing foliage-roosting bats. ▪ Removal of any occupied tree, if necessary, shall be mitigated for by the creation of a snag or other artificial roost structure. 	<p>CPWD</p>	<p>CPWD</p>	<p>Prior to and during construction.</p>	
<p>BIO-10: Focused surveys for roosting colonies of monarch butterflies shall be conducted over the winter season (November to March) prior to construction activities. An examination of tree stands near and/or adjacent to the project area shall follow survey methods specified by the Xerces Society for Invertebrate Conservation (Xerces, 2004). The City shall avoid removing or trimming trees utilized by monarch butterflies or trees adjacent to the winter roost to prevent indirect changes to the humidity, wind exposure, and temperature within the immediate vicinity of the roost site. Any routine tree trimming shall be done between April and August to eliminate the risk of disturbance to monarch colonies, and shall be conducted under the guidance of a qualified monarch butterfly specialist if butterflies have been documented in the project area.</p>	<p>CPRD</p>	<p>CPRD</p>	<p>Prior to construction.</p>	

Table IV-1 *continued*

Mitigation Measures	Party Responsible for Implementation*	Agency Responsible for Monitoring	Monitoring Timing	Monitoring Compliance Record (Name/Date) ^b
<p>4.3 Geology and Soils</p> <p>GEO-1: A project geotechnical investigation shall be conducted and reviewed and approved by the City Engineer prior to issuance of a grading permit. This report shall address the stability of fill materials at the Arana Gulch Creek area and the nature and stability of materials apparently deposited as fill on the slope where the elevated multi-use trail is proposed across Hagemann Gulch. Measures outlined in the feasibility study shall be incorporated into the construction plans. Measures to reduce the potential impacts from slope instability may include but are not limited to:</p> <ul style="list-style-type: none"> ▪ Slope reconstruction. ▪ Installation of buttresses or engineered fills. ▪ Installation of lateral restraint structures. ▪ Installation of pile supports. ▪ Re-location of the proposed trails. <p>With the incorporation of all geotechnical recommendations into the project design and construction, this impact would be reduced to less than significant.</p>	CPRD and CPWD	CPWD and CPRD	Prior to issuance of grading permit.	
<p>GEO-2(a): The contractor for the project must comply with the City of Santa Cruz Best Management Practices (BMPs) for Construction Work. The BMPs shall be incorporated into the project plans and shall be approved by the City Engineer prior to issuance of a grading permit. If the total area to be disturbed by the project is one or more acres, the City shall obtain coverage under the General Permit for Discharges of Storm Water Associated with Construction Activity and shall submit a Storm Water Pollution and Prevention Plan (SWPPP), as required by the Regional Water Quality Control Board.</p> <p>GEO-2(b): All grading shall be conducted during the dry season (April 15 through October 15) only, and all areas of exposed soil shall be replanted within three months of completion of grading activities or prior to the first rainfall or prior to October 31, whichever is earlier, to minimize erosion and subsequent sedimentation.</p> <p>GEO-2(c): All trails shall be constructed in accord with best management practices defined in "Best Management Practices For Erosion Control During Trail Maintenance and Construction" (NHDRED 2004), or an equivalent document such as the United States Forest Service, Trail Construction and Maintenance Notebook 2004 Edition (USFS, 2004). The combination of the above mitigation measures would reduce project impacts to less than significant.</p>	CPRD and CPWD	CPRD and CPWD	Prior to issuance of grading permit.	
<p>GEO-3: Refer to Mitigation Measure GEO-1.</p>	Refer to Mitigation Measure GEO-1.	Refer to Mitigation Measure GEO-1.	Refer to Mitigation Measure GEO-1.	

Table IV-1 *continued*

Mitigation Measures	Party Responsible for Implementation*	Agency Responsible for Monitoring	Monitoring Timing	Monitoring Compliance Record (Name/Date) ^b
<p>GEO-4: A geotechnical investigation shall be conducted and reviewed and approved by the City Engineer prior to issuance of a grading permit. See Mitigation Measure GEO-1. Measures outlined in the geotechnical investigation shall be incorporated into the construction plans. Measures to reduce the potential impacts from slope instability may include but are not limited to:</p> <ul style="list-style-type: none"> ▪ Slope reconstruction. ▪ Excavation of expansive soils to bedrock. ▪ Employment of piles to support and stabilize bridge footing. <p>This mitigation measure would reduce the potential impact to less than significant.</p>	<p>CPRD and CPWD</p>	<p>CPWD and CPRD</p>	<p>Prior to issuance of grading permit.</p>	
<p>4.4 Hydrology and Water Quality</p> <p>HYDROLOGY-1(a): Before initiating any grading at the site, the City shall prepare an erosion control plan incorporating construction-phase measures to limit and control erosion and siltation. The erosion control plan shall incorporate components such as phasing of grading, limitations on areas of disturbance, designation of restricted entry zones, diversion of runoff away from disturbed areas, protective measures for sensitive areas, and provisions for revegetation and mulching, as required. The plan shall also prescribe treatment measures to trap sediment once it has been mobilized.</p>	<p>CPWD</p>	<p>CPWD and CPRD</p>	<p>Prior to grading</p>	
<p>HYDROLOGY-1(b): The contractor for the project must comply with the City of Santa Cruz Best Management Practices (BMPs) for Construction Work. If the total area to be disturbed by the project is one or more acres, the City shall prepare a Storm Water Pollution Prevention Plan (SWPPP) for the project. The SWPPP shall include water quality control measures to reduce the potential risks of surface water and groundwater contamination during construction and post-construction stages of development. The SWPPP shall incorporate the erosion control measures outlined in Mitigation Measure HYDROLOGY-1(a) and shall be consistent with the treatment requirements contained in the City of Santa Cruz Storm Water Management Program.</p>	<p>CPRD, CPWD and Project Contractor</p>	<p>CPWD and CPRD</p>	<p>Prior to and during construction.</p>	
<p>HYDROLOGY-1(c): The City's project engineer shall complete a hydrologic and hydraulic analysis and computations to determine the appropriate location of the clear span bridge abutments and other appropriate design details for Hagemann Gulch. A scour analysis shall be completed if any structures would be located in the channel to demonstrate that the abutment or pier protection and channel scour protection design are adequate. All of these analyses and design refinements shall comply with State of California engineering standards.</p> <p>The combination of the above mitigation measures would reduce the potential impact to a less-than-significant level.</p>	<p>CPWD</p>	<p>CPWD and CPRD</p>	<p>Prior to construction.</p>	

Table IV-1 *continued*

Mitigation Measures	Party Responsible for Implementations ^a	Agency Responsible for Monitoring	Monitoring Timing	Monitoring Compliance Record (Name/Date) ^b
<p>HYDROLOGY-2(a): To maintain natural surface runoff conditions on the site, the paved multi-use trails shall be designed to minimize concentration of discharges. Possible approaches may include, but are not limited to, out-sloping of the trail to diffuse the runoff downslope or to more frequent discharges that would minimize concentration of discharge points.</p>	<p>CPWD and CPRD</p>	<p>CPRD and CPWD</p>	<p>Prior to trail construction.</p>	
<p>HYDROLOGY-2(b): To maintain natural shallow subsurface flow conditions in the coastal prairie grassland area, the sub-base of the paved trail shall use a permeable type system, such as the CU Structural Soil™ or equivalent system. The combination of the above mitigation measures would reduce the potential impact to a less-than-significant level.</p>	<p>CPWD and CPRD</p>	<p>CPRD and CPWD</p>	<p>During construction.</p>	
<p>4.5 Aesthetics</p>				
<p>AESTHETICS-1: City staff shall work with the project engineer to determine, through the use of samples checked at the project site, if uncolored block would be the most neutral color for the retaining walls so as to provide maximum blending with surrounding natural features, and thus minimize visual impact. Use of colored blocks in earth tones should be considered. Implementation of this mitigation measure would make this impact less than significant.</p>	<p>CPRD and CPWD</p>	<p>CPRD and CPWD</p>	<p>Prior to construction.</p>	
<p>4.6 Recreation</p>				
<p>REC-1: The City Parks and Recreation Department and Public Works Department shall carry out mitigation measures identified in other sections of this EIR to reduce the environmental impacts of the proposed trail improvements and other project provisions for Arana Gulch.</p>	<p>CPRD and CPWD</p>	<p>CPRD and CPWD</p>	<p>Refer to other mitigation measures.</p>	
<p>4.7 Transportation/Traffic</p>				
<p><i>There are no significant transportation/traffic impacts.</i></p>				
<p>4.8 Air Quality</p>				
<p>AIR-1: The following controls shall be implemented during construction:</p> <ul style="list-style-type: none"> ▪ Water all active construction areas at least twice daily, ▪ Cover all trucks hauling soil, sand, and other loose materials or require all trucks to maintain at least 2 feet of freeboard; ▪ Pave, apply water three times daily, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas and staging areas at construction sites; ▪ Sweep daily (with water sweepers) nearby paved access roads, parking areas and staging areas at construction sites; and ▪ Sweep streets daily (with water sweepers) if visible soil material is carried onto adjacent streets. 	<p>CPRD</p>	<p>CPRD</p>	<p>During construction.</p>	

Table IV-1 *continued*

Mitigation Measures	Party Responsible for Implementation ^a	Agency Responsible for Monitoring	Monitoring Timing	Monitoring Compliance Record (Name/Date) ^b
<p>4.9 Noise</p> <p>NOISE-1: The City shall carry out the following mitigation measures during construction activities:</p> <ul style="list-style-type: none"> ▪ A sign visible at a distance of approximately 50 feet shall be posted at the construction site. The sign shall indicate the dates and duration of the construction activities, as well as provide a telephone number for residents to call with questions or complaints about the construction process. ▪ A "noise disturbance coordinator" shall be designated. The disturbance coordinator shall be responsible for responding to any local complaints about construction noise. The disturbance coordinator would determine the cause of the noise complaint (e.g., starting too early, bad muffler, etc.) and would be required to implement reasonable measures such that the complaint is resolved. Notices shall be sent to residential units within 300 feet of the construction site and shall list the telephone number for the disturbance coordinator. ▪ Construction shall be limited to the hours of 8:00 a.m. to 5:00 p.m., or shall comply with the City's Noise Ordinance, whichever is stricter. ▪ Construction shall not occur on Sundays or holidays. ▪ Stationary equipment shall be located as far as possible from noise sensitive land uses. ▪ If necessary, temporary plywood noise barriers shall be installed around fixed equipment. 	<p>CPRD and CPWD</p>	<p>CPWD and CPRD</p>	<p>During construction.</p>	
<p>4.10 Cultural Resources</p> <p>CULT-1: If any indicators of the presence of cultural resources are discovered during the construction of the project, earth-disturbing work shall be halted in an area within a radius of 10 meters (33 feet) around the suspected deposits, and an archaeologist or cultural resource specialist shall be consulted in accordance with applicable laws and regulations. If deemed appropriate under CEQA, data and artifact recovery shall be conducted during the period when construction work is halted.</p> <p>CULT-2: If human remains are discovered during the construction of the project elements, an appropriate representative of Native American groups and the County Coroner shall be informed and consulted, as required by law. Mitigation Measure CULT-1 shall also apply in such a situation.</p>	<p>CPWD and CPRD</p>	<p>CPWD and CPRD</p>	<p>During construction.</p>	
<p>4.11 Hazards and Hazardous Materials</p> <p><i>There are no significant hazards and hazardous materials impacts.</i></p>				
<p>4.12 Population and Housing</p> <p><i>There are no significant population and housing impacts.</i></p>				

Table IV-1 *continued*

Mitigation Measures	Party Responsible for Implementation ^a	Agency Responsible for Monitoring	Monitoring Timing	Monitoring Compliance Record (Name/Date) ^b
4.13 Public Services <i>There are no significant public services impacts.</i>				
4.14 Utilities and Service Systems <i>There are no significant utilities and service systems impacts.</i>				
4.15 Agricultural Resources <i>There are no significant agricultural resources impacts.</i>				
4.16 Mineral Resources <i>There are no significant mineral resources impacts.</i>				

^a Notes: CPRD = City of Santa Cruz Parks and Recreation Department

CPWD = City of Santa Cruz Public Works Department

^b This column is to be filled in at time of verifying compliance with mitigation measure.

INTRODUCTION

This Addendum to the Final EIR is prepared after review of a letter from an attorney on behalf of the California Native Plant Society and the Ventana Chapter of the Sierra Club received at the Planning Commission public hearing on July 6, 2006. This Addendum, along with the Addendum issued on June 6, 2006, the previously issued proposed Final EIR (May 2006) and the Draft EIR (February 2006) on the Arana Gulch Master Plan, constitute the full Final EIR if the City of Santa Cruz certifies the Final EIR as complete and adequate under CEQA. This Addendum merely clarifies Mitigation Measure BIO-2(a) of the Draft EIR regarding seasonal wetlands. Recirculation of the EIR is not required because: 1) no new significant impact has been identified or would result from the revised mitigation measure; and 2) the severity of an environmental impact would not be increased. As stated in Section 15088.5 of the CEQA Guidelines, recirculation is not required "when the new information added to the EIR merely clarifies or amplifies or makes insignificant modifications in an adequate EIR."

The CEQA Guidelines (Section 15126.4) state "Formulation of mitigation measures should not be deferred until some future time. However, measures may specify performance standards which would mitigate the significant effect of the project and which may be accomplished in more than one specified way." A number of mitigation measures identified in the EIR will be necessary at a future date. The recommended jurisdictional wetland delineation is a further clarification of wetlands analyses and mapping that has already occurred at the project site. Mitigation Measure BIO-2(a), as revised, would ensure success of the mitigation and ensure that no significant impacts to wetlands would occur. The results of a jurisdictional wetland delineation would not result in any new significant impacts not already identified in the EIR, and any necessary trail realignment would be minor enough that new significant impacts would not result. Seasonal wetlands in the vicinity of the trail have already been mapped and are shown in Figure 4.2-1 of the Draft EIR. The trail has been sited to avoid any wetlands, but the exact location of the wetlands can occur with a jurisdictional delineation as recommended in the revision to Mitigation Measure BIO-2(a) and the final design of the trail, which has not yet occurred, can ensure that such wetlands are avoided.

Any changes to the text of the Draft or Final EIR are shown below with underlining, and any deleted text is shown with strikeouts (e.g. ~~strikeouts~~).

The following text on Page 4.2-40 of the Draft EIR is deleted as follows:

~~If there would be fill of seasonal wetlands due to construction of the new trail within the wetland area, a verification of the wetland jurisdictional delineation by the U.S. Army Corps of Engineers would be required, and adequate mitigation for such fill would also be required.~~

Mitigation Measure BIO-2(a) is revised as follows on page 2-5 of the Draft EIR, page 4.2-40 of the Draft EIR, and page 271 of the Final EIR:

~~Mitigation BIO-2(a): Following preparation of detailed design for the Creek View Trail, the trail alignment and the small seasonal wetlands at the southern end of Arana Gulch that are in the vicinity of the trail alignment should be staked to verify if the trail alignment would have a direct impact on seasonal wetlands. To the maximum extent feasible, the final Creek View Trail alignment should avoid direct impacts to these scattered seasonal wetland areas. If the paved, multi-use trail cannot be realigned to avoid direct wetland impacts due to the need to maintain an ADA-compliant gradient, the City shall ensure completion of a jurisdictional delineation of the wetlands that could be directly impacted, with verification by the U.S. Army Corps of Engineers (Corps). If the wetland is~~

~~determined to be a jurisdictional wetland, and based on the Corps and any other regulatory requirements, the impacted seasonal wetland areas within the Arana Gulch property shall be replaced within Arana Gulch at a 2:1 ratio, or at a ratio determined necessary by the regulatory agency, or agencies. This effort shall be under the guidance of a qualified botanist.~~

The City shall complete a jurisdictional wetland delineation pursuant to U.S. Army Corps of Engineers and California Coastal Commission criteria for any seasonal wetlands that could be impacted by the Creek View Trail alignment. If any of the seasonal wetlands are determined to be jurisdictional wetlands pursuant to California Coastal Commission or U.S. Army Corps of Engineers criteria, the trail shall be designed, under the guidance of a qualified botanist, to avoid the jurisdictional wetland.

The CNPS Alternative

Response to City of Santa Cruz Arana Gulch Master Plan Proposed Interpretation, Transportation and Habitat Management Components

Overview

The Santa Cruz Chapter of the California Native Plant Society (CNPS) presents the following alternative to the City of Santa Cruz's preferred project at Arana Gulch. The CNPS proposal is the result of years of CNPS scientific involvement with the project site, including formal and informal biological site surveys, management consultation and comparisons with other similar systems in the region. The CNPS Board includes some of the area's leading plant biologists, restorationists, and conservation experts. The proposal presented here is a more detailed analysis of an alternative prepared by CNPS and outlined in early negotiations with the City starting in approximately 1998.

CNPS has significant concerns with the City's proposed transportation alignment, which stem from potential impacts from the alignment to the Santa Cruz tarplant (*Holocarpha macradenia*) and its associated sensitive habitat, coastal prairie. As proposed, the City's alternative eliminates existing tarplant and coastal prairie habitat, unnecessarily fragments the DFG-delineated tarplant management area, and reduces the long term viability of both the remaining tarplant and coastal prairie system. The City's proposed alignment also overlooks an important bicycle and equal access interpretive opportunity provided at Arana, viewing and interpretation of the coastal wetlands within the Harbor.

The purpose of this proposal is to provide additional detail to prior communications with the City and the regulators overseeing this process and to more fully elucidate an alternate path that CNPS believes achieves the goal of resource protection in keeping with the Coastal Act, specifically with regard to Environmentally Sensitive Habitat Area (ESHA), while balancing the City's interest in coastal access. The following sections first present an evaluation of the City's proposal, and second outline the CNPS alternative. If the City is willing to seriously consider the CNPS alternative, CNPS would be willing to work with the City to provide further assistance with the alternative.

City-proposed route: evaluation

Overview

The Santa Cruz tarplant is State listed as endangered and as threatened by the Federal government. Coastal terrace prairie is listed as a California Department of Fish and Game (DFG) sensitive natural community. The listing status of the Santa Cruz tarplant reflects the best available science and highlights that the species is currently imperiled with extinction throughout its range. Furthermore, phenotypic observations and genetic analysis (Palmer 1986) have concluded that the Santa Cruz tarplant population at Arana Gulch is distinct from other populations and therefore of specific and elevated importance for conservation.

The coastal prairie habitat at Arana Gulch is an important conservation target requiring careful protection measures to ensure long term restoration and management success. Both the tarplant and coastal prairie habitat are threatened by unnecessary habitat fragmentation and hydrological alteration that will occur if the current City proposal is implemented. Further, the management measures proposed by the City are too geographically limited to sufficiently address the conservation goals.

As recognized by both the City and CNPS, much of the DFG-delineated tarplant management area contains extant Santa Cruz tarplant in the soil seedbank, occasionally expressing itself as seedlings when appropriate disturbance regimes have been introduced. CNPS notes that the specific locations that favor Santa Cruz tarplant, and all coastal prairie species, shift through time with variability in habitat management, species composition, and climate (Hobbs et al. 2007, Elmendorf and Harrison 2009). Therefore, it is essential that long term habitat management be coupled with improved reserve design to favor habitat continuity that can help ensure species persistence and movement across the Arana Gulch terrace as a whole.

Habitat fragmentation

Habitat fragmentation is a leading stress threatening the long term viability of species and habitats (Wilcove et al. 1998). Fragmentation alters habitat characteristics by increasing the amount of 'edge' habitat, effectively decreasing the 'core' habitat necessary for species persistence. Even localized fragmentation has been shown to have deleterious consequences for the viability of plant populations (Lennartsson 2002). Oftentimes, species movement patterns are altered by fragmentation and dispersal can be limited across the boundaries presented by edge areas.

The 8' (243.8 cm) width of the City's proposed transportation corridors bisecting the meadow at Arana Gulch potentially present effective barriers to dispersal of the Santa Cruz tarplant and other coastal prairie species. Santa Cruz tarplant, as with many of California's native coastal prairie species, is dispersal limited (Sokolow 2000, Ogden and Rejmanek 2005, Seabloom et al. 2005); tarplant seeds present no obvious means of dispersal. Preliminary studies have suggested limited movement of the seeds of up to 1.5' (45 cm), possibly propelled by gravity moderated by strong wind and perhaps mechanical forces when plants are abraded by passing mammals (Hayes and Holl, unpublished data).

The City's proposal enshrines unnecessarily large edge areas across the Arana Gulch terrace while fragmenting the tarplant and coastal prairie habitat into 3 habitat blocks. The effects of edge areas have been well documented in a variety of habitats generally and in California grasslands specifically. At habitat edges, patterns of light, water, and temperature vary, altering species composition from that found in core areas of habitat. This effect is especially pronounced in smaller reserves comparable to that at Arana (Kelly and Rotenberry 1993). The width of edge effects varies depending on many factors, but has been found to be most intense up to 30' from roads through California grasslands (Gelbard and Harrison 2003). When coupled with transportation corridors, edge areas in California grassland tend to be much more invaded by weedy species that

then spread into the surrounding habitat. Larger areas of grasslands unfragmented by roads have been shown to be more resistant to invasions of new exotic pest plants (Gelbard and Harrison 2005).

Total edge proposed by the City’s proposal for both North-South and East-West transportation corridors is 5914 linear feet (Table 1); conservative estimations of altered habitat of 3’ in width on either side of the paved path (in addition to the 8’ wide transportation corridor) suggest total altered habitat area of 0.4 acres. It should be noted that these impacts are in addition to habitat removed from the Tarplant Management Area, noted in the City’s EIR. Because specific design of transportation corridors has not been presented, this estimate is considered conservative depending on widening necessary for turnouts for passing and/or interpretation, placement of adjacent lighting or signs, and fencing needed for habitat management or trespass. Each of these additional and easily foreseen scenarios will inevitably increase edge area within the meadow. In addition, edge areas will be created by the fencing proposed around the small 5-acre livestock management area.

Table 1: Quantification of Edge Effects of City’s Proposed Transportation Corridors through Arana Gulch

Trail Name	Linear Feet of Edge	Acreage
N-S transportation corridor a.k.a. Arana Meadow Trail	3168	0.22
Eastern Portion of E-W transportation corridor a.k.a. Creek View Trail	2112	0.14
Western Portion of E-W transportation corridor a.k.a. Canyon Trail	634 (not entire trail has edge effects)	.04
Totals:	5914 linear feet	0.40 acres

As mentioned above, edge areas are often more conducive to exotic species invasion. Under the current proposal, the long term expense of managing Arana’s grassland habitat is predicted to increase. The City has maintained that, by paving existing trails, it is improving the current situation, whereas it has been demonstrated that higher contrast edge areas (paved vs. unpaved) have significantly increased negative effects in California grassland communities (Collinge and Palmer 2002). Increased traffic levels present increased opportunity for new invasions, including pathogen introductions, changing community composition and threatening native biodiversity, thus a shift from existing to proposed use, from recreational to traffic corridor, presents significantly increased threats to biota in Arana’s meadows (Jules et al. 2002, Malmstrom et al. 2006, Arevalo et al. 2008). Effects of trail to road conversion may take decades, often appearing long after mitigation funds are normally depleted (Findlay and Bourdages 2000).

Hydrological alteration

A specific edge effect of significant consideration to long term survival of the Santa Cruz tarplant is alteration of habitat due to the hydrological changes produced from engineered transportation corridors. Observations suggest that the Santa Cruz tarplant, as with a larger guild of other rare to common coastal prairie and other grassland species, prefers a narrow range of more moist, but not inundated hydrological regimes (Barnes and Harrison 1982, Reynolds et al. 1997). The location of these specific hydrological conditions vary due to surface and subsurface drainage patterns driven by topography, soil macropores, and subsurface geologic patterns. USGS studies in this region on terraces analogous to Arana have shown subsurface geologic patterns are distinct from the surface topography (Curry, pers comm.). Bedrock valleys and peaks in the terrace geology drive subsurface drainage. Soil pores are also a complex driving factor affecting hydrology in the loamy soils in this immediate region, on identical soils (Huffman 2001). Surface runoff patterns, though more easily described by elevational changes, are also complex due to the large more or less level areas of the terrace. And so, seemingly minor alterations to drainage from paved road construction could have quite major implications for the coastal prairie and tarplant.

The City has proposed engineering solutions to drainage alterations of proposed transportation corridors that are untested and should be seen as experimental rather than outright solutions. The permeability of the proposed pervious subsurface engineered material could be rendered ineffective by the unusual soil type found at Arana Gulch. The soils at Arana are shrink-swell soils with cracking that has the potential for sediment delivery within the soil column; in addition, soil macropores can potentially deliver sediment through the soil column. Studies suggest that, in these cases, geotextile solutions have a higher potential failure rate (Joint Departments of the Army and Air Force 1995). In the case of failure of permeable subsurface engineering, alteration of hydrological regimes will create drier and wetter patterns that may negatively affect the Santa Cruz tarplant and coastal prairie habitats. In the case of the success of subsurface roadway engineering, wetter areas may drain altogether, and water may be transported more rapidly from habitat areas on the terrace.

Management critique

Long term management

The City proposes active grazing management of a small portion, 5-acres (17%) of Santa Cruz tarplant habitat. Due to its evolutionary co-dependence on disturbance regimes and the invasion of its habitat by extensive non-native plant and animal populations, the Santa Cruz tarplant requires active management to persist (Holl and Hayes 2006). The small size of the City's proposed management area guarantees a reduced population size and extent of Santa Cruz tarplant at Arana Gulch. Reduced population size and extent increases the likelihood of extinction due to stochastic (changing/variable/random) climatic and disturbance events. Smaller populations of Santa Cruz tarplant also have been shown to have reduced seed viability, possibly because of reduced pollinator populations or inbreeding depression (Satterthwaite et al. 2006).



Figure 1: CNPS proposed alternative alignment for transportation corridors through Arana Gulch Greenbelt. Footpath alignments are not addressed in this map. Note CNPS notes that the Santa Cruz tarplant populations outlined in the map are artificial constructs of only recent, spotty surveys of just adult plants in some years; the true extent of the Arana Gulch populations is much broader, potentially enveloping the entire grassland area, where seeds of the species await the return of proper management. Almost all of the grassland area at Arana Gulch has been declared in a MOU between the City and the California Department of Fish and Game as the 'Tarplant Management Area.' Likewise, the entire grassland area at Arana has been legally declared critical habitat for the Santa Cruz tarplant by the US Fish and Wildlife Service.

The CNPS Alternative

Overview

The CNPS alternative presents significantly reduced fragmentation, far fewer edge effects, reduced hydrological impacts, and improved long term management scenarios. The CNPS alternative focuses proposed transportation corridors onto existing edge areas wherever feasible, effectively reducing fragmentation, edge, and hydrological impacts. In addition, CNPS proposes a much larger geographic scope of tarplant and coastal prairie management to better ensure species and habitat viability. There are significant cost reductions that favor this alternative.

Alternative alignment

The CNPS alternative routes for transportation corridors through Arana Gulch follow edge areas for both the North-South and East-West corridors (Figure 1). This alternative significantly reduces fragmentation and edge effects over what exists currently and over what the City proposes in its Management Plan.

Currently, the Tarplant Management Area is negatively impacted by edge effects along its boundaries. Weedy species are evident especially alongside residential areas, but are also evident along the more natural boundaries of Hageman Gulch and Arana Creek. Focusing the proposed transportation corridors along residential edges ensures reducing new edge area; furthermore it also can serve to buffer the adjoining impacts from the habitat at Arana. For instance, paved transportation corridors may reduce the creep of rhizomatous perennial invasive weeds such as English ivy (*Hedera helix*), kikuyu grass (*Pennisetum clandestinum*), periwinkle (*Vinca major*), and others. Native and non-native woody species invasion may also be curtailed by the transportation corridors along the current boundary.

By placing the proposed transportation corridors along existing habitat edge areas, the CNPS alternative eliminates many of the edge effects of the City's proposed transportation routes (Table 2; compare with Table 1). Total edge effects from the CNPS alternative are 1,954 linear ft, a reduction of 33%. Total acreage of edge effects would impact 0.13 acres of Tarplant Management Area. The CNPS alternative presents a 2/3 reduction of trail impacts when compared to the impacts of the route proposed by the City.

Table 2: Quantification of Edge Effects of CNPS's Proposed Alternative Alignment for Transportation Corridors through Arana Gulch

Trail Name	Linear Feet of Edge	Acreage
N-S transportation corridor	0	0
E-W transportation corridor	1,954	0.13
Totals:	1,954 linear feet	0.13 acres

One of the most important aspects of the CNPS alternative is the maintenance of the Tarplant Management Area as one contiguous block of habitat. This is a significant improvement upon the City's current proposal, allowing unimpeded Tarplant movement within the meadow without dispersal barriers, increasing the probability of the maintenance of biological diversity (Gelbard and Harrison 2003), and reducing the costs of control of invasive species (Gelbard and Harrison 2005).

Alternative management

CNPS proposes a larger geographic scale of management than is proposed by the current City proposal. Larger management areas have been shown to maintain higher species diversity (Quinn and Robinson 1987). A larger management area will also ensure larger, long term Santa Cruz tarplant and other coastal prairie species populations. Less fragmented and larger plant populations have a greater chance of remaining viable through time (Morgan 1999, Steffan-Dewenter and Tschamtkke 1999).

Carefully designed livestock grazing has been shown to be the most effective and low-cost management tool to maintain and restore the Santa Cruz tarplant and coastal prairie. Livestock reduce vegetation canopy through the growing season, increasing native grass cover (D'Antonio et al. 2004), increasing germination and seedling establishment of Santa Cruz tarplant (Hayes 2002), and generally increasing the diversity and abundance of native annual wildflowers (Hayes and Holl 2003).

Mowing as an alternative may be difficult to time correctly to reduce exotic species and, by creating homogeneity of canopy heights, could reduce wildlife and plant diversity (Holl and Hayes 2006). While livestock management has been shown to be compatible with carefully planned recreation, it may be wise to separate livestock use from desired higher speed transportation corridors through Arana Gulch. **The current City proposal** fences an approximately 5-acre area for livestock management. The CNPS alternative proposes fencing the entire meadow with fences placed inboard of trails placed along the perimeter. This effectively reduces the edges produced by the fencing around the City's proposed 5-acre livestock management area as well as the predicted edge from trailside incursions into habitat areas along transportation corridors. The larger management unit also ensures livestock use patterns more similar to historic patterns that maintained the tarplant at higher population levels.

Construction Alternatives

In addition to inboard fencing for the entirety of its proposed alternative location for transportation corridors at Arana, CNPS has several suggestions on design features that we would like to be considered for incorporation. First, the City should consider the use of elevated boardwalks to reduce hydrological impacts



Figure 2: Neary Lagoon Boardwalk provides good example of elevated system to reduce impacts to sensitive resources

to the Tarplant Management Area. As the City has expressed concern about the costs associated with such measures, CNPS volunteers surveyed similar construction at Neary Lagoon (Figure 2). At that site, fewer than 2 dozen of thousands of boards had been replaced since construction over a decade ago (Figure 3). At this time, boardwalks at Neary Lagoon seem to be in good working order with few and generally low cost repairs evident.

Such elevated boardwalks may also offset other design concerns that may be presented with the CNPS alternative. First, such boardwalks could minimize any necessary grading. Also, boardwalks could minimize compaction and other damage to tree roots. And, as with the Neary Lagoon boardwalks, it is relatively straightforward to incorporate fencing as part of the edge of the boardwalk, reducing the overall width of impact of trail infrastructure.



Figure 3: New boards provide evidence of repair of boardwalk

CNPS has evaluated the health of mature, large oak trees on the southern perimeter of the terrace, in proximity to the CNPS proposed alternative east-west transportation corridor. Preliminary consultation with experts including an ISA-certified Master Arborist suggests that best design principles should maintain the corridor outside of the root zone of these oaks, utilizing a Tree Protection Zone as outlined in Matheny and Clark (1998). Moving the trail to the CNPS alternative path would reduce current trail use impacts that lie well within the active root zone of heritage oaks. Constructing the corridor with these considerations in mind maintain access and trail use to within existing edge habitat, reducing impacts to the tarplant and coastal prairie as well as oaks and other trees.

References

- Arevalo, J. R., J. D. Delgado, and J. M. Fernandez-Palacios. 2008. Changes in plant species composition and litter production in response to roads and trails in the laurel forest of Tenerife (Canary Islands). *Plant Biosystems* 142:614-622.
- Barnes, P. W., and A. T. Harrison. 1982. Species distribution and community organization in a Nebraska Sandhills mixed prairie as influenced by plant/soil-water relationships. *Oecologia* 52:192.
- Collinge, S. K., and T. M. Palmer. 2002. The influences of patch shape and boundary contrast on insect response to fragmentation in California grasslands. *Landscape Ecology* 17:647-656.
- D'Antonio, C. M., S. J. Bainbridge, C. Kennedy, J. W. Bartolome, and S. Reynolds. 2004. Ecology and restoration of California grasslands with special emphasis on the influence of fire and grazing on native grassland species. white paper Department of Integrative Biology, Berkeley.
- Elmendorf, S. C., and S. P. Harrison. 2009. Temporal variability and nestedness in California grassland species composition. *Ecology* 90:1492-1497.

- Findlay, C. S., and J. Bourdages. 2000. Response Time of Wetland Biodiversity to Road Construction on Adjacent Lands. *Conservation Biology* 14:86.
- Gelbard, J. L., and S. Harrison. 2003. Roadless habitats as refuges for native grasslands: Interactions with soil, aspect, and grazing. *Ecological Applications* 13:404-415.
- Gelbard, J. L., and S. Harrison. 2005. Invasibility of roadless grasslands: An experimental study of yellow starthistle. *Ecological Applications* 15:1570-1580.
- Hayes, G. 2002. Cattle Grazing Effects on the Coastal Prairie Plant Community and Associated Annual Forbs. PhD dissertation. University of California at Santa Cruz, Santa Cruz, CA, USA.
- Hayes, G., and K. D. Holl. 2003. Cattle grazing impacts on annual forbs and vegetation composition of mesic grasslands in California. *Conservation Biology* 17:1694 - 1702.
- Hobbs, R. J., S. Yates, and H. A. Mooney. 2007. Long-term data reveal complex dynamics in grassland in relation to climate and disturbance. *Ecological Monographs* 77:545-568.
- Holl, K. D., and G. F. Hayes. 2006. Challenges to Introducing and Managing Disturbance Regimes for *Holocarpha macradenia*, an Endangered Annual Grassland Forb. *Conservation Biology* 20:1121-1131.
- Huffman, T. 2001. Preliminary Constraints Analysis: Long Marine Laboratory Coastal Long Range Development Plan. Long Range Development Plan Terry Huffman Associates.
- Joint Departments of the Army and Air Force. 1995. Engineering Use of Geotextiles. TM 5-818-8/AFJMAN 32-1030.
- Jules, E. S., M. J. Kauffman, W. D. Ritts, and A. L. Carroll. 2002. Spread of an invasive pathogen over a variable landscape: A nonnative root rot on Port Orford cedar. *Ecology (Washington D C)* 83:3167-3181.
- Kelly, P. A., and J. T. Rotenberry. 1993. Buffer zones for ecological reserves in California: replacing guesswork with science. Pages 85-92 in J. E. Keeley, editor. *Interface Between Ecology and Land Development in California*. Southern California Academy of Sciences, Los Angeles, CA.
- Lennartsson, T. 2002. Extinction thresholds and disrupted plant-pollinator interactions in fragmented plant populations. *Ecology* 83:3060-3072.
- Malmstrom, C. M., C. J. Stoner, S. Brandenburg, and L. A. Newton. 2006. Virus infection and grazing exert counteracting influences on survivorship of native bunchgrass seedlings competing with invasive exotics. *Journal Of Ecology* 94:264-275.
- Matheny, N. and J.R. Clark. *Trees and Development. A Technical Guide to Preservation of Trees During Land Development*. International Society of Arboriculture, Champaign, IL.
- Morgan, J. W. 1999. Effects of population size on seed production and germinability in an endangered, fragmented grassland plant. Pages 266-273 in *Conservation Biology*.
- Ogden, J. A. E., and M. Rejmanek. 2005. Recovery of native plant communities after the control of a dominant invasive plant species, *Foeniculum vulgare*: Implications for management. *Biological Conservation* 125:427-439.

- Palmer, R. 1986. Evolutionary relationships of *Holocarpha macradenia*. Pages 295-304 in T. S. Elias, editor. Conservation and Management of Rare and Endangered Plants. California Native Plant Society, Sacramento, CA.
- Quinn, J. F., and G. R. Robinson. 1987. The effects of experimental subdivision on flowering plant diversity in a California USA annual grassland. *Journal Of Ecology* 75:837-856.
- Reynolds, H. L., B. A. Hungate, F. S. Chapin, and C. M. D'Antonio. 1997. Soil Heterogeneity and Plant Community Competition in an Annual Grassland. *Ecology* 78:2076-2090.
- Satterthwaite, W. H., K. D. Holl, G. Hayes, and A. Barber. 2006. Seed banks in plant conservation: Case study of Santa Cruz tarplant restoration. *Biological Conservation* 135:57-66.
- Seabloom, E. W., O. N. Bjornstad, B. M. Bolker, and O. J. Reichman. 2005. Spatial signature of environmental heterogeneity, dispersal, and competition in successional grasslands. *Ecological Monographs* 75:199-214.
- Sokolow, S. 2000. Seed dispersal of prairie wild flowers with a focus on *Holocarpha macradenia*. Bachelor of Arts Senior Thesis. University of California at Santa Cruz, Santa Cruz.
- Steffan-Dewenter, I., and T. Tschamtkke. 1999. Effects of habitat isolation on pollinator communities and seed set. *Oecologia (Berlin)* 121:432-440.
- Wilcove, D. S., D. Rothstein, J. Dubow, A. Phillips, and E. Losos. 1998. Quantifying threats to imperiled species in the United States. *Bioscience* 48:607-611.