PLANNING & DEVELOPMENT
APPEAL FORM

SITE ADDRESS: 3861 Foothill Rd., Carpinteria CA 93013

ASSESSOR PARCEL NUMBER: 005-310-024

Are there previous permits/applications? ☐no ☐yes numbers: _____
(include permit# & lot # if tract)

Is this appeal (potentially) related to cannabis activities? ☐no ☑yes

Are there previous environmental (CEQA) documents? ☐no ☐yes numbers: _____

1. **Appellant:** Maureen Claffey + Foley Farms + Save Arroyo Paredon Watershed Phone: _____ FAX: _____
Mailing Address: _____ E-mail: redhencannery@gmail.com
Street City State Zip

2. **Owner:** _____ Phone: _____ FAX: _____
Mailing Address: _____ E-mail: _____
Street City State Zip

3. **Agent:** _____ Phone: _____ FAX: _____
Mailing Address: _____ E-mail: _____
Street City State Zip

4. **Attorney:** Elise Cossart-Daly Phone: (805) 380-8408 FAX: _____
Mailing Address: 1117 State St., Santa Barbara, CA 93103 E-mail ecd@cossart-dalylaw.com
Street City State Zip

COUNTY USE ONLY

Case Number: _____ *Companion Case Number:* _____
Supervisorial District: _____ *Submittal Date:* _____
Applicable Zoning Ordinance: _____ *Receipt Number:* _____
Project Planner: _____ *Accepted for Processing* _____
Zoning Designation: _____ *Comp. Plan Designation* _____

RECEIVED
2019 DEC -3 A 11:55
COUNTY OF SANTA BARBARA
BOARD OF SUPERVISORS

COUNTY OF SANTA BARBARA APPEAL TO THE:

✓ **BOARD OF SUPERVISORS**

_____ **PLANNING COMMISSION:** _____**COUNTY** _____ **MONTECITO**

RE: Project Title Cresco

Case No. 10DVP-00000-000010

Date of Action 9/3/2021

I hereby appeal the ✓ approval _____approval w/conditions _____denial of the:

_____Board of Architectural Review – Which Board? _____

_____Coastal Development Permit decision

_____Land Use Permit decision

✓ Planning Commission decision – Which Commission? SB County

_____Planning & Development Director decision

_____Zoning Administrator decision

Is the appellant the applicant or an aggrieved party?

_____ Applicant

✓ Aggrieved party – if you are not the applicant, provide an explanation of how you are and "aggrieved party" as defined on page two of this appeal form:

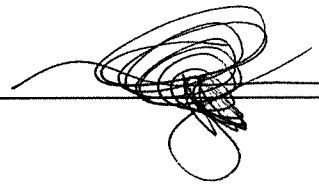
See attached.

Please include any other information you feel is relevant to this application.

CERTIFICATION OF ACCURACY AND COMPLETENESS Signatures must be completed for each line. If one or more of the parties are the same, please re-sign the applicable line.

Applicant's signature authorizes County staff to enter the property described above for the purposes of inspection.

I hereby declare under penalty of perjury that the information contained in this application and all attached materials are correct, true and complete. I acknowledge and agree that the County of Santa Barbara is relying on the accuracy of this information and my representations in order to process this application and that any permits issued by the County may be rescinded if it is determined that the information and materials submitted are not true and correct. I further acknowledge that I may be liable for any costs associated with rescission of such permits.

Maureen Claffey  9/13/21

Print name and sign – Firm Date

Print name and sign – Preparer of this form Date

Print name and sign – Applicant Date

Print name and sign – Agent Date

Print name and sign – Landowner Date

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Reason of grounds for the appeal – Write the reason for the appeal below or submit 8 copies of your appeal letter that addresses the appeal requirements listed on page two of this appeal form:

- A clear, complete and concise statement of the reasons why the decision or determination is inconsistent with the provisions and purposes of the County's Zoning Ordinances or other applicable law; and
- Grounds shall be specifically stated if it is claimed that there was error or abuse of discretion, or lack of a fair and impartial hearing, or that the decision is not supported by the evidence presented for consideration, or that there is significant new evidence relevant to the decision which could not have been presented at the time the decision was made.

See attached.

Specific conditions imposed which I wish to appeal are (if applicable):

a. See attached.

b.

c.

d.

Attachment to Appeal to Santa Barbara County Board of Supervisors

Maureen Claffey, Foley Family Farm, and Save Arroyo Paredon Watershed ("Appellants") hereby appeal the County of Santa Barbara ("County") Planning Commission's ("Planning Commission" or "Commission") approval of the proposed cannabis cultivation project located at 3861 Foothill Road in Carpinteria, California on APN 005-310-024 ("Project").

Through this appeal, Appellants adopt and incorporate all objections to the Project that have been previously raised by any other individual or entity in the administrative process for this Project before the County of Santa Barbara.

I. Appellants Are Aggrieved Parties.

Ms. Claffey was raised on the avocado farm adjacent to the proposed Project site ("Project Site"), and her family has farmed and lived in Carpinteria for six generations. Her relatives, the Bailard, Foley, and Claffey families, have lived on the property and farmed this land since the 1940s. Foley Farm and their family home on the farm are some of the last important remnants of Carpinteria Valley's early agricultural heritage. Appellants love this place and are invested in preserving and protecting it.

Ms. Claffey and Foley Family Farm provided a letter to the Planning Commission, appended as Attachment I and supplemental correspondence to the Planning Commission in response to an updated Project Application, appended as Attachment II to this Appeal. In addition, Ms. Claffey, in her capacity as an individual and as part of Save Arroyo Paredon Watershed, and her legal counsel, Elise Cossart-Daly of Cossart-Daly Law, A.P.C., spoke at both the August 11, 2021 and September 1, 2021 Planning Commission Hearings.

II. The Planning Commission's Findings Are Not Supported by Substantial Evidence.

Both a Coastal Development Permit and a Conditional Use Permit require the Planning Commission to find that the Project complies with the Costal Land Use Plan, including the Toro Canyon Plan, and the Coastal Zoning Ordinance. (See CZO, §§ 35.169.5(1), (2); 35-172.8.) The Commission found that the Project complies with the Costal Land Use Plan, including the Toro Canyon Plan, and the Coastal Zoning Ordinance in its decision dated September 3, 2021. (See Planning Commission Findings, pp. C-2, C-5, C-8.) Substantial evidence in the record, however, demonstrates that the Project does not comply with the Toro Canyon Plan or Coastal Zoning Ordinance in several respects. The Commission's findings, therefore, is not supported by substantial evidence.

A. Evidence in the record demonstrates that the Project is located in the ESH buffer and will impact ESH.

The Coastal Zoning Ordinance requires that where a Project cannot avoid environmentally sensitive habitat ("ESH") or ESH buffers, and the Project would involve impacts to ESH, the Applicant must prepare a Habitat Protection Plan. (CZO, Appendix G.)

As discussed in my August 2, 2021 letter to the Commission ("August 2nd Letter"), the Project is located in the ESH buffer: Greenhouse 1, which will be used for cannabis cultivation, protrudes into the ESH buffer, as does a road along the perimeter of the Greenhouse. (See Biological Resources Assessment, Figure 5; Attachment I, p. 2 [August 2nd Letter]; Attachment II, p. 3 [August 30, 2021 Letter to the Commission ("August 30th Letter")].)

Arroyo Paredon Creek and its surrounding ESH buffer serve as critical habitat for tidewater goby and steelhead trout – both federally endangered species. It supports rare species, including Cooper's Hawk, Yellow Warbler, California Red-legged Frog, Coast Range Newt, and Western Pond Turtle. There are rare and endangered species downstream in and around Arroyo Paredon Creek, including Crotch's Bumble Bee, Least Bell's Vireo, and Southwestern Willow Flycatcher. (Attachment I, p. 2 [August 2nd Letter]; Exhibit C to Attachment I, p. 3 [Magney Letter].)

As described in my August 2nd Letter, my August 30th Letter, and correspondence from Biologist David Magney, the evidence demonstrates that the Project would and may already have involved impacts to ESH that support these rare and endangered species. (Attachment I, pp. 5-6, Exhibit C [August 2nd Letter]; Attachment II, pp. 3-4 [August 30th Letter].) First, the Project Applicant's agent destroyed the avocado orchard without studying or mitigating impacts to sensitive species in the ESH buffer and riparian corridor. Second, the Byers system's odor masking agent, Ecosorb, and Cannabis odors may impact sensitive species. Third, during flood events, the detention basins will overflow into Arroyo Paredon Creek, resulting in the discharge of pollutants used at the Project.

Perhaps more importantly, there is insufficient evidence in the record to support a finding that the Project *will not* impact sensitive habitat. (Attachment I, pp. 6 – 9 [August 2nd Letter].) Without applying the Santa Barbara South Coast Riverine Wetlands HGM model ("HGM") the Applicant does not have sufficient information to conclude that the Project would not have significant impacts on sensitive species in and around Arroyo Paredon creek. (Attachment I, p. 7 [August 2nd Letter]; Exhibit C to Attachment I, pp. 4-5 [Magney Letter]; Attachment II, pp. 4-5.) In addition, the Applicant's agent destroyed the avocado orchard, which served as an extension of riparian habitat, without conducting a survey for birds or determining if destroying the avocado trees would impact sensitive species. (*Ibid.*)

As evidence in the record demonstrates that the Project is in the ESH buffer and will have an impact on sensitive habitat, the Applicant must prepare a Habitat Protection Plan, in order to comply with Appendix G of the Coastal Zoning Ordinance. As the Applicant has not done so, the Commission's finding that the Project conforms to the Coastal Zoning Ordinance is not supported by substantial evidence.

B. The evidence demonstrates that the Project's Odor Management Plan will not prevent odors in residential areas and is not the best available technology.

According to the Coastal Zoning Ordinance, an Odor Management Plan "must prevent odors from being experienced within residential zones." (CZO, § 35-144U(C)(5).) They may use vapor-phase systems, provided that they are "odor-neutralizing, not odor masking," and do not "produce a differing scent (such as pine or citrus)." (CZO, § 35-144U(C)(5)(e)(2).) "A Professional Engineer or a Certified Industrial Hygienist must review and certify that the equipment and methods to be used for reducing odors are consistent with accepted and available industry- specific best control technologies and methods designed to mitigate odor." (CZO, § 35-144U(C)(5)(d).)

Odors will still be detected in residential areas with the Applicant's proposed Odor Management Plan. As explained in my August 30th Letter, appended here as Attachment II, the evidence demonstrates that, even with the Applicant's carbon scrubbing system, which the Commission approved, odors will be detected in residential areas. (Attachment II, p. 5.) Tests conducted indicate that residential areas adjacent to the Project would still experience odors of 10 D/T, which is quite high. (Cresco August 9th Letter, p. 9, Figure 4.) The Project, as approved, will continue to use the Byers system while the carbon scrubbing system is developed. As explained in my August 2nd Letter, and in the correspondence from Dr. Paul Rosenfeld, the evidence demonstrates that odors will be detected in residential areas while the Project uses the Beyers vapor phase system.

As explained in my August 2nd and August 30th Letter, use of the Byers system while the carbon scrubbing system is developed would violate Section 35-144U(C)(5)(e)(2) of the Coastal Zoning Ordinance, as the Byers system is odor masking and produces a different scent. (See Attachment I, pp. 10 – 11 [August 2nd Letter]; Attachment II, pp. 5-6 [August 30th Letter].)

Finally, there is no evidence to support a certification that the carbon scrubbers are "consistent with accepted and available industry- specific best control technologies and methods designed to mitigate odor" as required by Section 35-144U(C)(5)(d) of the Coastal Zoning Ordinance. There is no evidence to substantiate that the carbon filtration system proposed by the Applicant will work. The Applicant proposes an entirely new odor mitigation system, that has only been tested on two occasions in the field.

The Commission's finding that the Project conforms with 35-144U(C), therefore, is not supported by substantial evidence.

III. Appellants request that the Board of Supervisors deny the Project, or, in the alternative, require additional study and impose additional conditions on the Project.

For the reasons discussed above, Appellants respectfully request that the Board of Supervisors ("Board") overturn the Commission's approval of the Project. The Project is inconsistent with the Coastal Zoning Ordinance and Toro Canyon Plan and threatens to harm the environment and the Carpinteria community.

If, however, the Board choses to approve a Coastal Development Permit for the Project, Appellants respectfully request that they require the Project Applicant to (1) implement biological expert David Magney's recommendations, outlined on pages eight and nine of my August 2nd Letter and in Mr. Magney's Correspondence, appended to my August 2nd Letter as Exhibit C; (2) prepare a Habitat Protection Plan for the environmentally sensitive habitat and rare and endangered species in and surrounding the Project; (3) prohibit the use of vapor phase odor management systems at the Project in order to protect ESH; and (4) implement a carbon filtration system, such as the system proposed by Dr. Paul Rosenfeld in Exhibit I to my August 2nd Letter, to control odor and air emissions for all aspects of the Project, including Greenhouse 1.

If the Board of Supervisors approves the Project with the Byers system, Appellants respectfully request that the Board prohibit the use of any vapor phase odor mitigation system until the County completes additional study of the impacts of such a system on the riparian habitat in Arroyo Paredon Creek and on residents and other sensitive receptors and appropriate mitigation is implemented to protect wildlife, critical habitat, and local residents.

Attachment I

August 2, 2021

Via Email
Honorable Planning Commissioners
Mr. Daniel Blough, Ms. Laura M. Bridley,
Mr. C. Michael Cooney, Mr. Larry Ferini, and
Mr. John Parke
c/o Mr. David Villalobos
Board Assistant Supervisor
Planning and Development Hearing Support
County of Santa Barbara
123 East Anapamu Street
Santa Barbara, California 93101
dvillalo@co.santa-barbara.ca.us

Re: Proposed Cannabis Development Project Located at 3861 Foothill Road in Carpinteria, California – APN 005-310-024 – Development Permit Number 10DVP-00000-00010

Dear Honorable Commissioners:

Maureen Claffey and Foley Family Farm have retained my office to represent them with respect to the proposed cannabis cultivation project located at 3861 Foothill Road in Carpinteria, California on APN 005-310-024 ("Project"). Ms. Claffey was raised on the avocado farm adjacent to the proposed Project site ("Project Site"), and her family has farmed and lived in Carpinteria for six generations. Her relatives, the Bailard, Foley, and Claffey families, have lived on the property and farmed this land since the 1940s. Foley Farm and their family home on the farm are some of the last important remnants of Carpinteria Valley's early agricultural heritage. My clients love this place and are invested in preserving and protecting it. As explained below, this Project threatens to cause great harm to Arroyo Paredon creek, local wildlife, and the community.

I. Project Overview

The Project site is adjacent to my client's avocado orchard and family home. It is also less than 700 feet from two Existing Developed Rural Neighborhoods. (See Odor Management Plan, p. 22.) It abuts Arroyo Paredon Creek, which is specifically called out in the Toro Canyon Plan as

environmentally sensitive habitat ("ESH") which supports rare Southern Live Oaks. (Toro Canyon Plan, p. 117.) Arroyo Paredon Creek is also designated critical habitat for tidewater goby and steelhead trout – both federally endangered species. (50 CFR 17, Exhibit A, Table 1, see also Exhibit B, pp. 17, 34-35 [Caltrans State Route 101/South Coast HOV Project Natural Environment Study, including Arroyo Paredon Creek]; Exhibit C, p. 4 [note that the tidewater goby critical habitat designation is downstream from the Project, but may be impacted by Project development.]) According to DFW, Arroyo Paredon Creek is "essential" to the tidewater goby's recovery. (*Ibid.*) Arroyo Paredon Creek also supports other rare species, including Cooper's Hawk, Yellow Warbler, California Red-legged Frog, Coast Range Newt, and Western Pond Turtle, and there are rare and endangered species downstream in and around Arroyo Paredon Creek, including Crotch's Bumble Bee, Least Bell's Vireo, and Southwestern Willow Flycatcher. (Exhibit C, p. 3.) The County has designated a 100 foot buffer for Environmentally Sensitive Habitat around the Arroyo Paredon creek bed. A portion of one of the greenhouses (Greenhouse 1) and a road are within the ESH buffer. (See Biological Resources Assessment, Figure 5.)

The Project Applicant, SLO Cultivation, doing business as Cresco California ("Project Applicant"), has applied for a Coastal Development Permit ("CDP") and Minor Conditional Use Permit ("Minor CUP") for seven acres of cannabis cultivation and production. The Project Site is owned by the Van Wingerden Family Trust. The Project Applicant requests that the Planning Commission ("Commission") approve a CDP and a CUP to: (1) use an existing 264,500 square foot – approximately six acre - greenhouse, designated Greenhouse 1 ("GH1"), for cultivating cannabis; (2) develop a 58,396 square foot addition to Greenhouse 1 as a cannabis nursery and for juvenile cannabis cultivation; (3) demolish three existing greenhouses which are approximately 40,700 square feet each; (4) build a new 24,751 square foot pack house for cannabis processing; (5) build 71 onsite parking spaces; (6) expand the Project Site's stormwater detention basins; and (7) add other items, including septic systems, cameras and lighting, remove storage containers, etc. (Project Description, p. 1.)

The Project, as proposed, does not comply with provisions of the Coastal Zoning Ordinance ("CZO") designed to protect the environment and the Carpinteria community. As discussed herein, the Project poses a threat to the environment and the local community. The Project is in environmentally sensitive habitat along the Arroyo Paredon Creek, which has been designated critical habitat for federally recognized endangered species, yet the Project Applicant has not sufficiently studied or provided proposed mitigation for the impacts it will have on the riparian habitat.

The evidence also demonstrates that the Project will contribute to Carpinteria's existing cannabis odor and air quality problem. As outlined below and appended to this correspondence, the Byers system proposed by the Project Applicant will not prevent cannabis odors in adjacent residential areas, and, in fact, will likely increase the cannabis odor as well as harmful VOCs. As

explained herein, other jurisdictions, odor experts, and the scientific community at large concur that carbon filtration, rather than vapor phase systems, are the best available technology for cannabis odor control, including odor control within greenhouses. The Project, therefore, both poses a threat to the health and safety of the Carpinteria community, and does not comply with the Coastal Zoning Ordinance's odor abatement requirements.

For these, and other reasons outlined in this letter, the Project is inconsistent with the Coastal Zoning Ordinance and other applicable regulations, and thus the Planning Commission cannot lawfully issue the Project Applicant a Coastal Development Permit or Conditional Use Permit. My clients, therefore, respectfully request that the Planning Commission does not approve a Coastal Development Permit or Conditional Use Permit for the Project. In the alternative, my clients request that the Planning Commission (1) implement various items, discussed below, to better study the impacts of the Project and protect the environment; (2) prepare a Habitat Protection Plan; (3) prohibit the use of vapor phase odor management systems at the Project in order to protect ESH; and (4) implement carbon filtration systems to control odor and air emissions for all aspects of the Project, including Greenhouse 1.

II. The Commission Cannot Issue a Coastal Development Permit for the Project, Because the Project Does Not Comply with the Coastal Zoning Ordinance or the Toro Canyon Plan.

The Coastal Zoning Ordinance provides that the County can only issue a Coastal Development Permit if they find that a proposed development meets the requirements of the Coastal Zoning Ordinance and the Land Use Plan. (CZO § 35.169.5(1), (2).) The Project fails to meet the requirements of the Coastal Zoning Ordinance and the Land Use Plan for several reasons.

A. The Project Applicant Has Not Prepared and Submitted a Habitat Protection Plan, and therefore, Cannot Receive a CDP.

The Coastal Zoning Ordinance requires that the Project Applicant create and comply with a Habitat Protection Plan before they receive a CDP. Under the Program Environmental Impact Report ("PEIR") for the Cannabis Land Use Ordinance, a cannabis project must prepare a Habitat Protection Plan, if "[c]annabis activities could have adverse effects on unique, rare, threatened, or endangered plant or wildlife species" and if "[c]annabis activities could have adverse effects on habitats or sensitive natural communities." (See Exhibit T [PEIR, ES-10].) Appendix G of the Coastal Zoning Ordinance implements these requirements. It specifically provides:

> Where avoidance of environmentally sensitive habitat (ESH) and ESH buffers is not feasible and would preclude reasonable use of the property, the Applicant for a land use entitlement for a cannabis activity that would involve impacts to

environmentally sensitive habitat, shall prepare and submit a Habitat Protection Plan prepared by a Department-approved biologist, in coordination with the U.S. Fish and Wildlife Service (USFWS) and California Department of Fish and Wildlife (CDFW) as required for State or Federal permits and State or Federally listed species, that includes siting and design measures necessary to ensure that the project will avoid impacts to ESH to the maximum extent feasible, and will minimize and mitigate unavoidable impacts.

i. The Project is adjacent to environmentally sensitive habitat that supports rare and endangered species.

The Project stretches along the Arroyo Paredon Creek, which the County of Santa Barbara has designated as environmentally sensitive habitat, and the Federal Department of Fish and Wildlife and the Central Coast Regional Water Quality Control Board have designated as critical habitat. According to the Toro Canyon Plan, Arroyo Paredon Creek provides critical habitat for steelhead, tidewater goby, and a rare southern oak riparian forest. (See Toro Canyon Plan, p. 113.) In addition, Arroyo Paredon Creek supports at least nine additional rare species. (Exhibit C, p. 3.)

The Toro Canyon Plan and Santa Barbara County's Local Coastal Program have designated the southern oak riparian forest surrounding Arroyo Paredon Creek environmentally sensitive habitat ("ESH"). (Exhibit R.) The Toro Canyon Plan specifically calls out the "Oak Riparian Forest along Arroyo Paredon Creek" as one of the "habitats found within the Plan area [that] have been designated ESH in the Santa Barbara County Local Coastal Program (LCP)." (Toro Canyon Plan, p. 117.)

According to the Central Coast Regional Water Quality Control Board's Water Quality Control Plan, Arroyo Paredon Creek supports "uses of water... where the preservation or enhancement of natural resources requires special protection" and provides "habitats necessary.. for the survival of [species] established under state or federal law as rare, threatened, or endangered." (See Exhibit O, pp. 1375-77, 1391.) Arroyo Paredon Creek is designated as critical habitat for Tidewater Goby by the Federal Department of Fish and Wildlife ("DFW"). (50 CFR 17, Exhibit A, Table 1, see also Exhibit B, p. 17 [Caltrans State Route 101/South Coast HOV Project Natural Environment Study, including Arroyo Paredon Creek].) According to DFW, Arroyo Paredon Creek is "essential for the recovery of the tidewater goby." (50 CFR 17, Exhibit A, Table 1.) According to CalTrans, "Arroyo Paredon Creek is within the geographical area known to be occupied by steelhead trout (*Onchorynus mykiss;* federally endangered) and has been federally designated as critical habitat for this species." (Exhibit B, pp. 34-35.) Arroyo Paredon Creek also supports species that have been designated as rare or endangered: Cooper's Hawk, Yellow Warbler, California Red-legged Frog, Coast Range Newt, and Western Pond Turtle. Arroyo Paredon Creek supports species designated as rare downstream: Crotch's Bumble Bee,

Least Bell's Vireo, and Southwestern Willow Flycatcher. (Exhibit C, p. 3; Exhibit B, p. 58 [describing red legged frog in the vicinity].) In addition, the Project Site is habitat for at least three rare terrestrial mollusk species, *Haplotrema caelatum*, *Helminthoglypta phlyctaena*, and *H. traskii*, which have been recorded from the Santa Barbara County. (See Exhibit C, p. 4.)

ii. The evidence demonstrates that the Project will impact sensitive habitat.

The Project Applicant's Biological Resources Assessment concludes that "the proposed project's impacts are at an insignificant level" and would not impact sensitive habitat or species, but this assertion is simply not supported by the evidence and relies on an incomplete analysis. (See Biological Resource Assessment, pp. 13 -14.)

The County has designated a 100 foot buffer for ESH in Arroyo Paredon Creek, delineated in Figure 5 in the Biological Resources Assessment. (See CZO § 35-97.19.) Cannabis activities for the Project are located within the ESH buffer. According to the Project Applicant, "Approximately 660 sq. ft. of existing GH1 overlaps into the 100' ESH buffer." (Biological Resources Assessment, p. 2, see also Figure 5 [showing the Project within the ESH buffer].) A roadway, to be used by the Project, also goes through the environmentally sensitive riparian canopy. (See *ibid.*)

Cannabis activity, including construction of the pack house, maintenance of cannabis plants, employee usage and transportation of cannabis from the Project site, and discharge of chemicals in an attempt to neutralize odor would involve impacts to environmentally sensitive habitat and to the endangered and sensitive species supported in and around Arroyo Paredon Creek. (See Exhibit C.) For example, given the more than seven acres of cannabis grow and production on site and the fertilizers and other chemicals required to cultivate such a large amount of cannabis, during large rain or flood events, chemicals will be discharged into the creek. (See Odor Management Plan, pp. 2-3; Exhibit C, p. 8; see also Exhibit D, establishing that the Project site's owner has discharged pollutants into a drainage swale that leads to the Carpinteria Salt Marsh.)

In addition, the continuous proposed release of vapor phase system masking agents for six acres of cannabis cultivation in Greenhouse 1 pose potentially significant impacts to critical riparian habitat. (See Odor Management Plan, pp. 4-5; Exhibit C, p. 8.) In an attempt to minimize odor, the Project will utilize Byers Vapor Phase Odor System ("Byers System"), in which PVC pipes will run along the perimeter as well as along vents in the roof of Greenhouse 1. This means that there will be PVC pipes running throughout the roof of the 6 acre greenhouse continuously spraying a chemical blend, called Ecosorb, into the open air. (Odor Management Plan, p. 4, Project Description, p. 11.) This will result in a significant amount of chemicals being released into the air in a vapor form adjacent to Arroyo Paredon Creek, as well as in and immediately adjacent to the

sensitive habitat surrounding Arroyo Paredon Creek. (See Odor Management Plan, pp. 4-5, Figure 5.)

There is no specific data available regarding the chemical composition of the proprietary blends in Ecosorb, nor is there an analysis, in the Program Environmental Impact Report for the Cannabis Ordinance ("PEIR") or otherwise, as to the environmental impacts of such a vapor. (See generally PEIR.) Other than the statement that the vapor consists of essential oils, a surfactant, and water, it is unclear what is in the formula and there are no studies included in the Project or PEIR that discuss or examine the accumulative effect of 24/7, 365-day spraying of the product into the environment. (Odor Management Plan, Attachment 5, p. 1; see also Exhibit C, p. 8.)

The only information provided that Ecosorb is non-toxic is a two page "Technical Data Sheet," which provides no substantive evidence as to what type of chemicals are used in Ecosorb. (Odor Management Plan, Attachment 5, p. 2.) The Safety Data Sheet for Ecosorb withholds specific ingredients, claiming the "specific chemical identity and exact percentages of this composition has been withheld as a trade secret" – trade secrets, however, do not prevent them from listing the ingredients. (See Exhibit C, p. 8.) The Fact Sheet states that Ecosorb's chemicals are or are not included on various chemical inventories, including the "TSCA" also known as the Toxic Substances Control Act Chemical Inventory, OSHA Hazard Communication Standard 29 CFR 1910.1200, and United States SARA section 313. (*Ibid.*) None of these lists definitively establish that Ecosorb is non-toxic. They have various criteria for inclusion, but a chemical's inclusion or exclusion from these lists does not demonstrate that a substance is not harmful, as in the United States, there is no regulatory scheme which ensures that chemicals are non-toxic. (See Exhibits E, F.) Nor do these regulatory schemes establish that, when released into the air in copious amounts, Ecosorb wouldn't have adverse effects on the federally listed endangered species in Arroyo Paredon Creek or the on environmentally sensitive habitat designated by the County of Santa Barbara. (See Exhibit C, p. 8.) Nor is there any evidence in the record, for that matter, establishing that Ecosorb will not impact on residents and sensitive receptors. (*Ibid.)*

iii. The Project's Biological Resources Assessment and June 15, 2021 CEQA Checklist are incomplete and do not support a finding that the Project would not impact sensitive habitat.

The Biological Resources Assessment does not take any of this into account. It underplays the potential impacts on the riparian corridor, critical habitat for tidewater goby and steelhead, Southern Live Oak, and other rare and sensitive species. (See Biological Resources Assessment, pp. 8-9.)

As explained by David Magney, an expert biologist who has worked extensively in Santa Barbara County and has served as an Expert Witness for the U.S. Department of Justice on an EPA

wetlands violation case within the County, in an analysis of the Biological Resources Assessment in Exhibit C, the Biological Resources Assessment lacks critical analysis and misstates information. It's determinations that the Project will not have a substantial impact on the environment, Arroyo Paredon Creek functions, and endangered and rare species both at the site and downstream are simply not supported by the evidence.

For example, the Biological Resources Assessment does not include any analysis or examination of the Project's potential impacts on Arroyo Paredon Creek itself. (Exhibit C, p. 4.) There is no discussion of impacts to Arroyo Paredon's creek functions in the Biological Resources Assessment. In addition, as described by Mr. Magney, the Biological Resources Assessment did not utilize the Santa Barbara South Coast Riverine Wetlands HGM model, an assessment tool developed specifically for analyzing impacts to habitat related to water in Santa Barbara County, and typically used to assess impacts to riparian habitat and species in this context. (Exhibit C, pp. 4-5; see Biological Resources Assessment.) The Biological Resources Assessment did not examine or account for the likelihood that during large rain events, runoff from the Project site will be discharged into the creek. (Exhibit C, p. 7.) Nor did it include any assessment or analysis of the potential impacts of the constant use of Ecosorb, as discussed above. (See Exhibit C; see Biological Resources Assessment.)

The Project Applicant's failure to examine impacts to Arroyo Paredon Creek, including harm posed by runoff during storm events and of the continuous application of Ecosorb into the air is particularly concerning because there is already a high level of toxicity in the creek. (See Exhibit G.) Arroyo Paredon Creek is on the 303(d) list adopted by the Regional Water Quality Control Boards ("Regional Water Boards") and approved by the State Water Board and USEPA of impaired waterbodies for toxicity associated with agriculture and urban runoff/storm sewers. (*Ibid.;* Exhibit H.) In addition, there are legitimate concerns about the likelihood that the Project Applicant will not comply with best management practices for protecting the creek from discharge, as the Project owner, Renee Van Wingerden, was cited in early July 2021 by the Central Coast Regional Water Quality Control Board ("Central Coast Water Board"), for the unauthorized discharge of pollutants into the Carpinteria Salt Marsh for Ocean Breeze Cannabis Project and for failure to submit the required notices to the Central Coast Water Board for more than a year and a half. (See Exhibit D.)[1]

In addition, as further outlined in Mr. Magney's correspondence, the Biological Resources Assessment has a number of discrepancies that call into question the veracity of its conclusion that the Project will not have environmental impacts. The Biological Resources Assessment is predicated on the presumption that the avocado orchard has not been removed, yet aerial photos of the site taken in March of 2021 indicate that the trees have been cut down and mulched, without

[1] The Ocean Breeze Project is located at 3900 North Via Real, adjacent to the Cresco Project.

Planning Commission approval. (See Exhibit C, pp. 2, 3.) It is unclear if proper precautions were taken to protect nesting birds as promised in the Biological Resources Assessment. (See *id.* at p. 3.)[2] The Biological Resources Assessment supports its conclusion that the Project will have minimal environmental impacts with a one day field study of local wildlife, and states that this, in addition to a "desktop" review, serve as "definitive negative findings" of special species wildlife. (See Exhibit C, p. 3.) This is insufficient to identify the variety of species that may exist on site and certainly cannot serve as a "definitive" negative finding, as such a finding is nearly impossible to make, even with extensive study, and there remain extensive days and times in which a biologist was not present on site to observe wildlife. (*Ibid.*) As explained by Mr. Magney, Biological Resources Assessment also fails to identify plants on site as special-status species, such as *Juglans californica* and fails to discuss rare terrestrial mollusks likely to occur in Arroyo Paredon Creek . (See Exhibit C, p. 4.)

Likewise, the County's June 15, 2021 CEQA Checklist's conclusion that the project does not "involve development within environmentally sensitive habitat (ESH) or ESH buffers that will result in impacts to ESH" is therefore unsupported by the evidence, as discussed above. (See CEQA Checklist, p. A-5.)

Given these deficiencies, prior to any issuance of a CDP, it is imperative that:

(1) the Project Applicant utilize the Santa Barbara South Coast Riverine Wetlands HGM model to assess the impacts to the creek, assess potential discharge into the creek during flood events, fully investigate and study the potential impacts of continuous use of Ecosorb on riparian habitat and sensitive and endangered species, including tidewater goby and steelhead trout, both adjacent to the Project site and downstream, then utilize information from these studies to formulate a Habitat Protection Plan;

(2) the County retain a biologist that specializes in after-the-fact investigations to examine the impacts to sensitive species caused by the removal of the avocado orchard and create a post-construction monitoring report and mitigation, or, in the alternative, assume that the avocado orchard contained habitat for special-status species and impose remedial mitigation, such as enhancing offsite portions of Arroyo Paredon Creek that have been degraded in the past;

(3) A certified arborist prepare a tree protection plan for the existing native trees, and each tree assessed for its health and condition. The tree protection zone needs to be at least

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[2] This, in conjunction with Project owner Renee Van Wingerden's violation of the Clean Water Act, documented in correspondence from the Central Coast Regional Water Quality Control Board in Exhibit D, as well as the significant issues posed by odor and Beyer's mist at EverBloom, owned by Mr. Van Wingerden (and discussed in Exhibits M and N), raise a concerning pattern of disregarding the health and welfare of the environment and community, and warrant the County's careful scrutiny of this Project to ensure the protection of both County residents and the environment.

10 feet beyond the edge of the canopy or 15 feet from the trunk, whichever is the greater distance, to protect the conditions of the tree's root zone;

(4) The Project Applicant update the landscape plan to remove non-native species, as outlined by Mr. Magney.

iv. Moving forward without a Habitat Protection Plan violates the Coastal Zoning Ordinance and poses a risk to important wildlife and habitat along Arroyo Paredon Creek, as well as the Carpinteria Salt Marsh and the Pacific Ocean.

Prior to any issuance of a CDP, it is imperative that the Project Applicant further study the Project's impacts, as recommended by expert biologist David Magney, then utilize information from these studies to formulate a Habitat Protection Plan.

B. Pursuant to the Toro Canyon Plan, the Project Should Not Receive a CDP Until the Applicant Has Complied with Permit Requirements from the California Department of Fish and Game and the U.S. Army Corps of Engineers.

The Toro Canyon Plan provides:

Development activity which requires ground disturbance which is proposed on parcels containing ephemeral (dry except during and immediately after rainfall) or intermittent (seasonal) streams and creeks, and associated riparian corridors, shall be subject to any permit requirements of the California Department of Fish and Game and the U.S. Army Corps of Engineers. (Toro Canyon Plan, DevStd BIO-TC-15.1)

As discussed herein, the Project site is adjacent to Arroyo Paredon Creek, and contains a riparian corridor associated with it. (Biological Resources Assessment, p. 1.) Project development will require significant grading, which will result in approximately 9,920 cubic yards of cut, 4,430 cubic yards of fill, and 5,490 cubic yards of export and constitutes ground disturbance. (Project Description, p. 5.) Yet the Project file contains no evidence that the Project Applicant has worked with the California Department of Fish and Game and the U.S. Army Corps of Engineers to determine if they require permitting or to obtain permits from these agencies. In order to ensure that the Project complies with the requirements of the Toro Canyon Plan, and that the Commission can lawfully issue a Coastal Development Permit, the Applicant should either provide evidence

that they have obtained the proper permits from the California Department of Fish and Game and the U.S. Army Corps of Engineers or that they are not required to do so.[5]

C. The Odor Management Plan Does Not Comply with the Coastal Zoning Ordinance.

According to the June 15, 2021 Odor Management Plan, Greenhouse 1 will be significantly expanded to 322,869 square feet, and will be used for growing juvenile and mature cannabis plants. (Odor Management Plan, p. 3.) If approved, the Project will have almost seven and a half acres of cannabis production on site.[6] The majority of Greenhouse 1 – more than six acres (or 264,500 square feet) - will be used to grow mature plants. (*Ibid.*) According to the Odor Management Plan, "the strongest occurrences of cannabis odor will be associated with... mature/adult flower cultivation" in Greenhouse 1.[7] (*Id.* at p. 4.) The Project Applicant plans to control cannabis odors emitted from Greenhouse 1 with the Byers Odor System. (*Ibid.*) The Byers System, however, does not meet the Coastal Zoning Ordinance's requirements for odor abatement.

The Coastal Zoning Ordinance requires an Odor Abatement Plan on all project sites, except those in AG-II. (CZO, § 35-144U(C)(5).) The parcel is zoned AG-I-10, and thus must have an Odor Abatement Plan. (Project Description, p. 1.) According to the Coastal Zoning Ordinance, an Odor Abatement Plan "must prevent odors from being experienced within residential zones." (CZO, § 35-144U(C)(5).) They may use vapor-phase systems, provided that they are "odor-neutralizing, not odor masking," do not "produce a differing scent (such as pine or citrus)", and have "supporting documentation which meet United States Environmental Protection Agency's Acute Exposure Guideline Levels or similar public health threshold." (CZO § 35-144U(C)(5)(e)(2).) "A Professional Engineer or a Certified Industrial Hygienist must review and certify that the equipment and methods to be used for reducing odors are consistent with accepted and available industry- specific best control technologies and methods designed to mitigate odor." (CZO, § 35-144U(C)(5)(d).)

i. The evidence establishes that the Byers System is not odor neutralizing and does not eliminate cannabis odors in residential zones.

The Byers System is not odor neutralizing, increases the smell of cannabis, and produces a citrus scent. In an expert analysis of the Project's proposed Odor Management Plan, Dr. Paul

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[5] The Biological Resources Assessment claims that the Project will not impact the riparian corridor, but this is not supported by their own data, which shows a Project road through the riparian canopy. (Compare Biological Resources Assessment, p. 6 to Figure 5.)

[6] At 43,560 square feet per acre, 322,869 square feet is equal to 7.412 acres. (See United States Geological Survey, *Conversion Factors*, available at https://pubs.usgs.gov/circ/2004/circ1268/htdocs/text-conversion.html.)

[7] The Odor Management Plan indicates that strong odors will be associated with processing as well. (See Odor Management Plan, p. 3.)

Rosenfeld, an expert in odor and air quality issues, received his doctorate in Odor Control, has published several peer reviewed papers on the effectiveness of activated carbon for odor control, and has worked extensively with masking agents, such as Ecosorb. (Exhibit I, p. 1, Exhibit A.) According to Dr. Rosenfeld, masking agents, such as Ecosorb, are not only ineffective, but magnify the intensity of odor. (*Id.* at p. 1.) Dr. Rosenfeld explains: "the Byers system... is not as much of a neutralizing agent as it is a masking agent using a lemony pine odor to try to mask the skunky cannabis odor." (*Id.* at p. 5.)

This is supported by the experiences of Carpinterians. The Byers' system is widely used in the Carpinteria Valley, yet scores of students and residents have reported overpowering cannabis odor. According to 2020 Santa Barbara County Grand Jury Report, Carpinteria School District sent two letters to the Board of Supervisors, explaining that the air quality at the high school "was being compromised by strong cannabis odors to the point that by afternoon the students and staff were reporting ill effects, such as headaches from the nauseating odor." (Exhibit J, p. 11.) Steve Mason, Assistant Director of Planning and Development for Santa Barbara County, stated: "The [Byers] system does appear to control odor under certain circumstances, but we do still receive wide spread cannabis odor complaints in the Carpinteria area." (Exhibit K.)

There is no evidence to suggest that the Byers system will "prevent odors from being experienced within residential zones." (CZO, § 35-144U(C)(5).) In addition to the expert evidence from Dr. Rosenfeld cited above and included in Exhibit I, local news stories have established that residents that live near other cannabis operations in Carpinteria have experienced ongoing intense cannabis odors in and around their homes despite the use of the Byers system. According to the Santa Barbara Independent "[t]he county received 363 odor-related complaints from residents [in Carpinteria] over the past year." (Exhibit K.) An article written by Grayce McCormick at the Santa Barbara News Press on March 30, 2021, provides an illustration of this issue:

> A coalition of residents living in Linden Meadows in Carpinteria is on year three of speaking up about their concerns regarding the odor of cannabis greenhouses adjacent to their neighborhood. The residents have brought their complaints to the Carpinteria City Council and the Santa Barbara County Board of Supervisors. Some have filed lawsuits against the local businesses running the greenhouses. The businesses include Ever-Bloom... owned by... the Van Wingerdens... (Exhibit L.)

Neighbors in Linden Meadows have experienced extreme cannabis odors despite the use of the Byers system at a cannabis operation almost a mile from their homes. (Exhibit M [explaining that neighbors filed a lawsuit due to the cannabis smell that occurs despite use of the Byers system]; Exhibit N [showing Linden Meadows is almost a mile from EverBloom].)

In this case, residential areas are significantly closer to the Proposed Project than Linden Meadows is from EverBloom. My clients' farm and homes are immediately adjacent to the Project. There are Existing Developed Rural Neighborhoods approximately 350 feet, 700 feet, and less than half a mile from the Proposed Project. (Odor Management Plan, p. 21-22.)[6] A residential neighborhood within the Carpinteria City limits is less than a quarter mile from the Project. (*Id.* pp. 21-22.) These residential areas are significantly closer to the Project than Linden Meadows is to EverBloom. EverBloom uses a Byers system, yet residents have experienced serious odor impacts and impacts from the Byers vapor. (See Exhibits L, M, N.) In light of this information and the expert analysis provided by Dr. Rosenfeld, the evidence demonstrates that residents in these areas, which are much closer to the Proposed Project than Linden Meadows, are very likely to experience cannabis odors if the Project utilizes the Byers system. There is little evidence in the record, on the other hand, which suggests that the Byers system will effectively prevent odors in residential zones.

ii. There is no evidence in the Odor Management Plan that the Byers System meets the United States Environmental Protection Agency's Acute Exposure Guideline Levels or a similar public health threshold.

The Coastal Zoning Ordinance only permits a vapor-phase system where the system has "supporting documentation which meet United States Environmental Protection Agency's Acute Exposure Guideline Levels or similar public health threshold." (CZO § 35-144U(C)(5)(e)(2).) There is no evidence in the Odor Management Plan that the Byers System meets the U.S. EPA's Acute Exposure Guideline Levels or a similar threshold. The Project Applicant must provide such data prior to receiving approval for use of the Byers system.

iii. Substantial evidence demonstrates that carbon filtration, and not a Vapor Phase System, is the best available technology for odor management at the Project.

The Odor Management Plan's conclusion that the Byer's system is the best available technology for odor mitigation is not supported by the evidence. In his expert analysis of the Odor Management Plan, attached as Exhibit I, Dr. Paul Rosenfeld explains "Both SCS Engineers and the general scientific community agree that activated carbon for vapor phase filtration of cannabis odor is superior to that to the Byers system." (Exhibit I, p. 5.) The Odor Management Plan itself indicates that carbon filtration systems "offer the leading effective odor control." (See Odor Management Plan, p. 18.)

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[6] The Van Wingerdens, it should be noted, own both EverBloom and the Project site at issue here.

Other public agencies, including the Puget Sound Clean Air Agency in the state of Washington and the Denver Department of Public Health and Environment in Colorado, have both found that carbon filtration is the Best Available Control Technology for cannabis odor. (See Exhibits I, p. 3; N, p. 11 [Puget Sound Notice of Construction Worksheet for the Puget Sound Clean Air Agency], P, Q.) The Denver Department of Public Health and Environment published a Cannabis Best Management Practices Guide in October 2018 and published an update in October 2020. (See Exhibits P, Q.) Both identify carbon filtration as the "best option for controlling odors and VOCs." (Exhibits P, p. 50; Q, p. 66.) Puget Sound Clean Air Agency has maintained that cannabis production projects cannot "continuously achieve 'no odor outside the property boundary' without the proper use of an enclosure where emissions are routed to a carbon absorption system." (Exhibit N, p. 11.)

iv. Contrary to the Odor Management Plan's conclusion, carbon filtration can be used at the Project site.

The Odor Management Plan states that the Project cannot utilize carbon filtration because the greenhouse isn't airtight, and suggests that with a porous greenhouse, the Project Applicant cannot cultivate cannabis. (See Odor Management Plan.) The Applicant, however, doesn't provide any evidence in the Odor Management Plan, or elsewhere in their application, to support this conclusion. (See *ibid.*)

In fact, data from other regulatory agencies, as well as from Dr. Rosenfeld, indicate that cannabis cultivation is feasible within greenhouses with carbon filtration systems. The Puget Sound Clean Air Agency requires carbon filtration in projects utilizing greenhouses. (See Exhibit N, pp. 1, 3, 12.)[7] Dr. Rosenfeld explains "[w]hile it has been argued that greenhouses cannot be airtight, that is a false claim. Greenhouses can be airtight, but if the proponent is unwilling or claims to be unable to design a completely airtight greenhouse, a greenhouse that is as close to airtight as possible is very feasible and would improve the effectiveness of the activated carbon filter." (Exhibit I, p. 6.) Dr. Rosenfeld, in fact, provides specifications from a carbon filtration vendor to provide a carbon filtration system that could be used in the Proposed Project and would be far superior to the Byers system. (See *id.*, p. 5, Exhibit B.) These specifications are appended to this letter as Exhibit B to Dr. Rosenfeld's correspondence.

The Coastal Zoning Ordinance provides that the County can only issue a Coastal Development Permit if they find that the Development conforms with the requirements laid out in the Coastal Zoning Ordinance. (CZO § 35.169.5(1), (2).) As laid out above, the Odor Management

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[7] In Puget Sound, a cannabis grower used fans equipped with carbon filters circulate and filter air in a greenhouse. While this was to be used for storage and processing, it demonstrates that it is possible to construct a greenhouse wherein one can effectively utilize carbon filtration. (Exhibit N, p. 6.)

Plan does not comply with the requirements of Section 35-144U (C)(5) of the Coastal Zoning Ordinance. The Planning Commission cannot, therefore, find that the Project complies with applicable provisions of the Coastal Zoning Ordinance. Without this finding, the Planning Commission cannot approve a Coastal Development Permit for this Project.[8]

III. The Planning Commission Should Exercise Their Power to Prohibit the Use of the Vapor Phase Systems in the Project in Order to Protect ESH.

According to the Biological Resources Assessment "Riparian habitat associated with Arroyo Paredon Creek... is mapped as Environmentally Sensitive Habitat Overlay (ESH) for Santa Barbara County." (Biological Resources Assessment, p. 7; Exhibit R [Toro Canyon ESH Map].)

In ESH zones, the Planning Department has the power to impose conditions on Coastal Development permits to protect habitat areas. Section 35-97.7 of the Coastal Zoning Ordinance provides:

> A Coastal Development Permit may be issued subject to compliance with conditions set forth in the permit which are necessary to ensure protection of the habitat area(s). Such conditions may, among other matters, limit the size, kind, or character of the proposed work, require replacement of vegetation, establish required monitoring procedures and maintenance activity, stage the work over time, or require the alteration of the design of the development to ensure protection of the habitat. The conditions may also include deed restrictions and conservation and resource easements. Any regulation, except the permitted or conditionally permitted uses, of the base zone district may be altered in furtherance of the purpose of this overlay district by express condition in the permit.

The Toro Canyon Plan Development Standard BIO-TC-1.7(c) provides: "the use of insecticides, herbicides or any toxic chemical substance which has the potential to significantly degrade ESH, shall be prohibited within and adjacent to ESH..." In addition, the Central Coast Basin plan provides: "All waters shall be maintained free of toxic substances in concentrations which are toxic to, or which produce detrimental physiological responses in human, plant, animal, or aquatic life." (See Exhibit G, p. 2.)

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[8] The Odor Management Plan also fails to comply with the recommendations of the Air Pollution Control District for the County of Santa Barbara ("APCD"). In an August 4, 2020 letter to Planner Gwen Beyler, Desmond Ho, Air Quality Specialist for APCD, recommended that the County include mitigation measures at the Project to ensure that "ensure that cannabis odors are not detected by nearby residential areas or sensitive receptors." (Exhibit S, p. 2.) As discussed above, as proposed, the Byers system does not ensure that cannabis odors will not be detected in nearby residential neighborhoods. The Odor Management Plan, therefore, should be updated to comply with Mr. Ho's recommendations.

As discussed above, the continuous release of Ecosorb or any other vapor phase masking agent into the air in close proximity to ESH and the ESH buffer zone, and, in some places, within the ESH buffer zone, poses a threat to critical habitat for endangered tidewater goby and steelhead trout, as well as rare Southern Live Oak, as well as several other rare and endangered species, discussed above and in Mr. Magney's correspondence. For this reason, unless and until Ecosorb can be studied and definitively established as non-toxic and as not posing a threat to critical habitat or endangered or rare species, any Coastal Development Permit for the Project should be conditioned upon the Project Applicant only using carbon filtration, and not implementing a vapor phase system for odor mitigation.

IV. The Record Does Not Contain Evidence to Support the Findings Required for the Issuance of a Minor Conditional Use Permit Under the Coastal Zoning Ordinance.

The Coastal Zoning Ordinance provides that a Minor Conditional Use Permit can only be issued if the decisionmaker makes specific findings. (CZO § 35-172.8.) These include:

> That adverse environmental impacts are mitigated to the maximum extent feasible... That the project is in conformance with the applicable provisions and policies of this Article and the Coastal Land Use Plan... [and] That the project will not be detrimental to the health, safety, comfort, convenience, and general welfare of the neighborhood and will not be incompatible with the surrounding area.

As discussed above, the Project, in its current iteration, using the Byers System, without a Habitat Protection Plan, does not mitigate environmental impacts to the maximum extent feasible. Further, as outlined in previous sections of this correspondence, the Project does not comply with applicable provisions of the Coastal Zoning Ordinance or the Toro Canyon Plan. Finally, substantial evidence does not support a conclusion "that the project will not be detrimental to the health, safety, comfort, convenience, and general welfare of" surrounding property owners and users, and Existing Developed Rural Neighborhoods ("EDRNs") in close proximity to the Project. Odors associated with cannabis production, that are, as discussed above, insufficiently mitigated by the Byers System, will negatively impact surrounding neighbors. Uninvestigated impacts of the Byers System and VOCs emitted by cannabis may also have a negative impact on the health, safety, and comfort of surrounding property owners and nearby EDRNs. (See Exhibit Q, pp. 65, 66 [discussing cannabis' release of VOCs and its impact on air quality and explaining that carbon filtration is the best available technology for reducing cannabis VOCs and odor].) As such, a finding that the project will not be detrimental to the health, safety, comfort, convenience, and general welfare of the neighborhood is not supported by the evidence. For these reasons, approving a Conditional Use Permit for this Project would violate the Coastal Zoning Ordinance.

V. Conclusion

For the reasons discussed above, my clients respectfully request that the Planning Commission does not approve a Coastal Development Permit for the Project. The Project is inconsistent with the Coastal Zoning Ordinance and Toro Canyon Plan and threatens to harm the environment and the Carpinteria community.

If, however, the Commission choses to approve a Coastal Development Permit for the Project, my clients respectfully request that the County require the Project Applicant to (1) implement biological expert David Magney's recommendations, outlined above and in Exhibit C; (2) prepare a Habitat Protection Plan for the environmentally sensitive habitat and rare and endangered species in and surrounding the Project; (3) prohibit the use of vapor phase odor management systems at the Project in order to protect ESH; and (4) implement carbon filtration systems to control odor and air emissions for all aspects of the Project, including Greenhouse 1.

If the Commission approves the Project with the Byers system, the Commission should prohibit the use of any vapor phase odor mitigation system until additional study of the impacts of the Byers system on the riparian habitat in Arroyo Paredon Creek and on residents and other sensitive receptors in the vicinity of the Project site is completed and appropriate mitigation is implemented to protect wildlife, critical habitat, and local residents.

Thank you for the opportunity to comment on this Project. If you have questions or wish to discuss the contents of this correspondence, please do not hesitate to contact me at ecd@cossart-dalylaw.com.

Sincerely,

E Cossart-Daly

Elise Cossart-Daly
Attorney

Exhibit A

AUTHENTICATED
U.S. GOVERNMENT
INFORMATION
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FEDERAL REGISTER

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Part III

Department of the Interior

Fish and Wildlife Service

50 CFR Part 17

Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Tidewater Goby; Final Rule

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R8–ES–2011–0085; 4500030114]

RIN 1018–AX39

Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Tidewater Goby

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Final rule.

SUMMARY: We, the U.S. Fish and Wildlife Service, designate critical habitat for the tidewater goby (*Eucyclogobius newberryi*) under the Endangered Species Act of 1973, as amended (Act). In total, approximately 12,156 acres (4,920 hectares) in Del Norte, Humboldt, Mendocino, Sonoma, Marin, San Mateo, Santa Cruz, Monterey, San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Orange, and San Diego Counties, California, fall within the boundaries of the critical habitat designation.

DATES: This rule becomes effective on March 8, 2013.

ADDRESSES: This final rule and the associated final economic analysis are available on the Internet at *http://www.regulations.gov* at Docket No. FWS–R8–ES–2011–0085, and from the Ventura Fish and Wildlife Office Web site at *http://www.fws.gov/ventura/*. Comments and materials received, as well as supporting documentation used in preparing this final rule, are available for public inspection, by appointment, during normal business hours, at the U.S. Fish and Wildlife Service, Ventura Fish and Wildlife Office, 2493 Portola Road, Suite B, Ventura, CA 93003; telephone 805–644–1766; facsimile 805–644–3958.

The coordinates or plot points or both from which the maps included in the regulation are generated are included in the administrative record for this critical habitat designation and are available at *http://www.fws.gov/ventura/*, at *http://www.regulations.gov* in Docket No. FWS–R8–ES–2011–0085, and at the Ventura Fish and Wildlife Office (see **FOR FURTHER INFORMATION CONTACT**). Any additional tools or supporting information that has been developed for this critical habitat designation will also be available at the Fish and Wildlife Service Web site and Field Office set out above, and may also be included in the preamble and/or at *http://www.regulations.gov.*

FOR FURTHER INFORMATION CONTACT: For general information, and information about the final designation in Santa Cruz, Monterey, San Luis Obispo, Santa Barbara, Ventura, and Los Angeles Counties, contact Diane K. Noda, Field Supervisor, U.S. Fish and Wildlife Service, Ventura Fish and Wildlife Office, 2493 Portola Road, Suite B, Ventura, CA 93003; telephone 805–644–1766; facsimile 805–644–3958. If you use a telecommunications device for the deaf (TDD), call the Federal Information Relay Service (FIRS) at 800–877–8339.

For information about the final designation in Del Norte, Humboldt, and Mendocino Counties, contact Nancy Finley, Field Supervisor, U.S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, 1655 Heindon Road, Arcata, CA 95521; telephone 707–822–7201; facsimile 707–822–8411.

For information about the final designation in Sonoma, Marin, and San Mateo Counties, contact Susan Moore, Field Supervisor, U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office, 2800 Cottage Way, Suite W–2605, Sacramento, CA 95825; telephone 916–414–6600; facsimile 916–414–6712.

For information about the final designation in Orange and San Diego Counties, contact Jim Bartel, Field Supervisor, U.S. Fish and Wildlife Service, Carlsbad Fish and Wildlife Service Office, 6010 Hidden Valley Road, Suite 101, Carlsbad, CA 92011; telephone 760–431–9440; facsimile 760–431–5901.

SUPPLEMENTARY INFORMATION:

Executive Summary

Why we need to publish a rule. This is a final rule to revise the designation of critical habitat for the endangered tidewater goby. Under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (Act), any species that is determined to be an endangered or threatened species requires critical habitat to be designated, to the maximum extent prudent and determinable. Designations and revisions of critical habitat can only be completed by issuing a rule. In total, approximately 12,156 acres (ac) (4,920 hectares (ha)) of critical habitat for the tidewater goby in California fall within the boundaries of the critical habitat designation.

We designated critical habitat for this species in 2000 and again in 2008. As part of a settlement agreement, we agreed to reconsider the 2008 designation. A proposed rule to revise the 2008 critical habitat designation was published in the **Federal Register** on October 19, 2011 (76 FR 64996). This constitutes our final revised designation for the tidewater goby.

We are making the following changes to the critical habitat designation. The 2008 final critical habitat designation (73 FR 5920) consisted of 44 units in Del Norte, Humboldt, Mendocino, Sonoma, Marin, San Mateo, Santa Cruz, Monterey, San Luis Obispo, Santa Barbara, Ventura, and Los Angeles Counties, California, totaling 10,003 ac (4,050 ha). In this final critical habitat designation, we have designated 65 critical habitat units for the tidewater goby throughout its range, including the 44 units designated in the 2008 final rule. These units are essential for the recovery of the tidewater goby as described in the Recovery Plan for the Tidewater Goby (Service 2005a; Recovery Plan).

The basis for our action. Under the Act, we must determine critical habitat for any endangered or threatened species to the maximum extent prudent and determinable. We are required to base the designation on the best available scientific data after taking into consideration the economic impact, the impact on national security, and any other relevant impact of specifying any particular area as critical habitat. The Secretary of the Department of the Interior (Secretary) may exclude an area from critical habitat if the benefits of exclusion outweigh the benefits of designation, unless the exclusion will result in the extinction of the species.

We prepared an economic analysis. In order to consider economic impacts, we prepared a new analysis of the economic impacts of the proposed revised critical designation. We announced the availability of the draft economic analysis (DEA) in the **Federal Register** on July 24, 2012 (77 FR 43222), allowing the public to provide comments on our analysis. We considered all comments and information received from the public during the comment period, incorporated the comments as appropriate, and have completed the final economic analysis (FEA) concurrently with this final determination. The economic analysis did not identify any areas with disproportionate costs associated with the designation, and no areas were excluded from the final designation based on economic reasons.

Peer review and public comment. We sought comments and information from independent specialists to ensure that our critical habitat designation is based on scientifically sound data, assumptions, and analyses. We had invited these peer reviewers to comment on our specific assumptions and

conclusions in the proposed revision of the critical habitat designation. These peer reviewers generally concurred with our methods and conclusions and provided additional information, clarifications, and suggestions to improve this final rule. Information we received from peer review is incorporated in this final revised designation. We also considered all comments and information received from the public during the comment period.

Previous Federal Actions

On April 15, 2009, the Natural Resources Defense Council (NRDC) filed a lawsuit in the U.S. District Court for the Northern District of California challenging a portion of the January 31, 2008, final rule that designated 44 critical habitat units in California (73 FR 5920, January 31, 2008). The lawsuit challenged the Service's failure to include any unoccupied habitat and the exclusion of some occupied habitat from critical habitat designation, and the failure to explain why unoccupied habitat previously included in the 2000 designation was not included in the 2008 designation. In a consent decree dated December 11, 2009, the U.S. District Court: (1) Stated that the 44 critical habitat units should remain in effect; (2) stated that the final rule designating critical habitat was remanded in its entirety for reconsideration; and (3) directed the Service to promulgate a revised critical habitat rule that considers the entire geographic range of the tidewater goby and any currently unoccupied tidewater goby habitat. The consent decree requires that the Service submit proposed and final revised rules to the **Federal Register** no later than October 7, 2011, and November 27, 2012, respectively. We published a proposed revised critical habitat in the **Federal Register** on October 19, 2011 (76 FR 64996). Information on the associated draft economic analysis for the revised proposed critical habitat was published in the **Federal Register** on July 24, 2012 (77 FR 43222). At the request of the Service on November 26, 2012, the U.S. District Court granted a 60-day extension to submit the final revised rule to the **Federal Register** no later than January 26, 2013. By publishing this final revised designation we are complying with the consent decree established by the Court. For additional information on previous Federal actions please refer to the 1994 listing rule (59 FR 5494; February 4, 1994), and previous critical habitat designation (73 FR 5920; January 31, 2008).

Background

It is our intent to discuss in this final rule only those topics directly relevant to the development and designation of critical habitat for the tidewater goby under the Act (16 U.S.C. 1531 *et seq.*). For more information on the biology and ecology of the tidewater goby, refer to the final listing rule published in the **Federal Register** on February 4, 1994 (59 FR 5494). For information on tidewater goby critical habitat, refer to the proposed rules to designate critical habitat for the tidewater goby published in the **Federal Register** on August 3, 1999 (64 FR 42250), November 28, 2006 (71 FR 68914), and October 19, 2011 (76 FR 64996); and the subsequent final critical habitat designations published in the **Federal Register** on November 20, 2000 (65 FR 69693), and January 31, 2008 (73 FR 5920); and to our Recovery Plan (Service 2005a), which is available from the Ventura Fish and Wildlife Office (see **ADDRESSES** section or *http://ecos.fws.gov*). Information on the associated draft economic analysis for the proposed rule to revise critical habitat was published in the **Federal Register** on July 24, 2012 (77 FR 43222).

Species Description and Genetic/Morphological Characteristics

The tidewater goby is a small, elongate, gray-brown fish rarely exceeding 2 inches (in) (5 centimeters (cm)) in length. This species possesses large pectoral fins, with the pelvic or ventral fins joined to each other beginning below the chest and belly and from below the gill cover back to just anterior of the anus. Male tidewater gobies are nearly transparent with a mottled brown upper surface. Female tidewater gobies develop darker colors, often black, on the body and dorsal and anal fins. The tidewater goby is a short-lived species; the lifespan of most individuals appears to be about 1 year (Irwin and Soltz 1984, p. 26; Swift *et al.* 1989, p. 4; Hellmair 2011, p. 5).

Various genetic markers demonstrate that pronounced differences exist in the genetic structure of the tidewater goby, and that tidewater goby populations in some locations are genetically distinct. A study of mitochondrial DNA and cytochrome b (molecular material used in genetic studies) sequences from tidewater gobies that were collected at 31 locations throughout the species' geographic range has identified six major phylogeographic (historical processes that may be responsible for the current geographic distributions) units (Dawson *et al.* 2001, p. 1171). These six regional units are the basis for the recovery units in the Recovery Plan (Service 2005a, p. 30), and include the following areas: (1) Tillas Slough (Smith River) in Del Norte County to Lagoon Creek in Mendocino County (North Coast (NC) Recovery Unit); (2) Salmon Creek in Sonoma County to Bennett's Slough in Monterey County (Greater Bay (GB) Recovery Unit); (3) Arroyo del Oso to Morro Bay in San Luis Obispo County (Central Coast (CC) Recovery Unit); (4) San Luis Obispo Creek in San Luis Obispo County to Rincon Creek in Santa Barbara County (Conception (CO) Recovery Unit); (5) Ventura River in Ventura County to Topanga Creek in Los Angeles County (Los Angeles-Ventura (LV) Recovery Unit); and (6) San Pedro Harbor in Los Angeles County to Los Peñasquitos Lagoon in San Diego County (South Coast (SC) Recovery Unit).

A more recent study to gather genetic distribution data for the tidewater goby used a panel of novel microsatellite loci (repeating sequences of DNA) assessed in a first-order (unbound strands of DNA) survey across its range (Earl *et al.* 2010, p. 104). More specifically, Earl *et al.* (2010, p. 103) described 19 taxon-specific microsatellite loci, and assessed genetic variation across the tidewater goby's range relative to genetic subdivision. The study concluded: (1) Populations of tidewater goby in northern San Diego County form a highly divergent clade (a genetically related group) with reduced genetic variation that appears to merit status as a separate species; (2) populations along the mid-coast of California are subdivided into regional groups, which are more similar to each other than different, contrary to conclusions from previous mitochondrial sequence-based studies (Dawson *et al.* 2001, p. 1176); and (3) that tidewater goby dispersal during the Pleistocene/Holocene sea level rise (approximately 7,000 years ago), followed by increased isolation during the Holocene, formed a star phylogeny (recent population formed from a common ancestor) with geographic separation in the northernmost populations and some local differentiation (Earl *et al.* 2010, p. 103). Genetic diversity among populations within a species may be important to long-term persistence because it represents the raw material for adapting to differing local conditions and environmental stochasticity (Frankham 2005, p. 754).

The conclusion that the populations of the tidewater goby in the North Coast Recovery Unit formed as a result of a single recent episode of colonization of newly formed habitats is supported by McCraney *et al.* (2010, p. 3325). They compared genetic variation of 13

naturally and artificially fragmented populations of the tidewater goby in northern California, including 8 Humboldt Bay populations and 5 coastal lagoon populations (Lake Earl, Stone Lagoon, Big Lagoon, Virgin Creek, and Pudding Creek), and reached similar conclusions to Earl *et al.* (2010, p. 113). McCraney *et al.* (2010, p. 3325) also concluded that natural and artificial habitat fragmentation caused marked divergence among the tidewater goby in the North Coast populations. Their study showed that Humboldt Bay populations, due to isolation by manmade barriers, exhibited very high levels of genetic differentiation between populations, extremely low levels of genetic diversity within populations, and no migration among populations. They concluded that this pattern makes the Humboldt Bay populations of tidewater goby vulnerable to extirpation because artificial fragmentation and its resulting genetic differentiation between subpopulations, extremely low levels of genetic diversity within subpopulations, and lack of migration among the subpopulations reduces fitness and adaptive potential of a subpopulation (McCraney *et al.* 2010, p. 3325). In contrast, the study found that, while coastal lagoon populations also exhibited very high levels of genetic differentiation between populations, these populations displayed substantial levels of genetic diversity within populations indicating occasional migration among lagoons (McCraney *et al.* 2010, p. 3325). Populations in all coastal lagoons, with the exception of Lake Earl in Del Norte County, appear to be stable and genetically healthy (McCraney *et al.* 2010, p. 3325). The Lake Earl population exhibited reduced levels of genetic diversity in comparison to similar coastal lagoon populations (McCraney *et al.* 2010, p. 3324). McCraney *et al.* (2010, p. 3324) suspects that the reduced genetic diversity detected within Lake Earl is likely due to repeated population bottlenecks (reduced genetic diversity due to reduced population size) resulting from regular artificial breaching of the sandbar at the lagoon mouth.

To summarize, the conclusions from these studies are:

(1) The species can be divided into six phylogeographic units based upon genetic similarities and differences.

(2) The tidewater goby to the south of the gap between Los Angeles and Orange Counties is probably a separate species from populations to the north based on its divergent genetic makeup.

(3) Natural and anthropogenic barriers have contributed to genetic differentiation among populations.

(4) Although genetic differences occur between populations north of the Los Angeles-Orange County line, they are not as divergent as those populations further south.

(5) Some north coast populations exhibit significantly reduced genetic diversity, reduced growth potential, and reduced duration of spawning period. These populations appear to be vulnerable to extirpation.

Metapopulation Dynamics

Local populations of tidewater goby are best characterized as metapopulations (Lafferty *et al.* 1999a, p. 1448; Smith, *in litt.* 2012). How a metapopulation functions through time is an important factor in the conservation of the tidewater goby and thus it is an important consideration in the designation of critical habitat. As such, using information primarily from Groom *et al.* (2006, pp. 216–219, 383–384, 424–428) and Primack (2006, pp. 285–287) and elsewhere as noted below, we present the general concept of metapopulation dynamics followed by a discussion of its application to the tidewater goby.

A metapopulation, in short, is a population of populations (often referred to as subpopulations). However, because of variations in the rates of birth, death, immigration, and emigration, each population is not static over time; as such, the interplay of a metapopulation's constituent populations results in a dynamic process of metapopulation maintenance. Thus, definitions of the term *metapopulation* within the scientific literature often incorporate the dynamic interaction of subpopulations, according to Groom *et al.* (2006, p. 706) a metapopulation consists of: "A network of semi-isolated populations with some level of regular or intermittent migration and gene flow among them, in which individual populations may go extinct [become extirpated] but can then be recolonized from other populations." The Recovery Plan also incorporates interpopulation interaction in its definition of metapopulation: "several to many subpopulations [of] tidewater goby that are close enough to one another that dispersing individuals could be exchanged" (Service 2005a, p. A–3).

Regarding this discussion, two points in particular are important to note in metapopulations: (1) Variability within subpopulations, and (2) connectivity between them through dispersing individuals. As mentioned above, subpopulations at different locations within a metapopulation vary over time. Because of intrinsic and extrinsic factors (Soulé and Simberloff 1986, pp. 27–28), some populations at given locations have high rates of growth in some years and other populations decline or even become extirpated. Yet, because subpopulations within a metapopulation are biologically connected through dispersing individuals, high-productivity subpopulations (sources) may augment the population size in low-productivity subpopulations (sinks); moreover, dispersing individuals may even recolonize extirpated areas. In this way, a metapopulation as a whole maintains a greater level of stability over time than its constituent subpopulations—in effect, metapopulation dynamics dampen the effects of variability. In addition to bolstering subpopulations or recolonizing extirpated areas, dispersing individuals are also important for maintaining gene flow between subpopulations (genetic connectivity) and thereby reducing the risk that certain alleles may be lost as a result of the extirpation of a subpopulation.

Moreover, the greater the number of constituent subpopulations within a metapopulation, the greater the likelihood the effects of variability will be attenuated in that metapopulation. In short, because of metapopulation dynamics, extirpation of a subpopulation is not necessarily permanent. This results in a situation where constituent subpopulations "blink out" and "blink on" over time. A metapopulation persists through time because the rate of extirpation in subpopulations is balanced by the rate of recolonization. As a result, occupancy of an area may change over time.

The balance discussed above is in large part dependent upon dispersal of individuals. Ultimately, when the rate of recolonization is reduced or eliminated, the effects of the threats are no longer dampened by metapopulation dynamics. In such a case, each constituent subpopulation becomes increasingly or completely independent, and extirpation of such a subpopulation is likely to be permanent.

The pattern of extirpation and recolonization observed in the tidewater goby suggests that some tidewater goby populations exhibit a metapopulation dynamic where some populations survive or remain viable by continually exchanging individuals and recolonizing after occasional extirpations (Doak and Mills 1994, p. 619). Individual populations of tidewater goby occupy coastal lagoons and estuaries that are separated from each other by land and, in most cases, are separated from the open ocean by

sandbars, or other barriers. Very few tidewater gobies have ever been captured in the marine environment (Swift *et al.* 1989, p. 7), which suggests that this species rarely occurs in the open ocean. Studies of the tidewater goby suggest that some populations persist on a consistent basis, while other populations appear to experience intermittent extirpations (local extinctions) (Lafferty *et al.* 1999a, p. 1452). These extirpations may result from one or a series of factors, such as the drying up of the lagoon during prolonged droughts (Lafferty *et al.* 1999a, p. 1451). Some of the areas where the tidewater goby has been extirpated apparently have been recolonized by nearby populations (those within approximately 6 miles (mi) (10 kilometers (km))) (Lafferty *et al.* 1999a, p. 1451; Smith, *in litt.* 2012). However, genetic research has revealed tidewater gobies are capable of dispersing up to 30 mi (48 km) (Jacobs *et al.* 2005, p.52).

Lafferty *et al.* (1999b, p. 618) monitored the postflood persistence of several tidewater goby populations in Santa Barbara and Los Angeles Counties after the heavy winter floods of 1995. All of the monitored populations persisted after the floods, and no significant changes in population sizes were noted (Lafferty *et al.* 1999b, p. 621). However, tidewater goby apparently colonized Cañada Honda in Santa Barbara County after one flood event (Lafferty *et al.* 1999b, p. 621). This suggests that flooding—where the barrier between the lagoon and the open ocean is breached and tidewater goby individuals are washed out to sea—may sometimes have a positive effect, forcing the dispersal of individuals and thereby allowing for recolonization of habitats where a tidewater goby population has become extirpated or allowing for genetic exchange between extant populations.

Historical records and survey results for several areas occupied by the tidewater goby are available (Swift *et al.* 1989, pp. 18–19; Swift *et al.* 1994, pp. 8–16). These studies suggest that the persistence of tidewater goby populations is related to habitat size, configuration, location, and proximity to human development. In general, the most stable and persistent tidewater goby populations tend to occur in lagoons and estuaries that are more than 2.5 ac (1 ha) in size, and that have remained relatively unaffected by human activities (Lafferty *et al.* 1999a, pp. 1450–1453). Conversely, some habitats less than 2.5 ac (1 ha) in size have tidewater goby populations that persist on a regular basis, such as Cañada del Agua Caliente in Santa Barbara County (Swift *et al.* 1997, p. 3). We also note that some systems that are affected or altered by human activities also have relatively large and stable populations; examples include Pismo Creek in San Luis Obispo County, the Santa Ynez River in Santa Barbara County, and the Santa Clara River in Ventura County. The best available information suggests that the lagoons and estuaries with persistent tidewater goby populations likely serve as source populations that provide individuals that colonize adjacent locations with intermittent populations (Lafferty *et al.* 1999a, p. 1452). However, a rangewide metapopulation viability analysis for the tidewater goby has not been conducted; data from such a study would help inform which tidewater goby populations are source populations and which are sinks, and allow for the development of metapopulation-based recovery objectives for the species. Until data on demography and dynamics of tidewater goby metapopulations are available, the Recovery Plan for the species calls for interim objectives that emphasize consistent occupancy of habitat capable of sustaining viable tidewater goby populations (Service 2005a, p. 39).

Distribution

The known geographic range of the tidewater goby is limited to the coast of California (Eschmeyer *et al.* 1983, p. 262; Swift *et al.* 1989, p. 12). The species historically occurred from locations 3 mi (5 km) south of the California—Oregon border (Tillas Slough in Del Norte County) to 44 mi (71 km) north of the United States—Mexico border (Agua Hedionda Lagoon in San Diego County). The available documentation (Eschmeyer *et al.* 1983, p. 262; Swift *et al.* 1989, p. 12) suggests that the northernmost extent of the current geographic range has not changed over time. Tidewater goby historically occurred in Agua Hedionda Lagoon, but the site is currently considered to be unoccupied. The species' southernmost, known, currently occupied locality is the San Luis Rey River, 5 mi (8 km) north of Agua Hedionda Lagoon in San Diego County. Although the northernmost extent of the tidewater goby's range has not changed and the southernmost extent has retracted by only 5 mi (8 km), its overall distribution has become patchy and fragmented along the coast. However, as discussed above in the *Metapopulation Dynamics* section, the occupancy of an area may change overtime and, when determining occupancy of an area, we first look at the rangewide occupancy for the species and then consider potential connectivity and source areas at the subpopulation or unit level.

The tidewater goby appears to be naturally absent from several long (50 to 135 mi (80 to 217 km)) stretches of coastline lacking lagoons or estuaries, where steep topography or swift currents may prevent the tidewater goby from dispersing between adjacent locations (Swift *et al.* 1989, p. 13; Earl *et al.* 2010, p. 104). One such gap occurs between the Eel River in Humboldt County and the Ten Mile River in Mendocino County. A second gap exists between Davis Lake in Mendocino County and Salmon Creek in Sonoma County. Another large natural gap exists between Monterey County and Arroyo del Oso in San Luis Obispo County. Habitat loss and other anthropogenic-related factors have resulted in the tidewater goby's absence from several locations where it historically occurred; the extirpation of tidewater goby from some of these locations has expanded gaps and created additional gaps in the species' geographic distribution (Capelli 1997, p. 7). Two examples of extirpations are San Francisco Bay in San Francisco and Alameda Counties, and Redwood Creek and Freshwater Lagoon in Humboldt County.

Swift *et al.* (1989, p. 13) reported that, as of 1984, tidewater goby occurred or had been known to occur at 87 locations, including those at the extreme northern and southern end of the species' historical geographic range. An assessment of the species' distribution in 1993, using records that were limited to the area between the Monterey Peninsula in Monterey County and the United States—Mexico border, found the tidewater goby occurring at four additional sites since 1984 (Swift *et al.* 1993, p. 129). Other locations have been identified since 1993, and to date the tidewater goby has been documented to have occurred at 135 locations. Of these 135 locations, 21 (16 percent) are no longer occupied by the tidewater goby.

Habitat

The lagoons, estuaries, backwater marshes, and freshwater tributaries that tidewater goby occupy are dynamic environments subject to considerable fluctuations on a seasonal and annual basis. Typically, a sandbar forms in the late spring as flow into a lagoon declines enough to allow the ocean surf to build up sand at the mouth of the lagoon. Winter rains and increased stream flows may bring in considerable sediment and dramatically affect the bottom profile and substrate composition of a lagoon or estuary. Fine mud and clay either move through the

lagoon or estuary, or settle out in the backwater marshes, while heavier sand is left behind. High flows associated with winter rains can scour out the lagoon bottom to a lower level, especially after breaching the mouth sandbar, with sand building up again after flows decline. These dynamic processes result in wetland habitats that, over time, move both up or down coast, and inland or coastward.

The horizontal extent of the lentic (pondlike) wetland habitat associated with a particular tidewater goby locality varies and is affected, in part, by local precipitation patterns and topography. In coastal areas where the topography is steep and precipitation relatively low, such as areas adjacent to the Santa Ynez Mountains in Santa Barbara County, the habitats occupied by tidewater goby may be a few acres in size and only extend a few hundred feet inland from the ocean, with backwater marshes small or absent. In other coastal settings where topography is less steep and precipitation is more abundant, surface streams are larger, and coastal lagoons or estuaries may be hundreds of acres in size and extend many miles inland and may include extensive backwater marshes (for example, Lake Earl in Del Norte County and Ten Mile River in Mendocino County). Some occupied locations, such as Bennett's Slough in Monterey County, receive water from upstream areas on a year-round basis. Such locations tend to possess wetland habitats that are larger and can extend inland for several miles. Other occupied locations do not possess stream channels or tributaries that provide a considerable amount of water throughout the summer or fall months. Such locations, such as Little Pico Creek in San Luis Obispo County, tend to possess wetland habitats that extend only a short distance inland.

Reproduction

The tidewater goby has been observed to spawn in every month of the year except December (Swenson 1999, p. 107). Reproduction tends to peak in late April or May to July, and can continue into November depending on seasonal temperature and rainfall. Hellmair's (2011) findings reveal year-round reproduction for some tidewater goby populations that have high genetic diversity and restricted spawning periods for other populations with low genetic diversity. Swenson (1995, p. 31) has documented the spawning activities of adult fish or the presence of egg clutches at water temperatures between 48 and 77 degrees Fahrenheit (°F) (9 and 25 degrees Celsius (°C)). Spawning tidewater gobies have been documented to breed in water salinities between 1 and 30 parts per thousand (ppt) (Swenson 1995, p. 31, Smith, *in litt.* 2012). However, tidewater gobies prefer salinities less than 10 ppt (Moyle 2002, p. 431).

Threats

The final listing rule for the tidewater goby published in 1994 (59 FR 5494; February 4, 1994) and the 5-year review (Service 2007) state that this species is threatened, or potentially threatened, by: (1) Coastal development projects that result in the loss or alteration of coastal wetland habitat; (2) water diversions and alterations of water flows upstream of coastal lagoons and estuaries that negatively impact the species' breeding and foraging activities; (3) groundwater overdrafting; (4) channelization of the rivers where the species occurs; (5) discharge of agricultural and sewage effluents; (6) cattle grazing and feral pig activity that results in increased sedimentation of coastal lagoons and riparian habitats, removal of vegetative cover, increased ambient water temperatures, and elimination of plunge pools and undercut banks utilized by the tidewater goby; (7) introduced species that prey on the tidewater goby (e.g., bass (*Micropterus* spp.), rainwater killifish (*Lucania parva*), and crayfish (*Cambarus* spp.)); (8) the inadequacy of existing regulatory mechanisms; (9) drought conditions that result in the deterioration of coastal and riparian habitats; and (10) competition with introduced species, such as the yellowfin goby (*Acanthogobius flavimanus*) and chameleon goby (*Tridentiger trigonocephalus*). Lastly, loss of genetic diversity has also been recently shown to threaten populations of tidewater goby (McCraney *et al.* 2010, Hellmair 2011).

Climate Change

Our analyses under the Endangered Species Act include consideration of ongoing and projected changes in climate. The terms "climate" and "climate change" are defined by the Intergovernmental Panel on Climate Change (IPCC). "Climate" refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2007, p. 78). The term "climate change" thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007, p. 78). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2007, pp. 8–14, 18–19). In our analyses, we use our expert judgment to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

In addition to the threats listed above, tidewater goby populations are threatened by global climate change. Sea level rise and hydrological changes associated with climate change are having and will continue to have significant effects on tidewater goby habitat over the next several decades.

Sea level rise is a result of two phenomena: thermal expansion (increased sea water temperatures) and global ice melt (Cayan *et al.* 2006, p. 5, National Research Council 2012, p. 33). Between 1897 and 2006, the observed sea level rise has been approximately 2 millimeters (0.08 in) per year, or a total of 20 cm (8 in) over that period (Heberger *et al.* 2009, p. 6). Older estimates projected that sea level rise along the California coast would follow a similar rate and reach 0.2–0.6 meters (m) (0.7–2 feet (ft)) by 2100 (IPCC 2007). Recent observations and models indicate that those projections were conservative and ignored some critical factors, such as melting of the Greenland and Antarctica ice sheets (Heberger *et al.* 2009, p. 6; Rahmstorf 2010, p. 44). Heberger *et al.* (2009, p. 8) have updated the sea level rise projections for California to 1.0–1.4 m (3.3–4.6 ft) by 2100, while Vermeer and Rahmstorf (2009, p. 21530) calculate the sea level rise globally at 0.57–1.9 m (2.4–6.2 ft); in both cases, recent estimates were more than twice earlier projections. Combined with California's normal dramatic tidal fluctuations and coincidental storms—the severity of the latter is projected to increase with more frequent El Niño Southern Oscillations due to increasing surface water temperature (Cayan *et al.* 2006, p. 17)—the effects of sea level rise are expected to result in greater coastal erosion (Scripps Institution of Oceanography 2012, p. 24) and reach farther inland than previously anticipated (Cayan *et al.* 2006, pp. 48–49; Cayan *et al.* 2009, p. 40).

Park *et al.* (1989, pp. 1–52) projected that, of the saltmarshes along the coast of the contiguous United States: 30 percent would be lost with a 0.5-m (1.6-

ft) sea level rise, 46 percent with a 1-m (3.3-ft) sea level rise, 52 percent with a 2-m (6.6-ft) sea level rise, and 65 percent with a 3-m (9.8-ft) sea level rise. While we cannot project directly to California from the estimates of Park *et al.* (1989, p. 1–52) who focused on the east coast and Gulf coast of the United States, we can anticipate that, with a projected global sea level rise of up to almost 2 m (6.6 ft), 46 to 65 percent of the remaining coastal saltmarshes in California would be lost by 2100. Applying Heberger *et al.'s* (2009, p. 8) more conservative estimates for California to Park *et al.'s* calculations, with a projected sea level rise of 1.0–1.4 m (3.3–4.6 ft) by 2100, somewhere between 46 and 52 percent of the coastal saltmarshes in California would be inundated.

For the tidewater goby, sea level rise estimates based on more recent projections, combined with the effects of storms and tidal fluctuations, have the potential to transform coastal lagoons into primarily saltwater bodies (Cayan *et al.* 2006, pp. 34, 48–49). More severe storms that are likely to result from climate change (Cayan *et al.* 2006, p. 17), especially along the northern coast of California (Cayan *et al.* 2009, p. 38), combined with the higher than normal sea levels, will breach lagoon mouths more frequently from the ocean side, allowing more saltwater intrusion, altering the physical conditions of the tidewater goby's habitat (increased salinity), and disrupting the tidewater goby's normal reproduction process that requires closed lagoons and a specific range of salinities. The conversion of coastal lagoons and estuaries from brackish to primarily saltwater bodies, in addition to the inundation and breaching of sandbars, would eliminate habitat for tidewater goby in many areas. For a species that exhibits metapopulation dynamics and was listed as endangered due to past habitat loss and fragmentation of metapopulations, the projection of further habitat loss due to sea level rise raises concerns for the tidewater goby's survival over the long term.

Summary of Changes From Previously Designated Critical Habitat and 2011 Proposed Revised Critical Habitat Designation

In this section we present the differences between what was designated in the January 31, 2008, final rule (73 FR 5920), what was included in the October 19, 2011, proposed rule (76 FR 64996), and what is included in this final designation.

The 2008 final critical habitat designation (73 FR 5920, January 31, 2008) consisted of 44 units in Del Norte, Humboldt, Mendocino, Sonoma, Marin, San Mateo, Santa Cruz, Monterey, San Luis Obispo, Santa Barbara, Ventura, and Los Angeles Counties, California, totaling 10,003 ac (4,050 ha). In this final critical habitat designation, we have designated 65 critical habitat units for the tidewater goby throughout its range, including the 44 units designated in the 2008 final rule. Of the 21 new units included in this designation, 5 units are within the geographical area occupied at the time of listing and 16 units are outside the geographical area occupied at the time of listing (Table 1). Of the 16 new units that are outside the geographical area occupied at the time of listing, 8 units are currently occupied (Table 1). These 16 units are essential for the conservation of the tidewater goby as described in the Recovery Plan (Service 2005a).

This final critical habitat designation for the tidewater goby also differs from our October 19, 2011 (76 FR 64996) proposed rule. We reviewed and considered comments from the public and peer reviewers on the proposed revised designation, and from the public on the draft economic analysis published on July 24, 2012 (77 FR 43222). As a result of comments received, our final designation differs from our proposed designation, as follows:

(1) Based on information we received in comments regarding our proposal to designate unoccupied units, we revised the language in the *Criteria Used To Identify Critical Habitat* section of this final rule to clarify our intent. In the proposed rule we stated that, "We also are proposing to designate specific areas outside the geographical area occupied by the species at the time of listing that were historically occupied, but are presently unoccupied, because such areas are essential for the conservation of the species" (p. 65004). However, we did not intend to limit the proposal to only specific areas outside the geographical area occupied by the species at the time of listing that were historically occupied. Our intent was to consider all areas that are essential for the conservation of the species and not only those that were known to be historically occupied; we were in error when we included "that were historically occupied, but are presently unoccupied" in the proposed rule. We proposed to designate six units that are outside the geographical area occupied by the species at the time of listing where the tidewater goby has not been detected historically. These units are: Pomponio Creek (SM–2), Bolinas Lagoon (MAR–5), Arroyo de la Cruz (SLO–1), Oso Flaco Lake (SLO–12), Arroyo Sequit (LA–1), and Zuma Canyon (LA–2). Subsequent to the publication of the proposed rule, tidewater gobies have been detected in Pomponio Creek (SM–2) (Rischbieter, *in litt.* 2012). These units are essential for the conservation of the tidewater goby as described in the Recovery Plan (Service 2005a) and the unit descriptions below.

(2) We revised and expanded our discussion on tidewater goby metapopulation dynamics and provided a discussion on the effects of climate change on the tidewater goby and its habitat.

(3) Based on comments received from the County of Santa Barbara pertaining to unit SB–12, Arroyo Paredon Creek, we reassessed the topography of the unit as originally proposed and determined that the gradient of the upper portion of the unit was a barrier to tidewater gobies. The unit now includes approximately 3 ac (1 ha), a net decrease of approximately 1 ac (less than 1 ha) from the proposal.

Critical Habitat

Background

Critical habitat is defined in section 3 of the Act as:

(1) The specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the Act, on which are found those physical or biological features.

(a) Essential to the conservation of the species and

(b) Which may require special management considerations or protection; and

(2) Specific areas outside the geographical area occupied by the species at the time it is listed, upon a determination that such areas are essential for the conservation of the species.

Conservation, as defined under section 3 of the Act, means to use and the use of all methods and procedures that are necessary to bring an endangered or threatened species to the point at which the measures provided pursuant to the Act are no longer necessary. Such methods and procedures include, but are not limited to, all activities associated with scientific resources management such as research, census, law enforcement, habitat acquisition and maintenance, propagation, live trapping, and transplantation, and, in the extraordinary case where population pressures within a given ecosystem cannot be otherwise relieved, may include regulated taking.

Critical habitat receives protection under section 7 of the Act through the requirement that Federal agencies ensure, in consultation with the Service, that any action they authorize, fund, or carry out is not likely to result in the destruction or adverse modification of critical habitat. The designation of critical habitat does not affect land ownership or establish a refuge, wilderness, reserve, preserve, or other conservation area. Such designation does not allow the government or public to access private lands. Such designation does not require implementation of restoration, recovery, or enhancement measures by non-Federal landowners. Where a landowner requests Federal agency funding or authorization for an action that may affect a listed species or critical habitat, the consultation requirements of section 7(a)(2) of the Act would apply, but even in the event of a destruction or adverse modification finding, the obligation of the Federal action agency and the landowner is not to restore or recover the species, but to implement reasonable and prudent alternatives to avoid destruction or adverse modification of critical habitat.

Under the first prong of the Act's definition of critical habitat, areas within the geographical area occupied by the species at the time it was listed are included in a critical habitat designation if they contain physical or biological features (1) which are essential to the conservation of the species and (2) which may require special management considerations or protection. For these areas, critical habitat designations identify, to the extent known using the best scientific and commercial data available, those physical or biological features that are essential to the conservation of the species (such as space, food, cover, and protected habitat). In identifying those physical or biological features within an area, we focus on the principal biological or physical constituent elements (primary constituent elements that provide for a species' life-history processes, such as roost sites, nesting grounds, seasonal wetlands, water quality, tide, soil type) that, under the appropriate species-specific circumstances, are essential to the conservation of the species.

Under the second prong of the Act's definition of critical habitat, we designate critical habitat in areas outside the geographical area occupied by the species at the time it is listed, upon a determination that such areas are essential for the conservation of the species. For example, we may determine that an area currently occupied by the species but outside the geographical area occupied at the time of listing is essential for the conservation of the species and include it in the critical habitat designation. We designate critical habitat in areas outside the geographical area occupied by a species only when a designation limited to its range would be inadequate to ensure the conservation of the species.

Section 4 of the Act requires that we designate critical habitat on the basis of the best scientific and commercial data available. Further, our Policy on Information Standards Under the Endangered Species Act (published in the **Federal Register** on July 1, 1994 (59 FR 34271)), the Information Quality Act (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001 (Pub. L. 106–554; H.R. 5658)), and our associated Information Quality Guidelines provide criteria, establish procedures, and provide guidance to ensure that our decisions are based on the best scientific data available. They require our biologists, to the extent consistent with the Act and with the use of the best scientific data available, to use primary and original sources of information as the basis for recommendations to designate critical habitat.

When we are determining which areas should be designated as critical habitat, our primary source of information is generally the information developed during the listing process for the species. Additional information sources may include the Recovery Plan for the species, articles in peer-reviewed journals, conservation plans developed by States and counties, scientific status surveys and studies, biological assessments, other unpublished materials, or experts' opinions or personal knowledge.

Habitat is dynamic, and species may move from one area to another over time. We recognize that critical habitat designated at a particular point in time may not include all of the habitat areas that we may later determine are necessary for the recovery of the species. For these reasons, a critical habitat designation does not signal that habitat outside the designated area is unimportant or may not be needed for recovery of the species. Areas that are important to the conservation of the species, both inside and outside the critical habitat designation, will continue to be subject to: (1) Conservation actions implemented under section 7(a)(1) of the Act, (2) regulatory protections afforded by the requirement in section 7(a)(2) of the Act for Federal agencies to insure their actions are not likely to jeopardize the continued existence of any endangered or threatened species, and (3) the prohibitions of section 9 of the Act if actions occurring in these areas may affect the species. Federally funded or permitted projects affecting listed species outside their designated critical habitat areas may still result in jeopardy findings in some cases. These protections and conservation tools will continue to contribute to recovery of this species. Similarly, critical habitat designations made on the basis of the best available information at the time of designation will not control the direction and substance of future recovery plans, habitat conservation plans (HCPs), or other species conservation planning efforts if new information available at the time of these planning efforts calls for a different outcome.

Physical or Biological Features

In accordance with section 3(5)(A)(i) and 4(b)(1)(A) of the Act and regulations at 50 CFR 424.12, in determining which areas within the geographical area occupied by the species at the time of listing to designate as critical habitat, we consider the physical or biological features essential to the conservation of the species and which may require special management considerations or protection. These include, but are not limited to:

(1) Space for individual and population growth and for normal behavior;

(2) Food, water, air, light, minerals, or other nutritional or physiological requirements;

(3) Cover or shelter;

(4) Sites for breeding, reproduction, or rearing (or development) of offspring; and

(5) Habitats that are protected from disturbance or are representative of the historical, geographical, and ecological distributions of a species.

We derive the specific physical or biological features essential to tidewater goby conservation from studies of this species' habitat, ecology, and life history as described in the Critical Habitat section of the proposed rule to revise critical habitat published in the **Federal Register** on October 19, 2011 (76 FR 64996), and in the information presented below. Additional information can be found in the final listing rule published in the **Federal Register** on February 4, 1994 (59 FR 5494), and the Recovery Plan for the tidewater goby (Service 2005a). We have determined that the tidewater goby requires the following physical or biological features:

Space for Individual and Population Growth and for Normal Behavior

Saline Aquatic Habitat

The tidewater goby occurs in lagoons, estuaries, and backwater marshes that are adjacent to the Pacific Ocean (Wang 1982, p. 14; Irwin and Soltz 1984, p. 27; Swift *et al.* 1989, p. 1; Swenson 1993, p. 3; Moyle 2002, p. 431). The tidewater goby is most commonly found in waters with relatively low salinities, that is, less than 10 to 12 parts per thousand (ppt) (Swift *et al.* 1989, p. 7) (see below for further details). This species can, however, tolerate a wide range of salinities and is frequently found in coastal habitats with higher salinity levels (Swift *et al.* 1989, p. 7; Worcester 1992, p. 106; Swift *et al.* 1997, pp. 15–22); the species has been collected in salinities as high as 42 ppt (Swift *et al.* 1989, p. 7). The species' tolerance of high salinities likely enables it to withstand some exposure to the marine environment, which has a salinity of about 35 ppt, allowing it to recolonize nearby lagoons and estuaries following flood events (Swift *et al.* 1989, p. 7). However, tidewater gobies have only rarely been captured in the marine environment (Swift *et al.* 1989, p. 7), and they appear to enter the ocean only when flushed out of lagoons, estuaries, and river mouths by storm events or human-caused breaches of sand bars. Salinity tolerance studies indicate that larval stages are largely intolerant of high salinities whereas adult tidewater gobies can tolerate higher salinities. These findings suggest spawning in saline conditions is unlikely to be productive and that migration among subpopulations is most likely the result of adult tidewater goby movement (Kinziger, *in litt.* 2012). The goal of the Recovery Plan is to preserve the diversity of habitats that occur within the range of the species, the metapopulation structure of the species, and genetic diversity (Service 2005a, p. 28).

Water Depth, Velocity, and Temperature

The tidewater goby is most commonly collected in water less than 6 ft (2 m) deep (Wang 1982, pp. 4–5; Worchester 1992, p. 53). However, recently tidewater gobies were collected in Big Lagoon in Humboldt County during the breeding season at a water depth of 15 ft (4.6 m) (Goldsmith, *in litt.* 2006a). Whether use of these deeper waters is confined to this locality or is more widespread will require additional sampling at various depths and locations. The tidewater goby tends to avoid currents and concentrate in slack-water areas; this suggests it is less likely to occur in areas with a steep gradient or microhabitats that have a substantial current. At Pescadero Creek in San Mateo County, tidewater gobies were absent from portions of the flowing creek that had a surface velocity of 0.15 m per second (0.49 ft per second), and the species was instead more densely concentrated in nearby eddies with lower water velocities (Swenson 1993, p. 3). Backwater marshes may provide important refuges that reduce the likelihood that a substantial number of tidewater gobies will be flushed out of the lagoons or estuaries and into the marine environment during heavy winter floods (Lafferty *et al.* 1999b, p. 619). Evidence that increased flows can eliminate the tidewater goby from a locality is suggested by the elimination of the tidewater goby from Waddell Creek in Santa Cruz County following a flood event in the winter of 1972–73 (Nelson as cited in Swift 1990, p. 2); this creek had been channelized and no longer afforded protection from high flows during flood events. Likewise, the channelization and elimination of habitat lateral to the main stream channel upstream of San Onofre Lagoon in San Diego County probably led to the flushing and extirpation of the tidewater goby from this locality during a storm in 1993 (Swift *et al.* 1994, p. 22–23). The importance of backwater marshes is also highlighted by the fact that tidewater gobies in these habitats can achieve a greater size at maturity than in adjacent lagoons and creeks (Swenson 1993, pp. 6–7).

Freshwater Habitat

The tidewater goby also occurs in freshwater streams up-gradient and tributary to brackish habitats; the salinity of these freshwater streams is typically less than 0.5 ppt. The available documentation demonstrates that, in some areas, tidewater goby can occur 1.6 to 7.3 mi (2.6 to 11.7 km) upstream from the ocean environment (Irwin and Soltz 1984, p. 27; Swift *et al.* 1997, p. 20; Goldsmith, *in litt.* 2006b). Within a 2-hour period, hundreds of tidewater gobies have been observed to move upstream of a fixed location into areas in the Santa Ynez River 3.2 mi (5.1 km) from the ocean in Santa Barbara County (Swift *et al.* 1997, p. 20). The fact that this many individuals were observed to move through an area suggests that freshwater tributaries in some riverine systems provide important habitat for individual and population growth. We have reviewed a variety of documents to determine how far tidewater gobies have been detected upstream from the ocean. Goldsmith (*in litt.* 2006b) found tidewater gobies 1.6 to 2.0 mi (2.6 to 3.3 km) upstream from the ocean in the Ten Mile River in Mendocino County; Swift *et al.* (1997, p. 18) found tidewater gobies 4.6 mi (7.3 km) upstream from the ocean in the San Antonio River in Santa Barbara County; Swift *et al.* (1997, p. 20) found tidewater gobies at various distances from 3.9 to 7.3 mi (6.2 to 11.7 km) upstream from the ocean in the Santa Ynez River in Santa Barbara County; and Holland (1992, p. 9) found tidewater gobies 3 mi (5 km) upstream from the ocean in the Santa Margarita River in San Diego County. Collectively, these data suggest the average maximum distance tidewater gobies have been detected upstream from the ocean in medium to large rivers is approximately 4.0 mi (6.4 km). Other than high stream gradient, the reasons for the variation in upstream movement between one locality and another have not been determined; salinity could be an important factor. Upstream salinity levels may vary with time of year, tidal cycles, storm events, and topography. However, Swift *et al.* (1997, p. 26) indicate that gradient and lack of barriers (e.g., beaver dams, sills) are more important factors than salinity to upstream dispersal.

Sandbars

Many of the locations occupied by the tidewater goby closely correspond to stream drainages. Under natural conditions, these stream drainages and the marine environment collectively act to produce sandbars that form a barrier between the ocean and the lagoon, estuary, backwater marsh, and freshwater stream system (Habel and Armstrong 1977, p. 39). These sandbars tend to be present during the late spring, summer, and fall seasons. The presence of a sandbar can create a lower salinity level (5 to 10 ppt) in the area up gradient from the sandbar (Carpelan 1967, p. 324) than would otherwise exist if there were no sandbar. The tidewater goby is more commonly associated with these lower salinity levels than with the salinity levels that occur in the ocean or an estuary without a sandbar, that is, about 35 ppt (Swift *et al.* 1989, p. 7). The formation of a sandbar also creates more habitat for aquatic organisms because water becomes ponded behind the sandbar. Artificial breaching of a sandbar tends to result in a rapid decrease in water levels, unlike natural breaching, and increases the likelihood that adult tidewater gobies, their nests, and their fry could become stranded and die, or become concentrated and subject to greater levels of predation pressure by birds or other predators. Natural breaching events tend to occur during

the late winter and early spring when tidewater goby breeding is at a low point in the reproduction cycle. Furthermore, tidewater gobies are likely able to detect storm events due to the increased inflow of fresh water that may cause a natural breaching event and swim upstream or take refuge in side channels (Lafferty *et al.* 1999b, p. 619).

In Humboldt Bay and the Eel River estuary in Humboldt County, a large amount of salt and brackish marsh habitat was historically eliminated through the construction of levees and drainage channels. As a result, several of the locations occupied by the tidewater goby do not contain natural sandbars between the ocean and habitat where the species is present. Instead, manmade water control structures such as tidegates and culverts exist between tidal waters and the locations where tidewater goby occur. These tidegates have been in place for decades, and in some cases they provide habitat conditions similar to those created by the presence of a seasonal sandbar. In fact, most of the occupied tidewater goby habitats in the Humboldt Bay-Eel River estuaries are above tidegates. Other examples where large amounts of brackish marsh habitat have been lost due to construction of levees and drainage channels include the tributaries to the San Francisco Bay, Tomales Bay, Waddell Creek, Salinas River, Goleta Slough, Santa Clara River, and Mugu Lagoon.

Food

The tidewater goby feeds mainly on macroinvertebrates (for example shrimp and aquatic insects) (Irwin and Soltz 1984, p. 21–23; Swift *et al.* 1989, p. 6; Swenson 1995, p. 87). The diets of adult and juvenile tidewater gobies tend to include the same relative abundance of different invertebrate species (Swenson and McCray 1996, p. 962). The nonnative New Zealand mudsnails (NZMS; *Potamopyrgus antipodarum*) have been a seasonally important component of the diet of tidewater gobies in the northcoast region (Hellmair *et al.* 2011, p. 1).

Cover or Shelter

A variety of native and nonnative fish species and fish-eating bird species, such as egrets (*Egretta* spp.) and herons (e.g., great blue herons (*Ardea herodias*)), prey on tidewater gobies. Therefore, escape cover or shelter is necessary to reduce the likelihood that tidewater gobies will be preyed upon. A species' ability to persist when it is subject to predation pressure frequently depends on the presence of different features that provide a greater level of structure, which makes it more likely a prey species will avoid predation (Crowder and Cooper 1982, p. 1802; Gilinsky 1984, p. 455). At locations where the tidewater goby occurs, submerged and emergent aquatic vegetation has the potential to provide cover from predators, and provide a greater degree of habitat heterogeneity or structure that would not otherwise exist if the aquatic vegetation was absent. Stable lagoons often possess dense aquatic vegetation that frequently consists of sago pondweed (*Potamogeton pectinatus*) or widgeon grass (e.g., *Ruppia maritima* and *R. cirrhosa*). At some locations, juvenile tidewater gobies are more prevalent in areas with at least some submergent vegetation as compared to other areas with no or little vegetation (Wang 1984, p. 16; Swenson 1994, p. 6; Trihey & Associates, Inc. 1996, p. 11). It is reasonable to assume that the presence of submerged or emergent vegetation reduces the likelihood that tidewater gobies will be preyed upon by native and nonnative species because this vegetation provides cover and increases the level of habitat heterogeneity in a way that makes it more likely that tidewater gobies will persist where they co-occur with predators.

Aquatic vegetation may provide some degree of shelter or refuge during flash flood events (Lafferty *et al.* 1999b, p. 621). These refuges presumably would result because the presence of vegetation would create lower water velocities than might otherwise occur in unvegetated areas. Such refuges would be especially important to fish species that are not strong swimmers, such as the tidewater goby.

Sites for Breeding, Reproduction, or Rearing (or Development) of Offspring

The eggs of the tidewater goby are laid in burrows that are excavated by male fish. The available literature suggests that burrows most commonly occur in areas with relatively unconsolidated, clean, coarse sand (Swift *et al.* 1989, p. 8), while other documents demonstrate that burrows may also occasionally occur in silt or mud (Wang 1982, p. 6). Swenson (1995, p. 148) demonstrated that tidewater gobies prefer a sandy substrate in the laboratory. Male tidewater gobies remain in the burrow to guard the eggs attached to the burrow ceiling and walls. Male tidewater gobies care for the embryos for approximately 9 to 11 days until they hatch, rarely if ever emerging from the burrow to feed (Swift *et al.* 1989, p. 4). The tidewater goby larvae occupy the water column after the eggs hatch (Wang 1982, p. 15). As they mature, they occupy the bottom substrate. Worcester (1992, pp. 77–79) found that larval tidewater gobies in Pico Creek Lagoon in San Luis Obispo County tended to use the deeper portion of the lagoon, that is, depths of 29 inches (in) (73 centimeters (cm)) versus 17 in (42 cm).

Habitats Protected from Disturbance or Representative of the Historical, Geographical, and Ecological Distributions of the Species

The majority of lagoons and estuaries that currently support the tidewater goby have experienced some level of disturbance. The lagoons and estuaries that support the tidewater goby range in size from approximately 3.5 square yards (3 m^2) of surface area to about 2,000 ac (800 ha). Most lagoons and estuaries that support the tidewater goby range from about 1.25 to 12.5 ac (0.5 to 5 ha). Surveys of tidewater goby locations and historical records indicate that size, configuration, location, and access by humans are all factors in the persistence of populations of this species (Swift *et al.* 1989, p. 15, 1994, p. 26–27). Lagoons and estuaries smaller than about 5 ac (2 ha) generally have histories of extirpation or population reduction to very low levels. These small locations are also often within a mile or so of another locality from which recolonization could occur following natural episodic catastrophic events. The most stable or largest populations today are in locations of intermediate sizes, which range from 5 to 125 ac (2 to 50 ha). In many cases these intermediate-sized locations likely serve as source populations for the smaller ephemeral sites (Lafferty *et al.* 1999b, p. 1452).

Primary Constituent Elements for Tidewater Goby

Under the Act and its implementing regulations, we are required to identify the physical or biological features essential to the conservation of the tidewater goby within the geographical area occupied at the time of listing, focusing on the features' primary constituent elements. We consider primary constituent elements to be the elements of physical or biological features that provide for a species' life-history processes that are essential to the conservation of the species.

Based on our current knowledge of the physical or biological features and habitat characteristics required to sustain the species' life-history processes, we determine that the primary constituent element (PCE) specific to the tidewater goby is:

(1) Persistent, shallow (in the range of approximately 0.3 to 6.6 ft (0.1 to 2 m)),

still-to-slow-moving lagoons, estuaries, and coastal streams with salinity up to 12 ppt, which provide adequate space for normal behavior and individual and population growth that contain one or more of the following:

(a) Substrates (e.g., sand, silt, mud) suitable for the construction of burrows for reproduction;

(b) Submerged and emergent aquatic vegetation, such as *Potamogeton pectinatus, Ruppia maritima, Typha latifolia,* and *Scirpus* spp., that provides protection from predators and high flow events; or

(c) Presence of a sandbar(s) across the mouth of a lagoon or estuary during the late spring, summer, and fall that closes or partially closes the lagoon or estuary, thereby providing relatively stable water levels and salinity.

Special Management Considerations or Protection

When designating critical habitat, we assess whether the specific areas within the geographical area occupied by the species at the time of listing contain features that are essential to the conservation of the species and which may require special management considerations or protection. Special management considerations or protection may be necessary to eliminate or reduce the magnitude of threats that affect the physical or biological features essential to the conservation of the tidewater goby. Threats identified in the final listing rule for the tidewater goby include:

(1) Coastal development projects, including proposed restoration projects that involve elimination of backwaters and loss or alteration of coastal wetland habitat, which may be crucial for flood refuge for the tidewater goby;

(2) water diversions and alterations of water flows upstream of coastal lagoons and estuaries that negatively impact the species' breeding and foraging habitat and activities;

(3) groundwater overdrafting that results in reduction of flows and negatively impacts the species' breeding and foraging habitat and activities;

(4) channelization of habitats where the species occurs that removes or reduces quality of habitat;

(5) discharge of agricultural and sewage effluents;

(6) cattle grazing and feral pig activity that result in increased sedimentation of coastal lagoons and riparian habitats, remove vegetative cover, increase ambient water temperatures, and eliminate plunge pools and collapsed undercut banks utilized by the tidewater goby;

(7) introduced species that prey on the tidewater goby (such as bass, rainwater killifish, African clawed frogs);

(8) the inadequacy of existing regulatory mechanisms;

(9) drought conditions that result in the deterioration of coastal and riparian habitats; and

(10) competition with introduced species, such as the yellowfin goby and chameleon goby.

For the purposes of this final rule, we have combined the "water diversions and alterations of water flows upstream of coastal lagoons and estuaries that negatively impact the species' breeding and foraging activities" threats category with "drought conditions" and "groundwater overdrafting," along with the addition of artificial breaching of sandbars, into one threat category. The combined category is referred to as "water diversions, alterations of water flows, artificial sandbar breaching, and groundwater overdrafting that negatively impact the species' breeding and foraging activities." Similarly, we have combined the two threat categories of "introduced species that prey on the tidewater goby (e.g., bass, African clawed frogs)" and "competition with introduced species such as the yellowfin goby and chameleon goby" into one category called, "introduced species that prey on, or compete with, the tidewater goby (for example, yellowfin goby, and bass)." We also recognize that where special management may be necessary, regulatory mechanisms may need to be added or amended by local, State, or Federal governmental entities if sufficient management is not achievable through voluntary mechanisms.

The tidewater goby's distribution reflects a pattern of occupancy and extirpation. The species requires refugia under drought conditions and places to recolonize under wetter conditions; otherwise, the tidewater goby would be relegated to existing only within those few lagoons and estuaries large enough to support it during periods of drought. If the suitable localities that are occupied during periods of normal precipitation cease to function as tidewater goby habitat due to modification or destruction while the localities are unoccupied, the metapopulation dynamics may be disrupted and the species may not be able to respond by recolonizing unoccupied localities under favorable conditions. The tidewater goby is facing numerous threats, including habitat loss from multiple sources, habitat fragmentation due to the loss of "stepping stone" localities between subpopulations, predation and nonnative competitors, alterations to hydrology (sandbar breaching, channelization, for example), changes in water quality, stochastic events such as drought, and the growing and inevitable impact of sea level rise. While some of these threats can singly have a substantial impact on individual tidewater goby subpopulations, in most cases it is the combined impact that is a threat to the species, especially in light of global climate change. A more detailed discussion of threats to the tidewater goby can be found in the final listing rule (59 FR 5494, February 4, 1994), and the final Recovery Plan (Service 2005a, pp. 16–19).

We find that the components of the PCE present within all the areas we are designating as critical habitat may require special management considerations or protection due to threats to the tidewater goby or its habitat. Using current information provided in the Recovery Plan (Service 2005a, Appendix E) and other information in our files, we have identified the components of the PCE that may require special management considerations or protection from known threats within each of the critical habitat units (see Critical Habitat Designation and Table 2 below for a unit-by-unit description). Some of the special management actions that may be needed for essential features of tidewater goby habitat are briefly summarized below.

(1) Implement measures to avoid, minimize or mitigate direct and indirect loss and modification of tidewater goby habitat due to dredging, draining, and filling of lagoons and estuaries. Additional management actions should be taken to restore historical tidewater goby locations and potential habitats as opportunities become available to eliminate, minimize, or mitigate the effects of existing structures and past activities that have destroyed or degraded tidewater goby habitat.

(2) Develop and implement measures to minimize the adverse effects due to channelization that can eliminate crucial backwater habitats or other flood refuges.

(3) Implement measures, such as best management practices, for managing excessive sedimentation in tidewater goby habitat. Measures should be implemented to control sedimentation in tidewater goby habitat due to cattle grazing, development, channel modification, recreational activity, and agricultural practices.

(4) Implement measures to prevent further decrease in freshwater inflow, water depth, and surface area within

tidewater goby habitat due to dams, water diversions, and groundwater pumping.

(5) Implement measures to avoid anthropogenic breaching of lagoons and use of pumping and other water control structures to regulate water levels, to maintain suitable habitat conditions during the summer and fall when tidewater goby reproduction is at its highest and freshwater inflow is at its lowest.

(6) Implement measures to improve water quality degraded as a result of agricultural runoff and effluent, municipal runoff, golf course runoff, sewage treatment effluent, cattle grazing, development, oil spills, oil field runoff, toxic waste, and gray-water dumping. Also, measures should be implemented to prevent further degradation of the water quality due to dikes, tidal gates, and other impedances to the natural freshwater/saltwater interface that alter the salinity regime in some of the tidewater goby habitats.

(7) Implement measures to control the abundance and distribution of nonnative species.

(8) Implement measures to restore genetic diversity within populations where the natural metapopulation dynamic will be unable to do so.

Criteria Used To Identify Critical Habitat

As required by section 4(b)(2) of the Act, we used the best scientific and commercial data available to designate critical habitat. We reviewed available information pertaining to the habitat requirements of this species. In accordance with the Act and its implementing regulation at 50 CFR 424.12(e), we considered whether designating areas outside those currently occupied as well as those occupied at the time of listing are essential to ensure the conservation of the species. We are designating critical habitat in areas within the geographical area occupied by the species at the time of listing in 1994. We also are designating specific areas outside the geographical area occupied by the species at the time of listing because such areas are essential for the conservation of the species.

In revising critical habitat for the tidewater goby, we made extensive use of the information in the Recovery Plan (Service 2005a), and incorporated the recovery goals and strategy identified in the Recovery Plan for the development of our revised designation. We also reviewed other relevant information, including peer-reviewed journal articles, unpublished reports and materials (for example, survey results and expert opinions), the final listing rule (59 FR 5494; February 4, 1994), the 2000 final critical habitat rule (65 FR 69693; November 20, 2000), the 2006 proposed critical habitat rule (71 FR 68914; November 28, 2006), the 2008 final critical habitat rule (73 FR 5920; January 31, 2008), the 2011 proposed critical habitat rule (76 FR 64996; October 19, 2011), the 5-year review for the tidewater goby (Service 2007), and regional databases and GIS coverages, for example, the California Natural Diversity Database, and National Wetlands Inventory maps. We analyzed this information to identify: (1) Specific areas within the geographical area occupied at the time of listing that contain the physical or biological features essential to the conservation of the tidewater goby and which may require special management considerations or protection, and (2) criteria for specific areas outside the geographical area occupied at the time of listing that are essential for the conservation of the tidewater goby.

The Recovery Plan focuses on preserving the diversity of tidewater goby habitats throughout the range of the species, preserving the natural processes of recolonization and population exchange (metapopulation dynamics) that enable recovery following natural episodic catastrophic events, and preserving genetic diversity (Service 2005a, p. 28). The conservation of the environmental, morphological, and genetic diversity across the range of the species is an important consideration in determining specific areas on which are found the physical or biological features essential to the conservation of the species and other specific areas that are essential for the conservation of the tidewater goby. For example, a population's ability to successfully adapt to changing environmental conditions is a function of the population size and genetic variation of the individuals at a given location (Reed and Frankham 2003, p. 233).

Local adaptations to different environmental conditions and morphological differences are likely linked to genetic variations among populations. These features may in turn be best protected by: (1) Identifying areas that represent the range of environmental, genetic, and morphological diversity; and (2) maximizing within these areas the protection of contiguous environmental gradients across which selection and migration can interact to maintain population viability and (adaptive) genetic diversity (Moritz 2002, p. 238). The Recovery Plan subdivides the geographical distribution of the tidewater goby into 6 recovery units, encompassing a total of 26 subunits defined according to genetic differentiation and geomorphology. We considered the conservation of the tidewater goby in each of the recovery units and subunits, as well as the species as a whole, in our analysis.

Based on the information and recommendations in the Recovery Plan, we developed a conservation framework and criteria to identify the specific circumstances under which the presence of the components of the PCE within the geographical area occupied by the species at the time of listing provides the physical or biological features essential to the conservation of the tidewater goby, and additionally what areas outside the geographical area occupied at the time of listing are essential for the conservation of the species.

Areas Within the Geographical Area Occupied at the Time of Listing

Within the geographical area occupied at the time of listing, the specific areas meeting the criteria below are designated as critical habitat in this final rule because they provide the physical or biological features essential to the conservation of the tidewater goby.

(1) Areas that support source populations (populations where local reproductive success is greater than local mortality (Meffe and Carroll 1994, p. 187)). For the purposes of this designation, we identified areas supporting source populations as those that are currently occupied and have been consistently occupied for 3 or more consecutive years based on survey data and published reports. Source populations are more likely to be capable of maintaining populations over many years and are, therefore, capable of providing individuals to recruit into surrounding subpopulations.

(2) Areas that support subpopulations within each metapopulation in addition to source populations in the event that the source population is extirpated due to a natural episodic catastrophic event such as a major flood or drought.

(3) Areas that provide connectivity between metapopulations. These areas are likely to act as "stepping stones" between more isolated populations, and thereby contribute to metapopulation persistence and genetic exchange. For the purposes of this designation, we generally identified locations that provide connectivity as those within approximately 6 mi (10 km) of another location. However, we included a few locations that exceeded 6 mi but were

within the maximum dispersal distance as determined through genetic research (Jacobs *et al.* 2005, p. 52) where there were no other locations with suitable habitat in that portion of the coast.

Areas Outside the Geographical Area Occupied at the Time of Listing

We have determined that the specific areas within the geographical area occupied at the time of listing alone are not sufficient to meet the recovery goals for the species because:

(1) The Recovery Plan recommends a targeted program of introduction and reintroduction of tidewater gobies into suitable habitat to minimize the chance of local extirpations resulting in extinction of a broader metapopulation (see the *Metapopulation Dynamics* section, above, for details) and resultant loss of its unique genetic traits (Service 2005a, p. 29);

(2) There has been loss and degradation (see the *Threats* section, above, for details) of habitat throughout the species' range since the time of listing;

(3) We anticipate a further loss of habitat in the future due to sea-level rise resulting from climate change (see the *Climate Change* section, above, for details); and

(4) The species needs habitat areas that are arranged spatially in a way that will maintain connectivity and allow dispersal within and between units (see the *Metapopulation Dynamics* section, above, for details).

One example of the need to designate areas outside the geographical area occupied at the time of listing is where distances between areas occupied at the time of listing may make it difficult for tidewater goby to disperse from one area to the next. Another example is to help prevent the extirpation of a metapopulation in which only one or two occupied sites remain. These areas that are outside the geographical area occupied at the time of listing include locations that are currently occupied and, in a few cases, ones that were historically occupied. In some unoccupied areas, the habitat would require some management: For example, restoration of a natural breaching regime, exotic predator management, or freshwater inflow enhancement.

Therefore, for areas outside the geographical area occupied at the time of listing, those meeting the criteria below are designated as critical habitat in this final rule because they are essential for the conservation of the species.

(1) Areas of aquatic habitat in coastal lagoons and estuaries with still-to-slow-moving water that allow for the conservation of viable metapopulations under varying environmental conditions, such as, for example, drought.

(2) Areas that provide connectivity between source populations or may provide connectivity in the future. These areas are likely to act as "stepping stones" between more isolated populations, and thereby contribute to metapopulation persistence and genetic exchange. For the purposes of this designation, we generally identified locations that provide connectivity as those within approximately 6 mi (10 km) of another location.

(3) Additional areas that may be more isolated but may represent unique adaptations to local features (habitat variability, hydrology, microclimate). For example, the Eel River (HUM–4) is essential for the conservation of tidewater goby because it possesses ecological characteristics that are important in maintaining the species' ability to adapt to changing environments, including the ability to disperse into higher channels and marsh habitat during severe flood events.

By applying the two sets of criteria to the 26 recovery subunits described in the Recovery Plan, we have identified 45 critical habitat units within the geographical area occupied by the species at the time of listing that we have determined contain the physical or biological features essential to the conservation of the tidewater goby and which may require special management considerations or protection, and 20 critical habitat units outside the geographical area occupied by the species at the time of listing that we have determined are essential for the conservation of the species. Please see Table 1, below, for the occupancy status of each of the 65 critical habitat units.

As emphasized throughout this rule and the Recovery Plan, the conservation of the tidewater goby is dependent on maintaining the metapopulation dynamics of the species, and we have therefore designated all those locations that we determined are essential for achieving that goal. In order to maintain metapopulation dynamics, we have determined that some locations where tidewater gobies have never been found or have not been found in recent years are essential for the conservation of the species. It should be noted, however, that some subpopulations within a metapopulation tend to decline or disappear periodically due to events such as drought and severe flooding, but then reappear or increase in abundance during more optimal conditions. However, surveys to determine the presence or absence of tidewater gobies are not usually conducted every year, and therefore the presence of tidewater gobies may have been missed. For example, tidewater gobies were known to occur in the San Luis Rey River in 1958. However, the river has only been surveyed five times in the last 65 years since 1958, and tidewater gobies were found in 2010.

As discussed previously, a metapopulation is generally considered to consist of several distinct but related subpopulations that are within dispersal distance of each other. Although the individual subpopulations may sometimes disappear, the metapopulation as a whole is often stable because immigrants from one population (which may, for example, be experiencing a population boom) are likely to re-colonize habitat which has been left open by the extirpation of another population as long as the habitat still remains. They may also emigrate to a small population and rescue that population from extirpation. In a metapopulation dynamic, connectivity of source populations is crucial, and locations considered unoccupied may serve this purpose. Although no single tidewater goby subpopulation may be able to guarantee the long-term survival of this species, the combined effect of many sporadically connected subpopulations may. Therefore, although a particular location may not be occupied at one point in time, or even for long periods of time, that location may be important for maintaining the connectivity between subpopulations, and hence contribute to the species' overall survival and conservation. For example, although tidewater gobies have not been detected in Arroyo del la Cruz, it is within dispersal distance of Arroyo del Corral, which is considered currently to be occupied in critical habitat. Arroyo de la Cruz is located approximately 2.0 mi (3.2 km) north of the Arroyo de Corral. Arroyo de la Cruz provides habitat for tidewater gobies that disperse from Arroyo del Corral, which may serve to decrease the risk of extirpation of this metapopulation through stochastic events. Arroyo de la Cruz is one of two locations with suitable habitat within the Central Coast Recovery Subunit (CC 1), as described in the Recovery Plan. Therefore, although tidewater gobies have not been detected at Arroyo de la Cruz, we consider this area to be essential to the conservation of the species because it contributes to ensuring the viability of the metapopulation because if the subpopulation within the Arroyo de

Corral unit (SLO–2) is extirpated, the entire metapopulation would be lost.

The process of making exclusions under Section 4(b)(2) considers the extent to which habitat restoration would be necessary to support the species in areas currently unoccupied. Where restoration is not likely due to cost or other factors, the benefits in terms of conservation value may not be as strong. Restoration activities would benefit all of the critical habitat units in this designation, and some form of restoration will be necessary to support the successful reintroduction or recolonization of the tidewater goby in the units that are unoccupied. For example, some of the unoccupied locations need improvements to water quality, barrier removal, exotic species management (e.g., Walker Creek, Salinas River, Arroyo de la Cruz, Oso Flaco Lake, etc.). However, designation of critical habitat does not mandate restoration or management of any areas. However, we determined it is feasible to restore all of the unoccupied habitat designated in this rule to the point where it can support gobies and we avoided designating unoccupied areas that are highly degraded or fragmented and not likely restorable (e.g., Los Angeles River, Mugu Lagoon). Such areas provide little or no long-term conservation value, and are not essential for the conservation of the species.

Mapping

After determining the lagoons and estuaries necessary for the conservation of the tidewater goby by applying criteria outlined above, the boundaries of each critical habitat unit were mapped. Unit boundaries were based on several factors, including species occurrence data that demonstrated where tidewater gobies have been observed, the presence of barriers and stream gradients that limit tidewater goby movements, and the presence and extent of the essential physical or biological features.

The geographic extent of each critical habitat unit was delineated, in part, using existing digital data. To determine the lateral boundaries of each critical habitat unit, we most frequently relied on the Pacific Institute global climate change model and National Wetland Inventory (NWI) maps that were prepared by the Service in 2006. The NWI maps are based on the Cowardin classification system (Cowardin *et al.* 1979, pp. 1–103). The Service has adopted this classification system as its official standard to describe wetland and deepwater habitats. Specifically, the following wetland types based on Cowardin (1979, p. 5) were used to delineate unit boundaries: Lake, Estuarine and Marine Deepwater, Estuarine and Marine Wetland, Freshwater Pond, Freshwater Emergent Wetland, Freshwater Forested/Shrub Wetland, and Riverine. These wetland types have, or are likely to have, components of the PCE at various times throughout the year, depending on the season and environmental factors such as storm or drought events. In some cases, we used existing anthropogenic structures, such as concrete or riprap channel linings that occur within wetland habitat types, to delineate the lateral boundaries of units. To a lesser extent, we also used aerial imagery from the National Agricultural Imagery Program (NAIP) to delineate the lateral boundaries of a critical habitat unit where insufficient NWI data were available.

The precise location of tidewater goby habitat at a particular locality may vary on a daily, seasonal, and annual basis; the habitats occupied by tidewater goby exist in a dynamic environment that varies over time. For example, the size and lateral extent of a coastal lagoon or estuary varies with daily tide cycles. Flood events may also change the precise location where surface water exists within a given lagoon, estuary, backwater marsh, or freshwater tributary. Therefore, it is appropriate to delineate each critical habitat unit to encompass the entire area that may be occupied by tidewater goby on a daily, seasonal, or annual basis. This was accomplished by using the boundaries delineated on the NWI maps to determine the lateral extent of each unit.

The delineation of the farthest upstream extent of a particular critical habitat unit was determined using one of four features that include:

(1) The average distance that tidewater gobies are known to move upstream from the ocean (4.0 mi (6.4 km)),

(2) the presence of barriers, such as culverts that may prevent tidewater gobies from moving upstream,

(3) the presence of a vertical drop, for example more than 4 to 8 in (10 to 20 cm) high, or steep gradient that precludes tidewater gobies from swimming upstream or can act as a barrier that makes it less likely tidewater gobies will be able to swim upstream (Swift *et al.* 1997, p. 20)), or

(4) limited surface water in the tributary up-gradient from the lagoon or estuary.

Each of the above features describes a barrier to upstream movement; therefore, the upstream extent of a particular unit was determined by whichever barrier was identified first through the mapping process regardless of whether or not components of the PCE were still present above it.

When determining critical habitat boundaries within this final rule, we made every effort to avoid including developed areas such as lands covered by bridges, docks, and other structures because such lands cannot provide habitat for the tidewater goby. The scale of the maps we prepared under the parameters for publication within the Code of Federal Regulations may not reflect the exclusion of such developed lands. Any such lands inadvertently left inside critical habitat boundaries shown on the maps of this final rule have been excluded by text in the rule and are not designated as critical habitat. Therefore, a Federal action involving these lands will not trigger section 7 consultation with respect to critical habitat and the requirement of no adverse modification unless the specific action may affect adjacent critical habitat.

The critical habitat designation is defined by the map or maps, as modified by any accompanying regulatory text, presented at the end of this document in the rule portion. We include more detailed information on the boundaries of the critical habitat designation in the preamble of this document. We will make the coordinates or plot points or both on which each map is based available to the public on *http://www.regulations.gov* at Docket No. FWS–R8–ES–2011–0085, on our Internet sites at *http://www.fws.gov/ventura/*, and at the field office responsible for the designation (see **FOR FURTHER INFORMATION CONTACT** above).

We are designating as critical habitat lands that we have determined are within the geographical area occupied at the time of listing and contain sufficient physical or biological features to support life-history processes essential to the conservation of the species, and lands outside of the geographical area occupied at the time of listing that we have determined are essential for the conservation of tidewater goby.

Units within the geographical area occupied at the time of listing are designated based on sufficient elements of physical or biological features being present to support tidewater goby life processes. Some units contain all of the identified elements of physical or biological features and support multiple life processes. Some units contain only some elements of the physical or biological features necessary to support the tidewater goby's particular use of that habitat.

Final Critical Habitat Designation

We are designating 65 units as critical habitat for tidewater goby (see Table 1 below). The critical habitat areas described below constitute our best assessment at this time of areas that meet the definition of critical habitat.

TABLE 1—OCCUPANCY OF TIDEWATER GOBY BY DESIGNATED CRITICAL HABITAT UNITS

Unit	Name	Within the geographical area occupied at time of listing?	Currently occupied [1]
DN–1	Tillas Slough (Smith River)	Yes	Yes.
DN–2	Lake Earl/Lake Tolowa	Yes	Yes.
HUM–1	Stone Lagoon	Yes	Yes.
HUM–2	Big Lagoon	Yes	Yes.
HUM–3	Humboldt Bay	Yes	Yes.
HUM–4	Eel River	No	Yes.
MEN–1	Ten Mile River	Yes	Yes.
MEN–2	Virgin Creek	Yes	Yes.
MEN–3	Pudding Creek	Yes	Yes.
MEN–4	Davis Lake and Manchester State Park Ponds.	Yes	Yes.
SON–1	Salmon Creek	Yes	Yes.
MAR–1	Estero Americano	Yes	Yes.
MAR–2	Estero de San Antonio	Yes	Yes.
MAR–3	Walker Creek	No	No.
MAR–4	Lagunitas (Papermill) Creek	No	Yes.
MAR–5	Bolinas Lagoon [2]	No	No.
MAR–6	Rodeo Lagoon	Yes	Yes.
SM–1	San Gregorio Creek	Yes	Yes.
SM–2	Pomponio Creek	No	Yes.
SM–3	Pescadero-Butano Creek	Yes	Yes.
SM–4	Bean Hollow Creek (Arroyo de Los Frijoles).	Yes	Yes.
SC–1	Waddell Creek	Yes	Yes.
SC–2	Scott Creek	No	Yes.
SC–3	Laguna Creek	Yes	Yes.
SC–4	Baldwin Creek	Yes	Yes.
SC–5	Moore Creek	Yes	Yes.
SC–6	Corcoran Lagoon	Yes	Yes.
SC–7	Aptos Creek	Yes	Yes.
SC–8	Pajaro River	Yes	Yes.
MN–1	Bennett Slough	Yes	Yes.
MN–2	Salinas River	No	No.
SLO–1	Arroyo de la Cruz [2]	No	No.
SLO–2	Arroyo del Corral	Yes	Yes.
SLO–3	Oak Knoll Creek (Arroyo Laguna).	Yes	Yes.
SLO–4	Little Pico Creek	Yes	Yes.
SLO–5	San Simeon Creek	Yes	Yes.
SLO–6	Villa Creek	Yes	Yes.
SLO–7	San Geronimo Creek	Yes	Yes.
SLO–8	Toro Creek	Yes	Yes.
SLO–9	Los Osos Creek	No	Yes.
SLO–10	San Luis Obispo Creek	Yes	Yes.
SLO–11	Pismo Creek	Yes	Yes.
SLO–12	Oso Flaco Lake [2]	No	No.
SB–1	Santa Maria River	Yes	Yes.
SB–2	Cañada de las Agujas	Yes	Yes.
SB–3	Cañada de Santa Anita	Yes	Yes.
SB–4	Cañada de Alegria	Yes	Yes.
SB–5	Cañada de Agua Caliente	Yes	Yes.
SB–6	Gaviota Creek	Yes	Yes.
SB–7	Arroyo Hondo	No	Yes.
SB–8	Winchester-Bell Canyon	Yes	Yes.
SB–9	Goleta Slough	No	Yes.
SB–10	Arroyo Burro	No	Yes.
SB–11	Mission Creek-Laguna Channel.	Yes	Yes.
SB–12	Arroyo Paredon	No	Yes.
VEN–1	Ventura River	Yes	Yes.
VEN–2	Santa Clara River	Yes	Yes.
VEN–3	J Street Drain-Ormond Lagoon.	Yes	Yes.
VEN–4	Big Sycamore Canyon	No	Yes.
LA–1	Arroyo Sequit [2]	No	No.
LA–2	Zuma Creek [2]	No	No.
LA–3	Malibu Lagoon	Yes	Yes.

TABLE 1—OCCUPANCY OF TIDEWATER GOBY BY DESIGNATED CRITICAL HABITAT UNITS—Continued

Unit	Name	Within the geographical area occupied at time of listing?	Currently occupied [1]
LA–4	Topanga Creek	No	Yes.
OR–1	Aliso Creek	No	No.
SAN–1	San Luis Rey River	No	Yes.

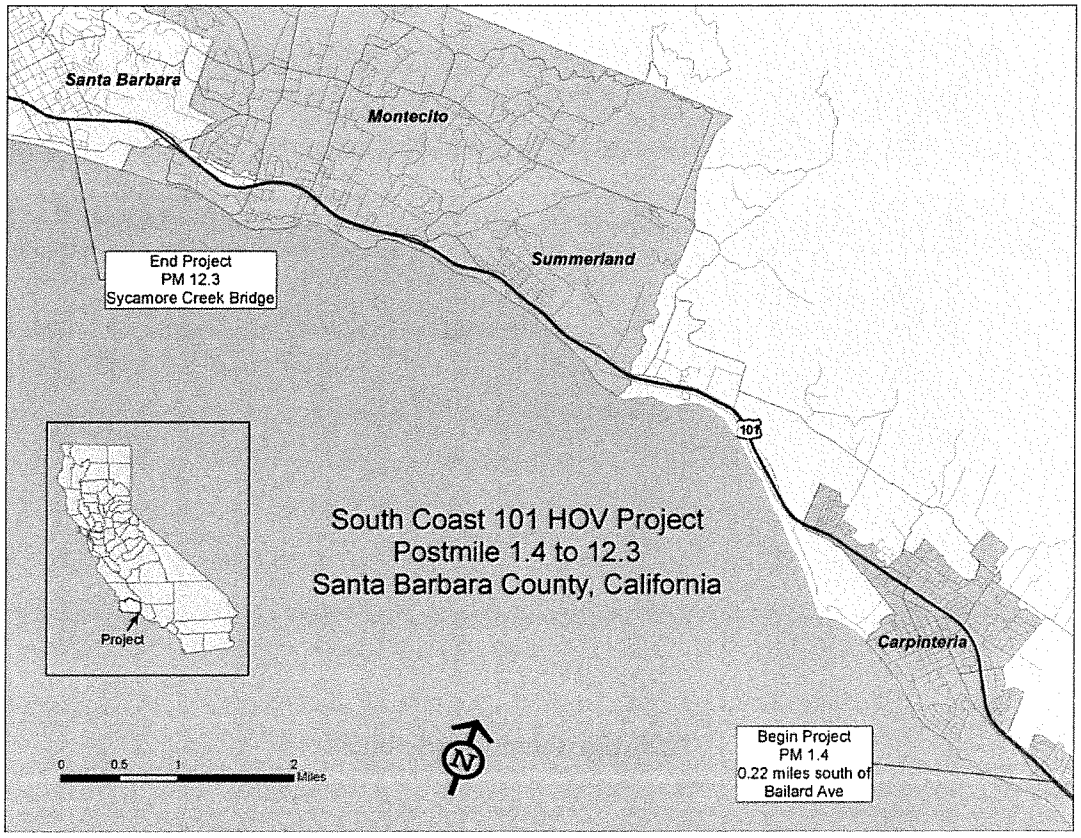
[1] Based on the Recovery Plan and subsequent survey information where available.
[2] Tidewater gobies have never been recorded from this location; however, regularly scheduled monitoring of these subpopulations has not been conducted.

The approximate area of each critical habitat unit is shown in Table 2.

TABLE 2—CRITICAL HABITAT UNITS DESIGNATED FOR THE TIDEWATER GOBY AND KNOWN THREATS THAT MAY REQUIRE SPECIAL MANAGEMENT CONSIDERATIONS OR PROTECTION OF THE ESSENTIAL PHYSICAL OR BIOLOGICAL FEATURES FOR UNITS WITHIN THE GEOGRAPHICAL AREA OCCUPIED BY THE SPECIES AT THE TIME OF LISTING

Unit name	Federal ac (ha)	State ac (ha)	Local ac (ha)	Private ac (ha)	Total [1] ac (ha)	Known threats that may require special management considerations or protection of the essential features [2]
DN–1: Tillas Slough (Smith River)	0 (0)	0 (0)	0 (0)	21 (8)	21 (8)	2, 3, 5
DN–2: Lake Earl/Lake Tolowa	0 (0)	2,335 (945)	0 (0)	348 (141)	2,683 (1,086)	1, 2, 4
HUM–1: Stone Lagoon	0 (0)	653 (264)	0 (0)	0 (0)	653 (264)	4
HUM–2: Big Lagoon	0 (0)	1,527 (618)	0 (0)	2 (1)	1,529 (619)	2, 4
HUM–3: Humboldt Bay	652 (264)	61 (24)	45 (18)	81 (33)	839 (339)	1, 3, 4, 5
HUM–4: Eel River	0 (0)	5 (2)	0 (0)	34 (13)	39 (15)	N/A
MEN–1: Ten Mile River	0 (0)	17 (7)	0 (0)	56 (23)	73 (30)	4
MEN–2: Virgin Creek	0 (0)	2 (1)	0 (0)	2 (1)	4 (2)	1, 4
MEN–3: Pudding Creek	0 (0)	10 (4)	1 (1)	6 (2)	17 (7)	1, 2, 4
MEN–4: Davis Lake and Manchester State Park Ponds	0 (0)	29 (12)	0 (0)	0 (0)	29 (12)	4
SON–1: Salmon Creek	0 (0)	47 (19)	14 (6)	47 (19)	108 (44)	1, 2, 4, 5
MAR–1: Estero Americano	0 (0)	0 (0)	0 (0)	465 (188)	465 (188)	1, 4, 5
MAR–2: Estero De San Antonio	0 (0)	0 (0)	0 (0)	285 (115)	285 (115)	1, 2, 4, 5
MAR–3: Walker Creek	0 (0)	9 (4)	0 (0)	109 (44)	118 (48)	N/A
MAR–4: Lagunitas (Papermill) Creek	318 (129)	459 (186)	0 (0)	221 (90)	998 (405)	N/A
MAR–5: Bolinas Lagoon	29 (12)	0 (0)	1,048 (424)	37 (15)	1,114 (451)	N/A
MAR–6: Rodeo Lagoon	40 (16)	0 (0)	0 (0)	0 (0)	40 (16)	1
SM–1: San Gregorio Creek	0 (0)	33 (13)	0 (0)	12 (5)	45 (18)	1, 3
SM–2: Pomponio Creek	0 (0)	1 (1)	0 (0)	6 (2)	7 (3)	N/A
SM–3: Pescadero-Butano Creek	0 (0)	241 (97)	0 (0)	4 (2)	245 (99)	1, 3, 4
SM–4: Bean Hollow Creek (Arroyo de Los Frijoles)	0 (0)	3 (1)	0 (0)	7 (3)	10 (4)	1, 2
SC–1: Waddell Creek	0 (0)	39 (16)	0 (0)	36 (14)	75 (30)	2, 3, 4
SC–2: Scott Creek	0 (0)	66 (27)	6 (2)	2 (1)	74 (30)	N/A
SC–3: Laguna Creek	0 (0)	26 (11)	0 (0)	0 (0)	26 (11)	2, 4
SC–4: Baldwin Creek	0 (0)	27 (11)	0 (0)	0 (0)	27 (11)	2, 4
SC–5: Moore Creek	15 (6)	0 (0)	0 (0)	0 (0)	15 (6)	2, 4
SC–6: Corcoran Lagoon	0 (0)	1 (1)	6 (2)	21 (8)	28 (11)	1, 4
SC–7: Aptos Creek	0 (0)	9 (4)	0 (0)	0 (0)	9 (4)	1, 3, 4
SC–8: Pajaro River	0 (0)	158 (64)	11 (4)	46 (19)	215 (87)	1, 3, 4
MN–1: Bennett Slough	0 (0)	108 (44)	5 (2)	54 (22)	167 (68)	1, 2, 3, 4
MN–2: Salinas River	195 (79)	33 (13)	1 (1)	237 (96)	466 (189)	N/A
SLO–1: Arroyo de la Cruz	0 (0)	25 (10)	0 (0)	8 (3)	33 (13)	N/A
SLO–2: Arroyo del Corral	0 (0)	4 (2)	0 (0)	1 (1)	5 (3)	1, 5
SLO–3: Oak Knoll Creek (Arroyo Laguna)	0 (0)	4 (2)	0 (0)	1 (1)	5 (3)	1, 3
SLO–4: Little Pico Creek	0 (0)	2 (1)	0 (0)	7 (3)	9 (4)	5
SLO–5: San Simeon Creek	0 (0)	17 (7)	0 (0)	0 (0)	17 (7)	2, 4, 5
SLO–6: Villa Creek	0 (0)	14 (6)	0 (0)	1 (1)	15 (7)	1, 2, 4, 5
SLO–7: San Geronimo Creek	0 (0)	1 (1)	0 (0)	0 (0)	1 (1)	5
SLO–8: Toro Creek	0 (0)	1 (1)	0 (0)	8 (3)	9 (4)	2, 3, 4
SLO–9: Los Osos Creek	0 (0)	62 (25)	1 (1)	10 (4)	73 (30)	N/A
SLO–10: San Luis Obispo Creek	0 (0)	0 (0)	3 (1)	28 (11)	31 (12)	1, 2, 3, 4
SLO–11: Pismo Creek	0 (0)	14 (6)	1 (1)	5 (2)	20 (9)	1, 3, 4
SLO–12: Oso Flaco Lake	0 (0)	165 (67)	0 (0)	6 (2)	171 (69)	N/A
SB–1: Santa Maria River	0 (0)	0 (0)	42 (17)	432 (174)	474 (192)	1, 2, 4, 5

Exhibit B



Natural Environment Study

South Coast 101 High Occupancy Vehicle (HOV) Project

Route 101 between the City of Carpinteria and the City of Santa Barbara

District 5- SB-101-1.4/12.3

05-0N7000

January 2012

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January 2012

STATE OF CALIFORNIA
Department of Transportation

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Summary

Project Description

The proposed project involves safety and operational improvements along Route 101 in Santa Barbara County. The proposed improvements would begin at Bailard Road at the south end of the City of Carpinteria and end in the City of Santa Barbara just south of Sycamore Creek. Improvements would include the addition of a single High Occupancy Vehicle (HOV) lane in both the northbound and southbound directions and reconstructed interchanges at Sheffield Drive and Cabrillo Boulevard.

Purpose and Need

The purpose of this project is to reduce congestion and delay, provide capacity for future travel demand, encourage modal shift to transit and carpooling, and improve travel time on U.S. 101 within the project limits.

Summary of Alternatives Comparison

Three build alternatives -- Alternatives 1, 2, and 3 -- and a No-Build Alternative are proposed for this project. All build alternatives add an additional lane in each direction to provide for a part time High Occupancy Vehicle (HOV) facility within the project limits, but have different ramp arrangements. All would have wetland impacts and mitigation requirements. Alternative 2 would have the largest footprint and thus would result in the greatest impacts to wetlands and waters of the U.S. and to roadside vegetation, including trees.

Special-Status Species

The project would not affect any listed plant species.

Special-status animal species with the potential to be impacted by this project include the steelhead trout (*Oncorhynchus mykiss;* federally endangered) and the tidewater goby (*Eucyclogobius newberryi;* federally endangered).

For all alternatives, five bridge structures would be replaced at creek crossings (Arroyo Paredon Creek, Toro Canyon Creek, Romero (Picay) Creek, San Ysidro Creek, and Oak Creek). Listed species occur at three of these creeks: Arroyo Paredon Creek (steelhead trout and tidewater goby), Romero Creek (steelhead trout) and San Ysidro Creek (steelhead trout).

Steelhead trout in southern California comprise a "distinct population segment" (DPS) of the species that is ecologically and reproductively discrete from the remainder of populations along the West Coast. Critical habitat was designated for the Southern California Steelhead DPS on September 2, 2005. Bridge-replacement is proposed at two creeks that are designated critical habitat for steelhead trout within the highway right of way (Romero and San Ysidro), and at Arroyo Paredon Creek which supports critical habitat for steelhead 350 feet upstream of the project area. Formal Section 7 Consultation with the National Oceanic and Atmospheric Administration National Marine Fisheries Service (NMFS) will be initiated for potential incidental take of steelhead trout and critical habitat.

Tidewater gobies are known to occur in Arroyo Paredon Creek. Revised critical habitat was proposed for tidewater goby on October 19, 2011 which includes Arroyo Paredon Creek. Formal Section 7 consultation under the Endangered Species Act will be initiated with the U.S. Fish and Wildlife Service (USFWS) for potential incidental take of tidewater gobies and proposed critical habitat at Arroyo Paredon Creek.

Wetland Impacts

All build alternatives would affect U.S. Army Corps of Engineers (ACOE) wetlands and Coastal Zone wetlands (wetlands not subject to U.S. Army Corps of Engineers/Environmental Protection Agency regulation), as well as other waters of the United States. Table 1 compares wetlands impacts for each alternative. Alternative 2 would have the greatest impacts. Differences between Alternatives 1 and 3 are minimal. The majority of impacts would result from bridge construction and soundwall installation. With the exception of the Arroyo Paredon Bridge, new bridges would not place piers within jurisdictional waters. Most bridge-related impacts would result from temporary construction access. With mitigation, no cumulative effect is expected.

Table 1: Impacts to Wetlands and Other Waters (acres)

Wetland Type	Alternative 1		Alternative 2		Alternative 3	
	Temp	Perm	Temp	Perm	Temp	Perm
U.S. Army Corps & Coastal Zone Wetlands	0.078	0.005	0.073	0.016	0.078	0.005
Other Waters of the U.S.	0.781	0.752	0.845	0.969	0.777	0.732
Additional Coastal Zone Wetlands	0.487	0.146	0.430	0.506	0.487	0.146

Riparian Habitat Areas

For all alternatives, five bridge structures would be replaced at creek crossings. Temporary and permanent impacts to riparian vegetation will occur at Arroyo Paredon Creek, Toro Canyon Creek, Greenwell Creek and San Ysidro Creek. Twenty-two native hardwood trees (oak, sycamore, cypress and pine) and nineteen arroyo willows will be removed from riparian areas. Invasive plant species will be targeted for removal in riparian zones and replacement planting will be implemented within the state Right of Way.

Coast Live Oak Trees

Up to 220 coast live oak trees, including riparian trees, would be removed from along the Highway Right of Way. Impacts to native oak trees would be offset by replacement planting within the project limits.

Permits Required

A streambed alteration agreement will be required from the California Department of Fish and Game for work at all creek crossings. Permits will be required from the U.S. Army Corps of Engineers and the Regional Water Quality Control Board for all culvert extensions, fill placement and bridge construction in jurisdictional areas. Two Biological Opinions will be required, one from the U.S. Fish and Wildlife Service for tidewater goby and one from NOAA's National Marine Fisheries Service for steelhead and critical habitat. The project is located within the coastal zone and will require coastal development permits from the City of Carpinteria, the City of Santa Barbara and the County of Santa Barbara prior to construction.

Avoidance and Minimization Measures

Avoidance and minimization measures that have been incorporated into the project design include placement of retaining walls and soundwalls to avoid or minimize impacts to sensitive natural resources. To minimize construction-related impacts to wetlands and riparian areas, Environmentally Sensitive Areas (ESAs) will be established at creeks and wetlands at 12 ft from cut/fill limits. Coast live oaks and other native trees $\geq$ 6" dbh that are located outside of the Area of Direct Impact (ADI) will be delineated on project plans and demarcated in the field with ESA fencing to protect them during construction.

Manmade roadside ditches and drainage features will be replaced in-kind within the project limits. Temporary effects to water quality from increased erosion on new cut and fill slopes will be avoided by implementing the best management practices

(BMPs) from Caltrans' National Pollution Discharge Elimination System statewide permit. Caltrans will hydroseed ditch banks with native seed where practicable to benefit water quality by decreasing run-off and sedimentation into waterways.

Avoidance and minimization measures for steelhead trout and tidewater goby would include limiting work in habitat creeks to the low flow period (June - October), implementing dewatering and water diversion plans for in-channel work, designating appropriately-sited staging and refueling sites, conducting pre-construction educational meetings for construction personnel, and replanting riparian areas with native vegetation within the ROW.

The contractor would be required to hire a biological monitor to complete measures required for protection of steelhead trout and tidewater goby. The biological monitor would also be required to help the Resident Engineer ensure that ESAs are established and adhered to.

Compensatory Mitigation

Compensatory mitigation would be required for riparian impacts because these affected plant communities are associated with jurisdictional streambeds. All riparian trees will be replaced within the state ROW. Chapter 4 identifies proposed mitigation ratios.

Impacts to oak trees planted along State Route 101 would be offset by replacement planting within the project limits.

Removing concrete channel lining at Toro Canyon Creek would restore up to 0.105 acre of channel bed. New bridge structures at Arroyo Paredon, Romero, San Ysidro and Oak creeks would have longer spans, expanding the area of natural creek beds 0.16 acres, 0.13 acres, 0.11 acres and 0.03 acres respectively. Following construction, the undersides of bridges at Romero, San Ysidro and Oak creeks would be temporarily blocked off to maintain their current channel widths until downstream facilities have been upgraded.

The U.S. Army Corps of Engineers and the California Coastal Commission require no net loss of wetlands and would require compensatory mitigation for wetland impacts. Impacts would be minimized at all jurisdictional areas. Wetlands impacts would be offset by constructing seasonal wetlands onsite to the extent practicable. Offsite mitigation is proposed in the Carpinteria Salt Marsh. The Carpinteria Marsh is the largest remnant of the native ecosystem in the region, and has the highest occurrence

of special-status species in the area (CNDDB). It is a critically important southern California coastal estuary, but impacts from agricultural runoff, sedimentation, and invasive species threaten its productivity. Restoration or habitat creation in the marsh should focus on enhancing the function and habitat value of this important natural resource.

Invasive Species

To prevent new invasive species from being imported to the site, Caltrans requires that the project contractor implement the following control measures:

1. Only certified noxious weed free erosion control materials will be used. All straw and seed material shall be certified weed free by the County Agricultural Commissioner prior to being used at the project site. The California Department of Food and Agriculture maintains a current listing of noxious weeds.

2. Imported fill material shall be weed-free.

Limitations

This impact analysis is based on the cut/fill limits for each alterative shown in Appendix C: *Project Map Sheets*. Features such as temporary detours, retention basins or staging areas may be designed in areas beyond the currently proposed cut/fill limits. This may incur impacts not addressed in this report. Also, the ACOE has not verified the wetland delineation. The Corps may take jurisdiction over areas that are not currently delineated or may decline to take jurisdiction over some areas.

The Milpas to Hot Springs Highway Improvements Project (Caltrans EA#: 05-44780) is proposing a modified design that would accommodate HOV lanes in the City of Santa Barbara in the northbound lanes between PM 11.9 and PM 12.3. If the design is not incorporated into the Milpas to Hot Springs Project in 2011, work will be conducted by this project and will be evaluated for potential impacts to natural resources.

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List of Abbreviated Terms

ACOE	Army Corps of Engineers
ACOE	Army Corps of Engineers
ADI	Area of Direct Impact
BMP	Best Management Practice
BSA	Biological Study Area
Caltrans	California Department of Transportation
CCC	California Coastal Commission
CDFG	California Department of Fish and Game
dbh	Diameter at breast height (~4 ft)
FHWA	Federal Highway Administration
ft	foot/feet
FWS	Fish and Wildlife Service
HOV	High Occupancy Vehicle
km	kilometer(s)
m	meter(s)
mi	mile(s)
NMFS	National Marine Fisheries Service
NOAA Fisheries	National Marine Fisheries Service
PM	post mile
ROW	Right of Way
SBCFC	Santa Barbara County Flood Control
NB	Northbound
SB	Southbound
UPRR	Union Pacific Railroad
USFWS	United States Fish and Wildlife Service

Chapter 1. Introduction

The California Department of Transportation (Caltrans) in cooperation with the Federal Highway Administration and the Santa Barbara County Association of Governments proposes the South Coast High Occupancy Vehicle Lane Project (South Coast HOV). The proposed project would construct a series of safety and operational improvements along Route 101 in Santa Barbara County beginning at Bailard Road at the south end of the City of Carpinteria and ending in the City of Santa Barbara just south of Sycamore Creek (Figure 1). The project would be 10.9 miles in length. Proposed improvements include the addition of a single High Occupancy Vehicle (HOV) lane in both the northbound and southbound directions and reconstructed interchanges at Sheffield Drive and Cabrillo Boulevard.

1.1. Project History

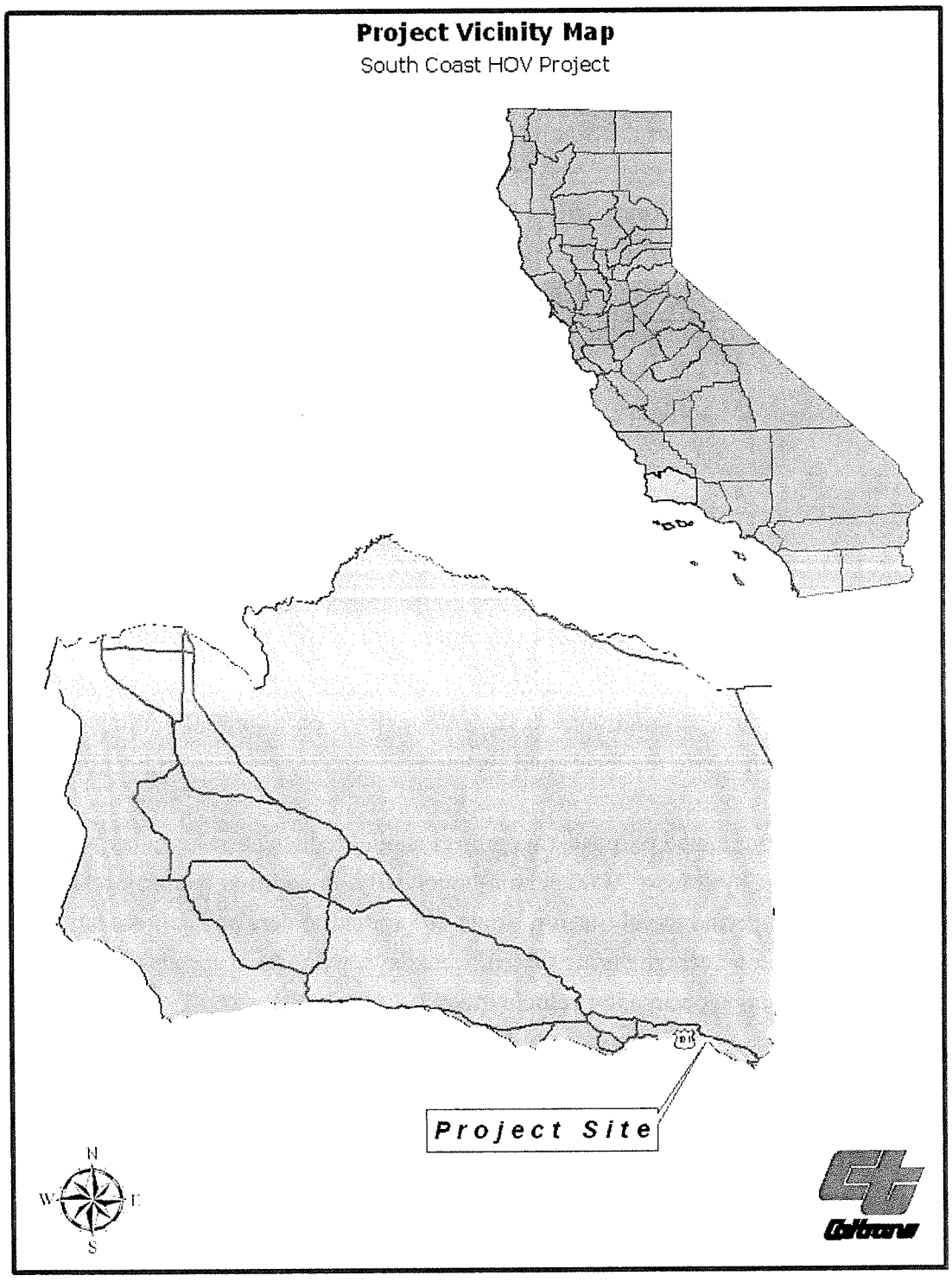
1.1.1. Purpose and Need

The purpose of this project is to reduce congestion and delay, provide capacity for future travel demand, encourage modal shift to transit and carpooling, and improve travel time on U.S. 101 within the project limits. This project is also anticipated to facilitate the flow of goods and services through the corridor and minimize diversion of freeway trips onto the local road system.

To achieve this stated purpose, this project should reduce corridor delay within the project limits by at least 7,000 person-hours daily. In addition the project should reduce peak-period travel time on Route 101 for carpoolers and express bus riders by at least 30% on average during typical weekdays, with travel speeds that are generally faster than single occupancy vehicle travel.

This project was initiated to implement one of the key elements from the *101 In Motion* consensus recommended package of projects; namely, an HOV lane on Route 101 from Milpas south to the county line. This proposed project is one of six elements that are being implemented through *101 In Motion*. Together this package will implement a multi-modal strategy to accommodate future travel demand while facilitating a modal shift to carpooling, transit, and passenger rail.

Figure 1. Project Vicinity Map



1.2. Project Description

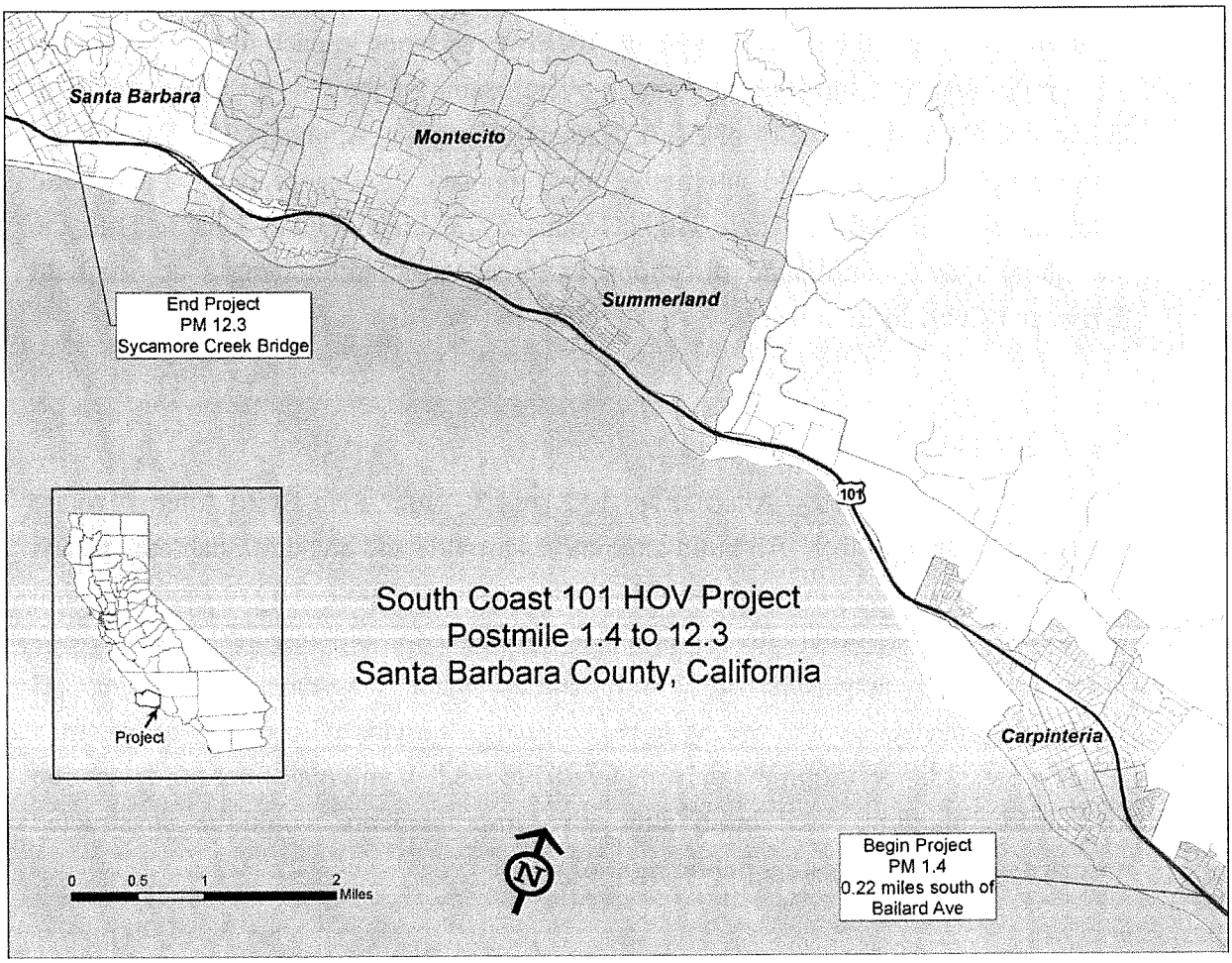
Proposed Action

Caltrans proposes to widen State Route 101 to three lanes in each direction between 0.22 miles south of the Bailard Avenue overcrossing in the City of Carpinteria and Sycamore Creek in the City of Santa Barbara (Figure 2, Appendix D). Three build alternatives and a no-build alternative are proposed for this project. Each build alternative would add a single High Occupancy Vehicle (HOV) lane in both the northbound and southbound directions and reconstruct interchanges at Sheffield Drive and Cabrillo Boulevard.

Build Alternatives

Three build alternatives -- Alternatives 1, 2, and 3 -- and a No-Build Alternative are proposed for this project. All build alternatives provide add an additional lane in each direction to provide for a part time High Occupancy Vehicle (HOV) facility within the project limits. Alternative 1 proposes to balance competing resource interests such as scenic views, wetlands, and median/outside landscaping. Alternative 2 proposes to maximize landscaping in the median. Alternative 3 proposes to construct all new paved lanes within the existing available median and maximizes the retention of outside planting. All build alternative improvements would be constructed primarily within the existing public right of way.

Figure 2. Project Location Map



1.2.1. Common Design Features of Build Alternatives 1, 2 and 3

Alternatives 1, 2 and 3 would include the following:

1.1.1 Basic Common Design Features

- Add an additional lane in each direction on Route 101 to provide for a part time, continuous access High Occupancy Vehicle (HOV) facility within the project limits.
- Replace bridge structures at: Arroyo Paredon, Toro Canyon, Romero (Picay), Oak, and San Ysidro Creeks.
- Widen bridge structures at Franklin and Santa Monica creeks.
- Widen traffic undercrossing structures at South Padaro Lane and Evans

Avenue.

- Construct a southbound auxiliary lane between the Sheffield Drive on ramp and the Evans Avenue off ramp.
- Reconstruct the interchanges at Sheffield Drive and Cabrillo Boulevard.
- Consideration, as design options, seven mutually exclusive Cabrillo Blvd. interchange configurations (F, H, I, J, L, M, and Q). Interchange configurations under consideration include:

  F) SB 1/2 DIAMOND -Close both median off ramps at Cabrillo Blvd.; improve the northbound Hermosillo Drive off ramp and the northbound Cabrillo Blvd. on ramp. Construct new on and off ramps to intersect at Cabrillo Blvd., northbound and southbound, immediately adjacent and to the right of the freeway lane.

  H) TIGHT DIAMOND- Close all existing off ramps, including the Los Patos Way and Hermosillo Drive ramps. Construct new on and off ramps to intersect at Cabrillo Blvd., northbound and southbound, immediately adjacent and to the right of the freeway lanes.

  I) EXISTING MAINLINES / IMPROVE LOS PATOS - Close both median off ramps at Cabrillo Blvd.; improve the northbound Hermosillo Drive off ramp, the southbound Los Patos Way off ramp, and the northbound Cabrillo Blvd. on ramp.

  J) EXISTING MAINLINES / IMPROVE LOS PATOS - Identical to Configuration "I" with the addition of a southbound Los Patos Way on ramp.

  L) NB 1/2 DIAMOND / IMPROVE LOS PATOS -Close northbound and southbound median off ramps at Cabrillo Blvd. and close the northbound Hermosillo Drive off ramp; add a southbound Cabrillo Blvd. off ramp; improve the southbound Los Patos Way off ramp and the northbound Cabrillo Blvd. on ramps.

  M) NB 1/2 DIAMOND / IMPROVE LOS PATOS -Identical to Configuration "L" with the addition of a southbound Los Patos Way onramp.

  Q) HALF SINGLE POINT -Close the Los Patos southbound off ramp, the northbound and southbound median off ramps at Cabrillo Blvd, and the northbound on ramp at Cabrillo; construct a new Cabrillo Blvd southbound right side off ramp that will undercross three southbound freeway lanes and a new northbound right side on ramp that will undercross three northbound freeway lanes - both will join at the existing median ramp intersections at Cabrilllo Blvd.; also improve the northbound Hermosillo Drive off ramp.

1.1.2 Additional Common Design Features

- Construct retaining walls at two locations: On the southbound outside shoulder at the right of way line along the southbound off ramp at Sheffield Drive (430 feet in length) and on the outside shoulder of the proposed southbound auxiliary lane from Sheffield Drive to Evans Avenue (1550 feet in length).
- Provide median landscaping in the first 0.2 mile at the southern limits of the project, and the last 0.5 mile of the project.
- Install replacement planting.
- Construct soundwalls for noise abatement where appropriate.
- Provide noise attenuating pavement surface on all travel lanes.
- Relocate underground and aboveground utilities as needed.
- Lengthen cross culverts to accommodate additional pavement width.
- Construct maintenance vehicle pullout areas.
- Construct stormwater treatment facilities within the project limits and on publicly owned property near the Bailard Interchange (PM 1.6).

1.2.2. Unique Design Features of the Build Alternatives

Alternative 1 - Balanced Resources

- This alternative proposes to balance competing resource interests such as scenic views, wetlands, and median/outside landscaping.
- Provide median landscaping, where appropriate, at several additional locations: from 0.2 mile from the southern limits of the project to Linden Avenue; the South Padaro Lane Interchange; and at the North Padaro Lane Interchange.
- The freeway outside edge of pavement requires widening in all locations where additional median landscaping is proposed.

Alternative 2 – Maximize Median Planting

- This alternative proposes to maximize landscaping in the median, and recognizes that some identified scenic resources may be partially blocked and some wetland areas impacted.

- Provide median landscaping, where appropriate, at several additional locations: from 0.2 mile from the southern limits of the project to Reynolds Avenue; and from Santa Monica Road to the Evans Avenue Interchange.
- The freeway outside edge of pavement requires widening in all locations where additional median landscaping is proposed.
- Construct additional southbound auxiliary lanes between 1) the Santa Claus Lane on ramp and the Carpinteria Avenue off ramp and 2) the Reynolds Avenue on ramp and the Linden Avenue off ramp.
- Construct 3 additional retaining walls. One on the southbound shoulder at the right of way line ending at the Santa Claus Lane southbound on ramp (500 feet in length), one on the northbound shoulder near Greenwell Creek (700 feet in length) and one on the northbound shoulder near the northbound offramp to Summerland (300 feet in length.)

Alternative 3 – Maximize Outside Planting

- This alternative proposes to construct all new paved lanes within the existing available median and maximizes the retention of outside planting.
- A single barrier separating the two inside paved shoulders will be provided in the median between Carpinteria Creek and Olive Mill Road, which largely retains the existing outside edge of pavement within these areas.

1.2.3 No Build Alternative

The existing conditions along Route 101 would remain as they are now. Traffic on Route 101 and local roads would continue to become more congested. The No-Build Alternative would not address the long term traffic on Route 101 and would fail to meet the purpose and need of the project.

1.3 Construction Work Schedule

The proposed project is expected to be constructed in four phases due to funding limitations. Construction activities on the first phase are expected to begin between 2015 and 2017, based on funding availability. During phases that include structures work in creeks, work would take place over three or four construction seasons, depending on the extent of work required. Unless directed otherwise by the resource agencies, work in and around Arroyo Paredon, San Ysidro and Romero Creeks will occur between June 1 and October 31, annually, to minimize potential impacts to

migrating steelhead trout and tidewater gobies. Tree removal would occur between September 1 and February 15 to avoid impacts to nesting birds.

1.4 Construction Staging and Storage Areas

Some potential staging areas within the BSA were identified on project design plans in August 2008. Borrow/disposal sites and utility relocations have not yet been identified.

1.5 ESA (Environmentally Sensitive Area) Fence

ESA fencing will be installed throughout areas of the project to limit construction activities and protect habitats of concern. ESA fencing will be delineated on the project plans and established in the field prior to beginning any construction activities. Special Provisions for the installation of ESA fencing and silt fencing will be included in the construction contract for this project.

Chapter 2. Study Methods

2.1. Studies Required

Prior to field studies, the project area was reviewed using the Caltrans photolog, USFWS species lists, and in-house inventories of the California Natural Diversity Database (CNDDB) and the California Native Plant Society's (CNPS) Electronic Inventory to identify special-status species occurrences within a 10 mile radius of the proposed project. The project occurs within the Carpinteria and Santa Barbara 7.5 minute U.S. Geological Service topographic quadrangles. Database searches included the Carpinteria, Santa Barbara, White Ledge Peak, Old Man Mountain, Hildreth Peak, Little Pine Mountain, San Marcos Pass, and Goleta topographic quadrangles.

A USFWS special-status species list for the project area was obtained from the Ventura Office of the U.S. Fish and Wildlife Service on May 21, 2010. The list is presented in Appendix A.

Agency staff and websites of the U.S. Fish and Wildlife Service, National Marine Fisheries Services and Santa Barbara County Flood Control were also consulted for information about sensitive species in the area. Published floral and faunal inventories were consulted, along with reports from past projects in the area. This information was used to develop Table 3 which lists the rare plants and wildlife that may potentially occur in the BSA.

Field studies conducted for this project included botanical surveys for sensitive plant species, jurisdictional delineations for wetlands and other waters of the U.S., USFWS protocol-level surveys for California red-legged frogs (*Rana aurora draytonii*), and habitat assessments for tidewater goby (*Eucyclogobius newberryi*), steelhead trout (*Oncorhynchus mykiss*), southwestern pond turtle (*Emys marmorata*), two-striped garter snake (*Thamnophis hammondii)*, Belding's Savannah sparrow (*Passerculus sandwichensis beldingi*), the light-footed clapper rail (*Rallus longirostris levipes*), southwestern willow flycatcher (*Empidonax traiillii extimus*), least Bell's vireo (*Viero bellii pusillus*), California least tern (*Sterna antillarum browni*) and the western snowy plover (*Charadrius alexandrinus nivsus*).

2.1.1. Biological Study Area

Appendix B shows the biological study area (BSA). The BSA includes the project footprint and all surrounding area that may be temporarily or permanently impacted

by construction or construction-related activities.

2.1.2. Special-Status Wildlife Surveys

Habitat requirements of special-status species described in Table 3 were compared with potential habitat found within the project limits. Reference materials were consulted to determine the nearest known locations of sensitive species.

Surveys for California red-legged frogs were conducted according to the US. Fish and Wildlife Service's *Revised Guidance on Site Assessments and Field Surveys for the California Red-legged Frog* (USFWS 2005). Surveys were conducted in Arroyo Paredon Creek (4500 feet upstream from Highway 101and downstream to the Pacific Ocean) and Romero Creek (3000 feet upstream from Highway 101 and downstream to the Pacific Ocean). Additional surveys were conducted at locations with potential to support populations of red-legged frogs, which included Greenwell Creek south of Highway 101 (Appendix C, Mapsheet 16), and the drainage ditches located north of the South Padaro Lane Overcrossing (Appendix C, Mapsheet 10).

General wildlife surveys of the BSA were conducted between March 1, 2009 and February 15, 2010, utilizing binoculars and identification of tracks, sign, nests and dens. Overhead structures were surveyed for roosting bats and nesting birds in May, June and July 2009. Structures were inspected for evidence of roosting bats, including bat sign, such as urine stains and guano. Surveys for Monarch butterfly roosts and raptor nests in the BSA were performed in January and February, 2010.

2.1.3. Special-Status Plant Surveys

Botanical surveys of the BSA were conducted by Caltrans Biologist Mitch Dallas and Jon Moule, a wildlife biologist with SWCA Environmental Consultants. A botanical survey of the Bailard Overcrossing area (PM 1.39 to PM 1.84) was conducted by Caltrans biologist Morgan Robertson after this area was added to the project.

2.1.4. Wetland Delineations

Delineations of jurisdictional wetlands and other waters of the U.S. were conducted by Bob Sloan (Senior Biologist) and Jon Claxton (Biologist) from SWCA Environmental Consultants to identify wetland resources and determine potential impacts. Over the course of two survey efforts (Survey 1: April 28 – May 1 and Survey 2: May 12 - 13), SWCA biologists studied three disjunctive sections of Caltrans ROW along Highway 101 between Carpinteria and Santa Barbara. The first

section (from south to north) is located at the Bailard Avenue overcrossing, and extends from PM 1.39 to PM 1.84. The second section extends from PM 1.97 to PM 2.2 in the southern portion of Carpinteria. The third section (and longest) extends from PM 3.3 (Franklin Creek in the center of Carpinteria) to PM 10.85 (Coast Village Circle in the eastern portion of the City of Santa Barbara).

Sections of the BSA not evaluated by SWCA were evaluated in other studies conducted by Caltrans for adjacent highway projects. Jurisdictional delineations from Post Mile 10.85 to Post Mile 12.3 were completed by Caltrans Associate Biologist David Hacker in 2006 as part of the Milpas to Hot Springs Highway Improvements Project (Caltrans EA#: 05-44780). A 401 Water Quality Certification was obtained from the California Regional Water Quality Control Board on December 5, 2006, and a U.S Army Corps of Engineers 404 Permit (# SPL-2006-2026-PHT) was obtained April 17, 2007. The City of Santa Barbara issued a Coastal Development Permit for the project on December 16, 2007 and road construction began in 2008. Jurisdictional waters and wetlands identified as part of the Milpas to HotSprings project would not be impacted since they are not within the footprint of the proposed alternatives for the South Coast HOV project. Delineations of waters of the U.S., including wetlands, between Post Mile 2.2 and 3.8 were conducted by Caltrans Associate Biologist Mitch Dallas on 3/1/02, 4/23/07 and 5/4/07, and by Caltrans Associate Biologists Morgan Robertson and Jimmy Walth on October 8, 2009 as part of the Linden-Casitas Highway Improvements Project. These delineations are documented in that project's Natural Environmental Study (Caltrans EA#: 05-4482U0).

Wetlands and other waters of the U.S were delineated according to the *1987 USACE Corps Wetland Delineation Manual* (Environmental Laboratory 1987), *the Final Arid West Regional Supplement Version 2.0 (USACE 2008), the Definition and Delineation of Wetlands in the Coastal Zone (CCC 2006), the Procedural Guidance for the Review of Wetland Projects in California's Coastal Zone (CCC 2007)*, and federal, state, and local guidelines for identification of wetland areas. The Wetland Study for the project contains jurisdictional delineations and a more detailed discussion of methods (Appendix G).

2.2. Personnel and Survey Dates

Caltrans Associate Biologist, Morgan Robertson, conducted wildlife surveys aided by Caltrans Associate Biologists, Nancy Siepel, Jennifer Moonjian, Jimmy Walth and Chuck Cesena. Caltrans Associate Environmental Planner, Samer Momani, assisted with two red-legged frog surveys. Botanical surveys of the BSA were conducted by

Caltrans Biologist Mitch Dallas and Jon Moule, a wildlife biologist with SWCA environmental consultants. Delineations of jurisdictional waters of the US, including wetlands, were conducted by Bob Sloan, Senior Biologist, and Jon Claxton, Biologist, with SWCA environmental consultants.

Table 2. Personnel and Survey Dates

Survey Type	Survey Date	Personnel
Botanical surveys of BSA, and habitat site assessments	May 2, 2008	Mitch Dallas
Botanical surveys of BSA, and habitat site assessments	June 10,12, 13,16,17, 19, 20, 24,25, 26, 2008	John Moule
General biological survey and habitat site assessments	March 3, 2009	Morgan Robertson
USFWS Protocol surveys-California red-legged frog	March 16, 2009	Morgan Robertson, Chuck Cesena
General biological survey and habitat site assessment	April 7, 2009	Morgan Robertson, Jimmy Walth
Wetland delineations	April 28, 2009	Bob Sloan, Jon Claxton
Wetland delineations	May 12-13, 2009	Bob Sloan, Jon Claxton
Focused surveys: swallow nesting on highway structures	May 18, 2009	Morgan Robertson
USFWS Protocol surveys-California red-legged frog	May 18, 2009	Morgan Robertson, Nancy Siepel
USFWS Protocol surveys-California red-legged frog	June 4, 2009	Morgan Robertson, Nancy Siepel
Focused surveys: bats and nesting birds	June 05, 2009	Morgan Robertson, Jennifer Moonjian
USFWS Protocol surveys-California red-legged frog	June 16-17, 2009	Morgan Robertson, Jennifer Moonjian
Botanical survey of BSA extension (PM 1.4-1.8)	June 22, 2009	Morgan Robertson
USFWS Protocol surveys-California red-legged frog	June 25, 2009	Morgan Robertson, Samer Momani

USFWS Protocol surveys-California red-legged frog	July 8, 2009	Morgan Robertson, Samer Momani
Focused surveys: bats and nesting birds	July 28, 2010	Morgan Robertson, Jennifer Moonjian
USFWS Protocol surveys-California red-legged frog	Sept 2, 2009	Morgan Robertson, Jimmy Walth
USFWS Protocol surveys-California red-legged frog	Sep 30, 2009	Morgan Robertson, Jimmy Walth
Focused surveys: Monarch roosting and raptor nests	Jan 26, 2010	Morgan Robertson
Focused surveys: Monarch roosting and raptor nests	Feb 2, 2010	Morgan Robertson

2.3. Agency Coordination and Professional Contacts

NOAA's National Marine Fisheries Service

In response to Caltrans Notice of Preparation for the project (dated May 12, 2009), NOAA's National Marine Fisheries replied by letter (dated May 29, 2009), identifying information needs, jurisdictional species and critical habitat in the project area, and the NOAA contact for the project (NOAA Biologist, Matthew McGoogan). Because the project was determined to be complex by NOAA, the agency recommended that Caltrans begin early consultation with agency staff.

Two field meetings with NOAA staff, Matthew McGoogan, David Crowder and Mark Capelli, took place on July 16, 2009 (Mr. McGoogan) and August 5, 2009 (Dr. Crowder and Mr. Capelli). Site reviews were conducted at the following locations: Carpinteria Creek, Arroyo Paredon Creek, San Ysidro Creek, Romero Creek, and Montecito Creek. During site visits, it was determined that project build alternatives as proposed would require formal consultation with NOAA under Section 7 of the Endangered Species Act for potential incidental take of southern California steelhead and for work in critical habitat. On July 16, Mr. McGoogan indicated that proposed bridge structures work at San Ysidro, Romero and Arroyo Paredon creeks would likely need to be assessed to determine if current and proposed conditions could result in hydraulic barriers to steelhead movement, and recommended coordinating field visit with Dr. David Crowder. Mr. McGoogan also noted that Caltrans would need to

include de-watering plans for Arroyo Paredon and Romero Creeks in a BA submittal.

On November 23, 2009, Caltrans conducted an additional meeting in Santa Barbara, CA with NOAA staff, Matthew McGoogan, David Crowder and Anthony Spina, and Maureen Spencer of Santa Barbara County Flood Control, to discuss potential impacts of proposed bridge designs on fish passage. Following the meeting, it was agreed that further communication would be needed to determine the extent of hydraulic analyses needed by NOAA for critical habitat creeks. Discussions regarding hydraulic analyses between Caltrans' Hydraulic Engineer, Lyn Wickham, and NOAA Engineer, David Crowder, have been ongoing.

U.S. Fish and Wildlife Service

On June 29, 2009, Caltrans biologist, Morgan Robertson, spoke with USFWS Biologist, Steve Kirkland, regarding negative survey findings for salt marsh bird's-beak, Gambel's watercress and other listed plant species. Following a brief discussion of the status of the light-footed clapper rail populations in Carpinteria Marsh, Mr. Kirkland concurred that the project would not affect the light-footed clapper rail since it will avoid Carpinteria Marsh. Ms. Robertson also apprised Mr. Kirkland of the survey schedule and negative survey results to date for California red-legged frogs.

On March 24, 2010, Mr. Kirkland confirmed that formal consultation under Section 7 of the Endangered Species Act would be required for potential incidental take of tidewater goby.

On May 21, 2010, A USFWS Species List was obtained from the Ventura Office of the USFWS (Appendix A).

California Department of Fish and Game

In response to Caltrans Notice of Preparation for the project (dated May 12, 2009), the California Department of Fish and Game (DFG) replied by letter (dated June 2, 2009) identifying information needs and the DFG contact for the project (DFG Environmental Scientist, Jamie Jackson).

A field meeting with Jamie Jackson, Caltrans biologist Morgan Robertson, Caltrans Environmental Planner Michael Sandeki, and Caltrans Hydraulic Engineer Lyn Wickham, took place on 12/10/09. Site reviews were conducted at the following locations: Franklin Creek, Arroyo Paredon Creek, Toro Canyon Creek, Romero

Creek, San Ysidro Creek, and Greenwell Creek. It was concluded that a 1602 streambed alternation agreement would be required for work in and adjacent to creeks in the project area. Ms. Jackson noted that Caltrans would need to submit dewatering and diversion plans as part of the 1602 permit application, and that riparian vegetation removal would need to be conducted between September 1 and February 15 to avoid potential affects to nesting migratory birds. Trees removed between February 16 and August 31 would require surveys for nesting birds and clearance prior to removal. Caltrans discussed plans to replant riparian vegetation impacts at a 3:1 ratio within the project area, but noted that flooding concerns from SBCFC would need to be considered when developing planting plans. Ms. Jackson noted that offsite mitigation measures could be considered to benefit southern California steelhead trout populations. Caltrans also discussed plans for Greenwell Creek that would incorporate bioengineering techniques, such as brush layering with willows.

2.4 Limitations That May Influence Results

One limitation or constraint that occurred during field studies was the timing of the final night survey for California red-legged frog breeding-season survey. The survey took place on 7/8/2009 with approval from Steve Kirkland of the USFWS. The USFWS protocol for surveys of the California red-legged frog states that the non-breeding season for frogs is defined as July 1- September 30. With the USFWS approval, the final night-time breeding season surveys were conducted on July 8, 2009. The timing of the last California red-legged frog survey should have no bearing on the negative survey results since it occurred close to the recommended time-frame. All other field surveys were conducted at the appropriate time of the year.

This impact analysis is based on the cut/fill limits for each alterative shown in Appendix C: *Project Map Sheets*. Features such as temporary detours, retention basins or staging areas may be designed in areas beyond the currently proposed cut/fill limits. This may incur impacts not addressed in this report. Also, the ACOE has not verified the wetland delineation. The Corps may take jurisdiction over areas that are not currently delineated or may decline to take jurisdiction over some areas.

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Chapter 3. Results: Environmental Setting

3.1 Description of the Existing Biological and Physical Conditions

The proposed project is located along Route 101 in Santa Barbara County, beginning at the south end of Carpinteria and ending immediately south of Sycamore Creek in Santa Barbara. This portion of Route 101 is located on a narrow coastal plain between the Pacific Ocean and the Santa Ynez portion of the Transverse Ranges.

Work would be confined primarily to the existing Highway Right-of Way (ROW) as it travels through the urban environments of Santa Barbara, Montecito, Summerland and Carpinteria. Areas adjacent to the project limits include the Union Pacific Railroad (UPRR) railroad corridor, residential and business areas, agriculture operations, and limited open space along bluffs. The UPRR railroad ROW borders the southern limits of the Highway ROW for approximately 70% of the project distance.

The physical conditions within the project limits consist of flat topography of a coastal plain dissected by the depositional zones of various creeks. The project crosses 13 floodplains and includes 11 creek-crossings. Improvements to highway structures are proposed at two creeks that are listed as critical habitat for the southern steelhead trout (federally endangered). One creek (Arroyo Paredon) is also known to support tidewater goby (federally endangered). Various species of birds, amphibians, reptiles and small mammals also utilize the more undisturbed creek corridors. Other hydrologic resources in the area include the Carpinteria Salt Marsh and the Andree Clark Bird Refuge, both of which contain valuable habitat for both aquatic and avian species.

3.1.1 Study Area

Appendix B shows the biological study area (BSA). The BSA delineates biological field study limits. The biological study area (BSA) consists of two components. The first is the area to be directly impacted by construction-related activities or the Area of Direct Impact (ADI). The ADI was defined as the State Highway ROW plus temporary construction easements up 40 feet beyond the ROW in areas where soundwalls or structure work is proposed. The second component of the BSA was the creek channels along Arroyo Paredon Creek and Romero Creek that were surveyed for herpetofauna, including the California red-legged frog (*Rana draytonii).*

Within the BSA, the project is divided into four major work areas:

1. Carpinteria (PM 1.4 – 4.59)
2. Summerland/Toro Canyon (PM 4.59 – 8.87)
3. Montecito (PM 8.87 – 10.54)
4. Santa Barbara (PM 10.54 – 12.30)

3.1.1.1 Carpinteria (PM 1.4 - 4.59)

This part of the BSA (Appendix C, Mapsheets 1-8) is located along a portion of a coastal terrace at an elevation of 50 ft or less that is bordered to the northeast by the Santa Ynez Mountains. Within the project limits, the coastal terrace is dissected by the depositional zone of Carpinteria, Franklin and Santa Monica Creeks. This portion of State Highway 101 is largely urban as it travels through the built urban environment (City of Carpinteria), surrounded primarily by residential and commercial development. Vegetation in the ROW is primarily limited to ornamental landscaping or ruderal weeds. Other areas adjacent to the project limits include intensive agricultural development to north of the Highway, and the Carpinteria Salt Marsh to the south of the UPRR railroad tracks between PM 4.2 and PM 4.75.

Between PM 4.3 and PM 4.7, the BSA runs adjacent to the Carpinteria Salt Marsh, a protected estuarine wetland that receives tidal flushing from the Pacific Ocean and nutrient rich freshwater from Santa Monica and Franklin Creeks. The mixture of these waters provides nutrients that support several coastal wetland species. The estuary covers 230 acres and supports rich and highly important ecosystem function (City of Carpinteria General Plan 2003). The Carpinteria Salt Marsh is the largest remnant of the native ecosystem in the broader project area, and has the highest occurrence of special status species in the area (CNDDB). It is a critically important Southern California coastal estuary, and is protected as a conservation and research reserve by the University of California Natural Reserve System.

Carpinteria, Franklin and Santa Monica Creeks flow southwest through the project area, crossing under Highway 101. Within and adjacent to the project limits, these creeks are characterized as having passed through the headwaters, areas of intensive agriculture within the depositional zone, and then past the project area into an urban setting before reaching the Pacific Ocean (Caltrans, 2008). South of the Highway,

Carpinteria Creek flows directly to the Pacific Ocean, whereas Franklin and Santa Monica creeks flow into the Carpinteria Salt Marsh.

3.1.1.2 Summerland/Toro Canyon (PM 4.59 –8.87)

Summerland and Toro Canyon (Appendix C, Mapsheets 8-16) are unincorporated areas of Santa Barbara County, located along the coast east of the city of Santa Barbara. The community of Montecito borders this area to the west, the Pacific Ocean to the south, the Los Padres National Forest to the north, and the city of Carpinteria to the east. Elevation ranges from 50 to 100 feet above mean sea level.

The portion of State Highway 101 that travels through Summerland and Serena Point is surrounded by residential and agricultural development. From Sand Point Road (PM 4.7) north to Garrapata Creek (PM 6.2) the north side of the highway is devoted to intensive agriculture (primarily commercial greenhouses) and polo fields. The Union Pacific Railroad traverses the southern portion of BSA in this area with residential development bordering the coastline south of the railroad tracks. Santa Claus Lane and Via Real at the eastern Padaro Lane/Highway101 interchange are the only commercial areas in Toro Canyon (Toro Canyon LCP).

Arroyo Paredon, Garrapta, Toro Canyon and Greenwell creeks flow south through this portion of the BSA, crossing under Highway 101 before reaching the Pacific Ocean. While the creek crossings at Highway 101 are developed, the upper watersheds of both Toro Creek and Arroyo Paredon Creek support stretches of relatively undisturbed habitat that serve as wildlife corridors between the mountainous Los Padres National Forest and the lower foothills and valley regions.

Garrapata Creek at PM 6.2 marks the approximate beginning of the "Memorial Oaks" area. Several dozen coast live oaks (*Quercus agrifolia*) trees were planted here in the 1920s, and grow alongside the highway with other ornamental trees such as eucalyptus, cypress and acacia. Most of these trees are found within the median or the southbound shoulder.

West of the Memorial Oaks area, agricultural fields abut the Highway ROW to the north, while the UPRR and the Pacific Ocean border the Highway to the south. The agricultural fields to the north soon give way to the commercial and residential land uses of the community of Summerland. The coastal area of Summerland has an extensive history of oil production which began in the 1890s. While oil production in the nearshore region of Summerland ended in the 1940s, remnants of on and offshore

oil activity are still evident today, especially on the beach and in the nearshore area (Summerland Community Plan 1992).

3.1.1.3 Montecito (PM 8.87 – 10.54)

Montecito is east of, and directly adjacent to the city of Santa Barbara, occupying the eastern portion of the coastal plain south of the Santa Ynez Mountains (Appendix C, Mapsheets 17-20). Beginning just west of Summerland, the highway alignment moves inland. The portions of State Highway 101 that travel through Montecito are surrounded primarily by residential areas with limited commercial development. The Southern Pacific Railroad traverses part of the southern edge of the BSA in this area from PM 8.87 to PM 9.55.

Romero (aka Picay), San Ysidro, Oak and Montecito creeks flow south through this portion of the BSA. Upstream and downstream of the project limits, creek alignments have been significantly altered for flood control purposes as they wind through urban and residential portions of Montecito. Within the project area, creek channels flow under multiple bridges (county, state highway, and railroad bridges) and into an urban setting before reaching the Pacific Ocean.

3.1.1.4 Santa Barbara (PM 10.54-12.30)

This part of the BSA is located at the western boundary of the city limits of Santa Barbara and is completely within an urbanized area (Appendix C: Mapsheets 20-24). While the mountains of the Los Padres National Forest to the north provide habitat for a wide range of species, the intervening urban area is a barrier that prevents most of these species from reaching the project limits. Exceptions would be avian species, fish and herpetofauna that utilize the more undisturbed stream corridors in the area and the Andree Clark Bird Refuge.

Between Los Patos Way and the Salinas Street on/off ramps (PM 11.7 to 12.1), Highway 101 and the Union Pacific Railroad tracks parallel the Andree Clark Bird Refuge. The Bird Refuge is a 42 acre brackish wetland which supports a large assortment of organisms, including insects, plankton diatoms and algae. 192 species of birds are known to make use of the Refuge, including migratory waterfowl and domestic geese and ducks. The Refuge includes a 29 acre lake with a salinity of about 15% and an average depth of four feet. The lake drains into East Beach and receives runoff from drainage culverts on the northern and eastern shores. Tidewater goby are known to inhabit portions of this lake (USFWS 2005). A groundwater well, situated

in the parking lot of the "Child's Estate Zoological Gardens" to the west, replenishes the lake during periods of rapid evaporation. (City of Santa Barbara Local Coastal Plan, 2004).

Sycamore Creek, the westernmost creek in the City of Santa Barbara, is located outside the limits of work for this project.

3.1.2 Physical Conditions

Climate

The climate of the South Central Coast is characterized as Mediterranean type climate, with approximately half the year (November to April) being wet and cool and the remainder of the year characterized by warm, dry warm weather. The average rainfall is 15-20 inches with the majority of precipitation occurring between November and April.

The proximity of the Pacific Ocean moderates Santa Barbara County's climate and temperatures near the coast. The adjacent steep mountain ranges paralleling the coast produce a significant "orographic effect," which occurs when storms approaching the county from the Pacific Ocean are forced upward against the mountains resulting in an increased precipitation release with the increased topographic elevation. This orographic effect, in conjunction with the steep, short watersheds, occasionally results in flash flooding along the county's south coast (Santa Barbara County Public Works, 2010).

Soils

The physical conditions within the project limits consist of a coastal terrace dissected by the depositional zones of various creeks. Elevation ranges from 0 to 200 feet above sea level with topography that is nearly level to moderately sloping. Soils formed in deep alluvium from sedimentary rock resulting in fine sandy loams, loams and silty clay loam soils on flood plains, valleys and alluvial fans. In the Carpinteria Valley and adjacent to the beaches in Santa Barbara, where the topography is nearly level, soils tend to be poorly drained fine sandy loams. Alluvial deposits of gravel sand silt and clay underlie modern drainage concourses (NRCS 1981). All soil test pits for wetland delineations were excavated in areas mapped as Camarillo Variant, a sandy loam found on nearly level soils in low alluvial plains (Wetland Report).

Watersheds

The project area consists of coastal terraces and broad valleys between the Pacific Ocean and the Santa Ynez portion of the Transverse Ranges. The project area crosses 13 floodplains and includes 11 creek-crossings. Watersheds within the project area include Sycamore, Montecito, Oak, San Ysidro, Romero, Toro, Garrapata, Arroyo Paredon, Santa Monica, Franklin, and Carpinteria. These are shown in relation to the project BSA in Appendix D - *Watershed Mapping*. Additional information for individual creeks and watersheds is included in Chapter 4 of this document, in the Wetlands Report.

3.1.3 Biological Conditions in the Biological Study Area

3.1.3.1. Habitat/Site Vegetation

The following briefly describes the vegetative communities observed within the BSA

Landscaped Vegetation

Vegetation within the project limits is predominantly freeway landscaping that was planted by Caltrans, with the exception of some creeks and vegetated drainage features. The Right of Way adjacent to the freeway shoulders is planted primarily with non-native trees and shrubs such as myopurum, eucalyptus, oleander, and acacia. Native species that were planted along with the non-native ornamental species account for approximately 15 percent of the vegetation and are randomly mixed in with the non-native species. Native species are predominantly coast live oak (*Quercus agrifolia*), western sycamore (*Platanus recemosa*), Monterey cypress (*Cupressus macrocarpus*), toyon (*Heteromeles arbutifoila*), holly-leaved cherry (*Prunus ilicifolia*), and lemonade berry (*Rhus integrifolia*).

Ruderal

Ruderal habitat covers most of the existing highway right-of-way that is not landscaped with trees or shrubs. Ruderal habitat is comprised of a combination of native and alien species resulting from invasive species introduction and highway construction, operation, and maintenance (Frenkel 1970). The Mediterranean climate combined with the horticultural history of the Santa Barbara region has significantly influenced and changed the natural plant ecology in the project area. Many of the non-native plant species are escaped or planted ornamentals. Common ruderal species found in the highway right of way include rip gut brome (*Bromus diandrus*), ice plant (*Carpobrotus edulis*), Bermuda butter cup (*Oxalis pes-capre*), radish (*Raphanus sativus),* Cape ivy (*Senecio mikanioides),* bindweed (*Convolvulus sp.*), and castor

bean (*Ricinus communis*).

Coastal Scrub

Within the BSA, Ortega Hill (PM 8.5-8.9) supports patches of coastal scrub (Holland 1986). In 2006 Caltrans constructed a Class II bike path within the NB Highway ROW at Ortega Hill between northern Summerland and Sheffield Drive in Montectio. Following construction of the bike route, temporarily disturbed areas were replanted with native coastal scrub species, including black sage (*Salvia mellifera*) and sagebrush (*Artemesia californica).* This area is adjacent to but outside of the proposed footprint (ADI) of this project.

Coast Live Oaks

The Memorial Oaks are parallel rows of coast live oak trees planted along Highway 101 between PM 6.3 and PM 6.7. Seventy-one trees were originally planted along the highway in 1928 to commemorate Santa Barbara County soldiers who had given their lives in service during Word War I. At the time, Route 101 was a two-lane conventional highway and trees flanked both sides of the road for approximately one-quarter mile. In the 1950s the highway department converted the old highway to a four-lane limited-access freeway, retaining the original highway as the southbound lanes and building the two new northbound lanes on the inland side. It was at this time that the trees that originally lined the north side of the old highway became part of the median of the new freeway. In July 2008, the total number of trees remaining was estimated at 33 (16 in the median and 17 on the southbound shoulder) (State of California Department of Parks and Recreation, Primary Record P-42-040797, 7/17/2008).

Aside from the Memorial Oaks grove, coast live oak trees that occur within and adjacent to the project limits are individual trees interspersed randomly throughout roadside landscaping along the highway shoulder.

Riparian

Riparian habitat occurs on banks of Arroyo Paredon, Garrapata, Toro Canyon and San Ysidro creeks. Riparian vegetation in and adjacent to creek channels is limited within the Highway ROW due to routine clearance according to Santa Barbara County Flood Control District's Annual Maintenance Plans. Franklin and Santa Monica Creeks have no riparian vegetation within or adjacent to the project limits

because they are concrete-lined channels.

Dominant species in the riparian canopy within and adjacent to the BSA included arroyo willow (*Salix lasiolepis*), western sycamore (*Plantus racemosa*), coast live oak (*Quercus agrifolia*), blue gum eucalyptus (*Eucalyptus globulus*) and alder (*Alnus rubra*). Dominant understory species include California blackberry (*Rubus ursinus*), Cape ivy (*Senecio mikanioides*), stinging nettle (*Urtica dioicia*), giant reed (*Arundo donax*), coyote brush (*Baccharis pilularis*), Kikuyu grass (*Pennisetum clandestinum*), sowthistle (*Sonchus oleraceaus*), Italian ryegrass (*Lolium multiflorum*), ripgut brome (*Bromus diandrus*), common horsetail (*Equisetum arvense*), ice plant (*Carpobrotus sp.*), garden nasturtium (*Tropaeolum majus*), broad-leaved cattail (*Typha latifolia*), watercress (*Rorippa sp.*), nightshade (*Solanum americanum)* and bristly ox-tongue (*Picris echioides*).

Wetlands and Other Hydrologic Features

Hydrology within the BSA is controlled by existing creeks, drainages, and storm drain systems, with extensive runoff occurring from urban and residential development, roadways, and parking areas. Numerous manmade roadside drainage ditches consisting of dirt or concrete v-ditches, and associated culvert structures occur along the route. These ditches are typically less than three feet deep and four feet wide, and showed evidence of regular maintenance.

The BSA crosses several large watersheds drained by creek channels. These creeks are mostly intermittent riverine coastal streams systems that convey both natural flows and hardscape runoff to the Pacific Ocean. Creeks within the project area (from north to south) include Sycamore, Montecito, Oak, San Ysidro, Romero, Toro, Garrapata, Arroyo Paredon, Santa Monica, Franklin, and Carpinteria, and are shown in relation to the project BSA in Appendix B. In the vicinity of Route 101, the creek channels are narrow and are constrained by development and numerous crossings, including Route 101, UPRR, county roads and private driveways. Creek alignments have been altered for flood control purposes and many of the channels are at least partially lined.

Characteristic plant species observed within potentially jurisdictional areas included arroyo willow (*Salix lasiolepis*), cattail (*Typha* sp.), mugwort (*Artemesia douglasana*), common horsetail (*Equisetum arvense*), California blackberry *Rubus ursinus*, curly dock (*Rumex crispus*), tall flatsedge (*Cyperrus eragrostis*), small-fruited bulrush (*Scirpus microcarpus*), watercress (*Rorippa nasturtiumaquaticum*),

rabbitsfoot grass (*Polypogon monspeliensis*), speedwell (*Veronica anagalis-aquatica*), and marsh baccharis (*Baccharis douglasii*).

No tidally influenced or brackish areas are present within the BSA. The project parallels the northern edge of the Carpinteria Salt Marsh between PM 4.2 and PM 4.7, separated from the marsh by the Union Pacific Railroad tracks. The Andree Clark Bird Refuge, adjacent to the BSA from PM 11.7 to PM 12.0, contains valuable habitat for both aquatic and avian species.

3.1.3. Wildlife

Wildlife observed during surveys of the BSA included the western fence lizard, California vole, California ground squirrel, brown towhee, red-tailed hawk, American kestrel, turkey vulture, mourning dove, Brewer's blackbird, Western gull, American crow, mallard duck, Anna's hummingbird, song sparrow, house finch, red-winged blackbird, great blue heron, and black phoebe. Pacific chorus frogs, steelhead trout, mosquito fish, raccoons, striped skunk, big brown bats and California myotis were observed in waterways or creek channels. Other typical birds in the area include the Northern mockingbird, European starling, Northern Flicker, Common Yellowthroat, house finch, lesser goldfinch, brown-headed cowbird, and bushtit. Common terrestrial mammals found within the biological study area include coyote, domestic cat, opossum, and Botta's Pocket Gopher.

3.1.4. Exotic and Invasive Species

Invasive plant species in the BSA which have the greatest possibility of negatively affecting the natural ecology in this project area are veldt grass *(Ehrharta calicina),* giant reed *(Arundo donax),* ice plant or Hottentot fig *(Carpobrotus eduli),* pampass grass *(Cortaderia jubata),* French broom *(Genista monspessulana),* Myopurum *(Myopurum laetum),* Cape ivy *(Senecio mikanioides),* garden nasturtium *(Tropaeolum majus),* and castor bean (*Ricinus communis*).

Single non-native red-eared slider turtles (*Trachemys scripta elegans)* were observed in Arroyo Paredon Creek and Greenwell Creek during herpetofauna surveys. These highly aquatic turtles have been introduced throughout California, especially in populated areas, primarily as a result of the release of pets by owners. Other exotic species observed in the BSA include unidentified crayfish and mosquito fish (*Gambusia affinis*). The mosquitofish, native to the eastern U.S., was introduced to the western U.S. to control mosquito larvae in ponds, streams and ditches.

3.2 Regional Species and Habitats of Concern

Table 3 provides data on special-status species that occur in the region and that may have potential to occur within the proposed project area.

Table 3: Regional Species and Habitats Potentially Occurring or Known to Occur within the Project Vicinity

Common Name	Scientific Name	Status	Habitat Type	Potential Habitat Present/ Absent	Rationale
PLANTS					
black-flowered figwort	*Scrophularia atrata*	CNPS 1B	sand dunes and diatomaceous shales	Present	Potential habitat present
Contra Costa goldfields	*Lasthenia conjugens*	FE	Vernal pools	Absent	No vernal pools in action area
Coulter's saltbush	*Atriplex coulteri*	CNPS 1B	coastal scrub, coastal dunes, grasslands	Present	Limited patches of coastal scrub present
Coulter's goldfields	*Lasthenia glabrata ssp. coulteri*	CNPS 1B	coastal alkaline soils in vernal pools, marshes, playas, grasslands	Present	Limited patches of coastal scrub present
Davidson's saltscale	*Atriplex sernana var. davidsonii*	CNPS 1B	coastal scrub, coastal bluff	Present	Limited patches of coastal scrub present
Gambell's watercress	*Rorippa gambelli*	FE, ST	Fresh and brackish water in marshes and swamps. Present in 1 location in Santa Barbara County on Vandenberg Air Force Base, and 1 location in San Luis Obispo County.	Present	Potential habitat present
Late-flowered mariposa lilly	*Calochortus weedii var. vestus*	CNPS 1B	chaparral, cistamonte woodland	Absent	Suitable habitat not present
Long-spined spineflower	*Chorizanthe polygonoides var. longspina*	CNPS 1B	Gabbroic clay in chaparral ,coastal scrub, grassland	Present	Limited patches of coastal scrub present
Marsh sandwort	*Arenaria paludicola*	FE	Marshes, bogs. Present in 2 locations in San Luis Obispo County	Present	Potential habitat present

Common Name	Scientific Name	Status	Habitat Type	Potential Habitat Present/ Absent	Rationale
Mesa horkelia	*Horkelia cuneata ssp. puberula*	CNPS 1B	Closed-cone coniferous forest, maritime chaparral ,coastal dunes or scrub	Present	Limited patches of coastal scrub present
Nutall's scrub oak	*Quercus dumosa*	CNPS 1B	Chaparral, coastal scrub	Present	Limited patches of coastal scrub present
Refugio manzanita	*Arctostaphylos refugioensis*	CNPS 1B	chaparral (sandstone)	Present	Limited patches of coastal scrub present
Salt marsh bird's beak	*Cordylanthus maritimus ssp. maritimus*	FE, SE	coastal dunes and salt marsh	Present	Carpinteria Marsh adjacent to BSA
Santa Barbara honeysuckle	*Lonicera subspicata var. subspicata*	CNPS 1B	coastal scrub and chaparral on south side of Santa Ynez Mountains	Present	Limited patches of coastal scrub present
Santa Ynez false lupine	*Thermopsis macrophylla*	CNPS 1B	chaparral (sandy, granitic)	Absent	Suitable habitat not present
Umbrella larkspur	*Delphinium umbraculorum*	CNPS 1B	Cistamonte woodland	Absent	Suitable habitat not present
Ventura Marsh Milk-vetch	*Astragalus pycnostachyus var. lanosissmus*	FE, SE	Coastal salt marsh, within reach of high tide or protected by barrier beaches	Present	Critical habitat designated in Carpinteria Marsh
BIRDS					
Bank swallow	*Riparia riparia*	ST	Colonial nester that requires vertical banks, on cliffs with sandy soils near streams	Absent	Nesting habitat not present in action area
Belding's savannah sparrow	*Passerculus sandwichensis beldingi*	SE	Coastal salt marshes, nests in *Salicornia* on and about margins of tidal flats	Absent	Nesting habitat not present in action area.
Brown pelican	*Pelecanus occidentalis*	FE	Nests on coastal islands free of mammalian predators	Absent	Nesting habitat not present in action area
California least tern	*Sterna antillarum browni*	FE, SE	Nests in coastal, sandy, open areas usually near estuaries	Absent	Nesting habitat not present in action area
Least Bell's vireo	*Vireo belli pusillus*	FE, SE	mature riparian woodland overstory with dense shrubby understory	Absent	Nesting habitat not present in action area

Common Name	Scientific Name	Status	Habitat Type	Potential Habitat Present/ Absent	Rationale
Light-footed clapper rail	*Rallus longirostris levipes*	FE, SE	Salt marshes traversed by tidal sloughs south of Pt. Conception., where cordgrass & picklegrass are dominant vegetation	Absent	Habitat not present in action area.
Southwestern willow flycatcher	*Empidonax trallii extimus*	FE	dense riparian vegetation in all layers present, with standing water or saturated soil, often larger tree overstory	Absent	Potential migrant through area. No known records in or near action area. Only narrow (≤30'), degraded strip of willow in action area within RR right-of-way.
Western snowy plover	*Charadris alexandrinus nivosus*	FT, SSC	Sandy beaches, dunes and shores of alkali lakes	Absent	no dunes, beaches, or alkali lakes in action area
AMPHIBIANS					
Arroyo toad	*Anaxyrus californicus*	FE,SSC	low-gradient rivers and streams with sandy banks, shallow pools, and cottonwoods, willows, and sycamores	Absent	Lack of habitat; not known from south side of Santa Ynez Mtns.
California red-legged frog	*Rana aurora draytonii*	FT, SSC	permanent and temporary waters and nearby uplands	Present	Pooled water in creeks & ditches in BSA
REPTILES					
Two-striped garter snake	*Thamnophis hammondii*	SSC	associated with permanent or nearly permanent water, often along streams with rocky beds and riparian growth	Present	Potential aquatic habitat in action area
Western pond turtle	*Actinemys marmorata pallida*	SSC	associated with permanent or nearly permanent water in a wide variety of habitats	Present	Potential aquatic habitat in action area
INVERTEBRATES					
monarch butterfly (roost sites)	*Danaus plexippus*	none	Roosts in wind-protected tree groves (eucalyptus, monterey pine, cypress)	Present	Documented roosts located near action area.
FISH					
Steelhead trout	*Oncorhynchus mykiss S. Ca. ESU*	FE, SSC, CH	Coastal streams and rivers from the Pajaro River to, but not including, the Santa Maria River	Present	Known to be present in five creeks in BSA which are designated critical habitat by NOAA's National Marine Fisheries Services

Common Name	Scientific Name	Status	Habitat Type	Potential Habitat Present/ Absent	Rationale
Tidewater Goby	*Eucyclogobius newberryi*	FE, SSC, CH (proposed)	Found in shallow lagoons and lower stream reaches with fairly still water containing high oxygen levels	Present	Known to be present in lagoon at Arroyo Paredon Creek (proposed critical habitat) and in Andre Clark Bird Refuge.

Absent [A] - no habitat present and no further work needed. Habitat Present [HP] -habitat is, or may be present. The species may be present. Present [P] - the species is present. Critical Habitat [CH] - project footprint is located within a designated critical habitat unit, but does not necessarily mean that appropriate habitat is present. Status: Federal Endangered (FE); Federal Threatened (FT); Federal Proposed (FP, FPE, FPT); Federal Candidate (FC), Federal Species of Concern (FSC); State Endangered (SE); State Threatened (ST); Fully Protected (FP); State Rare (SR); State Species of Special Concern (SSC); California Native Plant Society (CNPS).

Chapter 4. Biological Resources, Discussion of Impacts and Mitigation

This chapter addresses impacts to natural communities of special concern, special-status species and critical habitat occurring or having the potential to occur within the BSA.

4.1. Natural Communities of Special Concern, Wetlands and Other Waters

This section discusses natural communities of special concern found in the BSA, including those that are protected under Clean Water Act (CWA) Section 401 and 404, Fish and Game Code Section 1602 Streambed Alteration Agreements, and the California Coastal Act.

The purpose of the CWA is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters through prevention and elimination of pollution. Section 404 of the CWA establishes a permit program administered by the Army Corps of Engineers (ACOE) regulating the discharge of dredged or fill material into waters of the United States (including wetlands).

Waters of the U.S are waterways, either for commerce or recreation, below the Ordinary High Water Mark (OHWM). Wetlands are a subcategory of waters and are the transitional areas between open water and upland. The Corps has established a three parameter approach to determining if an area qualifies as a wetland. The area must exhibit wetland hydrology, hydric soils, and hydrophytic vegetation for Corps to take jurisdiction of a wetland. Areas below the OHWM but lacking anyone of the three parameters are considered "other waters."'

The California Coastal Commission (CCC) oversees implementation of the California Coastal Act. A permit from the California Coastal Commission (CCC) or the city or county with coastal permit jurisdiction is required if a project plans to place fill in wetlands within the coastal zone. The CCC takes jurisdiction over areas exhibiting only one wetland parameter.

The DFG regulates activities that would alter the flow, bed, channel or bank of streams and lakes by issuing Streambed Alteration Agreements. In riparian areas their jurisdictional limits are usually to the tops of the stream or lake banks or the outer edge of riparian vegetation.

4.1.1 Other Waters of the United States

This section discusses other waters of the U.S. which are present throughout the BSA. Hydrology in the BSA is controlled by existing creeks, drainages and storm drain systems. Waters of the U.S. delineated in this project fall into three general categories: partially altered creek channels, highly altered creek channels, and manmade drainage features associated with the Highway 101 and the Union Pacific Railroad (UPRR) transportation corridor.

Creeks within the project area (from north to south) include Montecito, Oak, San Ysidro, Romero, Greenwell, Toro Canyon, Garrapata, Arroyo Paredon, Santa Monica, Franklin, and Carpinteria, and are shown in relation to the project BSA in Appendix B. These creeks are mostly intermittent riverine coastal streams systems that convey both natural flows and hardscape runoff to the Pacific Ocean. In the vicinity of Route 101, the creek channels are narrow and are constrained by development and numerous crossings, including Highway 101, the UPRR line, county roads and private driveways. Creek alignments have been significantly altered for flood control purposes and many of the channels are at least partially lined. In addition to being other waters of the U.S., creeks in the project area fall under the jurisdiction of the DFG. Because the project occurs within the Coastal Zone, these creek areas are also under Coastal jurisdiction per the California Coastal Act.

4.1.1.1 SURVEY RESULTS

Eighty two potential "other waters" features (OW) were identified in the BSA. Individual "other waters" features that would be affected by construction are presented in Table 11 (Appendix E), and shown in Project Mapping (Appendix C).

Manmade drainage features

Sixty-one roadside drainage ditches and associated culverts were mapped within in the BSA. Ditches were typically less than 2 feet deep and showed evidence of regular maintenance (see Appendix G: *Wetland Report*). More than half of the constructed drainage features that would be impacted are concrete-lined. These lined channels provide stormwater control benefits but do not provide significant groundwater recharge or wildlife services.

Highly Altered Channels

Within the state ROW, Franklin and Santa Monica Creeks consist of open concrete

box channels and Garrapata Creek is completely culverted. No substrate or vegetative cover is present within these channels. These altered channels provide stormwater control benefits but do not provide significant biological diversity, groundwater recharge, or wildlife habitat.

Franklin Creek

Franklin Creek crosses Route 101 at PM 3.11. Within and adjacent to the BSA, Franklin Creek is confined to a concrete box channel. Franklin Creek provides no riparian or wildlife habitat within the BSA as the bottom and sides of the channel consist entirely of concrete. Channel lining extends for approximately 1000 feet downstream of the highway bridge. One half mile downstream, near to and within the Carpinteria Salt Marsh, there is known habitat for tidewater goby.

The existing bridge deck will be extended either 22 linear feet (Alternative 1 and 3) or 40 linear feet (Alternative 2) to the north, and will extend 26 linear feet in the center to enclose the currently open area between the two bridge decks. No permanent structures would be placed in the channel. Therefore, no permanent impacts on the creek channel shape or substrate would occur.

Santa Monica Creek

Santa Monica Creek crosses Route 101 at PM 3.78. Santa Monica Creek is confined to a concrete box channel within and adjacent to the project limits. Santa Monica Creek provides no riparian or wildlife habitat within the BSA as the bottom and sides of the channel consists entirely of concrete. Approximately 1000 feet downstream of Highway Bridge, Santa Monica Creek crosses under the UPRR bridge and drains into the Carpinteria Salt Marsh.

The existing bridge deck will be extended 16 linear feet to the north and 28 linear feet to the south and will extend 26 linear feet in the center to enclose the currently open area between the two bridge decks. No permanent structures would be placed in the channel. Therefore, no permanent impacts on the creek channel shape or substrate would occur.

Garrapata Creek

Garrapata Creek crosses Route 101 at PM 6.25. The creek enters the highway culvert to the north of Via Real on the north side of the highway and daylights directly south of the highway. Garrapata Creek provides very little riparian or wildlife habitat within

the BSA, as the majority of the drainage consists of a culvert beneath Highway 101. All build alternatives will avoid Garrapata Creek.

Partially Altered Channels

Of the eleven creeks that cross the route, eight contain areas of natural substrates. Channel banks within the state ROW typically consist of concrete walls, and in most cases there are county or railroad bridge structures and modified channel conditions immediately up and/or downstream. Limited riparian vegetation occurs within the ROW at several creeks. These natural-bottom creek channel sections provide stormwater control, groundwater recharge, biological diversity, and wildlife habitat.

Carpinteria Creek

No work is planned in the bed or banks of Carpinteria Creek. Bridge replacement and widening planned for the Linden Casitas Highway Improvements Project, currently in design, will accommodate HOV lanes proposed with this project.

Arroyo Paredon Creek

Arroyo Paredon Creek crosses under Route 101 at PM 5.63. Before crossing under the 101, the creek passes under a county bridge at Via Real Road upstream of the southbound and northbound Highway 101 bridges (two separate bridges). Downstream, the creek flows under the UPRR bridge and finally under Padaro Lane before following a rip-rap lined channel to the Pacific Ocean.

Within the BSA, Arroyo Paredon consists of a natural bottom channel that conveys water beneath the highway and drains to the Pacific Ocean during periods of high flow. During the dry season, a seasonal lagoon forms at the mouth which extends north of the railroad bridge and can even extend upstream of the highway. Beneath and adjacent to Highway 101, the channel is relatively flat and the bed material consists of natural sediments (sand and mud with some cobble). The banks are vertical concrete walls from the Via Real bridge inlet through the southbound Route 101 bridge outlet. Riparian vegetation is minimal within the state ROW; however, there is sparse emergent vegetation with some arroyo willow canopy existing on sections of the banks.

Arroyo Paredon Creek is within the geographical area known to be occupied by steelhead trout (*Onchorynus mykiss;* federally endangered) and has been federally designated as critical habitat for this species, although critical habitat designation

ends approximately 350 feet upstream of the Highway 101 crossing. Tidewater gobies (*Eucyclogobius newberryi*; federally endangered) are also known to inhabit the seasonal lagoon at the mouth of Arroyo Paredon Creek.

The NB and SB bridges at Arroyo Paredon Creek would be replaced with a single structure that would measure approximately 80 feet long and 173 feet wide. The new structure would enclose the open channel between the two bridges, resulting in 26 linear feet of additional shading by the bridge deck. Alternative 2 would extend the bridge deck an additional 7 linear feet to the north to accommodate median planting on the bridge deck. A new 40 foot-wide channel with a natural bottom will be constructed adjacent to the existing creek channel. The two channels will be separated by an instream pier. The new bridge structure will have a span approximately twice as long as the existing bridges to meet 25-year flood flow requirements. Banks of the creek will continue to consist of concrete walls, and the creek bed will consist of natural substrates. The second channel would result in a gain of approximately 0.160 acre of unlined creek bed.

Toro Canyon Creek

Toro Canyon Creek crosses Route 101 at PM 6.79. Within the BSA, Toro Canyon Creek consists primarily of a concrete-lined channel that conveys water beneath Highway 101. The natural bottom channel transitions to a concrete-lined channel beneath northbound Highway 101 and remains concrete-lined for the remainder of the the state ROW. A four-foot drop structure occurs immediately downstream of the state ROW at the UPRR ROW. Some riparian vegetation exists on the banks of the channel to the north of the NB highway bridge, where the channel bed and banks consists of natural cobbles and soil. This section of Toro Canyon Creek was included in the SBCFC 2009/2010 Annual Maintenance Plan and all vegetation was cleared from the channel in summer 2009.

The NB and SB bridges at Toro Canyon Creek would be replaced with a single structure that would measure approximately 35 feet long and 150 feet wide. The new structure would enclose the open channel between the two bridges, resulting in 30 linear feet of additional shading by the bridge deck. The structure will continue to span the channel without instream piers. Up to 0.105 acre of concrete bed lining will be removed within the state ROW to allow the restoration of the creek bottom.

Greenwell Creek

Greenwell Creek currently flows under Highway 101 at Post Mile 7.7 through a 72" corrugated pipe culvert. The culvert inlet would be replaced with a like structure, resulting in temporary impacts along 20 linear feet of creek bed at the north end. In June 2009, the area around the culvert inlet (outside the Caltrans ROW) consisted of earth banks and non-native vegetation.

Adjacent to the southbound lanes of Highway 101, the culvert outlets approximately 12 feet above a plunge pool, and flows travel along a disturbed open channel and under UPRR culverts before draining into the Pacific Ocean. The channel consists of a natural earthen bottom, although remains of sack-crete check-dams occur at varying intervals downstream of the pool. Several scattered willows are present, but the channel is dominated by escaped ornamental species such as iceplant (*Carpobrotus edulis*) and garden nasturtium (*Tropaeolum majus*), as well as invasive species like arrundo (*Arundo donax*) and castor bean (*Ricinis communis*). Although heavily disturbed, the drainage provides marginal habitat for a variety of wildlife species. Native species observed using this area of the creek include the Pacific chorus frog (*Pseudacris regilla*), raccoon (*Procyon lotor*), black phoebe (*Sayornis nigricans*) and mallard ducks (*Anas Platyrhynchos*).

A plunge pool has formed below the culvert outlet which measures approximately 12 feet in depth. Approximately 35 linear feet of rock slope protection (RSP) would be used to line the basin and side slopes immediately downstream of the culvert outlet to help prevent further erosion and dissipate flow. Bioengineering techniques such as brush-layering with willows would be used to stabilize the south bank. Approximately 120 feet downstream of the culvert outlet, the creek is eroding the fill-slope that supports Highway 101. Caltrans proposes to excavate slide material from the channel and stabilize the channel and banks adjacent to the fill-slope with RSP and brush layering or live siltation for up to 250 feet beyond the culvert outlet. Sack-crete and fill-material from previous work would be removed. Invasive plants castor bean and arrundo occur in the proposed work area and are listed on the California Invasive Plant Council's Invasive Plant Inventory. These invasives would be removed and temporarily disturbed areas would be planted with native species. Creek banks would be re-planted with native riparian species, including arroyo willow.

Santa Barbara County Flood Control's Conceptual Plan for Creeks in Montecito

In Montecito, the Santa Barbara County Flood Control District (SBCFCD) has a conceptual plan to improve the channel and bridge capacities at Romero, San Ysidro and Oak creeks. The county has replaced its bridges at North Jameson Lane directly upstream of Route 101 at these three creeks. The county bridges were designed to pass flood flows and have significantly greater capacity than adjacent facilities immediately downstream (Route 101 bridges and UPRR bridges). In order to avoid the hydraulic and geomorphic disruption caused by severe contraction and expansion downstream, all three county bridges were partially blocked to match their previous capacities for the indefinite future. With this project, Caltrans plans to replace the highway structures at Romero, San Ysidro and Oak creeks. The new highway bridges will have longer spans that match the county structures located directly upstream. While highway bridges will be built with longer spans, Caltrans would adopt a similar approach to the county and partially block capacity to maintain current channel widths until capacities are improved throughout the reach. Ultimately, when SBCFC achieves its goals of improving creek capacities throughout the reaches of concern, both county and highway bridges can be fully utilized. There are currently no set plans for when downstream improvements will be made.

Romero Creek

Romero Creek crosses under Route 101 at PM 9.34. Within the BSA the channel consists of a natural bottom drainage that conveys water beneath Highway 101. Channel substrate consists of cobble and boulders. Banks are vertical concrete walls from the county bridge inlet to the Railroad bridge outlet downstream of the highway. Romero is channelized in its lower reaches as it flows through the urban areas of Montecito. Some riparian habitat was present in open channel areas within the BSA during wetland surveys in spring 2009, consisting of sparse emergent vegetation and three sycamore saplings (< 3 inches dbh). This section of Romero Creek was included in the SBCFC 2009/2010 Annual Maintenance Plan and all vegetation was cleared from the channel in 2009.

Romero Creek is within the geographical area known to be occupied by steelhead trout (*Onchorynus mykiss;* federally endangered) and has also been federally designated as critical habitat for this species.

The NB and SB bridges at Romero Creek would be replaced with a single bridge structure that would measure approximately 105 feet long and 120 feet wide. The new structure will extend 10 feet to the north and south to support soundwalls, and

will span the channel without instream piers. The span of the new bridge structure will be designed to match the county bridge at Jameson Lane, directly upstream of Route 101 (see discussion of Santa Barbara County Flood Control's Conceptual Plan for Creeks on page 37). The longer bridge span will accommodate a wider channel, resulting in a gain of approximately 0.13 acre of unlined creek bed. The creek bed will continue to be a natural bottom and banks will continue to consist of concrete walls that support the bridge deck.

San Ysidro Creek

San Ysidro Creek is a moderately-sized drainage that crosses under Route 101 at PM 9.56. Within the BSA, the channel consists of vertical concrete banks and a natural bottom (primarily cobble) that conveys water beneath Highway 101 and drains to the Pacific west of Frenald Point. Upstream of the BSA, the creek is highly channelized with sack-crete walls. Downstream of the highway bridge, unlined channel banks extend for approximately 300 feet to the UPRR bridge.

San Ysidro Creek is within the geographical area known to be occupied by steelhead trout (*Onchorynus mykiss;* federally endangered) and has also been federally designated as critical habitat for this species.

The NB and SB bridges at San Ysidro Creek would be replaced with a single bridge structure that would measure approximately 80 feet long and 110 feet wide, and will span the channel without instream piers. The span of the new bridge structure across the channel will be designed to match the County Bridge at North Jameson Lane, directly upstream of Route 101 (see discussion of Santa Barbara County Flood Control's Conceptual Plan for Creeks on page 37). The longer bridge span will accommodate a wider channel, resulting in a gain of approximately 0.11 acre of unlined creek bed. The creek bed will continue to consist of a natural bottom and banks will continue to consist of concrete walls that support the bridge deck. ESA fencing will be placed around the western sycamore trees on the SE bank which provide shading to this portion of the creek.

Oak Creek

Oak Creek is a small drainage that crosses under Route 101 at PM 9.66. Within the BSA the channel consists of vertical concrete banks and a natural bottom (primarily cobble) that conveys water beneath Highway 101 and drains to the Pacific Ocean.

The NB and SB bridges at Oak Creek would be replaced with a single bridge structure that would measure approximately 44 feet long and 105 feet wide. The new structure will extend 23 feet to the north of the existing facility and the structure will span the channel without instream piers. The span of the new bridge structure across the channel will be designed to match the County Bridge at North Jameson Lane, directly upstream of Route 101 (see discussion of Santa Barbara County Flood Control's Conceptual Plan for Creeks on page 37). The longer bridge span will accommodate a wider channel, resulting in a gain of approximately 0.03 acre of unlined creek bed. The creek bed will continue to consist of a natural bottom and banks will continue to consist of concrete walls that support the bridge deck.

Montecito Creek

No work is planned in the bed or banks of Montecito Creek. The HOV lanes proposed with this project will be accommodated in the median of the existing bridge structure.

4.1.1.2 AVOIDANCE AND MINIMIZATION EFFORTS

- Work in creek channels would occur between May 1 and October 31, unless creek channels are dry earlier than May 1. At Arroyo Paredon, Romero and San Ysidro creeks, work would be limited to June 1 through October 31 to avoid impacts to migrating steelhead trout or tidewater goby.

- To minimize potential effects upon water quality it will be necessary to divert flows around the work site by means of coffer dams and water diversions in creeks that are flowing.

- To minimize temporary, construction-related impacts Environmentally Sensitive Area (ESA) fencing would be established at 12 feet from the edge of cut/fill limits at creeks. No equipment or earthwork would be allowed within the ESAs.

- Temporary effects to water quality will be minimized by implementing the best management practices (BMPs) from the Caltrans National Pollutant Discharge Elimination System statewide storm water permit.

- Equipment staging areas and storage/stockpile areas would be located in uplands.

4.1.1.3 PROJECT IMPACTS

Table 4 summarizes the temporary and permanent impacts to all "other waters" across

the project area per alternative. Table 5 summarizes impacts to creeks per alternative. Table 11 (Appendix E) presents impacts to individual OW features per alternative. Alternative 2 has greater temporary and permanent impacts to "other waters." Impacts do not differ substantially between Alternatives 1 and 3.

Table 4: Summary of Impacts to Other Waters of the U.S. (acres)

Wetland Type	Alternative 1 impacts		Alternative 2 impacts		Alternative 3 impacts	
	Temporary	Permanent	Temporary	Permanent	Temporary	Permanent
Other Waters of the U.S.						
Manmade drainage features	0.401	0.710	0.465	0.927	0.397	0.690
Creeks	0.380	0.042	0.380	0.042	0.380	0.042
TOTAL	**0.781**	**0.752**	**0.845**	**0.969**	**0.777**	**0.732**

* Creeks: Franklin, Santa Monica, Arroyo Paredon, Toro Canyon , Greenwell, Romero, San Ysidro and Oak creeks.

Temporary impacts to other waters would result from construction-related activities, including equipment access, temporary water diversions, and temporary fill placement. Permanent impacts would result from soundwalls, retaining walls, replacing or extending bridge structures, culvert extensions, and fill placement.

Table 5: Impacts to Other Waters of the U.S. at Creeks (acres) for all Alternatives

Creek	Mapsheet (Appendix C)	Temporary Impacts	Permanent Impacts
Franklin	Mapsheet C: 5	0.074	0.0
Santa Monica	Mapsheet C: 6	0.108	0.0
Arroyo Paredon [a]	Mapsheet C: 10	0.078	0.0
Toro Canyon [b]	Mapsheet C: 12	0.039 [b]	0.0
Greenwell [a, c]	Mapsheet C: 14	0.006 [c]	0.042 [c]
Romero/ Picay [a]	Mapsheet C: 18	0.021	0.0
San Ysidro [a]	Mapsheet C: 18	0.037	0.0
Oak [a]	Mapsheet C: 18	0.016	0.0

[a] Unlined creek reaches in the BSA are considered both "other waters" and Coastal Zone wetlands.

[b] At Toro Canyon Creek, the channel is partially lined. In addition to temporary impacts to "other waters" in the lined portion of the channel, temporary impacts will occur in 0.023 acres of unlined channel delineated as seasonal wetlands (ACOE & Coastal Zone).

[c] In addition to impacts to "other waters," work at Greenwell Creek would result in 0.104 acres of temporary impacts and 0.072 acres of permanent impacts to Coastal Zone wetlands. Restoration of the creek channel is proposed which would include bioengineering techniques such as live siltation or brush-layering with willow.

Table 5 summarizes impacts to creeks. Temporary impacts to creeks would result from construction-related activities, including equipment access, temporary water diversions and dewatering, and temporary fill placement. At Greenwell Creek, permanent impacts to 0.042 acres of other waters would occur from installing rock slope protection at the base of the scour pool and along the unlined channel where it is eroding the slope against the Highway at PM 7.6. New bridge structures will result in expanded area of unlined creek beds at multiple creeks (Arroyo Paredon and Toro Canyon creeks immediately; Romero, San Ysidro and Oak creeks once downstream conditions allow). At Arroyo Paredon and Toro Canyon creeks, jurisdictional waters that currently flow under two separate parallel bridge structures would flow under single elongated bridges.

4.1.1.4 COMPENSATORY MITIGATION

All manmade roadside drainage features delineated as "other waters" that are lost during construction would be replaced in-kind. Temporary impacts to other waters of the U.S will be re-graded, as needed, to reflect their pre-existing state. Unlined channels will be stabilized according to Caltrans' National Pollution Discharge Elimination System statewide storm water permit. Caltrans will hydroseed roadside banks with native seed mix where practicable to benefit water quality by decreasing run-off and sedimentation into waterways.

At creeks temporary impacts will be re-graded, as needed, to reflect their pre-existing state. All partially-modified creek channels are within the active floodplain and will quickly re-establish with vegetation naturally; however, vegetation in these creek reaches will continue to be subject to maintenance by SBCFC. Native vegetation will be planted on creek banks above other waters of the U.S where it does not conflict with flood control practices. Planting at creeks will occur in accordance with local coastal plans, and will be detailed in Caltrans' Landscape Architecture Landscape Planting Plan.

Removal of the concrete channel lining in Toro Canyon Creek will allow the restoration of up to 0.105 acres of creek bottom through state ROW. The longer bridge spans at Arroyo Paredon, Romero, San Ysidro and Oak creeks will result in wider natural channels at these four creeks (Arroyo Paredon immediately (+0.160 acre); Romero (+0.13 acre), San Ysidro (+0.110 acre) and Oak Creek (+0.030 acre) once downstream conditions allow). Wider channels will result in a net gain of an additional 0.430 acres of natural creek bed. Expanded channels would increase filtration capacity and groundwater recharge in these creek reaches.

At Greenwell Creek, impacts to other waters of the U.S would be offset by enhancement of 0.145 acres of the creek located south of Route 101. Sack-crete and other fill-material would be removed from the channel bed. Non-native plants (iceplant, arrundo and castor bean) will be removed from banks in the work area. Bioengineering techniques incorporating arroyo willows and other native plants will be applied in and above RSP along creek banks, to reduce erosion and enhance riparian habitat available for wildlife. Invasive plants castor bean and arrundo occur in the proposed work area and are listed on the California Invasive Plant council's Invasive Plant Inventory. Non-native invasive plants that are removed from the work area and creek banks during construction would be re-planted with native riparian

species, including willow and sycamore. Riparian plantings would be monitored for three years to ensure that successful revegetation has occurred. Disturbed areas that are not large enough to accept riparian trees and shrubs would be hydroseeded for erosion control.

4.1.1.5 CUMULATIVE IMPACTS

Cumulative impacts include the impacts of future State, Federal, tribal, local, or private actions that are reasonably certain to affect "other waters" in the project area. Caltrans is in the process of studying the Linden Casitas Highway Improvements Project, a project which includes interchange reconstruction, new bridge and soundwall construction and frontage road extensions starting 0.2 miles south of the Carpinteria Creek bridges and ending 0.4 miles north of Linden Avenue. The Linden Casitas Project would impact approximately 0.166 acres of other waters of the U.S. which will be fully mitigated as part of that project. Other than the Linden Casitas Project, and the updated list of local projects that the City of Carpinteria publishes, Caltrans is unaware of any other federal or non-federal actions that are reasonably certain to occur in the project area. Impacts to "other waters" with this project would be fully mitigated. Therefore, the project does not have the potential to contribute to a cumulative effect.

4.1.2 Jurisdictional Wetlands

Two types of wetlands occur within the BSA. The California Coastal Commission and County of Santa Barbara regulate some wetlands through the California Coastal Act (Coastal Zone wetlands). The U.S. Army Corps of Engineers regulates others through the Federal Clean Water Act (Army Corps wetlands).

Army Corps wetlands are labeled on project maps as "AC#" and exhibit three wetland parameters: hydrology, hydric soils, and hydrophytic vegetation (Appendix C: Mapsheets). Coastal zone wetlands are labeled on project maps as "CC#." The California Coastal Commission uses a "single parameter" wetland definition which states that "wetlands shall be defined as land where the water table is at, near or above the land surface long enough to promote the formation of hydric soils or to support the growth of hydrophytes, and shall also include those types of wetlands where vegetation is lacking and soil is poorly developed or absent as a result of frequent and drastic fluctuations of surface water levels, wave action water flow turbidity, or high concentrations of salts or other substances in the substrate."

Following the single parameter wetland definition, unlined creek channels within the

BSA were delineated as Coastal Zone wetlands (Arroyo Paredon, Romero, San Ysidro, Oak, Montecito Creeks, and portions of Toro Canyon Creek). Because these creek channels are also considered "other waters of the United States" they are discussed in detail in Section 4.2 *"Other Waters of the U.S."* Temporary and permanent impacts to these creeks are shown in Table 5.

4.1.2.1 SURVEY RESULTS

Forty-six potential wetland locations were identified in the BSA. Individual wetlands and "other waters" that would be affected by project construction are detailed in Table 11 (Appendix E), and shown in Project Mapping (Appendix C).

All alternatives will result in temporary impacts to 0.027 acres of a seasonal wetland (AC 2/CC2) in an earth-lined roadside drainage ditch along the NB lanes of Highway 101. The ditch receives run-off from the highway and nearby residential areas, and was covered in a dense layer of vegetation which included tall flatsedge, blackberry, and mugwort. Temporary impacts to this wetland would result from soundwall construction at this location.

Between PM 3.9 and 4.1, all alternatives will result in temporary and permanent impacts to vegetated roadside drainage ditches that run parallel to the NB and SB highway lanes (Army Corps and Coastal Zone wetlands AC5 and CC7, CC8, and CC9). Impacts will result from soundwall placement on both sides of the highway.

Alternative 2 will result in additional impacts to coastal zone wetlands in order to accommodate road widening. At PM 3.3, Alternative 2 would temporarily impact 0.019 acres of a vegetated roadside drainage channel (CC1) that flows along SB lanes and drains into Franklin Creek. Between PM 3.9 and 4.1 Alternative 2 will result in temporary and permanent impacts to vegetated roadside features (AC6 and CC6) to accommodate soundwall placement. Alternative 2 would also result in temporary and permanent impacts to a vegetated culvert outlet (CC10/OW 27) at PM 4.15 that leads into an open drainage channel dominated by arroyo willow and arrundo. The channel flows approximately 70 feet to the south, before entering a culvert under the frontage road and draining into Carpinteria Marsh. CC27 and CC28 consist of arroyo willows growing in drainage swales between Route 101 and the UPRR ROW, between PM 5.45 and PM 5.60. All build alternatives will result in temporary and permanent impacts to willows growing at these two locations resulting from soundwall placement.

Impacts for each creek are shown in Table 5. All build alternatives will result in temporary impacts to unlined portions of creek channels in the following creeks: Arroyo Paredon Creek, Toro Canyon Creek (partially-lined), Romero Creek, San Ysidro Creek and Oak Creek. Temporary and permanent impacts at Greenwell Creek will be offset would be offset by enhancement of 0.145 acres of the creek located south of Route 101. These creek reaches are discussed in detail in Section 4.2 "Other Waters of the U.S."

4.1.2.2 FUNCTIONS AND VALUES

With the exception of creeks, all wetlands that would be affected are constructed drainage features which are periodically disturbed for maintenance purposes. The vegetated drainage features along Highway 101 contribute some function to filter highway runoff, but provide little wildlife habitat.

Creeks in the BSA provide habitat and serve as corridors for movement of fish and wildlife through the area. However, creek reaches through the highway ROW are highly modified and maintained for flood control practices, which include vegetation removal. The functions and services of these channels vary according to watershed area, size, and location of each feature, the degree of channelization/concrete structures or lining present, and by the presence or absence of water and riparian/wetland vegetation. Factors that negatively affect the quality of functions and services provided by creeks within the BSA include regular disturbance from flood control practices, noise, lighting, limited vegetative diversity and the occurrence of exotic plant species (Wetland Report).

4.1.2.3 AVOIDANCE AND MINIMIZATION EFFORTS

- All design alternatives presented to the Project Development Team (PDT) were modified to minimize effects to wetlands.

- Work in creek channels would occur between May 1 and October 31, unless creek channels dry earlier than May 1. At Arroyo Paredon, Romero and San Ysidro creeks, work would be limited to June 1 through October 31 to avoid impacts to migrating steelhead trout or tidewater goby.

- To minimize potential effects upon water quality it will be necessary to divert flows around the work site by means of coffer dams and water diversions in creeks that are flowing.

- To minimize temporary, construction-related impacts Environmentally Sensitive

Area (ESA) fencing would be established at 12 ft from the cut/fill limits around wetlands.

- Temporary effects to water quality will be minimized by implementing the best management practices (BMPs) from the Caltrans National Pollutant Discharge Elimination System statewide storm water permit.

- Equipment staging areas and storage/stockpile areas would be located in uplands.

4.1.2.4 PROJECT IMPACTS

Table 6 summarizes the temporary and permanent impacts to Army Corps wetlands and Coastal Zone wetlands per alternative. Table 11 (Appendix E) catalogs impacts to each wetland per alternative. Alternative 2 has the greatest wetland impacts. Impacts do not differ between Alternatives 1 and 3.

Table 6: Impacts to Jurisdictional Wetlands (acres)

Wetland Type	Alternative 1 impacts		Alternative 2 impacts		Alternative 3 impacts	
	Temporary	Permanent	Temporary	Permanent	Temporary	Permanent
Army Corps & Coastal Zone	0.078	0.005	0.073	0.016	0.078	0.005
Additional Coastal Zone Wetlands	0.487	0.146	0.430	0.506	0.487	0.146

*Impacts to individual creeks are presented in Table 5. *Impacts to Other Waters of the U.S. at Creeks (acres).*

Temporary impacts to manmade drainage features would result from construction-related activities, including equipment access, vegetation removal, excavation and grading for new structures, and temporary water diversions. Permanent impacts would result from replacing or extending bridge structures, soundwalls, highway fill for road widening, and culvert extensions.

Temporary impacts to creeks would result from construction-related activities, including equipment access, temporary water diversions, and temporary fill placement. Permanent impacts at Greenwell Creek would occur from installing rock slope protection at the base of the scour pool and along the unlined channel where eroding the slope against the Highway at PM 7.6. New bridge structures will result in expanded area of unlined creek beds at five creeks (Arroyo Paredon and Toro Canyon creeks immediately; Romero, San Ysidro and Oak creeks once downstream conditions allow). At Arroyo Paredon and Toro Canyon creeks, jurisdictional waters

that currently flow under two separate parallel bridge structures would flow under single elongated bridges.

4.1.2.5 COMPENSATORY MITIGATION

The US Army Corps of Engineers and the California Coastal Commission have a 'no net loss of wetlands' policy and require compensatory mitigation for wetlands impacts. Caltrans should expect to mitigate at least at a 1:1 ratio and up to a 3:1 ratio for permanent impacts to Coastal Zone and Army Corps wetlands. The ratio required for compensating for impacts would be based on resource agency recommendations as well as the function and quality of wetland habitat that needs to be replaced. Table 7 below presents the range of compensatory mitigation that may be required for each alternative. Restoration in areas of temporary impacts would also be required and is not represented in the table.

Table 7. Compensatory Mitigation for Permanent Wetland Impacts (acres)

Wetland Type	Alternative 1	Alternative 2	Alternative 3
U.S. Army Corps & Coastal Zone Wetlands	0.005 – 0.015	0.016 – 0.048	0.005 – 0.015
Additional Coastal Zone Wetlands	0.146 – 0.438	0.506 – 1.518	0.146 – 0.438

Numbers based on mitigation ratios from 1:1 to 3:1.

Impacts to wetlands would be minimized at all jurisdictional areas. Wetlands that are temporarily disturbed during construction would be replaced onsite by restoring wetland areas to their original condition.

Removal of the concrete channel lining in Toro Canyon Creek will allow the restoration of up to 0.105 acres of creek bottom through state ROW. The longer bridge spans at Arroyo Paredon, Romero, San Ysidro and Oak creeks will result in wider natural channels at these four creeks (Arroyo Paredon immediately (+0.160 acre); Romero (+0.13 acre), San Ysidro (+0.110 acre) and Oak Creek (+0.030 acre) once downstream conditions allow). Wider channels will result in a net gain of an additional 0.430 acres of natural creek bed. Expanded natural channels would increase filtration capacity and groundwater recharge in these creek reaches and would lower peak water velocities for migrating steelhead trout. Improvements at Greenwell Creek are discussed in Section 4.1.1.4: *Other Waters of the U.S.-*

Compensatory Mitigation.

The functions of man-made wetlands (roadside drainage features) could easily be replaced with more manmade wetlands. Sites chosen for mitigation would be within the project limits where feasible. Constructing new vegetated ditches that receive and filter highway runoff would replace the function of the vegetated roadside ditches that are considered coastal zone wetlands. Enough room would be available in the proposed ROW to replace most or all of the coastal zone wetland losses onsite with vegetated ditches or bioswales. Grasses and other low-growing vegetation would provide the greatest filtering capacity. Plantings should include native species found locally, including horsetail, sedge, mugwort, marsh baccharis, and blackberry.

Where onsite mitigation is not practical due to constraints such as area required to offset impacts, then mitigation for permanent impacts to wetlands should occur where it will have the maximum benefits locally and regionally. The greatest benefit to wetlands locally and regionally would result from work to enhance the Carpinteria Salt Marsh. The Carpinteria Marsh, located immediately west of the City of Carpinteria, is the largest remnant of the native ecosystem in the region and has the highest occurrence of special status species in the area (CNDDB). It is a critically important southern California coastal estuary, and is protected as a conservation and research reserve by the University of California Natural Reserve System.

At least 75 percent of southern California's former coastal wetlands have been lost and the remainder experience varying levels of degradation (Wiley and Zembel 1989). Impacts to Carpinteria Marsh from agricultural runoff, sedimentation, and mosquito abatement threaten its productivity (Santa Barbara Coastal Plan 1982). Resource managers at Carpinteria Marsh have identified multiple needs, which include restoration or enhancement of degraded areas and control of invasive species that diminish the function and value of marsh resources (Andrew Brooks, Reserve Manager; personal communication 2009). In addition to benefiting water quality through increased filtration of sediment and pollutants, restoration of severely degraded areas of the marsh would benefit special-status animal species by increasing habitat available for shelter, foraging, breeding and rearing young.

4.1.2.6 CUMULATIVE IMPACTS

Cumulative impacts include the impacts of future State, Federal, tribal, local, or private actions that are reasonably certain to affect wetlands in the project area. Caltrans is in the process of studying the Linden Casitas Highway Improvements

Project, a project which includes interchange reconstruction, new bridge and soundwall construction and frontage road extensions starting 0.2 miles south of the Carpinteria Creek bridges and ending 0.4 miles north of Linden Avenue. The Linden Casitas Project would impact approximately 0.05 acres of Coastal Zone wetlands, which will be fully mitigated as part of that project. Other than the Linden Casitas Project, and the updated list of local projects that the City of Carpinteria publishes, Caltrans is unaware of any other federal or non-federal actions that are reasonably certain to occur in the project area. Impacts to wetlands with this project would be fully mitigated. Therefore, the project does not have the potential to contribute to a cumulative effect.

4.1.3 Riparian Community

Riparian habitat is a natural community of special concern that will be affected by this project. Currently some of the riparian vegetation within and adjacent to creeks in the BSA is routinely cleared as part of the SBCFC District Annual Maintenance Plan (2009-10, updated yearly). Maintenance, in combination with channel modifications such as concrete and/or sack-crete lined walls, results in limited opportunity for riparian communities to become established within the Highway ROW. Existing riparian areas in the ROW are patchy and exhibit limited species diversity.

4.1.3.1 SURVEY RESULTS

Patches of riparian vegetation were identified at Arroyo Paredon Creek, upstream of the highway bridge at Toro Canyon Creek, and downstream of the highway bridge at San Ysidro Creek. Four coast live oak trees grow at the top of the banks of the culvert outlet at Garrapata Greek. Franklin and Santa Monica Creeks have no riparian vegetation within or adjacent to the project limits because these are concrete-lined channels. Although riparian habitat occurs at Carpinteria Creek, no work is proposed at this location. Riparian trees that would be impacted by the proposed project were measured and delineated onto mapping. Dominant riparian vegetation in the ADI consisted of arroyo willow, western sycamore, Cape ivy, periwinkle, and garden nasturtium. Highway landscaping in upland areas near creeks included coast live oak, eucalyptus, cypress, pine and pittosporum trees.

4.1.3.2 AVOIDANCE AND MINIMIZATION EFFORTS

- All work will be confined to Caltrans ROW and delineated temporary construction easements.

- Prior to any ground-disturbing activities, (ESA) fencing will be installed around the dripline of trees and riparian vegetation to be protected. ESA fencing limits will be depicted on the final design layout plans.

- To avoid impacting nesting birds in the riparian vegetation, all clearing will be accomplished outside the nesting season (February 15- September 1).

4.1.3.3 PROJECT IMPACTS

Ten coast live oaks (*Quercus agrifolia*) ranging in size from 2 to 26-inch dbh will be removed from riparian areas during construction. Nineteen arroyo willows (*Salix lasiolepis*) ranging in size from 3 to 10 inch dbh will be removed from riparian areas. All build alternatives will avoid the large sycamore tree that provides shade to the south end of San Ysidro Creek and the four coast live oak trees that shade the culvert outlet at Garrapata Greek. See Table 8 for a summary of riparian impacts.

Table 8: Riparian Impacts

Number of Species	DBH & (# of Trees)	Locations
Arroyo Paredon Creek		
11- arroyo willows (*Salix lasiolepis)*	4 in (5), 5 in (2), 6 in (1), 7 in (2), 8 in (1)	6 –south bank 5- north bank
Toro Canyon Creek		
4- arroyo willows (*Salix lasiolepis)*	7 in (1), 8 in (1) 9 in (1), 10 in (1)	4- north bank
7- coast live oak (*Quercus agrifolia)*	2 in (1), 3 in (1), 4 in (4), 11 in (1)	5- north bank 2- south bank
6- Monterey Cypress (*Cupressus macrocarpa*)	9 in (1), 11 in (1), 12 in (1), 17 in (1), 19 in (1), 30 in (1),	2- north bank 4- south bank
2 – Eucalyptus (non-native) (*Eucalyptus globulus*)	16 in (1), 37 in (1)	2- south bank
Greenwell Creek		
4- arroyo willows (*Salix lasiolepis)*	3 in (3), 5 in (1)	4- south bank
San Ysidro Creek		
3- coast live oaks (*Quercus agrifolia)*	5 in (1), 6 in (1), 17 in (1)	3- south bank
2- Monterey pine (*Pinus radiata*)	24 in (1) , 28 in (1), 33 in (2)	2- south bank
1 – Eucalyptus (non native) (*Eucalyptus globulus*)	16 in (1)	1- south bank

4.1.3.4 COMPENSATORY MITIGATION

Impacts to native riparian vegetation would be offset by replacement planting within the project limits. Replanting plans for creek locations should be reviewed by Santa Barbara County Flood Control to ensure that plantings would not impede flows within creek channels to avoid flooding. Replacement planting will be achieved using a 3:1 ratio for willows and a 3:1 ratio for coast live oaks or western sycamore $\geq$ six inches dbh (See Table 9). Monterey cypress and Monterey pine trees will be replaced in kind. Plantings will be detailed in Caltrans' Landscape Architecture landscape planting plan. Although higher replacement ratios are sometimes appropriate, the fact that the state ROW along creek reaches is actively managed by the county for flood control, in combination with the fact that all replacement trees would be maintained within the Caltrans ROW, make this an appropriate number for this project.

Disturbed areas that are not replanted with riparian trees or shrubs would be stabilized and seeded with native grasses and forbs. If replacement ratios cannot be met at these locations due to flooding concerns, planting will occur at other appropriate locations within the state ROW. All riparian plantings will be monitored to ensure successful revegetation at six months after implementation and then once a year for three years. Removal of existing stands of invasive giant reed (*Arrundo donax*) on the south banks of Arroyo Paredon creek and at Greenwell Creek will be included in Caltrans Landscape Architecture landscape plans.

Table 9: Riparian Mitigation

Species	Total Trees Removed	Mitigation Ratio	Total Trees to be Replanted
Arroyo willows (*Salix lasiolepis*)	19	3:1	57
Coast live oaks (*Quercus agrifolia*)	7	3:1	21
Monterey Cypress (*Cupressus macrocarpa*)	6	1:1	6
Monterey Pine (*Pinus radiata*)	2	1:1	2

4.1.3.5 CUMULATIVE IMPACTS

Cumulative impacts include the impacts of future State, Federal, tribal, local, or private actions that are reasonably certain to affect riparian habitat in the project area. Caltrans is in the process of studying the Linden Casitas Highway Improvements Project, a project which includes interchange reconstruction, new bridge and soundwall construction and frontage road extensions starting 0.2 miles south of the Carpinteria Creek bridges and ending 0.4 miles north of Linden Avenue. The Linden Casitas Project would impact approximately 0.29 acres of riparian habitat which will be fully mitigated as part of that project. Other than the Linden Casitas Project, and the updated list of local projects that the City of Carpinteria publishes, Caltrans is unaware of any other federal or non-federal actions that are reasonably certain to occur in the project area. This project includes minimization and avoidance measures to reduce impacts to riparian areas, and impacts to riparian habitat would be fully mitigated. Therefore, the project does not have any cumulative impacts.

4.1.4 Coast Live Oaks

Senate Concurrent Resolution No. 17 Relative to Oak Woodlands defines oak woodlands as a five-acre circular area containing five or more oak trees per acre. Within and adjacent to the project limits, individual oak trees, but not true continuous oak woodlands (as defined by Senate Resolution 17) occur within the project limits.

4.1.4.1 SURVEY RESULTS

Approximately 220 individual coast live oaks or rows of oak trees occur within the maximum cut and fill limits of the project ADI. Ten of these oak trees occur within riparian areas and are addressed in Section 4.13 *Riparian Community*. Between PM 6.3 and 6.7 approximately 33 of the original 71 Memorial Oaks remain. These trees, planted in 1928 to commemorate local veterans of WWI, were planted on both sides of the two lane highway. The road was widened in the 1950s leaving the oaks to line the SB lanes only. Most of them have died over the years. As an important cultural resource for the local area, a replanting plan specific to the Memorial Oaks will be coordinated through the Caltrans Environmental Landscape Architecture and Caltrans Division of Cultural Resources. Although this section of the ROW arguably has the most terrestrial habitat value within the project limits, its habitat values are compromised by ornamental species present and the adjacent residential areas beyond the ROW. The habitat value of the trees is further limited by fragmentation, lack of

connectivity, regular pruning and traffic noise resulting from the surrounding four lane freeway.

The remaining oaks that occur within Caltrans right of way are individual trees that are interspersed randomly throughout roadside landscaping along the highway shoulder and are not considered a natural oak woodland community.

4.1.4.2 AVOIDANCE AND MINIMIZATION EFFORTS

- All oaks and other native trees ≥ 6" dbh that will remain in the project vicinity will be delineated on design plans. Prior to any ground-disturbing activities, ESA fencing will be installed around the dripline of trees to be protected.

- To avoid impacting nesting birds that might use the landscaped portions of the right of way, tree removal shall not occur between February 15 and September 1.

4.1.4.3 PROJECT IMPACTS

All oak trees to be impacted by the proposed project are coast live oaks (*Quercus agrifolia*). Up to 220 coast live oak trees, including riparian trees, would be removed from the state ROW during construction.

4.1.4.4 COMPENSATORY MITIGATION

Impacts to native oak trees ≥ 6" dbh would be offset by replacement planting within the project limits. Replacement plantings will be achieved using a 3:1 ratio for each oak tree removed, in accordance with Santa Barbara County's Draft Guidelines for Urban Oak Trees (2006). Although higher numbers are sometimes appropriate, the limited habitat value of the trees to be removed and the fact that all replacement trees would be maintained within Caltrans ROW make this an appropriate number for this project. Replacement plantings will be detailed in Caltrans' Landscape Architecture Landscape Planting Plan. Oak tree plantings would be monitored to ensure successful revegetation at six months and then once a year for three years. It is recommended that native tree and shrub species such as western sycamore, lemonade berry, toyon, laurel sumac and coyote brush also be included as replacement plantings.

4.1.4.5 CUMULATIVE IMPACTS

The statewide loss of oaks and oak woodlands to agricultural conversion, rangeland clearing, and development is well documented. It is also well known that grazing and invasive grasses have reduced oak regeneration and contributed to the decline of oak

woodlands statewide (Pavlik et al. 1991, Holland and Keil 1995).

With compensatory mitigation, the project would not contribute to the cumulative loss or degradation of oak woodland or isolated oak trees in southern Santa Barbara County.

4.2 Sensitive Species Potentially in the Project Area

Table 10, below, summarizes the sensitive species list for the project area. Species determined to be present were either observed in the BSA or presence was inferred based on suitable habitat and occurrences documented in the CNDDB, literature, or museum collections.

Table 10: Special-Status Species with the Potential to Occur in the Biological Study Area

Common Name	Scientific Name	Status	Species Present/ Absent	Rationale
Special-Status Plants				
Black-flowered figwort	*Scrophularia atrata*	CNPS 1B	A	Species not identified during botanical surveys
Coulter's saltbush	*Atriplex coulteri*	CNPS 1B	A	Species not identified during botanical surveys
Coulter's goldfields	*Lasthenia glabrata ssp. coulteri*	CNPS 1B	A	Species not identified during botanical surveys
Davidson's saltscale	*Atriplex sernana var. davidsonii*	CNPS 1B	A	Species not identified during botanical surveys
Gambell's watercress	*Rorippa gambelli*	FE, ST	A	Species not identified during botanical surveys
Long-spined spineflower	*Chorizanthe polygonoides var. longspina*	CNPS 1B	A	Species not identified during botanical surveys
Marsh sandwort	*Arenaria paludicola*	FE, SE	A	Species not identified during botanical surveys
Mesa horkelia	*Horkelia cuneata ssp. puberula*	CNPS 1B	A	Species not identified during botanical surveys

Common Name	Scientific Name	Status	Species Present/ Absent	Rationale
Nutall's scrub oak	*Quercus dumosa*	CNPS 1B	A	Species not identified during botanical surveys
Refugio manzanita	*Arctostaphylos refugioensis*	CNPS 1B	A	Species not identified during botanical surveys
Salt marsh bird's beak	*Cordylanthus maritimus ssp. maritimus*	FE, SE	A	Species not identified during botanical surveys
Santa Barbara honeysuckle	*Lonicera subspicata var. subspicata*	CNPS 1B	A	Species not identified during botanical surveys
Ventura Marsh Milk-vetch	*Astragalus pycnostachyus var. lanosissmus*	FE, SE	A	Species not identified during botanical surveys
Special-Status Wildlife				
Steelhead trout	*Oncorhynchus mykiss So. Ca. DPS*	FE, SSC	P	Known to be present in creeks in BSA. Some creeks are designated as critical habitat for steelhead.
Tidewater Goby	*Eucyclogobius newberryi*	FE, SSC	P	Known to be present in lagoon at Arroyo Paredon Creek (proposed critical habitat) and in lagoon at Andre Clark Bird Refuge.
California red-legged frog	*Rana aurora draytonii*	FT, SSC	A	Species not found during USFWS protocol level surveys
Two-striped garter snake	*Thamnophis hammondii*	SSC	A	Species not found during herpetofauna surveys
Western pond turtle	*Actinemys marmorata pallida*	SSC	A	Species not found during herpetofauna surveys
Belding's Savannah sparrow	*Passerculus sandwichensis beldingi*	SE	A	Nesting habitat not present in the BSA
California least tern	*Sterna antillarum browni*	FE, SE	A	Nesting habitat not present in the BSA
Least Bell's vireo	*Vireo belli pusillus*	FE, SE	A	Lack of specific habitat requirements.

Common Name	Scientific Name	Status	Species Present/ Absent	Rationale
Light-footed clapper rail	*Rallus longirostris levipes*	FE, SE	A	Nesting habitat not present in the BSA
Southwestern willow flycatcher	*Empidonax trallii extimus*	FE	A	Nesting habitat not present in the BSA
Western snowy plover	*Charadris alexandrinus nivosus*	FT, SSC	A	Nesting habitat not present in the BSA
Monarch Butterfly	*Danaus plexippus*		A	No known roosting sites in BSA. Aggregations not found in surveys of locations near documented roosting sites.

4.3 Special Status Plant Species

Appendix F summarizes the results of botanical surveys. No special-status plant species were found. No critical habitat for federally or state listed plant species occurs within the BSA. A plant list for the project is presented in Appendix F.

4.4 Special Status Animal Species Occurrences

Special-status animal species with the potential to occur in the project area include steelhead trout, tidewater goby, California red-legged frog, southwestern pond turtle, two-striped garter snake, light footed clapper rail, Belding's Savannah sparrow, southwestern willow flycatcher, least Bell's vireo, California least tern, western snowy plover, and Monarch butterfly.

4.4.1 California Red-Legged Frog

The project is within the geographic range for California red-legged frogs (USFWS 2002). California red-legged frogs [*Rana draytonii* (federally threatened, state species of special concern)] are known to occur in coast range watersheds from near Point Reyes to northern Baja California. California red-legged frogs breed in permanent or temporary freshwater bodies lacking predatory fishes and in areas holding water through July. They typically remain within 300 feet of water, but frogs will move between aquatic sites to breed, forage, or to escape drying conditions. Overland

movements occur up to 2 miles, often in straight lines and without regard to habitat type. California red-legged frogs also use uplands for foraging and have been observed using riparian areas for extended periods (USFWS 2002). Due to a decline in the population size and habitat, the species was listed as federally threatened under the Endangered Species Act of 1973, and amended effective 06/24/96. This project is not located in a designated critical habitat area for California red-legged frogs (USFWS 2010).

The BSA crosses the lower reaches of eleven intermittent creeks where channelization and man-made structures, combined with an altered hydroperiod due to urbanization and agriculture, result in altered flow regimes. Several of these creeks go dry at the Highway 101 crossings in spring or early summer. Montecito, Oak, San Ysidro, Toro Canyon and Garrapata creeks were all dry at Highway 101 by June 1, 2009.

There are no known records of California red-legged frogs within the BSA. The closest sighting to the project area was along upper Arroyo Paredon Creek in July 2008, when a single juvenile was observed northeast of the junction of the creek and Highway 192, approximately 1.3 miles north of the project area. Two other red-legged frog sightings are reported within five miles of the study area. In September 2005, a single adult red-legged frog was observed 1.6 miles north of the project area in upper Santa Monica Creek. In August 2002, three juvenile frogs and ten larvae were observed in Upper Hot Springs Creek, approximately 2 miles northwest of the project area (CNDDB).

SBCFC staff conducts annual walking surveys of creek reaches within the BSA each spring and staff members have not observed red-legged frogs in these creeks (Maureen Spencer, personal comment 2009). Previous protocol-level surveys of Arroyo Paredon Creek (2005) and Carpinteria Creek (2007) were negative for California red-legged frogs (Caltrans, District 5).

4.4.1.1 SURVEY RESULTS

At the recommendation of the USFWS Office in Ventura, Caltrans conducted protocol-level surveys of all suitable potential habitat in the BSA in 2009. Site assessments and field surveys were conducted according to the *Revised Guidance on Site Assessments and Field Surveys for the California Red-legged Frog* (USFWS 2005). Surveys were conducted at Arroyo Paredon Creek (4,500 feet upstream from Highway 101and downstream to the Pacific Ocean) and Romero Creek (3,000 feet

upstream from Highway 101 and downstream to the Pacific Ocean). Surveys were also conducted at Greenwell Creek south of Highway 101 and at the roadside drainage ditches located along the NB on and offramps at South Padaro Lane. Carpinteria Creek was not re-surveyed because previous negative survey results were less than 2 years-old.

Protocol-level surveys for California red-legged frog were negative. This project is not expected to affect California red-legged frogs. Minimization or avoidance measures are not warranted for this project.

4.4.2 Southern Steelhead

Steelhead trout (*Oncorhynchus mykiss*) are an ocean-going form of rainbow trout native to Pacific Coast streams from Alaska south to northwestern Mexico. Wild steelhead populations in California have decreased significantly from their historic levels. This decline prompted listing of the Southern California Distinct Population Segment (DPS) as endangered on 08/18/97 which includes populations from the Santa Maria River south to the Tijuana River at the U.S. Mexico border (NOAA 1997). Final critical habitat was designated by NOAA's National Marine Fisheries Service in September 2005 (NOAA 2005), and a Draft Recovery Plan for the Southern California Steelhead DPS was published in July 2009. The steelhead trout is also a state species of special concern.

Oncorhynchus mykiss exhibits one of the most complex suites of life history traits of any salmonid species. Although individuals may exhibit anadromy or freshwater residency, in California they typically migrate to marine waters after spending from 1-3 years in fresh water. They then reside in marine waters for typically 1-2 years prior to returning to their natural stream to spawn as 4-5 year-olds. Steelhead are iteroparous, meaning they are capable of spawning more than once before dying. However, it is rare for steelhead to spawn more than twice before dying. Adults typically spawn between January and March but spawning can occur as early as December or as late as June. Depending upon water temperature, steelhead eggs may incubate in nesting gravel for 1.5 to 4 months before hatching as "alevins" (a larval life stage dependent upon food stored in a yolk sac). Following yolk sac absorption, young juveniles or "fry" emerge from the gravel and begin actively feeding.

Higher elevation headwaters are the primary spawning and rearing areas for southern steelhead today. The lower elevation alluvial flats may have been important originally, although in central and southern California they may present potentially

inhospitably warm and fluctuating water temperatures and the streams are often intermittent.

4.4.2.1 SURVEY RESULTS

Steelhead trout occur in Carpinteria, Arroyo Paredon, Romero, San Ysidro, Montecito and Sycamore creeks (NOAA Fisheries list of current steelhead creeks, Stoeker 2002). In 2009, Caltrans biologists observed juvenile steelhead in pools in Romero Creek upstream of the state ROW.

No work is proposed in Carpinteria or Montecito Creeks, and Sycamore Creek is outside of the proposed project limits. The project proposes bridge replacements where the state highway crosses Arroyo Paredon, Romero and San Ysidro Creeks. Steelhead use these portions of creeks as migration corridors between the ocean and upstream spawning habitat. At these three locations, county roads, Highway 101, and the Union Pacific Railroad tracks cross each creek sequentially near their mouths. Channel beds are comprised of natural substrate (primarily cobble) and concrete walls line the banks. Upstream and downstream of highway crossings, channelization and man-made structures, combined with an altered hydroperiod due to urbanization and agriculture, have altered run-off patterns and flow regimes. County Flood Control's Annual Maintenance Plans typically include the removal of large woody debris and vegetation from these channels.

4.4.2.2 CRITICAL HABITAT

Within the BSA, the following creeks are designated critical habitat for federally endangered Southern Steelhead: Carpinteria, Romero, San Ysidro, Montecito and Sycamore Creeks. Critical habitat designation for Arroyo Paredon Creek ends approximately 350 feet upstream of the Highway 101 crossing. No work is proposed in Carpinteria or Montecito Creeks, and Sycamore Creek is outside of the proposed project limits. The project would affect designated critical habitat for the Southern California Steelhead DPS where the state highway crosses Romero and San Ysidro Creeks. Work at these locations will require formal consultation with the National Marine Fisheries Service for critical habitat.

4.4.2.3 AVOIDANCE AND MINIMIZATION EFFORTS

The following take avoidance and take minimization measures will be incorporated into each build alternative:

- All work activities within or adjacent to critical habitat creeks would only take

place during the low flow period between June 1 and October 31 to avoid impacting migrating steelhead trout, unless creek channels dry earlier than June 1.

- Pre-construction educational meetings discussing steelhead and other sensitive species will be required for construction personnel prior to work in creeks.

- Water diversions will be required at Arroyo Paredon and Romero creeks. San Ysidro Creek is typically dry at the state highway crossing by May 1 each year and remains dry until November.

- Only qualified personnel authorized under a Biological Opinion shall participate in activities associated with the capture, handling, and relocation of steelhead. The names and credentials of personnel who desire to conduct these activities shall be supplied to NOAA for their review and approval at least 15 day prior to the onset to these activities.

- If water is to be pumped around work sites, pump intakes shall be completely screened with wire mesh not larger than five millimeters (mm) to prevent fish from entering the pump system.

- During the de-watering effort, if present, steelhead shall be removed prior to draining the site. After barriers are constructed, steelhead shall be captured, transported in buckets, and released in the most appropriate habitat immediately adjacent to the de-watered area. Handling time for steelhead shall be minimized to the maximum extent practicable.

- Upon completion of construction activities each year, barriers to flow shall be removed in a manner that will allow flow to resume with the least disturbance to the substrate.

- All disturbance to potential steelhead habitat including riparian vegetation and jurisdictional waters shall be minimized with the use of ESA fencing and all soil exposed as a result of project construction shall be revegetated using native hydroseeding or live planting methods.

- If the substrate of the stream is altered during work activities, it shall be graded or otherwise treated to pre-construction conditions or better after the work is completed.

4.4.2.4 PROJECT IMPACTS

Proposed work within these creeks is the same for all three build alternatives. Build alternatives will result in both temporary and permanent impacts to migration habitat in Arroyo Paredon, Romero and San Ysidro creeks within the project limits.

All build alternatives may affect but are not likely to adversely affect steelhead trout and may result in incidental take. Incidental take could be a result of harassment, harm, or mortality of steelhead during water diversion, demolition and construction, or relocation actions if they become necessary. Following the selection of the project's preferred alternative, formal consultation under Section 7 of the Endangered Species Act will be initated with NOAA for potential incidental take of steelhead trout in Arroyo Paredon Creek, Romero Creek and San Ysidro Creek.

Temporary impacts could occur with the water diversion and dewatering. The water diversion and dewatering would temporarily raise water levels directly above the cofferdam, however creek flows would be maintained through a pipe culvert. Given that the window for work in the creek is outside of the time frame for steelhead trout migration, it is anticipated that any incidental take that might occur would be a take of steelhead trout juveniles during the water diversion and dewatering of Arroyo Paredon and Romero creeks (San Ysidro Creek typically dries up in May and remains dry until the winter rains in November). Following the water diversion, remaining fish within the area to be dewatered will be removed using a seine and dip nets. Any steelhead trout encountered during the seining of the dewatered area will be relocated to a suitable location within that creek.

Permanent impacts to Arroyo Paredon and Romero creeks would result from replacement bridge structures that extend beyond the footprint of the existing structures. New bridge structures at these locations would result in increased shading through these creek reaches. However, new bridge structures will also result in expanded area of natural creek beds at Arroyo Paredon Creek immediately; and at Romero and San Ysidro creeks once downstream conditions allow.

The NB and SB bridges at Arroyo Paredon Creek would be replaced with a single structure that would measure approximately 80 feet long and 173 feet wide. The new structure would enclose the open channel between the two bridges, resulting in 26 linear feet of additional shading by the bridge deck. For all build alternatives, a new 40 foot-wide channel with natural bed will be constructed adjacent to the original creek channel. The two channels will be separated by an instream pier. Banks of the

creek will continue to consist of concrete walls. The creek bed will continue to consist of natural substrates. The second channel will result in a gain of approximately 0.160 acre of natural creek bed.

Replacement highway bridges at Romero Creek and San Ysidro Creek will have longer spans that will match county bridges upstream to allow these bridges to pass flood flows. While the new highway bridges will have longer spans across the creek channels, the undersides would be temporarily walled off to match the existing conditions up and downstream conditions. The current channel width would be maintained until improvements are made to adjacent facilities immediately downstream (for more detail, see discussion of Santa Barbara County Flood Control's Conceptual Plan for Creeks on page 37). The bridge at Romero Creek would be widened an additional 10 feet to the north and south to support soundwalls. The twenty additional feet of bridge deck at Romero Creek would result in additional shading of the creek channel. Creek beds would continue to consist of natural substrates and no piers or permanent structures would be placed in channels.

Senate Bill 857 requires Caltrans rectify any fish passage impediments for anadramous fish when modifying a structure. Aside from one identified impediment at Carpinteria Creek, no physical obstructions to fish passage (in-stream structures, bed, lining, significant grade changes) were identified in steelhead creeks in the state ROW (Stoeker 2002, NOAA 2005). The impediment to fish passage at Carpinteria Creek (the current bike path) will be removed by the Linden-Casitas Highway Improvement Project prior to start of this project.

Caltrans began early consultation with NOAA's National Marine Fisheries Service in May 2009 to identify and conduct various hydraulic analyses of steelhead creeks where work is proposed (Arroyo Paredon Creek, Romero Creek and San Ysidro Creek). Although significant grade changes do not occur within in the BSA, the extent of channelization up and downstream at San Ysidro and Romero creeks results in peak flood flows that currently exceed recommended velocities for fish passage. While the extended spans of the new bridges would help to reduce velocities in the ROW, conditions at Romero and San Ysidro creeks would temporarily maintain current channel widths until the downstream structures are improved so as not to jeopardize downstream facilities. Consultations with federal and state agencies are currently ongoing.

4.4.2.4.1 COMPENSATORY MITIGATION

At Arroyo Paredon creek, the new channel will result in decreased velocities at peak flows, improving conditions for winter spawning in this portion of the creek reach. Similarly, the longer bridge spans at Romero Creek and San Ysidro Creek, will result in wider unlined channels and lower velocities at peak flow once the downstream facilities have been upgraded. Additional mitigation measures include 3:1 ratio for replanting of riparian vegetation to be removed during construction, as well as the removal of an existing stand of giant reed (*Arrundo donax*), an invasive non-native plant, at Arroyo Paredon Creek.

4.4.2.4.2 CUMULATIVE EFFECTS

Cumulative effects include the effects of past, present, and reasonably foreseeable future State, tribal, local, or private actions that are reasonably certain to occur in the project area. Caltrans is not aware of any federal or non-federal actions that have potential to affect steelhead or critical habitat within the project area.

4.4.3 Tidewater Goby

The tidewater goby (*Eucyclogobius newberryi*) is a small fish rarely exceeding 50 millimeters (2 inches) in length that occurs in tidal streams associated with coastal wetlands in California. Since 1900, the tidewater goby has disappeared from nearly 50 percent of the coastal lagoons within its historic range, including 74 percent of the lagoons south of Morro Bay in Central California (USFWS 2000). This decline prompted federal listing of the tidewater goby as endangered on February 4, 1994. Critical habitat was designated in November 20, 2000. Revised critical habitat was proposed on October 19, 2011 (USFWS 2011).

A member of the family *Gobiidae*, the tidewater goby is the only species in the genus Eucylogobius and is almost unique among fishes along the Pacific coast of the United States in its restriction to waters with low salinities in California's coastal wetlands. Tidewater gobies inhabit seasonally closed estuaries along the California coast, a habitat heavily impacted by anthropogenic filling and artificial opening, and the species exhibits varied metapopulation behavior as a consequence of hydrologic variation and anthropogenic impact. Their habitat is characterized by brackish water in shallow lagoons and in lower stream reaches where the water is fairly still but not stagnant. Gobies may use the edges of dense patches of vegetation, where they escape predation if disturbed. Substrate preference is for sand, mud, gravel, and silt, particularly associated with submerged vegetation that is likely used for cover. Tidewater gobies prefer

sand, coarse sand, and sand/mud substrates for breeding (USFWS 2006). Although usually associated with lagoons, the tidewater goby has been documented in ponded fresh water habitats as far as 8 kilometers (5 miles) upstream from San Antoino lagoon in Santa Barbara County (USFWS 2000).

4.4.3.1 SURVEY RESULTS

Surveys for tidewater gobies were not conducted for this project due to the known status of the species in Arroyo Paredon Creek and at the mouth of Franklin Creek. Tidewater gobies have been observed at Arroyo Paredon Lagoon just downstream of the project area (CNDDB). Tidewater gobies are not known to occur within the project limits on Franklin Creek due to an absence of appropriate habitat, however they have been observed near the mouth of the creek approximately one half mile downstream within the Carpinteria Salt Marsh.

The build alternatives are not likely to adversely effect, but may affect and may result in incidental take of tidewater gobies in Arroyo Paredon Creek. Incidental take of tidewater gobies is not anticipated although it has the potential to occur. Incidental take could be a result of harassment, harm, or mortality of tidewater gobies during water diversion, demolition, construction, or relocation actions if they become necessary. Following the selection of the projects preferred alternative, formal consultation under Section 7 of the Endangered Species Act will be initiated with the USFWS as a result of potential incidental take of tidewater gobies and potential impacts to critical habitat with proposed work in and adjacent to Arroyo Paredon Creek.

All alternatives propose to extend the Route 101 bridge deck over Franklin Creek. The existing bridge deck will be extended either 22 feet (Alternative 1 and 3) or 40 feet (Alternative 2) to the north, and will extend 26 feet in the center to enclose the currently open area between the two bridge decks. No permanent structures would be placed in the channel. This work is not expected to affect the tidewater goby at Franklin Creek due to a lack of habitat within or adjacent to the project limits.

4.4.3.2 CRITICAL HABITAT

Within the BSA, Arroyo Paredon Creek is proposed critical habitat for federally endangered tidewater goby (USFWS 2011). The project would affect proposed critical habitat for tidewater goby where the state highway crosses Arroyo Paredon Creeks. Work at this location will require consultation with the U.S. Fish and Wildlife Service

4.4.3.3 AVOIDANCE AND MINIMIZATION EFFORTS

The following avoidance and minimization measures will be incorporated into each build alternative:

- All work activities within and adjacent to Arroyo Paredon Creek and Franklin Creek shall be completed outside of the primary breeding season to reduce the potential harassment and mortality of tidewater gobies. The window of work for construction within or adjacent to Arroyo Paredon Creek and Franklin Creek would be during the low flow period between June 1st and October 31st.

- Pre-construction educational meetings discussing the tidewater goby will be required for construction personnel prior to work in Arroyo Paredon Creek and Franklin Creek.

- Only qualified personnel authorized under a biological opinion shall participate in activities associated with the capture, handling, and relocation of tidewater gobies. The names and credentials of personnel who desire to conduct these activities shall be supplied to the USFWS for their review and approval at least 15 day prior to the onset to these activities.

- If water is to be pumped from work sites, pump intakes shall be completely screened with wire mesh not larger than five millimeters (mm) or smaller to adequately prevent tidewater gobies from entering the pump system.

- During de-watering efforts, if present, as many tidewater gobies as possible shall be removed prior to draining the site. After barriers are constructed, tidewater gobies shall be captured, transported in buckets, and released in the most appropriate habitat immediately adjacent to the de-watered area. If a beach seine is used, it shall be pulled to shore in a deliberate manner with care being taken to avoid rolling the lead line inward. The number of tidewater gobies shall be estimated prior to release. All debris and aquatic and emergent vegetation in the pumped area shall be carefully inspected for tidewater gobies and other vertebrates. As the work site is de-watered, remaining pools shall be inspected for tidewater gobies. As many individuals as possible shall be captured using dipnets and other appropriate tools and moved as described above. Handling time for tidewater gobies shall be minimized to the maximum extent practicable.

- Upon completion of construction activities each year, barriers to flow shall be

removed in a manner that will allow flow to resume with the least disturbance to the substrate.

- All disturbance to potential tidewater goby habitat including riparian vegetation and jurisdictional waters shall be minimized with the use of ESA (environmentally sensitive area) fencing and all soil exposed as a result of the project shall be revegetated using native hydroseeding or live planting methods.

- If the substrate of the stream is altered during work activities, it shall be graded or otherwise treated to pre-construction conditions or better after the work is completed.

4.4.3.4 PROJECT IMPACTS

All build alternatives will result in both temporary and permanent impacts to tidewater goby and proposed critical habitat at Arroyo Paredon Creek. Proposed bridgework at Arroyo Paredon Creek within the project limits is discussed in detail in Section *4.4.2.4 Southern Steelhead- Project Impacts.*

Temporary impacts could occur with the water diversion and dewatering. Individual fish will be captured and relocated as described above. While handling time for tidewater gobies would be minimized to the maximum extent practicable, incidental take may occur with these activities.

Permanent, beneficial impacts would include an expanded area of natural creek bed at Arroyo Paredon Creek, which could provide additional habitat for tidewater gobies at this location. The new bridge structure would also result in increased shading through this portion of the creek reach.

4.4.3.5 COMPENSATORY MITIGATION

Mitigation measures include the 3:1 ratio for replanting of riparian vegetation to be removed during construction in addition to the removal of an existing stand of giant reed (*Arrundo donax*), an invasive non-native plant, at Arroyo Paredon Creek.

4.4.3.6 CUMULATIVE IMPACTS

Cumulative effects include the effects of past, present, and reasonably foreseeable future State, tribal, local, or private actions that are reasonably certain to occur in the project area. Caltrans is unaware of any federal or non-federal actions that are reasonably certain to affect tidewater goby in Arroyo Paredon and Franklin Creek watersheds.

4.4.4 Western Pond Turtle

The Western pond turtle (*Actinemys marmorata pallida*) is a state species of special concern. The distribution of the southwestern pond turtle is from the vicinity of the Monterey Bay southward through the Coastal Ranges to Baja California, Mexico (Jennings et al 1992). Western pond turtles are mostly aquatic, requiring habitat with a perennial water source. They can be found in ponds, marshes, rivers, streams, and irrigation ditches that typically have a muddy or rocky bottom. Aquatic habitats favored by pond turtles are characterized by emergent and floating vegetation such as watercress, cattails, and water lilies in areas with some slack or slow moving water. Dense cover and basking sites are very important to the turtle's habitat (Stebbins 1985).

Western pond turtles require upland habitat near aquatic habitat for nesting and overwintering (Jennings and Hayes 1994). Although most turtles tend to construct their nests within 32-623 feet of the water, they have been known to travel as far as 1,312 feet or more. Southwestern pond turtle populations are declining throughout their range, mainly because of human disturbance. This disturbance includes habitat alteration and land conversion, collecting, disease, and the introduction of non-native predators. The effects of increased urbanization and flood control practices in Southern California have been especially damaging to the turtle's suitable habitat.

The closest known occurrence of southwestern pond turtle is approximately 5 miles NW of the project area in and along San Roque Creek in the Los Padres National Forest (CNDDB).

4.4.4.1 Survey Results

No western pond turtles were observed in the BSA. Potential aquatic habitat was observed at the outlet of Greenwell Creek and downstream of the BSA at Arroyo Paredon Creek. Adjacent uplands are fragmented by Highway 101, county roads, railroad tracks and urban development and do not provide suitable nesting and overwintering habitat.

Single non-native red-eared slider turtles (*Trachemys scripta elegans)* were observed in Arroyo Paredon Creek and Greenwell Creek during herpetofauna surveys. Red-eared slider turtles have been introduced throughout California, especially in populated areas, primarily as a result of the release of pets by owners. While the project would temporarily affect potential aquatic habitat, no potential habitat would be permanently lost. Southwestern pond turtles are unlikely to occur in these

locations during construction. The project is not expected to affect western pond turtles. Minimization or avoidance measures are not warranted for this species.

4.4.5 Two-Striped Garter Snake

The two-striped garter snake (*Thamnophis hammondii*) is designated as a state species of special concern. Two-striped garter snakes range from northern Monterey County south to Baja California. Two-striped garter snakes are associated with permanent or semi-permanent bodies of water in a variety of habitats from sea level to 2400 meters in elevation. The species is highly aquatic and is associated with streams and aquatic habitats bordered with dense vegetation that provide open areas for basking. The two-striped garter snake is currently gone from about 40% of its original range (Jennings and Hayes 1994).

The closest known occurrence to the project area is approximately 3.5 miles north of the BSA in Rattlesnake Creek in the Los Padres National Forest (CNDDB).

4.4.5.1 Survey Results

No garter snakes were observed in the BSA during herpetofauna surveys. Potential aquatic habitat was observed upstream of the BSA in Arroyo Paredon Creek. Two-striped garter snakes are unlikely to occur in the BSA or in modified creek reaches upstream and downstream due to a lack of dense vegetation and protected areas for basking. The project is not expected to affect two-striped garter snakes. Minimization or avoidance measures are not warranted for this project.

4.4.6 Monarch Butterfly

Monarch butterflies aggregate in California coastal woodlands between October and March. Monarchs typically aggregate in eucalyptus groves, Monterey cypress, Monterey pines, and coast live oaks. They first collect in smaller numbers in autumn, then in much larger aggregations when cold weather and storms begin. The large aggregations are typically in groves that offer wind protection, slightly warmer temperatures, and basking sites. Large aggregations are fairly predictable as monarchs typically use the same sites each year.

4.4.6.1 Survey Results

The CNDDB does not contain any records of monarch butterfly roosts in the BSA. Meade (1999) mapped autumnal, permanent and overwintering sites throughout Santa Barbara County, and identified two overwintering sites near the study area, one along

the north edge of a eucalyptus grove at Ortega Hill "between US 101, Sheffield Drive and Ortega Hill Road," and the second along a private driveway at 3177 Padaro Lane, outside the western boundary of the BSA. Surveys were conducted in areas of the BSA adjacent to these locations to determine if monarch butterflies were overwintering in trees within or immediately adjacent to the work area. On January 26, 2010, six monarch butterflies were observed flying in the study area at Ortega Hill. On February 2, 2010, five monarch butterflies were observed flying in the study area adjacent to Padaro Lane. No aggregations were observed at either location. Surveys were conducted in the morning when temperatures were cool and monarchs would be expected to aggregate. This project is not expected to affect monarch butterfly roosting sites. Minimization or avoidance measures are not warranted for this project.

4.4.7 Bats

Roosts are important habitat features for bats. Bats often select roost locations because they are within range of foraging areas. Bats must not expend more energy retrieving forage than they can get from that forage. Bats also select roost sites based on thermal characteristics, predation potential, noise and other disturbance levels, and light levels. Night roosts provide resting areas with suitable temperature mediation characteristics that bats require for proper digestion at potentially any time of year. Day roosts provide essential resting areas, sleeping areas, mating and socialization areas, and thermoregulation required during torpor and all other terrestrial activities. Maternity roosts offer the cover, thermoregulation, and safety required for birthing and raising young.

Day roosts and maternity roosts are often regarded as the most important to protect because they allow for reproduction that perpetuates colonies. Disturbing maternal roosts when young are present can cause the adults to abandon young and to abort fetuses. Day and maternity roosts may be limiting factors for many bat populations, influencing species' distribution.

The CNDDB does not contain any bat occurrences in the project vicinity. No day roosts are known in the BSA.

4.4.7.1 Survey Results

Bridge structures in the BSA were surveyed for roosting bats in June and July 2009

by Caltrans Associate Biologists, Jennifer Moonjian and Morgan Robertson. All structures were inspected for evidence of roosting bats and bat sign, such as urine stains and guano. No day roosts or maternity roosts were found. The structure at Romero Creek showed signs of limited use as a night roost, including some urine staining. No accumulations of guano were observed. Five individual bats (four big brown bats (*Eptesicus fuscus*) and one Mexican free tail bat (*Tadarida brasilliensis)* were observed using bridge girders as night roosts on June 16 and June 25, 2009.

Within the BSA, some of the larger oak trees that would be removed likely have hollow cavities that could provide roosting habitat for bats. Most oak trees are near the highway and are not expected to contain bats because they are close to the existing highway. Bats may prefer not to roost in such trees because of human activity underneath the trees. Bats are not known to roost on structures over highways or roads, but are known to often roost on structures that highways or roads go over (bridges over creeks, rivers, or other open spaces).

4.4.7.2 AVOIDANCE AND MINIMIZATION EFFORTS

Oak trees would be removed between September and February to avoid impacting bats during the critical maternity season and to ensure survival of first-year bats. Bats are not expected to be present in oak trees at this time because they typically use trees only in warm seasons. Trees do not typically have the thermal mass required for winter temperature mediation.

4.4.7.3 PROJECT IMPACTS

All alternatives would replace the bridge at Romero Creek. This would displace the night roost observed at this location.

4.4.7.4 COMPENSATORY MITIGATION

To replace the lost night roost habitat resulting from the Romero Bridge removals, the new bridge would incorporate bat-friendly features:

1. Minimized sandblasting: a final surface treatment under box-girder bridges often includes sandblasting. This smoothes the surfaces and, unfortunately, removes any surface irregularities and roughness that bats can grasp while roosting. If the bridge construction includes sandblasting or otherwise smoothing-out of external or internal surfaces under the bridges, all surfaces

should be left rough within a few inches of the insides of corners that are 90 degrees or less. This can be accomplished by placing a small board in the corners while sandblasting to block the treatment.

2. Construct grooves or ridges: small grooves or ridges could be built into each corner underneath the bridges. Bats often grasp the slightest irregularities, such as the small ridges of concrete resulting from seams between boards used in the concrete forms.

4.4.7.5 CUMULATIVE IMPACTS

Cumulative effects include the effects of past, present, and reasonably foreseeable future State, tribal, local, or private actions that are reasonably certain to occur in the project area. Caltrans is unaware of any federal or non-federal actions that are reasonably certain to affect bats in the vicinity. If a cumulative impact exists, then the proposed project would not contribute to it because the lost night roost would be replaced.

4.4.8 Light-footed Clapper Rail

The light-footed clapper rail (*Rallus longirostris levipes*) is a state and federally listed endangered species. The subspecies is resident in dense coastal marsh vegetation consisting of cordgrass and pickle weed in regions of southern California and northern Baja California (Zembal and Massey 1985). Loss and degradation of habitat threaten the continued existence of this bird. The amount of suitable habitat for light-footed clapper rail is about one-third of what was known to occur historically. A decline the subspecies population led to the endangered listing status by the CDFG Commission on 06/27/71 under the California Endangered Species Act of 1970. Species decline also prompted a federal listing of endangered under the Endangered Species Act of 1973, as amended effective 10/13/70.

4.4.8.1 SURVEY RESULTS

Annual surveys for nesting pairs of light-footed clapper-rail in Carpinteria Marsh have reported between one and five pairs annually since 1987 (Zembel et al. 2009). In 2003, a single unmated female was heard vocalizing with no answering call. In 2004, two adult male clapper rails were released in the hope that the female was still alive. Subsequent annual surveys for light-footed clapper-rail in Carpinteria Marsh have been negative (Zembel et al. 2009). At present, non-native predators in the marsh, particularly feral cats and red foxes, constitute a major threat to this population.

The specific habitat type required by this species (dense coastal marsh) does not occur within or immediately adjacent to the project limits. The project will avoid the Carpinteria Salt Marsh. There are no known records of this species nesting in the biological study area. No impacts to the species will result from the current proposed project alternatives. No further studies for this species are required.

4.4.9 Beldings Savannah Sparrow

Belding's Savannah sparrow (*Passerculus sanwichensis beldingi*) was placed on the state endangered species list in 1974 after the population was estimated to be less than 1500 individuals. Belding's Savannah sparrow is a non-migratory subspecies of sparrow endemic to coastal salt marshes from Santa Barbara south through San Diego County. Birds are ecologically associated with dense pickleweed (*Salicornia* sp.), and nest in pickleweed on and about the margins of tidal flats (CNDDB). Threats to this population include non-native predators such as dogs, feral cats, red foxes and raccoon, agricultural runoff, upstream flood control projects and habitat degradation.

4.4.9.1 Survey Results

In Santa Barbara County, populations of Belding's Savannah sparrows are found in the Goleta Slough and the Carpinteria Salt Marsh. In May 2006, fifty-three breeding territories were counted in the Carpinteria Salt Marsh (Zembel et al. 2006). The majority of birds were observed at three locations in the marsh: the small central basin west of Santa Monica Creek, the western third of the basin most along the north side and the west basin at the southern end of the dirt road. Sparrows were concentrated on the higher edges of the marsh.

The specific habitat required for this species (dense pickleweed in coastal marsh) does not occur within or immediately adjacent to the project limits. The project will avoid the Carpinteria Salt Marsh. There are no known records of this species nesting in the biological study area. No impacts to the species will result from the current proposed project alternatives. No further studies for this species are required.

4.4.10 Southwestern Willow Flycatcher

There are four or five recognized subspecies (races) of the willow flycatcher (*Empidonax traillii*). These subspecies are distinguished primarily by subtle differences in color and morphology (size and shape). The southwestern willow flycatcher is somewhat paler, and has slightly different wing and tail length ratios. Each of the four subspecies occupy distinct breeding ranges.The southwestern willow

flycatcher (*E.t. extimus*) breeding range includes southern California (from the Santa Ynez River south), Arizona, New Mexico, extreme southern portions of Nevada and Utah, extreme southwest Colorado, and western Texas. Records of probable breeding southwestern willow flycatchers in Mexico are rare, and restricted to extreme northern Baja California and Sonora.

The southwestern willow flycatcher breeds in dense riparian habitats along rivers, streams, or other wetlands. The vegetation can be dominated by dense growths of willows (*Salix* sp.), seepwillow (*Baccharis salicifolia*), or other shrubs and medium-sized trees. There may be an overstory of cottonwood (*Populus* sp.), tamarisk (*Tamarix* sp.), or other large trees, but this is not always the case. In some areas, the flycatcher will nest in habitats dominated by tamarisk and Russian olive (*Eleagnus angustifolia*). One of the most important characteristics of the habitat is the presence of dense vegetation, usually throughout all vegetation layers present (USFWS 2005).

The southwestern willow flycatcher population has declined during the last 100 years, primarily due to the loss, fragmentation, and modification of riparian habitats. In 1993, the U.S. Fish and Wildlife Service formally proposed to list the flycatcher as a federal endangered species, and to designate critical habitat on 07/23/93. In a 1995 ruling, the Service found that the flycatcher population was currently very low and faced a significant threat of extinction unless protected. Therefore, the flycatcher was listed as endangered on 02/27/95, but designation of critical habitat was postponed.

The nearest known location for the southwestern willow flycatcher is approximately 8 miles to the north of the project area, north-east of Gibraltar reservoir and upper Santa Ynez in the Los Padres National Forest, reported in 1991 (CNDDB).

4.4.10.1 SURVEY RESULTS

The specific habitat types required for this subspecies do not occur within or adjacent to the project limits. There are no known records of this subspecies nesting in the biological study area. No impacts to the species will result from the proposed project alternatives. No further studies for this subspecies are required.

4.4.11 Least Bell's Vireo

The least Bell's vireo (*Vireo belli pusillus*) is a small, olive-gray migratory songbird that nests and forages almost exclusively in riparian woodland habitats. Least Bell's vireo nesting habitat typically consist of well-developed riparian overstories and understories, and low densities of aquatic and herbaceous cover. The understory

frequently contains dense subshrub and shrub thickets.

Due to population declines the species was listed as endangered by the CDFG Commission on 05/27/80 under the California Endangered Species Act of 1970. Species decline also prompted a federal listing of endangered under the Endangered Species Act of 1973, as amended effective 05/02/86. Critical habitat for this species was designated on 02/02/94 (USFWS 1994).

The nearest known location for least Bell's vireo is approximately six miles to the north of the project area on the Santa Ynez River at Juncal Campground, reported in 1980 (CNDDB).

4.4.11.1 SURVEY RESULTS

The specific habitat types required for this subspecies do not occur within or adjacent to the project limits. There are no known records of this subspecies nesting in the biological study area. No impacts to the species will result from the proposed project alternatives. No further studies for this subspecies are required.

4.4.12 California Least Tern

The California least tern (*Sterna antillarum browni)* is the smallest of the North American terns, distinguished by its long, narrow wings and a broad, forked tail. Its current breeding range runs from south of the San Francisco Bay Area to Baja California (USFWS 2006). The least tern feeds primarily in shallow estuaries or near-shore marine waters where small fish are abundant. Adults typically nest in small colonies at undisturbed sites on open, sandy beaches near feeding areas in estuaries. Historically least terns nested along beaches in colonies of varying size and density, but today nest sites are restricted to defined locations most of which persist due to active management. Management actions focus on limiting disturbance and controlling predators since predators can quickly decimate breeding colonies (USFWS 2009). A decline of the subspecies population led to the endangered listing status by the CDFG Commission on 06/27/71 under the California Endangered Species Act of 1970. Species decline also prompted a federal listing of endangered under the Endangered Species Act of 1973, as amended effective 10/13/70.

4.4.12.1 SURVEY RESULTS

California least tern nest on sandy beaches, which will be not affected by the proposed project. The specific habitat types required for this species do not occur within or adjacent to the project limits. There are no known records of this species

nesting in the biological study area. No impacts to the species will result from the current proposed project alternatives. No further studies for this species are required. The project will have no effect on California least tern critical habitat.

4.4.13 Western Snowy Plover

The western snowy plover (*Charadrius alexandrinus nivosus*) is a small shore bird distinguished from other plovers (family Charadriidae) by its small size, pale brown upper parts, dark patches on either side of the upper breast, and dark gray to blackish legs. The Pacific coast population of the western snowy plover is defined as those individuals that nest beside or near tidal waters, and includes all nesting colonies on the mainland coast, peninsulas, offshore islands, adjacent bays and estuaries from southern Washington to southern Baja California, Mexico. Habitats used by this subspecies include sandy beaches, salt pans, coastal dredged spoils sites, dry salt pond levees and gravel bars. The Pacific coast population of the western snowy plover breeds primarily on coastal beaches from southern Washington to southern Baja California, Mexico (USFWS 1999). Due to declines in the species population the species was listed as federally threatened under the Endangered Species Act of 1973, as amended effective 03/05/93. Critical habitat for this species was designated on 12/07/99.

4.4.13.1 SURVEY RESULTS

Snowy plovers live on sandy beaches or alkaline lakes, neither of which will be affected by the proposed project. The specific habitat types required for this species do not occur within or adjacent to the project limits. There are no known records of this species nesting in the biological study area. No impacts to the species will result from the current proposed project alternatives. No further studies for this species are required. The project will have no effect to western snowy plover critical habitat.

Chapter 5. Permits and Technical Studies for Special Laws or Conditions

This chapter describes state and federal endangered species act consultation, state and federal permit requirements and noxious/invasive weeds associated with the construction of the project.

5.1. Federal Endangered Species Act Consultation Summary

Two Biological Opinions will be required, one from the U.S. Fish and Wildlife Service and one from NOAA's National Marine Fisheries Service.

U.S. Fish and Wildlife Service

A special-status species list for the project area was requested from the USFWS on April 29, 2010. The list was received on May 21, 2010. A copy of the list is included in Appendix A. Section 2.3 of this document summarizes informal consultation to date. Protocol-level surveys for California red-legged frogs were negative. Formal Section 7 Consultation with USFWS will be required for the tidewater goby.

NOAA's National Marine Fisheries Service

In response to Caltrans Notice of Preparation for the project (dated May 12, 2009), NOAA National Marine Fisheries replied by letter (dated May 29, 2009). The letter identifies jurisdictional species and critical habitat in the project area, information needs, and assigns a NOAA representative to the project. Because NOAA categorized the project as "complex," the agency recommended that Caltrans conduct early consultation with NOAA staff in the region. Section 2.3 of this document summarizes informal consultation to date. Formal Section 7 Consultation NOAA will be required for steelhead trout and critical habitat.

5.2. California Endangered Species Act Consultation

The project alternatives as proposed will have no effect and are not likely to jeopardize the continued existence of any State listed threatened or endangered species. No consultation is required under the California Endangered Species Act because no state-listed species would be affected.

5.3. Permit Requirements

Caltrans will obtain a permit pursuant to Section 404 of the Clean Water Act, from the Army Corps of Engineers for the discharge of fill material into waters of the US. Additionally, pursuant to Section 401 of the CWA, Caltrans will obtain State certification from the Regional Water Quality Control Board for these discharges.

Caltrans will obtain a Streambed Alteration Agreement pursuant to Section 1602 of the California Fish and Game Code, from the California Department of Fish and Game for work to be completed in the following creeks: Franklin, Santa Monica, Arroyo Paredon, Toro Canyon, Greenwell, Romero, San Ysidro and Oak creeks.

The project is located within the coastal zone and will require coastal development permits from the City of Carpinteria, the City of Santa Barbara and the County of Santa Barbara prior to construction. Caltrans will consult with Santa Barbara County, the City of Carpinteria, and the City of Santa Barbara regarding the proposed work that would impact coastal wetlands and other environmentally sensitive habitat areas occurring within the project limits.

5.4. Migratory Bird Treaty Act

Migratory birds are protected according to provisions of the federal Migratory Bird Treaty Act. The Migratory Bird Treaty Act and California Fish and Game Code prohibit taking occupied nests. No raptor nests were observed in the BSA during surveys conducted in January and February 2010. To avoid impacts to nesting birds, tree removal would occur between September 1 and February 15, outside the breeding season for migratory birds. If tree removal is required during the nesting season, before any trees are removed, a qualified biologist will need to conduct a focused survey for active bird nests in the trees to be removed. If any active migratory bird nests are found, Caltrans will coordinate with DFG to determine an appropriate buffer based on the habits and needs of the species. Caltrans' Standard Specifications for Bird Protection will be included with the project's Plans and Specifications.

Swallows were observed nesting under some bridges within the BSA. Activities that result in the harassment or harm of nesting swallows violate the Migratory Bird Treaty Act. Non-standard Specifications for nesting swallows will be included with the project's Plans and Specifications.

Options for avoiding and minimizing impacts to swallows include the following:

- Work outside the swallows nesting season (March to August).

- If construction activities will occur on these structures during the swallow nesting season, a qualified biologist would need to inspect all nests to ensure that no birds are using them. If the nests are abandoned, the contractor can remove the nests before March 1 and either prohibit birds from accessing the structure using netting, or actively discourage nesting.

5.5. Invasive Species

On February 3, 1999, President Bill Clinton signed Executive Order 13112 requiring federal agencies to combat the introduction or spread of invasive species in the United States. The order defines invasive species as "any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem, whose introduction does or is likely to cause economic or environmental harm or harm to human health." Federal Highway Administration guidance issued August 10, 1999 directs the use of the state's noxious weed list to define the invasive plants that must be considered as part of the National Environmental Policy Act analysis for a proposed project.

The following plants found in the BSA occur on the California Invasive Plant Council's Invasive Plant Inventory:

- Arrundo *(Arundo donax)*
- Bermuda butter cup *(Oxalis pes-capre)*
- Common brass buttons *(Cotula coronopifolia)*
- Bristly ox-tongue *(Picris echioides)*
- Bur clover *(Medicago polymorpha)*
- Cape Ivy *(Senecio mikanioides),*
- Castor bean *(Ricinus communis)*
- Fennel *(Foeniculum vulgare)*
- French Broom *(Genista monspessulana),*
- Garden Nasturtium *(Tropaeolum majus)*
- Ice Plant *(Carpobrotus edulis)*
- Italian ryegrass *(Lolium multiflorum)*
- Italian thistle *(Carduus pycnocephalus)*
- Myopurum *(Myopurum laetum)*
- Pampass Grass *(Cortaderia jubata*

- Plantain *(Plantago lanceolata)*
- Poison hemlock *(Conium maculatum)*
- Radish *(Raphanus sativus)*
- Red brome *(Bromus madritensis ssp. rubens)*
- Ripgut brome *(Bromus diandrus)*
- Soft chess *(Bromus hordeaceus)*
- Veldt Grass *(Ehrharta calicina),*
- Vinca *(Vinca major)*

Invasive plant species which have the greatest possibility of negatively affecting the natural ecology in the project area are: Veldt Grass *(Ehrharta calicina),* Giant Reed *(Arundo donax),* Ice Plant or Hottentot fig *(Carpobrotus eduli),* Pampass Grass *(Cortaderia jubata),* French Broom *(Genista monspessulana),* Myopurum *(Myopurum laetum),* Cape Ivy *(Senecio mikanioides),* and Garden Nasturtium *(Tropaeolum majus).*

To avoid and minimize the spread of invasive weeds, the invasive species removed during construction activity and would not be replanted as part of highway landscaping. Care shall be taken to avoid including any species that occurs on the California Invasive Plant Council's Invasive Plant Inventory in the Caltrans erosion control seed mix or landscaping plans for the project.

To prevent new invasive species from being imported to the site, Caltrans recommends that the construction contractor implement the following control measures:

1. All imported fill material used on the construction site shall be weed-free.

2. The California Department of Food and Agriculture maintains a current listing of noxious weeds. Only certified noxious weed free erosion control materials will be used. All straw and seed material shall be certified weed free by the County Agricultural Commissioner prior to being used at the project site.

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Appendix A U.S Fish and Wildlife Service Species List

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ventura Fish and Wildlife Office
2493 Portola Road, Suite B
Ventura, California 93003

IN REPLY REFER TO:
81440-2010-CPA-0280

May 21, 2010

Morgan Robertson
Associate Environmental Planner
California Department of Transportation
50 Higuera Street
San Luis Obispo, California 93401-5415

Subject: Species List for Highway 101 HOV Lane Project Between the Cities of Santa Barbara and Carpinteria, Santa Barbara County, California

Dear Mr. Robertson:

We are responding to your request, dated April 29, 2010, and received in our office on May 3, 2010, for a list of endangered, threatened, and other special status species that may occur in the vicinity of the subject project. The California Department of Transportation (CalTrans) is considering implementing a project to widen Highway 101 in between Sycamore Creek in the city of Santa Barbara and 0.44 mile south of Carpinteria Creek in the city of Carpinteria. The proposed project would add a high occupancy vehicle lane on both the northbound and southbound sides of the highway. The CalTrans is the designated non-Federal representative of the Federal Highway Administration in California.

The enclosed list of species fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act of 1973, as amended (Act). CalTrans, as the lead Federal agency for the project, has the responsibility to review its proposed activities and determine whether any listed species may be affected. If the project is a construction project which may require an environmental impact statement[1], CalTrans has the responsibility to prepare a biological assessment to make a determination of the effects of the action on the listed species or critical habitat. If CalTrans determines that a listed species or critical habitat is likely to be adversely affected, it should request, in writing through our office, formal consultation pursuant to section 7 of the Act. Informal consultation may be used to exchange information and resolve conflicts with respect to threatened or endangered species or their critical habitat prior to a written request for formal consultation. During this review

[1] Construction project" means any major Federal action which significantly affects the quality of the human environment designed primarily to result in the building of structures such as dams, buildings, roads, pipelines, and channels. This includes Federal actions such as permits, grants, licenses, or other forms of Federal authorizations or approval which may result in construction.

TAKE PRIDE IN AMERICA

process, CalTrans may engage in planning efforts but may not make any irreversible commitment of resources. Such a commitment could constitute a violation of section 7(d) of the Act.

The enclosed list includes only those species listed by the Service; however, other species protected by the State of California may occur in the project area. We recommend that you review information in the California Department of Fish and Game's Natural Diversity Data Base. You can contact the California Department of Fish and Game at (916) 324-3812 for information on other sensitive species that may occur in this area.

If you have any questions regarding this matter, please contact David Simmons of our staff at (805) 644-1766, extension 368.

Sincerely,



Chris Dellith
Senior Biologist

Enclosure

ENDANGERED AND THREATENED SPECIES THAT MAY OCCUR NEAR HIGHWAY 101 BETWEEN THE CITIES OF SANTA BARBARA AND CARPENTERIA, SANTA BARBARA COUNTY, CALIFORNIA

Birds		
Brown pelican	*Pelecanus occidentalis*	E
California least tern	*Sterna antillarum browni*	E
Least Bell's vireo	*Vireo bellii pusillus*	E, CH
Light-footed clapper rail	*Rallus longirostris levipes*	E
Southwestern willow flycatcher	*Empidonax traillii extimus*	E
Western snowy plover	*Charadrius alexandrinus nivosus*	T, CH
Amphibians		
California red-legged frog	*Rana draytonii*	T, CH
Fish		
Tidewater goby	*Eucyclogobius newberryi*	E, CH
Steelhead trout	*Oncorhynchus mykiss*	*
Plants		
Salt marsh bird's-beak	*Cordylanthus maritimus* ssp. *maritimus*	E
Gambel's watercress	*Rorippa gambellii*	E
Marsh sandwort	*Arenaria paludicola*	E
Contra Costa goldfields	*Lasthenia conjugens*	E
Ventura marsh milk-vetch	*Astragalus pycnostachyus lanosissimus*	E, CH

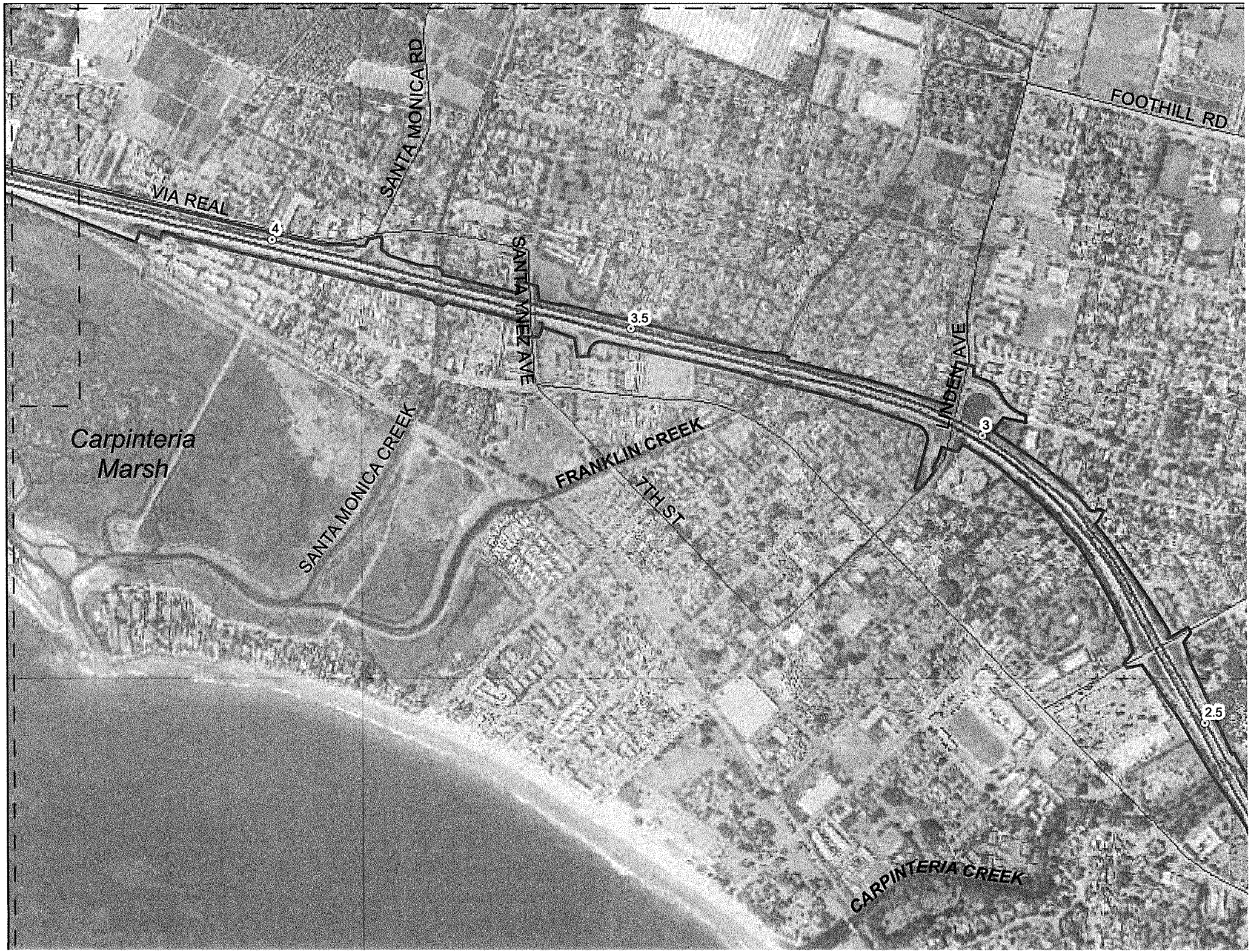
Key:

E Endangered
T Threatened
CH Critical habitat

* Species for which the National Marine Fisheries Service has responsibility. For more information, call the Santa Rosa Field Office at 707-575-6050 or go to http://swr.ucsd.edu/

Appendix B Project BSA Map

Appendix B Project BSA Map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2.5
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Marsh
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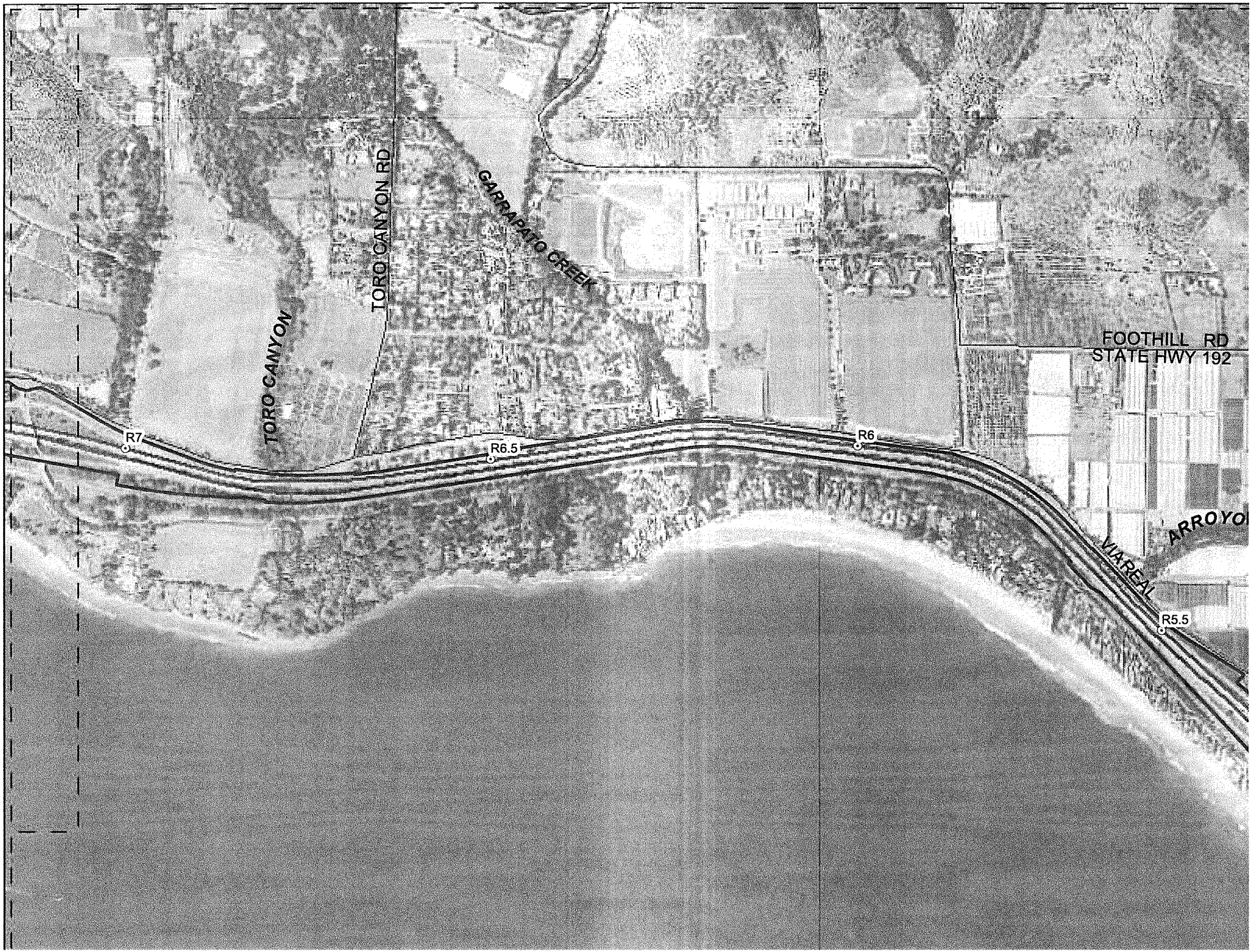
FRANKLIN CREEK
7TH ST
CARPINTERIA CREEK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R7
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R6
VIA REAL
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9
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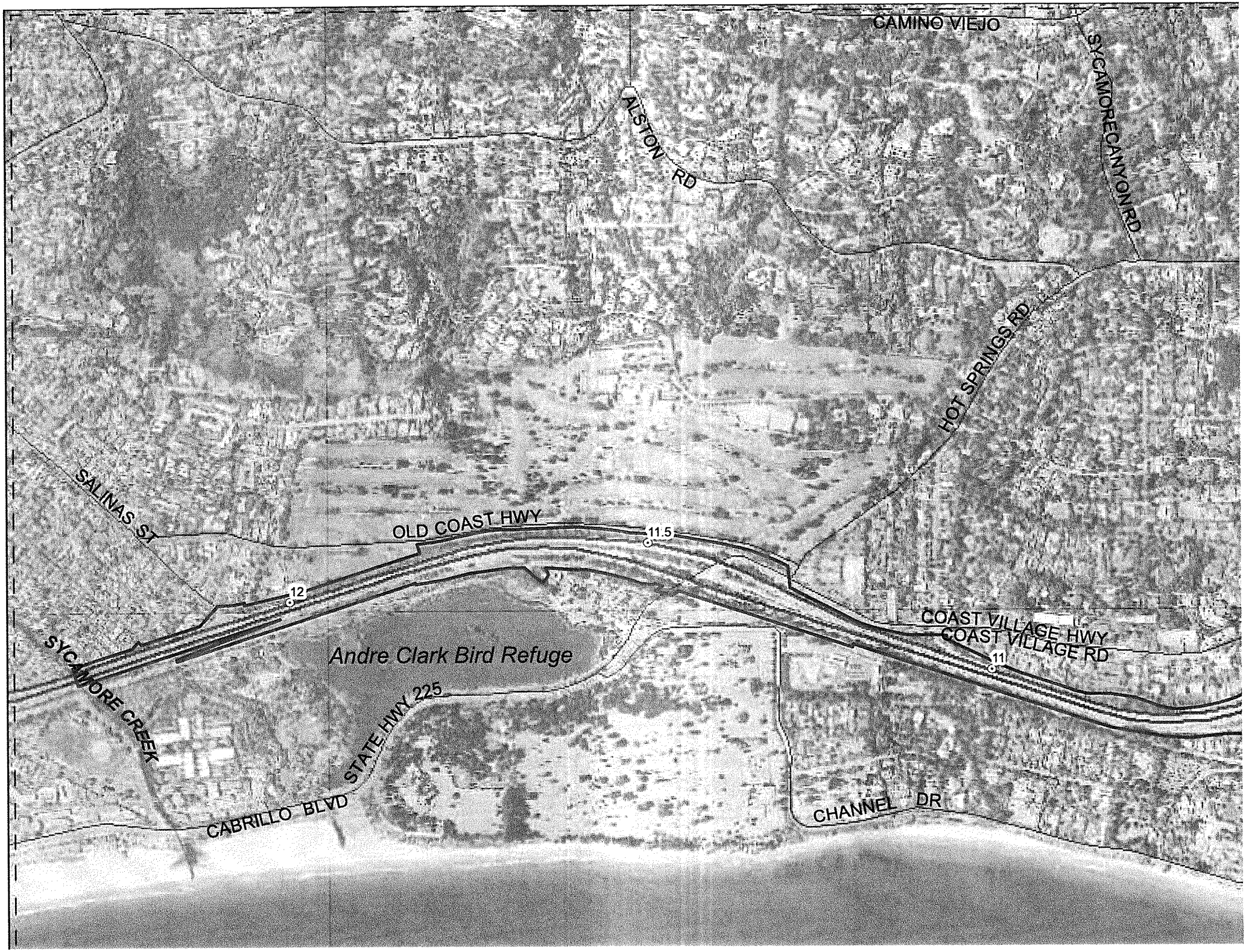
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ALSTON RD
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SALINAS ST
OLD COAST HWY
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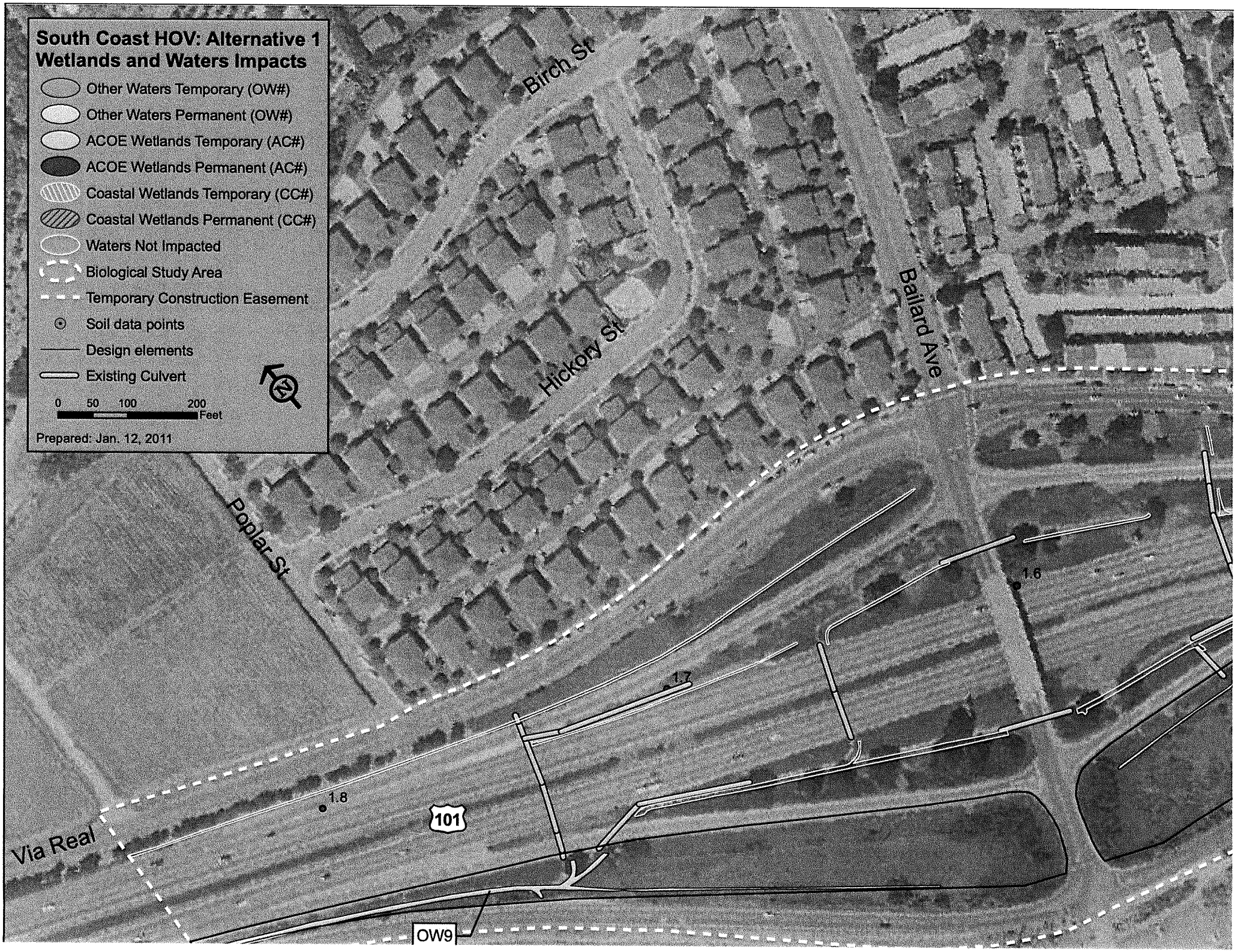
COAST VILLAGE HWY
COAST VILLAGE RD
11
Andre Clark Bird Refuge
SYCAMORE CREEK
STATE HWY 225
CABRILLO BLVD
CHANNEL DR

Appendix C Project Map Sheets

** See Attachment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Waters Not Impacted
Biological Study Area
Temporary Construction Easement
Soil data points
Design elements
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Feet
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Birch St
Hickory St
Ballard Ave
Poplar St
Via Real
101
1.6
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1.8
OW9


Carpinteria Creek Dr
Casitas Ln
Via Elsie
Via Ricardo
Bailard Ln
Via El Rincon
Oakwood Dr
Via Maria
Lemonwood Dr
Via Linda
Rogue Dr
OW12
OW12
2.4
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2.1


Star Pine Rd
Via Real
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Vallecito Rd


South Coast HOV: Alternative 1
Wetlands and Waters Impacts
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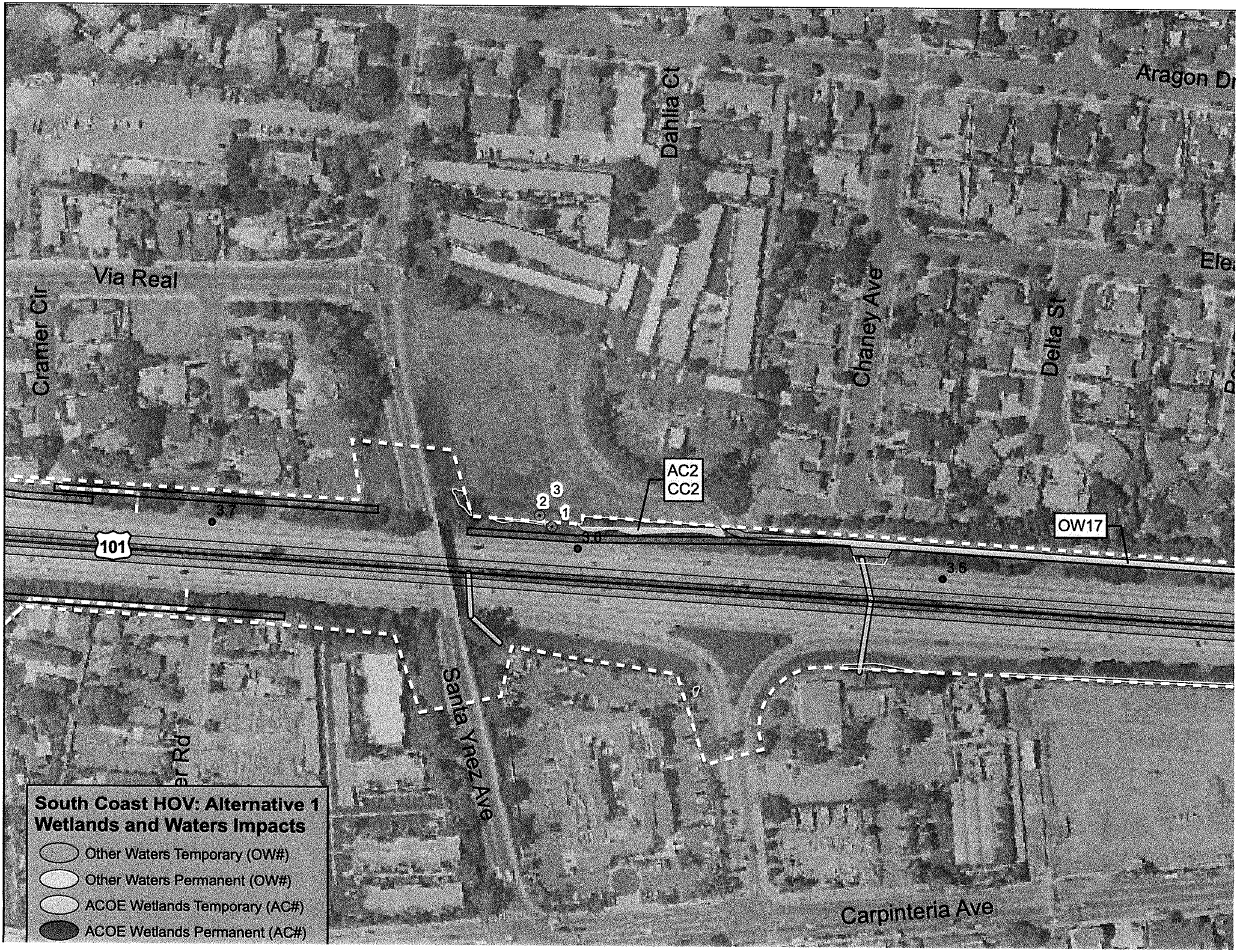
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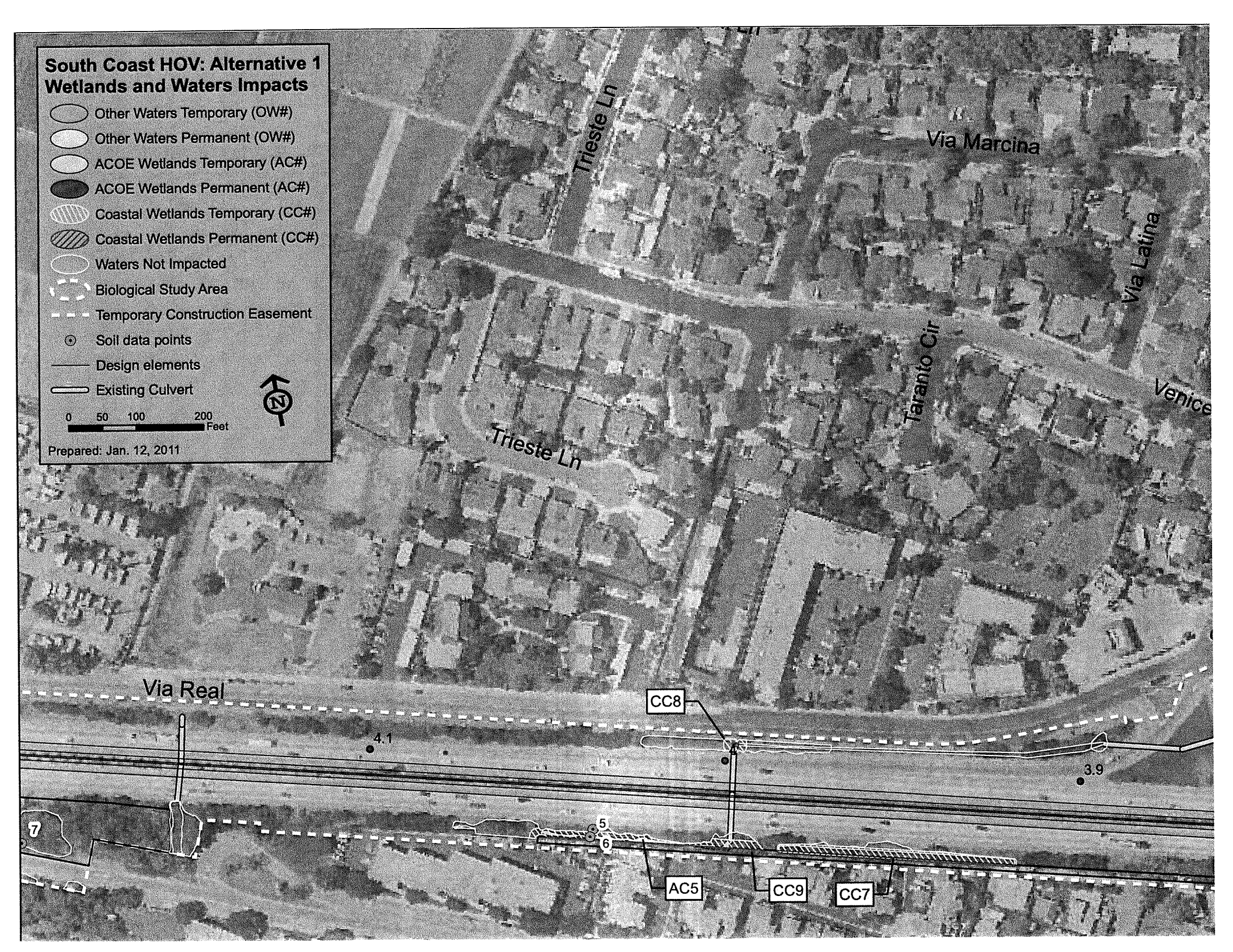
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Biological Study Area
Temporary Construction Easement
Soil data points
Design elements
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Via Marcina
Via Latina
Taranto Cir
Trieste Ln
Via Real
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4.1
3.9
7
5
6
AC5
CC9
CC7


Coast Dr
Sandpiper Dr
Bayside Dr
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Lemon Dr
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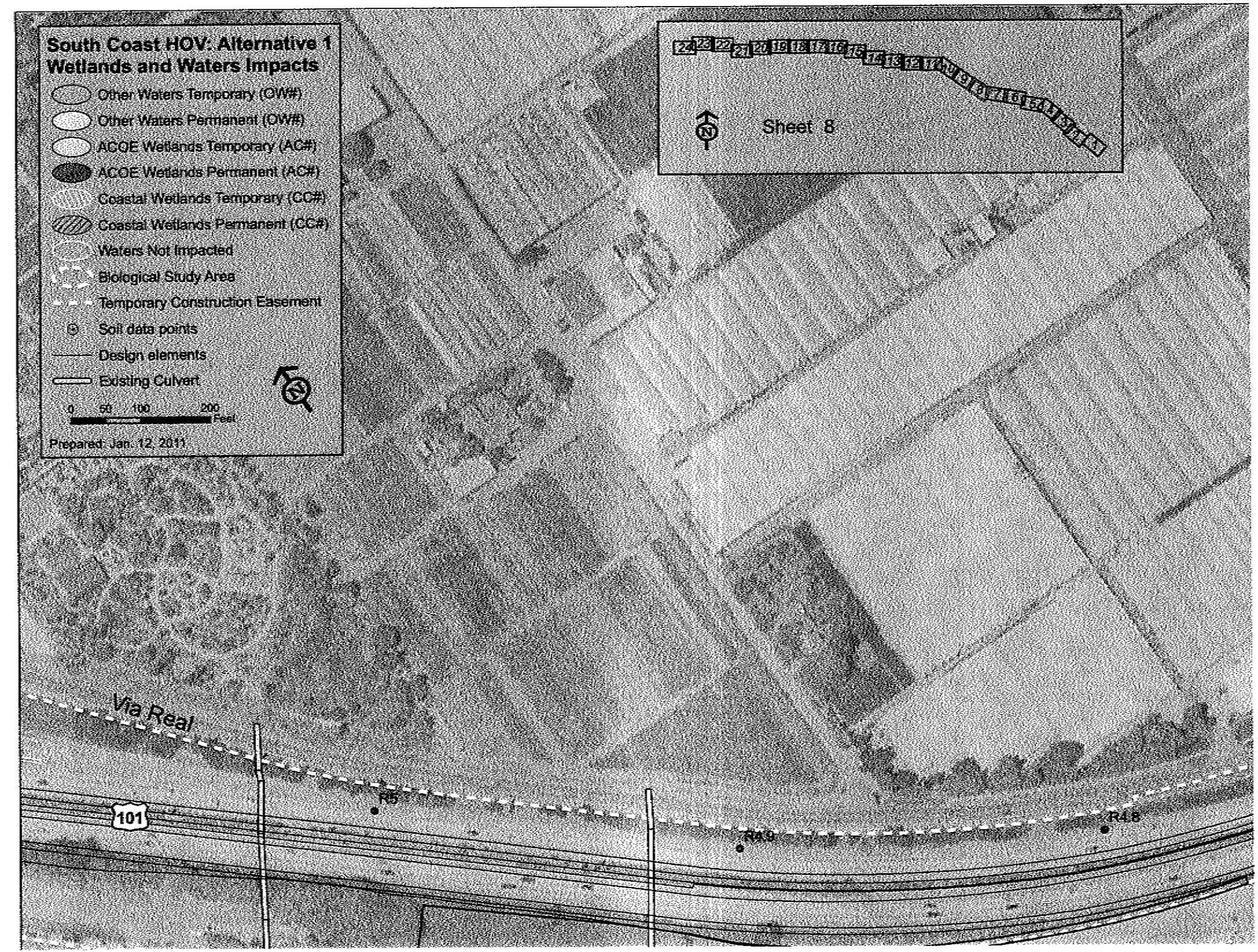
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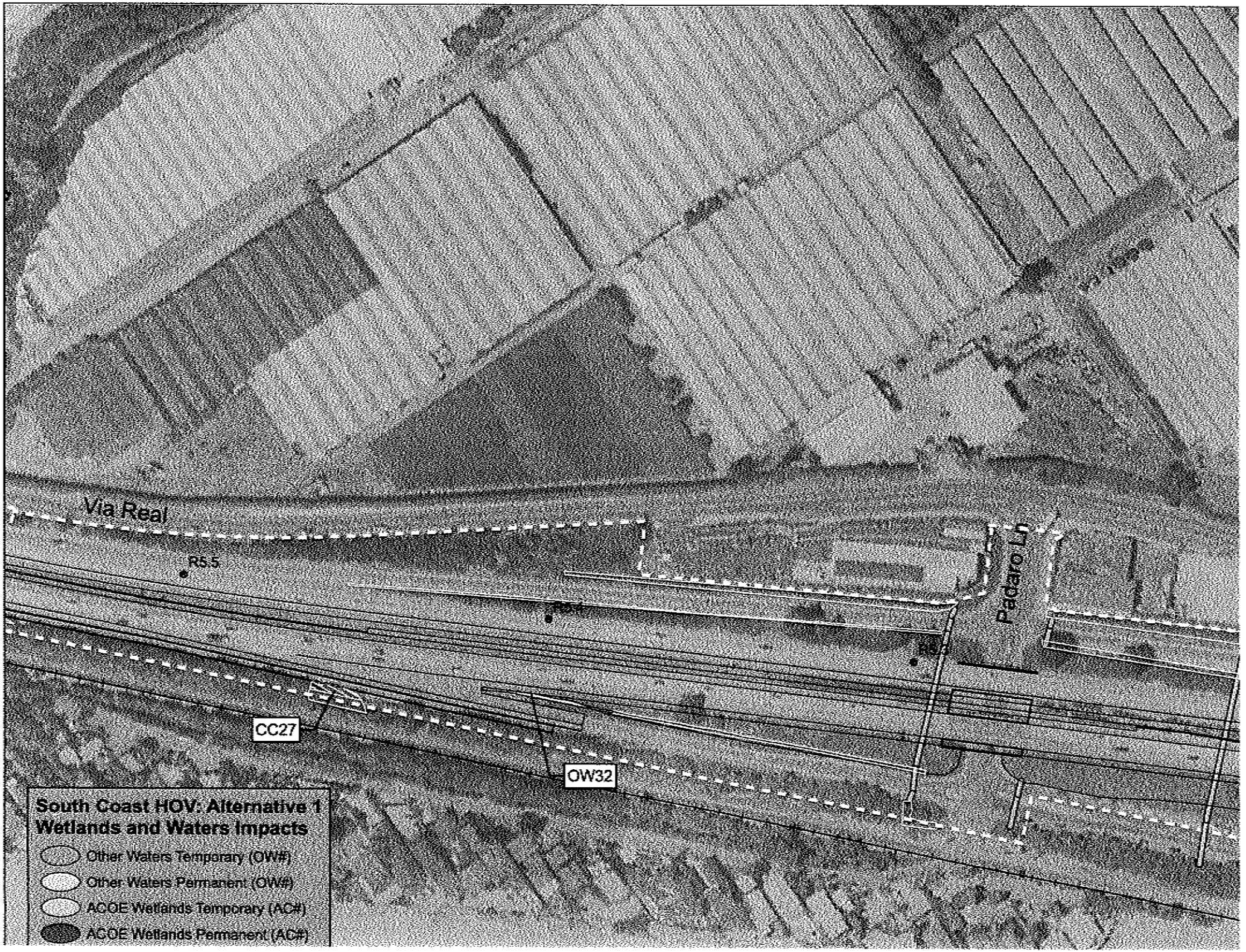
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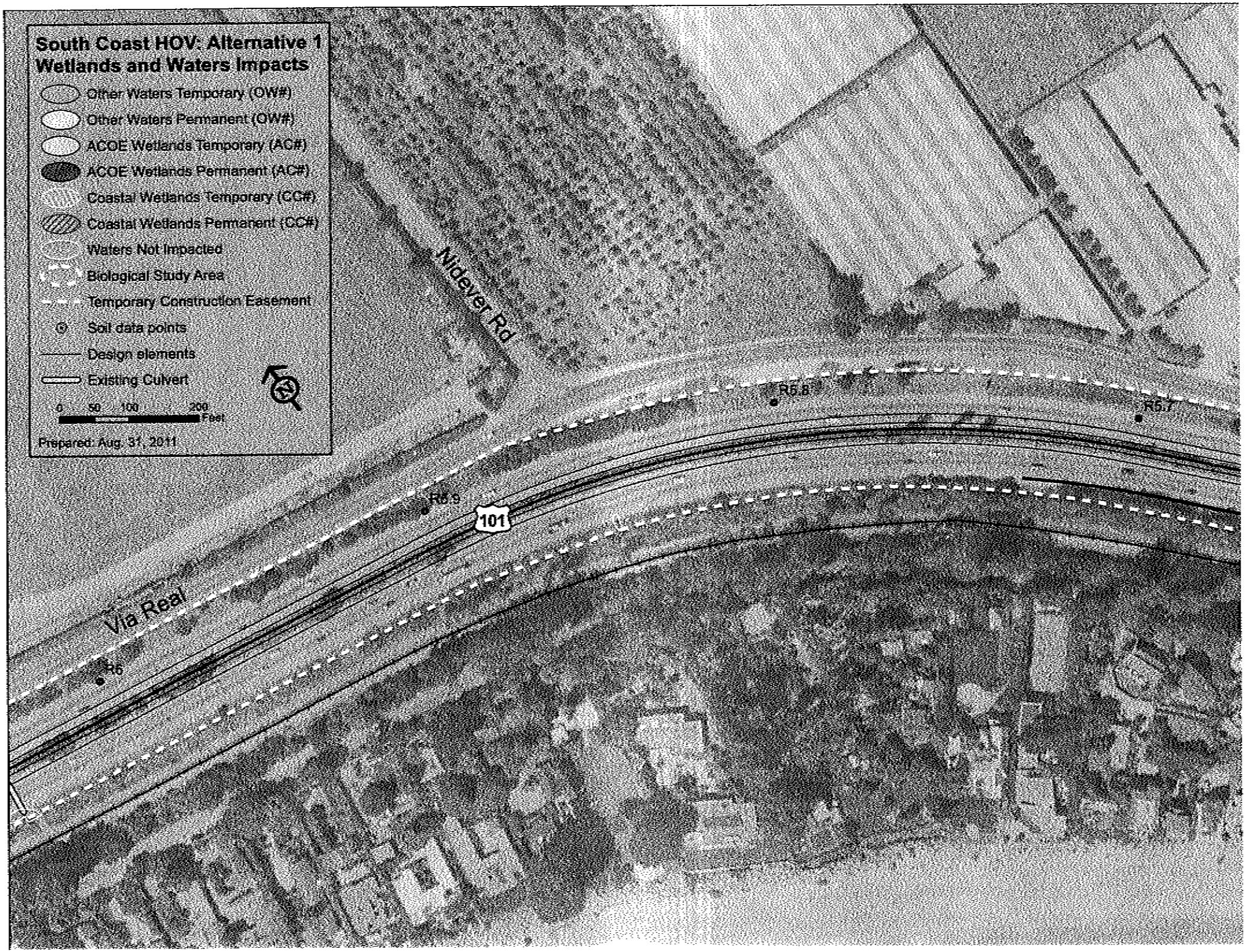
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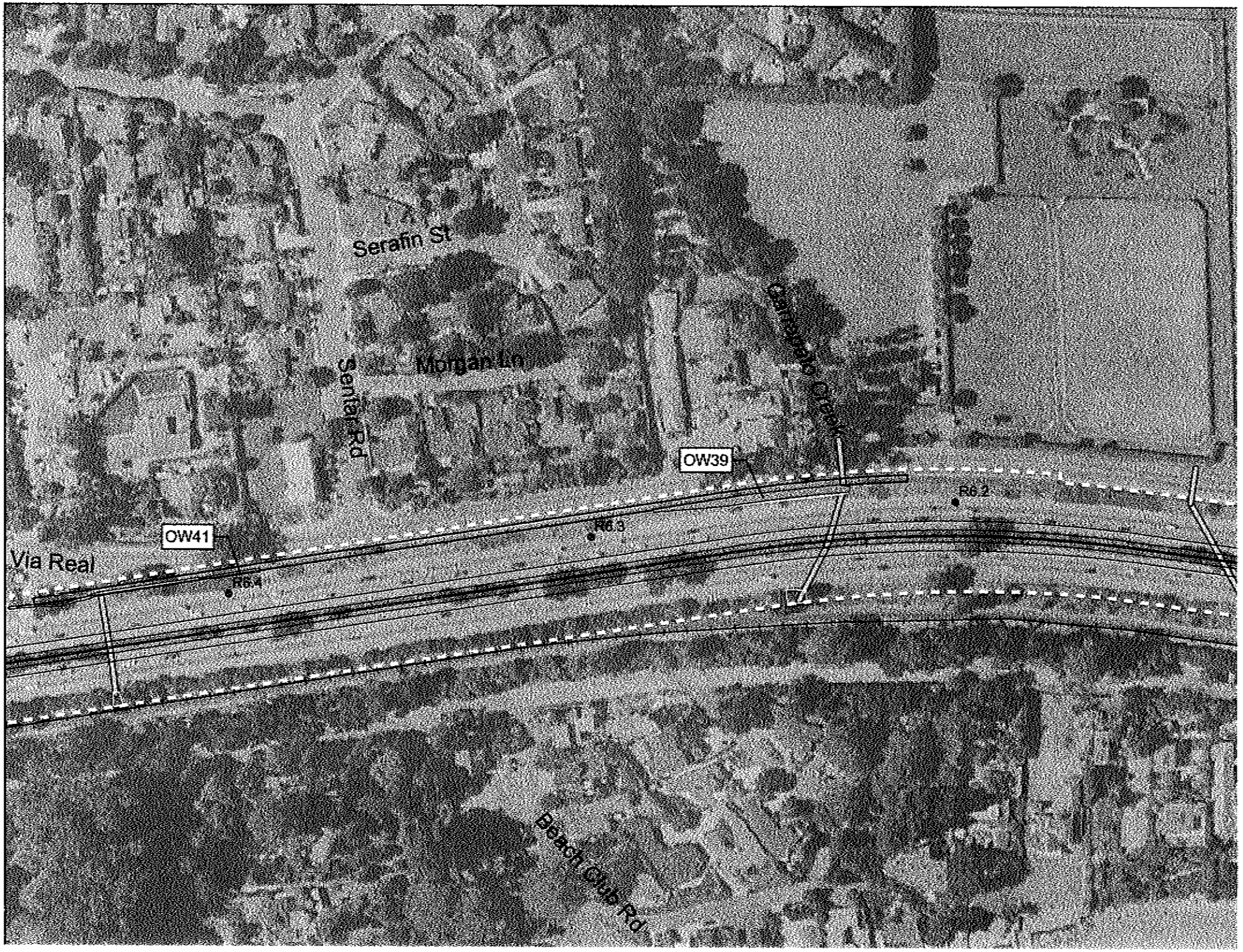
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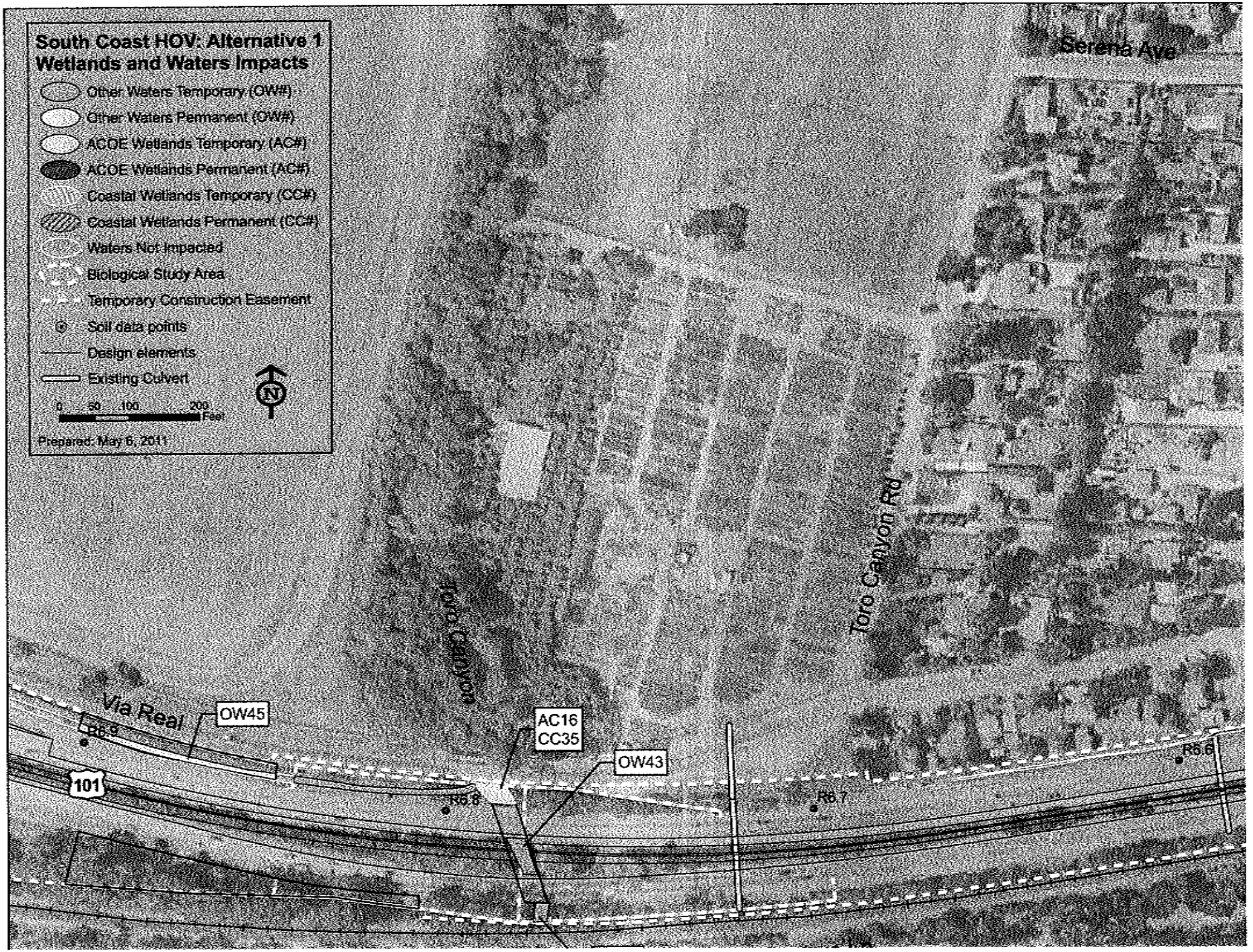
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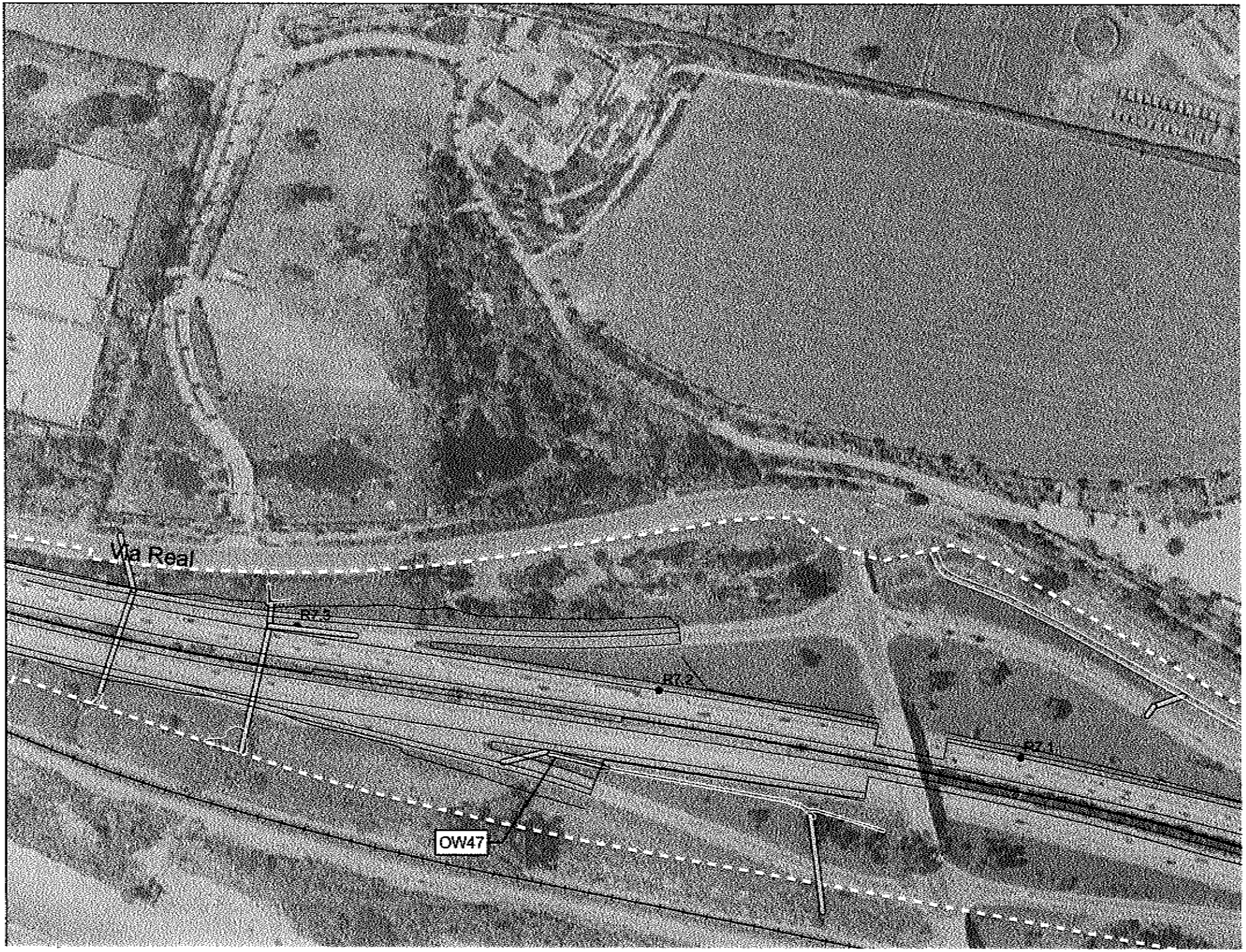
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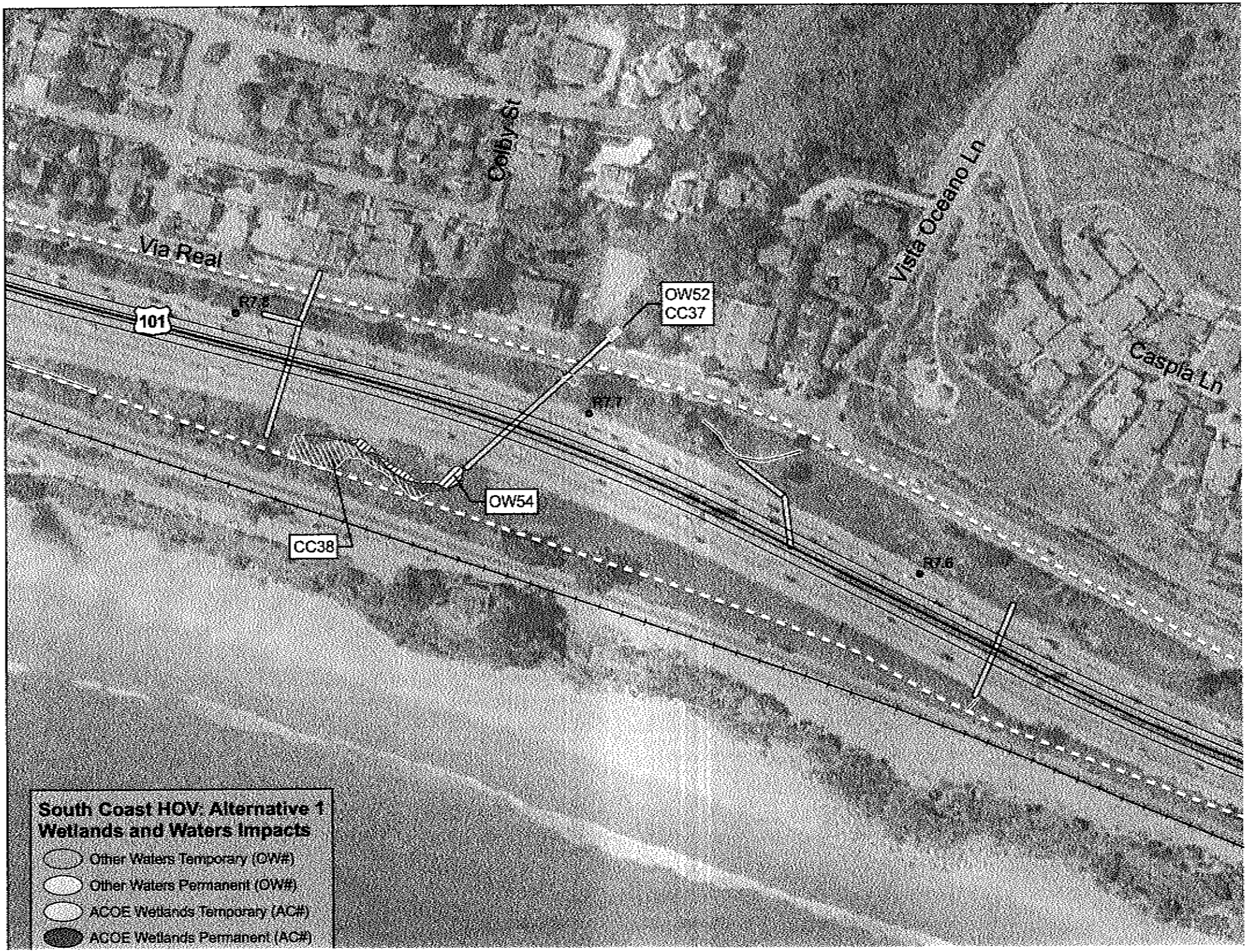
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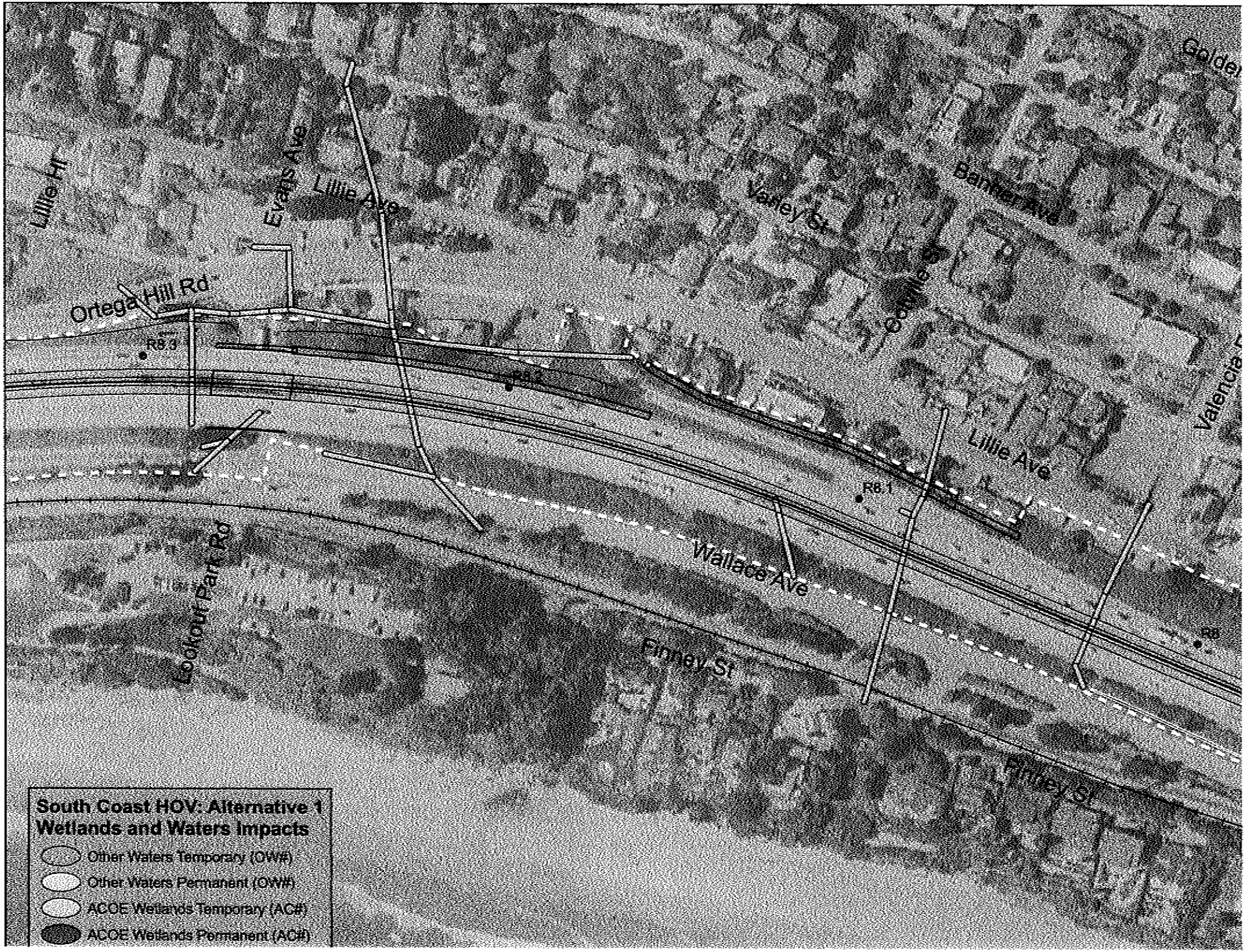
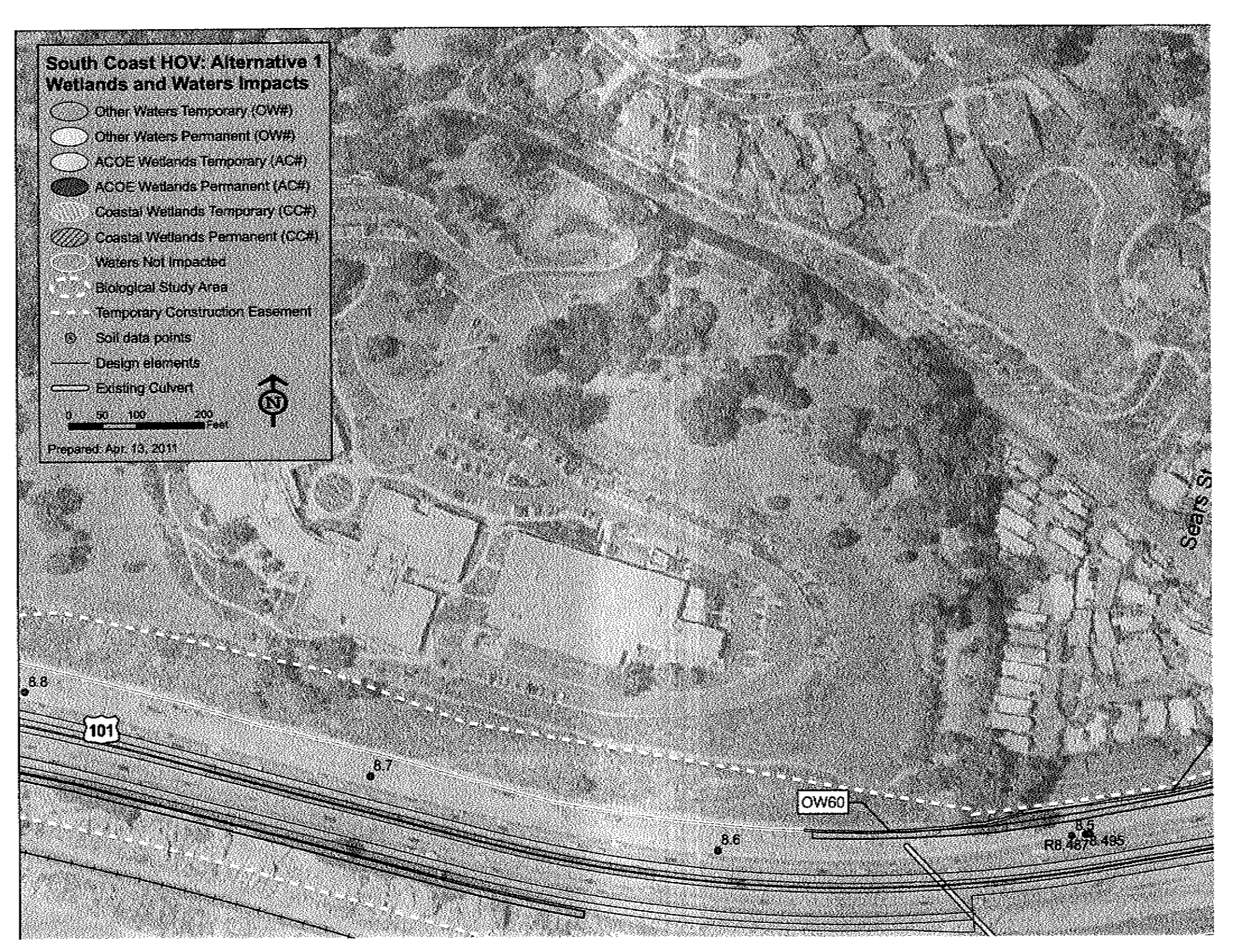
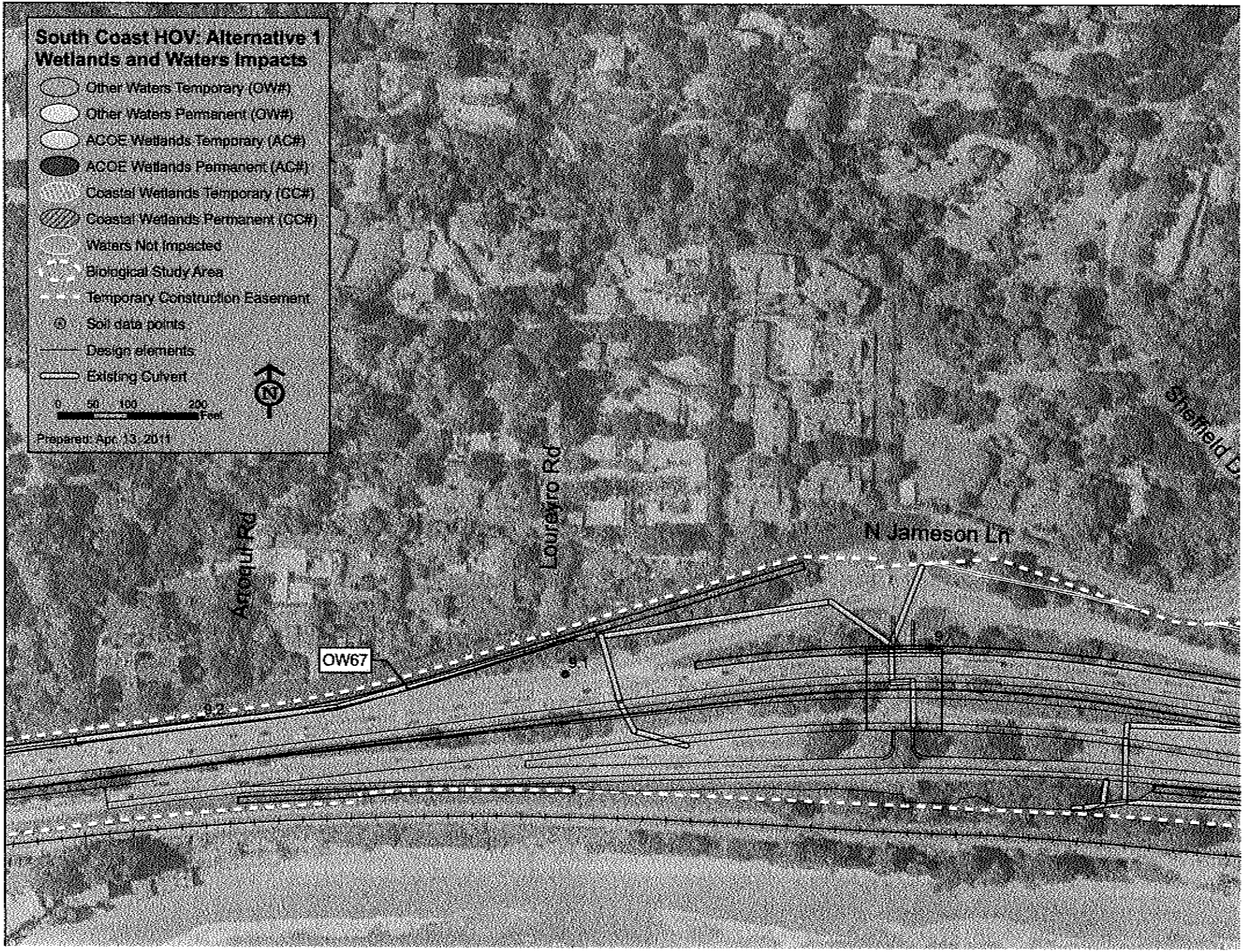
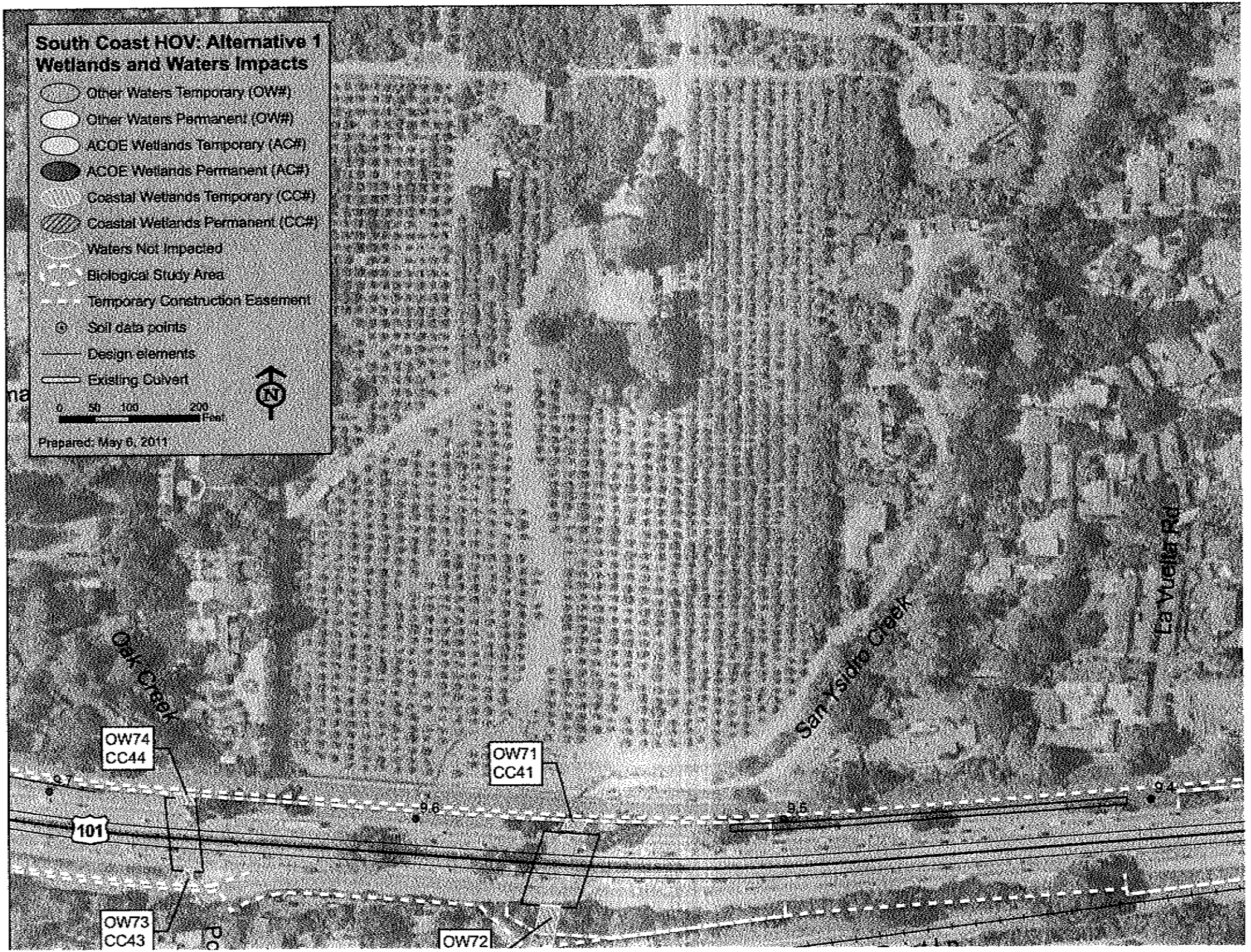
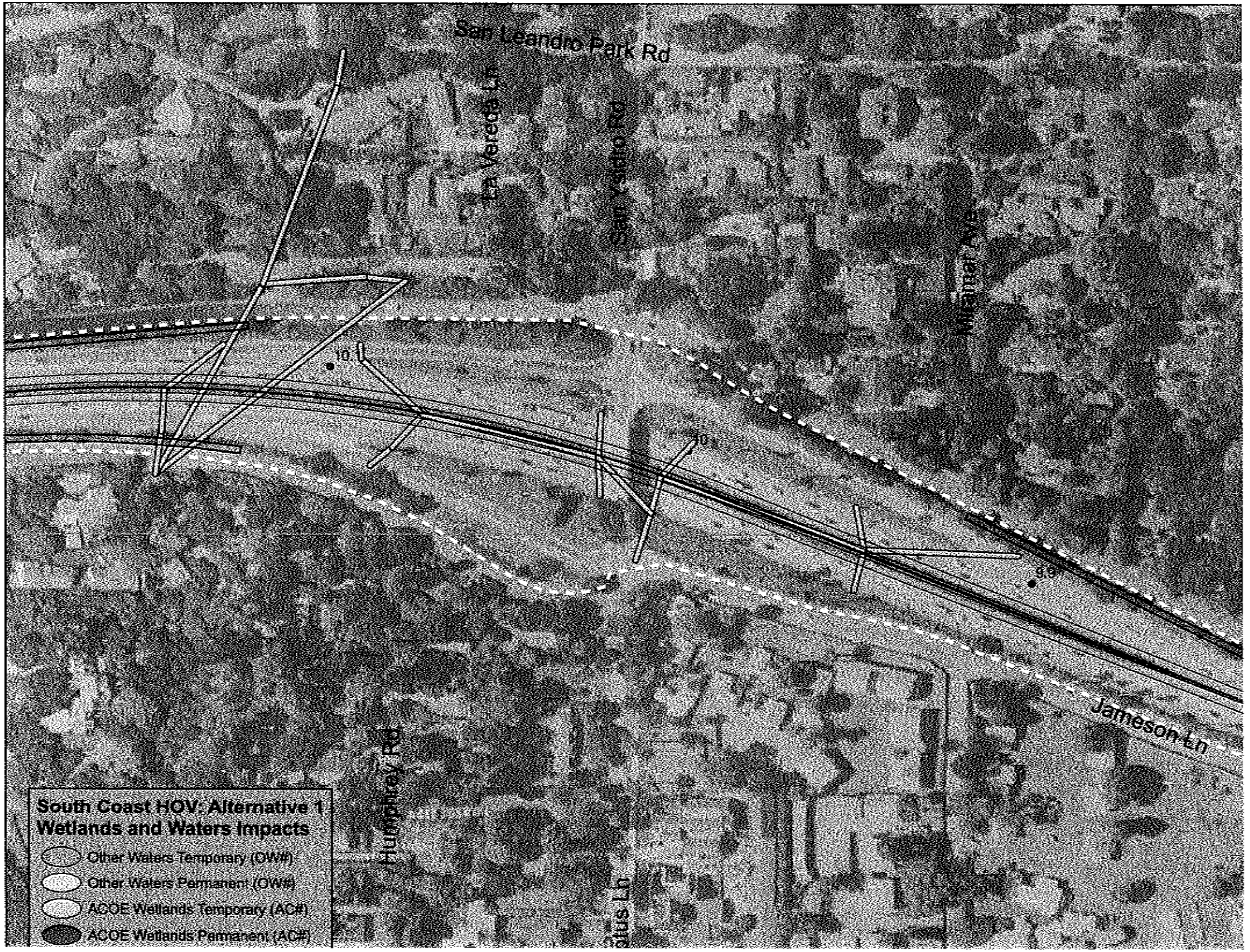
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)


Lillie Ht
Evans Ave
Lillie Ave
Valley St
Banner Ave
Ortega Hill Rd
R5.3
R5.2
R6.1
Lillie Ave
Wallace Ave
Lookout Park Rd
Finney St
R8
Finney St
South Coast HOV: Alternative 1
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)

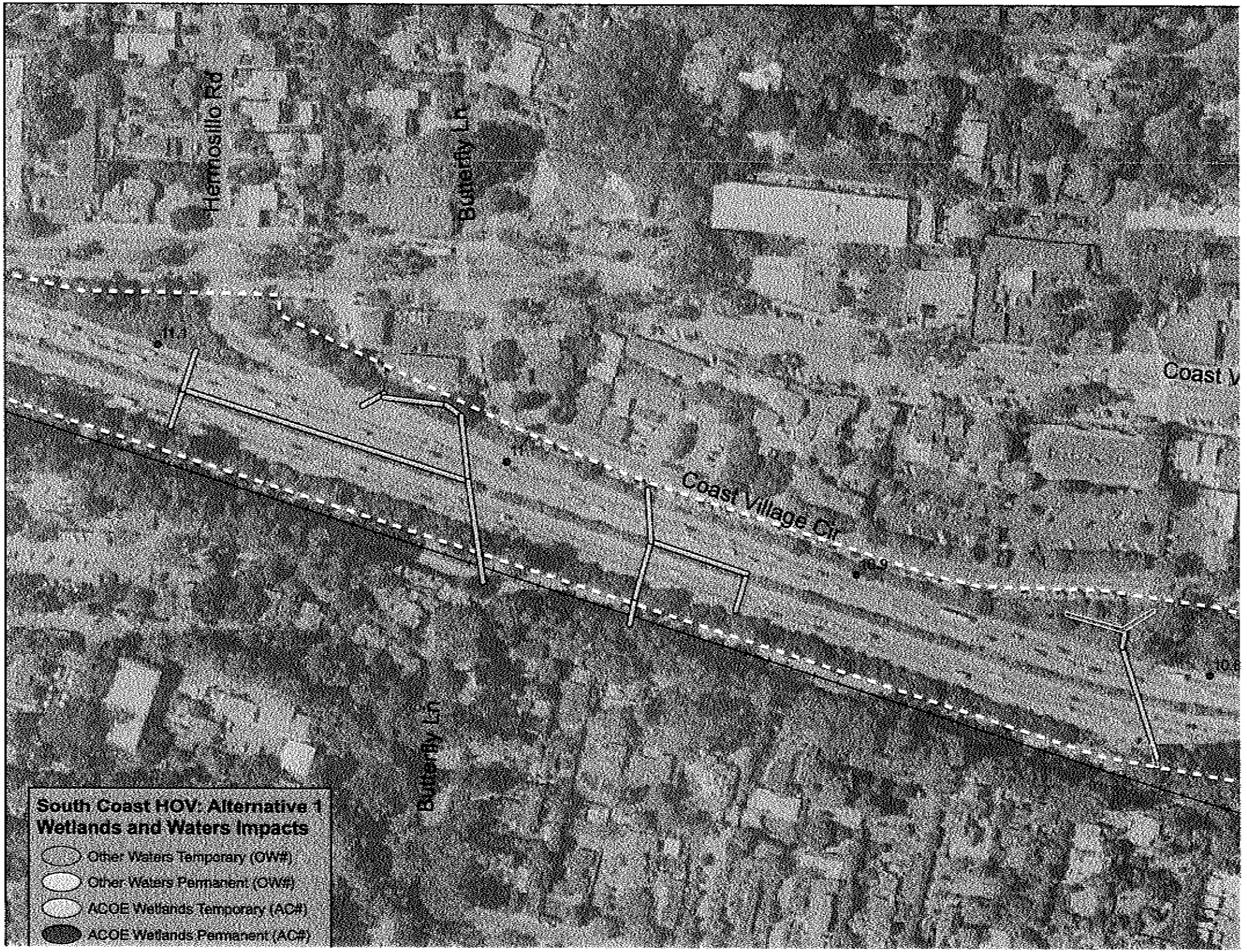

South Coast HOV: Alternative 1
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)
Coastal Wetlands Temporary (CC#)
Coastal Wetlands Permanent (CC#)
Waters Not Impacted
Biological Study Area
Temporary Construction Easement
Soil data points
Design elements
Existing Culvert
0 50 100 200 Feet
N
Prepared: Apr. 13, 2011
8.8
101
8.7
8.6
OW60
8.5
R8.467
8.485
Sears St

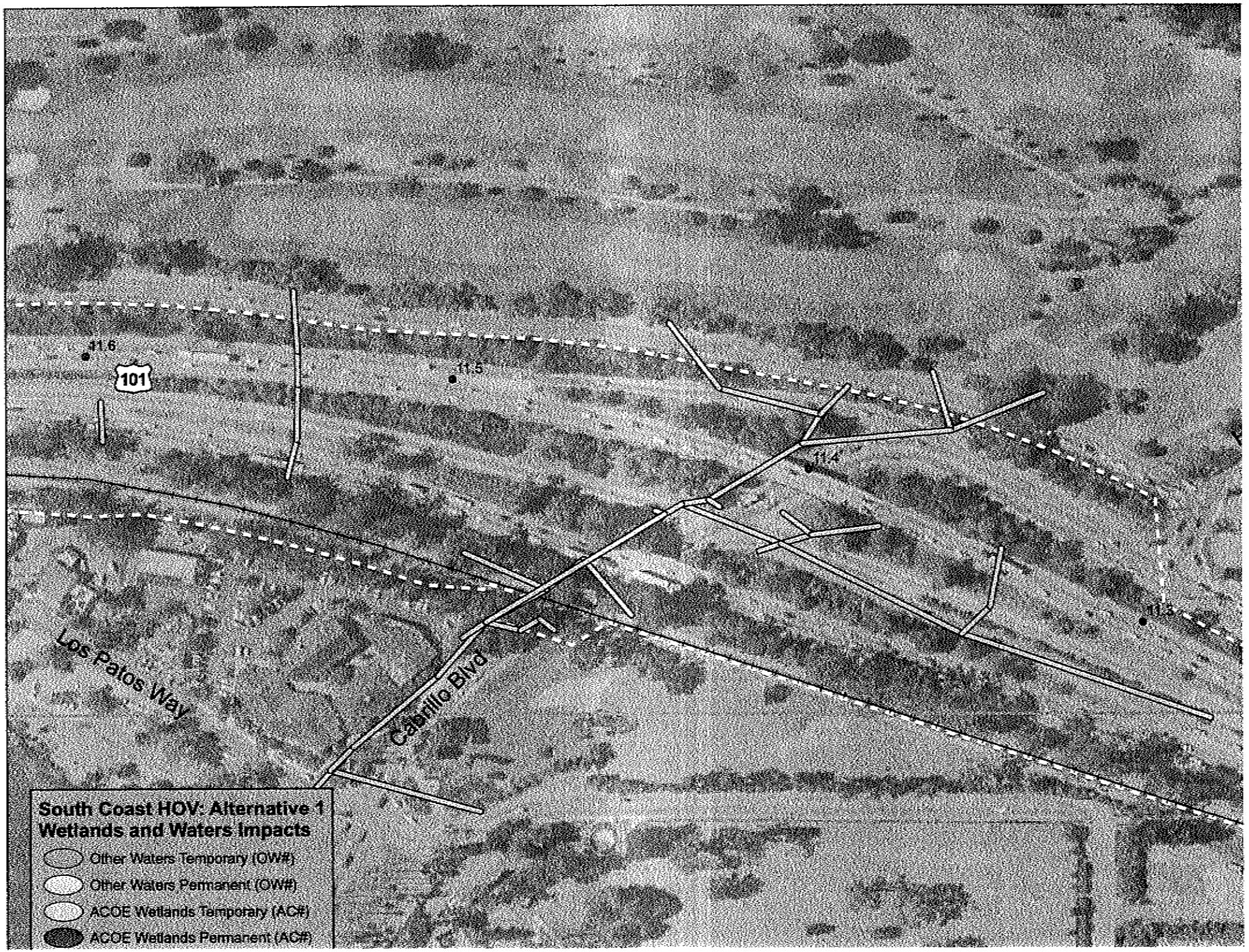

South Coast HOV: Alternative 1
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)
Coastal Wetlands Temporary (CC#)
Coastal Wetlands Permanent (CC#)
Waters Not Impacted
Biological Study Area
Temporary Construction Easement
Soil data points
Design elements
Existing Culvert
0 50 100 200
Feet
N
Prepared: Apr. 13, 2011
Arroqui Rd
Loureyro Rd
N Jameson Ln
Sheffield D
OW67
9.1
9.2


South Coast HOV: Alternative 1
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)
Coastal Wetlands Temporary (CC#)
Coastal Wetlands Permanent (CC#)
Waters Not Impacted
Biological Study Area
Temporary Construction Easement
Soil data points
Design elements
Existing Culvert
0 50 100 200 Feet
N
Prepared: May 6, 2011
Oak Creek
San Ysidro Creek
OW74
CC44
OW71
CC41
OW73
CC43
OW72
9.7
9.6
9.5
9.4
101


San Leandro Park Rd
La Vereda Ln
San Ysidro Rd
Miramar Ave
Jameson Ln
Humphrey Rd
10.1
10.5
9.9
South Coast HOV: Alternative 1
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)

Sheet 20
Olive Mill Rd
Eleven Oaks Ln
Santa Clara Way
Santa Isabel Ln
Virginia Ln
Virginia Rd
101


Hermosillo Rd
Butterfly Ln
Coast Village Cir
Butterfly Ln
11.4
10.9
South Coast HOV: Alternative 1
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)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101
11.5
11.4
11.3
Los Patos Way
Cabrillo Blvd
South Coast HOV: Alternative 1
Wetlands and Waters Impacts
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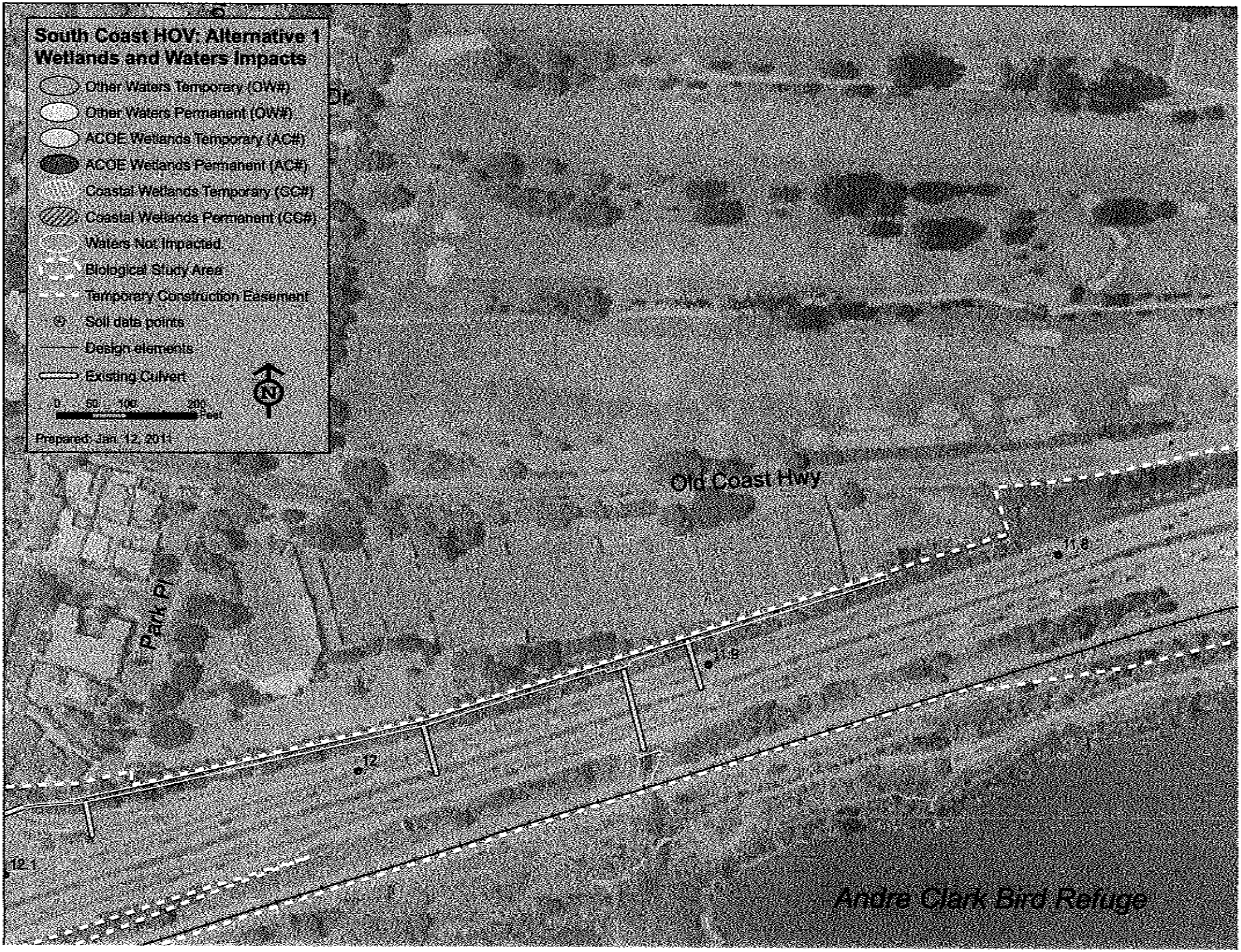
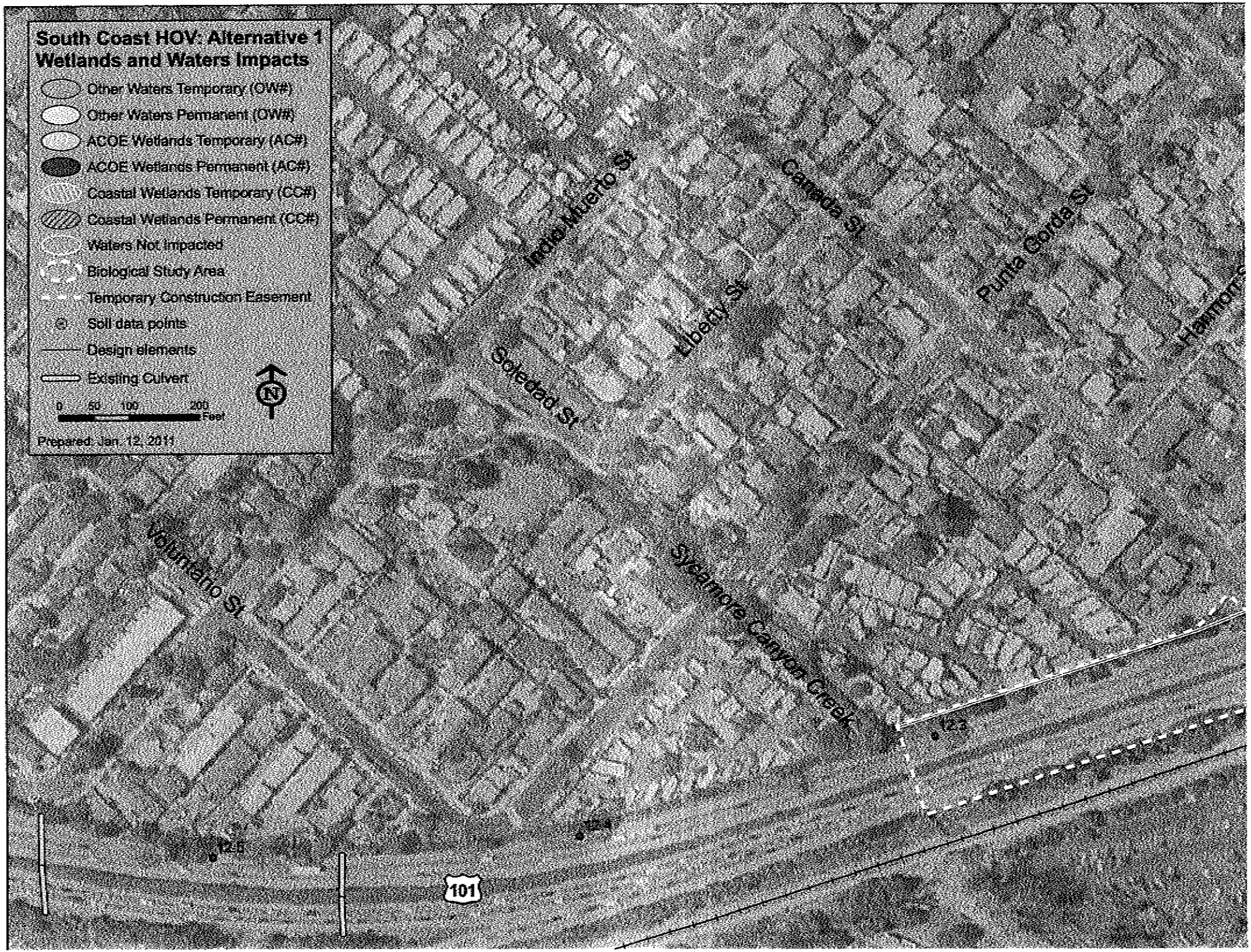
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)


South Coast HOV: Alternative 1
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)
Coastal Wetlands Temporary (CC#)
Coastal Wetlands Permanent (CC#)
Waters Not Impacted
Biological Study Area
Temporary Construction Easement
Soil data points
Design elements
Existing Culvert
0 50 100 200
Feet
N
Prepared: Jan. 12, 2011
Old Coast Hwy
Park Pl
11.8
11.8
12
12.1
Andre Clark Bird Refuge


South Coast HOV: Alternative 1
Wetlands and Waters Impacts
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Other Waters Permanent (OW#)
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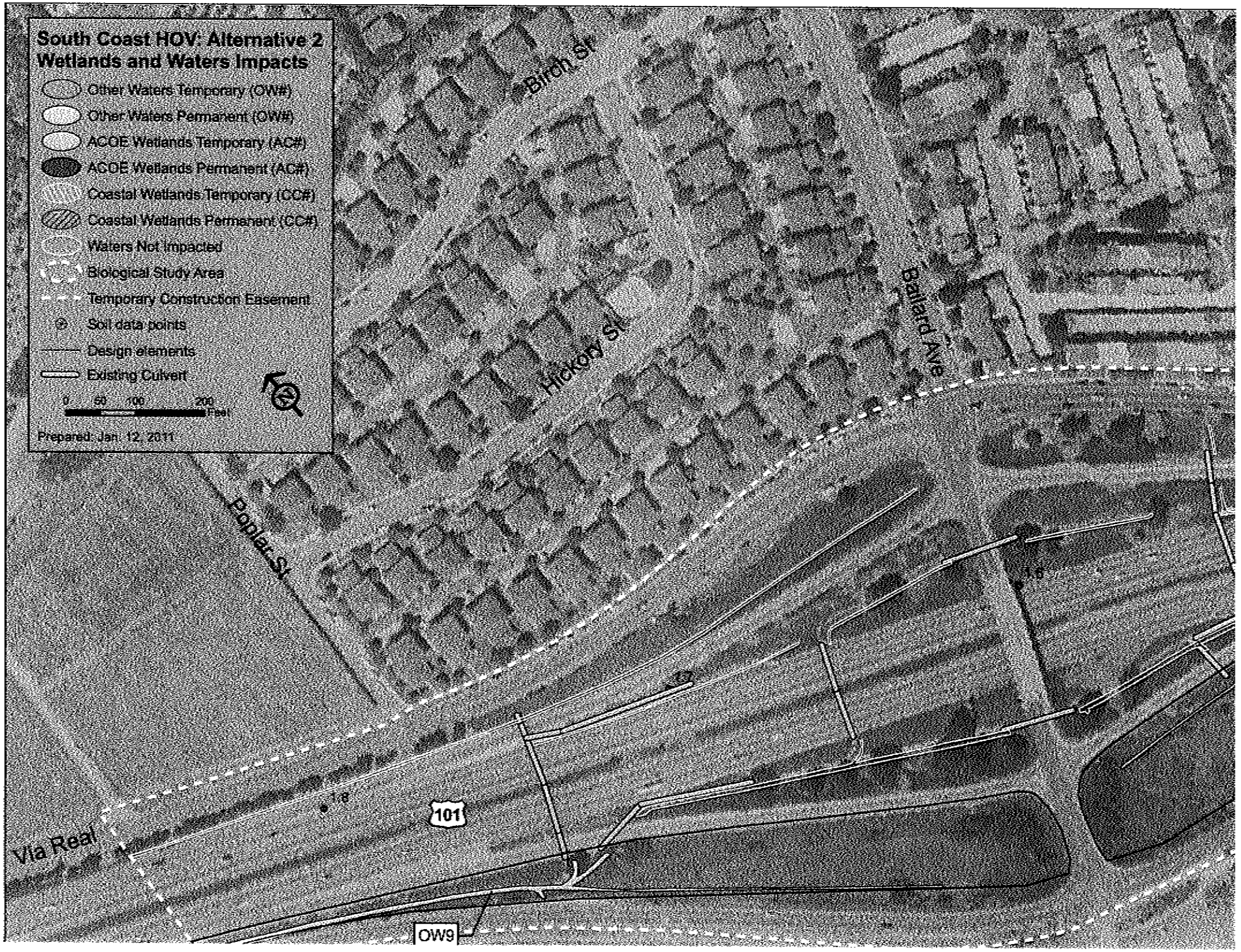
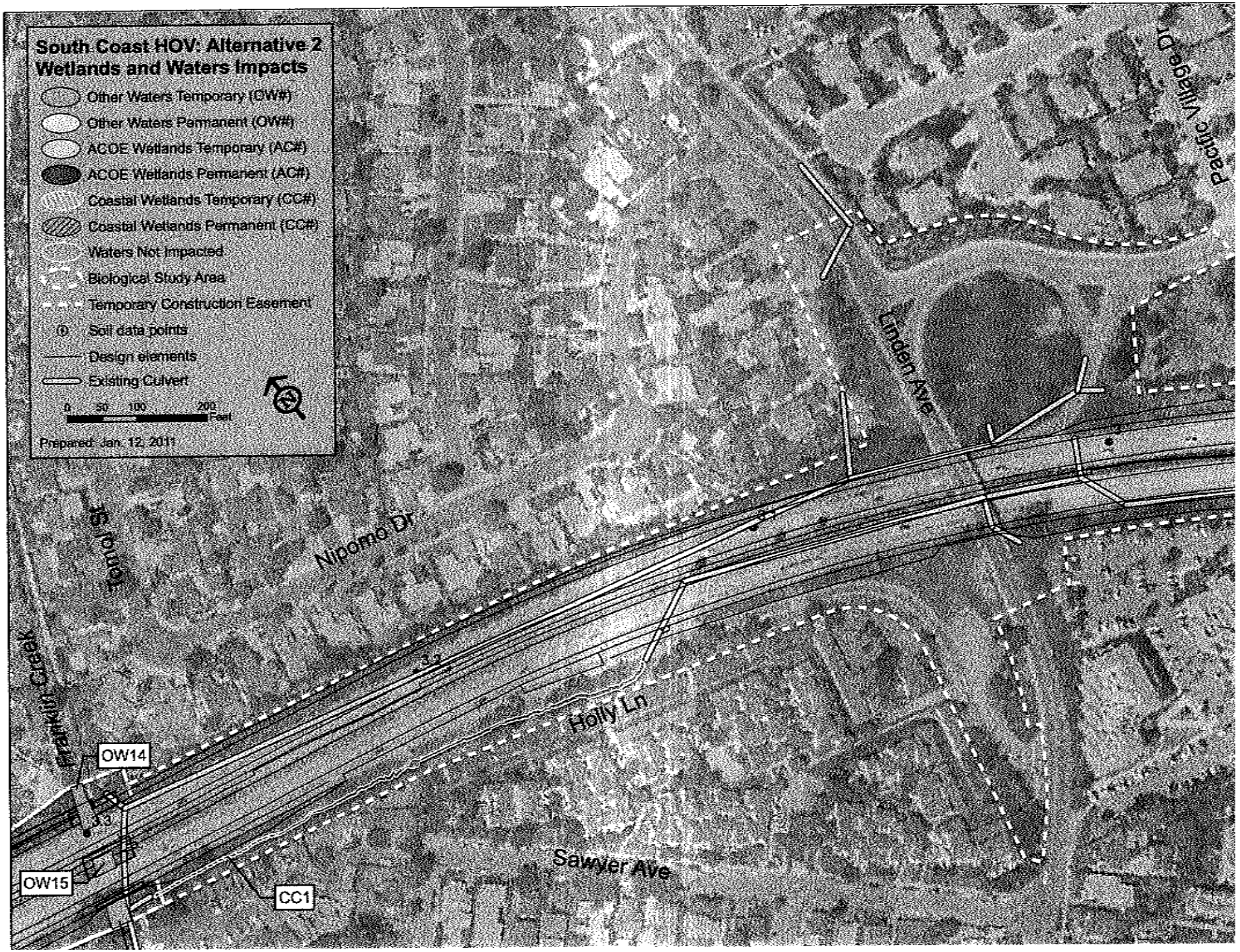
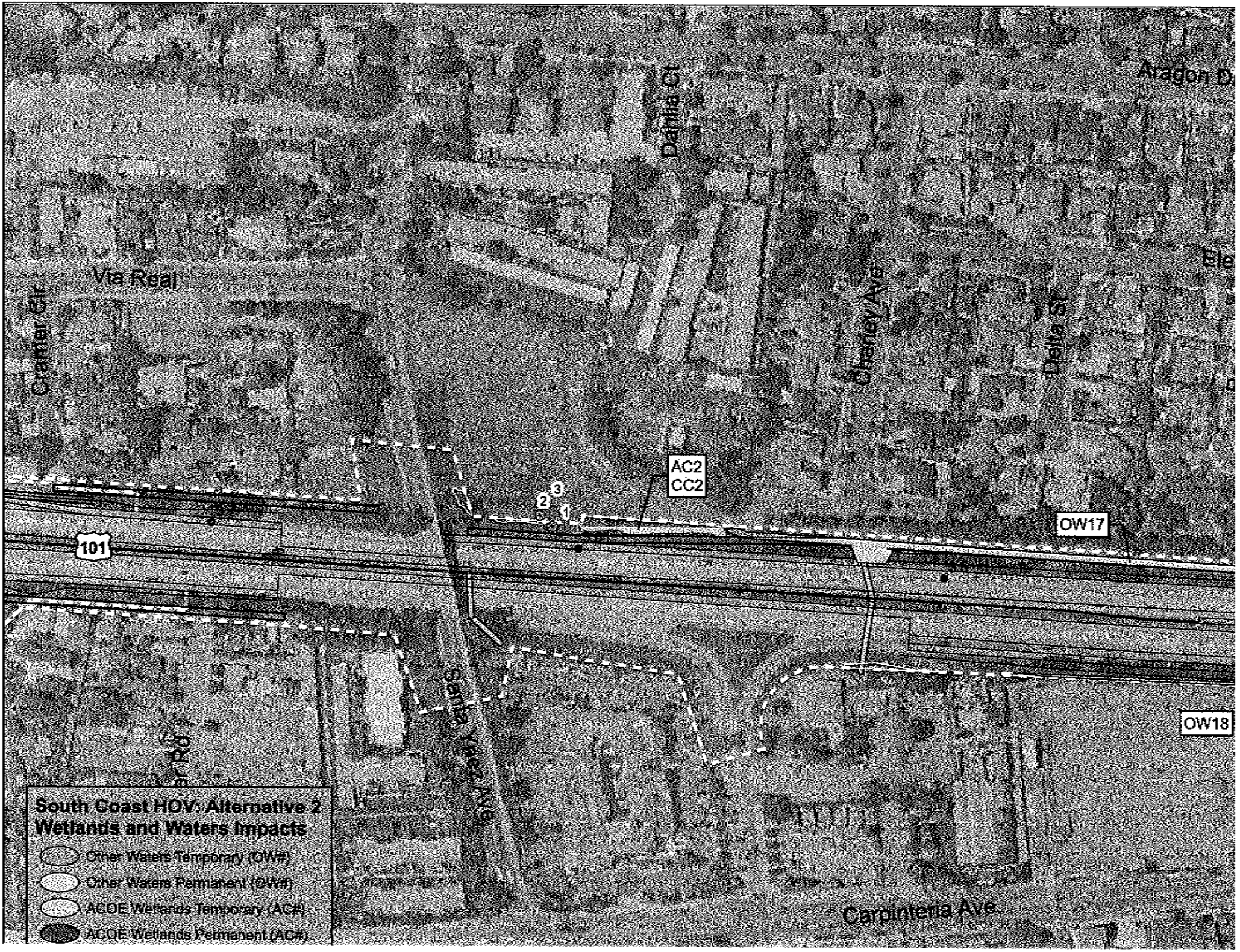
ACOE Wetlands Permanent (AC#)
Coastal Wetlands Temporary (CC#)
Coastal Wetlands Permanent (CC#)
Waters Not Impacted
Biological Study Area
Temporary Construction Easement
Soil data points
Design elements
Existing Culvert
0 50 100 200 Feet
N
Prepared: Jan. 12, 2011
Indio Muerto St
Canada St
Punta Gorda St
Liberty St
Soledad St
Voluntario St
Sycamore Canyon Creek
12.3
12.4
12.5
101

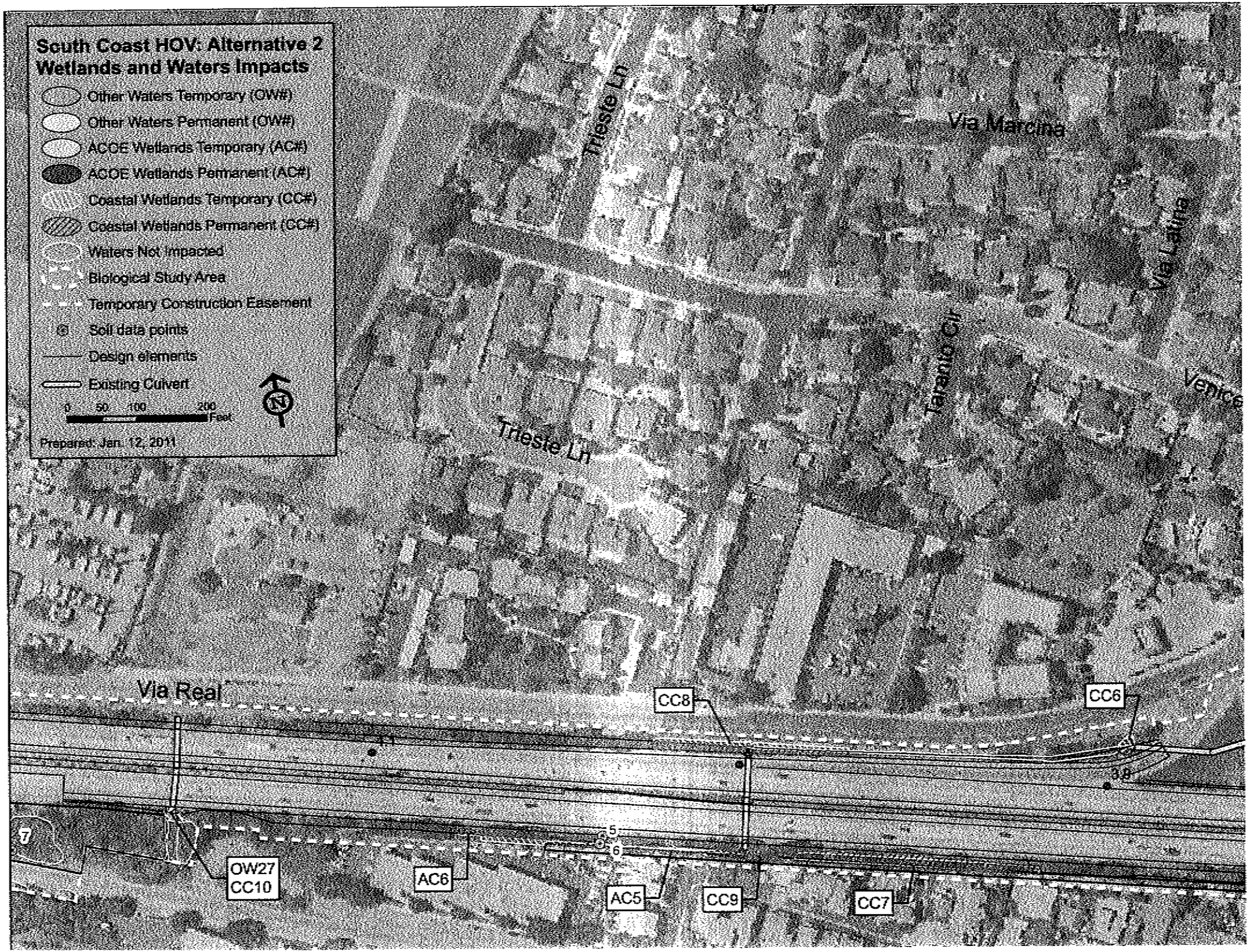

South Coast HOV: Alternative 2
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)
Coastal Wetlands Temporary (CC#)
Coastal Wetlands Permanent (CC#)
Waters Not Impacted
Biological Study Area
Temporary Construction Easement
Soil data points
Design elements
Existing Culvert
0 50 100 200 Feet
Prepared: Jan. 12, 2011
Birch St
Hickory St
Ballard Ave
Poplar St
Via Real
101
OW9


Carpinteria Creek Dr
Casitas Ln
Via Elsie
Via Ricardo
Ballard Ln
Via El Rincon
Oakwood Dr
Via Maria
Lemonwood Dr
OW12
Rogue Dr
OW12
Via Linda
2.2

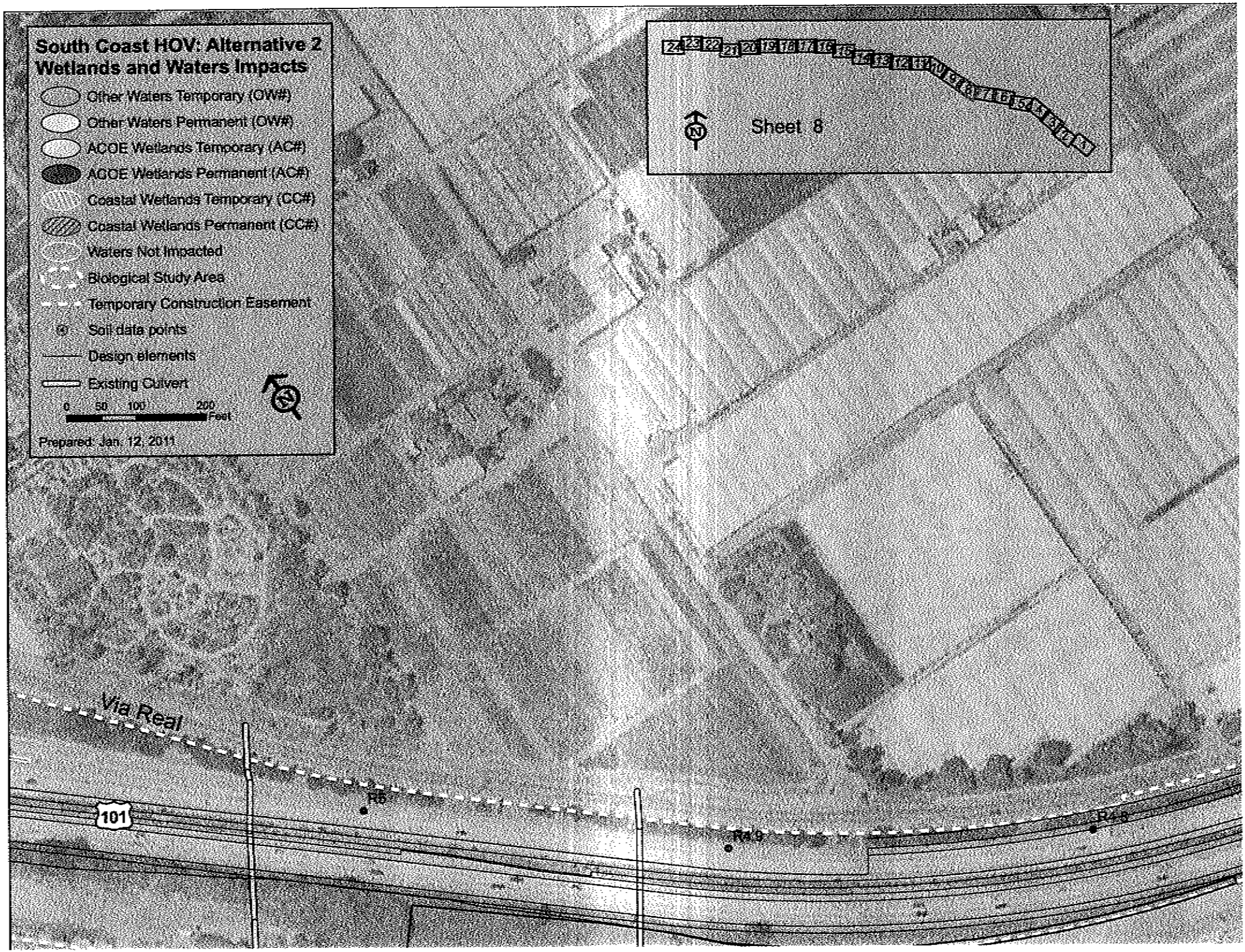
Byrnes Ln
Castlas Pass Rd
Hailes Ln
Star Pine Rd
Via Real
101
Vallecito Rd

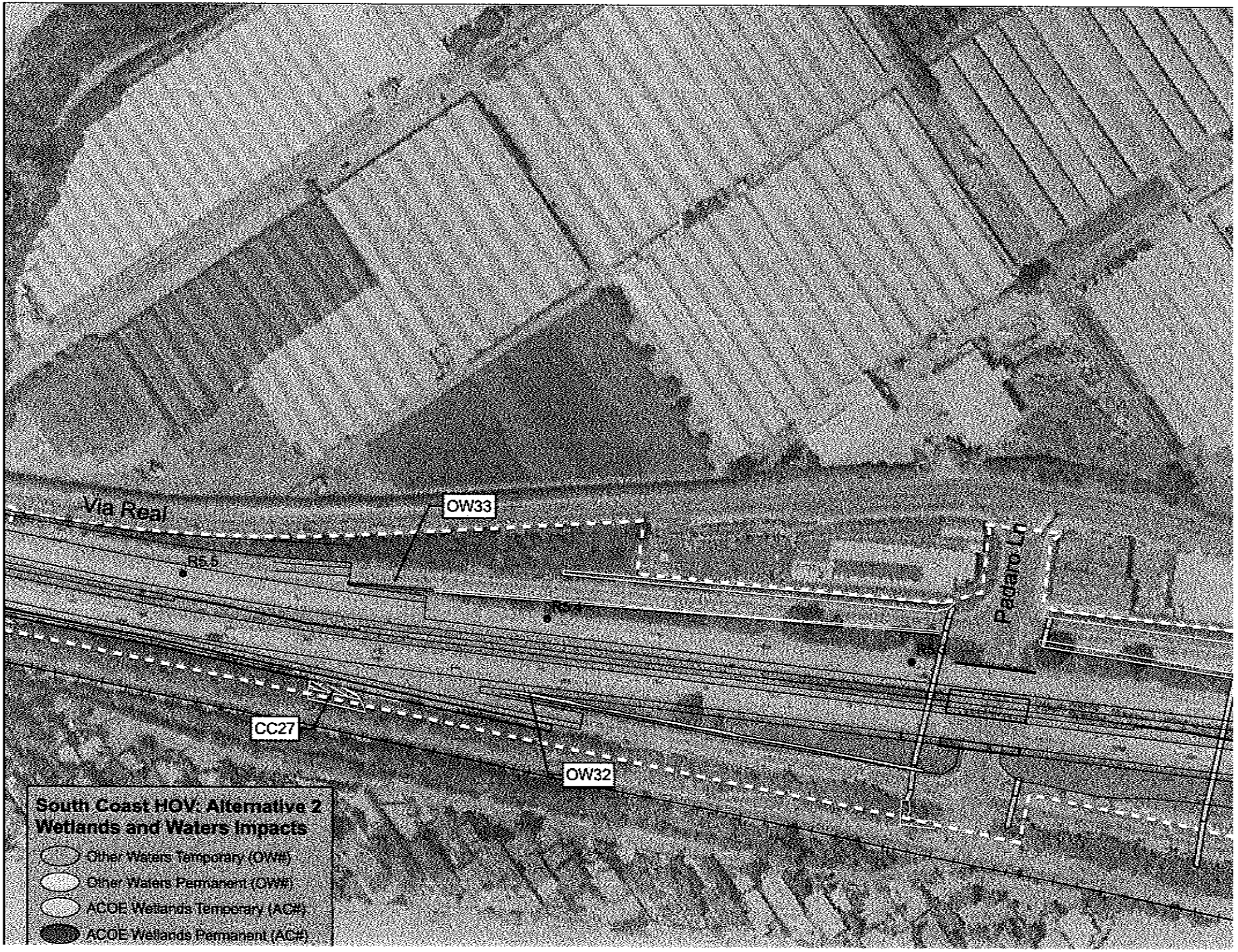

South Coast HOV: Alternative 2
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)
Coastal Wetlands Temporary (CC#)
Coastal Wetlands Permanent (CC#)
Waters Not Impacted
Biological Study Area
Temporary Construction Easement
Soil data points
Design elements
Existing Culvert
0 50 100 200 Feet
Prepared: Jan. 12, 2011
Pacific Village Dr
Linden Ave
Nipomo Dr
Tomol St
Franklin Creek
Holly Ln
Sawyer Ave
OW14
OW15
CC1

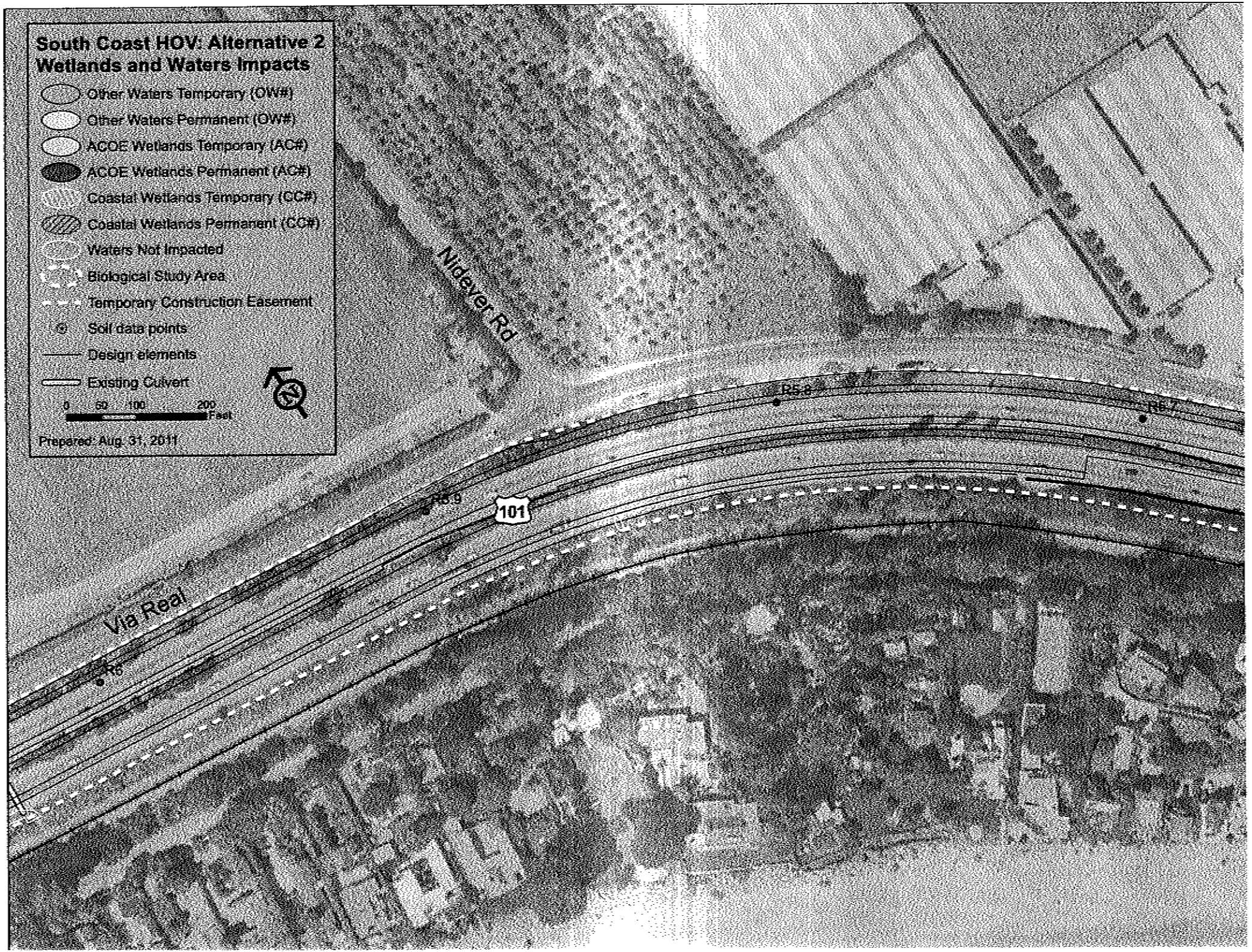

Aragon D
Dahlia Ct
Ele
Vta Real
Cramer Cir
Chaney Ave
Delia St
AC2
CC2
3
2
1
OW17
101
OW18
Santa Inez Ave
Carpinteria Ave
South Coast HOV: Alternative 2
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)

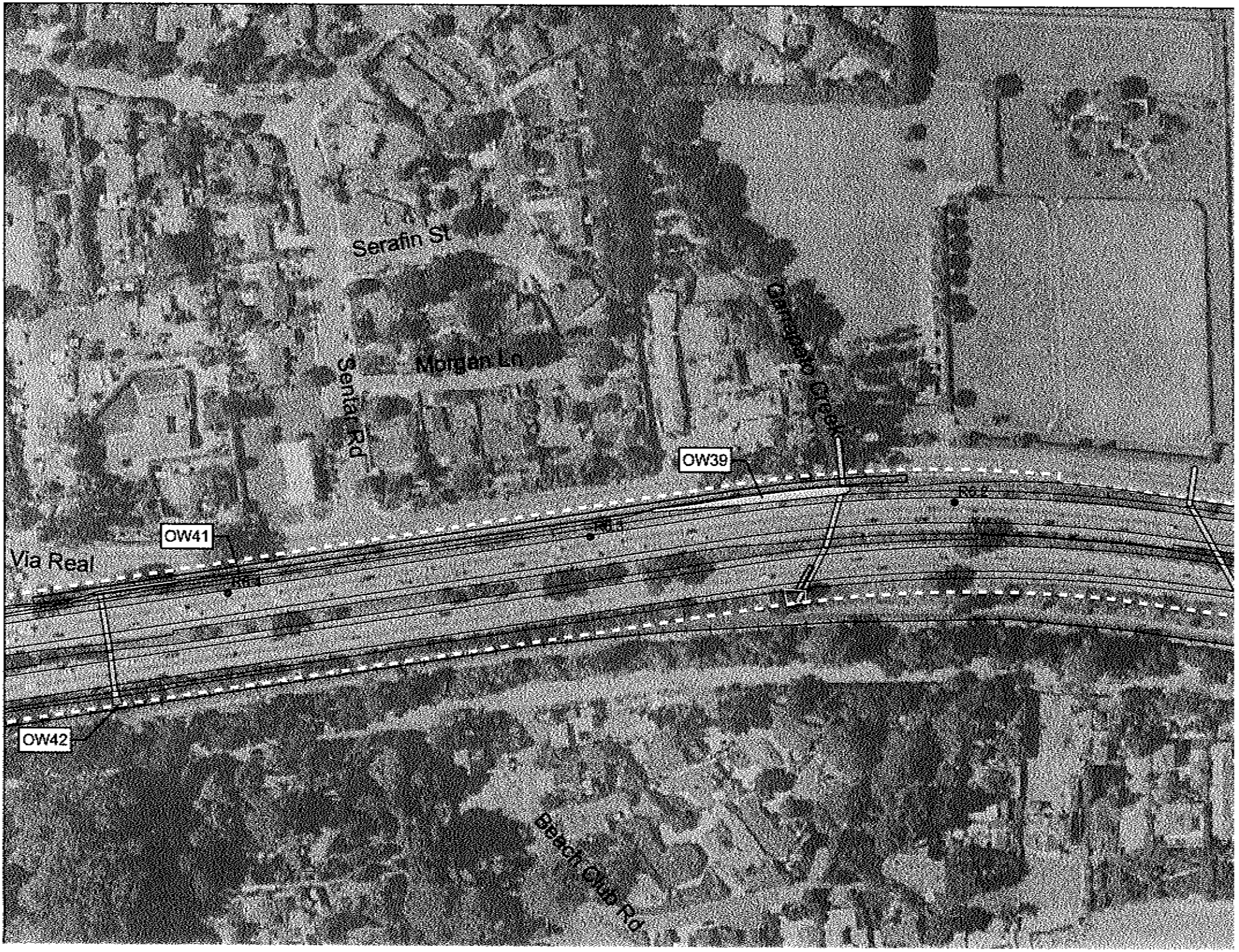

South Coast HOV: Alternative 2
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)
Coastal Wetlands Temporary (CC#)
Coastal Wetlands Permanent (CC#)
Waters Not Impacted
Biological Study Area
Temporary Construction Easement
Soil data points
Design elements
Existing Culvert
0 50 100 200 Feet
N
Prepared: Jan. 12, 2011
Trieste Ln
Via Marcina
Via Latina
Taranto Cir
Venice
Trieste Ln
Via Real
CC8
CC6
OW27
CC10
AC6
AC5
CC9
CC7
5
6
7


Cove St
Pearl St
Beach St
Bayside Dr
Lemon Dr
Cravens Ln
Francisan Dr
OW29
Via Real
101
AC11
CC18
CC17
AC10
CC15


South Coast HOV: Alternative 2
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)
Coastal Wetlands Temporary (CC#)
Coastal Wetlands Permanent (CC#)
Waters Not Impacted
Biological Study Area
Temporary Construction Easement
Soil data points
Design elements
Existing Culvert
0 50 100 200
Feet
Prepared: Jan. 12, 2011
Sheet 8
Via Real
101
R5
R4.9
R4.8


Via Real
OW33
R5.5
R5.4
R5.3
Padaro Ln
CC27
OW32
South Coast HOV: Alternative 2
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)


South Coast HOV: Alternative 2
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)
Coastal Wetlands Temporary (CC#)
Coastal Wetlands Permanent (CC#)
Waters Not Impacted
Biological Study Area
Temporary Construction Easement
Soil data points
Design elements
Existing Culvert
0 50 100 200
Feet
Prepared: Aug. 31, 2011
Nidever Rd
Via Real
101
R5-8
R5-7
R5-9
R5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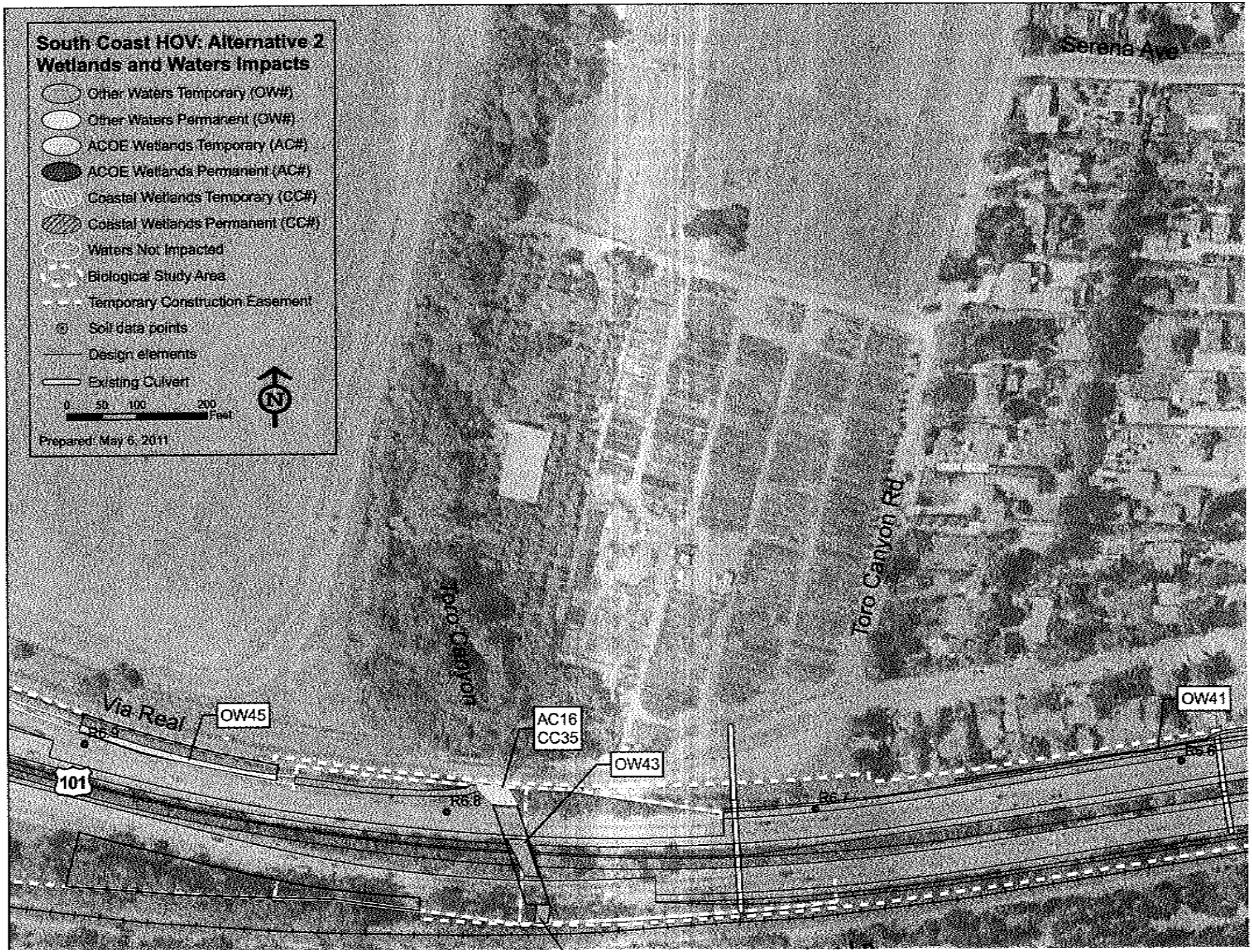
Morgan Ln
Sentar Rd
Carrapato Creek
OW39
OW41
Via Real
OW42
Beach Club Rd


South Coast HOV: Alternative 2
Wetlands and Waters Impacts
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Other Waters Permanent (OW#)
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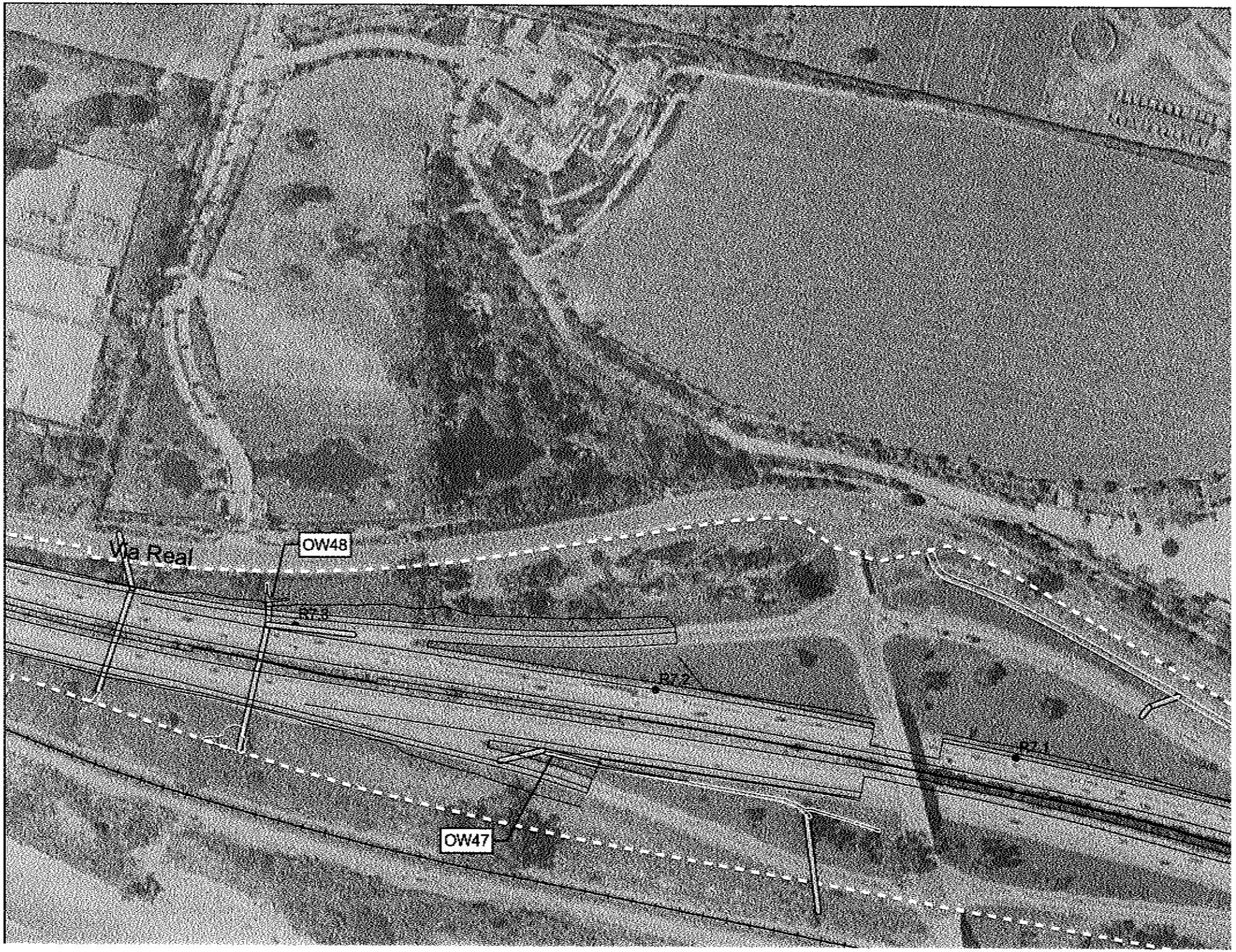
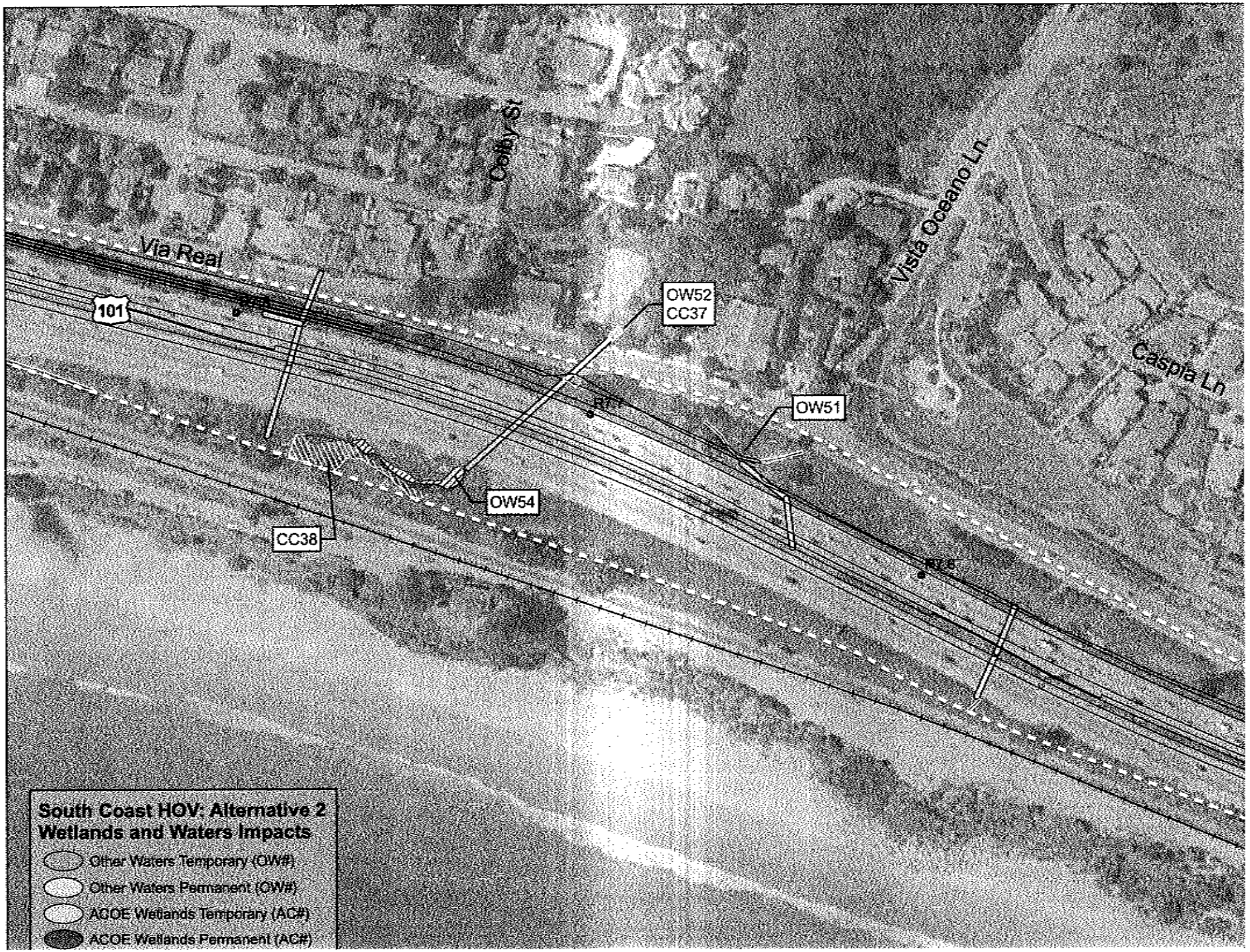
ACOE Wetlands Permanent (AC#)
Coastal Wetlands Temporary (CC#)
Coastal Wetlands Permanent (CC#)
Waters Not Impacted
Biological Study Area
Temporary Construction Easement
Soil data points
Design elements
Existing Culvert
0 50 100 200 Feet
N
Prepared: May 6, 2011
Serena Ave
Toro Canyon Rd
Toro Canyon
Via Real
101
OW45
AC16
CC35
OW43
OW41
R6.9
R6.8
R6.7
R6.6


Via Real
OW48
R7.3
R7.2
R7.1
OW47


Colby St
Vista Oceano Ln
Via Real
101
OW52
CC37
Caspia Ln
OW51
OW54
CC38
South Coast HOV: Alternative 2
Wetlands and Waters Impacts
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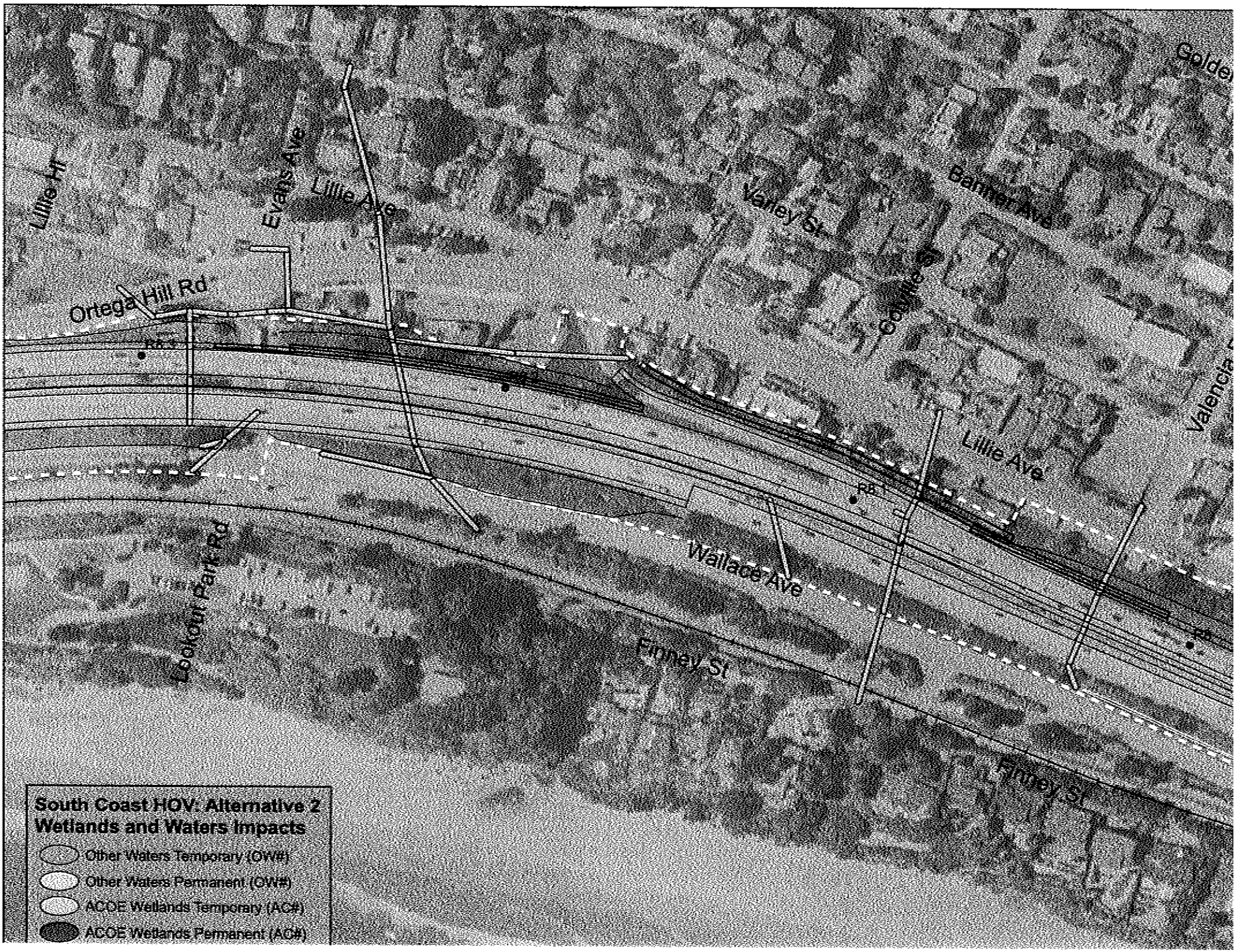
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)



Golden
Lillie Hl
Evans Ave
Lillie Ave
Varley St
Banner Ave
Ortega Hill Rd
Colville St
Valencia
Lillie Ave
Wallace Ave
Lookout Park Rd
Finney St
Finney St
South Coast HOV: Alternative 2
Wetlands and Waters Impacts
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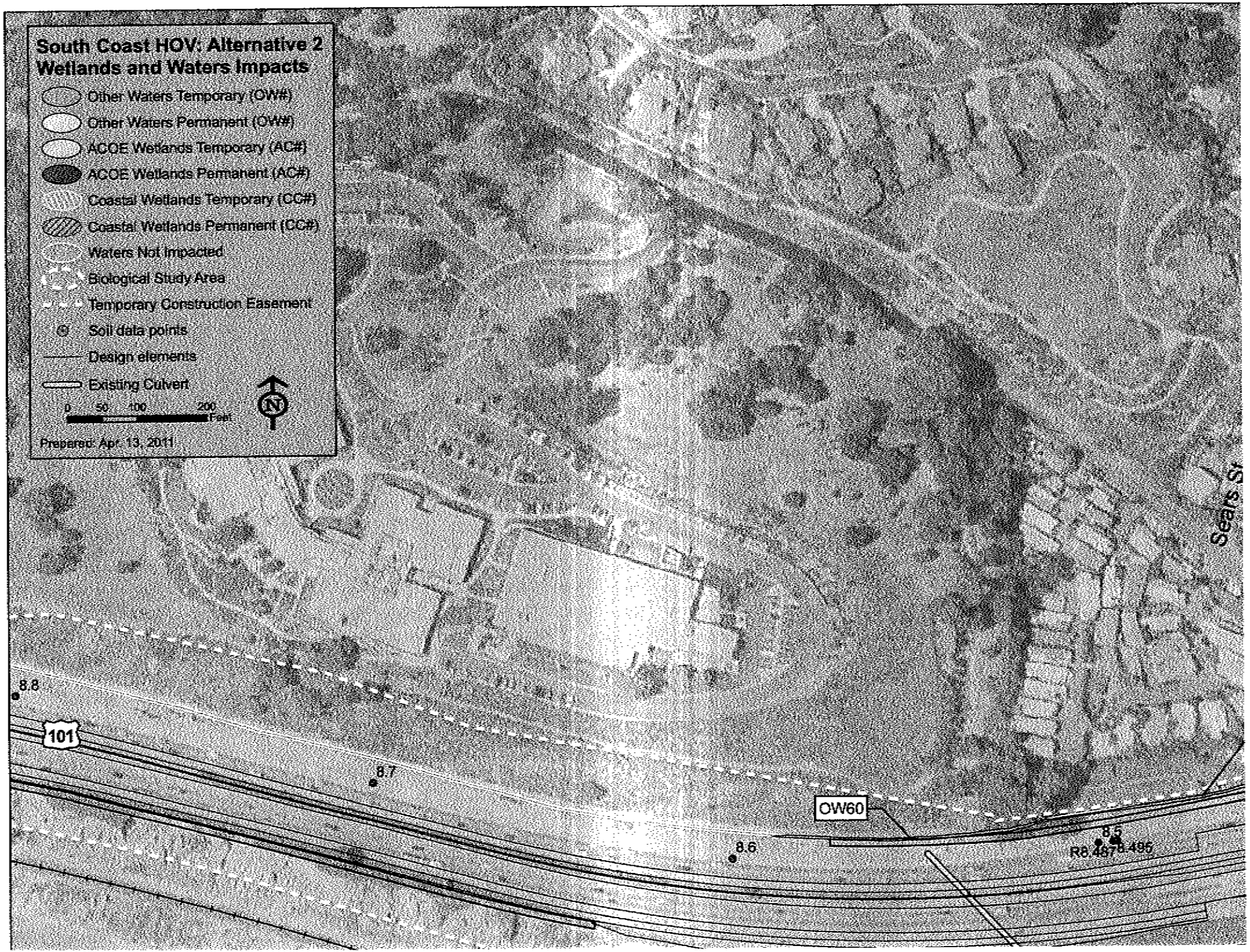
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)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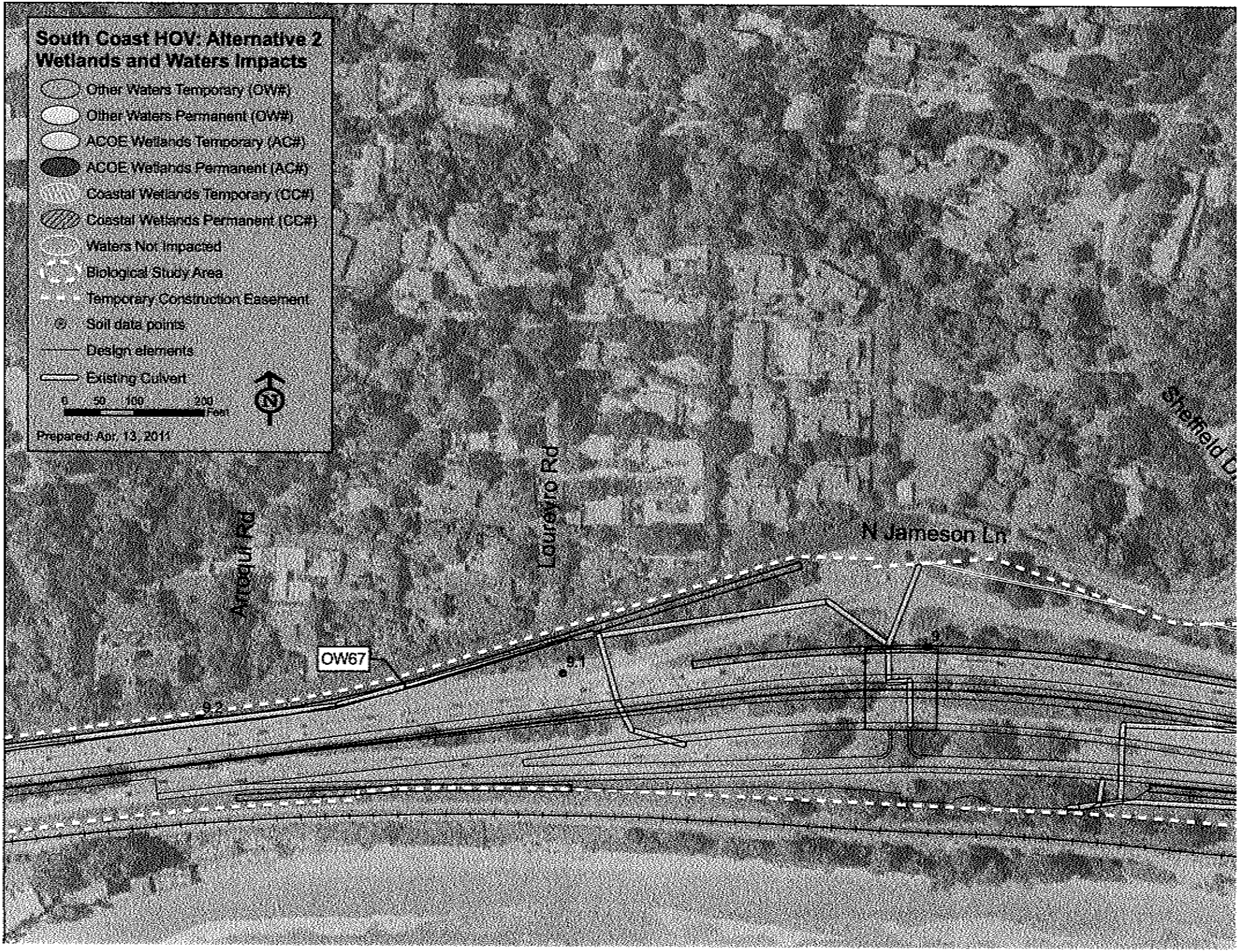
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)
Coastal Wetlands Temporary (CC#)
Coastal Wetlands Permanent (CC#)
Waters Not Impacted
Biological Study Area
Temporary Construction Easement
Soil data points
Design elements
Existing Culvert
0 50 100 200 Feet
N
Prepared: Apr. 13, 2011
Sears St
8.8
101
8.7
8.6
OW60
8.5
R8.487
8.495


South Coast HOV: Alternative 2
Wetlands and Waters Impacts
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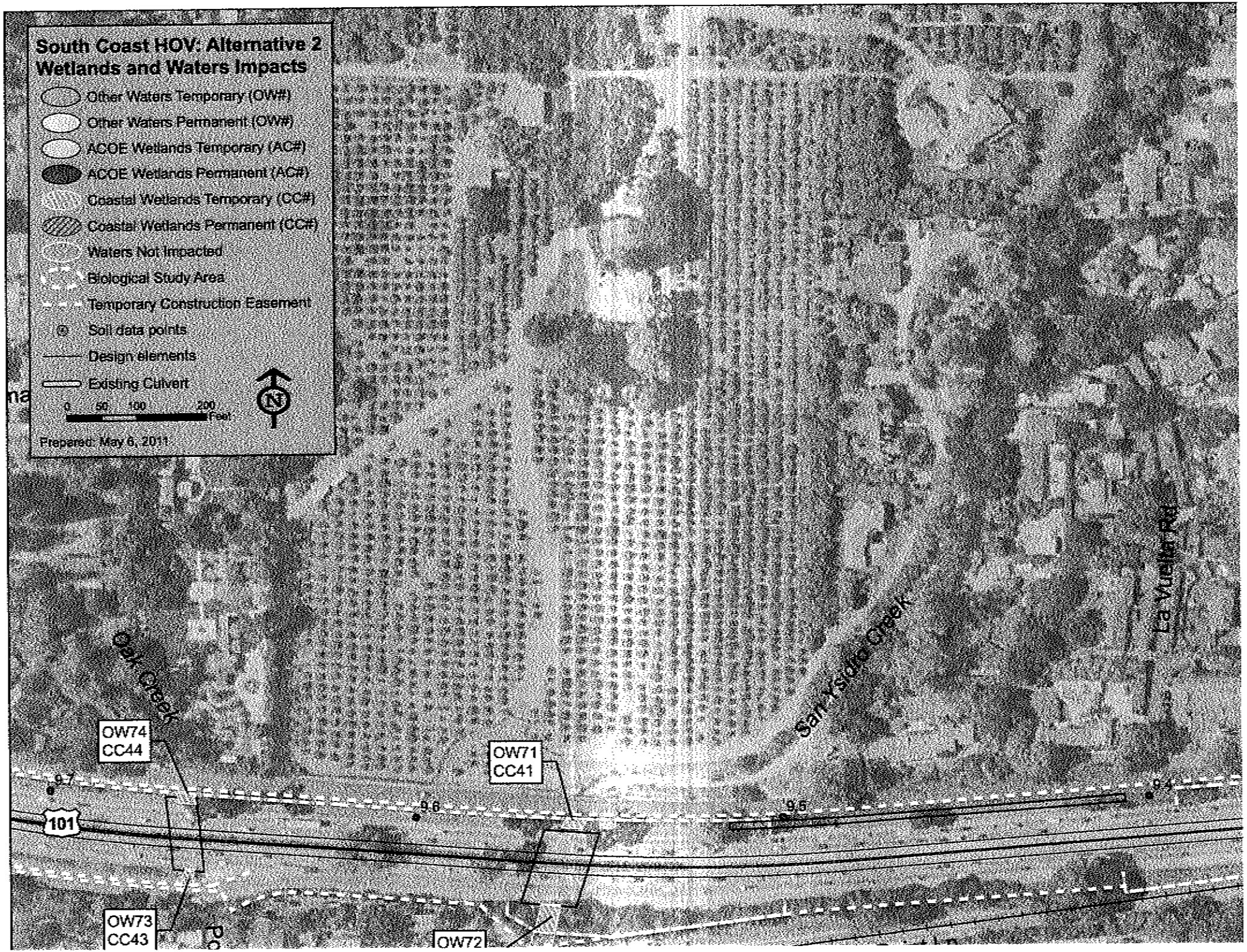
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)
Coastal Wetlands Temporary (CC#)
Coastal Wetlands Permanent (CC#)
Waters Not Impacted
Biological Study Area
Temporary Construction Easement
Soil data points
Design elements
Existing Culvert
0 50 100 200
Feet
N
Prepared: Apr. 13, 2011
Arroqui Rd
Loureyro Rd
N Jameson Ln
Sheffield D
OW67
9.1
9.2


South Coast HOV: Alternative 2
Wetlands and Waters Impacts
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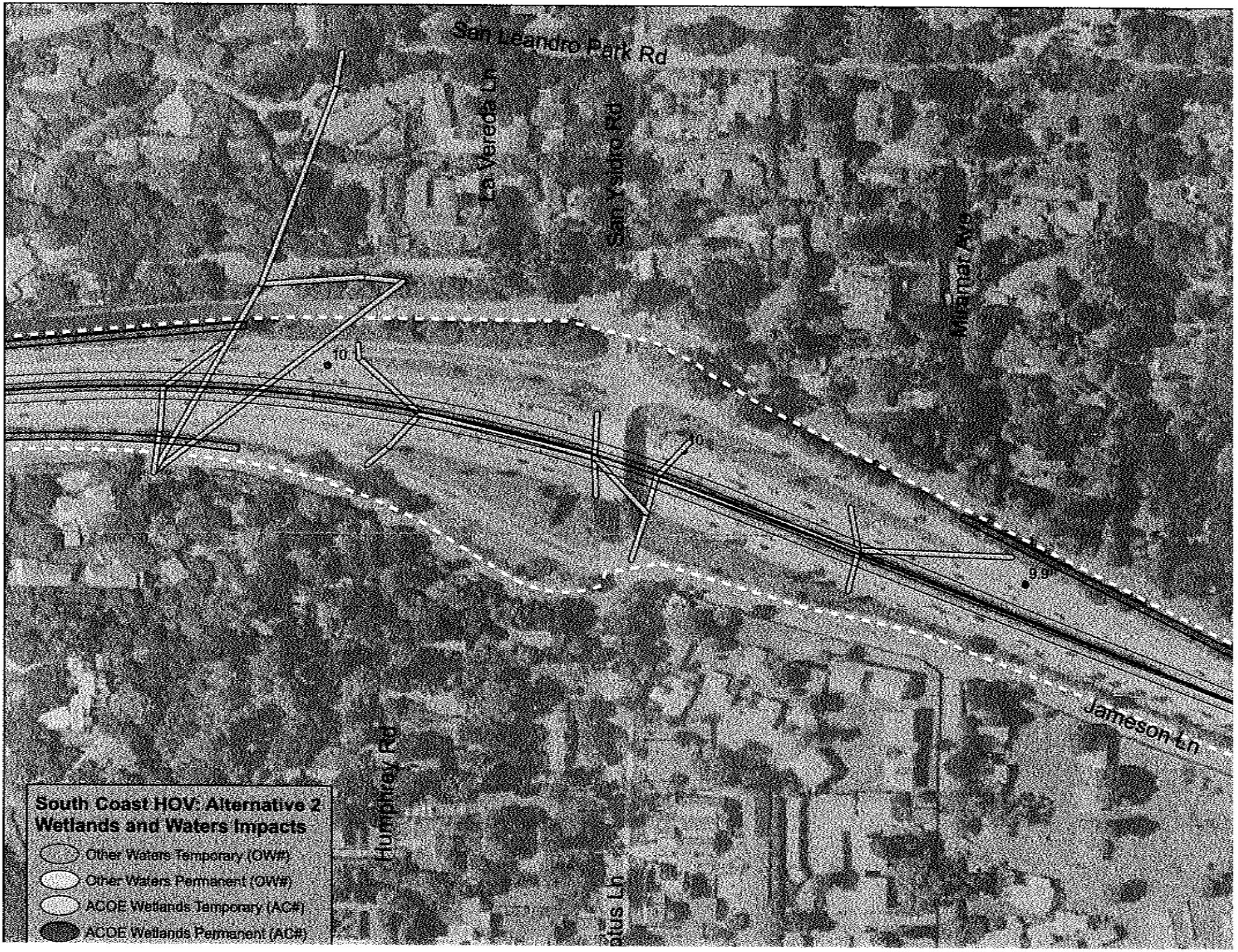
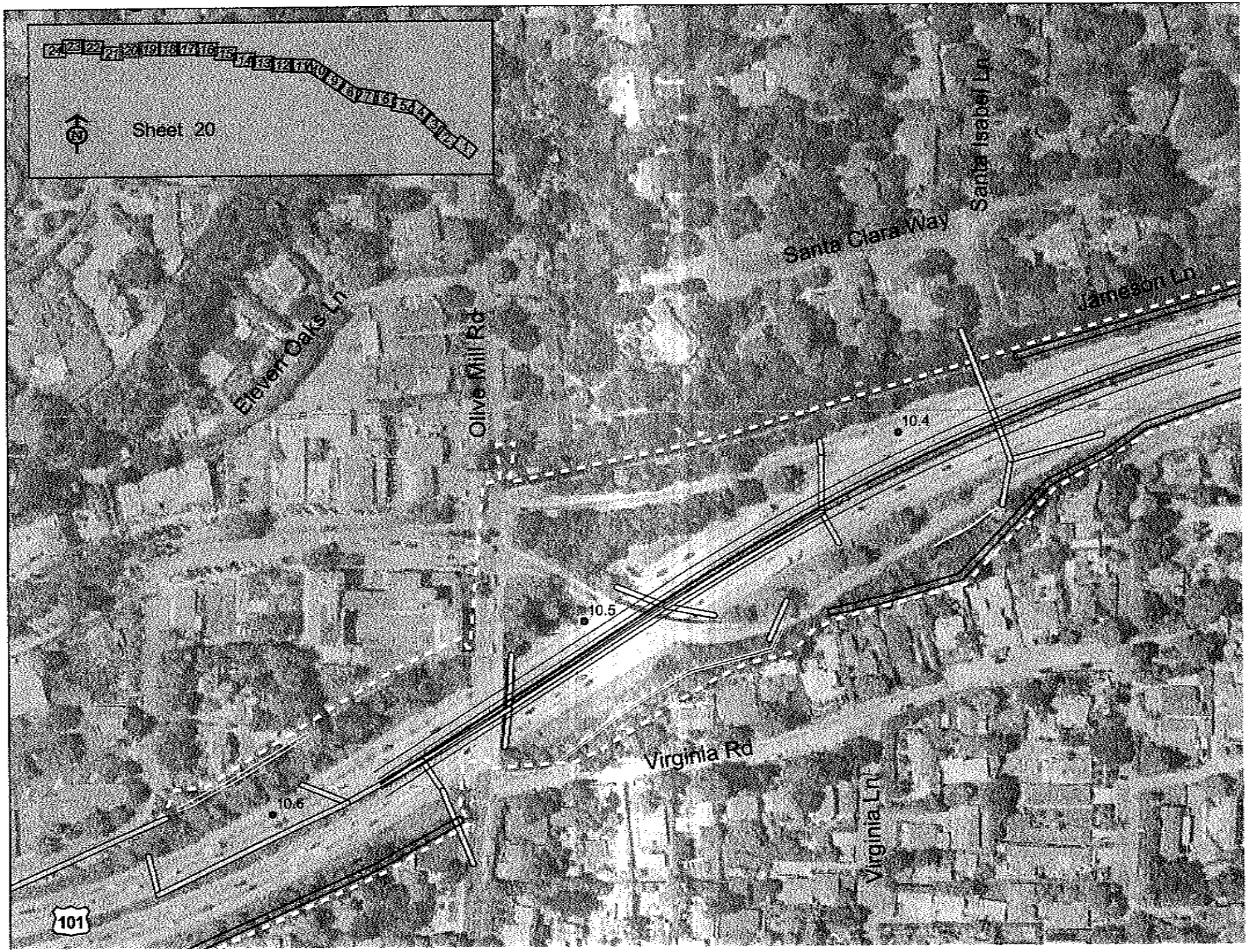
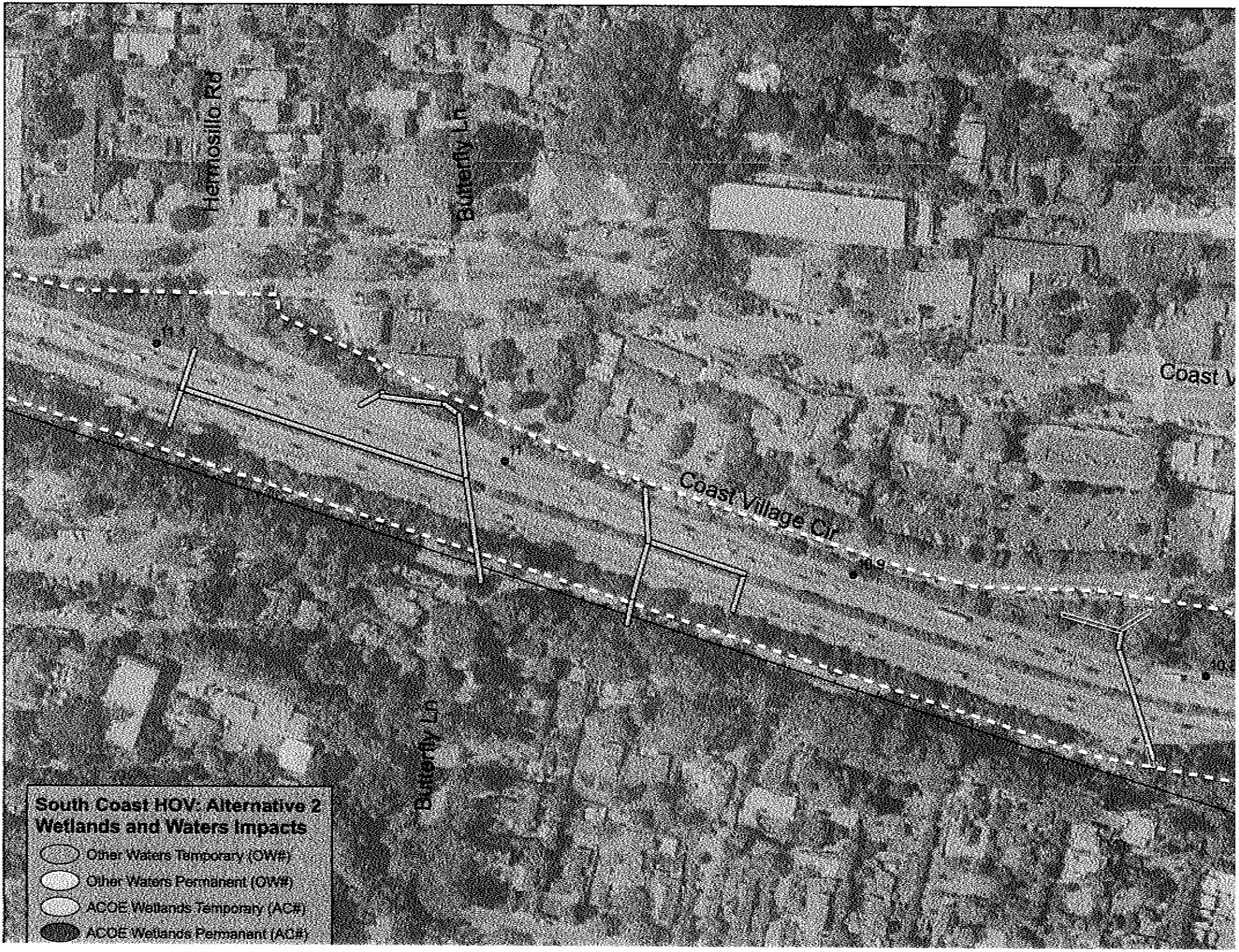
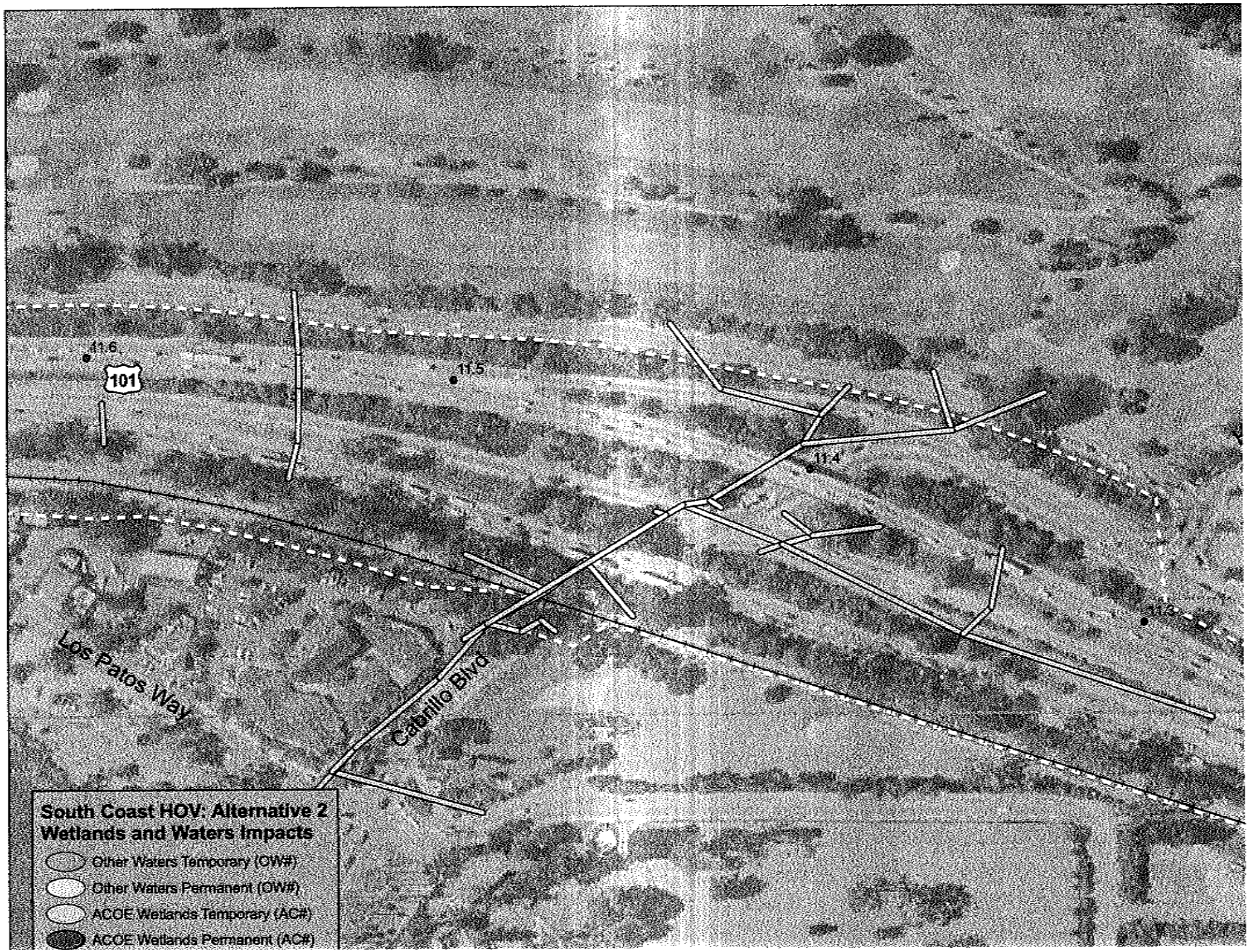
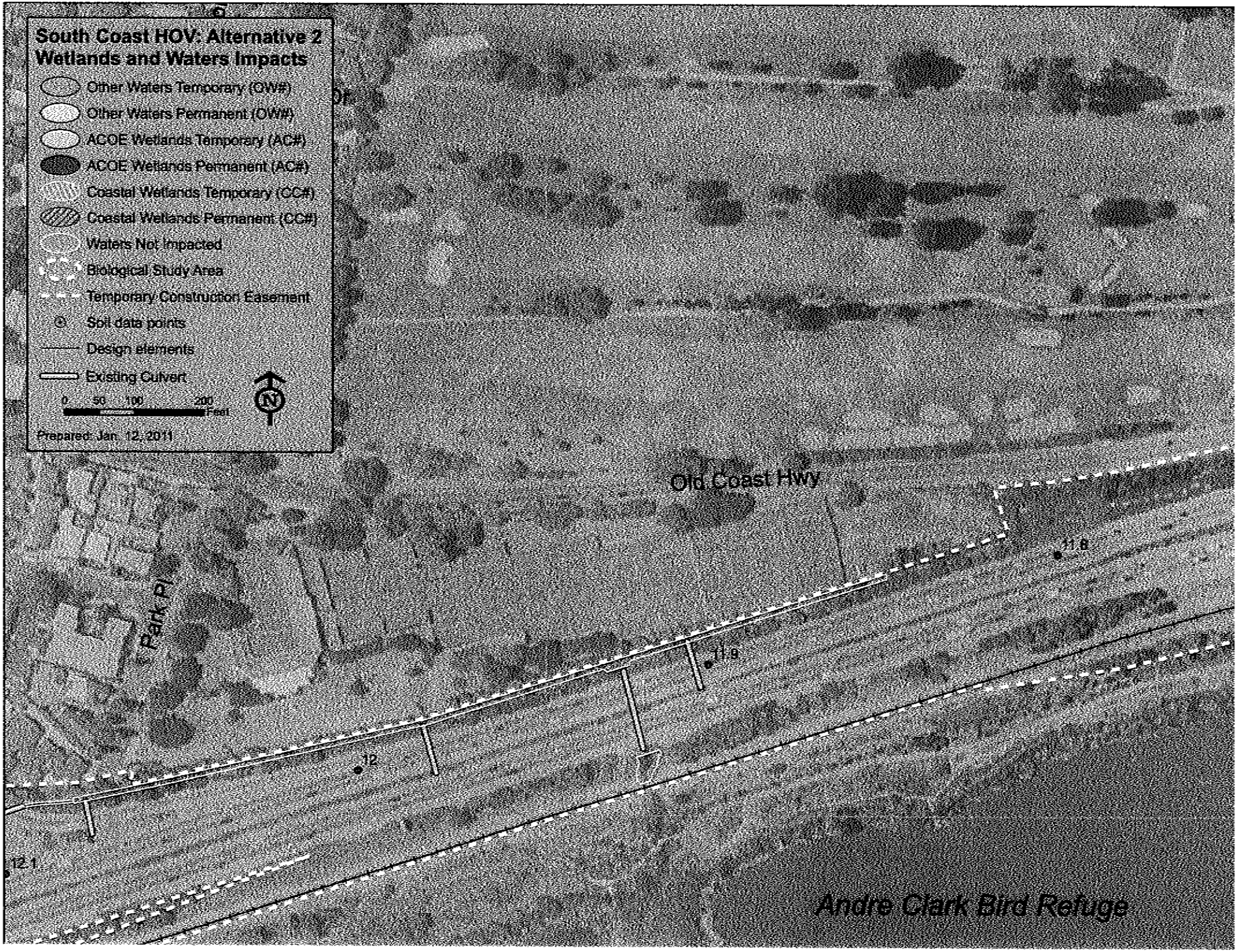
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)
Coastal Wetlands Temporary (CC#)
Coastal Wetlands Permanent (CC#)
Waters Not Impacted
Biological Study Area
Temporary Construction Easement
Soil data points
Design elements
Existing Culvert
0 50 100 200
Feet
N
Prepared: May 6, 2011
Oak Creek
San Ysidro Creek
La Media Rd
OW74
CC44
OW71
CC41
OW73
CC43
OW72
9.7
9.6
9.5
9.4
101

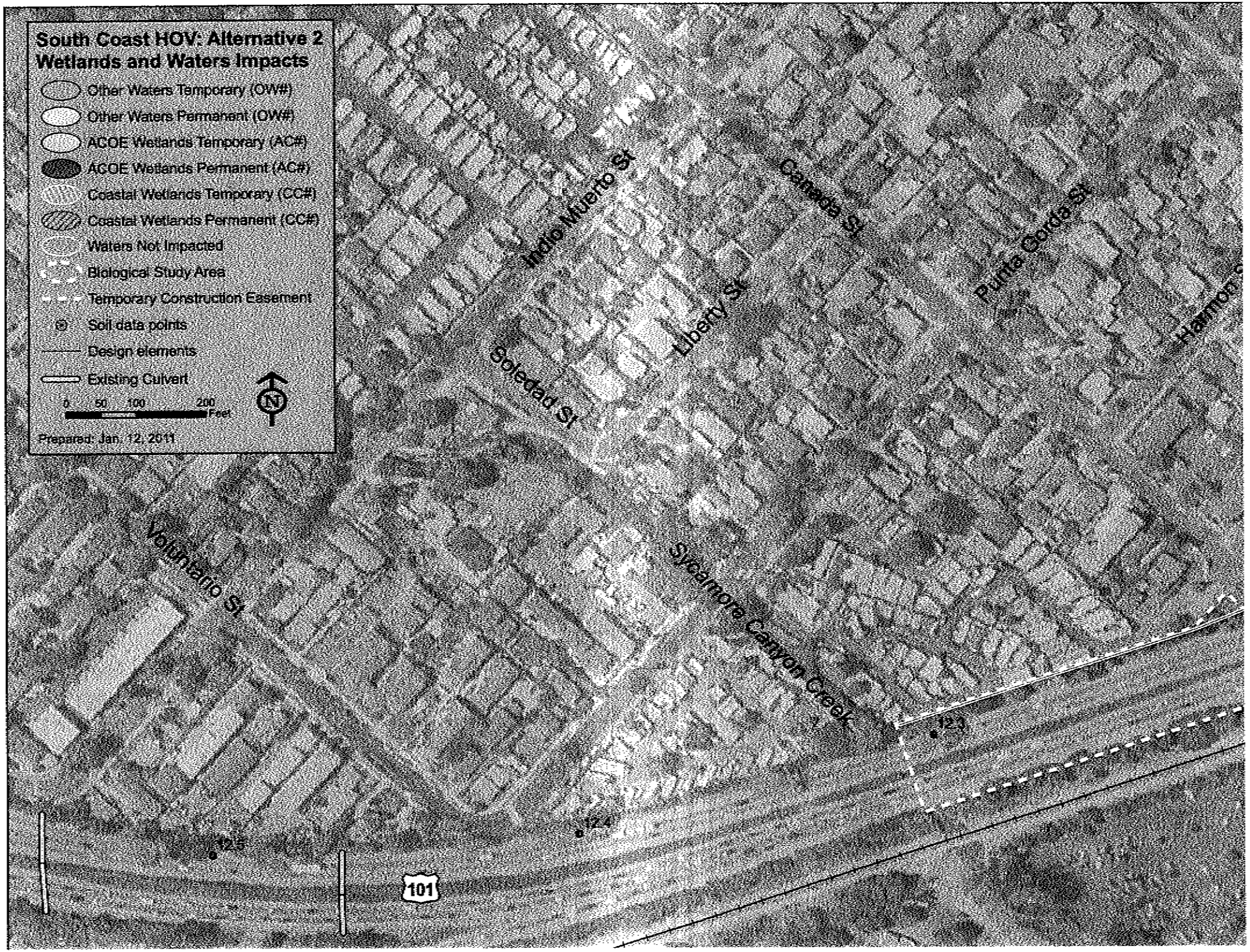

San Leandro Park Rd
La Vereda Ln
San Ysidro Rd
Miramar Ave
Jameson Ln
Humphrey Rd
10
10
9.9
South Coast HOV: Alternative 2
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)

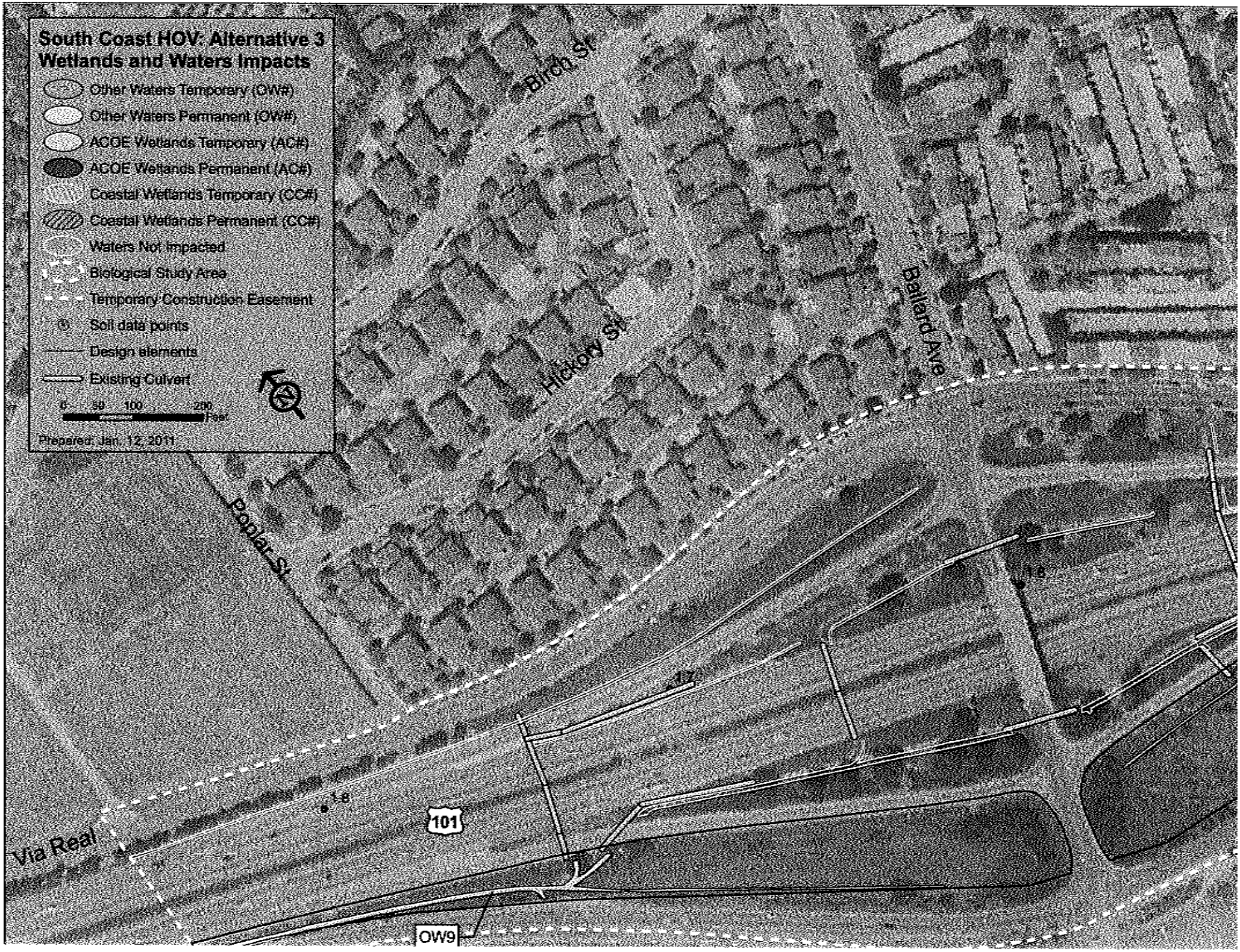

Sheet 20
Elevern Oaks Ln
Olive Mill Rd
Santa Clara Way
Santa Isabel Ln
Jameson Ln
10.4
10.5
10.6
Virginia Rd
Virginia Ln
101


Hermosillo Rd
Butterfly Ln
Coast Village Cir
Butterfly Ln
South Coast HOV: Alternative 2
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)


11.6
101
11.5
11.4
11.3
Los Patos Way
Cabrillo Blvd
South Coast HOV: Alternative 2
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)


South Coast HOV: Alternative 2
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)
Coastal Wetlands Temporary (CC#)
Coastal Wetlands Permanent (CC#)
Waters Not Impacted
Biological Study Area
Temporary Construction Easement
Soil data points
Design elements
Existing Culvert
0 50 100 200
Feet
N
Prepared: Jan. 12, 2011
Old Coast Hwy
Park Pl
11.8
11.9
12
12.1
Andre Clark Bird Refuge


South Coast HOV: Alternative 2
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)
Coastal Wetlands Temporary (CC#)
Coastal Wetlands Permanent (CC#)
Waters Not Impacted
Biological Study Area
Temporary Construction Easement
Soil data points
Design elements
Existing Culvert
0 50 100 200 Feet
N
Prepared: Jan. 12, 2011
Indio Muerto St
Canada St
Liberty St
Punta Corda St
Soledad St
Voluntario St
Sycamore Canyon Creek
12-3
12-4
12-5
101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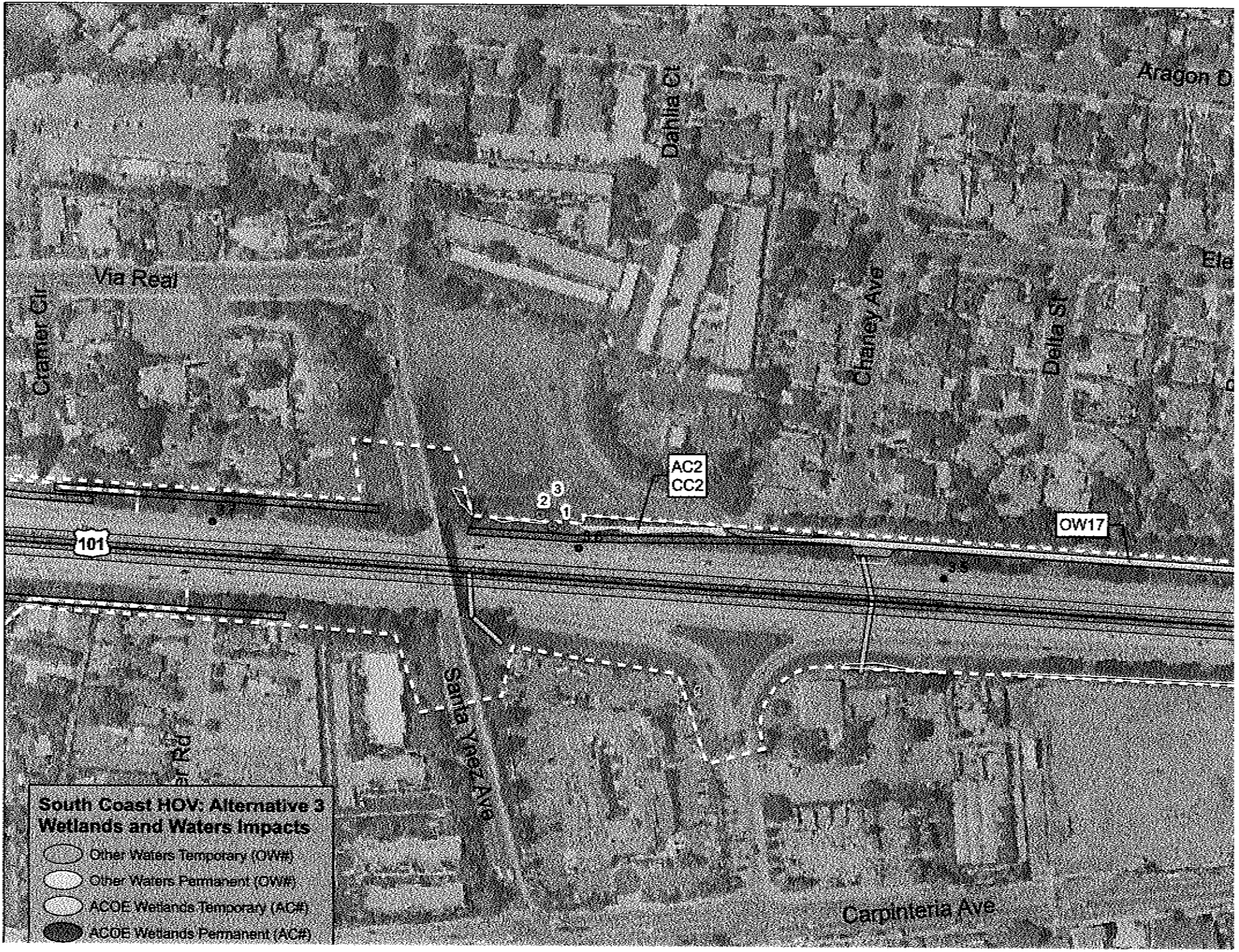
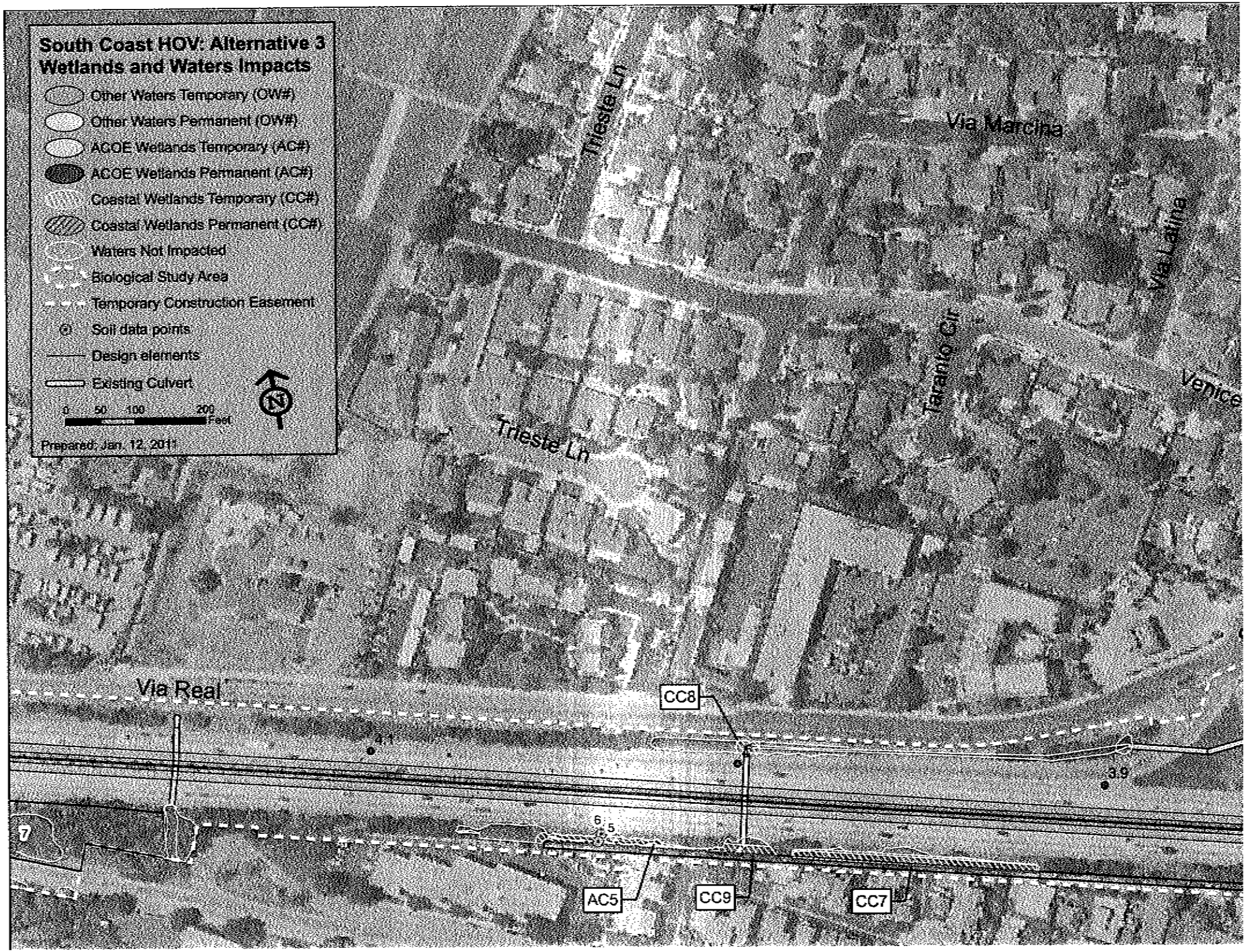
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)
Coastal Wetlands Temporary (CC#)
Coastal Wetlands Permanent (CC#)
Waters Not Impacted
Biological Study Area
Temporary Construction Easement
Soil data points
Design elements
Existing Culvert
0 50 100 200 Feet
Prepared: Jan. 12, 2011
Birch St
Hickory St
Ballard Ave
Poplar St
Via Real
101
OW9
18
17
16


Carpinteria Creek Dr
Casitas Ln
Bailard Ln
Via El Rincon
Oakwood Dr
Lemonwood Dr
Via Elsie
Via Ricardo
Via Maria
Via Linda
Rogue Dr
OW12
OW12
2-1
2-2
2-3

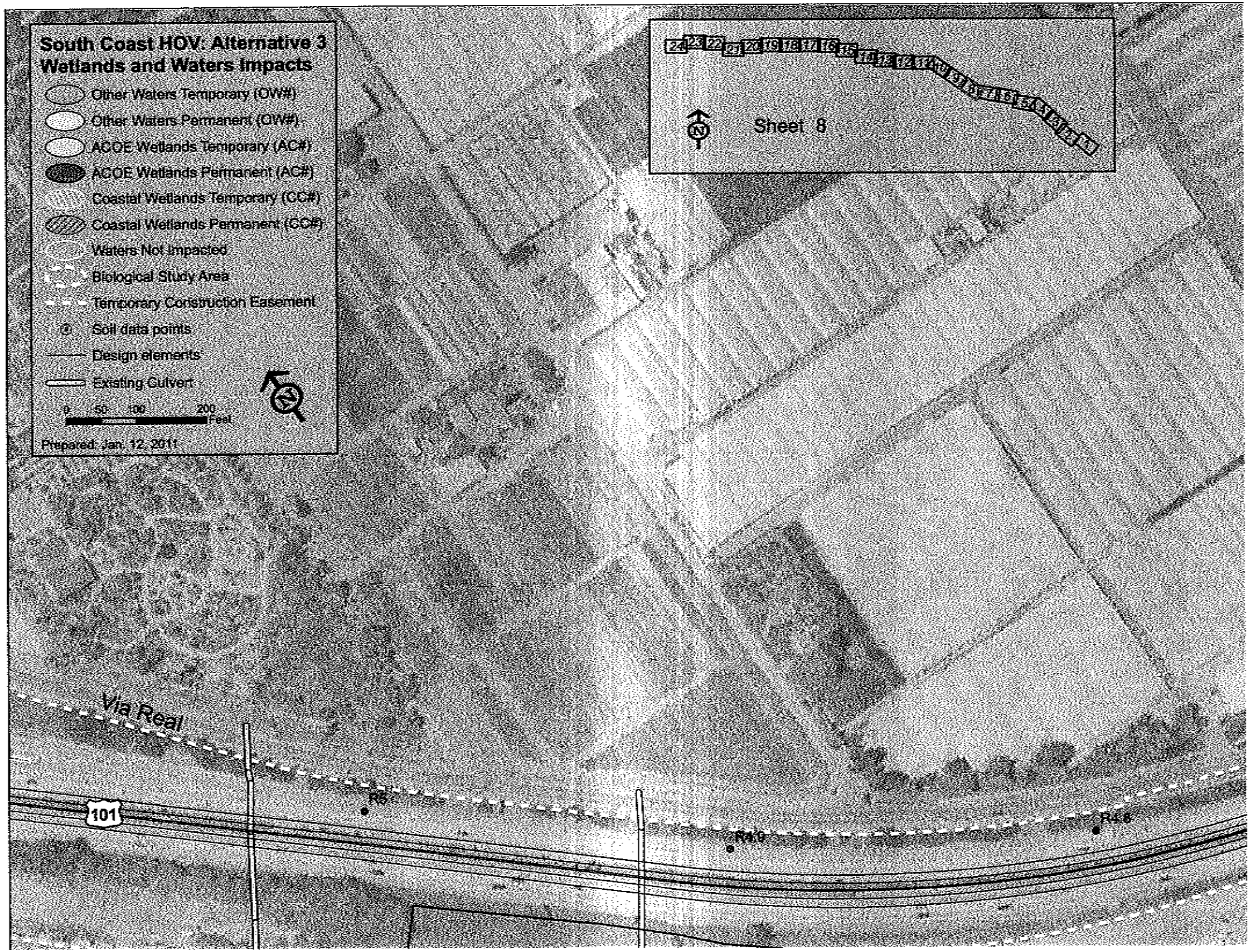

Star Pine Rd
Via Real
101
Hales Ln
Casitas Pass Rd
Byrnes Ln
Vallecito Rd

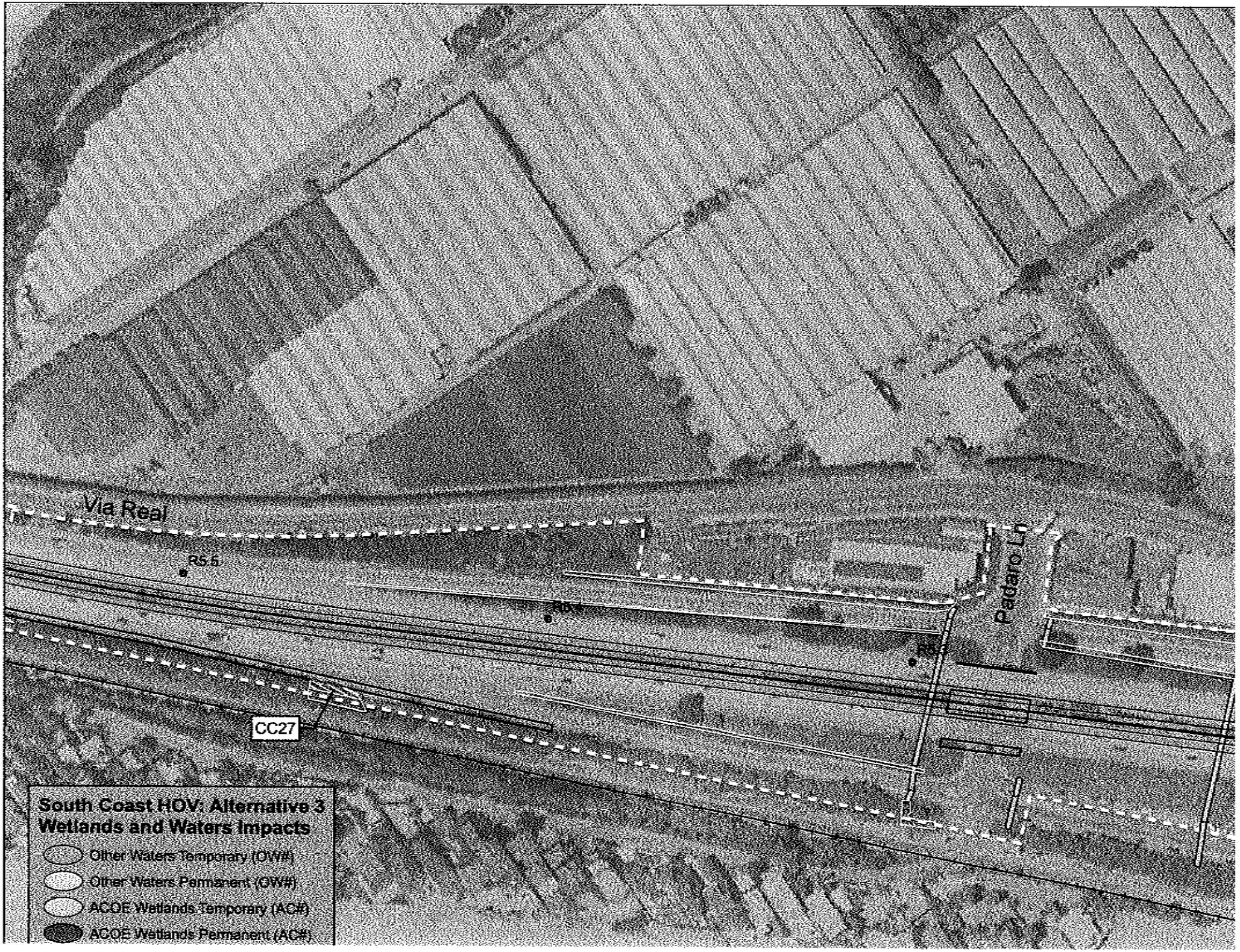

South Coast HOV: Alternative 3
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)
Coastal Wetlands Temporary (CC#)
Coastal Wetlands Permanent (CC#)
Waters Not Impacted
Biological Study Area
Temporary Construction Easement
Soil data points
Design elements
Existing Culvert
0 50 100 200
Feet
Prepared: Jan. 12, 2011
Pacific Village Dr
Linden Ave
Nipomo Dr
Holly Ln
Sawyer Ave
Franklin Creek
OW14
OW15
CC1

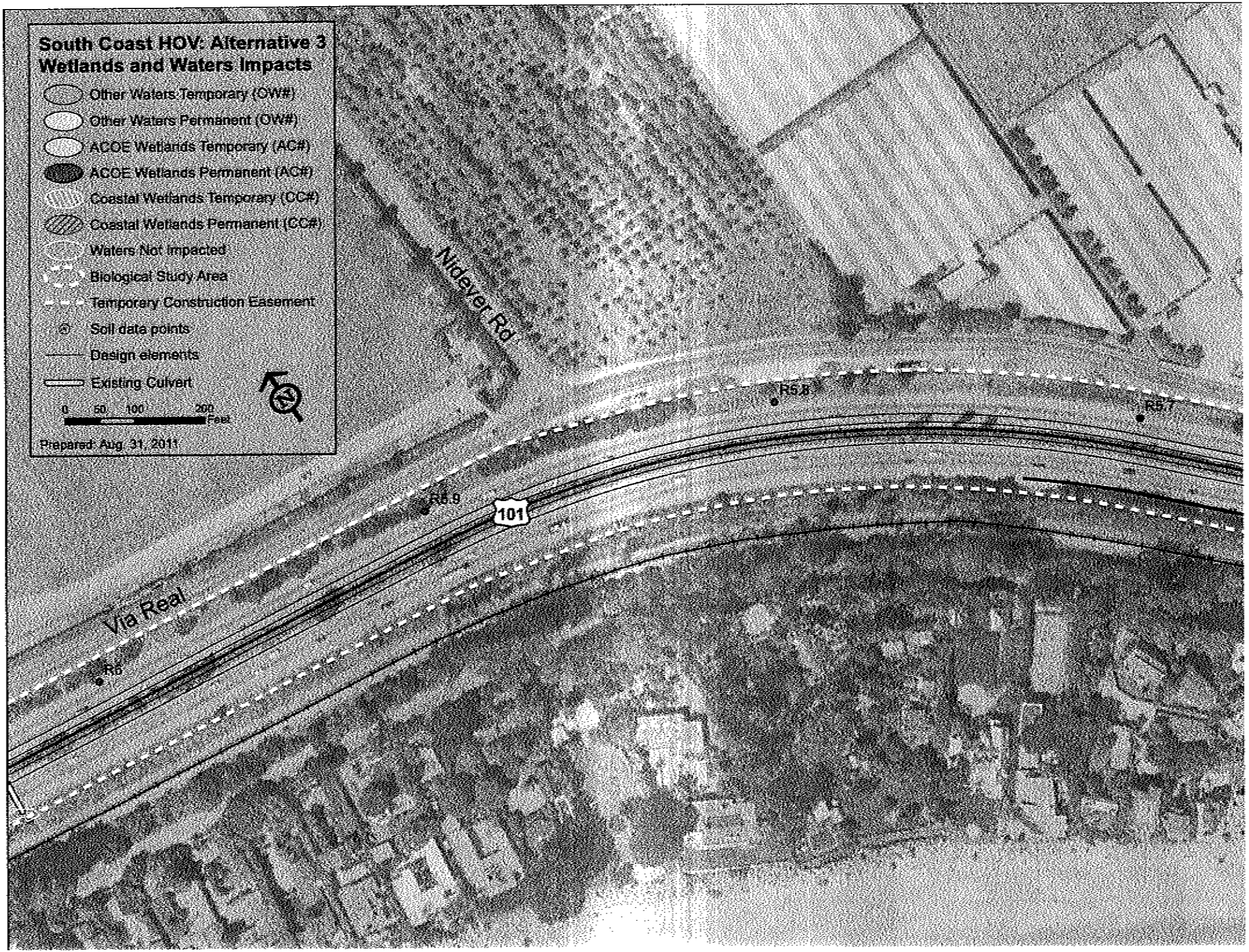

Aragon D
Dahlia Ct
Via Real
Cramer Cir
Chaney Ave
Delia St
Ele
AC2
CC2
3
2
1
OW17
101
Santa Ynez Ave
Carpinteria Ave
South Coast HOV: Alternative 3
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)

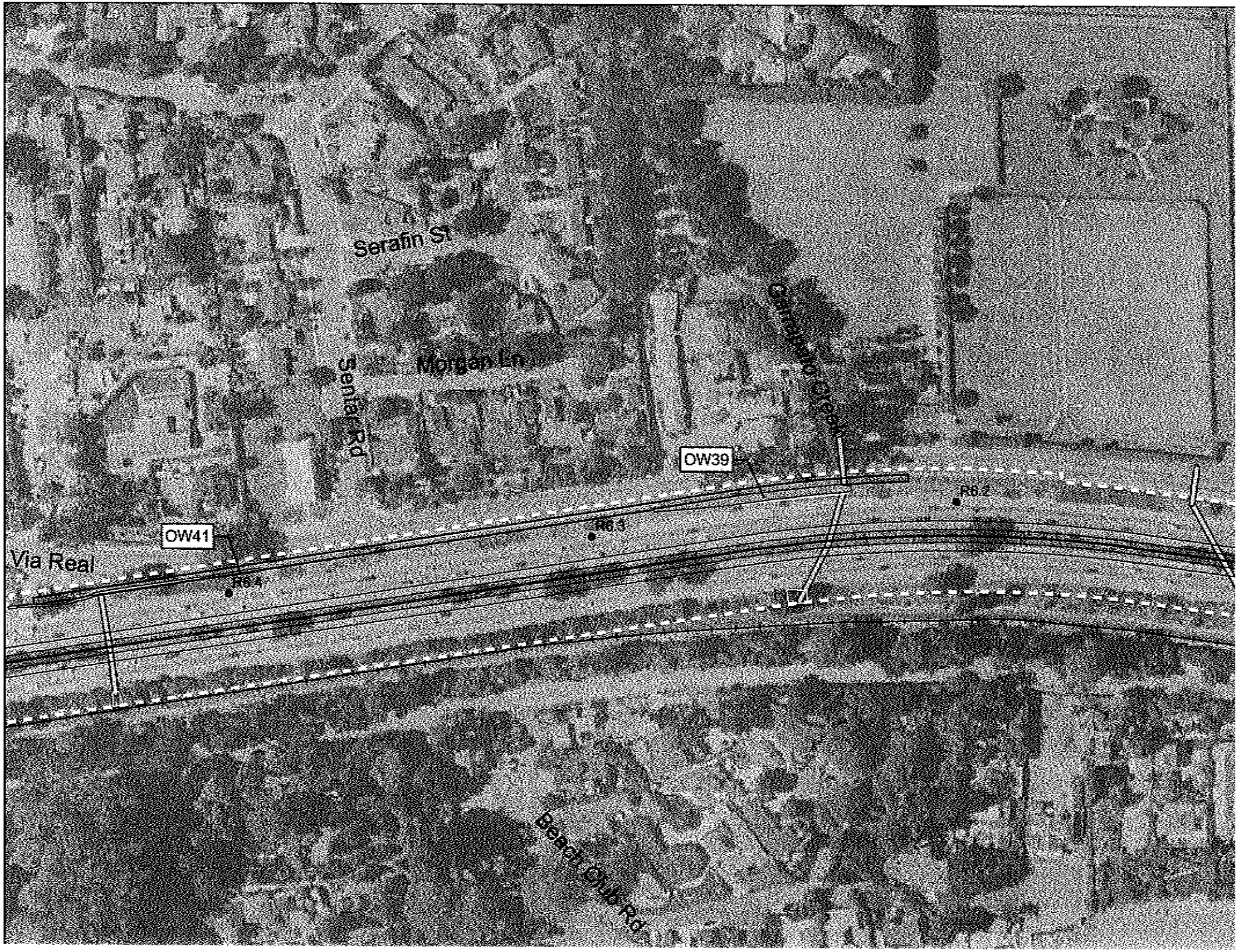

South Coast HOV: Alternative 3
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)
Coastal Wetlands Temporary (CC#)
Coastal Wetlands Permanent (CC#)
Waters Not Impacted
Biological Study Area
Temporary Construction Easement
Soil data points
Design elements
Existing Culvert
0 50 100 200
Feet
N
Prepared: Jan. 12, 2011
Trieste Ln
Via Marcina
Via Latina
Taranto Cir
Venice
Trieste Ln
Via Real
CC8
4.1
3.9
6.5
7
AC5
CC9
CC7

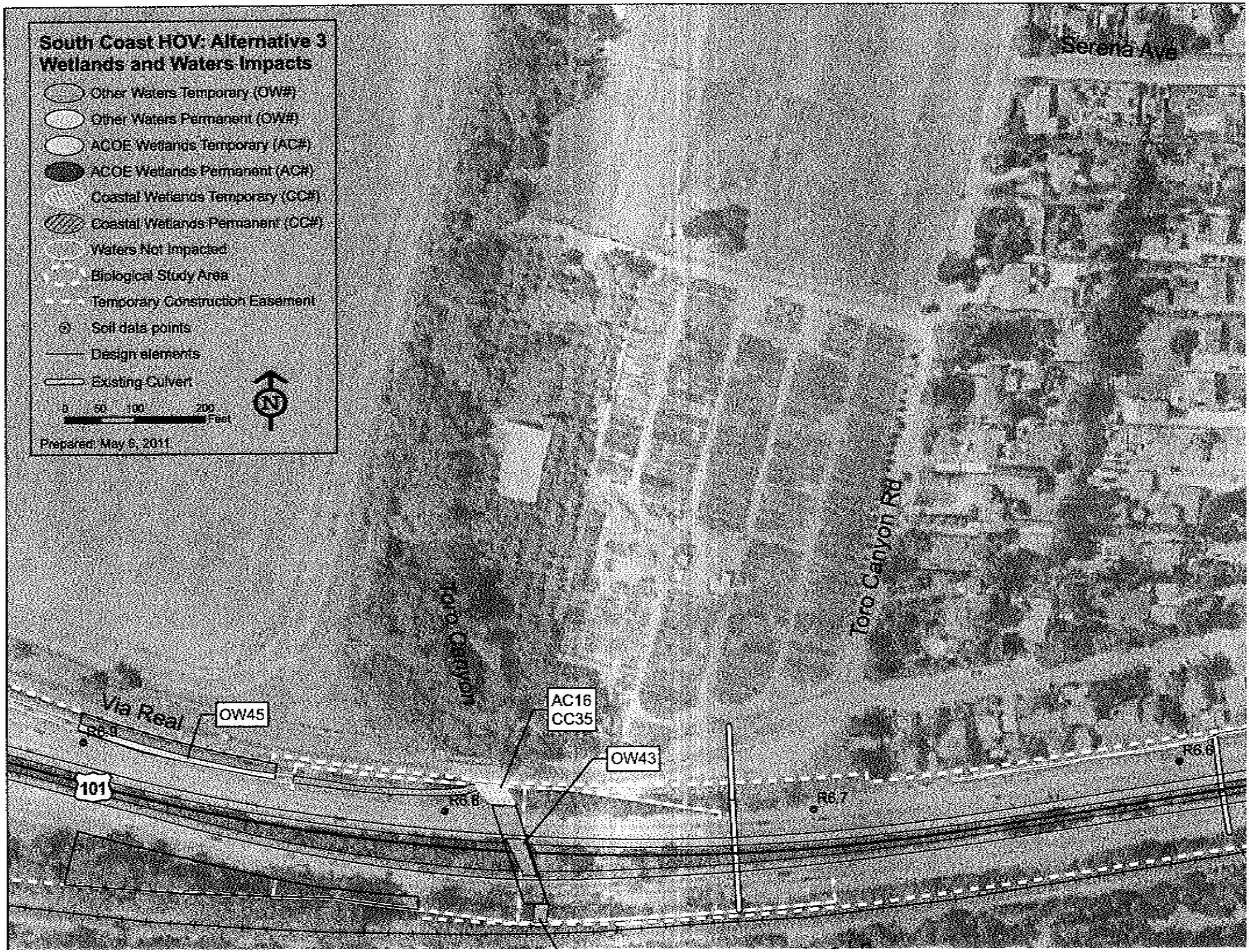

Cove St
Pearl St
Beach St
Bayside Dr
Lemon Dr
Cravens Ln
Francisca Dr
OW29
Via Real
101
4.6
4.4

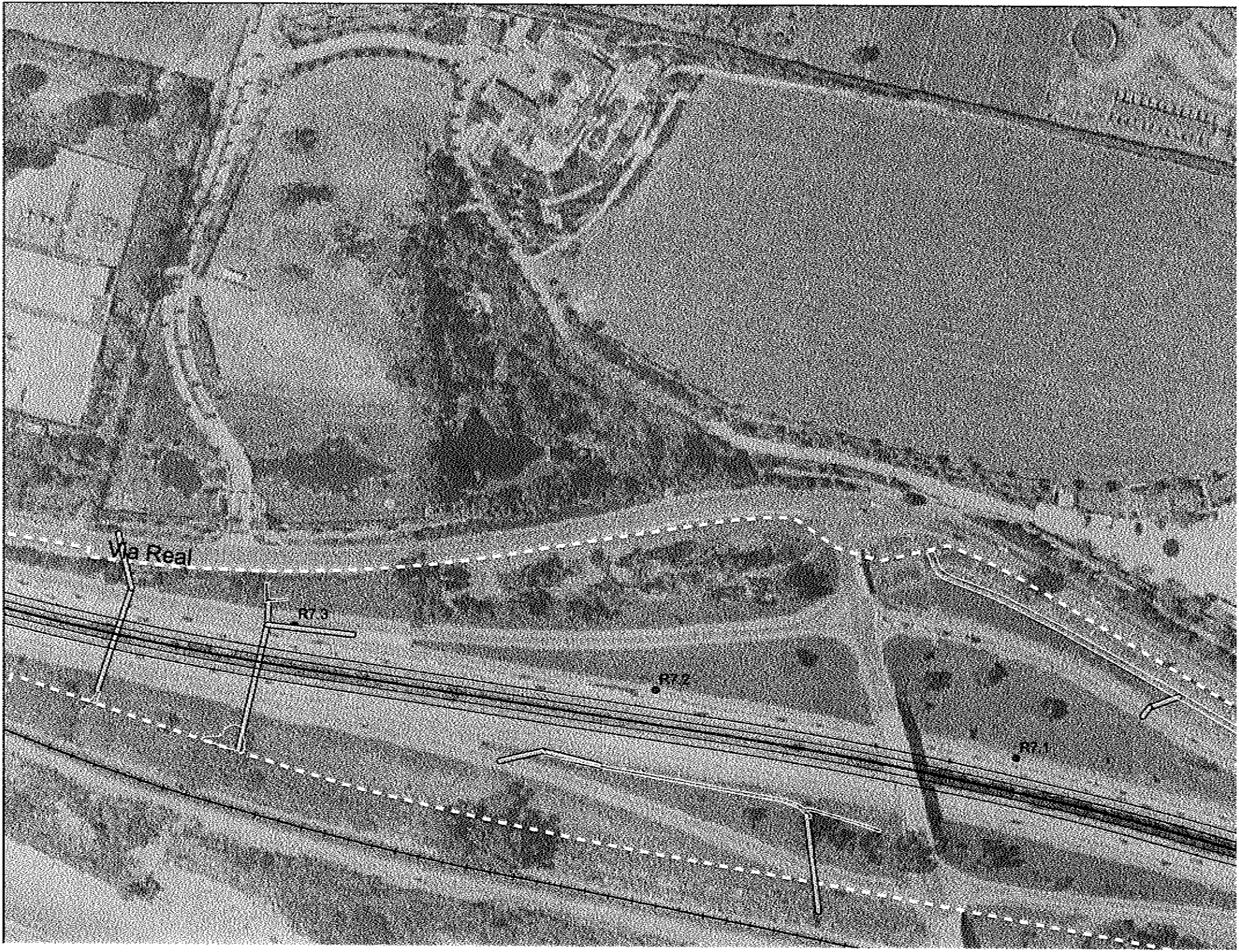

South Coast HOV: Alternative 3
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)
Coastal Wetlands Temporary (CC#)
Coastal Wetlands Permanent (CC#)
Waters Not Impacted
Biological Study Area
Temporary Construction Easement
Soil data points
Design elements
Existing Culvert
0 50 100 200
Feet
Prepared: Jan. 12, 2011
Sheet 8
Via Real
101
R5
R4.6
R4.5

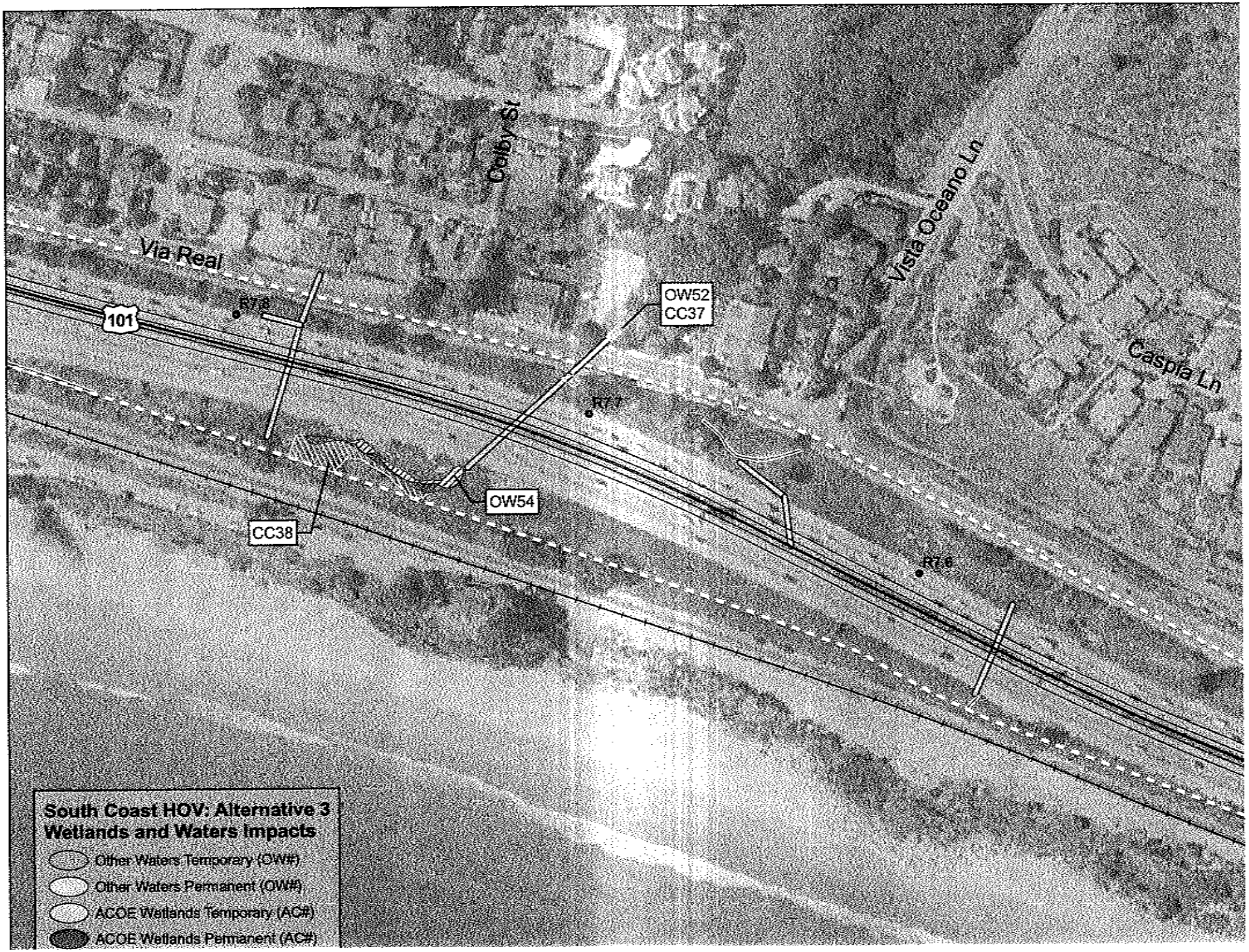

Via Real
R5.5
R5.4
R5.3
El Camino Real
CC27
South Coast HOV: Alternative 3
Wetlands and Waters impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)

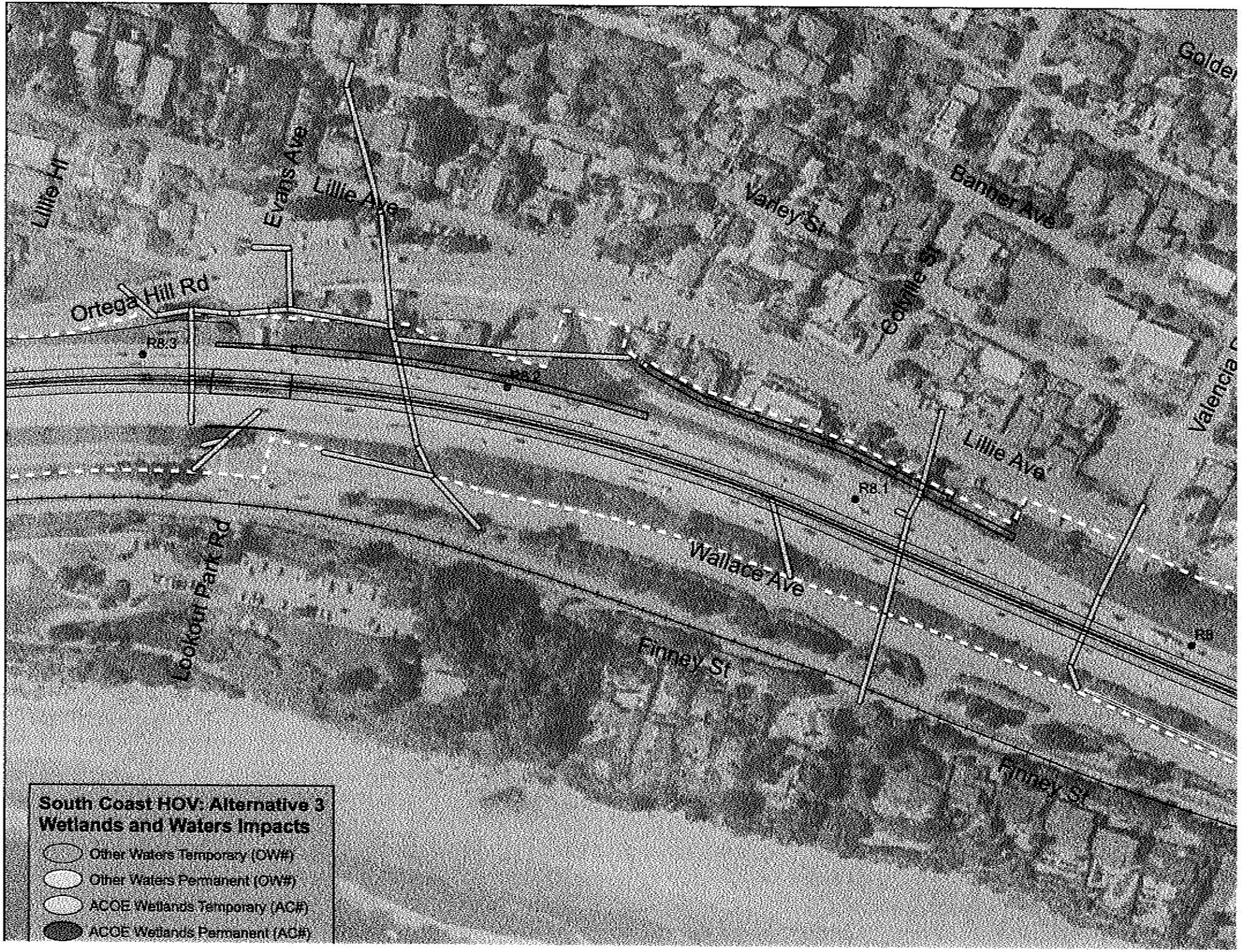

South Coast HOV: Alternative 3
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)
Coastal Wetlands Temporary (CC#)
Coastal Wetlands Permanent (CC#)
Waters Not Impacted
Biological Study Area
Temporary Construction Easement
Soil data points
Design elements
Existing Culvert
0 50 100 200 Feet
Prepared: Aug. 31, 2011
Nidever Rd
R5.8
R5.7
R5.9
101
Via Real
R6


Serafin St
Morgan Ln
Sentar Rd
Carrapato Creek
OW39
R6.2
R6.3
OW41
Via Real
R6.4
Beach Club Rd

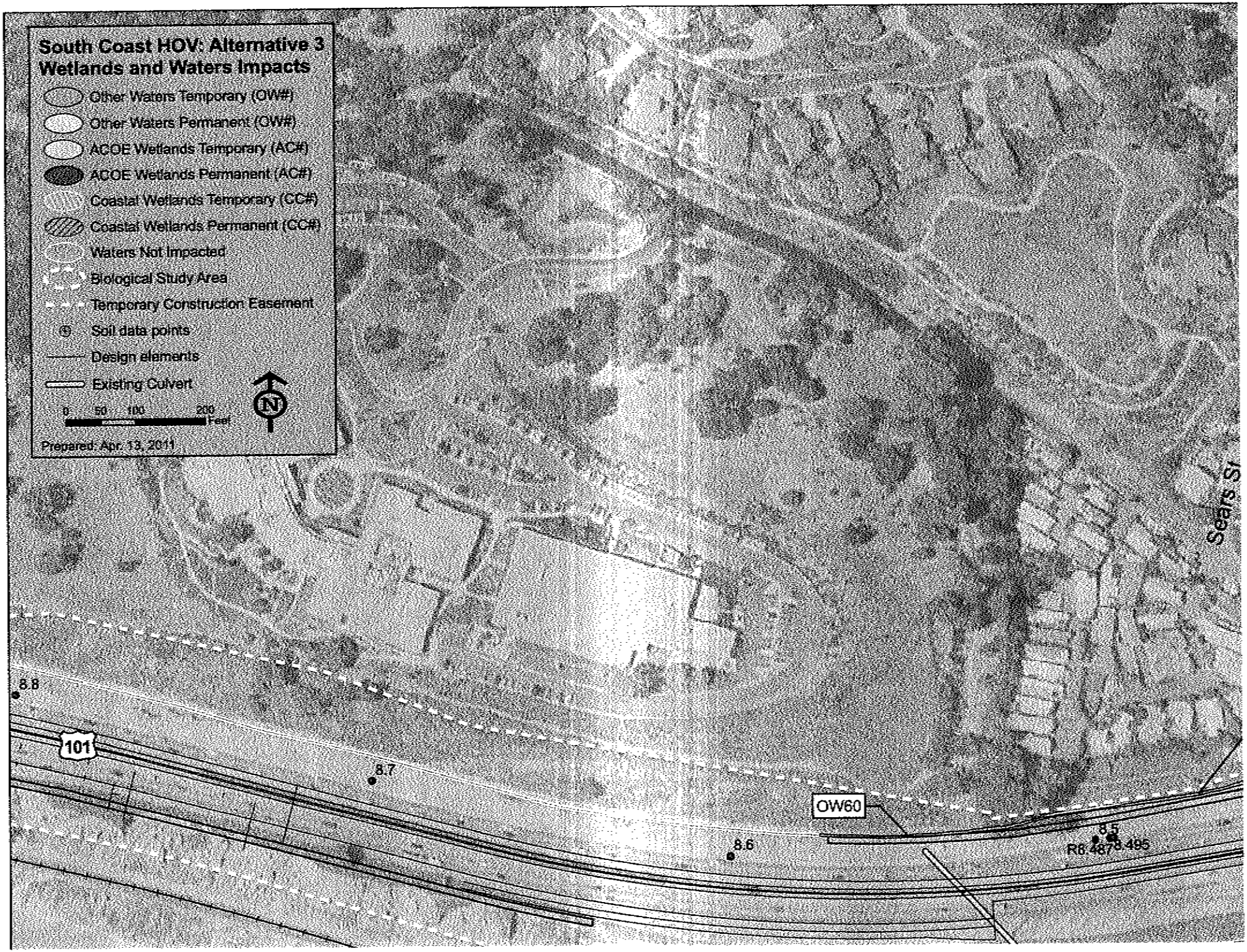

South Coast HOV: Alternative 3
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)
Coastal Wetlands Temporary (CC#)
Coastal Wetlands Permanent (CC#)
Waters Not Impacted
Biological Study Area
Temporary Construction Easement
Soil data points
Design elements
Existing Culvert
0 50 100 200 Feet
N
Prepared: May 6, 2011
Serena Ave
Toro Canyon Rd
Toro Canyon
Via Real
OW45
AC16
CC35
OW43
101
R6.9
R6.8
R6.7
R6.6

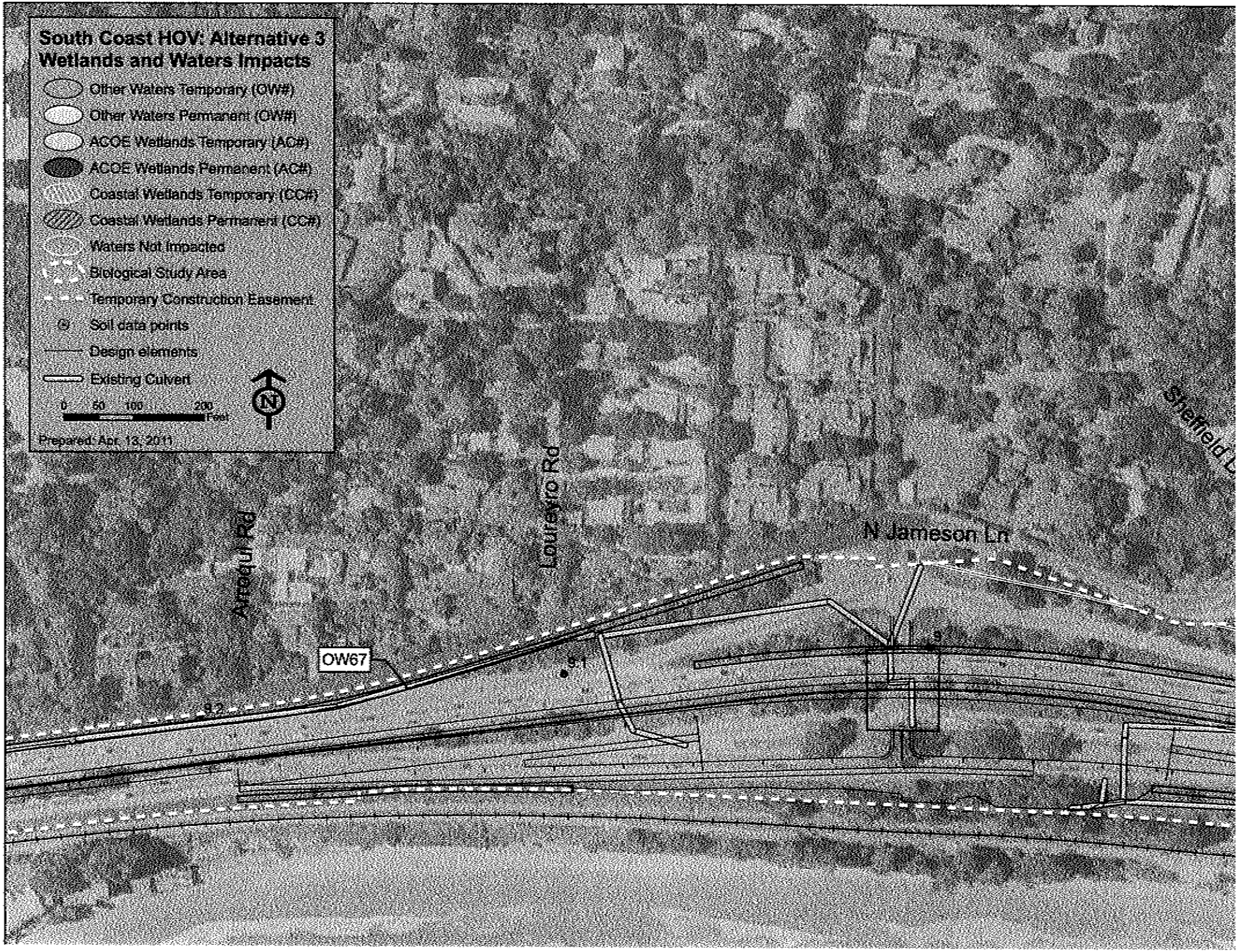

Via Real
R7.3
R7.2
R7.1

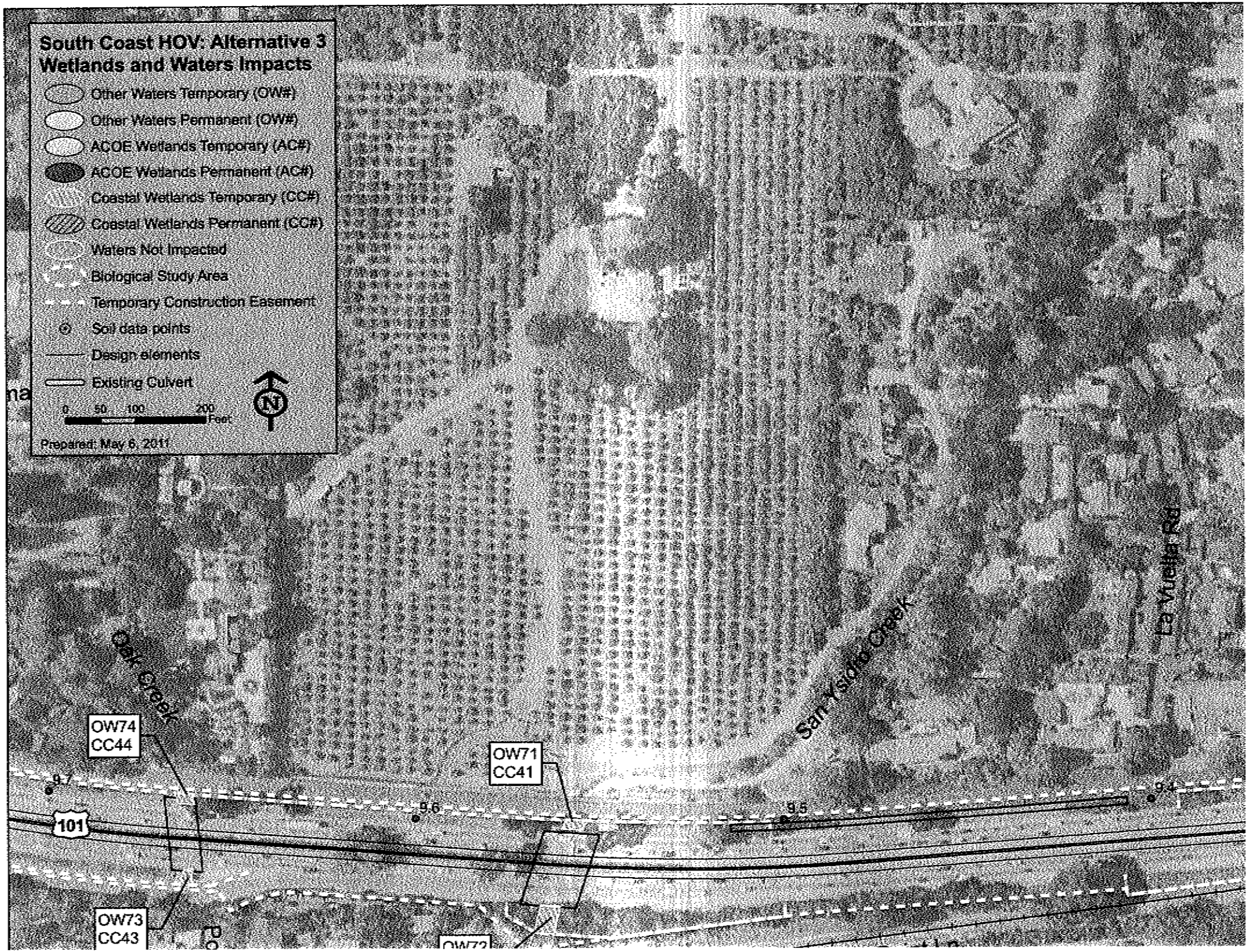

Via Real
Colby St
Vista Oceano Ln
Caspia Ln
101
R7.8
R7.7
R7.6
OW52
CC37
OW54
CC38
South Coast HOV: Alternative 3
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)

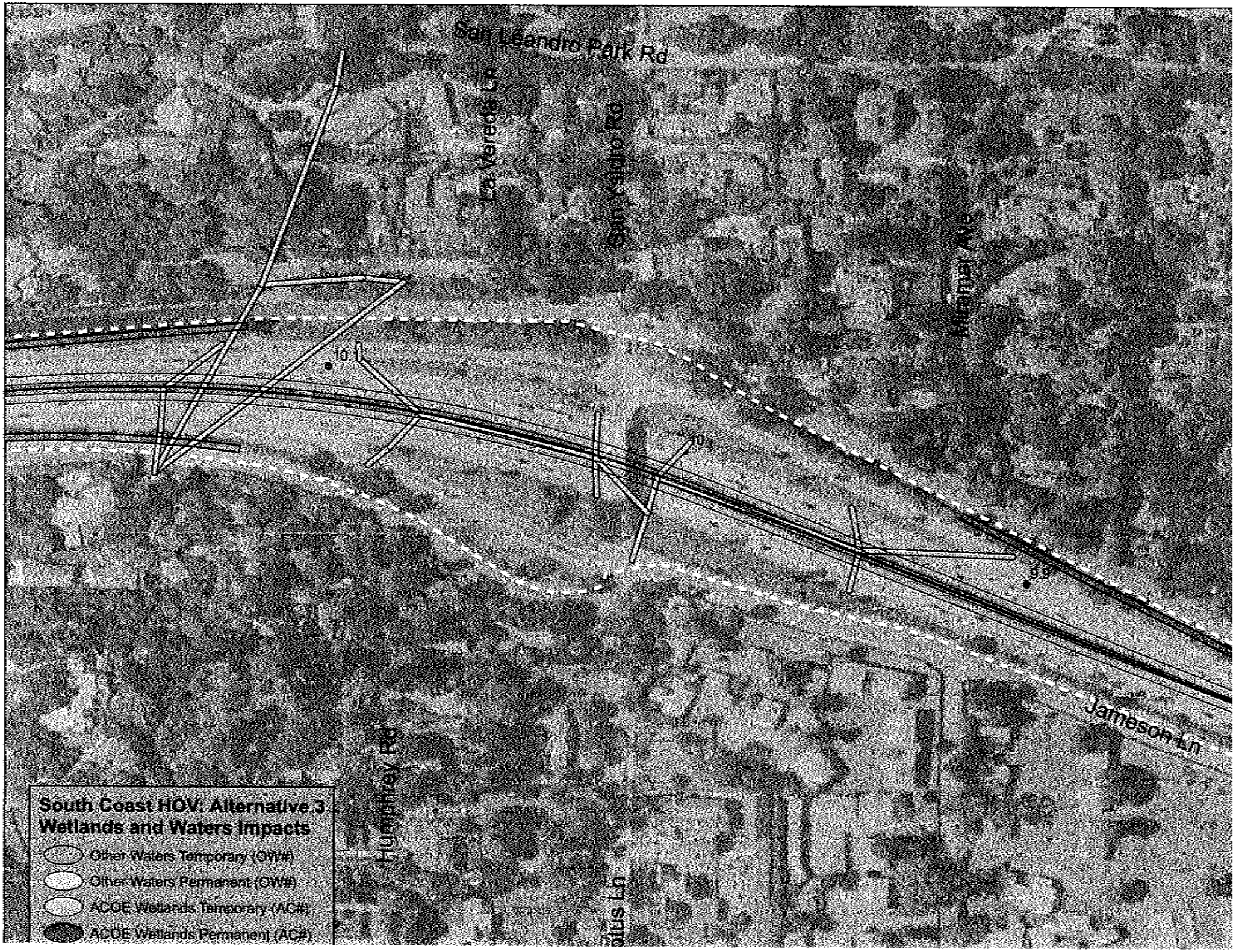


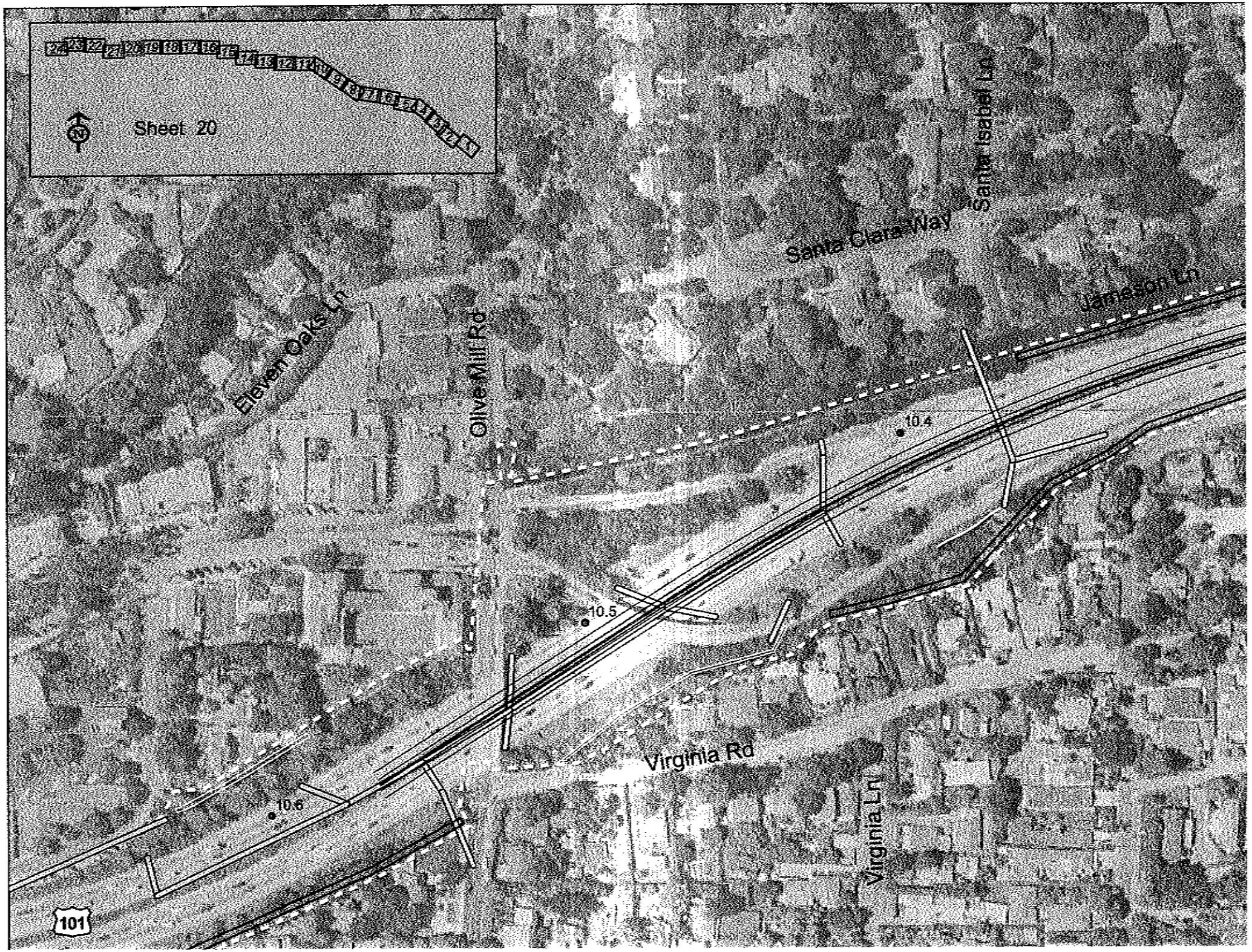
Golden
Lillie Hl
Evans Ave
Lillie Ave
Varley St
Banner Ave
Colville St
Ortega Hill Rd
R8.3
R8.2
Valencia
Lillie Ave
R8.1
Wallace Ave
Lookout Park Rd
Finney St
R8
Finney St
South Coast HOV: Alternative 3
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)

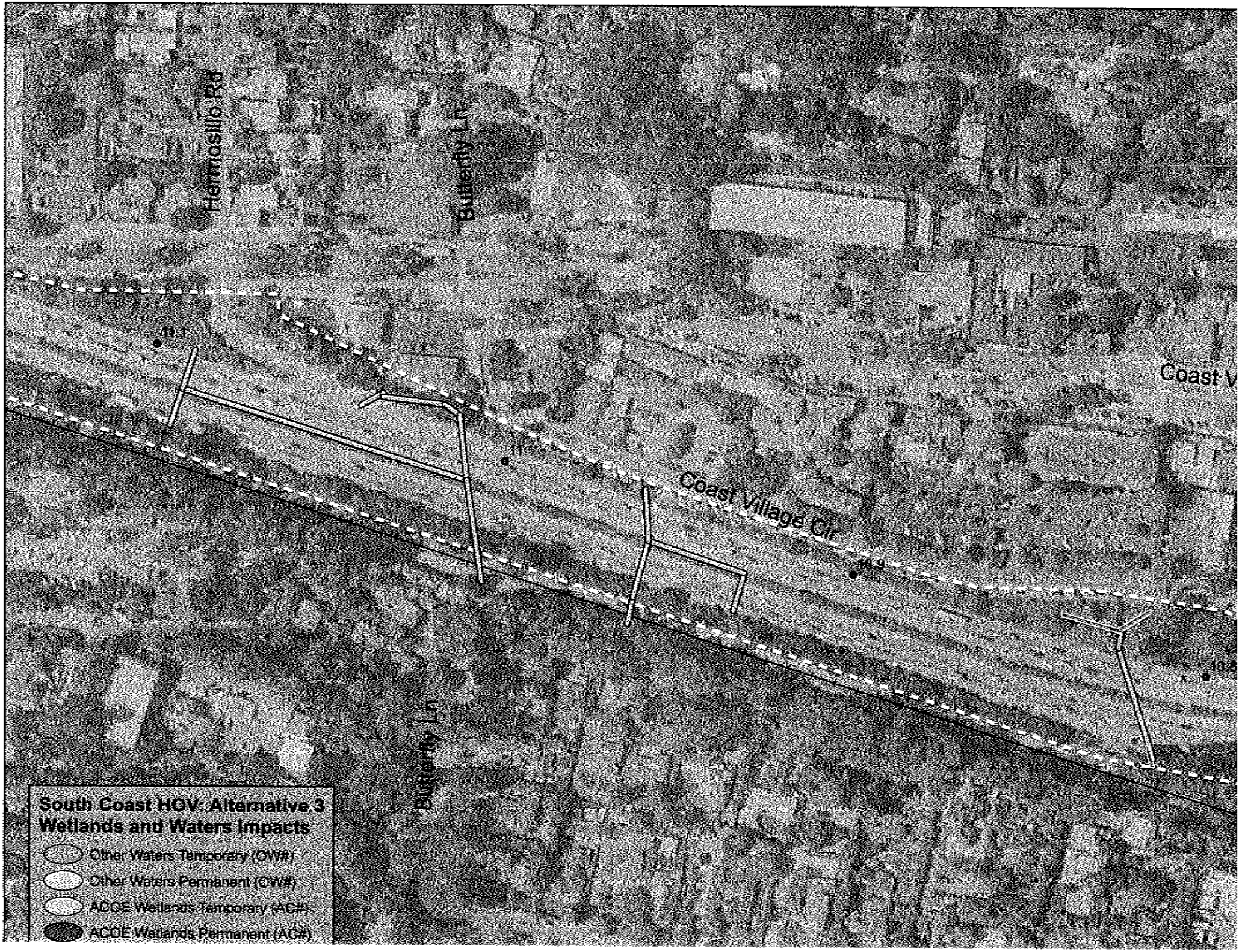

South Coast HOV: Alternative 3
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)
Coastal Wetlands Temporary (CC#)
Coastal Wetlands Permanent (CC#)
Waters Not Impacted
Biological Study Area
Temporary Construction Easement
Soil data points
Design elements
Existing Culvert
0 50 100 200 Feet
N
Prepared: Apr. 13, 2011
Sears St
8.8
101
8.7
8.6
OW60
8.5
R8.487
8.495

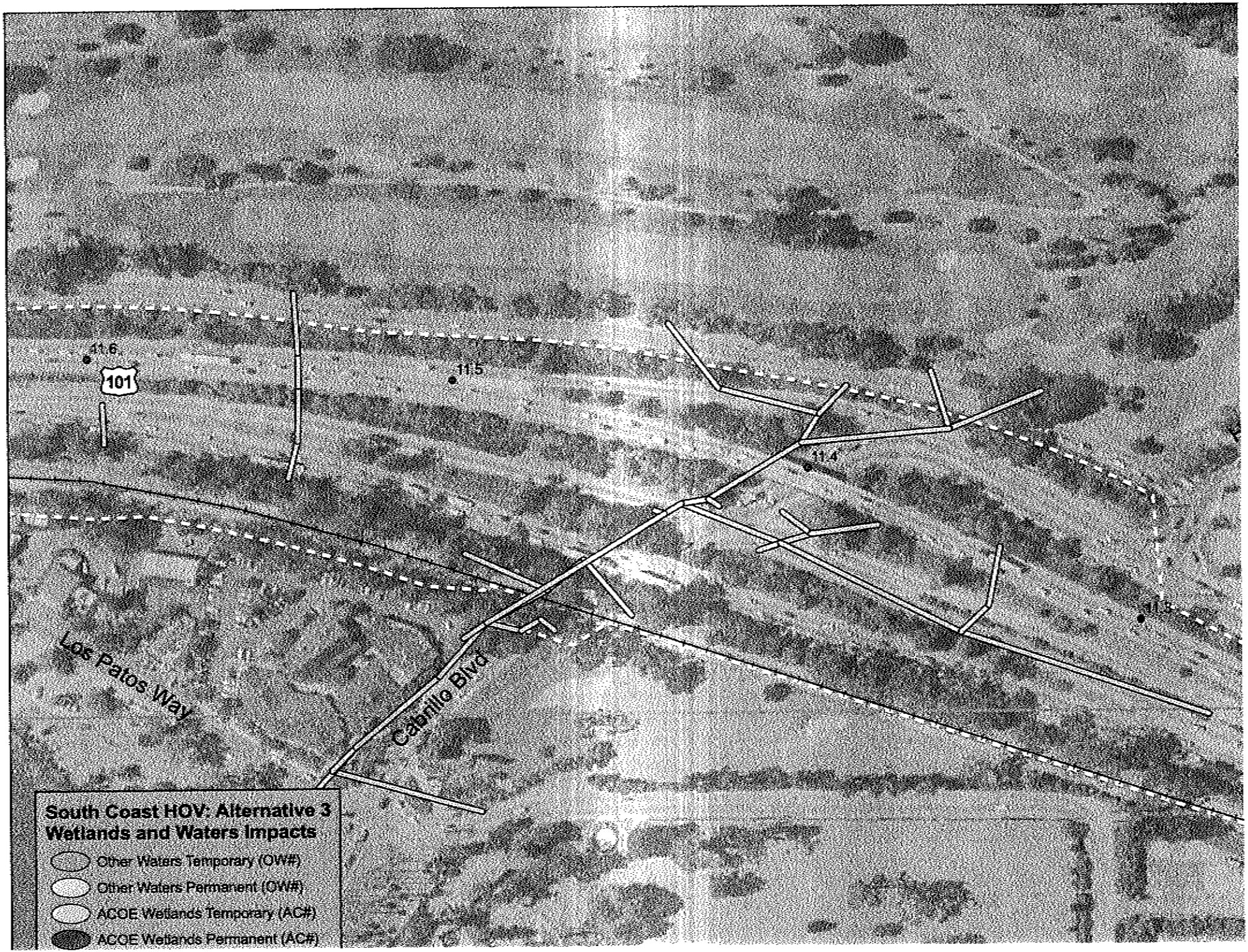

South Coast HOV: Alternative 3
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)
Coastal Wetlands Temporary (CC#)
Coastal Wetlands Permanent (CC#)
Waters Not Impacted
Biological Study Area
Temporary Construction Easement
Soil data points
Design elements
Existing Culvert
0 50 100 200 Feet
N
Prepared: Apr. 13, 2011
Arroyo Rd
Loureyro Rd
N Jameson Ln
Sheffield
OW67
S-1
S-2
S

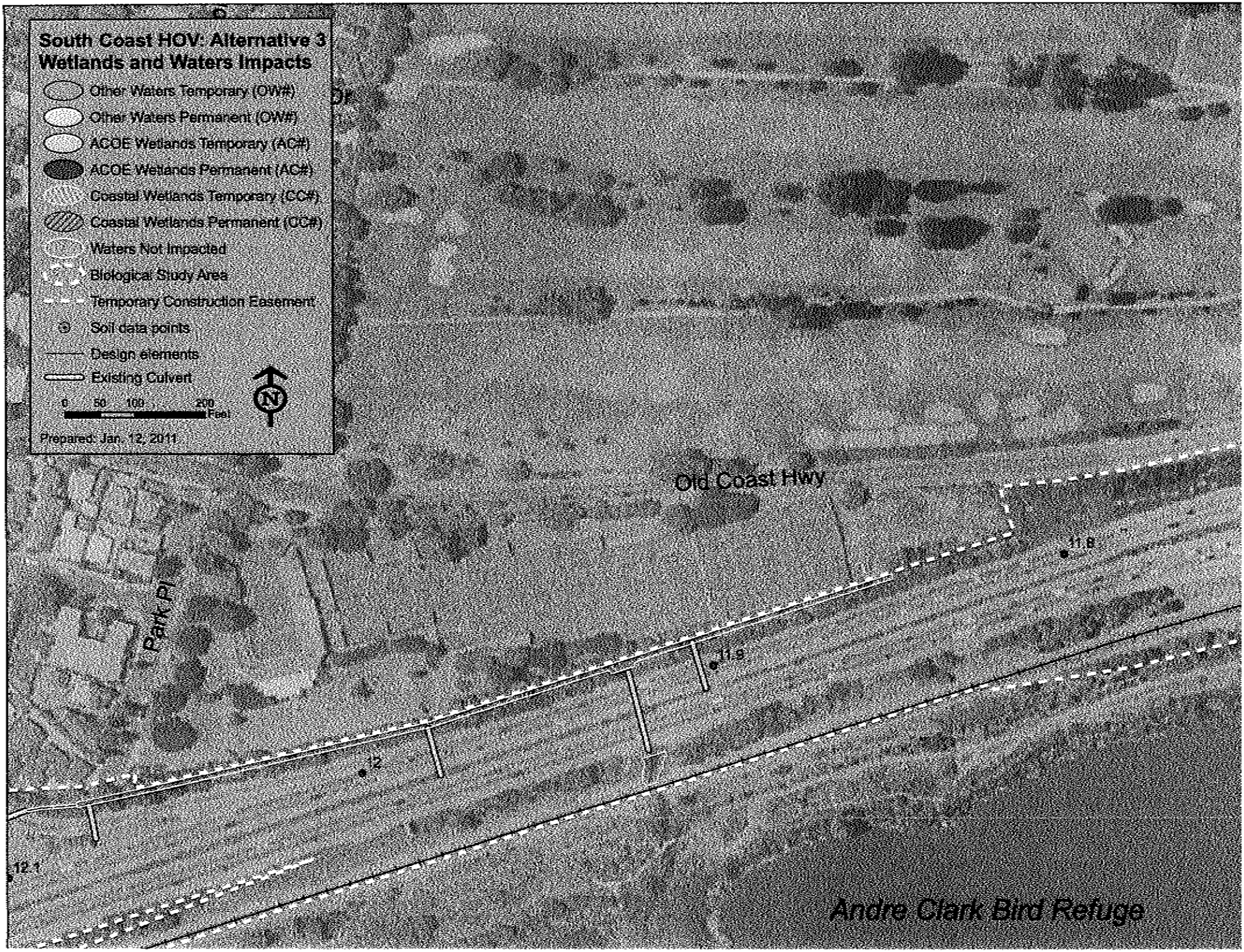

South Coast HOV: Alternative 3
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)
Coastal Wetlands Temporary (CC#)
Coastal Wetlands Permanent (CC#)
Waters Not Impacted
Biological Study Area
Temporary Construction Easement
Soil data points
Design elements
Existing Culvert
0 50 100 200 Feet
N
Prepared: May 6, 2011
Oak Creek
San Ysidro Creek
La Vuelta Rd
OW74
CC44
OW71
CC41
OW73
CC43
OW72
101
9.7
9.6
9.5
9.4

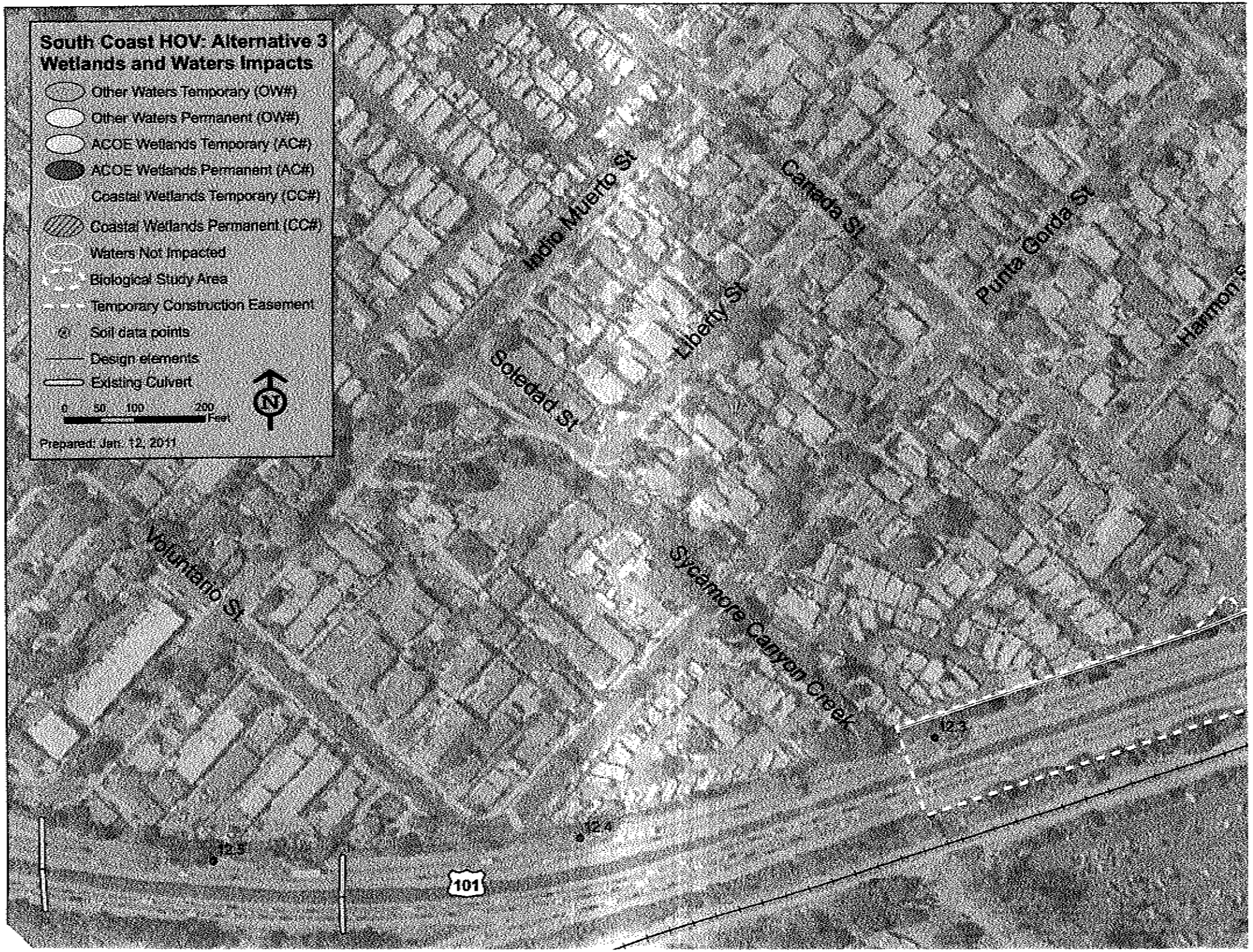

San Leandro Park Rd
La Vereda Ln
San Ysidro Rd
Miramar Ave
Jameson Ln
Humphrey Rd
10
10
9.9
South Coast HOV: Alternative 3
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)


Sheet 20
Eleven Oaks Ln
Olive Mill Rd
Santa Clara Way
Santa Isabel Ln
Jameson Ln
Virginia Rd
Virginia Ln
10.4
10.5
10.6
101

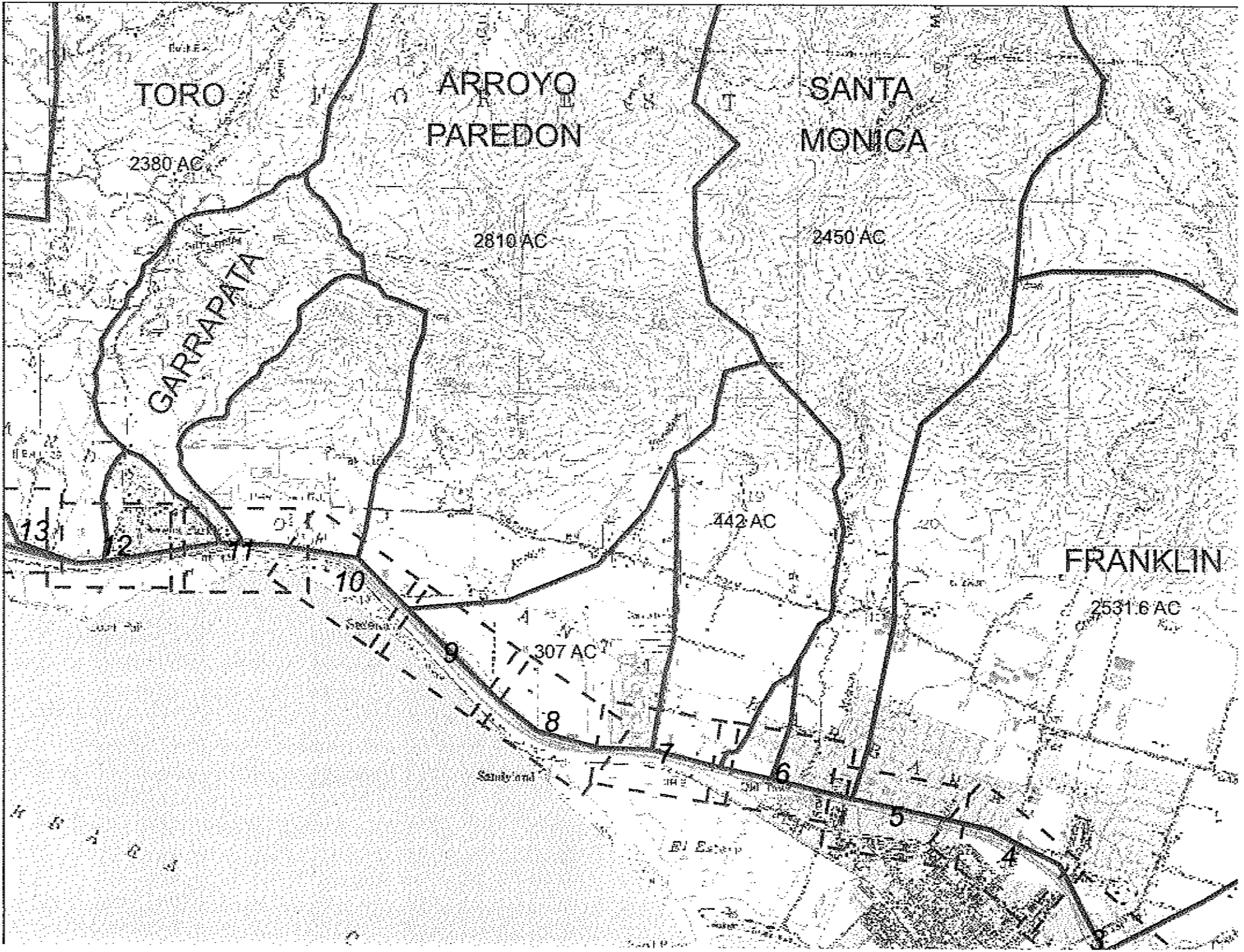

Hermosillo Rd
Butterfly Ln
Coast Village Cir
Coast V
11.1
11
10.9
10.8
Butterfly Ln
South Coast HOV: Alternative 3
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)

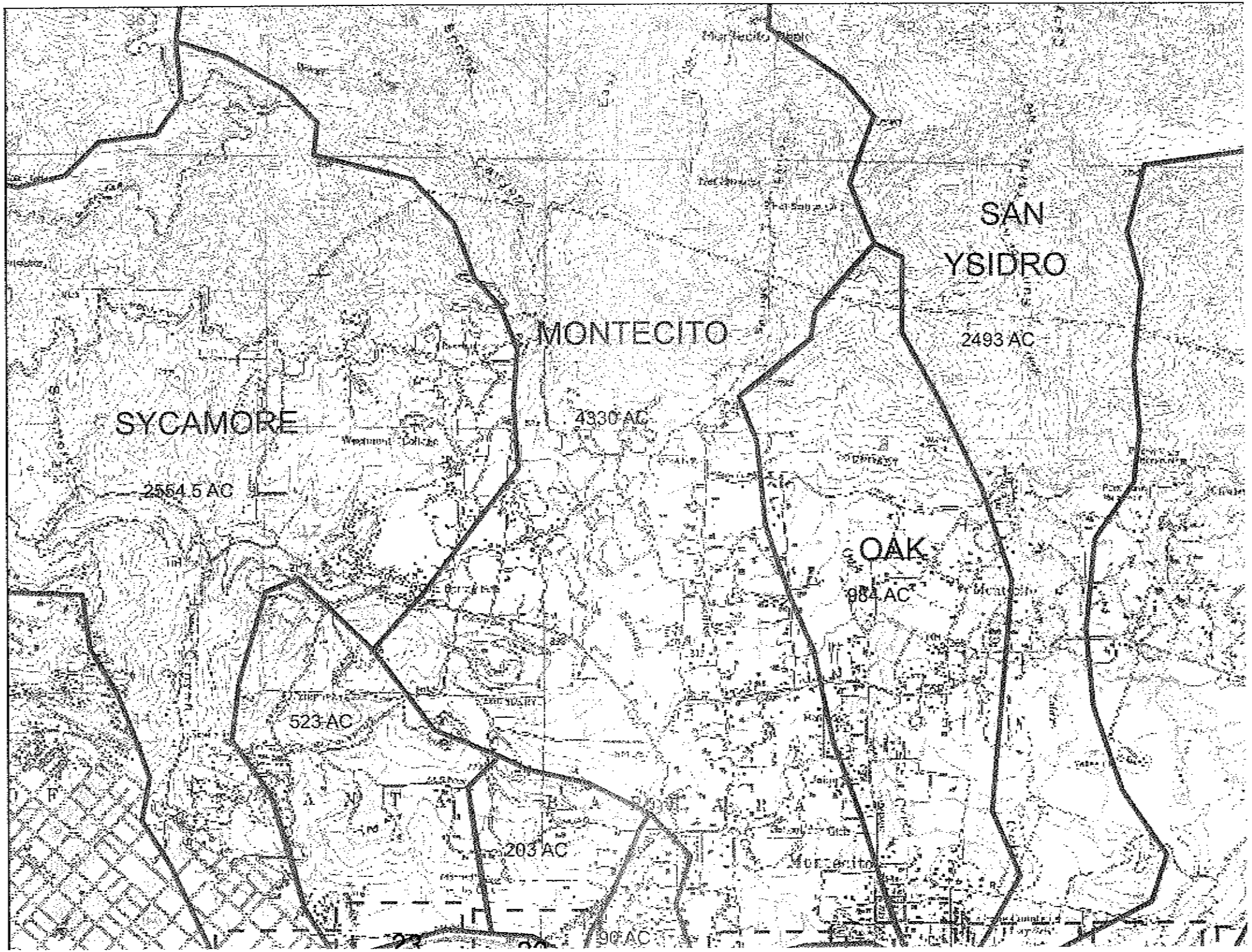

11.6
101
11.5
11.4
11.3
Los Patos Way
Cabrillo Blvd
South Coast HOV: Alternative 3
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)


South Coast HOV: Alternative 3
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)
Coastal Wetlands Temporary (CC#)
Coastal Wetlands Permanent (CC#)
Waters Not Impacted
Biological Study Area
Temporary Construction Easement
Soil data points
Design elements
Existing Culvert
0 50 100 200 Feet
N
Prepared: Jan. 12, 2011
Old Coast Hwy
Park Dr
11.8
11.9
12
12.1
Andre Clark Bird Refuge


South Coast HOV: Alternative 3
Wetlands and Waters Impacts
Other Waters Temporary (OW#)
Other Waters Permanent (OW#)
ACOE Wetlands Temporary (AC#)
ACOE Wetlands Permanent (AC#)
Coastal Wetlands Temporary (CC#)
Coastal Wetlands Permanent (CC#)
Waters Not Impacted
Biological Study Area
Temporary Construction Easement
Soil data points
Design elements
Existing Culvert
0 50 100 200 Feet
N
Prepared: Jan. 12, 2011
Mello Muerto St
Cañada St
Liberty St
Punta Gorda St
Harmon's
Soledad St
Voluntario St
Sycamore Canyon Creek
12.3
12.4
12.5
101

Appendix D Watershed Mapping


TORO
2380 AC
ARROYO
PAREDON
2810 AC
SANTA
MONICA
2450 AC
GARRAPATA
442 AC
307 AC
FRANKLIN
2531.6 AC
13
12
11
10
9
8
7
6
5
4
3
Sandy and


SAN
YSIDRO
2493 AC
MONTECITO
4330 AC
SYCAMORE
2554.5 AC
OAK
984 AC
523 AC
203 AC
90 AC

Appendix E Areas of Impacts to Individual Wetlands and Other Waters

** Refer to the maps in Appendix C for locations of wetlands and "other waters"

Table 11: Temporary and Permanent Impacts to Wetlands and Waters of the U.S.

Impact Areas Within Wetlands and Other Waters of the United States* Square feet within Area of Direct Impacts Waters and wetlands NOT affected are not listed in table.											
Other Waters (OW)	ACOE Wetlands (AC)	Coastal Wetlands (CC)	Map Sheet Appendix C	Feature: (ditch, creek, etc)	Lined / Unlined	Alternative 1 impacts		Alternative 2 impacts		Alternative 3 impacts	
						Permanent	Temporary	Permanent	Temporary	Permanent	Temporary
OW1	-	-	C:1	roadside ditch	L	3553.2	0.0	3553.2	0.0	3553.2	0.0
OW9	-	-	C:1	roadside ditch	L	6056.8	0.0	6056.8	0.0	6056.8	0.0
OW12	-	-	C:2	roadside ditch	L	5563.7	4440.0	5563.7	4440.0	5563.7	4440.0
-	-	CC1	C:5	roadside ditch	U	0.0	42.8	0.0	817.4	0.0	42.8
OW14	-	-	C:5	Franklin Ck	L	0.0	1356.2	0	1356.2	0	1356.2
OW15	-	-	C:5	Franklin Ck	L	0.0	764.8	0	764.8	0	764.8
OW16	-	-	C:5	Franklin Ck	L	0.0	1087.8	0	1087.8	0	1087.8
OW17	-	-	C:5	roadside ditch	L	9027.9	1711.3	10192.5	1027.0	9027.9	1711.3
-	AC2	CC2	C:5	roadside ditch	U	0.0	1166.4	0.0	1166.4	0.0	1166.4
OW18	-	-	C:5	roadside ditch	U	0.0	0.0	0.0	2228.5	0.0	0.0
OW21	-	-	C:6	S. Monica Ck	L	0.0	1980.93	0.0	1980.93	0.0	1980.93
OW22	-	-	C:6	S. Monica Ck	L	0.0	714.0	0.0	714.0	0.0	714.0
OW23	--	-	C:6	S. Monica Ck	L	0.0	2011.1	0.0	2011.1	0.0	2011.1

Other Waters (OW)	ACOE Wetlands (AC)	Coastal Wetlands (CC)	Map Sheet Appendix C	Feature: (ditch, creek, etc)	Lined / Unlined	Alternative 1 impacts		Alternative 2impacts		Alternative 3 impacts	
						Permanent	Temporary	Permanent	Temporary	Permanent	Temporary
-	-	CC6	C:6	culvert outlet	U	0	0	222.1	242.8	0	0
-	-	CC7	C:6	roadside ditch	U	1081.9	4040.1	5392.7	409.2	1081.9	4040.1
-	-	CC8	C:6	roadside ditch	U	50.0	499.0	2689.2	1743.4	50	499
-	-	CC9	C:6	roadside ditch	U	1031.1	3177.3	4855.7	2171.5	1031.1	3177.3
-	AC5	-	C:6	roadside ditch	U	223.6	1236.1	498.8	960.8	223.6	1236.1
	AC6	-	C:6	roadside ditch	U	0	0	28.8	22.2	0	0
OW27	-	-	C:6	roadside ditch	U	0	0	103.2	176.8	0	0
-	-	CC10	C:6	roadside ditch	U	0	0	141.1	288.5	0	0
-	AC10	-	C:7	roadside ditch	U	0	0	109.1	17.0	0	0
-	-	CC15	C:7	roadside ditch	U	0	0	1795.9	448.4	0	0
-	-	CC17	C:7	roadside ditch	U	0	0	1853.4	217.0	0	0
-	AC11	CC18	C:7	roadside ditch	U	0	0	80.5	16.0	0	0
-	-	CC27	C:9	roadside swale	U	65.2	759.6	65.2	759.6	65.2	759.6
OW29	-	-	C:8	roadside ditch	U	0.0	188.7	2321.2	0.0	0.0	188.7
OW32	-	-	C:9	roadside ditch	L	487.9	111.7	2468.3	5.0	0.0	0.0
OW33	-	-	C:9	roadside ditch	L	0.0	0.0	5.8	323.5	0.0	0.0
-	-	CC28	C:10	roadside swale	U	1222.0	1558.8	1421.5	1359.3	1222.0	1558.8
OW34	-	-	C:10	A. Paredon Ck	U	0.0	1249.5	588.4	666.1	0.0	1249.5

Other Waters (OW)	ACOE Wetlands (AC)	Coastal Wetlands (CC)	Map Sheet Appendix C	Feature: (ditch, creek, etc)	Lined / Unlined	Alternative 1 impacts		Alternative 2 impacts		Alternative 3 impacts	
						Permanent	Temporary	Permanent	Temporary	Permanent	Temporary
-	-	CC29	C:10	A. Paredon Ck	U	0.0	628.1	0	628.1	0.0	628.1
OW35	-	-	C:10	A. Paredon Ck	L	0.0	478.9	0.0	478.9	0.0	478.9
OW36	-	CC30	C:10	A. Paredon Ck	U	0.0	2770.0	0.0	2770.0	0.0	2770.0
-	-	CC31	C:10	roadside swale	U	0.0	1235.3	1128.7	106.6	0.0	1235.3
OW39	-	-	C:11	roadside ditch	U	94.2	2848.2	2906.4	482.1	94.2	2848.2
OW41	-	-	C:11	roadside ditch	U	707.6	760.8	735.6	3748.1	707.6	760.8
OW42	-	-	C:12	Culvert outlet	U	0.0	0.0	83.2	145.2	0.0	0.0
-	AC16	CC35	C:12	Toro Cyn Ck	U	0.0	1011.0	0.0	1011.0	0.0	1011.0
OW43	-	-	C:12	Toro Cyn Ck	L	0.0	1205.1	0.0	1205.1	0.0	1205.1
OW44	-	-	C:12	Toro Cyn Ck	L	0.0	514.8	0.0	514.8	0.0	514.8
OW45	-	-	C:12	roadside ditch	L	2454.2	2339.9	2454.2	2339.9	2454.2	2339.9
OW47	-	-	C:13	roadside ditch	L	376.6	50.2	376.6	242.0	0.0	0.0
OW48	-	-	C:13	roadside ditch	L	0.0	0.0	0.0	155.4	0.0	0.0
OW51	-	-	C:14	roadside ditch	U	0.0	0.0	0.0	224.2	0.0	0.0
OW52	-	CC37	C:14	Greenwell Ck	U	0.0	200.0	0.0	200.0	0.0	200.0
OW54	-	-	C:14	Greenwell Ck	U	1827.0	82.3	1827.0	82.3	1827.0	82.3
-	-	CC38	C:14	Greenwell Ck	U	3125.2	4324.5	3125.2	4324.5	3125.2	4324.5
OW57	-	-	C:15	Culvert inlet	U	0.0	0.0	373.1	0.0	0.0	0.0

Other Waters (OW)	ACOE Wetlands (AC)	Coastal Wetlands (CC)	Map Sheet Appendix C	Feature: (ditch, creek, etc)	Lined / Unlined	Alternative 1 impacts		Alternative 2 impacts		Alternative 3 impacts	
						Permanent	Temporary	Permanent	Temporary	Permanent	Temporary
OW59	-	-	C:16	roadside ditch	L	12.1	1330.1	12.1	1330.1	12.1	1330.1
OW60	-	-	C:16	roadside ditch	L	264.8	1655.9	264.8	1876.2	264.8	1655.9
OW62	-	-	C:16	roadside ditch	U	0.0	0.0	0.0	72.3	0.0	0.0
OW67	-	-	C:17	roadside ditch	U	869.0	620.4	869.0	620.4	869.0	620.4
OW68	-	-	C:17	roadside ditch	L	1401.9	359.7	1401.9	359.7	1401.9	359.7
OW69	-	CC39	C:18	Romero Ck	U	0.0	386.4	0.0	386.4	0.0	386.4
OW70	-	CC40	C:18	Romero Ck	U	0.0	517.9	0.0	517.9	0.0	517.9
OW71	-	CC41	C:18	San Ysidro Ck	U	0.0	427.1	0.0	427.1	0.0	427.1
OW72	-	CC42	C:18	San Ysidro Ck	U	0.0	1183.7	0.0	1183.7	0.0	1183.7
OW73	-	CC43	C:18	Oak Ck	U	0.0	326.8	0.0	326.8	0.0	326.8
OW74	-	CC44	C:18	Oak Ck	U	0.0	386.7	0.0	386.7	0.0	386.7

Appendix F List of Plants Observed in the Biological Study Area

List of Plants Observed in the South Coast HOV Project BSA during 2008 and 2009 Botanic Surveys

Genus	Specific Epitat	Common Name	NATIVE or EXOTIC
Acacia	dealbata	Silver wattle	Exotic Pest Plant
Agave	americana	Century plant	exotic
Alnus	Rhombifolia	White alder	native
Aloe	arborea	Bush Aloe	exotic
Anagallis	arvensis	scarlet pimpernel	exotic
Artemisia	californica	California or Coastal Sagebrush	native
Artemisia	douglasiana	Douglas mugwort	native
Arundo	donax	Giant reed, arrundo	Exotic Pest Plant
Aster	chilensis	California ater	native
Astragalus	sp	Vetch	
Atriplex	lentiformis	Brewers saltbrush	Native
Atriplex	rosea	Redscale	exotic
Atriplex	semibaccata	Australilan saltbrush	Exotic Pest Plant
Atriplex	triangularis	Spearscale	exotic
Avena	fatua	Wild oat	Exotic Pest Plant
Baccharis	douglasii	Marsh baccharis	native
Baccharis	pilularis	Coyote bush	native
Bambusa	sp.	Bamboo	exotic
Bougainvillea	sp.	Bougainvillea	exotic
Brassica	nigra	Black mustard	Exotic Pest Plant
Bromus	diandrus	Ripgut brome	Exotic Pest Plant
Bromus	hordeaceus	Soft chess brome	exotic
Bromus	madritensis ssp. rubens	Red brome	Exotic Pest Plant
Calendula	arvensis	Field Marigold	exotic
Callistemon	citrinus	Brilliant bottle-brush	exotic
Camissonia	Cheiranthifolia ssp. suffruticosa	Beach Evening Primrose	native
Carduus	pycnocephalus	Italian thistle	Exotic Pest Plant
Carpobrotus	edulis	hottentot fig	Exotic Pest Plant
Ceanothus	sp.	lilac	native
Centaurea	melitensis	tocolote	Exotic Pest Plant
Cercis	occidentalis	Western redbud	native
Clarkia	unguiculata	elegant clarkia	native
Conium	maculatum	Poison hemlock	Exotic Pest Plant
Convolvulus	arvensis	Field bindweed	Exotic Pest Plant
Cortaderia	jubata	Andean pampass	Exotic Pest Plant
Cotula	coronopifolia	Common brass butons	Exotic Pest Plant
Crassula	ovata	Jade plant	exotic
Cupaniopsis	anacardioides	carrot wood	exotic
Cupressus	macrocarpa	Monterey Cypress	native

Cuscuta	salina	California dodder	native
Cynodon	dactylon	Bermuda grass	exotic
Cynosurus	echinatus	Dog-tail grass	exotic
Cyperus	eragrostis	Tall flatsedge	exotic
Datura	wrightii	jimson weed	native
Dimorphotheca	sinuata	African daisy	Exotic Pest Plant
Echium	candicans	Pininana	Exotic Pest Plant
Ehrharta	calycina	Veldt grass	Exotic Pest Plant
Epilobium	parviflorum	Willow herb	native
Equisetum	hyemale	Giant Scouring rush	native
Equisetum	telmateia	Giant Horsetail	native
Ericameria	latifolia	Sawtooth goldenbush	native
Eriogonum	cinereum	Ashy leafed buckweat	native
Eriogonum	fasciculatum	California Buckwheat	native
Eriogonum	giganteum	St. Catherine's Lace	native
Eriogonum	parvifolium	Seacliff Buckwheat	native
Erodium	botrys	long-beaked filiaree	Exotic Pest Plant
Erodium	cicutarium	red-stemmed filaree	Exotic Pest Plant
Eriophyllum	confertifolium	Golden yarrow	native
Escallonia	sp.	Escallonia	exotic
Eschscholzia	californica	California poppy	native
Eucalyptus	globulus	Tasmanian blue gum	Exotic Pest Plant
Eucalyptus	sp.	Eucalyptus	Exotic Pest Plant
Euphorbia	crenulata	Chinese caps	native
Foeniculum	vulgare	Fennel, Annis	Exotic Pest Plant
Fremontodendron	californicum ssp. californicum	Fremontia, flannelbush	native
Galium	aparine	Bedstraw, Goose grass	exotic
Genista	monspessulana	French broom	Exotic Pest Plant
Geranium	dissectum	cut-leaved Geranium	exotic
Gnaphalium	californicum	green everlasting	native
Gnaphalium	luteo-album	weedy cudweed	exotic
Gnaphalium	stramineum	cotton-batting plant	native
Hedera	helix	English Ivy	Exotic Pest Plant
Heliotropium	curassavicum	heliotrope	native
Hemizonia	fasciculata	Fascicled tarweed	native
Heteromeles	arbutifolia	Toyon	native
Heterotheca	grandiflora	Telegraph Weed	native
Hordeum	murinum ssp. glaucum	foxtail barley	exotic
Ipomoea	sp.	Morning glory	exotic
Jacaranda	mimosifolia	Sharpleaf Jacaranda , Blue Jacaranda	exotic
Jaumea	carnosa	fleashy Jaumea	native
Juncus	phaeocephalus	Brownheaded rush	native
Lactuca	serriola	prickly lettuce	exotic
Lemna	minor	Duckweed	native
Leymus	condensatus	Giant rye	native
Lobularia	maritima	Sweet Alyssum	exotic
Lolium	multiflorum	Italian ryegrass	Exotic Pest Plant
Lonicera	japonica	Japanese honeysuckle	exotic
Lotus	scoparius	Deerweed, Calif. broom	native
Lupinus	albifrons	Silver bush lupine	native
Malacothamnus	fasciculatus	Chaparral, Mesa Bush	native
Malosma	laurina	Laurel Sumac	native
Malva	parviflora	Cheeseweed	Exotic Pest Plant

Marah	fabaceus	Wild cucumber, manroot	native
Medicago	polymorpha	California bur-clover	Exotic Pest Plant
Melaleuca	sp.	Paper bark Tree	exotic
Melilotus	alba	White sweet clover	exotic
Mesembryanthemum	crystallinum	Crystalline iceplant	Exotic Pest Plant
Myoporum	laetum	Myoporum, ngaio tree	Exotic Pest Plant
Nasella	pulchra	Purple needlegrass	native
Nasturtium	gambelii	Nasturtium, Gambel's watercress	exotic
Nerium	oleander	oleander	Exotic Pest Plant
Nicotiana	glauca	Tree tobacco	Exotic Pest Plant
Oenothera	elata ssp. hirsutissima	Hookers evening primrose	native
Olea	europaea	Common or Mission Olive	Exotic Pest Plant
Optunia	sp.	Prickly pear cactus	Exotic
Oxalis	pes-caprae	Bermuda buttercup	exotic
Pennisetum	setaceum	fountain grass	Exotic Pest Plant
Persea	americana	Avocado	exotic
Phoenix	sp.	Date Palm	exotic
Picris	echioides	Bristly ox-tongue	Exotic Pest Plant
Pinus	torreyana	Torrey Pine	exotic
Pinus	radiata	Monterey Pine	native
Piptotherum	Miliaceum	Smilo grass	exotic
Pittosporum	undulatum	Orange Pittosporum	exotic
Plantago	lanceolata	English Plantain	exotic
Platanus	racemosa	Western or California Sycamore	native
Podocarpus	macrophyllus	Yew Podocarpus	exotic
Polypogon	monspelliensis	Rabbitsfoot grass	exotic
Potamogeton	pectinatus	Fennel leaved pondweed	native
Quercus	agrifolia	Coast Live Oak	native
Raphanus	sativus	Wild Radish	Exotic Pest Plant
Rhus	integrifolia	Lemonade Berry	native
Rhus	laurina	Laurel-sumac	native
Rhus	ovata	Sugarbush	native
Ricinus	communis	Castor Bean	Exotic Pest Plant
Romneya	coulteri	Matilija Poppy	native
Rorippa	nasturtium-aquaticum	Watercress	exotic
Rubus	ursinus	California blackberry	native
Rumex	acetosella	Sheep Sorrel	exotic
Rumex	crispus	Curly dock	exotic
Salicornia	virginica	Pickleweed	native
Salix	babylonica	Weeping Willow	exotic
Salix	sp.	willow	native
Salsola	tragus	Russian thistle, tumbleweed	Exotic Pest Plant
Salvia	mellifera	Black sage	native
Sambucus	mexicana	Blue or Mexican Elderberry	native
Senecio	vulgaris	common groundsel	exotic
Senecio	mikanioides	Cape ivy, German ivy	Exotic Pest Plant
Schinus	molle	Peruvian pepper tree	Exotic Pest Plant
Scirpus	americanus	American three-square	native
Scirpus	microcarpus	Small-fruited bulrush	native
Scirpus	pugens	common three-square	native
Sequoia	sempervirens	Redwood	native
Sysyrinchium	elmeri	Western blue eyed grass	native
Solanum	douglasii	White nightshade	native

Sonchus	oleraceus	sowthistle	exotic
Stachys	bullata	Hedge Nettle	native
Stellaria	media	Common Chickweed	exotic
Stephanomeria	exigua	wire lettuce	native
Suaeda	calceoliformis	Horned sea blight	native
Syagrus	romanzoffiana	Queen Palm	exotic
Toxicodendron	diversilobium	Poison oak	native
Tropaeolum	majus	Garden Nasturtium	exotic
Typha	latifolia	Cattail	native
Urtica	dioica	Stinging nettle	exotic
Verbena	lasiostachys	Western verbena	native
Vicia	sativa	Spring vetch	exotic
Vinca	major	Vinca, periwinkle	Exotic Pest Plant
Vitis	vinifera	Wine Grape	exotic
Vulpia	myuros	mouse-tail fescue	exotic
Washingtonia	filifera	California Fan Palm	Exotic
Yucca	sp.	Yucca	exotic

Appendix G Wetlands Study

The *Preliminary Jurisdictional Determination for the South Coast 101 HOV Project, Santa Barbara, California* (Wetland Study) was prepared by SWCA Environmental Consultants for Caltrans in May 2010. Since its completion, Caltrans design alternatives have been updated, resulting in impacts calculations that differ from the values reported in Section 5 of the *Preliminary Jurisdictional Determination.*

Final temporary and permanent impacts to proposed jurisdictional areas are reported in Chapter 4 of the Natural Environmental Study and are shown in the Project Map Sheets (Appendix C).

Preliminary Jurisdictional Determination for the South Coast 101 HOV Lanes Project, Santa Barbara County, California

Prepared for:

Caltrans District 5

Prepared by:

SWCA Environmental Consultants

May 2010

PRELIMINARY JURISDICTIONAL DETERMINATION
FOR THE
SOUTH COAST 101
HIGH OCCUPANCY VEHICLE LANES PROJECT

Prepared for:

Caltrans District 5
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May 2010

SWCA Project Number: 15401

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1. INTRODUCTION

1.1 SCOPE

This Preliminary Jurisdictional Determination summarizes existing hydrology, soil, and vegetative conditions for a portion of the South Coast 101 High Occupancy Vehicle (HOV) Lanes Project (project), in Santa Barbara County, California (refer to Figures 1 and 2). SWCA Environmental Consultants (SWCA) has prepared this report at the request of the California Department of Transportation (Caltrans) District 5, and it is intended for use by Caltrans and affected regulatory agencies. This report identifies potential wetlands and waters of the United States, as defined by the U.S. Army Corps of Engineers (USACE), and potential waters of California, as defined by the State, including the State Water Resources Control Board (SWRCB), Regional Water Quality Control Board (RWQCB), and the California Coastal Commission (CCC). Findings reported herein are based on information gathered in the field at the time of investigation, and the investigator's understanding of the *USACE 1987 Wetlands Delineation Manual* (Environmental Laboratory 1987), the *Final Arid West Regional Supplement* Version 2.0 (USACE 2008), the *Definition and Delineation of Wetlands in the Coastal Zone* (CCC 2006), the *Procedural Guidance for the Review of Wetland Projects in California's Coastal Zone* (CCC 2007), and federal, state, and local guidelines for identification of wetland areas. This report is subject to review by the USACE, and should be submitted to the USACE for confirmation.

1.2 BACKGROUND

It is important to highlight that the South Coast 101 HOV Lanes Project, as a whole, includes additional study areas that were not investigated under the scope of work provided to SWCA by Caltrans. Specifically, there were two large portions of the total project area that were not investigated by SWCA. These two areas include the project boundaries for the Milpas to Hot Springs Highway Improvements Project (Post Mile [PM] 10.85 to PM 12.3) and the Linden-Casitas Highway Improvements Project (PM 2.2 to PM 3.4). The Milpas to Hot Springs project is currently under construction at the time this study was conducted and the report was prepared. The Linden-Casitas project is currently in the Project Approval (PA) and Environmental Document (ED) Phase. Because the jurisdictional features that will eventually be created (e.g., concrete lined ditches, etc.) within these two project areas may be impacted at a later date by South Coast 101 HOV construction activities, Caltrans has calculated and classified the potential impacts based on engineering plans. The total area of these impacts has been incorporated into the impact calculations within this report, at the request of Caltrans. Descriptions of these jurisdictional features can be found within the respective reports prepared for the projects.

Jurisdictional delineations from PM 10.85 to PM 12.3 were completed by Caltrans staff in 2006 as part of the Milpas to Hot Springs Highway Improvements Project (Caltrans Expenditure Authorization #: 05-44780). A 401 Water Quality Certification (34206WQ25) was obtained from the RWQCB on December 5, 2006, a California Department of Fish and Game 1602 Streambed Alteration Agreement (1600-2006-0418-R5), and a USACE 404 Permit (# SPL-2006-2026-PHT) was obtained April 17, 2007. The City of Santa Barbara issued a Coastal Development Permit for the project on December 16, 2007 and road construction began in 2008.

Jurisdictional delineations from PM 2.2 to PM 3.4 were conducted by Caltrans staff in 2007 and 2009 as part of the Linden-Casitas Highway Improvements Project (Caltrans Expenditure Authorization#: 05-4482U0), and are documented in the project's Natural Environmental Study. Jurisdictional delineations were conducted according to the *USACE 1987 Wetlands Delineation Manual* (Environmental Laboratory 1987) and the *Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid*

West Region (2006). Further information regarding environmental studies conducted for the Milpas to Hot Springs project and the Linden-Casitas project can be obtained by contacting Senior Environmental Planner, Chuck Cesena, Caltrans District 5 Division of Environmental Planning Division, San Luis Obispo, California (phone: (805) 549-3622; email: Chuck_Cesena@dot.ca.gov).

1.3 SITE LOCATION AND DESCRIPTION

The Biological Study Area (BSA) examined by SWCA as part of this study consists of three disjunctive sections of Caltrans right-of-way (ROW) along Highway 101 between the cities of Santa Barbara and Carpinteria, California (refer to Figure 3). The first section (from south to north) is located at the Bailard Avenue overcrossing, and extends from PM 1.39 to PM 1.84. The second section extends from PM 1.97 to PM 2.2 in the southern portion of Carpinteria. The third section (and longest) extends from PM 3.3 (Franklin Creek in the center of Carpinteria) to PM 10.85 (Coast Village Circle in the eastern portion of the City of Santa Barbara). Sections not evaluated in this report have been evaluated in other studies conducted by Caltrans for the project (refer to Section 1.2). For the purposes of this report, one BSA has been provided, which encompasses the study area from previous Caltrans studies and the study area that was investigated by SWCA. Refer to Appendix A for the Biological Study Area boundary.

1.4 PROJECT DESCRIPTION AND SETTING

Caltrans, in cooperation with the Santa Barbara County Association of Governments, proposes to add one HOV lane in each direction on Highway 101, resulting in a six-lane freeway from approximately one-half mile south of Carpinteria Creek in the City of Carpinteria to Sycamore Creek in the City of Santa Barbara. Three build alternatives and a no build alternative are proposed for evaluation in the environmental document. Alternative 1 proposes to add the HOV lane while balancing outside and inside (median) landscaping impacts. Alternative 2 proposes to add the HOV lanes while maximizing the amount of median planting within the project limits. Alternative 3 proposes to add the HOV lanes within the existing median with minor incidental outside widening.

The portion of the total project BSA addressed in this report crosses ten named creek channels, including: 1) Franklin Creek; 2) Santa Monica Creek; 3) Arroyo Parida Creek; 4) Garrapata Creek; 5) Toro Canyon Creek; 6) Greenwell Creek; 7) Romero Creek; 8) San Ysidro Creek; 9) Oak Creek; and, 10) Montecito Creek. Although not included within the BSA, the Carpinteria Salt Marsh is a major water feature that is located directly adjacent to the BSA. This natural estuary receives water from numerous drainages that transect the BSA. An extensive network of culverts, unnamed drainages, and ditches also convey water within the BSA. Many of the open water features are concrete lined channels; however, several of the open channel features (ditches and drainages) within the BSA have natural bottoms and contain wetland and/or riparian habitats.

Overall, flowing surface water within the BSA is generally directed into the highway storm drain system. The storm drain system associated with Highway 101 directs flows either to city storm drain systems or into larger creek channels that ultimately flow to the Pacific Ocean. For the purposes of this report, watersheds within the BSA are discussed in further detail below. This discussion includes natural channel features and manmade ditches and swales that convey normal flows and stormwater runoff through the BSA. Watershed areas are based on Caltrans engineering plans and are distinguished by post mile PM numbers. Field surveys were conducted during April and May of 2009, resulting in low surface water flow conditions for most drainage features within the BSA.

Figure 1. Regional Location Map

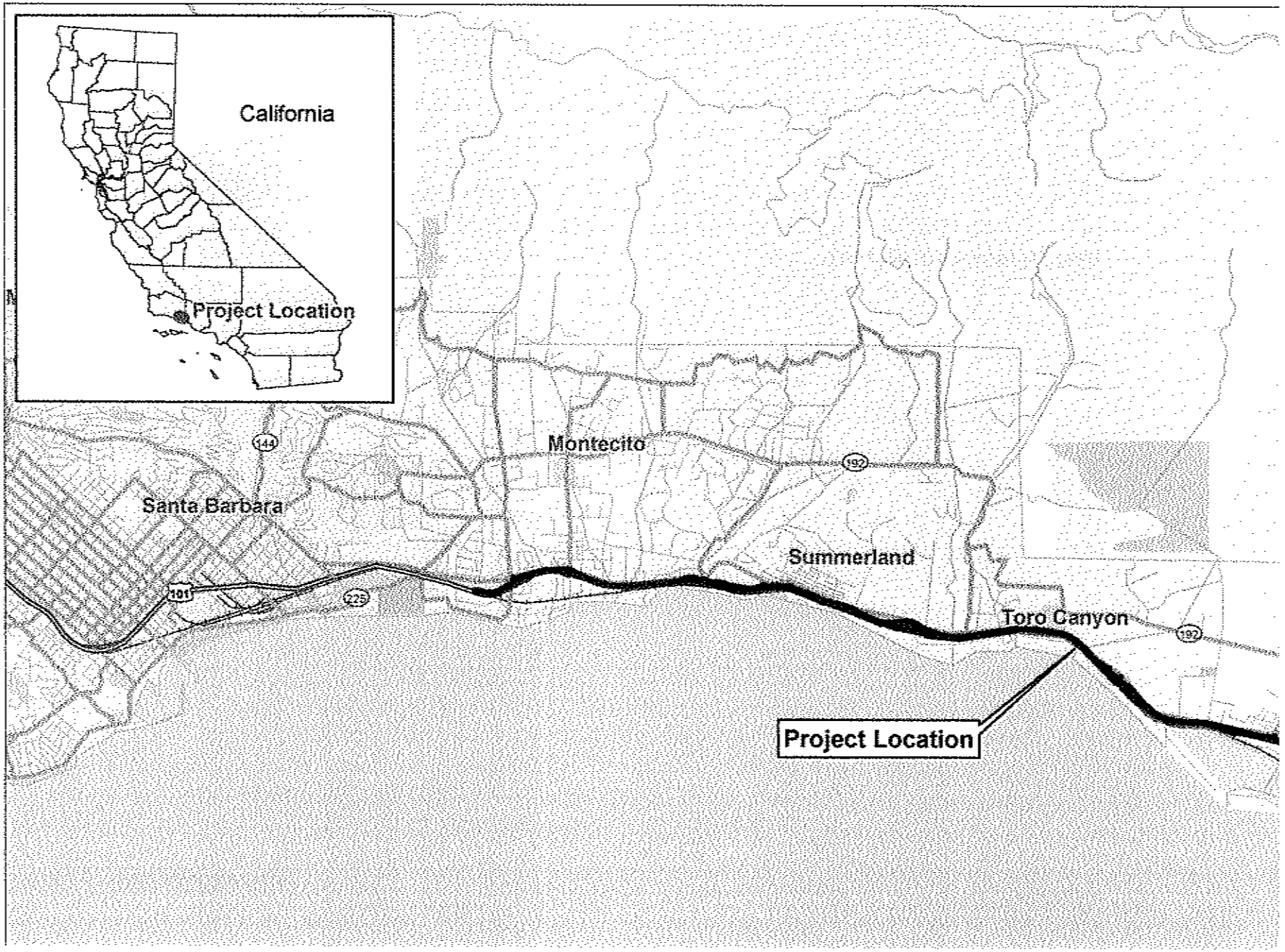

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Figure 2. Project Location Map

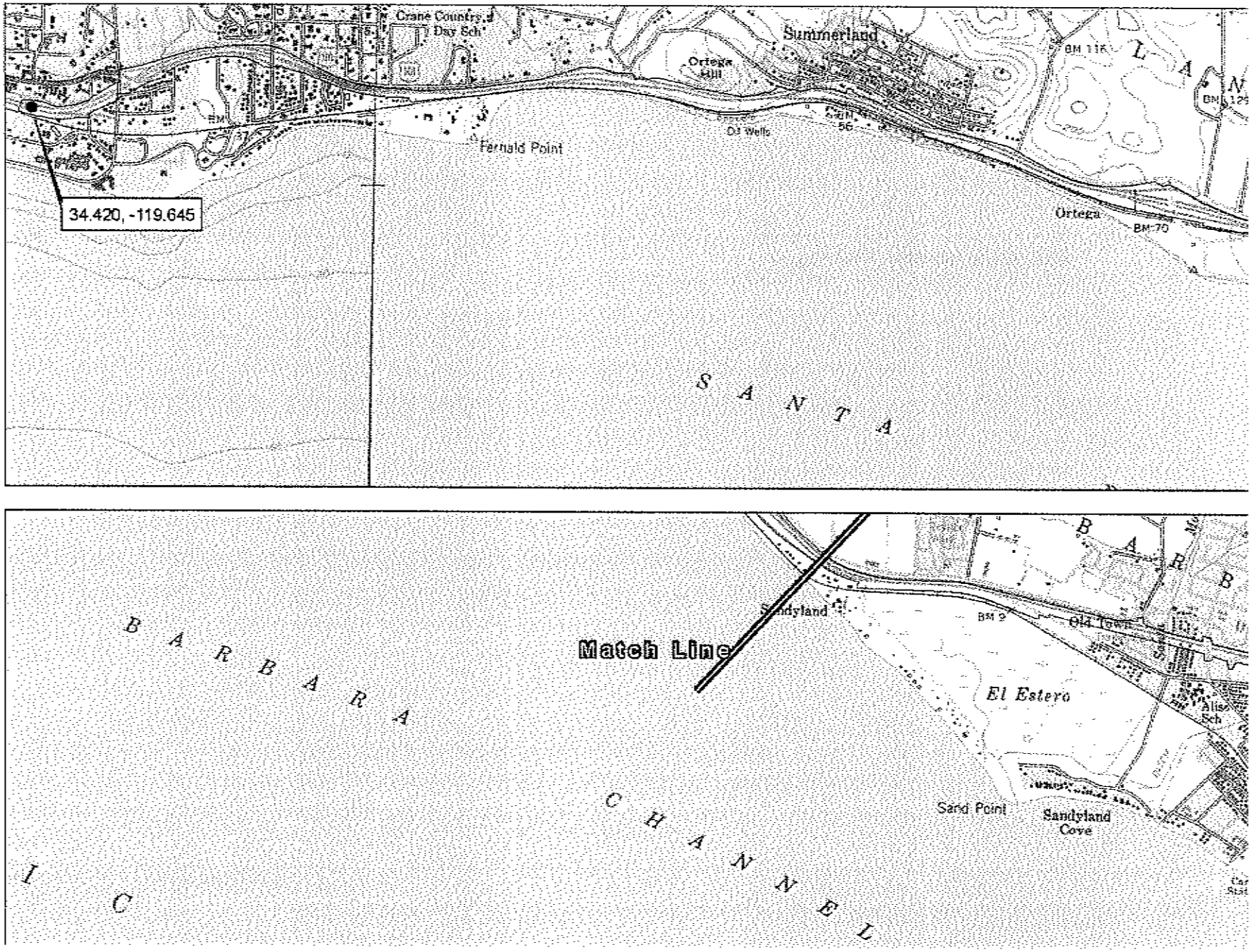

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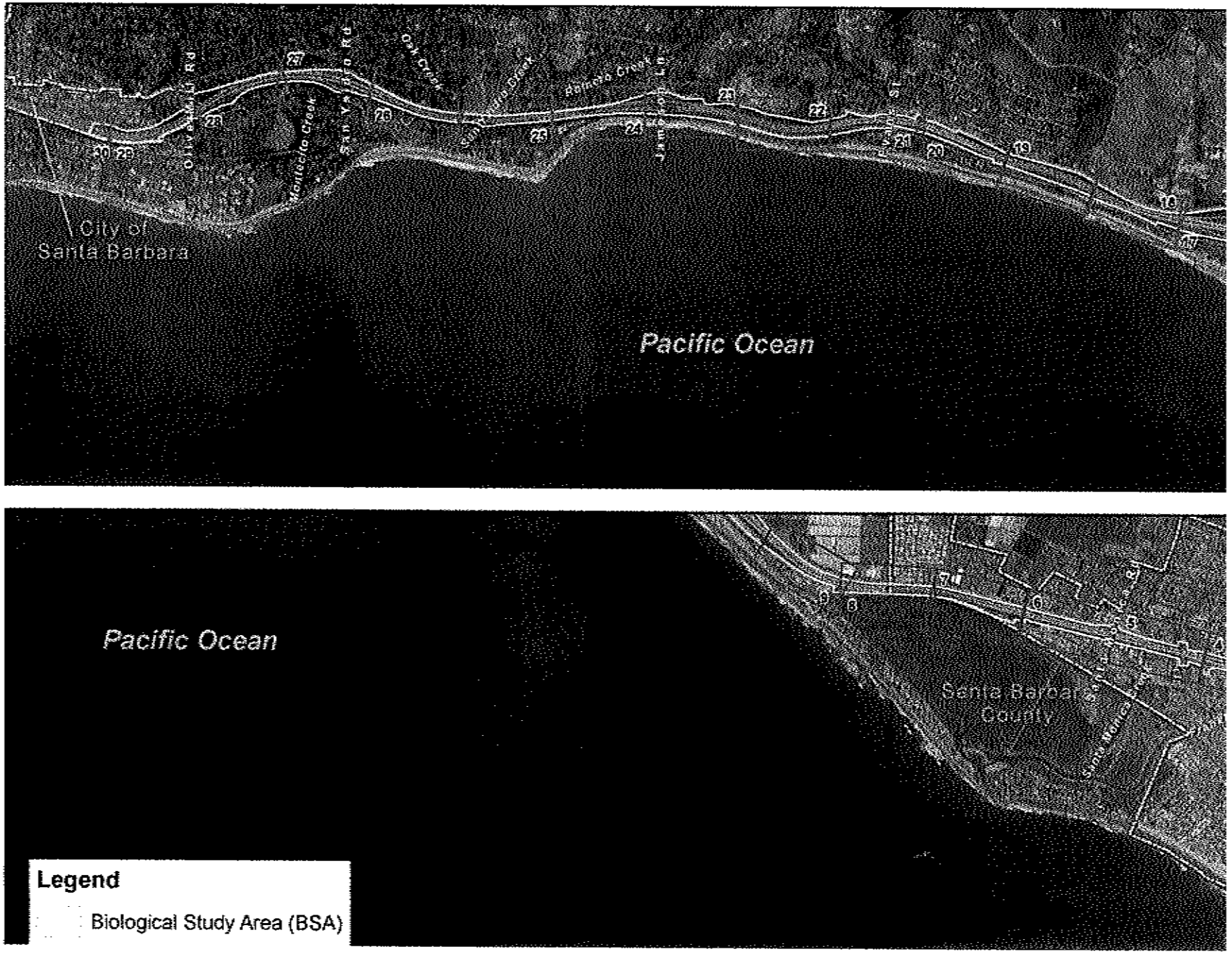
Figure 3. Map Sheet Index



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1.4.1 Franklin Creek

Within the BSA, Franklin Creek consists entirely of a concrete-lined box channel that conveys water beneath Highway 101 and drains to the Pacific Ocean. Franklin Creek is a relatively major drainage that has a watershed of approximately 2,532 acres, which includes the BSA and surrounding topography. Franklin Creek is influenced by Highway 101 storm water flows that occur between PM 2.55 and PM 3.68. Franklin Creek provides no riparian or wildlife habitat within the BSA, as the bottom of the channel consists entirely of concrete. During the field investigation, SWCA noted only a small surface flow within the channel, likely a result of urban runoff from surrounding development. The location of this drainage is shown in Appendix A, Sheet 4, and photo-documentation is included in Appendix C, Photo 4.

1.4.2 Santa Monica Creek

Similar to Franklin Creek, Santa Monica Creek consists entirely of a concrete-lined box channel that conveys water beneath Highway 101 and drains to the Pacific Ocean. Santa Monica Creek is a relatively major drainage with a watershed of approximately 2,484 acres, which includes the BSA and surrounding topography. Santa Monica Creek is influenced by Highway 101 storm water flows that occur between PM 3.68 and PM 3.84. Santa Monica Creek provides no riparian or wildlife habitat within the BSA, as the bottom of the channel consists entirely of concrete. During the field investigation, SWCA noted only a small surface flow within the channel, likely a result of urban runoff from surrounding development. The location of this drainage is shown in Appendix A, Sheet 6, and photo-documentation is included in Appendix C, Photo 9.

1.4.3 Carpinteria Salt Marsh

The Carpinteria Salt Marsh is a 230-acre coastal estuary managed by the City of Carpinteria and the University of California, Santa Barbara, Natural Reserve System. Although the Carpinteria Salt Marsh is not included directly within the BSA, this natural estuary receives surface water flow from several drainages that cross the BSA. The Carpinteria Salt Marsh watershed is relatively small at approximately 725 acres. The salt marsh is influenced by Highway 101 storm water flows that occur between PM 3.84 to PM 5.52. The majority of this storm water flow includes culverts that transect the BSA, conveying flows from the north side of Highway 101 to the south side of Highway 101, including water collected from drop inlets between the two end points. The northern edge of the Carpinteria Salt Marsh is separated from the BSA by the Union Pacific railroad tracks. No tidal influence is present within the channel between the highway and the railroad. The location of this drainage is shown in Appendix A, Sheets 7 and 8, and photo-documentation is included in Appendix C, Photo 20.

1.4.4 Arroyo Parida Creek

Within the BSA, Arroyo Parida Creek consists entirely of natural bottom channel that conveys water beneath Highway 101 and drains to the Pacific Ocean during periods of high flow. Arroyo Parida Creek is a relatively major drainage with a watershed of approximately 2,998 acres, which includes a portion of the BSA and surrounding topography. Arroyo Parida Creek is influenced by Highway 101 surface water flows that occur between PM 5.52 and PM 6.04. Riparian vegetation within the channel is minimal along the banks of the channel; however, there is sparse emergent vegetation within the BSA, with some arroyo willow canopy existing on sections of the bank. Beneath and adjacent to Highway 101, the bottom of the creek consists of natural sediments and the banks of the creek consist of concrete wing-walls. During the field investigation, SWCA noted that a substantial amount of standing water was present within Arroyo Parida Creek, providing open water habitat. The location of this drainage is shown in Appendix A, Sheet 10, and photo-documentation is included in Appendix C, Photos 24, 25, and 26.

1.4.5 Garrapata Creek

Within the BSA, Garrapata Creek consists almost entirely of a culverted drainage that conveys water beneath Highway 101 and drains to the Pacific Ocean through a series of culverts. Garrapata Creek is a relatively small drainage with a watershed of approximately 324 acres, which includes the BSA and surrounding topography. Garrapata Creek is influenced by Highway 101 storm water flows that occur between PM 6.04 and PM 6.27. Garrapata Creek provides very little riparian or wildlife habitat within the BSA, as the majority of the drainage consists of a culvert beneath Highway 101. The creek daylights north of the frontage road on the north side of the highway, and the creek daylights directly south of the highway. During the field investigation, SWCA noted no surface flow within the channel. The location of this drainage is shown in Appendix A, Sheet 11, and photo-documentation is included in Appendix C, Photo 27.

1.4.6 Serena Park

The Serena Park watershed area provides drainage for surface water that occurs between PM 6.27 and PM 6.71. The total area of this small watershed area is approximately 63 acres, which includes the BSA and surrounding topography. Surface water flow collected within the BSA is collected by a series of culverts which direct water flow to the south side of Highway 101. Small drainage features on the northern side of the highway run parallel to the Caltrans ROW boundary and focus water flow towards the culverts.

1.4.7 Toro Canyon Creek

Within the BSA, Toro Canyon Creek consists almost entirely of a natural bottom channel that conveys water beneath Highway 101 and drains to the Pacific Ocean at Loon Point during periods of high flow. Toro Canyon Creek is a relatively major drainage with a watershed of approximately 2,611 acres, which includes a portion of the BSA and surrounding topography. Toro Canyon Creek is only influenced by Highway 101 surface water flows that occur between PM 6.71 and PM 6.84. Toro Canyon Creek provides marginal habitat value. Some mature riparian vegetation exists within the channel on the north side of Highway 101, where the bottom of the channel consists of natural cobbles and soil. This natural bottom channel transitions to a concrete-lined channel immediately after crossing beneath northbound Highway 101. The channel remains entirely concrete-lined for the remaining width of the BSA, and then transitions back to natural bottom substrate after crossing beneath the Union Pacific Railroad. During the field investigation, SWCA noted a small amount of flowing water present within the channel. The location of this drainage is shown in Appendix A, Sheet 12, and photo-documentation is included in Appendix C, Photos 28-31.

1.4.8 Padaro Lane Interchange

The Padaro Lane Interchange watershed area provides drainage for surface water that occurs within between PM 6.84 and PM 7.70. The total area of this small watershed area is approximately 61 acres, which includes the BSA and surrounding topography. Surface water flow collected within the BSA is collected by a series of culverts which direct water flow to the south side of Highway 101.

1.4.9 Greenwell Avenue

The Greenwell Avenue watershed area provides drainage for surface water that occurs between PM 7.70 and PM 7.74. The Greenwell Avenue watershed area is approximately 284 acres, which includes the BSA and surrounding topography. Within the BSA, the Greenwell Avenue watershed consists entirely of a culverted drainage that conveys water beneath Highway 101 and daylights within Caltrans ROW directly

to the south of the southbound lanes of Highway 101. The culvert outlets approximately 15 feet above a plunge pool, and flows travel along a disturbed open channel and under UPPR culverts before draining into the Pacific Ocean. This channel contained a small amount of flowing and ponded water, and consisted of a natural earthen bottom. Several scattered willows are present, but the channel was dominated by escaped ornamental species such as iceplant (*Carpobrotus edulis*) and garden nasturtium (*Tropaeolum majus*). Numerous common weedy species were also present. Although heavily disturbed and isolated, the drainage provides marginal habitat for a variety of wildlife species. The location of this drainage is shown in Appendix A, Sheet 14, and photo-documentation is included in Appendix C, Photos 32 and 33.

1.4.10 Summerland

The Summerland watershed area provides drainage for surface water that occurs within between PM 7.74 and PM 8.71. The total area of this relatively small watershed area is approximately 214 acres, which includes the BSA and surrounding topography. Surface water flow generated within the BSA is collected by a series of culverts which direct water flow to the south side of Highway 101. Small drainage features also exist on the northern side of the highway and along the Ortega Hill bike path. These drainages run parallel to the Caltrans ROW boundary and direct water flow towards drop inlets within the ROW.

1.4.11 Romero Creek

Romero Creek is one of the largest watersheds within the BSA, second only to the Montecito Creek drainage. The Romero Creek watershed is approximately 3,824 acres, which includes the BSA and surrounding topography. The channel consists almost entirely of a natural bottom drainage that conveys water beneath Highway 101 and drains to the Pacific Ocean at Frenald Point. Romero is channelized in its lower reaches as it flows through the urban areas of Montecito, but does maintain some natural substrate. Romero Creek is influenced by Highway 101 storm water flows that occur between PM 8.71 and PM 9.51. Some riparian habitat is present in open channel areas within the BSA, consisting of sparse emergent vegetation and willow canopy. During the field investigation, SWCA noted minimal surface flow within the channel. The location of this drainage is shown in Appendix A, Sheet 18, and photo-documentation is included in Appendix C, Photos 37 and 38.

1.4.12 San Ysidro Creek

San Ysidro Creek is a moderately sized drainage with a watershed of approximately 2,493 acres, which includes the BSA and surrounding topography. Within the BSA, the channel consists of vertical concrete banks and a natural bottom that conveys water beneath Highway 101 and drains to the Pacific west of Frenald Point. San Ysidro Creek is influenced by Highway 101 storm water flows that occur between PM 9.51 and PM 9.78. The upstream and downstream portions of the channel within the BSA consist of natural sediment and provide minimal habitat value. These areas are dominated by non-native annual grass species and common weeds. No hydrophytic plant species were observed in association with this creek channel. During the field investigation, SWCA noted no surface flow within the channel. The location of this drainage is shown in Appendix A, Sheet 18, and photo-documentation is included in Appendix C, Photos 35 and 36.

1.4.13 Oak Creek

Oak Creek is a small drainage with a watershed of approximately 984 acres, which includes the BSA and surrounding topography. Oak Creek is influenced by Highway 101 storm water flows that occur between PM 9.88 and PM 10.68. Within the BSA, the channel consists of vertical concrete banks and concrete

channel which transect Highway 101 and drains to the Pacific Ocean. At the entrance and exits of these concrete channels, natural sediments are present which provide suitable substrate for non-native grasses and common weeds. No hydrophytic plant species were observed in association with this creek channel. During the field investigation, SWCA noted no surface flow within the channel. The location of this drainage is shown in Appendix A, Sheet 18, and photo-documentation is included in Appendix C, Photos 39 and 40

1.4.14 Montecito Creek

Montecito Creek is the largest watershed crossed by the BSA, with an approximate size of 4,330 acres. This area includes storm water flows that occur between PM 10.68 and PM 11.15. The westernmost terminus of the BSA is located at PM 10.85. The entire channel within the BSA consists of a concrete bridge that conveys flows beneath Highway 101 to the Pacific Ocean. The bridge structure begins and ends outside of the BSA, and no riparian habitat is present. During the field investigation, SWCA noted no surface flow within the channel. Dense riparian canopy was present upstream and downstream of the BSA. The location of this drainage is shown in Appendix A, Sheet 19, and photo-documentation is included in Appendix C, Photo 41.

2. REGULATORY BACKGROUND

2.1 U.S. ARMY CORPS OF ENGINEERS

The USACE regulates discharges of dredged or fill material into waters of the United States. These waters include wetland and non-wetland bodies of water that meet specific criteria. USACE regulatory jurisdiction, pursuant to Section 10 of the Rivers and Harbors Act of 1899 (33 United States Code [U.S.C.] 403), regulates almost all work in, over, and under waters listed as "navigable waters of the U.S." that results in a discharge of dredged or fill material within USACE regulatory jurisdiction, pursuant to Section 404 of the Clean Water Act. Under Section 404, the USACE regulates traditional navigable waters, wetlands adjacent to traditional navigable waters, relatively permanent non-navigable tributaries that have a continuous flow at least seasonally (typically three months), and wetlands that directly abut relatively permanent tributaries. The USACE will determine jurisdiction over waters that are non-navigable tributaries, that are not relatively permanent and wetlands adjacent to non-navigable tributaries, and that are not relatively permanent only after making a significant nexus finding.

33 Code of Federal Regulations (CFR) 328.3 defines waters of the United States as:

(1) All waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce;

(2) All interstate waters including interstate wetlands;

(3) All other waters such as intrastate lakes, rivers, streams (including intermittent streams) the use, degradation or destruction of which could affect interstate or foreign commerce;

(4) All impoundments of waters otherwise defined as waters of the United States under the definition; and,

(5) Tributaries of waters defined in paragraphs (a) (1)–(4) of this section

(6) The territorial seas;

(7) Wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (a)(1)-(6) of this section.

USACE jurisdiction over nontidal waters of the United States extends laterally to the Ordinary High Water Mark (OHWM) or beyond the OHWM to the limit of any adjacent wetlands, if present (33 CFR 328.4). The OHWM is defined as

> *"that line on the shore established by the fluctuations of water and indicated by physical characteristics such as a clear natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding area" (33 CFR 328.3).*

Jurisdiction over nontidal waters typically extends upstream to the point where the OHWM is no longer perceptible. USACE jurisdiction over tidal waters of the United States extends to the line on the shore reached by the highest high water.

The preamble to USACE regulations (Preamble §328.3, Definitions) states that the USACE does not generally consider the following waters to be waters of the United States. The USACE does, however, reserve the right to regulate these waters on a case-by-case basis.

- Nontidal drainage and irrigation ditches excavated on dry land;
- Artificially irrigated areas that would revert to upland if the irrigation ceased;
- Artificial lakes or ponds created by excavating and/or diking dry land to collect and retain water and used exclusively for such purposes as stock watering, irrigation, settling basins, or rice growing;
- Artificial reflecting or swimming pools or other small ornamental bodies of water created by excavating and/or diking dry land to retain water for primarily aesthetic reasons; and,
- Water-filled depressions created in dry land incidental to construction activity and pits excavated in dry land for purposes of obtaining fill, sand, or gravel unless and until the construction or excavation operation is abandoned and the resulting body of water meets the definition of waters of the United States.

Waters found to be isolated or not subject to USACE regulation are often still regulated by the RWQCB under the State Porter-Cologne Water Quality Control Act (Porter-Cologne Act).

2.2 STATE WATER RESOURCES AND REGIONAL WATER QUALITY CONTROL BOARDS

The SWRCB and nine RWQCBs regulate discharges of fill and dredged material in California, under Section 401 of the Clean Water Act and the Porter-Cologne Act, through the State Water Quality Certification Program. State Water Quality Certification is necessary for all projects that require a USACE permit, or fall under other federal jurisdiction, and have the potential to impact waters of the State. Waters of the State are defined by the Porter-Cologne Act as

> *"any surface water or groundwater, including saline waters, within the boundaries of the state."*

In order for a Section 404 permit to be valid, Section 401 of the Clean Water Act requires a Water Quality Certification or waiver to be obtained. The Water Quality Certification (or waiver) determines that the permitted activities will not violate water quality standards individually or cumulatively over the term of

the action. Water quality certification must be consistent with the requirements of the Federal Clean Water Act, California Environmental Quality Act (CEQA), California Endangered Species Act, and Porter-Cologne Act.

The SWRCB and RWQCB have not established a formal wetland definition nor have they developed a wetland delineation protocol; however, these agencies generally adhere to the same delineation protocol set forth by the USACE. Therefore, the methods used to determine potential Waters of the State were the same as those described above for potential Section 404 jurisdiction.

2.3 CALIFORNIA COASTAL COMMISSION

The CCC has jurisdiction over activities within the coastal zone under the California Coastal Act of 1976. The Coastal Act defines wetlands as:

> *"Wetland means lands within the Coastal Zone which may be covered periodically or permanently with shallow water and include saltwater marshes, freshwater marshes, open or closed brackish water marshes, swamps, mudflats, and fens." (Public Resources Code* [PRC] *Section 30121)*

CCC Administrative Regulations (Section 13577 (b)) provides a more explicit definition:

> *"Wetlands are lands where the water table is at, near, or above the land surface long enough to promote the formation of hydric soils or to support the growth of hydrophytes, and shall also include those types of wetlands where vegetation is lacking and soil is poorly developed or absent as a result of frequent or drastic fluctuations of surface water levels, wave action, water flow, turbidity or high concentrations of salt or other substance in the substrate. Such wetlands can be recognized by the presence of surface water or saturated substrate at some time during each year and their location within, or adjacent to, vegetated wetlands or deepwater habitats."*

The CCC has considered this definition as requiring the observation of one diagnostic feature of a wetland such as wetland hydrology, dominance by wetland vegetation (hydrophytes), or presence of hydric soils as a basis for asserting jurisdiction under the Coastal Act. In addition, if the Coastal Zone boundary line bisects a wetland resource, the CCC will typically consider the entire resource within the project area subject to CCC wetland regulations, since impacts to another portion of the resource could negatively affect the CCC area.

3. METHODOLOGY

3.1 DELINEATION METHODS

Wetland delineation efforts utilized the routine delineation methodology described in the *1987 USACE Wetlands Delineation Manual* (Environmental Laboratory 1987), and as supplemented in the *Final Arid West Supplement* Version 2.0, (USACE 2008). Delineators also utilized *A Field Guide to the Identification of the Ordinary High Water Mark in the Arid West Region of the Western United States* (USACE 2008). Habitat and plant species descriptions follow the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979), *Preliminary Description of Terrestrial Natural Communities of California* (Holland 1986), *The Jepson Manual* (Hickman 1993), and the *National List of Plant Species that Occur in Wetlands* (Reed 1988). Soils data was obtained from the *Soil*

Survey Geographic Database (SSURGO) *for Santa Barbara County, California* (2009). Specific references not listed above are cited in text.

Delineation of jurisdictional areas associated with the project study area were based on review of pertinent literature and a thorough on-site investigation conducted on April 28-30, and May 12-13, 2009, by SWCA biologists Jon Claxton and Bob Sloan. Mr. Sloan is a University of California, Berkeley Extension-trained wetland delineator, and Mr. Claxton has been trained and certified by Wetland Training Institute, Inc. Prior to beginning the field delineation, scaled aerial photographs, and U.S. Geological Survey (USGS) topographic maps of the project site were examined to determine the locations of potential areas of USACE/State jurisdiction. These resources were also used as a reference to determine hydrologic connectivity to a navigable water body. A detailed site examination including excavation of soil test pits was performed to identify boundaries between upland and jurisdictional habitats. Soil matrix colors were classified according to the *Munsell Soil Color Charts* (Munsell Color, 2000). Hydrological conditions, including any surface inundation, saturated soils, groundwater levels, and other hydrology indicators, were recorded.

Soil test pits were excavated in and adjacent to smaller drainage channels and other undefined areas that exhibited one or more of the standard wetland criteria. Pits were not excavated in defined natural or man-made channels that exhibited an OHWM, or in channels containing standing water or saturated soils dominated by Facultative Wetland (FACW) or Obligate Wetland (OBL) vegetation. Jurisdictional features, including OHWM and top-of-bank/edge of riparian canopy, were mapped using a Trimble® Pathfinder Global Positioning System (GPS) capable of sub-meter accuracy. Jurisdictional boundaries for the CCC were mapped where applicable. Identified jurisdictional boundaries are shown in Appendix C.

Plant species identified at soil test pit locations were assigned a wetland status according to the U.S. Fish and Wildlife Service (USFWS) list of plant species that occur in wetlands (Reed 1988). This wetland classification system is based on the expected frequency of occurrence in wetlands as follows:

- Obligate Wetland (OBL) – Almost always found in wetlands (estimated probability >99%)
- Facultative Wetland (FACW) – Usually occurs in wetlands (estimated probability 67-99%)
- Facultative (FAC) – Equally likely to occur in wetlands or non-wetlands (estimated probability 34-66%)
- Facultative Upland (FACU) – Usually occurs in non-wetlands (estimated probability 1-33%)
- No Indicator (NI) – Species has not been assigned an indicator status or frequency

4. RESULTS

4.1 SOIL CONDITIONS

The U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) *Santa Barbara County, California, South Coastal Part* maps eight soil series' containing twelve soil map units as present within the boundaries of the study area (refer to Figure 4). Soils within the BSA are composed primarily of fine sandy loams, with stony loamy sand, clay, Orthent, and Aquent soils also represented. Of these 12 soils, one is listed as hydric (Camarillo Variant), and one can contain an inclusion of Riverwash soils that are hydric (Cortina stony loamy sand). All soil test pits were excavated in areas mapped as Camarillo Variant soil type. The 12 soil map units present within the BSA are described below.

4.1.1 Soil Unit Descriptions

Aquents, fill areas (AC)

Aquents, fill areas, are reclaimed areas of soils resulting from filling low, poorly drained areas near the ocean. Soil colors and horizons vary according to the type of fill used. Slopes are 0-2%, and the parent material consists of earthy fill from variable sources. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. This soil is rarely flooded, and is not ponded. This soil does not meet hydric criteria. Aquents, fill areas soils are used mainly for urban development.

Ballard Series - Ballard fine sandy loam, 0-2% slopes (BaA), Ballard fine sandy loam, 2-9% slopes (BaC)

Ballard fine sandy loam consists of well-drained soils on alluvial fans and low terraces. The surface layer is typically a dark brown (10YR 3/3 moist) fine sandy loam approximately 14 inches thick, underlain by dark brown (5YR 3/4 moist) fine sandy loam to 23 inches. The parent material consists of alluvium derived from sedimentary rock. Depth to a root restrictive layer is greater than 60 inches. This soil is rarely flooded, and is not ponded. This soil does not meet hydric criteria. Ballard soils are used mainly for citrus, avocados, and urban development.

Camarillo Variant, fine sandy loam (Cb)

Camarillo Variant is a nearly level soil on low alluvial plains. The surface layer is typically a dark brown (7.5YR 3/2 moist) sandy loam approximately 12 inches thick, underlain by dark reddish brown (5YR 3/3 moist) sandy loam to 19 inches. Slopes are 0-2%, and the parent material consists of alluvium derived from calcareous sedimentary rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. This soil is frequently flooded, but is not ponded. This soil meets hydric criteria. Camarillo Variant soils are used for lemons and field crops.

Cortina stony loamy sand, 2-9% slopes (ChC)

Cortina stony loamy sand is a gently to moderately sloping soil found along major stream channels and on alluvial fans. The surface layer is typically a dark brown (10YR 4/3 moist) stony sandy loam approximately nine inches thick, underlain by very dark brown (10YR 2/2 moist) stony sandy loam to 44 inches. The parent material consists of alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat excessively drained. This soil is frequently flooded but is not ponded. This soil does not meet hydric criteria, but can contain an inclusion of riverwash soil which does meet hydric criteria. Cortina soils are primarily used for urban development.

Diablo clay, 9-15% slopes (DaD)

Diablo clay consists of well drained soils on low hills within three miles of the coast. The surface layer is typically a black (10YR 2/1 moist) clay 30 to 37 inches thick. The parent material consists of residuum weathered from mudstone and/or soft shale. Depth to a root restrictive layer, bedrock, paralithic, is 45 to 60 inches. The natural drainage class is well drained. This soil is not flooded or ponded, and does not meet hydric criteria. Diablo soils are used for orchard, range, and urban development.

Goleta Series - Goleta fine sandy loam 0-2% slopes (GcA), Goleta fine sandy loam 2-9% slopes (GcC)

Goleta fine sandy loam consists of well-drained soils on flood plains and alluvial fans. The surface layer is typically a very dark grayish brown (10YR 3/2 moist) fine sandy loam approximately 13 inches thick, underlain by dark brown (10YR 4/3 moist) fine sandy loam to 29 inches. The parent material consists of alluvium derived from sedimentary rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. This soil is rarely flooded and is not ponded. This soil does not meet hydric criteria.

Milpitas-Positas Series - Milpitas-Positas fine sandy loam, 2-9% slopes (MeC), Milpitas-Positas fine sandy loam, 9-15% slopes, eroded (MeD2), Milpitas-Positas fine sandy loam, 15-30% slopes, eroded (MeE2)

Milpitas-Positas Series soils consist of moderately well drained soils on terraces. The surface layer is typically a dark brown (10YR 3/3 moist) fine sandy loam approximately eight inches thick, underlain by dark brown (10YR 3/3 moist) loam to 24 inches. Eroded map units may have lost between eight and 24 inches of soil. The parent material consists of mixed alluvium. The natural drainage class is moderately well drained. This soil is not flooded or ponded. This soil does not meet hydric criteria. Milpitas-Positas soils are used for rangeland, lemons, avocados, and urban development.

Orthents, 50-75% slopes (OAG)

Orthents typically consist of stony fine sandy loam, and are found on steep and very steep escarpments. The parent material consists of mixed alluvium. Soil colors and horizons vary according to the location and slope. This soil is not flooded or ponded, and does not meet hydric criteria.

4.1.2 Data Point Descriptions

A total of seven soil pits were excavated during the jurisdictional determination. Pits were excavated in and adjacent to smaller drainage channels and other undefined areas that exhibited one or more of the standard wetland criteria. Areas with defined natural or man-made channels that exhibited an OHWM, or areas containing water or saturated soils dominated by FACW or OBL vegetation, were considered to meet jurisdictional requirements.

USACE data sheets and photographs for each test pit location are provided in Appendix C. Several additional exploratory pits were dug throughout the BSA, as needed, to check soil characteristics during wetland boundary identification. The observed soils consisted of clay, clay loam, sandy loam, and loam, and included several areas of obvious fill soils. Soils observed at Test Pit locations 4, 6, and 7 generally corresponded with the mapped series characteristics of Camarillo Variant fine sandy loam. Detailed descriptions of the conditions observed at each soil pit location are presented below.

Soil Test Pit 1

Test Pit 1 was located on the northbound shoulder of Highway 101, just south of the Santa Ynez Avenue overcrossing (refer to Appendix A, Sheet 5). This pit documents upland conditions between the highway edge and a dirt drainage ditch along the BSA boundary line that connects to Franklin Creek. The investigation revealed very dark brown (10YR 3/2) dry clay loam soils from zero to 22 inches. No hydrophytic vegetation, hydric soil indicators, or wetland hydrology indicators were noted at this location. This pit location is in uplands.

Soil Test Pit 2

Test Pit 2 was located approximately 15 feet northwest of Pit 1, in the center of the dirt drainage ditch. The investigation revealed very dark brown (10YR 2/2) moist to saturated clay loam soils from zero to 10 inches, with organic staining present above 15 inches in black soil (10YR 2/1). Vegetation consisted of three FACW species: California blackberry (*Rubus ursinus*), tall flat sedge (*Cyperus eragrostis*), and mugwort (*Artemisia douglasiana*). The drainage ditch receives road and urban runoff, and channels flow east along Highway 101 to Franklin Creek. Due to the presence of hydrophytic vegetation, wetland hydrology, and hydric soil indicator (depleted matrix), Test Pit 2 was determined to be located within a wetland.

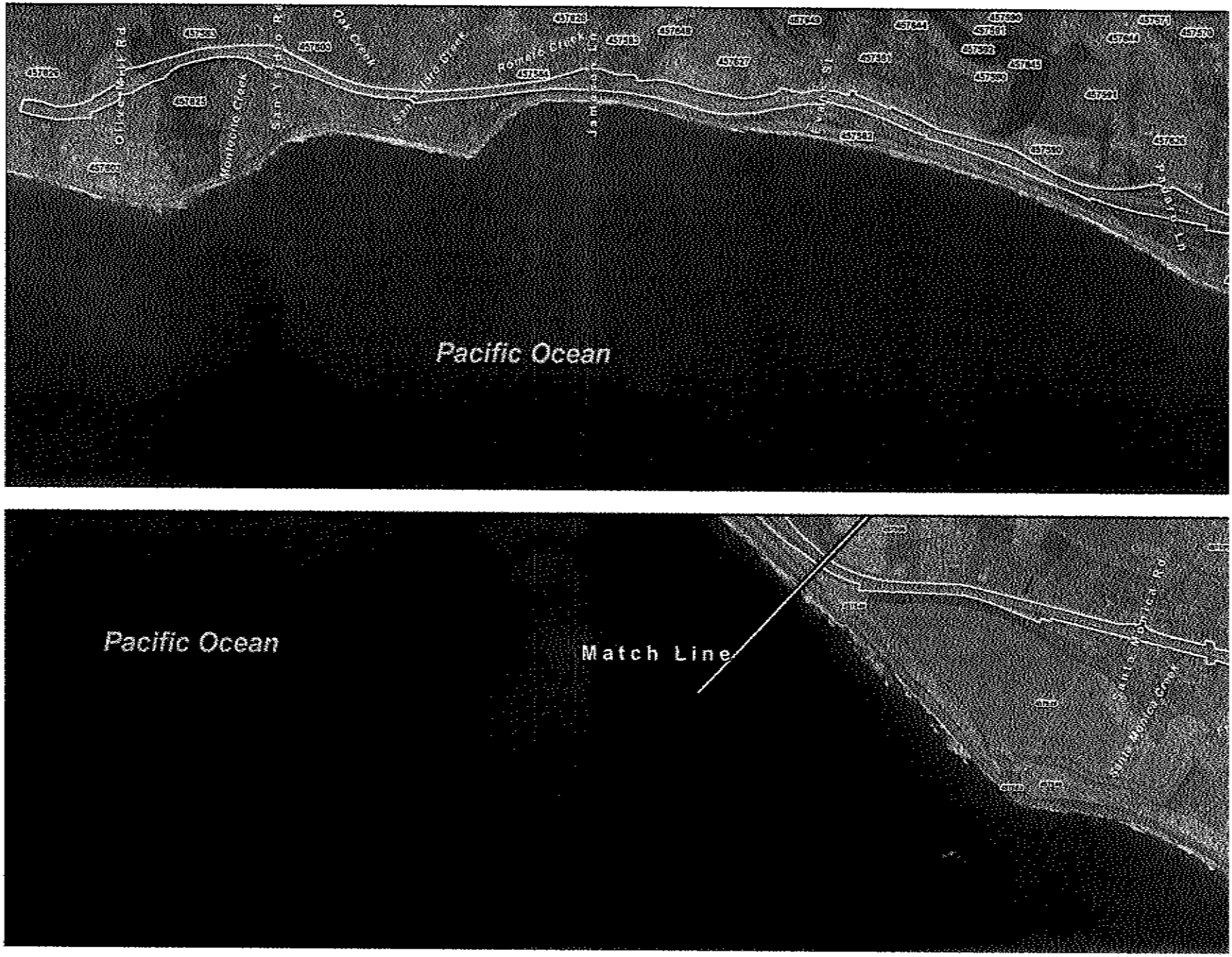
Soil Test Pit 3

Test Pit 3 was located approximately 15 feet north of Pit 2, in the empty field adjacent to the dirt drainage ditch. The investigation revealed very dark brown to dark brown (10YR 3/2) dry clay loam soils from zero to 7, and brown (10YR 3/3) dry clay loam soils from 7 to 20 inches. A plow pan was noted at a depth of seven inches. Vegetative cover was dominated by annual grass species. No hydrophytic vegetation, hydric soil indicators, or wetland hydrology indicators were noted at this location. This pit location is in uplands.

Soil Test Pit 4

Test Pit 4 was located on the northbound shoulder of Highway 101, on the southern edge of the Santa Monica Road offramp (refer to Appendix A, Sheet 6). This pit documents conditions in a small dirt drainage ditch located between the offramp and the adjacent gas station. A defined OHWM was not visible in the drainage during the investigation, but is expected to be present during the winter months following flow events. The investigation revealed dark brown (10YR 3/3) dry sandy loam and clay loam soils from zero to 20 inches. The upper half of the horizon contained trash and appeared to be regularly disturbed by maintenance efforts. Vegetative cover was dominated by a dense stand of the FAC species common horsetail (*Equisetum arvense*). The drainage ditch receives road and urban runoff, and channels flow under Highway 101 through a concrete culvert. Runoff from this ditch likely reaches Santa Monica Creek through the storm drain system. Although no hydric soil or hydrology indicators were present, dominance of FAC vegetation and connectivity to the storm drain system indicate that Test Pit 4 is located within non-wetland waters of the U.S.

Figure 4. Soil Survey Map



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Soil Test Pit 5

Test Pit 5 was located on the southbound shoulder of Highway 101, in the center of a dirt drainage ditch that parallels the highway (refer to Appendix A, Sheet 6). The investigation revealed very dark brown (10YR 2/2, 10YR 3/2) moist to saturated clay loam soils from 0-13 inches, and brownish yellow (10YR 6/8) saturated gravely clay from 13 to 20 inches. Black organic material and redoxomorphic features were present from nine to 13 inches, and black stains and greenish gray gley (5/10Y) were present from 13 to 20 inches. Vegetation was dominated by a dense stand of the FAC species common horsetail, with small, non-dominant occurrences of the OBL species cattail (*Typha latifolia*), and FACW species California blackberry, tall flat sedge, and rabbitsfoot grass (*Polypogon monspeliensis*). The drainage ditch receives road and urban runoff, and channels flow east along Highway 101 to a storm drain inlet that leads to Santa Monica Creek. Due to the presence of hydrophytic vegetation, wetland hydrology, and hydric soil indicators, Test Pit 5 was determined to be located within a wetland.

Soil Test Pit 6

Test Pit 6 was located on the southbound shoulder of Highway 101, two feet above and approximately five feet north of Pit 5. The investigation revealed dark brown (10YR 3/3) dry loam and clay loam soils from zero to 22 inches. Vegetation was dominated by UPL species ice plant (*Carpobrotus edulis*), with FAC species common horsetail as a lesser co-dominant. No hydric soil indicators or wetland hydrology indicators were noted at this location, and hydrophytic vegetation cover does not exceed 50 percent. This pit location was determined to be in uplands.

Soil Test Pit 7

Test Pit 7 was located on a median strip between the southbound lanes of highway 101 and the Carpinteria Avenue offramp (refer to Appendix A, Sheet 7), in a level area containing willow trees. The investigation revealed dark brown (10YR 3/3) dry loam soils from zero to nine inches, and reddish brown (2.5YR 5/4) dry gravely sandy loam from nine to 20 inches. Vegetation was dominated by the UPL species Bermuda buttercup (*Oxalis pes-caprae*), with FACW species mugwort and arroyo willow (*Salix lasiolepis*), as co-dominants. A faint depressional area was noted within a portion of the willow canopy, but no connection to a hydrologic feature was observed. The area receives limited amounts of runoff from adjacent highway road surfaces. Due to the presence of dominant wetland vegetation, this area was mapped as potential CCC wetlands, and was considered non-jurisdictional for USACE due to the lack of connectivity.

4.2 VEGETATIVE CONDITIONS

The potentially jurisdictional areas examined in this report contained a diverse mixture of riparian and wetland plant species, including native and non-native plants, and numerous escaped ornamental species. Named creek channels with natural bottom sections contained a variety of riparian canopy cover, and scattered occurrences of emergent wetland species. The two unnamed natural channels were dry during the examination, and did not contain significant vegetative resources. Franklin and Santa Monica creeks consist of concrete-lined box channels, and did not contain vegetative resources. The larger roadside ditches contained a variety of wetland indicator species, intermixed with common upland annual species. Dominant riparian canopy, understory, and wetland indicator species observed during the examination are listed below.

Dominant tree species encountered as riparian canopy included coast live oak (*Quercus agrifolia*), sycamore (*Platanus racemosa*), arroyo willow, blue gum eucalyptus (*Eucalyptus globulus*), black

cottonwood (*Populus balsamifera* ssp. *trichocarpa*), California bay (*Umbellularia californica*), and big leaf maple (*Acer macrophyllum*). Most riparian corridor areas exhibited canopy cover within and extending past the top of the defined creek banks, while smaller roadside ditches were generally dominated by shrub, forb, or emergent species.

Dominant understory species observed within and adjacent to potentially jurisdictional areas included California blackberry, coyote brush (*Baccharis pilularis*), stinging nettle (*Urtica dioicia*), Kikuyu grass (*Pennisetum clandestinum*), sowthistle (*Sonchus oleraceaus*), Italian ryegrass (*Lolium multiflorum*), common horsetail, ice plant, garden nasturtium (*Tropaeolum majus*), and bristly ox-tongue (*Picris echioides*).

Dominant wetland indicator species observed within potentially jurisdictional areas included arroyo willow, cattail (*Typha* sp.), mugwort, common horsetail, California blackberry, curly dock (*Rumex crispus*), tall flatsedge, small-fruited bulrush (*Scirpus microcarpus*), watercress (*Rorippa nasturtium-aquaticum*), rabbitsfoot grass, speedwell (*Veronica anagalis-aquatica*), and marsh baccharis (*Baccharis douglasii*).

4.3 HYDROLOGIC CONDITIONS

Hydrology within the BSA is controlled by existing creeks, drainages, and storm drain systems, with extensive runoff occurring from urban and residential development, roadways, and parking areas. The BSA crosses several large watersheds drained by blue-line stream channels. No tidally influenced or brackish areas are present within the BSA, but the project parallels the northern edge of the Carpinteria Salt Marsh.

Numerous manmade roadside drainage ditches consisting of dirt or concrete v-ditches, and associated culvert structures were mapped along the route. These ditches were typically less than two feet deep and four feet wide, and showed evidence of regular maintenance. In some cases, connectivity from the ditches could be traced to nearby natural creek channels through culvert inlet and outlet structures. Other roadside ditches had no evidence of direct connection to identified jurisdictional areas, but did connect with municipal or highway storm drain systems. Water entering storm drain systems is assumed to eventually reach jurisdictional waters associated with the natural creek channels or the Pacific Ocean.

The BSA parallels the coastline between Carpinteria and Santa Barbara, and all stormwater runoff generated within or traveling through the BSA flows into the Pacific Ocean through creek channels, storm drain outlets, and the Carpinteria Salt Marsh. This hydrologic nexus with the Pacific Ocean establishes potential jurisdictional status as waters of the United States for all natural and man-made hydrologic features within the BSA.

4.4 FUNCTIONS AND SERVICES OF JURISDICTIONAL AREAS

The potentially jurisdictional areas identified in the project study area function as a series of extended, mostly intermittent riverine coastal stream systems that convey both natural flows and hardscape runoff to the Pacific Ocean. Some of the jurisdictional features consist of concrete lined channels; however, many of the creeks and drainages within the BSA have natural bottoms and contain wetland and/or riparian habitat. These natural and manmade channels combine to provide significant ground water recharge, flood control, and wildlife habitat/migration corridor services within the urbanized project area. The functions and services of the identified areas vary according to watershed area, type, size, and location of each feature, the degree of channelization/concrete structures present, and by the presence or absence of water and riparian/wetland vegetation. Factors that negatively affect the quality of functions and services

provided within the project area include noise, lighting, limited vegetative diversity, exotic plant species occurrences, and disturbance from flood control practices.

Natural Channels

Of the ten named channels that cross the route, seven contain areas of natural substrates and associated riparian vegetation within the ROW. These natural-bottom creek channel sections provide significant stormwater control, groundwater recharge, biological diversity, and wildlife services. These areas provide the highest level and variety of functions and services found within the ROW.

Altered Channels

Within the ROW, Franklin and Santa Monica Creeks consist of open concrete box channels, and Garrapata Creek is completely culverted. No substrate or vegetative cover is present within these channels. These altered channels provide stormwater control benefits, but do not provide significant biological diversity, groundwater recharge, or wildlife services within the ROW.

Manmade Channels

Numerous manmade roadside swales and channels are present within and immediately adjacent to the ROW, and consist of either earthen or concrete bank construction. These small features provide some level of function and service that is dependant on their size, hydrologic regime, and composition. In addition, vegetative cover and bank contours of manmade channels are routinely altered by maintenance activities, resulting in varying levels of services provided. Both types of ditches provide stormwater control benefits, but earthen bank ditches within the ROW typically contained some type of vegetative cover, and appeared to provide more biological diversity and potential wildlife services than concrete-lined ditches.

5. PRELIMINARY JURISDICTIONAL DETERMINATION

This Preliminary Jurisdictional Determination report identifies potential federal and state jurisdictional areas within the proposed project site, and discusses the potential jurisdictional impacts that would result from project implementation. Calculations for those potential jurisdictional areas identified were provided by Caltrans staff based on data collected by SWCA biologists. These jurisdictional results are preliminary, and are subject to review by the USACE prior to issuance of any permits. This preliminary jurisdictional determination report should be submitted to the USACE as part of any permit application. During the permit review process, the USACE will conduct a site visit to verify the conditions and jurisdictional areas identified in this report, and will approve or request amendments to the report based on their findings.

5.1 U.S. ARMY CORPS OF ENGINEERS JURISDICTIONAL AREAS

The following table summarizes the areas within each alternative that would be potentially subject to USACE jurisdiction, and therefore, subject to jurisdiction under Section 404 of the Clean Water Act. USACE jurisdictional determinations were based on the presence/absence of wetland indicators, definable OHWM's, and connectivity to relatively permanent waters.

Table 1. Impacts to USACE Jurisdictional Areas

Alternative	Total Area within Project Study Area	Permanent Impacts	Temporary Impacts
USACE Other Waters of the U.S.			
Alternative 1	0.72 ha (1.79 ac)	0.53 ha (1.31 ac)	0.19 ha (0.48 ac)
Alternative 2	0.76 ha (1.89 ac)	0.53 ha (1.32 ac)	0.23 ha (0.57 ac)
Alternative 3	0.65 ha (1.62 ac)	0.48 ha (1.20 ac)	0.17 ha (0.42 ac)
USACE Wetlands			
Alternative 1	0.022 ha (0.045 ac)	0.002 ha (0.005 ac)	0.02 ha (0.04 ac)
Alternative 2	0.046 ha (0.11 ac)	0.024 ha (0.06 ac)	0.022 ha (0.05 ac)
Alternative 3	0.019 ha (0.045 ac)	0.002 ha (0.005 ac)	0.017 ha (0.04 ac)

ha = hectares, ac = acres

5.2 Regional Water Quality Control Board Jurisdictional Areas

The following table summarizes the areas within each alternative that would be potentially subject to RWQCB jurisdiction and, therefore, subject to jurisdiction under Section 401 of the Clean Water Act. RWQCB jurisdictional determinations were based on the presence/absence of wetland indicators, definable OHWM's, and connectivity to relatively permanent waters, and the jurisdictional areas are the same as USACE areas.

Table 2. Impacts to RWQCB Jurisdictional Areas

Alternative	Total Area within Project Study Area	Permanent Impacts	Temporary Impacts
RWQCB Waters of the State			
Alternative 1	0.74 ha (1.83 ac)	0.53 ha (1.31 ac)	0.21 ha (0.52 ac)
Alternative 2	0.80 ha (2.00 ac)	0.55 ha (1.38 ac)	0.25 ha (0.62 ac)
Alternative 3	0.66 ha (1.66 ac)	0.48 ha (1.21 ac)	0.19 ha (0.46 ac)

ha = hectares, ac = acres

5.3 CALIFORNIA COASTAL COMMISSION JURISDICTIONAL AREAS

The following table summarizes the areas within each alternative that would be potentially subject to CCC jurisdiction, all of which is subject to jurisdiction under the California Coastal Act of 1976 and associated Local Coastal Plans (LCPs). The CCC considers any area that supports any one of the three wetland indicators to be jurisdictional. CCC boundaries were delineated by the presence of a defined bed and bank, hydrophytic vegetation, hydric soils, or evidence of hydrology.

Table 3. Impacts to CCC Jurisdictional Areas

Alternative	Total Area within Project Study Area	Permanent Impacts	Temporary Impacts
CCC Jurisdiction			
Alternative 1	0.49 ha (1.21 ac)	0.24 ha (0.58 ac)	0.25 ha (0.63 ac)
Alternative 2	0.62 ha (1.53 ac)	0.29 ha (0.72 ac)	0.33 ha (0.81 ac)
Alternative 3	0.49 ha (1.21 ac)	0.23 ha (0.57 ac)	0.26 ha (0.64 ac)

ha = hectares, ac = acres

6. REFERENCES

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APPENDIX A:
PROJECT MAP SHEETS

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Project Map Sheets to be inserted by Caltrans

APPENDIX B:
PROJECT MAP SHEETS FOR ALTERNATIVES

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Project Map Sheets for Alternatives to be inserted by Caltrans.

APPENDIX C:
PHOTO DOCUMENTATION

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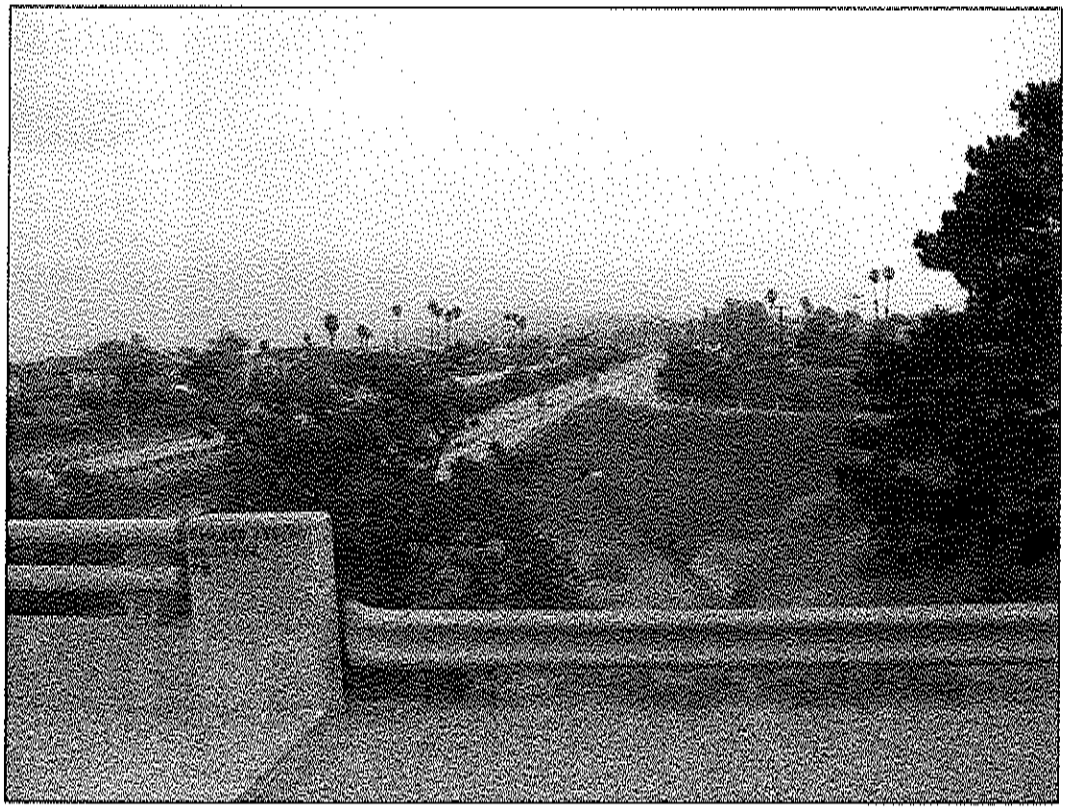

PHOTO 1:

View of Southbound Highway 101 at Bailard Avenue Bridge. Note trapezoidal concrete channel which transects the interchange, near the southbound on-ramp. Location is at PM 1.6.

Photo taken on April 30, 2009.



PHOTO 2:

View of concrete drainage channel located directly south of the Bailard Avenue offramp (southbound). Location is located near PM 1.65

Photo taken on April 30, 2009.



PHOTO 3:

View of typical habitat associated with 'other waters' drainage located north of Highway 101 between PM 2.1 and PM 2.2. Concrete v-ditch provides conveyance.

Photo taken on April 30, 2009.

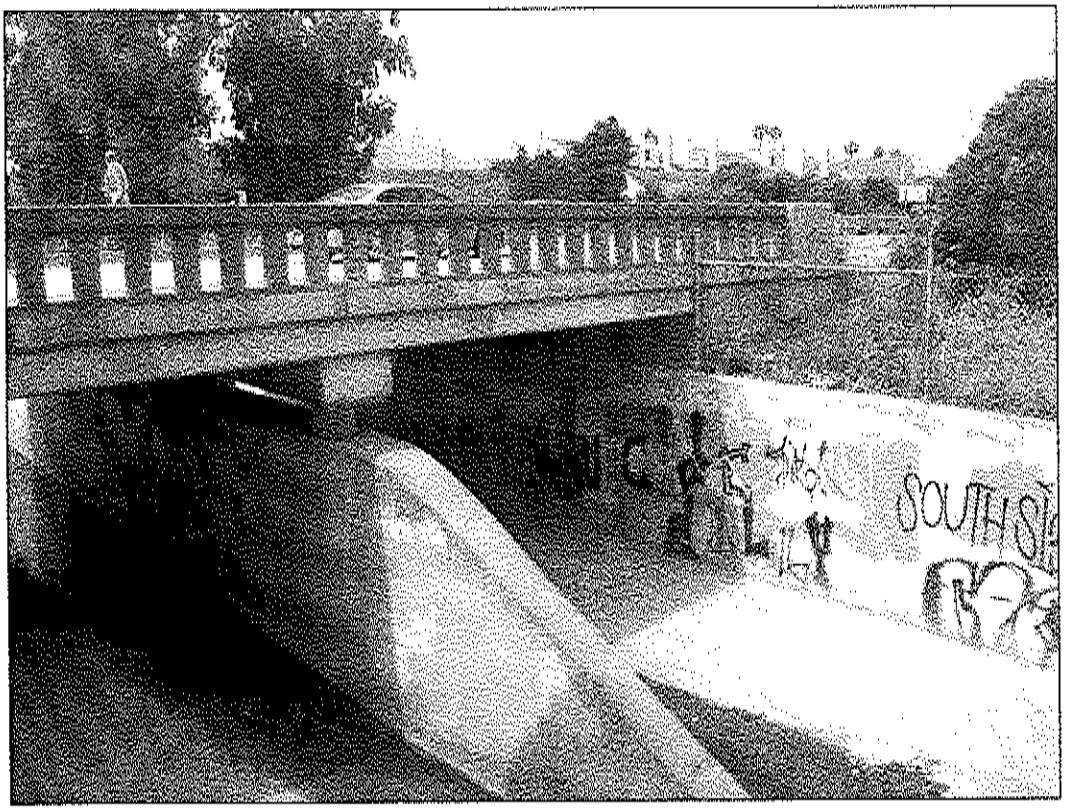

PHOTO 4:

View of Franklin Creek directly North of Highway 101. Northbound Highway 101 shown in background. Creek channel consists of concrete bottom and sides throughout the study area.

Photo taken on April 30, 2009



PHOTO 5:

View of concrete trapezoidal drainage located along northbound 101 between PM 3.4 and PM 3.5. View is looking east. Highway 101 northbound located to the right of photo (not shown). Private residences are on the left of the photo.

Photo taken on April 30, 2009

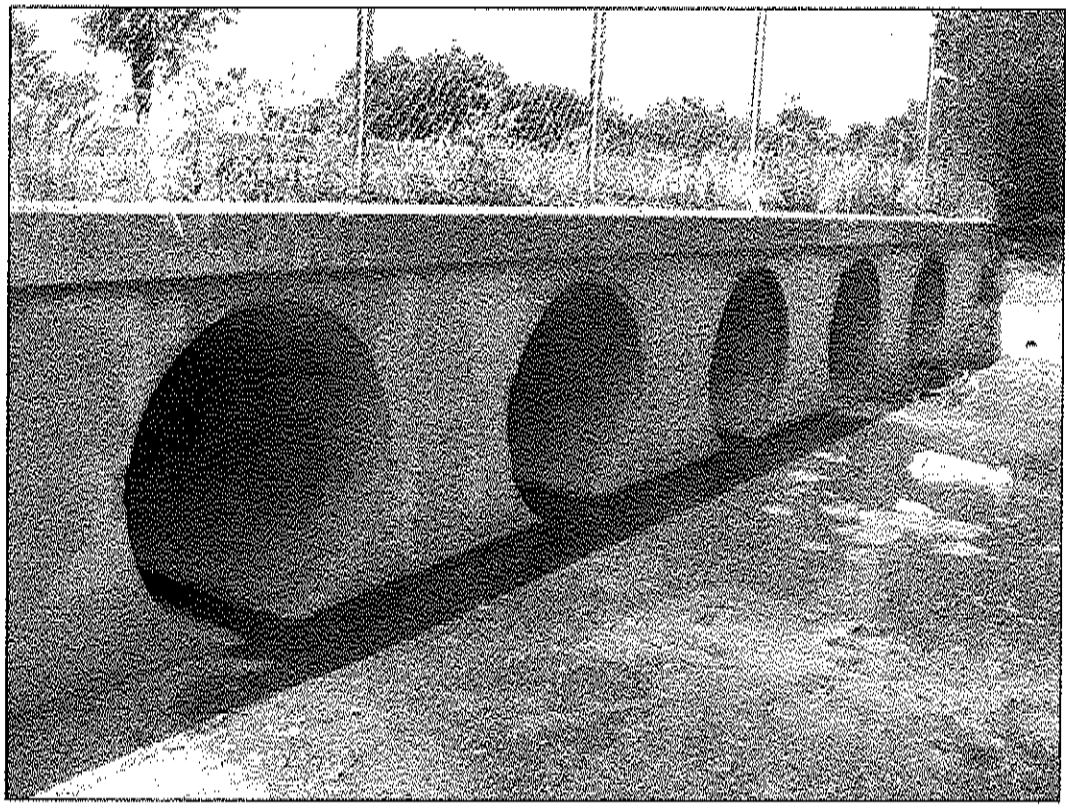

PHOTO 6:

View of concrete culverts which convey flows from the north side of Highway 101 to the south side of Highway 101. Location is near PM 3.5 on the north side of Highway 101.

Photo taken on April 30, 2009.

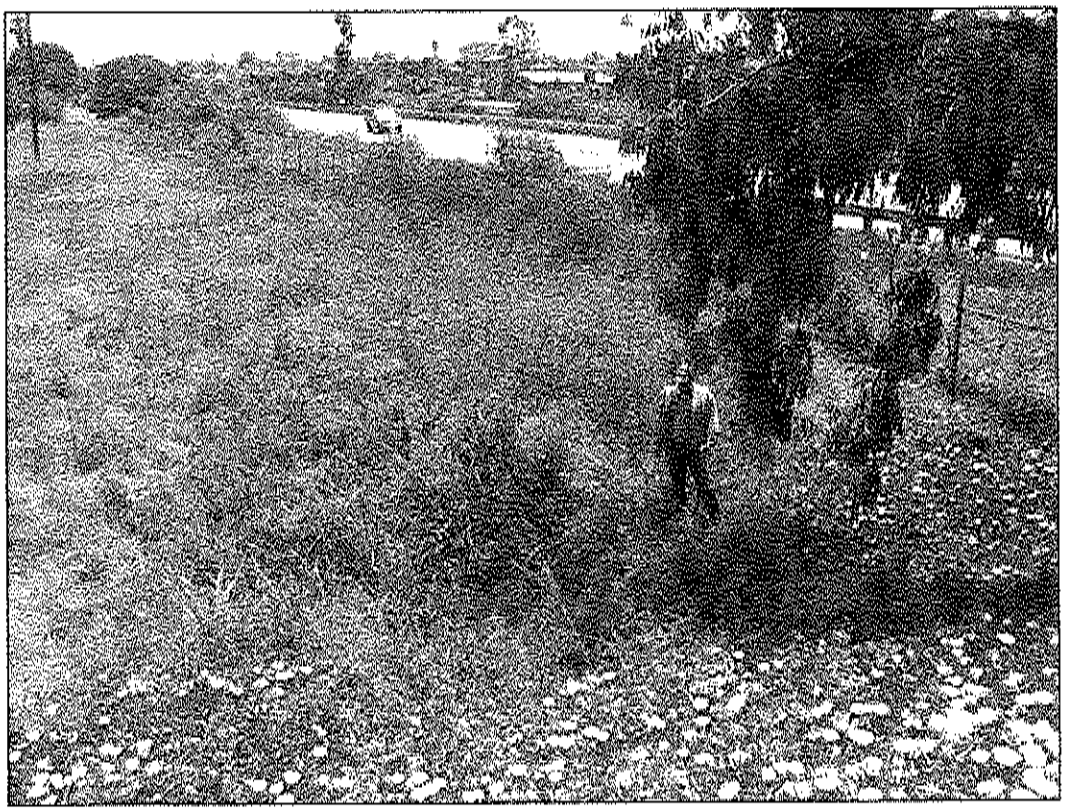

PHOTO 7:

Overview of wetland area located in the northeast corner of the Highway 101/Santa Ynez interchange. Photo is taken from Santa Ynez Road with northbound Highway 101 in the background.

Photo taken on April 30, 2009.

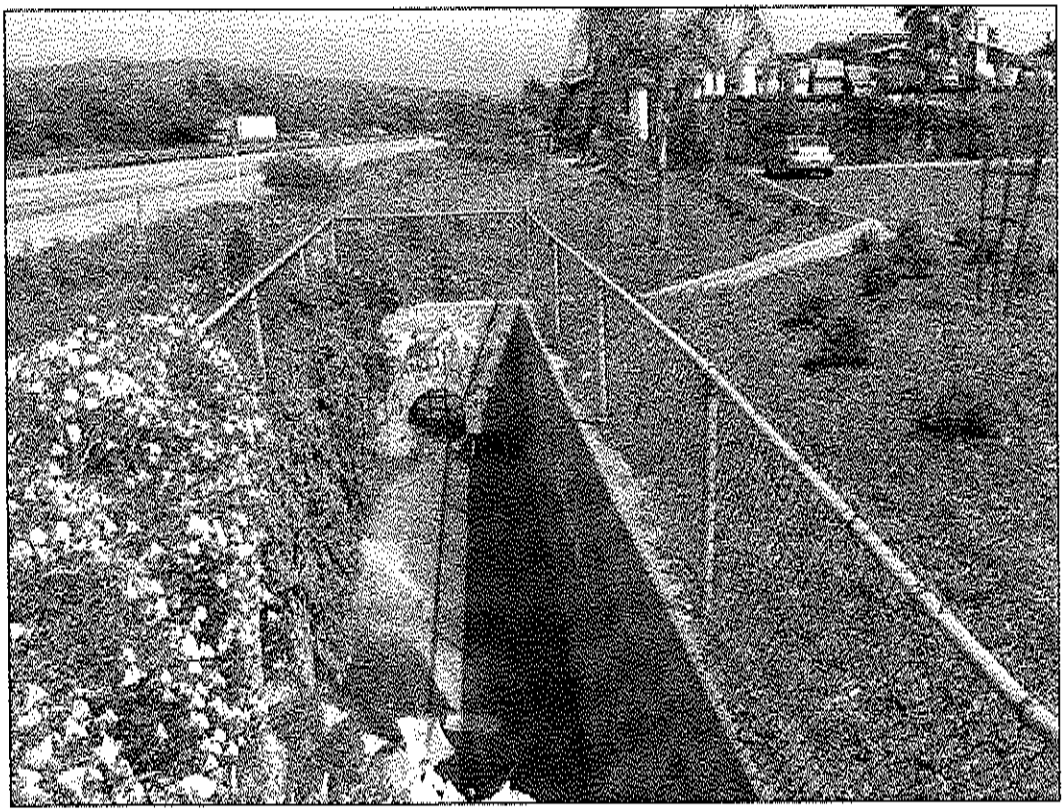

PHOTO 8:

View of concrete channel located along southbound Highway 101 near PM 3.5.

Photo taken on April 30, 2009.

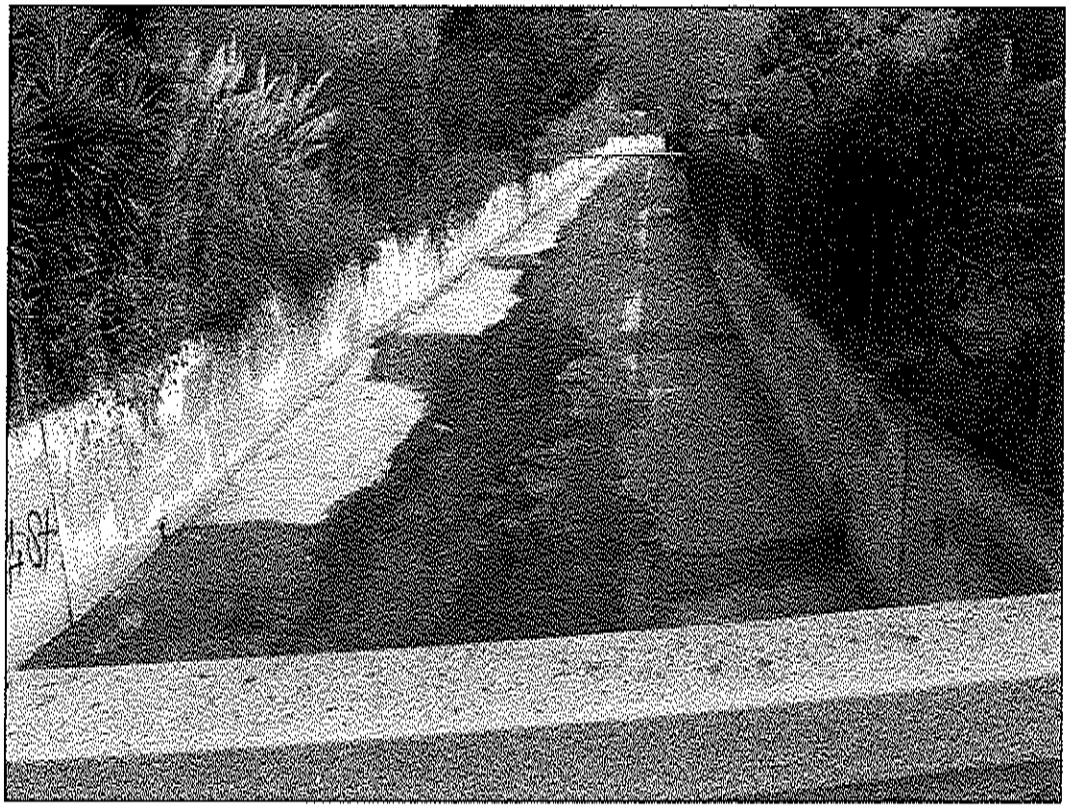

PHOTO 9:

View of Santa Monica Creek, looking upstream and to the north. Entire channel consists of concrete lined bottom and sides. Photo taken from Highway 101 northbound bridge.

Photo taken on April 30, 2009.



PHOTO 10:

View of wetland area located adjacent to the Santa Monica Road offramp. Location is near PM 3.86.

Photo taken on April 30, 2009.

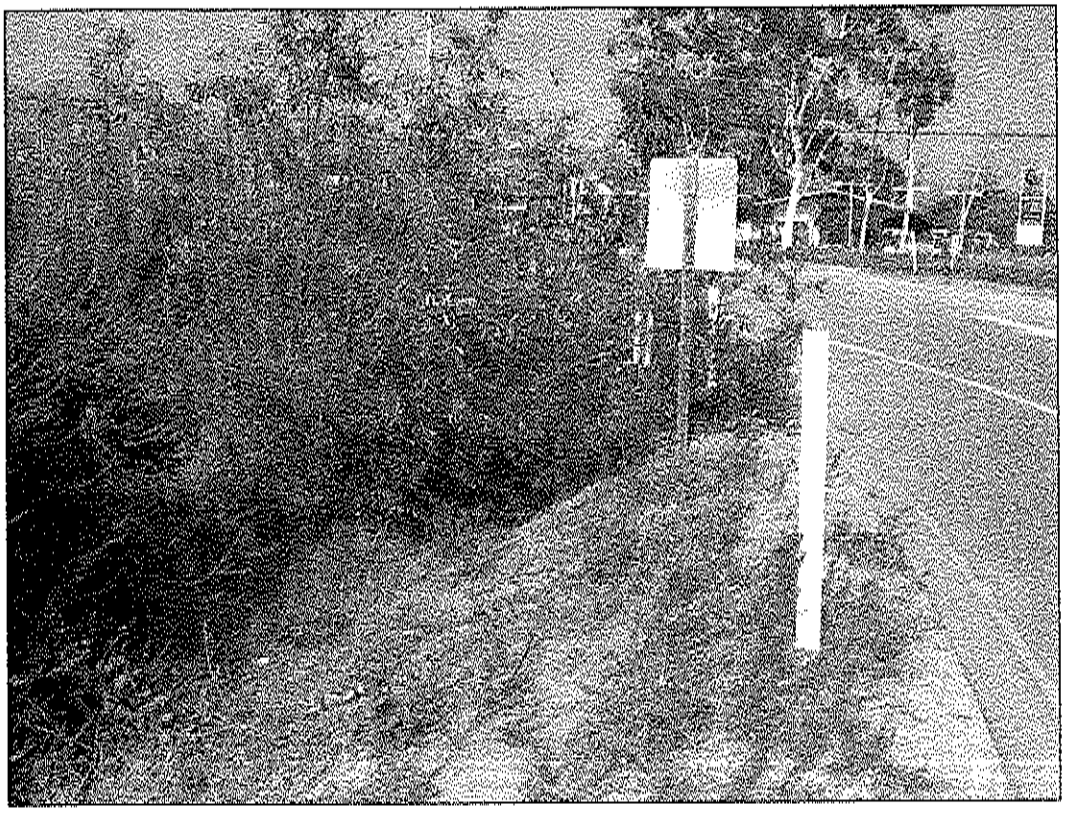

PHOTO 11:

View of Santa Monica Road onramp to Highway 101 northbound. Note arroyo willow growing in roadside ditch.

Photo taken on April 30, 2009.

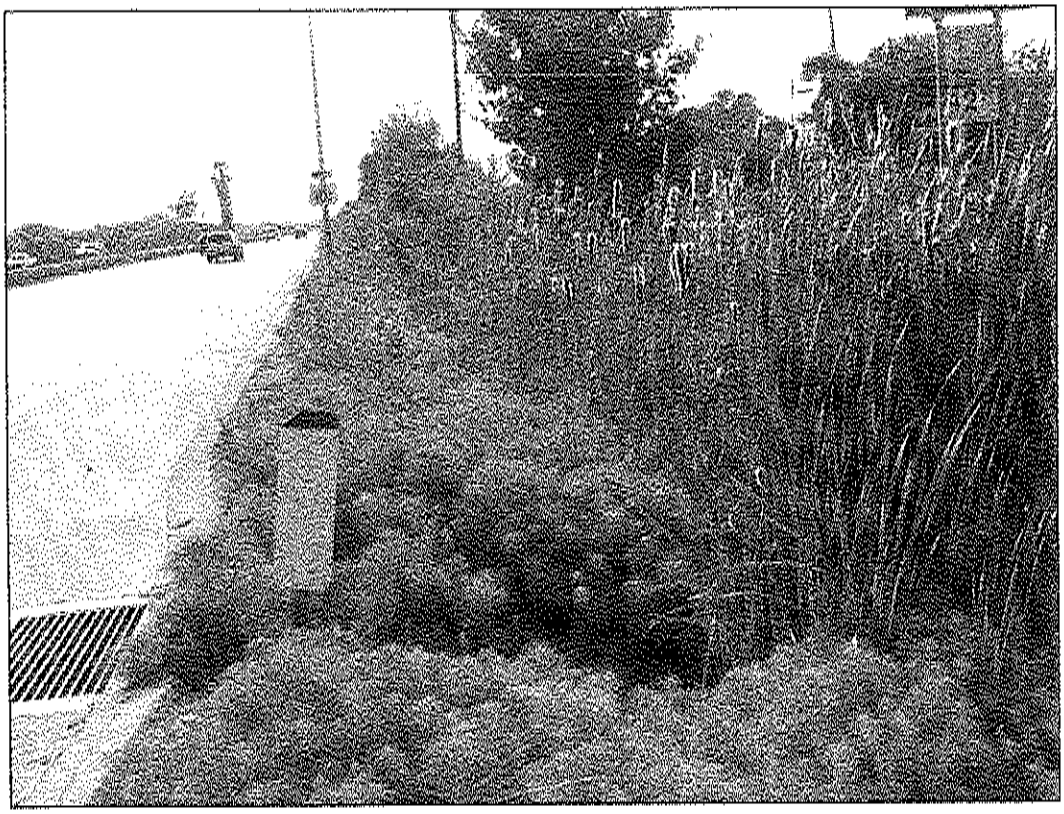

PHOTO 12:

View of wetland vegetation located within drainage that parallels the Santa Monica Road onramp to northbound Highway 101 (shown). Location is at PM 3.9.

Photo taken on April 30, 2009.

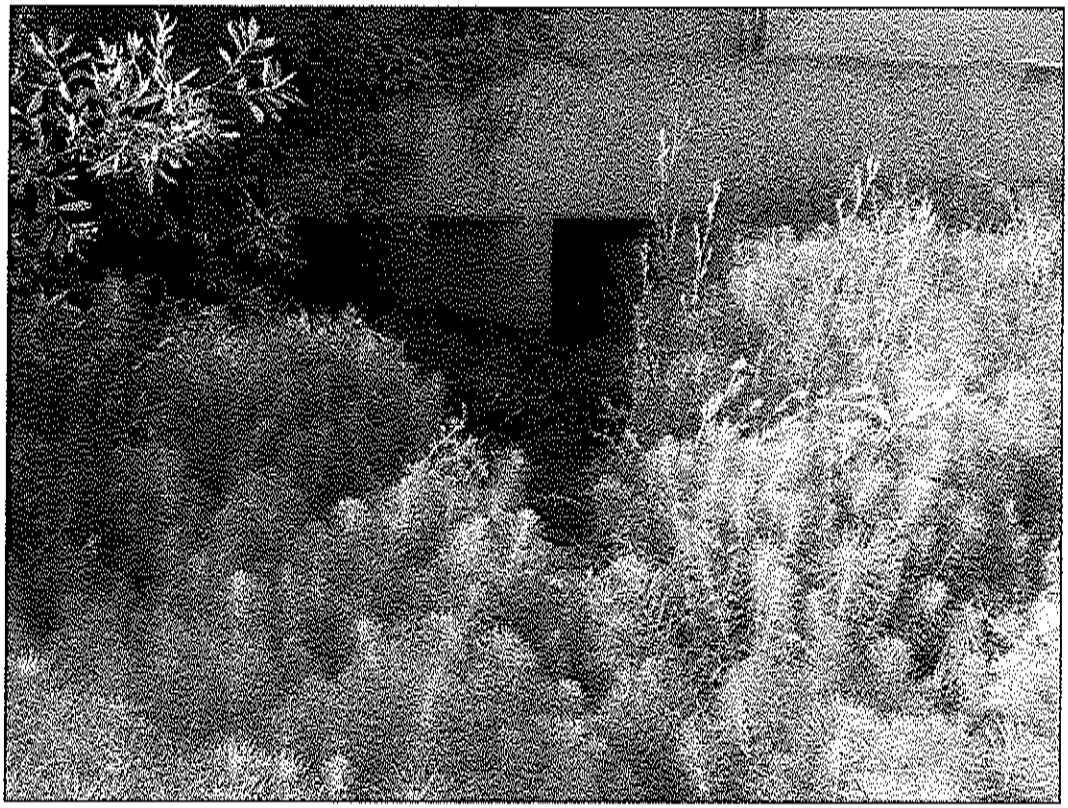

PHOTO 13:

View of concrete box culverts located directly south of the southbound Highway 101. Culverts convey water to urban area outside of Caltrans ROW. Drainage features within Caltrans ROW feed into the culverts. Location at PM 4.0.

Photo taken on April 30, 2009.

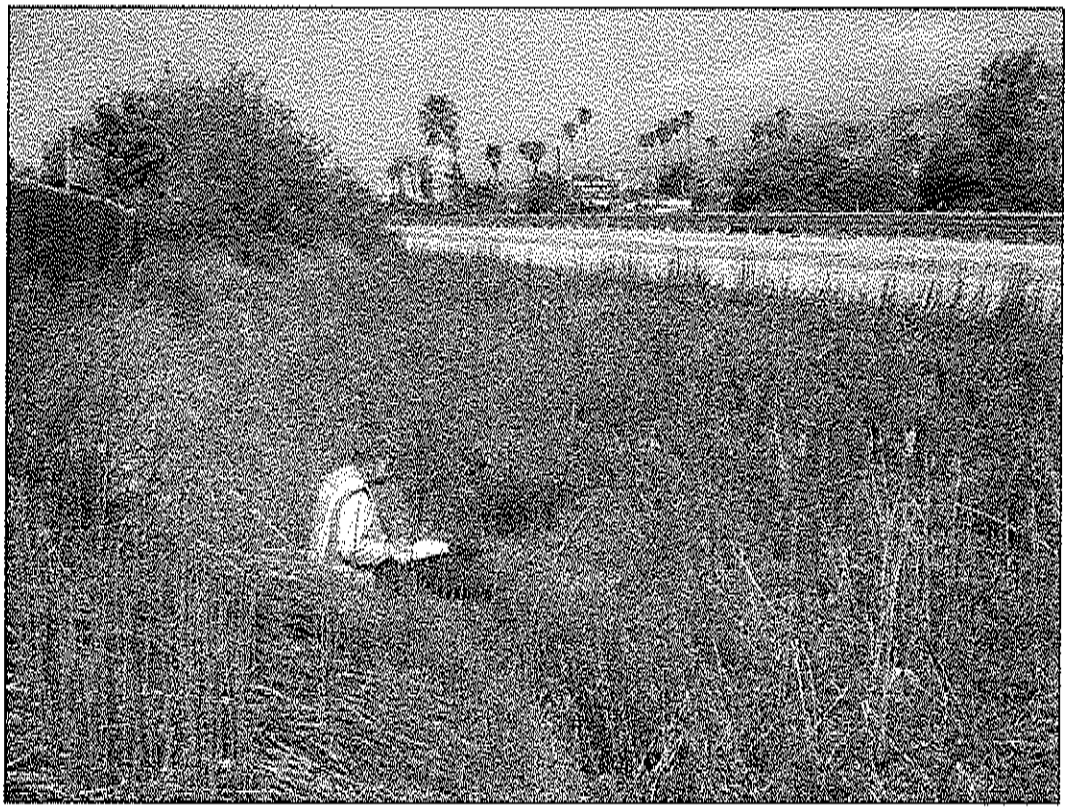

PHOTO 14:

View of roadside channel that conveys water towards the box culverts located at PM 4.9 (shown in photo above). Photo is taken from location between PM 4.0 and PM 4.1. Southbound Highway 101 shown in background.

Photo taken on April 30, 2009.

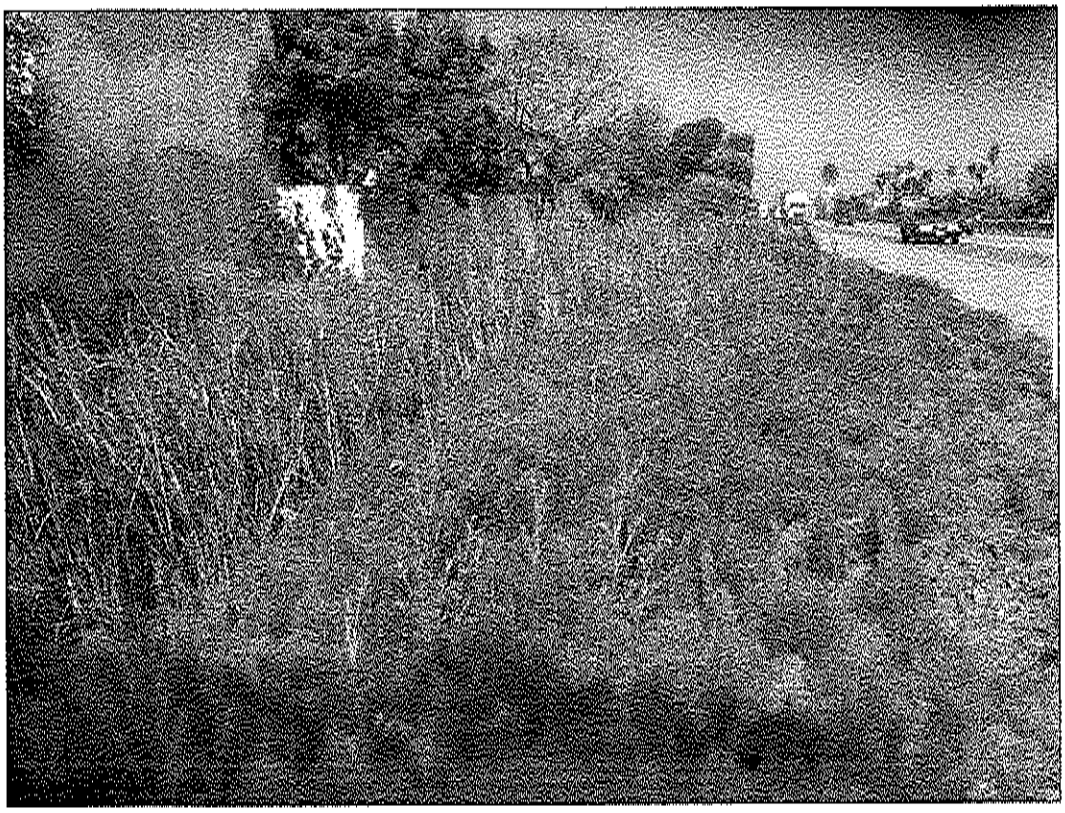

PHOTO 15:

View of drainage which conveys flow towards the box culverts at PM 4.0. Photo is taken from a location near PM 3.95. Note wetland vegetation consisting of cattails and Equisetum.

Photo taken on April 30, 2009.

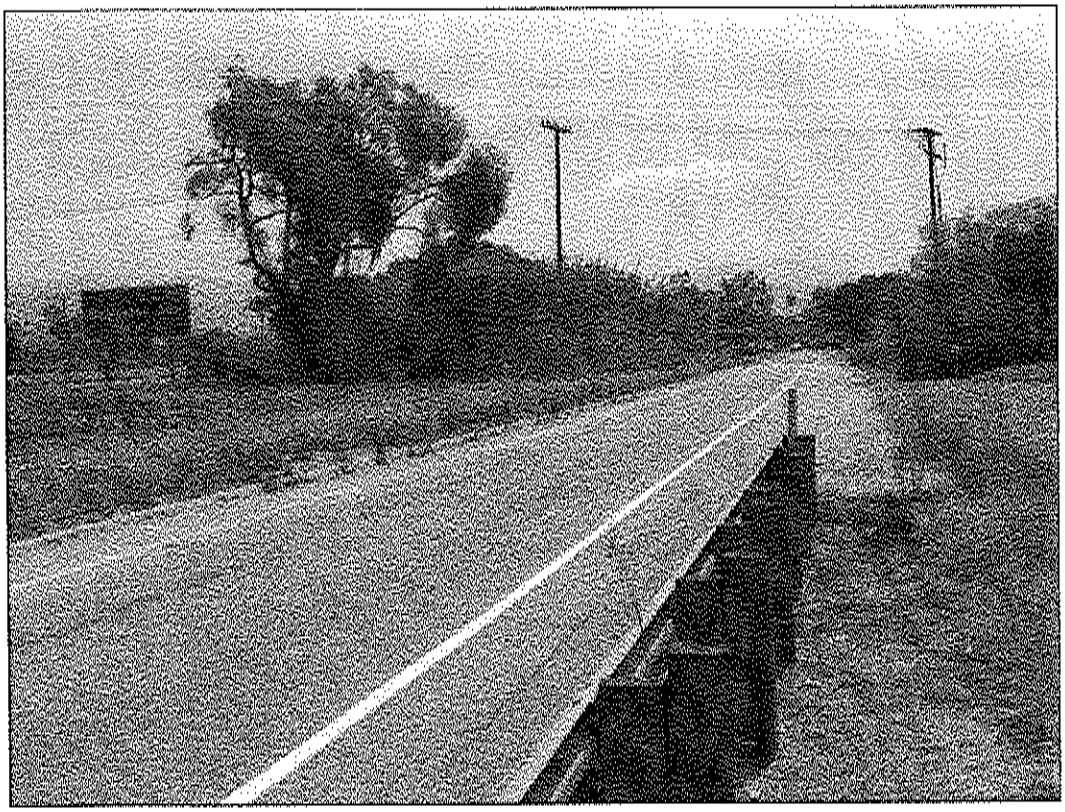

PHOTO 16:

Overview of Carpinteria Avenue offramp looking east from PM 4.3. Isolated willows and other trees have no connection to drainage features. Willow vegetation shown on the right is associated with nearby drainage feature (shown in photo below).

Photo taken on April 30, 2009.

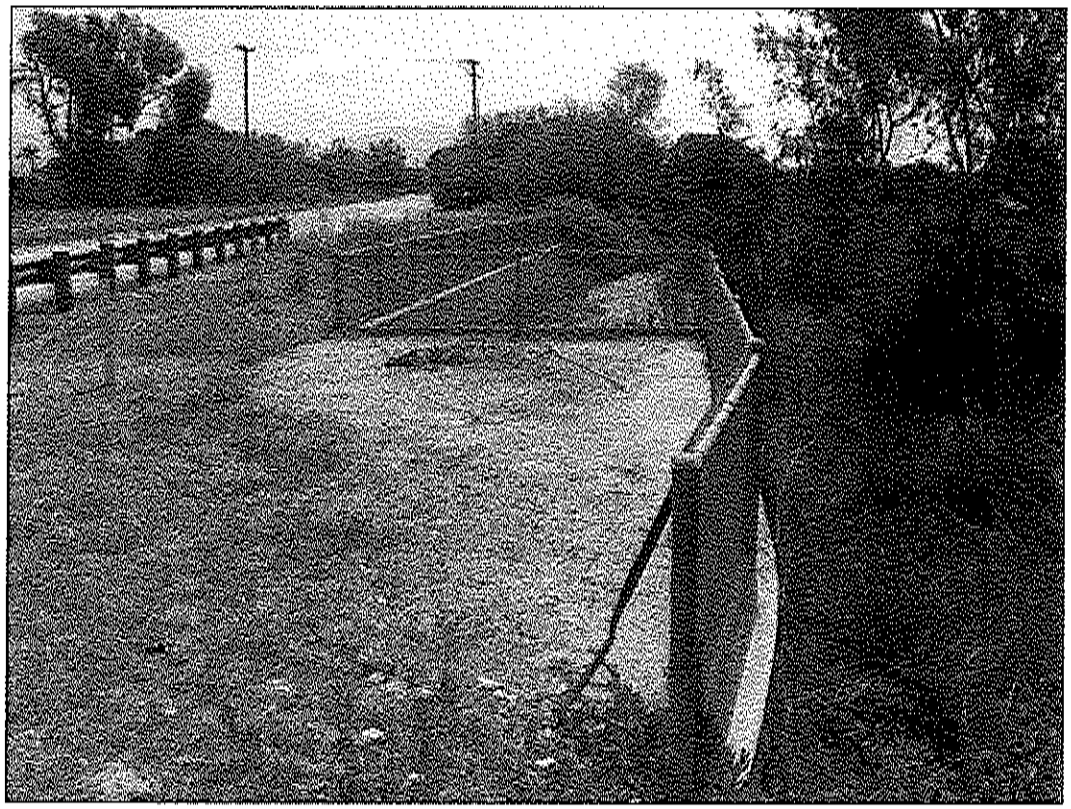

PHOTO 17:

View of drainage feature located directly to the south of Highway 101, between the Highway and the Union Pacific Railroad. Area includes standing water and hydrophytic vegetation. Area is adjacent to but almost entirely outside of Caltrans ROW.

Photo taken on April 30, 2009.



PHOTO 18:

View of small drainage and culvert outlets located near PM 4.4. Carpinteria Avenue offramp shown in the background.

Photo taken on April 30, 2009.

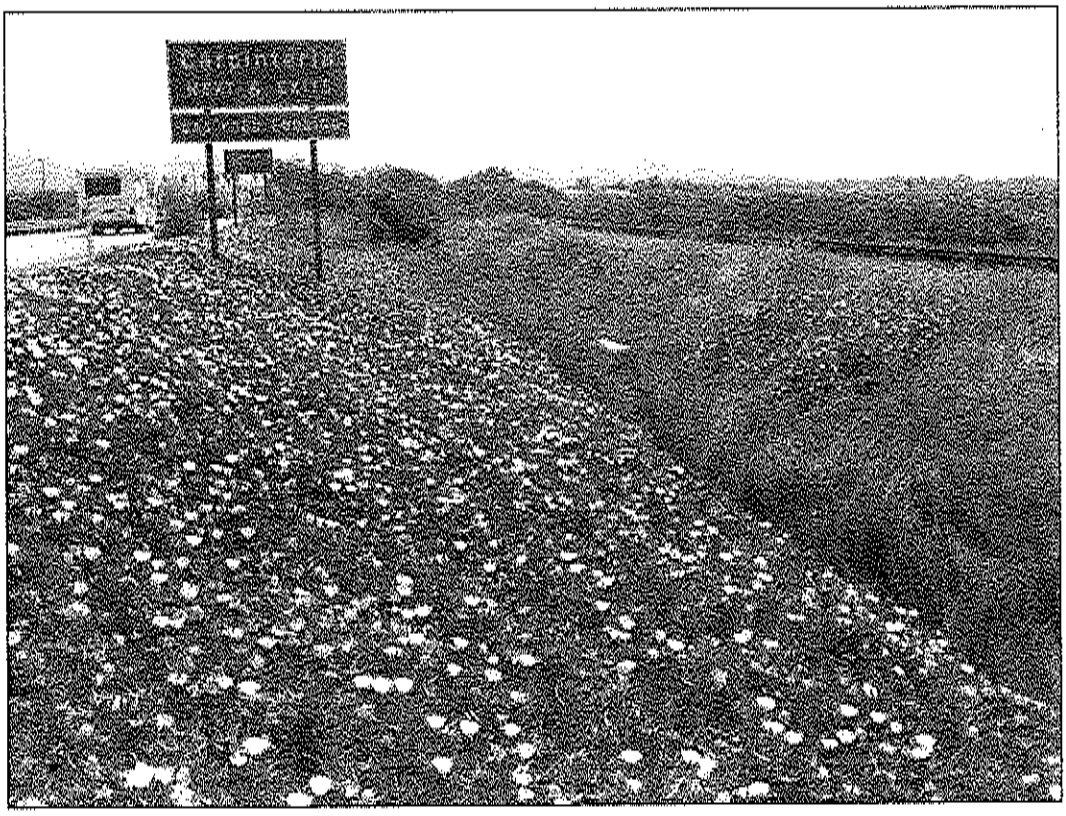

PHOTO 19:

View of natural bottom drainage feature located directly along the perimeter of the Caltrans and Union Pacific Railroad ROW boundaries. View is looking east from PM 4.6

Photo taken on April 30, 2009.

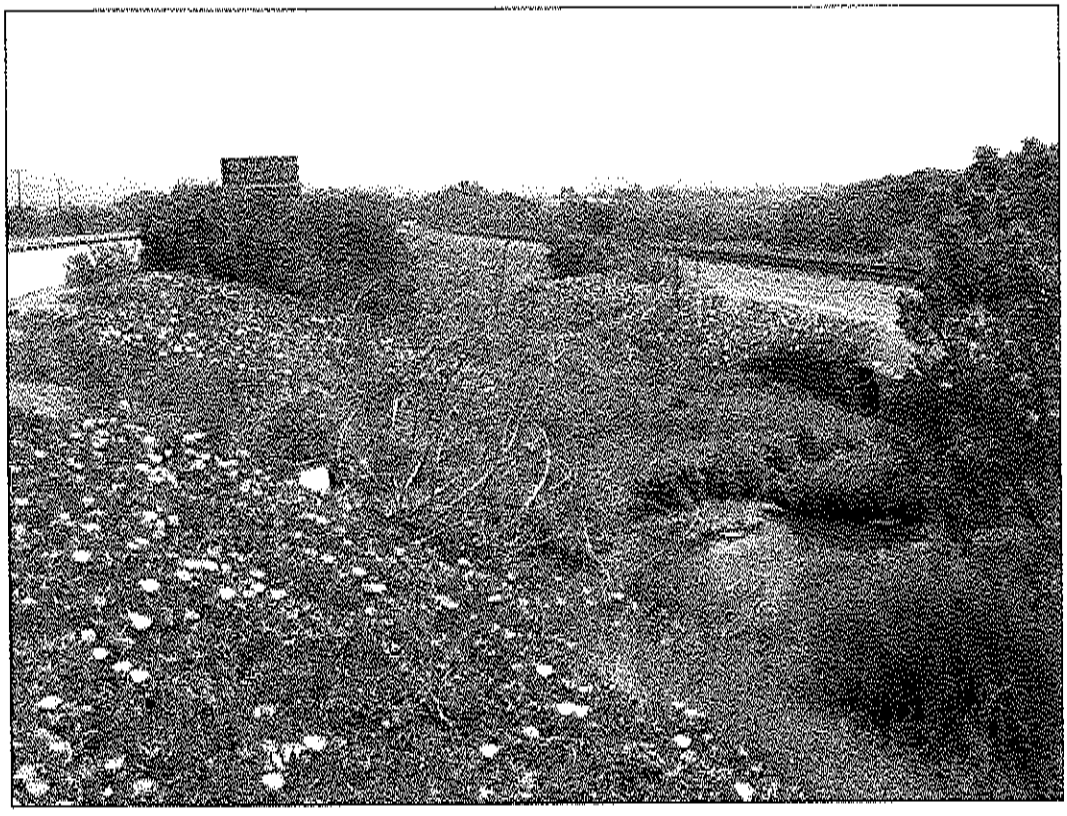

PHOTO 20:

Overview of culvert outlets that convey flows beneath Highway 101 and drain into the Carpinteria salt marsh. Photo taken near PM 4.6.

Photo taken on April 30, 2009.

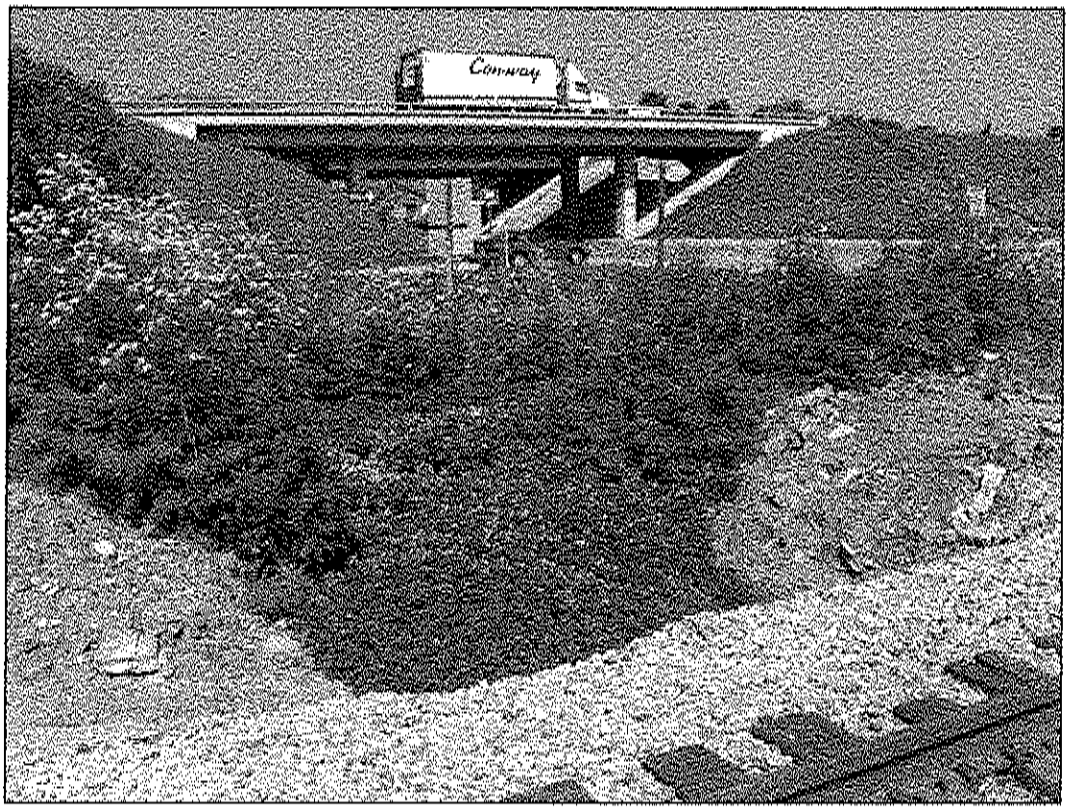

PHOTO 21:

View of drainage feature located at the Santa Claus Lane southbound offramp. Area is dominated by *Rorippa nasturtium-aquaticum*. Water is conveyed under the railroad ROW to the Carpinteria salt marsh.

Photo taken on April 30, 2009.

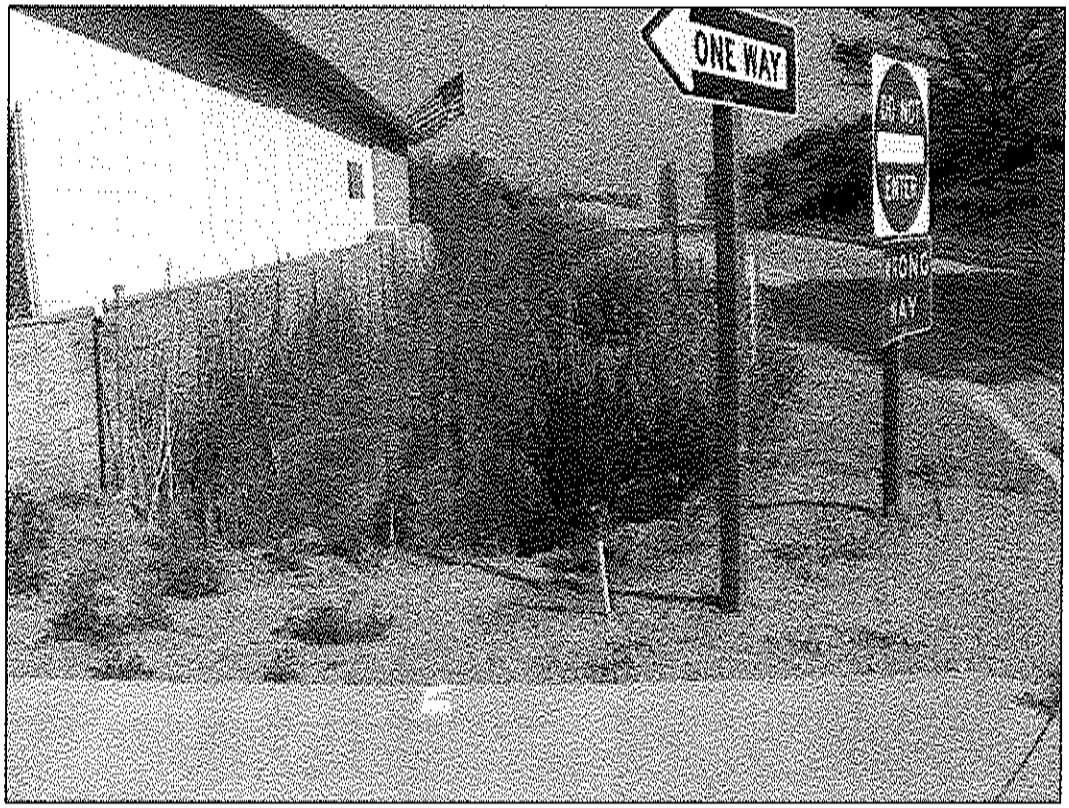

PHOTO 22:

View of drainage feature located adjacent to the northbound offramp for Padaro Lane, near PM 5.3. View is looking east. Water source is primarily runoff from intensive greenhouse operations in the adjacent area.

Photo taken on April 30, 2009.

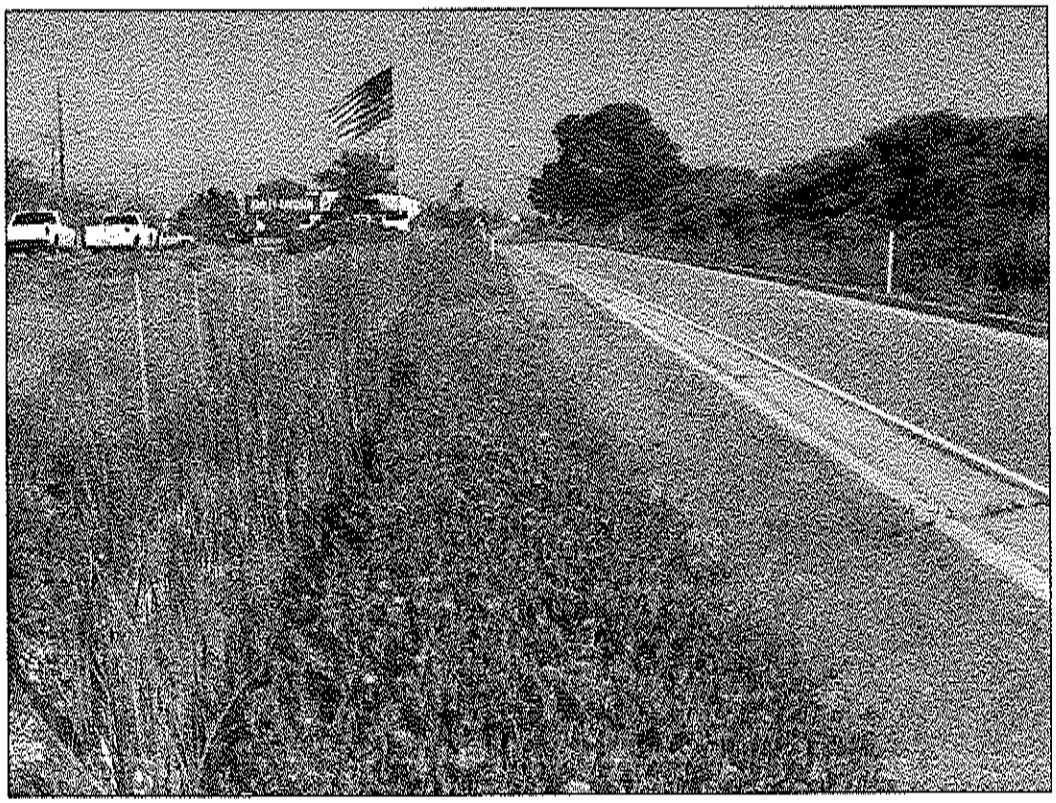

PHOTO 23:

View of drainage feature located along the northbound onramp at Padaro Lane.

Photo taken on April 30, 2009.

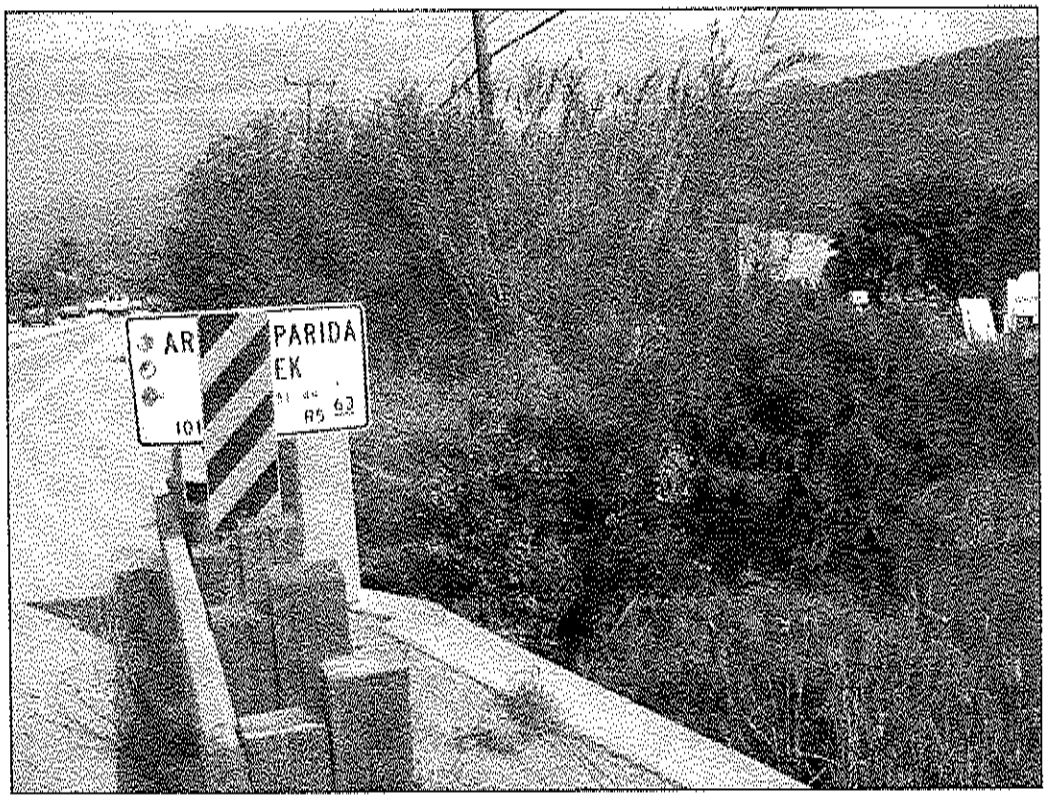

PHOTO 24:

View of upstream portion of Arroyo Parida Creek. Note concrete wing-walls shown in the bottom right-hand portion of photo. Channel bottom consists of natural substrate.

Photo taken on April 30, 2009.

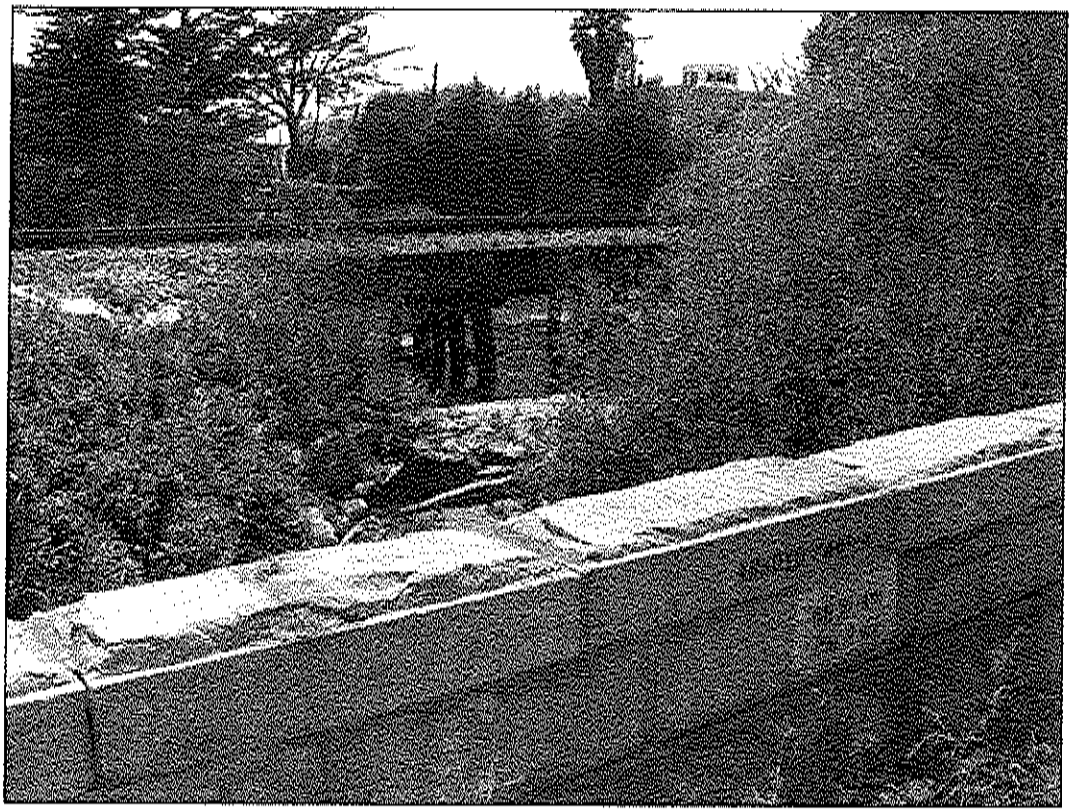

PHOTO 25:

View looking south along Arroyo Parida Creek, downstream of the Highway 101 bridge. Mature willow vegetation and standing water present in this area.

Photo taken on April 30, 2009.

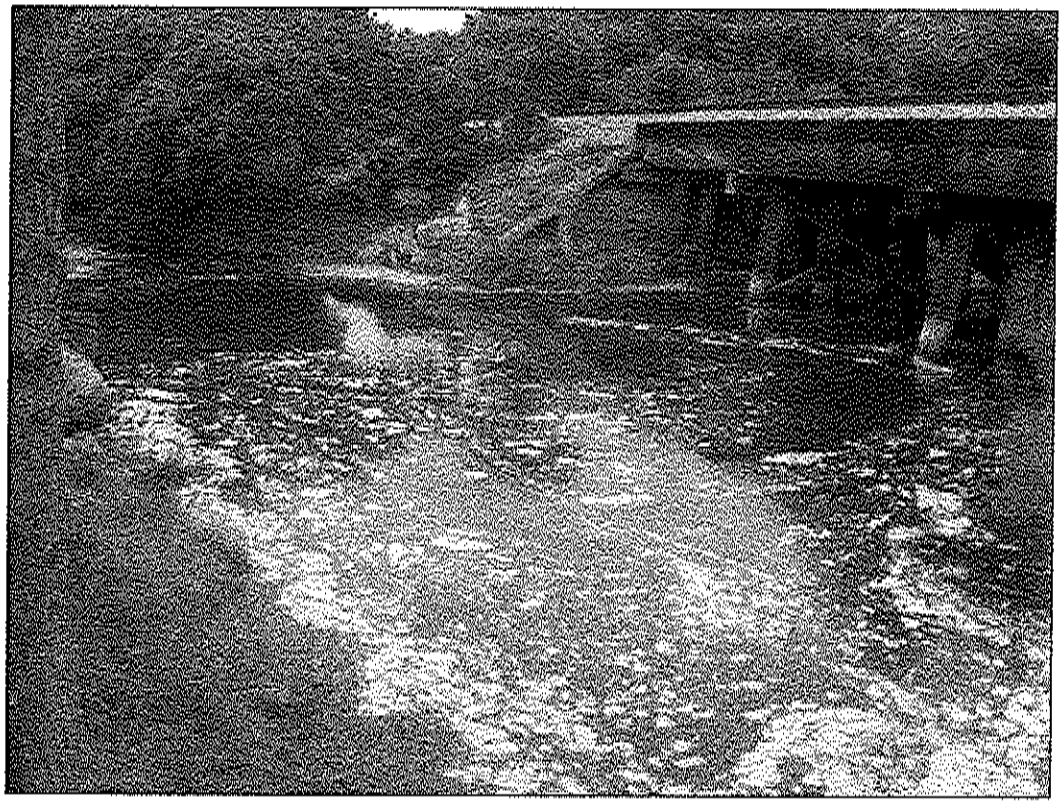

PHOTO 26:

View of Arroyo Parida Creek directly downstream of the railroad.

Photo taken on April 30, 2009.



PHOTO 27:

View looking south and downstream of Garapata Creek. Photo is taken from culvert that transects Highway 101 and is looking south at the railroad bridge.

Photo taken on April 30, 2009.



PHOTO 28:

View of Toro Creek, looking northwest along the northbound Highway 101 shoulder. Concrete v-ditch shown feeding into Toro Creek. Western sycamore dominates photo on the right.

Photo taken on April 30, 2009.

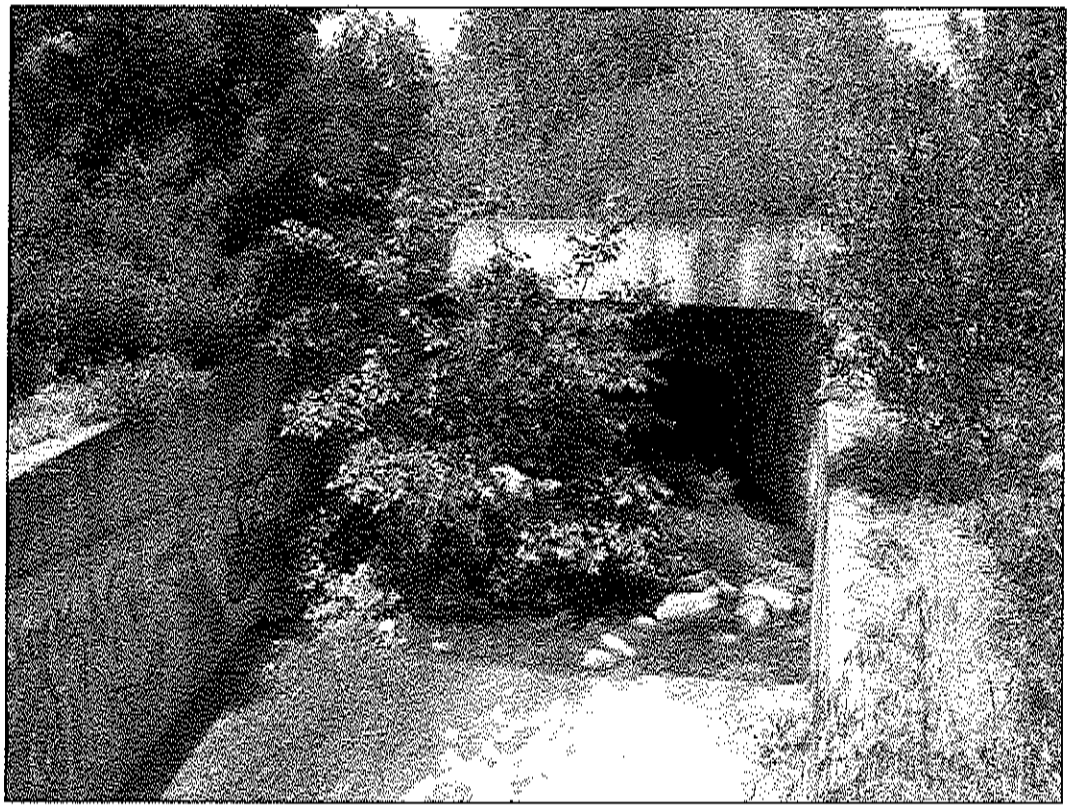

PHOTO 29:

View of Toro Canyon Creek, in between northbound and southbound Highway 101. Note: natural channel bottom section beneath northbound Highway 101. View looking north.

Photo taken on April 30, 2009.



PHOTO 30:

View of Toro Canyon Creek between northbound and southbound Highway 101. Opposite view of photo shown above. View is looking south. Note: concrete lined channel as creek transects beneath southbound Highway 101.

Photo taken on April 30, 2009.

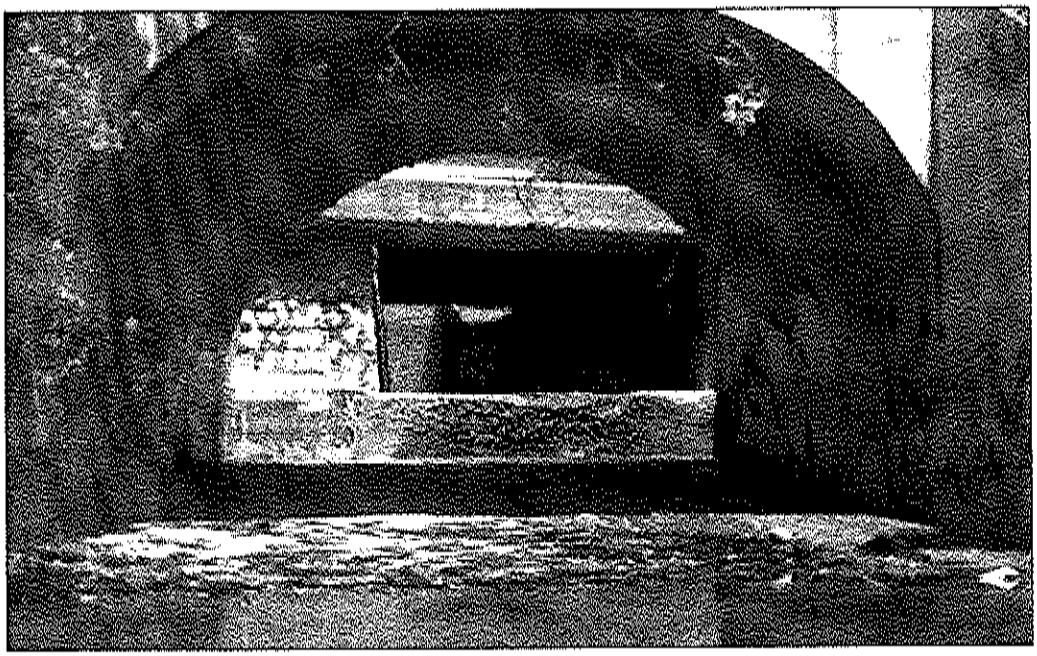

PHOTO 31:

View of Toro Canyon Creek, looking upstream. Highway 101 southbound lanes are visible behind the concrete arch railroad bridge Note: concrete lined channel bottom ends directly downstream of railroad bridge.

Photo taken on April 30, 2009.

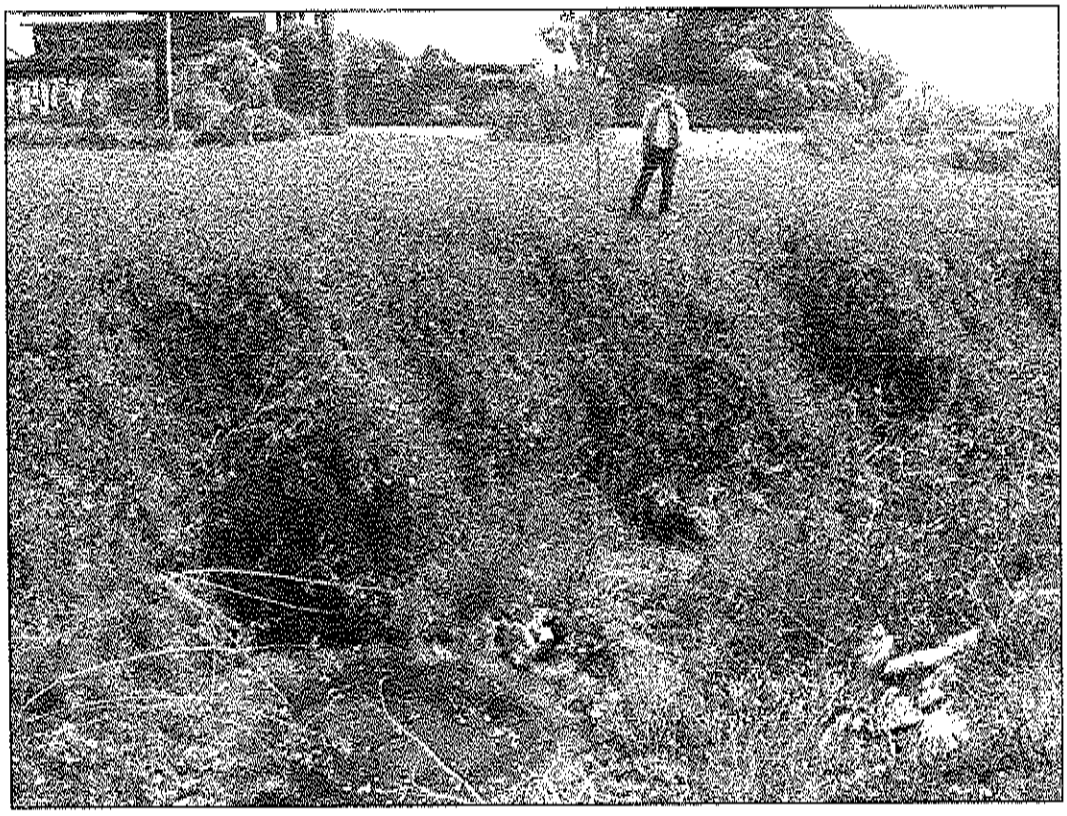

PHOTO 32:

Overview of Greenwell Creek on the south side of Highway 101. View looking south, with the railroad visible in the background. Photo taken near PM 7.7.

Photo taken on April 30, 2009.



PHOTO 33:

View of Greenwell Creek culvert outlet, looking north across Highway 101. Photo taken near PM 8.4.

Photo taken on April 30, 2009.

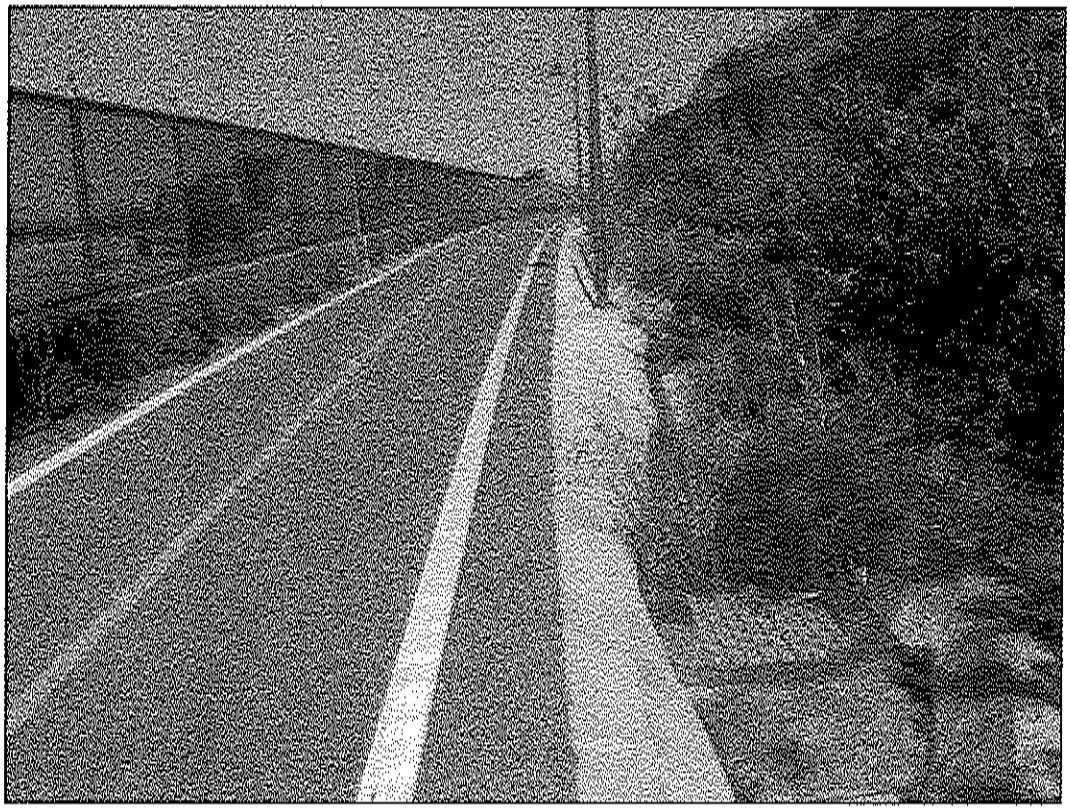

PHOTO 34:

View looking west at concrete v-ditch which runs adjacent to the Ortega Hill Road bike pathway. Photo taken near PM 8.4.

Photo taken on April 30, 2009.

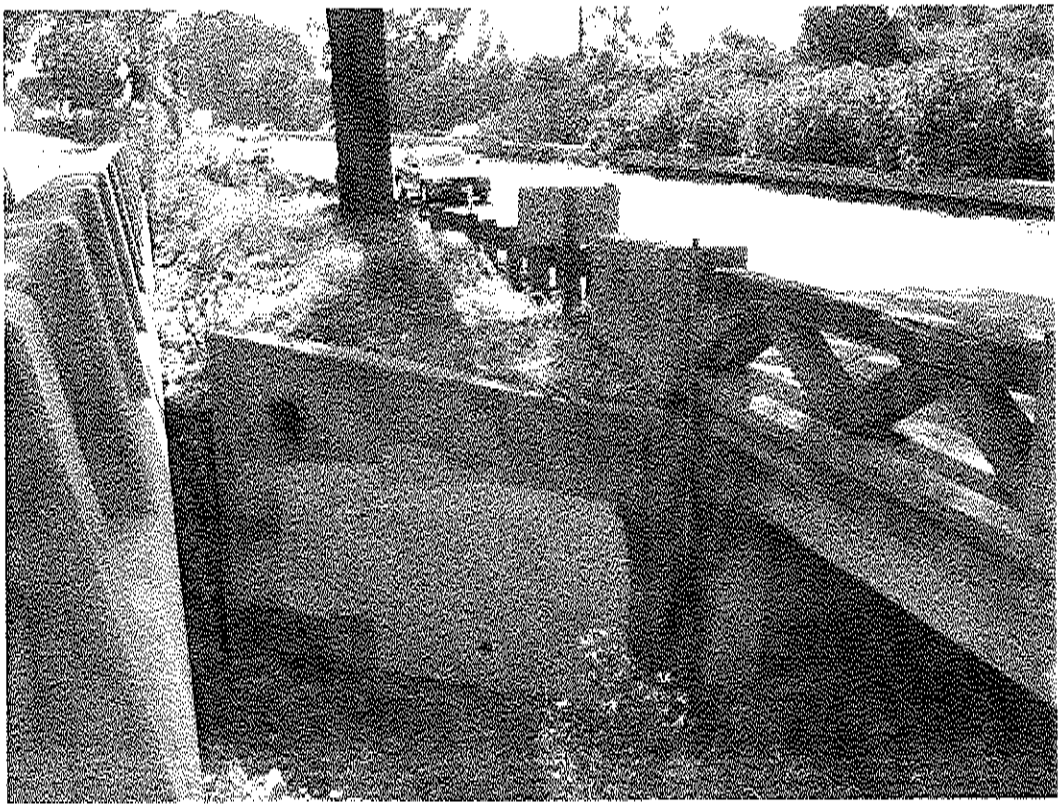

PHOTO 35:

View of San Ysidro Creek looking south along the Highway 101 northbound lanes. Note natural bottom features within channel. Photo taken near PM 9.55.

Photo taken on April 30, 2009.

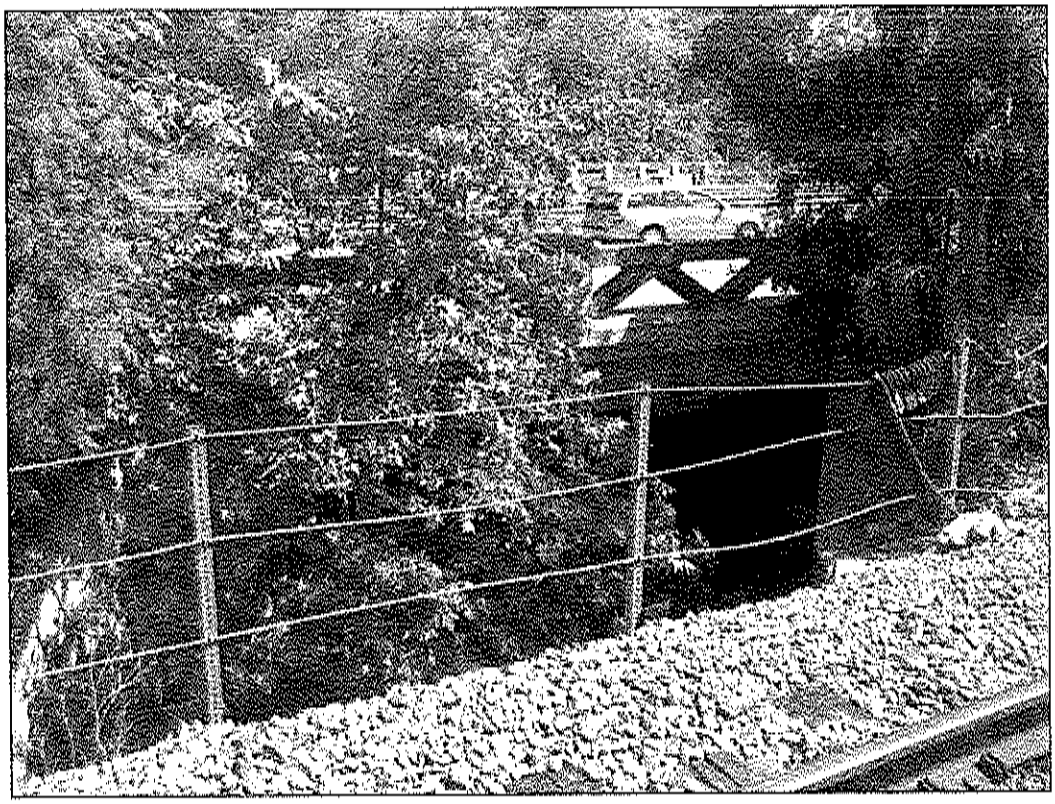

PHOTO 36:

View of San Ysidro Creek from the railroad looking toward Highway 101 southbound. Although not shown, natural bottom features continue through this section. Photo taken near PM 9.55.

Photo taken on April 30, 2009.

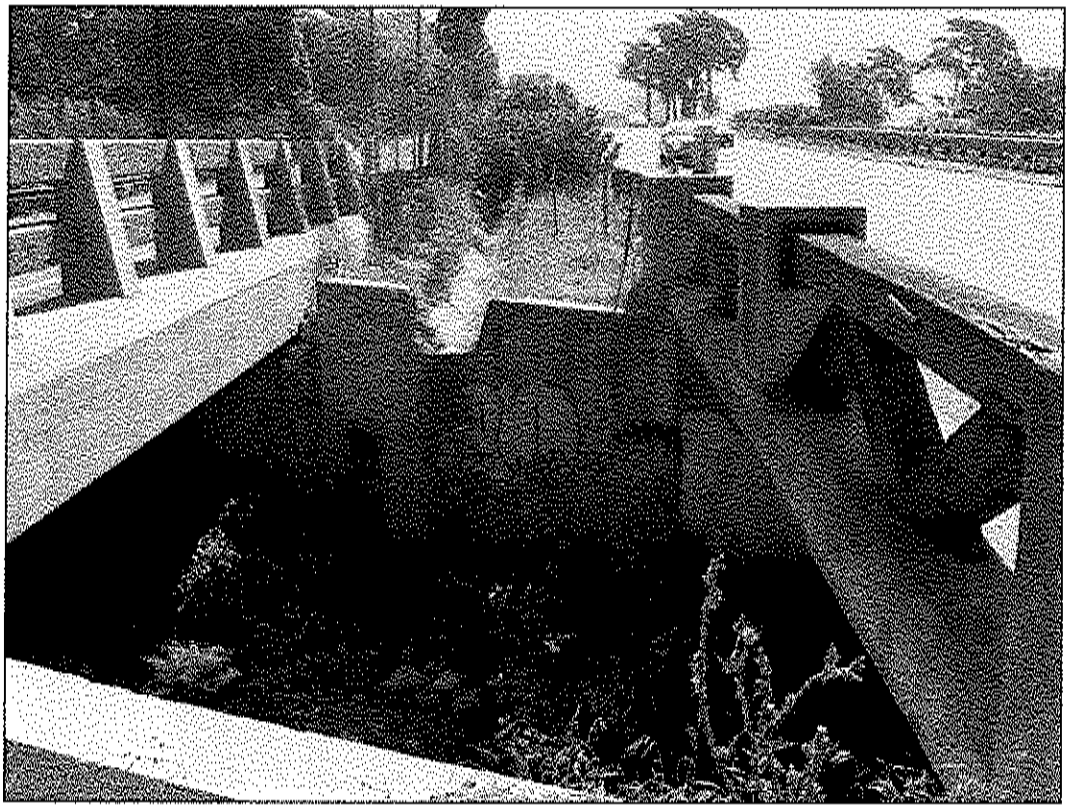

PHOTO 37:

View of Romero Creek between Northbound 101 and Jameson Lane. Note natural bottom features with hydrophytic vegetation. Concrete v-ditch shown in background directs road runoff to the creek channel.

Photo taken on April 30, 2009.



PHOTO 38:

View of Romero Creek from beneath Highway 101. View is looking upstream (north). Note natural bottom features and hydrophytic vegetation.

Photo taken on April 30, 2009.

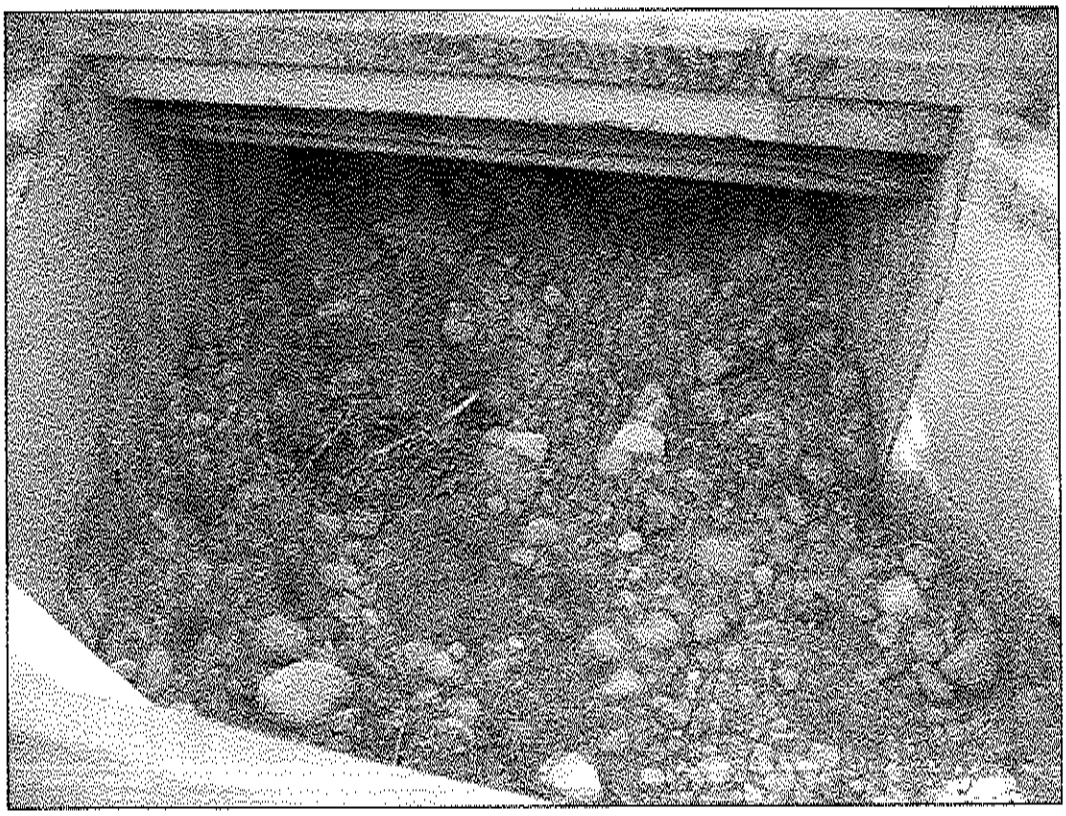

PHOTO 39:

View of Oak Creek upstream of Highway 101 northbound lanes. Photo taken from Jameson Lane bridge.

Photo taken on April 30, 2009.

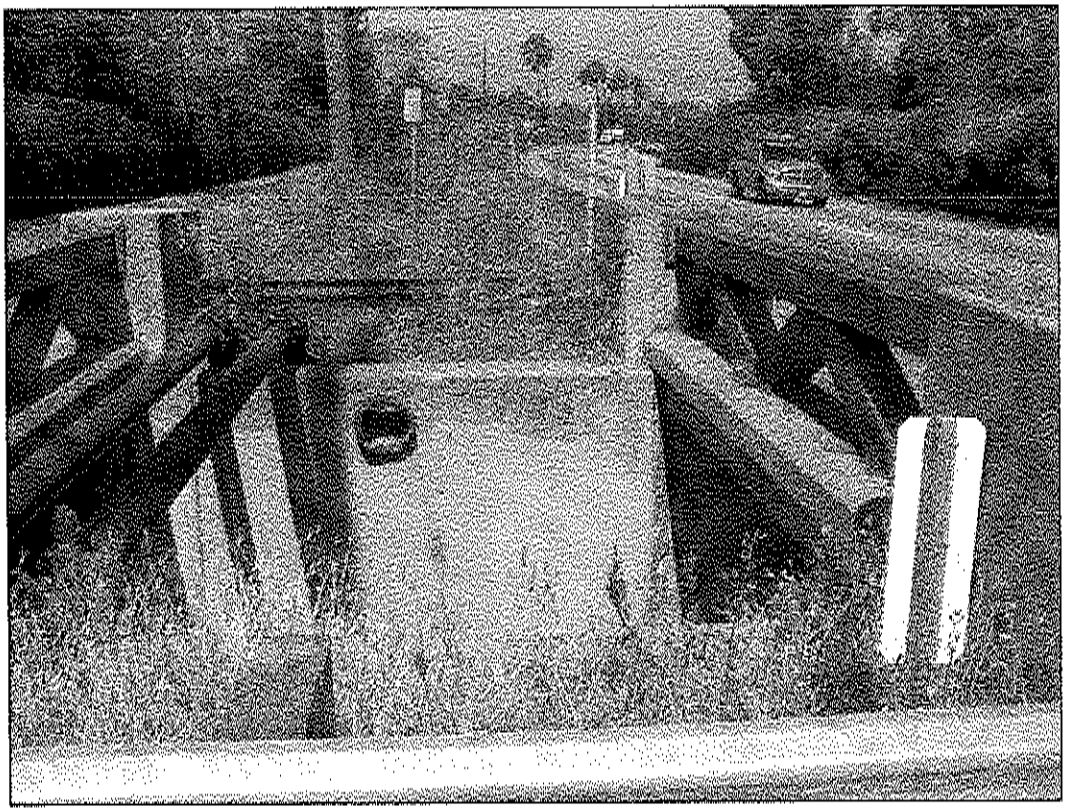

PHOTO 40:

View of Oak Creek daylighting between Highway 101 douthbound and Jameson Lane. View looking west. Natural bottom features (not shown) continue in this portion of the creek.

Photo taken on April 30, 2009.



PHOTO 41:

View of Montecito Creek upstream of Jameson Lane and Highway 101. This portion of Montecito Creek is outside the study area. Montecito Creek is fully culverted through the study area. Photo demonstrates habitat quality and natural bottom features found in adjacent sections of the creek.

Photo taken on April 30, 2009.



PHOTO 42:

View looking east over roadside v-ditch along Highway 101 southbound lanes near San Ysidro Road. Note dominant ruderal vegetation along the ditch.

Photo taken on April 30, 2009.

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APPENDIX D:
FIELD DATA SHEETS AND
PIT PHOTOGRAPHS

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WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: South Coast Highway 101 HOV City/County: Santa Barbara County Sampling Date: 04/28/09

Applicant/Owner: Caltrans - District 5 State: CA Sampling Point: 1

Investigator(s): B. Sloan, J. Claxton Section, Township, Range: PUEBLO LANDS OF SANTA BARBARA

Landform (hillslope, terrace, etc.): Road Edge Local relief (concave, convex, none): none Slope (%): <2%

Subregion (LRR): Mediterranean California (LRR C) Lat: 34.40338016850 Long: -119.52596039100 Datum: NAD 83

Soil Map Unit Name: CAMARILLO VARIANT, FINE SANDY LOAM NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ✓	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	

Remarks:

Site consists of a disturbed upland road edge area between Highway 101 and an undeveloped property. Soils, vegetation, and hydrology have been altered by highway construction.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1. --			
2.			
3.			
4.			
	-- = Total Cover		
Sapling/Shrub Stratum (Plot size: ____)			
1. --			
2.			
3.			
4.			
5.			
	-- = Total Cover		
Herb Stratum (Plot size: ____)			
1. Carpobrotus chilensis	90	Y	UPL
2. Vicia sativa	1	N	FACU
3.			
4.			
5.			
6.			
7.			
8.			
	91 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1. --			
2.			
	-- = Total Cover		

% Bare Ground in Herb Stratum -- % Cover of Biotic Crust --

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species ____	x 1 = ____
FACW species ____	x 2 = ____
FAC species ____	x 3 = ____
FACU species ____	x 4 = ____
UPL species ____	x 5 = ____
Column Totals: ____ (A)	____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No ✓

Remarks:

Pit located in Caltrans landscaped area between the right-of-way fence and Highway 101 edge of pavement.

SOIL

Sampling Point: 1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-20	10 YR 3/2	100	--	--	--	--	clay loam	fill soil, many roots,

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ___ No ✓

Remarks:

Soil homogenous throughout profile, many roots present, soil dry, loosely blocky. No indicators present. Observed soil did not match map unit description.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): _____

Water Table Present? Yes ___ No ✓ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ___ No ✓ Depth (inches): _____

Wetland Hydrology Present? Yes ___ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No hydrology features present.



PHOTO 1:

View of general area of Pits 1-3, looking north along the Hwy 101 northbound lanes Right-of-Way fence. Note freeway landscaping of Carpobrotus inside the fence, and small swale along the outside fence edge. Picture taken on 4/28/09.

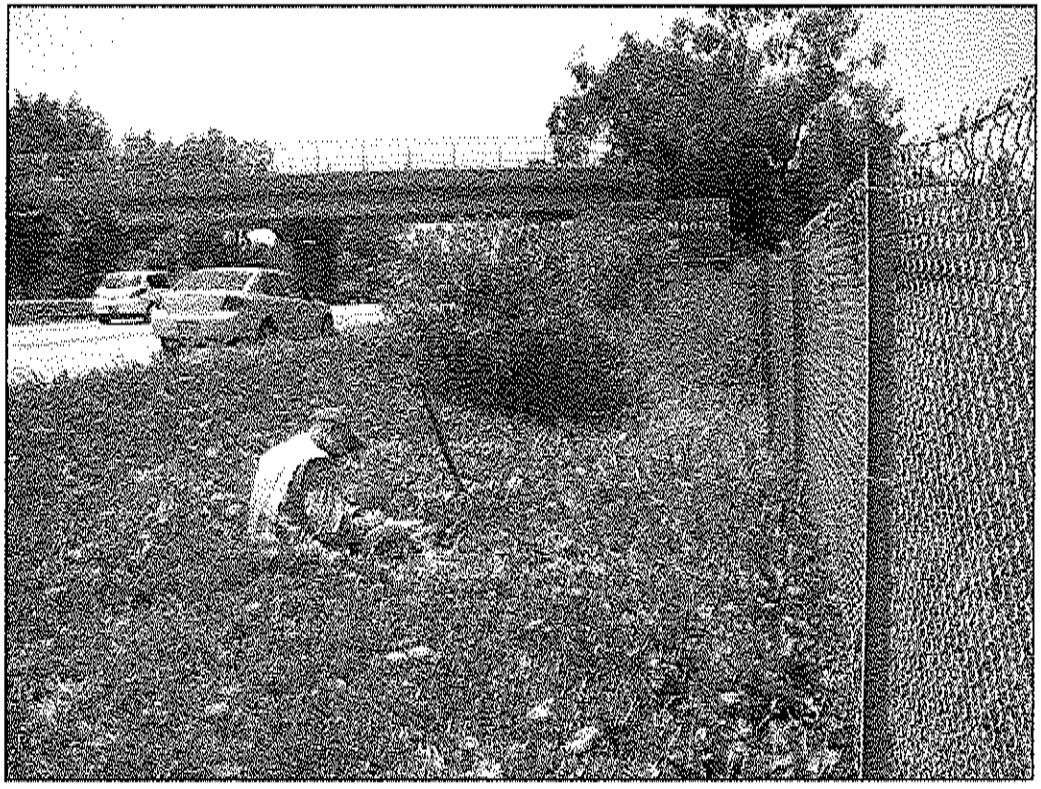


PHOTO 2:

View of Pit 1 location, looking north along the Hwy 101 northbound lanes. Note disturbed upland conditions at pit location. Picture taken on 4/28/09.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: South Coast Highway 101 HOV City/County: Santa Barbara County Sampling Date: 04/28/09

Applicant/Owner: Caltrans - District 5 State: CA Sampling Point: 2

Investigator(s): B. Sloan, J. Claxton Section, Township, Range: PUEBLO LANDS OF SANTA BARBARA

Landform (hillslope, terrace, etc.): Drainage channel Local relief (concave, convex, none): concave Slope (%): <2%

Subregion (LRR): Mediterranean California (LRR C) Lat: 34.40343171760 Long: -119.52601105800 Datum: NAD 83

Soil Map Unit Name: CAMARILLO, VARIANT, FINE SANDY LOAM NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No _____	**Is the Sampled Area within a Wetland?** Yes ✓ No _____
Hydric Soil Present?	Yes ✓	No _____	
Wetland Hydrology Present?	Yes ✓	No _____	

Remarks:

Site located in small dirt drainage ditch along ROW boundary. Area disturbed by highway construction and landscaping. Ditch leads to Franklin Creek.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	--	= Total Cover	
Sapling/Shrub Stratum (Plot size: _____)			
1. Artemisia douglasiana	25	Y	FACW
2. Rubus ursinus	20	Y	FACW
3.			
4.			
5.			
	45	= Total Cover	
Herb Stratum (Plot size: _____)			
1. Cyperus eragrostis	50	Y	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	50	= Total Cover	
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
		= Total Cover	

% Bare Ground in Herb Stratum -- % Cover of Biotic Crust --

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species	x 1 =	
FACW species	x 2 =	
FAC species	x 3 =	
FACU species	x 4 =	
UPL species	x 5 =	
Column Totals: (A)		(B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No _____

Remarks:

Dense cover of wetland species present within ditch and along the edges of the ditch.

SOIL

Sampling Point: 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-10	10 YR 2/2	100	--	--	--	--	clay loam	moist to top
10-15	10 YR 2/2	80	10 YR 4/6	15	RM	M	clay loam	saturated
15-20	10 YR 2/1	85	Black	15	D	PL	clay loam	organic staining - rotting roots

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

Soil moist to surface, saturated at 10 inches. Many large and small roots. Lower section of profile saturated, stained with black oxidized root sheaths. Observed soil did not match map unit description.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ✓ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): _____

Water Table Present? Yes ___ No ✓ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): 10

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Dirt drainage channel leading to concrete V ditch - 15 ft wide, 2.5 ft deep. Channel receives runoff from roadways and nearby residential areas, and connects to Franklin Creek.

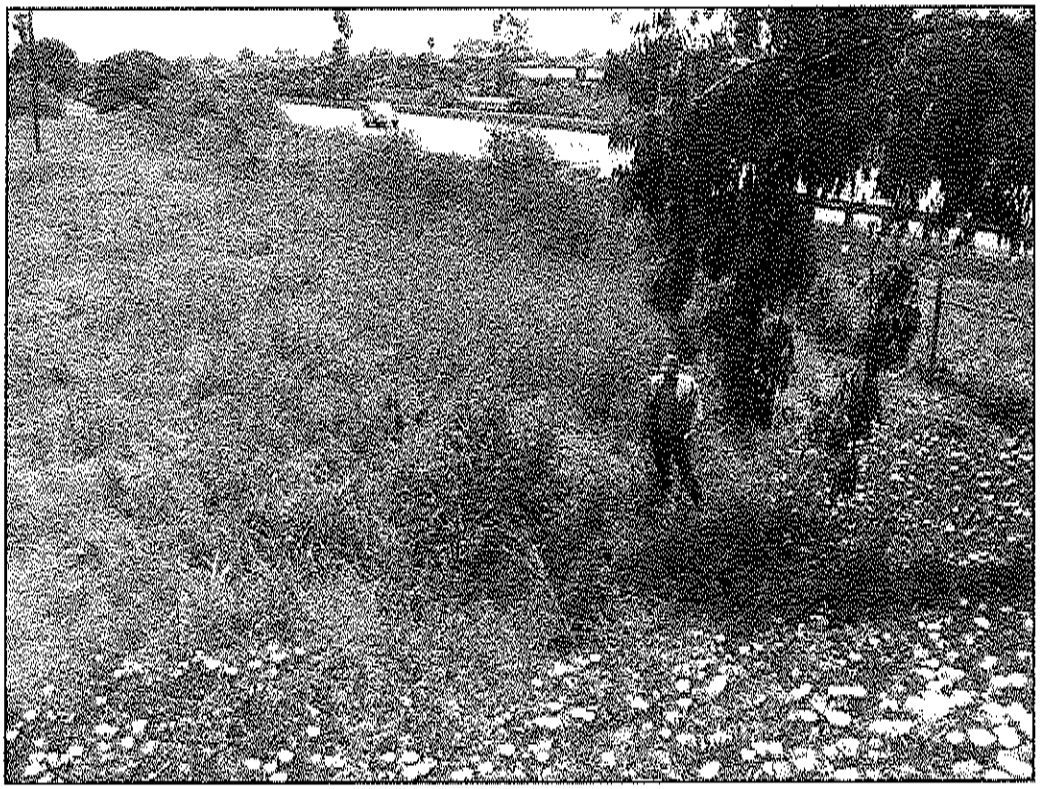


PHOTO 3:

View of general area of Pits 2 and 3, looking south along the Hwy 101 northbound lanes. Swale along ROW fence conveys runoff south to Franklin Creek. Picture taken on 4/28/09.



PHOTO 4:

View of Pit 2, looking west across the Hwy 101 northbound lanes. Note dominant Cyperus eragrostis in bottom of swale. Picture taken on 4/28/09.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: South Coast Highway 101 HOV City/County: Santa Barbara County Sampling Date: 04/28/09

Applicant/Owner: Caltrans - District 5 State: CA Sampling Point: 3

Investigator(s): B. Sloan, J. Claxton Section, Township, Range: PUEBLO LANDS OF SANTA BARBARA

Landform (hillslope, terrace, etc.): graded terrace Local relief (concave, convex, none): flat Slope (%): <2%

Subregion (LRR): Mediterranean California (LRR C) Lat: 34.40347565010 Long: -119.52598287500 Datum: NAD 83

Soil Map Unit Name: CAMARILLO, VARIANT, FINE SANDY LOAM NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ✓	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	

Remarks:

Site located in field near edge of dirt drainage channel.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	--	= Total Cover	
Sapling/Shrub Stratum (Plot size: ____)			
1. Artemisia douglasii	5	Y	FACW
2. Rubus ursinus	1	N	FACW
3.			
4.			
5.			
	6	= Total Cover	
Herb Stratum (Plot size: ____)			
1. Avena fatua	50	Y	UPL
2. Bromus diandrus	40	Y	UPL
3. Gallium aparine	1	N	FACU
4. Pennisetum clandestinum	2	N	FACU
5. Rumex crispus	1	N	FACW
6.			
7.			
8.			
	94	= Total Cover	
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	--	= Total Cover	

% Bare Ground in Herb Stratum -- % Cover of Biotic Crust --

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species ____	x 1 = ____
FACW species ____	x 2 = ____
FAC species ____	x 3 = ____
FACU species ____	x 4 = ____
UPL species ____	x 5 = ____
Column Totals: ____ (A)	____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No ✓

Remarks:

Disturbed field dominated by annual grasses and escaped ornamentals.
Southern edge nearest dirt channel contains outlying wetland species.

SOIL

Sampling Point: 3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-7	10 YR 3/2	100	--	--	--	--	clay loam	soil loose, many small roots
7-20	10 YR 3/3	100	--	--	--	--	clay loam	solid, blocky, few large roots

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No ✓

Remarks:

Plow pan visible at seven inches - upper soils loosely aggregated, below seven inches soil exhibits solid blocky structure.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No ✓ Depth (inches): _____

Water Table Present? Yes _____ No ✓ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No ✓ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Pit located in field above dirt channel. No hydrology features noted.



PHOTO 5:

View of general area of Pit 3, looking northeast from the Hwy 101 northbound lanes ROW fence. The area consists of a vacant field, dominated by ruderal vegetation. Picture taken on 4/28/09.



PHOTO 6:

View of Pit 3 location, looking south toward the Hwy 101 northbound lanes. Note dominant annual grass vegetation in pit area. Picture taken on 4/28/09.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: South Coast Highway 101 HOV City/County: Santa Barbara County Sampling Date: 04/28/09

Applicant/Owner: Caltrans - District 5 State: CA Sampling Point: 4

Investigator(s): B. Sloan, J. Claxton Section, Township, Range: PUEBLO LANDS OF SANTA BARBARA

Landform (hillslope, terrace, etc.): drainage ditch Local relief (concave, convex, none): concave Slope (%): 3%

Subregion (LRR): Mediterranean California (LRR C) Lat: 34.40450747140 Long: -119.53018727500 Datum: NAD 83

Soil Map Unit Name: CAMARILLO, VARIANT, FINE SANDY LOAM NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	

Remarks:

Site consists of a dirt ditch along highway offramp that receives runoff from roadways and residential/commercial areas.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1. --			
2.			
3.			
4.			
	--	= Total Cover	
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
	--	= Total Cover	
Herb Stratum (Plot size: ____)			
1. Equisetum arvense	80	Y	FAC
2. Bromus carinatus	5	N	UPL
3. Sonchus oleraceous	2	N	NI
4. Oxalis pes-caprae	1	N	UPL
5. Rumex crispus	1	N	FACW
6.			
7.			
8.			
	____	= Total Cover	
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	--	= Total Cover	

% Bare Ground in Herb Stratum -- % Cover of Biotic Crust --

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species ____	x 1 = ____
FACW species ____	x 2 = ____
FAC species ____	x 3 = ____
FACU species ____	x 4 = ____
UPL species ____	x 5 = ____
Column Totals: ____ (A)	____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks:

Dirt ditch dominated by a dense cover of Equisetum.

SOIL

Sampling Point: 4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-8	10 YR 3/3	100	--	--	--	--	sndy loam	deposits/dist by maint /dry
8-20	10 YR 3/3	100	--	--	--	--	sandy CL	fill soil, dry

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No ✓

Remarks:

Fill soils/sediment deposits in maintained dirt ditch. No hydric soil indicators observed. Old Coca Cola can found at 12 inches depth.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No ✓ Depth (inches): _____

Water Table Present? Yes _____ No ✓ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No ✓ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Ditch receives road runoff from highway offramp and adjacent surface streets, drains into culvert under highway. Runoff from this ditch eventually reaches Santa Monica Creek.



PHOTO 7:

View of general area of Pit 4, looking southwest along the Hwy 101 northbound lanes. Picture taken on 4/28/09.

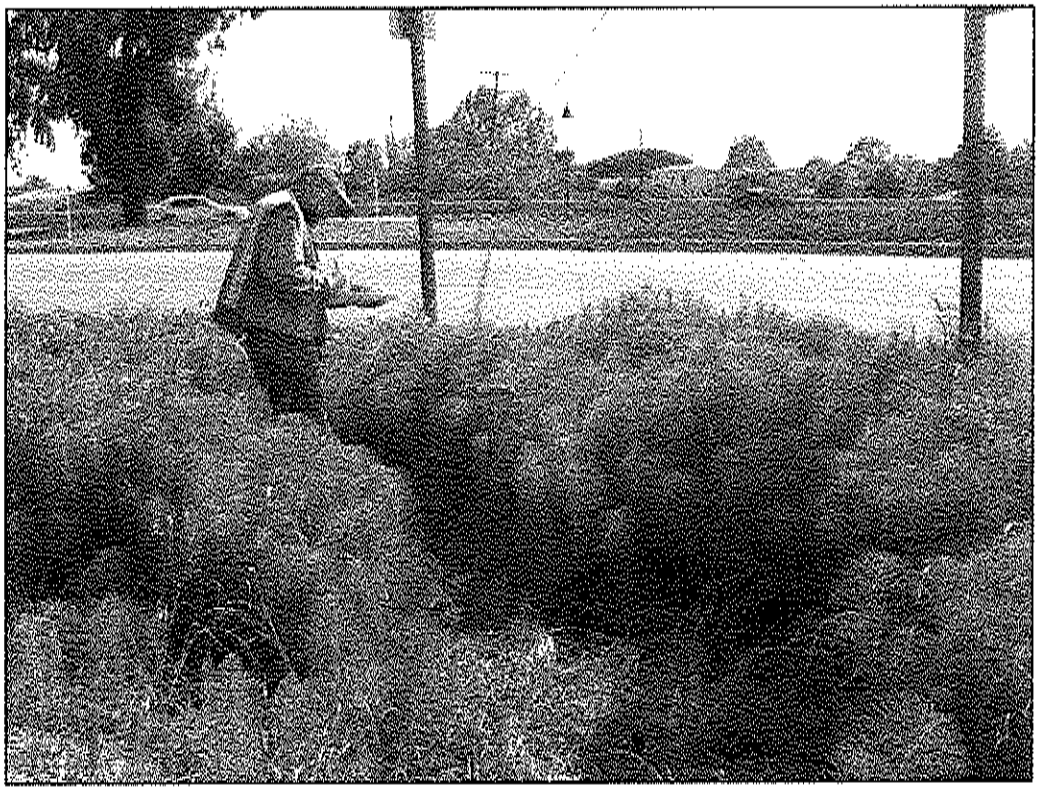


PHOTO 8:

View of Pit 4, looking southwest. Note dense stand of Equisetum in the roadside ditch. Picture taken on 4/28/09.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: South Coast Highway 101 HOV City/County: Santa Barbara County Sampling Date: 04/29/09

Applicant/Owner: Caltrans - District 5 State: CA Sampling Point: 5

Investigator(s): B. Sloan, J. Claxton Section, Township, Range: PUEBLO LANDS OF SANTA BARBARA

Landform (hillslope, terrace, etc.): drainage Local relief (concave, convex, none): concave Slope (%): 3%

Subregion (LRR): Mediterranean California (LRR C) Lat: 34.40436662430 Long: -119.53339457800 Datum: NAD 83

Soil Map Unit Name: CAMARILLO, VARIANT, FINE SANDY LOAM NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No _____	**Is the Sampled Area within a Wetland?** Yes ✓ No _____
Hydric Soil Present?	Yes ✓	No _____	
Wetland Hydrology Present?	Yes ✓	No _____	

Remarks:

Site located in roadside ditch along Highway 101 between pavement edge and sound wall.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1. --			
2.			
3.			
4.			
	--	= Total Cover	
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	--	= Total Cover	
Herb Stratum (Plot size: _____)			
1. Equisetum arvense	55	Y	FAC
2. Cyperus eragrostis	15	N	FACW
3. Piptatherum miliaceum	10	N	NI
4. Rumex crispus	5	N	FACW
5. Typha latifolia	5	N	OBL
6. Polypogon monspeliensis	5	N	FACW
7. Carpobrotus chiliensis	5	N	UPL
8.			
	100	= Total Cover	
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	--	= Total Cover	

% Bare Ground in Herb Stratum -- % Cover of Biotic Crust --

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No _____

Remarks:

Roadside drainage ditch with dirt banks. Densely vegetated.

SOIL

Sampling Point: 5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-9	10 YR 3/2	100	--	--	--	--	clay loam	moist, few roots
9-13	10 YR 3/2	85	7.5 YR 3/3	15	RM	M	sandy clay	saturated, black OM
13-20	10 YR 6/8	65	5 10 Y gley 1	35	RM	M	gravely cl	saturated/ponded/OM stains

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ✓ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

Soils moist to surface. Black OM stains present/common from nine to 20 inches. Gley Chart 1 used. Although F2 depth criteria exceeded by one inch, soil exhibits F2 characteristics and is functioning as a wetland soil.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ✓ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): ___

Water Table Present? Yes ✓ No ___ Depth (inches): 17

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): 9

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Channel bottom two ft wide, three ft deep. Flow pattern/drift deposits visible in channel bottom. Channel receives road and residential runoff and directs to deeper cattail-dominated swale to east, and connects to Santa Monica Creek through storm drains.

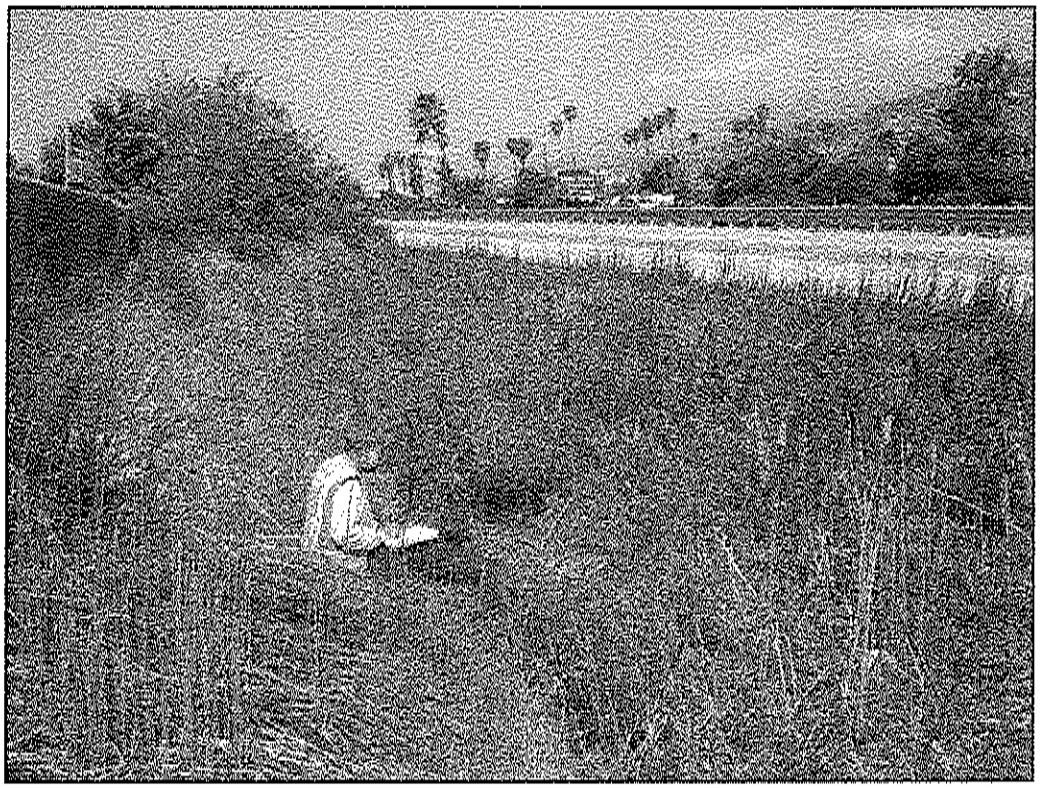


PHOTO 9:

View of general area of Pits 5 and 6, looking north along the Hwy 101 southbound lanes. Pit 5 location is marked by the shovel handle visible in the bottom of the swale. Picture taken on 4/29/09.



PHOTO 10:

Closeup of soil conditions at Pit 5. Note moist soils, and standing water visible in lower portion of pit. Picture taken on 4/29/09.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: South Coast Highway 101 HOV City/County: Santa Barbara County Sampling Date: 04/29/09

Applicant/Owner: Caltrans - District 5 State: CA Sampling Point: 6

Investigator(s): B. Sloan, J. Claxton Section, Township, Range: PUEBLO LANDS OF SANTA BARBARA

Landform (hillslope, terrace, etc.): slope Local relief (concave, convex, none): convex Slope (%): 12%

Subregion (LRR): Mediterranean California (LRR C) Lat: 34.40439573620 Long: -119.53337250400 Datum: NAD 83

Soil Map Unit Name: CAMARILLO, VARIANT, FINE SANDY LOAM NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	

Remarks:

Site located on edge of Highway 101 above dirt drainage channel.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1. --			
2.			
3.			
4.			
	--	= Total Cover	
Sapling/Shrub Stratum (Plot size: ____)			
1. --			
2.			
3.			
4.			
5.			
	--	= Total Cover	
Herb Stratum (Plot size: ____)			
1. Carpobrotus edulis	45	Y	UPL
2. Equisetum arvense	25	Y	FAC
3. Ricinus communis	10	N	FACU
4. Carduus pycnocephalus	10	N	UPL
5. Polypogon monspeliensis	5	N	FACW
6. Picris echoides	5	N	FAC
7. Rhaphanus sativus	5	N	UPL
8. Sonchus oleraceus	2	N	NI
	100	= Total Cover	
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	--	= Total Cover	

% Bare Ground in Herb Stratum -- % Cover of Biotic Crust --

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species ____	x 1 = ____
FACW species ____	x 2 = ____
FAC species ____	x 3 = ____
FACU species ____	x 4 = ____
UPL species ____	x 5 = ____
Column Totals: ____ (A)	____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks:

Equisetum growing up dirt channel banks from wetter bottom areas.

SOIL

Sampling Point: 6

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10 YR 3/3	100	--	--	--	--	loam	loose, unconsolidated, dry
2-20	10 YR 3/3	100	--	--	--	--	clay loam	blocky, few roots

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No ✓

Remarks:

Fill soil from highway construction. Observed soils do not match map unit description.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No ✓ Depth (inches): _____

Water Table Present? Yes _____ No ✓ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No ✓ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No hydrology indicators observed.

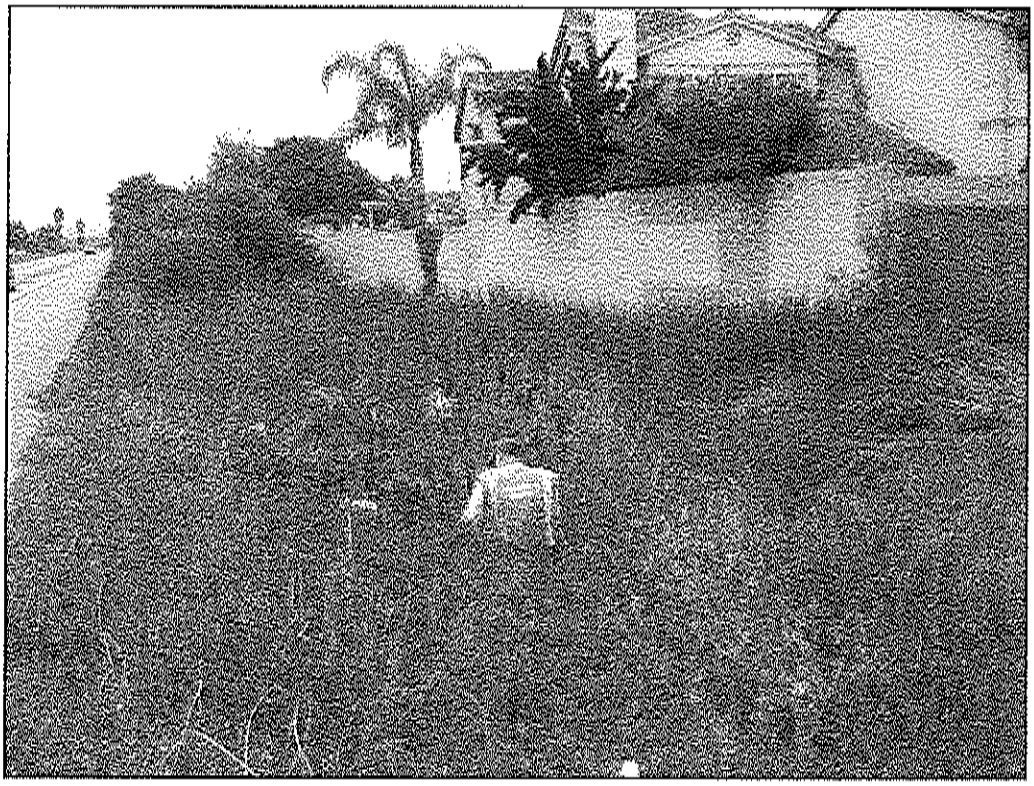


PHOTO 11:

View of general area of Pits 5 and 6, looking south along the Hwy 101 southbound lanes. Pit 6 location is marked by the shovel handle visible approximately halfway up the bank of the swale. Picture taken on 4/29/09.



PHOTO 12:

Closeup of soil conditions at Pit 6. Note dry soils, and mixed vegetation types. Picture taken on 4/29/09.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: South Coast Highway 101 HOV City/County: Santa Barbara County Sampling Date: 05/12/09

Applicant/Owner: Caltrans - District 5 State: CA Sampling Point: 7

Investigator(s): B. Sloan, J. Claxton Section, Township, Range: PUEBLO LANDS OF SANTA BARBARA

Landform (hillslope, terrace, etc.): slope Local relief (concave, convex, none): slope Slope (%): 12%

Subregion (LRR): Mediterranean California (LRR C) Lat: 34.40439573620 Long: -119.53337250400 Datum: NAD 83

Soil Map Unit Name: CAMARILLO, VARIANT, FINE SANDY LOAM NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No _____	**Is the Sampled Area within a Wetland?** Yes _____ No ✓
Hydric Soil Present?	Yes _____	No ✓	
Wetland Hydrology Present?	Yes _____	No ✓	

Remarks:

Site located in freeway median area that receives limited runoff from adjacent roadway.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1. Salix lasiolepis	80	Y	FACW
2. Myoporum laetum	10	N	NI
3.			
4.			
	--	= Total Cover	
Sapling/Shrub Stratum (Plot size: _____)			
1. --			
2.			
3.			
4.			
5.			
	--	= Total Cover	
Herb Stratum (Plot size: _____)			
1. Oxalis pes-caprae	35	Y	UPL
2. Artemisia douglasii	20	Y	FACW
3. Carpobrotus edulis	15	N	UPL
4. Bromus diandrus	15	N	UPL
5.			
6.			
7.			
8.			
	_____	= Total Cover	
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	--	= Total Cover	

% Bare Ground in Herb Stratum -- % Cover of Biotic Crust --

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No _____

Remarks:

Freeway median area dominated by oxalis and ice plant. Clump of willow and myoporum present at east end.

SOIL

Sampling Point: 7

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10 YR 3/3	100	--	--	--	--	loam	loose, few roots
4-9	10 YR 3/3	100	--	--	--	--	loam	weakly blocky, few roots
9-20	2.5 Y 5/4	100	--	--	--	--	sndy loam	hard, gravelly, no roots

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ___ No ✓

Remarks:

Lower portion of profile appears to consist of compacted road base. This layer may be impenetrable and create perched water from rainfall and road runoff. No indicators noted.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): ___

Water Table Present? Yes ___ No ✓ Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No ✓ Depth (inches): ___

Wetland Hydrology Present? Yes ___ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Faint depressional area under willow canopy, but no connection to any hydrologic feature. Road base may create a shallow aquitard in this area.

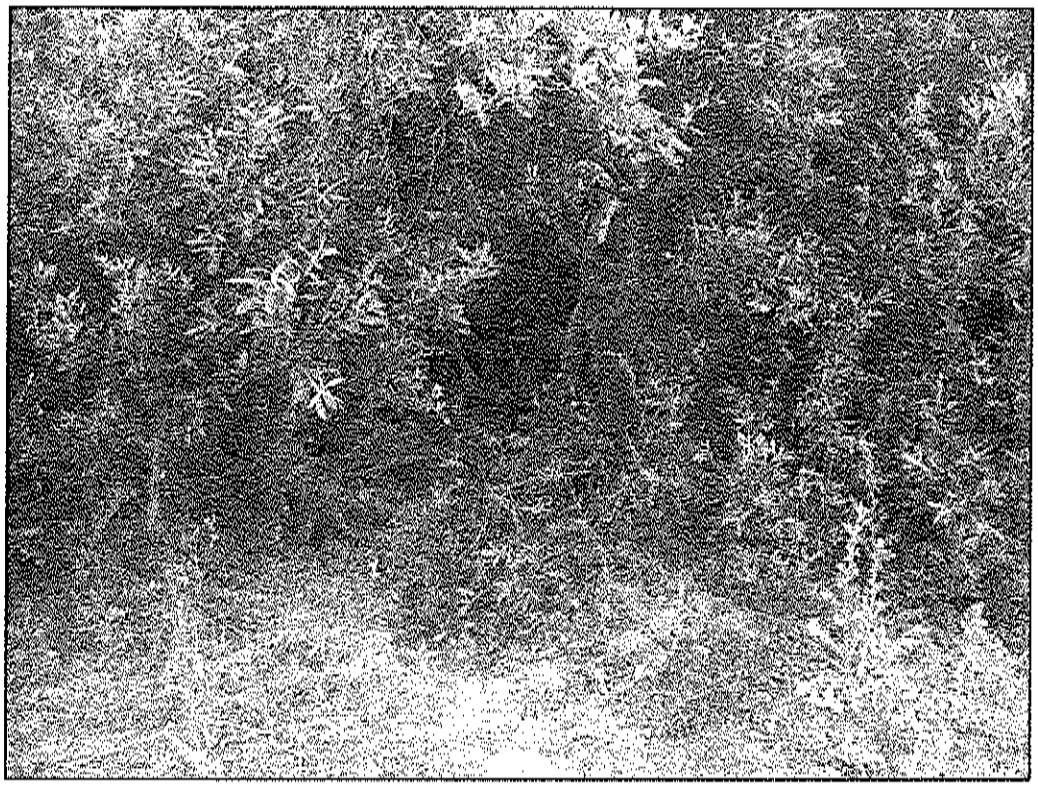


PHOTO 13:

View of Pit 7 location, looking north from the Carpinteria Avenue southbound offramp. Willow canopy in this area is not associated with any surface hydrologic features. Picture taken on 5/12/09.



PHOTO 14:

Closeup of soil conditions at Pit 7. Note dry soils, and lack of understory vegetation. Picture taken on 5/12/09.

Exhibit C

David Magney Environmental Consulting
P.O. Box 1539, Cedar Ridge, California 95924-1539 * E-mail: david@magney.org
530/273-1799 Voice * www.magney.org

30 July 2021

Elise Cossart-Daly, Esq.
Cossart-Daly Law, A.P.C.
1117 State Street
Santa Barbara, California 93101

Subject: Review of the Initial Study and Biological Resource report for Cresco California CUP (18CDH-00000-00031, 20RVP-00000-00058, 21CUP-00000-00006)

Dear Ms. Cossart-Daly,

Per your request, David Magney Environmental Consulting (DMEC) has reviewed the biological resources report for the proposed coastal development permit for light cannabis cultivation at 3861 Foothill Road, Carpinteria, California.

David Magney is a California Certified Consulting Botanist (#0001), ISA Certified Arborist (#WE-4746), approved biological consultant for Santa Barbara, Ventura, Los Angeles, and San Luis Obispo Counties, and has served as an Expert Witness for the U.S. Department of Justice on an EPA wetlands violation case in Santa Barbara County. He has extensive knowledge and experience with the biological resources of Santa Barbara County and the region. Mr. Magney also serves as the Special Projects Program Manager (part of the Rare Plant Program) and served as the Rare Plant Program Manager for the California Native Plant Society (CNPS). He is also researching the flora of Ventura County and has authored several publications on biological resources. Mr. Magney is the chair of the California Board of Certification [1], serving in that capacity since its inception in 2015. His resume is attached to establish his expertise and experience in biological resource issues.

In February 2018, the County of Santa Barbara prepared and certified a Program Environmental Impact Report (PEIR) for future cannabis cultivation project in the county, which set forth specific mitigation measures to determine of a proposed commercial cannabis operation requires a subsequent EIR or Negative Declaration (ND).

Cresco California is proposing to convert a set of existing agricultural greenhouses and relative facilities into a cannabis cultivation site. The 7.98-acre site in located on the bank of Arroyo Paredon Creek, which flows into the Pacific Ocean to the south. The project site in located in the Carpinteria Valley, in southeastern Santa Barbara County.

Existing greenhouses will either be replaced or revised to make the facilities suitable for cannabis cultivation and will remove an abandoned avocado orchard next to the creek and restore it to "natural" conditions. Natural runoff will be diverted into a row of narrow detention basins located on the west and south sides of the property, designed to retain a 25-year flooding event. Drainage offsite would be directed to the southwestern corner of the property. A new 25,281 square foot detention basin will be constructed at the north end of the property adjacent to Arroyo Paredon Creek, which is considered Environmentally Sensitive Habitat (ESH). This detention basin would encroach within the designated 100-foot ESH buffer

[1] California Board of Certification for botanists: https://www.cnps.org/education/botanist-certification/board

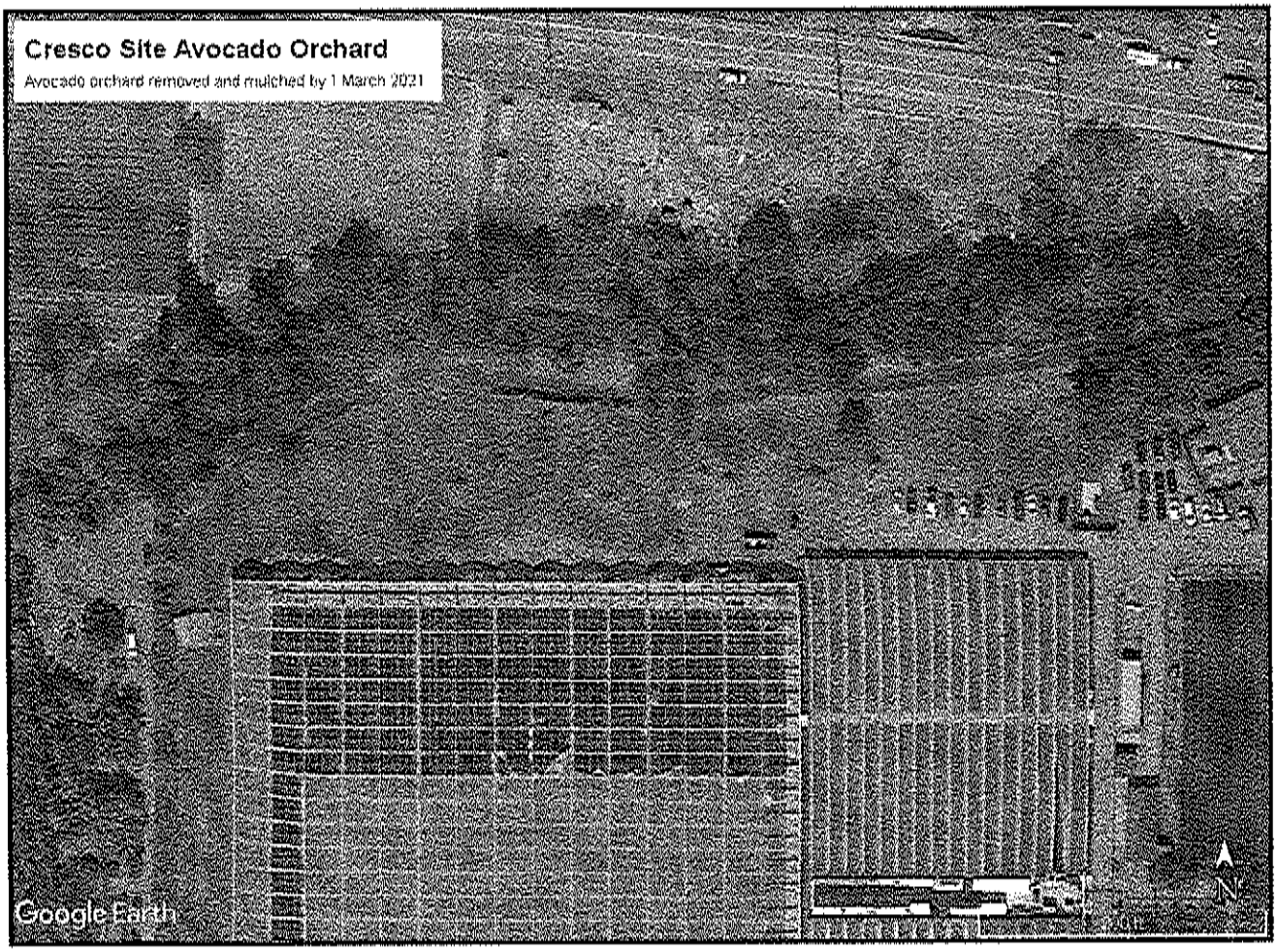
zone. The northeastern corner of the northernmost greenhouse would also encroach upon the ESH buffer zone.

Irrigation of the cannabis crop will be highly regulated and basically entirely recycled onsite with unwanted precipitates (mineralized return water)will be hauled off and disposed offsite.

Table C.1 of the application (Mitigation Measures/Requirements for P&D Staff Review) indicates that mitigation measures MM BIO-1a, MM HWR-1a, and MM BIO-3 will be required. BIO-1a requires a Tree Protection Plan. HWR-1a requires a Cannabis waste discharge to demonstrate compliance with State Water Resources Control Board policy regarding cannabis cultivation. BIO-3 requires development of a wildlife movement plan.

Sage Institute, Inc. (SII), prepared the biological resources assessment report (BRA) for SLO Cultivation/Cresco California, with the most recent version dated July 6, 2021. The BRA states on page 1 that the project site is 13.66 acres, which is nearly twice the size as stated in the Initial Study application.

The BRA presumes that Arroyo Paredon Creek has perennial flows in the reach adjacent to the project site and assumes that the creek meets the definition as ESH. A paved access road occurs between the avocado orchard on site and Arroyo Paredon Creek. Based on examination of a Google Earth aerial photo dated 1 March 2021, the avocado trees have already been cut down and mulched, as shown below.



The BRA states that Arroyo Paredon riparian vegetation includes native trees *Quercus agrifolia*, [sic] *Juglands hindsii*, and *Platanus racemosa*. *Juglans hindsii* is not native to southern California; rather, *J. californica* is the species native to southern California. The only way *J. hindsii* would be found here is if it was a remnant of an old walnut orchard or was planted as part of landscaping. Later on page 5, the BRA states that the *Platanus racemosa* Woodland Alliance is dominated by *Juglans californica*, so are both species present or is there a typo? Note, *J. californica* is a special-status species with a California Rarity Rank of 4.2 by the California Native Plant Society (CNPS).

The BRA states on page 1 that the existing linear detention basins are vegetated by "non-native weedy herbaceous forbs and grasses but do support some widely scattered Mulefat and willow".

The BRA states in section 1.2 on page 1 that it focuses its assessment on the proposed "physical expansion of the site's existing …detention system and proposed landscape plan", and that "the existing avocado trees will be removed"… It is clear that by the time the revised BRA was published the avocado orchard had already been removed, precluding any potential to protect any sensitive wildlife habitat that that orchard provided, such as active bird nests. On page 2 the BRA states that "Clearing the existing avocado orchard is proposed for a window between September 1st to February 1st that is outside the nesting season for birds". Was a nesting bird survey conducted by a qualified ornithologist prior to the removal of the orchard? Was it performed during the timeframe proposed?

The BRA continues on page 1 to state that the orchard "will be planted with appropriate native riparian and transitional upland vegetation". The same is planned for the revised detention basins.

A SII biologist "conducted a field reconnaissance walking survey of the Project Site on April 24, 2020" on page 3. The BRA further states that the conclusions presented in the BRA are based on that one field reconnaissance survey.

In describing wildlife resources onsite on page 5, the BRA states that the orchard habitat "provides only limited habitat values for resident and migratory wildlife species typical in the predominantly agricultural land uses in the region…" without providing any supporting evidence to this conclusion. The BRA lists a few common mammals that typically occur in this area. Had the SII biologist conducted a more thorough survey or surveyed the site multiple times he would have almost certainly been able to observe directly or evidence of numerous species of wildlife using this part of the project site. Rather, he only observed fourteen (14) species of wildlife, mostly birds, onsite.

Table B-1 in Appendix B of the BRA lists a number of plant and wildlife species that are known to occur in the region of the project site, as well as Natural Communities of Concern. Six (6) wildlife species were identified as using habitats associated with Arroyo Paredon Creek: Cooper's Hawk, Yellow Warbler, California Red-legged Frog, Coast Range Newt, Western Pond Turtle, and Southern Steelhead. These rare species have a higher probability of being adversely affected by certain components of the proposed project. Other species that occur downstream could also be indirectly impacted by degradations in habitat functions onsite and adjacent, as well as downstream, including listed species such as Tidewater Goby, Crotch's Bumble Bee, Southern Steelhead, Least Bell's Vireo, and Southwestern Willow Flycatcher.

Indirect impacts to habitat (wetland) functions associated with Arroyo Paredon Creek may have adverse, and cumulatively significant, impacts on one or more of the species that use Arroyo Paredon Creek and downstream habitats. The listed species are endangered because of the cumulative effects almost entirely the result of anthropogenic activities and actions. The cumulative impacts should be assessed as part of the BRA.

The BRA fails to list CNPS List 4 plants as special-status species, such as *Juglans californica*, reported along Arroyo Paredon Creek at the project site, or any locally rare plant species of Santa Barbara County (Wilken 2021[2]).

On page 8 of the BRA, it states regarding the presence of special-status wildlife species, "The SII field observations and desktop review stand as definitive negative findings for potential special-status invertebrates potentially occurring within the proposed project area, and no additional surveys are recommended". This statement lacks any credibility since "definitive negative findings" are nearly impossible to actually make, and incredible since only one reconnaissance field survey was conducted. Furthermore, no evidence or justification for this conclusion has been provided.

No mention was made about special-status mollusks known to occur in the region and are likely to occur in Arroyo Paredon Creek. The project site is habitat for at least three rare terrestrial mollusk species, *Haplotrema caelatum*, *Helminthoglypta phlyctaena*, and *H. traski*, which have been recorded from the Santa Barbara County (Magney 2009[3], Roth and Sadeghain 2003[4]). Distribution maps of each of these species are attached. Surveys for rare terrestrial mollusks, and other invertebrates, need to be conducted to adequately characterize the biological resources of the site. However, now that the avocado orchard has been removed, an accurate accounting of what wildlife species **did** use that habitat is impossible.

The BRA discusses indirect impacts to wildlife in Arroyo Paredon Creek on pages 12 and 13; however, there is never an evaluation, and certainly no objective assessment, of impacts to wetland functions as a result of the proposed project, understanding that similar operations have occurred onsite for many years. Previous and current operations almost certainly have adverse impacts on wetland functions in the creek based on the analysis and assessments made in association with development of the regional riverine wetlands hydrogeomorphic assessment method (HGM) model developed for Santa Barbara County, the Santa Barbara South Coast Riverine Wetlands HGM model[5]. This HGM model characterizes and scores 14 wetland functions, such as Arroyo Paredon Creek perform. DMEC has used this model numerous times to determine how a project would impact wetland functions, if at all, to satisfy CEQA and NEPA assessment requirements (DMEC 2001[6], 2006a[7], 2006b[8], 2009[9]), which has been accepted by the

[2] Wilken, D. 2021. Rare Plants of Santa Barbara County. (version 2.5, January 2021.) Santa Barbara Botanic Garden, Santa Barbara, California. California Native Plant Society, Channel Islands Chapter, Ojai, California. (Published on www.cnpsci.org.)

[3] Magney, David L. 2009. Atlas of Native California Terrestrial Snails in Santa Barbara County. 4 November 2009. David Magney Environmental Consulting, Ojai, California. Prepared for Sespe Institute, Inc., Ojai, California.

[4] Roth, Barry, and Patricia S. Sadeghain. 2003. Checklist of the Land Snails and Slugs of California. (*Santa Barbara Museum of Natural History Contributions in Science* No. 3.) Santa Barbara, California.

[5] Lee, L.C., P.L. Fiedler, S.R. Stewart, R.R. Curry, D.J. Partridge, J.A. Mason, I.M. Inlander, R.B. Almay, D.L. Aston, and M.E. Spencer. 2001. *Draft Guidebook for Reference Based Assessment of the Functions of Riverine Waters/Wetlands Ecosystems in the South Coast Region of Santa Barbara County, California.* Santa Barbara County Water Agency, Santa Barbara, California.

[6] David Magney Environmental Consulting. 2001. Wetland Functional Assessment of the Odyssey Program Middle School Project, Malibu, California. December 2001. (PN 00-0301.) Ojai, California. Prepared for Odyssey Program, Malibu, California.

[7] David Magney Environmental Consulting. 2006a. Baseline HGM Assessment for Mountains Restoration Trust, Dry Canyon Creek, Calabasas, California. (Corps File No. 200601215-JWM). August 2006. (PN 05-0262-1). Ojai, California. Prepared for Mountains Restoration Trust, Calabasas, California; City of Calabasas, Calabasas, California; U.S. Army Corps of Engineers, Ventura, California; and California Department of Fish and Game, San Diego, California.

[8] David Magney Environmental Consulting. 2006b. Wetland Functional Assessment of the Gramckow Property Project, Rancho Matilija, California. 15 June 2006. (PN 06-0041.) Ojai, California. Prepared for Ventura County Planning Division, Ventura, California, on behalf of Martin Gramckow, Ojai, California.

regulatory and permitting agencies. Without such an objective holistic assessment of the proposed project, actual changes in wetland functions cannot be fairly identified nor can the significance of those changes be determined.

Another benefit of using the HGM model is that the results of running the model for a proposed project can identify specific actions that can be taken to improve one or more of the 14 functions a creek like Arroyo Paredon posseses. For example, DMEC's assessment of the Gramchow single-family home project in the Ojai Valley, to be located between two streams and entirely within each stream's 100-foot setback zones identified decreases in some of the 14 wetland functions. Using this model, we were able to identify specific variables that were weighing down the function scores, pointing us to specific habitat restoration or enhancement actions that could easily be implemented to improve functional index scores to even higher levels than without the house being built. The proposed project, and the environment, would benefit if this same approach were used on this project.

The BRA relies heavily on the current county regulatory buffer setbacks of 50 and 100 feet as justification for a "no impact" from the proposed project, however, there is little if any justification for the efficacy of such buffer zones, certainly none were provided in the BRA. Many studies have been conducted about buffer zone widths and conditions for a wide variety of plant and wildlife species, as well as for protecting water quality from upslope land uses.

A study by Jones & Stokes Associates for Napa County (Robbins 2002[10]) was commissioned with the goal of identifying setback buffers that would help remove the Napa River from the State's 303(d) Impaired Stream listing. The technical memo points out that buffer widths set for water quality are insufficient to protect habitat functions, often exceeding 325 feet. The memo also clarifies the differences between setbacks and buffers – they are not the same. A riparian/stream **buffer** is:

1. a strip of vegetated land between a stream and adjacent upland;
2. an area maintained in permanent vegetation and free from agricultural or urban encroachment;
3. an area designed to intercept surface flow and groundwater flow from upland sources; and
4. an area managed to maintain the integrity of the channel and floodplain ecosystem and their related habitats. (Robbins 2002.)

The Robbins memo goes on to clarify the difference between a regulatory setback and a buffer zone, stating that for a setback to achieve its stated goals needs to require the setback zone to become a true buffer as defined above. The memo discusses several riparian wetland functions and targets and summarizes the identified buffers for each, which concludes that a 100 meter (325-foot) buffer is more appropriate in protecting most wetland functions and wildlife using riparian habitats.

While the current regulatory setback of 100 feet is important, it should be understood that the setback does not function as a buffer for riparian wetland functions unless that setback zone is entirely vegetated with

[9] David Magney Environmental Consulting. 2009. Wetland Functional Assessment of the Lyons Property Mitigation Bank Project, Santa Paula Canyon, California. 10 March 2009. (PN 08-0152.) Ojai, California. Prepared for BioResource Consultants, Ojai, California, on behalf of Richard Lyons & Laurie Prange Lyons, Ojai, California.

[10] Robins, J.D. 2002. Stream Setback Technical Memo. 18 October 2002. Jones & Stokes Associates, Inc., Oakland, California. Prepared for Charles Wilson, Napa County Conservation Development & Planning Department, Napa, California.

natural/native vegetation. Incursions or other uses allowed within the setback zone decreases the level of the 14 wetland functions as identified by Lee et al. (2001[11]).

The BRA should run the regional HGM model to determine existing conditions, project conditions, and determine conditions with mitigation implemented. This is the objective approach DMEC has used on several projects as previously mentioned above.

For all the reasons stated above, DMEC concludes that the BRA's conclusion that the proposed project impacts to biological resources would all be less than significant is not based on fact or substantial evidence. On the contrary, there is no substantial evidence provided to support the BRA's conclusion, in particular impacts on wetland functions.

The BRA makes conclusions about each potential impact, which is summarized below:

Impact BIO-1 – impacts to special-status species, none, based on project implementation timing, would be less than significant. The project implementation timing has already been violated with the removal of the avocado orchard prior to approval of the minor CUP.

Impact BIO-2 – could result in adverse effects on habitats or sensitive natural communities, no impacts will occur. While existing riparian habitat (ESH) will not be directly impacted, there is no assessment of indirect impacts to the wetland functions that the riparian habitat provides. DMEC recommends an objective assessment be performed by using the Santa Barbara South Coast HGM model.

Impact BIO-3 – could have adverse effects on the movement or patterns of any native resident or migratory species, no impacts and the fencing and landscaping would have a net benefit. This conclusion is not based on substantial evidence and is premature without an objective assessment, such as using the HGM model described above or focused assessments of specific species known or likely to use Arroyo Paredon Creek habitats.

Impact BIO-4 – may conflict with adopted local plans, policies, or ordinances, no impact and "net benefit to the ESH via replacing existing fallow avocado with native riparian and upland transition species" (page 14). This conclusion is also made without substantial evidence to support the determination. Furthermore, the proposed plant palette (BRA Appendix C, Sheet L-1.2) includes non-native species and native cultivars that may have negative effects on native plant through gene swamping (Schierenbeck 2021[12]) and unintended impacts on wildlife species.

The BRA recommends five mitigation measures: tailgate education training, construction monitoring, post-construction monitoring report, special-status wildlife pre-construction surveys, and detention basin maintenance. Unfortunately, it is already too late as work has already been initiated (removal of the avocado orchard), apparently without tailgate education training or construction monitoring. If any sensitive species did occur in the avocado orchard, they have been adversely impacted already. A forensic investigation is now warranted by a biologist with expertise in conducting after-the-fact investigations. Short of that, the County should assume that the avocado orchard did indeed contain habitat for special-

[11] Lee, L.C., P.L. Fiedler, S.R. Stewart, R.R. Curry, D.J. Partridge, J.A. Mason, I.M. Inlander, R.B. Almay, D.L. Aston, and M.E. Spencer. 2001. *Draft Guidebook for Reference Based Assessment of the Functions of Riverine Waters/Wetlands Ecosystems in the South Coast Region of Santa Barbara County, California.* Santa Barbara County Water Agency, Santa Barbara, California.

[12] Schierenbeck, K.A. 2021. The Genetic Consequences of Hybridization Between California Native Plant Species With Closely Related Taxa. *Artemisia 48(2):25-29.*

status species and impose remedial mitigation, such as enhancing offsite portions of Arroyo Paredon Creek that have been degraded in the past. A post-construction monitoring report is already warranted even before the project has been approved.

The fifth mitigation measure, detention basin maintenance, suggests timing of the maintenance to be between September 1st and February 1st to ensure activities occur outside the nesting season for birds. This avoidance period is generally correct for most bird species; however, some bird species in the Santa Barbara region nest year round; therefore, to "ensure" avoidance of an active bird nest, a qualified ornithologist should monitor the project site for nesting activities prior to any maintenance activities be initiated.

Another concern about the design of the detention basins is their capacity to retain flood waters. The design goal of the proposed basins is to retain runoff for up to 25-year flood events. The 25-year event is a probability of event, not really a measure of the frequency of the flood event. With climate change effects resulting in storms of greater intensity with greater frequency, the size of the detention basins may be insufficient to actually retain intense precipitation events in the foreseeable future and are likely undersized. What modelling method was used to determine the required detention capacity? This needs to be examined to ensure that the detention basins actually retain water onsite for the vast majority of precipitation events.

The BRA concludes in 5 bullet points that the recommended mitigation measures and level of project impacts are all avoided or fully mitigated; however, they are not supported by substantial evidence, and if fact DMEC has provided substantial evidence that the potential impacts have not been avoided or mitigated, and in fact, impacts have already occurred onsite. There certainly has been, or will be, a net benefit to the environment from what is proposed.

A certified arborist needs to prepare a tree protection plan for the existing native trees, and each tree assessed for its health and condition, not from a hazard perspective (which is the typical assessment approach for arborists). The tree protection zone needs to be at least 10 feet beyond the edge of the canopy or 15 feet from the trunk, whichever is the greater distance, to protect the conditions of the tree's root zone.

The fence adjacent to the riparian habitat of Arroyo Paredon Creek needs to be wildlife permeable, not a typical chain-link type fence. If security is an issue, then move the security fence to the outside edge of the 100-foot buffer zone and redesign the facilities to accommodate the creation of a true vegetated buffer zone.

Reviewing the proposed landscape plan finds that several nonnative and cultivars of natives are proposed for planting onsite. Those that should NOT be used onsite include *Arctostaphylos* 'Sunset' and *Ceanothus gloriosus* 'Anchor Bay'. The only *Arctostaphylos* species native to the Carpinteria Valley is *A. glauca*. Use of a cultivar manzanita increases the risk of hybridization with the locally native species and damaging the genetic diversity of the local populations.

Ceanothus gloriosus is not native to southern California, much less the Carpinteria Valley and should not be planted onsite, and the same concern exists for *Ceanothus* cultivars as hybridization in the genus *Ceanothus* is common. It would be more appropriate to use *C. spinosus* or *C. oliganthus* at the project site.

Additionally, the plant palette is too small, containing only nine (9) species. To provide habitat for wildlife, the plant palette needs to be much richer, with at least twenty (20) species to reach anything similar to a natural habitat of 1 or 2 acres. The native species found onsite and nearby are the logical best

candidates, including *Heterotheca grandiflora*, which is known to attract many invertebrate species as pollinators.

All species on the plant palette need to be from local genetic stock as there can be great variability in a taxon's ability to grow and thrive at the project site. For example, *Achillea millefolium* has a very wide distribution with many variants described, and some cultivated for the horticulture trade. Without using the local variant, there is risk of both failure to become established and thrive and with genetic contamination with native populations.

All the plants on the plant palette need to be contract grown from local genetic stock, which required advanced planning and contracting to ensure sufficient material is available when needed. Substitutions for species not available commercially simply from a lack of supply happens too frequently and is entirely avoidable.

Odor from the cannabis will be masked by applying a misting spray near the ceiling vents, using the Byers Vapor Phase Odor System (Byers System), spraying a chemical blend called Ecosorb into the air. The BRA does not discuss this part of the project and how it might affect wildlife species.

No data on the chemical makeup of Ecosorb has been provided, and no analysis of how this product might affect receptors, such as birds (Safi et al. 2016[13], Wallraff 2015[14]) and invertebrates that occur in the region. It has been well-established that birds are affected by noise, less so for odors, but birds do respond to odors. For example, a website for wildlife management suggests using Naphthalene, "Naphthalene is a repellent that may offend the bird's olfactory sense"[15]. The Safety Data Sheet for Ecosorb CNB 100 fails to list its ingredients, claiming the "specific chemical identity and exact percentages of this composition has been withheld as a trade secret"; however, that does not prevent them from listing the ingredients. Regarding odors, it is also possible that the odor of cannabis that the Byers System is meant to mask has adverse effects on wildlife. DMEC is not aware of any studies one way or the other. It is clear that humans have experienced negative effects from cannabis production odors based on the numerous complaints that have been filed with the county. The Safety Data Sheet also states that users must "provide adequate ventilation", and to "minimize exposure in accordance with good hygiene practice". These warnings should be a signal that there is at least potential adverse effects from breathing this chemical blend.

Since very little is known about most species of birds behavior to odors, and the CEQA review process does not require original research to address such unknowns, a prudent approach to the issue is to act on the side of caution and eliminate the potential impact. In this case, using the more effective process of filtering the air with carbon filters would seem to be the preferred approach.

In conclusion, DMEC finds that the impact assessment fails to provide substantial evidence that the project site does not provide habitat for special-status species or that significant impacts to wetland functions will not occur because the BRA failed to actually identify the wetland functions or their level of functionality and the proposed mitigation measures have already failed, even before the project has been permitted. Furthermore, the proposed buffer plantings may cause harm to the natural environment rather than

[13] Safi, K., A. Gagliardo, M. Wikelski, and B. Kranstauber. 2016. How Displaced Migratory Birds Could Use Volatile Atmospheric Compounds to Find Their Migratory Corridor: A Test Using a Particle Dispersion Model. *Frontiers in Behavioral Neuroscience* 10:175.

[14] Wallraff, H. G. 2015. An Amazing Discovery: Bird Navigation Based on Olfaction. *Journal of Experiential Biology* 218:1464-1466.

[15] Internet Center for Wildlife Damage Management - http://icwdm.org/species/birds/pigeons/pigeon-damage-control-and-prevention-methods/

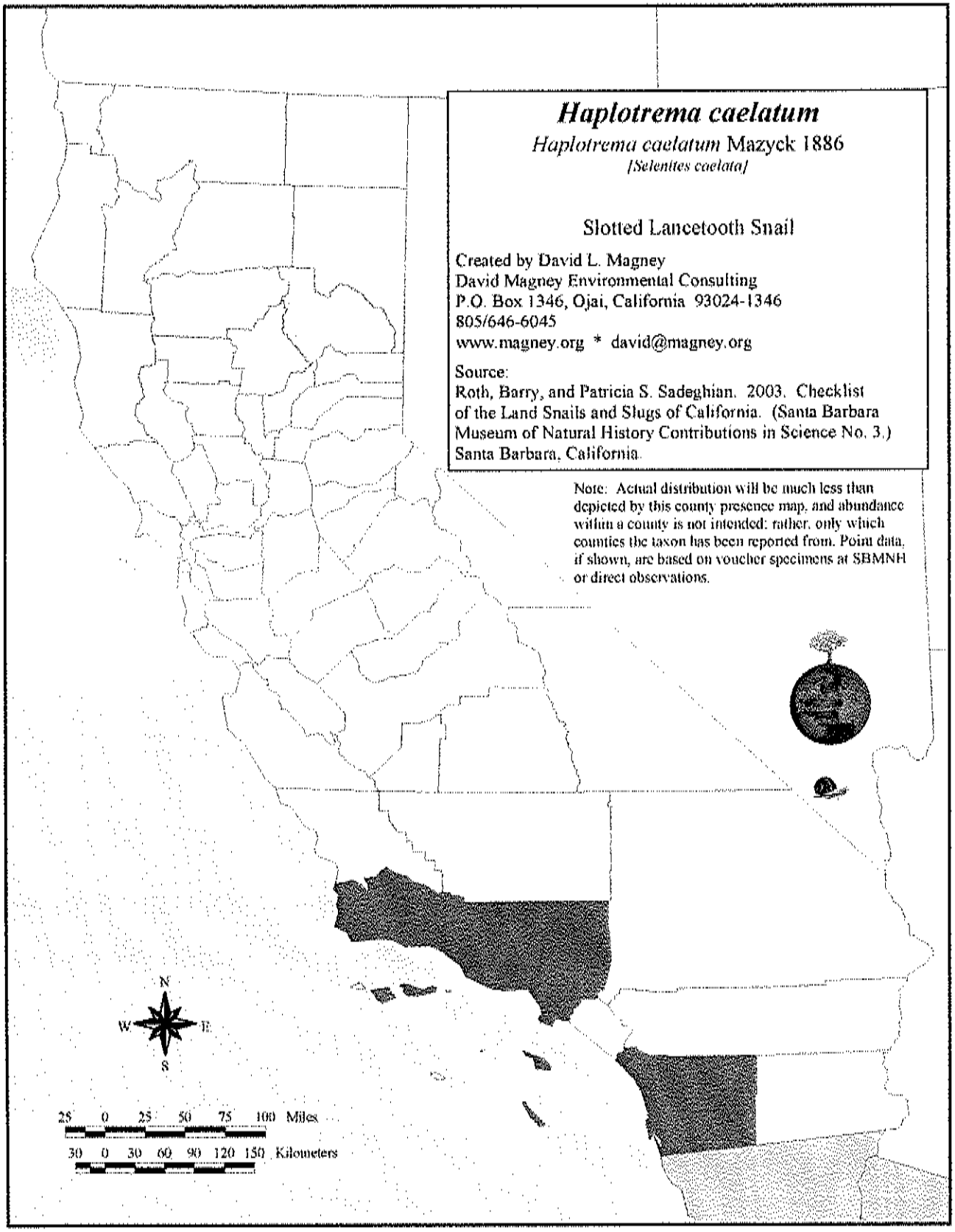
providing positive mitigation. DMEC recommends that these deficiencies be rectified as described in this letter.

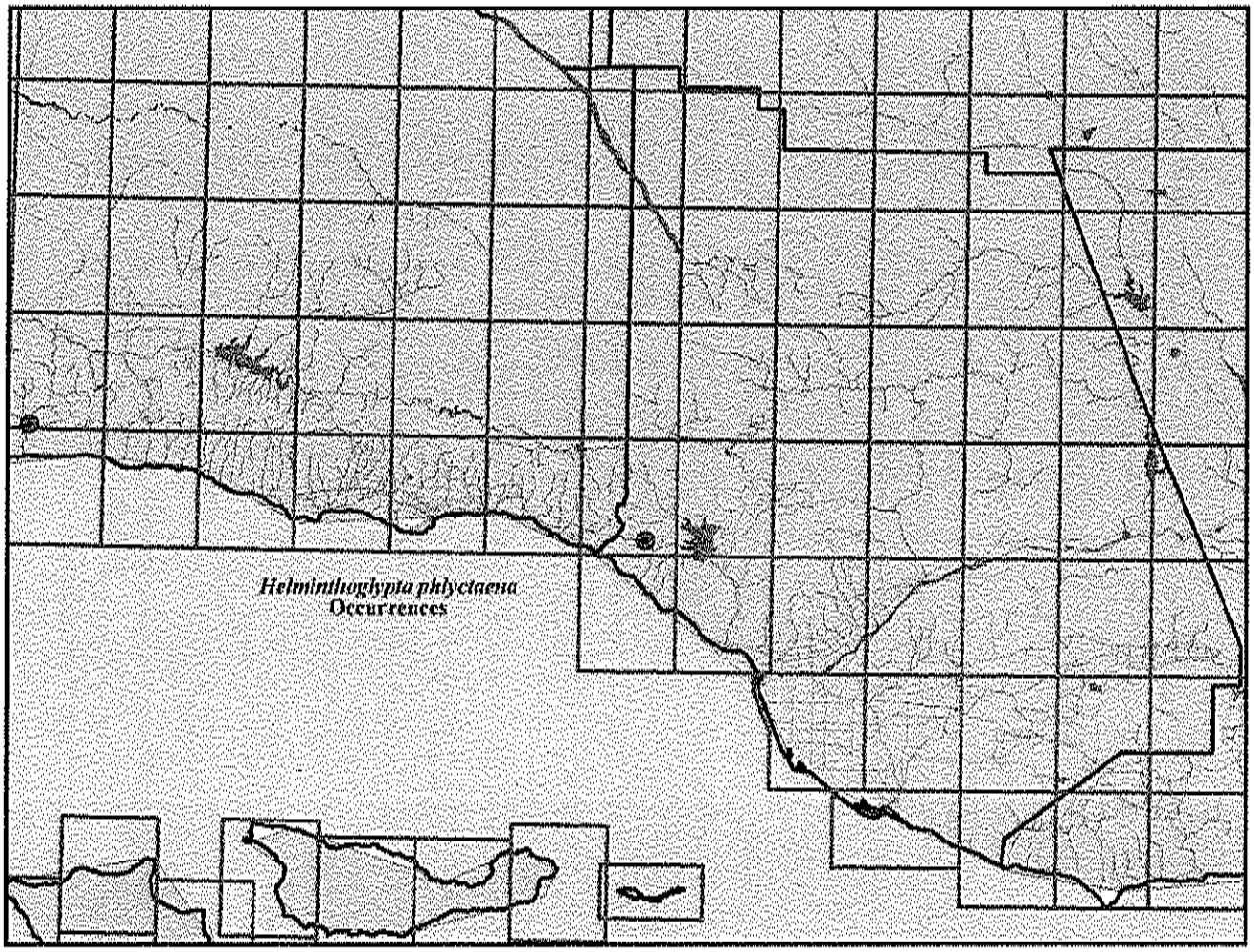
Sincerely,

David L. Magney, CCB-0001
President, Certified Consulting Botanist, Certified Arborist

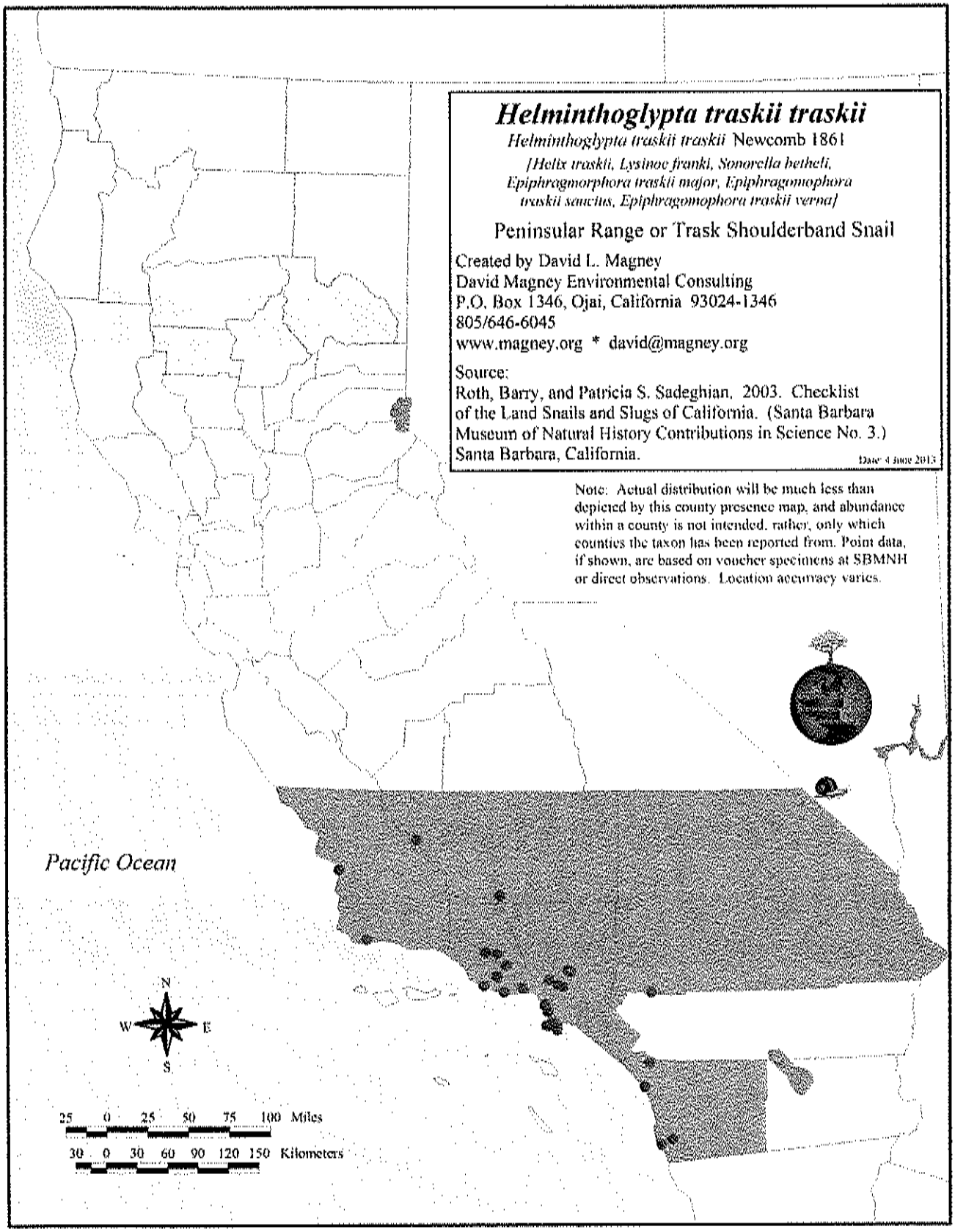
Attachments: Distribution maps of *Haplotrema caelatum*, *Helminthoglypta phlyctaena*, and *H. traskii*
Magney resume
Jones & Stokes technical memo

DMEC


Haplotrema caelatum
Haplotrema caelatum Mazyck 1886
[Selenites caelata]
Slotted Lancetooth Snail
Created by David L. Magney
David Magney Environmental Consulting
P.O. Box 1346, Ojai, California 93024-1346
805/646-6045
www.magney.org * david@magney.org
Source:
Roth, Barry, and Patricia S. Sadeghian. 2003. Checklist of the Land Snails and Slugs of California. (Santa Barbara Museum of Natural History Contributions in Science No. 3.) Santa Barbara, California.
Note: Actual distribution will be much less than depicted by this county presence map, and abundance within a county is not intended; rather, only which counties the taxon has been reported from. Point data, if shown, are based on voucher specimens at SBMNH or direct observations.
N
W
E
S
25 0 25 50 75 100 Miles
30 0 30 60 90 120 150 Kilometers


Helminthoglypta phlyctaena
Occurrences

DMEC


Helminthoglypta traskii traskii
Helminthoglypta traskii traskii Newcomb 1861
[Helix traskii, Lysinoe frankii, Sonorella bethelii, Epiphragmorphora traskii major, Epiphragomophora traskii sanctus, Epiphragomophora traskii verna]
Peninsular Range or Trask Shoulderband Snail
Created by David L. Magney
David Magney Environmental Consulting
P.O. Box 1346, Ojai, California 93024-1346
805/646-6045
www.magney.org * david@magney.org
Source:
Roth, Barry, and Patricia S. Sadeghian. 2003. Checklist of the Land Snails and Slugs of California. (Santa Barbara Museum of Natural History Contributions in Science No. 3.) Santa Barbara, California.
Date: 4 June 2013
Note: Actual distribution will be much less than depicted by this county presence map, and abundance within a county is not intended, rather, only which counties the taxon has been reported from. Point data, if shown, are based on voucher specimens at SBMNH or direct observations. Location accuracy varies.
Pacific Ocean
N
W
E
S
25 0 25 50 75 100 Miles
30 0 30 60 90 120 150 Kilometers

Resume

David Magney Environmental Consulting

David L. Magney

President, Biologist/Certified Consulting Botanist, Wetland Scientist, Certified Arborist

EDUCATION:

B.A. Environmental Studies and Geography (emphasis is botany, cartography, and remote sensing), University of California at Santa Barbara, 1985.

A.S. Landscape Horticulture and Certificate of Completion in Natural Resources, Ventura College, 1975.

CERTIFICATIONS AND PERMITS:

Certified Consulting Botanist #0001, California Native Plant Society, Board of Certification

Approved Biologist: Los Angeles County Regional Planning Department, Sensitive Ecological Areas

Approved Biologist: Ventura County Planning Division

Approved Biologist: Santa Barbara County Planning Department

Certified Arborist: International Society of Arboriculture (certification #WE-7674A)

Approved Arborist: City of Oxnard

Expert Witness, Botanist: U.S. Department of Justice

California Dept. of Fish and Game Scientific Collecting Permit #801066-05

TRAINING:

Improving Wetland Restoration Success: Riverine/Riparian Wetland Restoration Webinar, Assoc. of State Wetland Managers, 9 June 2015

Hydrogeomorphic Assessment of Wetland Function training course: National Wetland Science Training Cooperative, 1996.

Hydrogeomorphic Approach to Assessment of Functions of Waters of the U.S., Including Wetlands, in the Santa Margarita Watershed. National Wetland Science Training Cooperative, 1997.

Wetland Delineation, Federal Wetland Policy: Wetland Training Institute, 1989, 1991.

Desert Tortoise Handling and Surveying: trained by Desert Tortoise Council (John Weir), 1988.

Hazardous Waste Health and Safety Monitoring Training: Dames & Moore, 1987.

ArcView 3 (GIS) training: Geo InSight International, 1998.

ArcGIS 10.4 (GIS) trainings: beginning and intermediate, ESRI 2017

Vegetation Rapid Assessment Classification: California Native Plant Society, 2003.

Successful CEQA Compliance 2005: Ron Bass, for Ventura County Resource Management Agency, 16 June 2005. CEQA = California Environmental Quality Act.

California Red-legged Frog Survey Methods: Vince Semonsen 2005.

The Wildlife Society San Joaquin Valley Chapter workshop: Habitat Conservation Planning, 1992.

American Association for the Advancement of Science symposium: Vernal Pools, 1989.

Professional Soil Scientists of California workshop: Field Identification of Hydric Soils, 1989.

SPOT Image Corporation: Satellite Imagery and GIS training course, 1995.

Jones & Stokes Associates workshops: Project Management Seminars, 1990-92, Hydric Soils, 1991, 1992; Clean Water Act Regulations Concerning Wetlands (1989), and CEQA Requirements and Document Preparation, 1993, 1990, 1989; WordPerfect, Lotus 1-2-3 and Allways, Microsoft Word, Excel, ArcView, and GRASS software programs.

Project Management Training: Dames & Moore seminar, 1988.

California Agricultural Pest Control Adviser's License, 1975-77 (expired).

QUALIFICATIONS AND EXPERIENCE:

Mr. Magney, President of David Magney Environmental Consulting, has over 30 years experience in biological studies and 25 years in environmental consulting. He has worked on or managed projects focusing on large-scale habitat classification and mapping, wetlands inventory and restoration planning, and water reuse and diversion that affect wetland habitats (palustrine, riverine, and estuarine) containing Southern Steelhead Trout, Tidewater Goby, Unarmored Threespine Stickleback, California Red-legged Frog, and Southwestern Pond Turtle. He has surveyed for and/or monitored projects with Desert Tortoise, Giant Garter Snake, Blunt-nosed Leopard Lizard, San Diego Horned Toad, Snowy Plover, California Least Tern, Least Bell's Vireo, California Gnatcatcher, Burrowing Owl, San Joaquin Kit Fox, San Joaquin Antelope Squirrel, Mojave Ground Squirrel, Giant Kangaroo Rat, Tipton's Kangaroo Rat, Stephen's Kangaroo Rat, Los Angeles Pocket Mouse, fairy shrimp, as well as numerous special-status plant species. Mr. Magney also managed special-status species surveys in the Four Corners Region, Great Valley, Sierra Nevada, the California Central Coast, Southern California (coastal and Inland Empire), and on Santa Cruz Island.

David L. Magney

President, Biologist/Certified Consulting Botanist, Wetland Scientist, Certified Arborist

QUALIFICATIONS AND EXPERIENCE (continued):

Mr. Magney has prepared and reviewed biological resources sections of Environmental Impact Statements (EIS) and Environmental Assessments (EA) prepared pursuant to the National Environmental Policy Act (NEPA).

He managed the botanical resources section for EIS on the Central Valley Project Improvement Act of 1990, which included most of California; EAs for Fort Hunter Ligget, Camp Roberts, a drilling project in the Los Padres National Forest (LPNF), off-highway vehicle trails in the LPNF, and the Santa Cruz Island Acoustic Range Facility (a former Navy facility).

Mr. Magney has prepared and managed biological resources sections of Environmental Impact Reports (EIRs) and Initial Studies (IS) pursuant to the CEQA for numerous projects in California. He has prepared EIRs for: General Plans for the Cities of Lodi and Fairfield; the San Joaquin North County Landfill; a water main extension for Newhall County Water District, the Bridle Ridge Development in Santa Barbara County, and the Lyons Canyon Ranch development in Newhall for Los Angeles County Regional Planning. Mr. Magney has prepared numerous Initial Studies on biological resources for the Ventura County Planning Division since 1995. He has critically reviewed numerous CEQA documents since 1982, including Ventura Regional Sanitation District's EIR for the Toland Road Landfill on behalf of Ventura County Planning, and an EIR on a landfill project in Orange County for a neighboring city.

Mr. Magney has conducted numerous floristic, focused rare plant surveys, and vegetation sampling throughout California and the West. He has completed a floristic survey of 62,000+ acres of the Tejon Ranch for the Tejon Ranch Conservancy, documenting the flora, rare plants, and plant communities of 5 areas of the ranch; a floristic survey of the Wind Wolves Preserve in southern Kern County, and is currently conducting floristic surveys of the Bitter Creek National Wildlife Refuge in southwestern Kern County.

Mr. Magney has sampled natural vegetation in a wide variety of habitats, including grasslands, wetlands, chaparral, and desert communities. He conducted floristic and rare plant surveys for Sprint's fiberoptic cable between San Bernardino and Las Vegas, Nevada, which included construction monitoring. Mr. Magney has conducted botanical surveys at scattered sites throughout the Great Basin, Mojave, and Colorado Deserts, including near China Lake, the Owens Valley, Granite Mountains, Clark Mountains, Randsburg/Johannasburg, Clipper Mountains, Chuckwalla Mountains, Chuckwalla Bench, Needles area, and the I-10 corridor (ARCO Line 90 pipeline from Colton, California to Albuquerque, New Mexico).

Mr. Magney has managed projects to establish wetland habitat mitigation banks, one in the Mojave Desert focused on playa and desert wash wetlands, and two banks focused on perennial, intermittent, and ephemeral wetland and upland habitats in Ventura County. These projects included delineation of jurisdictional wetlands, measuring wetland functions using HGM, determining existin biological resources at each site, and developing restoration and management plans for increasing wetland functions.

Mr. Magney has served as an expert witness in Federal and California state courts. He was the U.S. Department of Justice's expert witness botanist on the EPA vs. Adam Bros. et al. wetlands violation case (Los Angeles District Court). He served as wetlands/environmental expert witness for the Old Creek Ranch vs. Robert Watson (Ventura County Superior Court) on a property damages liability lawsuit. Both cases were settled prior to trial in DMEC's client's favor. Mr. Magney is also an expert witness one a property damage case related to landscape maintenance and a personal injury case focusing on nonvascular plants for Pro/Consul, Inc.

Mr. Magney has interpreted and processed satellite and aerial imagery (Landsat, SPOT, SAR, and color and IR aerial photography) using GRASS, ARC/INFO, and ERDAS Imagine software for large-scale projects: all of California to support an EIS for the Central Valley Project Improvement Act of 1992, natural vegetation of the Calleguas Creek watershed (n Ventura County) for the USFWS, Camp Pendleton Marine Corps Base, endangered species habitats within the Contra Costa Water District interim service area, central Ventura County for Unocal, the Ventura River for the Matilija Dam Removal Project, pipeline projects in coastal Ecuador and Mississippi to Alabama, and an impact evaluation for an oil-related project in Amazonian Ecuador. He has used satellite imagery to map vegetation/land cover for the Great Basin as part of a transmission line routing study.

David L. Magney

President, Biologist/Certified Consulting Botanist, Wetland Scientist, Certified Arborist

QUALIFICATIONS AND EXPERIENCE (continued):

Mr. Magney has managed oak tree assessment projects in California, including for the Lyons Canyon Ranch development in Newhall, creating a unique and robust GIS database and maps of all assessed oak trees, working closely with Certified Arborists.

Mr. Magney is conducting extensive research on the flora of Ventura County, California, which will be published a A Flora of Ventura County, California, with an expected publication date in late 2013. A complete checklist was published in October 2011. This project was started in earnest in 1982 and includes original research and research on collections made by other botanists.

Mr. Magney has worked on watershed management plans, including the Calleguas Creek watershed in Ventura County, focusing on upland and wetland habitat functions, characterizing habitat conditions, and developing restoration and management strategies to restore or enhance impacted functions. He also characterized and analyzed the urban streams within the City of Ojai.

Mr. Magney has been involved with a wide variety of projects including studies for oil/gas facilities, dams, residential and commercial developments, transportation facilities, landfills, sand and gravel mining operations, off-highway vehicle trails, wind farm siting, and electrical/communications transmission lines. He has studied botanical and zoological resources, classified and mapped vegetation, delineated jurisdictional wetlands and waters of the United States, identified opportunities and constraints for land development, conducted initial studies and investigations for projects requiring CEQA and NEPA documentation, and prepared Natural Environmental Studies for Caltrans. Mr. Magney has extensive experience in wetlands, developing mitigation and restoration plans for coastal, riparian, and vernal pool wetlands.

Mr. Magney has conducted water quality sampling and monitoring for several projects to establish baseline conditions and conduct construction and post-construction monitoring, such as for Exxon's Las Flores refinery in Corral Canyon, Santa Barbara County. He has developed and implemented water quality controls for use during project construction and mitigation implementation. Mr. Magney is developing a water quality field sampling educational program for the Ojai Unified School District, including purchasing of field sampling equipment.

Prior to establishing David Magney Environmental Consulting, Mr. Magney worked as Senior Program Manager for Natural Resources at Fugro West, Inc. from 1995 to 1997; as a Senior Botanist for Jones & Stokes Associates, Inc., of Sacramento, California, from 1989 to 1995 where he worked on and managed projects with major biological or regulatory compliance components; and prior to 1989, and as the Botanist for Dames & Moore at their Santa Barbara office. He has also worked with the U.S. Forest Service, Los Padres National Forest, as a GS-9 Botanist (temporary) and on a voluntary basis, and as a Research Associate with the UC Santa Barbara Herbarium, NOREAS, and BioResource Consultants. Mr. Magney formerly owned and operated the Ojai Wilderness Institute.

PROFESSIONAL AFFILIATIONS:

American Society of Plant Taxonomists
AnacapaGIS, co-founder
Association of State Wetland Scientists
Botanical Society of America
California Botanical Society
California Lichen Society, Conservation Committee
California Native Plant Society (President 1991-1994; Chairman of Chapter Council 2011-2014; Board Member 2002-2007, VP Conservation 1996; VP Legislation 1995; Channel Islands Chapter President 2004-2013, Redbud Chapter Conservation Committee Chairman 2010-2016, Fellow), Botanist Certification Program Committee Chairman (2014-2018)
Channel Islands Regional Geographic Information Systems (CIRGIS), charter board member
International Society for Arboriculture (ISA), Western Chapter ISA, since 2006
Native Plant Coalition, founder
Northern California Botanists
Sespe Institute, cofounder and president
Society of Wetland Scientists
Southern California Academy of Sciences
Southern California Botanists

David L. Magney

President, Biologist/Certified Consulting Botanist, Wetland Scientist, Certified Arborist

PUBLICATIONS:

Magney, David L. in ed. *A Flora of Ventura County*. David Magney Environmental Consulting, Cedar Ridge, California.

Magney, David L. in ed. Vascular Flora of Ventura County, California. Submitted to *Madroño*.

Magney, David L. in ed. A Comparison of Swedish and American Wetland Protection Laws.

Magney, D.L., J. Broberg, J. Logan, and V. Peters. 2015. A Preliminary Draft Regional Guidebook for Applying the Hydrogeomorphic Approach to Assessing Wetland Functions of Playa Depressional Wetlands in the Mojave Desert. (PN 12-0004.) David Magney Environmental Consulting, Ojai, California. Prepared for U.S. Army Corps of Engineers, Los Angeles, California. Prepared on behalf of Richard and Laurie Lyons, Ojai, California.

Magney, David L. 2015. Lichens of Ventura County: Annotated Checklist. (Version 1.3.) David Magney Environmental Consulting, Ojai, California. First published January 2014. http://www.magney.org/photofiles/Ventura_County_Lichens.htm

Magney, David L., and Shirley Tucker. 2012. Lichens of Burton Mesa Chaparral, Santa Barbara County, California. Sespe Institute, Inc., Ojai, California. www.sespeinstitute.com.

Magney, David L. 2011. Checklist of Vascular Plant Flora of Ventura County, California. 19 October 2011. Ojai, California. www.venturaflora.com

Magney, David L. 2011. Vascular Plants of the Palos Verdes Penisnula, Los Angeles County, California. 20 July 2011. David Magney Environmental Consulting, Ojai, California. www.sespeinstitute.com.

Magney, David L. 2010. Flora of Kings County, California. 6 December 2010. David Magney Enviornmental Consulting, Ojai, California. www.sespeinstitute.com.

Magney, David L. 2010. Native Trees of Southern California (list). (30 December 2010.) California Native Plant Society, Channel Islands Chapter, Ojai, California. http://cnpsci.org/html/PlantInfo/Checklists.htm

Magney, David L. 2010. Terrestrial Gastropods of Los Angeles County. 29 September 2010. David Magney Environmental Consulting, Ojai, California. www.sespeinstitute.com.

Magney, David L. 2009. Checklist of Ventura County Rare Plants. 19 October 2009, Fifteenth edition. California Native Plant Society, Channel Islands Chapter, Ojai, California. www.cnpsci.org.

Magney, David L., and Callen L. Huff. 2010. Preliminary Checklist of Los Angeles County Bryophytes. 16 March 2010. David Magney Environmental Consulting, Ojai, California. www.sespeinstitute.com.

Magney, David L. 2009. Ventura County Bryophytes. 12 November 2009. David Magney Environmental Consulting, Ojai, California. http://www.venturaflora.com/files/checklists/Ventura_County_Bryophytes.pdf

Magney, David L. 2009. Ventura County Wildlife - Terrestrial Snails and Slugs. 1 June 2009. David Magney Environmental Consulting, Ojai, California. http://www.magney.org/photofiles/VenturaCountySnails1.htm.

Magney, David L. 2008. Spenceville Wildlife Area, Nevada and Yuba Counties, California, Checklist of the Vascular Plants. 21 June 2008. David Magney Environmental Consulting, Ojai, California. http://magney.org/photofiles/Spenceville_Wildlife_Area.htm

Chattin, L., L. Rubin, and D. Magney. 2006. A Winning Combination: Local Land-use Planning and Fine-scale Vegetation Maps. *Fremontia* 34:3(9-13).

Knudsen, Ken, and David L. Magney. 2006. Rare Lichen Habitats and Rare Lichen Species of Ventura County, California. January 2006. *Opuscula Philolichenum* 3:49-52.

Magney, David L. 2006. Vascular Plants of South Ormond Beach, Oxnard, Ventura County, California. California Native Plant Society, Channel Islands Chapter, Ojai, California. Published on http://www.cnpsci.org/html/PlantInfo/SouthOrmondBeachPlants.pdf.

Magney, David L., and Illeene Anderson. 2005. Plants of the Clipper Mountains, Mojave Desert. 24 March 2005. Ojai, California. http://magney.org/photofiles/ClipperMtns.htm

David L. Magney

President, Biologist/Certified Consulting Botanist, Wetland Scientist, Certified Arborist

PUBLICATIONS (continued):

Magney, David L., and Illeene Anderson. 2005. Plants of the Dead Mountains, Mojave Desert, California. 22 March 2005. David Magney Environmental Consulting, Ojai, California. http://magney.org/photofiles/DeadMtnpics.htm

Magney, David L., and Illeene Anderson. 2005. Plants of the Granite Mountains, Mojave Desert, California: Al A. Alanson Trail Plant Checklist. 23 March 2005. David Magney Environmental Consulting, Ojai, California. http://magney.org/photofiles/GraniteMtns.htm

Magney, David L. 2004. How Common Are Mistletoes Anyway? *Crossosoma* 30:1

Magney, David L., and K.G. Niessen. 2005. Oak Tree Data Assessment Solutions Using GIS. 9 May 2005. David Magney Environmental Consulting, Ojai, California. Presented to ESRI ArcView User's Group, Ventura College, California.

Magney, David L. 2005. Atlas of California Native Terrestrial Snails in Ventura County. 16 March 2005. David Magney Environmental Consulting, Ojai, California. Prepared for County of Ventura, Resource Management Agency, Planning Division. Ventura, California.

Magney, David L. 2004. Checklist of Ventura County Rare Plants. 15 June 2004. California Native Plant Society, Channel Islands Chapter, Ojai, California. Updated periodically.

Magney, David L. 2001. Ventura County Plant Species of Local Concern. December. California Native Plant Society, Channel Islands Chapter, Ventura, California.

Magney, David L. 1999. Preliminary List of Rare California Lichens. *Bulletin of the California Lichen Society* 6(2):22-27.

Tupen, Gaylene, and David Magney. 1996. San Antonio Creek Habitat Characterization Study. Poster presented at the American Fisheries Society Southern Steelhead Symposium, Ventura, California, March.

Ferren, Wayne R. Jr., David L. Magney, and Teresa Sholars. 1995. The Future of California Floristics and Systematics: Collecting Guidelines and Documentation Techniques. *Madroño* 42(2): 197-210, April-June.

Magney, David L., and Emily B. Roberson. 1995. CNPS Statement on Seeding Following Wildfire. In *Brushfires in California: Ecology and Resource Management* (conference proceedings). International Association of Wildland Fire, Fairfield, Washington.

Clark, George M., and David L. Magney. 1994. Vascular Plants of Bear Valley, Walker Ridge, and Surrounding Areas, Colusa and Lake Counties, California. *Four Seasons* 9(4):25-32.

Magney, David L., and Kenneth M. Bogdan. 1993. What are ARNIs? *National Wetlands Newsletter* 15(3):4-5, May/June.

Magney, David L. 1993. Focus On Vernal Pools. *National Wetlands Newsletter* 15(3):6, May/June.

Magney, David L. 1993. Faults with Growing Season Determinations Using the U.S. Army Corps of Engineers Wetlands Delineation Manual. In *Riparian Management: Common Threads and Shared Interests* – Proceedings of a Conference, February 4-6, 1993; Water Resources Research Center, Albuquerque, New Mexico; College of Agriculture, University of Arizona, Tucson.

Magney, David L. 1992. Descriptions of Three New Southern California Vegetation Types: Southern Cactus Scrub, Southern Coastal Needlegrass Grassland, and Scalebroom Scrub. *Crossosoma* 18(1):1-9, June.

Ferren, Wayne, Mark Capelli, Anuja Parikh, David Magney, K. Clark, and John R. Haller. 1990. *Botanical Resources at Emma Wood State Beach and the Ventura River Estuary, California: Inventory and Management.* (Herbarium Environmental Report No. 15.) University of California, Santa Barbara.

Magney, David L. 1988. Habitat Survey for California Jewelflower *Caulanthus californicus* (S. Watson) Payson in the Los Padres National Forest. Ojai Wilderness Institute, Ojai, California. Prepared for U.S. Forest Service, Los Padres National Forest, Supervisor's office, Goleta, California, August 3.

David L. Magney

President, Biologist/Certified Consulting Botanist, Wetland Scientist, Certified Arborist

PUBLICATIONS (continued):

Magney, David L. 1988. Analysis of water quality of an intermittent stream, Santa Barbara County, California. (Presented as a poster at the California Riparian Systems Conference), Davis, California, September.

Magney, David L. 1987. Distribution and Two New Populations of *Boschniakia strobilacea* (Orobanchaceae). *Madroño* 34(4):379-380.

Olson, T., and David L. Magney. 1987. Distribution of Sensitive Plant and Wildlife Species Along Transmission Line Corridors in Southwestern San Joaquin Valley, California. In *Endangered and Sensitive Species of the San Joaquin Valley, California,* (proceedings of a conference) Contribution 36, December 10-11, California State College, Bakersfield.

Ferren, Wayne, and David Magney. 1986. Wetland Vegetation of the Proposed Mandalay Beach State Park. Campbell & Campbell Associates, Santa Monica, California.

Magney, David L. 1986. A Flora of Dry Lakes Ridge, Ventura County, California. (Herbarium Publication No. 5.) University of California, Santa Barbara.

AWARDS AND GRANTS:

California Native Plant Society - 1985, grant to conduct research on the flora of Ventura County, California.

Swedish-American Bicentennial Fund - 1995, grant from Swedish government to conduct research on a comparison of American and Swedish wetland protection laws and how they are applied.

California Native Plant Society – 2013, designated as a Fellow.

COMMITTEES:

California Native Plant Society, Botanist Certification Program Committee chairman since 2014.

Ojai Trees, Inc., Advisor Arborist, 2014-2016.

Caltrans Environmental Advisory Committee member, 1991-1996; also a panelist for Caltrans Mid-Level Managers training workshops.

U.S. Army Corps of Engineers Regional Assessment Team "A-Team" vernal pool expert for developing Hydrogeomorphic Model for Vernal Pool Wetlands, an inter-agency task force for the National Plan to implement the Hydrogeomorphic Approach for assessing wetland functions, 1995-1996.

Caltrans CaliforniaWILD (Wildflowers in Landscape Design) steering committee member.

Calleguas Creek Watershed Management Plan Committee member, since 1996. Habitat and Recreation Subcommittee and Scientific Advisory Group member.

Ojai Valley Land Conservancy, Lands Committee

Sespe Institute, nonprofit California Corp.

California Lichen Society, Conservation Committee

California Native Plant Society, Rare Plant Program Committee, since 2000, Conservation Committee.

Channel Islands Regional Geographic Information Systems Collaborative (CIRGIS), charter member since 2000, Incorporator, Chairman for 2002-2003, Board of Directors 2004-2007.

East Merced County NCCP, Habitat & Biological Resources Committee, 2002-2004.

Ventura County Planning Division, Sensitive Biological Resources Committee, since 2003.

City of Ojai, Tree Committee, 2005-2016.

Los Angeles County Regional Planning, Environmental Review Board, member 2006-2016.

Ventura River Watershed Planning Committee, member 2005-2016

Jones & Stokes

Memorandum

Date: October 18, 2002

To: Charles Wilson, Director, Napa Co Conservation Development & Planning Department

cc: R. Patrick Lowe and William Selleck

From: James D. Robins

Subject: **STREAM SETBACK TECHNICAL MEMO**

INTRODUCTION

At the September 25, 2002, Napa County Planning Commission (Commission) hearing, Napa County (County) staff were directed by the Commission to undertake a comprehensive review of the scientific justification for the proposed stream setbacks and to develop alternative recommendations based on science. Accordingly, this technical memo has been developed to aid both the Commission and interested community members in understanding the logic and scientific support that forms the foundation of the revised stream setback recommendations articulate herein. This memo will be discussed at the October 30, 2002, Commission hearing. Based on a review of the scientific research and discussions with the community and technical experts, County staff recommendations include the following revisions to the stream setbacks proposed in the proposed ordinance (**bold text represents revised text**).

- Class I Streams: 100-foot "No New Development Zone," plus a-50 foot "Limited Management Zone"
- **Class II Streams: 75-foot "No New Development Zone," plus additional width based on slope as follows:**
  - **30% to 40% slopes = 85 feet**
  - **40% to 50% slopes = 105 feet**
  - **50% to 60% slopes = 125 feet**
  - **>60% slopes = 150 feet**
- Class III Streams: 25-foot setback
- Class IV Streams: no setback

This technical memo is intended to provide insight into the development of these revised setbacks by examining the following: (1) the specific goals to be achieved by the stream setbacks, as articulated in the Napa River Watershed Task Force's (NRWTF's) *Phase II Report,*

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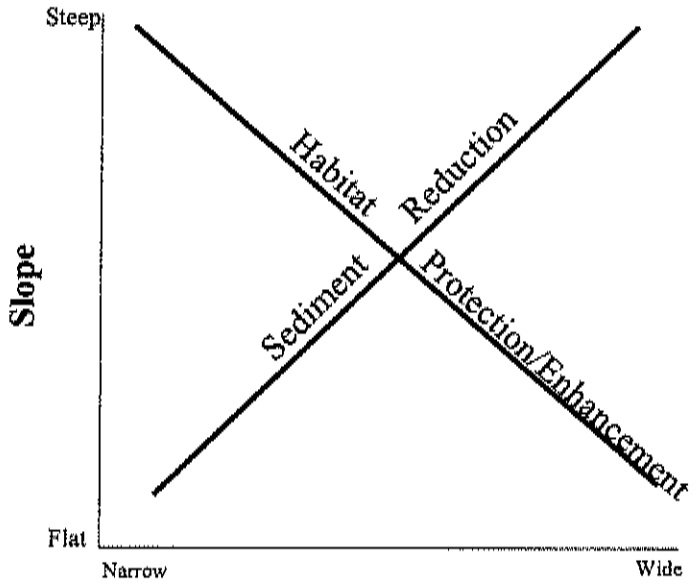
and how those goals influenced development of appropriate setbacks; (2) the scientific justification for the proposed stream setbacks on Class I, II, and III streams; and (3) how the County's proposed setbacks fit into the context of existing and proposed stream setback regulations elsewhere in the state and country.

GOALS

The specific goals of stream setback regulation are central to the development of appropriate setbacks because these goals drive many of the subsequent decisions regarding setback width and placement in the watershed. The relationship between goals and formulation of stream setbacks is clearly illustrated by the conceptual graphic on the following page (Chart 1). This chart illustrates the generalized relationship between recommended stream setback widths and slope (a proxy for location within the watershed) for achieving two different goals, sediment reduction versus protection/enhancement of habitat. Setbacks designed to address sediment delivery issues are commonly developed to increase in width as slope increases. On the other hand, setbacks designed to protect and enhance habitat generally increase as natural floodplain width increases or as slope decreases. Chart 1 highlights the setback design criteria disconnect that drove the NRWTF to recommend the proposed definitions of Class I, II, and III streams and the associated fixed setbacks articulated in the *Phase II Report* (NRWTF 2000 pp. 24-26). The 1991 Napa County Conservation Regulations required stream setbacks ranging from 35 to 150 feet along perennial and seasonal creeks for the explicit purpose of protecting water quality by filtration of sediment, nutrients, and pathogens. Because the primary goal was to protect water quality by reducing sediment and nutrient loading, these stream setbacks were based on slope, and setback widths increased with steepness of slope. As the NRWTF developed broader riparian/stream ecosystem protection and enhancement goals, shortcomings of the existing setback regulation became clear: "The existing setbacks, however, are not necessarily sufficient to protect the critical riparian zone next to the stream, particularly in lower slope areas (NRWTF 2000, pg. 23)."

Chart 1.

Conceptual Relationship between Slope, Stream Setback Width, and Stream Setback Function



Recommended Stream Setback Widths

The goals of the revised stream setback outlined in the *Phase II Report* include: (1) increase water quality with the hope of removing the Napa River from the State's 303(d) Impaired Stream listing; (2) protect and enhance stream and riparian resources; and (3) support and maintain the local agricultural economy. These goals were adopted by the Napa County Board of Supervisors with the adoption of the *Phase II Report* and form the foundation of the proposed stream setback ordinance. As such, the proposed setbacks must be designed to address a variety of riparian functions in addition to sediment, nutrient, and pathogen filtration. These additional functions include control of stream temperature, inputs of woody debris, maintenance of channel complexity, and protection/enhancement of riparian and stream-related habitats. Realization of these goals does not lend itself to a simple slope-based approach to setbacks; instead, a more nuanced approach that blends slope-based setbacks for upper watershed protection with ecosystem-based setbacks for floodplain and valley riparian habitat protection is needed. In their review of existing literature on riparian buffers, Fischer et. al. (2000) provide an appropriate summation of this new setback equation when they state the bottom line: "Recommended widths for ecological concerns in buffer strips typically are much wider than those recommended for water quality concerns, often exceeding 100m [325 ft] in width."

SCIENTIFIC JUSTIFICATION

Applied research into the effective widths of stream buffers first appears in the scientific literature in the mid-1960s. Over the past 40 years, numerous empirical studies have been conducted in labs and in the field in a variety of locations across the country. Although none of these studies was conducted in Napa County, there is a tremendous amount of valuable information in this body of work. The following 3 issues of clarification are critical to analyzing and understanding the applicability of the existing body of scientific knowledge.

1. Buffers vs. Setbacks – This body of research focuses directly on riparian/stream buffers rather than setbacks. A riparian/stream buffer is: (a) a strip of vegetated land between a stream and adjacent upland; (b) an area maintained in permanent vegetation (trees, shrubs, and/or grasses) and free from agricultural or urban encroachment, (c) an area designed to intercept surface flow and groundwater flow from upland sources for the purpose of removing or buffering the effects of associated nutrients, sediment, organic matter, toxins and/or pathogens; and (d) an area managed to maintain the integrity of the channel and floodplain ecosystem and their related habitats. **Thus, experimental findings developed from research on buffer strips are based on the function of a completely undeveloped buffer. As such, these findings should be viewed as optimistic estimates of the function of buffers in settings where existing improvements preclude development or protection of intact buffers.**

   Moreover, it is important to understand the relationship between buffers and setbacks. Whereas buffers represent the physical, on-the-ground systems that directly accomplish articulated goals, setbacks are the regulatory tools used to protect existing and potential buffers from future encroachment. Thus, in order to achieve the desired ecosystem function, setbacks in disturbed systems need to be actively managed to become buffers and, it could be argued, widened based on the degree of existing encroachment.

2. Scale of Data – Napa County, like most counties and cities developing/refining stream setback regulations, is confronted with a body of scientific information developed elsewhere. Although this might be problematic if we were designing site-specific setbacks, data gathered from a diverse array of stream environments provides information at the ideal **scale** for developing county-wide setbacks. Because the County encompasses a tremendous array of natural variability, which is apparent in soil development, bedrock formations, precipitation, upland vegetation, groundwater dynamics, and surface flow patterns, the development of a countywide setback is best served by general trends deciphered from research across variable settings. For example, research on the buffers to reduce sediment delivery into streams has been conducted in the forests of the Northeast and Northwest and in agricultural areas of the Southeast, Midwest and West. The basic relationships illustrated through this research holds true for any natural system (i.e., naturally vegetated buffer zones slow the movement of overland flow, allowing sediment to deposit in buffers; the finer the sediment the wider the buffer needed to filter it; the steeper the slope the wider the buffer).

Applicable trends also exist for biologic components such as salmonid protection (the importance of shade for stream temperature control, the need to reduce fine sediments that clog spawning gravels, and the importance of woody debris for food chain development and channel complexity). A comprehensive review of research from labs across the country is also a powerful tool from a statistical perspective. The larger the data set you are working with, the more likely it is the relationships observed are real and not data anomalies.

An additional benefit of conducting a comprehensive literature review is that it enables the County to bound the range of recommended setbacks and fine-tune the setbacks to best represent the ecological priorities of the community.

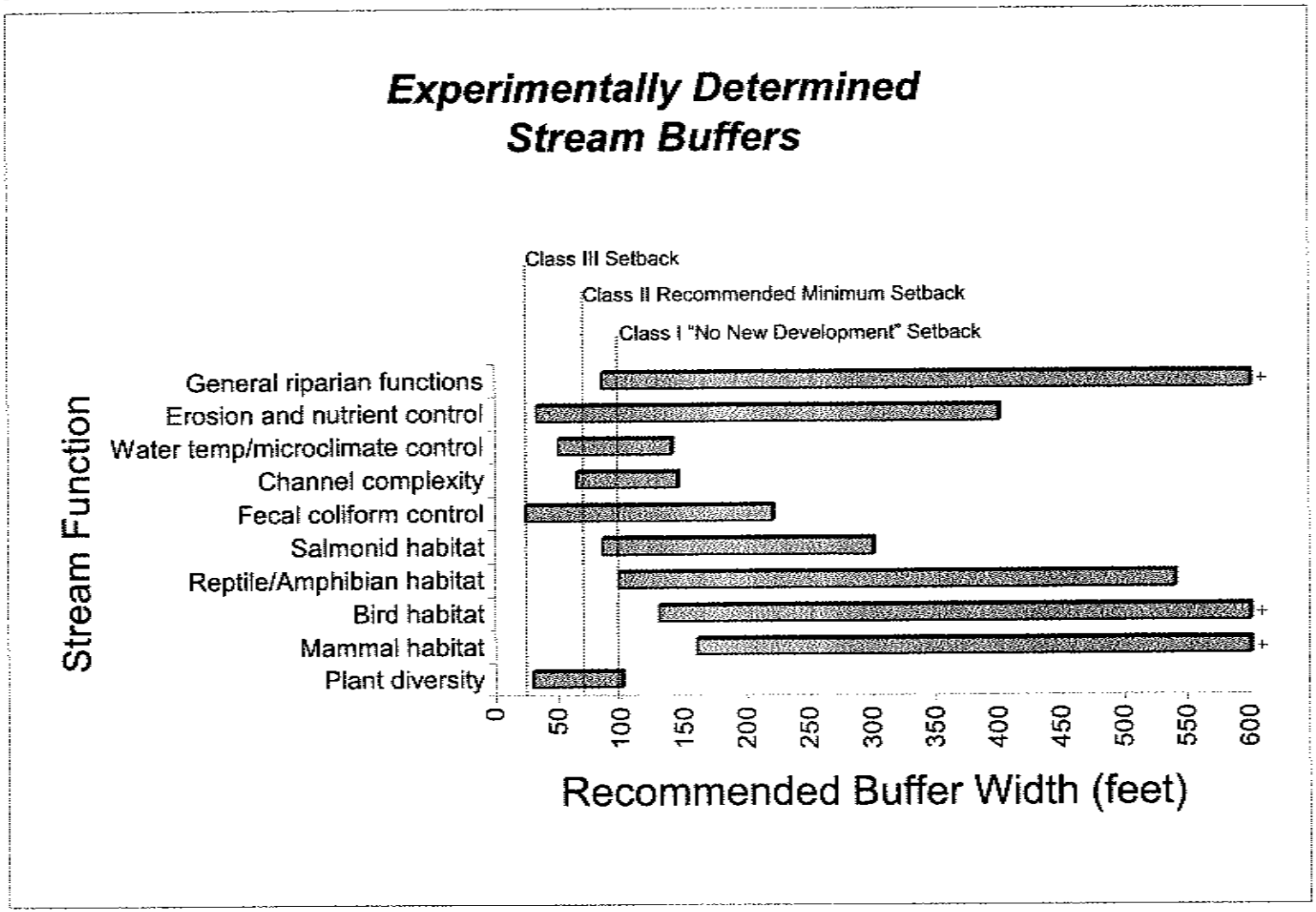
3. Buffer Length – The length or continuity of buffers is tremendously important for wildlife, although it is less of a direct issue for filtration of sediments, nutrients, and pathogens from upland source. A vegetated stream buffer that is isolated from other vegetated buffers will not function as a wildlife migration corridor and may also have limited value as wildlife habitat due to its limited area and high degree of exposed edges. In addition, if upstream sediment, nutrient, and/or pathogen sources are not controlled, a well-developed downstream buffer system that maintains natural floodplain function can potentially mitigate water quality issues during high flows by encouraging deposition on the floodplain.

Review of Existing Literature

Chart 2 illustrates the range of buffer widths, derived from scientific research studies, needed to achieve specific ecosystem functions. The bulk of the variability in these data can be attributed to local site conditions such as soil type, topography, and precipitation, and the size of the active channel generally measured by bankfull conditions during the 1.5-year recurrence interval flow. For more information on the data used to develop this chart refer to Appendix A, which provides a listing of specific citations and recommended buffer widths for each data source. In addition to the chart and table in Appendix A, this memo summarizes below the major ecological concepts and information discussed in the literature.

- General Riparian Ecosystem Function – Although the bulk of scientific research to date has been focused on the relationship between buffer width and specific ecosystem functions, such as sediment filtration or shade, a number of studies evaluated an array of functions to develop general ecosystem models for riparian buffers. These studies range from research on wildlife movement, seed dispersal, and biodiversity (Levey et. al. 2002) to research on methods for protection of geomorphic functions such as stream meander and floodplain development (Marcus et. al. unpublished). In general, research indicates that a minimum 80-foot wide buffer is essential for maintaining some semblance of terrestrial biodiversity (Levey et. al. 2002). It should be noted that this 80-foot recommendation reflects a minimum width for a corridor that connects 2 larger, more intact habitat patches. Therefore, an 80-foot buffer is based on the existence of larger adjacent habitat stands upstream and downstream

Chart 2.


Experimentally Determined
Stream Buffers
Class III Setback
Class II Recommended Minimum Setback
Class I "No New Development" Setback
General riparian functions
Erosion and nutrient control
Water temp/microclimate control
Channel complexity
Fecal coliform control
Salmonid habitat
Reptile/Amphibian habitat
Bird habitat
Mammal habitat
Plant diversity
Stream Function
0
50
100
150
200
250
300
350
400
450
500
550
600
Recommended Buffer Width (feet)

and thus underestimates the actual buffer width needed to maintain both corridors and patches. Although Marcus' (pers comm) work on the Russian River in Sonoma County was developed to be used at a site-specific scale, it focuses on developing buffers to maintain a stream meander corridor and the associated functions. In general, this research indicates that an area of approximately 4X the bankfull channel width will allow most unconfined and semi-confined (steams with some floodplain) watercourses sufficient room to meander.

Welsch (1991), probably the most commonly cited paper on the topic of riparian forest ecosystem buffers, recommends a minimum 95-foot buffer to maintain a host of ecosystem functions. (This buffer is divided into 3 zones with the first 2 left relatively undisturbed and the third managed as grassland and regularly maintained to remove excess sediment and nutrients from the system). **Other cited research indicates that buffers should be between 100 feet and 650 feet wide, depending on the potential width of the valley floor and the specific suite of target species the buffer is being designed to protect.**

- Filtration (Sediments, Nutrients, and Fecal Coliform Removal) – Sediment and nutrient delivery are natural processes that shape and maintain the physical and biological function of stream systems. Agricultural and urban land uses that involve activities such as grading, construction, deep ripping, and/or concentration of runoff may have a detrimental affect on the rate of sediment delivery to adjacent watercourses. Increases in sediment delivery can result in ecosystem problems associated with both turbidity and siltation. In addition, application of chemical fertilizers (i.e. nitrogen and phosphorous) on residential landscaping and in agricultural production can enter watercourses via runoff or groundwater. These excess nutrients can result in increased algal growth and associated water quality issues such as depleted dissolved oxygen and increased pH.

  Research has clearly demonstrated that vegetated riparian buffers can help mitigate sediment and nutrient inputs. Research from around the country suggests that buffers between a minimum of 33 feet (Corely et. al. 1999, Peterson et. al. 1992) and maximum of 400 feet (Wilson 1967) can accomplish the necessary filtration. **The bulk of the data suggests that buffers between 50 feet and 100 ft wide are generally appropriate for filtration of sand and silt on moderate slopes. Higher slopes and finer materials will increase the necessary width of the buffer.** All of the data suggest that buffer width be tied to soil type and slope. Moreover, the data is replete with reminders that no stream is too small for sediment/nutrient buffers and, in fact, many authors argue that sediment filtration buffers in particular are most important in low-order intermittent or ephemeral headwater streams because these watercourses represent the major conduits of sediment entering the system.

  Although listed as a separate heading in Chart 2 and Appendix A, the general concepts regarding filtration of fecal coliform mirror those discussed above. The primary difference is that recommended buffer widths are generally higher for effective fecal coliform filtration because of both the size of the organism and the necessity of effective buffering for public

health. Johnson and Ryba (1992) published a comprehensive review of research on buffer width and removal of fecal coliform. **Their analysis indicates that buffers between 75 feet and 300 feet are necessary for removal of fecal coliform.** Similar to sediment and nutrient filtration buffers, the width of these buffers is dependent on slope and vegetation type within the buffer.

- Moderation of Water Temperature and Microclimate – Elevated stream temperature can have a profound impact on fish populations by increasing virulence of fish diseases and general stress on fish populations, as well as creating thermal migration barriers for migratory fish, including steelhead/rainbow trout and salmon. Increased stream temperatures can also have a detrimental affect on important macro-invertebrate populations that form the backbone of the aquatic food chain. Forested riparian canopy provides shade, which helps maintain lower summer stream temperatures. **The available research suggests that forested riparian buffers between 50 feet and 140 feet wide are necessary to provide shade and control summer stream temperatures.** It is important to note that these data represent research on the effectiveness of natural buffers and therefore reflect buffer conditions without encroachment from existing land uses.

- Channel Complexity – The bulk of the research that falls into this category is focused on 2 related process: stream meander and inputs of large woody debris to the watercourse. Stream meander is crucial to the maintenance of aquatic habitat because as a stream cuts through its valley, it builds instream complexity by developing floodplains and cutbanks. This natural process of erosion and deposition increases exposure of overhanging woody material and coarse sediments imbedded in the banks, both of which, in turn, increase instream habitat complexity. In addition, although historic stream maintenance efforts have focused on removal of woody debris for flood prevention, large wood plays a vital role in the maintenance and development of pools and meander bends, as well as providing habitat and a food source of stream insects. **Research on channel complexity indicates that 65 feet is the minimum necessary buffer width for woody debris recruitment and channel meander in headwater streams or streams in steep terrain with limited natural floodplain development (Corbett and Lynch 1985). Research also suggest that in wider valley streams, buffers of between 100 feet and 220 feet (approximately 2 to 3 canopy widths or 4X bankfull width) are necessary to provide adequate room for meander and woody debris recruitment.**

- Salmonid Habitat – Protection of salmonid habitat is the driving concern in much of the research coming out of the Northeast and the Northwest. Essentially, protection and restoration of salmonid habitat is dependent on the suite of physical functions listed above (sediment and nutrient filtration, water temperature moderation, channel complexity) in combination with the removal of migration barriers and protection of appropriate instream flows. Of these limiting factors, stream setbacks and the potential resulting buffer functions are the appropriate means to address all but the instream flow component and *physical*

barriers (buffers can address *thermal* barriers that result from a lack of shade in denuded stream reaches), which are imposed by forces beyond the purview of this discussion. Thus, salmonid habitat protection/restoration can be partially realized through the creation of buffers to address the physical properties discussed above. As such, much of the information on salmonid habitat protection is based on existing research captured above. Perhaps the most relevant and current information on buffers and salmonid habitat is contained in Lignon et. al.'s (1999) *Report of the Scientific Review Panel on the California Forest Practice Rules and Salmonid Habitat.* **The basic recommendations for salmonid protection can be distilled down to the following: a minimum 150-foot buffer on Class I streams, a minimum 100-foot buffer on Class II streams, and a 35-foot to 50-foot buffer on Class III streams (these stream classes reflect California Department of Forestry (CDF) classification).** There are also numerous agency reports, such as those developed by the United States Forest Service (USFS), Bureau of Land Management (BLM), and National Marine Fisheries Service (NMFS), that recommend 300-foot buffers on all salmonid-bearing streams.

- Terrestrial Habitats (Reptiles, Amphibians, Birds, and Mammals) – In the Pacific Coast ecoregion, 60% of amphibian species, 16% of reptiles, 34% of birds and 12% of all mammals are classified as "riparian obligates," meaning that their survival is dependent on riparian systems (Kelsey and West 1998). In addition, it is estimated that 70% of all threatened and endangered vertebrate species are riparian obligates (Johnson 1989).

  Although these numbers reinforce the importance of riparian buffers for wildlife habitat, they do not take into account the myriad terrestrial species that use intact riparian corridors for migration, foraging, etc. There appear to be 3 critical physical factors that differentiate riparian habitat from upland habitat: proximity to surface water, perennial moisture (microclimate), and habitat complexity. Access to a water source is a fundamental need of most large mammals. The high moisture environments of riparian systems are often highly productive and provide an array of insect food sources for amphibians, reptiles, birds, and mammals. Riparian microclimates are also important to terrestrial species because they provide varying degrees of moist and cool refugia year round. Habitat complexity is a result of stream meander and floodplain processes caused by periodic flooding. This results in a mosaic of habitat types within riparian buffers. These naturally complex systems offer an array of niches for wetland and terrestrial species, and thus lead to high levels of species diversity. Therefore, maintenance of the basic natural disturbance regime—flooding—is essential to the protection/enhancement of a riparian buffer for wildlife habitat. The literature is filled with research on the requirements of riparian buffers for various species. **These data reveal a minimum buffer width of approximately 100 feet (Rudolph and Dickson 1990) for certain reptiles to over 1600 feet for certain specialized birds (Kilgo et. al. 1998).** Perhaps the most appropriate research comes from the Riparian Habitat Joint Venture (2000), which looks at buffers for specific bird species of local interest. This report cites the warbling vireo, known to occur in riparian habitat in Napa County, and suggests that

this species requires a minimum buffer of 250 feet.

- Plant Diversity – Diversity of flora is generally an indicator of a healthy riparian buffer and by extension a healthy stream. **Spackman and Hughes (1995) found that buffers ranging from 30 feet to 100 feet (depending on the size of the floodplain) were large enough to protect 90% of the local floral biodiversity.**

Review of these data allow us to identify a number of general trends with regard to buffer widths and ecosystem function. In general, the trends illustrated in Chart 1 are supported by the findings reviewed above. Sediment and nutrient filtration functions require that buffers expand in width as slopes increase and soils becomes less developed (i.e., as you move higher in the watershed). On the other hand, microclimate control, inputs of large woody debris, and protection of both meander corridors and the associated riparian wildlife mandate that buffer widths expand as floodplain width expands (i.e. as you move down the watershed). In addition, the research supports the contention that as the goals of riparian buffers change from single function to multiple or system functions, the required buffer widths increase. Once again, Fischer et. al., (2000) in their review of existing literature on riparian buffers, conclude: "Recommended widths for ecological concerns in buffer strips typically are much wider than those recommended for water quality concerns, often exceeding 100m [325 ft] in width."

Review of Existing/Proposed Stream Setback Ordinances

The concept of stream setbacks has recently become a hot topic in urban and rural watersheds throughout the country. A review of recently enacted and proposed setback regulations across the country indicates that there are common pressures driving these processes. The most powerful driving force appears to be the threat (perceived or real) of federally mandated regulation via the Clean Water Act (CWA) and/or the Endangered Species Act (ESA). As such, many of the efforts to develop and implement stream buffers are intended to circumvent externally imposed regulation and address local water quality issues and protect habitat for endangered and/or threatened species. In Napa County, the threat of NMFS's 4(d) rule and the State Water Resources Control Board's 303(d)/(CWA) listing of the Napa River as "impaired" looms large.

In an effort to help local jurisdictions meet CWA and ESA and requirements, several federal efforts have produced general setback guidance and guidelines. As part of EPA's Office of Water stream buffer model ordinance, the Office of Water generated design standards for forest buffers. Under EPA's design standards, forest buffers should be a minimum of 100 feet from the stream, with the requirement to expand the buffer depending on the stream order, percent slope, and proximity to wetlands or other sensitive areas to the stream and buffer. EPA's guidance provides specific examples to adjust buffer width for steep slopes (see Appendix B). PACFISH[1]

1 PACFISH is a joint USFS and BLM strategy for restoring and protecting habitat for anadromous fisheries on federal lands in the west outside of the range of the northern spotted owl

and Forest Ecosystem Management Assessment Team (FEMAT)[2], two complementary federal research initiatives with focus on protection and restoration of anadramous fisheries in federal forest lands from the Bay Area north to Washington and Idaho, both recommend 300-foot no-touch riparian buffers along fish-bearing streams. Although both PACFISH and FEMAT represent setback guidelines for activities on federal lands, NMFS recommends 300-foot riparian buffers along all salmonid-bearing streams in private and public ownership. Finally, the Regional Water Quality Control Board in San Francisco is currently developing stream setback guidelines for streams listed as "impaired" on the State's 303(d) list (S. Potter, pers. comm.).

Although valid scientific research is often the foundation of stream setback regulations, it is often difficult to translate science into policy and regulation. This difficulty is highlighted by 2 conflicting realities.

1. The body of scientific information is based on natural, vegetated, and uncompromised buffers. As such, recommended buffer widths should be considered overly conservative when applied in developed landscapes where intact natural buffers will be difficult to establish.

2. Land is valuable, and socioeconomic forces must be incorporated into the setback equation. Existing agricultural and residential development is difficult, if not impossible to remove from the potential buffers. Thus, setback regulation must be pragmatic and focus on limiting future development in setbacks and encouraging landowners to restore degraded buffers.

Because of this inherent conflict, which is constantly playing itself out in rural and urban areas across the country, it is appropriate to balance a review of the scientific literature with a review of existing and proposed stream setback regulations both nationwide and close to home.

Across the United States, numerous cities and counties have adopted riparian setback polices and ordinances to protect their local resources. The width of stream buffers varies widely depending on the jurisdiction, the resource being protected, and the political realities in the community (Heraty 1993). Heraty conducted a nationwide review of 36 local *urban* buffer/setback programs. He found that most local regulations were composed of fixed-width setbacks. The larger setbacks generally had some type of zonation, which incrementally limited development activities as one moved closer to the stream. Heraty's research also indicates that urban buffers ranged from 20 feet to 200 feet in width, with a median width of 100 feet. In general, the width of the setbacks in most communities was developed to incorporate the 100-year floodplain with additional width to pick-up steep slopes, adjacent wetlands, and critical habitat areas.

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2 FEMAT was commissioned by President Clinton to develop strategies for conducting ecosystem assessments and development land use policies for protection of riparian ecosystem components on federal lands with spotted owls in from Washington state to and portions of California.

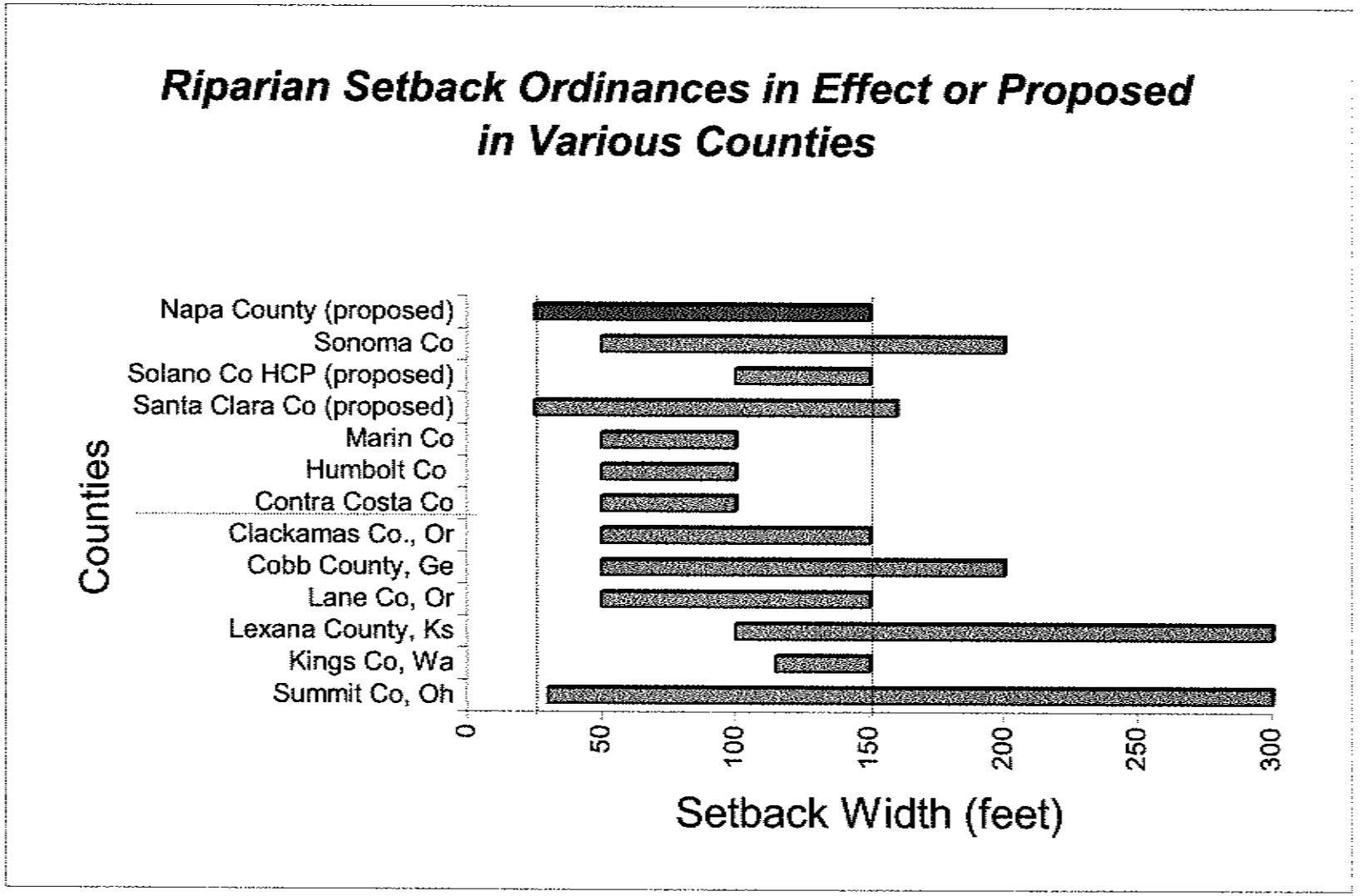
Jones & Stokes conducted research to complement Heraty's work and gather new information regarding recently adopted urban and rural riparian setback ordinances across the county. This research effort was initiated to broaden the context of the local debate and provide a wider range of examples to learn from. The finding include setback ordinances from Summit County, Ohio, where riparian buffer width is based on the size of the watershed. These setbacks range from 30 feet to 300 feet. In Lexana, Kansas, buffer widths vary, ranging from 125 feet to 300 feet, depending on stream order and the sensitivity of the stream. Along the Suwanne River in Florida, established stream buffers widths range from 75 feet to 250 feet, depending on soil type. In both Lane and Clackamus Counties, Oregon, stream buffer width ranges from 50 feet to 150 feet, and is largely based on the size of the stream. Appendix B provides a summary of these findings. Chart 3 provides a graphic comparison of the findings from this research and the currently proposed setbacks for Napa County.

In the San Francisco Bay Area, Sonoma, Marin, and Contra Costa Counties have adopted stream setbacks ranging from 50 feet to 200 feet. Santa Clara County has proposed setbacks of 150 feet for all streams draining into watersheds greater than 1 square mile. The lead agency in the Solano County HCP is currently proposing minimum setbacks of 100 feet from the top of ban or edge of the riparian vegetation (whichever is greater) on all third order and above streams. Other local examples include 100-foot setbacks on all watercourses and springs in the City of Santa Cruz and 100-foot setbacks for all new non-single family development in Palo Alto.

CONCLUSION: A METHODOLOGY FOR DEVELOPING RECOMMENDED SETBACKS FOR NAPA COUNTY STREAMS

The 1991 Conservation Regulations require slope-based stream setbacks for all new land-clearing activities. The fundamental goal of these setbacks is the reduction of fine sediment delivery into Napa County's stream network. Although these setbacks have reduced sediment delivery into Napa County's fish-bearing streams, NRWTF understood that these setbacks were not, "...sufficient to **protect the critical riparian zone** next to streams, particularly in lower slope areas (NRWTF 2000, pg. 23)." Thus, NRWTF was tasked with developing a new set of setbacks that would reflect multiple ecosystem goals, not just sediment filtration. Because a misunderstanding apparently exists among NRWTF members regarding the stream definitions and their associated recommended setbacks, the Napa County Planning Commission asked County staff to conduct a comprehensive review of the existing scientific research and review/revise the existing setback recommendations. The methodology County staff employed consists of balancing 3 elements: (1) science (comprehensive review of the existing research on buffers); (2) socioeconomic pragmatism (review of existing and proposed stream setback ordinances in effect or being proposed elsewhere in the U.S., with a particular emphasis on Bay Area counties and cities); and (3) development of a weighting system (weighting of relative importance of particular buffer functions or suites of functions for each stream class). The first 2 elements are explained in detail in previous sections of this memo. The third element, the weighting system, has been developed to prioritize functional objectives from stream setbacks by stream class. Chart 4 provides a schematic illustration of the general weighting of setback/buffer

Chart 3.

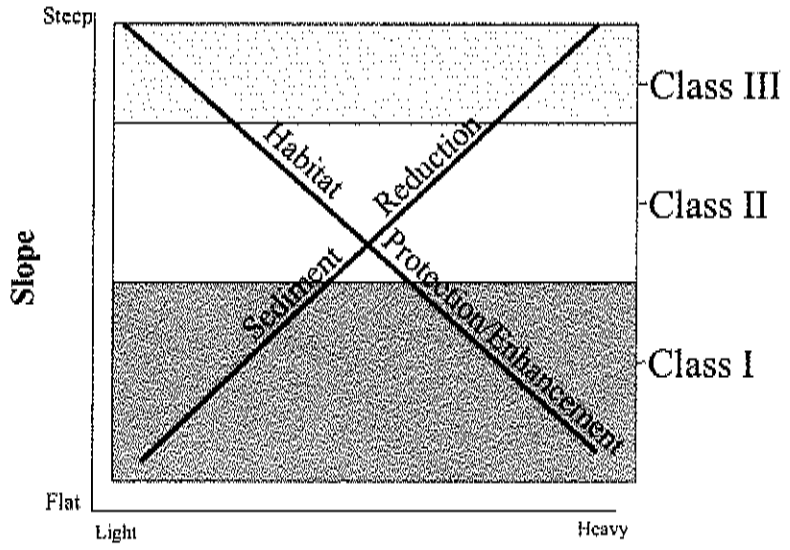

Riparian Setback Ordinances in Effect or Proposed in Various Counties
Napa County (proposed)
Sonoma Co
Solano Co HCP (proposed)
Santa Clara Co (proposed)
Marin Co
Humbolt Co
Contra Costa Co
Clackamas Co., Or
Cobb County, Ge
Lane Co, Or
Lexana County, Ks
Kings Co, Wa
Summit Co, Oh
Counties
0
50
100
150
200
250
300
Setback Width (feet)

functions by stream class.

- Class I Streams – As Chart 4 illustrates, Class I streams are heavily weighted toward ecosystem goals or habitat preservation and enhancement. On these fish-bearing streams, setbacks should be designed to encourage natural stream meander, contribute woody debris, develop mature riparian forest (where applicable), moderate stream temperatures, and facilitate wildlife migration and habitat use. According to the scientific research, buffers ranging from 100 feet to 150 feet on the low end and 300+ feet on the high end would be necessary to accomplish these functional goals. Because the creation of true buffers will not be possible due to existing land uses within the proposed setback, the low end of this range should be considered extremely conservative from a scientific perspective. The science must, in turn, be balanced by socioeconomic concerns and NRWTF's articulated goal of maintaining vital, sustainable agriculture in Napa County. After a comparison with stream setback ordinances elsewhere, it appears that NRWTF's proposed stream setbacks on Class I streams fall within the bounds of current setback regulations in Sonoma and Marin Counties, and those currently proposed in Santa Clara County. As such, although 100 feet of "Non New Development" and 50 feet of "Limited Management" basically reflect the absolute minimum recommendations put forth in the scientific literature, staff believe that these setbacks, if managed properly, will provide many of the desired ecosystem functions.

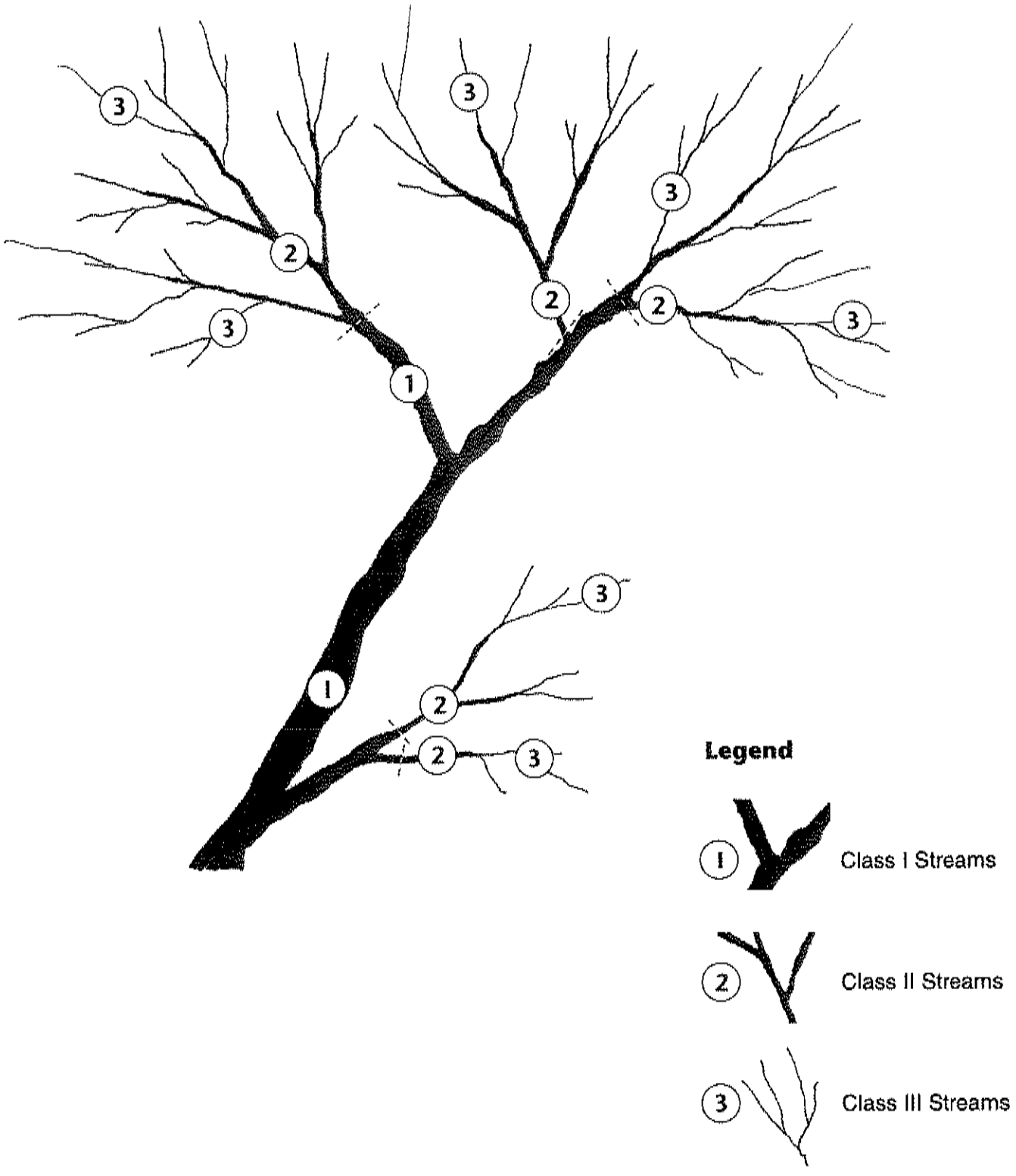
Chart 4.

Generalized Schematic of Weighted Stream Setback Function for Stream Classes



- Class II Streams – Class II streams contain habitat for a suite of non-fish aquatic vertebrate species, but do not contain fish. These streams are found higher in the watershed than Class I streams and generally contain limited natural floodplain development and, as a result, reduced natural riparian corridor widths. Although these riparian corridors are not as wide as what might be found on a Class I stream, they still serve as vital migration corridors and habitat to a wide variety of wildlife. In Napa County, Class II streams generally drain rural watersheds with existing and future land-uses focused on hillside vineyards, livestock grazing, and ranchette development. These earth disturbance-intensive land uses, coupled with steeper hillside slopes, explain why Class II streams currently represent the major sediment conduits into Class I streams. As such, the weighting of functions for Class II streams setbacks should reflect a balance between the need to protect and enhance the existing riparian and stream habitat and the need to reduce sedimentation and nutrient loading, and prevent contamination arising from animal production (i.e., fecal coliform). Because Class II streams occur in more dense drainage networks than do Class I streams (Figure 1), a given landowner is more likely to have multiple Class IIs on their property than Class Is. Thus, from a socioeconomic perspective, Class II setbacks should also reflect the

Schematic of Stream Drainages Illustrating the Increasing Density of Class I, II, and III Streams



potential of multiple burdens on local landowners. For these reasons, a minimum setback of 75 ft with additional setback protection based on slope (i.e., the same formula used in the 1991 Conservation Regulations) is appropriate for meeting an array of both biological and physical functions.

- Class III Streams - Class III streams do not contain aquatic vertebrate or macro-invertebrate species. These streams are generally intermittent or ephemeral and represent the physical transition of runoff moving from sheet flow to concentrated flow in a channel. As such, these streams represent the first point of entry of sediments, nutrients, and/or contaminants into the stream ecosystem. For this reason, Class III streams do require regulation and the setbacks should be heavily weighted toward filtration of sediment and nutrients. The need to buffer sediment and nutrients is balanced by 3 factors: (1) the density of Class III streams within the landscape (Figure 1); (2) the fact that Class III streams drain small watersheds; and (3) the limited potential for natural development of wide limited riparian corridors. Thus, although the 25-foot setback recommended by NRWTF represents the bare minimum buffer for maintaining filtration functions, this setback is appropriate when weighed against the economic costs. The data indicate that this although effective for mitigating sediment transport, this setback will be ineffective for buffering pathogen contamination such as fecal coliform or cryptoporidium.

In summary, the setbacks proposed in this technical memo generally represent the *minimum* setbacks needed to accomplish the specific ecosystem functions highlighted for each stream type. Moreover, although setbacks are an effective regulatory tool for protecting existing resources and preventing future encroachment, the success of Napa County's stream setback program (i.e. improved water quality and enhanced wildlife/fisheries habitat) is dependant upon on the ability of stakeholders to work cooperatively toward realizing stream and riparian restoration within these setbacks.

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APPENDIX A

	Function	Citation	Recommended Width/Range
Physical Properties	**Sediment and Nutrient Reduction**	Corley et. al. 1999	>33 ft
		Nichols et. al. 1998	>60 ft
		Woodward and Rock 1995	>50 ft
		Desbonnet et. al. 1994	80 ft
		Peterson et. al. 1992	>33 ft
		Castelle et. al. 1992	>50 ft
		Schellinger and Clausen 1992	75 ft
		Welsch 1991	>85 ft
		Dillaha et. al. 1989	>30 ft
		Gilliam and Skaggs 1988	290 ft- 50% sediment deposition
		Budd et. al. 1987	50 ft
		Jacobs and Gilliam 1985	50 ft
		Lynch et. al. 1985	98 ft
		Erman et. al. 1983	98 ft
		Lowrance 1984	60-120 ft
		Moring 1982	98 ft
		Young et. al. 1980	80 ft
		Erman et. al. 1977	98 ft
		Karr and Schlosser 1977	75% removal 98-125 ft
		Broderson 1973	50-200 ft (one tree height)
		Wilson 1967	49 ft (silt), and 400 ft (clay)
	Removal of Fecal Coliform	Johnson and Ryba 1992*	75-300 ft
	Moderation of Stream Temperature/Microclimate	Lynch and Corbett 1990	100 ft
		Jones et. al. 1988	100-140 ft
		Lynch et. al. 1985	98 ft
		Steinblums et. al. 1984	75-125 ft for 60-80% shade
		Hewlet and Fortson 1982	50-100 ft
	Channel Complexity	Marcus 2002	4X bankfull width
		Brosofske et. al. 1997	>145 ft
		Chapel et. al. 1992	135-220 ft
		Lynch et. al. 1985	65-100 ft
Biological Properties	**Salmonid Habitat**	Ligon et. al. 1999	>150 ft
		USFS/BLM 1994	300 ft
		Welsch 1991	>85ft
	Reptile/Amphibian Habitat	Burbink et. al. 1998	>325 ft
		Semlitsch 1998	540 ft
		Buhlmann 1998	440 ft
		Rudolph and Dickson 1990	98 ft
	Bird Habitat	RHJV 2000	250 ft
		Whitaker and Montevechi 1999	>160 ft
		Hagar 1999	>130 ft
		Kilgo et. al. 1998	>1600 ft
		Richardson and Miller 1997	>160
		Mitchell 1996	>325 ft
		Hodges and Krementz 1996	>325 ft
		Spackman and Hughes 1995	450 ft for 90% of species diversity
	Mammal Habitat	Dickson 1989	>160 ft
	Plant Diversity	Spackman and Hughes 1995	30-100 ft for 90% of species
	General Riparian/Ecosystem Function	Levey et. al. 2002	>80 ft
		NH FSSWT 2000	100 ft, 300 ft, 600 ft by stream order
		Spence et. al. 1996	98-145 ft
		Johnson and Ryba 1992*	> 98 ft
		Chapel et. al. 1992	160-650 ft
		Welsch 1991	>85ft

*article does not present new data, but instead is a review of existing data

APPENDIX B

Local Setback Ordinances Currently in Effect or Proposed	**Buffer Width**
Sonoma County	upland/urban = 50ft Russian River = 200ft flatland/valleys = 100ft
Marin County	coastal/rural = 100ft urban = 50ft
Humbolt County	100 ft perennial streams 50 ft intermittent streams
Santa Cruz County	50 ft no development zone on perennial streams 30 ft no development zone on intermittent streams
Contra Costa County	Development near Natural Creeks and Streams • new urban development = 50 ft • buildings = 30-50 ft (depending on site specific calculations) • intensification of cattle grazing = 100 ft (as part of discretionary use permit)
Santa Clara County (proposed)	150ft on all streams draining watersheds ≥ 1mi^2 (320 acres), unclear on smaller drainages
Solano County HCP	Lead agency is proposing a minimum 100 ft setback from top of bank or edge of existing riparian vegetation, whichever is greater on all 3rd order or higher streams
City of Palo Alto	100 ft buffer zone for any development other than single family residential
City of Santa Cruz	all watercourses = 100ft

Selected Setback Ordinances in Effect Elsewhere in the U.S.	
Clackamas County, Oregon	Principal River 100 -150 ft from MHW Large Streams - 100 ft from MHW Medium Stream - 70 ft from MHW Small Stream - 50 ft from MHW
Cobb County, Georgia	50-200 ft depending on the size of the watershed
Lane County, Oregon	Large Streams w/ T&E species = 150 ft Other streams with T&E species = 125 ft Fish-bearing streams w/o T&E = 50-100 ft
Lexana County, Kansas	Sensitive Streams: • Stream order 1 = 150 ft • Stream order 2 = 250 ft • Stream order 3 = 300 ft

	Restorable Streams: • Stream order 1 = 125 ft • Stream order 2 = 200 ft • Stream order 3 = 250 ft Impacted Streams: • Stream order 1 = 100 ft • Stream order 2 = 150 ft • Stream order 3 = 200 ft
Kings County, Washington	150 ft - if property is outside urban growth area 115 ft - if property is inside urban growth area
Summit County, Ohio	Watershed >300 sq.mi. =300 ft Watershed >20 sq. mi. = 100 ft Watershed <.5 sq. mi.=30-75 ft
Suwanne River, Florida	75-250 ft depending on soil type

Generic Setbacks

EPA Ideal	100 ft minimum + slope variable • 15-17%= +10 ft • 18-20%= +30 ft • 21-23%= +50 ft • 24-25%= +60 ft
USFS, Northeastern Area Recommendations (Welsh 1991)	95 ft min (zone 1=15 ft; zone 2 min = 60; zone 3 min = 20 ft)
Storm Water Center	100 ft to 150 ft min (zone 1 = 25 ft min, zone 2 = 50 ft to 100 ft, zone 3 = 25 ft min)
Kondolf et. al. 1996	2 zones: inner zone is fixed, but based on veg. community type and energy; outer zone variable, but based on proximity to stream, hillside steepness, soil erodibility
NRCS	general purpose buffer – min. 15 ft from top of bank or normal water line To reduce excess amounts of sediment, organic matter, nutrients, pesticides – 2 zones: min 100 ft or 30% of the geomorphic flood plain whichever is less, but not less than 35 ft
Oregon Forest Practices Act - Commercial Timber Harvesting on Private Forest Land	100 ft from fish bearing streams

Exhibit D

Central Coast Regional Water Quality Control Board

July 13, 2021

Ocean Breeze International
c/o Rene Van Wingerden
3910 N. Via Real
Carpinteria, CA 93013
Email: rene@oceanbreezeintl.com

via Certified and Electronic Mail
No. 7020 1810 0002 0773 8033

Ocean Breeze Properties
4601 Foothill Road
Carpinteria, CA 93013

via Certified Mail
No. 7020 1810 0002 0773 8026

Dear Landowner / Responsible Party:

ENFORCEMENT PROGRAM: OCEAN BREEZE INTERNATIONAL AND OCEAN BREEZE PROPERTIES, 3900 N. VIA REAL, CARPINTERIA, SANTA BARBARA COUNTY – NOTICE OF VIOLATION FOR FAILURE TO SUBMIT A REPORT OF WASTE DISCHARGE AND FOR UNAUTHORIZED DISCHARGES TO WATERS OF THE UNITED STATES, AND REQUIREMENT TO SUBMIT A TECHNICAL REPORT

The California Regional Water Quality Control Board (Central Coast Water Board) is a state regulatory agency with the responsibility for protecting the quality of the waters of the state within its area of jurisdiction. The Central Coast Water Board has authority to require submission of information, direct action, establish regulations, levy penalties, and bring legal action when necessary to protect water quality.

Background

On May 3, 2021 and May 7, 2021, the Central Coast Water Board received documentation that demonstrates significant nutrient-laden discharges are occurring from greenhouses located at 3900 N. Via Real in Carpinteria (Santa Barbara County Assessor Parcel (APN) 005-430-042). The alleged discharges are entering a tributary to Carpinteria Marsh (El Estero Marsh), a water of the United States, and may be causing or contributing to algal blooms in the western portion of the marsh.

Central Coast Water Board staff understand that the property owner for this property is Ocean Breeze International, Inc. Our records also indicate that on December 2, 2019, the Central Coast Water Board issued Ocean Breeze Properties a requirement to obtain regulatory coverage to operate commercial irrigated lands on that parcel.

The purpose of this letter is to notify Ocean Breeze International and Ocean Breeze Properties of alleged violations and to require a technical report pursuant to California Water Code section 13267 by **August 12, 2021**, as described in further detail in this letter.[1]

Unauthorized Discharges of Waste

The discharges from the property located at 3900 N. Via Real are unauthorized waste discharges to Carpinteria Marsh (El Estero Marsh), a waters of the United States, and constitute a violation of Clean Water Act section 301, which prohibits all discharges to United States waters except those authorized by permit.

California Water Code (Water Code) section 13385 provides that any person who violates the Clean Water Act section 301 may be subject to administrative civil liability of up to $10,000 for each day the violation occurs, and up to $10 per gallon of waste discharged but not cleaned up over 1,000 gallons. Alternatively, the court may impose civil liability of up to $25,000 for each day the violation occurs, and up to $25 per gallon of waste discharged but not cleaned up over 1,000 gallons.

Failure to Obtain Regulatory Coverage

On December 2, 2019, the Central Coast Water Board sent Ocean Breeze Properties the attached directive letter to obtain regulatory coverage to operate commercial irrigated lands at APNs 005-430-042, 005-430-043, and 004-003-007. The Central Coast Water Board directed Ocean Breeze Properties to respond to the letter in writing within 30 calendar days of receiving it, by doing one of the following:

- Submit a Report of Waste Discharge[2]
- Confirm existing regulatory coverage
- Confirm the operation was not required to obtain regulatory coverage

The Central Coast Water Board does not have record of a response from Ocean Breeze Properties to the December 2, 2019 directive letter. The directive to obtain regulatory coverage to operate commercial irrigated lands at APNs 005-430-042, 005-430-043, and 004-003-007 is still in effect. **You must immediately comply with the attached December 2, 2019 directive letter.**

The Central Coast Water Board may impose penalties of up to $1,000 per day pursuant to Water Code section 13261, for failing to comply with the requirement to obtain

[1] Failure to timely comply with this directive may subject you to penalties pursuant to Water Code section 13268.

[2] The electronic Notice of Intent is located on the GeoTracker website at the following link: https://geotracker.waterboards.ca.gov/agland/noi_operation_info.asp. Select Region 3 - Central Coast from the initial dropdown menu. Central Coast Water Board staff changed this link since the issuance of the December 2, 2019 letter.

regulatory coverage as described in the attached letter. As of the date of this notice of violation, you are approximately 557 days late in obtaining regulatory coverage.

Water Code section 13261 states, in relevant part:

a) Any person failing to furnish a report or pay a fee under section 13260 when so requested by a regional board is guilty of a misdemeanor and may be liable civilly in accordance with subdivision (b).
b) (1) Civil liability may be administratively imposed by a regional board … in an amount that may not exceed one thousand dollars ($1,000) for each day in which the violation occurs.

The Central Coast Water Board reserves its right to take any enforcement action authorized by law, including seeking penalties for unauthorized discharges and for failure to obtain regulatory coverage.

Requirement to Submit Technical Report

The Central Coast Water Board requires Ocean Breeze International and Ocean Breeze Properties to submit a technical report that, at a minimum, includes:

a) Details on operations for APN 005-430-042.
b) A map showing the points and pathways of discharge from APN 005-430-042.
c) A sampling and analysis plan for discharge sampling.
d) Sampling results at all discharge points from APN 005-430-042.
e) Management measures implemented (or planned to be implemented) to treat discharge or otherwise ensure discharge from APN 005-430-042 is not causing or contributing to algal blooms, is not causing or contributing to exceedances of water quality objectives, and is protective of beneficial uses in Carpinteria Marsh (El Estero Marsh).

Central Coast Water Board Staff Site Inspection

Central Coast Water Board staff intends to conduct a site visit at 3900 N. Via Real to document site conditions at the operation. We plan to conduct that inspection on **August 19, 2021 at 10:30 AM**. The attendance of a responsible party or landowner is preferred. If their attendance is not possible, access to the operation must be provided to Central Coast Water Board staff on that date and time. Alternatively, you may propose an alternative date and/or time within 10 business days of the date of this letter via e-mail to Paula Richter at Paula.Richter@waterboards.ca.gov. The site visit will take 60 to 90 minutes. All areas of the operation must be available for inspection. We will meet at the entrance to the greenhouse on 3900 N. Via Real.

Legal Requirements

The requirement that Ocean Breeze International and Ocean Breeze Properties submit a technical report that includes operator information, a map showing points of discharge from the operation, pathways of discharge from the operation, a sampling and analysis plan for follow-up sampling, sampling results of discharge(s) from the operation, and management measures implemented (or planned to be implemented) to treat discharge or otherwise ensure discharge from APN 005-430-042 is not causing or contributing to algal blooms, is not causing or contributing to exceedances of water quality objectives, and is protective of beneficial uses in Carpinteria Marsh (El Estero Marsh) for the operation located at the 3900 N. Via Real Parcel by **August 12, 2021** is made pursuant to section 13267 of the California Water Code.

The Central Coast Water Board needs the required information to ensure that waste discharges from APN No. 005-430-042 are not causing threats to water quality and public health. Ocean Breeze International and Ocean Breeze Properties are required to submit this information because Central Coast Water Board records indicate that Ocean Breeze International and Ocean Breeze Properties are the owners and operators of the operation at 3900 N. Via Real in Carpinteria. The alleged nutrient-laden discharges described in this letter are occurring from greenhouses located at APN 005-430-042.

Many of the items required above provide information about the operation and ownership history of APN 005-430-042, and within your possession and control. The cost of hiring a technical assistance provider to develop and submit the technical report required in this letter is estimated to be in the range of $1,440 to $1,920.[3] The requirement for a technical report is needed to assist the Central Coast Water Board in evaluating the alleged nutrient-laden discharges and its impacts to water quality and public health. Thus, the burden, including costs of the technical report, bears a reasonable relationship to its need and the benefits to be obtained.

Any person affected by the Central Coast Water Board's section 13267 requirements described herein may petition the State Water Resources Control Board (State Water Board) to review the action in accordance with section 13320 of the California Water Code and title 23, California Code of Regulations, section 2050. The petition must be received by the State Water Board, Office of Chief Counsel, P.O. Box 100, Sacramento, California 95812 within 30 days of the date of this order. Copies of the law and regulations applicable to filing petitions are available at: https://www.waterboards.ca.gov/public_notices/petitions/water_quality/wqpetition_instr.shtml.

[3] Cost estimates provided by technical assistance providers that serve the Central Coast region to conduct this work at an average hourly rate of $160. Cost estimates represent responding to the directive letter (one to two hours) and collection and submission of discharge information required by this letter (eight to ten hours).

Should you have any questions about this letter, please contact Paula Richter at Paula.Richter@waterboards.ca.gov or (805) 549-3865 or Jamie Pratt at Jamie.Pratt@waterboards.ca.gov or (805) 549-3761.

Sincerely,

Harvey C. Packard
2021.07.13 13:48:41 -07'00'

for Thea S. Tryon
Assistant Executive Officer

Attachment: Directive Letter issued December 2, 2019

cc (with attachment):

Julie Macedo, State Water Board; Julie.Macedo@waterboards.ca.gov
Thea Tryon, Central Coast Water Board; Thea.tryon@waterboards.ca.gov
Tamara Anderson, Central Coast Water Board; Tamara.Anderson@waterboards.ca.gov
Paula Richter, Central Coast Water Board; Paula.Richter@waterboards.ca.gov
Jamie Pratt, Central Coast Water Board; Jamie.Pratt@waterboards.ca.gov

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December 2, 2019

CERTIFIED MAIL: 7019-2280-0000-9502-0407
OCEAN BREEZE PROPERTIES
4601 FOOTHILL RD
CARPINTERIA, CA 93013

Si necesita ayuda deje un mensaje al (805) 549-3148

如果協助必要用中文，請叫 (805) 549-3148

Dear Landowner / Responsible Party:

REQUIREMENT TO OBTAIN REGULATORY COVERAGE TO OPERATE COMMERCIAL IRRIGATED LANDS

You are receiving this letter because, based on information available to staff of the Central Coast Regional Water Quality Control Board (Central Coast Water Board), you own the parcel/s of land listed below and may be conducting commercial irrigated agricultural activities on them. The parcels listed below may be in operation without the appropriate regulatory coverage. Discharges of waste from commercial irrigated agricultural activities are regulated by the Central Coast Water Board.

APNs:	005-430-042 005-430-043 004-003-007
County:	Santa Barbara
Address / Location:	3900, 3910 VIA REAL AND 4697 FOOTHILL RD

You must respond to this letter in writing within 30 calendar days of receiving this letter, by doing one of the following:

- Submit a Report of Waste Discharge.
- Confirm Existing Regulatory Coverage.
- Confirm You Are Not Required to Obtain Regulatory Coverage.

Agricultural Order

On March 8, 2017, the Central Coast Water Board approved Order No. R3-2017-0002, *Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands*, also known as the Agricultural Order[1]. The Agricultural Order addresses the discharge of waste from irrigated lands to surface water and groundwater, including but not limited to irrigation return

[1] The Central Coast Water Board has regulated commercial irrigated agricultural lands since 2004. Order No. R3-2017-0002 is the most recent version of the Order, and is available here: https://www.waterboards.ca.gov/centralcoast/water_issues/programs/ag_waivers/.

flows, tailwater, drainage water, stormwater runoff, runoff resulting from frost control, and/or operational spills. These discharges can contain wastes that could affect the quality of waters of the State and impair beneficial uses.

The Agricultural Order regulates discharges from irrigated lands where commercial crops are grown including (1) discharges of waste from irrigated lands, including, but not limited to, land planted to row, vineyard, field, and tree crops where water is applied for producing commercial crops; (2) discharges of waste from commercial nurseries, nursery stock production, and greenhouse operations with soil floors that do not have point-source type discharges and are not currently operating under individual waste discharge requirements; and (3) discharges of waste from lands that are planted with commercial crops that are not yet marketable, such as vineyards and tree crops. The Agricultural Order applies to all owners and/or operators of commercial irrigated lands in the Central Coast Region

Requirement to Submit a Report of Waste Discharge

Pursuant to California Water Code section 13260, you must obtain regulatory coverage prior to conducting commercial irrigated agricultural activities.

Water Code section 13260 states, in relevant part:

(a) Each of the following persons shall file with the appropriate regional board a report of the discharge, containing the information which may be required by the regional board:
   (1) Any person discharging waste, or proposing to discharge waste, within any region that could affect the quality of waters of the state, other than into a community sewer system.

A report of waste discharge must contain information and data required by the Central Coast Water Board, unless the Central Coast Water Board waives such requirement[2]. The Agricultural Order identifies commercial irrigated agricultural activities as sources of waste discharges (e.g., sediment, fertilizers, and pesticides) that affect the quality of waters of the state. Persons owning or operating facilities conducting such activities are discharging waste or proposing to discharge waste and must therefore file a report of waste discharge. In the Central Coast region, this requirement is satisfied by filing an electronic Notice of Intent as described below (also referred to as "obtaining regulatory coverage" or "enrolling"). All owners and operators of commercial irrigated lands in the Central Coast region are required to file an electronic Notice of Intent to comply with the Agricultural Order.

Therefore, the Central Coast Water Board requires that you obtain regulatory coverage for your commercial irrigated agricultural activity by submitting a report of waste discharge unless conditions 2 or 3 below apply.

You must respond to this letter in writing within 30 calendar days of receiving this letter, by doing one of the following:

1. **Submit a Report of Waste Discharge.**
   You must submit a completed electronic Notice of Intent according to Agricultural Order Conditions 54 through 60. The electronic Notice of Intent is located on the Central Coast

[2] While the Agricultural Order is a conditional waiver, it does **not** waive the Water Code section 13260 requirement to file a report of waste discharge in the form of an electronic Notice of Intent to comply with the Agricultural Order.

Water Board's website at the following link:

http://www.waterboards.ca.gov/centralcoast/water_issues/programs/ag_waivers/noi_submittal.shtml

Review and follow the instructions in *Attachment 1: How to Enroll*

2. **Confirm Existing Regulatory Coverage.**
You must submit documentation that demonstrates that you have already submitted an electronic Notice of Intent and the parcels are properly enrolled in the Agricultural Order.

To confirm your enrollment you must complete, sign, and submit to the Central Coast Water Board *Attachment 2: Enrollment Confirmation*, or

3. **Confirm You Are Not Required to Obtain Regulatory Coverage.**
You must submit documentation that confirms you received this notice, but one or more of the following situations apply:

a. You no longer own the parcel(s) identified above,
b. The parcel(s) are not used for commercial agriculture purposes,
c. The parcel(s) are not irrigated agriculture,
d. The parcel(s) are used for cannabis production.
For further information on the Cannabis Program, please contact (805) 594-6194 or CentralCoast.Cannabis@waterboards.ca.gov.

To confirm you are not required to obtain regulatory coverage under the Agricultural Order, you must complete, sign, and submit to the Central Coast Water Board *Attachment 3: Not Required to Enroll Confirmation*.

The requirement that you submit a report of waste discharge (electronic Notice of Intent) is required pursuant to California Water Code section 13260. **Failure to provide the required information may subject the operator and landowners to enforcement action by the Central Coast Water Board, including civil administrative liability penalties of up to $1,000 per day for each day the violation occurs, pursuant to California Water Code section 13261.** If the Central Coast Water Board imposes a penalty, the required information still needs to be submitted. The Central Coast Water Board reserves to right to take any enforcement action authorized by law.

Once you are successfully enrolled, you must then comply with the requirements of the Agricultural Order, including but not limited to individual or group monitoring and reporting, and the development and implementation of a Farm Water Quality Management Plan. For a copy of the requirements and general information about the Central Coast Water Board's Irrigated Lands Regulatory Program, please visit:

http://www.waterboards.ca.gov/centralcoast/water_issues/programs/ag_waivers/index.shtml

The Agricultural Order is a conditional waiver of waste discharge requirements. Enrollment under the Agricultural Order is based on compliance with the Agricultural Order conditions. As described in Agricultural Order Conditions 4, 7, and 8, failure to comply with Agricultural Order conditions may result in termination of enrollment and issuance of individual waste discharge requirements. Though individual waste discharge requirements are similar in some ways, in

comparison to general waivers such as the Agricultural Order, individual waste discharge requirements typically result in greater and more specific oversight by the Central Coast Water Board, higher application and annual fees, as well as individual monitoring and reporting requirements specific to the parcels you operate.

If you have any questions regarding this matter, or wish to contact the Central Coast Water Board, please contact Corinne Huckaby at (805) 549-3504 (or email Corinne.Huckaby@waterboards.ca.gov).

Para información en español llame y deje su mensaje al (805) 549-3881 (o por correo electrónico al Monica.Barricarte@waterboards.ca.gov).

Or write to:
Central Coast Water Board
Attn: Irrigated Lands Regulatory Program
895 Aerovista Place Suite 101
San Luis Obispo, CA 93401

Sincerely,

Elaine Sahl

for John M. Robertson
Executive Officer

Attachments:

1. How to Enroll
2. Enrollment Confirmation
3. Not Required to Enroll Confirmation

Cc:

Julie Macedo, Attorney IV
State Water Resources Control Board

Todd Stanley, Water Resource Control Engineer
Central Coast Water Board

ATTACHMENT 1

HOW TO ENROLL

How to enroll in the Irrigated Lands Regulatory Program, Agricultural Order: Enrolling in the Irrigated Lands Regulatory Program is straightforward and completed electronically. To enroll, owners or operators must submit an electronic Notice of Intent (eNOI) for their agricultural operation and individual farm(s)/ranch(es).

Prior to filling out the eNOI, you will need the following information:

- Operation contact information
- Landowner contact information
- Ranch operator contact information
- Assessor parcel number(s)
- Farm water quality education hours
- Ranch map(s) and location
- Total irrigated acreage
- Total tailwater acres
- Irrigation type(s)
- Crop type(s)
- Pesticide permit information
- Name of any waterbodies near farm/ranch

To access the eNOI, go to:
http://www.waterboards.ca.gov/centralcoast/water_issues/programs/ag_waivers/noi_submittal.shtml

To access the eNOI Instructions, go to:
https://www.waterboards.ca.gov/rwqcb3/water_issues/programs/ag_waivers/docs/enoi/2019_enoi_fielddescriptions.pdf

Technical Assistance:
Most owners and operators complete the eNOI successfully themselves; however, technical assistance providers are available to assist you, if necessary. The website includes a list of technical assistance providers, some of whom may charge a fee. You may also contact Central Coast Water Board staff at (805) 549-3148 for assistance. To complete your eNOI submittal, you will be prompted to print a copy that you must sign and mail to the Central Coast Water Board. Upon receipt of the required eNOI information and signature page, your irrigated agriculture operation/business will be enrolled under the Irrigated Lands Agricultural Order, unless the Central Coast Water Board determines otherwise.

Surface Water Quality Monitoring Requirements and Permit Fees:
Upon enrollment, you are required to pay permit fees and begin surface water quality monitoring. If you select cooperative monitoring in your eNOI, a third-party organization - the Central Coast Water Quality Preservation Inc. (CCWQP), can assist you in complying with the surface water quality monitoring requirements and paying the necessary permit fees at a decreased rate. If you select individual monitoring in your eNOI, you are responsible for conducting individual surface water quality monitoring and paying the necessary permit fees at an increased rate.

ATTACHMENT 2

ENROLLMENT CONFIRMATION

If you **have submitted** an electronic Notice of Intent (eNOI), please complete this form and return it to the Central Coast Water Board to confirm your enrollment of the applicable assessor parcel numbers (APNs).

AW #(s):	
eNOI Submittal Date(s):	
Operation Name(s):	
# of Ranches Enrolled:	
APNs Enrolled:	
Comments / Explanations:	

I certify under penalty of perjury under the laws of the State of California that to the best of my knowledge and belief, the information provided above is true, accurate, and complete.

Print Name

Title

Signature

Date

MAIL COMPLETED FORM TO:

Central Coast Water Board
ATTN: Irrigated Lands Program
895 Aerovista Place, Suite 101
San Luis Obispo, CA 93401

ATTACHMENT 3

NOT REQUIRED TO ENROLL CONFIRMATION

I am not required to enroll in the Irrigated Lands Regulatory Program because (select all that apply and provide information):

A) I no longer own the parcels identified in the letter.
Provide information regarding current ownership of the parcels identified in the letter:

B) The parcels identified in the letter are not used for commercial agriculture purposes. Provide information on what type of operation is currently operating on the parcels identified:

C) The parcels identified in the letter are not used for irrigated agriculture purposes. Provide information on what type of operation is currently operating on the parcels identified, and what type of irrigation system is on the parcels:

D) The parcels identified in the letter are used for cannabis production.
Provide your WDID or application number to confirm your enrollment in the Cannabis Program.

I certify under penalty of perjury under the laws of the State of California that to the best of my knowledge and belief, the information provided above is true, accurate, and complete.

Print Name	Title
Address	APNs
Signature	Date

MAIL COMPLETED FORM TO:

Central Coast Water Board
ATTN: Irrigated Lands Program
895 Aerovista Place, Suite 101
San Luis Obispo, CA 93401

Exhibit E

OCTOBER 25, 2016

BLOG, SPECIAL EDITION: DEAR MADAM/MISTER PRESIDENT

New Toxic Substances Control Act: An End to the Wild West for Chemical Safety?

by Cory Gerlach
figures by Tito Adhikary

There are currently more than 85,000 chemicals in the US that make up the products in our daily lives and few, besides medications and pesticides, have been assessed thoroughly for safety. In fact, the federal government has had relatively little oversight over most chemicals in commerce (Figure 1). As a result, nearly all of the chemicals in our cosmetics, clothing, furniture, electronics, cleaning products, gasoline, and construction materials have not been

tested. This has led to certain chemicals like asbestos and lead remaining in the marketplace for decades before their detrimental effects on human health were recognized. Until recently, the United States has been like the Wild West with regards to chemical regulation.

Figure 1: Everything we see, hear, taste, smell or touch is made up of chemicals. Chemicals are found in cosmetics, clothing, furniture, electronics, cleaning products, gasoline and construction materials. Unfortunately, few of them have been tested for safety before entering commerce.

The Frank R. Lautenberg Chemical Safety for the 21st Century Act intends to address many of these problems. The Environmental Protection Agency (EPA) will finally have the authority to require testing of every new chemical that enters the marketplace and can also ban chemicals if they are shown to pose risks to human health or the environment. This new law was passed overwhelmingly by Congress and was signed by President Obama in June 2016, after receiving enormous support from public health and environmental groups as well as the chemical industry. But now the question becomes: will the new law keep us safe?

What is chemical safety anyway?

In toxicology, the guiding principle is "the dose makes the poison." This means that any chemical, including water, could be toxic if given in high enough amounts over a short enough time. Before prescription drugs can be safely given to people, for instance, pharmaceutical companies must first conduct thorough toxicity studies in the lab (Figure 2). In most cases,

small animals (like mice and rats) are given the drug at increasing doses and assessed for short- and long-term side effects. These side effects may include changes in behavior, appetite, or serious responses such as cancer, organ failure, reproductive problems, or death. If a safe dose is determined in at least two animal species, drugs may then be given to a small group of human volunteers who are monitored for any negative reactions. Pesticides go through a similar level of scrutiny to determine concentrations that are safe to humans and the environment. However, what has separated drugs and pesticides from the chemicals in most other consumer products is that there has been little toxicity testing and few limitations on exposure from the latter. Other than some short-term tests like ensuring that a chemical does not cause a serious skin reaction, most chemicals are not assessed for long-term effects such as their ability to cause cancer or affect brain development.

Figure 2: Pharmaceuticals must undergo multiple levels of toxicity testing before they are approved for human use. This includes extensive preclinical testing in animals such as mice and rats before going through successive stages of human testing with increasing numbers of diverse patients. However, before the Frank R. Lautenberg Chemical Safety for the 21st Century Act passed early in 2016, chemicals in consumer products underwent little or no toxicity testing before being approved.

Did any regulations exist before the new law passed?

Forty years ago, the Toxic Substances Control Act (TSCA) granted the EPA the responsibility to ensure the safety of chemicals in manufactured products. At first glance, it appeared that the law would work, but over time TSCA was largely viewed as a failure. First, TSCA exempted the 60,000-plus chemicals that were already in use before 1976 from any new testing. Second, though TSCA required all new chemicals to be approved by the EPA before reaching market, companies were only mandated to submit toxicity data that they had already generated. That meant that the EPA would have to judge chemicals based only on the limited information it was given. After passing this stage, or if the EPA did not make a ruling after 90 days, chemicals could then enter the marketplace without further oversight.

Since TSCA became law, the EPA has placed legal limits on the production of only a handful of chemicals, deemed The Toxic Five (Figure 3). This is largely because the burden of proof has been on the EPA to show that a chemical posed an "unreasonable risk" to public health or the environment. Moreover, the EPA was also required to choose the "least burdensome" regulation while considering both public health and the impact on the manufacturer. For example, the EPA previously attempted to use TSCA to institute a total ban on asbestos, which was ubiquitous in building materials and is still responsible for thousands of deaths in the US each year. However, the courts overturned the EPA's complete ban in 1991 because they determined the agency did not choose the least burdensome regulation. Because of the difficulty regulating chemicals using TSCA, the EPA has mostly suggested a "voluntary phase-out" for other potentially harmful chemicals like flame retardants, which they admit are linked to learning disorders in children.

Figure 3: The so-called Toxic Five include cancer-causing compounds like asbestos, dioxin,

polychlorinated biphenyl ethers and hexavalent chromium, as well as fully halogenated chlorofluorocarbons, which were responsible for the holes in the ozone layer. These are the handful of chemicals that have been regulated by the EPA using TSCA. However, TSCA was not strong enough to sustain a total asbestos ban.

What does the new law actually do?

The Frank R. Lautenberg Chemical Safety for the 21st Century Act finally gives the EPA the authority to ban new and existing chemicals that pose a risk to human health and the health of the environment. To do this, the EPA must now make an affirmative determination on all new chemicals and all new uses of existing chemicals. Importantly, the EPA can now require more toxicity testing before chemicals are approved and, without considering economic impacts to the company, stop chemicals or limit their use based on the scientific evidence regarding human and environmental health. In addition, the EPA must develop a screening process for all existing chemicals that ranks them according to their level of risk. They will then develop a risk management strategy for chemicals that raise concerns.

The new overhaul also includes many provisions that will protect the greatest number of people while also ensuring innovations in science. For instance, all chemicals will be evaluated with considerations for vulnerable sub-populations (such as pregnant women and small children), in addition to possible chemical accumulation up the food chain. Furthermore, animal welfare will be increased due to new requirements to reduce, improve and ultimately replace vertebrate animal testing. New methods of assessing toxicity will be further developed such as computer programs that model how a chemical interacts within the body, biological markers that predict toxicity using human tissue, and building models using human cells from different organs that create the human body on a chip. To fund the law, companies will be required to pay fees to the EPA for evaluating data and regulating chemicals as well as for testing new chemicals should companies choose to outsource this responsibility. Lastly, nearly every aspect of the new law requires strict and enforceable deadlines for its implementation.

How did these new regulations pass Congress?

Back in 2011, Senator Frank Lautenberg (D-NJ) made it his mission to finally put some teeth into TSCA. He earned early bipartisan support from Senator David Vitter (R-LA), an ally of the chemical industry, and by 2013 had the backing of senators from both parties. However, there was one big snag: whether any future federal rulings would supersede state regulations. Over

the last few decades, states like California and Massachusetts had tightened their chemical safety laws in the absence of strong federal oversight. The chemical industry, however, argued that disparate state laws made it too difficult to conduct business and that any new reforms should include uniform federal standards. Because of concern that the overhaul could threaten the autonomy of states to impose tighter regulations than the federal government, the chairwoman of the committee with jurisdiction over TSCA, Barbara Boxer (D-CA), temporarily halted the reform efforts. Shortly after, Senator Lautenberg passed away and TSCA reform was increasingly uncertain.

Senator Vitter then joined forces with Senator Tom Udall (D-NM) to keep the momentum moving forward. Eventually, Senator Boxer struck an agreement that ensured that the EPA could not supersede chemical laws enacted in states before 2016. Everyone agreed though that when the EPA makes a ruling on a specific chemical or its use, it would preclude states from issuing any new regulations on that matter. Chemical safety advocates such as the Environmental Defense Fund applauded the new authority that would be given to the EPA, and industry groups like the American Chemistry Council supported the establishment of uniform federal standards. In the end, the Frank R. Lautenberg Chemical Safety for the 21st Century Act passed with overwhelming support. Congress prioritized bipartisanship throughout this process and many are hopeful that both parties will continue to support its implementation well into the future.

How will this new law be implemented?

Currently, the EPA is seeking public comment for some aspects of how the new reforms will be implemented, which was required by the law. Time will tell whether the new law has the regulatory bravado Senator Lautenberg once envisioned. Because of the legacy of TSCA and its previous vulnerabilities in court, there is some concern that aspects of the new law could be challenged in the future. Still, public health advocates and industry groups involved in drafting this law argue that it will strengthen chemical safety while also ensuring chemical innovation. An American Chemistry Council spokesperson told Science in the News, "the new law will give Americans greater confidence that chemicals in commerce are being used safely, decrease the number of inconsistent state-based chemical initiatives... while also promoting innovation and growth by American manufacturers." At this moment, with all sides of the issue cheering the new reforms, it appears that a new renaissance for chemical safety is real and here to stay.

Cory Gerlach is a PhD Candidate studying toxicology and drug development at Harvard University. Cory is a teaching fellow for the course "Principles of Toxicology: Molecular and Translational

Exhibit F

The Washington Post
Democracy Dies in Darkness

The bizarre way the U.S. regulates chemicals — letting them on the market first, then maybe studying them

By Puneet Kollipara

March 19, 2015

UPDATE: This post has been updated to include further details about the Vitter-Udall bill, and clarifies the details of the cost determinations the proposes.

Chemicals are everywhere — we're made of them, and so are the products we use and the objects we come into contact with. Naturally, some of these substances could be bad for our health, perhaps capable of causing cancer and other diseases.

Regulators have presumably barred unsafe chemicals from being made and used, right? Not so. In fact, only a tiny percentage of chemicals are regulated.

How could this be? A major reason is that the Toxic Substances Control Act (TSCA), a 1976 law that protects humans and the environment from toxic industrial chemicals (pesticides, drugs and cosmetics are handled under different laws), has created so many hoops for regulators to jump through that it has often rendered them powerless. That's one rationale that the Government Accountability Office, Congress's nonpartisan watchdog arm, has cited in repeatedly calling toxic chemicals regulation one of the government's "high-risk" programs.

Now, a bipartisan bill from Sens. David Vitter (R-La.) and Tom Udall (D-N.M.), introduced last week, would overhaul TSCA's core provisions for the first time since its birth nearly 40 years ago.

Here's the problem: Congress has tried repeatedly to fix this issue and failed. It's tough to get all stakeholders involved — including chemical companies and environmental and health groups — to find a middle ground. And in today's gridlock-marred age of toxic politics, not even a bipartisan toxics law reform bill such as Udall-Vitter is guaranteed to survive.

Taking TSCA to task

So, what's wrong with the current law? For starters, TSCA allowed all 62,000 chemicals that were in commerce before 1976, the year it became law, to stay on the market unless the Environmental Protection Agency later found that they posed an "unreasonable risk." How many of these has the EPA studied since then? Just a couple of hundred. How many has it banned? Only *five*, among them dioxins and hexavalent chromium.

risk." The problem: The agency has only 90 days to make that decision, and rarely does it have all the toxicity data it needs. As a result, nearly all substances the industry wants to make and sell are allowed to go on the market.

And to make matters worse, environmentalists have argued that this "unreasonable risk" standard, as defined now, has proved too tough a bar for EPA to meet. Why? Because EPA has to consider the costs of regulation in deciding what makes the risk "unreasonable." In 1991, a judge struck down the agency's ban on asbestos — fibrous minerals that are known to cause the deadly lung cancer mesothelioma — in part because the agency hadn't fully considered the costs of banning it. Since that ruling, the EPA hasn't successfully used its TSCA ban powers.

Other aspects of TSCA simply make the EPA's life even tougher. For instance, it can't require companies to test substances unless the agency shows that there might be a risk to begin with. If it sounds like a chicken-and-egg problem, that's because it is.

It's little wonder, then, that our toxics law is so ineffective. So why haven't we fixed it? The answer lies in how we would do so. For so many of the law's problems, consensus has been hard to come by. Key among these issues is something known as the safety standard: the minimum bar for safety a substance must meet.

Can we find some chemistry here?

Some, particularly in the environmental/health community, want our chemical laws to look more like the European Union's. There, substances generally can't go on the market unless manufacturers can provide data showing they're safe. The E.U. places much more trust in the precautionary principle, the idea that in the absence of evidence, it's better not to take any chances.

But don't expect the United States to go with an E.U.-like safety standard. Past efforts by the late Sen. Frank Lautenberg (D-N.J.) to enact legislation with that kind of standard failed, in large part because of industry opposition. These concerns might not be totally unjustified — reasonable people can disagree about how precautionary we should be before we become too precautionary.

But a bill that doesn't go far enough won't get enough support from public-interest groups and Democrats. One bipartisan measure from Lautenberg and Vitter last Congress used the far weaker "unreasonable risk" standard that TSCA currently has, with a few tweaks. Environmental and health groups opposed it for that and other reasons. That bill also died.

A reasonable middle ground?

Now, the Vitter-Udall bill, seeking to strike a middle ground, keeps the standard that requires proof that there's no "unreasonable risk" that a product is harmful, but changes specific aspects of that standard. Under the bill, chemical makers would now generally need to show their substances meet this standard for them to enter commerce — and couldn't go on the market by default after 90 days. And no longer would the EPA have to consider costs in deciding whether a substance's risk is unreasonable and pick the least costly solution — the very issue that doomed the asbestos ban.

The EPA also would face deadlines for assessing and regulating chemicals already on the market, starting first with 25 substances the agency thinks pose the highest threat. And unlike today, EPA could require companies to do additional testing of a chemical without first having to show that it might be risky. At least on the surface, all this seems to add up to a tougher system than what we have now.

But once again, a familiar problem has emerged: To some, this middle-ground solution may not be so good. Nearly all environmental and health groups — the lone exception being the Environmental Defense Fund — and liberal Democrats such as Sen. Barbara Boxer (Calif.) are opposing Vitter-Udall, saying it could be worse than current law. They worry that it wouldn't require EPA to act quickly enough or review enough chemicals, all while blocking states from enacting future restrictions on substances the EPA designates as "high priority." To them, that's a recipe for disaster.

A lot is at stake here. For one, a number of substances may cause cancer, a reason the President's Cancer Panel in 2010 called for reforming TSCA. Other potential health problems are at stake, too, including birth defects and neurological and developmental problems. And the current laws haven't given people much confidence in the industry. If there's something that chemical makers and environmental/health groups agree on, it's that TSCA needs fixing.

But as TSCA reform's futile history has shown us, sometimes even the problems we agree on the most can't be fixed so easily — because it's much tougher to agree on the solutions.

Exhibit G

STATE OF CALIFORNIA
REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION

STAFF REPORT FOR REGULAR MEETING OF MARCH 14-15, 2013
Prepared February 2013

ITEM NUMBER: **11**

SUBJECT: **Adopting a Total Maximum Daily Load for Diazinon and Additive Toxicity with Chlorpyrifos in the Arroyo Paredon Watershed, Santa Barbara County, California**

STAFF CONTACT: **Howard Kolb 805/549-3332 or hkolb@waterboards.ca.gov**

SUMMARY

Staff recommends adoption of the proposed Total Maximum Daily Load (TMDL) for Diazinon and Additive Toxicity with Chlorpyrifos in the Arroyo Paredon Watershed.

The proposed TMDL, numeric targets, and load allocations for diazinon will result in meeting narrative water quality objectives for pesticides and toxicity in the Arroyo Paredon watershed. Central Coast Water Board staff has identified sources of diazinon that are causing or contributing to water quality impairment, has identified parties responsible for these sources, and has proposed load allocations necessary to achieve the TMDL.

Staff has identified the *Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands in the Central Coast Region* (Agricultural Order) as the existing regulatory mechanism to achieve the TMDL. No new regulatory mechanism is being proposed to implement and achieve the TMDL.

This TMDL is not being adopted through a basin plan amendment, but through the Central Coast Water Board's approval of the resolution associated with this agenda item, which includes findings that compliance with the Agricultural Order will implement the TMDL. According to state policy, Regional Water Quality Control Boards are encouraged to take this approach of TMDL approval when the impairments can be addressed through a single action by the Board; the approach conserves valuable state resources and avoids regulatory redundancy.

Arroyo Paredon is on the 2008-2010 Clean Water Act section 303(d) list of impaired waters due to diazinon. Arroyo Paredon is also on the 2008-2010 Clean Water Act section 303(d) list of impaired waters due to unknown toxicity; unknown toxicity 303(d) listings are toxicity impairments in the water column. Toxicity tests were positive for toxicity to invertebrates, which are target organisms of diazinon. The water quality objectives for pesticides and toxicity are not being met because concentrations of diazinon are present at levels toxic to the environment.

In this agenda item, staff recommends the Central Coast Water Board approve the resolution (Attachment 1 to this Staff Report) that establishes a Total Maximum Daily Load for Diazinon and Additive Toxicity with Chlorpyrifos in the Arroyo Paredon watershed.

Staff developed the technical basis for the TMDL and associated allocations, which is provided in the Final Project Report (Attachment 2 to this staff report). The Project Report is provided at the Central Coast Water Board's website:

http://www.waterboards.ca.gov/centralcoast/water_issues/programs/tmdl/docs/arroyo_paredon/index.shtml

DICUSSION

Project Development for the TMDL

Staff developed the TMDL using data and information from the Central Coast Ambient Monitoring Program (CCAMP), Central Coast Cooperative Monitoring Program (CMP), and California Department of Pesticide Regulation (CDPR). Staff also used land use data and conversations with staff from other agencies.

Numeric Targets

The Basin Plan contains general water quality objectives for all inland surface waters, enclosed bays, and estuaries. The narrative water quality objective for toxicity states, in part:

> *"All waters shall be maintained free of toxic substances in concentrations which are toxic to, or which produce detrimental physiological responses in human, plant, animal, or aquatic life."*

The narrative water quality objective for pesticides states, in part:

> *"No individual pesticide or combination of pesticides shall reach concentrations that adversely affect beneficial uses."*

The TMDL numeric targets are numeric interpretations of the narrative water quality objectives for pesticides. The numeric targets for the proposed TMDL are identical to numeric targets derived by the California Department of Fish and Game in 2004 and the Central Valley Regional Water Quality Control Board for diazinon. The Central Valley Regional Water Quality Control Board has used the same targets for several TMDLs that are USEPA approved. These targets were also approved by the Central Coast Water Board on May 5, 2011, for the Lower Salinas River Watershed Chlorpyrifos and Diazinon TMDL, which was approved by USEPA on October 7, 2011. Achieving the proposed TMDL numeric targets will result in achieving the water quality objectives for pesticides in water bodies degraded by diazinon.

Water Column Numeric Targets:
Numeric targets for the TMDL include acute and chronic water column numeric targets for diazinon. The water column numeric targets for diazinon are outlined in the table below:

Compound	CMC [A] (ppb)	CCC [B] (ppb)
Diazinon	0.16	0.10

[A] CMC – Criterion Maximum Concentration or acute (1- hour average). Not to be exceeded more than once in a three-year period

[B] CCC – Criterion Continuous Concentration or chronic (4-day (96-hour) average). Not to be exceeded more than once in a three-year period

Additive Toxicity Numeric Targets:
Data collected in the Arroyo Paredon watershed indicates that chlorpyrifos is also present and needs to be considered in terms of additive toxicity. Diazinon and chlorpyrifos have the same mechanism of toxic action and exhibit additive toxicity to aquatic invertebrates when they co-occur. Mixtures of compounds acting through the same mechanism suggest there is no concentration below which a compound will no longer contribute to the overall toxicity of the mixture. Therefore, the total potential toxicity of co-occurring diazinon and chlorpyrifos needs to be assessed, even when one or both of their individual concentrations would otherwise be below thresholds of concern. Technical guidance developed by staff of the Central Valley Regional Water Quality Control Board (CVRWQCB) ("Policy for Application of Water Quality Objectives" and policy on "Pesticide Discharges from Nonpoint Sources") include formulas for addressing additive toxicity. Additive toxicity can be evaluated by the following formula from *Basin Plan Amendments to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins for Diazinon and Chlorpyrifos Runoff into the Sacramento and Feather Rivers*; the following additive toxicity numeric target formula is a numeric target of this TMDL.

For additive toxicity of diazinon and chlorpyrifos when both are present:

$$S = \leq 1.0 = \frac{C_D}{LC_D} + \frac{C_C}{LC_C}$$

Where:

S = Sum of additive toxicity
C_D = Diazinon concentration in waterbody
C_C = Chlorpyrifos concentration in waterbody
LC_D = Criterion Continuous Concentration (0.10 µg/L) or Criterion Maximum Concentration (0.16 µg/L) diazinon loading capacity.
LC_C = Criterion Continuous Concentration (0.015 µg/L) or Criterion Maximum Concentration (0.025 µg/L) chlorpyrifos loading capacity.

Value of S cannot exceed 1.0 more than once in any consecutive three-year period.

Aquatic Toxicity Numeric Target:
The aquatic toxicity numeric target is the evaluation of the Basin Plan general objective for toxicity using standard aquatic toxicity tests to determine toxicity in the water column. The general objective for toxicity is:

All waters shall be maintained free of toxic substances in concentrations which are toxic to, or which produce detrimental physiological responses in, human, plant, animal, or aquatic life. Compliance with the objective will be determined by use of indicator organisms, analyses of species diversity, population density, growth anomalies, toxicity bioassays of appropriate duration, or other appropriate methods.

The following standard aquatic toxicity tests will be used to determine compliance with the aquatic toxicity numeric target:

Table 1 Standard Aquatic Toxicity Tests

Parameter	**Test**	**Biological Endpoint Assessed**
Water Column Toxicity	Water Flea – *Ceriodaphnia (7-day chronic)*	Survival and reproduction

Source Analysis

Discharges from irrigated agriculture in the project area are the single controllable source causing impairment due to diazinon.

In 2000, USEPA began a phase-out of allowable diazinon use. Retail sales for residential indoor use of these pesticides ended in 2002 and retail sales for outdoor residential uses ended in 2004. Since 2004, agricultural applications of diazinon remain as the significant use of this pesticide.

The half-life of diazinon in the water column ranges from 12-138 days, depending on field conditions. Based on application dates, staff concludes that it is likely that exceedance of diazinon targets seen in 2001 and 2002 were the result of an application of diazinon (D.Z.N. Diazinon AG600 WBC) to nursery-greenhouse grown cut flowers or greens.

The impaired waterbody in the project area is flanked by lands used for agricultural purposes where diazinon is applied. Staff described diazinon applications in the project area in Chapter 4 of the Final Project Report (which is Attachment 2 of this staff report).

TMDL and Allocations

The TMDL for Diazinon and Additive Toxicity with Chlorpyrifos in Arroyo Paredon is a concentration-based TMDL and is equal to the numeric targets as described in the numeric targets section above. Concentration-based TMDLs are an appropriate expression of TMDLs and meet USEPA requirements for TMDL approval. USEPA has approved concentration-based diazinon TMDLs for the Central Coast and the Central Valley Regional Water Quality Control Boards.

Owners and operators of agricultural lands using diazinon are assigned load allocations equal to the TMDL and numeric targets; the load allocations are receiving water allocations.

Implementation and Monitoring

Implementing parties will comply with the Conditional Waiver of Waste Discharge Requirements for Irrigated Lands (Order R3-2012-0011) and the Monitoring and Reporting Programs in accordance with Orders R3-2012-0011-01, R3-2012-0011-02, and R3-2012-0011-03 to meet load allocations and achieve the TMDL.

Current requirements in the Agricultural Order that will result in achieving the load allocations include:

a. Enroll in the Agricultural Order.
    i. Current enrollment requirements inform staff whether chlorpyrifos or diazinon is applied; growers update this information annually.
b. Implement monitoring and reporting requirements described in the Agricultural Order.
    i. Current reporting requirements include a description of discharges leaving the growers field, which can be a primary mode of pesticide transport, and management practices used to mitigate pesticide loading. Reporting requirements also include analysis of diazinon and toxicity tests at cooperative monitoring sites, including the Arroyo Paredon.

c. Implement, and update as necessary, management practices to reduce pesticide loading.
d. Develop and update and implement Farm Plans. The Farm Plans should incorporate measures designed to achieve load allocations assigned in this TMDL.

The TMDL implementation plan also utilizes an interagency approach between the Department of Pesticide Regulation (DPR) and the Water Boards to address impairments. The approach is described in the California Pesticide Management Plan for Water Quality (California Pesticide Plan), which is an implementation plan of the Management Agency Agreement (MAA) between DPR and the Water Boards. The agricultural commissioners of Santa Barbara and San Luis Obispo counties are also responsible for implementing the California Pesticide Plan.

Monitoring: Owners and operators of irrigated agricultural lands will perform monitoring and reporting in accordance with Monitoring and Reporting Program Orders R3-2012-0011-01, R3-2012-0011-02, and R3-2012-0011-03, as applicable to the operation. Monitoring requirements include both chlorpyrifos and diazinon monitoring. Additionally, water standard column toxicity tests are required in the current monitoring orders.

Determination of Compliance with Load Allocations for Irrigated Lands: Demonstration of compliance with the load allocations is consistent with compliance with the Agricultural Order. Load allocations will be achieved through a combination of implementation of management practices and strategies to reduce pesticide loading and water quality monitoring. Flexibility to allow owners and operators of irrigated lands to demonstrate compliance with load allocations is a consideration; additionally, staff is aware that not all implementing parties are necessarily contributing to or causing surface water impairments.

To allow for flexibility, Water Board staff will assess compliance with load allocations using one or a combination of the following:

1. Attaining the load allocations in the receiving water.
2. Attaining zero toxicity attributable to pesticides in receiving water.
3. Implementing management practices that are capable of achieving interim and final load allocations identified in this TMDL.
4. Owners and operators of irrigated lands may provide sufficient evidence to demonstrate that they are and will continue to be in compliance with the load allocations; such evidence could include documentation submitted by the owner or operator to the Executive Officer that the owner or operator is not causing waste to be discharged to impaired waterbodies resulting or contributing to violations of the load allocations.

Time Schedule for Tracking Progress and Achieving the TMDL

The target date to achieve the allocations, numeric targets, and TMDL in the impaired waterbody is March 2019. This date coincides with planned monitoring efforts to help defray costs to implementing parties and reflects the apparent decrease in diazinon use in the Arroyo Paredon watershed and associated ease with which the TMDL can likely be achieved.

The Agricultural Order has established milestones to achieve water quality standards; achieving water quality standards will result in achieving the TMDL. Dischargers will show verifiable progress towards achieving water quality objectives through requirements described in the Agricultural Order.

Water Board staff will reevaluate impairments caused by diazinon when monitoring data is submitted and during renewals of the Agricultural Order. Water Board staff will propose

modifications of the Agricultural Order or other regulatory mechanisms, if necessary, to address remaining impairments.

ANTI-DEGRADATION

The proposed TMDL is consistent with the provisions of State Water Resources Control Board Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality of Waters in California" and 40 CFR 131.12. The TMDL requires actions that will result in improved water quality throughout the watershed and maintenance of the level of water quality necessary to protect existing and anticipated beneficial uses. The TMDL is implemented through the Agricultural Order, which is adopted in compliance with Water Code section 13269. The Order includes conditions and prohibitions requiring compliance with water quality standards, implementation of management practices to attain water quality objectives, and monitoring and reporting programs. The Order is enforceable and subject to review at least every five years.

PUBLIC INVOLVEMENT

Staff conducted stakeholder outreach efforts during TMDL development. Staff made a presentation in August 2012 and engaged with stakeholders during the development of the TMDL. Staff provided a formal written comment period from November 26, 2012, through January 11, 2013, where comments were solicited from interested parties. No comments were received.

RECOMMENDATION

Adopt Resolution No. R3-2013-0004

ATTACHMENTS:

The attachments are available at:

http://www.waterboards.ca.gov/centralcoast/water_issues/programs/tmdl/docs/arroyo_paredon/index.shtml

1. Draft Resolution No. R3-2013-0004
2. Final Project Report: "Total Maximum Daily Load for Diazinon in Arroyo Paredon Watershed, Santa Barbara County"
3. Notice of Public Hearing

Exhibit H

Re: Ocean Breeze International Violations in Carpinteria, California

Mo Foley <maureenkathrynfoley@gmail.com> Tue, Jul 20, 2021 at 4:27 AM
To: "Richter, Paula@Waterboards" <Paula.Richter@waterboards.ca.gov>
Cc: "Tryon, Thea@Waterboards" <Thea.Tryon@waterboards.ca.gov>, "Packard, Harvey@Waterboards" <Harvey.Packard@waterboards.ca.gov>, "Anderson, Tamara@Waterboards" <Tamara.Anderson@waterboards.ca.gov>, "Stanley, Todd@Waterboards" <Todd.Stanley@waterboards.ca.gov>, "Pratt, Jamie@Waterboards" <Jamie.Pratt@waterboards.ca.gov>

Hello Paula,

Thank you so much for all the information. I will be in touch if we have questions. I really appreciate your effort!

Maureen

Sent from my iPhone

> On Jul 15, 2021, at 9:45 PM, Richter, Paula@Waterboards <Paula.Richter@waterboards.ca.gov> wrote:
>
> Dear Ms. Foley:
>
> Thank you for your inquiry and the work your organization is doing to protect the Arroyo Paredon Creek watershed. The alleged discharge is entering an unnamed tributary to Carpinteria Salt Marsh (El Estero Marsh). This is a concrete-lined channel that flows in a southerly direction along the Ocean Breeze International property. The tributary flows under Highway 101 and the railroad tracks before flowing into the marsh. The flows do not enter Arroyo Paredon Creek. Below is a map marked with the general flow direction of the unnamed tributary (in yellow) and the Ocean Breeze International parcel (in red).
>
> <image001.png>
>
> <image002.png>
>
> <image009.png>
>
> <image010.png>
> <image011.jpg>
>
> Arroyo Paredon Creek is on the 303(d) List of impaired waterbodies for boron, chloride, diazinon, *Escherichia coli (E. coli)*, fecal coliform, nitrate, sodium, and toxicity associated with agriculture and urban runoff/storm sewers. The California 303(d) List is a compilation of the 303(d) lists adopted by the Regional Water Quality Control Boards (Regional Water Boards) and approved by the State Water Board and USEPA.
>
> Publicly available water quality data from monitoring sites along Arroyo Paredon Creek is housed on the California

Environmental Data Exchange Network (CEDEN). As a courtesy, I have downloaded that data for you and attach it as an Excel file. The data covers sampling events from 2006 through 2019. The 2020 CEDEN data is still undergoing quality assurance/quality control and is currently not available. Water quality data is collected under several programs for Arroyo Paredon Creek: our Central Coast Ambient Monitoring Program (CCAMP) and the Central Coast Cooperative Monitoring Program for Agriculture (CMP). CCAMP monitoring occurs on a rotational basis throughout the Central Coast region. The Santa Barbara Channelkeepers Stream Team also began monitoring at these sites in 2010. Two focused sampling studies have also been conducted along Arroyo Paredon Creek.

Please do not hesitate to contact us with any further questions.

Regards,

~Paula

Paula Richter

Senior Environmental Scientist (Specialist)

Irrigated Lands Program

(805) 549-3865

Paula.Richter@waterboards.ca.gov

Note: I am teleworking until further notice due to the COVID-19 pandemic. You can reach me through e-mail or leave a message on my office phone if I am unavailable to take your call.

From: Mo Foley <maureenkathrynfoley@gmail.com>
Sent: Thursday, July 15, 2021 3:45 AM
To: Richter, Paula@Waterboards <Paula.Richter@Waterboards.ca.gov>
Cc: Tryon, Thea@Waterboards <Thea.Tryon@waterboards.ca.gov>; Packard, Harvey@Waterboards <Harvey.Packard@waterboards.ca.gov>; Anderson, Tamara@Waterboards <Tamara.Anderson@waterboards.ca.gov>; Stanley, Todd@Waterboards <Todd.Stanley@waterboards.ca.gov>; Pratt, Jamie@Waterboards <Jamie.Pratt@Waterboards.ca.gov>
Subject: Ocean Breeze International Violations in Carpinteria, California

EXTERNAL:

Hello,

I lead a grassroots environmental water quality group in Carpinteria, California called Save Arroyo Paredon Watershed. Our group recently became aware of a possible violation at Ocean Breeze International. (I've attached the letter sent to Ocean Breeze from your organization that we acquired.) I am also cc'ing the environmental land-use attorney that we're working with on this project.

To summarize, here is an excerpt from the letter sent by your agency: "On May 3, 2021 and May 7, 2021, the Central Coast Water Board received documentation that demonstrates significant nutrient-laden discharges are occurring from greenhouses located at 3900 N. Via Real in Carpinteria (Santa Barbara County Assessor Parcel (APN) 005-430-042). The alleged discharges are entering a tributary to Carpinteria Marsh (El Estero Marsh), a water of the United States, and may be causing or contributing to algal blooms in the western portion of the marsh."

Because this property is within the Arroyo Paredon Watershed area, I would like more information about the "discharges" discussed in the letter. What is the name of the waterway that these discharges are released into? How do they connect to the marsh? Also, as Arroyo Paredon (a nearby creek) is our primary focus, how do these discharges affect ARroyo Paredon? Last, is there any way to gather more information from your body about the water quality of Arroyo Paredon and/or any other general information about that waterway?

Thank you for your time,

Maureen Claffey

<Arroyo Paredon Creek_ceden_data_20210715.xlsx>

Exhibit I

SWAPE Technical Consultation, Data Analysis and Litigation Support for the Environment

2656 29th Street, Suite 201
Santa Monica, CA 90405
Paul Rosenfeld Ph.D.
(310) 795-2335
prosenfeld@swape.com

June 25, 2021

Elise Cossart-Daly, Attorney
Cossart-Daly Law, A.P.C.
Phone: 805.380.8408
ecd@cossart-dalylaw.com

Subject: Inadequate Odor Management Plan for the Proposed SLO Cultivation Project at 3861 Foothill Road, Carpinteria, CA 93103

Dear Ms. Cossart-Daly:

Soil Water Air Protection Enterprise LLC ("SWAPE") has been retained to review the "SLO Cultivation - Odor Management Plan prepared for SLO Cultivation, 3861 Foothill Road, Carpinteria, CA 93103."[1]

My name is Dr. Paul Rosenfeld. I received a Ph.D. in Odor Control from the University of Washington, and I have published my peer reviewed papers of the effectiveness of activated carbon for odor control. My CV is attached to the letter as **Exhibit A.** I have also worked extensively with masking agents, such as the lemon pine like masking agent/neutralizing chemicals proposed for this project, and do not find masking agents to be effective for odor control. In fact, my observations have been that masking agents actually magnify the intensity of the odor, but change the character.

An Odor Management Plan ("Plan") has been prepared for a proposed project located at Project Site ("Site") located at 3861 Foothill Road also identified as APN 005-310-024 by SCS Engineers. The Site is approximately 13.66 acres in size and currently contains four (4) existing greenhouse structures and twelve (12) pre-fabricated supporting structures (freezers, equipment & material storage, etc.), totaling approximately 389,800 square feet of development. The proposed project will redevelop the Site to retain the largest existing greenhouse, demolish three (3) existing greenhouses, develop a new greenhouse addition for nursery space, and develop a new cannabis processing support building.

[1] SCS Engineers, "SLO Cultivation - Odor Management Plan prepared for SLO Cultivation, 3861 Foothill Road, Carpinteria, CA 93103" February 19, 2021

In the Odor Management Plan SCS Engineers state:[2]

> *"The phases of growing and processing cannabis proposed by SLO Cultivation have two main stages that emit odors. These odor emitting phases are mature/flowering plant cultivation and bucking/processing. During an initial period of four (4) to six (6) weeks immature/non-flowering plant cultivation occurs during which minimal odors are expected. Once the juvenile plants become mature and begin to flower they enter the mature plant cultivation phase where they emit stronger odors; this phase spans approximately eight (8) weeks. Once the cannabis plants have matured plants are harvested and either:*
>
> *1. Wet-bucked (bucking is the process of mechanically stripping cannabis flowers from the stem and leaf matter), weighed, and placed into bulk plastic bags which are vacuum sealed prior to freezing.*
> *2. Placed in totes with sealed lids and transported to drying & curing rooms. After the plants are dried and cured, they are dry-bucked, and the flowers are packaged into consumer goods (such as jars or pre-rolls).*
>
> *These cannabis containers will then be loaded into trucks for export... It is important to note that due to the rotational crop management, the Site is expected to have approximately 30% of the total cannabis crop in a mature, strong odor emitting phase at any given time."*

The Odor Management Plan relies heavily on the Byers odor control system, but then suggests that the Byers system will be inadequate for the 24,751 square foot pack house/processing building, where all cannabis processing and storage will occur, and that vapor phase carbon will be used in the pack house/process building. SCS Engineer's Plan states:[3]

> *"The proposed 24,751 square foot pack house/processing building, where all cannabis processing and storage will occur, will be a purpose built metal building with vapor barriers and opening seals that will limit air (and odor) exfiltration at the exterior building envelope. The air handling system will maintain interior air quality for employees,*

[2] SCS Engineers, "SLO Cultivation - Odor Management Plan prepared for SLO Cultivation, 3861 Foothill Road, Carpinteria, CA 93103" February 19, 2021
[3] SCS Engineers, "SLO Cultivation - Odor Management Plan prepared for SLO Cultivation, 3861 Foothill Road, Carpinteria, CA 93103" February 19, 2021

maintain a slight negative pressure differential between the inside and outside air, and control odor exfiltration. ***HVAC exhaust ducts to the outside will be controlled with industrial grade carbon odor adsorbers. The system will be designed by a professional mechanical engineer and maintained throughout the life of the Project. In particular, on-site personnel will be required to regularly check the carbon media for saturation and degradation of the system's ability to mitigate odor, at that time the carbon media shall be replaced... Carbon scrubbers will be distributed throughout each room which contains odiferous cannabis activities*** *with the exception of the freezer rooms where all cannabis is vacuum sealed in thick plastic bags."*

This suggests that the Byers system is inadequate for the pack house/processing building. I will argue that there is evidence via news reports that the Byers system does not adequately reduced odor for the growing mature plants, and the Byers system may actually contribute to the nuisance in the residential areas in the Carpentaria area.

SCS Engineer's goes on to state:[4]

Carbon filtration systems (when properly designed and maintained) offer the leading effective odor control for enclosed spaces such as the Project's processing structures. Other regulatory agencies involved with the emerging cannabis industry have recognized carbon filtration as a Best Available Control Technology (BACT) for odor, including the Puget Sound Clean Air Agency[5] in Washington state and the Denver Department of Public Health & Environment[6] in Colorado. If properly designed and maintained, the carbon filtration system should be sufficient to control nuisance odors emanating from the Project's processing structures.[7]

This suggests that SCS Engineers acknowledges that carbon filtration is the best available control technology for cannabis odor, but yet they do not propose using it for the entire project.

There have been multiple news stories suggesting not only does the Byers System not adequately control odor, but that the Byers chemicals used to mask the odor can contribute to the overall nuisance. A news

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[4] SCS Engineers, "SLO Cultivation - Odor Management Plan prepared for SLO Cultivation, 3861 Foothill Road, Carpinteria, CA 93103" February 19, 2021

[5] https://pscleanair.gov/DocumentCenter/View/3364/11237-wks

[6] https://www.denvergov.org/content/dam/denvergov/Portals/771/documents/EQ/MJ%20Sustainability/Cannabis_BestManagementPracticesGuide_FINAL.pdf

[7] SCS Engineers, "SLO Cultivation - Odor Management Plan prepared for SLO Cultivation, 3861 Foothill Road, Carpinteria, CA 93103" February 19, 2021

article on the Santa Barbara Independent entitled "Is the Byers Scientific the Solution for Carpinteria's Odor Issues?" by Sunidhi Sridhar states:[8]

> *Hardly any commercial enterprise escaped the past year unscathed, but the cannabis industry, which celebrated a banner year in 2020, was not one of them. Marijuana sales surpassed a record-shattering $18.3 billion, and five U.S. states passed legislation to legalize recreational cannabis use, propelling the burgeoning industry to unprecedented levels.*
>
> *As the number of prospective cannabis growers looking to venture into the lucrative business has surged across the country, neighborhoods and communities in Santa Barbara County that are situated near these farms and greenhouses are faced with an unwanted byproduct: the pungent odor of marijuana cultivation.*
>
> *Steve Mason, the assistant director of Planning and Development for Santa Barbara County, explained that cannabis zoning rules, which regulate the types of odor control systems that are allowed in different areas, also outline the requirements to which each location must adhere.*
>
> *While an odor management system known as Byers Scientific is widely deployed in Santa Barbara County, especially around Carpinteria, the effectiveness of the technology seems to be inconclusive.*
>
> *"The system does appear to control odor under certain circumstances, but we do still receive wide spread cannabis odor complaints in the Carpinteria area," Mason said. The county received 363 odor-related complaints from residents over the past year, down from 448 in 2019...*
>
> *"This neighborhood has multiple streets that are adjacent to greenhouse operations that are located on Foothill Road," he explained.*
>
> *"There is virtually no science on the long-term effects of concentrated cannabis terpenes and the Byers technology and other mist systems on the lungs of children, adults, and employees," said Maureen Foley, a member of the grassroots group Concerned*

[8] Santa Barbara Independent. "Is the Byers Scientific the Solution for Carpinteria's Odor Issues?" by Sunidhi Sridhar, March 17, 2021

Carpinterians, which focuses on protecting the quality of life in Carpinteria from cannabis practices.

Anna Carrillo, also a member of the group, echoed these concerns. "Many residents complain of burning, itchy eyes, asthma, and other health issues from this new ingredient," Carrillo said. "When the high school was in session, many people complained of headaches and nausea. Classrooms had to be aired out every morning."

Both SCS Engineers and the general scientific community agree that activated carbon for vapor phase filtration of cannabis odor is superior to that to the Byers system, which is not as much of a neutralizing agent as it is a masking agent using a lemony pine odor to try to mask the skunky cannabis odor.

If the project is to be approved, the Best Available Odor Control Technology should be utilized by the project proponent, as required by the Santa Barbara County Coastal Zoning Ordinance. I have been working with Envent Corporation, a vendor of activated carbon vapor phase air filters, and received a quote to purchase twenty 2000 activated carbon vessels and 10 blowers to actually control the odor from the proposed project. Envent Corporation is the vendor and the quote is attached as **Exhibit B**.[9] Envent proposes using 10 blowers with a volumetric flow rate of 5000 cubic feet per minute, and each blower would be connected to two 2000 pound vapor phase carbon vessels in series. The 10 blowers and 20 carbon vessels can filter 3,000,000 cubic feet of air per hour. If one were to assume to proposed project is 300,000 square feet and 10 feet tall, it would be 3,000,000 cubic feet. That means the proposed system would have 1 air exchange per hour. This system would be superior to the Byers system. The proposal with the cost for the vapor phase activated carbon filtration system is attached.

While it has been argued that greenhouses cannot be airtight, that is a false claim. Greenhouses can be airtight, but if the proponent is unwilling or claims to be unable to design a completely airtight greenhouse, a greenhouse that is as close to airtight as possible is very feasible and would improve the effectiveness of the activated carbon filter.

It should be noted that activated carbon as proposed in this letter will not only filter out odorants, but will also filter out terpenes and other volatile organic compounds, and this will improve the over all air quality in the community.

Is should also be noted that the Byers system, or any similar vapor phase odor control system, actually creates air pollution, for chemicals are being sprayed into the air of the community in Carpinteria. The health effects of the chemicals used by the Byers system, and similar systems, have not been sufficiently

[9] Carpinteria Cannabis Odor Control Equipment Sale. Prepared by Dan Rapoport on June 7,l 2021.

evaluated for sensitive individuals such as infants and people with preexisting health conditions such as COPD, asthma, or emphysema, just to name a few. The above reference news article suggests that some individuals in Carpinteria are already suffering from already installed Byers systems. Utilization of activated carbon for filtration of volatile organic and odorous compounds being produced by the cannabis plants and operations would eliminate the possibility of the Byers system or similar system contributing to health harms in the community.

In conclusion, based on numerous news articles and my knowledge of working with masking agents and neutralizing odorous chemicals similar to those utilized by the Byers system, I know the Best Available Control Technology for cannabis odor is activated carbon, and I have attached a proposal for a system that should be incorporated into the proposed project in order to protect the public from nuisance odor, volatile organic compounds, and potential health impacts to sensitive individuals.

Respectfully,



Paul Rosenfeld Ph.D.

Exhibit A

SWAPE Technical Consultation, Data Analysis and Litigation Support for the Environment

SOIL WATER AIR PROTECTION ENTERPRISE
2656 29th Street, Suite 201
Santa Monica, California 90405
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Email: prosenfeld@swape.com

Paul Rosenfeld, Ph.D.

Chemical Fate and Transport & Air Dispersion Modeling

Principal Environmental Chemist

Risk Assessment & Remediation Specialist

Education

Ph.D. Soil Chemistry, University of Washington, 1999. Dissertation on volatile organic compound filtration.

M.S. Environmental Science, U.C. Berkeley, 1995. Thesis on organic waste economics.

B.A. Environmental Studies, U.C. Santa Barbara, 1991. Thesis on wastewater treatment.

Professional Experience

Dr. Rosenfeld has over 25 years' experience conducting environmental investigations and risk assessments for evaluating impacts to human health, property, and ecological receptors. His expertise focuses on the fate and transport of environmental contaminants, human health risk, exposure assessment, and ecological restoration. Dr. Rosenfeld has evaluated and modeled emissions from oil spills, landfills, boilers and incinerators, process stacks, storage tanks, confined animal feeding operations, industrial, military and agricultural sources, unconventional oil drilling operations, and locomotive and construction engines. His project experience ranges from monitoring and modeling of pollution sources to evaluating impacts of pollution on workers at industrial facilities and residents in surrounding communities. Dr. Rosenfeld has also successfully modeled exposure to contaminants distributed by water systems and via vapor intrusion.

Dr. Rosenfeld has investigated and designed remediation programs and risk assessments for contaminated sites containing lead, heavy metals, mold, bacteria, particulate matter, petroleum hydrocarbons, chlorinated solvents, pesticides, radioactive waste, dioxins and furans, semi- and volatile organic compounds, PCBs, PAHs, creosote, perchlorate, asbestos, per- and poly-fluoroalkyl substances (PFOA/PFOS), unusual polymers, fuel oxygenates (MTBE), among other pollutants. Dr. Rosenfeld also has experience evaluating greenhouse gas emissions from various projects and is an expert on the assessment of odors from industrial and agricultural sites, as well as the evaluation of odor nuisance impacts and technologies for abatement of odorous emissions. As a principal scientist at SWAPE, Dr. Rosenfeld directs air dispersion modeling and exposure assessments. He has served as an expert witness and testified about pollution sources causing nuisance and/or personal injury at sites and has testified as an expert witness on numerous cases involving exposure to soil, water and air contaminants from industrial, railroad, agricultural, and military sources.

Professional History:

Soil Water Air Protection Enterprise (SWAPE); 2003 to present; Principal and Founding Partner
UCLA School of Public Health; 2007 to 2011; Lecturer (Assistant Researcher)
UCLA School of Public Health; 2003 to 2006; Adjunct Professor
UCLA Environmental Science and Engineering Program; 2002-2004; Doctoral Intern Coordinator
UCLA Institute of the Environment, 2001-2002; Research Associate
Komex H_2O Science, 2001 to 2003; Senior Remediation Scientist
National Groundwater Association, 2002-2004; Lecturer
San Diego State University, 1999-2001; Adjunct Professor
Anteon Corp., San Diego, 2000-2001; Remediation Project Manager
Ogden (now Amec), San Diego, 2000-2000; Remediation Project Manager
Bechtel, San Diego, California, 1999 – 2000; Risk Assessor
King County, Seattle, 1996 – 1999; Scientist
James River Corp., Washington, 1995-96; Scientist
Big Creek Lumber, Davenport, California, 1995; Scientist
Plumas Corp., California and USFS, Tahoe 1993-1995; Scientist
Peace Corps and World Wildlife Fund, St. Kitts, West Indies, 1991-1993; Scientist

Publications:

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Cheremisinoff, N.P., & **Rosenfeld, P.E.** (2010). *Handbook of Pollution Prevention and Cleaner Production: Best Practices in the Wood and Paper Industries*. Amsterdam: Elsevier Publishing.

Cheremisinoff, N.P., & **Rosenfeld, P.E.** (2009). *Handbook of Pollution Prevention and Cleaner Production: Best Practices in the Petroleum Industry*. Amsterdam: Elsevier Publishing.

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Tam L. K.., Wu C. D., Clark J. J. and **Rosenfeld, P.E.** (2008). A Statistical Analysis Of Attic Dust And Blood Lipid Concentrations Of Tetrachloro-p-Dibenzodioxin (TCDD) Toxicity Equivalency Quotients (TEQ) In Two Populations Near Wood Treatment Facilities. *Organohalogen Compounds*, 70, 002252-002255.

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Hensley, A.R. A. Scott, J. J. J. Clark, **Rosenfeld, P.E.** (2007). Attic Dust and Human Blood Samples Collected near a Former Wood Treatment Facility. *Environmental Research*. 105, 194-197.

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Rosenfeld P. E., J.J. Clark, I.H. (Mel) Suffet (2004). The Value of An Odor-Quality-Wheel Classification Scheme For The Urban Environment. *Water Environment Federation's Technical Exhibition and Conference (WEFTEC) 2004*. New Orleans, October 2-6, 2004.

Rosenfeld, P.E., and Suffet, I.H. (2004). Understanding Odorants Associated With Compost, Biomass Facilities, and the Land Application of Biosolids. *Water Science and Technology*. 49(9), 193-199.

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Rosenfeld, P.E., and C.L. Henry. (2001). Characterization of odor emissions from three different biosolids. *Water Soil and Air Pollution*. 127(1-4), 173-191.

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Choilack, T. and **P. Rosenfeld.** (1998). Compost Amendment Handbook For Landscaping. Prepared for and distributed by the City of Redmond, Washington State.

Rosenfeld, P. E. (1992). The Mount Liamuiga Crater Trail. *Heritage Magazine of St. Kitts*, 3(2).

Rosenfeld, P. E. (1993). High School Biogas Project to Prevent Deforestation On St. Kitts. *Biomass Users Network*, 7(1).

Rosenfeld, P. E. (1998). Characterization, Quantification, and Control of Odor Emissions From Biosolids Application To Forest Soil. Doctoral Thesis. University of Washington College of Forest Resources.

Rosenfeld, P. E. (1994). Potential Utilization of Small Diameter Trees on Sierra County Public Land. Masters thesis reprinted by the Sierra County Economic Council. Sierra County, California.

Rosenfeld, P. E. (1991). How to Build a Small Rural Anaerobic Digester & Uses Of Biogas In The First And Third World. Bachelors Thesis. University of California.

Presentations:

Rosenfeld, P.E., Sutherland, A; Hesse, R.; Zapata, A. (October 3-6, 2013). Air dispersion modeling of volatile organic emissions from multiple natural gas wells in Decatur, TX. *44th Western Regional Meeting, American Chemical Society*. Lecture conducted from Santa Clara, CA.

Sok, H.L.; Waller, C.C.; Feng, L.; Gonzalez, J.; Sutherland, A.J.; Wisdom-Stack, T.; Sahai, R.K.; Hesse, R.C.; **Rosenfeld, P.E.** (June 20-23, 2010). Atrazine: A Persistent Pesticide in Urban Drinking Water. *Urban Environmental Pollution*. Lecture conducted from Boston, MA.

Feng, L.; Gonzalez, J.; Sok, H.L.; Sutherland, A.J.; Waller, C.C.; Wisdom-Stack, T.; Sahai, R.K.; La, M.; Hesse, R.C.; **Rosenfeld, P.E.** (June 20-23, 2010). Bringing Environmental Justice to East St. Louis, Illinois. *Urban Environmental Pollution*. Lecture conducted from Boston, MA.

Rosenfeld, P.E. (April 19-23, 2009). Perfluoroctanoic Acid (PFOA) and Perfluoroactane Sulfonate (PFOS) Contamination in Drinking Water From the Use of Aqueous Film Forming Foams (AFFF) at Airports in the United States. *2009 Ground Water Summit and 2009 Ground Water Protection Council Spring Meeting*, Lecture conducted from Tuscon, AZ.

Rosenfeld, P.E. (April 19-23, 2009). Cost to Filter Atrazine Contamination from Drinking Water in the United States" Contamination in Drinking Water From the Use of Aqueous Film Forming Foams (AFFF) at Airports in the United States. *2009 Ground Water Summit and 2009 Ground Water Protection Council Spring Meeting*. Lecture conducted from Tuscon, AZ.

Wu, C., Tam, L., Clark, J., **Rosenfeld, P.** (20-22 July, 2009). Dioxin and furan blood lipid concentrations in populations living near four wood treatment facilities in the United States. Brebbia, C.A. and Popov, V., eds., *Air Pollution XVII: Proceedings of the Seventeenth International Conference on Modeling, Monitoring and Management of Air Pollution*. Lecture conducted from Tallinn, Estonia.

Rosenfeld, P. E. (October 15-18, 2007). Moss Point Community Exposure To Contaminants From A Releasing Facility. *The 23rd Annual International Conferences on Soils Sediment and Water*. Platform lecture conducted from University of Massachusetts, Amherst MA.

Rosenfeld, P. E. (October 15-18, 2007). The Repeated Trespass of Tritium-Contaminated Water Into A Surrounding Community Form Repeated Waste Spills From A Nuclear Power Plant. *The 23rd Annual International*

Conferences on Soils Sediment and Water. Platform lecture conducted from University of Massachusetts, Amherst MA.

Rosenfeld, P. E. (October 15-18, 2007). Somerville Community Exposure To Contaminants From Wood Treatment Facility Emissions. The *23rd Annual International Conferences on Soils Sediment and Water*. Lecture conducted from University of Massachusetts, Amherst MA.

Rosenfeld P. E. (March 2007). Production, Chemical Properties, Toxicology, & Treatment Case Studies of 1,2,3-Trichloropropane (TCP). *The Association for Environmental Health and Sciences (AEHS) Annual Meeting*. Lecture conducted from San Diego, CA.

Rosenfeld P. E. (March 2007). Blood and Attic Sampling for Dioxin/Furan, PAH, and Metal Exposure in Florala, Alabama. *The AEHS Annual Meeting*. Lecture conducted from San Diego, CA.

Hensley A.R., Scott, A., **Rosenfeld P.E.**, Clark, J.J.J. (August 21 – 25, 2006). Dioxin Containing Attic Dust And Human Blood Samples Collected Near A Former Wood Treatment Facility. *The 26th International Symposium on Halogenated Persistent Organic Pollutants – DIOXIN2006*. Lecture conducted from Radisson SAS Scandinavia Hotel in Oslo Norway.

Hensley A.R., Scott, A., **Rosenfeld P.E.**, Clark, J.J.J. (November 4-8, 2006). Dioxin Containing Attic Dust And Human Blood Samples Collected Near A Former Wood Treatment Facility. *APHA 134 Annual Meeting & Exposition*. Lecture conducted from Boston Massachusetts.

Paul Rosenfeld Ph.D. (October 24-25, 2005). Fate, Transport and Persistence of PFOA and Related Chemicals. Mealey's C8/PFOA. *Science, Risk & Litigation Conference*. Lecture conducted from The Rittenhouse Hotel, Philadelphia, PA.

Paul Rosenfeld Ph.D. (September 19, 2005). Brominated Flame Retardants in Groundwater: Pathways to Human Ingestion, *Toxicology and Remediation PEMA Emerging Contaminant Conference*. Lecture conducted from Hilton Hotel, Irvine California.

Paul Rosenfeld Ph.D. (September 19, 2005). Fate, Transport, Toxicity, And Persistence of 1,2,3-TCP. *PEMA Emerging Contaminant Conference*. Lecture conducted from Hilton Hotel in Irvine, California.

Paul Rosenfeld Ph.D. (September 26-27, 2005). Fate, Transport and Persistence of PDBEs. *Mealey's Groundwater Conference*. Lecture conducted from Ritz Carlton Hotel, Marina Del Ray, California.

Paul Rosenfeld Ph.D. (June 7-8, 2005). Fate, Transport and Persistence of PFOA and Related Chemicals. *International Society of Environmental Forensics: Focus On Emerging Contaminants*. Lecture conducted from Sheraton Oceanfront Hotel, Virginia Beach, Virginia.

Paul Rosenfeld Ph.D. (July 21-22, 2005). Fate Transport, Persistence and Toxicology of PFOA and Related Perfluorochemicals. *2005 National Groundwater Association Ground Water And Environmental Law Conference*. Lecture conducted from Wyndham Baltimore Inner Harbor, Baltimore Maryland.

Paul Rosenfeld Ph.D. (July 21-22, 2005). Brominated Flame Retardants in Groundwater: Pathways to Human Ingestion, Toxicology and Remediation. *2005 National Groundwater Association Ground Water and Environmental Law Conference*. Lecture conducted from Wyndham Baltimore Inner Harbor, Baltimore Maryland.

Paul Rosenfeld, Ph.D. and James Clark Ph.D. and Rob Hesse R.G. (May 5-6, 2004). Tert-butyl Alcohol Liability and Toxicology, A National Problem and Unquantified Liability. *National Groundwater Association. Environmental Law Conference*. Lecture conducted from Congress Plaza Hotel, Chicago Illinois.

Paul Rosenfeld, Ph.D. (March 2004). Perchlorate Toxicology. *Meeting of the American Groundwater Trust*. Lecture conducted from Phoenix Arizona.

Hagemann, M.F., **Paul Rosenfeld, Ph.D.** and Rob Hesse (2004). Perchlorate Contamination of the Colorado River. *Meeting of tribal representatives*. Lecture conducted from Parker, AZ.

Paul Rosenfeld, Ph.D. (April 7, 2004). A National Damage Assessment Model For PCE and Dry Cleaners. *Drycleaner Symposium. California Ground Water Association*. Lecture conducted from Radison Hotel, Sacramento, California.

Rosenfeld, P. E., Grey, M., (June 2003) Two stage biofilter for biosolids composting odor control. *Seventh International In Situ And On Site Bioremediation Symposium Battelle Conference* Orlando, FL.

Paul Rosenfeld, Ph.D. and James Clark Ph.D. (February 20-21, 2003) Understanding Historical Use, Chemical Properties, Toxicity and Regulatory Guidance of 1,4 Dioxane. *National Groundwater Association. Southwest Focus Conference. Water Supply and Emerging Contaminants*., Lecture conducted from Hyatt Regency Phoenix Arizona.

Paul Rosenfeld, Ph.D. (February 6-7, 2003). Underground Storage Tank Litigation and Remediation. *California CUPA Forum*. Lecture conducted from Marriott Hotel, Anaheim California.

Paul Rosenfeld, Ph.D. (October 23, 2002) Underground Storage Tank Litigation and Remediation. *EPA Underground Storage Tank Roundtable*. Lecture conducted from Sacramento California.

Rosenfeld, P.E. and Suffet, M. (October 7- 10, 2002). Understanding Odor from Compost, *Wastewater and Industrial Processes. Sixth Annual Symposium On Off Flavors in the Aquatic Environment. International Water Association*. Lecture conducted from Barcelona Spain.

Rosenfeld, P.E. and Suffet, M. (October 7- 10, 2002). Using High Carbon Wood Ash to Control Compost Odor. *Sixth Annual Symposium On Off Flavors in the Aquatic Environment. International Water Association*. Lecture conducted from Barcelona Spain.

Rosenfeld, P.E. and Grey, M. A. (September 22-24, 2002). Biocycle Composting For Coastal Sage Restoration. *Northwest Biosolids Management Association*. Lecture conducted from Vancouver Washington..

Rosenfeld, P.E. and Grey, M. A. (November 11-14, 2002). Using High-Carbon Wood Ash to Control Odor at a Green Materials Composting Facility. *Soil Science Society Annual Conference*. Lecture conducted from Indianapolis, Maryland.

Rosenfeld. P.E. (September 16, 2000). Two stage biofilter for biosolids composting odor control. *Water Environment Federation*. Lecture conducted from Anaheim California.

Rosenfeld. P.E. (October 16, 2000). Wood ash and biofilter control of compost odor. *Biofest*. Lecture conducted from Ocean Shores, California.

Rosenfeld, P.E. (2000). Bioremediation Using Organic Soil Amendments. *California Resource Recovery Association*. Lecture conducted from Sacramento California.

Rosenfeld, P.E., C.L. Henry, R. Harrison. (1998). Oat and Grass Seed Germination and Nitrogen and Sulfur Emissions Following Biosolids Incorporation With High-Carbon Wood-Ash. *Water Environment Federation 12th Annual Residuals and Biosolids Management Conference Proceedings*. Lecture conducted from Bellevue Washington.

Rosenfeld, P.E., and C.L. Henry. (1999). An evaluation of ash incorporation with biosolids for odor reduction. *Soil Science Society of America*. Lecture conducted from Salt Lake City Utah.

Rosenfeld, P.E., C.L. Henry, R. Harrison. (1998). Comparison of Microbial Activity and Odor Emissions from Three Different Biosolids Applied to Forest Soil. *Brown and Caldwell*. Lecture conducted from Seattle Washington.

Rosenfeld, P.E., C.L. Henry. (1998). Characterization, Quantification, and Control of Odor Emissions from Biosolids Application To Forest Soil. *Biofest.* Lecture conducted from Lake Chelan, Washington.

Rosenfeld, P.E, C.L. Henry, R. Harrison. (1998). Oat and Grass Seed Germination and Nitrogen and Sulfur Emissions Following Biosolids Incorporation With High-Carbon Wood-Ash. Water Environment Federation 12th Annual Residuals and Biosolids Management Conference Proceedings. Lecture conducted from Bellevue Washington.

Rosenfeld, P.E., C.L. Henry, R. B. Harrison, and R. Dills. (1997). Comparison of Odor Emissions From Three Different Biosolids Applied to Forest Soil. *Soil Science Society of America.* Lecture conducted from Anaheim California.

Teaching Experience:

UCLA Department of Environmental Health (Summer 2003 through 20010) Taught Environmental Health Science 100 to students, including undergrad, medical doctors, public health professionals and nurses. Course focused on the health effects of environmental contaminants.

National Ground Water Association, Successful Remediation Technologies. Custom Course in Sante Fe, New Mexico. May 21, 2002. Focused on fate and transport of fuel contaminants associated with underground storage tanks.

National Ground Water Association; Successful Remediation Technologies Course in Chicago Illinois. April 1, 2002. Focused on fate and transport of contaminants associated with Superfund and RCRA sites.

California Integrated Waste Management Board, April and May, 2001. Alternative Landfill Caps Seminar in San Diego, Ventura, and San Francisco. Focused on both prescriptive and innovative landfill cover design.

UCLA Department of Environmental Engineering, February 5, 2002. Seminar on Successful Remediation Technologies focusing on Groundwater Remediation.

University Of Washington, Soil Science Program, Teaching Assistant for several courses including: Soil Chemistry, Organic Soil Amendments, and Soil Stability.

U.C. Berkeley, Environmental Science Program Teaching Assistant for Environmental Science 10.

Academic Grants Awarded:

California Integrated Waste Management Board. $41,000 grant awarded to UCLA Institute of the Environment. Goal: To investigate effect of high carbon wood ash on volatile organic emissions from compost. 2001.

Synagro Technologies, Corona California: $10,000 grant awarded to San Diego State University.
Goal: investigate effect of biosolids for restoration and remediation of degraded coastal sage soils. 2000.

King County, Department of Research and Technology, Washington State. $100,000 grant awarded to University of Washington: Goal: To investigate odor emissions from biosolids application and the effect of polymers and ash on VOC emissions. 1998.

Northwest Biosolids Management Association, Washington State. $20,000 grant awarded to investigate effect of polymers and ash on VOC emissions from biosolids. 1997.

James River Corporation, Oregon: $10,000 grant was awarded to investigate the success of genetically engineered Poplar trees with resistance to round-up. 1996.

United State Forest Service, Tahoe National Forest: $15,000 grant was awarded to investigating fire ecology of the Tahoe National Forest. 1995.

Kellogg Foundation, Washington D.C. $500 grant was awarded to construct a large anaerobic digester on St. Kitts in West Indies. 1993

Deposition and/or Trial Testimony:

In the United States District Court for the Eastern District of Texas Beaumont Division
Robinson, Jeremy et al *Plaintiffs*, vs. CNA Insurance Company et al.
Case Number 1:17-cv-000508
Rosenfeld Deposition: March 25, 2021

In the Superior Court of the State of California, County of San Bernardino
Gary Garner, Personal Representative for the Estate of Melvin Garner vs. BNSF Railway Company.
Case No. 1720288
Rosenfeld Deposition 2-23-2021

In the Superior Court of the State of California, County of Los Angeles, Spring Street Courthouse
Benny M Rodriguez vs. Union Pacific Railroad, A Corporation, et al.
Case No. 18STCV01162
Rosenfeld Deposition 12-23-2020

In the Circuit Court of Jackson County, Missouri
Karen Cornwell, *Plaintiff,* vs. Marathon Petroleum, LP, *Defendant.*
Case No.: 1716-CV10006
Rosenfeld Deposition. 8-30-2019

In the United States District Court For The District of New Jersey
Duarte et al, *Plaintiffs,* vs. United States Metals Refining Company et. al. *Defendant.*
Case No.: 2:17-cv-01624-ES-SCM
Rosenfeld Deposition. 6-7-2019

In the United States District Court of Southern District of Texas Galveston Division
M/T Carla Maersk, *Plaintiffs,* vs. Conti 168., Schiffahrts-GMBH & Co. Bulker KG MS "Conti Perdido" *Defendant.*
Case No.: 3:15-CV-00106 consolidated with 3:15-CV-00237
Rosenfeld Deposition. 5-9-2019

In The Superior Court of the State of California In And For The County Of Los Angeles – Santa Monica
Carole-Taddeo-Bates et al., vs. Ifran Khan et al., Defendants
Case No.: No. BC615636
Rosenfeld Deposition, 1-26-2019

In The Superior Court of the State of California In And For The County Of Los Angeles – Santa Monica
The San Gabriel Valley Council of Governments et al. vs El Adobe Apts. Inc. et al., Defendants
Case No.: No. BC646857
Rosenfeld Deposition, 10-6-2018; Trial 3-7-19

In United States District Court For The District of Colorado
Bells et al. Plaintiff vs. The 3M Company et al., Defendants
Case No.: 1:16-cv-02531-RBJ
Rosenfeld Deposition, 3-15-2018 and 4-3-2018

In The District Court Of Regan County, Texas, 112th Judicial District
Phillip Bales et al., Plaintiff vs. Dow Agrosciences, LLC, et al., Defendants
Cause No.: 1923
Rosenfeld Deposition, 11-17-2017

In The Superior Court of the State of California In And For The County Of Contra Costa
Simons et al., Plaintiffs vs. Chevron Corporation, et al., Defendants
Cause No C12-01481
Rosenfeld Deposition, 11-20-2017

In The Circuit Court Of The Twentieth Judicial Circuit, St Clair County, Illinois
Martha Custer et al., Plaintiff vs. Cerro Flow Products, Inc., Defendants
Case No.: No. 0i9-L-2295
Rosenfeld Deposition, 8-23-2017

In United States District Court For The Southern District of Mississippi
Guy Manuel vs. The BP Exploration et al., Defendants
Case: No 1:19-cv-00315-RHW
Rosenfeld Deposition, 4-22-2020

In The Superior Court of the State of California, For The County of Los Angeles
Warm Gilbert and Penny Gilber, Plaintiff vs. BMW of North America LLC
Case No.: LC102019 (c/w BC582154)
Rosenfeld Deposition, 8-16-2017, Trail 8-28-2018

In the Northern District Court of Mississippi, Greenville Division
Brenda J. Cooper, et al., *Plaintiffs,* vs. Meritor Inc., et al., *Defendants*
Case Number: 4:16-cv-52-DMB-JVM
Rosenfeld Deposition: July 2017

In The Superior Court of the State of Washington, County of Snohomish
Michael Davis and Julie Davis et al., Plaintiff vs. Cedar Grove Composting Inc., Defendants
Case No.: No. 13-2-03987-5
Rosenfeld Deposition, February 2017
Trial, March 2017

In The Superior Court of the State of California, County of Alameda
Charles Spain., Plaintiff vs. Thermo Fisher Scientific, et al., Defendants
Case No.: RG14711115
Rosenfeld Deposition, September 2015

In The Iowa District Court In And For Poweshiek County
Russell D. Winburn, et al., Plaintiffs vs. Doug Hoksbergen, et al., Defendants
Case No.: LALA002187
Rosenfeld Deposition, August 2015

In The Circuit Court of Ohio County, West Virginia
Robert Andrews, et al. v. Antero, et al.
Civil Action N0. 14-C-30000
Rosenfeld Deposition, June 2015

In The Iowa District Court For Muscatine County
Laurie Freeman et. al. Plaintiffs vs. Grain Processing Corporation, Defendant
Case No 4980
Rosenfeld Deposition: May 2015

In the Circuit Court of the 17th Judicial Circuit, in and For Broward County, Florida
Walter Hinton, et. al. Plaintiff, vs. City of Fort Lauderdale, Florida, a Municipality, Defendant.
Case Number CACE07030358 (26)
Rosenfeld Deposition: December 2014

In the County Court of Dallas County Texas
Lisa Parr et al, *Plaintiff*, vs. Aruba et al, *Defendant.*
Case Number cc-11-01650-E
Rosenfeld Deposition: March and September 2013
Rosenfeld Trial: April 2014

In the Court of Common Pleas of Tuscarawas County Ohio
John Michael Abicht, et al., *Plaintiffs,* vs. Republic Services, Inc., et al., *Defendants*
Case Number: 2008 CT 10 0741 (Cons. w/ 2009 CV 10 0987)
Rosenfeld Deposition: October 2012

In the United States District Court for the Middle District of Alabama, Northern Division
James K. Benefield, et al., *Plaintiffs*, vs. International Paper Company, *Defendant.*
Civil Action Number 2:09-cv-232-WHA-TFM
Rosenfeld Deposition: July 2010, June 2011

In the Circuit Court of Jefferson County Alabama
Jacanette Moss Anthony, et al., *Plaintiffs*, vs. Drummond Company Inc., et al., *Defendants*
Civil Action No. CV 2008-2076
Rosenfeld Deposition: September 2010

In the United States District Court for Eastern District of Arkansas, Eastern District of Arkansas
Harry Stephens Farms, Inc, and Harry Stephens, individual and as managing partner of Stephens Partnership, *Plaintiffs*, vs. Helena Chemical Company, and Exxon Mobil Corp., successor to Mobil Chemical Co., *Defendants.*
Case Number 2:06-CV-00166 JMM (Consolidated with case number 4:07CV00278 JMM)
Rosenfeld Deposition: July 2010

In the United States District Court, Western District Lafayette Division
Ackle et al., *Plaintiffs*, vs. Citgo Petroleum Corporation, et al., *Defendants.*
Case Number 2:07CV1052
Rosenfeld Deposition: July 2009

In the United States District Court for the Southern District of Ohio
Carolyn Baker, et al., *Plaintiffs*, vs. Chevron Oil Company, et al., *Defendants.*
Case Number 1:05 CV 227
Rosenfeld Deposition: July 2008

In the Ninth Judicial District Court, Parish of Rapides, State of Louisiana
Roger Price, et al., *Plaintiffs*, vs. Roy O. Martin, L.P., et al., *Defendants.*
Civil Suit Number 224,041 Division G
Rosenfeld Deposition: September 2008

In the Superior Court of the State of California in and for the County of Los Angeles
Leslie Hensley and Rick Hensley, *Plaintiffs*, vs. Peter T. Hoss, as trustee on behalf of the Cone Fee Trust; Plains Exploration & Production Company, a Delaware corporation; Rayne Water Conditioning, Inc., a California Corporation; and DOES 1 through 100, *Defendants.*
Case Number SC094173
Rosenfeld Deposition: September 2008, October 2008

Exhibit B

Q-18420
Developed Especially for:

Paul Rosenfeld
SWAPE
2656 29th Street, Suite 201
Santa Monica, CA 90405
Phone:
Email: prosenfeld@swape.com

Prepared on June 7, 2021 by:

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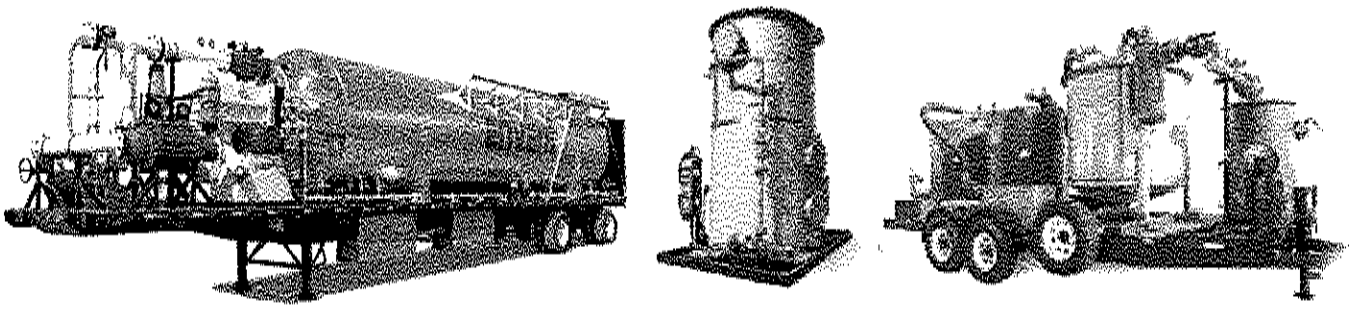

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Date: June 7, 2021
Proposal Number: Q-18420

Paul Rosenfeld
prosenfeld@swape.com

SWAPE
2656 29th Street, Suite 201
Santa Monica, CA 90405

Carpinteria Cannabis Odor Control Equipment Sale

Envent is pleased to provide this Budgetary Proposal to SWAPE for the purchase and delivery of ten odor control systems for a Cannabis grow facility in Carpinteria, CA.

Each system would consist of one 5,000SCFM Blower assembly which would be powered by 480V 3 phase power provided and tied in by the facility. This would be used along with 2 Envent CannaGac High Flow odor control vessels. Each vessel holds 2,000lbs of carbon media which is included with initial fill of media in the attached pricing.

Customer responsible for all interconnecting piping to tie the vessels and blower along with connections to the facility structure and an exhaust stack per Air district requirements.

40 hours of time(billed T&M) for an Envent staff engineer to work with consultants and site staff for final layout and attend meetings at the site as necessary. If site meetings are required per Diem and other travel costs may be required.

This is budgetary pricing and subject to change.

Envent to provide Carbon change-outs as needed during operation of the system at pre-agreed upon rates finalized at time of purchase.

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Services

PRODUCT	COMMENTS	RATE	UNIT OF MEASURE	QTY PER UOM	TOTAL QTY	SUBTOTAL	TOTAL PRICE
Equipment Delivery		$3,600.00	Each	1	1	$3,600.00	$3,600.00
						Total Cost:	$3,600.00

Equipment

PRODUCT	COMMENTS	RATE	UNIT OF MEASURE	QTY PER UOM	TOTAL QTY	SUBTOTAL	TOTAL PRICE
Freight	Inbound freight- Cost plus estimate	$14,600.00	Each	1	1	$14,600.00	$14,600.00
Supplemental Equipment	Price per system which includes 2 CannGac2000 Vessels, 5,000SCFM Blower and 4,000lb sof Virgin GAC Media	$21,240.00	Each	10	1	$212,400.00	$212,400.00
						Total Cost:	$227,000.00

Labor

PRODUCT	COMMENTS	RATE	UNIT OF MEASURE	QTY PER UOM	TOTAL QTY	SUBTOTAL	TOTAL PRICE
Engineer	Engineer for project meetings prior to installation of equipment	$138.00	Hour - ST	40	1	$5,520.00	$5,520.00
						Total Cost:	$5,520.00

Total Recurring Cost Estimate:	$0.00
Total Non-Recurring Cost Estimate:	$236,120.00
Grand Total:	$236,120.00

Confidentiality Notice: This quotation and any associated document(s) are privileged and confidential, and are intended for the sole use of the addressee(s). They cannot be used, circulated, duplicated, quoted or otherwise referred to or disclosed to third parties for any reason without the written consent of an Officer of Envent Corporation. If you have received this information in error, please immediately contact us at daniel.rapoport@envent.net. Thank you.

Assumptions:

- Work performed Monday - Friday. Additional costs for weekends/holidays.
- This estimate is based on our best information and actual time may vary.
- System designed without job walk or site sampling, or liquid/vapor profiling. Changes to system to improve performance are billed to customer at T&M.
- Forklift to be provided by customer or at cost plus.
- Budgetary estimate only.
- Carbon Change-outs when required; quoted per event.
- Customer to facilitate all job site access including but not limited to plates or other method for driving on sand, mud, or over tank berms.
- All pre-job engineering, permitting, Hazop meetings will be billed at engineering rate.
- Carbon disposal/recycle handled by Envent unless otherwise directed.
- Adjustment Clause: Granular Activated Carbon is a commodity and can fluctuate. Therefore, Envent reserves the right to request modification to the pricing presented herein if our supply pricing is impacted.

By signing and accepting below you are acknowledging that you have read and agree to the specific terms outlined in this document and wish to proceed with the implementation of the aforementioned products and services.

Authorized Signature for Envent Corporation

Authorized Signature for SWAPE

Remittance Address:

Envent Corporation
3220 E. 29th St
Long Beach, CA 90806

*PO Available:

PO Number:

PO Amount:

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Terms and Conditions

1. DEFINITIONS. "**Agreement**" means this Equipment Rental and Services Agreement between Customer and Envent Corporation, and includes the Cover Page, the Terms and Conditions and any Schedule or Exhibit attached to the Agreement. Execution of the Cover Page by Customer and Event shall be deemed to be execution of the Agreement. "**Cover Page**" means the Cover Page to the Agreement between Customer and Event and page one to this Agreement. "**Customer**" means the party identified on the Cover Page including any representative, agent, officer or employee of Customer. "**Envent**" or "**Company**" means Envent Corporation. "**Envent Shop**" means the Envent facility, identified on the Cover Page, from which the Equipment is being rented. "**Equipment**" means any one or more items of equipment listed on the Cover Page this Agreement being rented by Customer from Envent and includes accessories, attachments or other items. "**Services**" means the Services which Customer has requested Envent to provide as identified on the Cover Page.

2. EQUIPMENT AND SERVICES. Customer has entered into this Agreement with Envent to rent the Equipment and to obtain the Services identified on the Cover Page (and applicable Schedules) for use at the Customer Job Site identified on the Cover Page. If the Services are to be provided by Envent employee(s), the name and/or position and such other relevant information (which may include the hourly or other payment rate) of such Envent employee shall be set forth on the Services Schedule attached to this Agreement.

3. DELIVERY, RECEIPT AND INSPECTION OF EQUIPMENT. Unless otherwise agreed to in writing, Envent, or its authorized designee, shall deliver the Equipment to the Customer Job Site designated on the Cover Page. Customer agrees not to remove the Equipment from that location without the prior written consent of Envent, except in the case of equipment specifically designed and intended for mobility (as noted on the Cover Page). Customer acknowledges by executing this Agreement that Customer has inspected the Equipment prior to taking possession thereof, finds it in good working order and repair, and suitable for Customer's needs. Customer acknowledges that, although the Equipment has, prior to delivery to Customer Job Site, been cleaned in accordance with Envent's usual cleaning procedures, Envent does not warrant that the Equipment is free of any contaminants (unless a separate specific written agreement to the contrary has been entered into by Envent with Customer) and Customer accepts the Equipment in the condition as delivered. Customer is familiar with the proper operation and use of each item of Equipment. Customer has inspected or will inspect all hitches, bolts, safety chains, hauling tongues, welds and other devices and materials used to connect the Equipment to any of Customer's equipment, including any towing vehicle, if any, and acknowledges that Envent is not responsible for any damage to Customer's equipment or towing vehicle caused by any detachable hitches or mirrors.

4. USE OF EQUIPMENT. Customer will not use, or allow anyone to use, the Equipment: (a) for an illegal or unauthorized purpose or in an illegal or unauthorized manner, (b) without a valid license, if a license for operation is required under any applicable law, or (c) who is not qualified to operate it. Customer agrees, at Customer's sole expense, to comply with all applicable municipal, state, and federal laws, ordinances and regulations (including O.S.H.A.) which may apply to the use of the Equipment. Customer is solely responsible

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for supervising the use and operation of the Equipment. Customer agrees that the Equipment shall be used only in the normal course of its business, and is aware of all limitations of the Equipment. Customer shall keep the Equipment in good and efficient working order, condition and repair, reasonable wear and tear excepted. Customer agrees to properly maintain and care for the Equipment and to protect the health and safety of persons required to operate or come in contact with the Equipment. Customer agrees to regularly check filters, oil, fluid levels, pressures; to visually inspect the Equipment daily and immediately notify Envent if Equipment needs repair or maintenance; and to perform all necessary compliance monitoring. Customer acknowledges that Envent has no responsibility to inspect the Equipment while it is in Customer's possession although Envent has the right, in its discretion, to conduct such an inspection and to test any contents, which may be contained in the Equipment, and to access Customer's premises or job site during normal business hours for that purpose. Customer acknowledges and warrants that Envent shall incur no liability whatsoever for damage to person or property resulting from use of or caused by the Equipment or the failure of the Equipment to perform the services intended or desired by Customer, or for any damage to property of Customer or others or other property for which Customer might be held responsible resulting from use of or caused by the Equipment. Customer will not operate the Equipment in a manner that may cause damage or harm to the Equipment. In connection with its use of the Equipment, Customer will not use or process any hazardous materials unless a Supplemental Hazardous Material Agreement has been executed by both parties. If any hazardous materials are stored or transported in the Equipment, Customer agrees that Customer shall be deemed to be the generator of those materials and shall, upon request, provide Customer's EPA or other environmental licensing number to be used by Envent in connection with the disposal of any such hazardous materials. Customer acknowledges and agrees that some Equipment is equipped with pressure/vacuum relief devices or throttle stop and governor devices and Customer agrees that its employees or agents will not to tamper with or adjust such devices without prior written consent of Envent.

5. IMPROVEMENTS OR CHANGES TO EQUIPMENT. Customer shall not make any modifications, changes in or to the Equipment or make any improvements to the Equipment without the prior written consent of Envent, which consent may be withheld in Event's sole discretion. Any modifications or improvements, changes or additions to the Equipment shall become and remain the property of Envent. Envent reserves the right to charge the Customer for the removal of any modifications, additions, changes or improvement made to the Equipment by Customer during the rental period.

6. MALFUNCTIONING EQUIPMENT. Should the Equipment malfunction, require repair, or become unsafe, Customer shall immediately cease using such Equipment and immediately notify Envent and provide information to Envent as to the nature of the problem. If such condition is the result of normal operation, Envent will repair or replace the Equipment with similar Equipment if such replacement Equipment is available. Envent has no obligation to replace Equipment rendered inoperable by misuse, abuse or neglect by the Customer. Customer's sole remedy for any failure or defect in Equipment shall be the termination of this Agreement and any rental charges accruing after the date and time of notification to Envent of such failure or malfunction. The Equipment must be returned to Envent within twenty-four hours from the time of notification of defect or malfunction in order to terminate rental charges.

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7. RETURN OF EQUIPMENT, DAMAGED AND LOST EQUIPMENT. At the expiration of the rental period, the Customer will return the Equipment to Envent in the same condition as when the Equipment was delivered to the Customer, empty of all contents and in clean condition, normal wear and tear excepted. Envent reserves the right to charge Customer for any repairs that may be necessary, including cleaning of interior or exterior and disposal of any contents. Customer shall be liable for all damage to or loss of the Equipment by Customer or its agents and any damage to the Equipment during transit to or from Customer. Customer shall be obligated to pay to Envent the reasonable cost of transportation, the cost of repair or replacement and the rental rate at the Envent rental rate noted on the Cover Page until all lost Equipment has been replaced or repairs to damaged Equipment have been completed. Envent shall be under no obligation to commence repair work or replacement until Customer has paid to Envent the estimated cost of such replacement or repair. In the case of the loss or destruction of any Equipment, or inability or failure to return same to Envent for any reason whatsoever, Customer will pay Envent the then full replacement list price for such item of Equipment together with the full rental rate as specified on the Cover Page until such Equipment is replaced.

8. REASONABLE WEAR AND TEAR. Reasonable wear and tear of the Equipment shall mean only the normal deterioration of the Equipment caused by ordinary and reasonable use for a one-shift (eight hours per day) for each day that Equipment is rented from Envent. The following shall not be deemed reasonable wear and tear: (a) damage resulting from lack of lubrication or maintenance of necessary oil, water and air pressure levels; (b) damage resulting from the lack of servicing or preventive maintenance; (c) damage resulting from any collision, overturning, or improper operation, including overloading or exceeding the rated capacity of the Equipment or any part thereof; (e) wear resulting from use in excess of standard shift time; and (f) any other damage to the Equipment which is not considered ordinary and reasonable in the equipment rental industry. Repairs to the Equipment shall be made only by a facility approved by Envent, to the reasonable satisfaction of Envent and in a manner that will not adversely affect the operation, manufacturer's design or value of the Equipment.

9. RENTAL PERIOD AND CALCULATIONS OF CHARGES. Rental charges commence when the Equipment leaves Envent's Shop and end when the Equipment is returned to the same Envent location. Rental charges accrue during Saturdays, Sundays, and holidays. Rental rates are for normal usage based on an eight hour day, forty (40) hours per week and 160 hours per month. On power equipment, operation in excess of one shift (eight (8) hours per day) will be at Envent's standard premium rates as provided by Envent to the Customer from time to time or upon request of the Customer. Customer will truthfully and accurately certify to Envent the number of shifts for which the Equipment was operated. Transportation costs for delivery and pick up of the Equipment covered by this Agreement shall be in accordance with Envent's standard rates at the time of such delivery or pick up. The Equipment is furnished F.O.B. Envent's shop and Customer shall pay the transportation charges for the Equipment to and from Envent's Shop to the customer Job Site, as noted on the Cover Page. Customer shall pay all rental charges without any offsets, deductions, or claims.

10. EQUIPMENT CHARGES AND PAYMENT. All obligations of Customer under this Agreement shall be paid in full upon return of the Equipment to Envent if rental is for a period of less than 30-days. If rental period is for a period longer than 30-days, Envent shall invoice the Customer, and payment is due within 10 days. Customer acknowledges that timely payment of Charges is essential to Envent's business operations and it would be

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impractical and extremely difficult to fix the actual damages caused by late payment. If Customer shall fail to pay any Charges (for Equipment or Services) when due, Customer agrees to pay a late charge of *[six] percent ([6]%)* of Charge due. Customer acknowledges that Envent will suffer damages in an amount that cannot be easily ascertained and that the late charge provided herein represents liquidated damages and a fair approximation of such damage. In addition, Customer shall pay interest on the charges or payment due at the rate of [ten] percent ([10]%) per annum, but in no event greater than the maximum amount allowed by law, until the Payment or charges are paid in full.

11. LATE RETURNS. Customer agrees to pay for any damage to or loss of the Equipment occurring between the time the Equipment is returned and the commencement of Envent's next business day in the event the Equipment is returned to Envent at a time other than Envent's regular business hours.

12. CHARGES FOR SERVICES. Charges for Services to be provided by Envent personnel, shall be at the hourly or other rates specified for the Services as set forth in the Cover Sheet or the Services Schedule attached to the Agreement and shall be invoiced to and paid by Customer in accordance with procedures set forth on the Cover Page/Services Schedule.

13. DEPOSIT. In addition to securing the payment of rental charges hereunder, Customer agrees that any rental deposit required by Envent, shall be deemed to be a guaranty by Customer of the full and complete performance of each and all of the terms, covenants, and agreements to be performed by Customer hereunder, and in the event of any breach by Customer thereof said deposit shall be credited against any damages, costs or expenses incurred.

14. TERMINATION. Envent shall have the right to terminate this Agreement for any reason upon notice to Customer and require the Customer to return the Equipment to Envent within twenty-four (24) hours of such notification, Customer shall be required to pay for the use of the Equipment or services through the date of the notice of termination and agrees to be bound by these Terms and Conditions until Equipment is returned and all charges are paid in full.

15. PERMITS. If Customer is using or renting a piece of equipment associated with any Envent or EC Vapor Control permit, the customer is fully responsible for the compliance with all permit conditions and any applicable rules and regulations. Any variances will be mitigated immediately and be reported within 30 minutes to Envent Corporation account manager, dispatcher or supervisor. Permits include by are not limited to: AQMD, APCD, EPA, DTSC. Any time a customer chooses to maintain the compliance with an Envent or EC Vapor Control system; they accept complete responsibility for any and all notices of violation, notices of compliance or any other action taken by any environmental agency or department.

16. RELEASE. Customer releases and forever discharges Envent from any and all liability or damages (including consequential and special damages) which might be caused by Envent's failure or inability to deliver any Equipment or Services by any specified date or time.

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17. TITLE/NO PURCHASE OPTION/NO LIENS AND SECURITY INTEREST. This Agreement is not a contract of sale, and title to the Equipment shall at all times remain with Envent. Unless covered by a specific supplemental agreement signed by Envent, the Customer has no option or right to purchase the Equipment. Customer shall keep the Equipment free and clear of all mechanics and other liens and encumbrances and shall immediately notice Envent of any claim, lien, levy or legal process issued against or involving the Equipment. Customer hereby grants Envent a first priority security interest in the Equipment (including any replacements, substitution, additions, attachments and proceeds). Customer will deliver to Envent such signed documents as Envent may request to protect Envent's interest in the Equipment. Operator irrevocably authorizes Envent to file a UCC-1 financing statement in appropriate jurisdictions to perfect the security interest granted by this Agreement. Envent shall have the right to attach or place a serial number or other form of identification on each item of Equipment and Customer agrees not to remove or obstruct such identification. Envent possess all rights as a secured creditor and Envent shall have all remedies available to a secured creditor under the Uniform Commercial Code. In the event of any default, Customer shall, at the request of Envent, assemble the Equipment and make the Equipment available to Envent at a place designated by Envent which is reasonably convenient to both parties. Customer acknowledges and agrees that the Equipment shall be utilized in the Customer's trade or business, and agrees that the Equipment shall not be used for personal, family or household purposes.

18. TIRE/TUBE REPAIR OR REPLACEMENT. Repair or replacement of tires and tubes is the responsibility of the Customer, and is not included in the rental rate.

19. DEFAULT. Should Customer in any way fail to perform, observe or keep any provision of this Agreement, Envent may, at its option, do any one or more of the following: (a) terminate this Agreement; (b) declare the entire rent immediately due and payable and commence legal action thereof; (c) retake possession of the Equipment, holding the Customer liable for all rental and other charges; or (d) pursue any other remedies available by law.

20. REPOSSESSION OF EQUIPMENT. In the event of any actual or anticipatory violation of or default in any of the terms and conditions of this contract by the Customer, Envent may terminate the Agreement and without notice or legal process, go upon Customer's property or the Job Site and take all action reasonably necessary to take possession of the Equipment. Customer waives all claims for damages and losses, physical or pecuniary, caused thereby, and shall pay all costs and expenses incurred by Envent in taking possession of the Equipment. Should Customer claim that any of said Equipment contains property belonging to Customer, the Customer shall give written notice to Envent of such fact within a period twenty-four (24) hours. Failure to give such notice within said twenty-four (24) hours shall forever bar Customer from asserting any claim or claims against Envent on account of property alleged to have been in said retaken Equipment.

21. CUSTOMER'S INSURANCE COVERAGE. Customer agrees to maintain and carry, at its sole cost, adequate liability, physical damage, public liability, property damage and casualty insurance for the full replacement cost of the Equipment, including all risks of loss or damage covered by the standard extended coverage endorsement to cover any damage or liability arising from the handling, transportation, maintenance, operation

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or use of the Equipment during the entire rental period. When requested, Customer shall supply to Envent proof of such insurance by Certificate of Insurance clearly setting forth the coverage for the Equipment and naming Envent as loss payee and additional insured. In addition to and as a separate and distinct obligation from the Indemnification duties contained herein, Customer agrees that it now carries and will maintain in force, at its sole cost, during the performance of this Agreement, and shall require its subcontractors to maintain, insurance as follows: (i) Workers' Compensation - statutory limits and Employer's Liability - $1,000,000 per occurrence; (ii) Commercial General Liability - $2,000,000 per occurrence/$5,000,000 aggregate (This coverage shall include comprehensive form, premises, operations, XCU (explosion, collapse, and ground hazard), products/completed operations, broad form contractual liability, independent underground hazard), products/completed operations, broad form contractual liability, independent contractors, property damage, and personal injury; and (iii) Automobile Liability for owned, nonowned, or hired vehicles - $2,000,000 per occurrence and $5,000,000 aggregate. Customer shall maintain insurance to cover loss or damage to Equipment, materials, and tools that are owned, leased, or rented by or for which Customer has responsibility. All policies shall: (A) include Envent as Additional Insureds, without regard to the liabilities contained in this Agreement; (B) be primary to any other insurance maintained by Envent; (C) contain a waiver of subrogation on behalf of the Insurer and Customer; (D) contain a Severability of interest and/or cross liability provision; and (E) provide 30-days' notice to Envent in the event of any nonrenewal cancellation, restriction, or modification of insurance. Customer shall provide Envent with certificates of such insurance or satisfactory evidence of the above-stated coverages prior to using the Equipment or the performance of the Services.

22. ENTIRE AGREEMENT/ONLY AGREEMENT. This written Agreement (and all attached Schedules and exhibits and any amendments or supplemental agreement entered into between the Parties) together with the Credit Application, if any, which Customer has provided to Event, represents the entire agreement between the Customer and Envent relating to the Equipment and the Services. In the event of any conflict in terms, this Agreement shall control. There are no oral or other representations or agreements not included herein. None of Envent's rights or Customer's rights may be changed and no extension of the terms of this Agreement may be made except in writing, signed by both Envent and Customer. Any use or reference to Customer's purchase order number on this Agreement is for Customer's convenience only and such purchase order shall not be deemed to be incorporated into or part of this Agreement. This Rental Agreement supersedes any purchase order or other Customer provisions or forms whether sent to or received prior, or subsequent to this Agreement.

23. DISCLAIMER OF WARRANTIES. ENVENT MAKES NO WARRANTIES, EXPRESS OR IMPLIED, AS TO THE MERCHANTABILITY OF THE EQUIPMENT OR ITS FITNESS FOR ANY PARTICULAR PURPOSE. There is no warranty that the Equipment is suited for Customer's intended use or that it is free from defects. Except as specifically set forth in this Agreement, Envent disclaims all other warranties, either expressed or implied, made in connection with this Agreement, the Equipment and the Services and all remedies, rights, liabilities, warranties, expressed or implied, arising from law or otherwise, including but not limited to any claim of implied warranty of merchantability, any claim of implied warranty arising from course of performance, course of dealing or

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usage of trade and any claim of implied warranty of fitness are disclaimed by Envent and waived by Customer. These warranty provisions can only be amended or modified in a writing signed by Envent and cannot be amended or modified orally and they supersede any contrary representations or warranties, expressed or implied. In addition, Envent shall not be responsible for any damage or loss caused by the negligence of Envent's employees or agents occurring in connection with the Services performed pursuant to this Agreement.

24. INDEMNITY/HOLD HARMLESS/DAMAGES. Customer acknowledges and assumes all risks inherent in the operation and use of the Equipment by Customer, and while in possession of the Equipment will take all necessary precaution to protect all persons and property from injury or damage. Envent shall not be responsible to Customer or to any other party for any loss, damage or injury (including any loss of profits, business interruption or other special or consequential damages) caused by, resulting from, or in any way connected with the Equipment, its operation or use, or any defect with respect thereto. CUSTOMER SHALL DEFEND, INDEMNIFY, AND HOLD HARMLESS ENVENT AND ITS AFFILIATES, AGENTS, OFFICERS, DIRECTORS, MANAGERS, MEMBERS, REPRESENTATIVES AND EMPLOYEES, FROM AND AGAINST ANY AND ALL CLAIMS AND DAMAGES, CAUSES OF ACTION, COSTS, EXPENSES, REASONABLE ATTORNEYS' FEES, LOSSES, OR LIABILITY, OF EVERY NATURE OR CHARACTER WHATSOEVER ("CLAIMS") ARISING OUT OF, IN CONNECTION WITH OR RELATED TO CUSTOMER'S BREACH OF ANY REPRESENTATION OR OBLIGATION OF CUSTOMER UNDER THIS AGREEMENT OR CLAIMS FOR INJURIES TO OR DEATH OF PERSONS OR DAMAGE TO PROPERTY ARISING OUT OF THE USE, MAINTENANCE, INSTRUCTION, OPERATION, POSSESSION OR RENTAL OF THE EQUIPMENT, INCLUDING ANY CLAIMS CAUSED BY THE NEGLIGENCE OF ENVENT, FOR:

A. PERSONAL INJURY, DEATH, OR DAMAGE TO PROPERTY, INCLUDING CONTAMINATION OF OR ADVERSE EFFECTS ON THE ENVIRONMENT;
B. ANY VIOLATION BY CUSTOMER OR ITS CUSTOMERS OF ANY APPLICABLE FEDERAL, STATE, OR LOCAL LAW, ORDER, RULE, OR REGULATION, INCLUDING RULES AND REGULATIONS IN THIS AGREEMENT;
C. ANY PATENT OR COPYRIGHT INFRINGEMENT BY CUSTOMER OR ITS CUSTOMERS OR SUPPLIERS;
D. ANY INJURY, ILLNESS, DISEASE, DEATH, OR OTHER HARM SUFFERED OR INCURRED BY ANY EMPLOYEE OF THE CUSTOMER, ITS EMPLOYEES, OR CUSTOMERS;
E. CUSTOMER'S OR ITS CUSTOMERS' BREACH OF THIS AGREEMENT;
G. ANY ATTORNEYS' FEES, COSTS AND EXPENSES INCURRED BY ENVENT IN ENFORCING THIS PROVISION.

CUSTOMER'S DUTY TO INDEMNIFY ENVENT SHALL APPLY EVEN IN THE EVENT THE LOSS WAS CAUSED BY THE NEGLIGENT ACT OR OMISSION OF ENVENT. CUSTOMER SHALL FULLY INDEMNIFY, DEFEND AND HOLD HARMLESS ENVENT FROM ANY AND ALL LOSS TO THE PROPERTY OR EQUIPMENT OF CUSTOMER OR ANY OF ITS CUSTOMERS AND ANY AND ALL CLAIMS BROUGHT BY OR ON BEHALF OF CUSTOMER'S EMPLOYEES, AGENTS OR SERVANTS OR ANY OF ITS CUSTOMERS AGAINST ENVENT. THE INDEMNIFICATION PROVISION SHALL SURVIVE THE TERMINATION OF THIS AGREEMENT. THE LIABILITY OF THE CUSTOMER TO ENVENT IS NOT LIMITED TO THE CONTRACTOR'S INSURANCE COVERAGE.

25. NO ASSIGNMENT, LENDING OR SUBLETTING. Customer shall not sublease, subrent, assign or loan the Equipment, and any such action by Customer shall be void. Customer agrees to use and keep the Equipment

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at the job site set forth on the Cover Page of this Agreement unless Envent has so authorized otherwise in writing.

26. OTHER PROVISIONS. Any failure of Envent to insist upon strict performance by Customer of any terms and conditions of this Agreement shall not be construed as a waiver of Envent's right to demand strict compliance. Customer has carefully reviewed this Agreement and waives any principle of law which would construe any provision hereof against Envent as the draftsperson of this Agreement.

27. GOVERNING LAW. This Agreement shall be governed by and construed, interpreted, and enforced in accordance with the laws of the State of California.

28. SUBMISSION TO JURISDICTION. The parties irrevocably and unconditionally submit, for itself and its property, to the nonexclusive jurisdiction of the courts of the State of California sitting in Los Angeles, CA and of the United States District Court of the Southern District of California, and any appellate court from any thereof, in any action or proceeding arising out of or relating to this Agreement, or for recognition or enforcement of any judgment, and each of the parties hereto irrevocably and unconditionally agrees that all claims in respect of any such action or proceeding may be heard and determined in such California state court or, to the fullest extent permitted by applicable law, in such Federal court. Each of the parties hereto agrees that a final judgment in any such action or proceeding shall be conclusive and may be enforced in other jurisdictions by suit on the judgment or in any other manner provided by law. Customer irrevocably and unconditionally waives, to the fullest extent permitted by applicable law, any objection that it may now or hereafter have to the laying of venue of any action or proceeding arising out of or relating to this Agreement in any court referred to in this Section. Each of the parties hereto hereby irrevocably waives, to the fullest extent permitted by applicable law, the defense of an inconvenient forum to the maintenance of such action or proceeding in any such court.

29. WAIVER OF JURY TRIAL. TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW, CUSTOMER HEREBY IRREVOCABLY AND EXPRESSLY WAIVES ALL RIGHT TO A TRIAL BY JURY IN ANY ACTION, PROCEEDING, OR COUNTERCLAIM (WHETHER BASED UPON CONTRACT, TORT, OR OTHERWISE) ARISING OUT OF OR RELATING TO THIS AGREEMENT OR THE TRANSACTIONS CONTEMPLATED HEREBY, OR THE ACTIONS OF HILLWOOD IN THE NEGOTIATION, ADMINISTRATION, OR ENFORCEMENT HEREOF. THIS WAIVER OF RIGHT TO TRIAL BY JURY IS GIVEN KNOWINGLY AND VOLUNTARILY BY CUSTOMER, AND IS INTENDED TO ENCOMPASS INDIVIDUALLY EACH INSTANCE AND EACH ISSUE AS TO WHICH THE RIGHT TO A TRIAL BY JURY WOULD OTHERWISE ACCRUE. HILLWOOD IS HEREBY AUTHORIZED TO FILE A COPY OF THIS PARAGRAPH IN ANY PROCEEDING AS CONCLUSIVE EVIDENCE OF THIS WAIVER BY CUSTOMER.

30. ATTORNEYS' FEES AND COSTS. In the event of any litigation, arbitration or other proceeding or other dispute (other than mediation) arising as a result of this Agreement, the prevailing party shall be entitled, in

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addition to any other damages assessed, to its reasonable attorneys' fees and all other costs and expenses incurred in connection with settling or resolving such dispute. The attorneys' fees which the prevailing party shall be entitled to recover shall include any fees for prosecuting or defending any appeal and supplemental proceedings until the final judgment is satisfied in full, and for any post-judgment proceedings to collect or enforce the judgment. Subject to the provisions of local law, the prevailing party shall recover all such fees, costs or disbursements as costs assessable by the court or arbiter in the action or proceeding itself without the necessity for a cross-action by the prevailing party.

31. FORCE MAJEURE. Any delay or failure of either party to perform its obligations hereunder shall be excused if, and to the extent, caused by acts of God, action of a governmental authority (including, but not limited to, changes in applicable laws, regulations, rules or administrative practices), unusually severe weather conditions, fire, flood, explosion, riot, war, sabotage, labor problems (including lockouts, strikes and slowdowns), court injunction or order or other such causes that are beyond the reasonable control of the affected party and without its fault or negligence; provided, that prompt notice of such delay shall be given by the affected party to the other party. Each of the parties hereto shall be diligent in attempting to remove such cause or causes but shall not be under any obligation to settle strikes by its employees.

32. COUNTERPARTS. This Agreement may be executed by the parties hereto in any number of counterparts, each of which when so executed and delivered shall be deemed to be an original and all of which taken together shall constitute one and the same instrument, respectively. Executed copies of the signature pages of this Agreement sent by facsimile or transmitted electronically in either Tagged Image Format Files or Portable Document Format shall be treated as originals, fully binding and with full legal force and effect, and the parties waive any rights they may have to object to such treatment.

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Exhibit J

Cannabis

SUMMARY

The action taken by the Santa Barbara County Board of Supervisors to certify the development of a robust cannabis industry as the primary objective of the cannabis ordinances has altered the quality of life in Santa Barbara County, perhaps forever.

The fulfillment of that objective dictated the actions taken by the Board from the excessive allowance of licenses and acreage, creation of an unverified affidavit system, ignoring widespread odor complaints, not acknowledging the conflict between cannabis cultivation and traditional agriculture, to rejecting the environmentally superior alternatives of limited cannabis development.

Instead of a balanced approach carefully evaluating how the cannabis industry would be compatible, both as to amount of acreage and location, the Board simply opened the floodgates. These ordinances must be amended.

INTRODUCTION

The 2019-20 Santa Barbara County Grand Jury (Jury) received several requests for investigation of the actions of the Santa Barbara County Board of Supervisors (Board) surrounding the creation and passage of the Ordinance 5026, adding Chapter 50A of the Santa Barbara County Code; Ordinance 5027, amending Chapter 35-1 of the Santa Barbara County Code, the Santa Barbara County Land Use and Development Code (LUDC); Ordinance 5028, amending Article II, the Coastal Zoning Ordinance of Santa Barbara County (CZO); and creation and passage of Ordinance No. 5037, adding Chapter 50 of the Santa Barbara County Code, Licensing of Commercial Cannabis Operations (License), and related impacts. The Jury, comprised of professional people, including attorneys and CPAs, former law enforcement, business owners, government officials, and educators, spent countless hours reviewing documents, reviewing Board and Santa Barbara County Planning Commission hearings and interviewing numerous witnesses including the five members of the Board.

The rules of the Santa Barbara County Grand Jury do not permit the naming of individuals within a report. The intent of the investigation, initially undertaken pursuant to *California Penal Code Section 919(c),* was to examine the process of the creation and passage of the ordinances and resulting issues.

The Jury does not express an opinion on the legalization of cannabis.

This investigation by the Jury was hindered by the denial of its request for subpoenas to be issued to non-government witnesses who might have been helpful to the inquiry. The investigation was further hindered by a two month delay in the final production of requested documents from the County of Santa Barbara that was purported to be responsive and complete. During the investigation, the Jury learned that all documents requested have not been provided.

The California Supreme Court has stated, "In California, unlike some other American jurisdictions, the grand jury's role as a vigilant 'watchdog' over the operations of a variety of local government activities has a long and well respected heritage."[1]

[1] *People v. Superior Court* (1973 Grand Jury) (1975) 13 Cal. 3rd 430, 436

The Grand Jury is aware that the Santa Barbara County Board of Supervisors initiated a process in July, 2019 to review and possibly amend the cannabis related ordinances. The insights and recommendations provided by the Jury in this report should be of great assistance in creating a legal cannabis framework going forward that will best serve the interests of the residents, local businesses and the agricultural industry of Santa Barbara County.

METHODOLOGY

In the course of its investigation, the Grand Jury interviewed:

- the five members of the Santa Barbara County Board of Supervisors who voted on the ordinances
- a senior member of the Santa Barbara County CEO staff
- a senior member of the Santa Barbara County Planning and Development staff
- a school district superintendent
- a high school principal
- a public school teacher
- a senior Santa Barbara County Public Health Department official
- a senior member of the Santa Barbara County Agriculture Commissioner staff
- a former Santa Barbara County Planning Commission member
- a local land use attorney
- a senior member of the Santa Barbara County Tax Collector staff
- a senior member of Santa Barbara County Air Pollution Control District staff
- a Cal OSHA staff member
- a UCSB professor of environmental science
- a senior member of the Santa Barbara County District Attorney staff
- Santa Barbara County residents
- Santa Barbara County avocado growers
- Santa Barbara County vineyard owners
- a Santa Barbara County cannabis cultivator
- a Santa Barbara County cannabis activist

The Jury also reviewed:

- Santa Barbara County Board of Supervisors meetings and supporting written material
- Santa Barbara County Planning Commission meetings and supporting written material
- numerous local, state and national news articles regarding cannabis
- scientific articles on cannabis

- in excess of one thousand documents produced by the County of Santa Barbara
- emails and texts produced by the County of Santa Barbara
- County Code of Ethics published by the Research Division of the National Association of Counties, County Services Department, 2009
- Santa Barbara County Board of Supervisors official website

BACKGROUND

On November 8, 2016, the voters of California passed Proposition 64, The Adult Use of Marijuana Act, which legalized non-medical adult use of cannabis.

In 2017, at the direction of the Ad Hoc Sub Committee made up of two members of the Board and pursuant to the California Environmental Quality Act (CEQA), a Program Environmental Impact Report (EIR) was prepared by the Santa Barbara County Planning and Development Department (P&D) for the Cannabis Land Use Ordinances and Licensing Program (Project).

The Project lists ten primary objectives. (See Appendix 1.) The first objective was "Develop a robust and economically viable legal cannabis industry to ensure production and availability of high quality cannabis products to help meet local demands, and, as a public benefit, improve the County's tax base." The last objective was to "Limit potential for adverse impacts on children and sensitive populations by ensuring compatibility of commercial cannabis activities with surrounding existing land uses, including residential neighborhoods, agricultural operations, youth facilities, recreational amenities and educational institutions."

On February 13, 2018, the Santa Barbara County Board of Supervisors adopted Ordinance 5026, adding Chapter 50A to the Santa Barbara County Code.

On February 27, 2018, the Santa Barbara County Board of Supervisors adopted Ordinance 5028, amending the CZO, and adopted Ordinance No. 5027, amending the LUDC.

On May 1, 2018, the Santa Barbara County Board of Supervisors adopted Ordinance No. 5037, adding Chapter 50, Licensing of Commercial Cannabis Operations, to the Santa Barbara County Code.

OBSERVATIONS AND ANALYSIS

The investigation was undertaken to examine various issues and the actions that were taken by the Board in the process of creating the ordinances. These issues include the following:

1. **Ad Hoc Committee** - The use of an Ad Hoc Sub Committee that was not open to the public and not subject to the Ralph M. Brown Act (Brown Act).[2]
2. **Robust Cannabis Industry** - The approval of the primary objective of the Cannabis Ordinance Project to be the development of a robust and economically viable legal cannabis industry.
3. **Access Granted To the Cannabis Industry** - The granting, by the Board, of nearly unfettered access to cannabis growers and cannabis industry representatives during the creation of the ordinances.

[2] The Ralph M. Brown Act, codified as California Government Code 54950 et seq.

4. **Significant and Unavoidable Environmental Impacts.**
5. **Rejection by the Board of Environmentally Superior Alternatives** - The rejection of Project Alternatives including the Environmentally Superior Alternative of Reduced Registrants.
6. **"Skunky" Smell** - The allowance of unpermitted operators to continue to operate with no effective odor control in place.
7. **Impact on Agriculture** - The failure to consider the impacts of cannabis cultivation on traditional agriculture knowing the State of California requirement of testing for pesticides on cannabis.
8. **Legal Non-Conforming Status.**
9. **Affidavit System** - The employment of an unverified affidavit system to qualify growers as legal non-conforming and the failure to determine the scope of the claimed qualifying use.
10. **Taxation** - Santa Barbara County was one of only a few counties within the State that did not tax cannabis cultivation on a square footage basis. In addition, the Santa Barbara County Treasurer-Tax Collector, an elected position, was excluded from the creation of the tax portion of the License ordinance. Also, the allowance for cannabis acreage far exceeded the demand in California.
11. **Statement of Overriding Considerations.**
12. **The Interference with the Santa Barbara County Air Pollution Control District** - The Santa Barbara County Chief Executive Office's (CEO) staff and P&D staff interceded and revised the Cannabis Air Quality Advisory issued by the Air Pollution Control District (APCD), an independent agency.
13. **Ethics** - The acceptance of campaign contributions by Board members at or near the time the donor had a matter pending a decision before the Board.

Ad Hoc Committee

On February 14, 2017, the Board voted to establish an Ad Hoc Sub Committee (Ad Hoc) consisting of two Supervisors. The stated purpose was to review and create regulations for adult use and cannabis cultivation in the County.[3] The Ad Hoc was created as a body not subject to the Brown Act and not open to the public.

The Board decision not to have open meetings on the ordinances created issues. One issue was the lack of transparency that inevitably results when the public is excluded from the process, especially on such a controversial matter as cannabis. In contrast, the 2015 Board, which included some current Board members, voted to create an Ad Hoc Sub Committee, subject to the Brown Act and open to the public, to engage in discussions with the Santa Ynez Valley Band of Chumash Indians regarding similarly controversial land use issues.

Of concern to the Jury was the fact that agendas were not prepared and minutes were not taken for the Ad Hoc meetings. The Jury learned that notes and minutes were not prepared in order to avoid any Public Records Act Requests for such documents. The lack of a paper trail does not fit with the concept of open government which seeks input from all interests. This unchecked process led to an imbalanced perspective.

[3] February 14, 2017 Santa Barbara County Board of Supervisors meeting "Board Letter" santabarbara.legistar.com/LegislationDetail.aspx?ID=2957248&GUID=605FD80A-4670-40ED-B1DD-EDBDB3C7A65D&Options=&Search=

A major issue according to witnesses interviewed by the Jury was that the process created by the use of the Ad Hoc resulted in a top down decision making process. The normal process provides for multiple public meetings held by the P&D staff with community input. The normal process allows for exploration of potential impacts to the various parts of the County prior to Board involvement. The Ad Hoc inserted the Board at the beginning of the process and not at the conclusion after community input.

A recent example of the normal process would be the proposed amendment of the LUDC to adopt new development standards, permit requirements and procedures regarding winery developments.

The Board directed P&D staff to update the then current winery regulations as part of the 2011/2012 Long Range Planning Annual Work Program.[4]

As the November 1, 2016 Board letter recounts, the staff conducted extensive stakeholder engagement and public outreach to gather information and discuss winery ordinance issues that should be addressed in the ordinance update. The public outreach included eighteen separate group meetings with wine industry and agricultural groups, neighborhood groups and non-profit organizations.

In addition, there were five public meetings, beginning in August 2012 continuing through February 2013, which discussed among other topics, neighborhood compatibility and wine ordinance structures, permitting, monitoring and enforcement. In March 2014, based on the community input received during the public outreach process, the P&D staff prepared draft ordinance language for public review. In June of 2014, the staff revised and finalized the draft ordinance.

There were hearings before the Planning Commission that occurred in August and September of 2016. The matter finally came before the Board on November 1, 2016.

In the matter of the cannabis ordinances, the Ad Hoc put the Board at the start of the process and not at the conclusion after community input. Public comment, for the cannabis ordinances, came after the forming of the ordinances had already occurred in the Ad Hoc. This is not good government, unsurprisingly leading to a seriously flawed law.

Robust Cannabis Industry

In 2017, P&D staff worked with the AD Hoc to determine the type of environmental document that would be required under CEQA to evaluate the environmental impacts associated with the new cannabis ordinance. The Ad Hoc concluded that an EIR was the appropriate document and directed staff to take the actions necessary for its preparation.

The purpose of this EIR was for use by government bodies to review and consider the environmental impacts of the Project as part of its decision-making process.

The P&D staff decided to consider the EIR a Program EIR. As was described in the Final EIR document, "As a Program EIR, the level of detail included in the project description and methodology for impact analysis is relatively more general than a project-level EIR, as individual cannabis activity site-level details are not available for prospective license applications or would be considered too speculative for evaluation. This approach allows the Board to consider broad implications and impacts associated with the project while not requiring a detailed evaluation of individual properties."[5]

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[4] November 1, 2016 Santa Barbara County Board of Supervisors meeting "Board Letter" https://santabarbara.legistar.com/LegislationDetail.aspx?ID=2858292&GUID=882F40A4-1328-4B74-9465-CCE36E9E75C9&Options=&Search=

[5] Final Environmental Impact Report for the Cannabis Land Use Ordinance and Licensing Program Volume 1 http://cannabis.countyofsb.org/uploadedFiles/cannabis/Documents/Final_PEIR/Santa%20Barbara%20_Cannabis%20FE

The Program EIR allowed for a more cursory analysis rather than project level as was performed in other counties .When considering the EIR was "cranked out in less than thirty days" by the P&D staff, the use of a Program EIR becomes telling.[6]

CEQA guidelines require that the EIR project description include a statement of the objectives of the cannabis Ordinance. The objectives were created in the Ad Hoc. A complete list of the objectives can be found in Appendix 1.

The first listed primary objective was as follows:

> "Develop a robust and economically viable legal cannabis industry to ensure production and availability of high quality cannabis products to help meet local demands, and, as a public benefit, improve the County's tax base."

This objective became the guiding principle for the Board. The many actions that were then taken along the way in the creation and passage of the cannabis ordinances reflect this objective including the allowance of an excessive amount of acreage and the excessive grants of business licenses.

The information reviewed by the Jury describes the Board being cautioned at a Board hearing on December 14, 2017 by their retained expert, a former Board member of Humboldt County and now member of Hinderliter, de Llamas & Associates Companies[7] (HdL), that there was a glut of cannabis statewide. He testified that the statewide cannabis production level was 13.5 million pounds with a statewide demand between 1.6 and 2.5 million pounds.

In addition, the report prepared by HdL for the Board stated as follows: "Santa Barbara is just one of 58 counties in California, but with almost 500 registrants seeking as many as 1,365 separate cultivation permits, the County's growers could potentially produce over 3.7 million pounds of cannabis per year, which is more than double the legal amount of cannabis consumed by the entire state."

On matters regarding Planning and Zoning, County Counsel advised the Board that they must operate under the review standard that their decisions must have a rational basis.[8] The decision by the Board that the primary objective of the cannabis ordinances was to develop a robust and economically viable legal cannabis industry in the face of that information does not appear rational.

Access Granted To the Cannabis Industry

The testimony obtained from witnesses during the investigation, as well as documents produced pursuant to a request by the Jury, describe the granting by the Board of easy and frequent access to cannabis industry lobbyists during the creation of the ordinances. The Jury sought to interview a cannabis industry lobbyist and additional cannabis growers, but received no response.

The Jury's review of emails and interviews with Board members showed that cannabis industry lobbyists were very aggressive in their attempt to have the ordinances be as favorable as possible to the cannabis industry. This effort was amplified by some of the cannabis industry lobbyists having recently left the employment of Santa Barbara County. It was described to the Jury that some of these cannabis industry lobbyists could be regularly seen roaming the halls of the Board's offices.

IR-Volume%201.pdf

[6] Video of October 17, 2017 Santa Barbara County Board of Supervisors meeting http://sbcounty.granicus.com/MediaPlayer.php?view_id=3&clip_id=3123&meta_id=345212

[7] https://www.hdlcompanies.com/

[8] Video of February 6, 2018 Santa Barbara County Board of Supervisors meeting http://sbcounty.granicus.com/MediaPlayer.php?view_id=3&clip_id=3228&meta_id=354710

To be clear, this report should not be seen as commenting on the actions of the lobbyists. They are working to promote their clients' interests. Rather, this report demonstrates that the Board did not set reasonable limits as to the number of contacts, both written and in private meetings. Most importantly, there was an apparent lack of limits as to when these contacts occurred, including just prior to or even during Board meetings with cannabis decisions on the agenda

Evidence obtained in the Jury's investigation showed cannabis industry representatives had two meetings, one on January 30, 2017 and one on February 9, 2017, with a Board member prior to the matter of cannabis first being added to the Board agenda on February 14, 2017.

Further documents reviewed by the Jury show a Board member meeting with cannabis industry representatives throughout 2017 including on October 16, 2017 on the topic of non-conforming uses that was to be discussed by the Board on October 17, 2017. Another member of the Board met with different cannabis lobbyists on October 11, 2017 to discuss the same topic.

Other examples of meetings just prior to a Board meeting include a Board member having two meetings with different cannabis lobbyists on November 13, 2017, the day before a Board meeting on November 14, 2017 that was to hear discussion on Letters of Authorization for Temporary State Cannabis Licenses. Those two meetings repeated with the same Board member on December 13, 2017 for the Board hearing on December 14, 2017 where the Board approved the Santa Barbara County letter to the State of California regarding Temporary State Licenses and discussed the taxation of cannabis. Those meetings create the appearance of an imbalance of access and undue influence.

Perhaps most concerning to the Jury was a meeting by a Board member just before the Board meeting of February 6, 2018. The Board member accepted an invitation to tour a cannabis operation on February 1, 2018 to discuss with the owner the issue of how to measure the distance from a cannabis operation to a sensitive receptor, such as a school. On February 5, 2018, the owner sent an email to the Board member advocating for the measurement of the buffer distance to be the property line of the sensitive receptor to the premises of the cannabis operation instead of the Planning Commission recommended buffer distance of property line to property line. This would allow his cannabis operation to remain open. The Board rejected the recommended measurement procedure and instead voted to measure the buffer from the property line of the sensitive receptor to the premises of the cannabis operation.

Documents obtained by the Jury, that had not been previously disclosed to the public, show voluminous emails from cannabis lobbyists and cannabis growers to Board members. While the Jury understands that sending emails to advocate positions favorable to the interests of their client is part of the job of a lobbyist, it was unnerving to the Jury to see both the tone and timing of these emails.

The tone of these emails appeared at times as if to direct specific actions to the Board members and gave the perception of an attempt to command instead of recommend. Understanding that no such authority exists with the lobbyists, the Jury felt that limits on such direct conversations should have been established by the Board members receiving these emails.

The timing of these emails was also concerning to the Jury. The documents reviewed show many being sent the day before a Board meeting, with some confirming the discussions had that day at a meeting with a Board member. The Jury also found two emails sent from a cannabis lobbyist to a Board member the morning of a Board of Supervisors meeting. On March 20, 2018, the most extreme example was an email sent by a Board member to a lobbyist, during a Board meeting, asking the lobbyist if they agreed with a P&D staff recommendation.

This kind of direct access far outweighs the access of others which was typically through emails complaining of odor and other issues, or the three-minute public comment at a Board meeting, limiting the opportunity for exchange with the Board members.

Significant and Unavoidable Environmental Impacts

The EIR assessed potential environmental impacts that could occur with the implementation of the Project. These included potential direct, indirect, secondary and cumulative impacts. Four categories described as classes were used.[9] This report will examine Class I.

> "Class I - Significant Unavoidable Adverse Impacts: Significant impacts that cannot be feasibly mitigated or avoided. No measures could be taken to avoid or reduce these adverse impacts to achieve insignificant or negligible levels. Even after application of feasible mitigation measures, the residual impact would be significant. If the project is approved with significant and unavoidable impacts, then the decision-makers are required to adopt a Statement of Overriding Considerations pursuant to CEQA Section 15093. This CEQA section requires the explanation why benefits of the Project outweigh the potential damage caused by these significant unavoidable impacts."

The analysis completed in the EIR found that implementing the proposed Project would create significant and unavoidable direct or indirect impacts. Two of the impacts were:

> "Agricultural resources - the loss of prime soils due to the unavoidable installation of greenhouses and similar agricultural structures for agricultural uses."

> "Air quality and greenhouse emissions - cannabis activities involve emissions from additional vehicle travel as well as ongoing stationary operations. In addition, the scent of cannabis plants can produce a variety of odors, especially during the flowering phase, which is often considered and perceived by some individuals as objectionable or offensive. Despite mitigation implementation, this nuisance may not be entirely removed and this impact would remain significant and unavoidable."

Documents reviewed by the Jury demonstrate that P&D and the Board were made aware in a presentation at the February 14, 2017 Board hearing by a member of the CEO's office that the State of California would require nonmedical marijuana to be comprehensively tested by independent testing services for the presence of contaminants, including mold and pesticides, before it could be sold by licensed businesses.

With that information in hand, the Jury questions why the issue of the conflict between traditional agriculture and cannabis grows was omitted in the EIR. It was hardly a secret that traditional agriculture in Santa Barbara County necessarily utilizes insecticides in dealing with destructive pests and fungicides for mold and mildew. That glaring omission is very hard to understand and is very troubling. It will be discussed separately in this report.

The EIR acknowledges that the odor of cannabis plants is a significant and unavoidable impact on the environment. The odor issue is of such consequence that it also merits separate discussion in this report.

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[9] Final Environmental Impact Report for the Cannabis Land Use Ordinance and Licensing Program Volume 1 http://cannabis.countyofsb.org/uploadedFiles/cannabis/Documents/Final_PEIR/Santa%20Barbara%20_Cannabis%20FEIR-Volume%201.pdf

Rejection by the Board of Environmentally Superior Alternatives

Section 15126.6(d) of the State CEQA Guidelines requires the EIR to assess a reasonable range of alternatives to the proposed Project. These included alternatives that could feasibly attain most of the basic objectives while avoiding or substantially lessening one or more of the significant effects of the proposed Project.

Alternatives typically involve changes to the location, scope, design, extent, intensity, or method of construction or operation of the proposed project. A fundamental mandate of CEQA is that "public agencies should not approve projects as proposed if there are feasible alternatives or feasible mitigation measures which would substantially lessen the significant environmental effects of the projects."[10]

The EIR analyzed four alternatives to the Project. These are described as follows:

The No Project Alternative

Alternative 1: Exclusion of Cannabis Activities from the AG-1 Zone District

Alternative 2: Preclusion of Cannabis Activities from Williamson Act Land

Alternative 3: Reduced Registrant Alternative

Each of the alternatives was evaluated based on significance, location, extent and magnitude of impacts, potential benefits, and relative impacts in comparison to other alternatives. The alternative with the fewest adverse impacts was then considered the Environmentally Superior Alternative.

The No Project Alternative was rejected in the EIR. The finding was that under the No Project Alternative, the banning of cannabis, the direct impacts associated with licensing of an expanding cannabis industry would not occur. This alternative, however, would not address unregulated and illegal cannabis activities. Further, it would not offer an avenue for licensing and permitting, thus it was likely that illegal cannabis activities would continue to exist.

Under the No Project Alternative, the EIR found that aesthetic and agricultural resources impacts would likely be reduced but other environmental impacts would not be due to the illegal cannabis operations.

The EIR stated that the Project, Alternative 1 and Alternative 2 would all result in significant and unavoidable impacts to agricultural resources, air quality, noise, and transportation. Only Alternative 3 would reduce impacts to agricultural resources to a less than significant level.

Alternative 1: Exclusion of Cannabis Activities from the AG-1 Zone District. Under this alternative cannabis related activities would not be allowed within the AG-1 zone districts throughout Santa Barbara County. This alternative would reduce the areas of eligibility in the County, in particular the Carpinteria Valley and the Santa Ynez Valley.

The EIR found that Alternative 1 would reduce the total amount of eligible area and sites as compared to the proposed Project and would require substantial relocation or abandonment of existing cannabis operations. Existing cultivators would need to find locations within the reduced area of eligibility.

While adoption of Alternative 1 would achieve most of the Project objectives, the EIR found that it failed as it would not achieve Project Objective 1, the development of a robust and economically viable legal cannabis industry or Objective 4, encouraging businesses to operate legally and secure a license to operate in full compliance with County and State regulation. The EIR states that Alternative 1 also

[10] California Public Resources Code section 21002.

does not achieve Objective 6, the minimization of adverse effects of cultivation, manufacturing and distribution activities on the natural environment.

Next, consideration was given to Alternative 2: Preclusion of Cannabis Activities from Williamson Act Land. Under this alternative, cannabis activities would not count towards the minimum cultivation requirements to qualify for an agricultural preserve contract pursuant to the Williamson Act.[11]

While under this alternative cannabis activities would be considered compatible uses on lands that are subject to agricultural preserve contracts, they would be limited to a maximum of 22,000 square feet of cannabis canopy cover for each Williamson Act contract premises.

The EIR notes that this alternative would result in limiting the potential for cannabis activities on over 50 percent of eligible County area and would eliminate hundreds of potential operations from occurring on Williamson Act lands.

Although adoption of Alternative 2 would have met some of the Project objectives, such as a permitting process, the regulation of sites and premises to avoid degradation of the visual setting and neighborhood character, odors, hazardous materials, and fire hazards, it was rejected.

The failing of Alternative 2 was that it did not achieve some of the basic Project objectives namely those related to development of a robust and economically viable legal cannabis industry, Objective 1. That is understandable considering this alternative limits how robust the cannabis can then become. What is unclear is how this alternative prevents the accomplishment of Objective 4, encouraging businesses to operate legally and secure a license to operate in full compliance with County and State regulations, or Objective 6, minimization of adverse effects of cultivation and manufacturing and distribution activities on the natural environment.

The last alternative considered was the Reduced Registrant Alternative. As described in the EIR, this would limit the total number of licenses issued by the County to one half of the number of each category of licenses that were listed as part of the 2017 Cannabis Registry. This would limit the representative buildout of the Project analyzed in the EIR by a commensurate 50 percent. The EIR goes on to state that existing cannabis operators that were identified in the registry would be prioritized for licensing, which would substantially reduce the net new buildout, while allowing for limited growth.

Selection of Alternative 3 would result in substantial reductions in the severity of most impacts compared to the proposed ordinances. This alternative would reduce significant and unavoidable impacts to agricultural resources to a less than significant level. However, the EIR found that it would not achieve the most basic Project objectives of the development of a robust and economically viable and legal cannabis industry, Objective 1, and encouraging businesses to operate legally and secure a license to operate in full compliance with County and State regulations, Objective 4.

Alternative 3 was found to be the Environmentally Superior Alternative to the Project, as it would result in less severe impacts to the environment due to the limited extent of cannabis development and limited granting of licenses by the County. As stated in the EIR, "With implementation of mitigation measures, the Reduced Registrants Alternative provides a balance between meeting Project objectives, including quality of life concerns and addressing environmental impacts and allowing for limited amounts of growth in the cannabis industry."

Despite this statement, Alternative 3 was rejected in the EIR, as this alternative was found to not adequately meet Objective 1 of the Project, the development of a robust cannabis industry, and

[11] The California Land Conservation Act of 1965

Objective 4, encouraging businesses to operate legally. Therefore, the EIR found the Environmentally Superior Alternative was infeasible.

Skunky Smell

The most complaints the Jury received about cannabis involved the skunky smell that is produced by cannabis operations. Perhaps the most surprising discovery was the willingness of the Board to justify subjecting Carpinteria, and the rest of the County, to a condition that affects the health and enjoyment of residents. This was not an unexpected result of the Board's actions in creating the cannabis ordinances. They knew about the quality of life concerns and chose the revenue potential of cannabis instead.

Board members received many emails, reflected in submissions for Board meetings from Carpinteria residents, explaining how this skunky smell was impacting their lives. The residents described that their health was being impacted. They told the Board that the way of life that they so cherished in Carpinteria was being ruined. They feared their property values were declining. There was no shortage of complaints, including from the City of Carpinteria itself, through its six letters to the Board.

Most startling was that the Board received two letters from the Carpinteria School District prior to the passage of the cannabis ordinances. The letters detailed that the air quality in Carpinteria High School was being compromised by strong cannabis odors to the point that by afternoon the students and staff were reporting ill effects, such as headaches from the nauseating odor. The Jury found no evidence of a Board member contacting the Carpinteria School District to discuss the buffer zone distances and measurements prior to the passage of the ordinances. The School District sought buffers of 1,000 feet to 1,500 feet from the high school to the cannabis operation. The Board approved 600 feet from nursery operations and 750 feet from cultivation operations, ignoring Planning Commission and staff recommendations.

Carpinteria was not the only victim. The Santa Ynez Valley including Buellton, the Santa Rita Hills AVA wine tasting rooms, Cebada Canyon and Los Alamos residents also voiced their complaints at Board meetings and through emails. There can be no doubt that the Board knew the extent of the odor problem.

So why would the Board ignore this obvious concern? The answer is found in the Program EIR cannabis project objectives that were created by the Ad Hoc, made up of two Supervisors, and a staff support group. The decision to make the development of a robust cannabis industry the first primary objective of the cannabis ordinances project meant that known serious problems such as odor were not sufficiently important to derail their goal.

This is not speculation on the part of the Jury. The EIR, certified by the Board, describes cannabis odor as a significant and unavoidable impact. Instead of choosing environmentally superior alternatives that would lead to smaller and better located operations, the Board chose to proceed with these cannabis ordinances. The most telling document though was the Board's finding of overriding considerations.

In the CEQA required Statement of Overriding Considerations, as in the rejection of Environmentally Superior Alternatives, the first stated reason to choose these ordinances was the goal of developing a robust cannabis industry, despite the odor issue. That goal overrode the complaints of the residents.

Impact on Agriculture

The action of the Board in allowing cannabis operations to be located in close proximity to traditional agriculture has led to disastrous results. That action is very distressing to the Jury as the members of the Board knew of the incompatibility of cannabis. They knew about the odor issues. They knew about the

State rules regarding pesticides and cannabis. Their response was to change the County Uniform Rules, against staff recommendations, that would have allowed for such a compatibility analysis prior to approval. If that was not enough, they certified an EIR that did not even address this known incompatibility.

The February 6, 2018 Board hearing was a pivotal moment for Santa Barbara County. At this hearing, which unfortunately was held shortly after the mudslides in Montecito, the Board certified the cannabis EIR and began the process of amending the LUDC. The amendment of the LUDC provided for cannabis permit applications to be governed by the land use permit requirements rather than by the more exacting conditional use permit process, except if said cannabis operations are located near an existing developed rural neighborhood.

The EIR that was approved and certified by the Board did not address the incompatibility issue between traditional agriculture and cannabis. On February 14, 2017, the Board was advised by CEO senior staff that the State would be testing cannabis for pesticides. The Board knew, or certainly should have known, that many crops in Santa Barbara County from lemons, to avocados, and grapes require effective insecticides and fungicides to survive.

These crops are valuable. According to the Santa Barbara County Agricultural Production Report, avocados were valued at more than $38 million in 2017 and $52 million in 2018. Lemons were valued at over $15 million in 2017 and $17 million in 2018. Wine grapes were valued at more than $146 million in 2017 and $121 million in 2018.

The P&D response to the issue of pesticides in the EIR, as recently as the Board letter of March 10, 2020, was "CEQA requires the assessment of a project's impact on the environment. The issue of pesticide drift is an important issue but it would not be considered an environmental impact resulting from the project".

The EIR fails to consider the impossible situation in which traditional agriculture finds itself when using approved pesticides, applied by licensed pesticide applicators. Post application winds or even insects or birds can transfer pesticides on to the cannabis. As the State has set extremely low pesticide tolerances for cannabis, it seems clear that this known incompatibility left cannabis the chosen winner and traditional agriculture the chosen loser in the Board certified EIR.

For vineyard and winery owners in the Santa Rita Hills AVA,[12] the area between Buellton and Lompoc, the issues of odor and terpenes, an aromatic hydrocarbon obtained from plant oils, are severe. Vintners have been growing in the Santa Rita Hills since 1971 and the area finally became recognized as a coveted AVA in 2001. There are now 2,700 planted acres by 59 total wineries.

The sense of smell, or olfaction, is evoked by scents, which are airborne molecules that are volatile enough to reach the olfactory receptors located at the top of the nostril. Volatile stimuli can be perceived directly via the orthonasal pathway, directly through the nostrils, or indirectly, via the retro-nasal pathway when the wine is already in the mouth.

These two factors contribute to why experts state that wine perception is 80 percent olfactory. Flavors inherent in wine, much like food, rely heavily on sense of smell to produce a favorable experience while consuming. When other strong odors are introduced, it obviously changes the perception of the taster.

[12] American Viticultural Area

Winery operations, including tasting facilities and vineyards, have been prevalent in the Santa Rita Hills long before the AVA designation. Winery and vineyard operators have spent millions of dollars developing and building their operations and brands. The proposed introduction of over 625 acres of open air cannabis grows, with the ever-present north and west winds averaging between 9.1 to 10.5 MPH daily,[13] makes it virtually impossible for these two types of operations to co-exist, weighing heavily against the viability of the wine industry. The heavy skunky odor, of even just a few cannabis plants, can elicit a strong response from people nearby. Olfactory molecules do not stop at the property line. Several hundred acres of cannabis will be devastating to the region's wine reputation, tourism and sales.

The issue of terpene drift from cannabis to grapes was another issue not adequately considered by the hastily crafted EIR. Currently, there are studies underway being conducted by the wine grape[14] and cannabis industries to determine the impact of terpenes on the characteristics of grapes, and the cannabis skunky smell on the taste of wine. It is of note to consider that two other famous wine growing regions of California, Napa County and Sonoma County, have taken steps to protect their wine industries by either banning cannabis (Napa) or severely limiting it (Sonoma). In comparison, the Board has set a cap of 1,575 acres of cannabis in the County plus 186 acres in the Carpinteria greenhouses.

On March 20, 2018, the Board approved amendments to the Uniform Rules for Agricultural Preserves and Farmland Security Zones (Uniform Rules) that regulate allowed uses on lands that are subject to agricultural preserve contracts. Consequently, by making these amendments, the Board chose to ignore the recommendations of P&D staff and the County's Agricultural Preserve Advisory Committee (APAC) whose duties include reviewing proposed projects for compatibility to neighboring agricultural properties.

The Board amended the Uniform Rules by declaring cannabis to be an agricultural use instead of the recommended compatible use. That decision was significant as it allowed cannabis growers to obtain the benefits of the property tax breaks under the Williamson Act. Perhaps of even more calculated significance was the designation of cannabis as an agricultural use thereby removing the APAC review for compatibility with adjacent agricultural properties which would have been required if cannabis had been designated as a compatible use.

Thus, the framework of these decisions had been established by the Board. The results are the approvals by the Board of large cannabis operations in the Santa Rita Hills region with many more already in the pipeline. The Board has created a situation where the court system is likely the only hope for relief for traditional agriculture, at a huge legal cost and possible damages to taxpayers.

Legal Non-Conforming Status

In January 2016, the Board approved the creation of a legal non-conforming use exemption for then existing medical marijuana cultivation operations that were in compliance with State laws. To be legal, the cultivation was limited to 100 square feet on a lot with a residential structure. The Board failed to insist on a process that would have identified those that claimed this status. Thus, the County had no idea how much cannabis was being grown by claimed medical marijuana growers.

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[13] www.weatherspark.com/y/1262/Average-Weather-in-Lompoc-California-United-States-Year-Round#Sections-Wind

[14] May 5, 2020 Santa Barbara County Board of Supervisors meeting "Public Comment - University of Califorina, Davis" https://santabarbara.legistar.com/LegislationDetail.aspx?ID=4430356&GUID=4C9684C9-80B0-4D18-AEBC-4772570E1BB7&Options=&Search=

This status allowed the cannabis operations to continue without a County permit and thus not subject to the requirements that follow with a permit. This status created a myriad of problems that continue to the present.

A major problem that developed with the legal non-conforming use status was the illegal expansion of the use. The expansion of acreage, while enjoying this status, was improper and unpermitted. The reaction of P&D staff to complaints in this regard was to forgive as long as an application was in preparation instead of moving to eradicate the illegal expansion. It is not surprising that this position by P&D staff was, and remains, problematic, as the allowance of continued operation removed the incentive to complete the permit application.

Even more of a problem resulting from the legal non-conforming status being authorized was the fact that only those growers who followed through and obtained a permit are subject to regulations to control the odor from cannabis operations that remains such a problem countywide.

A memorandum of January 15, 2020 to the Planning Commission from a senior member of P&D describes the issue clearly. Most cannabis cultivation that currently exists within the County consists of medical cannabis activities which operators assert are legal non-conforming pursuant to Article X of the Land Use Code[15] (Article X) and, consequently, are allowed to operate pursuant to Article X and the non-conforming regulations of the zoning ordinances. Specifically, out of the 270 acres of cannabis that currently exist within the County, approximately 199 acres, 74 percent, consist of legal non-conforming cannabis cultivation subject to Article X, and the remaining approximately 71 acres, 26 percent, consist of cannabis cultivation that is subject to the current County zoning and licensing requirements.

The memorandum continues on to remind the Planning Commission that these legal non-conforming commercial cannabis cultivation activities are not currently subject to the cannabis zoning regulations which are designed to control the adverse impacts of commercial cannabis activities. Thus, when the Planning Commission is considering the efficacy of commercial cannabis regulations, the focus should be on examples of commercial cannabis activities that are operating in compliance with cannabis regulations that apply to the 26 percent of acreage and not the unregulated 74 percent.

Under this poorly constructed scenario, the unpermitted cannabis operations continue to operate without mandatory odor control.

Affidavit System

Without question, one of the most perplexing decisions made by the Board was the utilization of an unverified affidavit system to qualify applicants who claimed to be existing medical cannabis growers and thus eligible to apply for licenses to continue to grow cannabis.

This affidavit system was the creation of a senior member of the CEO's staff, not the result of a group process. The affidavit executed by the cannabis grower, under penalty of perjury, was in lieu of a formal permit or license as required by the State. The affidavit was then submitted to the State of California by the applicant as part of the process to obtain a temporary State license.

The major and obvious flaw of this affidavit system was the lack of any required verification as to the veracity of whether the applicant had indeed been growing cannabis as of January 19, 2016. This concern was noted by the Planning Commission that recommended a process that included a public hearing wherein the applicant could prove their affidavit was truthful.

[15] library.municode.com/ca/santa_barbara_county/codes/code_of_ordinances?nodeId=CH35ZO_ARTXMEMARE

Despite a comment by a Board member, at a Board hearing, that a verification process was needed, "I trust some cannabis operators but not all", the Board member still voted with the majority and declined to follow the Planning Commission recommendation of a verification process. The Board's disregard for potential abuse is incomprehensible.

This serious error was compounded by the Board's failing to require those who claimed to have been medical cannabis growers as of January 19, 2016 to prove the extent of their acreage as of that date. The absence of a verified benchmark encouraged the expansion of the grower's acreage beyond what was in the ground on January 19, 2016, if any. Once again, the Board's decision in this regard is truly baffling.

As there were no enforcement procedures established, complaining neighbors were left to report suspected violators to P&D, both as to eligibility and expansion of operations. Even when shown that the suspicions were indeed correct, P&D staff simply allowed the operation with the expanded acreage to continue if the operator had begun the application process for a County permit. It is not surprising that claimed legal non-conforming operators have been less than diligent in getting their applications ready for approval.

By requiring only a signature, many of the same people previously involved in illegal activities were given an unverifiable opportunity to legitimatize their cannabis operations. The purpose of a law, any law, is to regulate human behavior. Laws should punish bad behavior and reward good behavior. The affidavit system and the cannabis ordinances do exactly the opposite.

Taxation

Work on the taxation components of the ordinances began in early 2017. One of the first steps was to hire the consulting firm of Hinderliter, de Llamas & Associates (HdL) to assist the County with, among other things, the development of application fee structures, taxation structure options and fiscal analysis based on a variety of assumptions for medical and recreational cannabis in Santa Barbara County.[16] HdL has provided revenue management services, including sales, property, lodging, business license, cannabis regulation and tax strategies to nearly every county in California.

HdL's report, dated October 14, 2017 was presented to the Board on December 14, 2017.[17] The report noted that a Standardized Regulatory Impact Assessment prepared for the California Department of Food and Agriculture estimated statewide cannabis production at 13.5 million pounds, though the estimate of cannabis consumption by California residents at just 2.5 million pounds.[18] The report also mentions that a separate study performed for the California Cannabis Industry Association put statewide consumption even lower, at 1.6 million pounds. HdL estimated that "the County's growers could potentially produce over 3.7 million pounds of cannabis per year."

An important consideration of any cannabis tax is the ability to help create a legal market that attracts customers and discourages them from buying on the illicit market. Cannabis users are willing to pay more for the convenience, selection, and quality-control benefits offered by legal businesses, however there is a limit to how much more they are willing to pay.[19] If an important goal is to significantly

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[16] *"Contract For Marijuana Consulting Services"*, approved and signed April 10, 2017

[17] santabarbara.legistar.com/LegislationDetail.aspx?ID=3289847&GUID=70A26A7A-4031-43B3-A0B8-24A6BAC7A074&Options=&Search=

[18] Duncan McEwan, et al (January 2017) *"Economic Impact Analysis of Medical Cannabis Cultivation Program Regulations"* California Department of Food and Agriculture

[19] Michael Amlung, Derek D. Reed, Vanessa Morris, Elizabeth R. Aston, Jane Metrik, James MacKillop. "Price elasticity of illegal versus legal cannabis: a behavioral economic substitutability analysis," Society for the Study of

diminish the illicit market the cumulative cannabis tax levied must not be so high as to be greater than the benefits provided by a legal cannabis industry.

The report lists four main approaches to taxing the various cannabis commercial activities:

- Taxation on cultivation area by square foot
- Tax on gross receipts of a cannabis business
- Per-Unit tax on the product by weight or volume
- Retail sales tax at point of sale

The first two of these relate to cultivation, and will be the focus of the rest of this section.

Square Footage Tax – A square footage cultivation tax is based on the activity of growing cannabis. It is the most commonly used method for the taxation of cultivation in California. Santa Barbara County is one of only a few counties within California to not use that method. An advantage of this method is that it allows the grower and the county to know upfront exactly how much the annual tax will be at the time the permit is issued. This also allows the grower to make the required payments at any time up until the end of the fiscal year. A downside for the grower to this method is that it does not account for variations in yield, so if the grower has crop loss or reduced yield they still pay the full tax. An upside for a grower is that if there is higher yield, or several crops, the tax remains constant. HdL stated in their report that this method is the easiest and most reliable to administer.

Gross Receipts on Cultivation – A cultivation tax based on gross receipts is a tax on production or earnings, rather than activity. This form of taxation, while less common, has the advantage that if production is high and gross receipts follow then higher revenue would be collected by the County. Growers may prefer this method as it ties the taxes due to actual production. This method, however, presents problems with verification of the volume of the actual cannabis grown and sold, and could be subverted by growers who try to hide their actual yield and sales. In their report, HdL stated that this method can be difficult to administer, as the County must verify the business's reported earnings or production.

The Jury learned that Santa Barbara County is one of a few counties within California that exclusively uses the Gross Receipts method for cannabis cultivation. The Jury asked those interviewed as to why the County did not follow the path that was more reliable and easier to administer and that many other counties in California were using. The answer the Jury received was that the Gross Receipts method had the potential to be much more lucrative than the Square Footage method. To date, the belief that using the Gross Receipts method would result in more taxes has not proven to be true. While the County initially predicted cannabis tax revenues as high as $25 million, in 2018-19 the actual revenue was only $6.8 million.[20] Monterey County, which until this year only allowed indoor grows and uses the Square Footage method, had 2018-19 cannabis tax revenues of $15.4 million.[21]

This difference in revenue collected is more alarming when compared to the number of acres of permitted cultivation in each county. Santa Barbara County has 217 permitted acres compared to Monterey's 62.

Addiction,114(1):112-118 (2019).

[20] Santa Barbara County Comprehensive Annual Financial Report, Fiscal Year Ended June 30, 2019 https://www.countyofsb.org/uploadedFiles/auditor/content/FY2018_19CAFR.pdf

[21] Monterey County Budget End of Year Report, Fiscal Year 2018-2019 https://www.co.monterey.ca.us/home/showdocument?id=84679

The Jury also learned that some of the assumptions supporting the use of the Gross Receipts method over the Square Footage method were flawed. The Jury was told that verification would be easy, accurate and complete, using the State of California's METRC 'Track & Trace' system. METRC is intended to be used to track commercial cannabis activity and movement across the distribution chain from "seed-to-sale".[22] The concept of METRC is that every plant is 'tagged' with a tracking number and can be followed from seed germination, through cultivation, manufacturing and retail sale. It appears that Ad Hoc had not adequately investigated the METRC 'Track and Trace' system and accepted at face value promises made and sales materials provided. There are two significant problems with the decision to rely on this system. First, the system is still being tested and has not been proven to work to the levels promised. Santa Barbara County has been accepted as a Beta tester but that process has only begun. Secondly, except for surprise visits to cultivation sites to audit the METRC system tagging, there is no way to assure that all plants are properly tagged and tracked, or that all product harvested is accurately reported to the taxing agencies. Just this past January, Deputies from the Santa Barbara County Sheriff's Office served a warrant and raided a cannabis farm in Carpinteria and found 'off-book' sales.[23] How can the County be certain that other growers are not doing the same?

The Ad Hoc appeared to not be interested in the Square Footage method, which is a more reliable and safer method of taxing cultivation and is used nearly ubiquitously in California. It was also the preferred method by most within County government whom the Jury interviewed. The Jury was told that a member of the Ad Hoc working group led the charge for using the Gross Receipts method and even had asked HdL to revise an early draft of its report to focus more on that tax method.

The Jury was also told that a senior member of the CEO's office did not include the Santa Barbara County Treasurer - Tax Collector (Tax Collector) when the Ad Hoc was working on the taxation portions of the cannabis ordinances. Additionally, the Jury learned that the two members of the Board assigned to Ad Hoc took no steps to override the decision by the staff member and took no action to include the Tax Collector in the drafting of the taxation portion of the cannabis ordinances. The Jury found that the Tax Collector, an elected official, failed to insert himself in the process to draft the taxation portion of the cannabis ordinances. The Jury was told that it was known to the Ad Hoc that the Tax Collector did not favor the use of the Gross Receipts method as it made it harder, or nearly impossible, to audit.

Even with the apparent bias of Ad Hoc toward using the Gross Receipts method, the Board had adequate warning that using that method may not have been in the best interests of the County. In its report to the Board, HdL stated it "has commonly recommended cultivation taxes based on square footage, as they are simple, predictable and easy to administer." While HdL also stated, "A single, all-encompassing tax on gross receipts may allow greater flexibility for cultivators to structure their business more competitively", this statement is more favorable to the growers, and not necessarily in the best interest of the County.

Further, using a Gross Receipts method subjects the County to the challenges of market prices. As cannabis revenues fall, so will the related taxes. In Colorado, wholesale cannabis prices have dropped 61 percent from their peak in 2015.[24] With the excess of cannabis supply to cannabis demand in California, it is highly likely the same fate will befall California and the County.

Furthermore, during the first year of the program, most of the revenue generated by cannabis taxes was

[22] https://www.metrc.com/california
[23] https://www.latimes.com/california/story/2020-02-14/carpinteria-pot-farm-accused-of-selling-on-black-market
[24] https://itep.org/taxing-cannabis/#_edn49

spent on enforcement of the cannabis ordinances. Since then, this revenue is being considered to help solve many of the current budget difficulties. A robust cannabis industry requires a robust enforcement process. No apparent consideration has yet been given to the costs of actual enforcement costs. These costs must be factored in prior to diverting one penny to existing budget problems.

Statement of Overriding Considerations

The Board, faced with the knowledge that the proposed cannabis Project would cause significant and unavoidable impacts on the environment including air quality and odor, found reasons to justify their decision to proceed forward. The methodology for this was the Statement of Overriding Considerations.

The first listed justification is that the Project provides for a robust and economically viable legal cannabis industry to ensure production and availability of high quality cannabis products to help meet local demands and as a public benefit, improves the County's tax base. The next listed justification is that the Project enhances the local economy and provides opportunities for future jobs, business development, and increased living wages. Moreover, the Project promotes continued agricultural production as an integral part of the region's economy by giving existing farmers access to the potentially profitable cannabis industry, which in turn will provide relief for those impacted by competition from foreign markets and rising costs of water supply.

The Jury investigation confirmed that the farmers being referenced were the flower growers in Carpinteria. Their ability to grow cannabis was deemed an overriding consideration by the Board paramount to the skunky smell endured by the residents of Carpinteria. The Board found that the benefits of giving flower growers access to growing cannabis "outweigh the unavoidable adverse environmental effects and therefore the adverse environmental effects may be considered acceptable." Amazingly, the Board went on to find that this reason alone would be enough to justify the approval of the cannabis ordinances, even if all other reasons were struck by a court.

For a full list of all Overriding Considerations see Appendix 2.

The Interference with the Air Pollution Control District

One of the most disturbing matters that came to the attention of the Jury was the interference by the CEO senior staff and P&D senior staff in the operations of the Santa Barbara County Air Pollution Control District (APCD).

An independent agency since 1994, the mission of the APCD is: "To protect the people and environment of Santa Barbara County from the effects of air pollution". In furtherance of that mission the APCD issues air quality advisories to the public. [25]

On Friday, April 26, 2019, the APCD issued online an APCD Advisory (Advisory) titled Air Quality and Cannabis Operations. Among a number of matters discussed in the Advisory, the issue of buffers from outdoor cannabis operations was raised. The APCD advised that with outdoor grows, a reasonable buffer should be established between the grow site and any residential, commercial or public access point with the APCD "strongly encouraging large buffer zones (e.g.,1 mile) to allow for maximum odor dispersion, as well as other odor abatement strategies, to avoid nuisance odors". [26]

Within a few days, a senior member of the CEO's office contacted the APCD about the Advisory. This

[25] https://www.ourair.org/

[26] APCD Advisory, April 26, 2019 advisory (updated May 7, 2019) https://www.ourair.org/wp-content/uploads/APCD-Cannabis-Advisory-v2.pdf

was followed by phone calls from this individual to the APCD the next day requesting the APCD take down the Advisory. The Jury learned that the APCD refused to remove the Advisory.

What followed were communications from a senior member of P&D that convinced the APCD to remove the Advisory. The senior member of P&D then sent the APCD a rewording of the Advisory that included the removal of the language cited above, including "strongly encouraged large buffer zones (e.g. 1 mile)". The Advisory now only states that the district encouraged the use of buffer zones. No recommended distance of a buffer remained in the replacement Advisory. The various changes were made and a revised Advisory was issued on May 7, 2019. The Jury was told that no such request had ever previously been made to the APCD.

Ethics

Santa Barbara County has been in turmoil since the legalization of recreational cannabis in 2016. There has been public protest over cannabis odor, controversy between the cannabis industry and traditional agriculture, the appearance of financial irregularities and accusations of undue influence. Rarely a day goes by without media coverage of some aspect of the Santa Barbara cannabis industry.

The Santa Barbara County Board of Supervisors does not have a formal code of ethics to inspire and guide the conduct of its members and staff. It relies instead on a simple statement of mission, as reflected below:

> "Provide quality public services to the people of Santa Barbara County in response to their need for a healthy, safe and prosperous environment; and to establish and maintain a workforce which reflects the diversity of the community."[27]

While these statements lay a sound foundation, they are insufficient to provide detailed guidance to a powerful and influential Board that governs the everyday life of approximately 450,000 local citizens. The challenges of governing a constantly evolving Santa Barbara County demand a more powerful statement and oversight of ethics for the future.

Counties throughout the nation have chosen to establish Codes of Ethics to promote ethical decision making and conduct, and increase public trust in their elected leaders. Such Codes frequently address issues such as:

- Conflict of interest: Potential conflicts are defined
- Acceptance of gifts: Dollar and timing limits are put into effect
- Exploitation of official position: Personal influence and hiring friends and relatives is restricted
- Financial disclosure reports: Disclosure requirements and reporting frequency are defined
- Limitations on campaign contributions: Dollar caps and timing relative to issues under consideration are defined
- Declaration of contact outside of public hearings with subjects of prospective legislation is required
- Outside employment: Disclosure and authorization for outside employment is required
- A "two-year rule": Establish time limits before which government officials can seek employment with entities they've worked with after they leave government service

[27] https://www.countyofsb.org/bos

Many counties also establish independent Ethics Commissions to provide oversight of government functions and transparency to the general public. These commissions develop and publish a Code of Ethics, review and assess the performance of government functions against those ethical standards, and report their findings to the public. Such commissions are an excellent tool for assuring accountability of government officials.

CONCLUSION

The 2019-20 Santa Barbara County Grand Jury began an investigation initiated by concerns of residents over the influence of the cannabis industry on the creation of the cannabis ordinances. The Jury discovered unequal access was granted to the cannabis industry representatives by the Santa Barbara County Board of Supervisors to the point of allowing email communications during a Board of Supervisors meeting.

A more sobering realization for the Jury was that the governance in this matter took the form of some Supervisors aggressively pushing through their own agendas while other Supervisors meekly followed or resigned themselves to the inevitable.

Some senior staff in the office of the Santa Barbara County Chief Executive Office and the Santa Barbara County Planning and Development Department became cannabis advocates, losing their objectivity to the point of interfering in the responsibilities of independent agencies and elected officials.

The Board of Supervisors rushed through the cannabis ordinances, ignoring the Santa Barbara County Planning Commission and staff recommendations on verification of applicants claiming eligibility to grow cannabis, to buffer distances for odor, and to not establishing cannabis as a compatible use that would allow for an analysis of compatibility with traditional agriculture. The actions of the Board resulted in the picking of winners and losers.

The Board of Supervisors used the mechanism of an Ad Hoc Sub Committee to craft the cannabis ordinances out of public view. These ordinances are now the cautionary tale for other counties in the State of California on what ***not*** to do.

The Ralph M. Brown Act, codified as California Government Code 54950 et seq., declares as follows:

> "In enacting this chapter, the Legislature finds and declares that the public commissions, boards, and councils and the other public agencies in this State exist to aid in the conduct of the people's business. It is the intent of the law that their actions be taken openly and that their deliberations be conducted openly.
>
> The people of this state do not yield their sovereignty to the agencies which serve them. The people in delegating authority, do not give their public servants the right to decide what is good for the people to know and what is not good for them to know. The people insist on remaining informed so that they may retain control over the instruments they have created."

The Jury believes the Board of Supervisors, in their hubris, failed the people of Santa Barbara County. Now they must amend the cannabis ordinances to regain the people's trust.

FINDINGS AND RECOMMENDATIONS

Finding 1

The impact of cannabis production on the health and welfare of Santa Barbara County residents was inadequately weighed and considered by the Santa Barbara County Board of Supervisors.

Recommendation 1a

That the Santa Barbara County Board of Supervisors direct the Santa Barbara County Planning and Development Department Director to prepare Environmental Impact Reports addressing each region of Santa Barbara County after holding public hearings to evaluate public concerns.

Recommendation 1b

That the Santa Barbara County Board of Supervisors direct the Santa Barbara County Planning and Development Department Director to develop Project Objectives for the Environmental Impact Reports that reflect a balance between cannabis, traditional agriculture, and the residents of Santa Barbara County.

Finding 2

The creation of a non-Brown Act Ad Hoc Sub Committee that was not open to the public led to a lack of transparency and distrust by Santa Barbara County residents.

Recommendation 2

That the Santa Barbara County Board of Supervisors require all future Ad Hoc Sub Committees be open to the public and subject to the Brown Act.

Finding 3

The Board of Supervisors granted nearly unfettered access to cannabis growers and industry lobbyists that was undisclosed to the public during the creation of the cannabis ordinances.

Recommendation 3

That the Santa Barbara County Board of Supervisors develop standards that require Santa Barbara County Board of Supervisors members to publicly disclose all access granted to lobbying individuals or groups, especially while a matter involving these individuals or groups is before the Board of Supervisors.

Finding 4

The conflict between cannabis production and traditional agriculture is a major concern for the continued existence of certain segments of traditional agriculture in Santa Barbara County.

Recommendation 4a

That the Santa Barbara County Board of Supervisors amend the Land Use and Development Code and Article II, the Coastal Zoning Ordinance to require all pending cannabis land use permit applications be subject to a Conditional Use Permit review.

Recommendation 4b

That the Santa Barbara County Board of Supervisors amend the County's Uniform Rules for Agricultural Preserves and Farmland Security Zones to declare that cannabis cultivation and related facilities are compatible uses on contracted land instead of as an agricultural use.

Finding 5

The amount of cannabis production allowed under the current cannabis ordinances is excessive and has led to overconcentration in some portions of Santa Barbara County.

Recommendation 5a

That the Santa Barbara County Board of Supervisors require all applicants with cannabis use and development permit applications and licenses pending, who claim legal non-conforming status, to prove their claimed status before the Santa Barbara County Planning Commission.

Recommendation 5b

That the Santa Barbara County Board of Supervisors direct the Santa Barbara County Planning and Development Department Director, in conjunction with the Santa Barbara County Sheriff's Office, to eradicate all cannabis grown on acreage claimed under Legal Non-Conforming status when the cannabis operator fails to demonstrate to the Santa Barbara County Planning Commission that the planting of cannabis occurred prior to January 19, 2016.

Recommendation 5c

That the Santa Barbara County Board of Supervisors direct the Santa Barbara County Planning and Development Department Director to deny permits for the growth of cannabis on acreage claimed under Legal Non-Conforming status when the cannabis operator fails to demonstrate to the Santa Barbara County Planning Commission that the planting of cannabis occurred prior to January 19, 2016.

Finding 6

The approval by the Santa Barbara County Board of Supervisors of an unverified affidavit system does not require proof of prior cannabis operations to establish eligibility to continue to grow cannabis as a legal non-conforming use.

Recommendation 6

That the Santa Barbara County Board of Supervisors require all applicants with cannabis use and development permit applications and licenses pending, who claim legal non-conforming status, to prove their claimed status before the Santa Barbara County Planning Commission.

Finding 7

The affidavit system does not require proof of prior scope of the cannabis acreage.

Recommendation 7a

That the Santa Barbara County Board of Supervisors direct the Santa Barbara County Planning and Development Department Director, in conjunction with the Santa Barbara County Sheriff's Office, to eradicate all cannabis grown on acreage claimed under Legal Non-Conforming status when the cannabis operator fails to demonstrate to the Santa Barbara County Planning Commission that the planting of cannabis occurred prior to January 19, 2016.

Recommendation 7b

That the Santa Barbara County Board of Supervisors direct the Santa Barbara County Planning and Development Department Director to deny permits for the growth of cannabis on acreage claimed under Legal Non-Conforming status when the cannabis operator fails to demonstrate to the Santa Barbara County Planning Commission that the planting of cannabis occurred prior to January 19, 2016.

Finding 8

The option taken by the Santa Barbara County Board of Supervisors to tax cannabis cultivation using a Gross Receipts method was less reliable than the Square Footage method used by the vast majority of California counties.

Recommendation 8

That the Santa Barbara County Board of Supervisors amend Ordinance 5026 to tax cannabis cultivation using the Square Footage method.

Finding 9

The Santa Barbara County Treasurer-Tax Collector was not included in the creation of the tax portions of the cannabis ordinance.

Recommendation 9

That the Santa Barbara County Board of Supervisors require that all future ordinances that involve taxation require the Santa Barbara County Treasurer-Tax Collector be involved in the creation of the ordinance.

Finding 10

Members of the Santa Barbara County Chief Executive Officer's office and Santa Barbara County Planning and Development staffs unduly and without apparent Board knowledge successfully sought changes to the April 26, 2019 Cannabis Advisory from the Santa Barbara County Air Pollution Control District, an independent agency, eliminating a one mile buffer recommendation.

Finding 11

There has not been effective odor control at the boundary of cannabis cultivation and related activities, resulting in significant public outcry about odor, quality of life and health concerns.

Recommendation 11

That the Santa Barbara County Board of Supervisors suspend all County unpermitted cannabis operations until proof of odor control at the boundary of their operation is accepted by the Santa Barbara County Planning Commission.

Finding 12

The Santa Barbara County Board of Supervisors does not have a written Code of Ethics to formalize its ethical standards and guide its decision making processes.

Recommendation 12a

That the Santa Barbara County Board of Supervisors establish, staff and empower an independent Ethics Commission with oversight over the Board and its staff members.

Recommendation 12b

That the independent Ethics Commission develop a Code of Ethics, review Board activities on a periodic and as needed basis for compliance, and share its findings with the public.

Recommendation 12c

That the Santa Barbara County Board of Supervisors require all its members to publicly disclose receipt of campaign contributions from donors who have matters pending a decision by the Board.

Recommendation 12d

That the Santa Barbara County Board of Supervisors require those members receiving campaign contributions from donors with matters pending a decision, to recuse themselves from those matters or return the campaign contributions.

This report was issued by the Grand Jury with the exception of a grand juror who wanted to avoid the perception of a conflict of interest. That grand juror was excluded from all parts of the investigation, including interviews, deliberations, and the writing and approval of this report.

REQUEST FOR RESPONSE

Pursuant to *California Penal Code Section 933 and 933.05*, the Santa Barbara County Grand Jury requests each entity or individual named below to respond to the enumerated findings and recommendations within the specified statutory time limit:

Responses to Findings shall be either:

- Agree
- Disagree wholly
- Disagree partially with an explanation

Responses to Recommendations shall be one of the following:

- Has been implemented, with brief summary of implementation actions taken
- Will be implemented, with an implementation schedule
- Requires further analysis, with analysis completion date of no more than six months after the issuance of the report
- Will not be implemented, with an explanation of why

Santa Barbara County Board of Supervisors – 90 days

Findings 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12

Recommendations 1a, 1b 2, 3, 4a, 4b, 5a, 5b, 5c, 6, 7a, 7b, 8, 9, 11, 12a, 12b, 12c and 12d

Appendix 1

Project Objectives of the Cannabis Land Use and Licensing Program

1. Develop a robust and economically viable legal cannabis industry to ensure production and availability of high quality cannabis products to help meet local demands and, as a public benefit, improve the County's tax base;

2. Provide opportunities for legal commercial cannabis cultivation, testing, packaging, transportation, distribution, manufacturing, and retail sale in appropriate unincorporated areas of the County, consistent with state law and County regulations;

3. Develop a new regulatory program allowing for the orderly development and oversight of commercial cannabis activities and businesses, consistent with state law and existing agricultural industry practices, standards, and regulations;

4. Encourage commercial cannabis businesses to operate legally and secure a license to operate in full compliance with County and state regulations, maximizing the proportion of licensed activities and minimizing unlicensed activities;

5. Provide an efficient, clear, and streamlined commercial cannabis licensing and permit process and attainable regulations and standards to facilitate participation by commercial cannabis business in the unincorporated areas of the County;

6. Minimize adverse effects of commercial cannabis activities on the natural environmental, natural resources, and wildlife, including riparian corridors, wetlands, sensitive habitats, and water resources;

7. Promote energy and resource efficiency in all cannabis activities, consistent with existing agricultural and any other industry practices, standards, and regulations;

8. Establish land use requirements for commercial cannabis activities to minimize the risks associated with criminal activity, degradation of visual resources and neighborhood character, groundwater basin overdraft, noise nuisances, hazardous materials, and fire hazards;

9. Develop a regulatory program that protects the public health, safety, and welfare through effective enforcement controls(i.e., ensuring adequate law enforcement and fire protection services) for cannabis activities in compliance with state law, to protect neighborhood character and minimize potential negative effects on people, communities, and other components of the environment; and

10. Limit potential for adverse impacts on children and sensitive populations by ensuring compatibility of commercial cannabis activities with surrounding existing land uses, including residential neighborhoods, agricultural operations, youth facilities, recreational amenities, and educational institutions.

Appendix 2

Statement of Overriding Considerations

Pursuant to Public Resources Code Section 21081(b) and CEQA Guidelines sections 15043, 15092, and 15093, any unavoidable adverse environmental effects of the project (as modified by incorporation of EIR mitigation measures, and development standards shown in RV 01) are acceptable due to the following environment benefits and overriding considerations:

A. The project provides for a robust and economically viable legal cannabis industry to ensure production and availability of high quality cannabis products to help meet local demands, and, as a public benefit, improves the County's tax base.

B. The project enhances the local economy and provides opportunities for future jobs, business development, and increased living wages. Moreover, the project promotes continued agricultural production as an integral part of the region's economy by giving existing farmers access to the potentially profitable cannabis industry, which in turn would provide relief for those impacted by competition from foreign markets and rising costs of water supply.

C. The project expands the production and availability of medical cannabis, which is known to help patients address symptoms related to glaucoma, epilepsy, arthritis, and anxiety disorders, among other illnesses.

D. The project allows for the orderly development and oversight of commercial cannabis activities by applying development standards that require appropriate siting, setbacks, security, and nuisance avoidance measures, thereby protecting public health, safety, and welfare.

E. The project provides a method for commercial cannabis businesses to operate legally and secure a permit and license to operate in full compliance with County and state regulations, maximizing the proportion of licensed activities and minimizing unlicensed activities. Minimization of unlicensed activities will occur for two reasons. First, the County will be providing a legal pathway for members of the industry to comply with the law. Secondly, the County will use revenue from the project to strengthen and increase code enforcement actions in an effort to remove illegal and noncompliant operations occurring in the County unincorporated areas.

F. The project establishes land use requirements for commercial cannabis activities to minimize the risks associated with criminal activity, degradation of neighborhood character, groundwater basin overdraft, obnoxious odors, noise nuisances, hazardous materials, and fire hazards.

G. The project minimizes the potential for adverse impacts on children and sensitive populations by imposing appropriate setbacks and ensuring compatibility of commercial cannabis activities with surrounding existing land uses, including residential neighborhoods, agricultural operations, youth facilities, recreational amenities, and educational institutions.

H. The project provides opportunities for local testing labs that protect the public by ensuring that local cannabis supplies meet product safety standards established by the State of California.

I. The project protects agricultural resources, natural resources, cultural resources, and scenic resources by limiting where cannabis activities can be permitted and by enacting development standards that would further avoid or minimize potential impacts to the environment.

Exhibit K

THE RIVIERA RI SCHOOL

Recent News | Top Stories

COVID Takes No Holiday in July
By Jean Yamamura

Tensions Rise at SBCC as Faculty and Board Plan Return to Campus
By Ryan P. Cruz

Challenger Barrett Reed States His Case Against Sneddon; Admits Missed City Election Votes
By Jerry Roberts

Isla Vista 'Mirror Bus' Man Found Guilty on All Charges
By Ryan P. Cruz

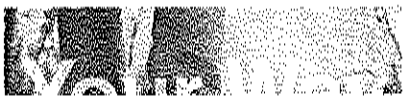
Poll Workers Recruited for California Recall Election
By Arnika Iyer



Premiere Events



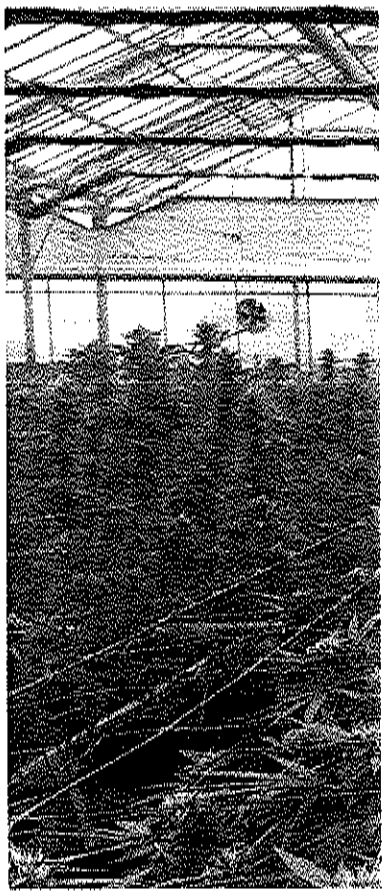
Dancing With Paint by Marlene Struss
Sat, Jul 24 1:00 PM
Santa Barbara



Business

Is Byer to Carp

Mixed Review



Credit: Courtesy

By **Sunidhi Sridha**

Wed Mar 17, 2021 |

Hardly any commerc which celebrated a b record-shattering $1 cannabis use, prope

Local

Upset over cannabis odor

by Grayce McCormick | March 30, 2021

0 comment

Carpinteria residents concerned a



RAFAEL MALDON
A coalition of residents living in Lir about the cannabis odor that is p gr

A coalition of residents living in Linden Me about their concerns regarding the odor of neighborhood.

The residents have brought their complaint Barbara County Board of Supervisors.

Some have filed lawsuits against the local b

Top 3 "Blue Gas" Stocks

The businesses include Ever-Bloom, Enigm owned by the same family, the Van Wingerd



Exhibit L

http://www.coastalview.com/news/carpinteria-residents-sue-cannabis-growers/article_e67bf208-5e67-11ea-bbe7-bb090941a68b.html

FEATURED

Carpinteria residents sue cannabis growers

By Debra Herrick
Mar 5, 2020

A row of greenhouses cultivating cannabis operate behind homes on Chapparal Drive.

Three Carpinteria residents filed a class action lawsuit with the Superior Court of California in Santa Barbara on Feb. 27, alleging punitive damages from multiple Carpinteria Valley cannabis cultivation facilities.

The class plaintiffs, Gregory and Marilus Gandrud and Paul Ekstrom, along with the nonprofit, Santa Barbara County Coalition for Responsible Cannabis, claim that commercial cannabis companies Ever-Bloom, Ednigma, Melodious Plots and Saga Farms—all owned by members of the Van Wingerden family—have exposed residents who reside near their facilities to "chemicals from ... vapor-phase systems" and "an ever-present noxious odor." The claim sights California's Unfair Competition Law, stating that plaintiffs seek monetary and injunctive relief for nuisance and trespass.

Over 1,000 individuals are estimated by the lawsuit to be members of the class, defined as "all owner-occupiers of residential property located within 4,500 feet of the named cannabis operations who purchased their property prior to Jan. 19, 2016."

The Gandruds have lived at 1493 Chapparal Drive since 1996. They claim that Ever-Bloom, owned by Ed and Ivan Van Wingerden, operates a Byers odor control system for its greenhouses less than 100 feet from their home's bedroom window, which, along with the other cannabis operations in close proximity, has affected their ability to enjoy their home and has negatively impacted their health.

According to the claim, the vapor-phase system used by cannabis growers has caused Marllus "to have severe and worsening asthma and difficulty breathing." Additionally, the vapor-phase system makes "annoying" hissing sounds that can be heard from their backyard. "To escape the misery" the Gandruds listed their property for sale over two years ago but state that because of cannabis and its impact on real estate prices, they have not received a single offer. According to Trulia, the Gandrud's home is not currently for sale, however, was listed in July 2018 for $1,049,000 and listed again in December 2019 at $1,060,000.

Ekstrom, a retired firefighter, has lived at 1489 Manzanita St. since 1976. According to the claim, Ekstrom's kitchen window is less than 100 feet from a cannabis operation causing the neighborhood to "routinely smell of strong skunky odor." The vapor-phase system also emits "strong odors," states the claim, "similar to the smell of laundry detergent."

Located at 4701 Foothill Road, Ever-Bloom operates a 15-acre greenhouse complex. Saga Farms, owned by Sofia Van Wingerden, is located at 4575 Foothill Road. Owned by Ed Van Wingerden, Ednigma holds 17 provisional state cannabis licenses for greenhouses at 4587 and 4701 Foothill Road. Ivan Van Wingerden's Melodious Plots holds 18 provisional state cannabis licenses for vented greenhouses also at 4701 Foothill Road.

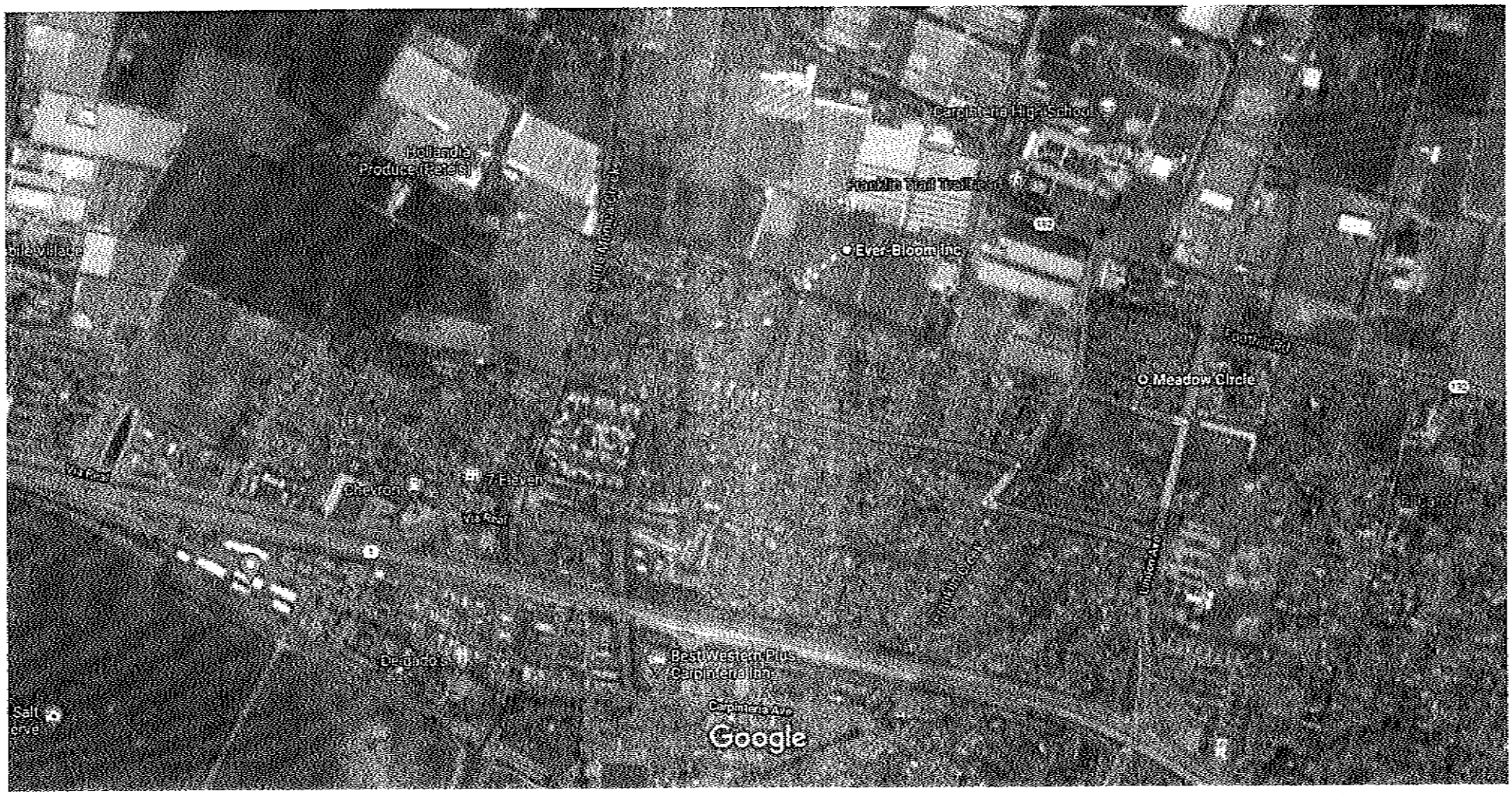
The lawyer representing the plaintiffs is Robert A. Curtis of Foley Bezek Behle & Curtis, LLP in Santa Barbara.

Debra Herrick
Managing Editor

Exhibit M

Ever-Bloom Inc to Meadow Cir, Carpinteria, CA 93013

Drive 0.9 mile, 4 min



Imagery ©2021 Data CSUMB SFML, CA OPC, Maxar Technologies, U.S. Geological Survey, USDA Farm Service Agency, Map data ©2021 500 ft

via El Carro Ln	4 min
Fastest route	0.9 mile

Exhibit N

Notice of Construction (NOC) Worksheet

pscleanair.org
Puget Sound Clean Air Agency

Applicant: Cloud Bud	**NOC Number**: 11237
Project Location: 20241 269th Ave SE Maple Valley, WA 98038	**Registration Number**: 29914
Applicant Name and Phone: William Cloud, 425-413-7961	**NAICS: 000000**
Engineer: Ralph Munoz	**Inspector**: Manolo Zaldivar

A. DESCRIPTION

For the Order of Approval:
Tier III cannabis production and processing facility consisting of approximately 15,680 square feet of enclosed production units. The enclosed production space consists of 11 production units and 3 drying units, each unit is controlled by a 1680 cfm carbon canister. Covered under this order is also a 36' by 30' greenhouse which can be used for cannabis processing and storage. The greenhouse consists of two rooms, which are both controlled with 1680 cfm carbon canisters while processing cannabis. No extraction is allowed under this order.

Additional Information (if needed):

Cloud Bud has a Tier 3 marijuana producer license with the Liquor & Cannabis Board as shown below.

Tradename	License #	UBI	Street Address	Suite/Rm	City	State	County	ZipCode	PrivDesc	PrivilegeStatus	DayPhone
CLOUD BUD	412129	603347614061 0001	20241 269TH AV		MAPLE VALLEY	WA	KING	980388824	MARIJUANA PRODUCER TIER 3	PENDING (ISSUED)	4254137961

CLOUD BUD

LICENSE INFORMATION: New search | Printable page

Entity name: CLOUD BUD, LLC
Business name: CLOUD BUD
Entity type: Limited Liability Company
UBI: 603-347-614 **Business ID:** 001 **Location ID:** 0001
Location: Open
Status: To check the status of this company, go to Department of Revenue eBusiness or Secretary of State

Location address:
20241 269TH AVE SE STE A
MAPLE VALLEY, WA 98038
View Additional Locations

Mailing address:
PO BOX 21
MAPLE VALLEY, WA 98038

ENDORSEMENTS

Endorsements held at this location	License #	Count	Details	Status	Expiration date	First issuance date
Marijuana Processor	412129			Active	Nov-30-2016	Nov-30-2014
Marijuana Producer Tier 3	412129			Active	Nov-30-2016	Nov-30-2014
Scale - Small		1		Active	Feb-28-2017	Feb-11-2016

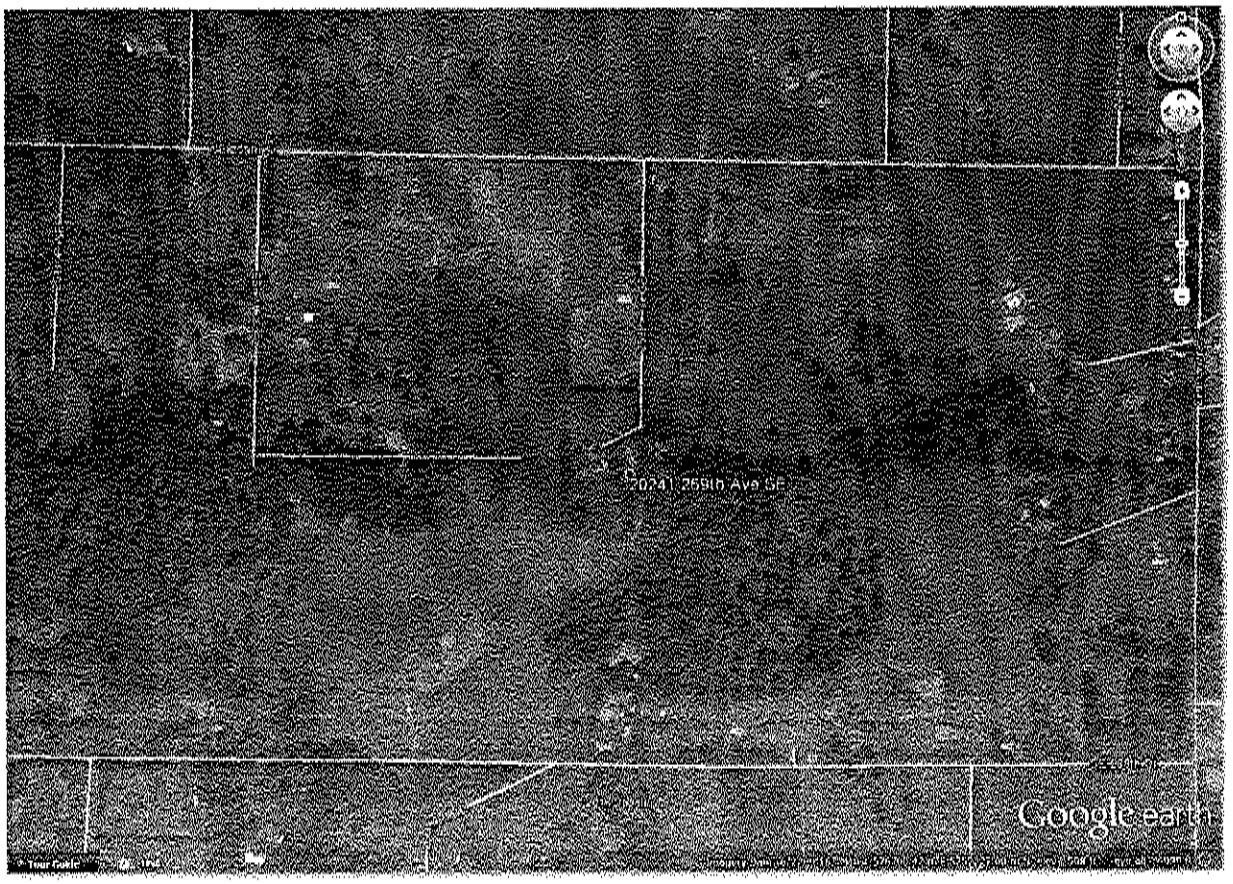
2 Rows

GOVERNING PEOPLE *MAY INCLUDE GOVERNING PEOPLE NOT REGISTERED WITH DOR*

Governing people	Title
CLOUD, SHARON	Manager, Member
CLOUD, SHARON	Manager, Member
CLOUD, WILLIAM	Member
CLOUD, WILLIAM	Member

4 Rows

Information current as of 9/28/2016 9:03:04 AM



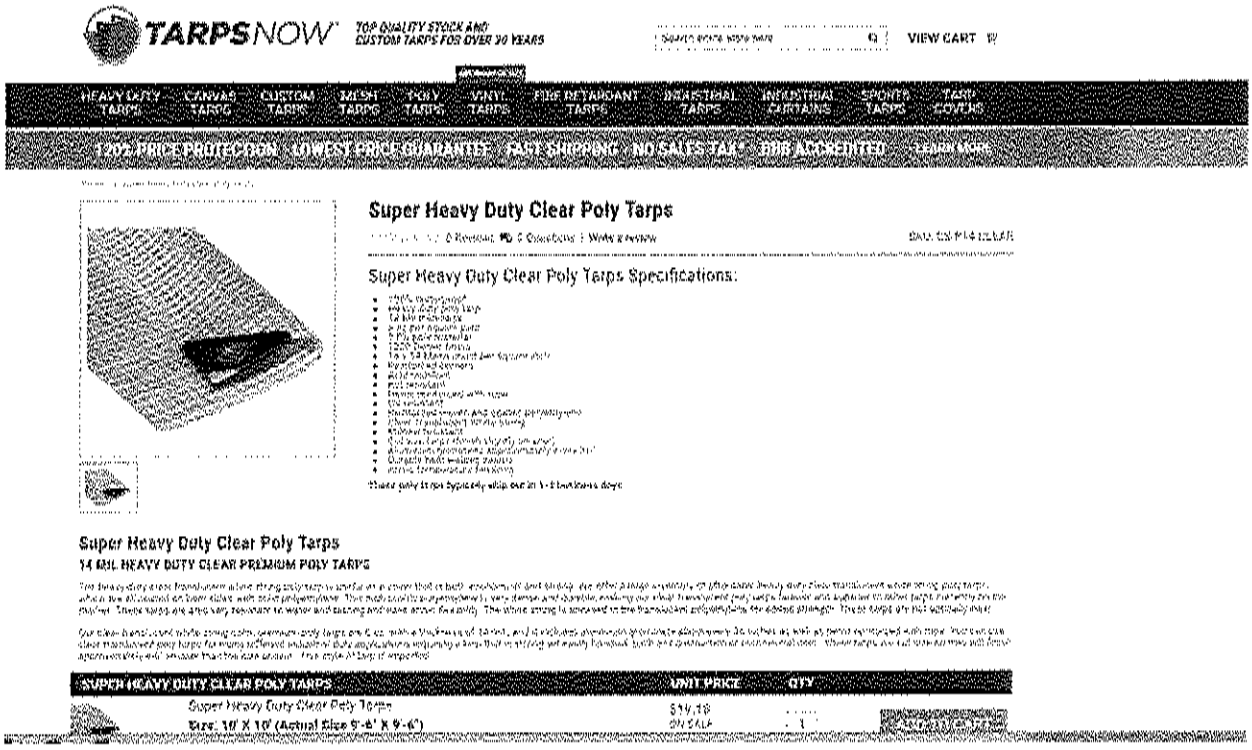
Google Earth view of Cloud Bud facility (project area is indicated by the red outline)

The original site diagram for Cloud Bud included a drawing for 14 outdoor growing/production areas, each 1,260 sq ft. Since original permit application was submitted, Cloud Bud has now modified these areas and will now be enclosed with a poly tarp cover and three of the units will be converted to drying units. The "drying units" will be used for all processing and trimming operations. No processing is currently being conducted in the greenhouse, only storage of cannabis in sealed bags; however, Cloud Bud did request the capability to do some processing in the future (William Cloud – 7/17/18). The two enclosed rooms inside the greenhouse are both equipped with Hydrofarm 1,680 cfm carbon canisters and will operate them if Cloud Bud decides to process cannabis in these rooms.

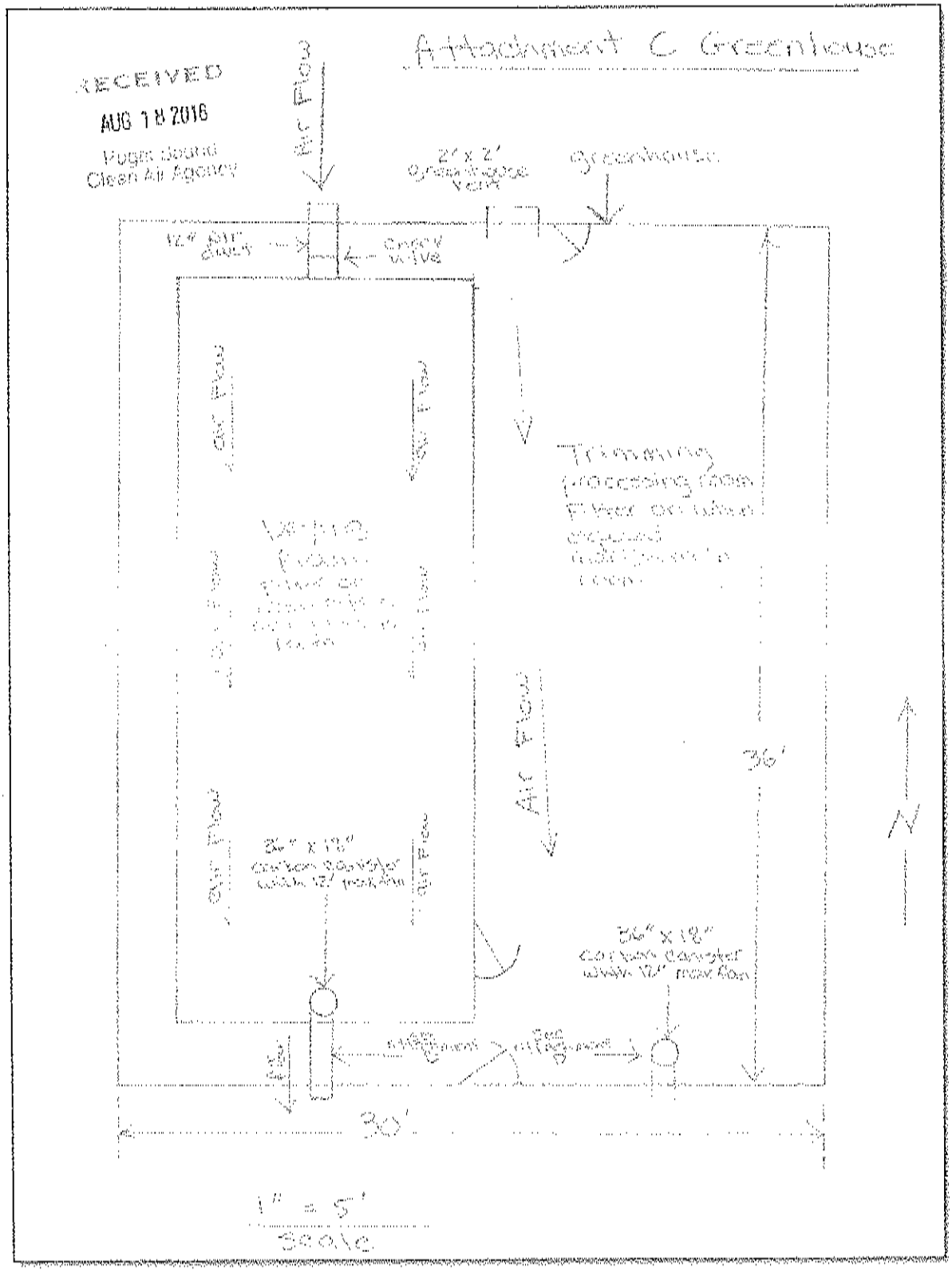
The production and drying unit enclosures will each be equipped with at least two fans, one blowing air in and the other blowing air out. These fans will be rated up to 1680 cfm, and all of the production units will be equipped with Hydrofarm carbon canister units at the exhausts that contain 81.5 pounds of carbon. Each of the units (11 production, 3 drying units) will be totally enclosed with a poly tarp (A sample spec sheet shown below for a 10' x 10' sheet, but Cloud Bud will be using larger tarp). Clear tarp will be used as the enclosure, and the darker shaded tarp will go over the top right before getting dark and for a few hours after the sun comes up. This is done to control the amount of light the plants are getting. A 30' x

45' poly tarp will be placed on top of the units; two 6' x 40' poly tarps will be used on the sides. Finally, the tarp covers will be joined with ball bungies to wrap the bungie cord around the posted steel frames. Cloud Bud will need to ensure these tarp covers are totally sealed once the bungie's go around the poles, which will be done with masking tape or other adhesive type material.

Sample spec sheet for the poly tarp



Cloud Bud greenhouse layout



As mentioned previously, this greenhouse schematic was the original design plan, which was to be used for drying and trimming. Cloud Bud has now modified their operation to do drying and trimming in the 3 drying units as described above. This greenhouse is currently being used for storage, but does have the capability of processing cannabis. Each of the rooms shown above does have carbon canisters on the exhausts in case Cloud Bud needs to use this greenhouse space in the future.

History:

Cloud Bud submitted their permit application on August 25, 2016 which included outdoor production. Cloud Bud received a notice of violation 3-008688 from the agency for operating without a permit on 6/7/17.

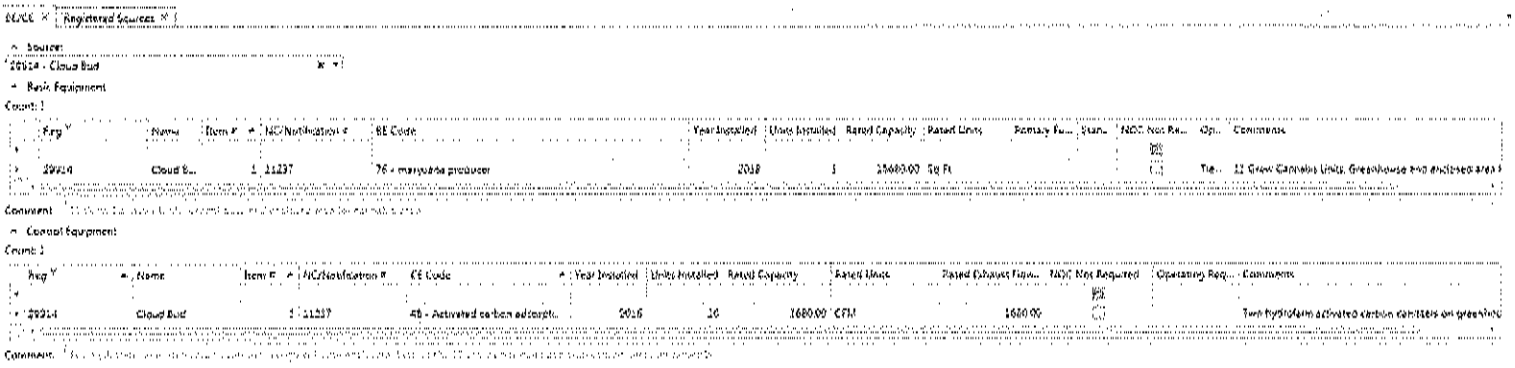
The original permit application requested 14 outdoor production areas, each approximately 1,120 sq ft. The operation was then modified to 11 production units and 3 drying units, each equipped with carbon canisters. The greenhouse was also changed as mentioned above, but Cloud Bud wants to keep the capability of processing cannabis in the greenhouse.

The application listed a total canopy size of 15,680 sq ft; however; the King County CUP application listed the total canopy as 30,000 sq ft.

2. On February 26, 2016, Cloud Bud LLC (Applicant) submitted an application to DPER for a CUP to allow approximately 30,000 square feet of marijuana production and a marijuana greenhouse within a fenced area and for the drying, curing, trimming, and packaging of the marijuana. Exhibits A-4[1], D-2. The Applicant intends to grow one crop of marijuana per year during the months of April–October. Exhibit D-2, Finding A, p. 3; Exhibit D-34; testimony of William Cloud and Ty Peterson. Although initial propagation will take place in the greenhouse, the marijuana will be grown primarily outdoors within the fenced area. Exhibit D-2, Finding A, p. 2; testimony of William Cloud.

The CUP was using the maximum amount allowed under the Tier III production license. This permit application and worksheet will evaluate the 15,680 sq ft canopy since this is what was applied for in the permit application.

B. DATABASE INFORMATION



New NSPS due to this NOCOA?	**No**
New NESHAP due to this NOCOA?	**No**
New Synthetic Minor due to this NOCOA?	**No**

No existing NSPS or NESHAPS applicable to this facility.

C. NOC FEES AND ANNUAL REGISTRATION FEES

NOC Fees:

Fees have been assessed in accordance with the fee schedule in Regulation I, Section 6.04. All fees must be paid prior to issuance of the final Order of Approval.

Fee Description	**Cost**	**Amount Received (Date)**
Filing Fee	$ 1,150	
Control Equipment (tier 3)	$1,800	
Process Equipment (Cannabis Production)	$600	
SEPA (DNS)	$0	
Public Notice (not including newspaper publication costs)	$700	
Publication costs (unknown at this time)	??	
Filing received		$ 1,150 (4/13/16)
Additional fee received		$3,100 (Paid 7/27/18)
Total	**$**	

On 9/28/16 Alan Butler sent Cloud Bud an invoice for $3,200 which was never paid by Cloud Bud.

William Cloud mailed payment into the agency 7/24/18, payment received 7/27/18 for $3,100 receipt 99648

Invoice needed for Cloud Bud, NOC 11237, Reg No. 29914

Alan Butler
Sent: Wed 9/28/2016 10:20 AM
To: Betsy Wheelock
Cc: Nelah Shami

Betsy: Please prepare and send an invoice for $3,200 for permit review fees to:

William Cloud
Cloud Bud
PO Box 21
Maple Valley, WA 98038

Email address: cloudbud@outlook.com

Fee Description	Cost	Amount Received (Date)
Filing Fee	$ 1,150	
Marijuana (odor generation)	$600	
Controls for marijuana odor (Tier 3)	$1,800	
SEPA (DNS)	$650	
Filing received		$1,150 (8/25/16)
Additional fee received		$3,200 (mm/dd/16)
Total	$2,550	$1,150

Thank you
ATB

The invoice included charges for SEPA; however, since this date – King County has issued a SEPA determination for which the Agency relied on for this permit application. The total amount actually due at this time (7/18/18) is $3,100.

Registration Fees:
Registration fees are assessed to the facility on an annual basis. Fees are assessed in accordance with Regulation I, Section 5.07.

Registration Applicability		
Regulation I	Description	Note
5.03(a)(5)(A)	Sources with odor control >200 cfm	
5.03(a)(8)(Q)	Marijuana production	

Annual Registration Fee		
Regulation I	Description	Fee
5.07(c)	Base fee	$1,150
	Total =	$1,150

D. STATE ENVIRONMENTAL POLICY ACT (SEPA) REVIEW

The **King County Department of Permitting and Environmental Review (DPER) was** the SEPA lead agency for this project and issued the associated DNS on June 9, 2017. A copy of this DNS is included in the NOC file.

https://www.kingcounty.gov/~/media/independent/hearing-examiner/documents/Cloud%20Bud/Determiniation_of_Non-Significance.ashx?la=en

After this DNS was issued by King County DPER, an appeal was filed on the SEPA Determination on July 3, 2017.

The final report and decision from the hearing examiner was issued on November 7, 2017: https://www.kingcounty.gov/~/media/independent/hearing-examiner/documents/Cloud%20Bud/CDUP160002_CloudBud_CorrectedReport.ashx?la=en

The SEPA DNS was upheld in the hearing, but imposed additional conditions requiring periodic monitoring of the operation to gauge compliance with the conditional use permit (CUP) conditions and a more timely approval on this NOC application, which King county is relying on to mitigate the odor impacts. One of the conditions of the hearing examiner was for the applicant to receive an NOC permit from PSCAA by August 1, 2018: (page 23 CUP)

> 146. The Examiner has revised Conditions 3 and 10 to require that the Applicant obtain the PSCAA NOC by later of August 1, 2018 or, in the event of an appeal(s), within 12 months of the final resolution of any appeal(s).

Another condition of the CUP and the hearing examiner is that Cloud Bud will need to meet BACT, which is no odor at the property boundary:

> 140. Exhibit A-40 is an example of conditions PSCAA imposed on an outdoor marijuana production use in Woodinville. It imposes a condition that no detectable cannabis odor from the facility is allowed outside the facility property line. Although Appellants characterized this condition as a regulatory standard, the Examiner was not able to find an adopted standard in chapter WAC 173-400 or PSCAA's rules requiring that cannabis odor not cross a property line. Nor did Appellants provide a citation to one. Mr. Hess described this condition as BACT. Therefore, the Examiner concludes that PSCAA imposed this condition as BACT.

The requirements of BACT will be evaluated and placed in the air permit for Cloud Bud, and is explained in more detail below in the BACT section.

The final SEPA report and decision was issued on November 7, 2017 by King County DPER (CDUP160002).

E. BEST AVAILABLE CONTROL TECHNOLOGY (BACT) REVIEW

Best Available Control Technology (BACT)

New stationary sources of air pollution are required to use BACT to control all pollutants not previously emitted, or those for which emissions would increase as a result of the new source or modification. BACT is defined in WAC 173-400-030 as, "an emission limitation based on the maximum degree of reduction for each air pollutant subject to regulation under Chapter 70.94 RCW emitted from or which results from any new or modified stationary source, which the permitting authority, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source or modification through application of production processes and available methods, systems, and techniques, including fuel cleaning, clean fuels, or treatment or innovative fuel combustion techniques for control of each pollutant."

An emissions standard or emissions limitation means "a requirement established under the Federal Clean Air Act or Chapter 70.94 RCW which limits the quantity, rate, or concentration of emissions of air contaminants on a continuous basis, including any requirement relating to the operation or maintenance of a source to assure continuous emission reduction and any design, equipment, work practice, or operational standard adopted under the Federal Clean Air Act or Chapter 70.94 RCW."

Best Available Control Technology for Toxics (tBACT)

New or modified sources are required to use tBACT for emissions control for TAP. Best available control technology for toxics (tBACT) is defined in WAC 173-460-020 as, "the term defined in WAC 173-400-030, as applied to TAP."

Similar Permits:

Permitting Action	BACT for Cannabis Production and Processing Operations
NC#10961	▪ All exhaust points (e.g. stacks, vents, windows, doors) associated with an enclosure, building or greenhouse housing cannabis production or processing operations must be designed to continuously control odors and VOCs. Carbon adsorption systems have been installed in all recent permitting actions. ▪ There shall be no detectable cannabis odors at or beyond the property line. Because the issue of olfactory fatigue, a person who has not been exposed to the smell will be required to periodically monitor the air at the property line. ▪ Maintenance of carbon adsorption systems must be implemented according to manufacturer recommendations. At a minimum the carbon units shall be replaced quarterly (as required in the permit conditions)
NC#11076	
NC#11277	
NC#11359	
NC#10835	
NC#10987	
NC#11096	
NC#11209	

Other Regulatory Agencies BACT:

There are a growing number of areas in the country where this type of facility is legal on a state or local basis, but it does remain illegal at the federal level. Air quality regulation of cannabis production is changing across the country as more states have approved recreational and medical cannabis production.

Locations with cannabis odor regulations include the following:

- Denver which adopted an Odor Control Plan requirement in 2016 which requires a plan and also engineering and/or procedural controls for odors from cannabis production (Denver Ordinance Section 4-10).
- The city of Boulder, Colorado, has a regulation which prohibits any odors from recreational cannabis producers and processors outside the facility (City of Boulder Regulation 6-16-8).
- The city of Aurora, Colorado, requires ventilation system to be installed to prevent any odor of cannabis off the premises of the establishment. (City of Aurora Building Division Regulations – Marijuana Related Occupancies, Mechanical Requirement: 1, 17, 19, 29)

- Napa County, California which prohibits outdoor cannabis production because of the odor impacts and requires indoor facilities to be fully enclosed and have ventilation and odor control to avoid nuisance odors (County Ordinance Chapter 8.10)
- In Washington, counties, clean air agencies and the Department of Ecology are regulating, or working towards regulating, cannabis producers in different ways including permitting, regulation by rule, prohibitions on production based on land use, and existing nuisance rules.

Analysis:

The purpose of the BACT review is to demonstrate that Cloud Bud will implement limitations or reductions for all increases in VOC and odor emissions from cannabis production and processing operations. For this permitting action, this project will increase emissions of odors and volatile organic compounds (VOCs). An odor and VOC BACT determination for cannabis production and processing operations has been established by the Agency from recent permitting actions and is discussed and presented below.

Technologies currently used for controlling odors and VOC from cannabis production include carbon canisters, odor masking (which is not allowed under Agency rules), odor neutralizers and ozone generators. There are other odor and VOC control technologies used in other industries including:

- packed bed scrubbers (won't work well on semi volatile organics),
- afterburners (expensive, uses fuel and creates other regulated pollutants),
- biofilters (would require too much room), and
- potassium permanganate filters (more expensive and this level of control is not needed for the semivolatiles at hand).

There is no information available that indicates these technologies are used in the cannabis production industry; so their technical feasibility for odor and VOC control has not been documented.

The Agency has determined that "no odor outside the property line" to be BACT since it is technically and economically feasible and achieved in practice by other sources of cannabis production in the region. The means by which this has been demonstrated is an enclosure with the use of carbon adsorption systems.

Based on existing, readily available information carbon adsorption is effective for controlling odors and VOC and is one of the most common control technologies in commercial cannabis facilities. The Agency has required all of the recent cannabis facilities to have carbon control (see the similar permits list above). This includes carbon canisters on all external vents from the building and internally circulating carbon canisters in many circumstances. The Agency does not believe that outdoor production facilities can continuously achieve "no odor outside the property boundary" without the proper use of an enclosure where emissions are routed to a carbon absorption system. In the specific case of Cloud Bud, the agency has received 11 odor complaints in the year 2017 and 8 so far in the year 2018.

Cloud Bud's original permit application requested 14 outdoor growing units, but an email from William Cloud on 7/12/18, updated this to 11 enclosed production units and 3 enclosed drying units. Each of these units is equipped with both an inlet and an exhaust fan (up to 1680 scfm each), and the exhaust fans are equipped with activated carbon for the control of odors (Hyrdofarm – 39.4 in high x 16.5 in diameter) same size for each units. Each canister contains activated carbon, and is rated for up to 1,680 cfm each.

The carbon canisters feature a 2.5 in bed depth of pelletized virgin-activated carbon and a perforated housing for filtered airflow. Cloud bud also has an indoor processing area located in the greenhouse, where one carbon is attached to the outlet of the drying room and another in the trimming processing room. Both of these rooms are enclosed and currently only used for storage. According to the manufacturers of the canister-type carbon, the carbon canister filters should be replaced yearly. (Source: http://canfilters.com/filters/can-filters/can-100.html)

For now, the Agency believes one carbon at the exhaust of each of these enclosed grow/dry units will be sufficient to control odors. However; Cloud Bud may need to install additional carbon canisters and/or carbon impregnated filters on the enclosures in order to control odors if there are odors detected beyond the property line.

Recommendations:

Permitting Action	BACT for Cannabis Production and Processing Operations
BACT 11237	▪ All exhaust points (e.g. stacks, vents, windows, doors) associated with an enclosure, building or greenhouse housing cannabis production or processing operations must be designed to continuously control odors and VOCs. Cloud Bud must enclose, capture and route all cannabis production and processing emissions to a carbon adsorption system in each of their 11 production units, 3 drying units, and both rooms inside the greenhouse. ▪ There shall be no detectable cannabis odors at or beyond the property line. Because the issue of olfactory fatigue, a person who has not been exposed to the smell will be required to periodically monitor the air at the property line. ▪ Maintenance of carbon adsorption systems must be implemented according to manufacturer recommendations or as needed to meet no odor at the property line. At a minimum the carbon units shall be replaced annually (as required in the permit conditions)

F. EMISSION ESTIMATES

Proposed Project Emissions

The purpose of this section is to identify each regulated air pollutant and present the amounts at which each regulated air pollutant will be emitted. Potential and actual emissions are the same in this case because the Order or Approval for the facility limits the production size to that for which they applied, 15,680 sq ft of canopy size.

Identification of Emissions

All emissions for this project will originate from the biogenic aspect of the production and processing of cannabis.

Emissions from the production and processing of cannabis depend on many factors (e.g. the genetics of the cannabis strain, the maturity cycle of the cannabis and the environment in which the cannabis is grown). For this permitting case, since production of cannabis occurs in a controlled environment, environmental factors will not contribute to significant increases in emissions. The production rooms are designed to maintain constant temperatures.

The emissions are complex mixtures of terpenoid, phenolic, cannabinoid and oxygen-containing compounds. Many compounds have been identified in several studies by looking at the composition of cannabis flowers, stems, leaves, roots and seeds.

Emissions Calculations

Emissions were calculated based on the actual canopy size reported in the application (15,680 sq ft). The Agency calculated emissions in two ways. First from air sample measurements conducted by the Puget Sound Clean Air Agency (the Agency) and second from a paper based on estimated biogenic VOC Emission Rates for Trees/Shrubs (max, as carbon). See spreadsheet below for details.

The first methodology to calculate emissions from the production and processing of cannabis used air sample measurements taken by the Agency with a hand-held FID. The emission calculations use an FID response factor that represents the cannabis emissions profile and corrections to the concentration to mass rate equation.

The second methodology to calculate emissions from the production and processing of cannabis using biogenic VOCs emission database for common U.S. tree and shrub genera and was used in many of the permitting actions listed above in the BACT section.

The VOC emissions estimates from these methods result in emissions ranging from 20.8 to 84 pounds/year using the different methodologies.



11237ram.xlsx

Input in yellow highlighted areas. Other cells calculated.

NOC #:	11237			
Facility Name:	Cloud Bud			
Facility yield per year:	600	lb	272.2	kg
Number of Crops/Year:	1			
Yield per Harvest:	600.0	lb	272155	gr
# of Carbon Canisters;	16			
Changeout period:	3	months		
Fan rating	1680	CFM		
Estimated Square Footage of canopy	15680	Sq ft		
Maximum per License	15680	Sq ft		

Summary of VOC Emissions

	Actual	Potential
Source	**lb/yr**	**lb/yr**
Emissions based on estimated biogenic VOC Emission Rates for Trees/Shrubs (max, as carbon)	20.8	20.8
Emissions based on measurements of outlet concentrations from the exhaust fans on the carbon filters	84	84

Reporting Status:
With the emissions from this NOC, it is unlikely that the facility will trigger emission reporting requirement per Agency's Regulation I, Section 5.05 (b). The actual emission rate is expected to emit less than:

- 2.5 ton/year of HAP
- 6.25 of Total HAPs
- 25 tons/year of CO, NOx, PM, Sox, or VOC.

G. OPERATING PERMIT or PSD

The Title V Air Operating Permit (AOP) program applicability for the entire source has been reviewed.

The facility is not a Title V air operating permit source because post project PTE remains below Title V applicability thresholds and criteria. The source is considered a "**natural minor**".

Emission increases associated with this project were reviewed for Prevention of Significant Deterioration (PSD) Program applicability. The facility is not an existing PSD major source and the increase in emissions from this permitting action is below PSD thresholds.

H. AMBIENT TOXICS IMPACT ANALYSIS

TAPs are not identified in the potential emissions increases; therefore, compliance demonstration with Chapter 173-460 WAC (Washington Air Toxics Rule) and PSCAA Regulation 3, Section 2.07 is not required.

I. APPLICABLE RULES & REGULATIONS

1. PUGET SOUND CLEAN AIR AGENCY REGULATIONS

SECTION 5.05 (c): The owner or operator of a registered source shall develop and implement an operation and maintenance plan to ensure continuous compliance with Regulations I, II, and III. A copy of the plan shall be filed with the Control Officer upon request. The plan shall reflect good industrial practice and shall include, but not be limited to, the following:
(1) Periodic inspection of all equipment and control equipment;
(2) Monitoring and recording of equipment and control equipment performance;
(3) Prompt repair of any defective equipment or control equipment;
(4) Procedures for startup, shut down, and normal operation;
(5) The control measures to be employed to ensure compliance with Section 9.15 of this regulation; and
(6) A record of all actions required by the plan.
The plan shall be reviewed by the source owner or operator at least annually and updated to reflect any changes in good industrial practice.

SECTION 6.09: Within 30 days of completion of the installation or modification of a stationary source subject to the provisions of Article 6 of this regulation, the owner or operator or applicant shall file a Notice of Completion with the Agency. Each Notice of Completion shall be submitted on a form provided by the Agency, and shall specify the date upon which operation of the stationary source has commenced or will commence.

SECTION 9.09: General Particulate Matter (PM) Standard. It shall be unlawful for any person to cause or allow the emission of particulate matter in excess of the following concentrations:
Equipment Used in a Manufacturing Process: 0.05 gr/dscf

SECTION 9.11: It shall be unlawful for any person to cause or allow the emission of any air contaminant in sufficient quantities and of such characteristics and duration as is, or is likely to be, injurious to human health, plant or animal life, or property, or which unreasonably interferes with enjoyment of life and property.

SECTION 9.13: It shall be unlawful for any person to cause or allow the installation or use of any device or use of any means designed to mask the emission of an air contaminant which causes detriment to health, safety or welfare of any person.

SECTION 9.15: It shall be unlawful for any person to cause or allow visible emissions of fugitive dust unless reasonable precautions are employed to minimize the emissions. Reasonable precautions include, but are not limited to, the following:
(1) The use of control equipment, enclosures, and wet (or chemical) suppression techniques, as practical, and curtailment during high winds;
(2) Surfacing roadways and parking areas with asphalt, concrete, or gravel;

(3) Treating temporary, low-traffic areas (e.g., construction sites) with water or chemical stabilizers, reducing vehicle speeds, constructing pavement or rip rap exit aprons, and cleaning vehicle undercarriages before they exit to prevent the track-out of mud or dirt onto paved public roadways; or (4) Covering or wetting truck loads or allowing adequate freeboard to prevent the escape of dust-bearing materials.

REGULATION I, SECTION 9.20(a): It shall be unlawful for any person to cause or allow the operation of any features, machines or devices constituting parts of or called for by plans, specifications, or other information submitted pursuant to Article 6 of Regulation I unless such features, machines or devices are maintained in good working order.

2. WASHINGTON STATE ADMINISTRATIVE CODE

WAC 173-400-040(3): Fallout. No person shall cause or allow the emission of particulate matter from any source to be deposited beyond the property under direct control of the owner or operator of the source in sufficient quantity to interfere unreasonably with the use and enjoyment of the property upon which the material is deposited.

WAC 173-400-040(4): Fugitive emissions. The owner or operator of any emissions unit engaging in materials handling, construction, demolition or other operation which is a source of fugitive emission:

3. FEDERAL

No federal rules or regulations apply to this source at this time.

J. PUBLIC NOTICE

This project meets the criteria for mandatory public notice under WAC 173-400-171(3). Criteria requiring public notice includes, but is not limited to, a project that exceeds emission threshold rates as defined in WAC 173-400-030 (40 tpy NOx, VOC, or SO_2, 100 tpy CO, 15 tpy PM_{10}, 10 tpy $PM_{2.5}$, 0.6 tpy lead), an Order of Approval that includes a WAC 173-400-091 synthetic minor limit, a project that has a toxic air pollutant emission increase above the acceptable source impact level in WAC 173-460-150, or one for which there is significant public interest.

The Agency has concluded there is significant public interest in this facility for several reasons as described below.

The agency has received a number of complaints from citizens around Cloud Bud:

Registered Sources | Complaints and Asbestos

Case #	Case Sen	Case Type	Received Date	Received Time	Incident Date	Incident Time	Inspector	Location Street	Location C
2018501399		1 Odor	7/8/2018	0812			JLL - Jessica Landtr...	20241 269th Ave SE	Maple Valley
2018501399		1 Odor	7/7/2018	0755	7/6/2018		JLL - Jessica Landtr...	20241 269th Ave SE	Maple Valley
2018501375		1 Odor	7/4/2018	1055	7/4/2018	1030	JLL - Jessica Landtr...	20241 269th Ave SE	Maple Valley
2018501356		1 Odor	7/4/2018	1035	7/4/2018	1030	JLL - Jessica Landtr...	20241 269th Ave SE	Maple Valley
2018501326		1 Odor	6/29/2018	0916			JLL - Jessica Landtr...	20241 269th Ave SE	Maple Valley
2018501323		1 Visible Emission	6/29/2018	0903	6/29/2018	0845	JLL - Jessica Landtr...	20241 269th Ave SE	Maple Valley
2018501199		1 Odor	6/16/2018	2151	6/16/2018	2145	JLL - Jessica Landtr...	20241 269th Ave SE	Maple Valley
2018501148		1 Odor	6/9/2018	0703	6/9/2018	0645	JLL - Jessica Landtr...	20241 269th Ave SE	Maple Valley
2017503790		1 Odor	10/7/2017	0932	10/7/2017	0900	JLL - Jessica Landtr...	20241 269th Ave SE	Maple Valley
2017503766		1 Odor	10/6/2017	1556	10/6/2017	1553	JLL - Jessica Landtr...	20241 269th Ave SE	Maple Valley
2017503749		1 Odor	10/6/2017	2109	10/6/2017	1852	JLL - Jessica Landtr...	20241 269th Ave SE	Maple Valley
2017503738		1 Odor	10/2/2017	1642	10/2/2017	1640	JLL - Jessica Landtr...	26429 SE 200th St	Maple Valley
2017503733		1 Odor	10/2/2017	1902	10/2/2017	1900	JLL - Jessica Landtr...	Near the cross of S...	Maple Valley
2017503732		1 Odor	10/2/2017	1858	10/2/2017	1857	JLL - Jessica Landtr...	20485 SE 200th St	Maple Valley
2017503651		1 Odor	9/27/2017	0857	9/27/2017	0847	JLL - Jessica Landtr...	20241 269th Ave SE	Maple Valley
2017503655		1 Odor	9/27/2017	0942	9/27/2017	0934	JLL - Jessica Landtr...	20241 269th Ave SE	Maple Valley
2017503655		1 Odor	9/26/2017	2005	9/26/2017	1955	JLL - Jessica Landtr...	20241 269th Ave SE	Maple Valley
2017503654		1 Odor	9/26/2017	2036	9/26/2017	1645	MDB - Nina Bomba...	200th & 276 Ave A...	Hobart
2017503653		1 Odor	9/25/2017	2031	9/25/2017	2030	MDB - Nina Bomba...	244 and 204th St	Hobart

On July 19, 2016 and again on Sept 10, 2016 the Agency received an email from Stacy Goodman indicating that she is requesting a public comment period for this project.

For these reasons, this permit will be posted in a local newspaper and the agency website for a mandatory public comment period. No public hearing has been requested at this time (7/16/18).

Placeholder for public notice dates

K. RECOMMENDED APPROVAL CONDITIONS

Standard Conditions:

1. Approval is hereby granted as provided in Article 6 of Regulation I of the Puget Sound Clean Air Agency to the applicant to install or establish the equipment, device or process described hereon at the installation address in accordance with the plans and specifications on file in the Engineering Division of the Puget Sound Clean Air Agency.

2. This approval does not relieve the applicant or owner of any requirement of any other governmental agency.

Specific Conditions:

3. All exhaust air from the greenhouse drying room and the trimming processing room while processing cannabis shall be vented through Hydrofarm activated carbon adsorption canisters before being exhausted to the outdoor atmosphere or to the inside of the building. The flow rate through each carbon adsorption canister shall not exceed 1,680 cfm and shall contain at least 81.5 pounds of activated carbon. The owner or operator may use an equivalent carbon canister that has at least the same amount of carbon in pounds and does not exceed the allowed flow rate.
4. The owner or operator must totally enclose all 11 production units and 3 drying units to prevent all emissions of cannabis odor. There shall be no gaps or holes in the enclosures, including at all tarp seams, at the ground, between the walls and the roof, or any other location. The grow units and drying units shall remain fully closed to the atmosphere at all times except as allowed by Permit Condition 13.

5. All exhaust exiting each production unit and each drying unit shall be controlled by Hydrofarm activated carbon adsorption canisters before being emitted to the atmosphere. The flow rate through each carbon adsorption canister shall not exceed 1,680 cfm and shall contain at least 81.5 pounds of activated carbon. The owner or operator may use an equivalent carbon canister that has at least the same amount of carbon in pounds and does not exceed the allowed flow rate.
6. Each carbon canister must be designed and equipped with a pre-filter to prevent debris getting into the carbon.
7. Manufacturer specification sheets showing the type of unit, amount of carbon media, and fan used for each carbon canister must be maintained on-site. If requested by the Agency, the owner or operator must provide safe access for inspecting any of the carbon canisters.
8. No detectable cannabis odor from the facility is allowed outside the property line.
9. The owner or operator shall monitor along and outside the property line for detectable cannabis odors from the facility once each calendar week (Sunday through Saturday). For at least one hour immediately prior to monitoring, the person performing the monitoring must remain in an atmosphere free of cannabis odors and may not be inside the facility. If cannabis odors from the facility are detected at or outside the property line during the monitoring or at any other time, the owner or operator shall immediately take corrective action to eliminate the odors. Corrective action includes, but is not limited to: changing out the carbon media or canister(s), adding new carbon adsorption systems, and adjusting or replacing the fan so that the airflow does not exceed the design airflow of a carbon adsorption canister or system. The owner or operator shall monitor along and outside the property line for detectable cannabis odors from the facility after the corrective action has been implemented. If odors are still identified, the owner or operator must continue to take corrective action until no odor is detected at the or beyond the property line.
10. The owner or operator shall have an independent third party who is familiar with cannabis odors monitor along and outside the property line for detectable cannabis odors at least once every three months. For at least eight hours immediately prior to monitoring, the person performing the monitoring must remain in an atmosphere free of cannabis odors and may not be inside the facility. If cannabis odors from the facility are detected at or outside the property line during the monitoring or at any other time, the owner or operator shall immediately take corrective action to eliminate the odors. Corrective action includes, but is not limited to: changing out the carbon media or canister(s) and/or adding new carbon adsorption systems. The independent third party who is familiar with cannabis odors shall monitor along and outside the property line for detectable cannabis odors from the facility after the corrective action has been implemented. If odors are still identified, the owner or operator must continue to take corrective action until no odor is detected at the or beyond the property line.
11. The owner or operator shall keep written and/or digital records of each inspection required by Conditions #9 and #10. Each inspection record must include the date of the inspection, the start and end time of the inspection, the name of the person performing the inspection, a certification that the person performing the inspection remained in an atmosphere free of cannabis odors for the required time prior to the inspection, whether any cannabis odors were detected, the date and time of detection of any cannabis odors, where any cannabis odors were detected, a description of all corrective actions taken, the time and date of the corrective action and the results of the corrective action.
12. The owner or operator shall replace the carbon media whenever required by Conditions #9 or #10, or every 12 months, whichever comes first. The owner or operator shall replace or clean the pre-filter to each carbon canister quarterly. The owner or operator shall record the date and location whenever the carbon media or unit is replaced or if a pre-filter was cleaned or replaced.
13. All entrances to, or other potential openings in the production units, drying units, and the greenhouse shall be closed except when personnel are going in or out.
14. All exterior windows and vents in the facility shall be closed at all times.

15. The owner or operator shall develop and implement a written complaint response plan. The owner shall record the name of the complainant, date and time of the complaint, and the complainant's phone number. The owner or operator shall investigate the complaint and record the results of the investigation including any corrective actions taken for all complaints received regarding odor, visible emissions or other air pollution issues. The complaint response plan and all records made under the plan shall be onsite and available to Agency personnel upon request.
16. All records and information required in this Order of Approval shall be kept in written and/or digital form for at least two years and made available to Agency personnel upon request.

L. CORRESPONDENCE AND SUPPORTING DOCUMENTS

Re: Cloud Bud - Controlling Grow units

Willie Cloud <cloudbud@outlook.com>
Sent: Mon 7/16/2018 11:07 AM
To: Ralph Munoz

When I applied for my NOC two years ago, it was not required to have the units enclosed with clear terps and carbon filters, therefore I only put them in the drying area in the greenhouse. There are now 11 grow units and 3 drying units for a total of 14 units. All will have Hydrofarm 1,680 cfm.

From: Ralph Munoz <RalphM@pscleanair.org>
Sent: Monday, July 16, 2018 7:49 AM
To: Willie Cloud
Subject: RE: Cloud Bud - Controlling Grow units

Thanks so much for all of this info Willie,

Let me make sure I understand. The original permit application requested a total of 14 outdoor grow units, and now you are saying that there are only 11, is that correct? Each grow unit is 27' x 40', 1,120 sq ft?
The grow units will be enclosed in a tarp like structure you sent me in the previous email, where the carbon canister control device will be on the exhaust fans. What kind of carbon units are these ones?
The original permit application only listed 2 carbon units – now there will be 13? (11 from the grow units, and the 2 existing on the greenhouse)? Are they all the same – Hydrofarm 1680 cfm? If not, ill need the spec sheets for the other 11 carbon filters you are using on the grow units.

As an aside, the agency has also had a request from the public to have a public hearing for this NOC. This will add some time to the permitting process, but I am working on getting this out to public notice as fast as possible. We will likely hold the public hearing and public notice periods concurrently.

I will keep you updated on the status of this as we move forward. Hopefully once you answer all my questions above, I will have a worksheet ready for you to review within the next couple of days.

Ralph Munoz
Puget Sound Clean Air Agency
1904 Third Ave. #105
Seattle, WA 98101
(206) -689-4021
Schedule – 6:30am – 3:00pm (M-F)
pscleanair.org
Puget Sound Clean Air Agency

M. REVIEWS

Reviews	Name	Date
Engineer	Ralph Munoz	7/18/18
Inspector	Manolo and Jessica	
Second Review:	Carole Cenci	7/17/18
Applicant Name:	William Cloud	

Exhibit O

ATTACHMENT A - APPENDIX ONE

BASIN PLAN AMENDMENT

CHAPTER TWO

The following Basin Plan amendment is proposed. (Note new language is in **bold**, existing language is shown in plain text, and deleted language is ~~struck out~~.)

1. Table 2-1 of California Central Coastal Regional Water Quality Control Plan (Basin Plan) is revised to include the following changes as shown in Appendix Two, Revised Table 2-1, Identified Uses of Water:

   a. Adds beneficial use categories not previously listed and assigns the uses to appropriate water bodies.

   b. Adds water bodies not previously listed and assigns appropriate beneficial uses to them.

   c. Corrects Table 2-1 assigned uses for Struve Slough.

   d. Changes all Existing "E" and Intermittent "I" designations to "X" to indicate occurrence in the water body.

2. Beneficial use definitions are revised as shown below.

Municipal and Domestic Supply (MUN) - Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply. **According to State Board Resolution No. 88-63, "Sources of Drinking Water Policy" all surface waters are considered suitable, or potentially suitable, for municipal or domestic water supply except where:**

a. TDS exceeds 3000 mg/l (5000 uS/cm electrical conductivity)
b. Contamination exists, that cannot reasonably be treated for domestic use
c. The source is not sufficient to supply an average sustained yield of 200 gallons per day
d. The water is in collection or treatment systems of municipal or industrial wastewaters, process waters, mining wastewaters, or storm water runoff
e. The water is in systems for conveying or holding agricultural drainage waters.

Agricultural Supply (AGR) - Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.

Industrial Process Supply (PRO) - Uses of water for industrial activities that depend primarily on water quality **(i.e., waters used for manufacturing, food processing, etc.).**

Industrial Service Supply (IND) - Uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well repressurization.

Ground Water Recharge (GWR) - Uses of water for natural or artificial recharge of ground water for purposes of future extraction, maintenance of water quality, or halting of saltwater intrusion into freshwater aquifers.

Freshwater Replenishment (FRSH) - Uses of water for natural or artificial maintenance of surface water quantity or quality (e.g., salinity) **which includes a water body that supplies water to a different type of water body, such as, streams that supply reservoirs and lakes, or estuaries; or reservoirs and lakes that supply streams. This includes only immediate upstream water bodies and not their tributaries.**

Navigation (NAV) - Uses of water for shipping, travel, or other transportation by private, military, or commercial vessels. ~~(Regional Board designation of this beneficial use will be added to the proposed Triennial Review Priority List.)~~ **This Board interprets NAV as, "Any stream, lake, arm of the sea, or other natural body of water that is actually navigable and that, by itself, or by its connections with other waters, for a period long enough to**

be of commercial value, is of sufficient capacity to float watercraft for the purposes of commerce, trade, transportation, and including pleasure; or any waters that have been declared navigable by the Congress of the United States" and/or the California State Lands Commission.

Hydropower Generation (POW) - Uses of water for hydropower generation. ~~(Regional Board designation of this beneficial use will be added to the proposed Triennial Review Priority List.)~~

Water Contact Recreation (REC-1) - Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing, or use of natural hot springs.

Non-contact Water Recreation (REC-2) - Uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.

Commercial and Sport Fishing (COMM) - Uses of water for commercial or recreational collection of fish, shellfish, or other organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes. ~~(Regional Board designation of this beneficial use will be added to the proposed Triennial Review Priority List.)~~

Aquaculture (AQUA) - Uses of water for aquaculture or mariculture operations including, but not limited to, propagation, cultivation, maintenance, or harvesting of aquatic plants and animals for human consumption or bait purposes. ~~(Regional Board designation of this beneficial use will be added to the proposed Triennial Review Priority List.)~~

Warm Freshwater Habitat (WARM) - Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

Cold Freshwater Habitat (COLD) - Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

Inland Saline Water Habitat (SAL) - Uses of water that support inland saline water ecosystems including, but not limited to, preservation or enhancement of aquatic saline habitats, vegetation, fish, or wildlife, including invertebrates. Soda Lake is a saline habitat typical of desert lakes in inland sinks.

Estuarine Habitat (EST) - Uses of water that support estuarine ecosystems including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds). **An estuary is generally described as a semi-enclosed body of water having a free connection with the open sea, at least part of the year and within which the seawater is diluted at least seasonally with fresh water drained from the land. Included are water bodies which would naturally fit the definition if not controlled by tidegates or other such devices.**

Marine Habitat (MAR) - Uses of water that support marine ecosystems including, but not limited to, preservation or enhancement of marine habitats, vegetation such as kelp, fish, shellfish, or wildlife (e.g., marine mammals, shorebirds).

Wildlife Habitat (WILD) - Uses of water that support terrestrial ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.

Preservation of Biological Habitats of Special Significance (BIOL) - Uses of water that support designated areas or habitats, such as established refuges, parks, sanctuaries, ecological reserves, or Areas of Special Biological Significance (ASBS), where the preservation or enhancement of natural resources requires special protection.

Rare, Threatened, or Endangered Species (RARE) -Uses of water that support habitats necessary, at least in part, for

the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened, or endangered.

Migration of Aquatic Organisms (MIGR) - Uses of water that support habitats necessary for migration or other temporary activities by aquatic organisms, such as anadromous fish.

Spawning, Reproduction, and/or Early Development (SPWN) - Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.

Shellfish Harvesting (SHELL) - Uses of water that support habitats suitable for the collection of filter-feeding shellfish (e.g., clams, oysters, and mussels) for human consumption, commercial, or sport purposes. **This includes waters that have in the past, or may in the future, contain significant shellfisheries.**

3. Revise Table 2-1 "Notes" to read as follows:

"Notes: **X: Existing beneficial water uses, whether perennial or ephemeral, intermittent or continuous flow.**

~~E: Existing beneficial water uses~~
~~I: Beneficial water use in a watercourse with seasonally intermittent flow characteristics. Use is concurrent with flow.~~

Table 2-1. Identified Uses of Inland Surface Waters

BASIN PLAN AMENDMENT

Waterbody Names	MUN	AGR	PRO	IND	GWR	REC1	REC2	WILD	COLD	WARM	MIGR	SPWN	BIOL	RARE	EST	FRESH	NAV	POW	COMM	AQUA	SAL	SHELL
Big Basin Hydrologic Unit (304.00)																						
Lucerne Lake Estuary						X	X	X	X			X	X	X	X				X			X
Lucerne Lake	X	X				X	X	X	X							X			X			
Arroyo de los Frejoles Creek	X	X			X	X	X	X	X	X	X	X	X	X		X			X			
Arroyo de los Frejoles Reservoir	X	X			X	X	X	X	X	X						X	X		X			
Gazos Creek Lagoon/Estuary						X	X	X	X	X	X	X	X	X	X				X			X
Gazos Creek	X	X			X	X	X	X	X		X	X				X			X			
Old Womans Creek	X					X	X	X	X		X	X	X						X			
Whitehouse Creek	X					X	X	X	X		X	X	X		X	X			X			
Cascade Creek Lagoon/Estuary						X	X	X	X		X	X	X	X	X				X			X
Cascade Creek	X	X			X	X	X	X	X		X	X	X	X		X			X			
Green Oaks Creek Lagoon/Estuary						X	X	X	X			X		X	X				X			X
Green Oaks Creek	X	X			X	X	X	X	X	X	X	X	X		X	X			X			
Ano Nuevo Creek	X	X			X	X	X	X	X		X	X	X	X	X	X			X			
Finney Creek	X	X				X	X	X	X				X		X	X			X			
Elliot Creek	X	X				X	X	X	X				X		X	X			X			
Waddell Creek Estuary					X	X	X	X	X		X	X	X	X	X				X			X
Waddell Creek (Main Stem)	X	X		X	X	X	X	X	X		X	X	X	X		X			X			
Waddell Creek, east branch	X				X	X	X	X	X		X	X	X	X		X			X			
Last Chance Creek	X	X			X	X	X	X	X		X	X		X					X			
Blooms Creek	X				X	X	X	X	X			X	X	X					X			
Sempervirens Creek	X				X	X	X	X	X		X	X	X						X			
Union Creek	X					X	X	X	X				X						X			
Sempervirens Res.	X					X	X	X	X				X			X			X			X
Opal Creek	X				X	X	X	X	X				X						X			
Rogers Creek	X					X	X	X	X				X						X			
Maddocks Creek	X					X	X	X	X				X						X			
Waddell Creek, west branch	X				X	X	X	X	X		X	X	X	X					X			
Kelley Creek	X				X	X	X	X	X										X			
Berry Creek	X				X	X	X	X	X										X			
Henry Creek	X				X	X	X	X	X				X						X			
Scott Creek Lagoon						X	X	X	X		X	X		X	X				X			X
Scott Creek	X	X		X	X	X	X	X	X		X	X		X		X			X			
Little Creek	X	X		X	X	X	X	X	X		X	X		X					X			
Big Creek (Ano Nuevo)	X	X		X	X	X	X	X	X		X	X		X				X	X			

Table 2-1. Identified Uses of Inland Surface Waters

Waterbody Names	MUN	AGR	PRO	IND	GWR	REC1	REC2	WILD	COLD	WARM	MIGR	SPWN	BIOL	RARE	EST	FRESH	NAV	POW	COMM	AQUA	SAL	SHELL
Berry Creek	X				X	X	X	X	X				X						X			
Deadman Gulch Creek	X				X	X	X	X	X			X		X					X			
Boyer Creek	X				X	X	X	X	X			X						X	X			
Mill Creek (Scott Creek)	X	X		X	X	X	X	X	X		X	X		X		X			X			
Mill Creek Res.	X					X	X	X	X	X	X	X				X	X		X			
Molino Creek	X	X			X	X	X	X	X						X	X			X			
San Vicente Creek	X	X	X	X	X	X	X	X	X		X	X		X	X	X			X			
Mill Creek (Bonnie Doon)	X				X	X	X	X	X		X	X							X			
Liddell Creek	X	X			X	X	X	X	X		X	X		X	X	X			X			
Liddell Creek, east branch	X	X		X	X	X	X	X	X		X	X							X			
Liddell Creek, west branch	X				X	X	X	X	X		X	X							X			
Laguna Creek Estuary					X	X	X	X	X		X	X		X	X				X			X
Laguna Creek	X	X		X	X	X	X	X	X		X	X		X		X			X			
Reggiardo Creek	X				X	X	X	X	X					X					X			
Majors Creek	X	X		X	X	X	X	X	X		X	X		X	X	X			X			
Baldwin Creek Estuary						X	X	X	X	X	X	X	X	X	X				X			X
Baldwin Creek	X	X			X	X	X	X	X		X	X	X	X		X			X			
Wilder Creek Estuary						X	X	X	X	X	X	X	X	X	X				X			X
Wilder Creek	X	X			X	X	X	X	X	X	X	X	X			X			X			
Cave Gulch	X				X	X	X	X	X	X									X			
Younger's Lagoon					X	X	X	X	X	X		X	X						X			X
Antonellis Pond					X	X	X	X		X	X	X		X					X			
Moore Creek	X	X			X	X	X	X	X	X		X	X			X			X			
Neary's Lagoon					X	X	X	X		X		X		X					X			
San Lorenzo River Estuary						X	X	X	X		X	X	X	X	X				X			X
San Lorenzo River	X	X		X	X	X	X	X	X		X	X	X	X		X			X			
Branciforte Creek	X	X			X	X	X	X	X		X	X							X			
Blackburn Gulch	X				X	X	X	X	X		X	X							X			
Tie Gulch	X				X	X	X	X	X		X	X							X			
Granite Creek	X			X	X	X	X	X	X		X	X							X			
Carbonera Creek	X	X		X	X	X	X	X	X		X	X							X			
Zayante Creek	X	X		X	X	X	X	X	X		X	X							X			
Bean Creek	X	X		X	X	X	X	X	X		X	X							X			
Mackenzie Creek	X				X	X	X	X	X		X	X							X			
Ruins Creek	X				X	X	X	X	X		X	X							X			
Lockhart Gulch Creek	X				X	X	X	X	X		X	X							X			
Mountain Charlie Gulch	X				X	X	X	X	X		X	X							X			

Table 2-1. Identified Uses of Inland Surface Waters

Waterbody Names	MUN	AGR	PRO	IND	GWR	REC1	REC2	WILD	COLD	WARM	MIGR	SPWN	BIOL	RARE	EST	FRESH	NAV	POW	COMM	AQUA	SAL	SHELL
Lompico Creek	X	X			X	X	X	X	X		X	X							X			
Mill Creek (SLR)	X				X	X	X	X	X										X			
Newell Creek	X	X		X	X	X	X	X	X		X	X				X			X			
Loch Lomond Res.	X	X		X	X	X	X	X	X	X	X	X		X		X	X		X			X
Love Creek	X				X	X	X	X	X		X	X							X			
Fritch Creek	X				X	X	X	X	X		X	X							X			
Smith Creek	X				X	X	X	X	X										X			
Spring Creek Gulch	X				X	X	X	X	X										X			
Bear Creek	X	X			X	X	X	X	X		X	X							X			
Connelly Gulch	X				X	X	X	X	X		X	X							X			
Shear Creek	X				X	X	X	X	X		X	X							X			
Deer Creek	X				X	X	X	X	X		X	X							X			
Hopkins Gulch	X				X	X	X	X	X		X	X							X			
Two Bar Creek	X				X	X	X	X	X		X	X							X			
Kings Creek	X				X	X	X	X	X		X	X	X						X			
Logan Creek	X				X	X	X	X	X		X	X							X			
Sleeper Gulch	X				X	X	X	X	X				X						X			
McDonald Gulch	X				X	X	X	X	X		X	X	X						X			
Spring Creek	X				X	X	X	X	X		X	X							X			
Boulder Creek	X	X			X	X	X	X	X		X	X							X			
Bracken Brae Creek	X				X	X	X	X	X					X					X			
Hare Creek	X				X	X	X	X	X		X	X		X					X			
Jamison Creek	X				X	X	X	X	X		X	X							X			
Peavine Creek	X				X	X	X	X	X		X	X							X			
Silver Creek	X				X	X	X	X	X		X	X							X			
Foreman Creek	X				X	X	X	X	X		X	X							X			
Malosky Creek	X				X	X	X	X	X		X	X							X			
Clear Creek	X				X	X	X	X	X		X	X							X			
Alba Creek	X				X	X	X	X	X		X	X							X			
Marshall Creek	X				X	X	X	X	X		X	X							X			
Manson Creek	X				X	X	X	X	X		X	X							X			
Fall Creek	X	X		X	X	X	X	X	X		X	X	X						X			
South Fall Creek	X	X			X	X	X	X	X		X	X	X						X			
Bennett Creek	X	X		X	X	X	X	X	X		X	X	X						X			
Bull Creek	X				X	X	X	X	X			X							X			
Shingle Mill Creek	X				X	X	X	X	X		X	X							X			
Gold Gulch Creek	X				X	X	X	X	X		X	X							X			

Table 2-1. Identified Uses of Inland Surface Waters

Waterbody Names	MUN	AGR	PRO	IND	GWR	REC1	REC2	WILD	COLD	WARM	MIGR	SPWN	BIOL	RARE	EST	FRESH	NAV	POW	COMM	AQUA	SAL	SHELL
Woods Lagoon						X	X	X			X	X			X				X			X
Arana Gulch	X				X	X	X	X	X		X	X		X		X			X			
Schwan Lake						X	X	X		X		X	X	X					X			X
Corcoran Lagoon					X	X	X	X		X		X		X	X				X			X
Rodeo Creek Gulch (Doyle Gulch)	X	X		X	X	X	X	X	X			X				X			X			
Moran Lake					X	X	X	X		X		X							X			
Soquel Lagoon						X	X	X	X		X	X		X	X				X			X
Soquel Creek	X	X		X	X	X	X	X	X		X	X	X			X			X			
Bates Creek	X					X	X	X	X		X	X	X						X			
Grover Gulch	X				X	X	X	X	X		X	X							X			
Soquel Creek, east branch	X			X	X	X	X	X	X		X	X							X			
Hinckley Creek	X	X		X	X	X	X	X	X		X	X	X						X			
Amaya Creek	X				X	X	X	X	X		X	X							X			
Soquel Creek, west branch	X				X	X	X	X	X		X	X							X			
Hester Creek	X				X	X	X	X	X		X	X							X			
Laural Creek	X				X	X	X	X	X		X	X							X			
Burns Creek	X				X	X	X	X	X		X	X							X			
Moores Gulch	X				X	X	X	X	X		X	X							X			
Miners Creek	X				X	X	X	X	X		X	X							X			
Aptos Creek	X	X		X	X	X	X	X	X		X	X	X		X	X			X			
Valencia Creek	X				X	X	X	X	X		X	X							X			
Trout Gulch	X				X	X	X	X	X										X			
Bridge Creek	X	X				X	X	X	X		X	X	X						X			
Valencia Lagoon						X	X	X		X		X		X					X			
Pajaro River Hydrologic Unit (305.00)																						
Corralitos Lagoon						X	X	X	X										X			
Palm Beach Pond	X					X	X	X		X				X					X			
Pinto Lake	X	X			X	X	X	X		X		X							X			
Kelley Lake	X	X			X	X	X	X		X		X							X			
Drew Lake	X	X			X	X	X	X		X		X							X			
Tynan Lake	X	X			X	X	X	X		X		X							X			
Warner Lake	X	X			X		X	X											X			
Pajaro River Estuary						X	X	X	X	X	X	X	X	X	X				X			X
Pajaro River	X	X		X	X	X	X	X	X	X	X	X				X			X			

Table 2-1. Identified Uses of Inland Surface Waters

Waterbody Names	MUN	AGR	PRO	IND	GWR	REC1	REC2	WILD	COLD	WARM	MIGR	SPWN	BIOL	RARE	EST	FRESH	NAV	POW	COMM	AQUA	SAL	SHELL
San Benito River	X	X		X	X	X	X	X		X		X				X			X			
Bird Creek	X	X			X	X	X	X		X			X						X			
Pescadero Creek (S. Benito)	X	X			X	X	X	X	X	X	X	X							X			
Tres Pinos Creek	X	X		X	X	X	X	X		X		X							X			
Hernandez Reservoir	X	X			X	X	X	X		X		X				X	X		X			
Tequisquita Slough					X	X	X	X		X		X							X			
San Felipe Lake	X	X			X	X	X	X	X	X	X					X	X		X			
Pacheco Creek	X	X			X	X	X	X	X	X	X	X	X	X		X			X			
Pacheco Lake	X	X			X	X	X	X	X	X		X		X		X	X		X			
Llagas Creek (above Chesbro Res.)	X	X			X	X	X	X	X	X				X		X			X			
Chesbro Reservoir	X	X			X	X	X	X		X	X	X		X		X	X		X			
Llagas Creek (below Chesbro Res.)	X	X		X	X	X	X	X	X	X	X	X		X					X			
Alamias Creek	X	X			X	X	X	X	X	X	X	X							X			
Live Oak Creek	X	X			X	X	X	X	X	X	X								X			
Little Llagas Creek	X	X			X	X	X	X		X									X			
Camadero Creek	X				X	X	X	X	X	X	X			X					X			
Uvas Creek, downstream	X	X		X	X	X	X	X	X	X	X	X		X					X			
Uvas Res.	X	X			X	X	X	X		X		X		X		X	X		X			
Little Arthur Creek	X	X			X	X	X	X	X	X	X	X							X			
Bodfish Creek	X	X			X	X	X	X	X	X	X	X		X					X			
Black Hawk Canyon Creek	X					X	X	X		X	X	X		X					X			
Uvas Creek, upstream	X				X	X	X	X	X		X	X		X		X			X			
Little Uvas Creek	X	X			X	X	X	X		X									X			
Swanson Canyon Creek	X				X	X	X	X											X			
Alec Canyon Creek	X				X	X	X	X	X		X	X							X			
Croy Creek	X				X	X	X	X		X				X					X			
Eastman Canyon Creek	X	X			X	X	X	X		X									X			
Pescadero Creek	X	X			X	X	X	X	X		X	X	X						X			
Soda Lake							X	X		X				X					X			
Salsipuedes Creek	X	X			X	X	X	X	X		X	X							X			
Corralitos Creek	X	X		X	X	X	X	X	X	X	X	X							X			
Browns Creek	X	X		X	X	X	X	X	X	X	X	X							X			
Gamecock Creek	X				X	X	X	X	X		X	X							X			
Ramsey Gulch	X				X	X	X	X	X		X	X							X			
Redwood Creek	X					X	X	X	X		X	X							X			
Mormon Gulch	X				X	X	X	X	X										X			
Clipper Gulch	X				X	X	X	X	X										X			

Table 2-1. Identified Uses of Inland Surface Waters

Waterbody Names	MUN	AGR	PRO	IND	GWR	REC1	REC2	WILD	COLD	WARM	MIGR	SPWN	BIOL	RARE	EST	FRESH	NAV	POW	COMM	AQUA	SAL	SHELL
Cookhouse Gulch	X				X	X	X	X	X										X			
Shingle Mill Gulch	X				X	X	X	X	X		X	X							X			
Rattlesnake Gulch	X				X	X	X	X	X										X			
Diablo Gulch Creek	X				X	X	X	X	X										X			
Eureka Gulch	X				X	X	X	X	X										X			
Rider Gulch Creek	X				X	X	X	X	X		X	X							X			
Watsonville Slough						X	X	X		X		X	X	X	X				X			X
Struve Slough						X	X	X		X		X	X	X	X				X			X
Hanson Slough						X	X	X		X		X	X	X	X				X			X
Harkins Slough						X	X	X		X		X	X	X	X				X			X
Gallighan Slough						X	X	X		X		X		X	X				X			X
Bolsa-Nueva Hydrologic Unit (306.00)																						
McClusky Slough					X	X	X	X		X		X		X					X			X
Elkhorn Slough						X	X	X	X	X	X	X	X	X	X		X		X	X		X
Los Carneros Creek	X					X	X	X	X		X	X		X		X			X			
Bennett Slough/Estuary						X	X	X	X	X		X	X	X	X				X			X
Parsons Slough						X	X	X	X			X	X	X	X				X			X
Carmel River Hydrologic Unit (307.00)																						
Carmel River Estuary					X	X	X	X	X		X	X	X	X	X				X			X
Carmel River	X	X		X	X	X	X	X	X	X	X	X	X	X		X			X			
San Clemente Res.	X	X			X	X	X	X	X		X	X				X	X		X			
San Clemente Creek	X	X			X	X	X	X	X	X	X	X				X			X			
Pine Creek	X				X	X	X	X	X	X	X	X	X						X			
Los Padres Reservoir	X				X	X	X	X	X	X	X	X				X	X		X			
Cachagua Creek	X	X	X	X	X	X	X	X	X	X	X	X				X			X			
Finch Creek	X				X	X	X	X	X	X	X	X	X	X					X			
Tularcitos Creek	X	X			X	X	X	X	X	X	X	X							X			
Rana Creek	X				X	X	X	X	X	X	X	X							X			
Chupines Creek	X				X	X	X	X	X	X	X	X							X			
Black Rock Creek	X					X	X	X	X		X	X		X		X			X			
White Rock Lake	X					X	X	X	X	X	X	X					X		X			

Table 2-1. Identified Uses of Inland Surface Waters

Waterbody Names	MUN	AGR	PRO	IND	GWR	REC1	REC2	WILD	COLD	WARM	MIGR	SPWN	BIOL	RARE	EST	FRESH	NAV	POW	COMM	AQUA	SAL	SHELL
Santa Lucia Hydrologic Unit (306.00)																						
San Jose Creek Estuary						X	X	X	X		X	X	X	X	X				X			X
San Jose Creek	X	X			X	X	X	X	X	X	X	X	X			X			X			
Garrapata Creek	X					X	X	X	X		X	X		X	X	X			X	X		
Palo Colorado Canyon	X	X			X	X	X	X	X	X		X			X	X			X			
Rocky Creek	X					X	X	X	X	X	X	X			X	X			X			
Bixby Creek	X					X	X	X	X		X	X		X	X	X			X			
Mill Creek	X					X	X	X	X		X	X							X			
Little Sur River Estuary						X	X	X	X		X	X	X	X	X				X			X
Little Sur River	X	X			X	X	X	X	X		X	X	X	X		X			X			
Big Sur River Estuary						X	X	X	X	X	X	X	X	X	X				X			X
Big Sur River	X	X			X	X	X	X	X	X	X	X	X	X		X			X			
Big Creek	X					X	X	X	X	X	X	X	X	X	X	X			X			
Devils Canyon Creek, south fork	X					X	X	X	X		X	X	X						X			
Devils Canyon Creek, middle fork	X					X	X	X	X		X	X	X						X			
Devils Canyon Creek, north fork	X					X	X	X	X		X	X	X						X			
Big Creek, north fork	X					X	X	X	X				X						X			
Limeklin Creek	X	X			X	X	X	X	X		X	X	X	X	X	X			X			
Mill Creek (Cape San Martin)	X					X	X	X	X	X	X	X			X	X			X			
Willow Creek	X				X	X	X	X	X		X	X		X	X	X			X			
Salmon Creek	X					X	X	X	X		X	X		X	X	X			X			
Salinas Hydrologic Unit (309.00)																						
Moro Cojo Slough					X	X	X	X	X	X		X	X	X	X				X			X
Old Salinas River Estuary						X	X	X	X	X	X	X	X	X	X				X			X
Tembladero Slough						X	X	X		X		X		X	X				X			X
Espinosa Lake						X	X	X		X									X			
Espinosa Slough						X	X	X		X									X			
Salinas Reclamation Canal						X	X	X		X									X			
Gabilan Creek	X	X			X	X	X	X		X		X							X			
Alisal Creek	X	X			X	X	X	X	X	X		X							X			
Blanco Drain						X	X	X		X									X			
Salinas River Refuge Lagoon (South)						X	X	X	X	X	X		X	X					X			X

Table 2-1. Identified Uses of Inland Surface Waters

Waterbody Names	MUN	AGR	PRO	IND	GWR	REC1	REC2	WILD	COLD	WARM	MIGR	SPWN	BIOL	RARE	EST	FRESH	NAV	POW	COMM	AQUA	SAL	SHELL
Marina Pond #1					X	X	X	X	X			X	X	X					X			
Marina Pond #2					X	X	X	X	X				X	X					X			
Marina Pond #3					X	X	X	X	X				X	X					X			
Marina Pond #4/5					X	X	X	X	X				X	X					X			
Marina Pond #6					X	X	X	X	X				X	X					X			
Marina Pond #7					X	X	X	X	X			X	X	X					X			
Laguna Grande/Roberts Lake	X					X	X	X	X	X									X			
Del Monte Lake	X					X	X	X		X									X			
El Estero Lake	X				X	X	X	X	X	X		X							X			
Salinas River Lagoon (North)						X	X	X	X	X	X	X	X	X	X				X			X
Salinas River, dnstr of Spreckels Gage	X	X					X	X	X	X	X					X			X			
Salinas River, Spreckels Gage-Chualar	X	X	X	X	X	X	X	X	X	X	X								X			
Salinas Riv, Chualar-Nacimiento Riv	X	X	X	X	X	X	X	X	X	X	X	X		X					X			
Arroyo Seco River	X	X		X	X	X	X	X	X	X	X	X		X					X			
Abbott Lakes (The Lakes)	X				X	X	X	X	X	X		X					X		X			
Piney Creek	X					X	X	X	X		X	X							X			
Paloma Creek	X	X			X	X	X	X	X	X									X			
Tassajara Creek	X	X			X	X	X	X	X	X	X	X	X	X					X			
Santa Lucía Creek	X	X			X	X	X	X	X	X	X	X	X						X			
Vaqueros Creek	X	X				X	X	X	X		X	X							X			
Reliz Creek	X	X			X	X	X	X	X		X	X							X			
Hames Creek	X	X			X	X	X	X		X									X			
San Antonio Riv., dwnstr frm Res.	X	X		X	X	X	X	X		X	X	X		X					X			
San Antonio Reservoir	X	X			X	X	X	X	X	X		X		X		X	X	X	X			
San Antonio Riv, upstm Frm Res.	X	X		X	X	X	X	X	X	X	X	X		X		X			X			
Pancho Rico Creek	X	X			X	X	X	X		X		X							X			
San Lorenzo Creek	X	X			X	X	X	X		X		X							X			
Chalone Creek	X	X			X	X	X	X		X		X							X			
Salinas R.,Nacimiento R.-S. Margarita Res.	X	X	X		X	X	X	X	X	X	X	X		X					X			
Nacimiento River, upstream of Res.	X	X			X	X	X	X	X	X		X		X		X			X			
Salmon Creek	X					X	X	X	X		X	X		X					X			
Nacimiento Reservoir	X	X			X	X	X	X	X	X		X		X		X	X		X			
Nacimiento River, dwnstr Res.	X	X		X	X	X	X	X	X	X	X	X		X					X			
Las Tablas Creek	X	X			X	X	X	X	X	X		X		X					X			
Las Tablas Creek, north fork	X	X			X	X	X	X	X			X		X					X			
Las Tablas Creek, south fork	X	X			X	X	X	X	X			X		X					X			
Franklin Creek	X	X			X	X	X	X											X			

Table 2-1. Identified Uses of Inland Surface Waters

Waterbody Names	MUN	AGR	PRO	IND	GWR	REC1	REC2	WILD	COLD	WARM	MIGR	SPWN	BIOL	RARE	EST	FRESH	NAV	POW	COMM	AQUA	SAL	SHELL
San Marcos Creek	X	X			X	X	X	X		X									X			
Paso Robles Creek	X	X			X	X	X	X	X		X	X		X					X			
Jack Creek	X	X			X	X	X	X	X		X	X		X					X			
Santa Rita Creek	X	X		X	X	X	X	X	X	X	X	X		X					X			
Atascadero Creek	X	X			X	X	X	X	X			X		X					X			
Santa Margarita Reservoir (Lake)	X	X		X	X	X	X	X	X	X		X		X		X	X	X	X			
Salinas R., Reservoir-Headwaters	X	X			X	X	X	X	X		X	X				X			X			
Huerhuero Creek	X	X			X	X	X	X		X				X					X			
Vineyard Canyon Creek	X	X			X	X	X	X		X									X			
Big Sandy Creek	X	X			X	X	X	X		X			X	X					X			
Atascadero Lake	X				X	X	X	X	X	X		X					X		X			
Estero Bay Hydrologic Unit (310.00)																						
San Carpoforo Creek Estuary						X	X	X	X		X	X	X	X	X				X			X
San Carpoforo Creek	X	X		X	X	X	X	X	X	X	X	X		X		X			X			
Estrada Creek	X	X			X	X	X	X	X	X									X			
Chris Flood Creek	X	X			X	X	X	X	X	X									X			
Wagner Creek	X	X			X	X	X	X	X	X									X			
Dutra Creek	X	X			X	X	X	X	X	X									X			
Arroyo de los Chinos	X	X			X	X	X	X	X	X				X	X	X			X			
Arroyo de la Cruz Estuary						X	X	X	X		X	X	X	X	X				X			X
Arroyo de la Cruz Creek	X	X		X	X	X	X	X	X	X	X	X		X		X			X			
Burnett Creek	X	X			X	X	X	X	X	X	X	X		X					X			
Arroyo del Oso	X	X			X	X	X	X	X					X	X	X			X			
Arroyo del Corral	X	X			X	X	X	X	X	X	X	X		X	X	X			X			
Oak Knoll Creek	X	X			X	X	X	X	X	X				X	X	X			X			
Arroyo Laguna						X	X	X	X			X		X	X				X			X
Little Pico Creek Estuary						X	X	X	X		X	X	X	X	X				X			X
Little Pico Creek	X	X			X	X	X	X	X		X	X		X		X			X			
Pico Creek Estuary					X	X	X	X	X	X	X	X	X	X	X				X			X
Pico Creek	X	X			X	X	X	X	X	X	X	X	X	X		X			X			
Pico Creek, south fork	X	X			X	X	X	X	X		X	X		X					X			
Pico Creek, north fork	X	X			X	X	X	X	X		X	X		X					X			
San Simeon Creek Estuary					X	X	X	X	X		X	X	X	X	X				X			X
San Simeon Creek	X	X		X	X	X	X	X	X	X	X	X	X	X		X			X			

Table 2-1. Identified Uses of Inland Surface Waters

Waterbody Names	MUN	AGR	PRO	IND	GWR	REC1	REC2	WILD	COLD	WARM	MIGR	SPWN	BIOL	RARE	EST	FRESH	NAV	POW	COMM	AQUA	SAL	SHELL
Steiner Creek	X	X			X	X	X	X	X	X	X	X		X					X			
Santa Rosa Creek Estuary					X	X	X	X	X	X	X	X	X	X	X				X			X
Santa Rosa Creek	X	X		X	X	X	X	X	X X	X	X	X		X		X			X			
Perry Creek	X	X			X	X	X	X	X					X					X			
Green Valley Creek	X	X			X	X	X	X	X	X				X					X			
Villa Creek	X	X			X	X	X	X	X		X	X		X	X	X			X			
Cayucos Creek	X	X			X	X	X	X	X	X	X	X	X	X	X	X			X			
Old Creek, downstream	X	X			X	X	X	X		X				X	X	X			X			
Whale Rock Reservoir	X	X	X	X	X	X	X	X	X	X		X		X		X	X		X			
Old Creek, upstream	X	X	X	X	X	X	X	X	X	X		X		X		X			X			
Toro Creek	X	X			X	X	X	X	X	X	X	X		X	X	X			X			
Morro Creek	X	X			X	X	X	X	X	X	X	X		X	X	X			X			
Little Morro Creek	X	X			X	X	X	X	X		X	X		X					X			
Morro Bay Estuary				X		X	X	X	X		X	X	X	X	X				X	X		X
Chorro Creek	X	X			X	X	X	X	X	X	X	X	X	X		X			X			
Dairy Creek	X	X			X	X	X	X	X		X	X		X					X			
San Luisito Creek	X	X			X	X	X	X	X		X	X		X					X			
San Bernardo Creek	X	X			X	X	X	X	X		X	X		X					X			
Los Osos Creek	X	X			X	X	X	X	X	X	X	X		X		X			X			
Warden Lake Wetland		X			X	X	X	X		X		X		X					X			
Islay Creek	X	X			X	X	X	X	X		X	X	X	X	X	X			X			
Coon Creek	X	X			X	X	X	X	X		X	X	X	X	X	X			X			
Diablo Canyon Creek	X	X		X	X	X	X	X	X			X		X	X	X			X			
San Luis Obispo Creek Estuary (a)					X	X	X	X	X	X	X	X	X	X	X				X	X		X
S.L.O.Crk. above W. Marsh St.	X	X			X	X	X	X	X	X	X	X		X					X			
S.L.O.Crk. below W. Marsh St.	X	X			X	X	X	X	X	X	X	X				X			X			
Froom Creek	X					X	X	X						X					X			
Davenport Creek	X	X			X	X	X	X	X					X					X			
San Luis Obispo Creek, east fork	X	X			X	X	X	X	X		X	X		X					X			
Stenner Creek	X	X			X	X	X	X	X		X	X		X					X			
Brizziolari Creek	X	X			X	X	X	X	X		X	X		X					X			
Prefumo Creek	X	X			X	X	X	X	X		X	X		X		X			X			
Laguna Lake	X	X			X	X	X	X		X	X	X		X			X		X			
Pismo Creek Estuary					X	X	X	X	X		X	X	X	X	X				X			X
Pismo Creek	X	X		X	X	X	X	X	X	X	X	X	X	X		X			X			
Arroyo Grande Creek Estuary					X	X	X	X	X		X	X	X	X	X				X			X
Arroyo Grande Creek, downstream	X	X		X	X	X	X	X	X	X	X			X		X			X			

Table 2-1. Identified Uses of Inland Surface Waters

Waterbody Names	MUN	AGR	PRO	IND	GWR	REC1	REC2	WILD	COLD	WARM	MIGR	SPWN	BIOL	RARE	EST	FRESH	NAV	POW	COMM	AQUA	SAL	SHELL
Oceano Lagoon						X	X	X		X		X	X	X					X			
Meadow Creek	X	X			X	X	X	X	X				X	X					X			
Pismo Marsh (Lake)					X	X	X	X		X			X	X					X			
Los Berros Creek	X	X			X	X	X	X	X		X			X					X			
Lopez Reservoir	X	X	X	X	X	X	X	X	X	X		X		X		X	X		X			
Arroyo Grande Creek, upstream	X	X	X	X	X	X	X	X	X	X	X	X		X					X			
Big Pocket Lake (Dunes Lakes)					X		X	X						X					X			
Willow Lake " "					X	X	X	X		X		X		X					X			
Pipeline Lake " "					X	X	X	X		X		X		X					X			
Celery Lake " "					X	X	X	X		X		X		X					X			
Hospital Lake " "					X	X	X	X		X		X		X					X			
Big Twin Lake " "					X	X	X	X		X		X		X					X			
Small Twin Lake " "						X	X	X		X		X		X					X			
Bolsa Chico Lake " "					X	X	X	X		X		X		X					X			
White Lake " "					X	X	X	X		X		X		X					X			
Mud Lake " "					X	X	X	X		X		X		X					X			
Black Lake " "					X	X	X	X		X		X		X					X			
Dune Lakes Marsh Area " "					X	X	X	X		X		X		X					X			
Carrizo Plain Hydrologic Unit (311.00)																						
San Diego Creek	X	X			X	X	X	X		X			X	X		X			X			
Soda Lake				X			X	X		X			X	X					X			
Santa Maria Hydrologic Unit (312.00)																						
Oso Flaco Lake					X	X	X	X		X		X	X	X			X		X			
Oso Flaco Creek	X	X			X	X	X	X		X			X	X		X			X			
Santa Maria River Estuary					X	X	X	X		X	X	X	X	X	X				X			X
Santa Maria River	X	X		X	X	X	X	X	X	X	X			X		X			X			
Corralitos Canyon Creek	X	X				X	X	X											X			
Sisquoc River, downstream	X	X		X	X	X	X	X	X	X	X	X							X			
Sisquoc River, upstream	X				X	X	X	X	X		X	X	X	X					X			
Cuyama River, downstream	X	X			X	X	X	X		X				X					X			
Twitchell Reservoir	X	X			X		X	X		X				X		X			X			

Table 2-1. Identified Uses of Inland Surface Waters

Waterbody Names	MUN	AGR	PRO	IND	GWR	REC1	REC2	WILD	COLD	WARM	MIGR	SPWN	BIOL	RARE	EST	FRESH	NAV	POW	COMM	AQUA	SAL	SHELL
Cuyama River, upstream	X	X	X	X	X	X	X	X	X	X		X		X		X			X			
Alamo Creek	X	X			X	X	X	X	X	X		X		X					X			
Huasna River	X	X			X	X	X	X		X				X					X			
Orcutt Creek	X	X			X	X	X	X	X					X	X	X			X			
San Antonio Hydrologic Unit (313.00)																						
Shuman Canyon Creek	X	X				X	X	X		X		X			X	X			X			
Casmalia Canyon Creek	X	X				X	X	X		X		X							X			
San Antonio Creek Estuary					X	X	X	X	X	X	X	X	X	X	X				X			X
San Antonio Creek	X	X			X	X	X	X	X	X	X	X		X		X			X			
Barka Slough					X	X	X	X		X		X		X	X				X			X
Santa Ynez Hydrologic Unit (314.00)																						
Santa Ynez River Estuary						X	X	X		X	X	X	X	X	X				X			X
Santa Ynez River, downstream	X	X	X	X	X	X	X	X	X	X	X	X		X		X			X			
Graves Wetland						X	X	X		X		X							X			
Lompoc Canyon	X	X		X	X	X	X	X		X									X			
La Salle Canyon Creek	X	X			X	X	X	X		X									X			
Sloans Canyon Creek	X				X	X	X	X		X									X			
San Miguelito Creek	X	X			X	X	X	X	X	X		X							X			
Salsipuedes Creek	X	X		X	X	X	X	X	X	X	X	X							X			
El Jaro Creek	X	X		X	X	X	X	X	X	X	X	X							X			
El Callejon Creek	X				X	X	X	X		X									X			
Llanito Creek	X				X	X	X	X		X									X			
Yridisis Creek	X	X			X	X	X	X		X		X							X			
Canada de la Vina	X	X			X	X	X	X		X									X			
Nojoqui Creek	X	X			X	X	X	X	X	X		X							X			
Alamo Pintado Creek	X	X		X	X	X	X	X		X									X			
Zaca Creek	X	X			X	X	X	X	X	X				X					X			
Zaca Lake	X					X	X	X	X	X		X		X					X			
Santa Rosa Creek	X	X			X	X	X	X	X	X	X	X							X			
Santa Rita Creek	X	X		X	X	X	X	X		X									X			
Davis Creek	X				X	X	X	X		X									X			

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Table 2-1. Identified Uses of Inland Surface Waters

Waterbody Names	MUN	AGR	PRO	IND	GWR	REC1	REC2	WILD	COLD	WARM	MIGR	SPWN	BIOL	RARE	EST	FRESH	NAV	POW	COMM	AQUA	SAL	SHELL
Santa Lucia Canyon Creek	X	X			X	X	X	X		X									X			
Oak Canyon Creek	X	X		X	X	X	X	X		X			X						X			
Hilton Creek	X	X			X	X	X	X	X		X	X							X			
Cachuma Reservoir	X	X	X		X	X	X	X	X	X		X		X		X	X		X			
Santa Ynez River, upstream	X	X	X	X	X	X	X	X	X	X	X	X		X		X			X			
Gibralter Reservoir	X	X	X	X	X	X	X	X	X	X		X		X		X	X		X			
Jameson Reservoir	X	X	X		X	X	X	X	X	X		X		X		X	X		X			
Agua Caliente Canyon	X	X		X	X	X	X	X	X	X		X		X					X			
Mono Creek	X	X		X	X	X	X	X	X	X	X	X		X					X			
Indian Creek	X	X		X	X	X	X	X	X	X	X	X	X	X					X			
Santa Cruz Creek	X	X		X	X	X	X	X	X	X	X	X		X					X			
Cachuma Creek	X				X	X	X	X	X	X	X	X		X					X			
South Coast Hydrologic Unit (315.00)																						
Canada Honda Creek Estuary						X	X	X	X	X	X	X	X	X	X				X			X
Canada Honda Creek	X	X			X	X	X	X	X	X	X	X		X		X			X			
Canada Agua Viva	X				X	X	X	X		X					X	X			X			
Water Canyon Creek	X				X	X	X	X		X			X		X	X			X			
Canada del Jolloru	X					X	X	X		X					X	X			X			
Jalama Creek Esluary						X	X	X		X	X	X	X	X	X				X			X
Jalama Creek	X	X			X	X	X	X		X		X				X			X			
Escondido Creek	X				X	X	X	X	X	X	X	X		X					X			
Gasper Creek	X				X	X	X	X		X									X			
Espada Creek	X				X	X	X	X		X									X			
Wood Canyon Creek	X				X	X	X	X		X					X	X			X			
Canada del Cojo	X				X	X	X	X		X					X	X			X			
Barranca Honda	X	X			X	X	X	X		X				X	X	X			X			
Arroyo Bulito	X	X			X	X	X	X		X					X	X			X			
Canada de Santa Anita	X	X			X	X	X	X		X					X	X			X			
Canada del Sacate	X	X			X	X	X	X		X					X	X			X			
Canada Alegria	X				X	X	X	X		X					X	X			X			
Canada del Agua Caliente	X	X			X	X	X	X	X	X					X	X			X			
Canada de la Gaviota	X	X			X	X	X	X	X	X	X	X	X	X	X	X			X			
Canada San Onofre	X					X	X	X	X	X	X	X		X	X	X			X			
Canada del Molino	X					X	X	X		X				X	X	X			X			

Table 2-1. Identified Uses of Inland Surface Waters

Waterbody Names	MUN	AGR	PRO	IND	GWR	REC1	REC2	WILD	COLD	WARM	MIGR	SPWN	BIOL	RARE	EST	FRESH	NAV	POW	COMM	AQUA	SAL	SHELL
Arroyo Hondo	X					X	X	X	X	X	X	X		X	X	X			X			
Arroyo Quenado	X	X				X	X	X	X		X	X		X	X	X			X			
Tajigas Creek	X	X			X	X	X	X	X	X	X	X		X	X	X			X			
Canada del Refugio	X	X			X	X	X	X	X	X	X	X	X	X	X	X			X			
Canada del Capitan	X	X			X	X	X	X	X	X	X	X	X	X	X	X			X			
Dos Pueblos Canyon Creek	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X			X			
Tecolote Creek	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X			X			
Devereaux Ranch Lagoon						X	X	X		X	X	X	X	X	X				X			X
Devereaux Creek	X				X	X	X	X		X						X			X			
Goleta Point Marsh						X	X	X		X		X	X	X					X			
Goleta Slough/Estuary						X	X	X		X	X	X	X	X	X				X			X
Carneros Creek	X	X			X	X	X	X	X	X						X			X			
Tecolotito Creek	X				X	X	X	X	X	X	X					X			X			
Glen Anne Creek	X	X	X	X	X	X	X	X	X	X	X	X		X		X			X			
Los Carneros Wetland					X	X	X	X		X		X		X					X			
Los Carneros	X	X			X	X	X	X		X		X		X		X			X			
Atascadero Creek (SB)	X	X			X	X	X	X	X	X	X	X		X		X			X			
Maria Ygnacio Creek	X	X			X	X	X	X	X		X	X							X			
San Antonio Creek (S Barbara County)	X	X			X	X	X	X	X	X	X	X		X					X			
San Jose Creek (S Barbara County)	X	X			X	X	X	X	X	X	X	X		X		X			X			
Las Vegas Creek	X				X	X	X	X	X	X									X			
San Pedro Creek	X	X			X	X	X	X	X	X	X					X			X			
Las Palmas Creek	X				X	X	X	X		X									X			
Arroyo Burro Estuary						X	X	X		X		X			X				X			
Arroyo Burro Creek	X				X	X	X	X		X		X	X	X		X			X			
Mission Creek	X				X	X	X	X	X	X	X	X		X	X	X			X			
Rattlesnake Canyon	X				X	X	X	X	X	X	X	X							X			
Waste Slough					X	X	X	X		X		X							X			
Sycamore Creek	X	X			X	X	X	X	X	X	X	X		X	X	X			X			
Andree Clark Bird Refuge						X	X	X		X			X	X					X			X
San Ysidro Creek	X				X	X	X	X		X					X	X			X			
Romero Creek	X				X	X	X	X		X					X	X			X			
Toro Canyon Creek	X				X	X	X	X		X					X	X			X			
Arroyo Paredon	X	X			X	X	X	X		X	X	X		X	X	X			X			
Carpinteria Marsh (El Estero Marsh)						X	X	X		X	X	X	X	X	X				X			
Santa Monica Creek	X	X			X	X	X	X	X	X		X	X			X			X			
Franklin Creek	X	X			X	X	X	X	X	X	X	X		X		X			X			

Exhibit P

CANNABIS ENVIRONMENTAL
BEST MANAGEMENT PRACTICES GUIDE



DENVER
PUBLIC HEALTH &
ENVIRONMENT

OCTOBER 2018

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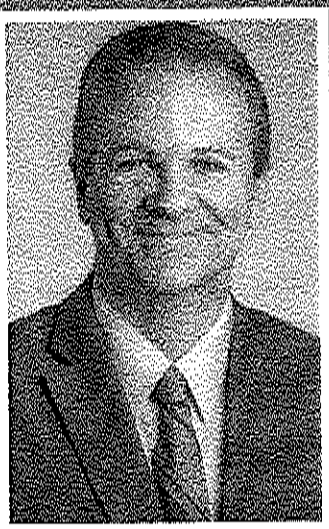
FROM THE EXECUTIVE DIRECTOR



Denver's Department of Public Health & Environment (DDPHE) is pleased to release the cannabis cultivation environmental sustainability guide. Developed by Denver's Sustainability Working Group, a collaborative effort that involves both DDPHE sustainability advisors and cannabis industry professionals, the guide aims to help cultivators reduce waste and conserve resources, turning this ever-expanding industry into a network of environmental leaders.

Specifically, the guide offers recommendations related to increasing energy efficiency while reducing waste and water use that have been tailored to the needs of cannabis cultivation operations. Each recommendation supports DDPHE's overall goal of helping Denver residents live better, longer. The health of our environment is inextricably linked to our physical health, and DDPHE works extensively with businesses across all industries, helping them to operate as sustainably as possible.

It is encouraging to see the interest and passion from cannabis cultivators throughout the industry, who have come together to craft this guide. Denver is now home to more than 591 active cultivation licenses operating out of 295 locations that has the capacity to consume a significant amount of natural resources. However, the opportunity also exists for each of these facilities to lead Denver toward lower resource consumption, bringing the community in line with Denver's 80x50 Climate Goal of reducing greenhouse gas emissions 80 percent below 2005 levels by 2050. This plan sets Denver at the forefront of efforts to address climate change by creating strategies to target the largest sources of emissions, commercial energy use chief among them.

By partnering with the cannabis cultivation industry, DDPHE sees endless opportunities to continue our commitment to partnerships and community collaboration, and to aggressively work to combat the threats and broad-reaching impacts of climate change.

As Mayor Michael B. Hancock stated in the City and County of Denver's 2015 Climate Action Plan, "climate action is the biggest opportunity of the 21st century to protect public health, grow our economy and secure a bright future for generations to come, and we have the technology to move to cleaner, more sustainable forms of energy. We must commit to being bold and inclusive about how we will meet this goal together."

Sincerely,

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INTRODUCTION

CANNABIS SUSTAINABILITY SECTOR OVERVIEW

Under the leadership of Mayor Michael B. Hancock, Denver has committed to reducing greenhouse gas emissions (GHG) 80 percent below 2005 levels by 2050 (80x50 Climate Goal). Commercial buildings represent 35 percent of citywide emissions, and – as cannabis businesses occupy an increasing amount of commercial building space – the cannabis industry plays an important role in helping the community meet its emission reduction targets.

National and international attention is increasingly being focused on the sustainability impacts of the cannabis industry in states where cannabis has been legalized. Some cannabis businesses have initiated sustainability programs to reduce environmental impacts and have partnered with local communities for environmental and social good. However, because sector-wide baseline sustainability metrics are not currently available, overall industry sustainability performance remains unverified – leaving public perception open to individual interpretation.

In 2016, Denver Department of Public Health & Environment collaborated with local cannabis industry representatives, sustainability practitioners and regional stakeholders to create the Cannabis Sustainability Work Group. The group's mission is to promote sustainability in the cannabis industry through education, the development and dissemination of best practices, and the facilitation of dialogue between the cannabis industry, the community and technical experts.

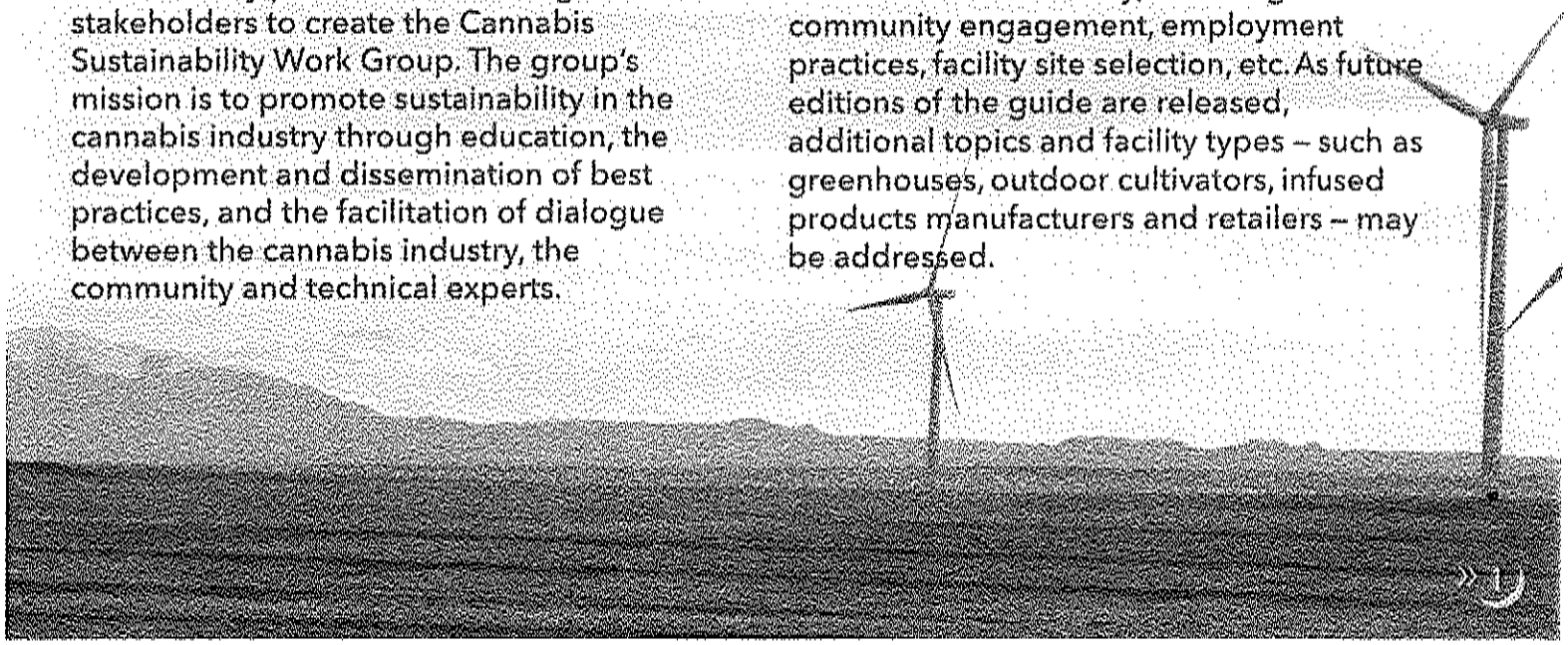
BEST PRACTICES GUIDE PURPOSE

The Guide provides recommendations for cannabis-specific sustainable practices based on an analysis of existing data from individual case studies and regional and national performance standards as well as individual technical expertise. The purpose of the Guide is to provide cannabis cultivation businesses with a snapshot of relevant sustainable practices and a starting point for process optimization techniques that facilitate continual improvement. In addition, the recommendations were designed and written with Denver's energy and climate sustainability goals in mind, including the 80x50 Climate Goal.

Alignment with regional stakeholders is critical to partnering for success in pursuit of social, economic and environmental sustainability. Longevity is key, and collaborating for healthy communities and holistic growth will ensure strong performance in the short and long term.

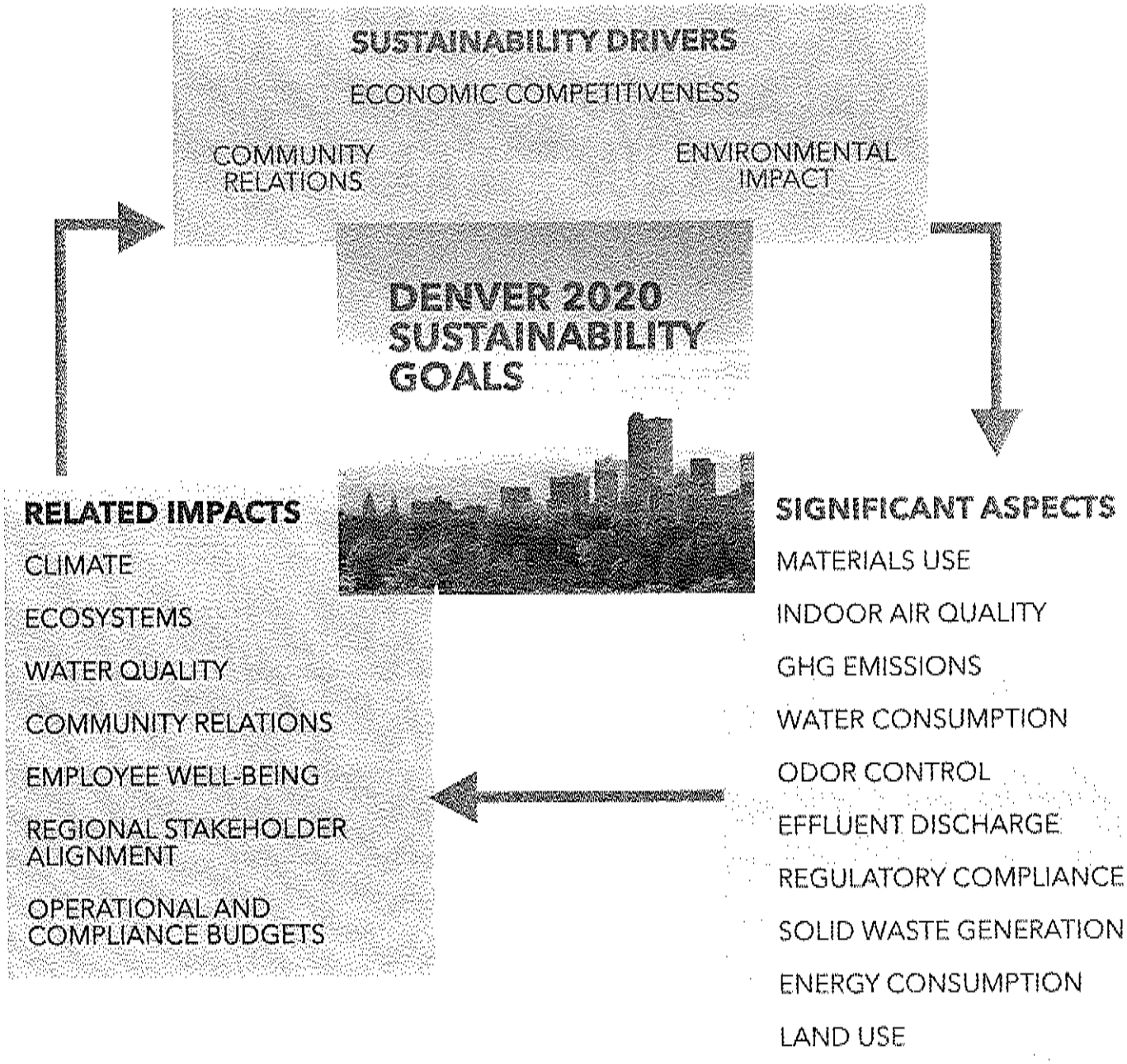
LIMITATIONS

The current version of the Guide addresses environmental best practices for energy, water and waste management in indoor cannabis cultivation facilities. There are also many other sustainability topics that pertain to the cannabis industry, including community engagement, employment practices, facility site selection, etc. As future editions of the guide are released, additional topics and facility types – such as greenhouses, outdoor cultivators, infused products manufacturers and retailers – may be addressed.



CANNABIS CULTIVATION SIGNIFICANT ASPECTS AND RELATED IMPACTS IN DENVER

The Denver 2020 Sustainability Goals, as well as the 80x50 Goals mentioned on the previous page, help guide sustainability work in the City and County of Denver. The cannabis industry's significant environmental aspects and related impacts are listed below and highlighted throughout this document.

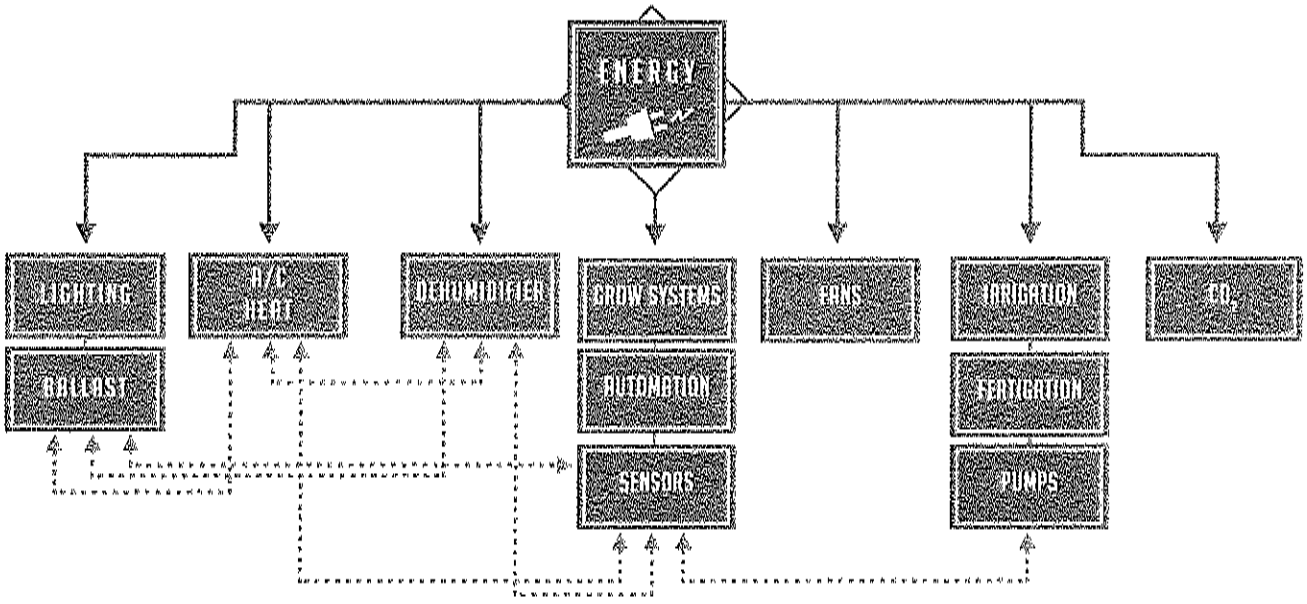


ENERGY EFFICIENCY & MANAGEMENT

OVERVIEW

Indoor cannabis cultivation is a resource-intensive process with energy demands as the greatest contributor to the industry's environmental footprint. While growing cannabis in a controlled indoor space leads to faster production and greater product variety, high energy costs and increasing price competition are pushing cultivators to get familiar with the energy impacts. Decisions relating to cultivation facility design should be driven by location-specific metrics and cultivation processes. High energy use and the associated air quality and emissions contributes to negative public perception therefore active energy efficiency efforts can help cannabis businesses create positive improvements within communities.

Figure 1: Primary Electricity Use for Indoor Cannabis Cultivation



According to a 2014 study performed by the Northwest Power and Conservation Council, electricity is generally used to perform key functions in the average cultivation facility as shown below:[1]

Table 1: End Use Electricity Consumption

FUNCTION	PERCENTAGE OF TOTAL FACILITY ELECTRICITY CONSUMPTION
HVAC and Dehumidification	51%
Lighting	38%
Space Heating (assuming electric heat)	5%
Water Handling	3%
CO_2 Injection	2%
Drying/Curing	1%

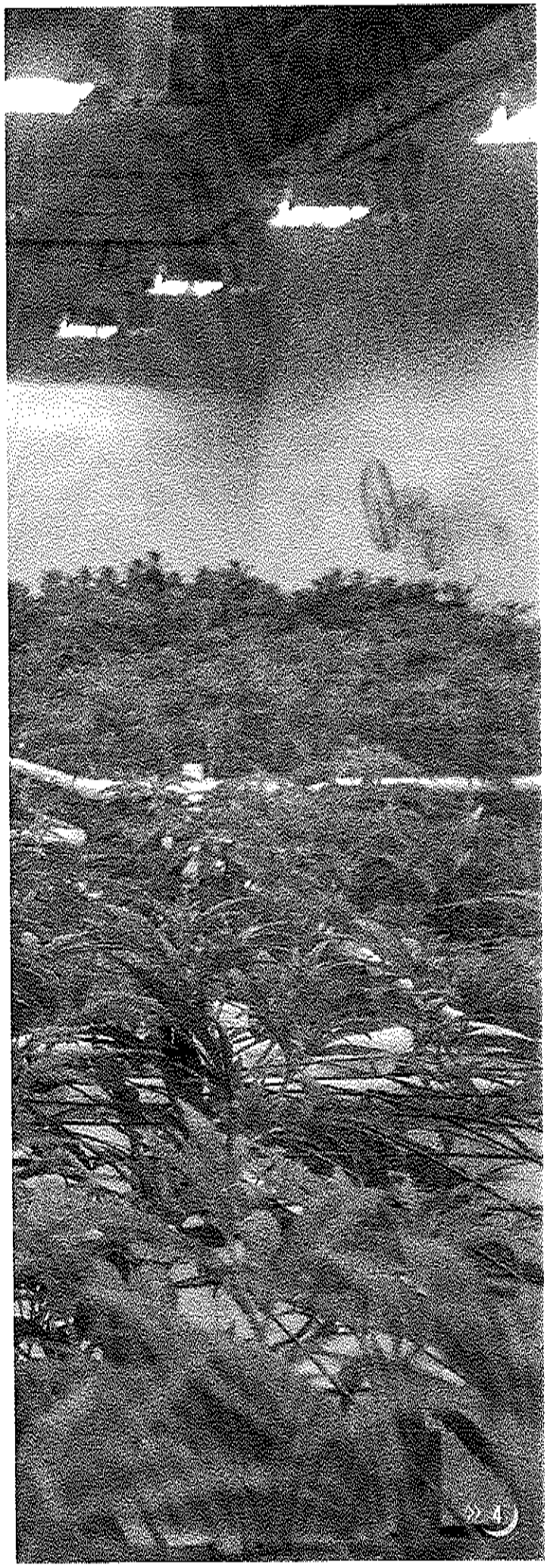
[1] Northwest Power and Conservation Council Memorandum - Electrical Load Impacts of Indoor Commercial Cannabis Production

There are three primary reasons why cultivators should look to reduce energy profiles:

- **Economic Competitiveness:** Energy use represents a significant portion of a cultivation facility's total operating budget. As the industry continues to mature in Colorado, the market is becoming increasingly price competitive. Organizations that reduce energy consumption, and thereby energy costs, will be better situated to succeed in this increasingly competitive market.
- **Community Relations:** As the cannabis industry continues to grow, the electric demands of cultivation facilities could potentially lead to grid outages that affect the local community. For example, Oregon's Pacific Power has attributed seven minor community outages to grow operations.[2]
- **Environmental Impact:** Electricity production is responsible for approximately one third of total greenhouse gas emissions in the United States. Over the past decade, various efforts to mitigate climate change have resulted in national electric demand remaining flat (zero percent growth). In contrast, Denver's electricity consumption has continued to increase over the past several years due to a variety of factors, including overall community growth. Electricity use from cannabis cultivation and infused products manufacturing grew by 36 percent annually, on average, between 2012 and 2016.

While there is no singular solution for cultivators looking to reduce facilities' energy profiles, the listed best practices are intended to provide a framework by which organizations can begin to develop a comprehensive energy management plan.

[2] Utility Dive - Marijuana Grow Houses Trigger 7 Summer Outages for Pacific Power



REGULATORY DRIVERS

Colorado state regulations and local regulations in the Denver metro area significantly impact the methods of cannabis cultivation employed by growers and the per-gram energy use of cannabis grown. For example, Denver's zoning and other land use regulations require cannabis cultivation facilities to operate in industrial areas. Therefore, the cultivation facilities that result are primarily indoor warehouses that use 100 percent artificial light – the most energy-intensive option. Alternatively, in localities that allow cannabis cultivation facilities on agricultural, commercial, industrial and mixed-used land areas, growers can choose the properties and cultivation methods that offer the greatest returns. As prices drop and energy use becomes a larger percentage of revenue (and earnings), market forces incentivize growers to transition from indoor facilities to greenhouses and outdoor farms.

Requirements for cultivation facilities to open and operate within a specified period often push growers to focus on the fastest rather than the most sustainable methods of cultivation. These types of requirements typically occur in licensing systems that limit the number of businesses as to ensure that cultivators are not idly sitting on their limited license. However, these regulations can be problematic for businesses that want to construct high-tech greenhouses customized for cannabis cultivation. Companies often opt to cultivate cannabis within existing warehouses to get up and operating faster. This focus on speed rather than energy efficiency increases the environmental costs of cannabis cultivation.

The City & County of Denver has ambitious, community-wide energy and GHG emission reduction goals. Cannabis cultivation facilities, like all businesses, operate within the context of these goals, and energy efficiency at the individual building level is part of the solution. Denver's Climate Action Plan 2015 describes these goals and potential strategies.

Denver's climate goals include reducing GHG emissions by 80 percent below 2005 levels by 2050.

In December 2016, Denver City Council passed a new benchmarking ordinance, known as Energize Denver (www.denvergov.org/EnergizeDenver). The ordinance requires owners and/or operators of large commercial and multifamily buildings to annually assess and report the buildings' energy performance using the free ENERGY STAR Portfolio Manager tool. In 2017, buildings exceeding 50,000 square feet in size are required to report, and buildings exceeding 25,000 square feet in size will be required to report beginning in 2018. The data will be made publicly available on an online map published by Denver Department of Public Health & Environment. The cannabis industry is expected to utilize two exemptions to the reporting requirements:

- Buildings used primarily for industrial or agricultural purposes are exempt.
- Businesses are exempt from reporting when energy performance is a confidential business practice.

Benchmarking laws are becoming more common throughout the U.S., and such exemptions may not apply in other localities. Cannabis businesses that do not meet the square footage requirement, can participate voluntarily to understand and compare energy usage. Business owners can reference the Portfolio Manager section below for more guidance on how to get started.

MEASUREMENT & VERIFICATION

Measuring and verifying (M&V) building- and system-level energy use is typically the first step for organizations that are looking to reduce the energy footprint. While all facilities receive monthly electric and gas usage statements from utility providers, the data included on these statements represents a general overview and typically lacks the granularity needed to develop a comprehensive energy management strategy. The best practices outlined below represent options for facility managers looking to develop an effective M&V process.

Sustainability Aspects and Impacts

- Energy consumption
- GHG emissions
- Regional stakeholder alignment
- Operational and compliance budgets

Process Description

Developing an appropriate M&V process will depend on both facility-specific factors (size, existing infrastructure, geography, etc.) and an organization's specific economic and sustainability goals. The following best practices are intended to provide a starting point for facility managers.

Track Metrics

There is currently a paucity of relevant, high quality energy data in the cannabis industry. To improve the current state of industry data, cultivators should begin or continue to measure and share facilities' energy usage data both to make more strategic equipment and process decisions as well as to contribute to an understanding of the current state of the industry.

Recommended metrics to track include:

- Grams/Watt (lighting only) – Dry weight of flower and trim production measured against lighting power.
- Grams/kWh (total energy usage) – Overall production-to-energy efficiency ratio; dry weight of flower and trim production measured against total building energy use.
- Grams/sqft of cultivation space (efficiency) – Measures space utilization efficiency per cycle and/or per strain.
- Micromole/sqft – Lighting intensity measurement to identify when bulbs or fixtures must be replaced; also can compare multiple lighting types.
- Return on Investment (ROI) – ROI of each technology (based on replacement timing, maintenance/labor, yield under each technology) over a specified period. The ROI of specific equipment should be calculated by identifying the incremental costs and benefits over the costs and benefits of standard equipment.
- Energy consumption (units and costs) – Energy consumed per unit of product produced and energy costs as a percent of total operating costs.



Table 2: Key Metrics to Track

METRIC	DESCRIPTION	UNITS	NOTES	AVERAGE RANGE
Lighting Yield per Watt	Used to compare lighting technologies and strains.	grams/Watt	Measure grams of flower and trim in dry weight. Use lighting wattages, including ballasts. Measure over one grow cycle and annually.	Overall average 1.6g/W Less than 1g/W - 8% 1g-1.49g/W - 16% 1.5g-1.99g/W - 8% 2g-2.49g/W - 10% 2.5+g/W - 3% Unknown to Operation 51%
Total Energy Efficiency	Identifies total production efficiency; helps identify trends in building.	grams/kWhs	Measure monthly and annually Use total kWhs for building.	Total dried product weight ÷ kWh/cycle = Yield per kWh
Space Utilization	Demonstrates if the cultivation space is being maximized for production.	grams/sqft	Use square footage of cultivation space only.	39.5g/sq. ft.
Lighting Intensity	Measures whether the lights are providing the desired photosynthetic photon flux density (PPFD); can help identify correct time to replace lights.	micromoles/ sqft	Measure at canopy. Measure for each type of lighting, for each stage of growth.	Currently unknown
Daily Light Integral	Measures the daily accumulation of photosynthetically active radiation (PAR) spectrum light reaching the plants.	mol/m^2/day	Formula: µMol/M^2S x 3600 s/ hr x photoperiod(hrs/day) ÷ 1,000,000 µMole/Mole = Mol/ M^2/Day	Denver Outdoor Avg. Winter 15-30 mol/m^2/ daySummer 25-45 mol/ m^2/day
Load Factor	Used to manage peak power demand; higher Load Factor reduces cost of energy.	kWhs / (peak kW * days * 24 hours per day)	Use monthly electricity figures. Days equals days in billing period.	<0.60 = poor 0.60 - 0.75 = fair >0.75 = good

OBTAINING BUILDING DATA FROM XCEL ENERGY

Energy usage data can include data pertaining to electricity, natural gas, steam, fuel oil, diesel, on-site solar or any other energy source. The data must cover consumption from January 1 through December 31 of the previous year. Certain parties may need to access more than 12 months of utility bills to fully cover the year. Consumption data can be collected through an Xcel Energy account, a natural gas supplier account or from past bills. Xcel Energy's My Account portal is a helpful online tool for obtaining monthly use figures and annual totals.

Xcel Energy has developed a data access portal which allows tenants and building owners to automatically receive aggregate energy consumption data imported directly into ENERGYSTAR Portfolio Manager accounts. ENERGYSTAR Portfolio Manager accounts must be set up prior to beginning the application. Visit www.xcelenergy.com, navigate to the Programs and Rebates page, click on the Business icon, then select the New Construction and Whole Building category to learn more about energy benchmarking.

PORTFOLIO MANAGER

As mentioned above, benchmarking energy use using Portfolio Manager is now required for commercial and multifamily buildings exceeding 25,000 square feet in Denver.

For a good example on how to set up an account, cannabis business owners and/or facility managers can refer to the City of Boulder: How-to Guide for Medical and Recreational Marijuana Business License Energy Reporting and Carbon Offset.

Guidance on Collecting Data

- Three levels of data to consider:
  - Level 1 – Properly interpreting and recording monthly utility bills.
  - Level 2 – Requesting utility interval data, if available.
  - Level 3 – Installing data loggers at the building or sub-meter level.
- Utility bills contain great information, but are often poorly interpreted and recorded. A facility manager should break out total energy used (kWh), peak demand (kW), consumption-based charges, demand-based charges, and fees and taxes for each bill. Inputting this info (along with water and production data) into a standardized spreadsheet, should only take a few minutes each month.

Utility Interval Data

- Facilities with smart meters can request 15-minute interval data from the energy provider.
- Facilities can also opt to pay for Xcel's InfoWise service, which uses interval data to create a web-based energy dashboard that provides various insights and metrics. This service costs $150 per month, with a $900 equipment charge if a smart meter is not already in place.
- Cultivators can also install equipment to log energy data. This can be done concurrently with a Building Management System (BMS)/Energy Management System (EMS) installation, or can be done solely for logging energy data. Installation will allow for capturing higher frequency, sub-metered data that can provide a great deal of insight into how a facility is using energy.
- When properly configured and monitored, a robust BMS/EMS can quickly alert a facility manager about broken or malfunctioning equipment, saving facilities from energy waste, equipment failure, power loss and even loss of crop in the event of malfunctioning environmental controls. See below for more information on BMS/EMS systems.

Engage Specialists

- An energy specialist (such as a Certified Energy Manager) can perform any of the above tasks for a cultivator, particularly, if a grower should seek out an experienced contractor to install sub-meters. Interested cultivators should consider a local trade group or association such as Rocky Mountain Association of Energy Engineers.
- Additionally, a specialist can perform an on-site energy audit or engineering assistance study (EAS) to reveal and evaluate energy savings opportunities. As mentioned below, Xcel Energy offers related grants/incentives.

As the cultivation industry matures, the availability of energy, water, lighting and space efficiency metrics as related to production data becomes imperative. Individual cultivators – as well as the industry at large – should have intimate knowledge of these measures and of how particular technologies and behaviors affect resource and production efficiency.

Building Management Systems/Energy Management Systems

Facility managers looking for a comprehensive data solution should consider installing a BMS or an EMS. As there are many different types of BMS/EMS systems available on the market, the U.S. Department of Energy has developed a suite of Specification and Procurement Support Materials to help managers identify the right fit for each facility.

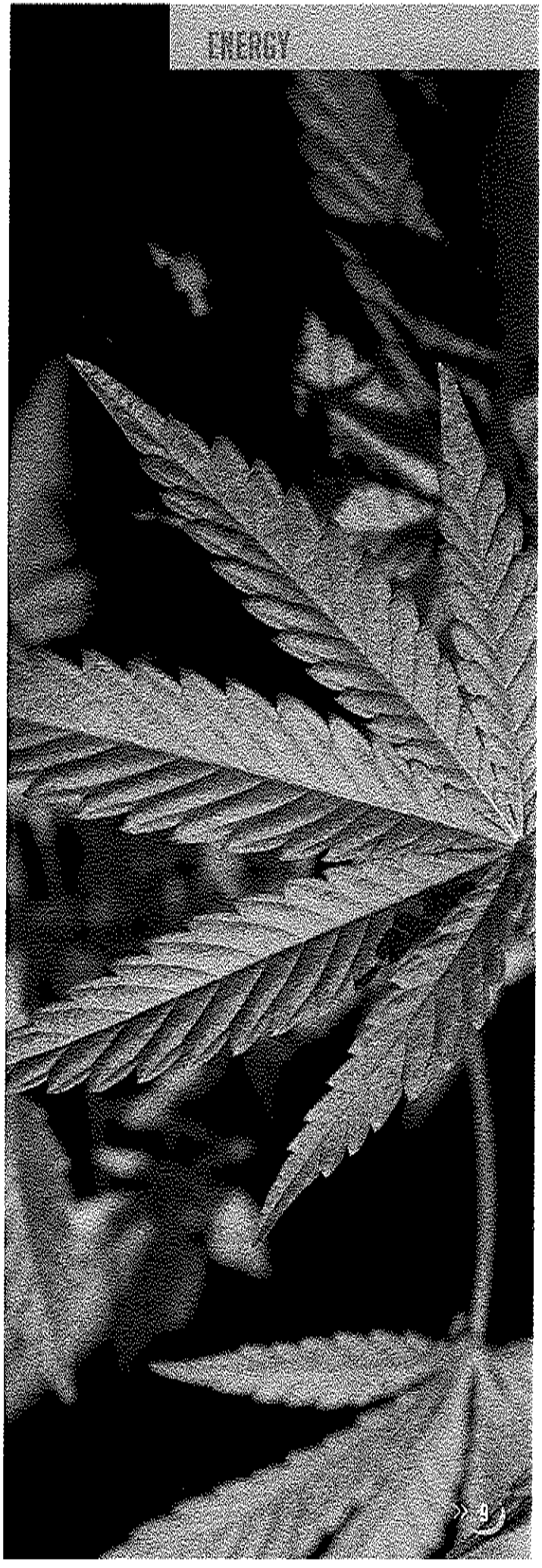
Energy Audit/Engineering Assistance Study

Performing a comprehensive energy audit or engineering assistance study (EAS) is often the quickest way to acquire the insights needed to develop an effective energy management strategy, but enacting this process typically requires partnering with a qualified third-party provider. Xcel's Energy Analysis Program is a good starting point for facility managers that are interested in pursuing these options and also offers several financial incentive programs to reduce an organization's out-of-pocket costs.

It would benefit the operator to install sub-meters inside the building to collect power usage data, for example, those manufactured by e-mon, or Power TakeOff. Sub-meters measure the power used in a specific area and/or by certain pieces of equipment, giving a more detailed picture of how and where energy is consumed in the building.

Resources:

- Xcel Energy - Business Programs & Rebates
- Sample Energy Audit Form



SCHEDULING

Cultivation facilities in the Denver metro area receive electric service from Xcel Energy and are billed according to total electricity consumption (kWhs) and peak demand (kW). While these two billing aspects are related, how a facility is operated can have significant impacts on peak demand and the actual cost of energy. Managing the operation of various systems within the facility by setting staggered room schedules can significantly reduce energy costs and negative impacts on the power grid. Reducing peak demand also creates community-level environmental benefits, because energy providers utilize "peaker plants" that are generally older, less efficient and have higher emissions to provide additional electricity during times of high demand.

Sustainability Aspects and Impacts

- Energy consumption
- GHG emissions
- Operational and compliance budgets

Process Description

Load-factor Optimization

Energy-efficient technologies can improve both the total energy use and peak demand of a facility. Operating schedules, on the other hand, play a critical role in minimizing peak demand over the month. Grow rooms, particularly in the flower stage, represent the largest sources of peak energy needs when factoring in lighting, cooling and ventilation. All grow room schedules should be staggered over the 24-hour period so the minimum number of rooms run concurrently. Any overlap of schedules, even for one hour or less, leads to higher spikes in peak electricity demand and higher costs. Similarly, other energy-intensive processes such as extraction, cleaning or electric heating can be staggered and scheduled carefully with lighting cycles to minimize peak power demands.

Time of Use

Xcel Energy does not charge time-of-use billing for Secondary General rate customers (the rate category most cultivation facilities fall under). Kilowatt-hours cost the same day or night, but energy can be saved by running extra equipment during cooler evening periods. If it is necessary to operate extra grow rooms simultaneously, cultivators should try to schedule those periods overnight when outdoor air temperatures are lower. This can reduce the cooling load during these times of extra production, thereby reducing energy use and saving money.



LIGHTING

Lighting is the most energy-intensive component of the cultivation environment. The design of a facility's lighting system and the types of lamps utilized in the grow process will affect both crop yield and quality. Lighting design also plays a significant role in the facility's overall sustainability profile. Employee health and safety should be considered in the design and delivery of indoor lighting as well.

Sustainability Aspects and Impacts

- Energy consumption
- GHG emissions
- Solid waste generation
- Employee well-being
- Climate
- Operational and compliance budgets

Process Description

Indoor cultivation facilities typically utilize a combination of High Pressure Sodium (HPS), Ceramic Metal Halide (CMH), Fluorescent and/or Light-Emitting Diode (LED) lamps. In addition to lamp type, lighting system design and time of lamp use are also critical to maximizing energy efficiency in cultivation facilities. Due to the operational impact of lighting choices, a host of production-related factors must also be considered as cultivators select the appropriate lighting technology.

Lighting technologies should be measured in terms of photosynthetically active radiation (PAR) or the measure of the specific light spectrum characteristics. PAR accounts for the spectrum of light between 400 nanometers (nm) and 700nm, most of the light spectrum used for photosynthesis. Infrared and ultraviolet light spectrums (sometimes useful, although widely debated) fall outside of PAR readings and thus do not register with standard light spectrum measuring equipment. The intensity of the lighting system or photosynthetic photon flux density (PPFD) is measured in micromoles per second per meter square (µmol/s-m2) and should be carefully monitored for optimal plant growth. PPFD can also be thought of as "PAR per square meter."

Equipment Overview

Cultivators have several choices when it comes to lighting technology. Historically, the top three lighting technologies used have been T5 fluorescent, metal halide (MH) and HPS. There are now several different options to choose from including (but not limited to): LED, light emitting plasma (LEP), CMH and various combinations of these. Many of these lighting types have specific spectrums of PAR and are generally used for one stage of growth or another. Prescribing specific heights above canopy for lighting systems is not recommended, as PPFD, age of fixture, bench height and plant height will all dictate the location of the fixture. There should be a perpetual review of micromole levels for cannabis and the need to adjust fixtures with the aid of a good light meter to obtain the necessary PPFD.

Lighting fixtures emit energy in the form of light, as measured in PAR or photosynthentic photon flux (PPF), and reflectors direct the light towards the canopy with varying levels of sophistication and success. LEDs tend to be directional in nature and thus generally do not require reflectors. Knowing the lighting output of a fixture alone without understanding, properly configuring and measuring the lighting intensity at the canopy will result in sub-optimal lighting conditions.

Below are general uses and specifications for each of these technologies.[3,4]

Table 3: Lighting Technologies for Cannabis Production

LIGHT TECHNOLOGY	GENERAL USE/GROWTH STAGE	SPECTRUM	RATED LIFE IN HOURS	INTENSITY* IN PPFD	EFFICACY IN UMOLES/J
T5 Fluorescent	Plant propagation — mothers and clones	Full spectrum with ability to fine tune colors	20,000	150 - 300	TBD
Metal Halide	Vegetative growth	Full spectrum with blue and green peaks	6,000 - 15,000	500 - 800	TBD
Ceramic Metal Halide	Both stages of growth	Full spectrum, UV	20,000	800	1.46
High Pressure Sodium (single-ended)	Flower growth stage or both stages	Full spectrum with yellow and red peaks	5,000 - 20,000	700 - 900	1.16
High Pressure Sodium (double-ended)	Flower growth stage or both stages	Full spectrum with yellow and red peaks	5,000 - 20,000	700 - 900	1.70
Light Emitting Diode	All stages of growth	Full spectrum with ability to fine tune colors, UV	50,000	800 - 1200	1.70
Light Emitting Plasma	Vegetative growth or both stages	Full spectrum, UV	30,000	700 - 900	1.00

**Intensity is measured at manufacturer's recommended mounting height.*

BEST PRACTICES

System Design

When designing for indoor cultivation, it is important to identify and understand target light levels for optimal growth. The correct measurement for obtaining best results is PPFD, or the number of photons of PAR that are hitting the top of the canopy. This measurement only gives the total amount of photons that the plants use in the process of photosynthesis. PPFD uniformity is critical to maximizing crop yield. The more useable photons consistently hitting the crop, the quicker the crop will grow. Many double-ended HPS fixtures have multiple reflector options. To decrease the amount of photons wasted on the side of the grow rooms, more directional reflectors are placed around the perimeter of the flower rooms. Broader reflectors are placed in the center of the room. The result is less wasted light on walls and more efficient production.

Once an operator has determined the target PPFD, the cultivator should work with an engineer or vendor to design the system around the target. If a manufacturer cannot assist in the design and technical review, the cultivator should consider seeking a more capable vendor, or be sure to have an appropriate consultant on the team. Master controllers should be used with quantum meters for 24-hour monitoring of light levels. It is also a best practice to make sure growers have access to handheld quantum meters for daily monitoring.

[3] Yorio, Neil. (2014) Towards Sustainable Lighting For Commercial Cannabis Production. Biological Innovation and Optimization Systems (BIOS)

[4] Nelson, Jacob A. and Bugbee, Bruce. (2014) Economic Analysis of Greenhouse Lighting: Lighting Emitting Diodes vs. High Intensity Discharge Fixtures. PLOS one.

Maximizing Production & Efficiency

Racks

Many cultivators are moving to tiered production on vertical racks or shelving. This strategy is most common in vegetation rooms where plants are smaller and require lower light intensity. Fluorescent lights or LEDs are typically used in these stacking situations because they radiate less heat and can be placed closer to plants. A common question is, "How far away from the canopy should lights hang?"

While each light is different, the most important factors to consider when hanging lights are the temperature of the canopy and how many micromoles are hitting it. Ensuring the plants are consistently receiving the appropriate micromole level of lighting and the appropriate temperature level is essential for efficient growth.

Pruning

Pruning is important to maximize production. Some plants may need to be topped in the vegetative stage to keep them short and bushy. Artificial lights can only achieve approximately 24 inches of penetration on a dense canopy. Taller plants take more time to grow and ultimately produce less yield per kWh. For these reasons, it is important to prune plants multiple times throughout the growth cycle. Typical pruning activities consist of pruning off all branches on the bottom third of the plant. Lower branches can occasionally be left on the plant if they reach the top half of the canopy. Interior branches in the plant canopy can also be removed if they are smaller than one-eighth of an inch. This heavy pruning will create larger top colas with enhanced terpene profile and higher potency.

GREENHOUSES

Greenhouses will continue to take over a large portion of the cannabis industry as regulations become more favorable. Any expansion plans should at least take into consideration greenhouse production, as it can be a much more sustainable approach. With greenhouse production, lights will only be needed occasionally for supplemental light. Weather stations wired to a quantum meter should be used to ensure lights are only activating when the meter dips below the minimum micromole target. These weather stations allow for the most efficient use of electricity.

When designing greenhouse cultivation facilities, many of the system designs with regard to lighting will be different when compared to indoor cultivation. Greenhouse lighting is still based on desired PPFD, but must take into consideration how much natural light/sunlight will be obtained. Light fixture count will undoubtedly decrease in most geographies compared with indoor operations, as the lights will only be used to supplement during periods of low sunlight levels.

Another aspect of greenhouse lighting system design is controllability. Many light fixtures and associated ballasts or drivers have the ability to be dimmed. There are times in both stages of growth that the plants may desire a light level lower than the full output. Therefore, cultivators can reduce energy consumption with a dimming control system. A control system can also stagger the power up and power down of any room and can help prevent unnecessary power spikes and potential damage to electrical equipment.

SEE ALSO: Appendix B: Greenhouses

Trellising

Trellis nets should be used in most grow systems to help maximize plant density. Cultivators should install trellis netting in the first week of the flower stage before plants stretch. Installing low trellising early will help keep the plants stable and encourage heavier bud set. It is important to weave the plants up through the trellis daily for the first 30 days of the flowering cycle. The goal is to maximize production by making sure there is at least one branch/bud coming up through each four-inch square on the trellis netting. Monitoring the canopy via a step ladder can be helpful to make sure there are no gaps in the canopy.

Adjustable Light Fixtures

It can be beneficial to have adjustable ratchets on the light depending on the technology and layout. Having the ability to move the light closer to shorter plants can greatly increase the level of micromoles the plant receives. It can also be helpful to pull the lights up and away from taller plants to prevent burn. Cultivators should be sure to use non-combustible cables or chains when using adjustable lighting fixtures.

Lighting Maintenance & Replacement

Proper maintenance of lighting and lighting components is important for performance and efficiency. A dirty optic lens or reflector could reduce performance by more than 10 percent. Different lighting technologies have different maintenance considerations.

High-Intensity Discharge Lighting

- **Aluminum Reflectors:** Calcium, dust and sulfur will damage reflectors and decrease efficiency. Cultivators should use caution in cleaning reflectors, as any wiping of the reflector will damage the finish. Cultivators should dip the reflector in a two percent vinegar solution and let it air dry, taking care to never wipe the reflector. This should be done once every six months or more often if heavy accumulation of dust is noticed. Tracking micromole levels at the canopy level will insure the proper amount of photons is hitting plants. Most manufacturers recommend replacing reflectors every 12 months along with the bulb, however tracking light levels and only replacing reflectors when they are underperforming is a more sustainable approach.
- **Bulbs:** Cultivators should make sure lights are unplugged and have had at least 20 minutes to cool before cleaning or replacing. Using glass wipes to wipe down the bulb and lens is advised, if applicable. Cultivators should wipe down lights once every two months or in between harvests, but should not wipe the base of the lamp or the socket. Most manufacturers recommend replacing bulbs every 12 months along with the reflector. However, bulbs used on a 12 hours on/12 hours off ("12/12") schedule will typically have more rated life hours remaining after one year. Tracking micromole levels at the canopy level will insure the proper amount of photons is hitting the plants. Tracking light levels and only replacing bulbs or lenses when they are underperforming is a more sustainable approach.
- **Ballasts:** While magnetic ballasts should be replaced every two to three years because of decreased efficiency, electronic ballasts can often perform eight to 10 years. Buying a light used to consist of purchasing a bulb, ballast and reflector separately. However, most new technology includes an electronic ballast with the reflector, so no choice needs to be made.
- **Magnetic:** Magnetic ballasts preceded electronic ballast, are heavier, less efficient, create more heat and are noisier than electronic ballasts. However, they may come with a longer warranty than electronic ballasts, are less expensive and easier to repair.
- **Electronic:** Electronic ballasts have sensitive circuitry that is more difficult to repair than magnetic ballasts. Many electronic ballasts have dimmable options that can help put less light on the plants during sensitive

stages of growth. The dimmable option can also be helpful in controlling the room temperature in extreme weather conditions. As mentioned above, the electronic ballast is more efficient, creates less heat and noise, and typically lasts longer than a magnetic ballast. RFI (radio frequency interference) has been a problem with older electronic ballasts, but manufacturers have been working hard to correct that deficiency.

- **Cords/Connection:** Cultivators should thoroughly check electrical cords for any damage, cuts or abrasions that could affect performance. Also, cords should be inspected for secure connection at the outlet as well as the fixture.

LED

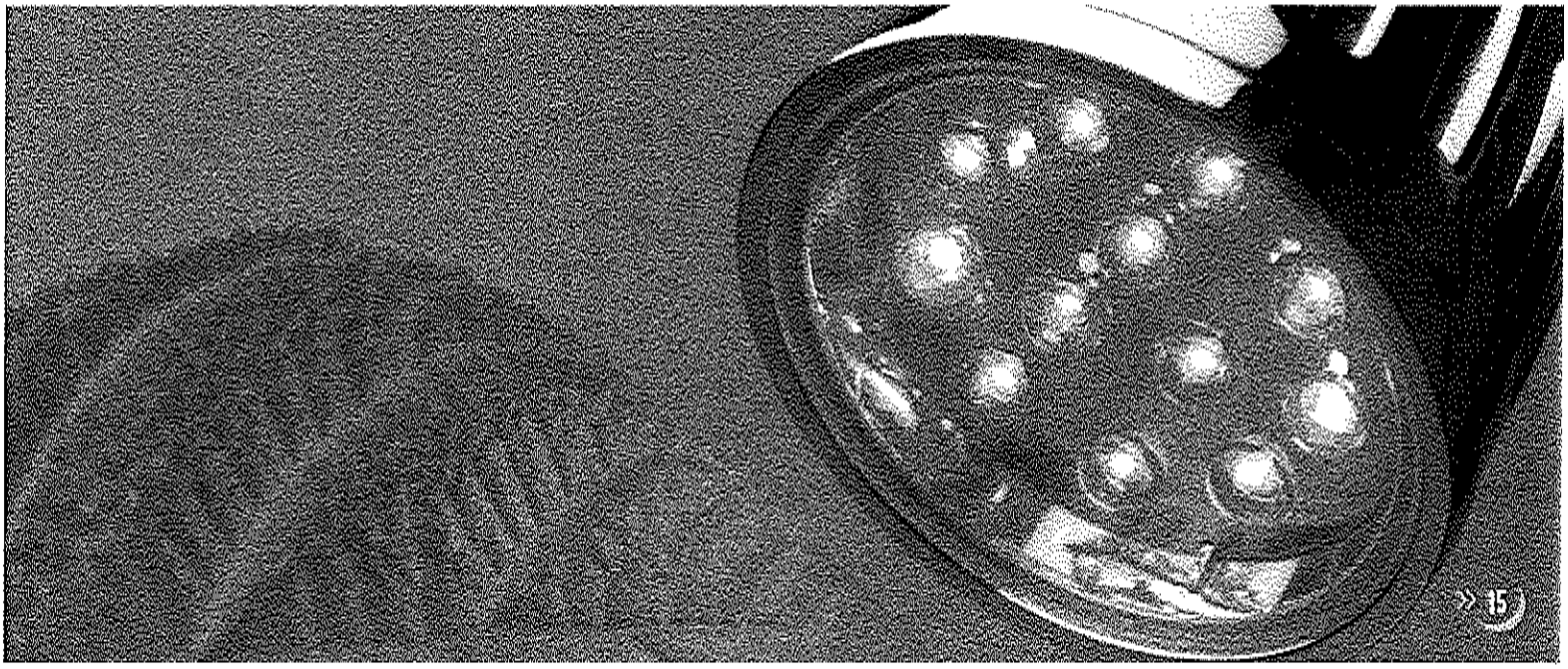
- **Optics:** Quality LED manufacturers will utilize a glass optic over the diodes. These optics should be cleaned every two months with a non-solvent cleaner and non-abrasive microfiber cloth.
- **Diodes:** Most diodes are rated for 50,000 hours. This means they could run, in theory, for more than a decade without replacement on a 12/12 schedule. However, they are still relatively new and the technology is still improving. Even if the diode is capable of lasting 50,000 hours, drivers would also need to last that long, and consideration would need to be taken for how often the optic lens would need replaced.
- **Fans:** Some LED fixtures also include cooling fans. Most advanced LED manufacturers build lights without fans. These fans have moving parts that can fail and may need to be replaced. Cultivators should look for wet location-rated fixtures, indicated with an IP65 label.

Cost of Light

It is important to consider all applicable costs when designing or updating a facility's lighting setup. Purchase price is a small portion of the total cost over the equipment lifetime. Cost to operate, useful life, maintenance cost and disposal cost – as well as failure scenarios and associated costs – should be calculated and included in lighting decisions.

Resources:

- Gavita Lighting - Lumens are for Humans
- Greenhouse Product News - Greenhouse Lighting Options
- ACF Greenhouses - Indoor Plant Grow Light Guide
- Economic Analysis of Greenhouse Lighting -Light Emitting Diodes vs. Intensity Discharge Fixtures



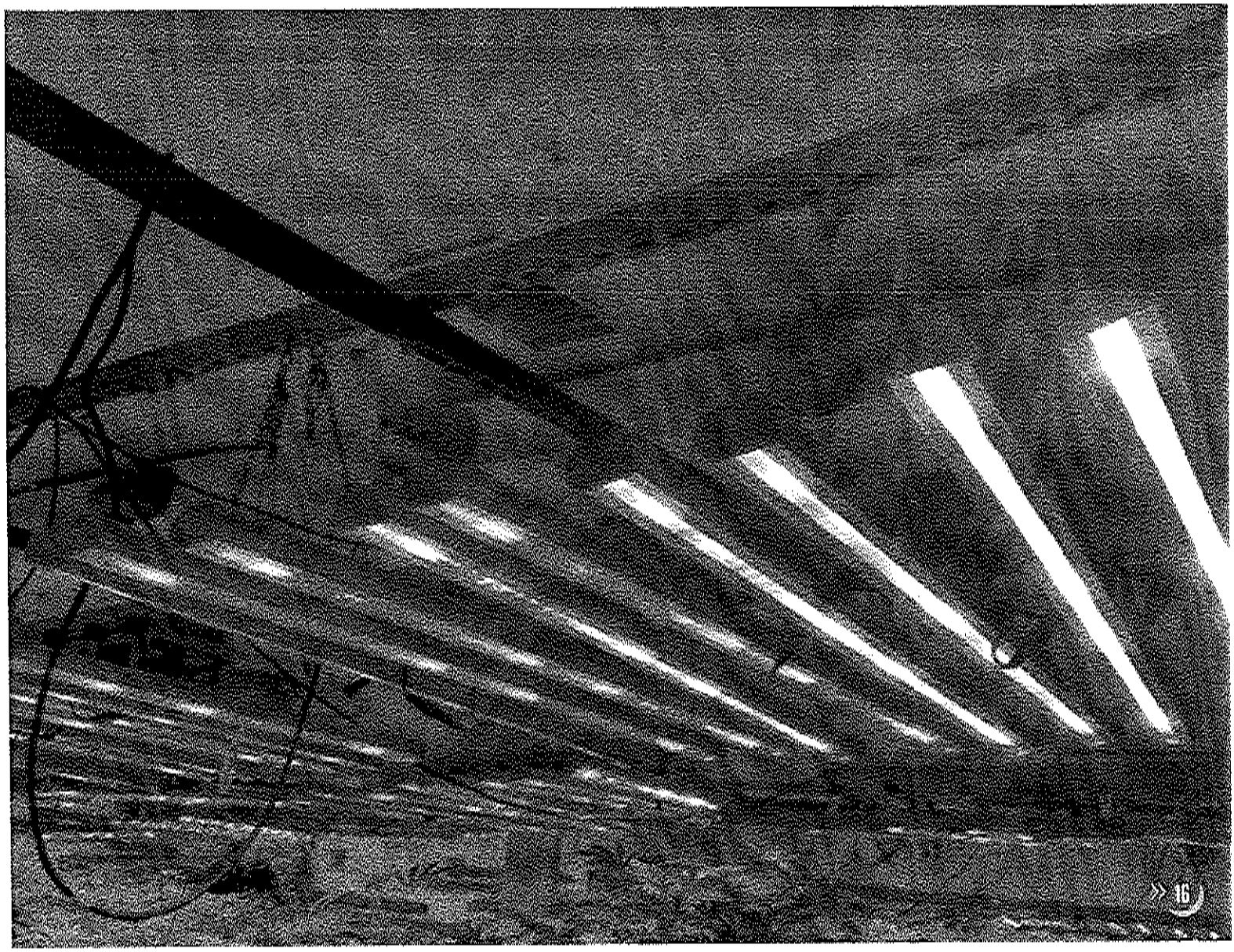
CASE STUDY:

HPS TO LED CONVERSION IN VEG

The Clinic replaced 72 1000w single-ended HPS lights in their vegetative room with a mix of 6 bar and 10 bar BML (now Fluence) LED lights. There was an immediate electrical savings of 36,360w in that room. The Clinic also saw a decreased demand on their aging HVAC equipment due to the lower load in the room and ability to increase the temperature set point without detriment to the crop. In addition to the energy savings in the room, the LED lights have actually sped up the process to get the plants to the right size and decreased the growing period by 1-2 weeks.

By the numbers:

Original Configuration	72 HPS single ended	72,000W
New Configuration	72 BML LED fixtures (36 660w, 36 333w)	35,640W
Monthly Electric Savings	36 kW 19,000 kWhs	$1,400
AC Tonnage Reduction		10 Tons



HVAC & DEHUMIDIFICATION

Climate control systems can account for 50 percent or more of the total energy consumption in an indoor cultivation facility.[5] Climate control consists of multiple components of heating, ventilation, air conditioning (HVAC) and dehumidification. As such, proper climate system design, installation, commissioning, and maintenance are crucial aspects of a sustainable cultivation process. Proper climate design is critical to operational efficiency and biosecurity. In most cases, climate control will be the single largest capital investment a cultivator makes after real estate. While purpose-built cannabis cultivation facilities allow for optimal climate design, the majority of indoor cultivation sites are repurposed facilities – which adds a layer of complexity to the HVAC optimization equation.

Sustainability Aspects and Impacts

- Indoor air quality
- Odor control
- Energy consumption
- GHG emissions
- Regulatory compliance
- Climate
- Community relations
- Employee well-being
- Operational and compliance budgets

Process Description

In addition to requiring different approaches for purpose-built versus retrofitted facilities, optimizing climate system operations will depend on myriad facility-specific factors such as size, layout, growing method, lighting system design, watering schedule and local ambient conditions. Due to the complexity of HVAC and dehumidification systems, it is strongly recommended that facility managers consult with a mechanical designer familiar with the cultivation space. Engineering firms stamping mechanical designs must be licensed by the Colorado Secretary of State. Installing contractors operating in Denver must be licensed by the city in addition to holding a license from the State of Colorado. Facility managers may also find it beneficial to select engineering firms with specific sustainability credentials such as a Certified Energy Manager® or LEED® accreditations.

It is important to note that typical HVAC systems are designed for comfort cooling and occupancy ventilation. These systems can present challenges in cultivation environments that will need to be understood and addressed at the design phase. Systems specifically designed for process cooling will often address these challenges and should be considered when budget allows.

Cooling is not the addition of cold air, it is the removal of heat. The act of cooling is simply the absorption and relocation of British thermal units (BTUs) – the amount of thermal energy required to change the temperature of one pound of water one degree in one hour. The more energy efficient the heat exchange, the more energy efficient the cooling system.

Commonly used equipment ratings SEER (Seasonal Energy Efficiency Rating), EER (Energy Efficiency Rating) and IPLV (Integrated Part Load Value) are limited to specific uses and often specific equipment. On the surface, a high rating might make one system look more energy efficient than another. For instance, when comparing the EER rating on a 100-ton chiller and the EER rating on a three-ton mini-split air conditioner, it might appear that using 33 mini splits is more energy efficient. This is not the case, as the other components of the chiller system (fan coils, pumps, transport energy, etc.) are not accounted for in this rating. Further, adding up the running load amps (RLA) of 33 three-ton mini splits and comparing those to the RLA of one 100-ton chiller will show that the 100-ton chiller consumes significantly less energy in operation. It is important to understand the efficiency of the system as a whole for the intended purpose when evaluating any climate system.

[5] Evan Mills - The Carbon Footprint of Indoor Cannabis Production

COOLING METHODOLOGY

Evaporative Cooling

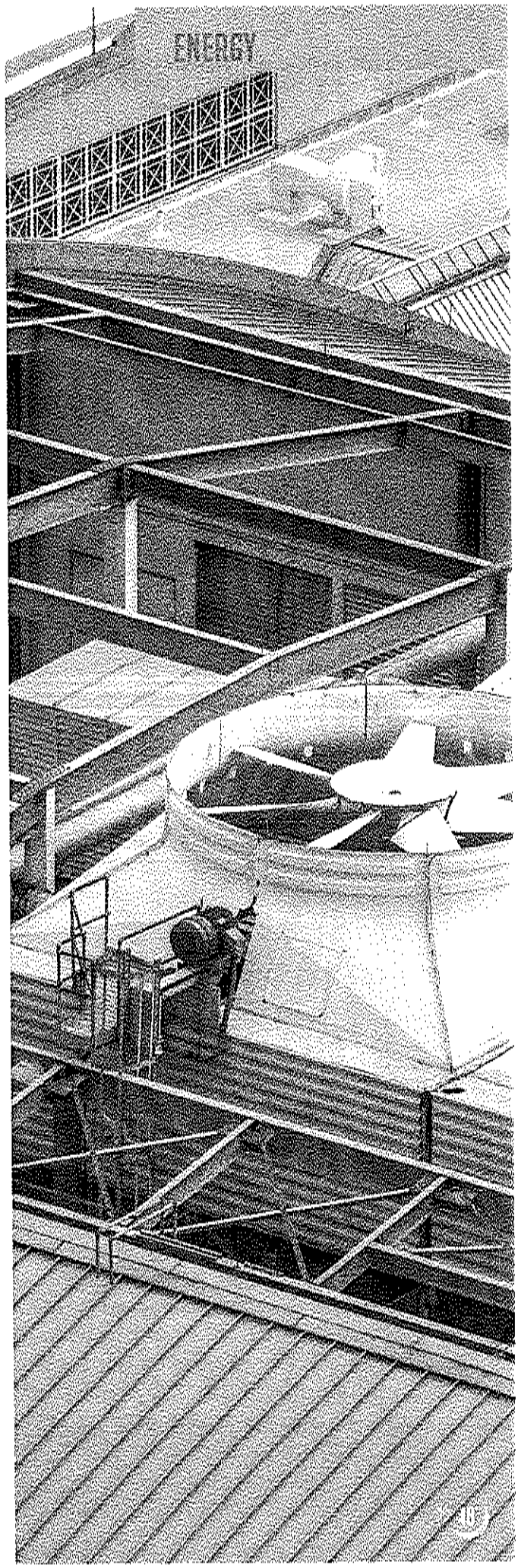
Evaporative cooling is a low-energy cooling method in which heat is absorbed from the space through the evaporation of water. When water evaporates, BTUs are absorbed and temperatures are reduced. This is an energy-efficient method of cooling for comfort applications and is especially attractive in dry climates, but also requires substantial amounts of water. This method is not recommended for cultivation spaces due to the introduction of humidity to the space.

Mini Splits

Small, ductless HVAC units allow for quick owner installation at relatively low cost. These units have high efficiency and low ambient temperature options available. They are a viable option for small-scale facilities (less than 1,000 square feet in size) but should not be considered in large operations due to the limitation on available tonnage and, therefore, additional space and electrical connection points required. These systems lack direct dehumidification control and are designed for comfort cooling application, though they will provide some indirect dehumidification capability (if the space's relative humidity is high enough) as a byproduct of the cooling process. The important thing to note is that the dehumidification capability cannot be directly controlled and, thereby, does not allow the cultivator precise control of the indoor relative humidity (RH).

Standard HVAC Systems

Generally described as rooftop units (RTUs), these units are common and relatively inexpensive. The complete HVAC system comprises a supply fan, filtration (limited), compressor, condenser and evaporator contained in a single housing. Air from the cultivation space is moved through ducts to the unit's evaporator, where heat is removed, and cold air is returned to the cultivation space. This is generally an inexpensive option with mid-range energy efficiency, but can present challenges associated with excessive ductwork, redundancy, low temperature operation and requirements for building ventilation. Many existing facilities are using RTUs in ways that are far beyond the original design intent of the systems. This leads to poor performance and high energy bills. Frequently, microbial problems arise due to the inability of these systems to successfully manage the cultivation environment.



Variable Refrigerant Flow

Variable Refrigerant Flow (VRF) systems are refrigerant-based heat pump systems that allow the use of one outdoor condensing unit with multiple fan coil unit (FCU) zones within a facility. Each FCU has variable cooling capacity to meet load, promoting a higher level of indoor unit zoning and distributed cooling without ductwork that would be typical of a packaged HVAC system. Further, VRF systems, which include variable speed compressors that offer varying cooling loads, allow for variation in power consumption. With these systems, heat can be redirected to cooling zones (and vice versa) to offer energy savings. This is typically more useful in an office environment where loads vary based on external environmental conditions than in cultivation facilities where loads stay consistent. Overall, VRF is a more energy-efficient option than traditional HVAC methods but is comparatively expensive to purchase and install. VRF also carries the potential risk of leakage from exposed refrigerant piping.

Chilled Water Systems

Chilled water systems offer a standard solution for large-scale process cooling, data centers, large-scale buildings such as hospitals and airports, and energy-intensive manufacturing operations. In this system, the packaged water cooling machine (i.e., chiller) maintains a constant discharge water temperature (typically around 45 degrees F) from the warmer water returning from the space, thereby removing BTUs and heat load. This chilled water is then pumped indoors to distributed fan coils or air handlers throughout the space.

Chillers come in two types: air-cooled, which can be located outdoors and expel heat to the ambient air, or water-cooled, which can be located inside and expel heat to a cooling tower.

Chilled water systems are typically more expensive than traditional HVAC on small and mid-sized facilities, but on large facilities they are an extremely competitive option. Along with high energy efficiency, chilled water systems offer:

- The ability to isolate cultivation spaces without dedicating compressors to specific zones of the facility. This promotes the highest levels of system redundancy and allows for a reduction in the number of compressors needed when cultivators are "flipping" flowering rooms, which reduces system cost, electrical infrastructure and peak load operation.
- A high level of installation flexibility, allowing for changing capacity within any given space without changing the central system design.
- Dedicated dehumidification control when coupled with a reheat system; dehumidification can occur without sub-cooling the space.
- The ability to design for redundancy as backups can take over if one piece of equipment fails.

Water Cooled Condensers, Cooling Towers and Geothermal Systems

Generally speaking, water-cooled HVAC equipment (i.e., chillers, packaged unitary units, ground-source heat pumps) create a more energy-efficient heat removal process through the condenser and reduce operating costs substantially. Water-cooled condensers are available for both typical air conditioning packaged units and chilled water systems. On a water-cooled condenser, the water can be fairly warm (in some cases as warm as 90 degrees F) and still be effective, so cooling towers and ground loops can be utilized in these cases. However, cooling towers typically require intensive maintenance and consume large amounts of water. Thus, they are typically not cost effective until the total load reaches 500 to 600 tons. Onsite ponds and/or excavated geothermal loops can be useful in these cases, assuming the capacity for heat absorption is available.

DEHUMIDIFICATION METHODOLOGY

Cultivation facilities are notoriously high-humidity environments due to the massive amounts of water being added to the space. Ultimately, the water that is applied to plants is transpired by the plants and then needs to be removed from the space. The needs of dehumidification equipment will change as the parameters in the room change. The warmer the rooms can be kept during lights-off periods, the more efficiently dehumidification equipment will operate.

Standalone Dehumidifiers

Standalone dehumidifiers typically consist of small, free-hanging (plug and play) dehumidification units used to supplement the dehumidification offered by the cooling system during lights-on periods and as primary source of dehumidification during lights-off. Standalone dehumidifiers are more energy intensive than larger-scale dehumidification methods due to the use of small compressors, and output is limited by temperature parameters in the space (the lower the temperature, the less output the units produce). Generally, standalone dehumidifiers are the most affordable and easiest systems to integrate, but due to their plug and play nature they can be difficult to integrate with other climate control equipment.

Reheat

Reheat describes heating the space to allow the cooling system to run 24 hours a day to produce dehumidification without reducing temperatures. Reheat allows for more energy-efficient dehumidification via larger compressors. Energy is required to produce heat, which in some cases can offset the consumption savings. Reheat can also benefit the efficiency of standalone dehumidifiers by raising the temperature in the space. Increasing temperature has the added effect of decreasing relative humidity (RH) through expansion of air. Reheat can be produced by the following methods:

- **Electric reheat:** Electric heat strips are utilized to produce heat. Electric heat is not particularly energy efficient (consumption is comparable to or higher than standalone dehumidifiers in overall consumption), and the energy use should be compared carefully to standalone dehumidifiers to determine which solution is more efficient in a specific facility.
- **Hot gas reheat:** Heat removed from the space through the refrigerant system is rerouted to a reheat coil to be used to heat to neutral temps before being returned to the space. This method is near-zero energy reheat, but is limited in capacity and is generally not recommended in low ambient conditions due to difficulty managing refrigerant pressures. Additional standalone dehumidification or reheat from other sources will be required in conjunction with this source.
- **Natural gas or propane reheat:** Natural gas or propane is used to produce heat in order to reduce the ambient air relative humidity. More advanced air handlers (in chilled water or standard HVAC systems) will often have this as an integrated option, or this function can be achieved with standalone gas heaters.
- **Hot water reheat:** Common in chilled water systems, hot water is supplied to FCUs through a gas-fired boiler system. Superior energy efficiency can be achieved by modulating flow rates of hot and chilled water, allowing the system to consume exactly what it needs.
- **Heat recovery:** When water-cooled condensers are in use and rooms are running on opposite light cycles (i.e., some rooms are lit while others are dark), heat removed from the lit room can be absorbed from the condenser and returned to a dark room through the hot water loop described above. This improves the efficiency of the condensing unit and allows for nearly free reheat.

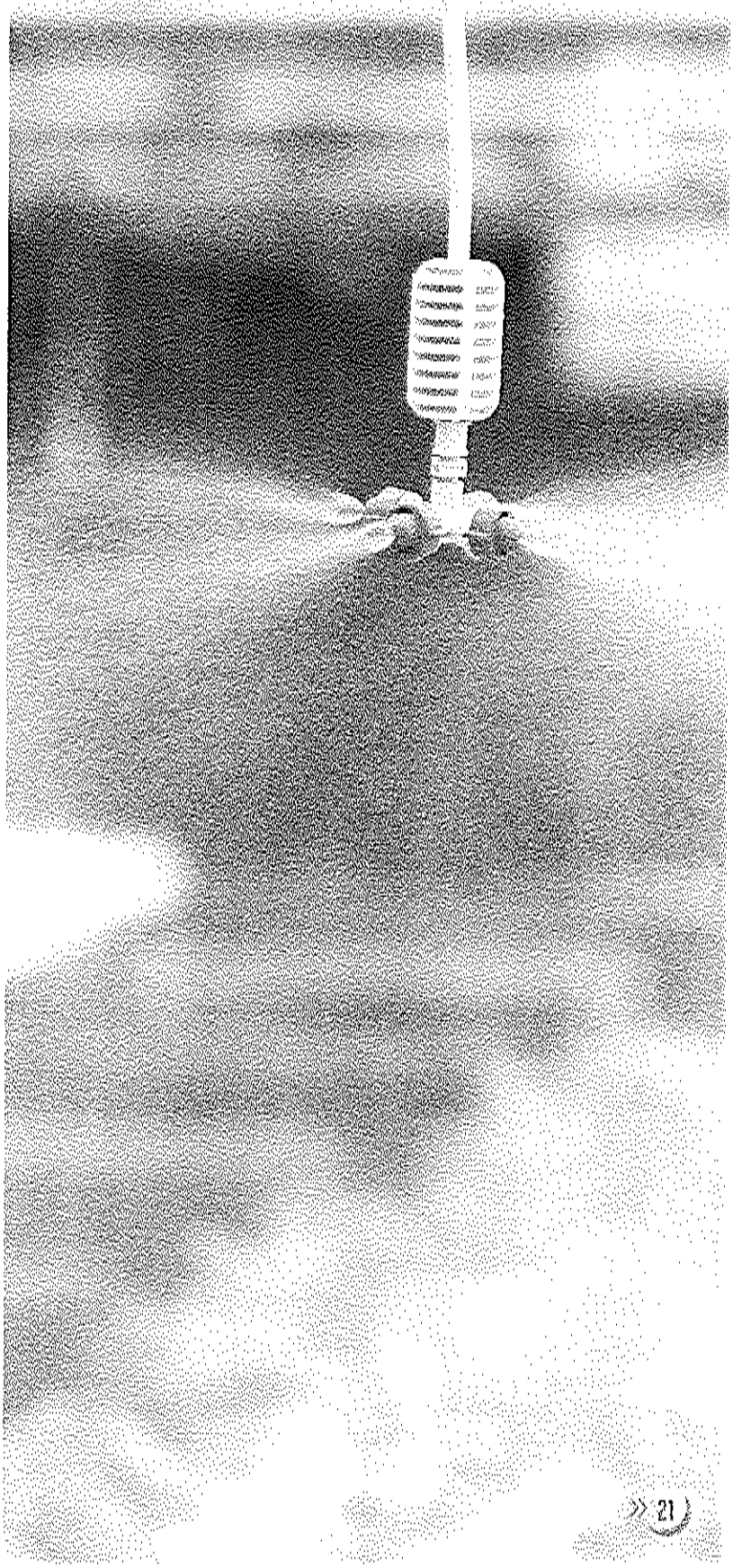
Desiccant

Desiccant dehumidifiers use desiccant media to absorb moisture from the space by rejecting the added moisture to an exhaust air scavenger airstream. For this system to work optimally, the desiccant media is heated on the exhaust side so that the moisture can be released outside to the environment, and the desiccant is reused. Desiccant humidifiers require the lowest amount of energy and can operate in a wide range of temperatures, but can be cost prohibitive and are generally only used on large-scale facilities.

Economizers

"Economizer" is another term for free cooling, utilizing the outdoor ambient environment to assist with temperature management of the cultivation space. Air-side economizers are units that utilize ventilation as a cooling method when ambient temperatures are below the set point in the cultivation space. While air-side economizers are an energy-efficient solution, they create more problems in cultivation environments than they solve with regard to CO_2 enrichment, biosecurity and odor control, and are generally not recommended (See "Ventilation and CO_2" section for additional detail).

Water-side economizers (or fluid coolers) can be utilized in both chilled water systems and in water-cooled condensing units and allow for free cooling without ventilation. When utilized in chiller systems, water-side economizers can reduce wintertime energy consumption dramatically by bypassing the compressors entirely when temperatures drop below 40 degrees F, utilizing cold outdoor temperatures to chill the water. On water-cooled condensers (in certain geographies) fluid coolers can be utilized in place of cooling towers for the condensing water loop.



AIR MOVEMENT

Air movement over the plant canopy is critical for transpiration of moisture and the prevention of pests and fungus. Cultivators should examine cubic feet per minute (CFM) per watt when evaluating canopy fans for efficiency.

Destratification fans are important to energy-efficient climate management when ceiling heights exceed 10 feet. Destratification fans create vertical airflow and ensure that heat and humidity trapped at the plant canopy reach the ceiling, where the cooling and dehumidification equipment is typically located.

Airflow and airspeed need to be studied more closely in controlled cannabis environments so the industry can create a baseline standard for airspeed.

VENTILATION AND CO_2

In many CO_2-enriched environments, ventilation or air-side economization may waste significant amounts of CO_2 (which can conflict with the energy code and efficiency efforts overall). Cultivators should carefully weigh efficiency gains associated with ventilation against CO_2 waste to determine accurate costs and greenhouse gas emissions associated with both. Limiting ventilation can also be helpful to biosecurity efforts and in minimizing exposure to contaminants, possibly reducing reliance on pesticides or fungicides.

Although common, CO_2 generators should not be used in modern indoor grow facilities. Generators contribute high levels of waste heat while operating and many are not vented properly, leading to dangerous indoor environments. Bottled CO_2 is a better substitute practice.

DESIGN STANDARDS

The American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) publishes commonly accepted HVAC standards for architects and engineers. As a starting point, facility owners may benefit from familiarizing themselves with ASHRAE 90.1, Energy Standard for Buildings. ASHRAE has also published an Advanced Energy Design Guide Series focused on reducing energy building use, which is available as a free PDF download.

BEST PRACTICES

One of the most common mistakes made by business owners is failure to invest in regular HVAC system maintenance. While initial system design and equipment procurement are critical, all HVAC systems require regular maintenance to ensure peak operating efficiency. Periodic inspections should be completed during which time filters should be inspected and replaced, condenser/evaporator coils should be cleaned and electrical connections should be checked. The U.S. Environmental Protection Agency (EPA) recommends semi-annual maintenance checkups for all commercial HVAC systems.

As described above, selecting the most energy-efficient HVAC and dehumidification systems is highly dependent on operational factors, including the size of the facility and the budget. Below are some general energy efficiency recommendations:

- For very small facilities, mini-split systems are a highly efficient HVAC option.
- For larger facilities, variable refrigerant flow and chilled water systems offer higher efficiency and redundancy.
- If using standalone dehumidifiers, cultivators should consider pints per kWh when evaluating for efficiency. Cultivators should also pay attention to performance curves – dehumidifiers are rated at Association of Home Appliance Manufacturers (AHAM) standards of 80 degrees and 60 percent humidity, but some manufacturers publish output at 86 degrees and 80 percent humidity, which can be misleading if it not being compared using a common reference.
- Hot water and heat recovery are the two most efficient choices for reheat dehumidification.
- Desiccant dehumidification is highly efficient but costly.
- Cultivators should seal spaces to reduce CO_2 exhaust, improve biosecurity and reduce odors emanating from the facility.
- Cultivators should keep rooms warmer at night to manage latent load.

Cultivators should provide shade for rooftop units to reduce operating temperature and extend life.

Resources:

ASHRAE, Air Conditioning, Refrigeration and Heating Institute, See sample Preventative Maintenance schedule in appendix.

ENERGY SUPPLY

OVERVIEW

While the previous section discussed best practices pertaining to energy demand reduction, a comprehensive energy management strategy should also consider opportunities for supply-side improvements. Nearly all cultivation facilities in Denver receive electricity directly from the grid. For Xcel Energy customers, this means that the electricity being consumed in Denver facilities is generated using a mix of technologies as outlined below.

Table 4: Xcel Energy - Power Supply Mix for Colorado Customers

XCEL ENERGY - 2017 POWER SUPPLY MIX FOR COLORADO CUSTOMERS[6]		
	TOTAL GENERATION MIX (%)	MEDIAN LIFECYCLE CO_2 EMISSIONS (GRAMS/KWH)[7]
Coal	44%	1001
Natural Gas	28%	469
Wind	23%	12
Solar	3%	46
Hydroelectric	2%	4
Other*	0%	-
**Includes biomass, oil and nuclear generation*		

There are two primary approaches to supply-side energy optimization that cultivators should consider as part of a broader energy management strategy:

- **On-Site Power Generation:** One approach for facility managers looking to make supply-side improvements is on-site power generation. While a host of on-site generation technologies exist in the marketplace, two of the more common on-site options for cultivators to consider are solar photovoltaic (PV) and combined heat and power (CHP). While the economic, environmental and resiliency benefits of these technologies will vary depending on facility-specific factors, one advantage all on-site generation options share is the elimination of transmission losses. Roughly 5 percent of grid-generated electricity is lost in the transmission and distribution process.[8] Onsite renewables such as PV may only offset 10 percent to 15 percent of a facility's energy consumption, unless an area other than the roof footprint of the cultivation building is available to host PV panels.
- **Off-Site Optimization:** The second approach is entering into an alternative energy supply contract with a utility company. As discussed more specifically in the topic breakout, Denver businesses have multiple clean energy procurement options. While utilizing this approach does not typically have the same economic or operational benefits associated with on-site generation, off-site optimization likely represents the simplest alternative for cultivators looking to reduce the environmental impact of their facilities.

As with the demand reduction strategies presented in the previous section, there is not a one-size-fits-all solution to supply-side energy management. While the following best practices are intended to provide a starting point for discussion, facility managers are strongly encouraged to consult with a licensed professional prior to acting.

[6] Xcel Energy - Energy that Works for Colorado

[7] IPCC Renewable Energy Sources and Climate Change Mitigation

[8] U.S. Energy Information Administration

REGULATORY DRIVERS

Denver does not have regulations that place special conditions on energy use for cannabis businesses. However, other local jurisdictions have passed requirements for renewable energy use and/or offset purchases, and it is expected that this type of regulation will become more popular as municipalities in California and across the U.S. develop regulations for the cannabis industry.

Boulder County Marijuana Licensing requires commercial marijuana growers to either offset electricity use with renewable energy or pay a 2.16-cent charge per kWh. Proceeds from this required fee will be funneled to the Boulder County Energy Impact Offset Fund. This fund is used to educate and encourage best cannabis cultivation practices regarding energy use, and to fund other carbon offset projects such as the development of more renewable energy.

ON-SITE POWER GENERATION

Power generated on-site, commonly referred to as distributed generation (DG), can deliver economic, environmental and operational benefits to cultivation facilities in certain situations. Two DG technologies cultivators should evaluate are solar photovoltaic arrays (Solar PV) and natural gas cogeneration systems (Combined Heat & Power or CHP). While these on-site generation options can result in excellent returns for facilities, implementation is a complex process and requires technical expertise, detailed coordination with the local utility and careful financial planning. Cultivators should consult with an experienced technical specialist as part of the assessment process.

Sustainability Aspects and Impacts

- GHG emissions
- Land use
- Climate
- Regional stakeholder alignment
- Employee well-being
- Operational and compliance budgets

Process Description

Performing a desktop feasibility study (also known as a qualification study) is typically the first step in the on-site power generation procurement process. Facility managers should retain a technical specialist to perform this study, which is provided free of charge by many on-site power generation specialists. While there are many approaches to desktop feasibility studies, the process typically requires facility managers to fill out a brief survey and provide six to 12 months of utility bills. Using this information, specialists can build a high-level model that provides a "ballpark" economic, environmental and operational impact assessment.

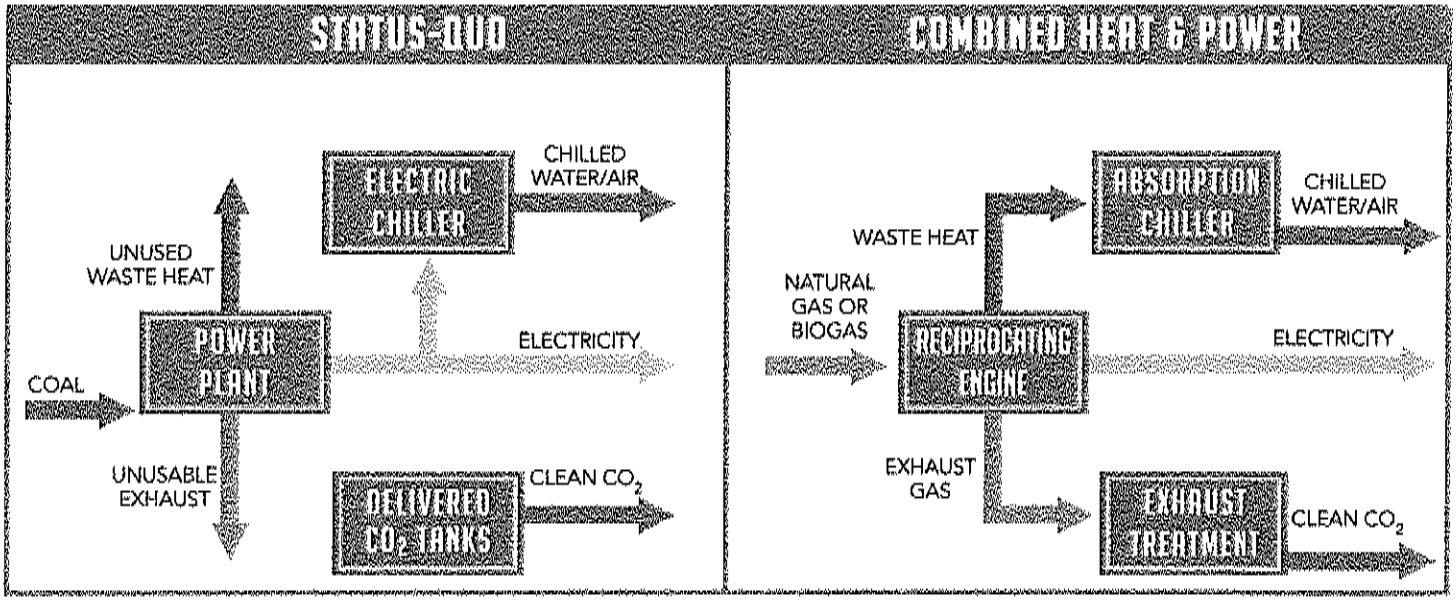
If the desktop feasibility study indicates an attractive value proposition, the next step is performing a Level 1 Feasibility analysis. The EPA provides a sample Level 1 Feasibility Analysis for facility managers to review in the event a project proceeds, a Level 2 Feasibility Analysis is subsequently performed. During this process, project-specific design engineering is accomplished, equipment options are formally evaluated and detailed financial analysis is completed. Following the conclusion of the Level 2 Feasibility Analysis, the project team is typically ready to submit necessary permits, with construction beginning shortly thereafter.

Financial planning for cannabis businesses can be different from traditional businesses. Many financial stimuli from local, county, state and federal entities exist to accelerate the adoption of energy efficiency measures and renewable technologies, and they should be thoroughly leveraged. However, for a cannabis business it would be wise to consult with financial specialists before making assumptions about tax treatments with regard to renewable investment tax credits, utility rebates and operating expense deductions versus capital expenses (depreciation).

Table 5: No-Carbon and Low-Carbon Energy Sources for Cultivation Facilities

ENERGY TYPE	NOTES
Solar PV	Solar Photovoltaic Systems (Solar PV), convert sunlight into usable electricity. Solar panels use sunlight to generate electricity, and inverters convert that electricity from variable direct current (DC) to alternating current (AC) at the correct voltage, frequency, and phase needed to tie into the facility's electrical infrastructure and the larger electrical grid. For cannabis cultivation facilities, these systems will most frequently be installed on the building's roof, though some properties might be able to benefit from solar system installed on the ground (ground-mounted) or in the facility's parking lot. Because the economic returns from on-site solar systems are typically dependent on utility-specific regulations, facility owners should consult with utilities prior to project design.
Cogeneration (CHP)	CHP systems use a natural gas generator (engine, turbine, or fuel cell) to produce electricity and repurpose the waste products to offset the facility's HVAC and CO_2 needs. When done properly, this process can reduce a cultivation facility's emissions footprint by 25 percent to 45 percent, generate attractive economic returns and serve as reliable source of power during grid outages. While CHP systems offer an exciting value proposition, these systems also feature comparably complex technology and require significant technical expertise throughout the design, build and maintenance phases. Cultivators looking to benefit from CHP technology should enlist a qualified third party to guide the process.
Wind	Small wind turbine systems can be installed alone or in conjunction with solar photovoltaic systems. The small size and variability of energy produced by these systems makes them most applicable for supplementing another power source. The amount of energy small wind turbines can provide depends on the site, size and height of the turbine, but small wind systems for commercial buildings typically generate 20 kilowatts to 100 kilowatts. To determine the amount of wind energy available at a site, installing an anemometer for at least 12 months prior to system purchase is recommended. Wind power is not commonly used in metropolitan areas as permitting and conformance with local zoning and building codes may prove challenging.

Figure 2: Comparison of energy inputs and associated outputs of standard or grid energy use versus a Combined Heat and Power (CHP) system.



Resources:

- National Renewable Energy Laboratory - Solar Energy Basics
- Environmental Protection Agency - CHP Benefits
- National Renewable Energy Laboratory – Commercial & Industrial Solar Best Practices
- U.S. Environmental Protection Agency - CHP Project Development Steps
- Xcel Energy - Distributed Generation Guidelines
- Boulder County Marijuana Energy Impact Offset Fund

OFF-SITE ENERGY SUPPLY

An alternative for cultivators looking to reduce the environmental footprint associated with electricity production is to explore off-site energy supply opportunities. Denver facilities served by Xcel Energy should investigate the Solar Rewards Community program, commonly referred to as solar gardens.

Program Description

Colorado was the first state to offer community solar opportunities for customers of investor-owned utility companies, and Denver grow facilities can benefit from renewable energy production situated and managed offsite. Customers "subscribe" to a portion of the solar array and benefit from the array's output over medium- and long-term contracts. Any entity with an Xcel electric account can benefit from this arrangement, including building owners, renters or managing parties. Recently, community solar developers have been hesitant to contract with the cannabis industry. It is important to continue reaching out to developers to assist in the evolution of this portion of the clean energy industry.



Sustainability Aspects and Impacts

- GHG emissions
- Land use
- Climate
- Regional stakeholder alignment
- Operational and compliance budgets

Best Practices

In Denver, electricity consumers can also choose to independently contract with the owner/operator of a qualified solar array. Under this arrangement, a third party builds a community solar system and sells the electrical output to Xcel. Xcel then credits the customer for that electricity on the customer's monthly electric bill, commonly referred to as net-metering. It is important to note that cultivators may or may not save money by participating in this arrangement, as agreements are made directly with the owner of the community solar array. The utility simply acts as a facilitator in this arrangement. Contracts are generally longer-term, where monthly electric savings outweigh financing costs leading to positive cash flow for the customer.

Resources:

- Xcel Energy - Community Solar Program
- Colorado Energy Office Community Solar Information

WATER USAGE & QUALITY

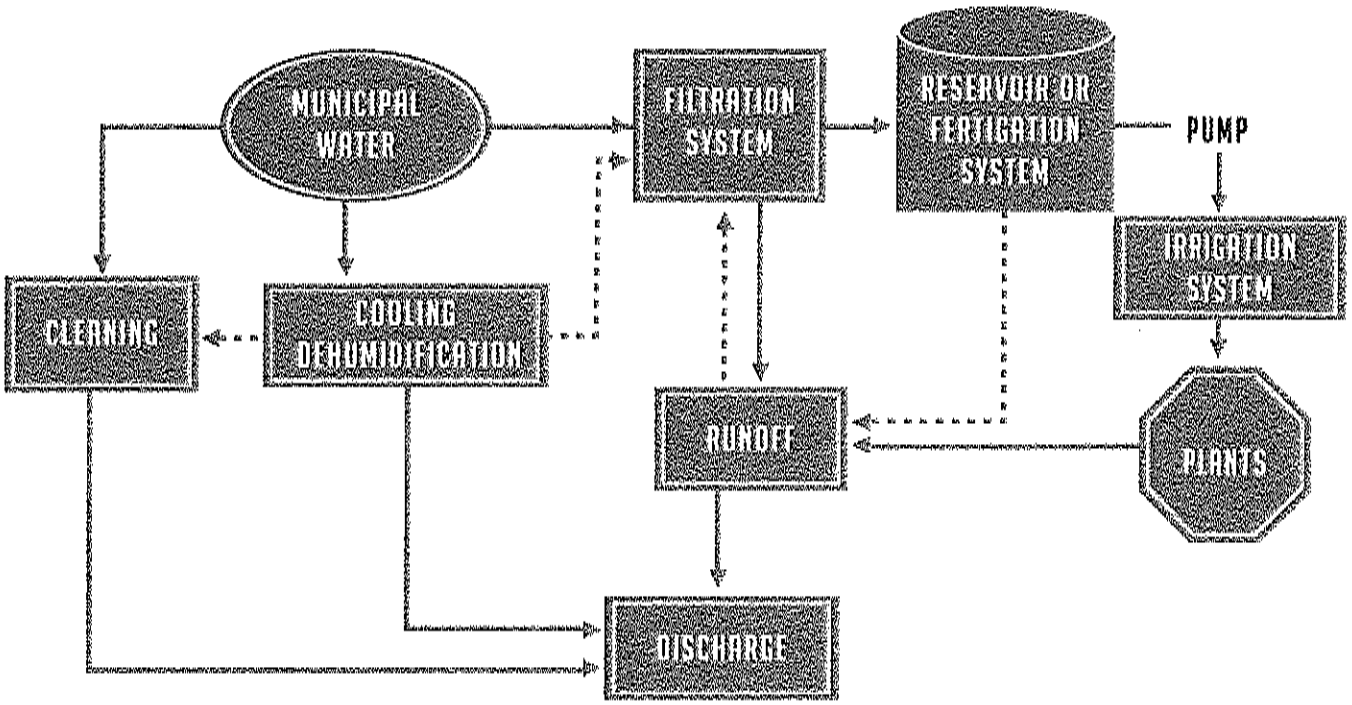
WATER OVERVIEW

Indoor cannabis cultivation within Denver and surrounding municipalities is currently reliant on the municipal water distribution system for irrigation and operational effluent discharge. As such, there are specific process points of environmental impact, including net consumptive use (influent - effluent), filtration and treatment, and effluent discharge water quality.

In general, the environmental impacts of municipal consumptive water use include state-specific issues such as increased urban demand resulting in reduced water availability for rural agricultural production and associated watershed impacts, water-energy nexus concerns and indirect carbon emissions associated with municipal water treatment systems. In addition, for indoor cultivation operations, influent filtration and treatment requirements result in solid waste generation, energy consumption and efficiency challenges, while effluent water quality is impacted as a result of the agricultural inputs required for cultivation. The flow of water through a typical indoor cannabis cultivation is presented below.

While consumptive water use and water quality have been preliminarily identified as significant aspects for indoor cannabis cultivation, it is important to note that these concerns are not unique to the cannabis sector. Neither a sector-specific water use baseline nor production unit theoretical minimum is currently available. However, the implementation of proactive operational efficiency and monitoring practices can readily address the potential water use and quality environmental impacts, while setting the stage for leadership in process integration of progressive technologies for use and cost optimization.

Figure 3: Water Flow for Cannabis Cultivation Facilities



The sustainability impacts of water use and quality include:

- **Economic Competitiveness** - The introduction of water use efficiency measures can lower operational costs by reducing direct resource purchase (i.e., lower volume equals lower cost). In addition, water use efficiency may also result in lower levels of consumables use due to a reduction in influent treatment volume and less wear and tear on process equipment.
- **Community Relations** - As discussed above, concerns about municipal consumptive water use in Colorado include increased urban demand resulting in reduced water availability for rural agricultural production and associated watershed impacts, increased energy usage for operational influent treatment and indirect carbon emissions associated with municipal water treatment systems. By proactively integrating water use efficiency techniques and effluent water quality monitoring, a cannabis cultivation operation can demonstrate the commitment to integrated resource management and community partnering that is required to cultivate strategic relationships with municipal leadership and neighborhood residents – while anticipating regulatory changes.
- **Environmental Impact** - Water and energy are inextricably linked, as there is a significant amount of energy embedded in the water supply due to factors intrinsic to the water and energy infrastructure. Water and wastewater utilities account for approximately 5 percent of overall U.S. electricity use, resulting in significant GHG emissions.[9] In addition, regional water resource concerns – such as loss of agriculture in rural areas and biodiversity and watershed impacts of piping water outside of its native watershed – are of increasing concern. As such, introducing efficiencies in water use and quality can result in quantifiable reductions in GHG emissions and watershed impacts.

The following topic-specific sections will provide guidance and recommendations for water filtration and purification, irrigation methods and automation, wastewater recycling and improving wastewater quality for an indoor cultivation facility.

REGULATORY DRIVERS

Cannabis facilities in Denver receive water and wastewater service through Denver Water and Metro Wastewater, respectively. Fees from both services are based on incoming water usage and are generally combined into one monthly bill issued by Denver Water. For 2017, the combined rates for water and wastewa ter are $6.88 per 1,000 gallons. Higher summer water use may result in higher-tier charges. Metro Wastewater currently does not require any pre-treatment of effluent for cannabis facilities.

[9] Electric Power Research Institute (EPRI). 2002. "Water and Sustainability (Volume 4): U.S. Electrical Consumption for Water Supply and Treatment - The Next Half Century. See also https://www.theclimateregistry.org/



Recapturing and reusing water within a facility's watering process is allowed and can be very beneficial for water efficiency. Conversely, facility water reused for alternate purposes is considered Graywater and is only allowed in specific instances, such as for using as wash water for outdoor irrigation on non-consumable plants. Review City of Denver Graywater Regulations prior to any possible greywater application.

Rainwater capture for indoor water use is not allowed, nor is it permitted to dump any liquids (or materials) down storm drains. Nothing is allowed in storm drains except rainwater and snowmelt. Storm drains empty directly into local waterways.

Best Practices

Industry best practices for water use span from tap to drain and can substantially reduce water needs while improving water quality. Many practices can be instituted regardless of specific growing or watering procedures.

WATER FILTRATION & PURIFICATION

To meet the demands of rapid maturation and high yields for indoor cannabis production the applied water must meet strict specifications. A cultivation facility's incoming water – regardless of whether it is tap water or well water – should be tested by a trusted analytical lab, such as the Colorado State University soil and water testing lab, to understand if additional filtering is necessary prior to plant application. Similarly, excess process water captured via flood trays or through HVAC condensate will exhibit different characteristics, requiring the need for analysis and purification before subsequent applications. There are multiple ways to improve the quality of incoming water including carbon filtering, reverse osmosis and UV sterilization.

Sustainability Aspects and Impacts

- Water conservation
- Water quality
- Regional stakeholder alignment
- Operational and compliance budgets

Process Description

According to the Colorado State University Cooperative Extension, irrigation water should be evaluated for four basic criteria:

1. Total soluble salt content (salinity hazard).
2. Relative proportion of sodium cations (Na+) to other cations (sodium hazard).
3. Excessive concentration of elements that causes toxicity or ionic imbalance in plants.
4. Bicarbonate anion (HCO3-) concentration as related to calcium (Ca++) plus magnesium (Mg++) cations.

When it comes to a facility's incoming water supply, salinity hazards and sodium hazards are of particular concern. Generally, incoming water will not meet the strict specifications for optimal plant growth, therefore, some level of purification is needed. Water to be applied to plants should be purified and nutrified on demand or purified and held in storage tanks until nutrients can be added prior to application to the crop. Water can be purified using several different methods including carbon filtration, reverse osmosis and UV sterilization.

Best Practices

When considering environmental inputs, water treatment using carbon filtration has emerged as the most efficient method to reduce contaminants – such as chlorine, chloromine, sodium and bicarbonate levels – in a facility's incoming water. Carbon filters are very effective at achieving the desired nutrient load for cannabis plants when filtering is performed according to manufacturer's specifications. Additionally, filtering leads to very low levels of waste. Only water used to periodically clean filters is disposed of, whereas sterilizing water through reverse osmosis generates substantial water losses in the brine byproduct.

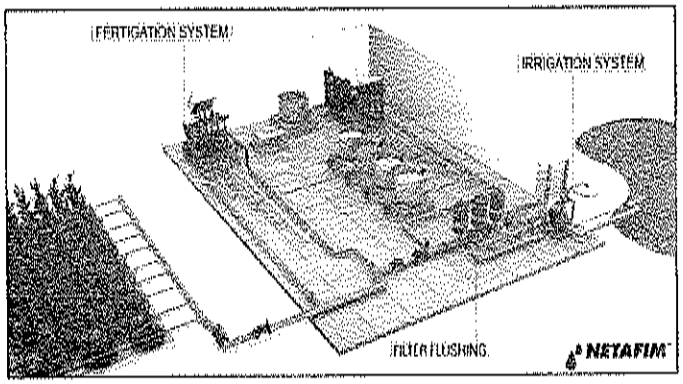
Resources:

- Colorado State University - Soil and Water Testing Laboratory
- Denver Water Quality Reports
- Example of water testing report

IRRIGATION METHODS & AUTOMATION

Accurate irrigation is essential to the growth of healthy plants and the overall performance of a cultivation facility. Inefficient water use not only wastes this precious resource, but can cause facility damage by encouraging fungal growth, create worker safety hazards and add extra load to the HVAC system, wasting energy. A variety of irrigation methods are used in today's cannabis industry. Selecting both the right method for a given facility and following good operational practices for that method are equally important for achieving optimal efficiency and plant growth.

Figure 4: Irrigation & Fertigation System Diagram. Source: Netafim



Sustainability Aspects and Impacts

- Water consumption
- Water quality
- Pest control

Process Description

Seven different methods are commonly used in indoor cultivation facilities: flood tables, aeroponic systems, wick systems, nutrient film technique (NFT), water culture systems, drip irrigation and hand watering.

Flood Tables

Flood tables are very popular in agriculture and horticulture greenhouses. Generally used with seed trays, plug trays or small pots, flood tables (also known as ebb and flow tables) work by periodically flooding the entire tray with nutrients while pots wick up the water through the drainage holes. This method can be more difficult with large pots. Most often with the flood method, tray water not absorbed by the plants is run through a pipe to a holding tank to be re-used. Typically, the recycled water will be treated to kill any waterborne plant pathogens (i.e., Pythium, Phytopthora, Fusarium), which can be done chemically or through UV light exposure. Flood tables use a lot of water per irrigation cycle, so this method is best used when the majority of the water will be absorbed or when the cultivator is prepared to sanitize, re-nutrify and re-use the water. Flood tables are often used with rock wool mediums and the runoff is captured in a tank directly below the tray to be sanitized and re-nutrified in place.

Aeroponics

Many cultivators use aeroponic systems such as an EZ-Clone machine for propagation. Aeroponic systems utilize spray nozzles to mist the stem or roots with a nutrient solution. Cultivators using large-scale aeroponic systems are more likely to use a channel system in which the roots of many plants are enclosed within a channel and spray misters line the inside of the channel. Another method is the bucket system, in which nutrified water and air are maintained in buckets into which the roots grow.

Wick Systems

Using a wick, the plants pull nutrient solution up from a reservoir through capillary action. This system is better suited for smaller plants. Heavy feeders like cannabis can lose weight and yield if the wicking process is too slow.

NFT Systems

The Nutrient Film Technique (NFT) consists of a very shallow nutrient solution that cascades downward in a tube or tray toward the reservoir where it is reused. It is most commonly used on smaller plants with a short crop cycle, and cannabis plants are very sensitive to interruptions in electricity and the water cycle. This system also allows only a relatively small space for cannabis roots to thrive. An overcrowding or overgrowing of roots in these systems can lead to disease and loss of crops.

Water Culture Systems

In water culture systems, the plant is held in a basket just above the nutrient solution and the roots hang down into the nutrient solution. The roots do not suffocate because the reservoir is continuously aerated. This allows the plant to receive an ideal amount of nutrients as well as oxygen.

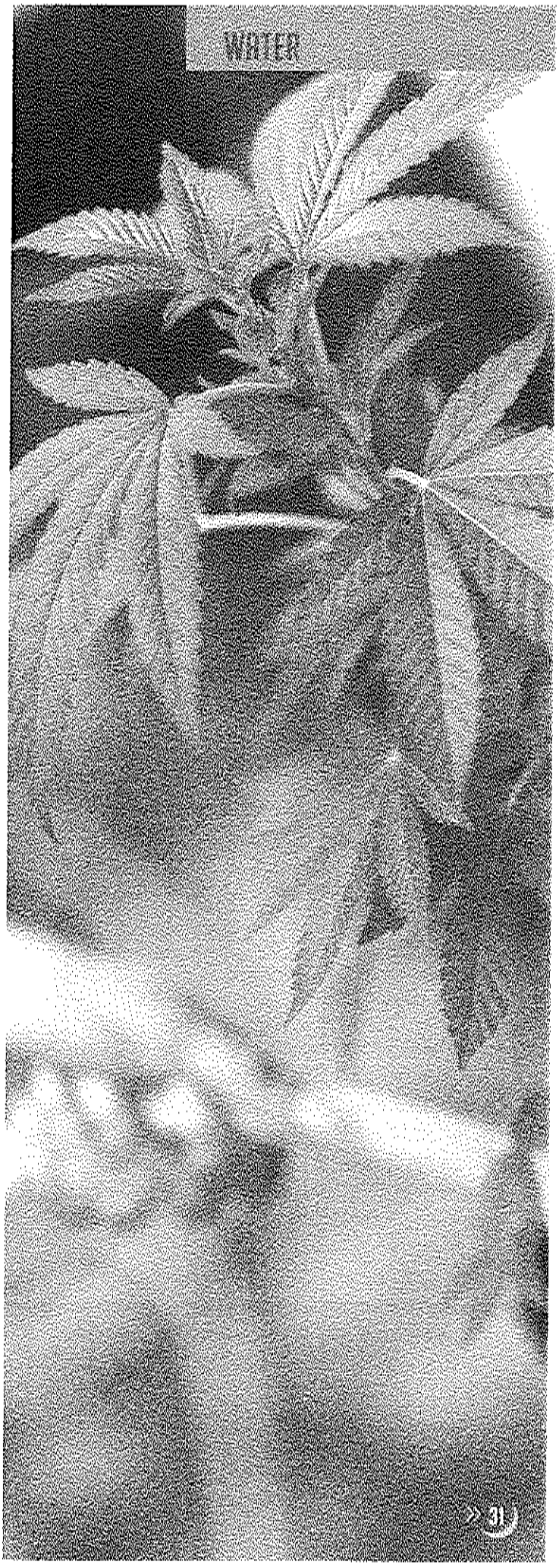
Hand Watering

Watering by hand using hoses or watering cans is probably the most common watering method currently being used. Many growers prefer the hands-on aspect of hand mixing and hand feeding each plant. However, this method allows for the largest margin of error. Nutrient mixing by hand can easily vary by day or by employee, leading to inconsistent final solutions. The total volume of water being applied to each plant can vary greatly, especially if staff are inattentive.

Nevertheless, most cultivation operations use the hand watering method at some stage of plant growth. Cultivators must have good standard operating procedures and employee training for hand watering to minimize mistakes.

Drip Watering

Drip irrigation is widely considered the most water efficient way of irrigating a crop. Nutrified water is pumped through irrigation tubes and drip emitters to each plant. Many options exist for flow volumes and types of emitters. Cultivators should consult with an irrigation specialist to help determine the correct emitter based on water pressure, length of irrigation runs, container sizes, number of plants to be irrigated at once, etc. Drip irrigation allows the cultivator to fine tune how much water is given to each plant. High-quality drip emitters are pressure compensated, so each plant gets the same amount of water regardless of position on the irrigation line. Many cultivators using drip irrigation systems water several times per day (pulse irrigation), delivering the total desired volume of water over a longer period. This allows the cultivator to carefully manage the amount of water runoff. Drip irrigation is usually accompanied by a fertigation system that automatically injects nutrients into the water line according to specifications and can be run on programmed time schedules.



Best Practices

The selection of watering methods is highly influenced by an individual cultivator's personal preferences, as the benefits and drawbacks of each method are varied. It is generally recommended to select the most efficient method(s) that fit within the budget and expertise of facility staff. However, any facility exceeding 2,500 square feet in size should seriously consider an automated watering system. Clear standard operating procedures and frequent training of staff with irrigation responsibilities are essential to ensuring that the chosen system operates optimally.

Table 6 below highlights some of the benefits and drawbacks of the three most commonly used irrigation methods:

Table 6: Irrigation Methods for Indoor Cannabis Cultivation

IRRIGATION METHOD	EFFICIENCY	BENEFITS	DRAWBACKS
Hand Watering	Low	• Eyes on all plants during watering • Gives grower "hands on" feel	• Inconsistency of volume per pot • Inconsistency between employees responsible for task
Drip	High	• Automated • Precise volume of water • Allows cultivator to water a large number of plants at once	• Potential clogging of dripper • Manual inserting/removal of dripper when moving plants • High cost to install and maintain
Flood Tables	High	• Automated • Less chance of under-watering plants • Easy and inexpensive to build	• Large amounts of water used at once • Increased humidity if reservoirs do not have lids • Manual labor to clean and refill reservoirs

Automation

Automated watering systems are highly recommended to help control accuracy and efficiency and to increase data collection as well as the ease of mining that data. Cultivators mining the most data for anomalies, efficiencies and tracking will continue to stay on the cutting edge of the industry. Automated data collection insures real-time data is collected daily. Several major manufacturers currently offer environmental and fertigation packages that tie into one software program, allowing for a streamlined data collection process and easy, intuitive data mining. Production is all about repeatability, and data collection helps insure repeatability. Data collection also helps improve procedures by targeting issues and concerns.

Measurement

The water applied to plants should be measured during each phase of growth. This is most easily achieved when using an automated watering system as described above. Similarly, cultivators should measure runoff to ensure that water is not being wasted, and should set a low runoff target. Ten percent to 15 percent runoff per watering event is an efficient and achievable target. Ongoing measurement against this target will help maintain overall water efficiency and identify factors that affect water use, such as employee turnover, schedule changes and equipment changes.

Electrical Conductivity

Many growers are feeding plants based on specific electrical conductivity (EC) levels identified by the nutrient line they are using. It is important to frequently monitor the EC levels of both the nutrient water being given to the plants and the EC level of the planting medium. Cultivators have had success with very high EC levels and very low EC levels.

- Averages for vegetative growth: 1.0-2.5 EC.
- Averages for flowering growth: 2.0-4.0 EC.

Growers should test runoff frequently to determine if any salts are building up in the medium. Total volumes of water applied to the plant to create run-off may hinge on these numbers. If the plants are able to absorb all water provided, frequent flushing may not be necessary.

Resources:

Hydroponic and aeroponic system resources:

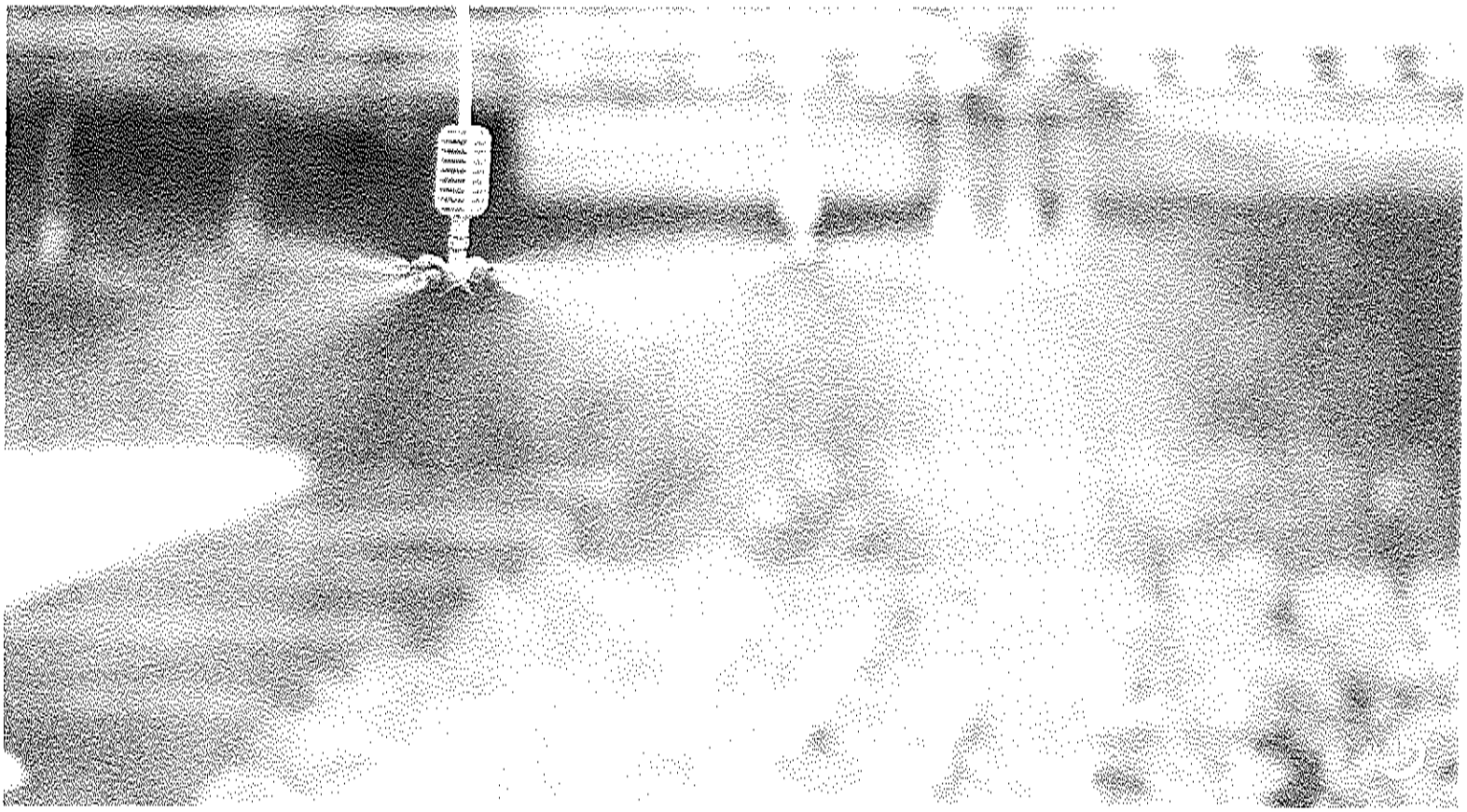
- Home Hydro Systems - Aeroponic Systems
- How to Grow Marijuana - Aeroponics
- Current Culture H20 - Hydroponic System Info

Drip irrigation resources:

- Irrigation Tutorials - The Basic Parts of a Drip System
- Irrigation Tutorials - Drip Irrigation Design Guidelines

Procedure for flushing plants:

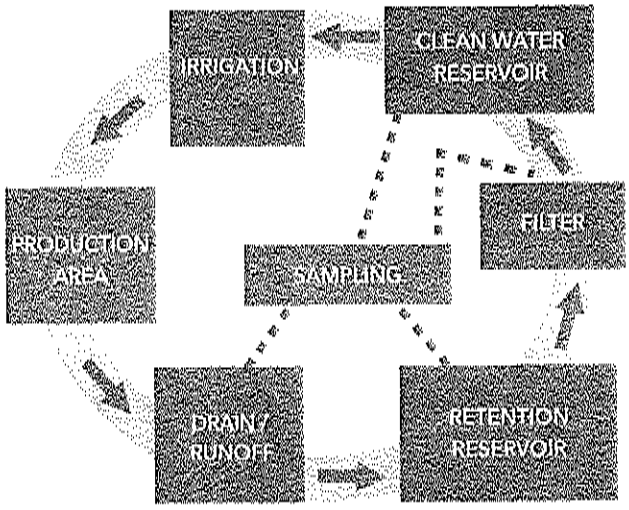
- American Agriculture - Flushing Potted Plants



WATER RECYCLING

The agriculture industry by nature requires significant amounts of water, which may stress local watersheds. Indoor agriculture is similarly water intensive, yet cultivating cannabis in controlled indoor environments provides multiple opportunities for water efficiencies and water recycling. Indoor cultivation rooms can be thought of as closed systems for water use. Virtually all excess water runoff and water vapor can be captured and delivered back to the beginning of the watering process.

Figure 5: Irrigation water recapture process



Note: This water re-use practice is not to be confused with Denver's updated graywater regulations. Graywater – which includes wash water, shower water and sink water – can only be applied to outdoor landscapes, not re-used indoors nor applied to consumable crops.

Sustainability Aspects and Impacts

- Water consumption
- Water quality

Process Description

Water applied to cannabis plants through hand watering, flood trays or drip methods can be easily captured in two complementary ways. First, applying water onto plants generally produces some amount of excess water which can be captured and piped back to water storage tanks. This excess water should be filtered and sterilized again to avoid contaminants and then stored for the next round of watering.

The second water recycling method involves capturing HVAC condensate. Healthy cannabis plants naturally transpire a majority of the applied water after each watering cycle through the photosynthetic process. This water vapor passes through the cultivation room's HVAC equipment and is expelled to the outdoor environment. While passing through a cooling, ventilation and/or dehumidification unit, the water vapor condenses back to relatively clean liquid water and can be easily directed to a facility's water storage area to begin the water process anew.

Best Practices

Water should not be a single-pass ingredient for cannabis production. Cultivation facilities equipped with water storage can easily incorporate water recapture methods into existing cultivation practices. Water can be captured as follows:

- As excess runoff while watering: Best accomplished when all runoff water is contained in drain lines or ditches.
- As HVAC condensate and dehumidification water: Very clean (almost reverse osmosis quality) water that most cultivators are not taking advantage of.
- Through piping: This method can be somewhat costly, compared to the cost of water, but well worth the investment, especially when there is a need to dilute captured nutrified water from other areas of the facility.
- Through a sediment filter: This method removes much of the larger-sized organic and inorganic material from the water.
- Pipe captured water to a holding tank.

Recaptured water must be purified again. There are several options available, but selection should be based on what the cultivator is trying to remove from the irrigation water. Cultivators should look for technologies that kill waterborne pathogens such as Pythium, Phytopthora, Fusarium and Rhizoctonia. Options include:

- UV technologies, which are very popular in the greenhouse/nursery industry.
- Copper technologies, which are helpful for use against pythium and phytopthora.
- Electrochemically Activated Water (ECA).
- Water storage located immediately above-stream of the water filtering process.

Subsequent rounds of watering should first be pulled from this storage tank before requiring any new "tap" water to be drawn. This recaptured water can make up the vast majority of the next watering cycle's water.

Resources:

- DDPHE Rules and Regulations Governing Graywater Treatment Works
- Greenhouse Management - 10 Tips for Recycling Irrigation Water
- Greenhouse Product News - Grower 101, Water Disinfection
- Greenhouse Management - Disinfecting Recycled Irrigation Water
- Clean Water 3 - Treatment Technologies

Examples of UV purification products:

- Hortimax Growing Solutions
- Superior Aqua Systems

Examples of copper purification products:

- Aqua-Hort
- Priva Vialux Line Water Disinfection

Examples of ECA products:

- Horti-Daily
- Royal Brinkman

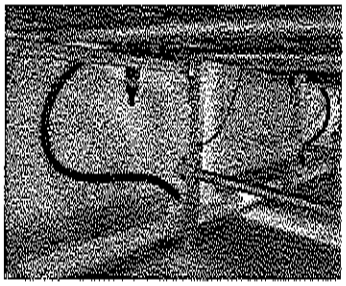


Figure 6: Example of piped drainage from trays

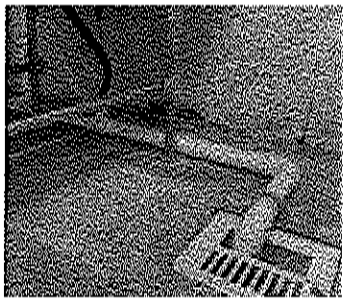


Figure 7: Piped drainage running into floor sink

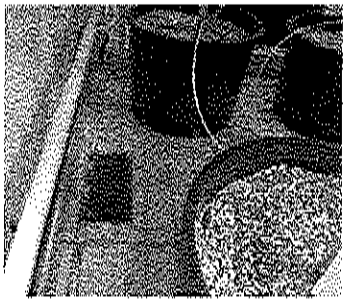


Figure 8: Example of coarse filter on tray to keep large debris out of recycled water

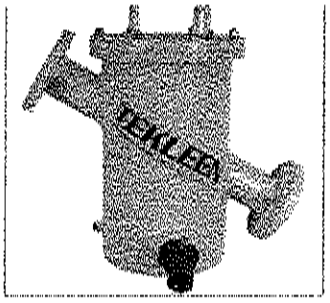


Figure 9: Sediment Filter

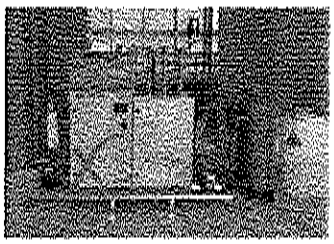


Figure 10: Hortamax Vitalite UV Filter

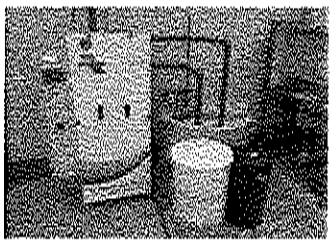


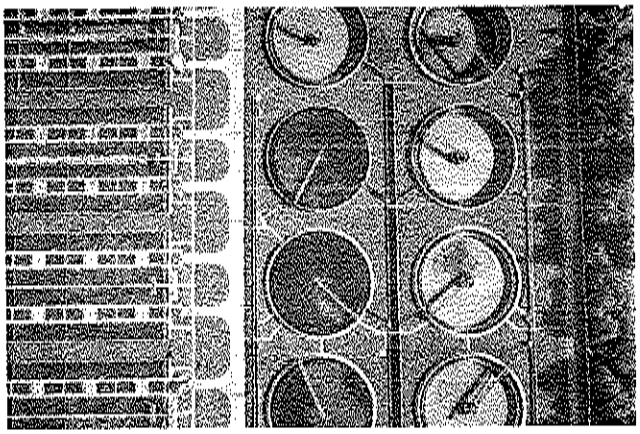
Figure 11: Brinkman ECA System

IMPROVING WASTEWATER QUALITY

Certain practices in cannabis production can lead to unintended high levels of contaminants in a facility's wastewater discharges. Such contaminants can add stress to treatment facilities and may be largely unnecessary.

Sustainability Aspects and Impacts

- Water quality
- Water consumption
- Indoor air quality
- Employee well-being



Process Description

Purifying water using reverse osmosis generates significant volumes (at least a 1:1 wastewater to water ratio) of brine which must be discarded to sanitary drains. The concentration of brine (high in salts and minerals) creates difficulties in removal at water treatment plants. It is best to avoid the reverse osmosis process altogether and use other water filtration methods (see Water Filtration and Purification above).

High concentrations of cleaning agents in wastewater are difficult to process as well. When cleaning cultivation rooms and associated equipment, cultivators should use cleaning products according to the manufacturer's specifications. Concentrated cleaning solvents should be diluted appropriately as described on the label. A higher concentration of solvent does not necessarily clean better and will lead to poor indoor air quality and difficulties in processing the wastewater.

Best Practices

Cultivators should:

- Use cleaning products as directed; dilute concentrated products according to the intended cleaning purpose on the label.
- Use environmentally friendly cleaners such as those rated by Green Seal, Eco Logo or Safer Choice.
- Use filtration for water purification to avoid significant water discharges from reverse osmosis.
- Use water nozzles for any cleaning operations to avoid excess water use.
- Avoid over-watering crops as this can lead to unintended high levels of chemicals and suspended solids in sanitary drains.
- Refrain from dumping any liquids into storm drains.

Resources:

- Green Seal
- Eco Logo
- EPA Safer Choice

Additional Considerations

Storm drains empty directly into local waterways. There is no treatment to storm drain effluent. In fact, by law nothing is allowed to be dumped down storm drains – only rainwater and snow melt. Cultivators can help keep local streams clean by not dumping into storm drains, keeping property free of litter and using dry, absorbent cleanup methods for liquid spills outdoors.

WASTE MANAGEMENT & DIVERSION

OVERVIEW

The cannabis industry generates waste and can benefit from the adoption of sustainable waste management practices. Currently in Denver, landfilling is the main form of waste disposal with recycling and composting used to a lesser extent. Therefore, cultivation facilities should aim to reduce, reuse and recycle as much as possible. Cannabis operations should consider the sources of the resources used and purchase items that are made from natural, compostable or recycled materials, when available. The industry can further reduce the waste generated and landfilled by designing compliant packaging that minimizes materials or by implementing package collection.

The sustainability impacts of waste management and diversion include:

- **Economic Competitiveness:** Operational efficiencies required for overall solid waste reduction result in budget optimization through reduced raw materials procurement and disposal costs. Reduction of raw material use and material re-use results in consumables reduction and solid waste output reduction. This waste reduction is linked to water and energy usage levels, so the implementation of efficiency strategies for the water and energy sustainability factors can result in lower consumable use and subsequent solid waste reduction.
- **Community Relations:** Waste reduction and diversion creates a point of outreach with the community by reassuring neighborhood residents that a cannabis cultivation operation is a responsible environmental partner, committed to the health and well-being of the local area. In addition, because land use impacts and GHG emissions are reduced, a progressive solid waste management program can dovetail with municipal goals, such as the City of Denver climate, energy and land use sustainability goals.[10]
- **Environmental Impacts:** As water and energy are inextricably linked, consumable use reduction is enabled through optimization of operational processes related to water and energy, such as those discussed in the energy and water sections of this manual. In addition, waste reduction and diversion results in lower volumes of municipal solid waste (MSW) and subsequently lower embedded energy, landfill gas (LFG) emissions and landfill leachate.

Cultivation facilities' waste is mainly generated from agricultural inputs, equipment, and product packaging and can be categorized as either organic, recyclable, universal or hazardous waste. Though cannabis waste is strictly regulated, this section will outline compliance best practices that minimize the industry's environmental impacts from waste.

REGULATORY DRIVERS

Waste from cannabis cultivation facilities in Colorado is strictly regulated. Colorado's Retail and Medical Marijuana Rules include multiple provisions that either encourage or create challenges to reducing the environmental impact of waste from this industry. For example, the rules explicitly allow plant waste to be disposed of in a compost facility, encouraging that practice. On the other hand, the requirement to render plant waste unusable by mixing it with other wastes can create a barrier to composting if a facility does not have enough other compostable waste to mix with plant waste material.

Under Colorado Marijuana Enforcement Division regulations, after the marijuana waste is made unusable and unrecognizable, the rendered waste shall be:

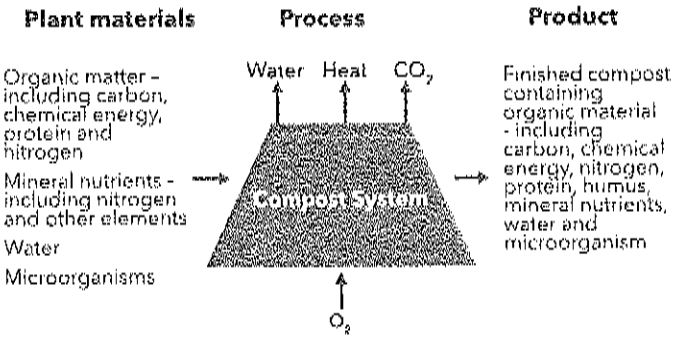
- Disposed of at a solid waste site and disposal facility that has a Certificate of Designation from the local governing body.
- Deposited at a compost facility that has a Certificate of Designation from the Department of Public Health and Environment or...
- Composted on-site at a facility owned by the generator of the waste and operated in compliance with the Regulations Pertaining to Solid Waste Sites and Facilities (6 CCR 1007-2, Part 1) in the Colorado Department of Public Health and Environment (CDPHE).

[10] Denver 2020 Sustainability Goals.

ORGANIC WASTE MANAGEMENT

Organic wastes represent a significant component of the cannabis production waste stream. Unusable plant material, soil and other growing media, paper and food waste are all compostable in commercial compost facilities. Alternatively, plant and food waste can be processed on or off site using Bokashi fermentation. In either scenario, separating these materials from the general waste stream can present some logistical and compliance challenges. Careful implementation of best practices for organic waste management can reduce the environmental impact of a facility by creating valuable agricultural inputs while maintaining compliance.

Figure 12: Composting process diagram



Sustainability Aspects and Impacts

- Land use
- Solid waste
- Operational and compliance budgets
- Climate
- GHG emissions

Process Description

Bokashi Fermentation

Plant waste can be treated onsite using the Bokashi method, an acidic anaerobic fermentation process. To take advantage of Bokashi fermentation, the marijuana waste must be made "unusable and unrecognizable" on the licensed marijuana cultivator's property by grinding the waste and letting it fall into a 55-gallon drum or other similar container that is capable of becoming air-tight when closed, adding additional material to achieve a 50 percent marijuana-waste mix, and adding Bokashi or other compost activator and water. It is important that the proportions of Bokashi compost activator to organic material and resulting pH of the mixture be correct. Otherwise, the material will fail to ferment and will rot.

Having been made "unusable and unrecognizable" the waste should be allowed to rest at the licensed facility, or be transported to an offsite facility. Micro-organisms contained in the Bokashi compost activator will quickly "pickle" the marijuana and begin breaking down the organic matter. After a two-week anaerobic (oxygen-free) fermentation period, the resulting liquid (probiotic tea) may be used as nutrient-rich fertilizer. The solid organic matter may be used as a soil amendment.

Bokashi fermentation can be done throughout the year and requires a very small footprint. It is easily scalable, produces neither heat nor gases, and eliminates nuisance factors linked to composting sites like odors and vermin. The fermenting container will not attract flies because it is kept sealed.

Bokashi fermentation remains a largely unknown technology with numerous nuances. It is also new to regulators such as Colorado Marijuana Enforcement Division (MED), Colorado Department of Public Health and Environment and Colorado Department of Agriculture (CDA) and carries additional regulatory requirements not expanded upon within this procedure. Cultivation facilities that are interested in adopting this new technology, and its technical and regulatory nuances, are advised to seek professional assistance.

Composting

Plant waste and other compostable wastes – including growing media, paper and food waste – can be diverted from the landfill through disposal with a licensed hauler to a commercial composting facility. Per MED rules, cannabis plant debris must be rendered "unusable and unrecognizable" before disposal. The most sustainable way to accomplish this is by grinding plant debris with paper or cardboard waste, growing media or soil. Once this has been done, plant debris can be composted by a licensed commercial composter.

Best Practices

Organic waste recycling through Bokashi fermentation on-site or through off-site composting are the two most sustainable options for managing organic waste.

Paper or cardboard that cannot be recycled due to contamination should be discarded with the compostable materials. Common sources include paper towels from restrooms, handwashing stations and kitchens, shredded paper, and soiled or wet cardboard. These materials can help contribute to compliance with MED requirements for mixing plant waste.

Cultivators should place separate receptacles for compostable waste throughout the facility anywhere the waste is generated. Cultivators should always include descriptive signage (photos of compostable materials are helpful), and it is generally a best practice to co-locate a compost bin with each trash and recycling bin.

Employees may not be familiar with composting practices. Providing a short training to all staff on which items belong in each bin is important to ensure that recyclable matter is not contaminated with other types of waste.

Additional Considerations

Incorporating composting into a facility requires an additional waste receptacle outdoors. Cultivators should ensure that there is adequate space for the receptacle and that it meets MED requirements for security and control requirements.

Marijuana waste that can support the rapid growth of undesirable micro-organisms should be held in a manner that prevents the growth of these micro-organisms as required by MED Rule R504 Health and Safety Requirements.

Resources:

Certifiably Green Denver Composting Resource Sheet

Bokashi Fermentation Method and Resources



UNIVERSAL & HAZARDOUS WASTE

Hazardous and universal wastes are present in most cannabis cultivation and extraction facilities. Reducing and managing these wastes can reduce risks to employees and the environment and is essential for maintaining compliance. Source reduction and substitution represent the best opportunities for reducing risk and saving money on hazardous waste management and disposal.

Sustainability Aspects and Impacts

- Materials use
- Water quality
- Employee well-being
- Operational and compliance budgets

Process Description

Regulatory requirements for any given business depend on the quantity of hazardous waste generated. Universal wastes are a subset of hazardous wastes that have reduced management standards as defined by federal, state and local laws, regulations, rules or other requirements. Most hazardous wastes commonly generated by cannabis facilities are considered universal wastes. These include mercury-containing lighting and ballasts, many types of pesticides or other chemicals used in the cultivation process, certain solvents or other chemicals used in the production of marijuana concentrate, marijuana soaked in a flammable solvent for purposes of producing a marijuana concentrate, electronics (e-waste) and batteries.

Cultivators must determine which regulations apply to the waste before disposal, including making a hazardous waste determination. Cultivators should consult with the Hazardous Materials and Waste Management Division's Customer Technical Assistance line at 303-692-3320 with any questions about hazardous waste. Hazardous wastes must be disposed of properly by a registered hazardous waste transporter shipping to a hazardous waste treatment, storage and disposal facility (TSDF).

CASE STUDY: LIVING SOIL AT DISTRICT 8

You can't produce high-quality cannabis without first starting with high-quality soil. District 8 is a provider of wholesale cannabis and hemp-wrapped blunts, and produces it all using a no-till, living soil method. Building a strong ecosystem within the soil allows them to grow their cannabis utilizing nutrients from natural systems that have already been shown to be effective through the Earth's ecological processes. Natural methods and beneficial organisms such as insects, fungi, and bacteria increase the health of the soil and nutrient content every harvest.

With ever-increasing soil health, District 8 is able to completely eliminate their soil waste and address one of the main industrial waste issues facing this industry. Living soil also benefits their plants and process by creating greater water infiltration and retention, greatly reducing their water usage and wastewater production. This method eliminates the need for artificial chemical fertilizers and uses only biologically proven processes. When they do need supplemental nutrients, they even go so far as to utilize ingredients from other industries' by-products and their very own compost.

This means they use 0 lbs of fertilizer a year and waste 0 lbs of plant and soil annually. This closed-loop system District 8 has created allows them to create less waste, use less water, lower their soil costs, and produce a more natural cannabis that is not only safe but high quality.

Any generation of regulated hazardous wastes must be disclosed to CDPHE. Cultivators must obtain an EPA identification number before wastes can be accepted for disposal by a TSDF.

Considerations:

Prior to beginning any marijuana-related operations, cultivators should consider the following:

- Is a plan in place for dealing with solid and hazardous wastes generated during operations?
- What quantities of waste will be generated and what are the various waste streams?
- If the operation is generating hazardous waste, has the cultivator determined which is the appropriate generator category and what rules may apply?
  - Conditionally exempt small quantity generator (CESQG).
  - Small-quantity generator (SQG).
  - Large-quantity generator (LQG).
- Is there a waste storage plan addressing storage methods and locations and length of time the waste may be stored?
- What readily available materials could be used to render marijuana plant material and marijuana products unusable and unrecognizable?
- Where will the waste be sent and how will it be transported?
- Will any composting of marijuana-related waste occur on-site?
- What licensing and permitting requirements will apply to this operation?

Best Practices

The best way to reduce the expense and risk associated with managing hazardous wastes is to reduce the amount of hazardous materials entering the facility. Opportunities for cultivators include:

- Planning usage of pesticides and chemicals.
  - Purchase materials in smaller quantities and buy no more than a one-year supply of product. This helps avoid excess material expiring or becoming obsolete as regulations change.
  - Preparing only the amount needed for each application.
- If applying or handling pesticides, lawfully adhering to all pesticide label instructions. It is also recommended that at least one employee has obtained a CDA Private Applicator license. More information can be found at www.colorado.gov/pacific/agplants/private-pesticide-applicators.
- Selecting ideal lamps and ballasts.
  - Purchase lamps and ballasts with the longest burn time possible to reduce the frequency of replacement.
  - Consider LED lighting, which does not become hazardous waste at the end of its life.
  - Recycle universal waste lamps, ballasts and batteries with a qualified recycler.

Resources:

- CDPHE Generator Assistance Program
- EPA Resource Conservation and Recovery Act (RCRA)
- Colorado Hazardous Waste Generator Handbook
- CDPHE Solid Waste Regulations
- Hazardous Waste Management and Guidance
- Marijuana Enforcement by the Colorado Department of Revenue
- Mercury-Containing Lighting
- Universal Wastes

PACKAGING

Packaging cannabis products for sale to consumers represents a significant downstream waste source. Reducing the amount of non-recyclable product packaging reduces overall impact and can be attractive to customers.

Sustainability Aspects and Impacts

- Materials use
- Operational and compliance budgets
- Solid waste
- Community relations

Process Description

Cannabis products are sold in a variety of packaging, encompassing a number of different materials, sizes, shapes and functionalities. Below is an overview of some common types of packaging as well as attributes and uses.

- **Vials:** Typically made from virgin polypropylene (#5) plastic and widely used for packaging flower. Vials are accepted in most municipal recycling programs, some manufacturers include recycled materials in the containers. Versions with child-proof caps are available, eliminating the need for an additional exit package.
- **Mylar Bags:** Used to package a variety of products, typically concentrate and food products. Mylar, or polyethylene terephthalate (PET) plastic film, is typically not accepted in mixed recycling programs. Resealable versions are preferable because they enable longer use by the customer.
- **Concentrate Containers:** Small, typically screw-top containers can be made from a variety of materials, including polystyrene, acrylic, silicone, glass, or mixed materials such as polystyrene with a silicone insert. While some of these materials are technically recyclable, recycling facilities sort out very small items, and the small size of these containers generally means they will end up in the landfill even if placed in a recycling bin.
- **Pre-Roll Tubes:** Narrow plastic tubes, typically made from same materials as polypropylene vials, are used to sell single joints. Similar to concentrate containers, small dimensions make pre-roll tubes difficult to recycle.
- **Exit Bags:** Child-resistant bags used as outer packaging when products sold are in non child-resistant packaging. Often made with mixed materials, such as foil with polyethylene coating, these are typically not recyclable. Reusable versions are available.

Best Practices

Cultivators should:

- Choose packaging that is lightweight, as lightweight materials require less fuel to ship, reducing the associated emissions.
- When possible, select packaging that is made from recycled content and is recyclable and/or compostable, such as recycled PET plastics, recycled high-density polyethylene (HDPE) or cardboard.
- Implement a packaging return program at the point of sale. Some customers may not have recycling service at home, so returning to the store may be the only recycling option. Also, smaller plastic pieces and containers, 5- or 10-mL concentrate containers, are so compact and lightweight that they often miss getting sorted out in the recycling process, ending up in the landfill.

Similarly, discuss with packaging suppliers or manufacturers the possibility of a take-back program. Manufacturers may be able to accept used packaging and reuse it or re-form it into new packaging, helping lead to a closed-loop for product packaging.

- Utilize child-resistant packaging to eliminate the need for an additional exit package. If exit packaging is necessary, operations should offer a reusable type and encourage customers to return them to the store.

Resources:

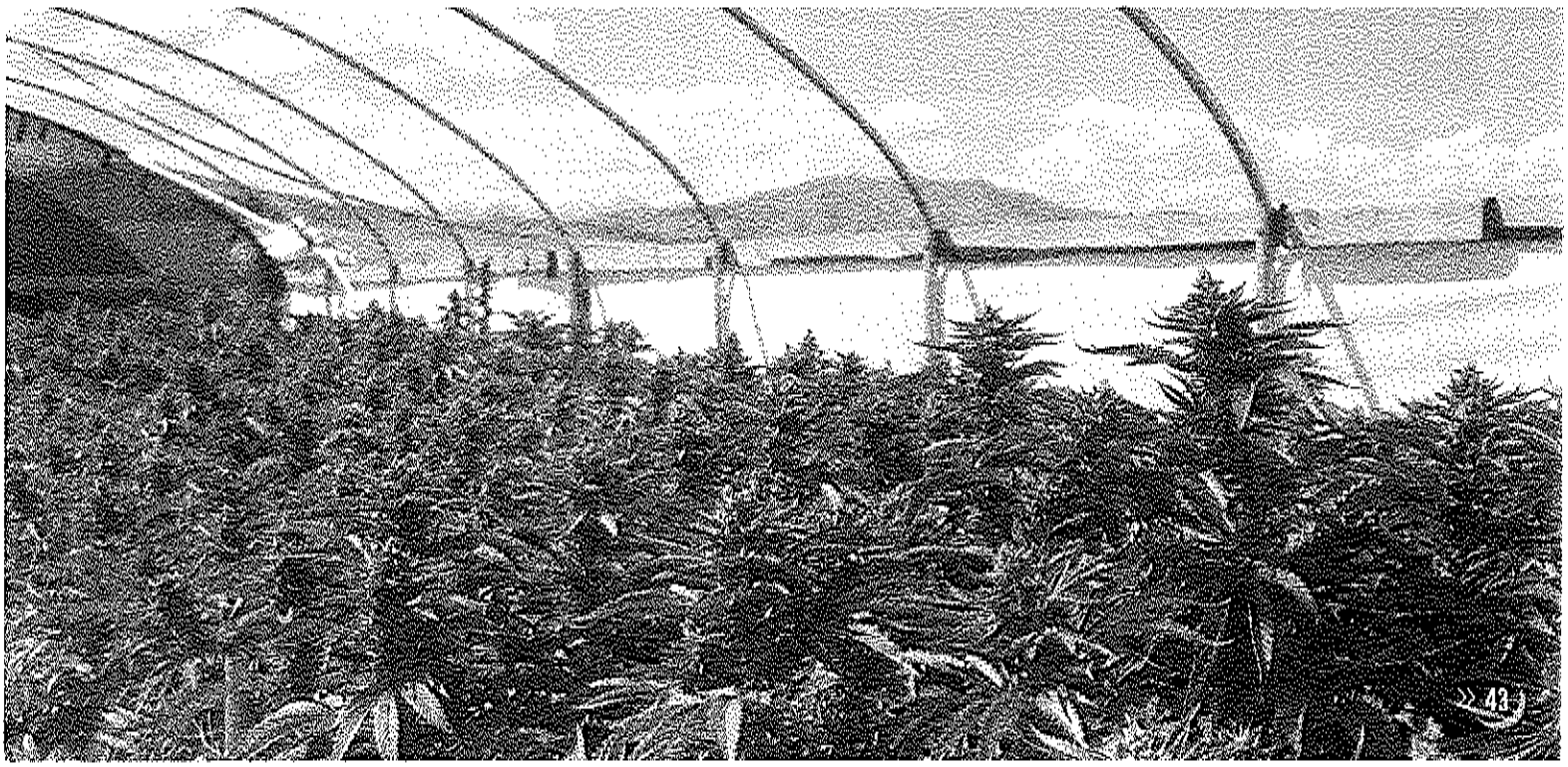
Table 7: Sources of Environmentally Preferable Packaging

SOURCES OF ENVIRONMENTALLY PREFERABLE PACKAGING				
COMPANY	WEBSITE	RECYCLED CONTENT	RECYCLABLE	COMPOSTABLE
Higher Standard Packaging	www.higherstandardpackaging.com	Yes	Yes	No
Elevate Packaging	www.elevatepackaging.com	Yes	Yes	Yes
Sun Grown Packaging	www.sungrownpackaging.com	Yes	Yes	Yes
Sana Packaging	www.sanapackaging.com	Yes	Yes	No

- Marijuana Enforcement Division Permanent Retail Marijuana Rules
- Sustainable Packaging Coalition - Definition of Sustainable Packaging
- Framework for Sustainable Food Packaging Design

Additional Considerations

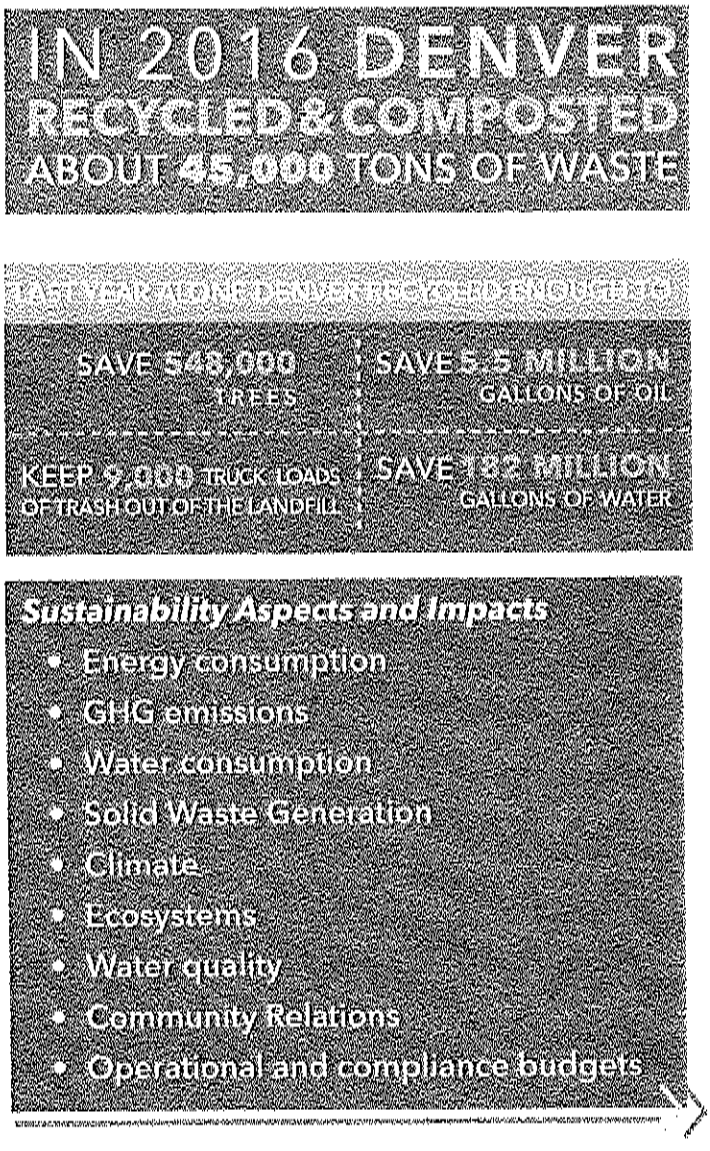
Packaging materials and designs are quickly evolving, in many cases with enhanced sustainability attributes. As consumers and business customers demand more sustainable options, the industry responds with more recyclable, compostable and innovative material options. One future opportunity would be to make cannabis packaging closed-loop, whereby cannabis plant waste is used as a feedstock for polylactic acid (PLA) plastic and turned into product packaging.



RECYCLING

Denver's recycling rate of 18 percent falls well below the 34 percent national average.[11] Currently, recycling in Denver is not mandatory, helping lead to low rates of waste diversion. However, businesses can benefit from properly sourcing, separating and diverting recyclable materials. Single-stream collection and hauling is the practice of choice of local recyclers, making it simple for the customer to participate. Combined with the sophistication of area Materials Recovery Facilities (MRFs), the single-stream process can lead to high rates and high quality of material recapture. Recycling reduces environmental impact of waste generated in cannabis operations.

Figure 13: Diversion Totals for Denver 2016



Sustainability Aspects and Impacts

- Energy consumption
- GHG emissions
- Water consumption
- Solid Waste Generation
- Climate
- Ecosystems
- Water quality
- Community Relations
- Operational and compliance budgets

Process Description

Recycling opportunities in the cannabis industry are similar to those in other warehouse-based industries. The exceptions to this are the packaging and universal waste recycling mentioned in previous sections. Packaging from inbound materials, waste generated during operations and employee waste are the main sources of recyclable materials. Recyclable materials should be separated from other waste streams and picked up by a recycling service provider to achieve environmental benefit.

Best Practices

Cultivators should:

- Make sure recyclables are clean, dry, and separated from solid waste items like plastic bags, waxed paper, broken glass and packaging that looks like cardboard but is actually plastic (meal packaging, receipts, coffee cups, etc.).
- Co-locate recycling bins with all trash receptacles and include signage for all bins, ideally using photos of acceptable items for each bin.
- Use signage provided by the waste hauler, or create custom signage for specific items. Hang signage on bins or above bins to help employees when sorting materials.

Examples of Recycle, Compost, General Signage are available through local waste hauler websites.

Additional Considerations

Recycling technology and service providers in the Denver area are improving and growing. Many items that were not accepted for recycling in the past, such as cartons and polystyrene foam, are now accepted by some or all local recycling haulers. Two-way communication between haulers and businesses is necessary to ensure that business managers stay up to date on the correct recycling processes.

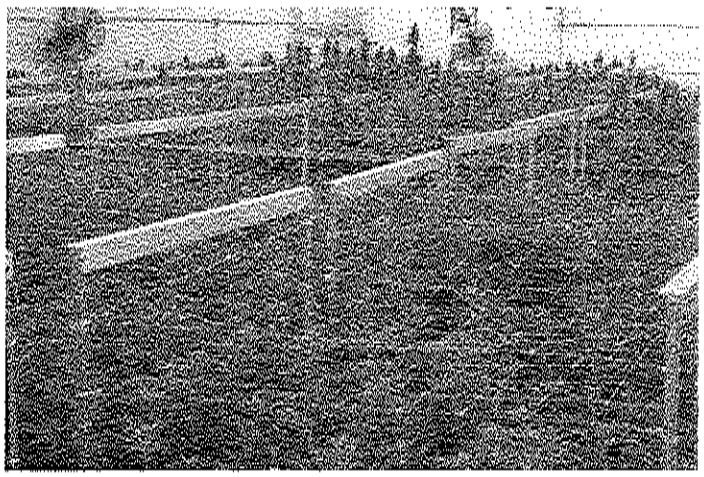
[11] CoPIRG and EcoCycle

INTEGRATED PEST MANAGEMENT

INTRODUCTION

The goal of an Integrated Pest Management program is to apply a combination of control methods to prevent, reduce, or maintain pest populations at non-damaging levels by utilizing a variety of mechanical, physical, and biological controls. An effective IPM program, implemented and monitored by a facility's Director of Cultivation (or equivalent role), can eliminate potential levels of crop damage, mitigate risk, and control pests. Early identification of pest infestations is critical. All staff that work in the cultivation area should be trained in and responsible for plant inspection and pest identification.

Cultivation facilities' waste is generated mainly from agricultural inputs, equipment, and product packaging and can be categorized as organic, recyclable, universal or hazardous waste. Though cannabis waste is strictly regulated, this section will outline compliance best practices that minimize the industry's environmental impacts from waste.



OVERVIEW

An effective IPM program requires the use of Standard Operating Procedures (SOPs) for a number of processes, including daily/weekly inspection, identification, logging and immediate control of pests. All data shall be recorded in a pest and disease monitoring log to track pest presence or population. The ideal cannabis cultivation environment is one with tightly sealed and positively pressured sterile rooms under strict ventilation control and monitoring. This includes consideration for certain biosafety level inclusions to mitigate odor pests, and disease. Facility air handling intake points should be equipped with bird screen and 2-inch MERV 8 pre-filter and HEPA filters capable of capturing at least 99.95% of particulates. IPM programs are typically structured to follow the multi-variable approach outlined below:

1. Prevention, which includes general cleanliness; using new, sterile media with each batch; always using clean, sterile tools; cultivating disease-resistant plants; focusing on the health of plants (proper nutrient levels and avoiding stress); and impeccably controlling climate;
2. Biological controls (natural predators and parasites)
3. Removal of infected plants;
4. Organic controls;
5. **Synthetic controls should never be used, unless approved by the appropriate regulatory agency (in Colorado, the Colorado Department of Agriculture).**

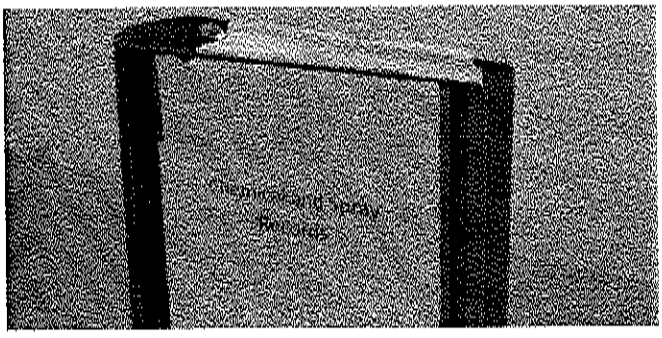
Pest control is approached as a progression of steps, with prevention as the first and most important step in controlling pests. The logical progression of methods in accomplishing IPM includes prevention, suppression, and eradication. Prevention methods utilized include:

- Cultural practices such as: spacing, pruning, and sanitation, as well as staff access prevention and mitigation
- Evaluating the cost of prevention in relation to yield and quality improvements (economic threshold)
- Observational practices ensuring cultivation areas are properly sealed;
- Maintaining a controlled environment and removing pest habitats
- Trap setting
- Pest scouting
- Requiring that room-specific uniforms be used by staff in each space
- Suppression methods that include cultural practices, such as pruning and immediate removal of diseased plants, biological controls, and low-dose natural oils
- Eradication methods that include increased natural oil dose and increased biological controls, if approved by the Department

BIOLOGICAL CONTROL AGENT (BCA) PLAN

In nearly all cases, production of cannabis crops relies on the use of biological control agents ("BCAs"), as the goal of zero pesticide residues is favorable for product quality and patient health. BCAs provide a desirable solution for insect and mite control due to their ability to effectively kill, and keep at bay, common insect and mite pests on cannabis crops. BCAs demand a proactive strategy in which action is taken prior to insect and mite pest presence or at the first sign of presence. BCAs work by preventing the buildup of these pest populations. Control of moderate insect and mite pest populations may be achieved with BCAs, but this reactive control will come with a higher price tag and greater effort. For greatest success, use of BCAs will be an active endeavor from the time of first planting.

Crops are scouted, and release rates are adjusted, based on detected insect and mite pests and the observance of any expanding populations. It is also important to maintain proper fertility and general health of the crop to avoid extra stressors that will make crops more susceptible to insect and mite pests. Successful use of BCAs requires dedicated scouting and strong recordkeeping for both pest and BCA populations throughout the crop. BCAs will effectively prevent the establishment of insect and mite pest populations when the BCAs are released early. Best control will be achieved by layering several BCAs to provide control against multiple life stages of the insect and mite pests or to simply augment the BCA activity. For indoor medicinal crops, the need to layer the BCAs for greatest impact is significant, as rescue treatment options are very limited or prohibited at certain crop stages. It is also important to recognize that releases must be planned and executed over the entire crop, not just early in the crop.



Considerations:

Before using any prevention, suppression, or eradication methods, facility staff must consider the:

- Status of infestation;
- Location, size and density of infestation;
- Potential to spread;
- Pest and crop life cycle stage;
- Regulatory considerations;
- Public perception;
- Environmental impacts;
- Previous results of measures; and
- Measurability.

IPM methodologies include quarantining all new cannabis plants or products entering the facility for 21 days, documenting any pest populations, outbreaks, treatment methods, and treatment results. Pest-monitoring traps shall be utilized and grow media will never be reused under any circumstances. As part of the IPM program, the cultivator will proactively manage any identified pest outbreaks prior to the issuance of a treatment order. Good facility maintenance practices include keeping facility areas clean, dry, orderly, and free of clutter or trash. The facility managers should ensure the proper repair and maintenance of cracks, window frames, door frames, drain areas, and floor joints with sealant to limit pest movement. Eradicating any weeds or pest habitats surrounding the facility and utilizing appropriate traps and baits on a regular basis are good practices.

CULTURAL CONTROLS

Because of the sensitive nature of the cannabis plants and the inability to utilize synthetic controls to control pests, maintaining a culture of cleanliness is essential. This includes:

- A requirement that all staff who work within a restricted access area enter through a locker area where they are required to remove all street clothes and shower prior to their shift;
- Require staff to wear a company-provided uniform, which includes shoes that must never be worn outside of the restricted access area;
- Place foot baths with a mild bleach solution outside of every door that enters into a room where cannabis plants are present. Require staff to place the soles of their shoes into these rubber mats prior to entering the room and upon exit;
- Place adhesive tacky mats outside of every door that enters into a room where cannabis is in process during harvest, drying and curing, extraction, processing, manufacturing, packaging and labeling and storage. Require staff to step both feet onto these mats prior to entering the room and upon exit.

Third-Party Pest Management

Many companies choose to contract with a local certified environmentally conscious pest management company to maintain regular inspections and rodent traps, and to preventatively spray (the exterior of the building) in compliance with all applicable regulations.

PESTICIDES

When all other aspects of IPM have not been enough to control pests and diseases, chemical controls may be necessary. The use of pesticides on cannabis is strictly regulated in Colorado by the Department of Agriculture (CDA). CDA maintains an updated list of approved pesticides and rules for use on their website.

In addition to consulting state and local pesticide rules, operators should first consider products listed by the Organic Materials Review Institute for prevention and control of pests and diseases. Along with OMRI-listed EPA-registered products, an operator may consider using a natural oil or combination of oils, usually found on a 25b (aka "minimum risk") labeled product.

EPA-registered pesticides have gone through extensive testing and are required to list all active ingredients on the label. It is preferred that if a registered pesticide is used that it is labeled in a way that:

1. All active ingredients of the pesticide product are exempt from the requirements of a tolerance, as established under 40 C.F.R. Part 180, Subparts D and E, and;
2. The pesticide product label allows use on the intended site of application. The term "site" for purposes of this Rule includes any location or crop to which the application is made, and;
3. The pesticide product label expressly allows use on crops or plants intended for human consumption, and;
4. The active ingredients of the pesticide product are allowed for use on tobacco by the Environmental Protection Agency.

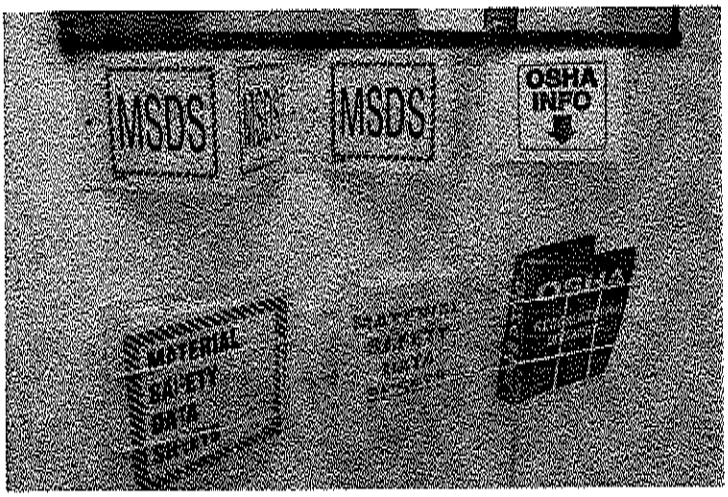
(from 3-30-2016 Colorado Department of Agriculture Pesticide Applicators Act rule update - Use of Pesticides in Cannabis; attached)

When allowed by the local and state regulatory bodies, use of synthetic pesticides may be considered as a last resort. If the use of organic and natural pesticides hasn't been enough to control the pest or disease and the economic threshold for the destruction of the crop by the pest has been reached, the operator may decide to use a synthetic pesticide. However, EPA-registered synthetic pesticides are technically illegal to use on cannabis since there is no current EPA labeling with cannabis listed as a crop/site.

It's worth noting that any use of pesticides, organic or otherwise, while potentially aiding in the control of pests or diseases, can have longer lasting impacts to concentrates made from the treated plant material. All users should do thorough testing of treated product with their concentrate manufacturer to ensure usage doesn't affect concentrate color, consistency or flavor. This is true even if the product is used as specified on the label or even if label rates are decreased and PHI (post-harvest interval) exceed label recommendations.

WORKER PROTECTION STANDARDS

The EPA's Agricultural Worker Protection Standard (WPS) is aimed at reducing the risk of pesticide poisoning and injury among agricultural workers and pesticide handlers. It is a pesticide safety training program that is mandated for all agricultural workers who have the potential for pesticide exposure. Cannabis cultivators who use pesticides must maintain a WPS program and ensure all proper training as well as provide all necessary personal protective equipment. The Colorado Department of Public Health and Environment has developed a Guide to Worker Safety and Health in the Marijuana Industry which covers several pesticide-related topics and may be of use to operators.





HELPFUL LINKS

Colorado Department of Agriculture Pesticide Information:
https://www.colorado.gov/pacific/agplants/pesticide-use-cannabis-production-information

Organic Materials Review Institute Lists:
https://www.omri.org/omri-lists

EPA registered pesticide information:
https://www.epa.gov/pesticide-registration/registration-information-type-pesticide

EPA Minimum Risk Pesticide information:
https://www.epa.gov/minimum-risk-pesticides

National Pesticide Information Center, organic pesticide ingredients information:
http://npic.orst.edu/ingred/organic.html

EPA Worker Protection Standard information:
https://www.epa.gov/pesticide-worker-safety/agricultural-worker-protection-standard-wps

https://www.epa.gov/pesticide-worker-safety/pesticide-worker-protection-standard-how-comply-manual

Colorado marijuana occupational safety and health resources:
https://www.colorado.gov/pacific/cdphe/marijuana-occupational-safety-and-health

AIR QUALITY

INTRODUCTION

The cannabis industry directly impacts air quality in two predominant operations; plant growth cultivation and Marijuana Infused Product (MIP) facilities. At cultivation facilities, the natural growth of cannabis plants and other processes emit terpenes which are VOCs known for their strong odors. At MIP facilities, the evaporation of solvents and other processes in the production cycle result in Volatile Organic Compound (VOC) emissions. VOC's alone do not typically pose a direct threat to human health or the environment. However, they do contribute to ground-level ozone by chemically reacting with other types of pollution, specifically, nitrogen oxides (NOx) in the presence of sunlight. Ozone is an air pollutant that is harmful to human health and negatively impacts the environment, therefore it is important that the cannabis industry mitigate VOCs in their processes. This chapter provides recommended best management practices to improve air quality impacts and reduce VOC emissions from cannabis industry operations.



In Colorado's Front Range, cultivation and MIP facilities are generally in dense urban areas near heavily trafficked highways and other industrial sources of NOx pollution. Because VOCs require the presence of NOx and sunlight to form harmful ozone, VOCs from these facilities have a greater impact on ozone formation than facilities in rural areas. This makes mitigating VOC emissions from the cannabis industry especially important in these regions. Fortunately, most odor control practices at cultivation and MIP facilities also substantially reduce VOC emissions. The correct operation and maintenance of odor control systems at cultivation and MIP facilities is a best management practice for reducing air quality impacts from the cannabis industry.

CULTIVATION FACILITIES

As cannabis plants grow, they release a distinctive range of odors which are made up of different types of VOCs called terpenes. Activities during the cultivation or production cycle that release significant odors also release elevated VOCs during that time. Installing control technologies can reduce the amount of VOC emissions released from the cultivation process *and* control odors in compliance with the Denver city and county odor ordinance. Highly reactive, ozone forming terpenes commonly emitted from cannabis cultivation include: isoprene, pinene, carene, limonene, myrcene, and terpinolene.

REGULATORY DRIVERS

The State of Colorado designates cultivation facilities as an agricultural activity. State regulation, 25- 7- 109(8)(a), C.R.S. provides the Colorado Air Quality Control Commission the authority to regulate certain agricultural production. Cannabis cultivation may be exempt from both state Air Pollution Emission Notice (APEN) and Permitting requirements, unless they are considered a "major source" of air emissions.

In the City and County of Denver, an odor ordinance requires that cultivation facilities control the odor impacts of their growing operations. Denver Revised Municipal Code, Chapter 4 - Air Pollution Control, Section 4-10.

Sustainability Aspects and Impacts

- Odor control
- Regulatory compliance
- Indoor air quality
- Community relations
- Employee well-being
- Regional stakeholder alignment
- Operational and compliance budgets

CARBON FILTRATION - BEST OPTION FOR CONTROLLING ODORS AND VOCS

Carbon filtration is currently the best control technology for reducing VOC emissions from cannabis cultivation facilities. Carbon filters are simple to install, inexpensive, effective, and reliable when properly maintained and replaced. These filters work by using an absorption process where porous carbon surfaces chemically attract and trap VOCs along with other gas phase contaminants. Depending on the filter system, carbon filtration can remove 50% - 98% of VOCs. As the filter ages, less carbon surface area is available to trap VOCs; at this point the filter will need to be replaced. Depending on the filter load, most carbon filters will last 6-12 months in a commercial cultivation environment and should be replaced according to the manufacturer's recommendations.



Carbon filters can operate as stand-alone units that clean and recirculate the air, or can be integrated into the HVAC system. Typically, carbon filters are at their peak performance when positioned at the highest point in your grow space where heat accumulates. High humidity levels hinder filter performance so this control technology is better suited for facilities with environmental controls. An effective filtration system must be properly sized according to the space needed for volume and air-flow requirements. Maintaining an optimal environment can require multiple filters. Carbon filters can be used in combination with other odor control technologies.

Benefits:

- Improve indoor air quality by capturing airborne gas phase contaminants and odors.
- Control the odor impacts of the facility: a properly installed and maintained carbon filtration system is highly effective at controlling odors. This satisfies the requirements of the odor ordinance in Denver and improves community relations as well as business reputation.
- Control VOC emissions: a carbon filtration system can remove 50 - 98% of VOC emissions. This improves public health and the environmental impacts of the facility.

Recommended best practices:

- Design and invest in a carbon filtration system that meets the specific needs of your facility. It is recommended that you work with an HVAC consultant with cannabis industry experience.
- Get information from the manufacturer about the effectiveness of the filter at removing VOCs and choose a filter with a high efficiency rate.
- Do not exceed the maximum rated cubic feet per minute rating for air circulation through the filter. If you exceed this max flow rate, the passing air will not have enough "contact time" with the carbon, and the filter will not be effective at removing VOCs.
- Regularly inspect your filter and replace the filter if it is releasing a smell near the filter effluent, or has reached its lifespan according to the manufacturer's specifications.
- Time your filter replacement schedule so that filters are replaced in early May, the beginning of the ozone season. This ensures that the filter is at peak performance for VOC removal during the high ozone season resulting in the greatest public health benefits.
- Using a pre-filter can help preserve the life span of your carbon filter because it can capture particles before they take-up surface area on the filter. Pre-filters should be replaced about every 6-8 months for proper air flow.

ADDITIONAL ODOR CONTROL METHODS -
BIOFILTERS AND CHEMICAL ODOR TECHNOLOGY

Biofilters are an emerging odor technology that could prove to be more cost effective and less resource intensive than carbon filtration once it is refined in the future. These filters use an organic medium such as wood chips that are inoculated with bacteria and consume odorous molecules. Research is currently being conducted on biofilters that contain bacteria which will consume terpenes and will not harm the cannabis plants. Biofiltration is successful at treating biodegradable VOCs, but it requires a large footprint and careful operation control.

Odor absorbing neutralizers: use oils and liquids from plant compounds and mist them into the exhaust air at cultivation facilities to neutralize odorous VOCs. Contact your odor control supplier about the effectiveness of VOC reduction as it will vary (20%-90%) by product and contact time.

Masking and counteractive agents: use chemical odor control technologies that are misted at the cultivation facility's exhaust. The use of these agents is subject to Colorado's air quality regulations. Higher VOCs are associated with this technology which lead to more severe impacts of air quality and are not recommended in urban areas.

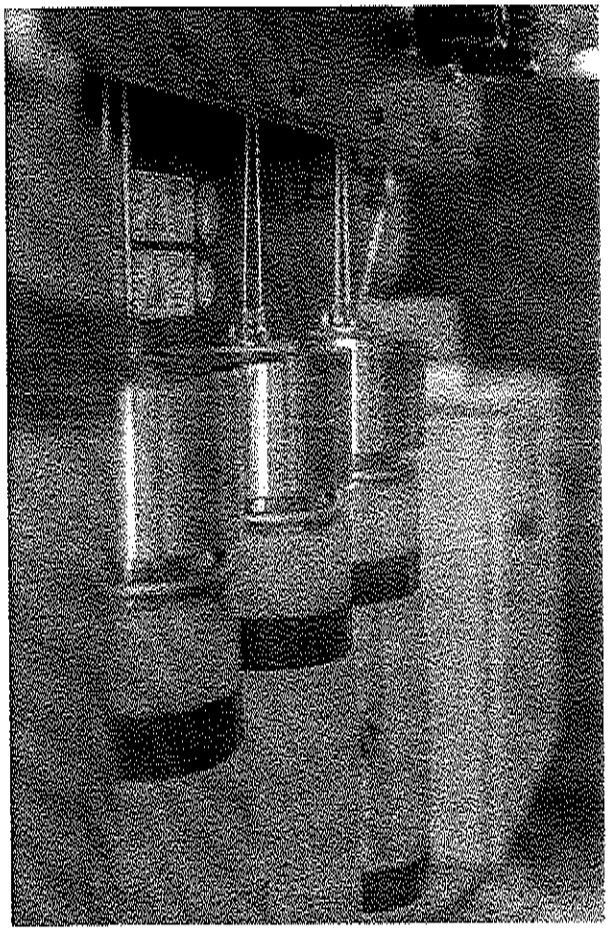
Ozone generators: are mostly used for sanitization purposes and have also been used in industrial settings to control strong odors. These generators are harmful to humans and can damage or destroy crops because they are a direct emission source of ozone pollution, therefore ozone generators are not recommended as a best practice for odor control.

Recommended best practices:

- Regularly inspect and perform maintenance checks on your HVAC system and ducting to ensure it is operating optimally and that the airflow is properly controlled. Keep windows and doors closed in cultivation areas, and inspect the infrastructure for potential leaks.
- For greenhouses, "sealing" the grow space and circulating inside air for one week's time is a common practice that allows the VOC concentration to build up within the greenhouse. When it is time to "purge" the greenhouse by bringing in fresh air, do this at a time when the potential for ozone formation is lowest (i.e. evenings, windy days, and cloudy days). Avoid purging air during times that have the highest risk of ozone formation (i.e. mornings, sunny and hot days, and stagnant weather).
- Make sure that the temperature and relative humidity are under control within tolerance levels of the cultivation room. High temperature and humidity will perpetuate any odor issues that facility is producing; this is especially true during the flowering phase of cultivation. Proper air circulation is critical for maintaining temperature and humidity control.
- Have a documented system in place for recording and responding to odor complaints in compliance with Denver's Odor Ordinance.
- Purchase a "scentometer" or Nasal Ranger to be able to quantify odors and record "defensible data" from self-testing. This can be used to determine if your operation is meeting local odor regulations.
- The harvesting phase results in a higher emission of VOCs than other cultivation phases. Time the harvesting phase to minimize its ozone impact, with respect to time of day, time of year and periods with high forecasted ozone. Minimize emissions during the morning and early afternoon, and during the summer.
- Develop training and allocate responsibilities for staff members to ensure best practices are being implemented consistently and continually as a part of the routine facility operating procedure.
- Communicate and coordinate with other cannabis cultivators to learn what solutions are the most practical and effective.

MIP FACILITIES AND EXTRACTION PROCESS

MIP facilities manufacture marijuana concentrates and infused products such as edibles, ointments, and tinctures. These methods can be divided into two main categories: solvent and solventless extractions. Solvent extraction methods apply a chemical to remove terpenes and cannabinoids from the plant which results in a variety of different products. Solventless extraction methods involve the use of physical methods to create concentrates.



The processing of plants where solvents are used to extract cannabis concentrates is considered a manufacturing process that is subject to state air quality regulations. The applicability of the air quality regulations will depend on the annual amount of VOC emissions quantified in tons emitted per year. It is the responsibility of the business to calculate an estimate of their VOC emissions from solvent extraction. For specific guidance on air quality requirements for MIP facilities and how to calculate emissions, visit: www.colorado.gov/cdphe/greencannabis. The Colorado Small Business Assistance Program can also help you calculate your annual air emissions for free by calling 303-692-3175.

Regulatory Applicability

- CCR 212-1 M 605 D4 requires a professional grade, closed-loop extraction system capable of recovering the solvent, with the exception of ethanol and isopropanol solvent based systems (CCR 212-1 M 605 E). The disposal of VOCs by evaporation or spillage is prohibited under 5 CCR 1001-9 Regulation 7 V.A.
- CCR 212-2 R 605 A2 delineates the solvents that are permitted for use. The rule states: "A Retail Marijuana Products Manufacturing Facility may also produce Solvent-Based Retail Marijuana Concentrate using only the following solvents: butane, propane, CO2, ethanol, isopropanol, acetone, heptane and pentane. The use of any other solvent is expressly prohibited unless and until it is approved by the Division."
- All permitted solvents besides CO2 are VOC based and result in direct VOC emissions when evaporated. The law is the same for medical marijuana concentrate production and is provided in CCR 212-1 M 605 A2. This list of solvents was formulated with the health and safety of workers in mind and using any other solvent is a violation of the law and could also lead to negative air quality impacts. CCR 212-1 M 605 D5 requires that all solvents used are food grade or at least 99% pure.

Recommended best practices:

- Regularly inspect and maintain all storage devices of solvents to prevent leaks.
- Conduct regular maintenance and inspection of the extraction system to ensure that it is functioning properly without direct leaks of the solvent.
- Take caution to prevent leaks during the transfer of solvents between containers and systems at all stages of the production processes.
- Never dispose of a solvent through direct evaporation or spillage; ensure that the solvent is always recovered and kept in a closed-loop extraction system or designated container.

- Maintain an inventory of all solvent liquids and ensure that the facility operating procedure allocates responsibility to keep an updated list.
- Develop training and allocate responsibilities for staff members to ensure best practices are being implemented consistently and continually as a part of the routine facility operating procedure

Sustainability Aspects and Impacts

- Effluent discharge
- Regulatory compliance
- Indoor air quality
- Energy consumption
- GHG emissions
- Water quality
- Community relations
- Employee well-being
- Operational and compliance budgets
- Climate

CONCLUSION

Limiting activities that emit VOCs and making sure that odor control systems are optimally operating during high ozone periods can substantially improve the air quality impacts of cannabis facilities. It is recommended that an employee committee is designated to develop and implement a BMP plan specific to the facility needs. Establishing and communicating BMPs through adequate training can help ensure that this becomes an integrated part of the routine operation in cannabis facilities. Colorado's cannabis industry can adopt BMPs which improve their air quality impacts, bolster their reputations as stewards of the environment, and control their odor as well as air quality emissions.

CARBON FOOTPRINTING

INTRODUCTION

Indoor cannabis cultivation uses the largest amount of energy when compared to any other production method, and creates the largest associated carbon footprint. Greenhouse Gas (GHG) emissions baselining provides companies with a snapshot of short-term energy use and long-term financial risk. Studies have consistently found that implementing comprehensive climate protection programs makes companies more competitive for a wide variety of reasons, including significant financial savings, brand reputation, and increased employee and customer satisfaction. A recent report from Goldman Sachs[1] found that companies that are leaders in environmental, social and good governance policies are outperforming the MSCI world index of stocks by 25% since 2005. Seventy-two percent of the companies on the list outperformed industry peers.[2]

Taking a more in-depth view of fuel use and electricity/resource consumption allows cannabis companies to identify opportunities to increase efficiencies and reduce costs while minimizing GHG emissions. This will also keep the company's policies, procedures and operations ahead of rapidly evolving, energy-related building codes and regulatory frameworks. Denver has determined that maintaining progress toward the 2050 carbon reduction targets is critical to the longevity of the city. These factors show us that not only is it a good business decision to look at your carbon output and how you can create reductions, but it also contributes to the local community and reduces the environmental impact of the industry.

What is a Carbon Footprint?

A carbon footprint in the context of the cannabis industry can be defined as the total amount of GHGs emitted during the production of raw cannabis and cannabis-related products. However, a holistic approach to carbon footprinting should include:

- A detailed breakdown of GHG emission sources, factors and calculation methodologies.
- Short- and long-term emission reduction goals.
- Specific strategies for reduction and tracking reductions
- A management plan for updating and continued tracking of the GHG emissions and sources.

Creating a carbon footprint that is also a strategic planning document will lead to a better incorporation of carbon reduction strategies and provide deeper insight into company operations, revealing the potential for cost-saving efficiency investments.

The heavy data analysis portion of a carbon footprint will be the GHG Inventory. This section is a detailed accounting of all greenhouse gases emitted during the production process and operations of a cannabis company. These GHGs can include Methane, Nitrous Oxide, Butane, Propane, and many other gases, but will usually be expressed as Carbon Dioxide Equivalent or CO2e. For any quantity and type of greenhouse gas, CO2e signifies the amount of CO2 which would have the equivalent global warming impact. Specific operational and company data are needed to make an accurate accounting of GHG emissions. Emissions factors, or the amount of CO2e per unit of energy/input are readily available for most activities in the cannabis growing industry.

A well-rounded carbon footprint should analyze the applicable data and set reasonable, achievable goals based on the specific cannabis company and its projected strategic plan. This will allow the operations of the company to grow alongside its sustainability goals, creating a more resilient and adaptable business.

[1] "GS Sustain". Goldman Sachs 2007 http://www.natcapsolutions.org/Presidio/Articles/Climate/GoldmanSachsReport_v2007.pdf

[2] Alderton, Margo, "Recent report finds corporations that lead in corporate responsibility also lead in the market," Socially Responsible Investing 07-11 17:57, also at http://www.csrwire.com/companyprofile?id=4489

TYPES OF CARBON EMISSIONS

Organizing and collecting all the data necessary for a carbon footprint is a good exercise in itself for looking at company operations but can seem overwhelming at first. It is easier to understand what kind of data is necessary for the GHG inventory by breaking it down into the three primary scopes:

- **Scope 1 Emissions: an organization's direct GHG emissions produced on site.** Examples include diesel generators, transportation fuel for delivery/company vehicles, CO2 supplementation being used in facility grow operations or any excess natural gas emissions attributed to concentrate production.
- **Scope 2 Emissions - An organization's off-site carbon emissions, or indirect emissions.** This figure is most frequently attributed to electricity usage, unless a company is producing all of its energy through renewables on-site. For Denver, the primary sources of power generation are coal and natural gas which both have associated carbon emissions. Those carbon emissions are reflected in a reporting organization's electricity usage. This is the largest area of impact for the cannabis industry in Denver due to the exclusive use of indoor grow operations.
- **Scope 3 Emissions - all other indirect carbon emissions associated with the operation of a business.** Examples include employee travel/commuting in their personal vehicles, grid transmission and distribution losses of electricity, waste products, water usage, packaging, product transport and delivery, and nutrients. Scope 3 examines operations and sourcing in-depth, making it a fantastic tool for analyzing a supply chain. Some analyses even go as far to calculate associated processes and ingredients of production. For example, if a product uses plastic packaging, scope 3 could include the entire life cycle of the product, such as carbon emissions from the raw oil extraction process, the refinement of the oil, the synthesis of plastic from the oil and the transport of the materials between phases.

According to an analysis conducted by Evan Mills in 2012, for each kilogram of cannabis produced, roughly 4,600 kg of CO2 is emitted. More data and research are needed to confirm this analysis, as many experts have brought up potential issues and new efficiency practices in the determination of this number.

CALCULATION & TRACKING METHODS

Setting a Boundary

The preliminary action required for undertaking a carbon footprint analysis is setting a boundary around the study. A boundary defines the breadth and depth of the GHG inventory. It is up to the developer of the footprint to determine the appropriate boundary limits, but it is recommended that the process goes back as far as it can for more transparency and accuracy in the final report.

A proper boundary analysis should include a detailed layout of the system and processes which will be analyzed. It is important to consider the full life cycle of the product or operation being calculated. This will include extensive research into ingredient sourcing, where and how ingredients were developed, what type of transport was utilized, and the energy consumption related to their production, etc. As carbon tracking has become more mainstream, many vendors have this information readily available. Furthermore, companies can make or request carbon tracking of their vendors to facilitate more detailed data collection.

The detail of the calculations should encompass all operations of the business, including processes or products that may seem irrelevant or may not be immediately evident. For example, waste from plants or soil, water usage and courier usage are all relevant to the analysis. It is crucial to get a complete, comprehensive look at company operations to ensure the utmost accuracy in a GHG inventory. This stage of planning will set the boundary for the inventory and determine which data is necessary to collect in order to calculate an accurate carbon footprint.

Calculating a Carbon Footprint

Calculating a carbon footprint can be a complex process that requires time and analytical proficiency. It is recommended that if a cannabis organization wishes to undertake creating a carbon footprint and calculating a GHG inventory, they utilize comprehensive guides such as the WRI GHG Protocol: A Corporate Accounting and Reporting Standard or the EPA Center for Corporate Climate Leadership Greenhouse Gas Inventory Guidance. Otherwise it is recommended to look for help from outside professionals to assist in the detailed calculations necessary for a comprehensive inventory. Outlined below are examples of calculations for the various scopes.

Facility Variations

Each facility and operation will have its own unique inputs in a carbon footprint calculation. It is important to closely review every area of an operation to identify the largest drivers of carbon emissions. The chart outlines some of the unique carbon emission sources in different types of facilities:

DISPENSARIES	MIPS	GROWS
Customer Transit	Butane/Propane/ CO2 Usage & Ventilation	CO2 Supplementation
Packaging	Delivery & Courier Services	Delivery & Courier Services
Vendors & Products	Manufacturing Waste	Soil & Fertilizers
Retail Waste	Manufacturing Equipment	Water

Tracking metrics over time

It is important that a carbon footprint is continually updated to track and report progress over time. The data can be managed easily when appropriately developed in a data analysis program. An annually updated carbon footprint progress report demonstrates commitment to customers and shareholders.

Tracking carbon data allows for proper allocation of resources based on which area is lagging behind or stalling. Once data has been regularly tracked for an extended period it is possible to compare carbon metrics to other important industry metrics (sales, ROI, repeat customer generation, etc.) and look for general trends and correlations.

Reduction Strategies

Once the calculation of the carbon footprint is complete, strategies to reduce the carbon output of the facilities can be identified. It is important to understand that this is a long-term goal and will have many stages of planning, implementation and progress. The best way to make progress is by focusing on projects with a significant return on investment and contribute to the operation's overall mission.

A good initial approach is to increase operational efficiencies within the facility and operations of the company. Creating efficiencies wherever possible will reduce the largest impacts of a carbon footprint while simultaneously saving money and resources. This way, when larger potential projects are considered, the resources required to fulfill that project's needs will be much lighter. For example, it will be much easier to install on-site renewable energy if the facility's operating energy has already been quartered thanks to efficiency upgrades. Examples of efficiency and zero carbon upgrades are discussed more in-depth in other sections of this guide, and include:

- High-efficiency lighting and HVAC systems
- Increased insulation in facilities
- Heat recapture systems on operational machinery
- On-site renewable energy
- Electric or natural gas fleet vehicles
- Composting and/or recycling
- Sourcing carbon neutral ingredients
- Carbon neutral, recyclable, or compostable packaging
- Solventless extraction methods

Goal setting is essential for any organization wishing to reduce its carbon footprint. It is imperative to set a baseline from which to develop carbon reduction goals. Organizations can either set one baseline year (i.e. X% reduction against their 2018 baseline year by 2025) or use the most recent year as their baseline year - a "rolling" approach (this approach is more challenging to show large amounts of reductions). Using a rolling approach will not allow the reporting organization to "count" the same reduction year after year towards their goals and become idle. Whichever approach is chosen, the concept and establishment of a baseline year is essential. Once a goal is achieved, it is essential to establish a new goal that challenges the organization to come up with new ideas and implement more aggressive reduction strategies.

Another option for reducing carbon for cannabis facilities is looking at local options for carbon mitigation and renewable energy credits, but this should be a final approach to reducing carbon output after reduction initiatives have been undertaken. Cannabis operations can contact their electricity supplier to learn about options for purchasing local renewable energy. Alternatively, renewable energy credits can be purchased from organizations like carbonfund.org or carbon credits from the Colorado Carbon Fund, which funds Colorado-based carbon projects. Though these options are helpful in the short term, they have fewer long-term benefits than carbon reduction strategies and projects.

Examples of calculations for the various scopes:

1. Scope 1 Example: Company A uses 140 gallons of gas per year on company-owned vehicles used at the site of operations.
    a. The EPA conversion rate for gallons of gas to grams of carbon:
        i. 8,887 grams of CO2/gallon of gasoline.
    b. Use this conversion rate and multiply by gallons of gasoline used that year:
        i. 140 gal X 8,887g CO2 = 1,244,180 grams of carbon.
        ii. This number can also be represented as 1,244.18 kilograms of CO2 or 1.24 metric tons of CO2. It is up to the analyzer to determine the best metric to use. The metric system is the globally recognized standard for reporting, as opposed to pounds and tons.
2. Scope 2 Example: Company A uses 2,000 kWh monthly of electricity in their grow operation.
    a. The EPA conversion rate for kWh to CO2 is 740 grams per kWh.
    b. Take the conversion rate and multiply it by the number of kWhs emitted annually.
        i. 2000 kWh X 12 months X 744g CO2 = 17,856,000 grams of carbon.
        ii. Again, this number can be represented as 17,856 kilograms of CO2 or 17.86 metric tons of CO2.
        iii. NOTE: these numbers are derived from EPA standards that do not take into account regional variations. It is very important to source regionally based emission factors annually as well as CO2 equivalences to get the most accurate reading for all emissions associated with an organization's operations. For Denver all electricity emissions are available on an annual basis from Xcel's community energy reports. This emission factor changes every year as the generation of electricity comes from more renewable sources.
3. Scope 3 Example: Staff from company A drive a total of 200 miles commuting to and from work.
    a. The EPA conversion rate for miles to CO2e is 408 grams of CO2e per mile.
        i. 200 miles X 408g CO2e = 81,600 grams of CO2e or 81.6 kilograms of CO2e.

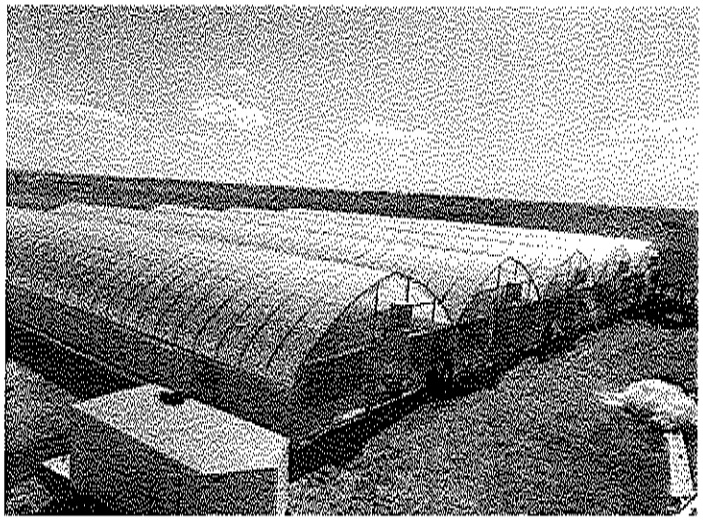
Cannabis is unique for calculating carbon footprints in that it uses CO2 to grow; therefore, a negative value can be applied to the overall carbon footprint of the operation. Unfortunately, at this time no concrete numbers exist for the carbon sequestration capacity of cannabis, so for now we can extrapolate the sequestration performance of hemp. Hemp sequesters 22 tons of CO2 per hectare.[1] This number can be used to determine the carbon sink of a grow operation.

[1]*The Role of Industrial Hemp in Carbon Farming,* James Vosper BSCHons, FRGS

GREENHOUSE CULTIVATION

INTRODUCTION

Greenhouses are quickly becoming the preferred structure for cannabis cultivation, with almost half (45%) of current cultivators nationwide using them in some capacity.[1] As utility costs rise and already tight profit margins continue to shrink, more operations are viewing greenhouses as an economical solution. By utilizing natural sunlight as the primary lighting source rather than lighting fixtures, greenhouses are more energy efficient and have been shown to reduce production costs by 30 percent compared to indoor grow facilities. Greenhouses now account for one quarter of all production space, with a little under half (43%) of current growers considering expanding into greenhouses. In Colorado, the trend towards greenhouse as well as outdoor growing can be seen in the 154% increase in cultivated plants in Pueblo during 2017.



A greenhouse is any structure for the cultivation of crops with a transparent (glazed) roof that allows natural light to penetrate the growing space. Glazing can vary from low-cost polyethylene film to semi-rigid polycarbonate to tempered glass panels. The sidewalls can be constructed out of various materials, ranging from simple fabric/sheeting to insulated metal siding. Greenhouse structures run the gamut in size and complexity, from hoop houses to state-of-the-art sealed buildings. All greenhouses are essentially structures that protect crops from the elements while utilizing the energy of the sun.

The structure of commercial greenhouses can be free-standing or gutter-connected. Free-standing greenhouses can have a variety of roof shapes, with hoop, gothic, or gable being the most predominant. A gutter-connected greenhouse uses a series of trusses connected at the gutter level to customize the width of the structure. These roofs are predominantly hoop or gable shaped. Greenhouses can be made to any length but are usually determined by available glazing sizes. Greenhouses tend to use modular frame construction with spacing of 4'-5' for hoop houses and 10'-12' for gutter-connected designs.

For cannabis cultivation, a Light Deprivation System, also called a blackout system, is required to create the photoperiodism needed to induce flowering. These systems can be manual or automatic and utilize a range of fabrics. Breathable fabrics are preferred because they prevent condensation from forming and dropping on the plants, creating an ideal environment for disease.

Considerations

FREE-STANDING GREENHOUSES	GUTTER-CONNECTED GREENHOUSES
Easier to provide separate grow environments as each house is controlled by its own heating/cooling system.	Reduced heating costs (up to 25%) as surface area to floor area ratio is lower.
Individual houses are easier to build and maintain.	Less land is needed. About 30% more growing space can be placed on the same amount of land area.
Ideal for non-level sites.	Heating and cooling can be centralized.
	More cost effective for areas greater than 10,000 sq. ft.

[1] *State of the Industry Report. 2018. Cannabis Business Times.*

Greenhouse Decision-Making

When deciding to grow in a greenhouse there are a multitude of factors to consider. Start with a review of state and local cultivation regulations and zoning codes to ensure greenhouse cultivation is approved in your area, and pay specific attention to security requirements. Contacting the proper licensing and zoning offices is always a good idea, as many non-rural municipalities and zoning departments are unfamiliar with commercial greenhouse structures.

Greenhouses require adequate land to allow for roads, parking, and buffer zones, in addition to the structures themselves. Greenhouse operations typically require a minimum of two acres. When siting a greenhouse, look for a flat topography to ensure proper drainage and orient the structure to maximize unobstructed southern views to provide drainage and adequate sunlight and solar gain. The local geography and climate will further determine a suitable type and style of greenhouse. The temperature range and solar angle of incidence will determine the appropriate type of glazing with regards to transparency, dispersion, and insulation rates. The growing period, whether year-round or seasonal, will also determine the style of greenhouse.

Design

At a minimum, greenhouses provide protection from wind and rain and help to minimize pest pressures while sealed. Environmentally controlled greenhouses provide the opportunity to control all aspects of the grow environment, similar to an indoor facility. A well-designed greenhouse that incorporates the many equipment systems with accurate environmental controls and good space utilization is the key to a successful cannabis production facility. Installing peninsular or moveable benches can achieve 80-90 percent space utilization, resulting in a more efficient lighting system and higher yields.

Lighting

The main benefit of using a greenhouse is that the primary source of lighting is the sun and grow lights are used only as occasional supplement. Grow lights are used to extend the seasons when daylight is limited. This allows the plants to maintain a vegetative state for the proper durations, to boost daily light levels when necessary, and to ensure consistent light levels. Since artificial light is secondary, larger light fixture spacing is used when compared to indoor setups. The lighting types most commonly used are LEDs and HPS. Automation is essential for energy efficiency, and controls should be set to a specific light level (PPFD) to ensure lights are on only when needed. A timing delay helps to account for temporary cloud cover. Lights should also be subdivided in a checkerboard pattern so that the minimum number of lights are used to achieve the appropriate light level.



In regard to controlling the sunlight that enters a greenhouse, the standard glazing material is light-diffusion fabric. This type of material spreads out the light particles and infrared radiation while blocking UVB to dampen the sun's intensity and generate more light. Shade cloths can also be used during summer months to lessen the sun's intensity and lower solar heat gain. Some grows are experimenting with painted films to achieve these results. Double- or triple-glazed material will increase the insulation factor, reducing heat loss if needed.

Climate Control

Utilizing the sun as the primary source of light brings with it unique climate control challenges in the form of solar heat gain. Due to the "greenhouse effect," special attention needs to be paid to the HVAC system. The "greenhouse effect" is when solar radiation enters the greenhouse, heats up the thermal mass, and then the glazed panels trap the infrared radiation inside. In addition, greenhouses are traditionally leaky structures due to the space between the glazed panels and frame. Solutions to the HVAC dilemma diverge depending on the type of system employed, either open (passive) or closed (sealed).

Open greenhouses rely on more passive systems such as vents and actuators to provide climate control via air circulation and can be thought of as an extension of the outdoor environment. These systems depend on temperature and wind gradients to cool, resulting in low average air volume exchanges of around two to three times per hour. Some common structural elements are open-roof designs and guillotine or roll-up sides which reduce the need of fans for ventilation. In drier climates, a fan and pad system can be ideal. When employing fans, a design with several stages of ventilation can be more energy efficiency than one with just a single stage. Using light-colored groundcover and pots will limit heat absorption in the greenhouse. In regions with hot days and cold nights, thermal mass can be added to absorb and store heat during the day and then release it at night. When heating is required, it should be located in the floor or under the benches to target the root zone, which will reduce the need to heat the entire greenhouse by 5-10F. For every 1F the air temperature can be set, fuel consumption is reduced by 3%. To avoid excessive drying of the growing media, it is best to limit root zone heat to 25 BTU/sq.ft.

Closed greenhouses, on the other hand, closely resemble indoor facilities and rely on equipment with advanced climate control systems to control heat and humidity. These systems seek to eliminate air exchanges in order to better control the indoor environment. Newer structures that utilize this system are often hybrid designs with vertical metal insulated walls and a glazed roof. The insulated walls better protect against temperate swings. An added benefit of a sealed environment is reduced contamination from outside sources, such as pests, disease, and hemp pollen. In more urban environments, odor can be controlled. In this system, each greenhouse or bay should have independent temperature and climate control to account for variations within a site. For larger greenhouses, an energy-efficient cooling technology currently being used is cooling towers, which are similar to a wet wall but housed in a separate unit. For dehumidification, desiccant boxes are now being employed, as they need little energy to operate. They utilize a media such as silicone gel to absorb water vapor from the air. This process is known as Ground to Air Heat Transfer (GAHT).

Heat exchangers store excess heat in a medium such as water or soil. The system circulates hot air from the greenhouse through pipes buried underground, whereby the heat gets transferred to the soil. The air is then exhausted back into the greenhouse cooler and drier. Thus, the GAHT system creates a closed-loop airflow, which cools and dehumidifies the greenhouse.

Energy Conservation Techniques

- Insulate perimeter (side and end walls), foundation, and distribution piping.
- Install windbreaks on the north side to reduce wind-induced heat loss.
- Install automatic closing doors.
- Weather strip doors, vents, fan openings.
- Lubricate louvers.
- Repair broken or torn glazing.
- Install an infrared inhibitor on the inner lining of glazing for 15% savings.
- For older structures, add a single or double layer of plastic covering to reduce infiltration and heat loss by 50%.
- Aspirate thermostats for more uniform temperature control.
- Select fans that meet AMCA standards and have a Ventilation Efficiency Ratio greater than 15.
- Use the largest diameter fans with the smallest motor that meets ventilation requirements.

SAMPLE ENERGY AUDIT FORM

Name:	

Grow Type:	
Cultivation Sq. Ft.	
Building Type	
Building Age	

Basic Overview

Annual Energy Used (kWh)	
Annual Water Used	
Production (Dried Wt.)	

Month	Energy (kWh)	Water (gallons)	Production (Dried Wt.)
January			
Feburary			
March			
April			
May			
June			
July			
August			
September			
October			
November			
December			

Growing System

Grow Medium Description:

Plant Phase	Capacity (# of Plants)	Cycle Duration	Cycles Per Year	Irrigation Type	Irrigation Schedule/Amount	Lighting Type	Make	Model	# of lights	Lighting Hours

Equipment	Make	Model	Quantity	Est. Run time (hrs/day)	Location/Phase Used
HVAC					
Oscillating Fans					
Fertigation					
Dehumidifiers					

SAMPLE WATER QUALITY REPORT

COLORADO STATE UNIVERSITY
Soil, Water & Plant Testing Laboratory
Room A320, NESB
Fort Collins, CO 80523-1120
Phone: 970-491-5061 / Fax: 970-491-2930

Billing:

Date Received: 11/3/16
Date Reported: 11/8/16

IRRIGATION WATER ANALYSIS

SOURCE: Arapahoe City **LAB #** W519 1

"Metals" and "Individual Element" Analysis

	mg/L	Recommended Limit mg/L
Aluminum	0.13	5.0
Ammonium	*	N/A
Arsenic	*	0.2
Barium	0.03	1.0
Boron	<0.01	5.0
Cadmium	<0.005	0.05
Chromium	<0.01	1.0
Copper	0.02	0.5
Fluoride	*	2.0
Iron	<0.01	N/A
Lead	0.01	0.1
Manganese	<0.01	N/A
Mercury	*	0.01
Molybdenum	0.02	N/A
Nickel	<0.01	N/A
Phosphorus	<0.01	N/A
Selenium	*	0.05
Zinc	0.06	24.0

* Not requested

"Routine Package"

	Results	Results
Conductivity	398	µmhos/cm
pH	7.5	
pHc	8.0	
	mg/L	meq/L
Calcium	29.2	1.46
Magnesium	7.24	0.60
Sodium	19.8	0.86
Potassium	1.87	0.05
Carbonate	<0.1	<0.1
Bicarbonate	103	<0.01
Chloride	7.20	0.20
Sulfate	50.5	1.05
Nitrate	0.9	0.9
Nitrate-Nitrogen	0.2	0.2
Boron	<0.01	
Pounds of Sulfate per acre foot	44.9	
Pounds of Nitrate per acre foot	0.5	

SAR 0.8 Salinity Hazard Low Sodium Hazard Low

COMMENTS: This is good quality water for irrigation.

COLORADO STATE UNIVERSITY
Soil, Water & Plant Testing Laboratory
Room A320, NESB
Fort Collins, CO 80523-1120
Phone: 970-491-5061 / Fax: 970-491-2930

Billing:

SOURCE: Arapahoe City

2020 Sustainability Goals	The 2020 Sustainability Goals focus on 12 resource areas and set goals for the City and County of Denver, and community. The resource areas are Air Quality, Climate, Energy, Food, Health, Housing, Land Use, Materials, Mobility, Water Quantity, Water Quality and Workforce.
AHAM	Association of Home Appliance Manufacturers: AHAM provides leadership, advocacy, and a forum for public policy, standards and business decisions to consumers and appliance manufacturers.
anion	A negatively charged ion.
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
BMS	Building Management System: A system that controls the environment of a facility and which, when monitored, may alert to alert facility managers about broken or malfunctioning equipment.
Ca++	Calcium cation
cation	A positively charged ion.
CDA	Colorado Department of Agriculture: The mission of the CDA is to strengthen and advance Colorado agriculture; promote a safe and high-quality food supply; protect consumers; and foster responsible stewardship of the environment and natural resources.
CDPHE	Colorado Department of Public Health and Environment: State department providing services in the areas of health, environment, marijuana, vital records, public records, laboratory services, health equity, and emergency preparedness and response.
CESQG	Conditionally Exempt Small Quantity Generator: An EPA category for waste generators, based upon quantities of hazardous and acutely hazardous waste generated and accumulated.
CHP	Combined Heat and Power: CHP systems, also called cogeneration systems, generate power and heat in a single system.
CMH	Ceramic Metal Halide: CMH lamps provide energy-efficient wide-spectrum lighting.
CO_2	Carbon Dioxide: CO_2 is a naturally and artificially produced compound. It is naturally produced by decompositions, respiration, and other natural sources and used by plants for photosynthesis (along with water and sunlight). It is artificially produced from burning fossil fuels, deforestations and manufacturing processes.
CSWG	Cannabis Sustainability Workinggroup, also called "the Workgroup": The CSWG was developed by DDPHE to determine best practices and to develop this manual and other education resources for the industry.
DG	Distributed Generation: DG is an approach to energy production that generates power at the end-user location.
DDPHE	Denver Department of Public Health & Environment: The DDPHE works with city, state and community partners to conduct education, community engagement, and enforcement to ensure healthy people, healthy pets and a sustainable environment.
Denver's Climate Action Plan 2015	Denver's Climate Action Plan 2015 is a document developed that sets forth Denver's goals, priorities, and strategies to meet the 2020 Sustainability Goals and to reduce greenhouse gas emissions 80 percent from its 2005 baseline by 2050.
EAS	Engineering Assistance Study: An EAS is conducted to identify and evaluate energy savings opportunities.

EC	Electrical Conductivity: EC is the potential for material to conduct electricity (i.e. the potential for an electrical current to move through water.)
ECA	Electrochemically Activated Water: ECA is water mixed with food-grade salt fed through a reactor that electrically charges the salt water to produce disinfect or detergent solutions.
EER	Energy Efficiency Ratio: The EER is the ratio of cooling capacity to power input.
EMS	Energy Management System: A system that monitors the environment of a facility and which may be used to alert to alert facility managers about broken or malfunctioning equipment.
Energize Denver	A benchmark ordinance requiring owners/operators of large commercial and multifamily buildings to annually assess and report the buildings' energy performance using the free ENERGYSTAR Portfolio Manager tool.
EPA	U.S. Environmental Protection Agency
FCU	Fan Coil Unit: An FCU is a device consisting of a heating and/or cooling heat exchanger or coil and fan. It is part of an HVAC unit.
Feasibility Study	Also called a qualification study, a specialist performs the feasibility study using 6 to 12 months of utility bills to build a high-level model that provides a "ballpark" economic, environmental and operational impact assessment.
g/kW	grams per kilowatts
g/W	grams per Watts
g/sq ft or g/SF	grams per square feet
HCO_{3-}	Bicarbonate anion
HPS	High Pressure Sodium
HVAC	Heating, Ventilation and Air Conditioning: The system used to heat and cool buildings.
InfoWise	An Xcel Energy service providing interval data that is used to create a web-based energy dashboard.
ion	An electrically charged atom or groups of atoms.
IPLV	Integrated Part Load Value: IPLV describes the performance of a chiller capable of capacity modulation.
kW/cycle	Kilowatts per cycle
LED	Light-Emitting Diode: An LED is a two-lead semiconductor light-source.
LEP	Light-Emitting Plasma: LEP is high-intensity full-spectrum light source.
LFG	Landfill Gas: LFG is created by the microorganisms in a landfill.
LQG	Large-Quantity Generator: An EPA category for waste generators based upon quantities of hazardous and acutely hazardous waste generated and accumulated.
MED	Marijuana Enforcement Department, Department of Revenue: The MED's mission is to promote public safety and reduce public harm by regulating the Colorado commercial marijuana industry through consistent administration of laws and regulations and strategic integration of process management, functional expertise and innovative problem-solving.

Mg^{++}	Magnesium cation
MH	Metal Halide: An MH lamp is a high-intensity gas discharge lamp.
mL	milliliter
$mol/m^2/day$	mole per square meter per day
$mol/m^2/S$	mole per square meter per Siemens
mol/µmol	mole per micromole
µmol/mol	micromole per mole
µmol/SF	micromole per square foot
$µmol/m^{-2}\ s^{-1}$	micromole per square meter and second (PPFD unit)
MSW	Municipal Solid Waste: MSW is non-hazardous waste, such as household trash.
Na^+	Sodium cation
NFT	Nutrient Film Technique: NFT is a hydroponic technique whereby the bare roots of a plant are watered using a controlled, shallow, nutrient-dense stream.
nm	nanometer
PAR Spectrum	Photosynthetically Active Radiation: PAR designates lighting spectral range.
PPFD	Photosynthetic Photon Flux Density: PPFD is the number of photons in the photosynthetically active range per square meter per second.
PV	Photovoltaic: Conversion of light into electricity.
Qualification Study	See Feasibility Study
Reheat	A term used to describe heating a space to allow a cooling system to run 24 hours a day to produce dehumidification without reducing temperatures in the space.
RH	Relative Humidity: RH is the ratio of actual vapor density in the air to saturated vapor density of the air.
ROI	Return on Investment: ROI is calculated as gains-costs/costs. Though typically used in costs analyses, it can be used to calculate investment benefits of any type.
SEER	Seasonal Energy Efficiency Rating: A measure of the efficiency of an air cooling system.
SQG	Small-Quantity Generator: An EPA category for waste generators based upon quantities of hazardous and acutely hazardous waste generated and accumulated.
VRF	Variable Refrigerant Flow: VRF is an HVAC technology that is used to reduce loss of efficiency.
XCEL	Xcel Energy is a utility company serving several Midwestern and Western States, including Colorado.

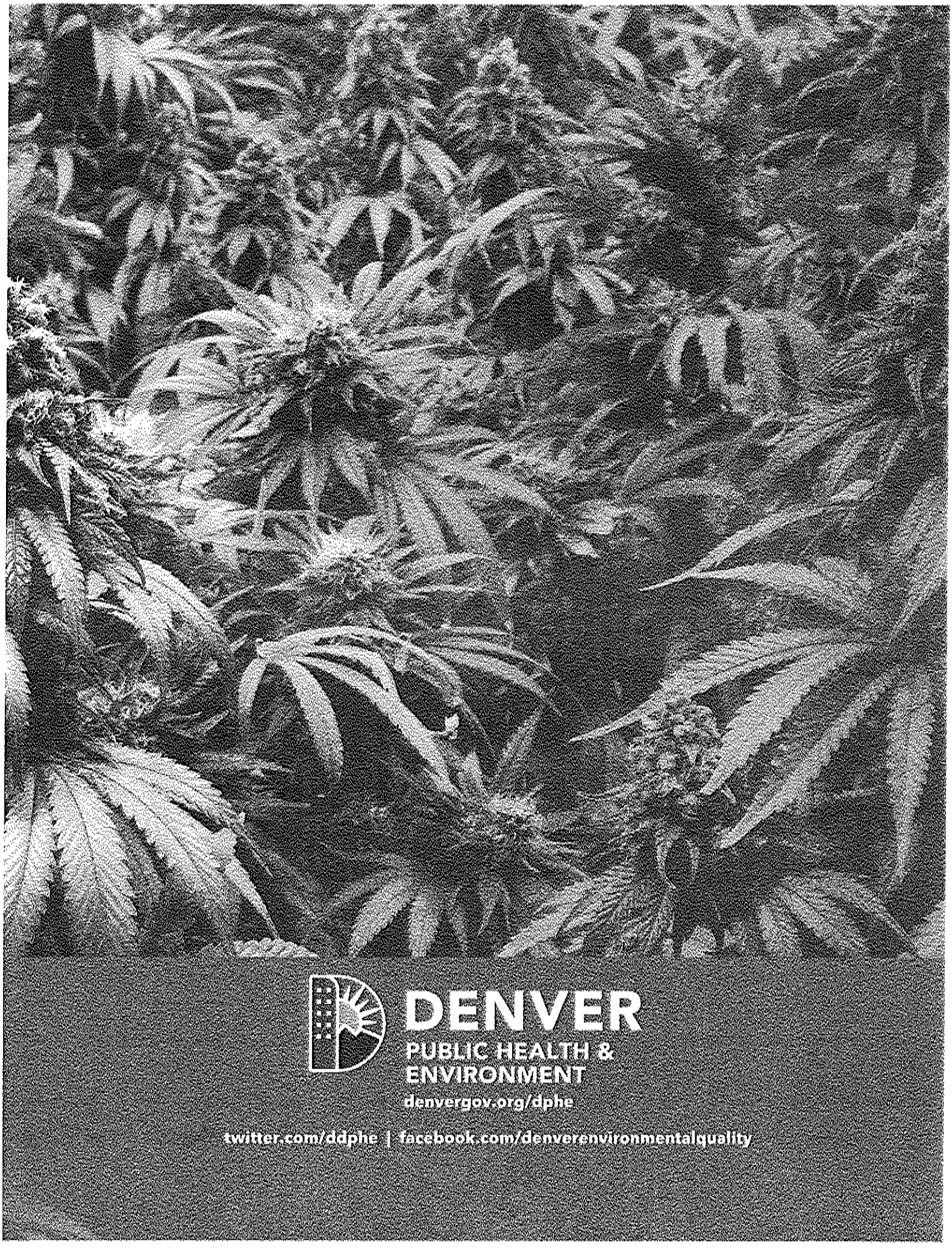

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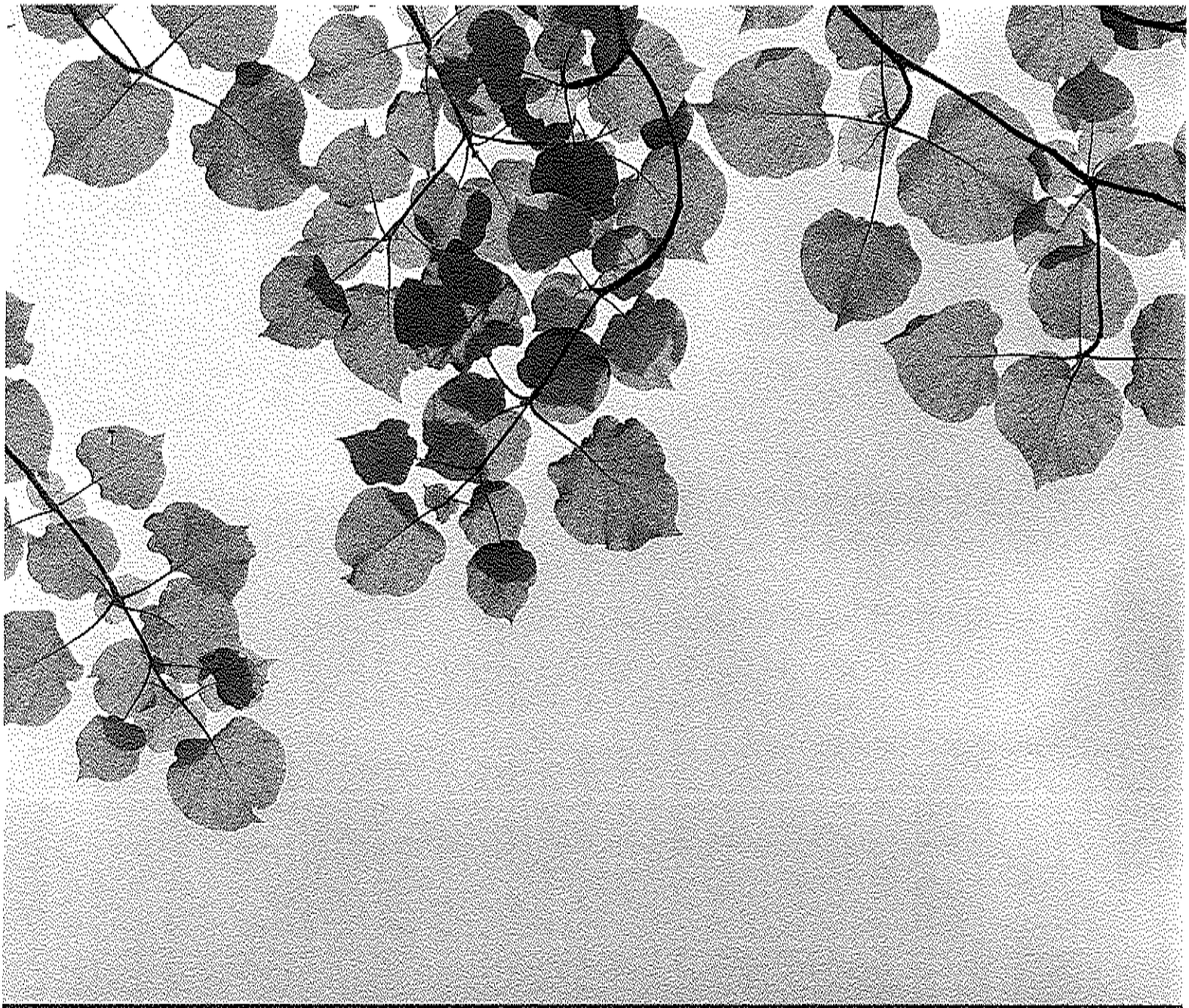
Exhibit Q



CANNABIS ENVIRONMENTAL BEST MANAGEMENT PRACTICES GUIDE

CANNABIS CERTIFICATION COUNCIL

OCTOBER 2020

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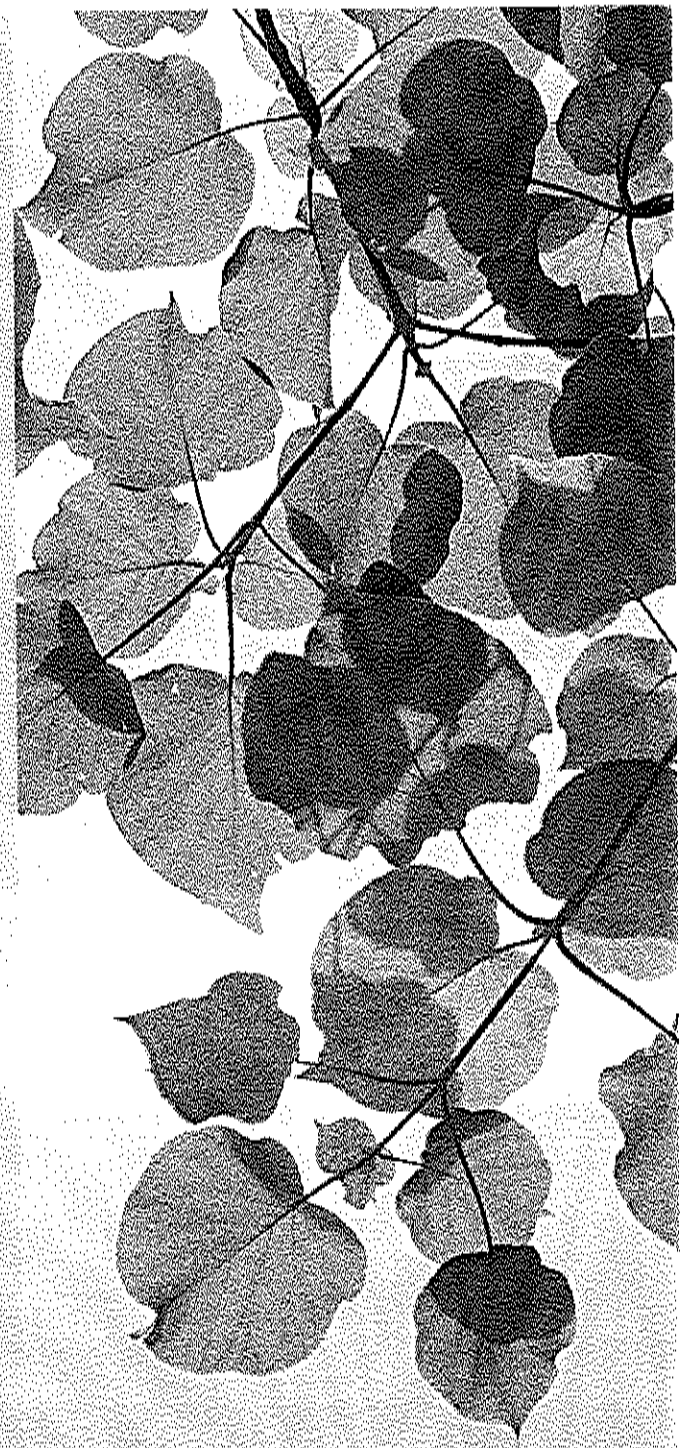

ACKNOWLEDGEMENTS

The Cannabis Environmental Best Management Practices Guide (Guide) is the product of the Denver Environmental Health (DEH) Cannabis Sustainability Work Group (CSWG), an interdisciplinary collaborative sustainability workgroup convened in 2016 for the purpose of providing sector-specific sustainability resources and guidance to the local cannabis industry. The CSWG includes experts from cannabis business, sustainability science and engineering firms, legal experts, and local government.

The Guide would not have been possible without the insight and efforts of CSWG members and peer reviewers. Particular thanks go to the best management practices committee:

Andrew Alfred, LivWell Enlightened Health
Andrew Bennett, Energy Outreach Colorado
Karuna Chourey, Growcentia
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Brandy Keen, Surna
Emily Long, Byers Scientific
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Brandon Rhea, Native Roots
Marc Ross, Needle Consultants, LLC
Derek Smith, RII
Kim Stuck, Allay Consulting
Joe Sullivan, Cultivate EO
Ambra Sutherlin, Boulder County
Kaitlin Urso, CDPHE.

FROM THE EXECUTIVE DIRECTOR,



Denver's Office of Climate Action, Sustainability and Resiliency would like to congratulate the Cannabis Sustainability Work Group on the 2020 update to the Cannabis Environmental Best Management Practices Guide. The content for this guide has been developed over 5 years with the input from industry professionals, the community, environmental experts and state and local governmental agencies with the aim to help cultivators increase efficiency and reduce their climate and environmental impacts.

This Work Group was born from the desire to proactively embed an ethos of sustainability within the cannabis industry upon legalization in Colorado. Recognizing that the cultivation of cannabis has the capacity to consume considerable amounts of energy and natural resources, the group has worked tirelessly to create tools to educate industry professionals and foster a network of environmental leaders within this ever-expanding industry. Denver is now home to over 500 active cultivation licenses; thanks to this group and guide, many are taking strides to increase efficiency while reducing their consumption and environmental impacts. In addition to this guide, the group also hosts regular workshops and an annual Cannabis Sustainability Symposium with over 100 speakers and 45 sessions in 2020 alone.

The partnership between cannabis professionals and local and state governments serves as a model for successful community collaboration to make meaningful progress toward common sustainability goals. Their work helps to advance programs and policy, remove barriers where appropriate and foster the broad adoption of sustainable business practices, ultimately helping the City achieve its 80x50 Climate Goals.

We would like to express our sincere gratitude for the Cannabis Sustainability Work Group and for their commitment to fostering sustainability practices within the cannabis industry in Denver, in Colorado and beyond. We hope that you find this guide useful and inspiring and continue to engage with the Cannabis Sustainability Work Group through their workshops, tools and symposium.

Sincerely,

Grace Rink

Executive Director, Office of Climate Action, Sustainability and Resiliency

INTRODUCTION

CANNABIS SUSTAINABILITY SECTOR OVERVIEW

Under the leadership of Mayor Michael B. Hancock, Denver has committed to reducing greenhouse gas emissions (GHG) 80 percent below 2005 levels by 2050 (80x50 Climate Goal). Commercial buildings represent 35 percent of citywide emissions, and — as cannabis businesses occupy an increasing amount of commercial building space — the cannabis industry plays an important role in helping the community meet its emission reduction targets.

National and international attention is increasingly being focused on the sustainability impacts of the cannabis industry in states where cannabis has been legalized. Some cannabis businesses have initiated sustainability programs to reduce environmental impacts and have partnered with local communities for environmental and social good. However, because sector-wide baseline sustainability metrics are not currently available, overall industry sustainability performance remains unverified — leaving public perception open to individual interpretation.

In 2016, Denver Department of Public Health & Environment collaborated with local cannabis industry representatives, sustainability practitioners and regional stakeholders to create the Cannabis Sustainability Work Group. The group's mission is to promote sustainability in the cannabis industry through education, the development and dissemination of best practices, and the facilitation of dialogue between the cannabis industry, the community and technical experts.

BEST PRACTICES GUIDE PURPOSE

The Guide provides recommendations for cannabis-specific sustainable practices based on an analysis of existing data from individual case studies and regional and national performance standards as well as individual technical expertise. The purpose of the Guide is to provide cannabis cultivation businesses with a snapshot of relevant sustainable practices and a starting point for process optimization techniques that facilitate continual improvement.

In addition, the recommendations were designed and written with Denver's energy and climate sustainability goals in mind, including the 80x50 Climate Goal.

Alignment with regional stakeholders is critical to partnering for success in pursuit of social, economic and environmental sustainability. Longevity is key, and collaborating for healthy communities and holistic growth will ensure strong performance in the short and long term.

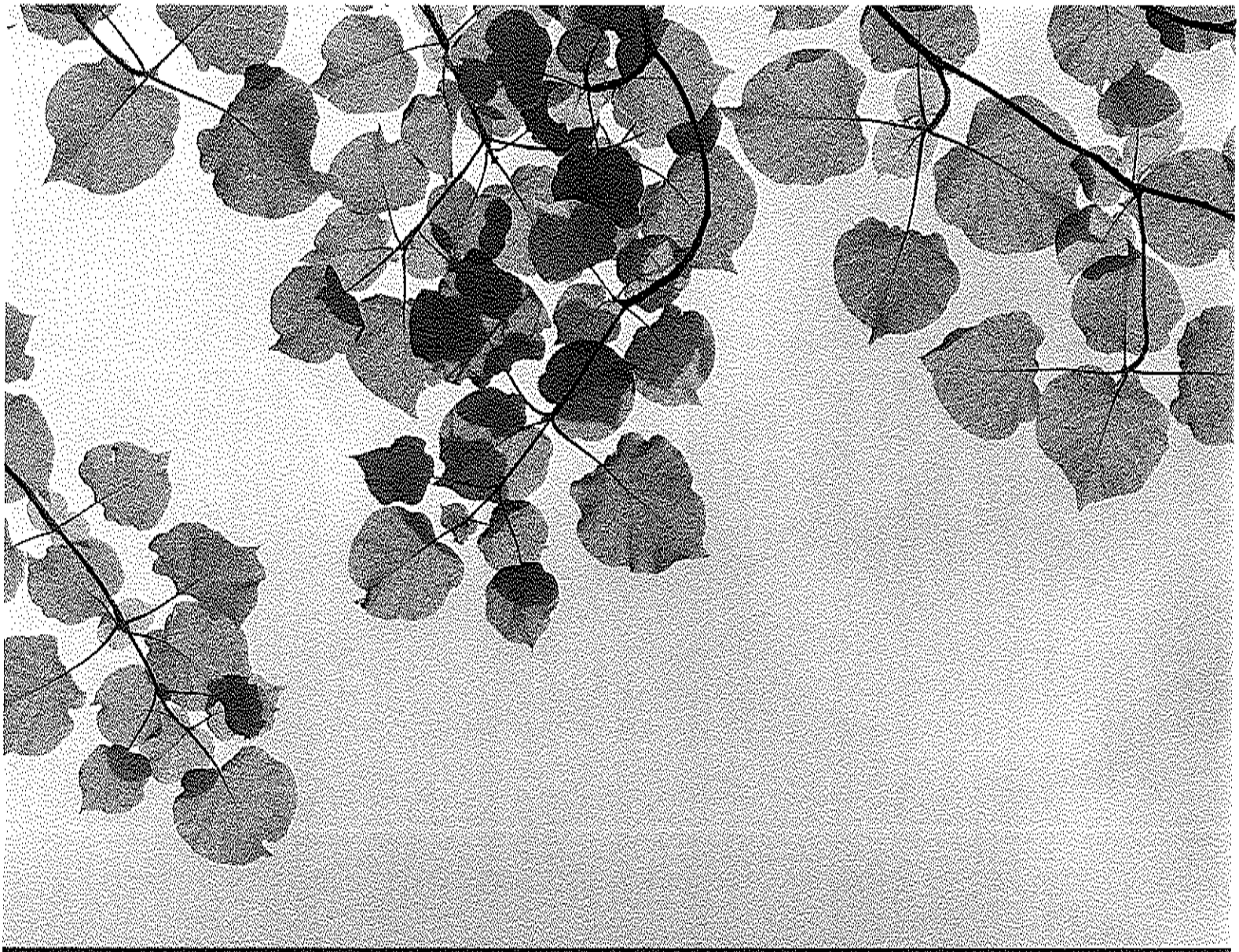
LIMITATIONS

This 2020 release is the fourth version of the Guide, which was originally released in 2017. The authors recognize that sustainability encompasses many topics, not all of which are addressed by this document. The Work Group strives to add timely and relevant new content annually.

CANNABIS CULTIVATION SIGNIFICANT ASPECTS AND RELATED IMPACTS IN DENVER

The Denver 2020 Sustainability Goals, as well as the 80x50 Goals mentioned on the previous page, help guide sustainability work in the City and County of Denver. The cannabis industry's significant environmental aspects and related impacts are listed below and highlighted throughout this document.





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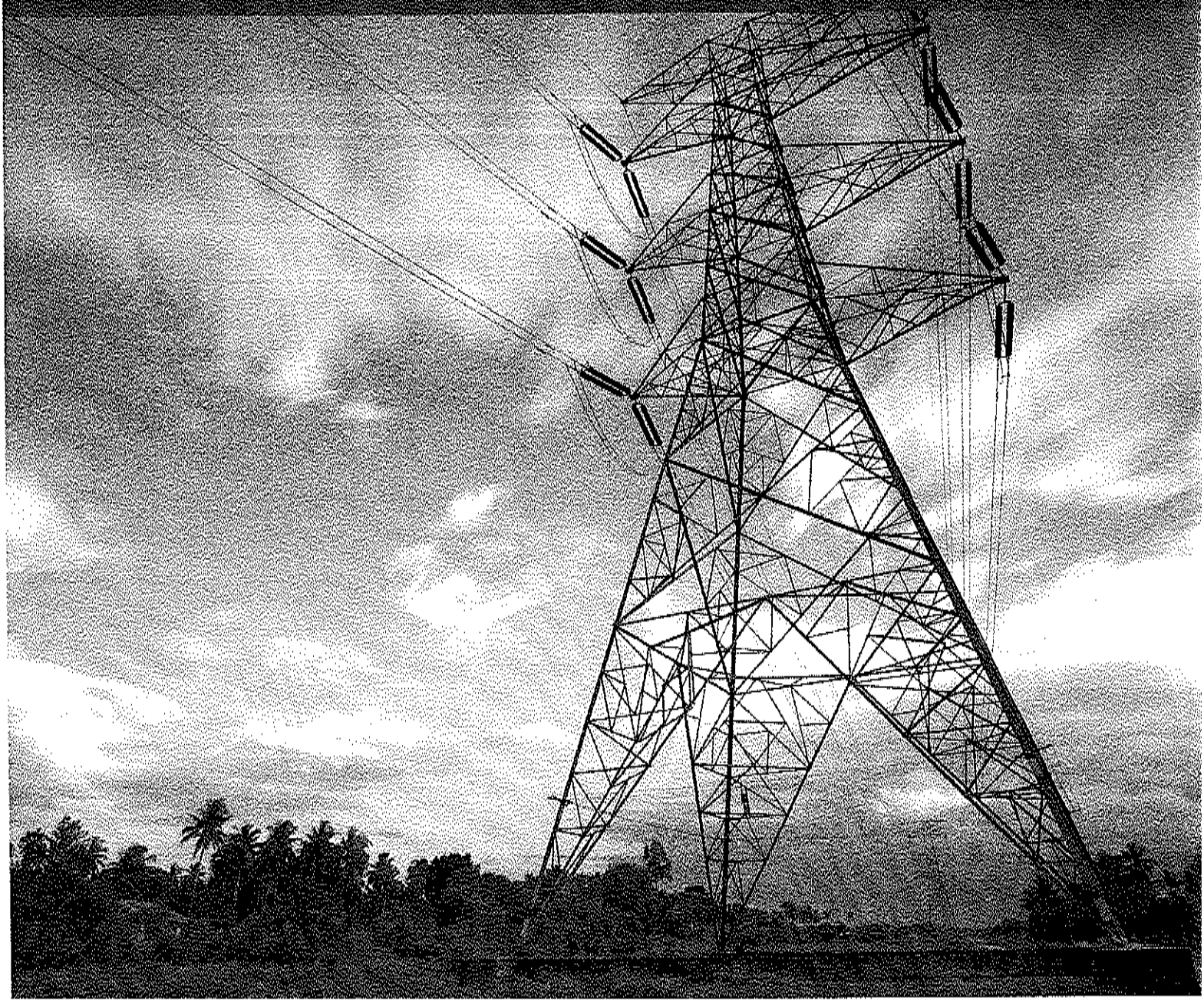
CANNABIS ENVIRONMENTAL BEST MANAGEMENT PRACTICES GUIDE

ENERGY



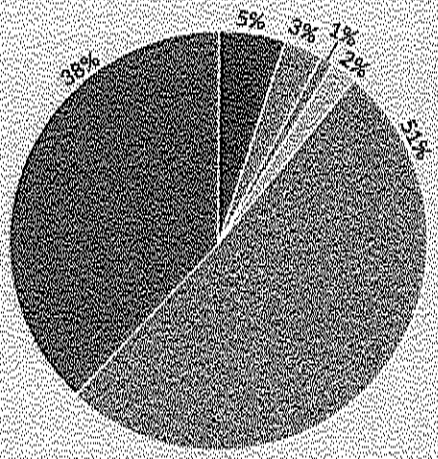
EXECUTIVE SUMMARY

Depending on the environment, growing cannabis can be a very energy-intensive process. This energy consumption is the leading driver of greenhouse gas emissions for the industry and is one of the biggest opportunities for growers to cut costs, critical in a market where decreasing wholesale prices and increasing competition are putting pressure on grows to be more cost effective to stay in business.[1]

The best time to incorporate energy efficiency and renewable energy measures into a cultivation is before it is built, but there are plenty of retrofit actions that growers can take to improve their energy usage in established facilities, as well.

During the process of designing a cultivation, one of the most immediately impactful actions one can take to reduce energy costs is to grow in a greenhouse or outdoors. However, there are important economic and risk tradeoffs with these options — such as having limited outdoor growing seasons in Colorado and the more complex architecture of a greenhouse — that must be considered when weighing how and where to build your grow.[2]

Figure 1[2]: End Use Electricity Consumption for an Indoor Grow



As shown by the above chart, lighting and HVAC are the largest loads in a typical indoor cannabis facility. For growers looking for low-hanging fruit in existing or new-build indoor facilities, tackling the efficiency of your lighting and HVAC systems is the easiest and most impactful first opportunity.

Best management practices that will be covered in this report include (in order of appearance):

- Measurement and verification
- Scheduling
- Lighting
- Greenhouses
- HVAC & Dehumidification
- On-site and off-site power generation

Hood, G. (2018) Colorado Public Radio. Nearly 4 Percent of Denver's Electricity is Now Devoted to Marijuana

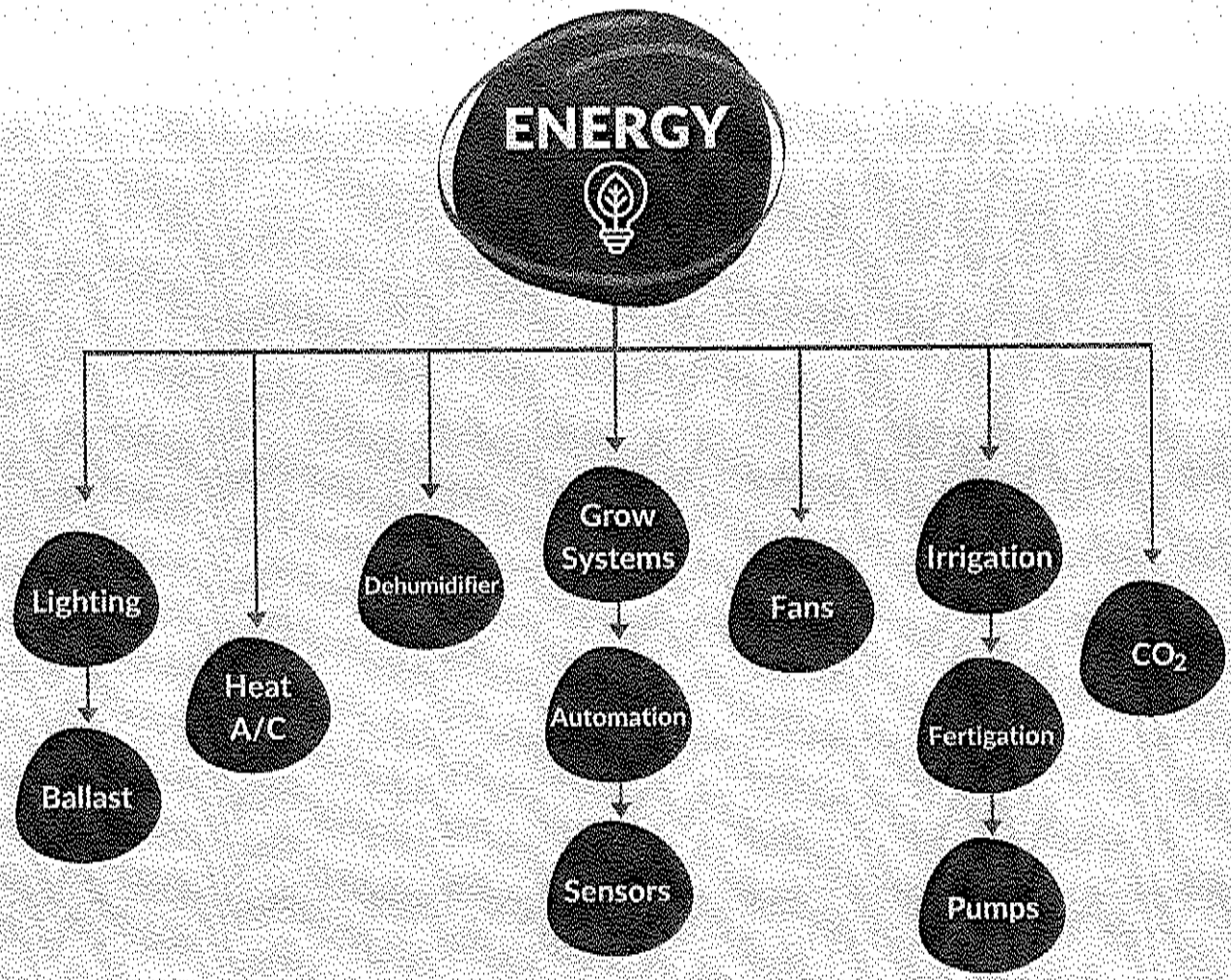
Kenney, N. (2017) EWEEB. A Budding Opportunity: Energy Efficiency Best Practices for Cannabis Grow Operations

ENERGY EFFICIENCY & MANAGEMENT

OVERVIEW

Indoor cannabis cultivation is a resource intensive process with energy demands as the greatest contributor to the industry's environmental footprint. While growing cannabis in a controlled indoor space leads to more consistent year-round production, high energy costs and increasing price competition are pushing cultivators to get familiar with the energy impacts. Decisions relating to cultivation facility design should be driven by location specific metrics and cultivation processes. High energy use and the associated air quality and emissions contribute to negative public perception; therefore, active energy efficiency efforts can help cannabis businesses create positive improvements within communities.

Figure 2: Primary Electricity Use for Indoor Cannabis Cultivation



There are three primary reasons why cultivators should look to reduce energy profiles:

Economic Competitiveness:

Energy use represents a significant portion of a cultivation facility's total operating budget. As the industry continues to mature in Colorado, the market is becoming increasingly price competitive. Organizations that reduce energy consumption, and thereby energy costs, will be better situated to succeed in this increasingly competitive market.

Community Relations:

As the cannabis industry continues to grow, the electric demands of cultivation facilities could potentially lead to grid outages that affect the local community. For example, Oregon's Pacific Power has attributed seven minor community outages to grow operations.

Environmental Impact:

Electricity production is responsible for approximately one third of total greenhouse gas emissions in the United States. Over the past decade, various efforts to mitigate climate change have resulted in national electric demand remaining flat (zero percent growth).

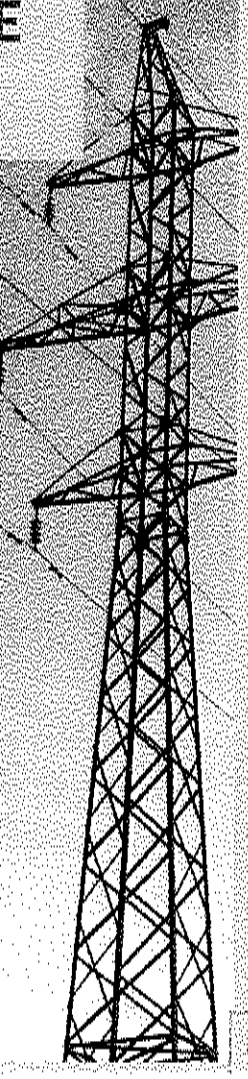
In contrast, Denver's electricity consumption has continued to increase over the past several years due to a variety of factors, including overall community growth. Electricity use from cannabis cultivation and infused products manufacturing grew from about 1% to about 4% of Denver's total electricity consumption between 2013 and 2018.

While there is no singular solution for cultivators looking to reduce facilities' energy profiles, the listed best practices are intended to provide a framework by which organizations can begin to develop a comprehensive energy management plan.

ELECTRICITY USE

2013-2018

Electricity use from cannabis cultivation and infused products manufacturing grew from about 1% to about 4% of Denver's total electricity consumption between 2013 and 2018.



MEASUREMENT & VERIFICATION

PROCESS DESCRIPTION

You don't know what you don't track. It is important for growers to understand and know how their facility uses energy in order to evaluate opportunities for improvement. Developing an appropriate M&V process will depend on both facility-specific factors (size, existing infrastructure, geography, etc.) and an organization's specific economic and sustainability goals. The following best practices are intended to provide a starting point for facility managers.

METRICS

There is currently a paucity of relevant, high quality energy data in the cannabis industry. Cultivators should measure and share facilities' energy usage data to make more strategic equipment and process decisions as well as to contribute to an understanding of the current state of the industry. One benchmarking tool is Resource Innovation Institute's Cannabis PowerScore.

Recommended metrics to track include:

Table 2: Key Metrics to Track

Metric	Description	Units	Notes	Average Range
Lighting Yield per Watt	Used to compare lighting technologies and strains.	grams/Watt	Measure grams of flower and trim in dry weight. Use lighting wattages, including ballasts. Measure over one grow cycle and annually	Overall average 1.0 g/W
Total Energy Efficiency	Identifies total production efficiency; helps identify trends in building.	grams/kWh	Measure monthly and annually Use total kWhs for building.	Total dried product weight ÷ kWh/cycle = Yield per kWh
Space Utilization	Identifies total production efficiency; helps identify trends in building.	grams/kWh	Measure monthly and annually Use total kWhs for building.	39.5g/sq. ft.
Lighting Intensity	Measures whether the lights are providing the desired photosynthetic photon flux density (PPFD); can help identify correct time to replace lights.	µmol/m2 /s	Measure at canopy. Measure for each type of lighting, for each stage of growth.	Refer to Table 3: Lighting Technologies for Cannabis Production
Daily Light Integral	Measures the daily accumulation of photosynthetically active radiation (PAR) spectrum light reaching the plants.	mol/m2 /day	Formula: µmol/m2 /s (or PPFD) x 3600s x photoperiod (hr/day) / 1,000,000	Denver Outdoor Avg. Winter 15-30 mol/ m2 /daySummer 25-45 mol/m2 /day
Load Factor	Used to manage peak power demand; higher Load Factor reduces cost of energy.	kWh / (peak kW * days * 24 hours per day)	Use monthly electricity figures. Days equals days in billing period.	<0.60 = poor 0.60 - 0.75 = fair >0.75 = good

GUIDANCE ON COLLECTING DATA

Three levels of data, in order from least granular to most, to consider are:

Level 1 — Properly interpreting and recording monthly utility bills.

Level 2 — Requesting utility interval data, if available.

Level 3 — Installing data loggers at the building or sub-meter level.

Utility bills contain great information but are often poorly interpreted and recorded. A facility manager should break out total energy used (kWh), peak demand (kW), consumption-based charges, demand based charges, and fees and taxes for each bill. Inputting this info (along with water and production data) into a standardized spreadsheet should take only a few minutes each month.

OBTAINING BUILDING DATA FROM XCEL ENERGY

Energy usage data can pertain to electricity, natural gas, steam, fuel oil, diesel, on-site solar or any other energy source. The data must cover consumption from January 1 through December 31 of the previous year. Consumption data can be collected through an Xcel Energy account, a natural gas supplier account or from past bills. Xcel Energy's My Account portal is a helpful online tool for obtaining monthly use figures and annual totals.

Xcel Energy has developed a data access portal that allows tenants and building owners to automatically receive aggregate energy consumption data imported directly into ENERGYSTAR Portfolio Manager accounts. ENERGYSTAR Portfolio Manager accounts must be set up prior to beginning the application. Visit www.xcelenergy.com and navigate to the Programs and Rebates page; click on the Business icon; then select the New Construction and Whole Building category to learn more about energy benchmarking.

UTILITY INTERVAL DATA

- Facilities with smart meters can request 15-minute interval data from the energy provider.
- Facilities can also opt to pay for Xcel's InfoWise service, which uses interval data to create a web-based energy dashboard that provides various insights and metrics. This service costs $150 per month, with a $900 equipment charge if a smart meter is not already in place.
- Cultivators can also install equipment to log energy data. This can be done concurrently with a Building Management System (BMS)/Energy Management System (EMS) installation, or can be done solely for logging energy data. Installation will allow for capturing higher frequency, submetered data that can provide a great deal of insight into how a facility is using energy.

When properly configured and monitored, a robust BMS/EMS can quickly alert a facility manager about broken or malfunctioning equipment, saving facilities from energy waste, equipment failure, power loss and even loss of crop in the event of malfunctioning environmental controls. See below for more information on BMS/EMS systems.

BUILDING MANAGEMENT SYSTEMS/ ENERGY MANAGEMENT SYSTEMS

Facility managers looking for a comprehensive data solution should consider installing a BMS or an EMS. As there are many different types of BMS/EMS systems available on the market, the U.S. Department of Energy has developed a suite of Specification and Procurement Support Materials to help managers identify the right fit for each facility.

ENERGY AUDIT/ENGINEERING ASSISTANCE STUDY

Performing a comprehensive energy audit or engineering assistance study (EAS) is often the quickest way to acquire the insights needed to develop an effective energy management strategy, but enacting this process typically requires partnering with a qualified third-party provider. Xcel's Energy Analysis Program is a good starting point for facility managers that are interested in pursuing these options and also offers several financial incentive programs to reduce an organization's out-of-pocket costs.

It would benefit the operator to install submeters inside the building to collect power-usage data, such as those manufactured by e-mon or Power TakeOff. Submeters measure the power used in a specific area and/or by certain pieces of equipment, giving a more detailed picture of how and where energy is consumed in the building.

PORTFOLIO MANAGER

Because of Denver's Benchmarking Ordinance, Denver commercial and multifamily buildings that exceed 25,000 square feet are required to analyze and report their energy performance using Energy Star's free Portfolio Manager tool.

For how to set up an account, cannabis business owners and/or facility managers can refer to the City of Boulder: How-to Guide for Medical and Recreational Marijuana Business License Energy Reporting and Carbon Offset.

ENGAGE SPECIALISTS

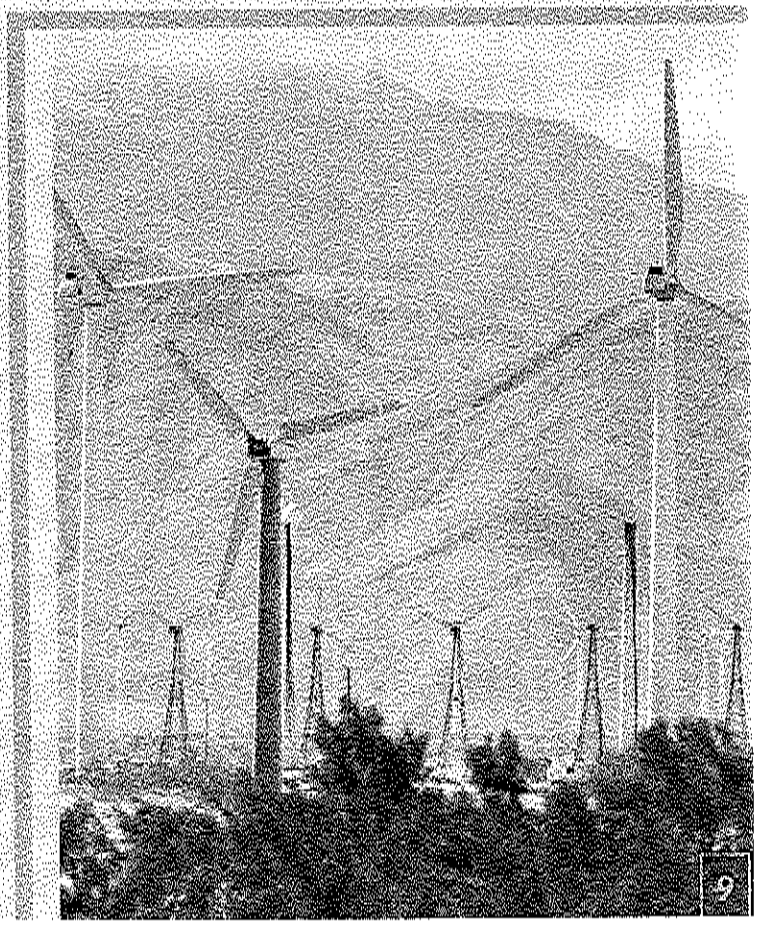
An energy specialist (such as a Certified Energy Manager) can perform any of the above tasks for a cultivator, particularly if a grower should seek out an experienced contractor to install submeters. Interested cultivators should consider a local trade group or association such as Rocky Mountain Association of Energy Engineers.

Additionally, a specialist can perform an on- site energy audit or engineering assistance study (EAS) to reveal and evaluate energy savings opportunities. As mentioned below, Xcel Energy offers related grants/incentives.

As the cultivation industry matures, the availability of energy, water, lighting and space efficiency metrics as related to production data becomes imperative. Individual cultivators — as well as the industry at large — should have intimate knowledge of these measures and of how particular technologies and behaviors affect resource and production efficiency.

Resources:

- Xcel Energy - Business Programs & Rebates
- Sample Energy Audit Form



SCHEDULING

Cultivation facilities in the Denver metro area receive electric service from Xcel Energy and are billed according to total electricity consumption (kWhs) and peak demand (kW). How a facility is operated can have significant impacts on peak demand and the actual cost of energy. Managing the operation of various systems within the facility by setting staggered room schedules can significantly reduce energy costs and negative impacts on the power grid. Reducing peak demand also creates community-level environmental benefits, because energy providers utilize "peaker plants" that are generally older, less efficient and have higher emissions to provide additional electricity during times of high demand.

PROCESS DESCRIPTION

ENGAGE SPECIALISTS

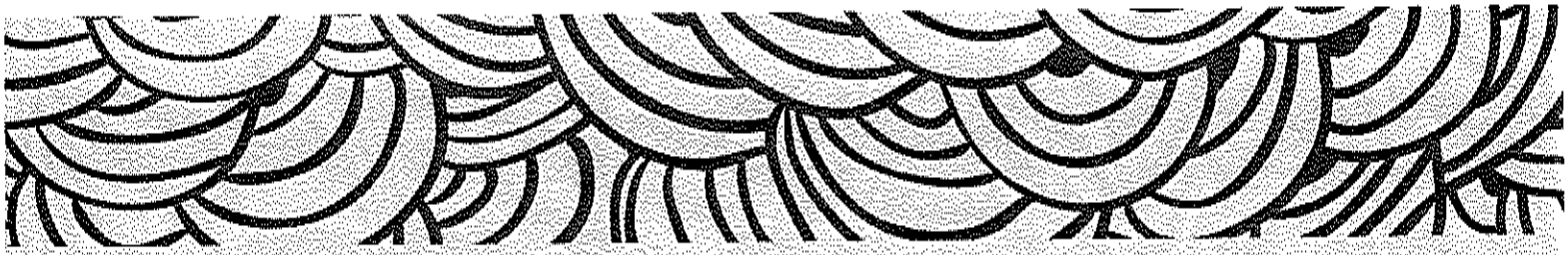
Energy-efficient technologies can improve both the total energy use and peak demand of a facility. Operating schedules, on the other hand, play a critical role in minimizing peak demand over the month. Grow rooms, particularly in the flower stage, represent the largest sources of peak energy needs when factoring in lighting, cooling and ventilation. All grow room schedules should be staggered over the 24-hour period so the minimum number of rooms run concurrently. Any overlap of schedules, even for one hour or less, leads to higher spikes in peak electricity demand and higher costs.

Similarly, other energy-intensive processes, such as extraction, cleaning or electric heating, can be staggered and scheduled carefully with lighting cycles to minimize peak power demands.

TIME OF USE

Many utilities are moving toward billing customers with varying rates based on the time of day they use electricity. Xcel Energy does not yet charge time-of-use billing for Secondary General rate customers (the rate category most cultivation facilities fall under). Kilowatt hours cost the same day or night, but energy can be saved by running extra equipment during cooler evening periods. If it is necessary to operate extra grow rooms simultaneously, cultivators should try to schedule those periods overnight when outdoor air temperatures are lower. This can reduce the cooling load during these times of extra production, thereby reducing energy use and saving money.





Should I Veg Under a 24hr or 18:6 Photoperiod?

Growers often ask this question when designing their operation, but what is the right answer? The truth is, both work! By keeping the lights on for 24 hours a day, plants are exposed to 33% more light than an 18:6 schedule. This means more light for photosynthesis. However, regular periods of darkness (lights off) are important for other plant functions. Plants actually use nighttime to take in oxygen (just like people) and burn the glucose that they stored up during the day to grow in a process called cellular respiration. Ultimately, the tradeoff between maximizing light during 24hr versus giving plants a break to use their stored energy in an 18:6 schedule more or less cancels out. The most sustainable strategy from an energy point of view is to employ an 18:6 schedule. This will yield happy and productive plants while keeping your energy bill lower at the same time.

TIME OF USE

Many utilities are moving toward billing customers with varying rates based on the time of day they use electricity. Xcel Energy does not yet charge time-of-use billing for Secondary General rate customers (the rate category most cultivation facilities fall under). Kilowatt hours cost the same day or night, but energy can be saved by running extra equipment during cooler evening periods. If it is necessary to operate extra grow rooms simultaneously, cultivators should try to schedule those periods overnight when outdoor air temperatures are lower. This can reduce the cooling load during these times of extra production, thereby reducing energy use and saving money.

LIGHTING

Lighting can be the most energy-intensive component of the cultivation environment. The design of a facility's lighting system and the types of lamps utilized in the grow process will affect both crop yield and quality. Furthermore, the lighting selection will have a substantial impact on the size of the HVAC system, and is therefore a significant driver of overall energy use in the facility. Employee health and safety should be considered in the design and delivery of indoor lighting, as well.

PROCESS DESCRIPTION

Due to the operational impact of lighting choices, a host of production-related factors must also be considered as cultivators select the appropriate lighting technology.

Lighting technologies should be measured in terms of photosynthetically active radiation (PAR), or the measure of the specific light spectrum characteristics. PAR accounts for the spectrum of light between 400 nanometers (nm) and 700nm, most of the light spectrum used for photosynthesis. Infrared (IR) and ultraviolet (UV) light spectrums fall outside of PAR readings and thus do not register with standard light spectrum measuring equipment. IR and UV light are actually classified in a range of light referred to as biologically active radiation (BAR). The concept of BAR is still new, and so for the purposes of this guide, the focus will be on PAR. The intensity of the lighting system or photosynthetic photon flux density (PPFD) is measured in micromoles per second per meter square (µmol/s-m2) and should be carefully monitored for optimal plant growth. This can be measured using a light meter with a quantum sensor.

LUMENS ARE FOR HUMANS

If you're familiar with lighting measurements, you have probably noticed that this document does not discuss some of the attributes usually important for interior lighting. The factors that determine light quality for plant growth are different from those to consider for working and living spaces. Measurements that are largely irrelevant for cannabis lighting include lumens, footcandles and lux.

EQUIPMENT OVERVIEW

Historically, the top three lighting technologies used have been T5 fluorescent, metal halide (MH) and HPS. There are now several different options to choose from, including (but not limited to): LED, light emitting plasma (LEP), CMH, and various combinations of these. LED adoption by cultivators appears to be growing. If you are considering an LED-lit grow environment, a peer-reviewed resource that may be helpful is Cultivating Cannabis with LED Lighting - A Primer: What You Need to Know.

Many of these lighting types have specific spectrums of PAR and are generally used for one stage of growth or another. Prescribing specific heights above canopy for lighting systems is not recommended, as PPFD, age of fixture, bench height and plant height will all dictate the location of the fixture. Fixture design and optics will also dictate where the light lands, and at what photon density at various heights, so height and location of fixture should be decided on with the help of the manufacturer to optimize photon density and limit waste. There should be a perpetual review of micromole levels for cannabis and the need to adjust fixtures with the aid of a good light meter to obtain the necessary PPFD.

Lighting fixtures emit energy in the form of light, as measured in PAR or photosynthetic photon flux (PPF), and reflectors direct the light toward the canopy with varying levels of sophistication and success. LEDs tend to be directional in nature and thus generally do not require reflectors. Knowing the lighting output of a fixture alone without understanding, properly configuring and measuring the lighting intensity at the canopy will result in suboptimal lighting conditions. Below are general uses and specifications for each of these technologies.[3,4]

Table 3: Lighting Technologies for Cannabis Production

Light Technology	General Use/Growth Stage	Spectrum	Rated Life in Hours	Intensity* in PPFD	Efficacy in µmoles/J
T5/T8 Fluorescent	Plant propagation — mothers, clones and early veg	Broad spectrum with ability	20,000	150 - 500	0.84 (T8)
Metal Halide	All stages of growth (most commonly vegetative)	Broad spectrum	6,000 - 15,000	500 - 800	TBD
Ceramic Metal Halide	All stages of growth	Broad spectrum	20,000	800	1.46
High Pressure Sodium (singleended)	All stages of growth (most commonly flower)	Broad spectrum with yellow	5,000 - 20,000	700 – 900	0.94-1.34
High Pressure Sodium (doubleended)	All stages of growth (most commonly flower)	Broad spectrum with yellow	5,000 - 20,000	700 - 2,000	1.70-2.2
Light Emitting Diode	All stages of growth	Broad spectrum or Single	50,000	up to 1,500	1.70 - 2.7
Light Emitting Plasma	All stages of growth	Broad spectrum	30,000	700 - 900	1

ntensity is measured at manufacturer's recommended mounting height

Times listed are the time it takes to reach 70-90% of original output, depending on the number listed by the manufacturer. Lights will sometimes need to be



BEST PRACTICES

SYSTEM DESIGN

When designing for indoor cultivation, it is important to identify and understand target light levels for optimal growth. The correct measurement for obtaining best results is PPFD measured at the top of the canopy. Once an operator has determined the target PPFD, the cultivator should work with an engineer or vendor to design the system around the target. If a manufacturer cannot assist in the design and technical review, the cultivator should consider seeking a more capable vendor, or be sure to have an appropriate consultant on the team.

An important consideration when designing a lighting system is PPFD uniformity. Ensuring crops receive uniform light intensity will help ensure that the crop grows uniformly. Deficiencies in light intensity often occur at the edges of cultivation spaces, such as aisles and walls. These areas often produce decreased yields due to a lack of light. Lighting vendors should provide light plans that at the very least show minimum, maximum and average PPFD of the designed area. PPFD uniformity can be improved by choosing the proper reflector type when using HID lighting, or in general by increasing the density of light fixtures. Further efficiency can be gained by using reflective coatings and paints on walls, floors and equipment to direct photons back toward the crop. In greenhouses, sensors can be used to monitor light during the day and turn lights on and off based on the amount of sunlight and the target PPFD. This is a great way to get the most out of a crop while trying to minimize electricity use.

[3] Neil Yorio. (2014) Towards Sustainable Lighting For Commercial Cannabis Production. Biological Innovation and Optimization Systems (BIOS)

[4] Jacob A. Nelson and Bruce Bugbee. (2014) Economic Analysis of Greenhouse Lighting: Lighting Emitting Diodes vs. High Intensity Discharge Fixtures. PLOS One.

MAXIMIZING PRODUCTION & EFFICIENCY

RACKS

Many cultivators are moving to tiered production on vertical racks or shelving. This strategy is most common in vegetation rooms where plants are smaller and require lower light intensity. Fluorescent lights or LEDs are typically used in these stacking situations because they radiate less heat and can be placed closer to plants. A common question is, "How far away from the canopy should lights hang?"

While each light is different, the most important factors to consider when hanging lights are the temperature of the canopy and how many micromoles are hitting it. Ensuring the plants are consistently receiving the appropriate micromole level of lighting and the appropriate temperature level is essential for efficient growth.

PRUNING

Pruning is important to maximize production. Some plants may need to be topped in the vegetative stage to keep them short and bushy. Light can only penetrate a portion of a dense canopy. Taller plants take more time to grow and ultimately produce less yield per kWh.

For these reasons, it is important to prune plants multiple times throughout the growth cycle. Typical pruning activities consist of pruning off all underdeveloped branches on the bottom third of the plant and removing large leaves that are either blocking light or not receiving light. While sometimes counterintuitive, by removing plant material, pruning allows the plant to redirect resources from underdeveloped areas to parts of the plant that will ultimately increase the overall yield.

GREENHOUSES

Greenhouses will continue to take over a large portion of the cannabis industry as regulations become more favorable. Any expansion plans should at least take into consideration greenhouse production, as it can be a much more sustainable approach although results will vary significantly based on location and design choices. With greenhouse production, lights will be needed only occasionally for supplemental light. Weather stations wired to a quantum meter should be used to ensure lights are only activating when the meter dips below the minimum micromole target. These weather stations allow for the most efficient use of electricity.

When designing greenhouse cultivation facilities, many of the system designs with regard to lighting will be different when compared to indoor cultivation. Greenhouse lighting is still based on desired PPFD, but must take into consideration how much natural light/sunlight will be obtained. Light fixture count will undoubtedly decrease in most geographies compared with indoor operations, as the lights will be used only to supplement during periods of low sunlight levels.

Another aspect of greenhouse lighting system design is controllability. Many light fixtures and associated ballasts or drivers have the ability to be dimmed. There are times in both stages of growth that the plants may desire a light level lower than the full output. Therefore, cultivators can reduce energy consumption with a dimming control system. A control system can also stagger the power up and power down of any room and can help prevent unnecessary power spikes and potential damage to electrical equipment.

SEE ALSO: Appendix B: Greenhouses

TRELLISING

Trellis nets should be used in most grow systems to support plants as they flower, as well as when they spread branches to increase light penetration. Cultivators should install trellis netting in the first week of the flower stage before plants stretch. Installing low trellising early will help keep the plants stable and support heavier bud development. Branches should be spread and placed evenly through the holes in the trellis netting to maximize benefit. Often multiple trellises will need to be applied to the same crop over the course of flowering, depending on the size of the plants.

ADJUSTABLE LIGHT FIXTURES

It can be beneficial to have adjustable ratchets on the light depending on the technology, layout and manufacturer's recommendations. Having the ability to move the light closer to shorter plants can greatly increase the level of micromoles the plant receives. It can also be helpful to pull the lights up and away from taller plants to prevent burn. Cultivators should be sure to use non-combustible cables or chains when using adjustable lighting fixtures

LIGHTING MAINTENANCE & REPLACEMENT

Proper maintenance of lighting and lighting components is important for performance and efficiency. A dirty optic lens or reflector could reduce performance by more than 10%. Different lighting technologies have different maintenance considerations.

Bulbs: Cultivators should make sure lights are unplugged and have had at least 20 minutes to cool before cleaning or replacing. Using glass wipes to wipe down the bulb and lens is advised, if applicable. Cultivators should wipe down lights once every two months or between harvests, but should not wipe the base of the lamp or the socket. Most manufacturers recommend replacing bulbs every 12 months, along with the reflector. However, bulbs used on a 12 hours on/12 hours off ("12/12") schedule will typically have more rated life hours remaining after one year. Tracking micromole levels at the canopy level will ensure the proper amount of photons is hitting the plants. Tracking light levels and only replacing bulbs or lenses when they are underperforming is a more sustainable approach.

Ballasts: While magnetic ballasts should be replaced every two to three years because of decreased efficiency, electronic ballasts can often perform eight to 10 years. Buying a light once consisted of purchasing a bulb, ballast and reflector separately. However, most new technology includes an electronic ballast with the reflector, so no choice needs to be made.

Magnetic: Magnetic ballasts preceded electronic ballasts, and are heavier, less efficient, and noisier than electronic ballasts. However, they may come with a longer warranty than electronic ballasts, and are less expensive and easier to repair.

Electronic: Electronic ballasts have sensitive circuitry that is more difficult to repair than magnetic ballasts. Many electronic ballasts have dimmable options that can help put less light on the plants during sensitive stages of growth. The dimmable option can also be helpful in controlling the room temperature in extreme weather conditions. As mentioned above, the electronic ballast is more efficient, creates less heat and noise, and typically lasts longer than a magnetic ballast. RFI (radio frequency interference) has been a problem with older electronic ballasts, but manufacturers have been working hard to correct that deficiency.

Cords/Connection: Cultivators should thoroughly check electrical cords for any damage, cuts or abrasions that could affect performance. Also, cords should be inspected for secure connection at the outlet as well as the fixture.

LED

Optics: Some LED manufacturers will utilize a glass or plastic optic over the diodes. These optics should be cleaned every two months with a nonsolvent cleaner and nonabrasive microfiber cloth.

Diodes: Top-of-the-line diodes are rated to maintain up to 90% of their output for 50,000 hours. That's over a decade on a 12:12 schedule (a grower will need to consider if 10% loss of light is acceptable). However, they are still relatively new, and the technology is still improving. Even if the diode is capable of lasting 50,000 hours, drivers would also need to last that long, and consideration would need to be taken for how often the optic lens would need replaced.

Fans: Some LED fixtures also include cooling fans. Most advanced LED manufacturers build lights without fans. These fans have moving parts that can fail and may need to be replaced. Cultivators should look for wet location-rated fixtures, indicated with an IP65 or higher label.

Cost of Light

It is important to consider all applicable costs when designing or updating a facility's lighting setup. Purchase price is a small portion of the total cost over the equipment lifetime. Cost to operate, useful life, maintenance costs and disposal costs — as well as failure scenarios and associated costs — should be calculated and included in lighting decisions.

CASE STUDY

HPS TO LED CONVERSION IN VEG

The Clinic replaced 72 1000w single-ended HPS lights in their vegetative room with a mix of 6 bar and 10 bar BML (now Fluence) LED lights. There was an immediate electrical savings of 36,360W in that room. The Clinic also saw a decreased demand on their aging HVAC equipment due to the lower load in the room and ability to increase the temperature set point without detriment to the crop. In addition to the energy reduction in the room, the LED lights have actually sped up the process to get the plants to the right size and decreased the growing period by 1-2 weeks.

BY THE NUMBERS:

Original Configuration	72 HPS single ended	72,000W
New Configuration	72 BML LED fixtures (36 660w, 36	35,640W
Monthly Electric Savings	36 kW 19,000 kWhs	$1,400
AC Tonnage Reduction		10 Tons

Resources:

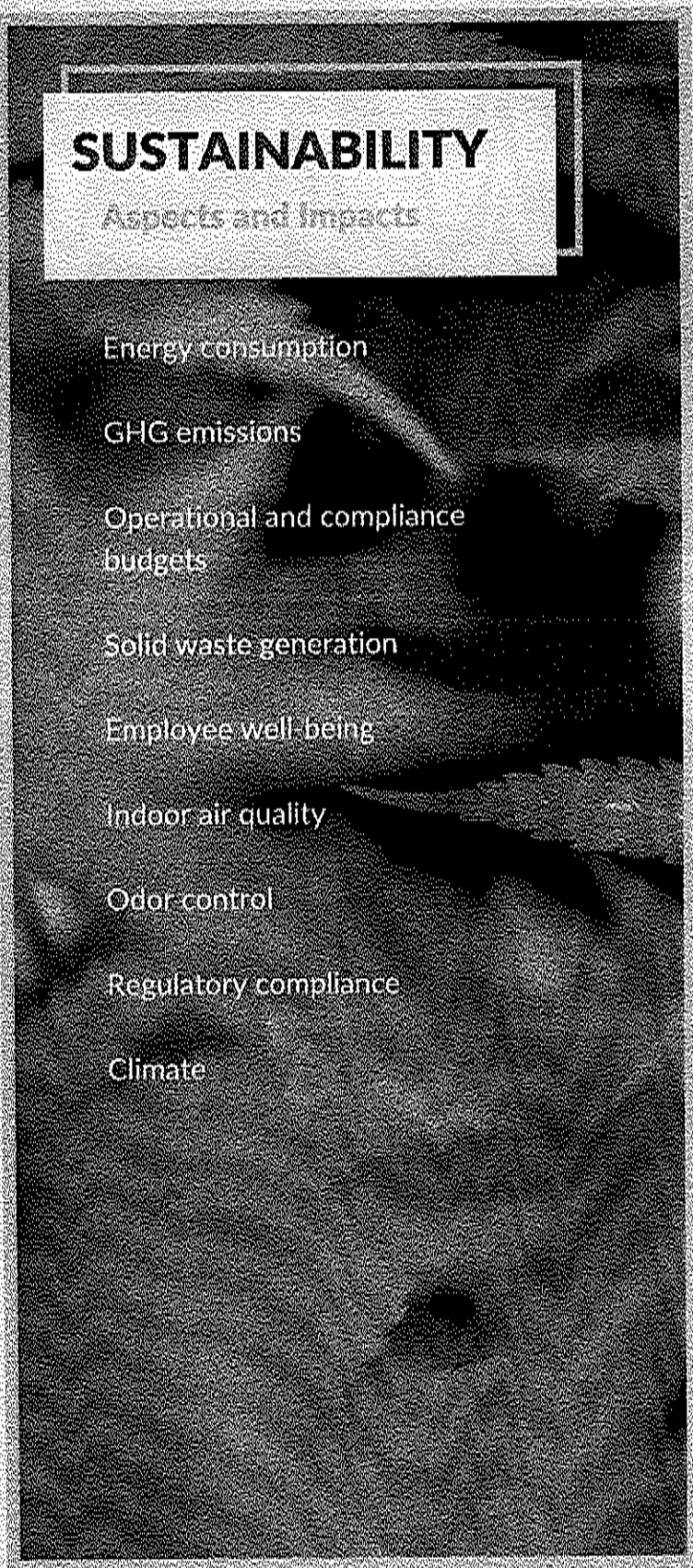
- Greenhouse Product News - Greenhouse Lighting Options
- ACE Greenhouses - Indoor Plant Grow Light Guide
- Economic Analysis of Greenhouse Lighting -Light Emitting Diodes vs. Intensity Discharge Fixtures

HVAC & DEHUMIDIFICATION

Climate control systems can account for 50 percent or more of the total energy consumption in an indoor cultivation facility.[5] Climate control consists of multiple components such as heating, ventilation, air conditioning (HVAC) and dehumidification. As such, proper climate system design, installation, commissioning, and maintenance are crucial aspects of a sustainable cultivation process. Proper climate design is critical to operational efficiency and biosecurity. In many cases, climate control will be the single largest capital investment a cultivator makes after real estate. While purpose-built cannabis cultivation facilities allow for optimal climate design, the majority of indoor cultivation sites are repurposed facilities — which adds a layer of complexity to the HVAC optimization equation.

PROCESS DESCRIPTION

In addition to requiring different approaches for purpose-built versus retrofitted facilities, optimizing climate system operations will depend on myriad facility-specific factors such as size, layout, growing method, lighting system design, watering schedule and local ambient conditions. Due to the complexity of HVAC and dehumidification systems, it is strongly recommended that facility managers consult with a HVAC/mechanical designer familiar with the cultivation space. Engineering firms stamping mechanical designs must be licensed by the Colorado Secretary of State. Installing contractors operating in Denver must be licensed by the city in addition to holding a license from the State of Colorado. Facility managers may also find it beneficial to select engineering firms with specific sustainability credentials such as a Certified Energy Manager® or LEED® accreditations. It is important



to note that typical HVAC systems are designed for comfort cooling and occupancy ventilation. These systems can present challenges in cultivation environments that will need to be understood and addressed at the design phase. Systems specifically designed for process cooling will often address these challenges and should be considered when budget allows.

Cooling is not the addition of cold air, it is the removal of heat. The act of cooling is simply the absorption and relocation of British thermal units (BTUs) — the amount of thermal energy required to change the temperature of one pound of water one degree in one hour. The more energy efficient the heat exchange, the more energy efficient the cooling system.

It is important to understand the efficiency of the system as a whole for the intended purpose when evaluating any climate system.

Commonly used equipment ratings SEER (Seasonal Energy Efficiency Rating), EER (Energy Efficiency Rating) and IPLV (Integrated Part Load Value) are limited to specific uses and often specific equipment. On the surface, a high rating might make one system look more energy efficient than another. For instance, when comparing the EER rating on a 100-ton chiller and the EER rating on a three-ton mini-split air conditioner, it might appear that using 33 mini splits is more energy efficient. This is not the case, as the other components of the chiller system (fan coils, pumps, transport energy, etc.) are not accounted for in this rating. Further, adding up the running load amps (RLA) of 33 three-ton mini splits and comparing those to the RLA of one 100-ton chiller will show that the 100-ton chiller consumes significantly less energy in operation.

COOLING METHODOLOGY

EVAPORATIVE COOLING

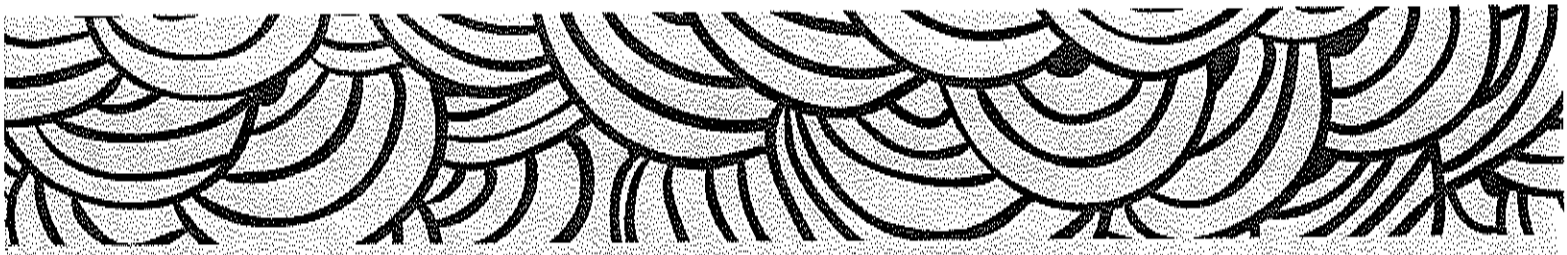
Evaporative cooling is a low-energy cooling method in which heat is absorbed from the space through the evaporation of water. Although this is an energy-efficient method of cooling for comfort applications and is especially attractive in dry climates, evaporative cooling is not recommended for cultivation spaces due to the introduction of humidity to the space.

MINI SPLITS

Small, ductless HVAC units allow for quick owner installation at a relatively low cost. These units have high-efficiency and low-ambient temperature options available. They are a viable option for small-scale facilities (less than 1,000 square feet in size), but should not be considered in large operations due to the limitation on available tonnage and, therefore, the additional space and electrical connection points required. These systems lack direct dehumidification control and are designed for comfort cooling applications, though they will provide some indirect dehumidification capability (if the space's relative humidity is high enough) as a byproduct of the cooling process. The important thing to note is that the dehumidification capability cannot be directly controlled, which means that it does not allow the cultivator precise control of the indoor relative humidity (RH).

STANDARD HVAC SYSTEMS

Generally described as rooftop units (RTUs), these units are common and relatively inexpensive. The complete HVAC system comprises a supply fan, filtration (limited), compressor, condenser and evaporator contained in a single housing. Air from the cultivation space is moved through ducts to the unit's evaporator, where heat is removed, and cold air is returned



to the cultivation space. This is generally an inexpensive option with mid-range energy efficiency, but can present challenges associated with excessive ductwork, redundancy, low temperature operation and requirements for building ventilation. Many existing facilities are using RTUs in ways that are far beyond the original design intent of the systems. This leads to poor performance and high energy bills. Frequently, microbial problems arise due to the inability of these systems to successfully manage the cultivation environment.

VARIABLE REFRIGERANT FLOW

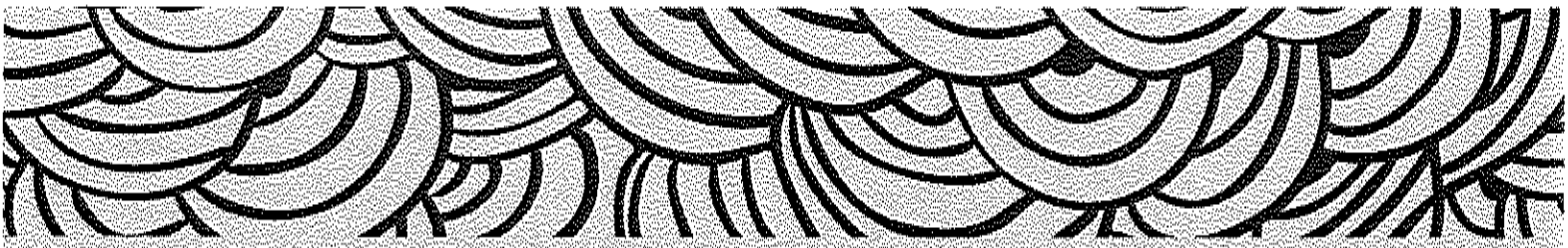
Variable Refrigerant Flow (VRF) systems are refrigerant-based heat pump systems that allow the use of one outdoor condensing unit with multiple fan coil unit (FCU) zones within facility. Each FCU has variable cooling capacity to meet load, promoting a higher level of indoor unit zoning and distributed cooling without the ductwork that would be typical of a packaged HVAC system. Further, VRF systems, which include variable speed compressors that offer varying cooling loads, allow for variation in power consumption. With these systems, heat can be redirected to cooling zones (and vice versa) to offer energy savings. This is typically more useful in an office environment where loads vary based on external environmental conditions than in cultivation facilities where loads stay consistent. Further, VRF systems lack the latent capacities requisite for the amount of dehumidification required in cultivation facilities, and do not allow for direct humidity control. Overall, VRF is a more energy-efficient option than traditional HVAC methods, but is comparatively expensive to purchase and install; will require extensive infrastructure with multiple small compressors in larger facilities; and will require the use of a separate, standalone dehumidification system. VRF also carries the potential risk of leakage from exposed refrigerant piping.

CHILLED WATER SYSTEMS

Chilled water systems offer a standard solution for large-scale process cooling, data centers, large-scale buildings such as hospitals and airports, and energy-intensive manufacturing operations. In this system, the packaged water cooling machine (i.e., chiller) maintains a constant discharge water temperature (typically around 45 degrees F) from the warmer water returning from the space, thereby removing BTUs and heat load. This chilled water is then pumped indoors to distributed fan coils or air handlers throughout the space.

Chillers come in two types: air-cooled, which can be located outdoors and expel heat to the ambient air; or water-cooled, which can be located inside and expel heat to a cooling tower. Chilled water systems are typically more expensive than traditional HVAC on small and mid-sized facilities, but on large facilities they are an extremely competitive option. Along with high energy efficiency, chilled water systems offer:

- The ability to isolate cultivation spaces without dedicating compressors to specific zones of the facility. This promotes the highest levels of system redundancy and allows for a reduction in the number of compressors needed when cultivators are "flipping" flowering rooms, which reduces system cost, electrical infrastructure and peak load operation.
- A high level of installation flexibility, allowing for changing capacity within any given space without changing the central system design.
- Dedicated dehumidification control when coupled with a reheat system; dehumidification can occur without subcooling the space.



- The ability to design for redundancy, as backups can take over if one piece of equipment fails.

WATER COOLED CONDENSERS, COOLING TOWERS AND GEOTHERMAL SYSTEMS

Generally speaking, water-cooled HVAC equipment (e.g., chillers, packaged unitary units, ground-source heat pumps) create a more energy-efficient heat removal process through the condenser and reduce operating costs substantially. Water-cooled condensers are available for both typical air conditioning packaged units and chilled water systems.

On a water-cooled condenser, the water can be fairly warm (in some cases as warm as 90 degrees F) and still be effective, so cooling towers and ground loops can be utilized in these cases. However, cooling towers typically require intensive maintenance and consume large amounts of water. Thus, they are typically not cost-effective until the total load reaches 500 to 600 tons. Onsite ponds and/or excavated geothermal loops can be useful in these cases, assuming the capacity for heat absorption is available.

DEHUMIDIFICATION METHODOLOGY

Cultivation facilities are notoriously high-humidity environments due to the massive amounts of water being added to the space. Ultimately, the water that is applied to plants is transpired by the plants and then needs to be removed from the space. The needs of dehumidification equipment will change as the parameters in the room change. The warmer the rooms can be kept during lights off periods, the more efficiently dehumidification equipment will operate.

STANDALONE DEHUMIDIFIERS

Standalone dehumidifiers typically consist of small, free-hanging (plug and play) dehumidification units used to supplement the dehumidification offered by the cooling system during lights-on periods and as the primary source of dehumidification during lights-off.

Standalone dehumidifiers are more energy intensive than larger-scale dehumidification methods due to the use of small compressors, and output is limited by temperature parameters in the space (the lower the temperature, the less output the units produce).Generally, standalone dehumidifiers are the most affordable and easiest systems to integrate, but due to their plug-and-play nature, they can be difficult to integrate with other climate control equipment.

REHEAT

Without a standalone dehumidifier to achieve dehumidification, AC systems often cool the air below the desired temperature, and then reheat the cooled air as needed. There are several methods to accomplish this reheat. For smaller grows, generally it is more energy efficient to use standalone dehumidifiers than to rely on a standard AC system with electric or fossil-fuel reheat for dehumidification.

However, chilled-water systems with heat recovery and AC systems with integrated hot gas reheat can provide cooling and dehumidification very efficiently for medium size or larger grows.

- **Electric reheat:** Electric heat strips are utilized to produce heat. Electric reheat is not energy-efficient, and standalone dehumidifiers will save energy compared to this option.
- **Natural gas or propane reheat:** Natural gas or propane is used to produce heat in order to reduce the ambient-air relative humidity. More advanced air handlers (in chilled water or standard HVAC systems) will often have this as an integrated option, or this function can be achieved with stand-alone gas heaters.



- **Hot-water reheat:** Common in chilled water systems, hot water is supplied to fan coil units through a gas-fired boiler system. Advanced systems can vary the flow rates of hot and chilled water to achieve environmental set points in the most efficient way, saving energy.
- **Chilled-water system heat recovery:** A chilled-water system can be designed to perform the needed reheat by using recovered heat from the system's condenser coil (basically, the heat removed through the dehumidification process is reinjected into the airstream prior to distribution to the room.) The cooled and dehumidified air is reheated through a heat exchanger with the water heated from the condenser.
- **Hot gas reheat:** Some more sophisticated rooftop AC systems come equipped with an additional outdoor condensing coil for reheat. This additional coil and the associated controls allow the system to reject heat to the outdoors when cooling is required in the space (lights-on periods), or to use the other condenser coil for reheat when there are minimal sensible cooling needs (during lights-off periods).

DESICCANT

Desiccant dehumidifiers use desiccant media to absorb moisture from the space by rejecting the added moisture to an exhaust air scavenger airstream. For this system to work optimally, the desiccant media is heated on the exhaust side so that the moisture can be released outside to the environment, and the desiccant is reused. Desiccant humidifiers require the lowest amount of energy and can operate in a wide range of temperatures, but can be cost prohibitive and are generally only used on large-scale facilities.

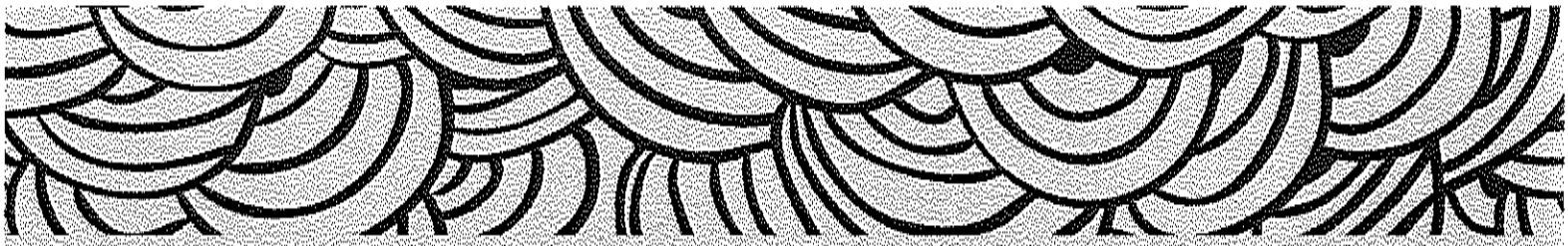
ECONOMIZERS

"Economizer" is another term for free cooling, utilizing the outdoor ambient environment to assist with temperature management of the cultivation space. Air-side economizers are units that utilize ventilation as a cooling method when ambient temperatures are below the set point in the cultivation space. While air- side economizers are an energy efficient solution, they create more problems in cultivation environments than they solve with regard to CO_2 enrichment, biosecurity and odor control, and are generally not recommended (See "Ventilation and CO_2" section for additional details).

Water-side economizers (or fluid coolers) can be utilized in both chilled water systems and in water-cooled condensing units and allow for free cooling without ventilation. When utilized in chiller systems, water-side economizers can reduce wintertime energy consumption dramatically by bypassing the compressors entirely when temperatures drop below 40 degrees F, utilizing cold outdoor temperatures to chill the water. On water-cooled condensers (in certain geographies) fluid coolers can be utilized in place of cooling towers for the condensing water loop.

AIR MOVEMENT

Air movement over the plant canopy is critical for transpiration of moisture and the prevention of pests and fungus. Cultivators should examine cubic feet per minute (CFM) per watt when evaluating canopy fans for efficiency. Destratification fans are important to energy efficient climate management, particularly when ceiling heights exceed 10 feet. Destratification fans create vertical airflow and ensure that heat and humidity trapped at the plant canopy reach the ceiling, where the cooling and dehumidification equipment is typically located and can exhaust heat and moisture.



Airflow and airspeed both need to be studied more closely in controlled cannabis environments so that the industry can create baseline standards; however, the baseline generally accepted for most crops for airspeed is 1 m/s.

VENTILATION AND CO_2

In many CO_2-enriched environments, ventilation or air-side economization may waste significant amounts of CO_2 (which can conflict with the energy code and efficiency efforts overall).

Cultivators should carefully weigh efficiency gains associated with ventilation against CO_2 waste to determine accurate costs and greenhouse gas emissions associated with both. Limiting ventilation can also be helpful to biosecurity efforts and in minimizing exposure to contaminants, possibly reducing reliance on pesticides or fungicides.

Although common, gas-fired CO_2 generators should not be used in modern indoor grow facilities. Generators contribute high levels of waste heat while operating and many are not vented properly, leading to dangerous indoor environments. Bottled CO_2 is a better substitute practice.

DESIGN STANDARDS

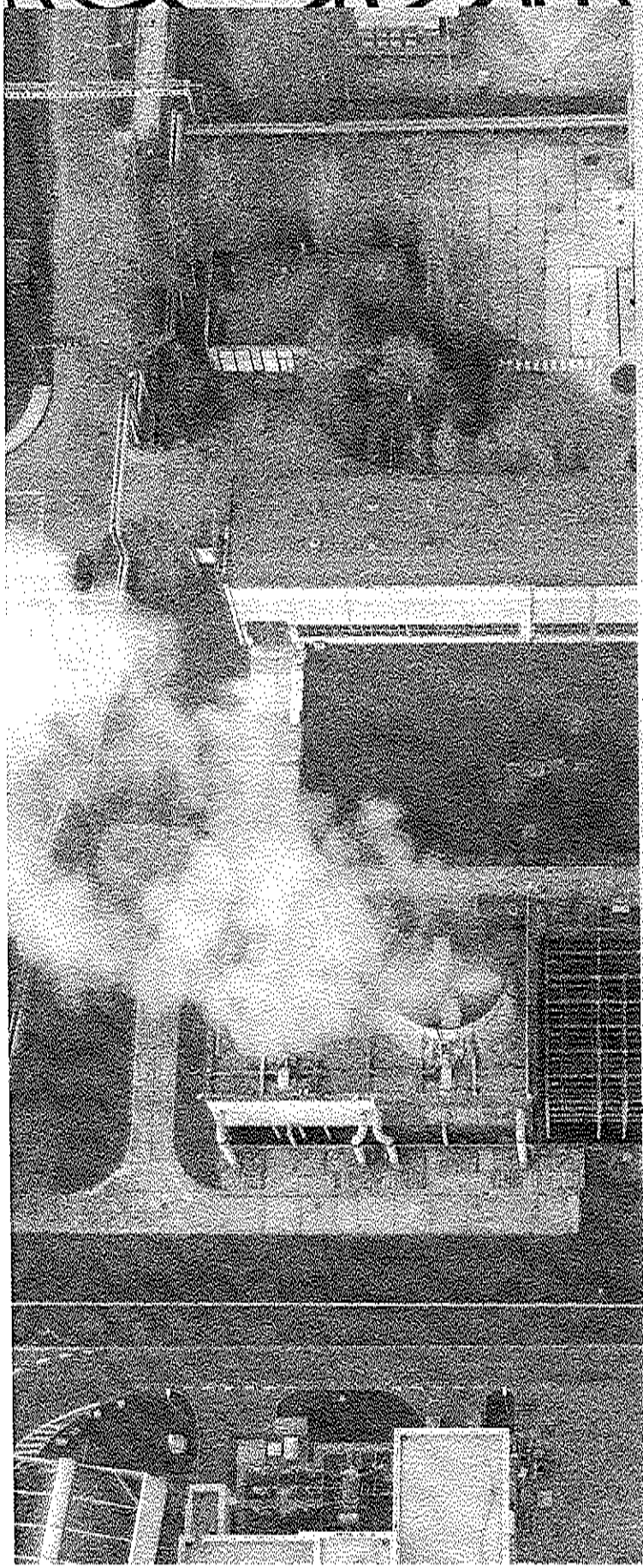
The American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) publishes commonly accepted HVAC standards for architects and engineers. As a starting point, facility owners may benefit from familiarizing themselves with ASHRAE 90.1, Energy Standard for Buildings. ASHRAE has also published an Advanced Energy Design Guide Series focused on reducing energy building use, which is available as a free PDF download.

BEST PRACTICES

One of the most common mistakes made by business owners is failure to invest in regular HVAC system maintenance. While initial system design and equipment procurement are critical, all HVAC systems require regular maintenance to ensure peak operating efficiency. Periodic inspections should be completed, during which time filters should be inspected and replaced, condenser/evaporator coils should be cleaned and electrical connections should be checked. The U.S. Environmental Protection Agency (EPA) recommends semi-annual maintenance checkups for all commercial HVAC systems.

As described above, selecting the most energy-efficient HVAC and dehumidification systems is highly dependent on operational factors, including the size of the facility and the budget. Below are some general energy efficiency recommendations:

- For very small facilities, mini-split systems can be an efficient HVAC option.
- For larger facilities, variable refrigerant flow and chilled water systems offer higher efficiency and redundancy compared to standard packaged systems.
- If using stand-alone dehumidifiers, cultivators should consider pints per kWh when evaluating for efficiency. Cultivators should also pay attention to performance curves — dehumidifiers are rated at Association of Home Appliance Manufacturers (AHAM) standards of 80 degrees and 60 percent humidity, but some manufacturers publish output at 86 degrees and 80 percent humidity, which can be misleading if it not being compared using a common reference.
- Chilled-water systems with heat recovery and AC systems with integrated hot gas reheat are the two most energy-efficient options for achieving integrated cooling and dehumidification.



- Desiccant dehumidification can be highly efficient, but costly.
- Cultivators should seal spaces to reduce CO_2 exhaust, improve biosecurity and reduce odors emanating from the facility.
- Cultivators should keep rooms warmer at night to manage latent load.
- When possible, cultivators should provide shade for outdoor condensing units to reduce operating temperature and extend life. However, it's important that provision of shade does not interfere with air flow around air cooled condensers, as interference with airflow can result in diminished capacity.

Resources:

- ASHRAE, Air Conditioning, Refrigeration and Heating Institute, See sample Preventative Maintenance schedule in appendix.
- National Renewable Energy Laboratory – Solar Energy Basics
- Environmental Protection Agency - CHP Benefits
- National Renewable Energy Laboratory – Commercial & Industrial Solar Best Practices
- U.S. Environmental Protection Agency - CHP Project Development Steps
- Xcel Energy - Distributed Generation Guidelines
- Boulder County Marijuana Energy Impact Offset Fund

ENERGY SUPPLY

OVERVIEW

While the previous section discussed best practices pertaining to energy demand reduction, a comprehensive energy management strategy should also consider opportunities for supply-side improvements. Nearly all cultivation facilities in Denver receive electricity directly from the grid. For Xcel Energy customers, this means that the electricity being consumed in Denver facilities is generated using a mix of technologies as outlined below.

There are two primary approaches to supply side energy optimization that cultivators should consider as part of a broader energy management strategy:

- **On-Site Power Generation:** One approach for facility managers looking to make supply-side improvements is on-site power generation. While a host of onsite generation technologies exist in the marketplace, two of the more common on-site options for cultivators to consider are solar photovoltaic (PV) and combined heat and power (CHP). While the economic, environmental and resiliency benefits of these technologies will vary depending on facility-specific factors, one advantage all on-site generation options share is the elimination of transmission losses. Roughly 5 percent of grid-generated electricity is lost in the transmission and distribution process. Onsite renewables such as PV may offset only 10% to 15% of a facility's energy consumption, unless an area other than the roof footprint of the cultivation building is available to host PV panels.
- Off-Site Optimization: The second approach is entering into an alternative energy supply contract with a utility company. As discussed more specifically in the topic breakout, Denver businesses have multiple clean-energy procurement options. While utilizing this approach does not typically have the same economic or operational benefits associated with on-site generation, offsite optimization likely represents the simplest alternative for cultivators looking to reduce the environmental impact of their facilities.

As with the demand-reduction strategies presented in the previous section, there is not a one-size-fits-all solution to supply-side energy management. While the following best practices are intended to provide a starting point for discussion, facility managers are strongly encouraged to consult with a licensed professional prior to acting.

TABLE 4: XCEL ENERGY - POWER SUPPLY MIX FOR COLORADO CUSTOMERS

Xcel Energy – 2018 Power Supply Mix for Colorado Customers		
Energy	Total Generation Mix (%)	Lifecycle CO2 Emissions (grams/kwh)[7]
Coal	39.10%	1001
Natural Gas	32.70%	469
Wind	23.50%	12
Solar	3.30%	46
Hydroelectric	1.40%	4
Other*	0%	

*Includes biomass, oil and nuclear generation

[6]Xcel Energy - Energy that Works for Colorado
[7]IPCC Renewable Energy Sources and Climate Change Mitigation
[8]U.S. Energy Information Administration

ON-SITE POWER GENERATION & STORAGE

Power generated on-site, commonly referred to as distributed generation (DG), can deliver economic, environmental and operational benefits to cultivation facilities in certain situations. Two DG technologies cultivators should evaluate are solar photovoltaic arrays (Solar PV) and natural gas cogeneration systems (Combined Heat & Power, or CHP). While these on-site generation options can result in excellent returns for facilities, implementation is a complex process and requires technical expertise, detailed coordination with the local utility, and careful financial planning. Cultivators should consult with an experienced technical specialist as part of the assessment process.

PROCESS DESCRIPTION

Performing a desktop feasibility study (also known as a qualification study) is typically the first step in the on-site power-generation procurement process. Facility managers should retain a technical specialist to perform this study, which is provided free of charge by many on-site power generation specialists. While there are many approaches to desktop feasibility studies, the process typically requires facility managers to fill out a brief survey and provide six to 12 months of utility bills. Using this information, specialists can build a high level model that provides a "ballpark" economic, environmental and operational impact assessment.

If the desktop feasibility study indicates an attractive value proposition, the next step is performing a Level 1 Feasibility analysis. The EPA provides a sample Level 1 Feasibility Analysis for facility managers to review; in the event a project proceeds, a Level 2 Feasibility Analysis is subsequently performed.

During this process, project-specific design engineering is accomplished, equipment options are formally evaluated and detailed financial analysis is completed. Following the conclusion of the Level 2 Feasibility Analysis, the project team is typically ready to submit necessary permits, with construction beginning shortly thereafter.

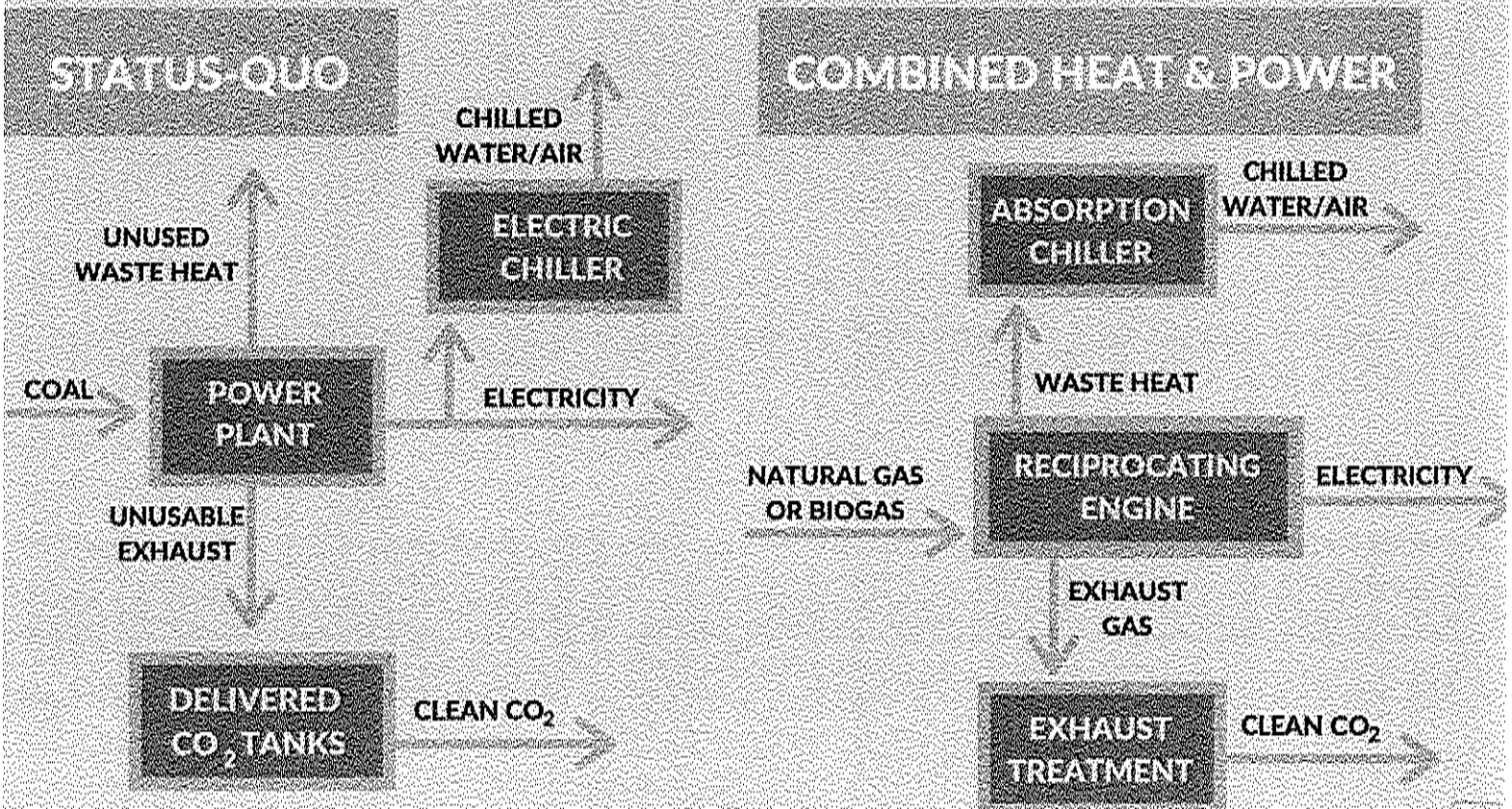
Financial planning for cannabis businesses can be different from traditional businesses. Many financial stimuli from local, county, state and federal entities exist to accelerate the adoption of energy-efficiency measures and renewable technologies, and they should be thoroughly leveraged. However, for a cannabis business, it would be wise to consult with financial specialists before making assumptions about tax treatments with regard to renewable investment tax credits, utility rebates, and operating expense deductions versus capital expenses (depreciation).



Table 5: No-Carbon and Low-Carbon Energy Sources for Cultivation Facilities

Energy Type	Notes
Solar PV	Solar Photovoltaic Systems (Solar PV), convert sunlight into usable electricity. Solar panels use sunlight to generate electricity, and inverters convert that electricity from variable direct current (DC) to alternating current (AC) at the correct voltage, frequency, and phase needed to tie into the facility's electrical infrastructure and the larger electrical grid. For cannabis cultivation facilities, these systems will most frequently be installed on the building's roof, though some properties might be able to benefit from solar system installed on the ground (ground-mounted) or in the facility's parking lot. Because the economic returns from on-site solar systems are typically dependent on utility-specific regulations, facility owners should consult with utilities prior to project design.
Cogeneration (CHP)	CHP systems use a natural gas generator (engine, turbine, or fuel cell) to produce electricity and repurpose the waste products to offset the facility's HVAC and CO2 needs. When done properly, this process can reduce a cultivation facility's emissions footprint by 25 percent to 45 percent, generate attractive economic returns and serve as reliable source of power during grid outages. While CHP systems offer an exciting value proposition, these systems also feature comparably complex technology and require significant technical expertise throughout the design, build and maintenance phases. Cultivators looking to benefit from CHP technology should enlist a qualified third party to guide the process.
Wind	Small wind turbine systems can be installed alone or in conjunction with solar photovoltaic systems. The small size and variability of energy produced by these systems makes them most applicable for supplementing another power source. The amount of energy small wind turbines can provide depends on the site, size and height of the turbine, but small wind systems for commercial buildings typically generate 20 kilowatts to 100 kilowatts. To determine the amount of wind energy available at a site, installing an anemometer for at least 12 months prior to system purchase is recommended. Wind power is not commonly used in metropolitan areas as permitting and conformance with local zoning and building codes may prove challenging.

Figure 2: Comparison of energy inputs and associated outputs of standard or grid energy use versus a Combined Heat and Power (CHP) system.



OFF-SITE ENERGY SUPPLY

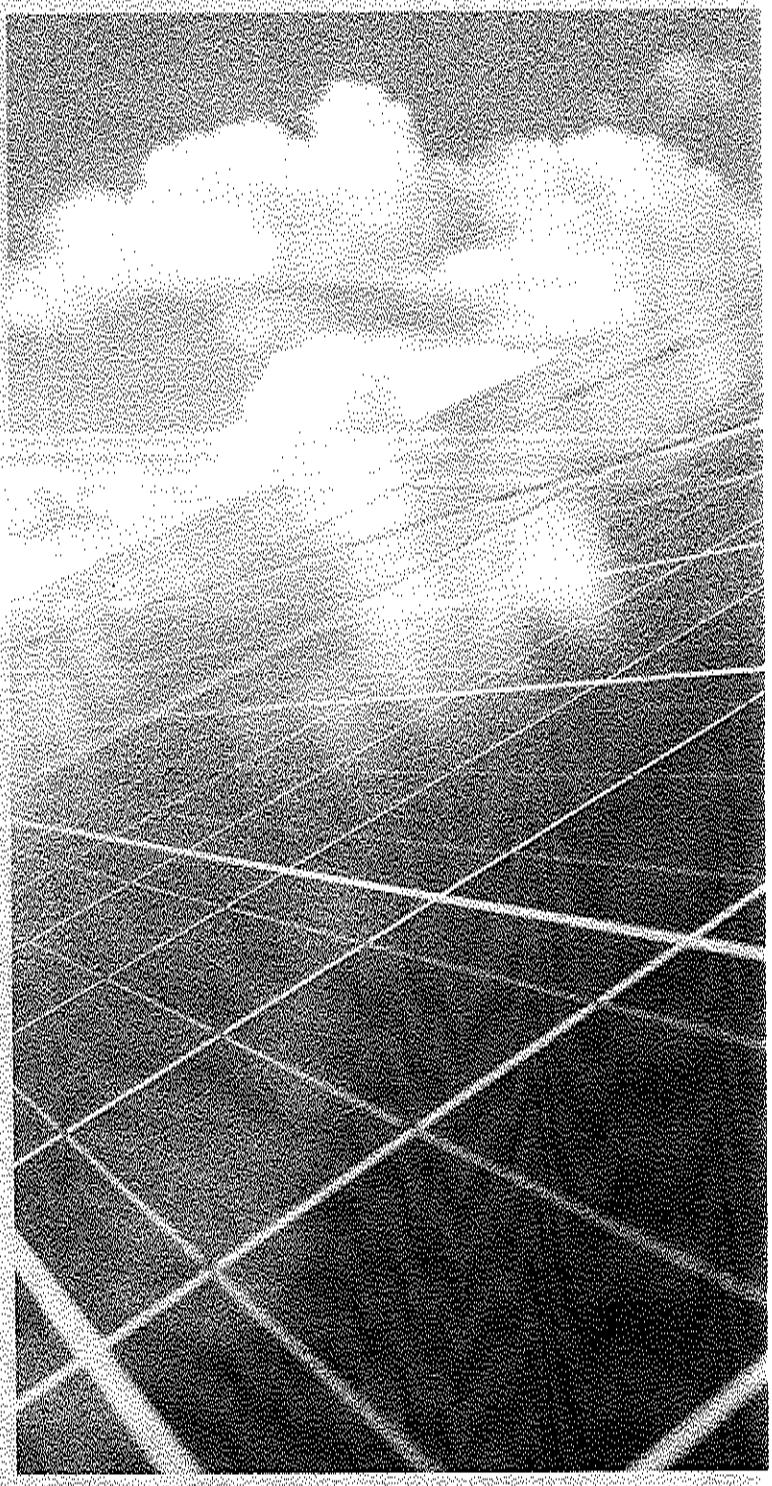
An alternative for cultivators looking to reduce the environmental footprint associated with electricity production is to explore off-site energy supply opportunities. Denver facilities served by Xcel Energy should investigate the Solar Rewards Community program, commonly referred to as solar gardens.

PROGRAM DESCRIPTION

Colorado was the first state to offer community solar opportunities for customers of investor owned utility companies, and Denver grow facilities can benefit from renewable energy production situated and managed off-site. Customers "subscribe" to a portion of the solar array and benefit from the array's output over medium- and long-term contracts. Any entity with an Xcel electric account can benefit from this arrangement, including building owners, renters or managing parties. Recently, community solar developers have been hesitant to contract with the cannabis industry. It is important to continue reaching out to developers to assist in the evolution of this portion of the clean energy industry.

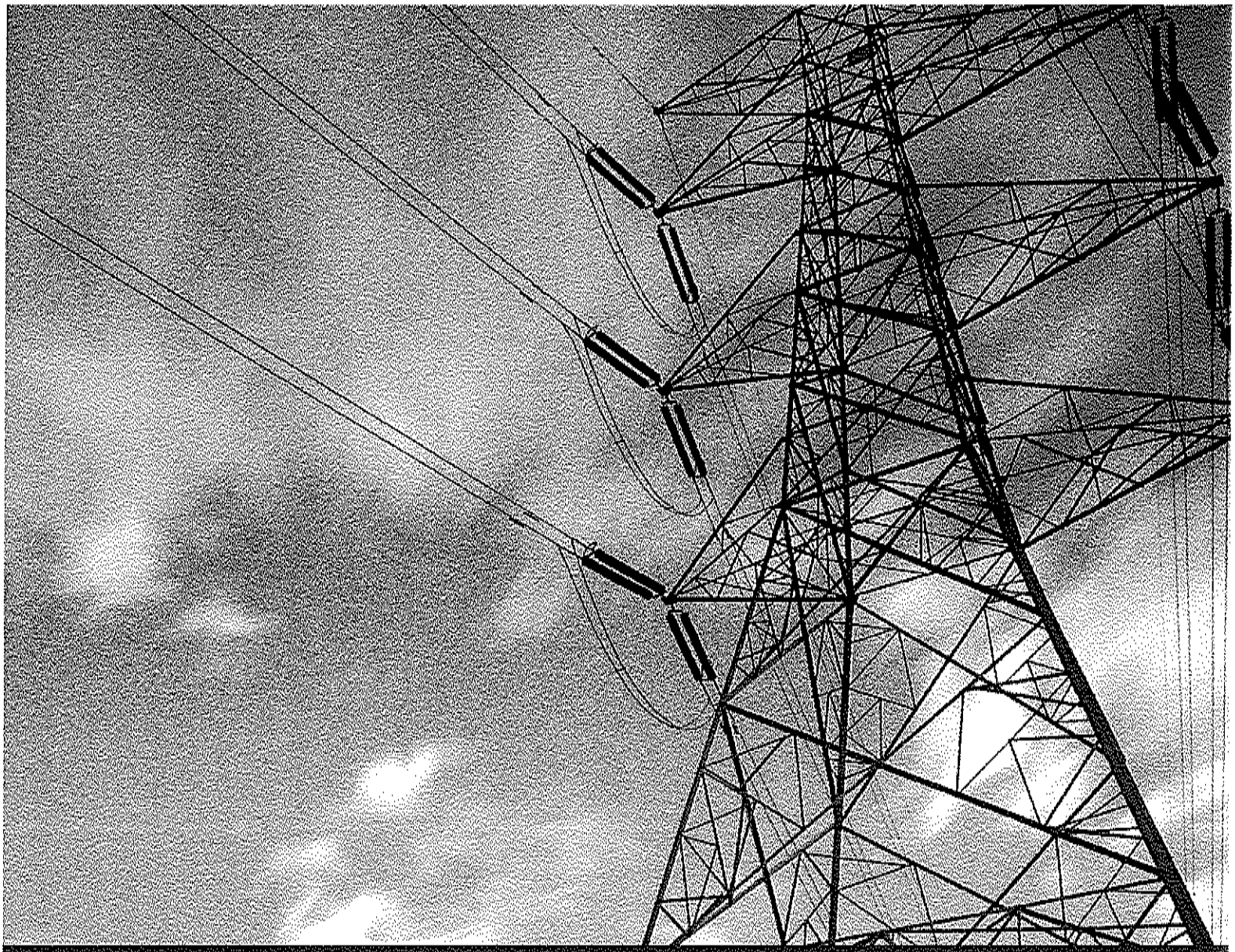
BEST PRACTICES

In Denver, electricity consumers can also choose to independently contract with the owner/operator of a qualified solar array. Under this arrangement, a third party builds a community solar system and sells the electrical output to Xcel. Xcel then credits the customer for that electricity on the customer's monthly electric bill, commonly referred to as net-metering. It is important to note that cultivators may or may not save money by participating in this arrangement, as agreements are made directly with the owner of the community solar array. The utility simply acts as a facilitator in this arrangement. Contracts are generally longer-term, where monthly electric savings outweigh financing costs leading to positive cash flow for the customer.



Resources:

- Xcel Energy – Community Solar Program
- Colorado Energy Office Community Solar Information



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OCTOBER 2020

CANNABIS ENVIRONMENTAL BEST MANAGEMENT PRACTICES GUIDE

WATER



EXECUTIVE SUMMARY

Central to all agricultural operations, water is one of the most key inputs. With water making up more than 90% of the mass of fresh cannabis weight, it becomes clear that delivering it effectively and efficiently is crucial to any savvy cultivator. Beyond the plant itself, farmers have a more intimate understanding than most of how important water is as a resource in a shared ecosystem. The water that is used to irrigate indoor cannabis crops is the same water that comes out of your faucet at home. After being used in the cities, it is allowed to flow east into the watershed shared by the eastern part of Colorado, as well as neighboring states, such as Nebraska and Kansas, where it will be used to water their crops and supply their homes. Effectively and efficiently using water becomes even more critical when consideration is taken for all of the other needs society has for this precious resource. In this section, the topics of water both as an input and an output in cannabis cultivation will be discussed, as well as the topic of how to manage the water inside of the cultivation area.

As a raw material, water used for irrigation must first be checked for its suitability to use on crops. Luckily, water delivered in the Front Range is of uniquely high quality due to the purification process of nature's water cycle, as it comes primarily from Rocky Mountain snowmelt. All water, though, should be checked for impurities. Impurities come in many shapes and sizes, but are largely thought of in a few categories: elemental (e.g., salts and heavy metals); microbial (e.g., E. coli) and manmade (e.g., pesticides and industrial chemicals). Growers should take routine water samples at least twice a year and send them to labs to monitor water quality.

If quality is found to be out of spec, a grower should use technologies that filter and sanitize the water (e.g., carbon filtration, reverse osmosis, ultraviolet light treatment) before applying it to their crops.

Once the water is deemed suitable, the next big challenge is delivering it to the plants efficiently. There are several approaches to irrigation, and each one has technology that can aid the grower. From low-tech hand-mixing nutrients and hand watering plants, to high-tech automated fertilizer dosing and delivery, a grower will have to make choices that strike a balance between capital and operating costs as well as plant performance and sustainability goals. Often, the most efficient systems are both best for the plants and have the lowest operating costs. Increased yields and decreased bottom lines are great ways to pay back the investment needed to use these sometimes more initially expensive solutions.

After the water is delivered to the plant, it usually shows up again in two main streams: leachate, or water that has flowed past the plant and not been taken up; or condensate, water that has transpired through the plant or evaporated into the farm and condensed inside of the dehumidification equipment. Both streams tend to flow to the drain that ultimately leads away from the facility and off to a local wastewater treatment plant. At this point, a farmer can either choose to utilize technology to reclaim and recycle that water so that it can be used again for irrigation, or to make sure that it is of a suitable quality to be sent on to the wastewater treatment site, where it will be processed to be used again for another application.

WATER USAGE & QUALITY

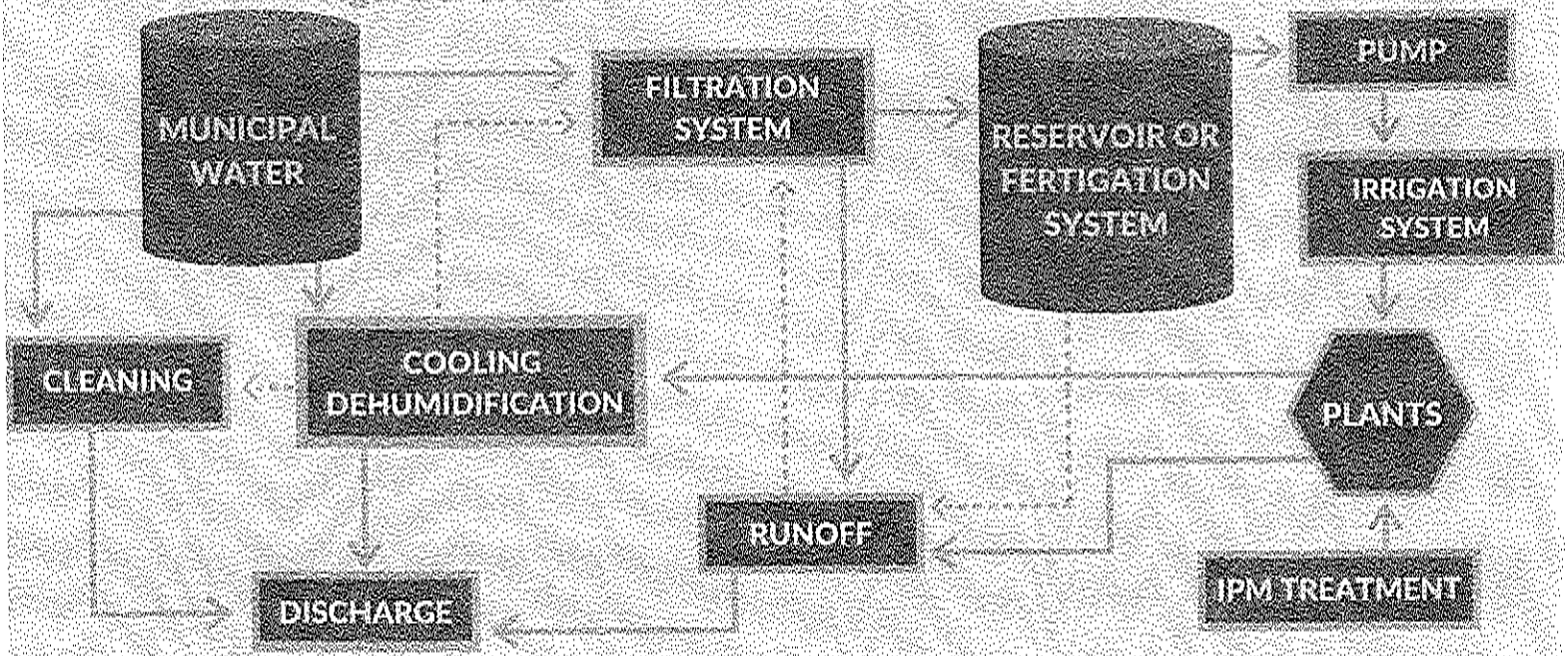
WATER OVERVIEW

Indoor cannabis cultivation within Denver and surrounding municipalities is currently reliant on the municipal water distribution system for irrigation and operational effluent discharge. As such, there are specific process points of environmental impact, including net consumptive use (= influent – effluent), filtration and treatment, and effluent discharge water quality.

In general, the environmental impacts of municipal consumptive water use include state-specific issues, such as increased urban demand resulting in reduced water availability for rural agricultural production and associated watershed impacts; water-energy nexus concerns; and indirect carbon emissions associated with municipal water treatment systems. In addition, for indoor cultivation operations, influent filtration and treatment requirements result in solid waste generation, energy consumption and efficiency challenges, while effluent water quality is impacted as a result of the agricultural inputs required for cultivation. The flow of water through a typical indoor cannabis cultivation is presented below.

While consumptive water use and water quality have been preliminarily identified as significant aspects for indoor cannabis cultivation, it is important to note that these concerns are not unique to the cannabis sector. Neither a sector-specific water-use baseline nor production unit theoretical minimum is currently available. However, the implementation of proactive operational efficiency and monitoring practices can readily address the potential water use and quality environmental impacts, while setting the stage for leadership in process integration of progressive technologies for use and cost optimization.

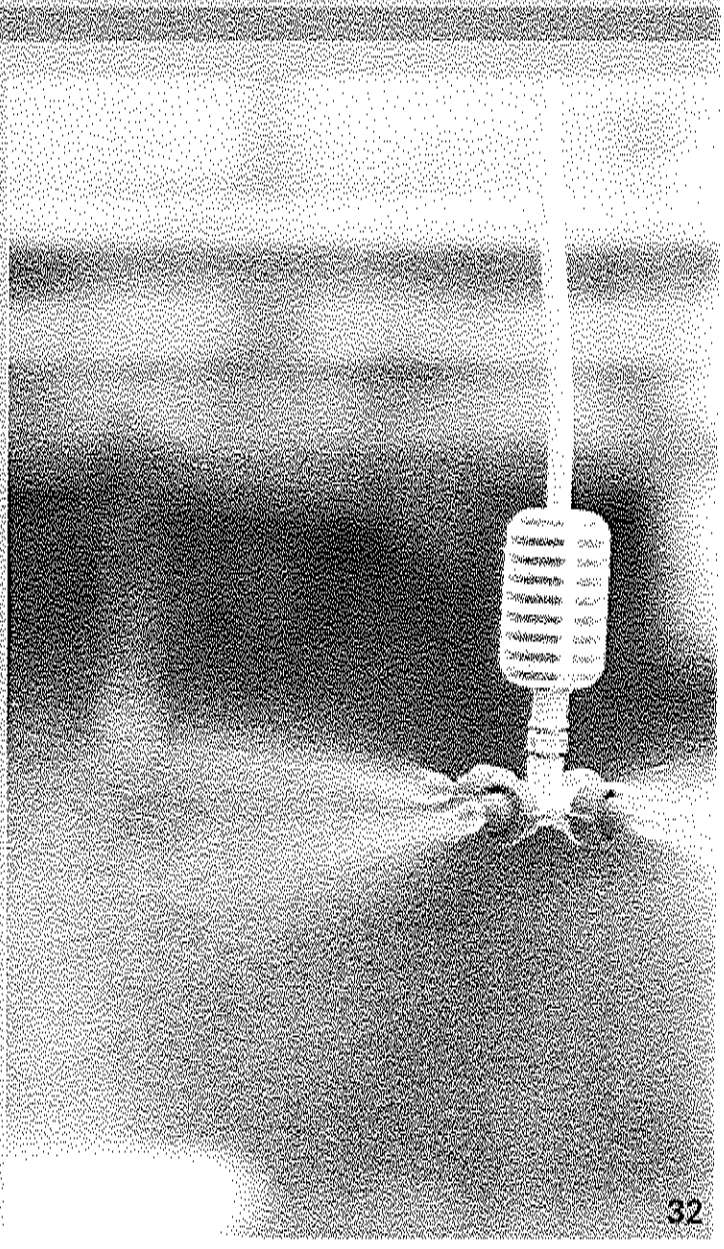
Figure 3: Water Flow for Cannabis Cultivation Facilities



The sustainability impacts of water use and quality include:

- Economic Competitiveness – The introduction of water-use efficiency measures can lower operational costs by reducing direct resource purchase (i.e., lower volume equals lower cost). In addition, water-use efficiency may also result in lower levels of consumables use due to a reduction in influent treatment volume and less wear and tear on process equipment.
- Community Relations – As discussed above, concerns about municipal consumptive water use in Colorado include increased urban demand resulting in reduced water availability for rural agricultural production and associated watershed impacts; increased energy usage for operational influent treatment; and indirect carbon emissions associated with municipal water treatment systems. By proactively integrating water-use efficiency techniques and effluent water-quality monitoring, a cannabis cultivation operation can demonstrate the commitment to integrated resource management and community partnering that is required to cultivate strategic relationships with municipal leadership and neighborhood residents – all while anticipating regulatory changes.
- Environmental Impact – There is a direct link between water and energy. Water and wastewater utilities account for approximately 5 percent of overall U.S. electricity use, resulting in significant greenhouse gas (GHG) emissions. In addition to energy impacts, there are regional water resource concerns from the cannabis industry – such as loss of agriculture in rural areas, and biodiversity and watershed impacts of piping water outside of its native watershed. Proper water management within a cultivation facility can result in reductions in GHG emissions and negative watershed impacts.

The following topic-specific sections will provide guidance and recommendations for water filtration and purification, irrigation methods and automation, wastewater recycling and improving wastewater quality for an indoor cultivation facility.



Electric Power Research Institute (EPRI). 2002. "Water and Sustainability (Volume 4): U.S. Electrical Consumption for Water Supply and Treatment – The Next Half Century. See also https://www.theclimateregistry.org/

BEST PRACTICES

Industry best practices for water use span from tap to drain and can substantially reduce water needs while improving water quality. Many practices can be instituted regardless of specific growing or watering procedures.

WATER FILTRATION & PURIFICATION

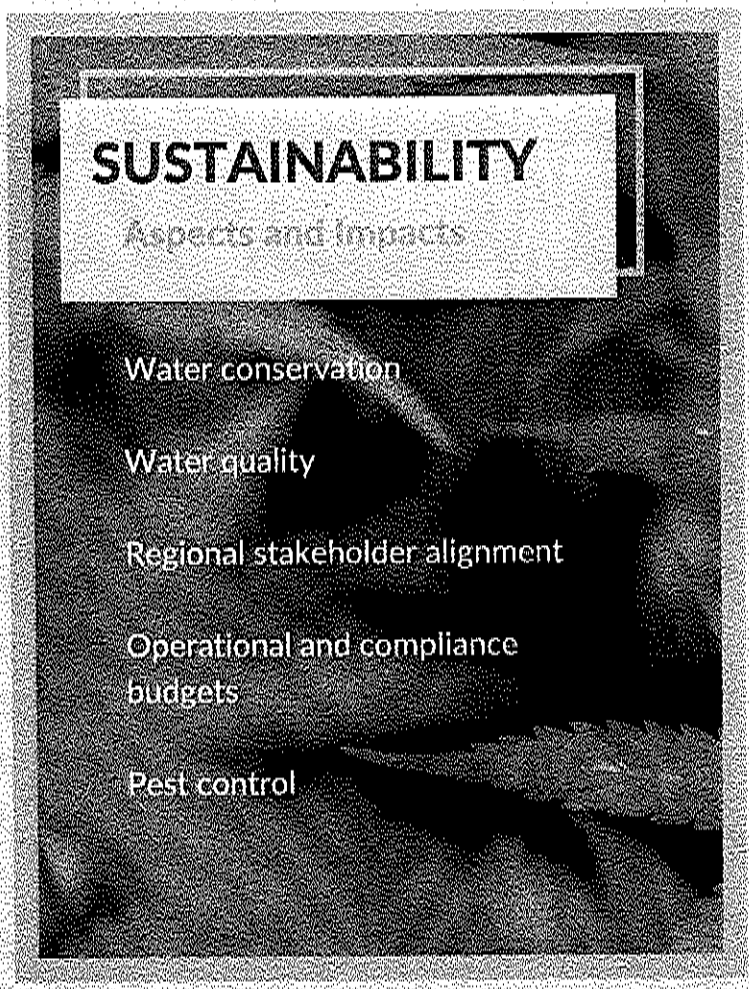
To meet the demands of rapid maturation and high yields for indoor cannabis production, the applied water must meet strict specifications. A cultivation facility's incoming water – regardless of whether it is tap water or well water – should be tested by a trusted analytical lab, such as the Colorado State University soil and water testing lab, to understand if additional filtering is necessary prior to plant application. Similarly, excess process water captured via flood trays or through HVAC condensate will exhibit different characteristics, requiring the need for analysis and purification before subsequent applications. There are multiple ways to improve the quality of incoming water including carbon filtering, reverse osmosis and UV sterilization.

PROCESS DESCRIPTION

According to the Colorado State University Cooperative Extension, irrigation water should be evaluated for four basic criteria:

1. Total soluble salt content (salinity hazard)
2. Relative proportion of sodium cations (Na^+) to other cations (sodium hazard)
3. Excessive concentration of elements that causes toxicity or ionic imbalance in plants
4. Bicarbonate anion (HCO_3^-)
5. Concentration as related to calcium (Ca^{++}) plus magnesium (Mg^{++}) cations

When it comes to a facility's incoming water supply, salinity hazards and sodium hazards are of particular concern. It is important to test water quality prior to watering crops. In some cases, incoming water may not meet the strict specifications for optimal plant growth; therefore, some level of purification is needed. Water to be applied to plants should be purified and nutrified on demand or purified and held in storage tanks until nutrients can be added prior to application to the crop. Water can be purified using several different methods including carbon filtration, reverse osmosis and UV sterilization. However, it is worth noting that reverse osmosis results in about 40-60% water loss in the treatment process, so it is not recommended for efficient water use.



BEST PRACTICES

When considering environmental inputs, water treatment using carbon filtration has emerged as the most efficient method to reduce contaminants — such as chlorine, chloramine, sodium and bicarbonate levels — in a facility's incoming water. Carbon filters are very effective at achieving the desired nutrient load for cannabis plants when filtering is performed according to manufacturer's specifications.

Additionally, filtering leads to very low levels of waste. Only water used to periodically clean filters is disposed of, whereas sterilizing water through reverse osmosis generates substantial water losses in the brine byproduct.

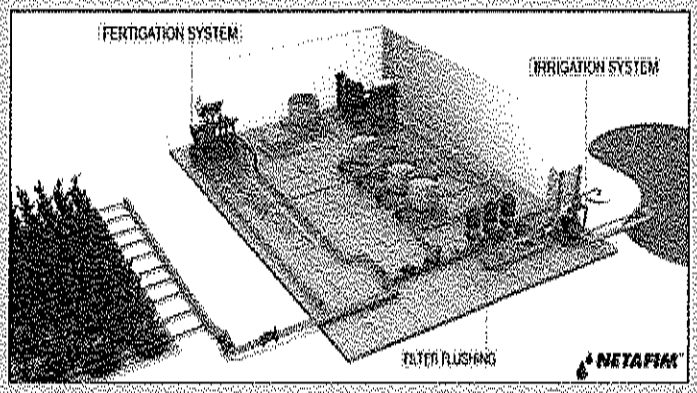
IRRIGATION METHODS & AUTOMATION

Accurate irrigation is essential to the growth of healthy plants and the overall performance of a cultivation facility. Inefficient water use not only wastes this precious resource, but also can harm the plant; cause facility damage by encouraging fungal growth; and create worker safety hazards and add extra load to the HVAC system, wasting energy. A variety of irrigation methods are used in today's cannabis industry. Selecting both the right method for a given facility and following good operational practices for that method are equally important for achieving optimal efficiency and plant growth.

BEST PRACTICES

Seven different methods are commonly used in indoor cultivation facilities: flood tables, aeroponic systems, wick systems, nutrient film technique (NFT), water culture systems, drip irrigation and hand watering.

Figure 4: Irrigation & Fertigation System Diagram



Source: Netafim

FLOOD TABLES

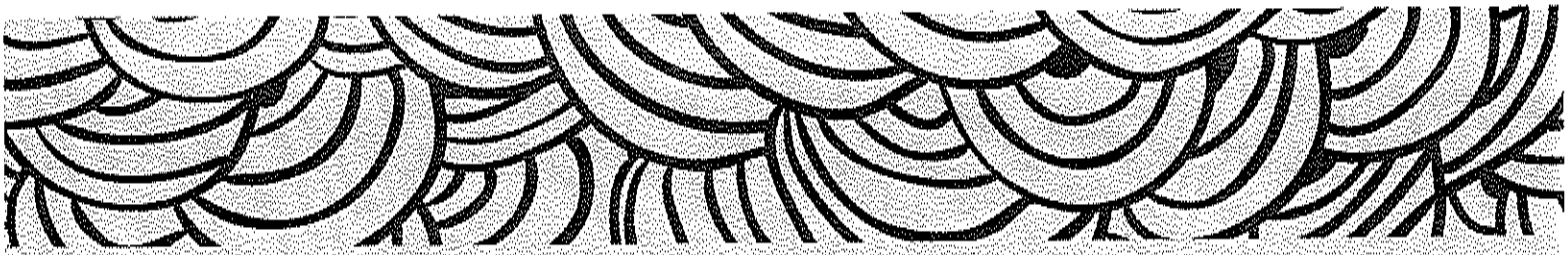
Flood tables are very popular in agriculture and horticulture greenhouses. Generally used with seed trays, plug trays or small pots, flood tables (also known as ebb and flow tables) work by periodically flooding the entire tray with nutrients while pots wick up the water through the drainage holes. This method can be more difficult with large pots. Most often with the flood method, tray water not absorbed by the plants is run through a pipe to a holding tank to be reused. Typically, the recycled water will be treated to kill any water-borne plant pathogens (e.g., Pythium, Phytophthora, Fusarium), which can be done chemically or through UV light exposure. Flood tables use a lot of water per irrigation cycle, so this method is best used when the majority of the water will be absorbed or when the cultivator is prepared to sanitize, renutrify and reuse the water. Flood tables are often used with rock wool mediums, and the runoff is captured in a tank directly below the tray to be sanitized and re-nutrified in place.

AEROPONICS

Many cultivators use aeroponic systems, such as an EZ-Clone machine, for propagation. Aeroponic systems utilize spray nozzles to mist the stem or roots with a nutrient solution. Cultivators using large-scale aeroponic systems are more likely to use a

esources:

- Colorado State University - Soil and Water Testing Laboratory
- Denver Water Quality Reports
- Example of water testing report



channel system in which the roots of many plants are enclosed within a channel and spray misters line the inside of the channel. Another method is the bucket system, in which nutrified water and air are maintained in buckets, into which the roots grow.

WICK SYSTEMS

Using a wick, the plants pull nutrient solution up from a reservoir through capillary action. This system is better suited for smaller plants. Heavy feeders like cannabis can lose weight and yield if the wicking process is too slow.

NFT SYSTEMS

The Nutrient Film Technique (NFT) consists of a very shallow nutrient solution that cascades downward in a tube or tray toward the reservoir, where it is reused. It is most commonly used on smaller plants with a short crop cycle, and cannabis plants are very sensitive to interruptions in electricity and the water cycle. This system allows only a relatively small space for cannabis roots to thrive, which can impact crop performance.

DEEP WATER CULTURE SYSTEMS

In water culture systems, the plant is held in a basket just above the nutrient solution and the roots hang down into the nutrient solution. The roots do not suffocate because the reservoir is continuously aerated. This allows the plant to receive an ideal amount of nutrients, as well as oxygen.

HAND WATERING

Watering by hand using hoses or watering cans is a common watering method used at cannabis cultivations. Many growers prefer the hands-on aspect of hand mixing and hand feeding each plant. However, this method allows for the largest margin of error and is the most labor intensive. Nutrient mixing by hand can easily vary by day or by employee, leading to inconsistent final solutions. The total volume of water being applied to each plant can vary greatly, especially if staff are inattentive.

Nevertheless, most cultivation operations use the hand-watering method at some stage of plant growth. Cultivators must have good standard operating procedures and employee training for hand watering to minimize mistakes.

DRIP WATERING

Drip irrigation is widely considered the most water efficient way of irrigating a crop. Nutrified water is pumped through irrigation tubes and drip emitters to each plant. Many options exist for flow volumes and types of emitters. Cultivators should consult with an irrigation specialist to help determine the correct emitter based on water pressure, length of irrigation runs, container sizes, number of plants to be irrigated at once, etc. Drip irrigation allows the cultivator to fine tune how much water is given to each plant. High-quality drip emitters are pressure compensated, so each plant gets the same amount of water regardless of position on the irrigation line. Many cultivators using drip irrigation systems water several times per day (pulse irrigation), delivering the total desired volume of water over a longer period. This allows the cultivator to carefully manage the amount of water runoff. To maximize water conservation, cultivators should measure moisture levels within the media as well as electrical conductivity to determine irrigation timing and quantity. Drip irrigation is usually accompanied by a fertigation system that automatically injects nutrients into the water line according to specifications and can be run on programmed time schedules.

BEST PRACTICES

The selection of watering methods is highly influenced by an individual cultivator's personal preferences, as the benefits and drawbacks of each method are varied. It is generally recommended to select the most efficient method(s) that fit within the budget and expertise of facility staff. However, any facility exceeding 2,500 square feet in size should seriously consider an automated watering system. Clear standard operating procedures and frequent training of staff with irrigation responsibilities are essential to ensuring that the chosen system operates optimally.

Table 6 below highlights some of the benefits and drawbacks of the three most commonly used irrigation methods:

Table 6: Irrigation Methods for Indoor Cannabis Cultivation

Irrigation Method	Efficiency	Benefits	Drawbacks
Hand Watering	Low	• Eyes on all plants during watering • Gives grower "hands on" feel • No high-tech equipment required	• Inconsistency of volume per pot • Inconsistency between employees responsible for task • Labor-intensive
Drip	High	• Automated • Precise volume of water • Allows cultivator to water a large number of plants at once	• Potential clogging of dripper • Manual inserting/ removal of dripper when moving plants • High cost to install and maintain • More technical, with high learning curve
Flood Tables	Medium	• Automated • Less chance of under-watering plants • Easy and inexpensive to build	• Large amounts of water used at once • Increased humidity if reservoirs do not have lids • Manual labor to clean and refill reservoirs

AUTOMATION

Automated watering systems are highly recommended to help control accuracy and efficiency and to increase data collection, as well as for the ease of mining that data. Cultivators mining the most data for anomalies, efficiencies and tracking will continue to stay on the cutting edge of the industry. Automated data collection ensures that real-time data is collected daily. Several major manufacturers currently offer environmental and fertigation packages that tie into one software program, allowing for a streamlined data collection process and easy, intuitive data mining. Production is all about repeatability, and data collection helps ensure repeatability. Data collection also helps improve procedures by targeting issues and concerns.

MEASUREMENT

The water applied to plants should be measured during each phase of growth. This is most easily achieved when using an automated watering system as described above. Similarly, cultivators should measure runoff to ensure that water is not being wasted, and should set a low runoff target. Ten percent to 15% runoff per watering event is a highly efficient target. Salt levels in the media should be monitored at these low runoff levels to ensure crop quality. Ongoing measurement against this target will help maintain overall water efficiency and identify factors that affect water use, such as employee turnover, schedule changes and equipment changes.

What measurements should I take when monitoring irrigation?

- Ascertaining pH is critical for nutrient uptake. Being outside of range can cause nutrient deficiencies.
- Electrical conductivity (EC) measures the amount of fertilizer in your nutrient solution or root zone. Controlling this value determines how much food you are feeding your plants.
- Volumetric water content (VWC) is the amount of water in the media relative to maximum capacity. Use this number to make sure your roots are getting enough water, but aren't staying too saturated.
- Temperature is critical for root health and function. Too cold and the plant won't eat; too warm and the roots become susceptible to disease.

Table 7: Grow Media Comparison

Grow Media	Description	Benefits	Drawbacks
Mineral Soil	Often thought of as "dirt," soil can vary greatly depending on its composition.	• Natural • Contains nutrients • Easily amended	• Not sterilized and may contain pests • Very heavy (worker safety) • Low steerability • Loose media requires more work to keep facility clean. • Not all soil is the same, selecting the right kind with the right amendments can be challenging
Rockwool	Made by melting rocks and spinning the molten material into fibers.	• Lightweight • Inert, so grower can control nutrients • Manufacturing process ensures material is clean • High steerability	• Natural high pH, requires conditioning before use. • One time use • Fast drainage leaves plants prone to wilting if not managed properly.
Coco Fiber	A fibrous media made from the husks of coconuts.	• Natural • Easily amended • Medium steerability (depends on thickness of fibers)	• Not sterilized and may contain pests • Very heavy (worker safety) • Loose media requires more work to keep facility clean.

ELECTRICAL CONDUCTIVITY

Many growers are feeding plants based on specific electrical conductivity (EC) levels identified by the nutrient line they are using. It is important to frequently monitor the EC levels of both the nutrient water being given to the plants and the EC level of the planting medium with either probes or a handheld device. Cultivators have had success with very high EC levels and very low EC levels.

- Averages for vegetative growth: 1.0-2.5 EC
- Averages for flowering growth: 2.0-4.0 EC

Growers should test runoff frequently to determine if any salts are building up in the medium. Total volumes of water applied to the plant to create runoff may hinge on these numbers. If the plants are able to absorb all of the water and nutrients provided, frequent flushing may not be necessary.

While production goals will often drive the target EC for feeding plants, it is important to remember that fertilizer use is another area where cultivators can look to improve their sustainability impact. Many fertilizers are mined from the ground, and some nutrients, such as phosphorus, are being depleted at a rapid pace. Avoiding overfeeding by keeping ECs on the lower side of a target range; recycling and reusing irrigation runoff; and using environmentally friendly sources of nutrients are a few examples of how growers can minimize their impact when it comes to fertilizers.

Resources:

- Home Hydro Systems: Aeroponic Systems
- How to Grow Marijuana: Aeroponics
- Current Culture H20: Hydroponic System Info

Drip irrigation resources:

- Irrigation Tutorials: The Basic Parts of a Drip System
- Irrigation Tutorials: Drip Irrigation Design Guidelines

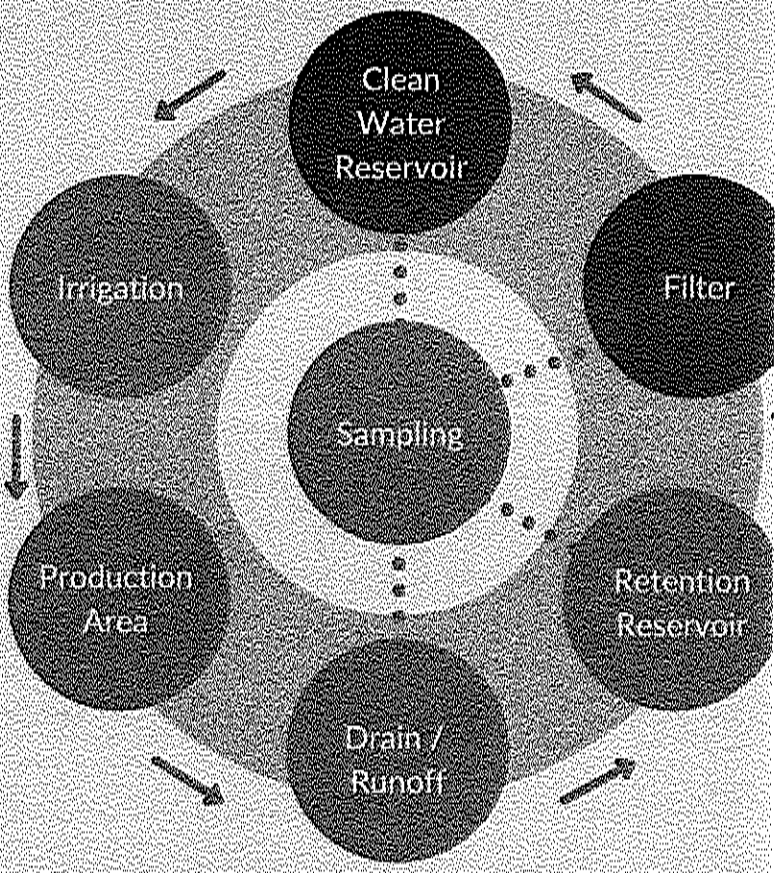
Procedure for flushing plants:

- American Agriculture: Flushing Potted Plants

WATER RECYCLING

Cultivating cannabis in controlled indoor environments provides multiple opportunities for water efficiencies and water recycling. Virtually all excess water runoff and water vapor can be captured and delivered back to the beginning of the watering process.

Figure 5: Irrigation water recapture process



Note: This water reuse practice is not to be confused with Denver's updated graywater regulations. Graywater — which includes wash water, shower water and sink water — can be applied only to outdoor landscapes, not reused indoors or applied to consumable crops.

Water applied to cannabis plants through hand watering, flood trays or drip methods can be easily captured in two complementary ways.

PROCESS DESCRIPTION

First, applying water onto plants generally produces some amount of excess water that can be captured and piped back to water storage tanks. This excess water should be filtered and sterilized again to avoid contaminants and then stored for the next round of watering. The second water recycling method involves capturing HVAC condensate. Healthy cannabis plants naturally transpire a majority of the applied water after each watering cycle through transpiration. This water vapor passes through the cultivation room's HVAC equipment and condenses back to relatively clean liquid water that can be directed to a facility's water storage area to begin the water process anew.

BEST PRACTICES

Water should not be a single-pass ingredient for cannabis production. Cultivation facilities equipped with water storage can easily incorporate water-recapture methods into existing cultivation practices for reuse. Water can be captured as follows:

- As excess runoff while watering: Best accomplished when all runoff water is contained in drain lines or ditches.
- As HVAC condensate and dehumidification water: Often very clean (almost reverse osmosis quality); however, it should be checked for heavy metals that can leach off the cooling coils.
- Pipe captured water to a holding tank for reuse.

Recaptured water may need to be purified again. There are several options available, but method selection should be based on what the cultivator is trying to remove from the irrigation water. Cultivators should look for technologies that kill waterborne pathogens such as Pythium, Phytophthora, Fusarium and Rhizoctonia.

Options include:

- UV technologies, which are very popular in the greenhouse/nursery industry
- Copper technologies, which are helpful for use against Pythium and Phytophthora
- Electrochemically Activated Water (ECA)
- Water storage located immediately upstream of the water-filtering process
- Chemical treatments, such as ozone and hydrogen peroxide, simultaneously disinfect and raise the oxygen levels within the water

Subsequent rounds of watering should first be pulled from this storage tank before requiring any new "tap" water to be drawn. This recaptured water can make up the vast majority of the next watering cycle's water.

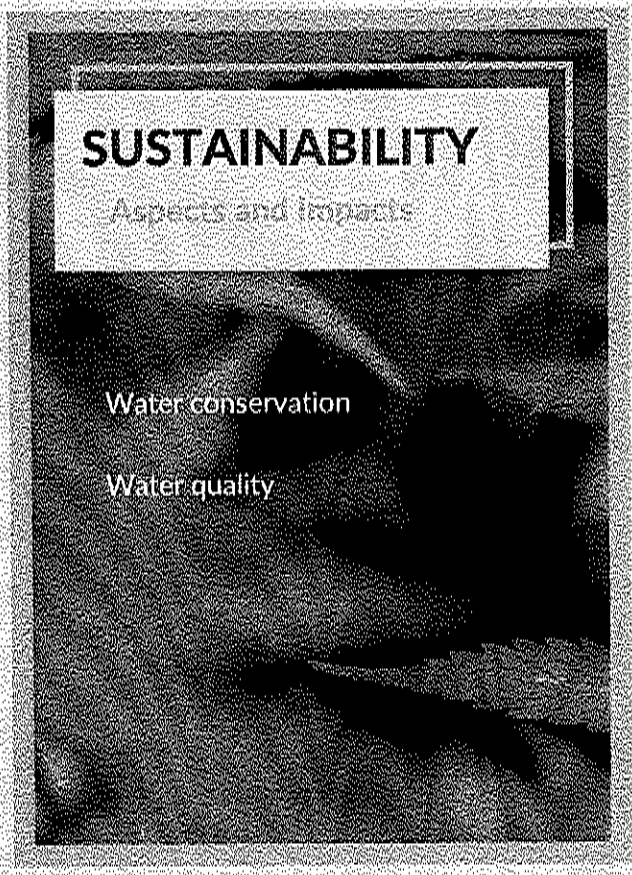




Figure 7: Piped drainage running into floor sink

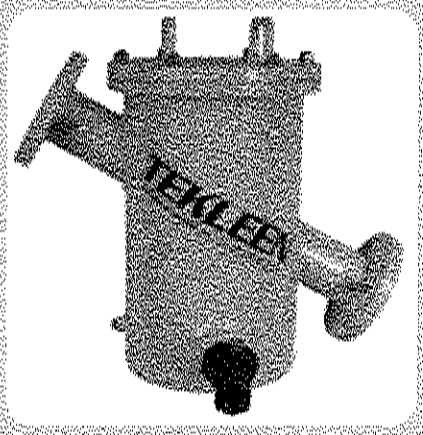


Figure 9: Sediment Filter

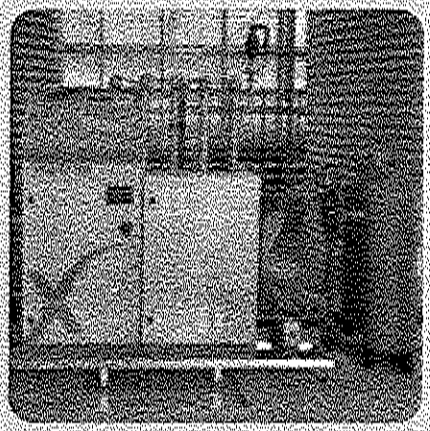


Figure 10: Hortamax Vitalite UV Filter

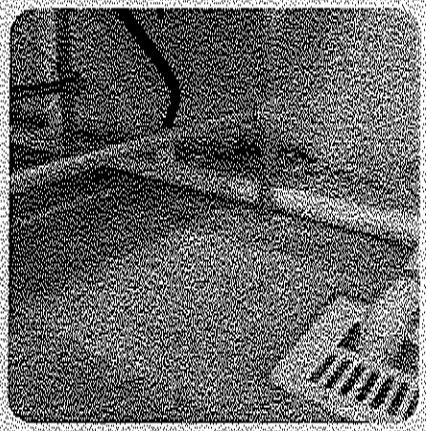


Figure 6: Example of piped drainage from trays

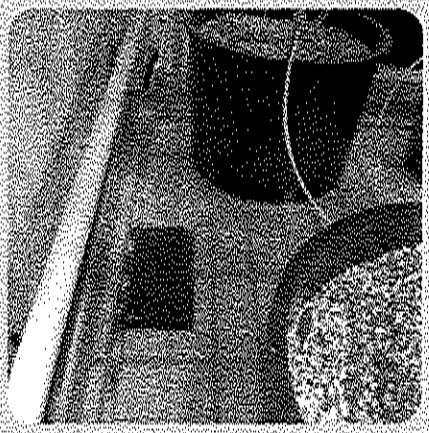


Figure 8: Example of coarse filter on tray to keep large debris out of recycled water

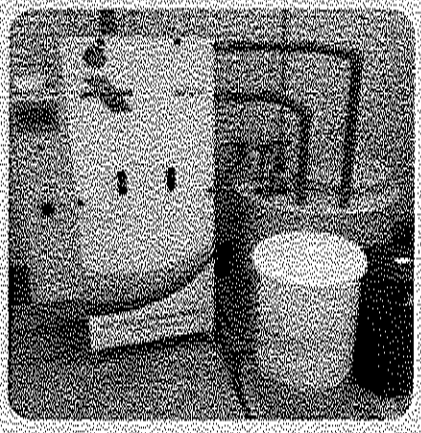


Figure 11: Brinkman ECA System

IMPROVING WASTEWATER QUALITY

Certain practices in cannabis production can lead to unintended high levels of contaminants in a facility's wastewater discharges. Such contaminants can add stress to treatment facilities and may be largely unnecessary.

PROCESS DESCRIPTION

Purifying water using reverse osmosis generates significant volumes (at least a 1:1 wastewater to water ratio) of brine which must be discarded to sanitary drains. The concentration of brine (high in salts and minerals) creates difficulties in removal at water treatment plants. It is best to avoid the reverse osmosis process altogether and use other water filtration methods (see Water Filtration and Purification above).

High concentrations of cleaning agents in wastewater are difficult to process as well. When cleaning cultivation rooms and associated equipment, cultivators should use cleaning products according to the manufacturer's specifications. Concentrated cleaning solvents should be diluted appropriately as described on the label.

A higher concentration of solvent does not necessarily clean better and will lead to poor indoor air quality and difficulties in processing the wastewater.

BEST PRACTICES

Cultivators should:

- Use cleaning products as directed; dilute concentrated products according to the intended cleaning purpose on the label.
- Use environmentally friendly cleaners such as those rated by Green Seal, Eco Logo or Safer Choice.
- Use filtration for water purification to avoid significant water discharges from reverse osmosis.
- Use water nozzles for any cleaning operations to avoid excess water use.
- Avoid over-watering crops as this can lead to unintended high levels of chemicals and suspended solids in sanitary drains.
- Refrain from dumping any liquids into storm rains.

ADDITIONAL CONSIDERATIONS

Storm drains empty directly into local waterways. There is no treatment to storm drain effluent. In fact, by law, nothing is allowed to be dumped down storm drains — only rainwater and snow melt. Cultivators can help keep local streams clean by not dumping into storm drains, keeping property free of litter and using dry, absorbent cleanup methods for liquid spills outdoors.

Resources:

- CASR Rules and Regulations Governing Graywater Treatment Works
- Greenhouse Management - 10 Tips for Recycling Irrigation Water
- Greenhouse Product News - Grower 101, Water Disinfection
- Greenhouse Management - Disinfecting Recycled Irrigation Water
- Clean Water 3 - Treatment Technologies

Examples of UV purification products:

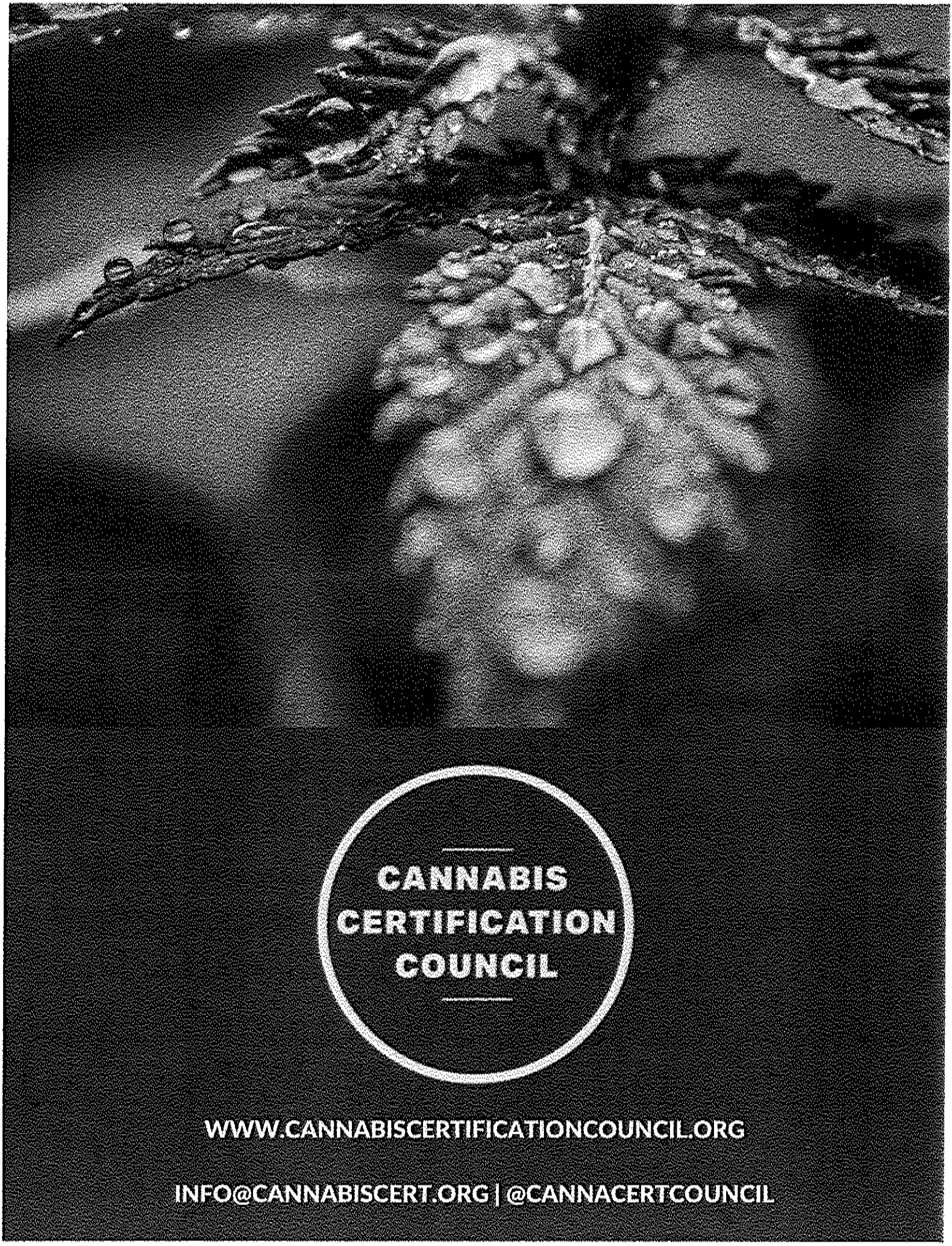
- Hortimax Growing Solutions
- Superior Aqua Systems

Examples of copper purification products:

- Aqua-Hort
- Priva Vialux Line Water Disinfection

Examples of ECA products:

- Horti-Daily
- Royal Brinkman
- Green Seal
- Eco Logo
- EPA Safer Choice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OCTOBER 2020

CANNABIS ENVIRONMENTAL BEST MANAGEMENT PRACTICES GUIDE

WASTE MANAGEMENT & DIVERSION



EXECUTIVE SUMMARY

Waste streams are capable of having big impacts on operations. Positive environmental impacts can be significant when sustainable practices are chosen. Also, economic competitiveness is an advantage of less waste. Community relations are also strengthened when operators prove to be responsible environmental partners. Unfortunately, landfilling is currently the main form of waste disposal in the cannabis industry. Some recycling and composting do take place, but at a much smaller percentage of total waste.

There are three waste categories that cultivators must deal with: organic, recyclable, and universal and hazardous waste. How these waste streams are disposed of is dictated by regulatory frameworks. For example, an operator can send organic waste to a certified waste or composting facility, but only after plant material has been made unusable and unrecognizable.

With low rates of waste diversion, more organic waste could be composted instead of shipped to landfills. Composting can take place on the licensed operator's property or at a certified compost or waste operators facility. Bokashi is an anaerobic type of composting that can be done on site with a relatively small footprint. Bokashi can be thought of as a fermentation process that "pickles" the organic material inside the composting container.

Packaging can be a large source of waste. Operators should consider the source of all vendor-related items. Is the item natural, compostable, or recyclable? Operators should focus on minimizing materials used for packaging as well as sourcing recycled materials when possible. It is important that recyclable waste be dealt with properly. Recycling bins and composting bins should be placed near trash receptacles throughout facilities to make organizing waste an easy process.

It is important for operators to minimize the amount of universal and hazardous waste they produce. When generating universal and hazardous waste, it is important for each operator to determine what generator category they fall into. Some small-quantity generators may be exempt. Using organic pesticides instead of synthetic chemicals will help reduce hazardous waste. Vendor selection can also reduce your generated waste; for example, ordering LEDs instead of mercury filled lighting fixtures will help. Facilities should have a written collection and disposal plan for used light bulbs and used batteries.

In conclusion, all operators should have a waste management plan to address each type of waste. Avoid over-purchasing and consider sustainable vendor options when available. Reduce, reuse, recycle and then track, track, track, to understand where improvements can be made.



OVERVIEW

The cannabis industry generates waste and can benefit from the adoption of sustainable waste management practices. Currently in Denver, landfilling is the main form of waste disposal, with recycling and composting used to a lesser extent. Therefore, cultivation facilities should aim to reduce, reuse and recycle as much as possible. Cannabis operations should consider the sources of the resources used and purchase items that are made from natural, compostable or recycled materials, when available. The industry can further reduce the waste generated and landfilled by designing compliant packaging that minimizes materials or by implementing package collection.

The sustainability impacts of waste management and diversion include:

Economic Competitiveness: Solid waste reduction efforts can save money through reduced materials procurement and disposal costs. Also, the implementation of water and energy efficiency strategies can also result in solid waste reduction. Don't throw your profit margins in the trash — instead, implement environmental efficiencies.

ORGANIC WASTE MANAGEMENT

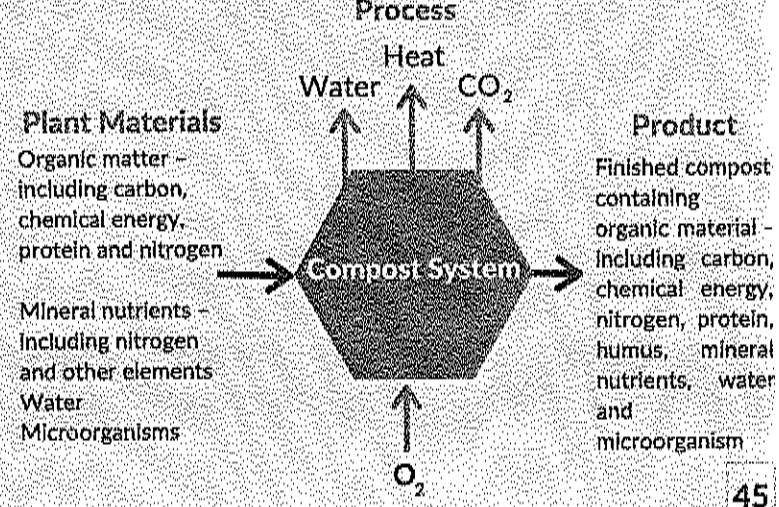
Organic wastes represent a significant component of the cannabis production waste stream. Unusable plant material, soil and other growing media, paper and food waste are all compostable in commercial compost facilities. Alternatively, plant and food waste can be processed on- or off-site using Bokashi fermentation or anaerobic digestion. In either scenario, separating these materials from the general waste stream can present some logistical and compliance challenges. Careful implementation of best practices for organic waste management can reduce the environmental impact of a facility by creating valuable agricultural inputs while maintaining compliance.

Community Relations: Waste reduction and diversion can reassure neighborhood residents that a cannabis cultivation operation is a responsible environmental partner, committed to the health and wellbeing of the local area. In addition, because land-use impacts and greenhouse gas (GHG) emissions are reduced, a progressive solid waste management program can dovetail with municipal goals, such as the City of Denver climate, energy and land use sustainability goals.

Environmental Impacts: Waste reduction and diversion results in lower volumes of municipal solid waste (MSW) and subsequently lower embedded energy, landfill gas (LFG) emissions and landfill leachate.

Cultivation facilities' waste is mainly generated from unused plant material, agricultural inputs, equipment, and product packaging and can be categorized as either organic, recyclable, universal or hazardous waste. Although cannabis waste is strictly regulated, this section will outline compliance best practices that minimize the industry's environmental impacts from waste.

Figure 12. Composting process diagram



PROCESS DESCRIPTION

COMPOSTING

Plant waste and other compostable wastes – including growing media, paper and food waste – can be diverted from the landfill through disposal with a licensed hauler to a commercial composting facility. Per MED rules, cannabis plant debris must be rendered "unusable and unrecognizable" before disposal. The most sustainable way to accomplish this is by grinding plant debris with paper or cardboard waste, growing media or soil. Once this has been done, plant debris can be composted by a licensed commercial composter. There is an exemption to this 50/50 mixing rule that allows stalks and stems to be diverted from the waste stream if used specifically for industrial fiber recovery.

BOKASHI FERMENTATION

Plant waste can be treated on-site using the Bokashi method, an acidic anaerobic fermentation process. To take advantage of Bokashi fermentation, the marijuana waste must be made "unusable and unrecognizable" on the licensed marijuana cultivator's property by grinding the waste and letting it fall into a 55-gallon drum or other similar container that is capable of becoming airtight when closed, adding additional organic material to achieve a 50% marijuana-waste mix, and adding Bokashi or other compost activator and water. It is important that the proportions of Bokashi compost activator to organic material and the resulting pH of the mixture be correct. Otherwise, the material will fail to ferment and will rot.

Having been made "unusable and unrecognizable", the waste should be allowed to rest at the licensed facility, or be transported to an off-site facility.

Microorganisms contained in the Bokashi compost activator will quickly "pickle" the marijuana and begin breaking down the organic matter. After a two-week anaerobic (oxygen-free) fermentation period, the resulting liquid (probiotic tea) may be used as nutrient-rich fertilizer. The solid organic matter may be used as a soil amendment.

Bokashi fermentation can be done throughout the year and requires a very small footprint. It is easily scalable, produces neither heat nor gases, and eliminates nuisance factors linked to composting sites, such as odors and vermin. The fermenting container will not attract flies because it is kept sealed.

Bokashi fermentation remains a largely unknown technology with numerous nuances. It is also new to regulators such as Colorado Marijuana Enforcement Division (MED), Colorado Department of Public Health and Environment, and the Colorado Department of Agriculture (CDA), and carries additional regulatory requirements not expanded upon within this procedure.

Cultivation facilities that are interested in adopting this new technology, and its technical and regulatory nuances, are advised to seek professional assistance.

BEST PRACTICES

Organic waste recycling through Bokashi fermentation on-site or through off-site composting are the two most sustainable options for managing organic waste.

Paper or cardboard that cannot be recycled due to contamination should be discarded with the compostable materials. Common sources include paper towels from restrooms, handwashing stations and kitchens, shredded paper, and soiled or wet cardboard. These materials can help contribute to

compliance with MED requirements for mixing plant waste.

Cultivators should place separate receptacles for compostable waste throughout the facility anywhere the waste is generated. Cultivators should always include descriptive signage (photos of compostable materials are helpful), and it is generally a best practice to co-locate a compost bin with each trash and recycling bin.

Employees may not be familiar with composting practices. Providing a short training to all staff on which items belong in each bin is important to ensure that recyclable matter is not contaminated with other types of waste.

ADDITIONAL CONSIDERATIONS

Incorporating composting into a facility requires an additional waste receptacle outdoors. Cultivators should ensure that there is adequate space for the receptacle, and that it meets MED requirements for security and control requirements.

Marijuana waste that can support the rapid growth of undesirable microorganisms should be held in a manner that prevents the growth of these microorganisms as required by MED Rule R504 Health and Safety Requirements.



Resources:

- Certifiably Green Denver Composting Resource Sheet
- Bokashi Fermentation Method and Resource

UNIVERSAL & HAZARDOUS WASTE

Hazardous and universal wastes are present in most cannabis cultivation and extraction facilities. Reducing and managing these wastes can reduce risks to employees and the environment and is essential for maintaining compliance. Source-reduction and substitution represent the best opportunities for reducing risk and saving money on hazardous waste management and disposal.

PROCESS DESCRIPTION

Regulatory requirements for any given business depend upon the quantity of hazardous waste generated. Universal wastes are a subset of hazardous wastes that have reduced management standards as defined by federal, state and local laws, regulations, rules or other requirements. Most hazardous wastes commonly generated by cannabis facilities are considered universal wastes. These include mercury-containing lighting and ballasts, many types of pesticides or other chemicals used in the cultivation process, certain solvents or other chemicals used in the production of marijuana concentrate, marijuana soaked in a flammable solvent for purposes of producing a marijuana concentrate, electronics (e-waste) and batteries.

Cultivators must determine which regulations apply to the waste before disposal, including making a hazardous waste determination.

Cultivators should consult with the Hazardous Materials and Waste Management Division's Customer Technical Assistance line at 303-692-3320 with any questions about hazardous waste. Hazardous wastes must be disposed of properly by a registered hazardous waste transporter shipping to a hazardous waste treatment, storage and disposal facility (TSDF).

Any generation of regulated hazardous wastes must be disclosed to CDPHE. Cultivators must obtain an EPA identification number before wastes can be accepted for disposal by a TSDF.

CONSIDERATIONS:

Prior to beginning any marijuana-related operations, cultivators should consider the following:

- Is a plan in place for dealing with solid and hazardous wastes generated during operations?
- What quantities of waste will be generated, and what are the various waste streams?
- If the operation is generating hazardous waste, has the cultivator determined which is the appropriate generator category and what rules may apply?
- Conditionally exempt small-quantity generator (CESQG).
    - Small-quantity generator (SQG).
    - Large-quantity generator (LQG).
- Is there a waste storage plan addressing storage methods and locations and length of time the waste may be stored?
- What readily available materials could be used to render marijuana plant material and marijuana products unusable and unrecognizable?
- Where will the waste be sent, and how will it be transported?
- Will any composting of marijuana-related waste occur on-site?
- What licensing and permitting requirements will apply to this operation?

Resources:

- CDPHE Generator Assistance Program
- EPA Resource Conservation and Recovery Act (RCRA)
- Colorado Hazardous Waste Generator Handbook
- CDPHE Solid Waste Regulations

CASE STUDY

LIVING SOIL AT DISTRICT 8

You can't produce high-quality cannabis without first starting with high-quality soil. District 8 is a provider of wholesale cannabis and hemp-wrapped blunts, and produces it all using a no-till, living soil method. Building a strong ecosystem within the soil allows them to grow their cannabis utilizing nutrients from natural systems that have already been shown to be effective through the Earth's ecological processes. Natural methods and beneficial organisms such as insects, fungi, and bacteria increase the health of the soil and nutrient content every harvest.

With ever increasing soil health, District 8 is able to completely eliminate their soil waste and address one of the main industrial waste issues facing this industry. Living soil also benefits their plants and process by creating greater water infiltration and retention, greatly reducing their water usage and wastewater production. This method eliminates the need for artificial chemical fertilizers and uses only biologically proven processes. When they do need supplemental nutrients, they even go so far as to utilize ingredients from other industries' byproducts and their very own compost.

This means they use 0 lbs of fertilizer a year and waste 0 lbs of plant and soil annually. This closed-loop system that District 8 has created allows them to create less waste, use less water, lower their soil costs, and produce a more natural cannabis that is not only safe but high-quality.

BEST PRACTICES

The best way to reduce the expense and risk associated with managing hazardous wastes is to reduce the amount of hazardous materials entering the facility. Opportunities for cultivators include:

- Planning usage of pesticides and chemicals.
- Purchasing materials in smaller quantities and buying no more than a one-year supply of product. This helps avoid excess material expiring or becoming obsolete as regulations change.
- Preparing only the amount needed for each application.
- Managing hazardous waste to minimize the potential for a release to the environment and ensuring proper recordkeeping. (e.g., store in a sealed and labeled container with secondary containment in a locked area.)
- If applying or handling pesticides, lawfully adhering to all pesticide label instructions. It is also recommended that at least one employee has obtained a CDA Private Applicator license. More information can be found at www.colorado.gov/pacific/agplants/private-pesticide-applicators.
- Selecting ideal lamps and ballasts.
- Purchasing lamps and ballasts with the longest burn time possible to reduce the frequency of replacement.
- Considering LED lighting, which does not become hazardous waste at the end of its life.
- Recycling universal waste lamps, ballasts and batteries with a qualified recycler

Resources:

- Hazardous Waste Management and Guidance
- Marijuana Enforcement by the Colorado Department of Revenue
- Mercury-Containing Lighting
- Universal Wastes

PACKAGING

Packaging cannabis products for sale to consumers represents a significant downstream waste source. Reducing the amount of nonrecyclable product packaging reduces overall impact and can be attractive to customers.

PROCESS DESCRIPTION

Cannabis products are sold in a variety of packaging, encompassing a number of different materials, sizes, shapes and functionalities. Below is an overview of some common types of packaging, as well as attributes and uses.

Vials: Typically made from virgin polypropylene (#5) plastic and widely used for packaging flower. Vials are accepted in most municipal recycling programs; some manufacturers include recycled materials in the containers. These containers are resilient enough to withstand cleaning/sterilization and reuse therefore take-back programs are encouraged at retail outlets. Versions with childproof caps are available, eliminating the need for an additional exit package.

Mylar Bags: Used to package a variety of products, usually concentrate and food products. Mylar, or polyethylene terephthalate (PET) plastic film, is typically not accepted in mixed recycling programs. Resealable versions are preferable because they enable longer use by the customer.

Concentrate Containers: Small, typically screw-top containers can be made from a variety of materials, including polystyrene, acrylic, silicone, glass, or mixed materials such as polystyrene with a silicone insert. While some of these materials are technically recyclable, recycling facilities sort out very small items, and the small size of these containers generally means they will end up in the landfill even if placed in a recycling bin.

Pre-Roll Tubes: Narrow plastic tubes, typically made from the same materials as polypropylene vials, are used to sell single joints. Similar to concentrate containers, small dimensions make preroll tubes difficult to recycle.

Exit Bags: Child-resistant bags used as outer packaging when products sold are in non-child-resistant packaging. Often made with mixed materials, such as foil with polyethylene coating, these are typically not recyclable. Reusable versions are available and take-back programs are encouraged.

BEST PRACTICES

Cultivators should:

- Choose packaging that is lightweight, as lightweight materials require less fuel to ship, reducing the associated emissions.
- When possible, select packaging that is made from recycled content and is recyclable and/or compostable, such as recycled PET plastics, recycled high-density polyethylene (HDPE) or cardboard.
- Implement a packaging return program at the point of sale. New regulations in 2019 now allow for retail locations to have take-back programs for recycling both packaging materials and spent vape cartridges. Some customers may not have recycling service at home, so returning to the store may be the only recycling option. Also, smaller plastic pieces and containers, 5- or 10-mL concentrate containers, are so compact and lightweight that they often miss getting sorted out in the recycling process, ending up in the landfill.

Similarly, discuss with packaging suppliers or manufacturers the possibility of a take- back program. Manufacturers may be able to accept

used packaging and reuse it or re- form it into new packaging, helping lead to a closed-loop for product packaging.

- Utilize child-resistant packaging to eliminate the need for an additional exit package. If exit packaging is necessary, operations should offer a reusable type and encourage customers to return them to the store.

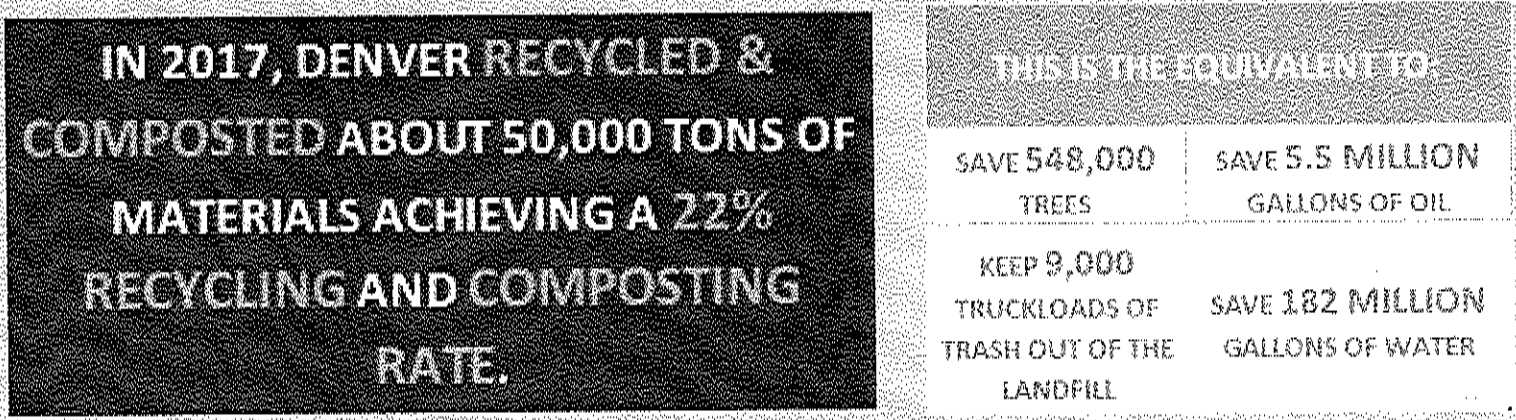
ADDITIONAL CONSIDERATIONS

Packaging materials and designs are quickly evolving, in many cases with enhanced sustainability attributes. As consumers and business customers demand more sustainable options, the industry responds with more recyclable, compostable and innovative material options. One future opportunity would be to make cannabis packaging closed-loop, whereby cannabis plant waste is used as a feedstock for polylactic acid (PLA) plastic and turned into product packaging.

Table 7: Sources of Environmentally Preferable Packaging

Sources of Environmentally Preferable Packaging				
Company	**Website**	**Recycled Content**	**Recyclable**	**Compostable**
Higher Standard Packaging	https://higherstandardpackaging.com/	Yes	Yes	No
STO Responsible	https://storesponsible.com/	Yes	Yes	No
Elevate Packaging	https://elevatepackaging.com/	Yes	Yes	Yes
Sun Grown Packaging	https://www.sungrownpackaging.com/	Yes	Yes	Yes
Sana Packaging	https://sanapackaging.com/	Yes	Yes	No

Figure 13: Diversion Totals for Denver 2017



esources:

- Marijuana Enforcement Division Permanent Retail Marijuana Rules
- Sustainable Packaging Coalition - Definition of Sustainable Packaging
- Framework for Sustainable Food Packaging Design

RECYCLING

Denver's recycling rate of 22 percent falls well below the 34% national average.11 Currently, recycling in Denver is not mandatory, helping lead to low rates of waste diversion. However, businesses can benefit from properly sourcing, separating and diverting recyclable materials. Single-stream collection and hauling is the practice of choice of local recyclers, making it simple for the customer to participate. Combined with the sophistication of area Materials Recovery Facilities (MRFs), the single-stream process can lead to high rates and high quality of material recapture. Recycling reduces environmental impact of waste generated in cannabis operations.

PROCESS DESCRIPTION

Recycling opportunities in the cannabis industry are similar to those in other warehouse-based industries. The exceptions to this are the packaging and universal waste recycling mentioned in previous sections. Packaging from inbound materials, waste generated during operations and employee waste are the main sources of recyclable materials. Recyclable materials should be separated from other waste streams and picked up by a recycling service provider to achieve environmental benefits.

CONSIDERATIONS

Recycling technology and service providers in the Denver area are improving and growing. Many items that were not accepted for recycling in the past, such as cartons and polystyrene foam, are now accepted by some or all local recycling haulers. Two-way communication between haulers and businesses is necessary to ensure that business managers stay up to date on the correct recycling processes.

BEST PRACTICES

Cultivators should:

- Make sure recyclables are clean, dry, and separated from solid waste items such as plastic bags, waxed paper, broken glass and packaging that looks like cardboard but is actually plastic (meal packaging, receipts, coffee cups, etc.).
- Co-locate recycling bins with all trash receptacles and include signage for all bins, ideally using photos of acceptable items for each bin.
- Use signage provided by the waste hauler, or create custom signage for specific items. Hang signage on bins or above bins to help employees when sorting materials.
- Take advantage of new regulations in 2019 that now allow for retail locations to have take-back programs for collecting and recycling both packaging materials and spent vape cartridges.

Examples of Recycle, Compost, General Signage are available through local waste hauler websites.





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OCTOBER 2020

CANNABIS ENVIRONMENTAL BEST MANAGEMENT PRACTICES GUIDE

INTEGRATED PEST MANAGEMENT



EXECUTIVE SUMMARY

Pest control is a critical component of cannabis cultivation. The goal of an Integrated Pest Management (IPM) program is to prevent, reduce, or maintain pest populations at non- damaging levels by utilizing a combination of structural, environmental, cultural, and biological controls in conjunction with compliant and responsible pesticide applications if necessary. The philosophy of IPM offers a sustainable framework for cannabis pest management by eliminating unnecessary pesticide applications, focusing on pest prevention, and combining multiple means of control to maximize impact.

The cornerstone of an effective IPM program is frequent and thorough scouting which provides real time information on the numbers and types of cannabis pests and diseases present in the cultivation environment. This requires knowledgeable cultivation staff that have been trained in the identification of cannabis pests and diseases. Scouting data is then combined with a robust understanding of both crop and pest biology, along with how both are influenced by the cultivation environment, to identify and implement the most effective means of control. These control measures typically fall within one of the following categories:



- Structural
  - Control elements present in the construction or maintenance of the cultivation facility.
    - Examples: air filtration, facility design elements for pest exclusion, and quarantine areas
- Environmental
  - Control category referring to the ability to manipulate the cultivation environment to promote crop health and negatively impact pest/disease development.
    - Examples: cooling and dehumidification capabilities, environmental monitoring, and air circulation.
- Cultural
  - All cultivation practices that influence pest management outcomes.
    - Examples: plant spacing/pruning, facility sanitation, and employee workflow.
- Biological
  - The use of living organisms to prevent and control pest infestations
    - Examples: predatory mites, insects, nematodes, and parasitoids.
- Compliant and Responsible Pesticide Use
  - Pesticides can be an effective and sustainable tool when used responsibly, but are considered a last resort within the IPM framework

INTRODUCTION

The goal of an IPM program is to prevent, reduce, or maintain pest populations at non- damaging levels by utilizing a combination of structural, environmental, cultural, and biological controls in conjunction with compliant and responsible pesticide applications when necessary.

An effective program, implemented and monitored by employees trained in IPM, can eliminate high levels of crop damage, mitigate risk, and control pests. Robust scouting and early identification of pest infestations is critical. This information is utilized to inform pest control strategies on an ongoing basis, forming a data driven feedback loop. The philosophy of integrated pest management puts a large focus on the prevention of pest outbreaks via proactive structural, environmental, cultural, and biological control measures. These elements, combined with scouting, create a cultivation environment in which pests are excluded, suppressed, and easily identified if preventative measures fail. If active pest management intervention is needed IPM practitioners can adjust cultural practices, conduct biological control releases and/or apply organic pesticides when needed.

SCOUTING

An effective IPM program requires the use of Standard Operating Procedures (SOPs) to govern an ongoing scouting program, including daily/weekly inspection of all cultivation areas, identification of cannabis pests, and logging of the data generated. All data should be recorded in a pest and disease log to track pest presence and population levels. Scouting SOPs commonly include scouting intervals for all cultivation areas, the use of sticky cards for flying pest monitoring/quantification, visual inspection of plant canopies, random leaf pulls from within canopy areas, and the integration of environmental monitoring data to identify areas in need of additional scrutiny.

RECOMMENDED BEST PRACTICES

- Maintain organized records of all scouting activities and use these to inform pest management decisions.
- Systematically scout all cultivation areas at least weekly.
- Provide scouts with note keeping tools, a 30x loop for quick diagnostic checks, disposable gloves, and tools for taking and analyzing samples under higher magnification if necessary.
- Scouts should be trained in the identification of common cannabis pests and diseases including the following:
  - Insect Pests including
    - Thrips, Foliar Aphids, Root Aphids, Fungus Gnats, Whiteflies, Caterpillars
  - Mite Pests including
    - Hemp Russet Mites, Spider Mites, Broad Mites
  - Fungal Pathogens including
    - Powdery Mildew, Botrytis, Pythium, Fusarium



STRUCTURAL CONTROLS

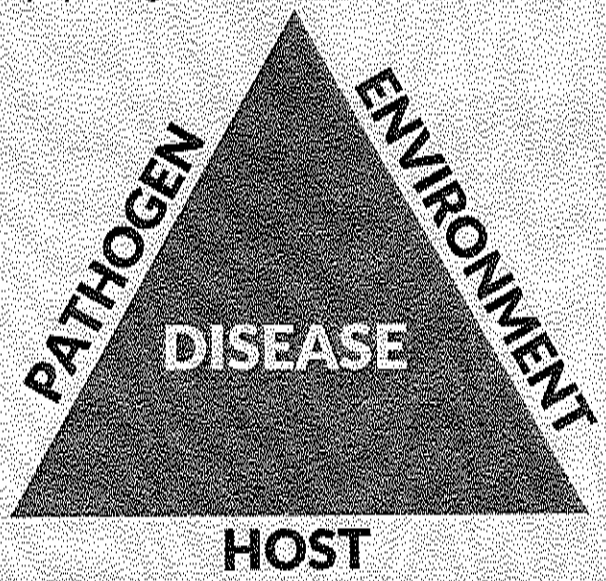
Structural controls are facility design features that exclude pests and diseases from cultivation areas. These design features act as the first line of defense in an IPM program and should be customized according to the needs of the facility as it is being constructed.

RECOMMENDED BEST PRACTICES:

- Facility Layout
  - Indoor and greenhouse facilities should be designed such that cultivation areas are isolated from facility entrances, offices/administrative areas, post-harvest work areas, and product storage areas.
  - The facility layout should require workers and visitors to pass through a sealed entry area with access to locker rooms and decontamination areas prior to moving into any production areas.
  - The layout of cultivation areas should facilitate separate access to propagation, vegetative, flowering, and post-harvest work areas.
- Air Filtration
  - All air entering cultivation areas should be filtered using a minimum of MERV 13 filter rating or equivalent.
- Quarantine Areas
  - Cultivation facilities should be equipped with quarantine areas for receiving cultivation materials and new plant material.
- Footbaths
  - Footbaths containing activated peroxide, bleach, quaternary ammonium, or similar disinfectants should be placed at the entrances to all cultivation areas.
- Irrigation drainage
  - Irrigation systems should be designed to prevent the transfer of plant pathogens. For drain to waste watering systems this can be accomplished by collecting irrigation drainage without allowing it to come into contact with additional plants. For hydroponic systems, or media based systems that re-use water, sterilization technologies such as ozonation or chemical injection are crucial in preventing the spread of plant pathogens.
- Infrastructure to facilitate proper decontamination of facility equipment and work areas.

ENVIRONMENTAL CONTROLS

Environmental systems should be structured in such a way that they offer cultivators the ability to adjust environmental parameters according to pest/pathogen scouting outcomes and crop needs. The disease triangle (pictured below) helps to illustrate the importance of environmental modulation in plant pathogen prevention and control. For a plant disease to develop there must be a susceptible host, the causal pathogen, and a conducive environment. Whenever possible, the cultivation environment should be manipulated to disrupt pathogen development.



RECOMMENDED BEST PRACTICES

- **Robust cooling systems**
  - Cooling systems should be sized according to the projected heat load produced from lighting systems, should take all other potential heat sources into consideration, and should be designed in conjunction with dehumidification systems.
- **Humidity control**
  - While dehumidification is often the primary focus of humidity control it is also important to consider where humidification may also be necessary, especially when bringing new facilities online prior to full plant load. Dehumidification needs should be developed by predicting total transpiration water loss according to the amount of plant canopy in each cultivation area. Systems should be oversized by at least 15% to account for variance in crop size and to provide the ability to lower humidity outside of normal parameters if necessary.
- **Airflow**
  - Maintaining proper airflow in all cultivation areas is critical in promoting plant health and reducing moist, still micro-climates that can be conducive to pathogen development. The use of Horizontal Air Flow (HAF) style fans are superior to wall mounted units and provide a solid platform for a customized facility air mixing plan.
- **Environmental Monitoring**
  - Cultivation areas should be equipped with environmental monitoring equipment capable for capturing temperature, humidity, and lighting intensity data that can analyzed to help cultivators maintain proper environmental conditions and to identify facility micro-climates that may be more prone to potential pest/pathogen development.

CULTURAL CONTROLS

Cultural control is a catch all term for cultivation practices that influence IPM outcomes. These can take the form of preventative cultural controls woven into normal procedures, or reactive cultural controls only utilized if pests/pathogens develop.

RECOMMENDED BEST PRACTICES

- Implementing SOPs for the ongoing cleaning and sanitation of all cultivation areas. This step is critical for both an effective IPM program and for the prevention of microbial contamination of cannabis products.
- Adequate plant spacing and routine pruning of under canopy areas to facilitate air movement, to avoid pockets of low light intensity and dead air within the canopy, and to remove under-growth that is not receiving sufficient light to be productive.
- Use of facility specific employee uniforms and footwear that are changed into at the beginning of the workday and stay at the facility to avoid pest introduction.
- Structuring staff duties and workflow to reduce the chances of cross contamination between different cultivation areas and/or crop phases.
- Utilizing harvest strategies that minimize contact between harvested materials and younger crop phases to reduce cross contamination.
- Use of beneficial plant inoculants to promote media/soil health and help guard against pathogen development.

- Plant nutritional monitoring to promote crop health and prevent over-fertilization.
- Manual removal of plant pests/pathogens if infestations occur. This step should be conducted in conjunction with other control efforts (I.E. clearing out pest damage prior to pesticide applications reduces pest numbers and increases pesticide contact).
- Culling infested plants if pest/pathogen pressure is concentrated in hot-spot areas and cannot be easily controlled can sometimes be useful in stopping the spread of infestations.

BIOLOGICAL CONTROLS

Biological control is the use of mite and insect predators and parasitoids to prevent or eliminate crop pests. Predators are organisms that hunt and consume pests, parasitoids are organisms that develop as pest parasites, but must kill their host in order to complete development to adulthood.

Most biocontrols relevant to cannabis IPM are limited in the types of prey they consume. For this reason, it is important to make releases according to scouting results and/or historical pest pressure. This ensures that the biocontrol agents selected are appropriate for the control of the target pest(s). The developmental cycles of biocontrols often lag behind those of the pests they control, for this reason they are more effective if applied when pest levels are low. It is important to consider the influence that environment and other pest control measures may have on biocontrol agents. If pesticides are being used their toxicity to potential biocontrol agents should be assessed before biocontrol release.

Commonly used biological controls in cannabis IPM and target pests (this list is not exhaustive)

- Phytoseiulus persimilis
  - Predatory mite used for spider mite control
- Neoseiulus californicus
  - Predatory mite used for prevention of several pest mites species including Spider mties and broad mites
- Green Lacewing (Chrysoperla carnea)
  - Predatory insect used for aphid control, larvae will also feed on other cannabis pests
- Minute Pirate Bug (Orius insidiosus)
  - Predatory insect used for thrips control, will also feed on other cannabis pests
- Steinernema feltiae
  - Entomopathogenic nematode used for fungus gnat control
- Aphidius colemani & Aphidius ervi
  - Parasitiod wasp species that target multiple aphid species

RECOMMENDED BEST PRACTICES

- Select biocontrols according to pest species and release when pest populations are low.
- Follow vendor application instructions and release biocontrols as quickly as possible after receiving them.
- If biocontrols must be stored, do so according to the vendor's instructions (many species require cool storage).
- Ensure that other IPM and cultivation techniques are compatible with the biocontrols being used.
- Tailor biocontrol strategies according to crop age because some species and application methods are not compatible with mature cannabis flowers due to resin content.

RESPONSIBLE AND COMPLIANT PESTICIDE USE

Pesticides should be considered the last line of defense in the IPM practitioners toolbox. However, the use of pesticides can be critical in meeting pest management outcomes and they can be an effective part of an IPM program when used responsibly. Cannabis cultivators are limited in the types of pesticides that can be legally applied during cultivation because pesticides are regulated at the Federal level and cannabis is not Federally legal. This means that pesticide use decisions for Cannabis cultivation must be made at the State level.

In Colorado the Colorado Department of Agriculture (CDA) is responsible for enforcement of Colorado specific rules that govern which pesticides can be used in the production of Cannabis and Federal/State regulations pertaining to safe pesticide use in all agricultural industries. In addition to maintaining a list of pesticides that are allowed for use in Colorado cannabis production, the CDA also enforces the Federal Worker Protection Standard (WPS). WPS is a large set of regulations that was developed to protect worker safety in agricultural industries that utilize pesticides. WPS regulations apply to all EPA registered and include specific supplies and information needed in cultivation facilities, training for general workers and pesticide handlers, notifications and restrictions related to employee movements into areas that have been treated by pesticides, and the maintenance of records related to training and pesticide use.

It is also important to understand that certain municipalities and local jurisdictions may have rules and regulations that act alongside or in addition to State/Federal regulations. As an example, in the city of Denver, the Denver Fire Department (DFD) requires pesticide inventory permits and the Denver



Department of Environmental Health is actively involved in monitoring for and carrying out enforcement actions related to pesticide residues in Cannabis.

RECOMMENDED BEST PRACTICES

- Utilize pesticides as a last resort and give preference to organic products if they must be used.
- Tailor pest management strategies to crop age and avoid the use of pesticides on developing cannabis flowers when possible.
- Always read pesticide labels and abide by all applicable regulations and safety guidelines.
- Apply pesticides according to label instructions in sufficient volumes and concentrations to be effective against target pests.
- In order to avoid crop damage:
  - Mix products according to label instructions and test for phytotoxicity before wide spread use.
  - Make sure plants are well watered before making pesticide applications.
  - Turn off any cultivation lighting prior to applications.
  - Avoid extremes in cultivation room temperature during applications.
- Utilize multiple modes of action and rotate pesticides with different modes of action to avoid the development of pest resistance.

HELPFUL LINKS

Colorado Department of Agriculture Cannabis Pesticide Use Information:
https://www.colorado.gov/pacific/agplants/pesticide-use-cannabis-production-information#Colorado

Department of Agriculture WPS Compliance Information:
https://www.colorado.gov/pacific/agplants/worker-protection-standards

Pesticide Informational Resources Collaborative:
http://www.pesticideresources.org/Colorado

Marijuana Occupational Safety and Health Resources:
https://www.colorado.gov/pacific/cdphe/marijuana-occupational-safety-and-health

Colorado Hemp Insect Project:
https://hempinsects.agsci.colostate.edu/



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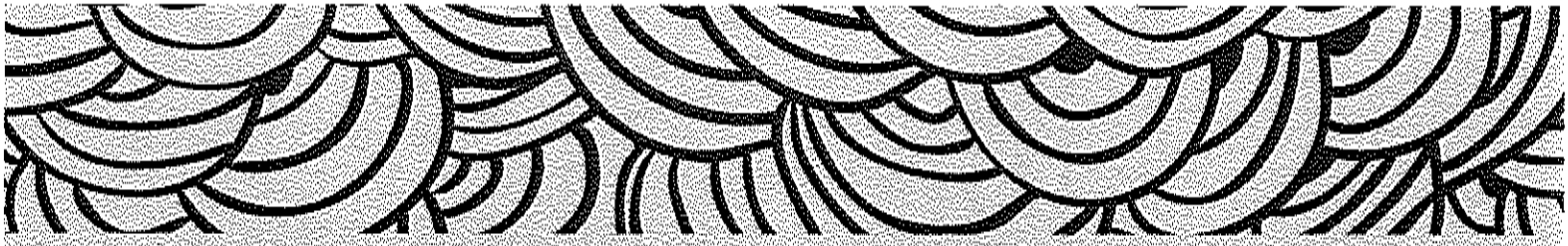
OCTOBER 2020

CANNABIS ENVIRONMENTAL BEST MANAGEMENT PRACTICES GUIDE

AIR QUALITY





Cannabis plants naturally emit terpenes, which are volatile organic compounds (VOCs), as they grow. Marijuana Infused Product (MIP) facilities also emit VOCs from solvent evaporation during extraction processes. VOCs react with oxides of nitrogen in the presence of sunlight to create ground-level ozone, a pollutant that is dangerous to human health and the environment. Controlling emissions of VOCs from cultivation and MIP facilities helps improve air quality, which is especially important in urban areas and from May to September, when ground-level ozone levels often exceed health standards.

This guide provides recommended best management practices to improve air quality impacts and reduce VOC emissions from cannabis industry operations.

CARBON FILTRATION

Installing control technologies can reduce the amount of VOC emissions released from cultivation and MIP processes while simultaneously controlling odors. Carbon filtration is currently the best control technology for reducing VOC emissions from cannabis cultivation and MIP facilities. Best management practices for carbon filtration include:

- Design and invest in a carbon filtration system appropriate to your facility and don't exceed the maximum rated cubic feet-per-minute rating for air circulation through the filter.
- Choose a filter with a high VOC removal efficiency.
- Inspect and conduct regular maintenance of HVAC systems and carbon filters.
- Make sure that all operations are conducted within sealed infrastructure, and check regularly to ensure there are no leaks.
- Have a documented system in place to respond to odor complaints.
- Develop training for staff members to ensure best practices are being implemented as a part of the routine facility operating procedure.

In Denver, an odor ordinance requires that cultivation facilities control the odor impacts of their growing operations. Denver Revised Municipal Code, Chapter 4 – Air Pollution Control, Section 4-10.

SOLVENT EXTRACTION

Only certain solvents are permitted for use in Colorado MIP facilities: butane, propane, CO_2, ethanol, isopropanol, acetone, heptane and pentane. All but CO_2 release VOCs when they evaporate. The disposal of solvents by evaporation or spillage is prohibited. Best management practices for solvent extraction include:

- Regularly inspect all solvent storage devices and extraction system to prevent leaks.
- Be careful to prevent leaks during the transfer of solvents between containers and systems at all stages of the production processes.
- Ensure that solvent is always kept in a closed-loop extraction system or sealed container.
- Maintain an inventory of all solvents and their use over time.

Air quality regulations may apply to MIP facilities, depending on the annual amount of solvent lost to evaporation:
www.colorado.gov/pacific/cdphe/greencannabis/air-quality

BENEFITS OF VOC/ODOR CONTROL

- Reduces community odor complaints and improves neighborhood relations.
- Improves public and environmental health by helping to reduce local ozone concentrations.
- Enhances your brand image with environmental stewardship.
- Helps to shift the cannabis industry at large toward sustainable and environmentally conscious business practices.

INTRODUCTION

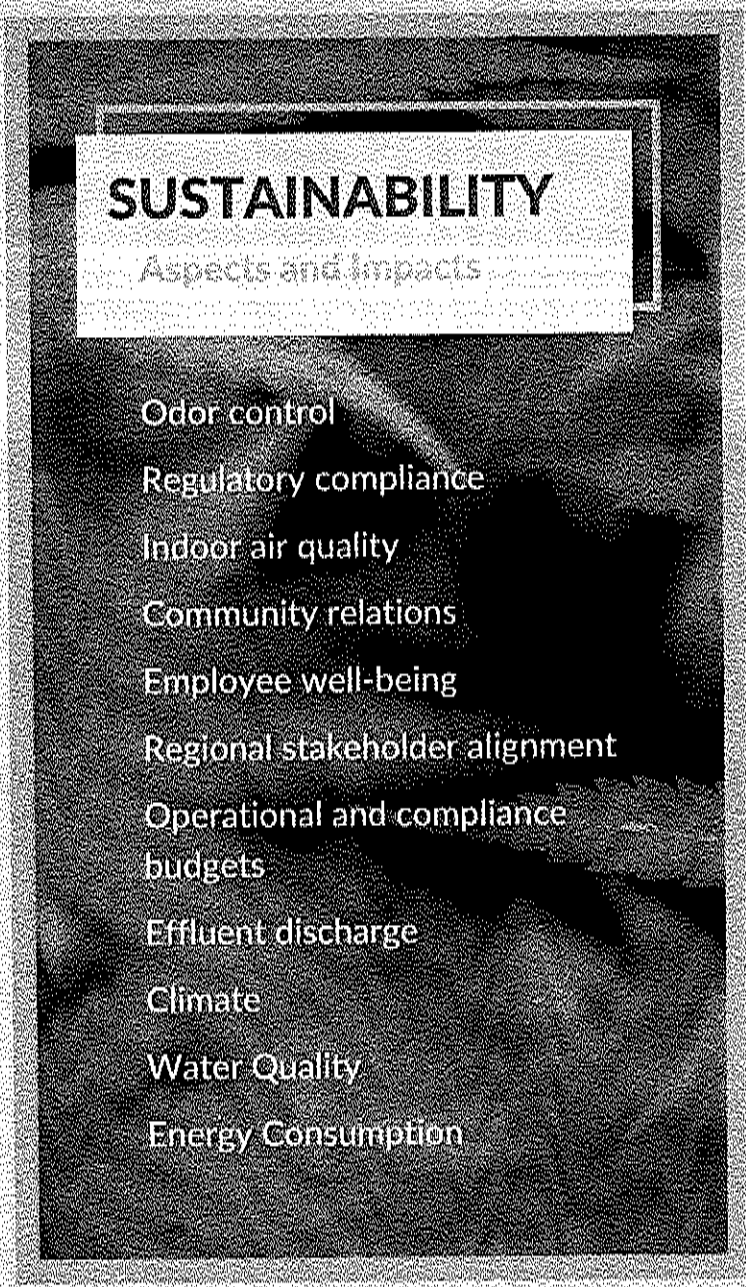
The cannabis industry directly impacts air quality in two predominant operations:

1. Plant growth cultivation
2. Marijuana Infused Product (MIP) facilities

At cultivation facilities, the natural growth of cannabis plants and other processes emit terpenes, which are Volatile Organic Compounds (VOCs) known for their strong odors. At MIP facilities, the evaporation of solvents and other processes in the production cycle results in Volatile Organic Compound (VOC) emissions. VOCs alone do not typically pose a direct threat to human health or the environment.

However, they do contribute to ground-level ozone by chemically reacting with other types of pollution, specifically, nitrogen oxides (NOx) in the presence of sunlight. Ozone is an air pollutant that is harmful to human health and negatively impacts the environment; therefore, it is important that the cannabis industry mitigate VOC emissions in their processes. This chapter provides recommended best management practices to improve air quality impacts and reduce VOC emissions from cannabis industry operations.

In Colorado's Front Range, cultivation and MIP facilities are generally in dense urban areas near heavily trafficked highways and other industrial sources of NOx pollution. Because VOCs require the presence of NOx and sunlight to form harmful ozone, VOCs from these facilities have a greater impact on ozone formation than facilities in rural areas. This makes mitigating VOC emissions from the cannabis industry especially important in these regions. Fortunately, most odor control practices at cultivation and MIP facilities also substantially reduce VOC emissions. The correct operation and maintenance of odor control systems at cultivation and MIP facilities is a best management practice for reducing air quality impacts from the cannabis industry.



CULTIVATION FACILITIES

As cannabis plants grow, they release a distinctive range of odors which are made up of different types of VOCs called terpenes.

Activities during the cultivation or production cycle that release significant odors also release elevated VOCs during that time. Installing control technologies can reduce the amount of VOC emissions released from the cultivation process and control odors in compliance with the Denver city and county odor ordinance. Highly reactive, ozone-forming terpenes commonly emitted from cannabis cultivation include: pinene, limonene, myrcene, and terpinolene.

CARBON FILTRATION - BEST OPTION FOR CONTROLLING ODORS AND VOCS

Carbon filtration is currently the best control technology for reducing VOC emissions from cannabis cultivation facilities. Carbon filters are simple to install, inexpensive, effective, and reliable when properly maintained and replaced. These filters work by using an absorption process where porous carbon surfaces chemically attract and trap VOCs along with other gas phase contaminants. As the filter ages, less carbon surface area is available to trap VOCs; at this point the filter will need to be replaced. Depending on the filter load, most carbon filters will last 6-12 months in a commercial cultivation environment and should be replaced according to the manufacturer's recommendations.

Carbon filters can operate as stand-alone units that clean and recirculate the air, or can be integrated into the HVAC system. Typically, carbon filters are at their peak performance when positioned at the highest point in your grow space where heat accumulates. High humidity levels hinder filter performance, so this control technology is better suited for facilities with environmental controls. An effective filtration system must be properly sized according to the space needed for volume and air-flow requirements. Maintaining an optimal environment can require multiple filters. Carbon filters can be used in combination with other odor control technologies.

BENEFITS:

- Improve indoor air quality by capturing airborne gas phase contaminants and odors.
- Control the odor impacts of the facility: A properly installed and maintained carbon filtration system is highly effective at controlling odors. This satisfies the requirements of the odor ordinance in Denver and improves community relations as well as business reputation.
- Control VOC emissions: a carbon filtration system will control odors and can remove VOC emissions. This improves public health and the environmental impacts of the facility.

RECOMMENDED BEST PRACTICES:

- Design and invest in a carbon filtration system that meets the specific needs of your facility. It is recommended that you work with an HVAC consultant with cannabis industry experience.
- Get information from the manufacturer about the effectiveness of the filter at removing VOCs and choose a filter with a high efficiency rate.
- Do not exceed the maximum rated cubic feet-per-minute rating for air circulation through the filter. If you exceed this max flow rate, the passing air will not have enough "contact time" with the carbon, and the filter will not be effective at removing VOCs.
- Regularly inspect your filter and replace the filter if it is releasing a smell near the filter effluent, or has reached its lifespan according to the manufacturer's specifications.
- Time your filter-replacement schedule so that

filters are replaced in early May, the beginning of the ozone season. This ensures that the filter is at peak performance for VOC removal during the high ozone season, resulting in the greatest public health benefits.

- Using a pre-filter can help preserve the life span of your carbon filter, because it can capture particles before they take up surface area on the filter. Pre-filters should be replaced about every 6-8 months for proper air flow.

BIOFILTERS AND CHEMICAL ODOR TECHNOLOGY

Biofilters are an emerging odor technology that could prove to be more cost effective and less resource intensive than carbon filtration once it is refined in the future. These filters use an organic medium, such as wood chips, that are inoculated with bacteria and consume odorous molecules. Research is currently being conducted on biofilters that contain bacteria that will consume terpenes and will not harm the cannabis plants. Biofiltration is successful at treating biodegradable VOCs, but it requires a large footprint and careful operation control.

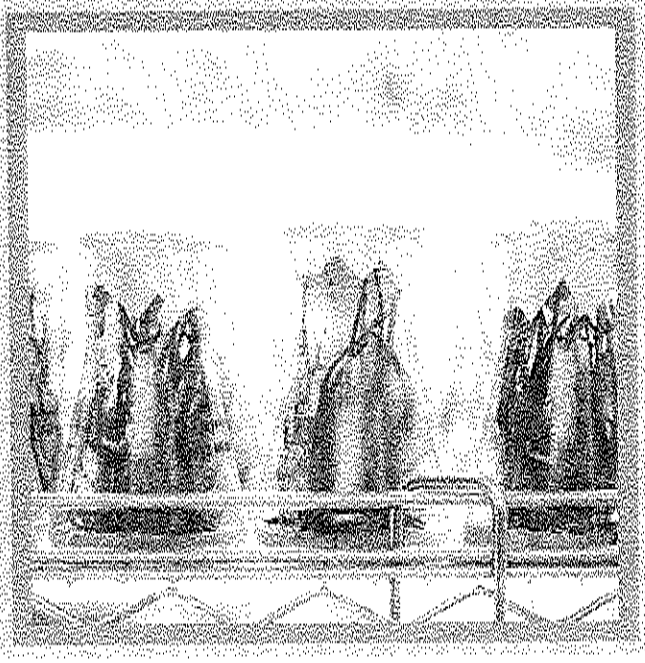
Odor absorbing neutralizers: use oils and liquids from plant compounds and mist them into the exhaust air at cultivation facilities to neutralize odorous VOCs. Contact your odor control supplier about the effectiveness of VOC reduction, as it will vary (20%-90%) by product and contact time.

Masking and counteractive agents: use chemical odor control technologies that are misted at the cultivation facility's exhaust. The use of these agents is subject to Colorado's air quality regulations. Higher VOCs are associated with this technology, which lead to more severe impacts of air quality and are not recommended in urban areas.

Ozone generators: are mostly used for sanitization purposes and have also been used in industrial settings to control strong odors. These generators are harmful to humans and can damage or destroy crops because they are a direct emission source of ozone pollution; therefore, ozone generators are not recommended as a best practice for odor control.

RECOMMENDED BEST PRACTICES:

- Regularly inspect and perform maintenance checks on your HVAC system and ducting to ensure it is operating optimally and that the airflow is properly controlled. Keep windows and doors closed in cultivation areas, and inspect the infrastructure for potential leaks.
- For greenhouses, "sealing" the grow space and circulating inside air for one week's time is a common practice that allows the VOC concentration to build up within the greenhouse. When it is time to "purge" the greenhouse by bringing in fresh air, do this at a time when the potential for ozone formation is lowest (e.g., evenings, windy days, and cloudy days). Avoid purging air during times that have the highest risk of ozone formation (e.g., mornings, sunny and hot days, and stagnant weather).



- Make sure that the temperature and relative humidity are under control within tolerance levels of the cultivation room. High temperature and humidity will perpetuate any odor issues the facility is producing; this is especially true during the flowering phase of cultivation. Proper air circulation is critical for maintaining temperature and humidity control.
- Have a documented system in place for recording and responding to odor complaints in compliance with Denver's Odor Ordinance.
- Purchase a "scentometer" or Nasal Ranger to be able to quantify odors and record "defensible data" from self-testing. This can be used to determine if your operation is meeting local odor regulations.
- The harvesting phase results in a higher emission of VOCs than other cultivation phases. Time the harvesting phase to minimize its ozone impact, with respect to time of day, time of year and periods with high forecasted ozone. Minimize emissions during the morning and early afternoon, and during the summer.
- Develop training and allocate responsibilities for staff members to ensure best practices are being implemented consistently and continually as a part of the routine facility operating procedure.
- Communicate and coordinate with other cannabis cultivators to learn what solutions are the most practical and effective.

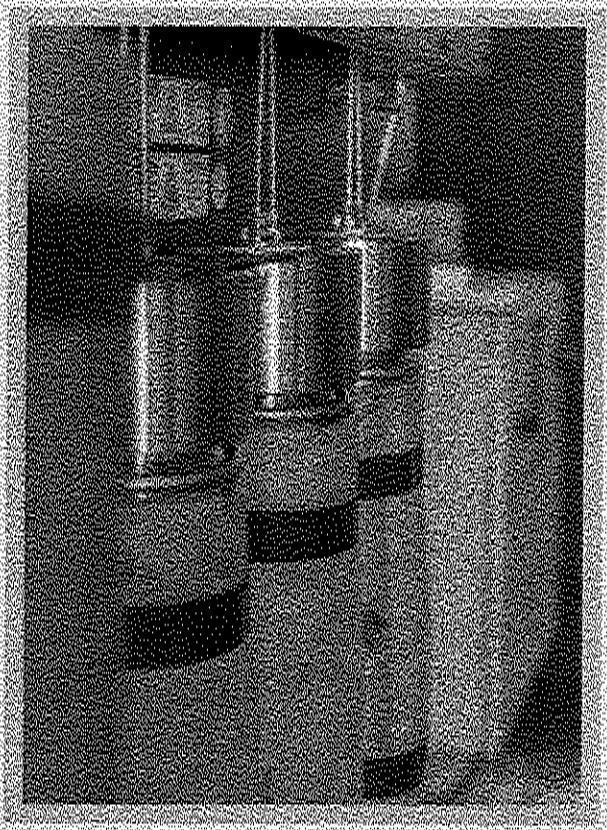
MIP FACILITIES AND EXTRACTION PROCESSES

MIP facilities manufacture marijuana concentrates and infused products such as edibles, ointments, and tinctures.

These methods can be divided into two main categories: solvent and solventless extractions. Solvent extraction methods apply a chemical to remove terpenes and cannabinoids from the plant, which results in a variety of different products. Solventless extraction methods involve the use of physical methods to create concentrates.

The processing of plants where solvents are used to extract cannabis concentrates is considered a manufacturing process that is subject to state air quality regulations. The applicability of the air quality regulations will depend on the annual amount of VOC emissions quantified in tons emitted per year. It is the responsibility of the business to calculate an estimate of their VOC emissions from solvent extraction. For specific guidance on air quality requirements for MIP facilities and how to calculate emissions, visit:

www.colorado.gov/cdphe/greencannabis



The Colorado Small Business Assistance Program can also help you calculate your annual air emissions for free by calling 303-692-3175.

REGULATORY APPLICABILITY

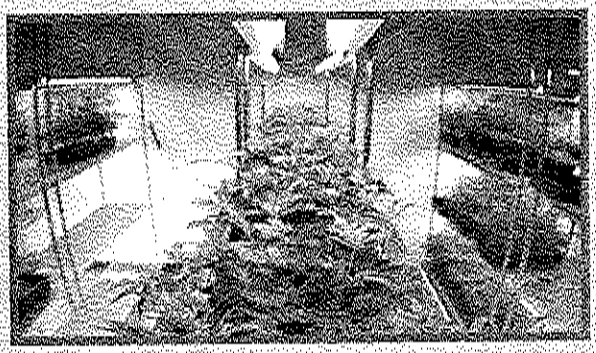
- CCR 212-1 M 605 D4 requires a professional-grade, closed-loop extraction system capable of recovering the solvent, with the exception of ethanol and isopropanol solvent-based systems (CCR 212-1 M 605 E). The disposal of VOCs by evaporation or spillage is prohibited under 5 CCR 1001- 9 Regulation 7 V.A.
- CCR 212-2 R 605 A2 delineates the solvents that are permitted for use. The rule states: "A Retail Marijuana Products Manufacturing Facility may also produce Solvent-Based Retail Marijuana Concentrate using only the following solvents: butane, propane, CO_2 , ethanol, isopropanol, acetone, heptane and pentane. The use of any other solvent is expressly prohibited unless and until it is approved by the Division."
- All permitted solvents besides CO_2 are VOC-based and result in direct VOC emissions when evaporated. The law is the same for medical marijuana concentrate production and is provided in CCR 212-1 M 605 A2. This list of solvents was formulated with the health and safety of workers in mind, and using any other solvent is a violation of the law and could also lead to negative air quality impacts. CCR 212-1 M 605 D5 requires that all solvents used are food grade or at least 99% pure.

RECOMMENDED BEST PRACTICES:

- Regularly inspect and maintain all storage devices of solvents to prevent leaks.
- Conduct regular maintenance and inspection of the extraction system to ensure that it is functioning properly, without direct leaks of the solvent.
- Take caution to prevent leaks during the transfer of solvents between containers and systems at all stages of the production processes.
- Never dispose of a solvent through direct evaporation or spillage; ensure that the solvent is always recovered and kept in a closed-loop extraction system or designated container
- Maintain an inventory of all solvent liquids and ensure that the facility operating procedure allocates responsibility to keep an updated list.
- Develop training and allocate responsibilities for staff members to ensure best practices are being implemented consistently and continually as a part of the routine facility operating procedure

CONCLUSION

Limiting activities that emit VOCs and making sure that odor control systems are optimally operating during high ozone periods can substantially improve the air quality impacts of cannabis facilities. It is recommended that an employee committee is designated to develop and implement a BMP plan specific to the facility needs. Establishing and communicating BMPs through adequate training can help ensure that this becomes an integrated part of the routine operation in cannabis facilities. Colorado's cannabis industry can adopt BMPs that improve their air quality impacts, bolster their reputations as stewards of the environment, and control their odor, as well as air quality emissions.





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SUPPORTING SECTIONS



INTRODUCTION

Indoor cannabis cultivation uses the largest amount of energy when compared to any other production method, and creates the largest associated carbon footprint. Greenhouse gas (GHG) emissions baselining provides companies with a snapshot of short-term energy use and long-term financial risk. Studies have consistently found that implementing comprehensive climate protection programs makes companies more competitive for a wide variety of reasons, including significant financial savings, brand reputation, and increased employee and customer satisfaction. A recent report from Goldman Sachs found that companies that are leaders in environmental, social and good governance policies are outperforming the MSCI world index of stocks by 25% since 2005. Seventy-two percent of the companies on the list outperformed industry peers.[1]

Taking a more in-depth view of fuel use and electricity/resource consumption allows cannabis companies to identify opportunities to increase efficiencies and reduce costs while minimizing GHG emissions. This will also keep the company's policies, procedures and operations ahead of rapidly evolving, energy-related building codes and regulatory frameworks. Denver has determined that maintaining progress toward the 2050 carbon reduction targets is critical to the longevity of the city. These factors show us that not only is it a good business decision to look at your carbon output and explore ways to create reductions, but it also contributes to the local community and reduces the environmental impact of the industry.[2]

WHAT IS A CARBON FOOTPRINT?

A carbon footprint in the context of the cannabis industry can be defined as the total amount of GHGs emitted during the production of raw cannabis and cannabis-related products.

However, a holistic approach to carbon foot-printing should include:

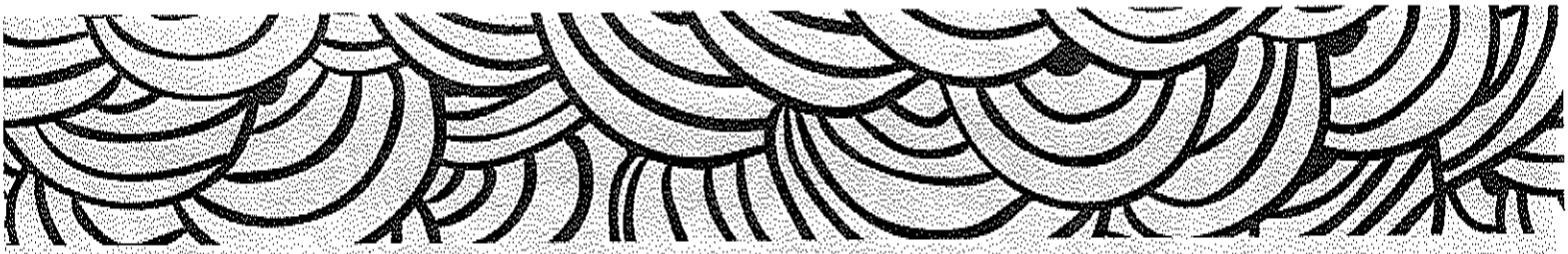
- A detailed breakdown of GHG emission sources, factors and calculation methodologies
- Short- and long-term emission reduction goals
- Specific strategies for reduction and tracking reductions
- A management plan for updating and continued tracking of the GHG emissions and sources

Creating a carbon footprint that is also a strategic planning document will lead to better incorporation of carbon reduction strategies and provide deeper insight into company operations, revealing the potential for cost-saving efficiency investments.

The heavy data analysis portion of a carbon footprint will be the GHG Inventory. This section is a detailed accounting of all GHGs emitted during the production process and operations of a cannabis company. These GHGs can include Methane, Nitrous Oxide, Butane, Propane, and many other gases, but will usually be expressed as Carbon Dioxide Equivalent or CO_2e. For any quantity and type of greenhouse gas, CO_2e signifies the amount of CO_2

[1] "GS Sustain." Goldman Sachs 2007 http://www.natcapsolutions.org/Presidio/Articles/Climate/GoldmanSachsReport_v2007.pdf

[2] Alderton, Margo, "Recent report finds corporations that lead i corporate responsibility also lead in the market," Socially Responsible Investing 07-11 17:57, also at http://



which would have the equivalent global warming impact. Specific operational and company data are needed to make an accurate accounting of GHG emissions. Emissions factors, or the amount of CO_2e per unit of energy/input, are readily available for most activities in the cannabis growing industry.

A well-rounded carbon footprint should analyze the applicable data and set reasonable, achievable goals based on the specific cannabis company and its projected strategic plan. This will allow the operations of the company to grow alongside its sustainability goals, creating a more resilient and adaptable business.

TYPES OF CARBON EMISSIONS

Organizing and collecting all the data necessary for a carbon footprint is a good exercise in itself for looking at company operations, but can seem overwhelming at first. It is easier to understand what kind of data is necessary for the GHG inventory by breaking it down into the three primary scopes:

- Scope 1 Emissions: An organization's direct GHG emissions produced on-site. Examples include diesel generators, transportation fuel for delivery/company vehicles, CO^2 supplementation being used in facility grow operations or any excess natural gas emissions attributed to concentrate production.
- Scope 2 Emissions: An organization's off-site carbon emissions, or indirect emissions. This figure is most frequently attributed to electricity usage, unless a company is producing all of its energy through renewables on-site. For Denver, the primary sources of power generation are coal and natural gas, both of which have associated carbon emissions. Those carbon emissions are reflected in a reporting organization's electricity usage. This is the largest area of impact for the cannabis industry in Denver due to the exclusive use of indoor grow operations.
- Scope 3 Emissions: All other indirect carbon emissions associated with the operation of a business. Examples include employee travel/commuting in their personal vehicles, grid transmission and distribution losses of electricity, waste products, water usage, packaging, product transport and delivery, and nutrients. Scope 3 examines operations and sourcing in-depth, making it a fantastic tool for analyzing a supply chain. Some analyses even go so far as to calculate associated processes and ingredients of production. For example, if a product uses plastic packaging, Scope 3 could include the entire life cycle of the product, such as carbon emissions from the raw oil extraction process, the refinement of the oil, the synthesis of plastic from the oil and the transport of materials between phases.

According to an analysis conducted by Evan Mills in 2012, for each kilogram of cannabis produced, roughly 4,600 kg of CO^2 is emitted. More data and research are needed to confirm this analysis, as many experts have brought up potential issues and new efficiency practices in the determination of this number.

CALCULATION & TRACKING METHODS

SETTING A BOUNDARY

The preliminary action required for undertaking a carbon footprint analysis is setting a boundary around the study. A boundary defines the breadth and depth of the GHG inventory. It is up to the developer of the footprint to determine the appropriate boundary limits, but it is recommended that the process go back

as far as it can for more transparency and accuracy in the final report.

A proper boundary analysis should include a detailed layout of the system and processes which will be analyzed. It is important to consider the full life cycle of the product or operation being calculated. This will include extensive research into ingredient sourcing, where and how ingredients were developed, what type of transport was utilized, and the energy consumption related to their production, etc. As carbon tracking has become more mainstream, many vendors have this information readily available. Furthermore, companies can implement or request carbon tracking of their vendors to facilitate more detailed data collection.

The detail of the calculations should encompass all operations of the business, including processes or products that may seem irrelevant or whose value may not be immediately evident. For example, waste from plants or soil, water usage and courier usage are all relevant to the analysis. It is crucial to get a complete, comprehensive look at company operations to ensure the utmost accuracy in a GHG inventory. This stage of planning will set the boundary for the inventory and determine which data is necessary to collect in order to calculate an accurate carbon footprint.

CALCULATING A CARBON FOOTPRINT

Calculating a carbon footprint can be a complex process that requires time and analytical proficiency. It is recommended that if a cannabis organization wishes to undertake creating a carbon footprint and calculating a GHG inventory, they utilize comprehensive guides such as the WRI GHG Protocol: A Corporate Accounting and Reporting Standard or the EPA Center for Corporate Climate Leadership Greenhouse Gas Inventory Guidance. Otherwise it is recommended to look for help from outside professionals to assist in the detailed calculations necessary for a comprehensive inventory. Outlined below are examples of calculations for the various scopes.

FACILITY VARIATIONS

Each facility and operation will have its own unique inputs in a carbon footprint calculation. It is important to closely review every area of an operation to identify the largest drivers of carbon emissions. The chart outlines some of the unique carbon emission sources in different types of facilities:

Dispensaries	MIPs	Grows
Customer Transit	Butane/Propane/ CO_2 Usage & Ventilation	CO_2 Supplementation
Packaging	Delivery & Courier Services	Delivery & Courier Services
Vendors & Products	Manufacturing Waste	Soil & Fertilizers
Retail Waste	Manufacturing Equipment	Water

TRACKING METRICS OVER TIME

It is important that a carbon footprint is continually updated to track and report progress over time. The data can be managed easily when appropriately developed in a data analysis program. An annually updated carbon footprint progress report demonstrates commitment to customers and shareholders.

Tracking carbon data allows for proper allocation of resources based on which area is lagging behind or stalling. Once data has been regularly tracked for



an extended period, it is possible to compare carbon metrics to other important industry metrics (sales, return on investment (ROI), repeat customer generation, etc.) and look for general trends and correlations.

REDUCTION STRATEGIES

Once the calculation of the carbon footprint is complete, strategies to reduce the carbon output of the facilities can be identified. It is important to understand that this is a long-term goal and will have many stages of planning, implementation and progress. The best way to make progress is by focusing on projects with a significant ROI and contribute to the operation's overall mission.

A good initial approach is to increase operational efficiencies within the facility and operations of the company. Creating efficiencies wherever possible will reduce the largest impacts of a carbon footprint while simultaneously saving money and resources. That way, when larger potential projects are considered, the resources required to fulfill that project's needs will be much lighter. For example, it will be much easier to install on-site renewable energy if the facility's operating energy has already been quartered due to efficiency upgrades. Examples of efficiency and zero-carbon upgrades are discussed more in-depth in other sections of this guide, and include:

- High-efficiency lighting and HVAC systems
- Increased insulation in facilities
- Heat recapture systems on operational machinery
- Onsite renewable energy
- Electric or natural gas fleet vehicles
- Composting and/or recycling
- Sourcing carbon neutral ingredients
- Carbon neutral, recyclable, or compostable packaging
- Solventless extraction methods

Goal setting is essential for any organization wishing to reduce its carbon footprint.

It is imperative to set a baseline from which to develop carbon-reduction goals. Organizations can either set one baseline year (e.g., X% reduction against their 2018 baseline year by 2025) or use the most recent year as their baseline year — a "rolling" approach (this approach is more challenging to show large amounts of reductions). Using a rolling approach will not allow the reporting organization to "count" the same reduction year after year toward their goals and become idle. Whichever approach is chosen, the concept and establishment of a baseline year is essential. Once a goal is achieved, it is essential to establish a new goal that challenges the organization to come up with new ideas and implement more aggressive reduction strategies.

Another option for reducing carbon for cannabis facilities is looking at local options for carbon mitigation and renewable energy credits, but this should be a final approach to reducing carbon output after reduction initiatives have been undertaken. Cannabis operations can contact their electricity supplier to learn about options for purchasing local renewable energy.

Alternatively, renewable energy credits can be purchased from organizations like carbonfund.org or carbon credits from the Colorado Carbon Fund, which funds Colorado-based carbon projects. Though these options are helpful in the short term, they have fewer long-term benefits than carbon-reduction strategies and projects.

SCOPE 1

- **Example:** Company A uses 140 gallons of gas per year on company owned vehicles used at the site of operations.
  - The EPA conversion rate for gallons of gas to grams of carbon:
  - 8,887 grams of CO_2/gallon of gasoline.
  - Use this conversion rate and multiply by gallons of gasoline used that year:
  - 140 gal X 8,887g CO_2 = 1,244,180 grams of carbon.
  - This number can also be represented as 1,244.18 kilograms of CO_2 or 1.24 metric tons of CO_2. It is up to the analyzer to determine the best metric to use.

SCOPE 2

- For this example 2000 kWhs for a grow operation will be calculated.
  - The EPA conversion rate for kWh to CO_2 is 740 grams per kWh.
  - Take the conversion rate and simply multiply it by the number of kWhs emitted annually.
    - 2000 kWh X 744g CO_2 = 1,488,000 grams of carbon.
    - Again this number can be represented as 1,488 kilograms of CO_2 or 1.49 metric tons of CO_2.
    - NOTE: It is important here to note that these number are derived from EPA standards that do not take into account regional sources or other GHGs associated with the various scopes emissions. It is very important to source regionally based emission factors as well as CO_2 equivalences in order to get the most accurate reading for all emissions associated with an organization's operations.

SCOPE 3

- A scope 3 calculation includes all other associated emissions such as employees driving to work. Assume in this scenario total employees driving distance is 200 miles.
  - The EPA conversion rate for miles to CO_2e is 408 grams of CO_2e per mile.
    - 200 miles X 408g CO_2e = 81,600 grams of CO_2e or 81.6 kilograms of CO_2e.

Carbon Sequestration and Negative Values

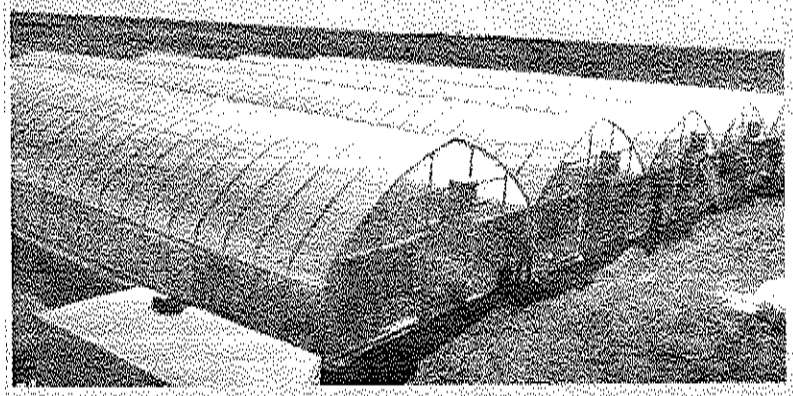
- Cannabis is unique for calculating carbon footprints in that it uses CO_2 in order to grow, therefore a negative value can be applied to the overall carbon footprint of the operation. Unfortunately at this time no concrete numbers exist for the carbon sequestration capacity of cannabis so for now we can extrapolate the sequestration performance of hemp. Hemp sequesters 22 tons of CO_2 per hectare. This number can be used to determine the carbon sink of a grow operation.



GREENHOUSE CULTIVATION

INTRODUCTION

Greenhouses are quickly becoming the preferred structure for cannabis cultivation, with almost half (45%) of current cultivators nationwide using them in some capacity.[3] As utility costs rise and already tight profit margins continue to shrink, more operations are viewing greenhouses as an economical solution.



By utilizing natural sunlight as the primary lighting source rather than lighting fixtures, greenhouses are typically more energy efficient and have been shown to reduce production costs by 30 percent when compared to indoor grow facilities, depending on the regional climate. Greenhouses now account for one quarter of all production space, with a little under half (43%) of current growers considering expanding into greenhouses. In Colorado, the trend toward greenhouse as well as outdoor growing can be seen in the 154% increase in cultivated plants in Pueblo during 2017.

A greenhouse is any structure for the cultivation of crops with a transparent (glazed) roof that allows natural light to penetrate the growing space. Glazing can vary from low-cost polyethylene film, to semi-rigid polycarbonate or tempered glass panels. The sidewalls can be constructed out of various materials, ranging from simple fabric/sheeting to insulated metal siding. Greenhouse structures run the gamut in size and complexity, from hoop houses to state-of-the-art sealed buildings.

All greenhouses are essentially structures that protect crops from the elements while utilizing the energy of the sun.

The structure of commercial greenhouses can be freestanding or gutter-connected. Freestanding greenhouses can have a variety of roof shapes, with hoop, gothic, or gable being the most predominant. A gutter-connected greenhouse uses a series of trusses connected at the gutter level to customize the width of the structure. These roofs are predominantly hoop- or gable-shaped. Greenhouses can be made to any length, but length is usually determined by available glazing sizes. Greenhouses tend to use modular-frame construction with spacing of 4'-5' for hoop houses and 10'-12' for gutter-connected designs.

For cannabis cultivation, a Light Deprivation System, also called a blackout system, is required to create the photoperiodism needed to induce flowering. These systems can be manual or automatic and utilize a range of fabrics. Breathable fabrics are preferred because they prevent condensation from forming and dropping onto the plants, creating an ideal environment for disease.

[3] State of the Industry Report. 2018. Cannabis Business Times

CONSIDERATIONS

Free-Standing Greenhouses	Gutter-Connected Greenhouses
Easier to provide separate grow environments ,as each house is controlled by its own heating/cooling system.	Reduced heating costs (up to 25%) as surface area-tofloor area ratio is lower.
Individual houses are easier to build and maintain.	Less land is needed. About 30% more growing space can be placed on the same amount of land area.
Ideal for non-level sites..	Heating and cooling can be centralized.
	More cost effective for areas greater than 10,000 sq. ft.

GREENHOUSE DECISION-MAKING

When deciding to grow in a greenhouse, cultivators need to consider a multitude of factors. Start with a review of state and local cultivation regulations and zoning codes to ensure greenhouse cultivation is approved in your area, and pay specific attention to security requirements. Contacting the proper licensing and zoning offices is always a good idea, as many nonrural municipalities and zoning departments are unfamiliar with commercial greenhouse structures.

Greenhouses require adequate land to allow for roads, parking, and buffer zones, in addition to the structures themselves. Greenhouse operations typically require a minimum of two acres. When siting a greenhouse, look for a flat topography to ensure proper drainage, and orient the structure to maximize unobstructed southern views to provide drainage and adequate sunlight and solar gain. The local geography and climate will further determine a suitable type and style of greenhouse. The temperature range and and solar angle of incidence will determine the appropriate type of glazing with regards to transparency, dispersion, and insulation rates. The growing period, whether year-round or seasonal, will also determine the style of greenhouse.

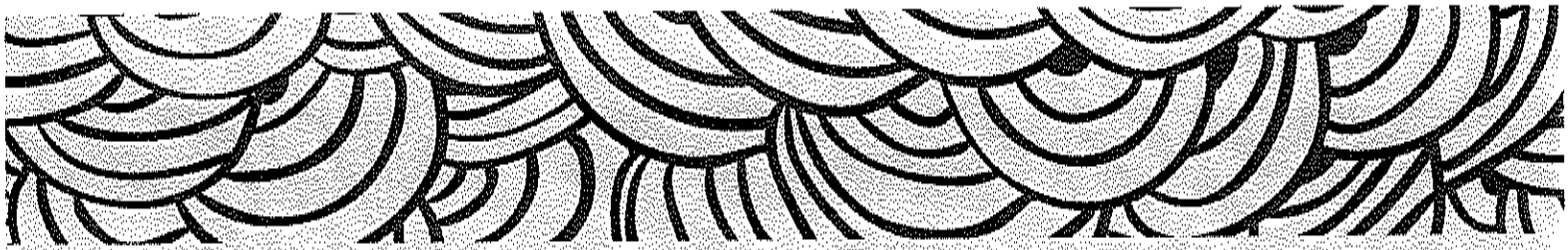
DESIGN

At a minimum, greenhouses provide protection from wind and rain and help to minimize pest pressures while sealed. Environmentally controlled greenhouses provide the opportunity to control all aspects of the grow environment, similar to an indoor facility. A well-designed greenhouse that incorporates the many equipment systems with accurate environmental controls and good space utilization is the key to a successful cannabis production facility. Installing peninsular or moveable benches can achieve 80-90 percent space utilization, resulting in a more efficient lighting system and higher yields.

LIGHTING

The main benefit of using a greenhouse is that the primary source of lighting is the sun, and grow lights are used only as an occasional supplement. Grow lights are used to extend the seasons when daylight is limited. This allows the plants to maintain a vegetative state for the proper durations, to boost daily light levels when necessary, and to ensure consistent light levels. Since artificial light is secondary, larger light fixture spacing is used when compared to indoor setups.

The lighting types most commonly used are LEDs and HPS. Automation is essential for energy efficiency, and controls should be set to a specific light level (PPFD) to ensure lights are on only when needed. A timing delay helps to account for temporary cloud cover. Lights should also be



subdivided in a checkerboard pattern so that the minimum number of lights are used to achieve the appropriate light level.

In regard to controlling the sunlight that enters a greenhouse, the standard glazing material is light-diffusion fabric. This type of material spreads out the light particles and infrared radiation while blocking UVB to dampen the sun's intensity and generate more light. Shade cloths can also be used during the summer months to lessen the sun's intensity and lower solar heat gain. Some grows are experimenting with painted films to achieve these results. Double- or triple-glazed material will increase the insulation factor, reducing heat loss if needed.

CLIMATE CONTROL

Utilizing the sun as the primary source of light brings with it unique climate control challenges in the form of solar heat gain. Due to the "greenhouse effect," special attention needs to be paid to the HVAC system. The "greenhouse effect" is when solar radiation enters the greenhouse and heats up the thermal mass; the glazed panels then trap the infrared radiation inside.

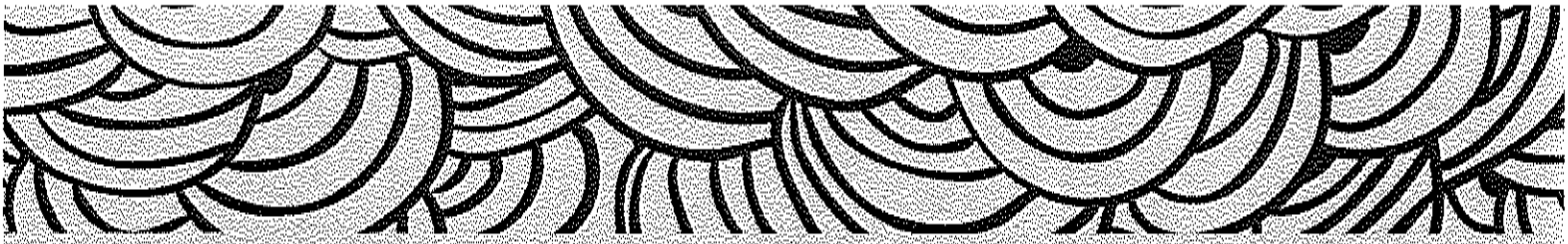
In addition, greenhouses are traditionally leaky structures due to the space between the glazed panels and frame. Solutions to the HVAC dilemma diverge depending on the type of system employed — either open (passive) or closed (sealed).

Open greenhouses rely on more passive systems, such as vents and actuators, to provide climate control via air circulation and can be thought of as an extension of the outdoor environment. These systems depend on temperature and wind gradients to cool, resulting in low average air volume exchanges of around two to three times per hour. Some common structural elements are open-roof designs and guillotine, or roll-up sides which reduce the need for ventilation fans. In drier climates, a fan and pad system can be ideal.

When employing fans, a design with several stages of ventilation can be more energy efficient than one with just a single stage. Using light-colored groundcover and pots will limit heat absorption in the greenhouse. In regions with hot days and cold nights, thermal mass can be added to absorb and store heat during the day and then release it at night.

When heating is required, it should be located in the floor or under the benches to target the root zone, which will reduce the need to heat the entire greenhouse by 5-10F. For every 1F the air temperature can be set, fuel consumption is reduced by 3%. To avoid excessive drying of the growing media, it is best to limit root zone heat to 25 BTU/sq.ft.

Closed greenhouses, on the other hand, closely resemble indoor facilities and rely on equipment with advanced climate control systems to control heat and humidity. These systems seek to eliminate air exchanges in order to better control the indoor environment. Newer structures that utilize this system are often hybrid designs with vertical metal insulated walls and a glazed roof. The insulated walls better protect against temperate swings. An added benefit of a sealed environment is reduced contamination from outside sources, such as pests, disease, and hemp pollen. In more urban environments, odor can be controlled. In this system, each greenhouse or bay should have independent temperature and climate control to account for variations within a site. For larger greenhouses, an energy-efficient cooling technology currently being used is cooling towers, which are similar to a wet wall but housed in a separate unit. For dehumidification, desiccant boxes are now being



employed, as they need little energy to operate. They utilize a media such as silicone gel to absorb water vapor from the air. This process is known as Ground to Air Heat Transfer (GAHT).

Heat exchangers store excess heat in a medium such as water or soil. The system circulates hot air from the greenhouse through pipes buried underground, whereby the heat gets transferred to the soil. The air is then exhausted back into the greenhouse cooler and drier. Thus, the GAHT system creates a closed-loop airflow, which cools and dehumidifies the greenhouse.

ENERGY CONSERVATION TECHNIQUES

- Insulate perimeter (side and end walls), foundation, and distribution piping.
- Install windbreaks on the north side to reduce wind-induced heat loss.
- Install automatic closing doors.
- Weatherstrip doors, vents, fan openings.
- Lubricate all louvers.
- Repair broken or torn glazing.
- Install an infrared inhibitor on the inner lining of glazing for 15% savings.
- For older structures, add a single or double layer of plastic covering to reduce infiltration and heat loss by 50%.
- Aspirate thermostats for more uniform temperature control.
- Select fans that meet Air Movement and Control Association International (AMCA) standards and have a Ventilation Efficiency Ratio greater than 15.
- Use the largest diameter fans with the smallest motor that meets ventilation requirements.

ENVIRONMENTAL JUSTICE

Environmental justice is equal protection for all communities from environmental hazards and equal access for all communities to environmental, social, and economic assets that promote health and well-being, such as clean air, safe drinking water, green space, public transit, and economic opportunity.[4]

The cannabis industry can be a model for sustainability. It also can be a model for environmental justice. It's not often that a novel industry enters the marketplace, builds infrastructure and scales up; typically, industries have to be retrofitted for sustainability. The open cannabis policy environment enables advocates in all 50 states to address environmental and social justice issues within local laws.

Extrinsic factors at the individual and community levels — such as race, gender, and socioeconomic status — can amplify the adverse effects of environmental hazards and contribute to health disparities.[5] Persons and public spaces impacted by the cannabis industry are considered vulnerable. Capitalizing on a particular vulnerability or vulnerable group is considered environmental racism. In some cases, cannabis cultivation spaces are located in low socioeconomic status neighborhoods, whereas cannabis cultivation licensees tend to be disproportionately white and male. Incarceration rates for cannabis crimes tend to disproportionately impact persons of color. The World Health Organization defines environment as "the conditions in which people are born, grow, live, work and age, and are shaped by the distribution of money, power and resources at global, national, and local levels."

The industry as a whole should seek to produce "Fair Trade Cannabis," which is grown sustainability and sold in a manner that causes the community to flourish and the industry to become an asset and partner.

Howard Frumkin. Environmental Health: From Global to Local, 3rd Edition. (Jossey-Bass, 2016), 267.
Frumkin. Environmental Health, 267.

CASE STUDY

CULTIVATION CO_2 SUPPLIED BY A SUSTAINABLE BREWERY

The State of Colorado's Kaitlin Urso facilitated a pilot program with Earthly Labs, Denver Beer Co., and The Clinic to establish the first commercial exchange of recovered carbon dioxide, a greenhouse gas, in the Spring of 2020. The pilot program captured and stored excess carbon dioxide produced during the beer fermentation process for later reuse by cannabis cultivators that require carbon dioxide to stimulate plant growth during cultivation. The exchange fills a need for both industries while reducing carbon dioxide emissions in Colorado. Beginning in January 2020, carbon dioxide produced by the beer brewing process at Denver Beer Co. was captured using Earthly Labs' system and then transferred via holding tanks to The Clinic where it was released to stimulate marijuana plant growth. The brewery can capture over 100,000 lbs/year with this technology. The pilot program proved to be an all-around environmental and economic success and now the exchange of CO^2 continues as part of normal business operations for both the brewery and cultivation.

THE BREWERY

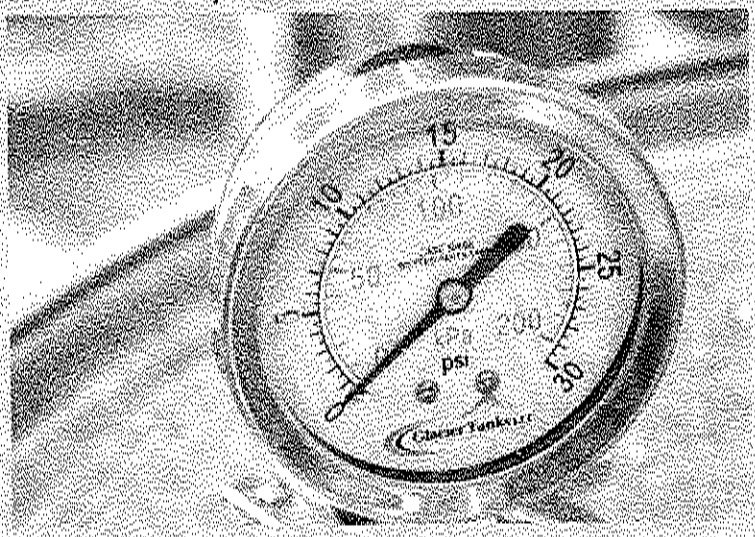
The beer-brewing process-- specifically, the fermentation stage-- naturally produces carbon dioxide. While beer makers use carbon dioxide to carbonate beer and pressurize lines throughout their facility, the current practice for most brewers, especially smaller-scale craft brewers, is to vent carbon dioxide from fermentation to the atmosphere and purchase commercial carbon dioxide from an outside source for the majority of carbonation. Using technology, brewers can instead capture and store excess carbon dioxide for use both in- house and sell it to other businesses who need CO^2 for their operations such as cannabis growers.

THE GROW

The legal marijuana industry is a large market for carbon dioxide consumption, as carbon dioxide enrichment is used to grow premium products in a condensed time span and increase yields. Carbon dioxide is a key component in the cannabis cultivation process as the plants utilize light energy to fix carbon into the basic building blocks of growth.

THE SUCCESS

The pilot program demonstrated a cost-efficient way for breweries and marijuana businesses to slash their carbon dioxide emissions, as companies will no longer have to purchase carbon dioxide from other sources and have it shipped by truck across the state. Implementation of this technology will meaningfully reduce the transportation portion of their carbon footprint. Additionally both businesses will cut the cost of the CO^2 supply that they use. The CO^2 captured has become a new source of revenue for the brewery.



THE RESULT

The cultivation saves about $0.20 per lb of CO_2 purchased from the brewery versus from a traditional supplier. During the pilot the Cultivation purchased 500 lbs a week of CO_2 from the Brewery and will continue to purchase more as they use the CO_2 throughout the rest of their operation. By using the Brewery's Supplied CO , the cultivation saw a slight increase in plant production and quality when compared to their traditional CO_2 supply:

Yield – 2.32% increase from average yield
Potency – 3%-5% variance from average – within tolerable range
Terpenes – 3%-5% variance from average – within tolerable range

This project reduces the amount of Carbon dioxide released into Colorado's atmosphere. We believe that with this single partnership, we will be able to capture more than 50,000 lbs/year of carbon dioxide. The state is relying on innovative investments by small businesses and innovation partners to achieve their aggressive greenhouse gas reduction plans. This is one such example of small businesses making investment to reduce CO_2 emissions in the state of Colorado.

"This is a classic win-win-win scenario," said Kaitlin Urso, environmental protection specialist for the small business assistance program at the Colorado Air Pollution Control Division. "We're connecting companies that have excess carbon dioxide with companies that need it, and in the process we're reusing CO_2 that would otherwise be released directly into the environment."



CASE STUDY

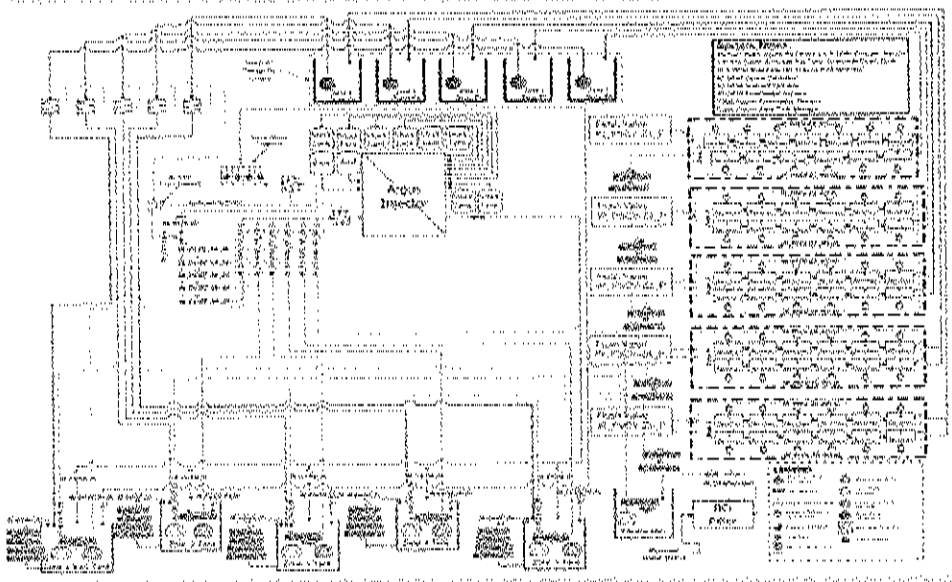
LIGHTSHADE, COLORADO'S PREMIER DISPENSARY

As one of Colorado's largest and oldest vertically integrated cannabis operators Lightshade is committed to using its position to promote sustainable practices within our industry. As part of that commitment LightShade's flagship greenhouse facility was designed with an irrigation water recapture system capable of collecting and recycling all irrigation water not utilized by the crop. LightShade's Greenhouse began cultivation in the summer of 2019. Production ramped up through the winter of 2019 and stabilized in the Spring/Summer of 2020. Due to a number of factors the recirculation system was not brought online until April of 2020. After working through a variety of challenges to bring the system online, implementation has reduced irrigation water consumption by about 50% in flowering areas. In the following case study, we will share some of the challenges our team had to overcome to implement the recirculation system and the lessons we have learned along the way. We will close by sharing some of the additional factors affecting our water usage and the greenhouse and efforts we have underway to further increase our water use efficiency.

GREENHOUSE IRRIGATION DESIGN AND RE-CIRCULATION SYSTEM INTEGRATION

The LightShade greenhouse utilizes a palletized benching system for all cultivation areas which allows individual 18x4 ft benches to be moved throughout the facility. This system is very convenient for harvesting and batch loading but presents some unique challenges for irrigation.

To accommodate the use of the palletized benching system the greenhouse was designed with an ebb/flood irrigation system in which rows of benches are flooded with nutrified water supplied by 5 zone specific water holding tanks (4 for flower sections and 1 for veg). The zone specific water tanks are filled with nutrified irrigation water supplied from the main facility water holding tank and dosed with nutrients using our Argus nutrient injection system.



Following irrigation events, excess water drains from benching and is funneled into zone specific holding pits by an integrated gutter system. Once the irrigation cycle has been completed the water collected in the pits is transferred back into the corresponding holding tank. All of the holding tanks are connected to an integrated ozonation system that allows the tanks to be cycled through the ozonation system to facilitate water sanitization. Systems diagram to the left:

After implementation, the recirculation system proved capable of returning about 50% of the water sent out during an irrigation event if the water was allowed to drain back into the holding pits within 1-3 hours after tray flooding events. The graphs from the Argus system below show tank volumes through the course of an irrigation and recapture event. The first tank volume is the level before irrigation, the low point is the tank level after flooding, the next plateau is the level after recirculation has finished cycling water back, the blue bar shows the tank being topped off from the main water holding tank, and the final plateau is the tank level after all irrigation operations have been completed. While the system is capable of returning about 50% of the water sent out in an ebb/flood event, actual water recapture has been lower (closer to 40%) due to the practice of leaving trays flooded for an extended period, especially in early growth phases, to increase overall media saturation.

PLANT PATHOGEN CONTROL

Irrigation water recirculation provides an ideal means of transport for plant pathogen inoculum and can lead to widespread disease incidence if adequate water sterilization solutions are not implemented. The greenhouse recirculation system was designed with an integrated ozonation system, but after beginning operations we found that the ozonation system was undersized for the volumes of water we needed to treat and that it was ineffective in the elimination of plant pathogen loads. This led to some significant root/vascular plant pathogen pressure in several of our production batches before we were able to implement an effective solution. Through the use of 3rd party plant pathogen testing services we identified the causal organisms as Fusarium sp. and Pythium sp. Both of these organisms can be spread through irrigation drainage. In order to eliminate the spread of these pathogens our team settled on a system of injecting a combination of concentrated calcium hypochlorite and a horticultural surfactant into our main water holding tank, combining these inputs with the existing ozonation system. This has proven effective in eliminating the spread of the pathogens and besides the batches initially infected, we have not had any additional production impacts from these organisms. In addition to having our scouting team monitor for any symptoms we have continued to conduct monthly pathogen load testing at various points within the irrigation system to verify elimination of pathogens. Below are test results obtained while we were still combating Pythium/Fusarium in several of the production batches showing the elimination of the pathogen load after treatment (feed sample taken at production bench, pit sample taken after irrigation cycle, tank sample taken after circulation back to tank and treatment/blending with fresh water).

MAINTAINING BALANCED PLANT NUTRITION DURING RECIRCULATION OPERATIONS

Another challenge has been ensuring that the operation of the recirculation system does not negatively impact the delivery of the correct nutritional balance to our crop. Due to the nature of the ebb/flood irrigation system typical feedings only return between 15-30% of the water delivered to the plants back into the holding tank. Our testing of the return water has shown that while the nutritional composition does vary from what was delivered to the plants the variation is not enough to significantly skew the overall nutritional balance of our recipes after the return water is blended with freshly nutrified water from the main irrigation holding tank. Our team continues to monitor and verify these findings through daily testing of nutrient solution EC/PH and bi-weekly third party testing of nutrient solution elemental composition.

OVERALL FACILITY WATER USAGE DATA

Below are graphs detailing the total monthly water usage and average daily water usage per production benching square foot at the greenhouse over the course of 2020 (each monthly average date listed is for the prior 30-day period). As you can see our water usage increased steadily over the Winter and into the Spring as production increased and then jumped significantly in early April, spiking during later May into mid June and then stabilizing at our current use rate. While the increase in water usage corresponds with the use of the recirculation system the usage increase has been driven by the use of our reverse osmosis (RO) system which was brought online at the same time. The use of the RO system was necessitated by plant stress that was occurring due to sodium chloride buildup driven by the use of the municipal water supply in conjunction with our sub-surface irrigation strategy. This issue was exacerbated by the implementation of the recirculation system and it became necessary to utilize the RO system. The RO system in use at the greenhouse is a high efficiency unit, but still produces about 4,000 gallons of waste for each 9,000 gallons of pure water produced. The generation of this wastewater has been the main driver behind our increase in water usage and has outweighed the water savings we have captured with the use of the recirculation system.

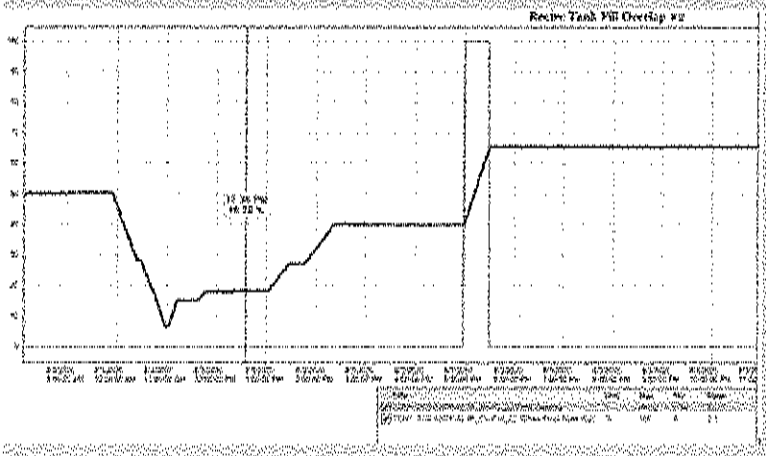
In an effort to further reduce water usage and to increase plant health outcomes the greenhouse cultivation team is currently in the process of transitioning our ebb/flood system over to a drip irrigation system. This is a more complex undertaking than it would normally be due to our use of palletized benching and has required significant design effort. However, we are confident that doing so will not only increase plant health, but also allow us to reduce overall water usage on two different fronts. First drip irrigation is more efficient than ebb/flood because it allows for more complete hydration of media with less water and it avoids water loss to the atmosphere. The second and more significant factor is that running drip irrigation will allow us to reduce our reliance on the RO system and significantly lower our production of wastewater via that system. We will continue to collect data on these projects and look forward to providing a case study update next year!

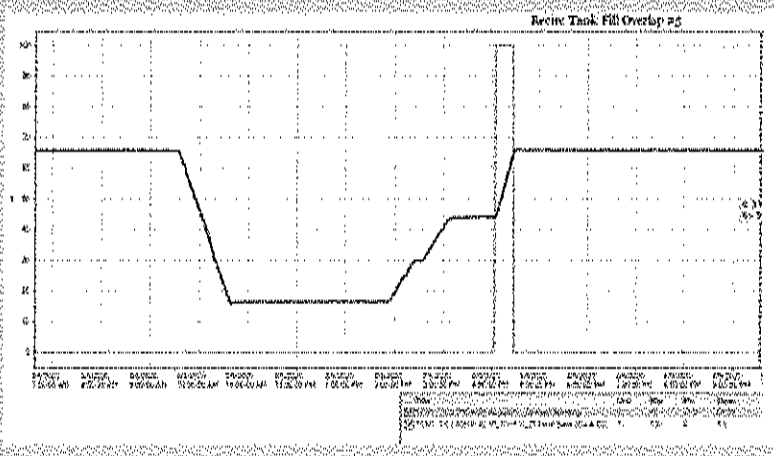
SEE ALSO: Appendix for graphs

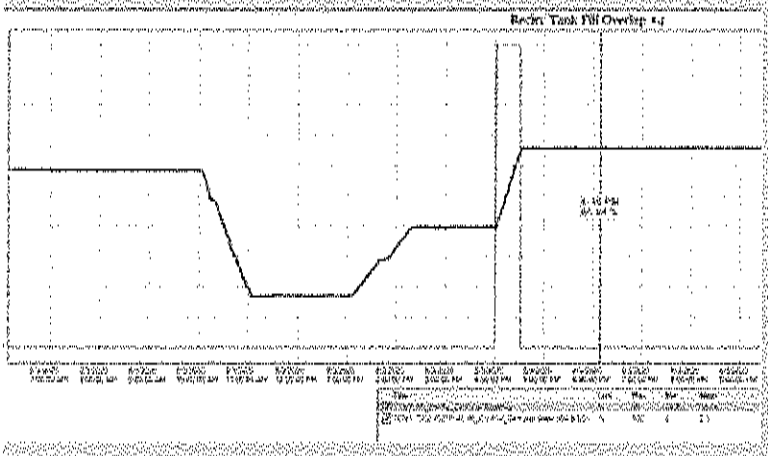
Results from Diagnostic Assays

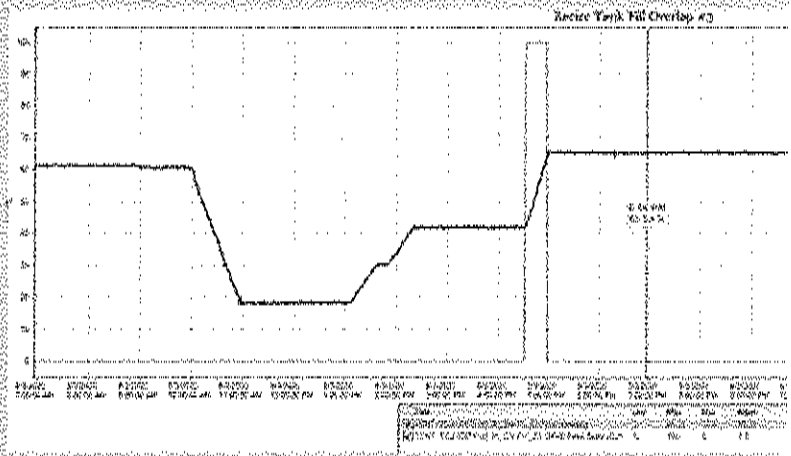
Sample	Sample ID	Sample Type	Fusarium (CFU/ml)	Pythium (CFU/ml)
1	Zone 1 Tank	Water	0	0
2	Zone 1 Feed	Water	0	0
3	Zone 3 Tank	Water	0	0
4	Zone 3 Feed	Water	0	0
5	Zone 1 Pit	Water	0.005	0.015
6	Zone 2 Pit	Water	40	0.013
7	Zone 3 Pit	Water	60	0

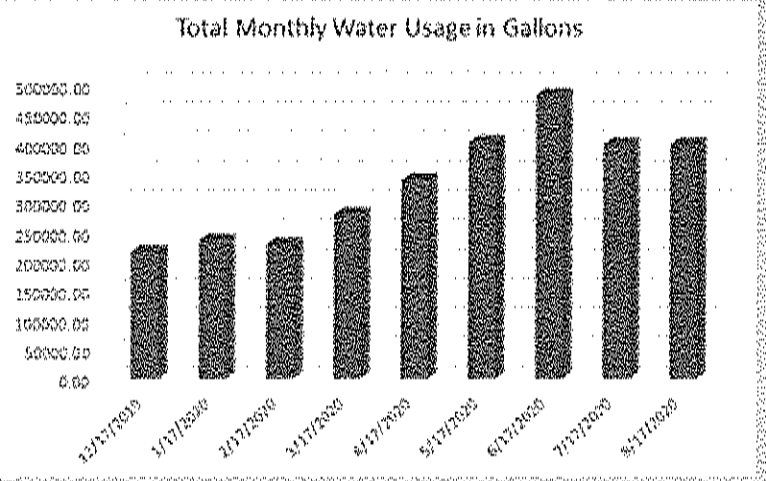
LIGHTSHADE CASE STUDY: IRRIGATION GRAPHS

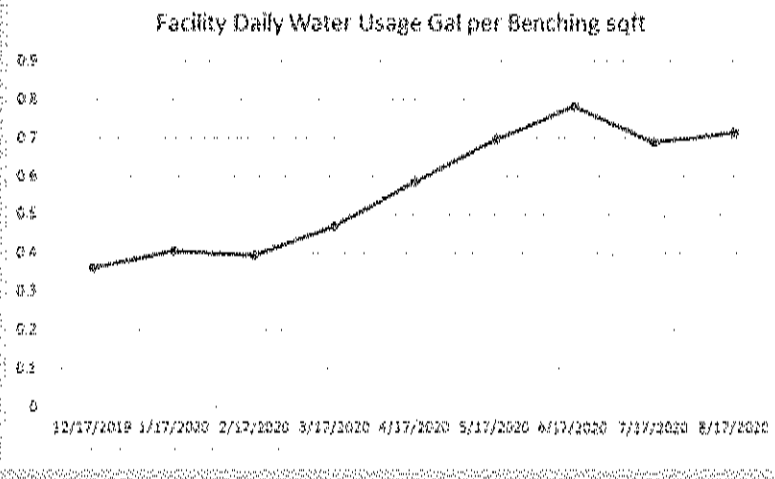












CASE STUDY

NATIVE ROOTS CANNABIS CO. COCO DONATION

Native Roots Cannabis Company is one of the largest marijuana companies in Colorado, with 20 retail locations and cultivation facilities around the state. With that footprint, it is vital that Native Roots embraces and leads the way in sustainable strategies. This includes efforts that span all three tiers of sustainability: economic, environmental and social. The recent pilot study regarding soil donations is a great example of a project that touches on all of those aspects.

One of the biggest outputs of indoor cannabis cultivation is the used grow medium, in addition to fibrous waste and marijuana products. Given that this is still a high value material after its initial use, finding an avenue for reuse seems intuitive. However, there are obviously challenges associated with various approaches. For example, there are opportunities for internal reuse of growth mediums, but this requires significant investments of equipment, space, labor and time. Those requirements can make internal repurposing difficult for many companies. Alternatively, external outlets could be used to supplement internal reuse strategies. Thus, in 2020 Native Roots began looking for external partners for reusing their grow medium, which in this case is coco choir.

The first step for this pilot program was outreach and collaboration. Identifying and connecting with organizations that would be interested in repurposing the coco choir required casting a wide net, but the primary organizations of focus were community gardens, local farmers and agricultural product suppliers. From that group, we identified one partner for a small scale pilot: SheGrows (a small Lavender & Cut Flower Farm on Colorado's Front Range).

During the initial outreach to potential partners, Native Roots was deliberate in providing as much useful information up front as possible. This included background on nutrient and pesticide usage, as well as soil contamination testing for pesticides and heavy metals. The intent was to ensure that all parties were satisfied with the safety and quality of the coco choir prior to any repurposing operations. Depending on the cultivation process, selection of partners may need to be more considered. For example, if the repurposed material is to be used for edible plants, contaminant testing would obviously be vital to ensure safety of end products. Conversely, if the grow medium will be utilized for non-edible products, such as cut flowers, the testing requirements may be less rigorous. It's important that these details be openly discussed with potential partners to ensure everyone is in agreement with the safest and best practices.

The next step was to strategize around the logistics of hauling and processing the material. Again, space can be an important and limiting factor when it comes to storage prior to hauling. Depending on the available supply and demand on a given day, some amount of advanced notice is helpful. For example, if a partner requests 100 lbs of coco, it may take a day or two to stage sufficient amounts for hauling. This means that an appropriate temporary storage solution must be coordinated, assuming this is how the transfer will occur. For Native Roots, it made the most sense to stage coco for hauling, then schedule a pick up time for our community partners to come by the facility to collect the material.

Another key aspect of the coco repurposing is the actual process of making the material usable. For example, the coco after the point of harvest at Native Roots is in the form of densely packed pots/cubes. Thus, some processing is required in order to convert the coco back into a more loose and aerated condition. Based on the feedback from our community partners, the easiest way to accomplish this was to utilize a chipper or tiller. As you can see in the example pictures, this allowed for rather quick and easy processing. Native Roots requested that this processing be handled by our community partners at their location in order to minimize the space, time and labor impacts at the cultivation facility. The end product was of extremely high quality, demonstrating a great overall impact for sustainable practices.

While this was a limited pilot project, the results were quite promising for future partnerships that would allow for continued growth and increased efficiency. For Native Roots, the project allowed for the reuse of grow material, which had a positive environmental impact by reducing the amount of material sent to landfill. Additionally, by having community partners haul and use the coco, Native Roots was able to reduce waste hauling costs during the period of the pilot project. Finally, this project presented a fantastic opportunity for Native Roots to build new relationships with community partners with shared ideals around sustainability. These types of relationships are vital for the continued growth and normalization of the cannabis industry in Colorado and abroad. Any projects similar to the one summarized here have a lot of potential for substantive impacts, which can scale up and evolve based on the needs of both the cannabis industry and community partners.



CASE STUDY

SMOKEY'S CANNABIS CO. LIVING SOIL

Located in the small town of Garden City, CO, Smokey's Cannabis Company is making great strides to raise the bar on what it really means to cultivate sustainable cannabis. Smokey's implements regenerative practices in cultivation that are often overlooked or abandoned due to logistical difficulties: reusing soil and reincorporating plant wastes. Smokey's team has developed a humane and environmentally friendly approach to indoor cultivation, incorporating closed-loop systems which reuse soil and plant waste without perpetuating pest and disease issues. Their stability and long-term success within such a competitive industry truly exhibits the economic viability of their production model.

Sustainable practices have allowed for substantial savings by reducing or negating the need for inputs like growing media, fertilizer, filtered water, and pesticides. Their growing media is never discarded, nor is it needed as a material to mix with plant wastes for compliance when leaving the facility, because plant wastes are not discarded. In a conservatively sized facility of about 3,000 ft^2, Smokey's diverts roughly over 6,500 lbs of plant wastes and over 160,000 lbs of growing media away from landfills every year.

By regenerating their soil harvest after harvest, cultivators focus on improving the soil microbiome by increasing its abundance and diversity of life. Microbes and plants develop numerous and complex symbiotic relationships. Compounds produced by/from microbiology not only provide mineral nutrition, but also boost the plants' abilities to create a greater diversity of phytochemicals such as cannabinoids and terpenes, which in turn increase



What this means in practical terms is that Smokey's cultivation techniques produce more complex flowers with less inputs.

Fresh plant wastes are recycled back into the soil either directly or after digestion via worms, reducing the need for supplemental nutrients. Instead of moving plant matter like leaves, stems, and root balls to the landfill, cultivators incorporate these materials directly back into the soil where they are decomposed by a plethora of invertebrates and microbial species, building soil health and providing recycled nutrition for new plants. The reuse of organic plant wastes feeds and supports a healthy soil microbiome, which in turn helps build soil with better structure and water retention. Smokey's realizes a reduction in water usage of nearly 65,000 gallons per year (in comparison to their previous hydroponic-based production model).

Increased phytochemical production from microbial relationships also helps strengthen the plants' immune systems, which in turn lessens the need for

pesticides (which are both costly and pose potential safety hazards). Smokey's uses beneficial insect predators for the bulk of their IPM strategy, only supplementing every few weeks with an organic spray - and never on developing flowers. Implementing a living soil system, they have reduced both frequency and volume of pesticide applications by at least 50%.

Microbes, arthropods, and worms all act to increase water use efficiency by developing networks and biofilms through the soil that increase aggregate structure and translocation of water & nutrients. A healthy soil microbiome also increases the rhizosphere's ability to buffer pH, meaning wasteful (yet common) methods of water filtration used to avoid pH imbalance and flush out excess nutrients (such as reverse osmosis filtration) are largely unnecessary. And because organic nutrients are being made available to plants on an as-needed basis by microbiology, the practice of "flushing" excess salts from the grow media with large amounts of water becomes extraneous altogether.



Through the creation of operating procedures that mimic certain principles of ecology, Smokey's cultivators have been using the same soil for over three years through more than 15 consecutive harvests, all the while continuing to improve plant health, quality, yield, and system resiliency. With their heels dug deeply into environmental and social sustainability, the Smokey's team knows what it takes to overcome the challenges that can arise with transitioning to organic production techniques. They have also been doing it long enough to see the immense benefits come to fruition.



APPENDICES

SAMPLE WATER QUALITY REPORT

COLORADO STATE UNIVERSITY
Soil, Water & Plant Testing Laboratory
Room A320, NESB
Fort Collins, CO 80523-1120
Phone: 970-491-5061 / Fax: 970-491-2930

Billing:

Date Received: 11/3/16
Date Reported: 11/8/16

SOURCE: Arapahoe City

LAB # W519 1

"Metals" and "Individual Element" Analysis

	mg/L	Recommended Limit mg/L
Aluminum	0.83	5.0
Ammonium	*	N/A
Arsenic	*	0.2
Barium	0.03	1.0
Boron	<0.01	5.0
Cadmium	<0.005	0.05
Chromium	<0.01	1.0
Copper	0.02	0.5
Fluoride	*	2.0
Iron	<0.01	N/A
Lead	0.01	0.2
Manganese	<0.01	N/A
Mercury	*	0.01
Molybdenum	0.02	N/A
Nickel	<0.01	N/A
Phosphorus	<0.01	N/A
Selenium	*	0.05
Zinc	0.06	24.0

* Not requested

IRRIGATION WATER ANALYSIS

"Routine Package"

	Results	Results
Conductivity	398	µmhos/cm
pH	7.8	
pHc	8.0	
	meq/L	mg/L
Calcium	2.3	1.46
Magnesium	2.24	0.60
Sodium	19.8	0.86
Potassium	1.87	0.05
Carbonate	<0.1	<0.1
Bicarbonate	1.03	<0.01
Chloride	7.20	0.20
Sulfate	5.05	1.65
Nitrate	0.8	0.9
Nitrate-Nitrogen	0.2	0.2
Boron	<0.03	
Pounds of Sulfur per acre foot	45.9	
Pounds of Nitrate per acre foot	0.5	

SAR 0.8 Salinity Hazard Low Sodium Hazard Low

COMMENTS: This is good quality water for irrigation.

COLORADO STATE UNIVERSITY
Soil, Water & Plant Testing Laboratory
Room A320, NESB
Fort Collins, CO 80523-1120
Phone: 970-491-5061 / Fax: 970-491-2930

Billing:

SOURCE: Arapahoe City

SAMPLE ENERGY AUDIT FORM

Name:

Grow Type:	
Cultivation Sq. Ft.	
Buidling Type	
Building Age	

Basic Overview

Annual Energy Used (kWh)	
Annual Water Used	
Production (Dried Wt.)	

Month	Energy (kWh)	Water (gallons)	Production (Dried Wt.)
January			
Feburary			
March			
April			
May			
June			
July			
August			
September			
October			
November			
December			

Equipment	Make	Model	Quantity	Est. Run time (hrs/day)	Location/Phase Used
HVAC					
Ocsillating Fans					
Fertigation					
Dehumidifiers					

Growing System

Grow Medium Description:

Plant Phase	Capacity (# of Plants)	Cycle Duration	Cycles Per Year	Irrigation Type	Irrigation Schedule/Amount	Lighting Type	Make	Model	# of lights	Lighting Hours

ANNOTATED BIBLIOGRAPHY: SUPPORTING CANNABIS SUSTAINABILITY

Leslie McAhren, University of Colorado School of Public Health

energy/energy efficiency
water
waste- recycle organic waste, haz waste
pest mgt
air quality
appendix a. carbon footprint

Methods

MeSH Terms (Medical Subject Headings) - environmental pollution; cannabis

I. Introduction

Carah, J. K., Howard, J. K., Thompson, S. E., Short Gianotti, A. G., Bauer, S. D., Carlson, S. M., ... Power, M. E. (2015). High Time for Conservation: Adding the Environment to the Debate on Marijuana Liberalization. Bioscience, 65(8), 822–829. doi:10.1093/biosci/biv083 Summary of Carah, 2015. Environmental harm caused by cannabis cultivation merits a direct policy response. neglecting discussion of the environmental impacts of cultivation when shaping future marijuana use and possession policies represents a missed opportunity to reduce, regulate, and mitigate environmental harm.

II. Energy

III. Water

Bauer, S., Olson, J., Cockrill, A., van Hattem, M., Miller, L., Tauzer, M., & Leppig, G. (2015). Impacts of surface water diversions for marijuana cultivation on aquatic habitat in four northwestern California watersheds. PloS one, 10(3), e0120016. doi:10.1371/journal.pone.0120016 Summary of Bauer, 2015. Environmental impacts associated with marijuana cultivation – reasons not to allow cultivation that is clandestine. This group used high-resolution aerial imagery to estimate the number of cannabis plants being cultivated in four watersheds in northwestern California, USA. This work was put together by the California Department of Fish and Wildlife, Eureka, California

IV. Waste

V. Integrated Pest Management (IPM)

Cuypers, E., Vanhove, W., Gotink, J., Bonneure, A., Van Damme, P., & Tytgat, J. (2017). The use of pesticides in Belgian illicit indoor cannabis plantations. Forensic Science International., 277, 59-65. Summary of Cuypers, 2017. Main risks may come from pesticide residues on plants, cultivation infrastructure and materials; mycotoxins from fungal pathogens on harvested plants; and/or high levels of pesticide residue in cannabis plant parts for consumption.

Appendix A. Carbon Footprint

Mills, E. (2012). The carbon footprint of indoor Cannabis production. Energy Policy, 46, 58-67. doi:10.1016/j.enpol.2012.03.023

TERMS AND DEFINITIONS

2020 Sustainability Goals	The 2020 Sustainability Goals focus on 12 resource areas and set goals for the City and County of Denver, and community. The resource areas are Air Quality, Climate, Energy, Food, Health, Housing, Land Use, Materials, Mobility, Water Quantity, Water Quality and Workforce.
AHAM	Association of Home Appliance Manufacturers: AHAM provides leadership, advocacy, and a forum for public policy, standards and business decisions to consumers and appliance manufacturers.
anion	A negatively charged ion.
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
BMS	Building Management System: A system that controls the environment of a facility and which, when monitored, may alert to alert facility managers about broken or malfunctioning equipment.
Ca++	Calcium cation
cation	A positively charged ion.
CASR	Climate Action, Sustainability, and Resiliency: The CASR works with city, state and community partners to conduct education, community engagement, and enforcement to ensure healthy people, healthy pets and a sustainable environment.
CDA	Colorado Department of Agriculture: The mission of the CDA is to strengthen and advance Colorado agriculture; promote a safe and high-quality food supply; protect consumers; and foster responsible stewardship of the environment and natural resources.
CDPHE	Colorado Department of Public Health and Environment: State department providing services in the areas of health, environment, marijuana, vital records, public records, laboratory services, health equity, and emergency preparedness and response.
CESQG	Conditionally Exempt Small Quantity Generator: An EPA category for waste generators, based upon quantities of hazardous and acutely hazardous waste generated and accumulated.
CHP	Combined Heat and Power: CHP systems, also called cogeneration systems, generate power and heat in a single system.
CMH	Ceramic Metal Halide: CMH lamps provide energy-efficient wide-spectrum lighting.
CO_2	Carbon Dioxide: CO_2 is a naturally and artificially produced compound. It is naturally produced by decompositions, respiration, and other natural sources and used by plants for photosynthesis (along with water and sunlight). It is artificially produced from burning fossil fuels, deforestations and manufacturing processes.
CSWG	Cannabis Sustainability Workinggroup, also called "the Workgroup": The CSWG was developed by CASR to determine best practices and to develop this manual and other education resources for the industry.
DG	Distributed Generation: DG is an approach to energy production that generates power at the end-user location.

Denver's Climate Action Plan 2015	Denver's Climate Action Plan 2015 is a document developed that sets forth Denver's goals, priorities, and strategies to meet the 2020 Sustainability Goals and to reduce greenhouse gas emissions 80 percent from its 2005 baseline by 2050.
EAS	Engineering Assistance Study: An EAS is conducted to identify and evaluate energy savings opportunities.
EC	Electrical Conductivity: EC is the potential for material to conduct electricity (i.e. the potential for an electrical current to move through water.)
ECA	Electrochemically Activated Water: ECA is water mixed with food-grade salt fed through a reactor that electrically charges the salt water to produce disinfect or detergent solutions.
EER	Energy Efficiency Ratio: The EER is the ratio of cooling capacity to power input.
EMS	Energy Management System: A system that monitors the environment of a facility and which may be used to alert to alert facility managers about broken or malfunctioning equipment.
Energize Denver	A benchmark ordinance requiring owners/operators of large commercial and multifamily building to annually assess and report the buildings' energy performance using the free ENERGYSTAR Portfolio Manager tool.
EPA	U.S. Environmental Protection Agency
FCU	Fan Coil Unit: An FCU is a device consisting of a heating and/or cooling heat exchanger or coil and fan. It is part of an HVAC unit.
Feasibility Study	Also called a qualification study, a specialist performs the feasibility study using 6 to 12 months of utility bills to build a high-level model that provides a "ballpark" economic, environmental and operational impact assessment.
g/kW	grams per kilowatts
g/W	grams per Watts
g/sq ft or g/SF	grams per square feet
HCO3-	Bicarbonate anion
HPS	High Pressure Sodium
HVAC	Heating, Ventilation and Air Conditioning: The system used to heat and cool buildings.
InfoWise	An Xcel Energy service providing interval data that is used to create a web-based energy dashboard.
ion	An electrically charged atom or groups of atoms.
IPLV	Integrated Part Load Value: IPLV describes the performance of a chiller capable of capacity modulation.
kW/cycle	Kilowatts per cycle
LED	Light-Emitting Diode: An LED is a two-lead semiconductor light-source.
LEP	Light-Emitting Plasma: LEP is high-intensity full-spectrum light source.

LFG	Landfill Gas: LFG is created by the microorganisms in a landfill.
LQG	Large-Quantity Generator: An EPA category for waste generators based upon quantities of hazardous and acutely hazardous waste generated and accumulated.
MED	Marijuana Enforcement Department, Department of Revenue: The MED's mission is to promote public safety and reduce public harm by regulating the Colorado commercial marijuana industry through consistent administration of laws and regulations and strategic integration of process management, functional expertise and innovative problem-solving.
Mg++	Magnesium cation
MH	Metal Halide: An MH lamp is a high-intensity gas discharge lamp.
mL	milliliter
mol/m2/day	mole per square meter per day
mol/m2/S	mole per square meter per Siemens
mol/µmol	mole per micromole
µmol/mol	micromole per mole
µmol/SF	micromole per square foot
µmol/m-2 s-1	micromole per square meter and second (PPFD unit)
MSW	Municipal Solid Waste: MSW is non-hazardous waste, such as household trash.
Na+	Sodium cation
NFT	Nutrient Film Technique: NFT is a hydroponic technique whereby the bare roots of a plant are watered using a controlled, shallow, nutrient-dense stream.
nm	nanometer
PAR Spectrum	Photosynthetically Active Radiation: PAR designates lighting spectral range.
PPFD	Photosynthetic Photon Flux Density: PPFD is the number of photons in the photosynthetically active range per square meter per second.
PV	Photovoltaic: Conversion of light into electricity.
Qualification Study	See Feasibility Study
Reheat	A term used to describe heating a space to allow a cooling system to run 24 hours a day to produce dehumidification without reducing temperatures in the space.
RH	Relative Humidity: RH is the ratio of actual vapor density in the air to saturated vapor density of the air.
ROI	Return on Investment: ROI is calculated as gains-costs/costs. Though typically used in costs analyses, it can be used to calculate investment benefits of any type.

SEER	Seasonal Energy Efficiency Rating: A measure of the efficiency of an air cooling system.
SQG	Small-Quantity Generator: An EPA category for waste generators based upon quantities of hazardous and acutely hazardous waste generated and accumulated.
VRF	Variable Refrigerant Flow: VRF is an HVAC technology that is used to reduce loss of efficiency.
XCEL	Xcel Energy is a utility company serving several Midwestern and Western States, including Colorado.



CANNABIS
CERTIFICATION
COUNCIL

WWW.CANNABISCERTIFICATIONCOUNCIL.ORG

INFO@CANNABISCERT.ORG | @CANNACERTCOUNCIL

Exhibit R

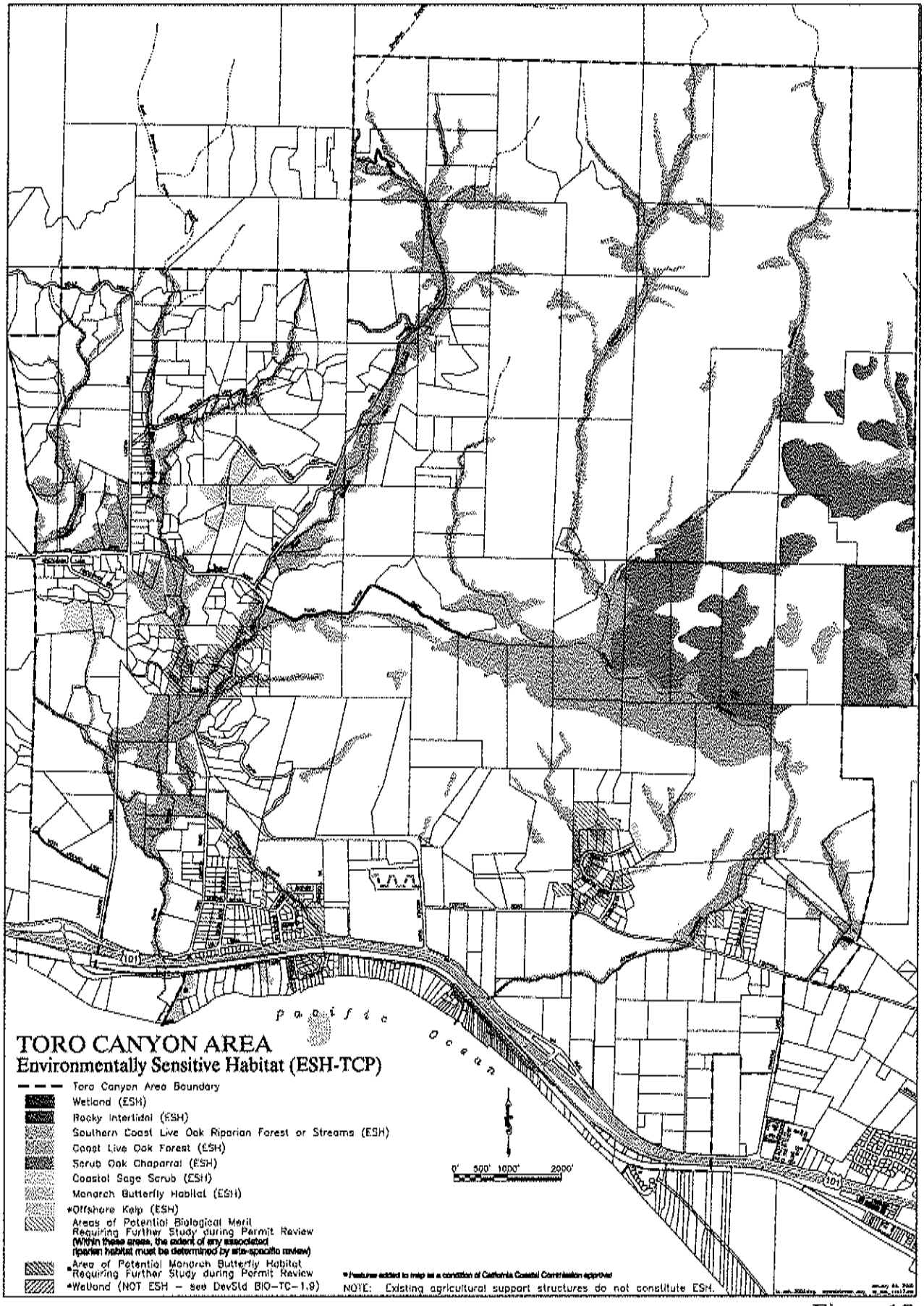

TORO CANYON AREA
Environmentally Sensitive Habitat (ESH-TCP)
Toro Canyon Area Boundary
Wetland (ESH)
Rocky Intertidal (ESH)
Southern Coast Live Oak Riparian Forest or Streams (ESH)
Coast Live Oak Forest (ESH)
Scrub Oak Chaparral (ESH)
Coastal Sage Scrub (ESH)
Monarch Butterfly Habitat (ESH)
*Offshore Kelp (ESH)
Areas of Potential Biological Merit Requiring Further Study during Permit Review
(Within these areas, the extent of any associated riparian habitat must be determined by site-specific review)
*Area of Potential Monarch Butterfly Habitat Requiring Further Study during Permit Review
*Wetland (NOT ESH – see DevStd BIO-TC-1.8)
* Features added to map as a condition of California Coastal Commission approval
NOTE: Existing agricultural support structures do not constitute ESH.
0' 500' 1000' 2000'
101
pacific ocean

Figure 17

Exhibit S

apcd air pollution control district
SANTA BARBARA COUNTY

August 4, 2020

Gwen Beyeler
Santa Barbara County
Planning and Development
123 E. Anapamu Street
Santa Barbara, CA 93101

Re: Santa Barbara County Air Pollution Control District Suggested Conditions on SLO Cultivation Inc. – Cannabis Cultivation, 18CDH-00000-00031

Dear Gwen Beyeler:

The Air Pollution Control District (District) has reviewed the referenced project, which consists of 386,600 square feet (SF) of mixed-light cultivation in existing greenhouses. Onsite processing activities will be limited to deboning/bucking, weighing and packaging the wet buds into either vacuum sealed bags for freezing or sealed containers for offsite drying. The Proposed Project includes the creation of an additional detention pond and modifications to combine and enlarge two existing detention basins by eliminating the adjoining berm. The new detention basin would be located on the northern portion of the parcel and would be approximately 105,000 cubic feet in size with a 12-foot-wide access ramp. A new 27kW (36hp) Generac emergency standby spark ignition generator is proposed. Existing boilers are used for cultivation purposes only.

The Odor Abatement Plan includes the use of a Byers vapor-phase odor mitigation system with Ecosorb CNB100. The site is served by existing water wells and municipal electricity. Grading is estimated at 6,600 cubic yards of cut and 300 cubic yards of fill. The subject property, a 13.66-acre parcel zoned AG-I-10 and identified in the Assessor Parcel Map Book as APN 005-310-024, is located at 3889 Foothill Road in the unincorporated area of Carpinteria.

The District has prepared an *Advisory on Air Quality and Cannabis Operations* (available at www.ourair.org/land-use) that provides local agencies and cannabis operators guidance regarding the air quality aspects of this industry. The advisory discusses the District's regulatory limitations on odors from agricultural operations, recommendations for odor abatement, and cannabis-related operations that may require a District permit. This advisory should be carefully reviewed by the County and cannabis operator.

Air Pollution Control District staff have the following specific **advisories and recommendations** related to the proposed project:

1. Based on the project description and information that has been provided, the project does not require a District permit. However, if the project description changes, the applicant should refer to the District's cannabis permitting webpage at www.ourair.org/cannabis/ to determine if any equipment or operations will require District permits.

2. Indoor and mixed-light cultivation (e.g., greenhouses) located near residential, commercial and other sensitive receptors shall abate cannabis odors through the use of containment, ventilation, filters, control and/or deodorizing systems. Outdoor cultivation and growing operations also create strong cannabis odors, and the District recommends that such operations not be located near public locations such as residences, commercial buildings, or other sensitive receptors. The District encourages the use of buffer zones to allow for maximum odor dispersion, as well as other odor abatement strategies, to avoid nuisance odors.

3. Any chemical used for deodorizing systems shall not cause adverse impacts to the community. Low-VOC (volatile organic compound) or no-VOC compounds are recommended, as well as compounds that do not contain toxic air contaminants (TACs) as identified by the State of California. The comprehensive list of TACs can be found at www.arb.ca.gov/toxics/healthval/contable.pdf. If odor control systems use chemicals that contain TACs, the County shall assess the potential for health risk by performing a refined Health Risk Assessment.

Air Pollution Control District staff offer the following suggested conditions:

1. Standard dust mitigations (**Attachment A**) are recommended for all construction and/or grading activities. The name and telephone number of an on-site contact person must be provided to the District prior to grading/building permit issuance.

2. The State of California considers particulate matter emitted by diesel engines carcinogenic. Therefore, during project grading, construction, and hauling, construction contracts must specify that contractors shall adhere to the requirements listed in **Attachment B** to reduce emissions of particulate matter (as well as of ozone precursors) from diesel equipment. Recommended measures should be implemented to the maximum extent feasible.

3. Spark ignition piston-type internal combustion engines (e.g., gasoline or propane-fired) used exclusively to supply emergency electrical power to any operation/system other than growing operations (e.g. office buildings, security systems, etc.) during times of utility power failure require a District permit. Such engines may be exempt from permit requirements pursuant to District Rule 202, Section F.1.d., provided the engine operates no more than 200 hours per calendar year and a record is maintained and is available to the District upon request. The record shall list the identification number of the equipment, the number of operating hours on each day the engine is operated and the cumulative total hours.

4. All agricultural diesel engines rated at 50 brake-horsepower or greater must be registered with the District. Please refer to the District's website at www.ourair.org/ag-diesel-registration/ for additional information.

5. Odor abatement strategies shall be implemented as laid out in a comprehensive odor abatement plan to ensure that cannabis odors are not detected by nearby residential areas or sensitive receptors. All odor abatement technology shall be operated according to the manufacturer's specifications and/or as recommended by a professional engineer or certified industrial hygienist. Any changes to the odor abatement chemical/solution or odor abatement technology shall be reviewed and approved by the County.

6. Natural gas-fired fan-type central furnaces with a rated heat input capacity of less than 175,000 Btu/hr and water heaters rated below 75,000 Btu/hr must comply with the emission limits and certification requirements of District Rule 352. Please see www.ourair.org/wp-content/uploads/rule352.pdf for more information.

7. Boilers, water heaters, and process heaters (rated between 75,000 and 2.0 million Btu/hr) must comply with the emission limits and certification requirements of District Rule 360. Note: Units fired on fuel(s) other than natural gas still need to be certified under Rule 360. Please see www.ourair.org/wp-content/uploads/rule360.pdf for more information.

If you or the project applicant have any questions regarding these comments, please feel free to contact me at (805) 961-8873 or via email at HoD@sbcapcd.org.

Sincerely,

Desmond Ho

Desmond Ho
Air Quality Specialist
Planning Division

Attachments: Fugitive Dust Control Measures
Diesel Particulate and NO_x Emission Measures

cc: William Sarraf, Supervisor, District Engineering Division [email only]
David Harris, Manager, District Engineering Division [email only]
Planning Chron File

air pollution control district
SANTA BARBARA COUNTY

ATTACHMENT A
FUGITIVE DUST CONTROL MEASURES

These measures are required for all projects involving earthmoving activities regardless of the project size or duration. Projects are expected to manage fugitive dust emissions such that emissions do not exceed APCD's visible emissions limit (APCD Rule 302), create a public nuisance (APCD Rule 303), and are in compliance with the APCD's requirements and standards for visible dust (APCD Rule 345).

- During construction, use water trucks or sprinkler systems to keep all areas of vehicle movement damp enough to prevent dust from leaving the site and from exceeding the APCD's limit of 20% opacity for greater than 3 minutes in any 60 minute period. At a minimum, this should include wetting down such areas in the late morning and after work is completed for the day. Increased watering frequency should be required when sustained wind speed exceeds 15 mph. Reclaimed water should be used whenever possible. However, reclaimed water should not be used in or around crops for human consumption.
- Onsite vehicle speeds shall be no greater than 15 miles per hour when traveling on unpaved surfaces.
- Install and operate a track-out prevention device where vehicles enter and exit unpaved roads onto paved streets. The track-out prevention device can include any device or combination of devices that are effective at preventing track out of dirt such as gravel pads, pipe-grid track-out control devices, rumble strips, or wheel-washing systems.
- If importation, exportation, and stockpiling of fill material is involved, soil stockpiled for more than one day shall be covered, kept moist, or treated with soil binders to prevent dust generation. Trucks transporting fill material to and from the site shall be tarped from the point of origin.
- Minimize the amount of disturbed area. After clearing, grading, earthmoving, or excavation is completed, treat the disturbed area by watering, OR using roll-compaction, OR revegetating, OR by spreading soil binders until the area is paved or otherwise developed so that dust generation will not occur. All roadways, driveways, sidewalks etc. to be paved should be completed as soon as possible.
- Schedule clearing, grading, earthmoving, and excavation activities during periods of low wind speed to the extent feasible. During periods of high winds (>25 mph) clearing, grading, earthmoving, and excavation operations shall be minimized to prevent fugitive dust created by onsite operations from becoming a nuisance or hazard.
- The contractor or builder shall designate a person or persons to monitor and document the dust control program requirements to ensure any fugitive dust emissions do not result in a nuisance and to enhance the implementation of the mitigation measures as necessary to prevent transport of dust offsite. Their duties shall include holiday and weekend periods when work may not be in progress. The name and telephone number of such persons shall be provided to the Air Pollution Control District prior to grading/building permit issuance and/or map clearance.

PLAN REQUIREMENTS: All requirements shall be shown on grading and building plans and/or as a separate information sheet listing the conditions of approval to be recorded with the map. **Timing**: Requirements shall be shown on plans prior to grading/building permit issuance and/or recorded with the map during map recordation. Conditions shall be adhered to throughout all grading and construction periods.

MONITORING: The Lead Agency shall ensure measures are on project plans and/or recorded with maps. The Lead Agency staff shall ensure compliance onsite. APCD inspectors will respond to nuisance complaints.

air pollution control district
SANTA BARBARA COUNTY

ATTACHMENT B
DIESEL PARTICULATE AND NO_x EMISSION REDUCTION MEASURES

Particulate emissions from diesel exhaust are classified as carcinogenic by the state of California. The following is a list of regulatory requirements and control strategies that should be implemented to the maximum extent feasible.

The following measures are required by state law:

- All portable diesel-powered construction equipment greater than 50 brake horsepower (bhp) shall be registered with the state's portable equipment registration program OR shall obtain an APCD permit.
- Fleet owners of diesel-powered mobile construction equipment greater than 25 hp are subject to the California Air Resource Board (CARB) In-Use Off-Road Diesel-Fueled Fleets Regulation (Title 13, California Code of Regulations (CCR), §2449), the purpose of which is to reduce oxides of nitrogen (NOx), diesel particulate matter (DPM), and other criteria pollutant emissions from in-use off-road diesel-fueled vehicles. Off-road heavy-duty trucks shall comply with the State Off-Road Regulation. For more information, see www.arb.ca.gov/msprog/ordiesel/ordiesel.htm.
- Fleet owners of diesel-fueled heavy-duty trucks and buses are subject to CARB's On-Road Heavy-Duty Diesel Vehicles (In-Use) Regulation (Title 13, CCR, §2025), the purpose of which is to reduce DPM, NOx and other criteria pollutants from in-use (on-road) diesel-fueled vehicles. For more information, see www.arb.ca.gov/msprog/onrdiesel/onrdiesel.htm.
- All commercial off-road and on-road diesel vehicles are subject, respectively, to Title 13, CCR, §2449(d)(3) and §2485, limiting engine idling time. Off-road vehicles subject to the State Off-Road Regulation are limited to idling no more than five minutes. Idling of heavy-duty diesel trucks during loading and unloading shall be limited to five minutes, unless the truck engine meets the optional low-NOx idling emission standard, the truck is labeled with a clean-idle sticker, and it is not operating within 100 feet of a restricted area.

The following measures are recommended:

- Diesel equipment meeting the CARB Tier 3 or higher emission standards for off-road heavy-duty diesel engines should be used to the maximum extent feasible.
- On-road heavy-duty equipment with model year 2010 engines or newer should be used to the maximum extent feasible.
- Diesel powered equipment should be replaced by electric equipment whenever feasible. Electric auxiliary power units should be used to the maximum extent feasible.
- Equipment/vehicles using alternative fuels, such as compressed natural gas (CNG), liquefied natural gas (LNG), propane or biodiesel, should be used on-site where feasible.
- Catalytic converters shall be installed on gasoline-powered equipment, if feasible.
- All construction equipment shall be maintained in tune per the manufacturer's specifications.
- The engine size of construction equipment shall be the minimum practical size.
- The number of construction equipment operating simultaneously shall be minimized through efficient management practices to ensure that the smallest practical number is operating at any one time.
- Construction worker trips should be minimized by requiring carpooling and by providing for lunch onsite.
- Construction truck trips should be scheduled during non-peak hours to reduce peak hour emissions whenever feasible.
- Proposed truck routes should minimize to the extent feasible impacts to residential communities and sensitive receptors.
- Construction staging areas should be located away from sensitive receptors such that exhaust and other construction emissions do not enter the fresh air intakes to buildings, air conditioners, and windows.

PLAN REQUIREMENTS AND TIMING: Prior to grading/building permit issuance and/or map recordation, all requirements shall be shown as conditions of approval on grading/building plans, and/or on a separate sheet to be recorded with the map. Conditions shall be adhered to throughout all grading and construction periods. The contractor shall retain the Certificate of Compliance for CARB's In-Use Regulation for Off-Road Diesel Vehicles onsite and have it available for inspection.

MONITORING: The Lead Agency shall ensure measures are on project plans and/or recorded with maps. The Lead Agency staff shall ensure compliance onsite. APCD inspectors will respond to nuisance complaints.

Exhibit T

Table ES-1. Summary of Impacts, Mitigation, and Residual Impacts

Impact	Mitigation Measure	Residual Significance
increase of a criteria pollutant for which the County is in nonattainment.		
Impact AQ-4. Cannabis activities under the Project could be potentially inconsistent with the Energy and Climate Action Plan.	MM UE-2a. Energy Conservation Best Management Practices MM UE-2b. Participation in a Renewable Energy Choice Program MM UE-2c. Plan Review by the County Green Building Committee	Significant and unavoidable (Class I)
Impact AQ-5. Cannabis activities under the Project could potentially expose sensitive receptors to objectionable odors affecting a substantial number of people.	MM AQ-5. Odor Abatement Plan	Significant and unavoidable (Class I)
Cumulative Impacts	No mitigation required	Significant and unavoidable (Class I)
Biological Resources		
Impact BIO-1. Cannabis activities could have adverse effects on unique, rare, threatened, or endangered plant or wildlife species.	MM BIO-1a. Tree Protection Plan MM BIO-1b. Habitat Protection Plan MM HWR-1a. Cannabis Waste Discharge Requirements Draft General Order (see Section 3.8, *Hydrology and Water Resources*)	Less than significant with mitigation (Class II)
Impact BIO-2. Cannabis activities could have adverse effects on habitats or sensitive natural communities.	MM BIO-1a. Tree Protection Plan MM BIO-1b. Habitat Protection Plan	Less than significant with mitigation (Class II)
Impact BIO-3. Cannabis activities could have adverse effects on the movement or patterns of any native resident or migratory species.	MM BIO-1b. Habitat Protection Plan MM BIO-3. Wildlife Movement Plan	Less than significant with mitigation (Class II)
Impact BIO-4. Cannabis activities may conflict with adopted local plans, policies, or ordinances oriented towards the protection and conservation of biological resources.	MM BIO-1a. Tree Protection Plan MM BIO-1b. Habitat Protection Plan	Less than significant with mitigation (Class II)
Cumulative Impacts	Mitigations above are required	Less than significant with mitigation (Class II)

Attachment II

August 30, 2021

Via Email
Honorable Planning Commissioners
Mr. Daniel Blough, Ms. Laura M. Bridley,
Mr. C. Michael Cooney, Mr. Larry Ferini, and
Mr. John Parke
c/o Mr. David Villalobos
Board Assistant Supervisor
Planning and Development Hearing Support
County of Santa Barbara
123 East Anapamu Street
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Re: SLO Cultivation, dba Cresco California's August 9, 2021 Comment Letter Regarding the Proposed Cannabis Development Project Located at 3861 Foothill Road in Carpinteria, California – APN 005-310-024 – Development Permit Number 10DVP-00000-00010

Dear Honorable Commissioners:

As outlined in my previous correspondence, dated August 2, 2021, my office represents Maureen Claffey and Foley Family Farm with respect to the proposed cannabis cultivation project located at 3861 Foothill Road in Carpinteria, California on APN 005-310-024 ("Project"). I am writing today to provide a brief response to the Project Applicant, SLO Cultivation, doing business as Cresco California's ("Project Applicant's") August 9, 2021's comment letter ("Cresco's August 9th Comment Letter").[1]

[1] Please note that this letter does not address every one of the Applicant's many contentions, but this does not mean that my clients or I agree with the Applicant's assertions. For the sake of time, clarity of analysis, and efficiency, I only address select issues with the August 9th Comment Letter in this correspondence.

The Applicant's August 9th Comment Letter, among other things: (a) claims that the Project will not have a significant impact on sensitive species or Arroyo Paredon Creek, and (b) proposes a new, carbon scrubbing odor management system for cannabis odor control. I am writing to provide the Commission with additional information and evidence to counter the Applicant's claims, so that the Commission can ensure the Project complies with the Coastal Zoning Ordinance.

I. The Applicant's Assertions that the Project Will Not Impact Sensitive Species and Does Not Require a Habitat Protection Plan are Not Supported by the Evidence.

a. The Applicant misstates the legal standards that the Planning Commission must follow when approving a Cannabis Project in the Coastal Zone.

According to Cresco's August 9th Comment Letter, "The Cannabis PEIR states that a (HPP) is only required for, 'Applicants who apply for a cannabis license for a site that would involve clearing of native vegetation or other sensitive vegetation.'" (Cresco's August 9th Comment Letter, p. 2.) But, the standard that the Planning Commission has to follow is not from the PEIR. Rather, in order to approve a Coastal Development Permit and conditional use permit for the Project the Commission must ensure that a Project complies with the Coastal Zoning Ordinance ("CZO"). (CZO § 35.169.5(1), (2); CZO § 35-172.8; see also Cossart-Daly August 2nd Correspondence to the Commission ["Cossart-Daly August 2nd Correspondence"].) As explained in my August 2nd Correspondence, Appendix G of the CZO provides: "Where avoidance of environmentally sensitive habitat (ESH) and ESH buffers is not feasible and would preclude reasonable use of the property, the Applicant for a land use entitlement for a cannabis activity that would involve impacts to environmentally sensitive habitat, shall prepare and submit a Habitat Protection Plan." Despite the Applicant's contentions, this project meets these criteria: (a) it's in the ESH buffer; (b) it would impact ESH and thus requires a Habitat Protection Plan. (See Cossart-Daly August 2nd Correspondence, pp. 5-9, Exhibit C.)

b. The evidence demonstrates that the Project likely will and already has had impacts on creek habitat and wildlife.

The Applicant maintains its position that there's no impact to sensitive species and that it does not need to create and implement a Habitat Protection Plan. (Cresco August 9, 2021 Letter, pp. 8.) The Applicant makes several unsubstantiated claims in support of this argument. First, the Project Applicant claims that there's no disturbance proposed within Arroyo Paredon Creek or the ESH buffer that was not managed or currently used for argiculture, (Cresco August 9, 2021 Letter, p. 8), yet their agent, Ocean Breeze, removed portions of an avocado orchard in the ESH buffer that had been unmanaged, and likely served as habitat for riparian species. Second, the Applicant also

claims that, though Greenhouse 1 is in the ESH buffer, because it previously existed in this location, the impact on ESH should not be examined by the Commission. This ignores the plain text of the Coastal Zoning Ordinance, which only requires that avoidance of ESH isn't "feasible". (See CZO, Appendix G.) There is nothing in the Ordinance that exempts projects that include pre-existing structures or activities in ESH. (See *ibid.*) Third, the Applicant claims that the Byers system is safe and has no effect on wildlife because it's been widely used in Carpinteria and at the site "with no apparently detrimental effect on the condition of native plants or wildlife." (Cresco August 9, 2021 Letter, p. 9.) The Applicant doesn't provide any data, scientific studies, or other relevant evidence to support this contention.

Three pieces of evidence demonstrate that the project will likely have and already has had an impact on sensitive species:

1. **The Project Applicant's agent destroyed the avocado orchard without studying or mitigating impacts to sensitive species in the riparian corridor.** The avocado orchard was not used for active agriculture at the time the Applicant's agents removed it, and had reverted to a wild extension of riparian bushes and trees. Wildlife will use whatever vegetation exists for nesting, hunting, etc., so the orchard likely served as habitat for birds and other animals within the riparian corridor.

2. **The Applicant's cannabis operation will (and has) produced significant odors from cannabis, and to the extent that the Project uses it, from the Byers system which may impact sensitive species.** (See Cossart-Daly August 2nd Correspondence, Exhibit C.) The Applicant admits that cannabis creates extremely strong smells. They indicate that, inside greenhouses in Carpinteria, "odor levels ranged from 7,599 to 8,296 D/T", when, people can detect an odor increase of 5 to 10 D/T. (Cresco's August 9th Comment Letter). This data substantiates that cannabis produces an extremely strong odor. Many animals rely heavily on smell, including insects, bears, and birds, in every aspect of their lives, including identifying and catching prey. (See Exhibits A - D.) It is likely that this smell from cannabis and Byers will impact sensitive species.

3. **The detention basins will overflow into the creek, taking any pollution in the runoff from the greenhouses, parking lot, and hardscapes with it.** The detention basins are designed to withstand up to a 25 year flood. As described in Mr. Magney's July 30, 2021 letter, with the impacts of climate change large flood events will be more frequent that every 25 years. (See Cossart-Daly August 2nd Correspondence, Exhibit C, pp. 1-2, 7.) When the detention basins overflow, the runoff will flow to the Southwest corner of the Property and eventually into Arroyo Paredon Creek. (See *ibid.*) This runoff will carry pollutants from the Project, which will impact the water quality in

Arroyo Paredon, and in turn, will likely impact habitat for steelhead trout, red legged frog, and tidewater goby.

c. **The Applicant hasn't sufficiently studied potential impacts to Arroyo Paredon Creek and related habitat, and therefore, cannot credibly draw a conclusion that the Project will not have a significant impact on sensitive species and does not require a Habitat Protection Plan.**

1. **Without applying the Santa Barbara South Coast Riverine Wetlands HGM model ("HGM") the Applicant does not have sufficient information to conclude that the Project would not have significant impacts on sensitive species in and around Arroyo Paredon creek.** (Cossart-Daly August 2nd Correspondence, Exhibit C, pp. 4-5.) In short, the HGM assesses how a stream and the surrounding area is currently functioning, then models how it will function after a development project is in place. The Applicant claims they shouldn't use this model, because there are no impacts proposed within ESH or the creek itself and because of all 28 HGM variables studied, only two involve area outside the creek itself. (Cresco August 9th Letter, p. 17.) Contrary to the Applicant's assertion, the Project will and has impacted ESH, and according to Mr. Magney, "9 of the 28 variables used in the riverine model consider conditions outside/beyond the stream channel." The Project also will and has had impacts on ESH, as described herein. Without applying the HGM, and projecting the potential impacts of the Project, to ESH, the Applicant's conclusion that the Project will not have a significant impact on sensitive species in and around Arroyo Paredon Creek is not supported by evidence.

2. **The Applicant's agent destroyed the avocado orchard, which served as an extension of riparian habitat, without conducting a survey for birds or determining if destroying the avocado trees would impact sensitive species.** The Project, therefore, may already have had a significant impact on sensitive habitat, but did not identify whether the orchard supported sensitive species. Without this information, the Applicant cannot credibly draw a conclusion that the Project won't have an impact on sensitive species. Destruction of the orchard was specifically part of the development project, as indicated in the Project Description. (Project Description, p. 5 ["Additionally, on the northern portion of the Project Site, approximately 0.89 acres of avocado orchard (44 non-native trees) and the existing employee parking area will be removed and replaced with a new 24,400 square foot detention basin."]) Without a survey of the birds or species in the avocado orchard, the Applicant cannot credibly and conclusively assert that the Project development has no impact on sensitive species.

As discussed in my August 2, 2021 Correspondence, prior to any issuance of a CDP, it is imperative that the Project Applicant further study the Project's impacts, as recommended by expert biologist David Magney, then utilize information from these studies to formulate a Habitat Protection Plan.

II. The Applicant's Proposed Carbon Scrubbers Will Not Ensure that Cannabis Odors Will Be Prevented in Residential Areas and Are Not the Best Available Technology.

While my clients appreciate the Applicant's attempts to move away from the Byers System and towards carbon odor mitigation, their existing proposed plan does not comply with the requirements for Odor Mitigation Plans under the Coastal Zoning Ordinance.

There is no evidence to substantiate that the carbon filtration system proposed by the Applicant will work. The Applicant proposes an entirely new odor mitigation system, that has only been tested on two occasions in the field. In addition, the tests conducted indicate that residential areas adjacent to the Project would still experience odors of 10 D/T, which is quite high. (Cresco August 9th Letter, p. 9, Figure 4.) This will be particularly problematic at night, when natural airflow and winds decrease, because the wind won't disperse remaining odors. This does not comply with the Coastal Zoning Ordinance's requirement that an Odor Abatement Plan "prevent odors from being experienced within residential zones." (CZO, § 35-144U(C)(5).)

The carbon filtration system proposed by Dr. Rosenfeld has been tested, used in large scale commercial grows, used and supported by other jurisdictions, and is confirmed to be the best available technology. Yet, the Applicant indicates that they do not wish to use the carbon filtration system proposed by Dr. Rosenfeld, as it needs to be a larger system. They argue that the blowers used for the system would create noise impacts, the carbon used to filter the odor would create waste, and the use a carbon filtration system would require more power than the carbon scrubbers they propose. (See Cresco August 9th Letter, pp. 11-12.)

The majority of these concerns are unsubstantiated and do not render it impossible to use this system. I spoke with Dr. Rosenfeld, who indicated that the Project Applicants could use sound proof blowers to render any noise impacts moot. He also indicated that the carbon filtration vendor he suggested, Envent, provides carbon regeneration, wherein all the carbon in the filtration system is taken off site, heated to a high temperature, and then reused, so the carbon filtration system does not result in carbon waste. The carbon filtration system Dr. Rosenfeld proposed does use more power, but this could be mitigated with solar or offsets. All of these issues do not make the use of the carbon filtration system infeasible or unavailable.

As even the Applicant indicates that a carbon filtration system, such as the one proposed by Dr. Rosenfeld, is the best available technology, we respectfully request that the Commission only

approve the Project with a carbon filtration system. If the Commission approves the Project with the carbon scrubbing system proposed by the Applicant, my clients respectfully request that the Commission add the following conditions to the Project approval:

(1) The Commission require the Project Applicant to cover the greenhouse with a material that cannot be permeated by odor, at night, in order to prevent the release of odors when there is less wind to disperse them. In order to reduce odor from being released in the morning, the Applicant should be required to run the carbon scrubbers all night. The cover could then be retracted during the day, and at that time, the carbon scrubbers can be run as proposed by the Applicant.
(2) Create a monitoring program to ensure the effective use of the carbon scrubbers, wherein if the County receives a complaint regarding odor at the Project site, a County investigator is immediately dispatched to confirm whether odor is detected. If odor is detected on three separate occasions by a County investigator, then the Planning Commission will require the Project Applicant to immediately implement the established carbon filtration system proposed by air quality expert Dr. Paul Rosenfeld.

Given the issues posed by the Byers and any other vapor phase system, we renew our request that the Planning Commission prohibit the use of any vapor phase odor mitigation system until the Applicant study of the impacts of the Byers system on the riparian habitat in Arroyo Paredon Creek and on residents in the vicinity of the Project site is completed and appropriate mitigation is implemented. (See Discussion in August 2nd Correspondence, pp. 5-6, 11, 12, 16.)

III. Conclusion

For these reasons, we respectfully request that, in order to comply with the requirements of the Coastal Zoning Ordinance, the Commission further investigate the impacts of the Project on sensitive habitat and Arroyo Paredon Creek, as outlined herein and in my August 2nd Correspondence. We also request that, in order to comply with the Coastal Zoning Ordinance's Odor Mitigation requirements, the Commission only approve a Project with a carbon filtration and not a carbon scrubbing system, and does not permit the use of the Byers System or another vapor phase system at any point during the life of the Project. Should the Commission approve a carbon scrubbing system, we respectfully request that you implement our requests for ensuring that it is effective and that there is a robust enforcement system.

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Thank you for the opportunity to comment on this Project. If you have questions or wish to discuss the contents of this correspondence, please do not hesitate to contact me at ecd@cossart-dalylaw.com.

Sincerely,

E Cossart-Daly

Elise Cossart-Daly
Attorney

Exhibit A

Your source for the latest research news

Science News *from research organizations*

Exposing Insects' Sense Of Smell

Date: January 9, 2002

Source: University Of California - Davis

Summary: A key step in insects' sense of smell has been uncovered by researchers in Switzerland, the United States and Japan. The discovery could lead to insecticides that stop insects from communicating through chemical signals.

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FULL STORY

A key step in insects' sense of smell has been uncovered by researchers in Switzerland, the United States and Japan. The discovery could lead to insecticides that stop insects from communicating through chemical signals.

Using nuclear magnetic resonance (NMR), the researchers showed how a protein in an insect's antenna picks up chemical signals called pheromones, then changes its shape to eject them precisely onto sensitive nerve endings.

Many insects depend on pheromones to communicate with each other, whether searching for food or finding a mate, said University of California, Davis, entomologist Walter Leal, who collaborated in the project.

"One could design new compounds that fit in the binding pocket of the protein, but cannot be ejected. This would prevent the insect from detecting other chemical signals," Leal said. These insects would not be able to survive without their sense of smell, he said.

Insects "smell" with their antennae. Pheromone-binding proteins (PBP) pick up pheromones at pores in the outside of the antenna and carry them through a watery layer to the nerve endings, where they are released.

The new NMR results showed that the PBP changes its shape to eject the pheromone molecule. The shape change is triggered by a drop in pH when the PBP-pheromone complex reaches the nerve endings.

The study by Reto Horst, Kurt Wuethrich and colleagues at the Eidgenoessische Technische Hochschule in Zurich, Switzerland, together with UC Davis' Leal and scientists at the National Institute of Agrobiological Sciences in Tsubuka, Japan, is published in the Dec. 4 issue of Proceedings of the National Academies of Sciences of the United States of America.

Editor's note: An animation of pheromone transport is available at http://chemecol.ucdavis.edu/animations/PBP1_w_sound.html.

Story Source:

Materials provided by **University Of California - Davis**. *Note: Content may be edited for style and length.*

Cite This Page:

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University Of California - Davis. "Exposing Insects' Sense Of Smell." ScienceDaily. ScienceDaily, 9 January 2002. <www.sciencedaily.com/releases/2002/01/020107075619.htm>.

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Exhibit B

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A common mole emerges from its underground tunnel in Massachusetts.
PHOTOGRAPH BY KEN THOMAS, SCIENCE SOURCE/PHOTO RESEARCHERS

Moles Smell in Stereo to Find Food, Dodge Predators

"I came at this as a complete skeptic," biologist says.

BY **KER THAN**, NATIONAL GEOGRAPHIC NEWS

PUBLISHED FEBRUARY 6, 2013 • 5 MIN READ

The common mole is nearly blind, but it makes up for its poor eyesight with a nose that can smell in stereo, a new study says.

Most mammals, including people, see and hear in stereo. For instance, stereo vision means that we see an object in three dimensions.

But only a few mammals have been confirmed to have a stereoscopic sense of smell. That means that each nostril operates independently of the other, sending different signals to the brain that are then computed to determine the direction of the odor.

A previous study showed that rats could be trained to tell whether an odor came from the left or right. But the new study in moles is the first to show a mammal using this ability as part of its natural foraging behavior.

Biologist Kenneth Catania showed that the common mole—also known as the Eastern American mole—relies on the ability to distinguish between subtle differences in the intensity of smells at each nostril to locate food. (See "Secrets of Smell: Different Nose Parts for Stinky, Sweet.")

"I came at this as a complete skeptic. I didn't really think it was possible, partly because the nostrils are pretty close together," said Catania, who is at Vanderbilt University in Nashville, Tennessee.

The Dirt on Mole Vision

In one experiment, Catania placed a mole into a circular arena with food wells spaced around a 180-degree circle. Pieces of chopped earthworm were placed randomly in different wells. Catania then temporarily sealed the chamber so that he could detect each time the mole sniffed by the change in air pressure.

When a mole first entered the chamber, it sniffed the air, and in five seconds or less would zero in on the earthworm pieces. "It would wiggle its nose ... and then just go straight toward the food in what looks like a straight line," said Catania, whose research appears February 5 in the

journal Nature Communications.

In another experiment, Catania blocked one of the moles' nostrils with a small plastic tube. When the left nostril was blocked, the moles consistently veered off to the right, and when their right nostrils were blocked, they veered to the left.

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The results are strikingly similar to a landmark study of hearing in barn owls performed in 1979, which found that blocking one of the owl's ears caused them to misjudge the location of a sound source, according to Catania.

Catania also inserted small plastic tubes in both of the moles' nostrils to cross them, so that the right nostril was sniffing air on the animal's left and the left nostril was smelling air on the right. When the nostrils were crossed, the confused moles searched back and forth repeatedly. (See "Moles, Shrews Can Smell Prey While Underwater, Study Suggests.")

Although it took them longer than usual to locate the food when their nostrils were blocked or crossed, the animals usually managed to find it after a while. Catania thinks that's because the moles aren't relying solely on their stereo sense of smell to find food.

The animals are also simultaneously sampling the intensity of an odor in different locations, comparing the intensities, and heading toward the stronger smell—a strategy that most mammals, including people, would use.

Stereo Smell Helps Avoid Enemies

Upinder Bhalla, a neuroscientist at the National Center for Biological Sciences in Bangalore, India, confirmed in 2006 that rats can smell in stereo.

Bhalla said that the ability to smell in stereo is useful for animals that have to make rapid decisions.

"If you can locate the direction of a cat in one sniff rather than two, you would be more likely to survive," Bhalla, who was not involved in the mole study, said by email.

"Similarly, if you are more accurate at tracking an odor to its source, especially in the rich mix of odors in the wild, you are more likely to find it and find it quickly."

Bhalla suspects that the ability to smell in stereo could be very common among mammals—including us. For instance, a 2010 study by Noam Sobel, a neuroscientist at the University of California, Berkeley, suggested people also use both nostrils to locate odors. (Also see "Better Smellers are More Sympathetic, Study Says.")

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"Even humans can do this if pushed to it—though we rarely are," Bhalla said in an email. For example, for the 2010 study, experiment subjects were asked to get on their hands and knees in a grassy area and track the smell of chocolate.

"I would certainly expect all the strongly [smell-dependent] animals—which is a large fraction of them—can use stereo."

Study author Catania agreed that many other mammals can sniff in stereo, but "for humans, I remain very

Exhibit C

From the Magazine Magazine

Birds Can Smell, and One Scientist is Leading the Charge to Prove It

For more than a century nearly everyone believed birds sense of smell was poorly developed or nonexistent. They were wrong.

By Nancy Averett

January-February 2014

By Nancy Averett
January-February 2014

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Hummingbird Feeding FAQs

Gabrielle Nevitt's supply list for her first Antarctic research cruise in 1991 contained some decidedly odd items. The huge kites and vats of fishy smelling liquid wouldn't be a problem, the macho National Science Foundation contractor told her.

Birds Tell Us to Act on Climate

Pledge to stand with Audubon to call on elected officials to listen to science and work towards climate solutions.

Sign the Pledge

Photo: Photographs by Ted Kinsman, Russ Widstrand/Getty Images

Then she asked for hundreds of boxes of super-absorbent tampons. "He just kind of stammered," recalls Nevitt a petite brunette who was then a 31-year-old zoology post-doc at Cornell University. "Then he said, 'Uh, I don't think I can get those for you, ma'am.' " So Nevitt lugged them onboard herself and set to work. She was hoping to lure albatrosses and petrels from the open sea with the scent of dinner, like a street-food vendor might entice passersby with a hot pretzel. She dipped the tampons in pungent compounds found in marine fish and small crustaceans called krill, and painstakingly attached the briny bait to parachute-like kites that she let fly off the rear deck. Then she waited.

It was an outlandish experiment, and not just because of the tampons. For more than a century nearly everyone believed that the sense of smell was poorly developed or nonexistent in most birds. So no one had ever fully investigated to what extent tube-nosed procellariiformes—petrels, albatrosses, and shearwaters—use their olfactory anatomy to pinpoint prey in the vast, featureless ocean. The long-lived birds spend nearly their entire existence at sea, soaring for hundreds to thousands of miles in search of ever-shifting schools of krill, fish, and squid. On the day Nevitt ran her experiment, dozens of them swooped in so close that she feared they would tangle in the line and drown. So she grounded the kites and improvised, releasing vegetable oil into the water, some of it laced with the fishy compounds. Albatrosses and petrels flocked to the stinky slicks. She was ecstatic. But she still had no idea how they used olfactory cues to home in on their ephemeral quarry. "I was really passionate about figuring this out, so I wasn't giving up," says Nevitt. "I knew I'd be back again soon on another cruise."

Nevitt is 53 now and a professor at the University of California-Davis. She is a woman obsessed with smell. As head of a sensory ecology lab, she's spent the past two decades picking apart how seabirds' ability to detect scents is key to their survival. Nevitt had the good fortune to arrive in the field on the heels of a handful of pioneering bird olfaction studies. Yet changing long-held beliefs takes time, and the scientific community is no exception. Dozens of Nevitt's grant proposals have been rejected because of the birds-can't-smell fallacy. A program officer once called to say her application was the worst he'd ever seen. "Your idea that birds can smell is ridiculous,"he said. "This will never be funded, so stop wasting your time." She ignored him, and her perseverance and inventive methods have inspired others who share her fascination.

"Gaby's been very influential," says Julie Hagelin, a wildlife biologist with the Alaska Department of Fish and Game who has conducted several studies on the role of odor in bird behavior. "Her work propelled me forward and helped me develop several ideas." Nevitt, Hagelin, and other avian olfaction trailblazers have pushed past criticism, failure, and even bodily injury in their quest to disprove one of biology's most pervasive myths. "In science," says Nevitt, "we rediscover the obvious sometimes."

Nevitt could blame John James Audubon, of all people, for the incredulity she's endured. In the 1820s the famous naturalist set out to prove that turkey vultures use their superior eyesight, rather than their nostrils, to find carrion. He stuffed a deerskin with grass and added clay eyes, sewed up the imposter, and placed it in a meadow with its legs in the air. He watched as a vulture swooped down on it. The duped bird ripped out the eyes and tore apart stitches, flying after failing to find any meat. Audubon later placed a dead hog, its carcass reeking of decay in the July heat, in a ravine and covered it with brush. This time vultures circled but didn't descend. The results were "fully conclusive," he wrote. Vultures did not scavenge by smell.

Audubon's ego would've taken a hit had he lived to see Kenneth Stager put his findings to the test. In 1960 Stager, an ornithologist at the Los Angeles County Natural History Museum, showed that turkey vultures prefer fresher carcasses—typically no more than four days old—to putrid ones like Audubon hid. Stager also identified the specific scent that drew vultures to carrion, with the help of natural gas engineers

who told him they followed the birds to ruptured pipelines. Decomposing carcasses, it turns out, give off ethyl mercaptan, the same sulfurous compound added to natural gas so humans can sniff out a leak (and which gives asparagus eaters' urine that distinctive rotten-egg odor). Stager had shattered Audubon's theory. Hardly anyone noticed.

If Stager was an early proponent of bird olfaction, his contemporary Bernice Wenzel quickly became a pioneer. A physiology professor at UCLA, Wenzel shared a penchant for wander-lust with the pigeons she studied. She jumped at an invitation in 1965 to travel to Japan to present a paper at the International Symposium on Olfaction and Taste conference on how pigeons could detect smells. Every time she exposed the birds to scented air, their heart rates went up. By attaching electrodes directly to the birds' olfactory bulbs, she saw that the signal spiked whenever they got a whiff of the scented air. "I thought, 'For heaven's sakes, that's kind of interesting. I think I'll go to Tokyo and give a paper on that,' " says Wenzel. "After that, inevitably, as crazy scientists are apt to do, avian olfaction became my main interest, and everything else was sort of shoved aside." Now 92, Wenzel's wavering voice and halo of white hair belie her gusto: She scours scientific journals for the latest olfaction papers and drives herself to the scientific conferences she attends.

During the next 25 years Wenzel launched olfaction studies at home and abroad. She repeated the electrode tests on a raven, a turkey vulture, mallards, canaries, bobwhite quail, and black-vented shearwaters. "Every bird we tested showed some kind of olfactory function," she says. Her fieldwork in New Zealand revealed that kiwis, the only bird with a nostril at the tip of its beak rather than at the base, sniff out their earthworm prey. The National Science Foundation nixed her request to visit an Antarctic station—scientists were required to share rooms, and they wouldn't let her bunk with a man—so she studied seabirds closer to home. Off the Southern California coast, she released odors of various substances, from fish oils to bacon fat, and found that two seabirds, northern fulmars and sooty shearwaters, were most attracted to the smells. "What was especially noticeable was that on a foggy morning the fulmars would appear out of the fog from downwind and fly around and round as if to say, 'There's got to be a fish here someplace,' " Wenzel recalls. "That convinced us it really was an important concept to pursue."

Wenzel retired in 1989, but before she did, her conviction inspired another young researcher to continue nailing down the slippery stuff of bird smell. Wenzel spoke at

a conference in Norway that year, and Nevitt was in the audience. "Bernice was just so fierce and passionate and emphatic that birds could smell," says Nevitt, who at the time was writing her dissertation on salmon olfaction. "It really impressed me."

By 1992 Nevitt was back at sea, riding out a rough storm near the Antarctic Peninsula. Hurricane-force winds blew. Sheets of rain and sleet pummeled the ship. Waves topped 40 feet. Below deck, Nevitt had secured her chair to her desk with a bungee cord to keep from tipping over as she tapped away at her computer. Suddenly the vessel pitched and the tether snapped. Nevitt flew across the room, slammed into a metal tool cabinet, and was knocked out. She awoke to excruciating pain from a torn kidney. She gutted out the rest of the voyage, lying in her bunk, unable to move without assistance, listening to a Mary Chapin Carpenter tape to help her stay conscious.

Grueling as it was, the injury led to a fortuitous encounter. When the ship finally docked a week later, Nevitt stayed aboard while a different scientific crew loaded its equipment and prepared for a new trip. Tim Bates, an atmospheric chemist with NOAA, poked his head into her cabin. He was studying dimethyl sulfide, or DMS, a gas emitted by phytoplankton, microscopic plants that live at the ocean's surface. Bates was interested in the gas because it might help combat climate change; it contributes to the formation of clouds, which reflect heat. He began calibrating his equipment as they chatted. Nevitt, who has a keen sense of smell herself, immediately picked up an aroma like oysters on the half shell. She felt a tingle of excitement. She knew that the gas is released when krill—a major food source for seabirds—devour phytoplankton. "I'd read about DMS," she says. "But it never occurred to me it might have an odor."

It all clicked into place. The birds pick up the DMS trail and follow it to schools of krill. When Bates showed her a map of DMS plumes, Nevitt saw that they were more concentrated in areas with geographic formations near the ocean's surface. "I could see peaks and valleys of DMS over shelf breaks, seamounts, and other underwater features, and I realized the ocean's surface wasn't featureless to the birds," she says. "They have their own map, an odor landscape, in the air above the water." It was, says Nevitt, the kind of "aha" moment scientists live for.

She still had to prove it, though. Four months later Nevitt was back in Antarctic

waters to test her theory. Her vessel, the RRS *James Clark Ross,* rescued the crew of another ship that had caught fire, and escorted the damaged vessel to port. That made for a slow trip, but Nevitt took advantage of the opportunity. She recruited the extra passengers to help with an experiment that would have been impossible at full speed. She launched aerosols of DMS and control substances into the air, and the volunteers tallied seabirds that turned back toward the boat. It worked— they made a beeline for the DMS plumes. She'd proved that the gas drew tube-nosed seabirds to their dinner on the open sea.

It's not all that surprising that Audubon's erroneous claim has persisted for so long. Birds sport flashy plumage, sing melodic songs, perform dramatic mating rituals. Vision and hearing are obviously important. But smell? Birds don't have noses, or sniff everything the way dogs do. They lack the vomeronasal organ that most mammals, amphibians, and reptiles use to detect odor particles. And the smelling equipment they do possess can be hard to find: Many species have microscopic olfactory bulbs, a structure in the forebrain that receives odor signals from the nasal cavity.

No wonder, then, that in 2008, when Indiana University post-doc Danielle Whittaker first proposed studying how dark-eyed juncos smell, a professor she confided in, Jim Goodson, was aghast. "I thought it was a monumental waste of time," says Goodson, a neurobiologist who studies bird brains. "Vertebrates that really emphasize olfaction have very prominent olfactory bulbs on the front of their brains, sometimes hanging off on long stalks, as in many fish. But you can't even see a bump on a junco brain."

"It just goes to show," he says, "appearances can be deceiving."

In fact, every bird tested has passed the sniff test. All 108 species examined in a landmark 1968 study possessed an olfactory bulb; the tissue took up as little as 3 percent of songbird brains and as much as 37 percent of seabird brains. Recent molecular studies back up the findings. In 2008 researchers looked at nine species that represent seven major branches of the avian family tree. They found that bulb size correlates with the number of genes that encode olfactory receptors, which detect odors. In other words, a bigger structure equals more genes. Two nocturnal birds, kakapos and kiwis, topped the list with more than 600 smell-related genes,

while canaries and blue tits had about a third as many. (Humans have about 400.)

Biologists generally assume that animals with larger olfactory bulbs and more receptor genes have a stronger sense of smell. The remarkable variation that birds display may be due to environmental adaptations. Nocturnal kiwis' acute sense of smell may help them find food at night. And then there are Nevitt's relatively large-bulbed tube-nosed seabirds. Their smelling anatomy includes an elongated tube on their upper beak, perfectly adapted to pick up odors in a cold, windy climate that chops up scent trails. One species, wandering albatrosses, are feathered bloodhounds that can follow their nose to food some 12 miles from their starting point, zigzagging upwind to keep track of the patchy odor plume.

Yet small scent machinery doesn't necessarily condemn a bird to a poor sense of smell. Blue tits will refuse to enter their nest boxes when they catch a whiff of the chemical cue of weasels. For Eurasian rollers, a different scent acts as an alarm. Frightened chicks vomit a foul-smelling orange liquid, likely becoming a less attractive snack to a potential predator; their parents pick up the odor when they return and react cautiously, delaying settling down in the nest where they might be an easier target if the marauder is still lurking nearby. Another songbird, the European starling, can detect and distinguish scents in aromatic herbs, such as the chrysanthemum-like odor of milfoil. Males weave these plants into their nests to attract females during the breeding season, like a man applying cologne.

Smell, of course, is just one of birds' six senses (in addition to the standard five, some species have a built-in magnetic compass). Nevitt has discovered that even among tube noses, the degree to which they rely on scent varies. Larger, more aggressive albatrosses and giant petrels follow DMS to food, but they also use visual cues, such as other birds feeding on krill. Burrow-nesting birds, such as smaller white-chinned and blue petrels, tend to be more attuned to the chemical trail. That's probably because, raised in the dark, smells dominate their early sensory experience. Burrow-nesting species use their nostrils for other purposes, too. Diving petrels distinguish their burrow from hundreds of similar-looking ones by scent, and Antarctic prions choose their mates by their unique odors.

For very visual and auditory birds, like crested auklets, olfaction is only part of the mix. But for juncos it may play a far larger role. Whittaker discovered that the odor of junco preen oil, secreted from a gland at the tail base, varies among individuals, and

that the birds can distinguish among those divergent smells. Those whose smells are most strongly "male-like" or "female-like" have the most chicks survive to fledglings. In fact, smell turned out to be far more important in making males attractive than other factors, such as a whiter tail, where there was no correlation. "Odor is probably a more reliable indicator of reproductive success than visual cues," she says.

That may be true for New Zealand's kakapos, too. Hagelin performed some of the first research showing the chicken-sized, critically endangered parrots could smell (the sweet, strong odor that some say smells of lavender and honey that both sexes produce tipped her off that the sense might be important). Now, a Swiss scientist, newly minted Ph.D. Anna Gsell, has picked up where Hagelin left off. Gsell is identifying the compounds and hopes to create a synthetic version of the odor of the best breeders. Less successful males sprayed with the stuff might have a better chance of wooing otherwise disinterested females, thus increasing the gene pool. With 124 birds left, they need all the help they can get.

Last year a sales rep tried to peddle Nevitt a textbook containing the tired meme that birds can't smell. She kicked him out of her office. Nevitt and her cohorts haven't convinced everyone yet, but word is getting out.

Besides, Nevitt is too busy to take on every naysayer. In addition to continuing her long-running studies, she's juggling several new investigations. Mammals, humans included, typically prefer potential mates whose immune system is different from their own. They pick up on the smell produced by immune function genes, known as the major histocompatibility complex. Nevitt and Scott Edwards, an evolutionary biologist at Harvard, have launched a large, multiyear study to see if the same is true for Leach's storm-petrels. Nevitt is wading into climate research, too, looking at how seabird losses due to global warming might be affecting krill and phytoplankton production and overall ocean health. And recently, the CIA came calling. She's teamed up with the agency to investigate whether birds can smell volatiles associated with plastic explosives. "It's a weird world," she says. But it's clear that Nevitt wasn't wasting her time after all.

This story originally ran in the January-February 2014 issue as "The Sniff Test."

Exhibit D

COVID-19 Response

Masks are required for everyone, regardless of location or vaccination status, in all NPS buildings, crowded outdoor spaces, and all forms of enclosed public transportation. Additional details are available at **www.nps.gov/coronavirus**. Before visiting, please check the **park website** to determine its operating status. Please **recreate responsibly**.

National Park Service

« Yosemite Ranger Notes

Bear Series, Part One: A Bear's Sense of Smell

October 01, 2014 || Posted by: JG - Park Ranger (Yosemite Valley)

When you visit Yosemite National Park, you are likely being smelled by at least one of Yosemite's black bears (Ursus americanus). Whether you're in Yosemite Valley, at Glacier Point, or at the top of Mt. Lyell, you are within the range of a bear's sense of smell. This fact can be attributed to the size of Yosemite's area, the size of the park's bear population, and the bears' amazing sense of smell.

Yosemite National Park has an area of 1,169 square miles;in comparison, the State of Rhode Island is 1,214 square miles. Park biologists believe that Yosemite's population of black bears is between 300 and 500 bears. This means, assuming an even distribution of Yosemite's bears, there's one bear every 2.3 to 3.9 square miles. A black bear's sense of smell can easily be measured in miles.

Looking at a black bear's head, it's obvious that they have a very large nose. The area inside a black bear's nose, called the nasal mucosa, is 100 times greater than ours. This large nose results in an excellent sense of smell! Even bloodhounds, dogs so famous for their sense of smell that they're used to track missing people, don't smell as well a black bear. It is estimated that black bears' sense of smell is about seven times greater than a bloodhound's.

A black bear's sense of smell is so good that it's difficult to measure. Bears are commonly thought to have the keenest sense of smell in the animal kingdom, and estimates of the range of their sense of smell vary widely.

Conservative estimates of a black bear's sense of smell state that a black bear can smell a food source from over a mile away, while other sources claim a black bear can smell food from over two miles away. A personal account from "*The Great Bear Almanac*" describes a black bear in California traveling "upwind three miles in a straight line to reach the carcass of a dead deer." More generous estimates place a black bear's sense of smell between 18 and 20 miles, which may sound extreme, until you learn that polar bears, the black bear's cousin, have been known to follow seals for up to 40 miles.

In summary, though it's difficult to measure just how far a black bear can smell, a range of a few miles isn't unrealistic. With 300 to 500 bears roaming Yosemite at any given time, it's more than likely that at least one of them are smelling you at all times. So the next time you're in Yosemite, take a minute to stop and think about everything you smell, and what also might be smelling you.

Nature Scene, **JG**

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