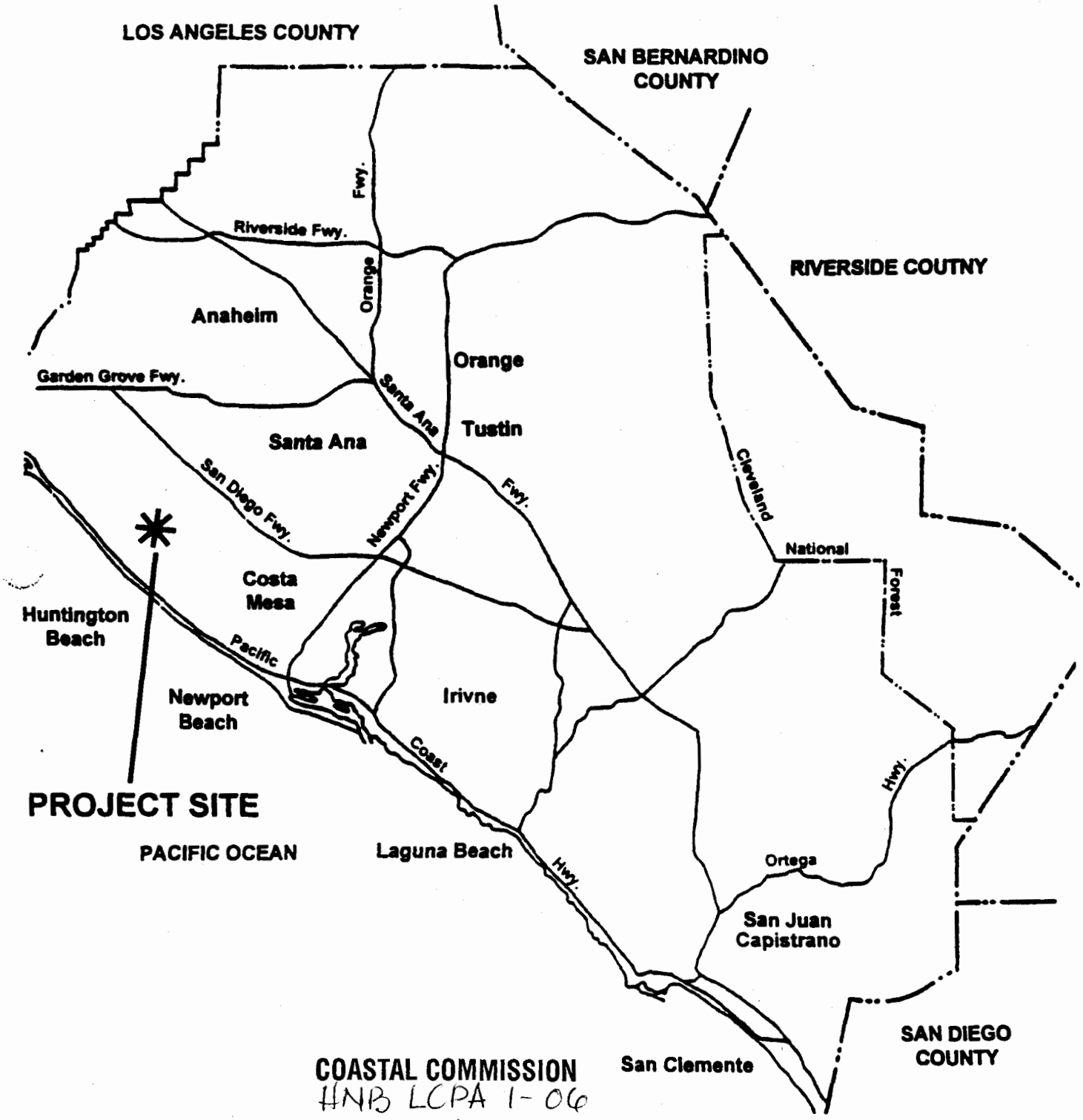


COASTAL COMMISSION
HNB LCPA 1-06
EXHIBIT # A
PAGE 1 OF 1

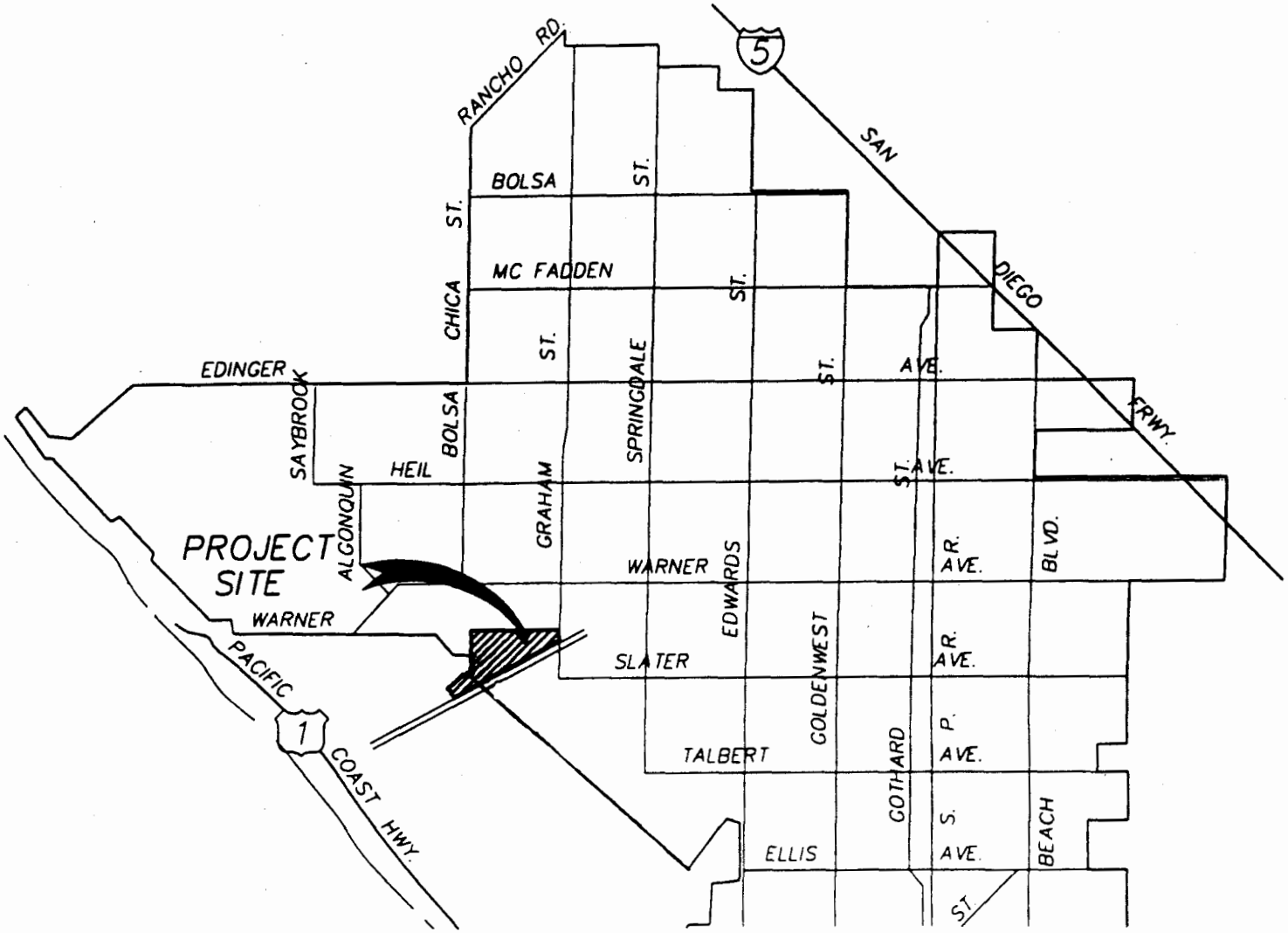
No Scale

EDAW, Inc.

Source: EDAW, Inc.

Exhibit 1

Regional Location



COASTAL COMMISSION
HNB LCPA 1-06
EXHIBIT # B
PAGE 1 OF 1

No Scale

EDAW, Inc.

Source: Hunsaker & Associates Irvine, Inc.

Exhibit 2

Local Vicinity

RESOLUTION NO. 2002-123

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF HUNTINGTON BEACH ADOPTING LOCAL COASTAL PROGRAM AMENDMENT NO. 96-4 TO AMEND THE LOCAL COASTAL PROGRAM LAND USE PLAN AND IMPLEMENTING ORDINANCES TO REFLECT GENERAL PLAN AMENDMENT NO. 98-1 AND ZONING MAP AMENDMENT NOS. 96-5A AND 96-5B BY AMENDING ZONE 2-LAND USE PLAN AND ACCOMPANYING TEXT OF THE CITY'S COASTAL ELEMENT FOR THE REAL PROPERTY GENERALLY LOCATED ON THE WEST SIDE OF GRAHAM STREET, SOUTH OF KENILWORTH DRIVE AND REQUESTING CERTIFICATION BY THE CALIFORNIA COASTAL COMMISSION

WHEREAS, the City of Huntington Beach seeks to amend its Local Coastal Program to reflect approximately 36.8 acres as Low Density Residential (maximum 7 units per acre) and 8.2 acres as Open Space-Park on 45 acres of the subject property within the City of Huntington Beach; and to reflect 1.6 acres as Low Density Residential (maximum 7 units per acre) and 3.3 acres as Coastal Conservation on an approximately 5 acre, pre-annexation portion of the subject property; and

After notice duly given pursuant to *Government Code* Section 65090 and *Public Resources Code* Section 30503 and 30510, the Planning Commission of the City of Huntington Beach held public hearings to consider the adoption of the Huntington Beach Local Coastal Program Amendment No. 96-4; and

Such amendment was recommended to the City Council for adoption; and

The City Council has, prior to the adoption of this Resolution, reviewed, considered, and certified as adequate and complete the Final Environmental Impact Report No. 97-2 (Exhibit F) and has adopted the Statement of Findings and Facts in Support of Findings, and Mitigation Monitoring Report for the Final EIR; and

The City Council, after giving notice as prescribed by law, held at least one public hearing on the proposed Huntington Beach Local Coastal Program Amendment No. 96-4, and the City Council finds that the proposed amendment is consistent with the Huntington Beach General Plan, the Certified Huntington Beach Local Coastal Program (including the Land Use Plan), and Chapter 3 of the California Coastal Act; and

The City of Huntington Beach intends to implement the Local Coastal Program in a manner fully consistent with the California Coastal Act.

NOW, THEREFORE, the City Council of the City of Huntington Beach does hereby resolve as follows:

COASTAL COMMISSION
HNB LCPA 1-06
EXHIBIT # C
PAGE 1 OF 4

SECTION 1: That the real property that is the subject of this Resolution is bounded by Graham Street, the East Garden Grove-Wintersburg Flood Control Channel, unincorporated Bolsa Chica, and single-family homes along Kenilworth Drive and consists of approximately 45 acres within the City of Huntington Beach which includes the approximate 40-acre Area of Deferred Certification, and approximately 5 acres within the County of Orange (Exhibit A).

SECTION 2: That the Huntington Beach Local Coastal Program Amendment No. 96-1, consisting of General Plan Amendment No. 98-1 and Zoning Map Amendment Nos. 96-5A and 96-5B, a copy of which is attached hereto as Exhibits B and C, and incorporated by this reference as though fully set forth herein, is hereby approved.

SECTION 3: That the Local Coastal Program Land Use Plan/Coastal Element for the Subject Property is hereby changed (Exhibit D) as follows:

A. The Area of Deferred Certification portion of the Subject Property amended to reflect approximately 2.8 acres as OS-P (Open Space-Park), and approximately 36.8 acres as RL-7 (Low Density Residential – maximum 7 units per acre); and

B. Pre-General Plan an approximately 5 acre portion located within the County of Orange as OS-C (Open Space – Conservation) – approximately 3.3 acres, and RL-7 (Low Density Residential – maximum 7 units per acre) – approximately 1.6 acres.

SECTION 4: That the Local Coastal Program/Implementing Ordinances (Zoning Maps) for the Subject Property are hereby changed (Exhibit E) to be consistent with the General Plan, Local Coastal Program Amendment, and Coastal Element as follows:

A. Rezone approximately 40 acres of the subject property to add CZ (Coastal Zone Overlay) to the existing RL-FP2 (Low Density Residential – Floodplain Overlay) designation; and

B. Rezone 8.2 acres from RA-CZ (Residential Agriculture-Coastal Zone Overlay) and RL-FP2 (Low Density Residential – Floodplain Overlay) to OS-PR-CZ (Open Space-Parks and Recreation-Coastal Zone Overlay); and

C. Pre-zone the approximately 5 acre portion located within the County of Orange as follows: approximately 1.6 acres RL-7 - FP2 – CZ (Residential Low Density – Floodplain Overlay – Coastal Zone Overlay); and approximately 3.3 acres CC - FP2 - CZ (Coastal Conservation – Floodplain Overlay – Coastal Zone Overlay).

SECTION 5: That all development shall comply with the requirements of the Local Coastal Program, including the Land Use Plan (Coastal Element) and Implementing Ordinances (Zoning and Subdivision Ordinance). The City will issue Coastal Development Permits in accordance with its Local Coastal Program, and intends the Local Coastal Program will, in all respects, be carried out in a manner fully in conformity with the Coastal Act.

C2

SECTION 6: That the City hereby requests delegation of Coastal Development Permit authority for the deferred certification area and pre-annexation area of the affected property. The date upon which the City shall begin issuing Coastal Development Permits shall be upon this Local Coastal Program Amendment certification and, for the pre-annexation area, upon Local Agency Formation Commission's approval of the annexation.

SECTION 7: That the California Coastal Commission is hereby requested to consider, approve and certify Huntington Beach Local Coastal Program Amendment No. 96-4.

SECTION 8: That pursuant to Section 13551(b) of the Coastal Commission Regulations, Huntington Beach Local Coastal Program Amendment No. 96-4 will take effect automatically upon Coastal Commission approval, as provided in *Public Resources Code* Sections 30512, 30513 and 30519. In the event that the Coastal Commission proposes revisions, this Land Use Plan and Implementing Ordinances amendment shall not take effect until the City Council adopts the Commission modifications and all the requirements of Section 13544 of Title 14 of the California Code of Regulations are met.

SECTION 9. This resolution supercedes City Council Resolution No. 2002-101.

PASSED AND ADOPTED by the City Council of the City of Huntington Beach at a regular meeting thereof held on the 18 day of November, 2002.

Debbie Cook
Mayor

ATTEST:

Connie Brockway
City Clerk

APPROVED AS TO FORM:

Gail Hutton
City Attorney
BA 11-13-02 JP 11/15/02

REVIEWED AND APPROVED:

Ray Silver
City Administrator

INITIATED AND APPROVED:

FOR HZ
Planning Director

EXHIBITS

A. Vicinity Map.
B. Resolution Adopting General Plan Amendment No. 98-1. (Res No. 2002-100)
C. Ordinances for Zoning Map Amendment Nos. 96-5A and 96-5B. (Ord. Nos. 3584 and 3585)
D. Changes in Coastal Element/ Land Use Plan:
   Pg. IV-C-11 Discussion and Table
   Pg. IV-C-21 Figure C-26
E. Changes in Coastal Element/ Implementing Ordinances: DM 33Z
F. Resolution Certifying Final Environmental Impact Report No. 97-2 (Res No. 2002-97)

C3

EXHIBIT "A" to Res. No. 2002-123

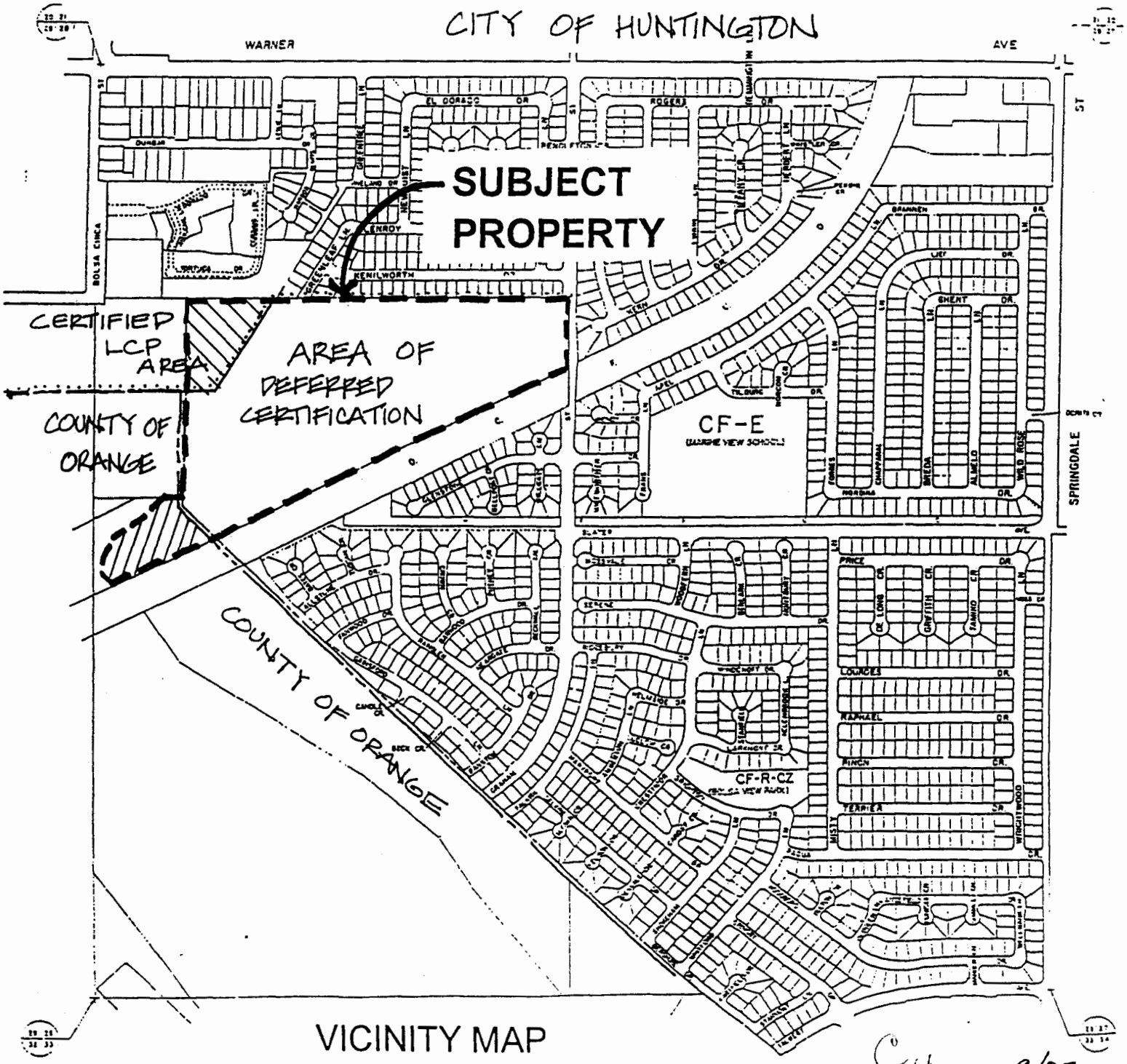
LANNING

SECTIONAL DISTRICT MAP • 28-5-11

CITY OF HUNTINGTON BEACH

ORANGE COUNTY, CALIFORNIA

USE OF PROPERTY MAP



VICINITY MAP

C4 8/02

City of Huntington Beach

2000 MAIN STREET CALIFORNIA 92648

DEPARTMENT OF PLANNING

Phone 536-5271
Fax 374-1540
374-1648

December 23, 2002

Steve Rynas
Orange County Area Supervisor
South Coast Area Office
California Coastal Commission
200 Oceangate, 10th Floor
Long Beach, CA 90802-4302

Re: **HUNTINGTON BEACH LOCAL COASTAL PROGRAM AMENDMENT NO. 02-2 (PARKSIDE ESTATES)**

Dear Mr. Rynas:

The City of Huntington Beach is transmitting Local Coastal Program Amendment (LCPA) No. 02-2 pursuant to City Council Resolution No. 2002-123 (HB LCPA No. 96-4). The Local Coastal Program Amendment is requested to amend the City's certified Local Coastal Program (Land Use Plan and Implementing Ordinances) relative to the adoption of a general plan amendment and zoning map amendment for approximately 50 acres in the Coastal Zone. Approximately 45 acres of the site are within the City of Huntington Beach and 4.9 acres of annexation area are within the County of Orange. Following is a summary of the project.

PARKSIDE ESTATES RESIDENTIAL AND OPEN SPACE AREA

Pursuant to Section 13551(a) of Article 15 of the California Coastal Commission Regulations, the City Council adopted Resolution No. 2002-100, and Ordinance Nos. 3584 and 3585 on October 21, 2002 (second reading of the Ordinances on November 6, 2002), and Resolution No. 2002-123 on November 18, 2002 to amend the City's certified Local Coastal Program to include a mix of three land uses for the subject site as follows:

LAND USE DESIGNATION	ACREAGE
Low Density Residential	38.4
Open Space – Park	8.2
Open Space – Conservation	3.3
TOTAL:	49.9

Copies of the relevant documents are enclosed. The proposed Local Coastal Program Amendment No. 02-2 is submitted as a major amendment that will take affect

HNB LCPA 1-06 Exhibit D 1/8

1. Project Description

The project site address is 17301 Graham Street. It is bounded by Graham Street to the east, East Garden Grove-Wintersburg Flood Control Channel to the south, unincorporated Bolsa Chica area to the west, and existing residential uses to the north. The proposed amendment would amend the Land Use Plan (LUP) and Implementing Ordinances for the subject 50-acre area as follows:

- The LUP currently designates the 45-acre portion of the property within the City as Open Space – Park and Area of Deferred Certification. The LUP would be amended to reflect approximately 36.8 acres of Low Density Residential (max. 7 u/nac) area, and 8.2 acres of Open Space – Park area. The zoning map would be changed to depict approximately 36.8 acres as RL-FP2-CZ (Low Density Residential with Floodplain and Coastal Zone Overlays), and 8.2 acres as OS-PR-CZ (Open Space – Parks and Recreation – Coastal Zone Overlay).

- For the 4.9-acre portion of the property within the County of Orange, the LUP would reflect 3.3 acres of Open Space – Conservation area and 1.6 acres of Low Density Residential (max 7 u/nac) area as a pre-annexation designation. The zoning map would depict 3.3 acres as CC-FP2-CZ (Coastal Conservation with Floodplain & Coastal Zone Overlays) and 1.6 acres as RL-7-FP2-CZ (Residential Low Density with Floodplain & Coastal Zone Overlays) as a pre-annexation designation.

Environmental Impact Report (EIR) No. 97-2 was processed concurrently with these entitlements and certified by the City Council on October 21, 2002. In addition, an annexation request to annex the 4.9 acre portion of the property into the City from the County of Orange was approved by the City Council on October 21, 2002.

There was an appeal of the Planning Commission's approval of two tentative tract maps, a conditional use permit, and coastal development permit that was conditionally approved by the City Council on October 21, 2002 in conjunction with the LCPA. These entitlements were conditionally approved including the Coastal Development Permit and do not become effective until such time as the LCPA is certified by the Coastal Commission.

The development project is a request to subdivide approximately 50 acres of property for development of 170 single family homes and dedicate an 8.2 (gross) acre neighborhood park. One tentative tract map is for a 162 single family residential lot subdivision on the 45 acre portion of the development site that is located in the City, and a separate tentative tract map is for an 8 single family residential lot subdivision on the 4.9 acre portion of the development site that is in the County. Approval of the annexation request by LAFCO is necessary for the County portion of the project to proceed. In the event that the annexation is not approved, an alternate layout on the tentative tract map has been conditionally approved that ensures that the project can be self-contained and function adequately within the City.

D2

The 50-acre site is owned by Shea Homes. Shea Homes intends to develop their site as soon as they receive the required approvals. The site has been used for farming since the 1950's.

2. General Plan Conformance

Although the majority of the site is within a non-certified area of the LCP, it has been zoned and general planned Low Density Residential and Open Space since the 1970's. In 1996, the City of Huntington Beach completed a comprehensive update to its General Plan, at which time it maintained the Low Density Residential and Open Space Land Use designations on the subject site within the City of Huntington Beach.

The proposed Local Coastal Program Amendment represents a change to the LUP (General Plan Amendment No. 98-1) and Implementing Ordinances (Zoning Map Amendment Nos. 96-5A & 5B) by expanding the amount of open space area within the City by 2.8 acres and adding a CZ (Coastal Zone) Overlay to the existing Low Density Residential zoning on the subject property. It was determined by the City Council that these entitlements are consistent with the goals, objectives and policies of the City's General Plan and certified LCP.

Goals and policies of the City's General Plan include:

Policy LU 9.3: Provide for the development of new residential subdivisions and projects that incorporate a diversity of uses and are configured to establish a distinct sense of neighborhood identity.

Objective LU 14.1: Preserve and acquire open spaces for the City's existing and future residents and provide, maintain and protect significant environmental resources, recreational opportunities and visual relief from development.

Policy LU 14.1.1: Accommodate the development of public parks, coastal and water-related occupational uses, and the conservation of environmental resources in areas designated for Open Space on the Land Use Map.

Goal LU 3: Achieve the logical, orderly, and beneficial expansion of the City's services and jurisdictional limits.

RSC Policy 2.1.3: Require parkland acquisitions to be fiscally efficient and beneficial to the needs of the community.

D3

Applicable Goals and Policies of the City's Coastal Element include:

- Develop a land use plan for the Coastal Zone that protects and enhances coastal resources, promotes public access and balances development with facility needs.
- Encouragement of alternatives to the private automobile for transportation to recreation areas.
- Preservation of adequate arterial capacities for recreational traffic.
- Protection of significant habitat areas requiring wetland enhancement and buffers in exchange for development rights.
- Improvement of the aesthetic and biological quality of wetland areas.
- Ensure that prior to approval of new development, that adequate sewage facilities can be provided to serve such development.
- Ensure that prior to approval of new development, that adequate drainage can be provided to serve such development.
- Ensure that prior to approval of new development, that adequate water service can be provided to serve such development.
- The City shall, at minimum, consider the following when evaluating annexation proposals in the coastal zone:

  a. Is the area to be annexed adjacent to existing corporate boundaries?

  b. Does/will the area to be annexed contain land uses that are compatible with City land uses?

  c. Does/will the area to be annexed contain land uses that have the ability to provide economic benefit to the City?

  d. Would the area to be annexed place an undue or excessive burden on the City's and/or other service provider's ability to provide services?

  e. Would the area to be annexed place an undue burden on school and other public services?

3. Coastal Issues

On September 10, 2002 and September 24, 2002, the Planning Commission held hearings to consider the Parkside Estates project. There were several people who spoke for and against the project. Neighbors who spoke in opposition cited concerns

D4

about traffic, storm water flooding, subsidence, fault lines, flood control channel capacity, liquefaction, Slater Pump capacity, and Fire Department response times.

The Planning Commission continued the project from the September 10, 2002 meeting and requested clarification regarding items pertaining to the Environmental Impact Report (EIR). Following the public hearing on September 24, 2002, the Planning Commission certified the EIR, and approved the subject entitlements.

At the October 21, 2002 City Council meeting there were 35 people who spoke to the Parkside project. The same issues raised at the Planning Commission meeting were raised at this meeting, including the issue of wetlands on the subject site.

The proposed LCPA does not conflict with the policies of the Coastal Element of the General Plan as described in Section 2 of this letter. Both State & Federal agencies that have jurisdictional authority over the determination of wetland existence on-site have made findings about the property. They concluded that the portion of the site within the City of Huntington Beach does not contain wetlands. They acknowledged that the County portion of the project site contains wetlands (estimated 0.2 acres of patchy pickleweed and 0.4 acres of EPA delineated pocket wetlands). Thus, the conclusion that 3.3 acres of the County portion is to be designated Open Space – Conservation. These 3.3 acres includes buffer areas.

In reference to water quality concerns there is a requirement for a Water Quality Management Plan showing conformance to the Orange County Drainage Area Management Plan and current National Pollution Discharge Elimination System (NPDES) requirements. It is required to be reviewed by the City and Orange County Coastkeepers prior to issuance of any grading or building permits.

In terms of coastal access, the project will not be gated, and there will be an 8.2 acre public park as well as conditions imposed requiring dedication of trails throughout the project and improvements to the trail adjacent to the flood control channel.

Finally, because the project is designed to be consistent with the General Plan for the City, the analysis has shown that there is adequate infrastructure in place or that can be constructed to serve the entire site. The proposed LCPA is submitted pursuant to Section 13511 of the Coastal Commission Administrative Regulations, which conforms to the requirements of Chapter 6 of the Coastal Act.

4. Compatibility with Surrounding Uses

The proposed LCPA will be compatible with existing land uses in the vicinity. The low density residential uses are consistent with the existing residential uses to the north, east and south. In addition, the project has been designed and EIR No. 97-2 includes mitigation measures to address potential impacts to residential uses to the north.

The existing 5.4-acre triangular area designated on the General Plan Land Use Map for a neighborhood park does not accommodate useable park area. The reconfiguration and expansion of this area proposed through the General Plan Amendment will provide

for a park that is 8.2± gross acres in size including 4.1± acres of bluff and down slopes and a 4.1± acre flat area at the base of the bluff, which will accommodate recreational activities.

The General Plan is also being amended to designate the 4.9-acre site proposed for annexation as a mix of RL-7 (Residential Low Density-maximum 7 units per acre), and OS-C (Open Space – Conservation). The proposed General Plan Amendment will permit a density that is consistent with surrounding land uses within the City, while preserving a portion of the area known to have sensitive biological resources. The Low Density Residential land use designation is located towards the east end of the annexed area, adjacent to the 45 acre parcel general planned and zoned for Low Density Residential. The westerly portion of the annexed parcel to be Open Space Conservation is compatible with the Bolsa Chica area.

5. Processing

The following is a summary of processing pursuant to Section 13552 (b) (c) of the California Coastal Commission Regulations concerning the adoption of the project and its relationship to other sections of the city's certified Local Coastal Program.

a. Staff determined, as required by the California Environmental Quality Act (CEQA), that an EIR was necessary for the project. EDAW, Inc. was hired to prepare EIR No. 97-2 to analyze the potential impacts of the project. A chronology of the procedure and public comment periods for the EIR is shown on pages 7-8 of the Huntington Beach Planning Commission Staff Report for EIR No. 97-2 dated September 10, 2002 (Enclosure No. 5). There was a scoping meeting to take comments on the Initial Study and Notice of Preparation (NOP) held on October 9, 1997, as well as a public information meetings on May 14, 1998 and July 25, 2001.

b. The proposed project was discussed at four (4) Planning Commission study sessions held on August 13, 2002, August 27, 2002, September 10, 2002, and September 24, 2002. The study sessions were open to the public.

c. The proposed project was discussed at two (2) Planning Commission public hearings held on September 10, 2002 and September 24, 2002. The public hearing was advertised in the City's usual local newspaper and notice sent to property owners and occupants within a 1000 foot radius, interested parties, applicant, and individuals/organizations that commented on the environmental documents.

d. The proposed project was discussed at one (1) City Council study session held on October 7, 2002. The study session was open to the public.

e. The proposed project was discussed at one (1) City Council public hearing held on October 21, 2002. The public hearing was advertised in the City's local newspaper and notice sent to property owners and occupants within a 1000-

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foot radius, interested parties, and individuals who spoke at the Planning Commission meetings.

6. Public Participation

All legal notices for the public hearings made reference to the future Local Coastal Program Amendment. All staff reports were made available for public review in the Planning Department and the Huntington Beach Public Library. During the public hearing process, staff made every effort to maximize public participation in the process. Pursuant to Section 13552 (a) of the Coastal Commission Administrative Regulations, enclosed are copies of the measures taken to ensure public participation, public hearing notices, mailing labels, and the minutes from the public hearings. Please refer to the enclosed public hearing minutes for the complete comments received at the public hearings.

Briefly stated, however, there were 17 speakers at the September 10, 2002 Planning Commission hearing, and 12 speakers at the September 24, 2002 Planning Commission hearing. Their comments focused on the flood zone designation, traffic impacts, subsidence and seismic activity, ponding on the site, dewatering, soil compaction, liquefaction, water quality and hydrology.

The attached submittal includes a list of items being provided to the Coastal Commission. Upon your review of the enclosed information, please call me if you need any additional information or clarification of the items provided. I will make myself available to meet with you to discuss or review any of the enclosed items at the earliest possible time. The City of Huntington Beach respectfully requests that the application be scheduled for the earliest possible Coastal Commission meeting. If you have any questions please contact Scott Hess, Planning Manager at (714) 536-5554.

Thank you for your prompt consideration of this matter.

Sincerely,

Howard Zelefsky
Planning Director

Enclosures
c: Scott Hess, Planning Manager
Mary Beth Broeren, Principal Planner
Ron Metzler, Shea Homes

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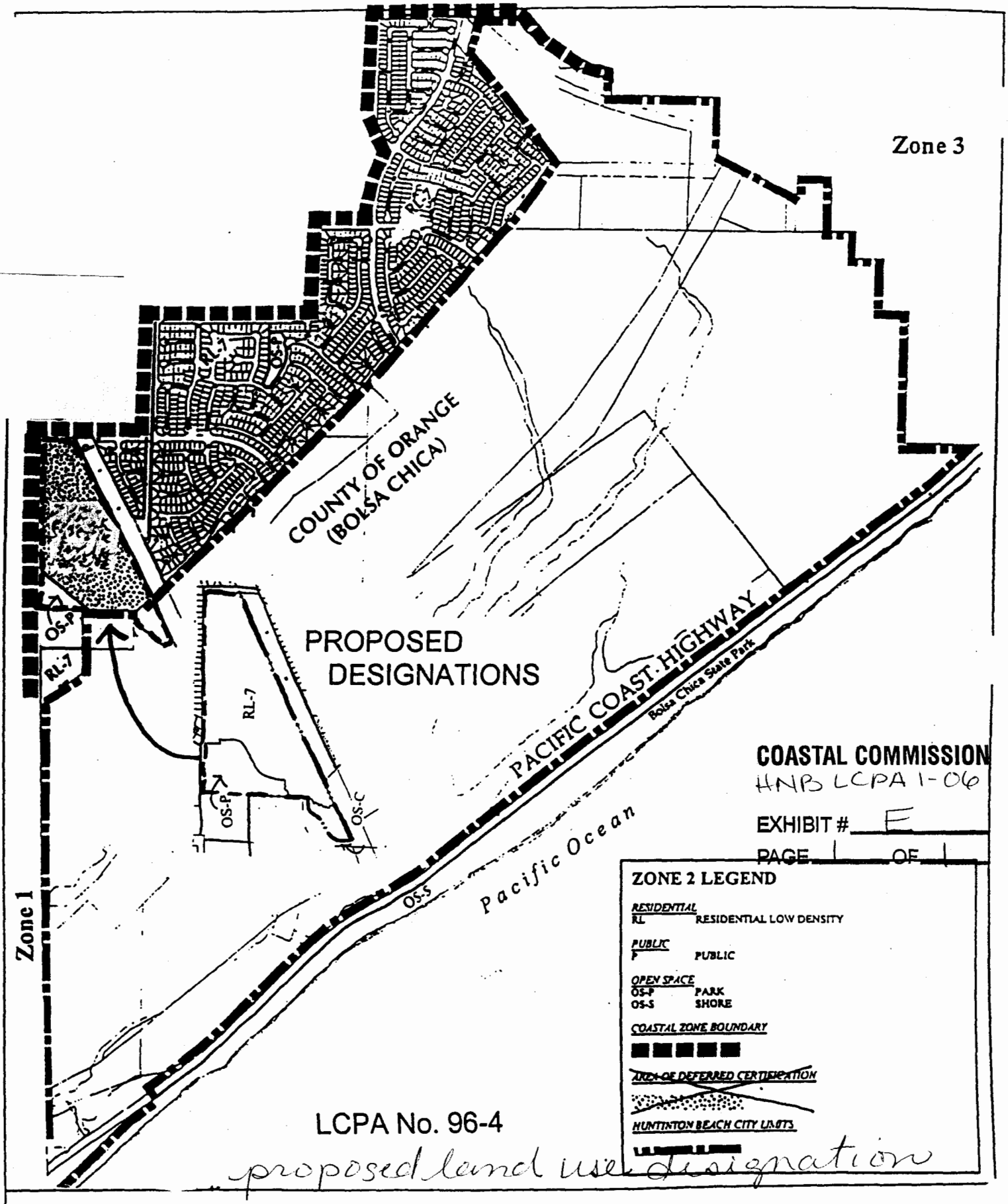
ENCLOSURES		DATES
1.	Statement of Action Letter from City Council with Minutes (LCPA No. 96-4).	December 18, 2002
2.	Resolution No. 2002-123 (LCPA No. 96-4) with attached Resolution No. 2002-100 (General Plan Amendment No. 98-1), Ordinance No. 3584 (adding "CZ" overlay to existing zoning and zoning 8.2 acres as Open Space – Park), Ordinance No. 3585 (pre-zoning the 4.9 acre portion of the property within the County of Orange to Coastal Conservation and Low Density Residential), and Resolution 2002-97 (certifying Final EIR No. 97-2).	November 18, 2002
3.	Local Coastal Program Amendment No. 96-4 Approved Request for Action City Council Report.	November 18, 2002
4.	General Plan Amendment No. 98-1, Zoning Map Amendment No. 96-5A and 96-5B, and Local Coastal Program Amendment No. 96-4 Approved Request for Action City Council Report (includes Planning Commission Staff Reports).	October 21, 2002
5.	EIR No. 97-2 Approved Request for Action City Council Report (includes Planning Commission Resolution, Planning Commission Staff Report dated September 10, 2002 with letters in opposition and/or support submitted to the Planning Commission before meeting, and Planning Commission Staff Report dated September 24, 2002 addressing the Planning Commission's concerns.	October 21, 2002
6.	Approved City Council Minutes	October 21, 2002
7.	Late Communications to City Council	October 21, 2002
8.	List of Comment Slips Received at City Council Meeting	October 21, 2002
9.	Notice of City Council Public Hearing, Proof of Publication, Copy of Mailing Labels.	October 10, 2002
10.	Mailing Labels to use for California Coastal Commission Hearing of all property owners and occupants within 1000 foot radius, interested parties, applicant, individuals/organizations that commented on the environmental documents, and those that spoke at the Planning Commission and City Council public hearings.	December 18, 2002
11.	Notice of Action Letters from Planning Commission for General Plan Amendment No. 98-1, Zoning Map Amendment No. 96-5A & 96-5B, Local Coastal Program Amendment No. 96-4, Annexation No. 98-1, and EIR No. 97-02.	September 26, 2002
12.	Parkside Estates Narrative Booklet.	August 28, 2002
13.	Approved Planning Commission Minutes.	September 24, 2002
14.	Approved Planning Commission Minutes.	September 10, 2002
15.	Notice of Planning Commission Public Hearing, Proof of Publication, Copy of Mailing Labels.	September 1, 2002
16.	Parkside Estates EIR No. 97-2: Volume I – Response to Comments on Draft EIR and New Alternatives to the Draft EIR.	July, 2002
17.	Parkside Estates EIR No. 97-2: Volume II – Final EIR.	July, 2002
18.	Parkside Estates EIR No. 97-2: Volume IIA – Final EIR Technical Appendices.	July, 2002
19.	Parkside Estates EIR No. 97-2: Volume III – Comment Cards and Letters; Public Information Meeting – May 14, 1998 and July 25, 2002.	July, 2002
20.	City of Huntington Beach Natural Resources Chapter Coastal Element.	November, 2001

D8



COASTAL COMMISSION
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EXHIBIT # E
PAGE 1 OF 1

HUNTINGTON BEACH COASTAL ZONE
ZONE 2 LAND USE PLAN

CITY OF HUNTINGTON BEACH COASTAL ELEMENT

EXISTING AND PROPOSED
LAND USE PLAN

NORTH

FIGURE C-6

EXHIBIT 'E'

PLANNING ZONING DM 33Z

SECTIONAL DISTRICT MAP • 28-5-11

CITY OF HUNTINGTON BEACH

ORANGE COUNTY, CALIFORNIA

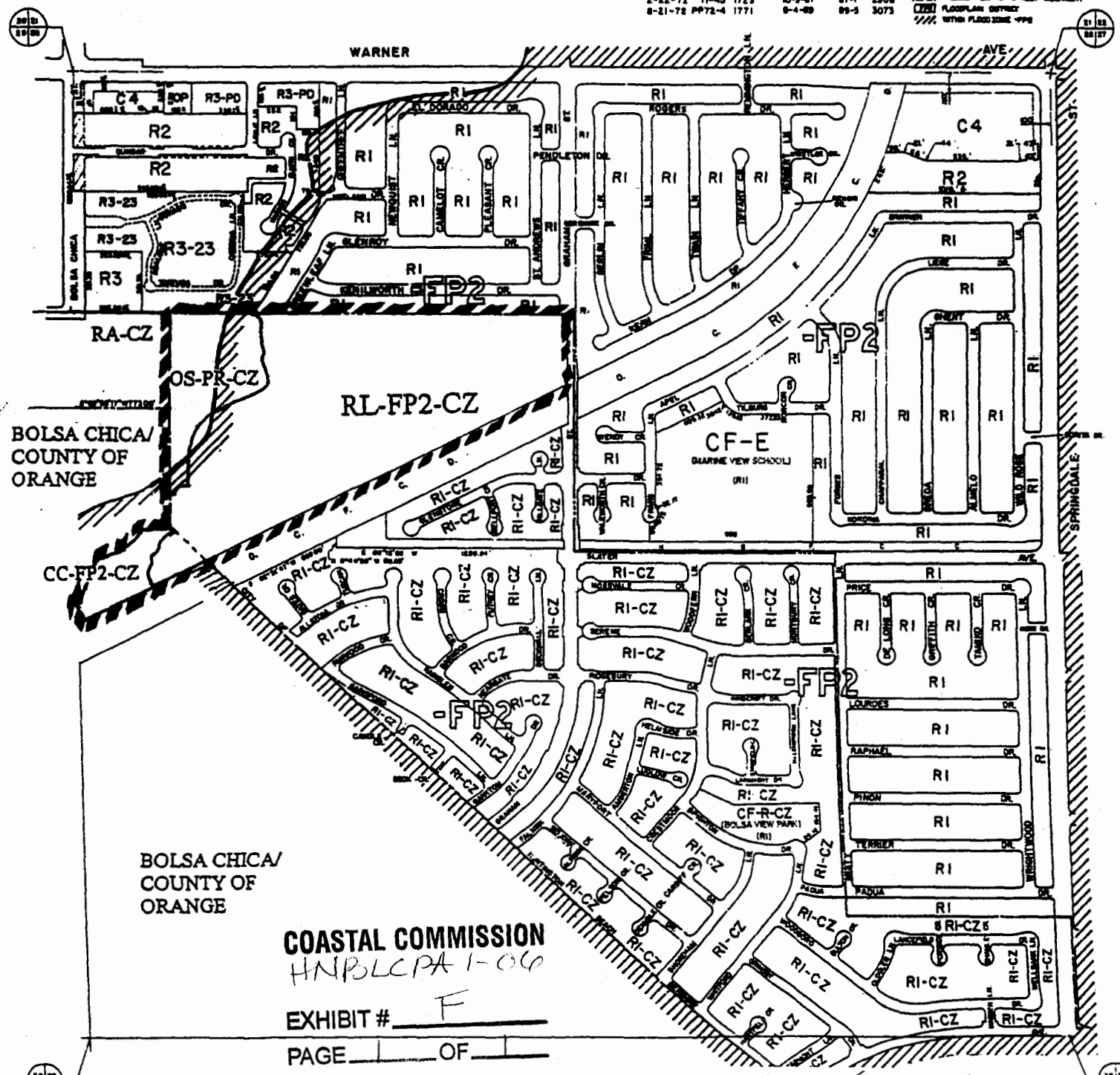
ADOPTED AUGUST 15, 1960

CITY COUNCIL ORDINANCE NO.

AMENDED	ZONE CASE	ORD. NO.	AMENDED	ZONE CASE	ORD. NO.
9-3-63	352	1000	10-16-72	71-20(L)	1781
10-7-63	365	1007	5-5-75	75-2	1978
4-6-64	396	1045	12-15-75	75-09	2029
5-18-64	426	1056	12-6-76	76-21	2133
4-5-65	505	1132	4-17-78	76-5	2279
10-18-65	526	1162	1-2-79	78-25	2330
6-6-66	66-16	1215	5-7-79	78-11A&B	2365
5-1-67	67-6	1318	5-7-79	79-2	2369
7-17-67	67-12	1339	9-15-81	81-4	2452
8-7-67	PP67-2	1343	7-2-84	84-7	2704
2-5-68	67-35	1369	8-20-84	84-13	2719
4-7-69	69-3	1467	4-1-85	85-1	2755
7-17-71	71-9	1659	1-17-85	FLOOD ZONE	2806
2-22-72	71-45	1723	10-5-87	87-1	2906
8-21-72	PP72-4	1771	9-4-89	89-5	3073

NOTE:
ALL DIMENSIONS ARE IN FEET
ANY ZONE ADJOINING ANY RIGHT OF WAY IS INTENDED TO EXTEND TO THE CENTER OF SUCH RIGHT OF WAY

LEGEND:
- SUBURBAN CLASSIFICATION
- RI LOW DENSITY RESIDENTIAL DISTRICT
- C4 HIGHWAY COMMERCIAL DISTRICT
- R3 MEDIUM-HIGH DENSITY RESIDENTIAL DISTRICT
- R2 MEDIUM DENSITY RESIDENTIAL DISTRICT
- OP OFFICE PROFESSIONAL DISTRICT
- RA RESIDENTIAL AGRICULTURAL DISTRICT
- CF-E COMMUNITY FACILITIES (EDUCATION) DISTRICT
- CF-R COMMUNITY FACILITIES (RECREATIONAL) DISTRICT
- CZ COASTAL ZONE SUFFIX
- COASTAL ZONE BOUNDARY
- SETBACK LINE
- ULTIMATE RIGHT OF WAY
- FREEZE PLAN OF STREET ALIGNMENT
- FP2 FLOODPLAIN DISTRICT
- WITHIN FLOOD ZONE VPS



COASTAL COMMISSION
HNBLCPA 1-06

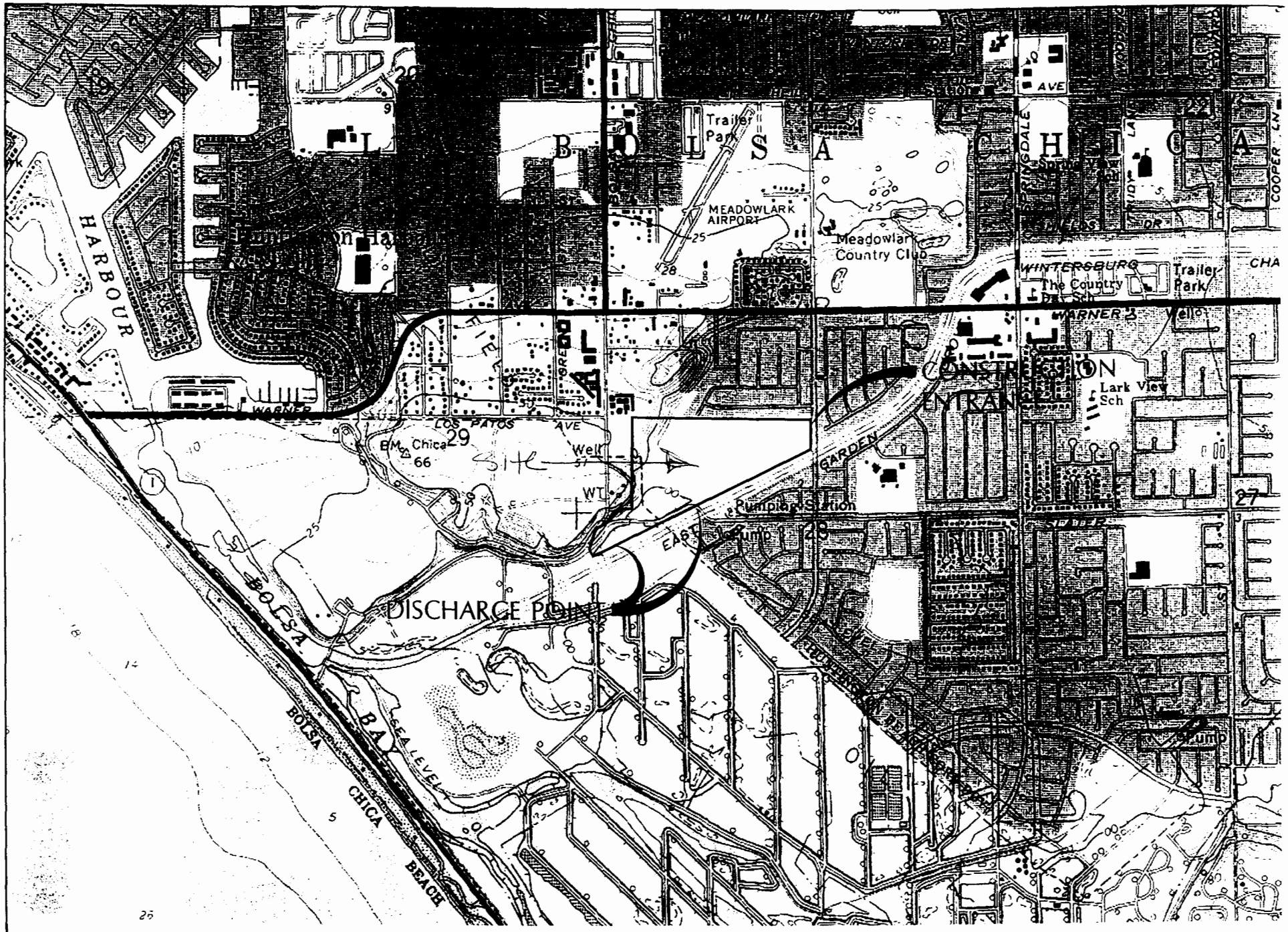
EXHIBIT # F

PAGE 1 OF 1

IMPLEMENTING ORDINANCES/ DM33Z (Revised)

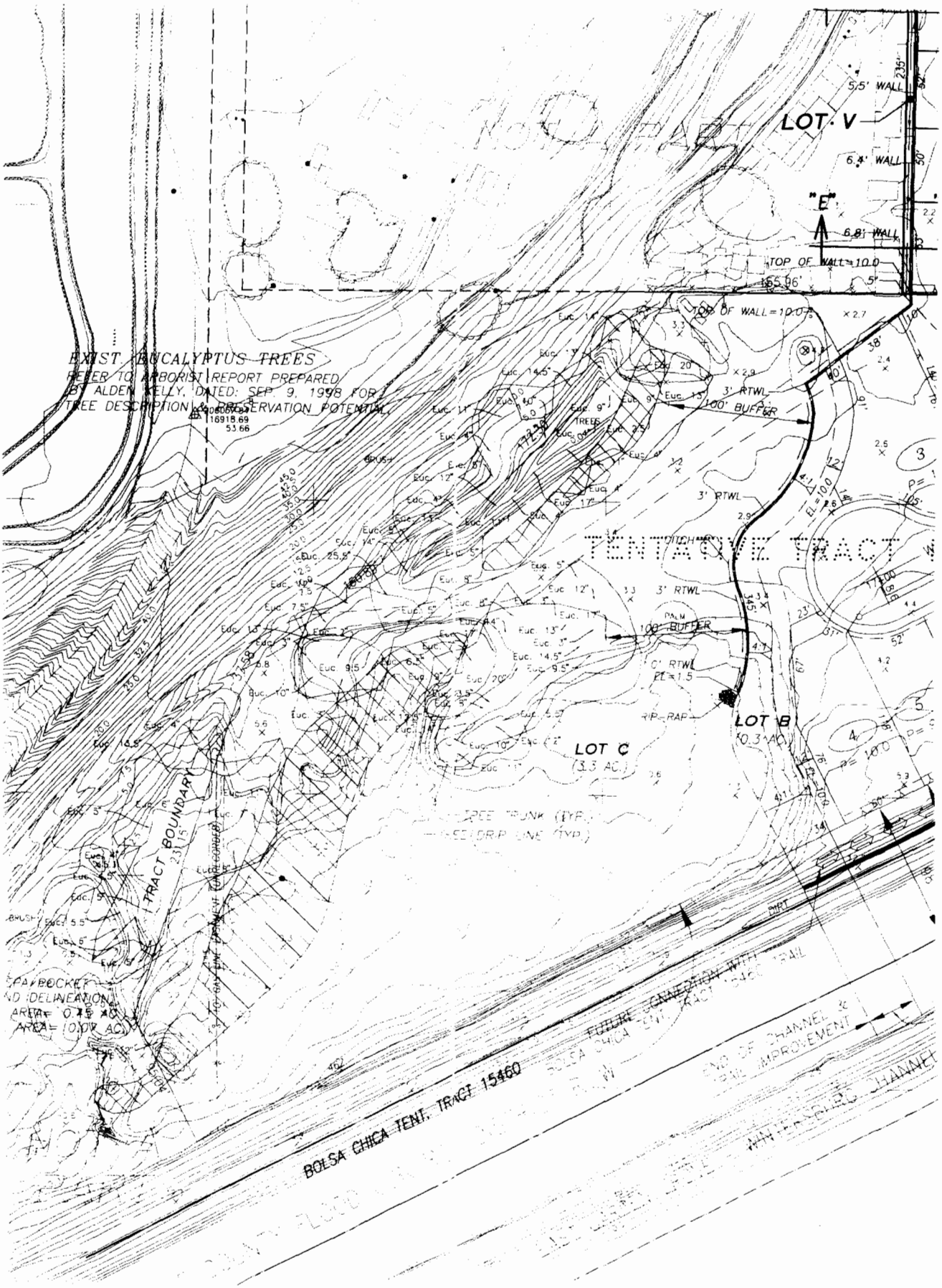
proposed zoning

Exhibit G



PREPARED BY:	PREPARED FOR:	DATE PREPARED:
[illegible]	SHEA HOMES	06/02/03

Exhibit H
HNB LCPA 1-04



CALIFORNIA COASTAL COMMISSION
45 FREMONT, SUITE 2000
SAN FRANCISCO, CA 94105-2219
VOICE AND TDD (415) 904-5200
FAX (415) 904-5400

24 July 2006

GEOTECHNICAL REVIEW MEMORANDUM

To: Meg Vaughn, Coastal Program Analyst
From: Mark Johnsson, Staff Geologist
Re: LCPA HNB-MAJ-LCPA1-06 and CDP 5-06-021 (Shea Homes)

With regard to the above-referenced project-driven LCPA and CDP application, I have reviewed the following documents:

1) Hunsakers and Associates 1997, "East Garden Grove - Wintersburg Channel (C05) 100-year inundation study for Tract 15377 & 15419, City of Huntington Beach", 9 p. hydrologic report dated 18 August 1997 and signed by S. E. Barnhart (CE 25167).

2) Hunsakers and Associates 1998, "Hydrology and hydraulic analysis for Tract 15377 & 15419, City of Huntington Beach", 4 p. hydrologic report dated 10 March 1998 and signed by S. E. Barnhart (CE 25167).

3) Pacific Soil Engineering 1998, "Preliminary geotechnical investigation, Proposed residential development, Tentative tract 15377, City of Huntington Beach, California and tentative tract 15419, County of Orange, California", 36 p. geotechnical report dated 2 February 1998 and signed by T. Wolfe (CEG 1626), M. and J. B. Castles (GE 192).

4) Pacific Soil Engineering 1999, "Response to comments pertaining to Parkside Estates EIR #97 Draft Environmental Impact Report, Tentative Tract 15377, City of Huntington Beach, California", 26 p. report dated 29 July 1999 and signed by M. F. Mills (CEG 994), J. B. Castles (GE 192) and T. Wolfe (CEG 1626), M.

5) Jordan, N.M., 2000, Diffusion Hydrodynamic Model: Using DHM rainfall-runoff output to estimate urban watershed existing condition hydrology: Journal of Floodplain Management, v. 1, p. 11-14.

6) Pacific Soil Engineering 2001, "Response to draft EIR comments, Parkside Estates, Tentative Tract 15377, City of Huntington Beach, California", 8 p. report dated 11 October 2001 and signed by J. B. Castles (GE 192).

7) Pacific Soil Engineering 2001, "Response to City of Huntington Beach regarding final EIR, Parkside Estates, Tentative Tract 15377, City of Huntington Beach, California", 3 p. report dated 12 October 2001 and signed by J. B. Castles (GE 192).

8) Pacific Soil Engineering 2002, "Response to City of Huntington Beach comments on Response to EIR Comments Document, Parkside Estates, City of Huntington Beach, California", 4 p. report dated 13 June 2002 and signed by J. B. Castles (GE 192).

9) Exponent 2002, "Consolidated report, FEMA submittals, detailed flood Insurance Study, Shea Homes Parkside Estates, Tentative tract Nos. 15377 & 15419, Expanded watershed analysis of East Garden Grove-Wintersburg Channel watershed from tide gates to I-405 freeway", 78 p. report dated 10 August 2002 and signed by Exponent.

10) Pacific Soil Engineering 2003, "Results of groundwater constituent testing, Parkside Estates Project, City of Huntington Beach, California", 1 p. report dated 5 August 2003 and signed by D. Obert and J. B. Castles (GE 192).

11) Pacific Soil Engineering 2004, "Summary of required grading operations and construction monitoring requirements, Parkside Estates, Tract 15377, City of Huntington Beach, California", 8 p. report dated 15 January 2004 and signed by J. B. Castles (GE 192).

12) Pacific Soil Engineering 2005, "Transmittal of additional information, temporary slope stability calculations, Parkside Estates, Tract 15377 in the City of Huntington Beach, California", 1 p. letter report to Mark Johnsson dated 26 April 2005 and signed by J. B. Castles (GE 192).

13) Exponent 2005, "Shea Homes topographic and displacement analysis with FEMA UNET Model", 7 p. report dated 18 May 2005 and signed by N. M. Jordan (PE).

14) Exponent 2006, "Correlation and frequency analysis of groundwater at Parkside Estates", 15 p. Technical memorandum dated 22 February 2006 and signed by N. M. Jordan (PE).

15) Exponent 2006, "Frequency analysis of precipitation and ponding at Parkside Estates", 16 p. Technical memorandum dated 22 February 2006 and signed by N. M. Jordan (PE).

16) Exponent 2006, "Summary response to Coastal Commission questions on flood control hydrology and hydraulics", 10 p. Technical

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memorandum dated 24 March 2006 and signed by N. M. Jordan (PE 44012).

I also have reviewed and commented on the draft Environmental Impact Report (EIR), and have reviewed the final EIR. In addition, I have had numerous meetings with the project proponent's technical consultants, especially Jim Castles and Mike Mills (geotechnical consultants with Pacific Soils Engineering), Neil Jordan (hydrologic consultant with Exponent), and Steve Barnhart (hydrologic consultant with Hunsakers and Associates). I have discussed hydrologic aspects of the project with Robert Riggetts of the City of Huntington Beach Public Works Department. In addition, I have visited both the subject site and the surrounding neighborhoods on several occasions.

This memo represents a review of both geotechnical and hydrologic issues raised by the proposed project.

Geomorphology of the site

The majority of the Parkside Estates site lies in the lowlands between Huntington Mesa and Bolsa Chica Mesa, known as the Bolsa Gap. In the recent geologic past, these lowlands, like the lowlands between Huntington Mesa and Costa Mesa, were occupied by the ancestral Santa Ana River, which shifted its position across these broad, low plains. Prior to channelization of the river and the construction of the East Garden Grove-Wintersburg Flood Control Channel, these lowlands constituted the broad floodplain of the lower Santa Ana River. Although the site is considered a floodplain geomorphologically, the levees associated with the East Garden Grove-Wintersburg Flood Control Channel prevent it from serving as a functional floodplain today. The northwestern corner of the property is crossed by a bluff, approximately 40 to 50 feet high, carved by the ancestral Santa Ana River. The portion of the site that is to be developed is a very flat surface at an elevation of one to two feet below sea level.

The site is underlain by 150-200 feet of very young marine and alluvial deposits, which are underlain unconformably by shallow marine sandstone, claystone and siltstone of the Pleistocene San Pedro Formation.

Geotechnical Issues

Geotechnical issues associated with the proposed project include ground shaking during a major earthquake on a nearby fault, possible surface rupture of the hypothesized Bolsa-Fairview Fault, liquefaction during such an earthquake, inadequate foundation support, the stability of both natural and temporarily excavated slopes, and tsunamis. Because the tsunami hazard is closely related to other hydrologic issues, I will discuss tsunamis in the "hydrology" section of this memo.

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Direct Seismic Hazards

The active Newport-Inglewood fault passes approximately 2000 feet south of the site. An earthquake along this fault would likely result in severe ground shaking and liquefaction of the soils at the site. The ground shaking hazards can be partially mitigated for by adherence to the Uniform Building Code given the design parameters outlined in reference (3), and the liquefaction hazard is discussed below.

Although no unequivocally active faults cross the site, the California Department of Water resources did map a strand of the Newport-Inglewood Fault across the site in 1968, and dubbed the strand the Bolsa-Fairview Fault. According to reference (3), the fault was located only indirectly on the basis of topographic expression, vertical offset of the base of the Bolsa aquifer, abrupt water quality changes between closely spaced wells, limited sea water intrusion northeast of the fault, and pumping test data. Accordingly, the State Geologist identified the fault as potentially active, and it was zoned as a Special Study Zone under the Alquist-Priolo Act. More recent studies by the California Division of Mines and Geology concluded that there was insufficient evidence to indicate that the fault was either active or, in fact, even that it exists, and the State Geologist accordingly de-listed the fault under the Alquist-Priolo Act. The studies undertaken as part of the EIR for the Parkside Estates project failed to yield any evidence for the existence of the fault. Accordingly, although the presence of the fault cannot be ruled out, the indirect evidence put forth by the Department of Water Resources seems insufficient tto warrant the inclusion of the fault as a an identified hazard.

Foundation support and liquefaction hazards

Reference (8) indicates that the soils at the site are susceptible to liquefaction during a major earthquake. In addition, the presence of peat could lead to settlement problems, because organic materials such as peat are subject to decay and volume loss with time. In order to mitigate for these hazards, Shea Homes proposes to overexcavate the entire site to depths as great as 17 feet below sea level, involving approximately 400,000 cubic yards of cut. Unsuitable fill materials such as peat would be exported, and the remainder of the material—as well as approximately 260,000 cubic yards of imported fill, would be compacted to suitable densities to provide structural support and to be invulnerable to liquefaction.

Several concerns arise regarding this overexcavation and recompaction. Since the excavations will extend well below sea level, dewatering operations will be necessary. Dewatering will be accomplished through a series of nine wells, 60 feet in depth, that are detailed in reference (11). This dewatering operation has the potential to result in lowering of ground water levels off-site, which could lead to settlement problems. In order to mitigate for this hazard, the excavations will take place in stages, with only narrow excavations open at any one time. In addition, a monitoring program will be in place (detailed in reference 11) to detect any settlement that occurs, allowing time for mitigation efforts. In my opinion, these efforts will greatly reduce the subsidence danger, but that some risk of subsidence of adjacent properties does remain. The

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water produced by the dewatering operations will be discharged into the storm water drainage system. Reference (10) demonstrates that this water is suitable for disposal into the ocean.

Slope stability

The backcuts of the excavations undertaken to mitigate the liquefaction hazard will extend to the Base of the north levee of the East Garden Grove Wintersburg Flood Control Channel. The loss of lateral support for the levee, especially if high pore water pressures persist due to the rapid removal of material in the cut, has the potential to destabilize the levees. Reference (12) contains slope stability calculations that demonstrate that even with the persistence of high pore pressures and loss of lateral support, the slope supporting the levee will have a factor of safety against sliding of 1.28, which is considered adequate for temporary excavations.

No slope stability calculations have been performed on the bluff in the northwestern corner of the site, and it is likely that it is only marginally stable. This area is planned for open space, however, so slope stability in this area is not a concern.

Hydrologic Issues

The Parkside Estates site is, geomorphologically, a flood plain. However, construction of the levees associated with the East Garden Grove Wintersburg Flood Control Channel have functionally isolated the river channel from the flood plain. Moreover, the Parkside Estates site lies at elevations of 1 to 2 feet below sea level. Areas of the surrounding neighborhoods lie at elevations of as low as 5 feet below sea level. Low berms in the Bolsa Chica lowlands, in addition to the East Garden Grove Wintersburg Flood Control Channel levees, protect these neighborhoods from tidal flooding. Storm water must be collected through a series of storm drains lying well below sea level, and pumped up into the East Garden Grove Wintersburg Flood Control Channel through a forebay at the Slater Pump station, which is on the south side of the flood control channel adjacent to the Parkside Estates parcel.

The capacity of the existing flood control channel is insufficient to carry the 100-year flood event. References (1) and (2) conclude that the channel will carry only about 4,200 cfs and will overflow in a 100 year event. Because the south levee is mostly lower than the north, more water would overflow to the south, and into the Bolsa Chica wetlands, than to the north. Nevertheless a total of about 52 acre feet would overtop the north levee in a 100-year flood event.

In fact, overtopping of the levees will likely result in their complete failure, with a resultant loss of capacity of the flood control channel and inundation by ocean waters.

Future development in this challenging environment must be undertaken to assure safety given inevitable flooding both from surface runoff and tidal surges and/or tsunamis.

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Background

The January 1997 Flood Insurance Rate Map (FIRM), issued by the Federal Emergency Management Agency (FEMA) designated the project site as an A99 zone. This designation applies to parts of the 100-year flood plain that are protected by a Federal flood protection system (in this case, The East Garden Grove Wintersburg Flood Control Channel). Because the A99 zone was considered an ”interim“ zone pending completion of the Santa Ana River project, the local authority (the City of Huntington Beach) had the discretion to dictate minimum pad elevations for the project. At the time the draft EIR was prepared, the City of Huntington Beach required minimum pad elevations for the project site to be 1.00 foot (NAVD 88 datum).

Subsequent to completion of the Santa Ana River flood control improvements in 1999, FEMA required the Orange County Flood Control District to conduct a new analysis of the watershed. The Orange County Flood Control District commissioned WEST Consultants to do a detailed study. Instead, WEST, at the direction of the County, provided an “approximate” watershed analysis. Subsequently, in June 2000, new base flood elevation contours were “informally” produced by the County of Orange from the WEST study. These new informal, non-published or “unofficial” base flood elevation contours were made available to the City of Huntington Beach on an information basis to establish minimum pad elevations for new developments within the watershed study area. The City's interpretation of the base flood contours required pad elevations for the Parkside Estates site that ranged between 10.9 feet and 11.4 feet (NAVD 88). FEMA then issued a Letter of Map Revision (LOMR) which became effective June 14, 2000 along with a revised Flood Insurance Rate Map based on the City’s interpretation of the WEST study.

However, Shea Homes objected to the use of an “approximate” study to establish Base Flood Elevations. They commissioned Exponent to conduct a “new focused detailed flood insurance study” to determine the Base Flood Elevation for the Parkside Estates site (summarized in reference 9). The Exponent analysis yielded a Base Flood Elevation of 4.5 feet (NAVD 88). The minimum pad elevations are required by the City to be one foot above the minimum Base Flood Elevation, or 5.5 feet (NAVD 88).

In February 2001, Shea Homes submitted a request for a Conditional Letter of Map Revision (CLOMR) application to FEMA for approval of the lower elevations. FEMA granted the CLMOR on 6 June 2002.

Mark Bixby and others have objected to this CLOMR on the basis of: 1) The East Garden Grove Wintersburg Flood Control Channel does not have the capacity to carry the 100-year flood, and the County would require throttling back of pumps that would be draining Parkside; accordingly Base Flood Elevations calculated assuming those pumps running at full capacity are in error, and 2) documented siltation and vegetation growing in the East Garden Grove Wintersburg Flood Control Channel decreases its capacity relative to the assumptions in the hydrological studies.

I have pursued these issues with Neil Jordan of Exponent and Steve Barnhart of Hunsakers and Associates, together with representatives of the City of Huntington Beach. It has been demonstrated to my satisfaction (references 9 and 16) that the detailed flood insurance study conducted by Exponent made use of many diverse hydrologic models that included complete

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failure of the East Garden Grove Wintersburg Flood Control Channel levees, failure of the pumps, and variations in timing of the failures of both levees and pumps. The Base Flood Elevation determined in this study is the worst case ponding elevations of all of these models. Accordingly, I feel that the 100-year Base Flood Elevations for the Parkside Estate site determined in reference (9) are consistent with FEMA policies and assure the safety of the site during a 100-year flood event.

As for the siltation and vegetation in the East Garden Grove Wintersburg Flood Control Channel that Mark Bixby documents, I concur that these materials lower the carrying capacity of these channels. Although these materials would lower the capacity of the channels to carry small or moderate-level flows, in the high flows (~4000 cubic feet per second) corresponding to bank-full discharge, these materials would be flushed from the channel.

Elevating the site above Base Flood Elevation

In order to concur with City and FEMA requirements, final building pad elevations must be one foot above the Base Flood Elevation. The proposed grading plan has final pad elevations ranging from 5.5 feet to 11.4 feet above sea level. Given that the existing site lies between 1 and 2 feet below sea level, these elevations are achieved by adding approximately 260,000 cubic yards of fill to the site. Actually, as described above, overexcavation to depths as great as 17 feet below sea level is necessary to mitigate the liquefaction hazard. Accordingly, development of the site requires approximately 400,000 cubic yards of cut and 660,000 cubic yards of fill, representing significant landform alteration.

In general, use of fill to elevate a building site above expected flood levels is poor planning practice. The volume of fill added to the site represents the volume of floodwater that will be displaced into neighboring areas. The Parkside Estates site, at 1 to 2 feet below sea level, is at a higher elevation than the lowest portions of the surrounding neighborhoods, where streets are at elevations as low as 5 feet below sea level. Building pads in these neighborhoods generally are higher than streets, at elevations of from one foot below sea level to 4 feet above sea level. If no mitigation were undertaken, flooding of these neighborhoods would be exacerbated by the addition of fill at the Parkside Estates site.

Tidal Flooding

The area to the southwest of the Parkside Estates site, north of the East Garden Grove Wintersburg Flood Control Channel and south of the Bolsa Chica mesa, is a lowland that is susceptible to tidal flooding. This susceptibility will be increased with the construction of a future tidal inlet as part of the Bolsa Chica wetlands restoration. In fact, according to reference (9), some 170 acres of the watershed, much of which is developed, would be threatened by tidal flooding by the restoration. This area would be protected only by low berms supporting oil field roads at elevations of less than 4 feet above sea level.

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Improvements to area drainage systems

Shea Homes has proposed to make several improvements to the area drainage system. These include: 1) improving the capacity and stability of the East Garden Grove Wintersburg Flood Control Channel, probably by widening it and by installing a sheet pile wall for levee support; 2) Making changes to storm drains under Kenilworth Drive and Graham Streets, improving their capacity; 3) Upgrading the Slater Pump Station by installing two more pumps, and 4) constructing a "Vegetated Flood Protection Feature" (essentially a vegetated berm) at an elevation of 11 feet above sea level between the bluff and the north levee of the East Garden Grove Wintersburg Flood Control Channel to prevent tidal flooding of the Parkside Estates site as well as 170 acres of the surrounding neighborhoods. Together, these improvements more than mitigate for the lost flood water storage caused by the addition of fill to the Parkside Estates site. According to references (9) (13) and (16), these improvements would remove 7000 homes from the functional flood plain, and would reduce flood elevations throughout the watershed. Still, overtopping of the East Garden Grove Wintersburg Flood Control Channel levees upstream of the Parkside Estates would occur in a 100-year event if these levees are not improved in a similar manner to that being done adjacent to Parkside Estates. These improvements are the responsibility of the County of Orange, and FEMA has directed the County to make these improvements. Even without these improvements, however, the proposed improvements at the Parkside Estates site would ensure that the Parkside Estates building pads would lie above the 100-year Base Flood Elevation, as required by FEMA.

Tsunamis

The Huntington Beach lowlands are quite vulnerable to a major tsunami. A tsunami that overtopped the low berms associated with the Pacific Coast Highway and the oil field roads in the Bolsa Chica wetlands could inundate a large area of the lowlands, much of which lies below sea level. The proposed "vegetated flood protection feature" and the improvements to the north levee of the East Garden Grove Wintersburg Flood Control Channel, together with the increased pad elevation, will lower the vulnerability of the Parkside Estates site. Although the placement of fill on the site would displace flood waters into the surrounding neighborhood during a major tsunami, the "vegetated flood protection feature" does lower the susceptibility of this area to smaller tsunamis.

Conclusions

In summary, the Parkside Estates is not suitable for residential development without fairly extensive mitigation measures, especially for the liquefaction and flood hazards. Shea Homes' planned method of remediation involves extensive landform alteration in the form of adding fill to raise the site above Base Flood Elevation. Although this is not a generally recommended method of mitigating a flooding hazard due to the effects it can have on adjacent areas, the planned drainage system improvements more than mitigate for these effects. The necessary excavations and dewatering operations have the capacity to induce subsidence or other instability in adjacent sites, but these effects will be mitigated by doing the excavation in stages and by

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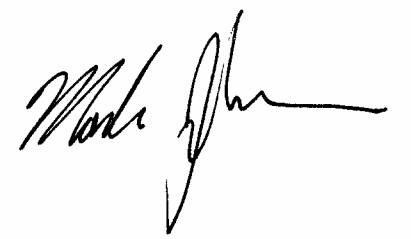
careful monitoring. The site will experience strong ground shaking during a major earthquake. Early reports that an active fault crosses the site cannot, however, be supported by the data currently available.

I hope that this review is helpful. Please contact me if you have additional questions

Sincerely,



Mark Johnsson, Ph.D., CEG, CHG
Staff Geologist

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California Coastal Commission

County of Orange

Public Facilities & Resources Department

John W. Sibley, Director

January 8, 1998

Mr. Jim Barnes
City of Huntington Beach
2000 Main Street
Huntington Beach, CA 92648

SUBJECT: Proposed Class I bikeway along the Wintersburg Channel

Dear Mr. Barnes:

This is in response to your verbal request for information on regional bikeway planning in the vicinity of the proposed Shea Homes project, on the north side of the East Garden Grove-Wintersburg Channel. The Commuter Bikeways Strategic Plan (CBSP) for Orange County depicts a proposed regional Class I (paved off-road) bikeway along the Slater Storm Channel, that continues along the Wintersburg Channel and connects to the off-road bikeway along the west side of Pacific Coast Highway (PCH). Currently a portion of this route exists along the Slater Storm Channel.

Although the CBSP depicts the bikeway along the entire length of the Wintersburg Channel through the Bolsa Chica area, land use planning for the wetlands requires the removal of the westerly portion of the levees berming the channel, and the relocation of the proposed Class I bikeway route to the northern perimeter of Bolsa Chica, as depicted in the enclosed exhibit from the Land Use Plan. The green highlighted segment in this exhibit identifies an error. Per Ron Tippets of the County's Planning and Development Services Department, this segment should have been identified as part of the regional Class I bikeway route.

Regarding the City's proposal to continue the Class I bikeway northerly along the Wintersburg Channel to Graham Street: the County supports this. It would provide an excellent bikeway connection between the City's road system and the off-road wetlands perimeter route. (We suggest referring to this entire route---between Graham Street and PCH---as the "Bolsa Chica Bikeway".)

I hope this has helped to answer your questions. Should you need additional information, please call Sherri Miller of my staff at 834-3137.

COASTAL COMMISSION
HNB LCPA 1-06

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Sincerely,

Jeff Dickman
Chief, HBP/Trail Planning & Implementation

SM:sm

LOCATION:
300 N. FLOWER ST

MAILING ADDRESS:
P.O. BOX 4048

TELEPHONE:
(714) 834-2300

WINTERSBURG BIKEW

County of Orange

MEMO

DATE: May 6, 1998

TO: Wayne Johnson, HBP/Facilities Development

FROM: Jeff Dickman, Chief, HBP/Trail Planning & Implementation

SUBJECT: Shea Homes/Parkside Estates Subdivision Draft EIR

We have reviewed the subject draft EIR and offer the following comments:

Exhibits 6b and 6c-1, Section "A"-"A": The label "Proposed Trail" should be changed to "Proposed Class I Bikeway". Also, the standard width for a Class I bikeway is 14 feet. This includes 10 feet of bikeway surface and at least 2 feet of clearance on each side.

Page 3-14, Park/Open Space Uses: We suggest linking the proposed park to a Class I (paved off-road) bikeway along the Wintersburg Channel, via a Class I connector bikeway.

Page 3-30, Project Objectives (Applicant): We suggest adding the following: "Provide a Class I bikeway connecting the project site to Graham Street, the proposed local park, and the future Bolsa Chica open space trails/bikeways system".

Exhibit 25: We suggest including an additional exhibit depicting the subject project's Class I bikeway network (see our comments above).

Class I bikeways help to mitigate traffic congestion, noise, and air pollution by promoting alternative modes of transportation and recreation.

If you have any questions, please call Sherri Miller at X3137.

SM:sm

J2

County of Orange

Public Facilities & Resources Department

John W. Sibley, Director

FEB 13 1998

Robert Eichblatt, City Engineer
City of Huntington Beach
Public Works Department
P.O. Box 190
Huntington Beach, CA 92648

Subject: East Garden Grove-Wintersburg Channel - Tentative Tract No. 15377 - Shea Parcel

Dear Mr. Eichblatt:

In response to your request we provide the follwing comments on subject TT15377.

1. The City and County comments on the EIR for this tract requires the developer to reconstruct the northerly levee of East Garden Grove-Wintersburg Channel (C05) consistent with the project report recommended channel section to convey the approved 100-year design discharge. Section A-A shown on the map submitted is inconsistent with the project report recommendations.

2. It is important to note that reconstructing the northerly levee alone might be insufficient to remove the subject tract from a FEMA flood plain. The Santa Ana River flood plain is anticipated to be removed only around year 2000. A residual flood plain study being conducted currently by the County might conclude that flood plain from C05 and local drainage might continue to remain at the site of the tract. Consequently, FEMA flood insurance regulations will apply if the area is not completely out of a floodplain.

3. Certification of the reconstructed levee by FEMA in accordance with 44 CFR 65.10(e) may also not be possible if the levee does not provide the required flood protection by removing the subject tract from the floodplain.

4. The developer's engineer stated at a meeting held regarding this matter that a conveyance structure significantly larger than the proposed 78-inch RCP will be located beneath the flood control channel to drain the tract. The size of the structure shown on the submitted map could therefore be different from that which is being proposed.

5. Work within Orange County Flood Control District (OCFCD) right of way will require a permit from our Real Property Division.

6. A bicycle trail along the C05 north levee maintenance road will be required. Conceptual approval for such a trail, subject to permitting details, has been provided by Ms. Sherri Miller of Harbors Beaches & Parks . Ms. Miller may be reached at 714-834-3137 to discuss trail issues.

If you have questions regarding this letter, please contact Neil Jordan at 714-834-3843.

Very truly yours,

for H. I. Nakasone, Manager
Program Development Division

J3

NJ:RSB:cd
cc: Sherri Miller, OC Harbors, Beaches and Parks
Ron Tippets, PDSD/EPS/Public Projects

Pfr175/98012.wd/cd010898

LOCATION:
300 N. FLOWER ST
SANTA ANA, CALIFORNIA

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M E M O R A N D U M

FROM: John Dixon, Ph.D.
Ecologist / Wetland Coordinator

TO: Meg Vaughn

SUBJECT: Wetlands at Shea Homes Parkside

DATE: July 27, 2006

Documents reviewed:

Barnes, J.R. (City of Huntington Beach). January 8, 1998. Letter to T. Dickerson (CDFG) re: "Request for comment on Shea Homes property wetlands status."

Bilhorn, T.W. (Earth Science Consultant). September 1986a. Seasonal variations in the extent of ponded surface water in the Bolsa Chica lowland, Orange County, California. A report to Signal Bolsa Corporation.

Bilhorn, T.W. 1986b. Shallow ground water system of the Bolsa Chica lowland, Orange County, California. A report to Signal Bolsa Corporation. [Not held; cited in Sanders (1987) and EPA (1989).]

Bilhorn, T.W. June 1987. Agricultural area delineation, Bolsa Chica, Orange County, California. A report to Signal Bolsa Corporation.

Bilhorn, T.W. February 25, 1995. Hydrology and cartography, Bolsa Chica Area, California. Supportive information to a Section 404 delineation. A report to D.R. Sanders & Associates.

Bixby, M. 2005. Ponding at Shea Parkside. A website containing ground-level and aerial photographs of the agricultural area and the former county parcel owned by Shea Homes (http://www.bixby.org/parkside/multimedia/ponding/index.html).

Bomkamp, T. (Glenn Lukos Associates). (May 7) 2005a. Memorandum to J. Dixon (CCC) re: "Areas requiring clarification within May 4, 2005, technical memorandum regarding application of atypical situation methodology for Parkside Estates.

Bomkamp, T. (June 8) 2005b. Letter to J. Dixon (CCC) re: "Analysis of 'Atypical Situation' methodology and hydrology on the Parkside Estates site, based on historic and existing conditions."

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Introduction

Any useful wetland analysis of the Shea Homes property (Figure 1) in Huntington Beach must attempt to answer the question, "Are any portions of the property wet enough long enough and frequently enough to promote the formation of hydric soils or to support the growth of a preponderance[1] of wetland plant species?" If the answer is "yes," then such areas meet the definition[2] of "wetland" under the Coastal Act and the Commission's Regulations. Unfortunately, wetland delineation at the Shea Homes site is difficult because (1) the site has been farmed for many years and both native and exotic non-crop plants are routinely removed; therefore, the absence of wetland vegetation is not informative, (2) although historically saltmarsh with hydric soils, the site is now dependent on rainfall for hydrology and the soil is repeatedly disturbed by plowing; therefore, neither the presence nor the absence of the usual physical indicators of wetland soils is easily interpretable, and (3) there are no long-term records of inundation or saturation. There is no entirely satisfactory solution to these problems. However, the hydrological character of the site can be inferred from photographs and rainfall records and the general type of vegetation (wetland or upland) that would develop in the absence of farming can be inferred from the character of a nearby site that is topographically and hydrologically similar, but generally not farmed.

Historical Background

The Bolsa Chica lowland was created by the down-cutting of the Santa Ana River prior to its change in course in the late 1800s. The wetlands once encompassed over 2000 acres, including the current Shea Homes property. Remnants of sinuous channels from the historical saltmarsh are still present in the portions of the lowland that are presently undergoing restoration and the ghosts of such channels can be seen on aerial photographs of the Shea Homes property as dark outlines that probably reflect residual differences in soil texture and moisture retention. As late as 1873, much of the area was still a tidal lagoon. However, significant anthropogenic impacts began toward the end of the 19th century. Since that time, the ocean inlet was closed, much of the wetlands was diked and filled for oil field construction, the East Garden Grove-Wintersburg Flood Control Channel was constructed, and residential neighborhoods replaced portions of the historical wetlands that are adjacent to the Shea Homes property. The Shea Homes property is the most constrained of the still-extant portions of the historical Bolsa Chica wetlands. It is bounded on the north by residential development, the final portion of which was completed around 1985. It is bounded on the east by Graham Street, on the south by the flood control channel, and on the west by the Bolsa Chica mesa and an elevated area that prevents runoff from most of the site

[1] "Preponderance" is defined as more than 50 % of the dominant species present (1987 Army Corps of Engineers Wetland Delineation Manual).

[2] For an area to meet the definition of "wetland" recognized by the Army Corps of Engineers and the U.S. Environmental Protection Agency, there must be field evidence of a preponderance of wetland plants, of hydric soils, and of wetland hydrology. The California Department of Fish and Game and the California Coastal Commission employ the same field methods as do the federal agencies, but require evidence of only one of the three wetland parameters for an area to be identified as a "wetland."

from draining to wetlands farther to the west. The topography of the site has been altered in partially documented ways by agricultural operations. The area has long been cutoff from tidal waters. Today, the only source of water is direct rainfall and runoff from the higher to the lower portions of the site.

Wetland Delineations

Extensive wetland delineation work was conducted at Bolsa Chica during the 1980s[3] by both the U. S. Environmental Protection Agency (EPA) and Signal Bolsa Corporation. In 1987, Dr. Terry Huffman, working for the EPA, identified 1,270 acres of wetlands and "other waters of the United States" within his approximately 1,400-ac study area, which did not include the Shea Homes property (Huffman 1987, Figure 3). Although not part of his study area, Huffman (1987, p.47 & Figure 15) noted that he found wetlands on the current Shea Homes property during an examination of upslope drainage patterns and refers to the area as "seasonally flooded agricultural lands." However, he did not depict the wetlands on a map. Also in 1987, Dr. Dana Sanders, working for Signal Bolsa Corporation, identified 826 acres of wetlands and "other waters of the United States within a study area of about 1,654 acres, which did include the current Shea Homes property where he mapped about 8 acres of wetlands, based largely on Bilhorn's (1987) wetland study (Figure 2).

After reviewing all the available evidence, EPA identified 927 acres of wetlands and other waters of the United States, including about 8 acres on the current Shea Homes property as identified by Bilhorn (1987) and Sanders (1987). Bilhorn (1987) based his conclusions on (1) a field examination (including test pits and borings) on April 15, 1987, (2) nearby rainfall records, (3) a 1980 topographic map, (4) approximately monthly low altitude, oblique aerial photographs covering the period 1981 - 1987, (5) historical aerial photos dating to 1927, and (6) the documented history of land alterations affecting the area. His wetland map was based on the wetted area shown on a 1982 aerial photograph (selected to represent a normal rainfall year) and the 1980 elevations. Referring to the agricultural portion of what is now the Shea Homes Property, Sanders (1987) found that [emphasis added]:

> "Surface elevations of much of the subunit are below sea level. Based on application of the multiparameter approach, the entire subunit (43.8 acres) is presently uplands. This is due to the absence of wetlands hydrology in most of the subunit and hydrophytic vegetation throughout. However**, it was determined that a portion of the subunit would probably be sufficiently wet to support**

[3] During this period, the Army Corps of Engineers was developing the methods that became codified in the 1987 Corps of Engineers Wetlands Delineation Manual and three of the four principal authors of that manual actually did field work at Bolsa Chica as paid consultants for either the EPA or for the major property owner, Signal Bolsa Corporation. At that time, the parcel now owned by Shea Homes was the property of the Metropolitan Water District of Southern California and the City parcel (Figure 1) had been farmed since the mid-1930s. The EPA, Region IX contracted with Dr. Terry Huffman, the co-author of the 1987 Manual who had developed the three-parameter approach to wetland delineation, to conduct a delineation of wetlands and other waters of the United States at Bolsa Chica. Other members of the EPA Technical advisory team included W. Blake Parker, who had developed hydric soil concepts while on loan to the Army Corps of Engineers from the Soil Conservation Service and who also co-authored the 1987 Manual, and William Sipple, the author of the 1988 EPA Wetland Identification and Delineation Manual. Dr. Dana Sanders, another co-author and the Technical Editor of the 1987 Corps Manual, was hired by Signal Bolsa Corporation to conduct an independent delineation.

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> **hydrophytic vegetation if the farming activities were to cease. Soils in a major portion of the root zone during years of near-normal rainfall would not be saturated by rise of water from the water table due to capillary action. The only source of sufficient water to saturate the soils in a major portion of the root zone in this subunit is from surface water runoff following significant rainfall events.** Only depressional areas would be saturated sufficiently to support the growth of hydrophytic vegetation."

EPA (1989) concluded that, "…portions of the agricultural fields would be inundated or saturated at a frequency and duration sufficient to support a prevalence of hydrophytic vegetation in the absence of 404(f)-exempted farming activities (see Bilhorn 1987) and are, therefore, wetlands subject to Section 404 regulation." These various conclusions were all based on the assumption that there was no wetland hydrology resulting from a seasonally high water table, but rather that direct rainfall and local runoff into depressions was sufficient to provide wetland conditions. There have been no significant alterations to the overall hydrology at the site since 1987.

In the 1988 National Food Security Act Manual, the Soil Conservation Service defined "prior converted croplands" as wetlands that, prior to December 23, 1985, were both cropped and manipulated to remove excess water to the extent that they no longer exhibit important wetland values. Specifically, such areas are inundated for less than 15 consecutive days during the growing season (all year in coastal California). In a Regulatory Guidance Letter (RGL 90-07) dated September 26, 1990, the Army Corps of Engineers declared that if an area meets the definition of "prior converted croplands," the alterations are generally permanent and constitute "normal circumstances," which makes the altered conditions relevant to the areas' wetland status under federal law, as the Army Corps' definition of wetlands (see 33 C.F.R. § 328.3(b)) relies on their function under "normal circumstances." Therefore, because such agricultural areas lack a "prevalence of hydrophytic vegetation" as a result of the farming activities, they would not be subject to regulation under Section 404 of the Clean Water Act. The following year, at the request of counsel, Dr. Sanders re-assessed the current Shea Homes property and concluded that it was "prior converted cropland" and not regulated under the Clean Water Act. Dr. Sanders made the following false assertions[4] (compare to bold text in above citation) in his 1991 letter to Beveridge and Diamond [emphasis added]:

> "According to my 1987 wetland delineation of the MWD property, **the source of wetlands hydrology for the 8.1 acres qualifying as wetlands is a water table that rises to nearer than 18 inches of the soil surface during years of normal rainfall (Sanders, 1987). The area was not delineated as wetlands on the basis of indicators that the area is periodically inundated. In fact, the area would not have been considered as wetlands except for the high water table expected during years of normal rainfall (Bilhorn, 1987). All available data**

[4] Section 5c of the Corps' RGL 90-07 states that, "The definition of 'normal circumstances'…is based upon the premise that…the basic soil and hydrological characteristics remain to the extent that hydrophytic vegetation would return if the cropping ceased. This assumption is valid for 'farmed wetlands' and as such these areas are subject to regulation under section 404." If Dr. Sanders had accurately represented his 1987 findings, wherein he said "it was determined that a portion of the subunit would probably be sufficiently wet to support hydrophytic vegetation if the farming activities were to cease," the area might not have been considered "prior converted cropland."

indicate that the area is not inundated for long periods following rainfall events." [5]

The conclusion that the wetland hydrology resulted from groundwater rather than surface inundation brought the area within the definition of "prior converted cropland" and rendered it outside of Section 404 regulation.]

In fact, no quantitative data regarding inundation of the MWD parcel was presented in any of the documents. The nearest thing to data was a statement by Sanders (1991) that during 1987-1988 he saw no indications of inundation and a statement by Bilhorn (1987) that, "Analysis of the monthly aerial photographs confirms that the surface layer remains dry from groundwater during the water table seasonal high. The appearance and disappearance of moist soils in this area are brief (days) and correlate to rainfall events and not water table fluctuations which are of shorter duration." On the other hand, in the same document Bilhorn states that the area he delineated, "…was indicated by aerial photographs to receive surface water repeatedly from adjacent areas during the winter rainy season." Although these observations are somewhat ambiguous, it was the professional judgment of both the Signal Bolsa Corporation scientists and the EPA scientists that portions of the current Shea Homes property were inundated for a frequency and duration that would promote the growth of hydrophytes in the absence of farming.

Homrighausen (2005) dismisses Sanders's contradictory observations as merely "background information" and suggests that the finding of "prior converted cropland" was only based on Sanders's (1991) conclusions that the previously identified wetlands would not pond water for more than 14 days because of a high evapotranspiration rate, low average rainfall, a small watershed, and no runoff from surrounding areas (none of which had changed since 1987). Even if one accepts this generous interpretation, one must still conclude that although the delineated area may not be sufficiently wet to be considered jurisdictional by the Army Corps of Engineers, it was, nevertheless, judged wet enough long enough to support a prevalence of hydrophytes in the absence of farming (Sanders 1987); therefore, as Sanders (1991) later put it, "technically qualifying as wetlands". Therefore, in 1991 the area met the definition of "wetlands" under the Coastal Act and the Commission's Regulations.

Apparently based on information from MWD and Dr. Sanders, the Corps of Engineers concluded in 1992 that the MWD property was not jurisdictional because it "…meets the criteria for prior converted cropland as presented in RGL 90-07, and the lack of information to the contrary…."[6] In 1998, the Natural Resources Conservation Service concurred with the Corps's conclusion based on a review of the record. Neither of these jurisdictional determinations were based on new data.

[5] Bilhorn (1987) actually wrote that: "Lithologic examinations show the surface to a 14- to 20-inch depth to be a silty clay." and "…the water table would lie 8 to 13 inches below the silty clay material and thus could not saturate this material by capillary processes." The affect of Sanders's later (1991) claim to the contrary - that the wetland was supported only by shallow groundwater and was not *inundated* - was to bring the area within the definition of "prior converted cropland" and outside of Section 404 regulation.

[6] Basing an affirmative conclusion on a "lack of information to the contrary" is, at the least, a questionable procedure.

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Sanders's (1991) misrepresentation of his and Bilhorn's 1987 reports has been perpetuated and, indeed, embellished by later commentators, further muddying the record. Kegarice (1997), after accurately quoting from Sanders (1987), then presented assertions from Sanders's contradictory 1991 letter without noting the obvious discrepancies, and gratuitously added the following, which was not in Sanders's letter: "Sanders later found out the hydrologic data observing a saturated condition and high ground water was taken in 1983. 1983 recorded the second highest rainfall ever, and did not represent the average year. Therefore, in 1991 Sanders revisited the site and modified his report based upon this additional information." In fact, there was no "additional information." Bilhorn's (1987) report was based on [emphasis added] a "…comparison of water table elevation differences throughout the Bolsa Chica Lowland piezometer network between the current 1986-1987 season **and the normal rainfall year of 1981-1982**…."[7] Like Kegarice, Young and Bomkamp (2004) incorrectly assert that, "In his 1991 evaluation, Dr. Sanders noted that his earlier finding of wetland hydrology in the 8.3-acre area was based entirely on the 1983 groundwater data collected by Bilhorn." Young and Bomkamp (2004) also grossly mischaracterize Bilhorn's (1987) report: "Bilhorn recorded groundwater at a sufficiently shallow depth during the spring of 1983 to cause saturation to the surface, assuming strong capillary action."

Although these egregious errors raise doubts about the general accuracy of the documents that contain them, I consider the technical issue moot because none of the original reports claimed or presented data to the effect that there were wetlands in the agricultural area of the current Shea Homes property whose hydrology was based on a seasonally shallow water table. Ground water isopleths become deeper inland along a steep gradient (Bilhorn 1986, as cited in EPA 1989; Bilhorn 1995). Ground water in the lower portions of the agricultural area probably varies seasonally from about –3.0 to –8.0 feet below the surface during most years. This was apparently verified by Pacific Soils (1998) in a study that was characterized by Kegarice (1997) as finding groundwater from –3 to –9.5 feet during the winter, and by Young and Bomkamp (2004) as showing that groundwater occurs at about –6.0 feet in the agricultural area. I think it is clear that any wetlands that may be present in the agricultural portion of the Shea Homes site result primarily from surface hydrology, and this was the conclusion of Bilhorn (1987), Sanders (1987) and EPA (1989) nearly twenty years ago.

In 1991, Feldmeth surveyed the property for the Koll Company, apparently because of a report of a ponded area with cattails. The latter turned out to be the result of water from an irrigation pipe. However, Feldmeth also noted that a 3.3-acre area adjacent to the East Wintersburg-Garden Grove Flood Control Channel (now designated WP) was dominated by the facultative (FAC[8]) wetland plant *Bassia hyssopifolia*, which is currently common on the County parcel[9].

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[7] Sanders's only reference to 1983 was in a assertion that there was no evidence that the area was periodically inundated, except "…during the 1983 rainfall year, for which the return frequency exceeded 100 years." However, Bilhorn (1987) had observed that the delineated area was, "…indicated by aerial photographs to receive surface water repeatedly from adjacent areas during the winter rainy season."

[8] Wetland plant species are categorized according to the frequency with which they are thought to occur in wetlands: "Obligate Wetland (OBL) – > 99% of occurrences in wetlands under natural conditions; Facultative Wetland (FACW) – 67-99% of occurrences in wetlands; Facultative (FAC) – 34-66% of occurrences in wetlands; Facultative Upland – 1-33% of occurrences in wetlands; Obligate Upland (UPL) - > 99% of occurrences in uplands under

Apparently, the next wetland assessment that included the Shea Homes property was that which was conducted by Tom Dodson and Associates (Kegarice, 1997). This assessment was based largely on a literature review and a site visit on November 20, 1997 to verify the earlier reports. Soil pits were dug but no data sheets were included with the report and no quantitative samples of vegetation were reported. It was stated that, "The soils on the site are not frequently flooded for long durations." However, no evidence was provided for that assertion. It was also asserted that the land did not support a predominance of hydrophytes based on the qualitative observation that the dominant cover was provided by non-wetland species. One would not expect a predominance of hydrophytes, even in wetlands, shortly after agricultural disturbance (see below). In addition to the errors noted above, Kegarice asserts that both Bilhorn and Sanders concluded that the site was not wet enough to support hydrophytes. Neither of them made that claim. In fact, Sanders (1987) found the opposite. Kegarice was accompanied on the site visit by Frank Hovore.

Biologists from Hovore and Associates visited the site in November and December 1996 and January and June 1997 in addition to the November 1997 visit with Kegarice. Hovore (1997) states that on several survey dates the surface soils were saturated by recent rains and there was standing water in depressions. The report also includes this apparent *non sequitur*, "There are no seasonal pools or channels on the site, but aerial photos frequently show a shallow accumulation of surface water in the northwestern corner of the City property, approximately where the 8.3 acre area was delineated." I speculate that Mr. Hovore may have meant that the observed inundation was relatively brief. However, he does not specify how long an area must be inundated for it to qualify as a "seasonal pool" by his reckoning. The Hovore report provides additional useful detail concerning the vegetation. The agricultural area had been left fallow for about 5 months prior to the November 1997 site assessment. Most portions of the fallow fields were dominated by a relatively homogeneous cover of Bermuda grass (FAC) and cheeseweed (Upland) with scattered patches of both upland and wetland indicator species. Less-disturbed areas were characterized by alkali heath (*Frankenia salina*, FACW), Salt bush (*Atriplex triangularis*; not listed as an indicator but a characteristic salt marsh species in California), sand spurrey (*Spergularia marina*, OBL), alkali mallow (*Malvella leprosa*, FAC*), and alkali weed (*Cressa truxillensis*, FACW). Hovore qualifies this observation by writing that, "…nowhere did they form natural stands or create native habitat." The meaning of this caveat is not clear, but it probably is an indication that these species occurred patchily and at low densities.

In response to a request from Coastal Commission staff for an updated wetland delineation confirmed by the California Department of Fish and Game, the City of Huntington Beach sent Kegarice's (1997) report to the Department with a request for comment. Based entirely on Kegarice's report, the Department concurred that the

natural conditions within the region, but occurs in wetlands elsewhere. A positive sign indicates a frequency toward the higher end of the category (more frequently found in wetlands), and a negative sign indicates a frequency toward the lower end of thecategory (less frequently found in wetlands). An asterisk (*) following a regional indicator identifies tentative assignments based on limited information. From Reed, P.B. Jr. 1988. National list of plant species that occur in wetlands: California (Region 0). U.S. Fish and Wildlife Service Biological Report 88 (26.10). 135 pages.

[9] The "County Parcel" was annexed by the City on October 1, 2003.

agricultural portion of the Shea Homes property did not meet wetland criteria (Rempel 1998). Due to the flawed nature of the consultant's report upon which it was based, the Department's concurrence adds nothing substantive to the record.

Kegarice's observations that much of the agricultural area supported upland plants in the fall of 1997 has been presented as strong evidence that the site can no longer support the growth of hydrophytes. Bomkamp and Young (2005) emphasized that the "delineation" conducted by Kegarice (1997) was done at the end of a wet cycle when the site was not in agricultural production. They argue as follows:

> "TDA/Kegarice did not detect a predominance of hydrophytes and also did not note in her list of dominant plants, the presence of opportunistic weedy species such as salt-marsh sand spurry (*Spergularia marina*, OBL), alkali weed (*Cressa truxillensis*, FACW), alkali heliotrope (*Heliotropum curassivicum*, OBL), and brass buttons (*Cotula coronopifolia*, FACW+).
>
> These species currently occur on the site but are not predominant, suggesting that their current distribution is in large measure associated with irrigation that was begun with re-initiation of farming after the TDA/Kegarice delineation. This is particularly noteworthy, since between 1999 and the current rainy season, southern California has been in a drought or dry cycle. It is unreasonable that the opportunistic species noted above would not be predominant on a site (if it were a wetland) during a wet cycle with no disturbance (i.e., agriculture) only to appear during a dry cycle with disturbance, without the additional factor, i.e., irrigation."

Based as it is on false premises (absence of hydrophytes and absence of agriculture), this syllogism is not convincing. First, the authors do not cite Hovore (1997), whose description of the site in November 1997 documented the presence of wetland species, including the sand spurry and alkali weed that were not noted by Kegarice (1997). Second, according to Hovore (1997), the entire site was disked shortly before June 7, 1997 and had only been fallow during that year's dry season. In southern California, it is not only common, it is characteristic of seasonal wetlands to be invaded by upland plants during the dry season. In this case, the site had been disked after the wet season, and it is quite reasonable that opportunistic wetland species would not be predominant at the end of the summer drought. The 1997 observations by Kegarice and Hovore provide absolutely no evidence that the depressions in the agricultural field cannot support hydrophytes. The 1997 observations also demonstrate that the presence of hydrophytes is not necessarily an artifact of irrigation practices.

Wetland scientists from Glenn Lukos Associates (Young & Bomkamp 2004) conducted field work for a wetland delineation within the agricultural area on January 23, March 31, May 24, and May 30, 2003. They concluded that there were "…no areas within the City parcel at the Parkside Estates site that meet the criteria used to define wetlands by any agency." Their conclusion was based primarily on the lack of indicators of wetland hydrology and the lack of recently formed hydric soil features.

Delineation within this parcel requires special techniques because it is a "problem area"[10] and an "atypical situation."[11] It is a problem area because the soils formed

[10] A "problem area" exists where normal conditions make the use of standard field indicators of wetland hydrology difficult. At the Shea Homes site, the lack of tidal hydrology is the "new normal" condition (i.e., it is essentially permanent).

under hydric conditions associated with tidal inundation that is no longer present and it is an atypical situation because continuing agriculture prevents the establishment of wetland plants and disrupts the soil column. These factors make wetland delineation difficult for many reasons, including: 1. Vegetation indicators cannot be expected, 2. Hydric soil indicators may be artifacts of prior conditions, 3. The soil surface is frequently disturbed, which removes indicators of recent inundation, 4. Plowing may drastically alter the soil profile, 5. Irrigation might confound the interpretation of the presence of recruiting wetland plants and the presence of indicators of recent hydric conditions.

Young and Bomkamp (2004) found no evidence that they thought indicative of wetland hydrology during their investigations. However, most of their samples were taken at times when one would not expect there to have been recent inundation or saturation. During the 32 days prior to their January sample there was essentially no rainfall (0.08") and the two May samples were taken too late in the season to be informative. The lack of indicators at the end of March is more interesting. January had no rainfall; February was wet with about 2.5 inches of rain from 2/11 to 2/13 and another 1.7 inches from 2/25 to 2/28; March was relatively dry (0.3 inches on 3/4) except for an extraordinary storm that dropped 3.8 inches on 3/16 & 3/17. Despite this deluge, there was no standing water or saturated soil at their sample points 14 days later on March 31. Young and Bomkamp take this as evidence that the site can not support wetland hydrology. However, since several portions of the site have been observed repeatedly to pond for longer than two weeks following similar amounts of rainfall, a reasonable alternative hypothesis is that inundation was relatively ephemeral because the storm occurred late in the rainy season when the land was covered with a dense crop of barley and the rate of evapotranspiration was relatively high. This storm caused extensive inundation of the County parcel that appears from photographs to have lasted between one and two weeks.

Under ordinary circumstances, when ponds form and then infiltrate and evaporate, surface indicators are left behind. However, in an area subject to agricultural practices, these indicators are likely to be destroyed. This is very limiting, since a lack of indicators is not necessarily indicative of a lack of inundation. Therefore, direct observations of ponding and saturation are particularly important. On March 31, Young and Bomkamp observed standing water in a 5 ft x 15 ft area at the base of the western slope, but this may have been partially due to dripping irrigation lines. On the same day, they also found evidence of recent ponding in a 2 ft x 20 ft "roadside collection area" next to the flood control channel. These ponding episodes were probably the result of the March 16-17 storm, although the dripping irrigation line is a confounding factor in the western area. They also observed sediment deposits ("light surface crust") that they noted indicated "past short-duration ponding"[12] in two locations (one with a preponderance of wetland indicator species) but concluded there was no wetland hydrology and that the points were not in a wetland.

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[11] An "atypical situation" exists where recent human activities (e.g., plowing) or natural events (e.g., fire) have resulted in the lack of positive indicators of one or more wetland parameters.
[12] Actually, such evidence does not enable one to estimate the duration of ponding - only that it occurred.

Young and Bomkamp also analyzed several aerial photographs and the rainfall record for the period preceding the photograph to assess inundation. I will discuss their aerial photographic evidence along with the photographic analysis done by LSA in a separate section below.

It is well-documented with photographs (Bixby 2005) that the soil on the Shea Homes property has the capability of ponding water for a week to months given the right patterns and amounts of rainfall (e.g., Figures 3 and 6). Young and Bomkamp's observations provide a mechanism. At the base of the Bolsa Chica mesa at the western edge of the Shea Homes property, they found a clay-rich subsoil at a depth of about 20 inches. This is the general area delineated by the EPA (which includes the area referred to as "AP" in later reports by Glenn Lukos Associates). The clay-rich layer apparently acts as a confining layer, perching water above it. In the depression near the flood control channel (referred to as "WP" in the later reports by Glenn Lukos Associates), a clay loam subsoil was found at a depth of about 22 inches. Bomkamp (2005a), described the area in somewhat different terms with clay-loam in the upper 9-20 inches and coarser material below. The clay-loam also acts as a confining layer.

Young and Bomkamp also noted shallow redoximorphic features in several areas. Most of their sample points in the areas delineated as a wetland by EPA and others had low chroma soil near the surface and mottles[13] between 13 and 30 inches below the surface. On the data sheets, these points were first noted to have hydric soils; later this was crossed out and the soils were noted as not hydric with the remark that the features were relicts due to hydrologic alterations of the site. It is likely that some of these features did form during the period when the site was a tidal salt marsh. However, the fact that they did not observe field indicators of hydrology in 2003 is scant evidence that the site has been so hydrologically altered as to preclude frequent soil saturation for a duration sufficient to promote hydric soils. The fact of the matter is that any inferences drawn from the existing soil features that they have described will necessarily be equivocal due to the history of the site and the continuing disturbance from farming.

In their discussion, Young and Bomkamp make the point that since redoximorphic features were identified "…within the tillage zone, in an irrigation-induced perched water table…, it is apparent that such features could form elsewhere on the property if reducing conditions had occurred for sufficient duration…." This was not observed. Although this is an appropriate type of comparison, it should not be considered in a vacuum. Areas where oxidized root channels[14] were not observed in 2003 had been inundated for over a month during the winter of 2000 - 2001 (Figure 3) and during other periods in the past. Under most circumstances, oxidized root channels and other redoximorphic features would tend to form under prolonged reducing conditions, and should still have been visible two years later, but were not found. Unfortunately for the delineator, there are many reasons why such features might not form despite the

[13] During periods of soil saturation, iron may be leached from the soils producing a dark coloration or "Low chroma"; soils that are subject to alternating periods of saturation and drying develop iron concentrations or "mottles."

[14] Under prolonged saturated soil conditions, a toxic environment is created. Some plants have the ability to release oxygen through their roots creating a safe microenvironment. This results in iron oxidation (i.e., rust) on the walls of the root channel or "rhizosphere." Hence, if a live root is present, "an oxidized root channel" is considered evidence of recent soil saturation.

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presence of anaerobic conditions (e.g, low iron concentration), and if they did form, soil disturbance due to repeated plowing and disking might make them difficult to observe.

Young and Bomkamp argue that the observation that upland species were predominant on November 20, 1997 "in the absence of farming and with above average precipitation" is evidence that upland vegetation would establish in the absence of farming and that the presence of scattered wetland plants in 2003 must have been a result of irrigation. I have already pointed out that there actually was not a substantial absence of farming in 1997, since the area had been disked in the late spring, and that wetland species were, in fact, present. With regard to the "above-average" precipitation, there had been no rainfall from February 14 to November 11, 1997. From the 11th to the 14th of November a storm brought about an inch of rain. One would hardly expect this event to affect the character of the vegetation viewed six days later.

In summary, Young and Bomkamp (2004) found no evidence of wetland conditions on the city portion of the Shea Homes property during the course of their investigations. They based their delineation on an assessment of soil features that are subject to various interpretations and on an assessment of hydrology based on very few data. In my opinion, the available evidence did not justify their strongly worded conclusion that no areas meet the wetland definition of any agency.

Coastal Commission Staff Analysis

Hydrology

Photographic Evidence of Inundation

There are additional analyses that one could do with the photographic record available on Bixby's (2005) website and, because many of the descriptions on the website are somewhat hyperbolic, I believed that an independent assessment was necessary. I asked the applicant to analyze these photographs. Unfortunately, I did not find their consultant's analysis (Bomkamp and Young 2005) useful for several reasons. First, portions of the record were rejected in a blanket fashion because the photographs were taken during a year of unusually high rainfall or during a period that included unusually high monthly rainfall totals. I think this approach is much too crude. Even during a wet year there may be periods that are not unusual and drying patterns may also be informative. For example, heavy rainfall in November or December may be many times greater than normal for those months, but well within the bounds of normal variation in January or February, and so quite informative, especially since the ground would generally not be charged from earlier storms. Second, the significance of photos of the AP area was denigrated because that area is "along the outer edge of the field where heavy farm traffic occurs," and "ponding is caused by artificial compaction at this location." Although presented as fact, the latter is really an *ad hoc* hypothesis. Since inundation often extended well into the plowed area, I am not convinced of the truth of their hypothesis. Third, the description of the photographs by the Glenn Lukos biologists did not always correspond to my perceptions. For example, they described the inundation shown in Figure 6 as follows: "The first measurable ponding started on 02/26 and persisted over very small areas (i.e., a few square feet until March 11) for 14

days of ponding over a very limited area." "Conclusion: …this area does not support a positive finding for wetland hydrology with (sic) possible exception of an area covering a few square feet; however, soil compaction and alteration of the soil structure indicate that this is (sic) not support a finding of wetland hydrology." It appears to me that the photographs show 8 days of inundation over a large area and 14 days of probable soil saturation over a slightly smaller area in a tilled depression and not just on the compacted road. The alteration of the soil structure is due to the atypical situation associated with farming and not germane unless it permanently drained the soil, which it obviously has not done. I believe that this series of photographs does, in fact, support a finding of wetland hydrology. Finally, Bomkamp and Young (2005) focused their report on a critique of the assertions of Mr. Bixby that accompany the photographs on his web site. Mr. Bixby is a citizen activist and not a wetland scientist. His important contribution has been his acquisition and presentation of the photographs, not his layman's analysis of them. In short, the Glenn Lukos report was not the independent, objective analysis of the available photographs that I had hoped for. Therefore, I have attempted such an analysis myself.

I analyzed the photographic record to investigate three related questions: 1. What patterns and amounts of rainfall result in inundation for long duration[15]? 2. For the 20-year period since 1985 (by which time all hydrological modifications had taken place), is there evidence of frequent (> 50% of all years) long-duration inundation? 3. What is the probable frequency distribution of ponding of various durations (<7 d, 7-14 d, 15-30 d, >30d). I chose seven days as the significant inundation event because the Army Corps of Engineers and the National Resource Conservation Service recognize seven days of inundation as the minimum period that could result in reducing conditions for a sufficient duration to promote the formation of hydric soils. Similarly, the EPA (1989) found that, "…inundation or saturation must meet or exceed a duration of 7 continuous days during the growing season in order to support hydrophytic vegetation and to exclude upland plant species (Sipple 1988)."

Not surprisingly, there are problems with this informal photographic record. Ground-level photographs are challenging to interpret because: 1. Photographs were obtained in an *ad hoc* or haphazard fashion, so they do not uniformly sample the rainy season each year, nor do they uniformly sample the site spatially. 2. They are not taken from the same vantage points nor is the focal length of the lens the same in each instance. As a result, one photograph may capture a large area and the next photograph in a temporal sequence may include only a portion of that area. Therefore, apparent changes over time may be difficult to generalize over space. 3. Because the field is plowed, the angle of the line-of-sight relative to the furrows determines what can be seen. Standing water between furrows is hidden when looking across the plow line. 4. When crops are mature they provide 100% cover in the agricultural area and prevent the after-the-fact assessment of inundation from photographs. Aerial photographs may also be difficult to interpret. In some cases, standing water shows as a reflective surface, which is usually distinctive. However, standing water is generally dark in photographs and sometimes difficult to distinguish from wet soil or shiny dry surface crusts. In several instances, LSA interpreted aerial photographs as showing standing

[15] "Long duration" is defined as continuous inundation for 7 days to one month. "Very long duration" is defined as continuous inundation for greater than 30 days.

water following a period when there was little or no rainfall and characterized these interpretations as "false positives." There may also be some cases of false negatives where inundation was not identified.

Despite these shortcomings, the existing photographic record (Bixby 2005 and aerial photos obtained by the applicant's consultants) contains a great deal of useful information and provides the only data in addition to the rainfall record that can be used to estimate the frequency and duration of ponding on the Shea Homes property.

Pattern of Rainfall Necessary to Result in At Least 7 Days of Inundation

Although the pattern and amount of rainfall that occurs at Bolsa Chica is central to this discussion, it is important to understand that, as for most locations, site-specific information is not available. However, rainfall is recorded at several nearby locations. Average annual rainfall at coastal stations within about 15 miles ranges from about 10 inches to about 13 inches. Bilhorn (1987, 1995) used the data from the Lake Street Fire Station in Huntington Beach, which is about 2 miles from the site. For the period 1929 - 1994 the median annual rainfall was 10.27 inches. Record keeping at this station ended in 2001. I have used rainfall data from the Los Alamitos Station (LSA 2005), which is about 5 miles from the site. For the period 1958 - 2005, median rainfall at Los Alamitos was 9.04 inches and the average rainfall was 9.99 inches. Data from either of these stations provides a reasonable index of the rainfall at Bolsa Chica (i.e., the days of rainfall will be nearly identical and the amounts of rainfall will be well-correlated).

I have analyzed the ground-level photographs posted on the web and submitted to the Coastal Commission by Mr. Mark Bixby in order to try to characterize the pattern of rainfall necessary to result in inundation for at least seven consecutive days. This is possible because, during several years, there are multiple ground-level photographs separated by days or weeks. Some of these photographs were taken during years of greater than normal rainfall. However, for those years, I have only used those photographs that were taken during a period when the pattern of precipitation was similar to what is commonly observed in January and February[16], and not following prior heavy rainfall.

The results are presented in Tables A2, A3, A5 and A8 in Appendix A. The shaded portions of the rainfall columns (lighter shading where two shades are used) are periods that represent patterns that would not be unusual for January or February and where rainfall earlier in the season was not so extreme as to bias the analysis. The shaded portions of the columns that contain descriptions of inundation for areas WP, AP, and

[16] In Tables A2, A3, A5 & A8 and in discussions with the applicant's consultants I have referred to such a pattern as "near normal." This determination is subjective and based on an examination of the existing record and an assessment of both the amount and timing of particular rainfall events. LSA (Homrighausen 2005) commissioned Exponent to conduct a statistical analysis of the rainfall record to assess my determinations. Exponent found that the rainfall in October 2004, which I had treated as "near normal," was unusual by their criteria. I disagreed based on the rainfall data from the Costa Mesa Station, which was all that was available until recently. However, based on the higher rainfall recorded at the Los Alamitos Station, I have not treated the early 2004 rainfall as "near normal." Exponent's analysis was not provided for critique and Homrighausen did not comment on the four tables used in my current analysis.

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the County wetlands indicate periods that demonstrate long duration ponding. Several of the descriptions contain rough estimates of the size of the ponds. These estimates were made by scaling off distinctive features in the photographs. Plowed furrows were assumed to be 2 feet from center to center (probably an underestimate), the distance between fence posts along the flood control channel was assumed to be 6 feet, and the distance between parallel tire tracks was assumed to be 5 feet. In addition, the distance between some topographical features was scaled off the Hunsaker (2004) map. These estimates were done quickly and are subject to many sources of error. They are probably generally underestimates, but at least give some rough idea of the relative size of the ponds that formed following rainfall events.

Area WP was inundated for long duration during each of the five years for which there are data. In general, area AP seemed to pond less readily and dry somewhat more quickly, but was, nevertheless, inundated for long duration during two of the three years for which there are data. The County wetland was also inundated for long duration for two of the three years for which there are data, but not the same years as AP. These data demonstrate that all three areas are capable of long duration ponding during periods of near normal rainfall. In general, long duration ponding appears to require a storm that drops two or more inches of rainfall after the ground has previously been partially charged with water by earlier precipitation events. The observance of such a pattern or more extreme rainfall was the basis for inferring long duration ponding during periods for which there were no photographs available.

Estimation of the Frequency of Long Duration Ponding Since 1958

The standard for wetland hydrology that I have applied is frequent inundation for at least seven consecutive days. The Corps defines “frequent” as occurring more than half the time (i.e., at least 51 out of 100 years, on average). All available data must be used to assess the record under this standard. Throwing out extreme years or extreme rainfall events would bias the result downward. If long duration ponding occurs during all years that have the median rainfall or greater, then this standard is met by definition. The years with greater than median rainfall will include mostly near normal rainfall, but will also include many extreme periods such as El Nino years. The point is that for judging frequency, the entire record must be used.

I used all the available aerial and ground-level photographs in conjunction with the rainfall record[17] for the period 1985 through 2005. I only included areas WP and AP in this analysis. I did not analyze photographs taken of the road adjacent to the residential development to the north, the former stable area, the bare staging area at the western edge of the fields, or the road along the toe of the flood control channel, when it existed. These areas have all been subject to compaction and all but the former stable area are essentially roads. I only used photographs taken after 1985, because the hydrological modifications associated with the construction of the Cabo del Mar condominium complex were completed by that time and, to my knowledge, there have been no

[17] All rainfall data (LSA 2005) for the period 1958 - 2005 come from the Los Alamitos station (Orange County Environmental Management Agency Station 170).

additional significant off-site modifications that would affect the hydrology of the Shea Homes property.

There is at least one photograph available for each of the 20 rain years (October through March for this analysis) since 1985. For each rain year for which there was an aerial photograph I tabulated the rainfall data (Appendix A: Tables A1-A20) and assessed whether the rainfall data provided strong evidence of periods when ponding was likely. I analyzed the ground-level and oblique aerial photographs myself. I used the results of the analyses conducted by LSA and Glenn Lukos Associates for the vertical aerial photographs. For the period and area of interest, the results were the same for the subset of photographs that both groups analyzed. I have summarized the results of my analysis in Table 1.

LSA (Homrighausen 2005) believes that the entire available record should be used for this determination. They have obtained aerial photographs and rainfall data for the period 1958 through 1985 and conducted an analysis similar to that described above (Appendix B: Tables B1-B27)[18]. However, the hydrology criterion they recommend applying is inundation for at least 14 days. Although aerial photographs were occasionally useful, most of their inferences regarding inundation were based on the observed pattern and amount of rainfall using criteria that were not discussed. In general, I am in agreement with their estimates of when inundation occurred. In most cases, they did not explicitly estimate the duration of inundation during each year. I have annotated their tables with my estimate of the duration of inundation for each year and have summarized the results of my analysis for this period in Table 2.

Rainfall and Probable Inundation During the Period 1958 - 2005

During the 20-year period from winter 1985 through spring 2005, the available evidence suggests that WP was inundated for long duration in each of 12 years and area AP was inundated for long duration in each of 11 years (Table 1). The pattern and abundance of rainfall suggests that WP was inundated for 7-14 days during 4 years, for 15-30 days during 3 years, and for more than 30 days during 5 years.

LSA concluded from their analysis of aerial photographs that during the 27-year period from winter 1958 through spring 1985, area AP ponded following significant rainfall but area WP generally did not until after about 1973. Based on their examination of historical aerial photographs, LSA did not find evidence that a topographical depression existed in the area of WP in the early years of the record. Based partly on photographic evidence, but mainly on the pattern and abundance of rainfall, LSA concluded that ponding occurred at area AP during 13 years and at area WP during 5 years of the 27-year record[19] for unspecified durations. Based on the pattern and

[18] Exponent (Jordan 2006a) took the analysis a step further and extrapolated rainfall back to 1770. They then fit the data to a probability density function and estimated the proportion of years that would have rainfall of various amounts. Although an enjoyable read, I don't think the analysis adds anything to the discussion. The actual available data are more germane.

[19] Actually in Appendix B, Table B28, the figures are 12 years and 4 years, respectively. However, this seems to be a mistake because Table B23 clearly indicates that both areas appeared inundated in photographs 15 days after

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abundance of rainfall, I conclude that during that period, area AP and any other significant topographical depressions that may have existed were inundated for 7-14 days during 9 years, for 15 - 30 days during 5 years, and for greater than 30 days during 4 years, for a total of 18 years during which there was continuous inundation for long duration (Table 2).

In general, years during which there was no long duration ponding received less than the median rainfall (Table 3). There was only one instance when the rainfall pattern suggested a lack of significant inundation even though the amount of rainfall was greater than the median. The reverse is not true, however. Continuous ponding for seven days or more probably occurred during seven of the years that received less than median rainfall. Both these observations demonstrate that the distribution of rainfall is more important than the annual total in determining whether long duration ponding occurs, especially for the middle 50 percent of rain years (6.5" -12.3"). The lower and upper 25 percent of rain years are, respectively, seldom or always inundated for long duration. This pattern is also apparent when one compares the estimated duration of ponding during years of differing rainfall (Table 4). During very dry years, inundation is generally ephemeral and during very wet years, there is generally extensive ponding for very long duration (>30 d). The estimated duration of ponding is more variable during years of intermediate rainfall.

The 1987 Army Corps of Engineers Wetland Delineation Manual defines wetland hydrology as inundation or saturation for at least 5% of the growing season (18.5 days in coastal California). However, this standard is not applied in routine delineations, which only require field evidence of inundation or saturation at the time of the site visit. The Coastal Commission does not have a quantitative standard for hydrology. Rather, the requirement is relative. Wetlands are those areas that are inundated or saturated at a frequency and duration sufficient to promote the formation of hydric soils or to support a predominance of hydrophytes. The evidence reported above indicates that the two areas in question (referred to as WP and AP herein) were inundated or saturated at a frequency and duration sufficient to promote the formation of hydric soils and to support a predominance of hydrophytes based on a 7-day standard for inundation. However, that does not necessarily mean that hydric soil conditions actually developed or that hydrophytes would predominate in the absence of farming. The following analysis addresses those questions.

Wetland Soils

The National Resource Conservation Service has formed the National Technical Committee for Hydric Soils to develop criteria for identifying and mapping hydric soils throughout the United States. The accepted definition of a hydric soil is "a soil that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part" (59 Fed. Reg. 35680 07/13/94). An accepted field indicator of hydric soils is frequent ponding for long

the beginning of a rainy period, and the text reads, "Likely at least AP area was ponded for 15 days or more in March."

duration. Based on this indicator, areas AP and WP are estimated to be ponded long enough and often enough to promote the formation of hydric soils.

The actual duration of ponding or saturation that results in anaerobic conditions is variable and dependent upon many factors, but four general conditions are required[20]: 1. Inundation or saturation that excludes atmospheric oxygen, 2. Organic tissues, 3. An active microbial population that is oxidizing organic tissues, and 4. Stagnant or near stagnant water (moving water tends to carry oxygen). The applicant's technical consultants have questioned whether 7 days of ponding is sufficient to result in anaerobic conditions in the upper 12 inches of the soil at AP and WP. To test this hypothesis, they applied a chemical test to saturated soils to directly assay for anaerobic conditions. The sampling stations and monitoring wells referred to in the text are shown in Figures 9 - 11.

Although there was relatively little precipitation during the 2005-2006 rain year, ground water was anomalously high throughout Huntington Beach due to the lagged effects of extremely high rainfall during 2004-2005[21]. Data from test wells demonstrate that groundwater at Parkside rose from about -6 feet (Mean Sea Level) in September 2005 to about +0.5 feet (MSL) by December and remained at that level through at least March 2006 (Castle 2006).[22] Although the observed shallow groundwater has little relevance to the pattern of inundation and shallow soil saturation during most years, it did provide an opportunity to directly assess reducing conditions in saturated soils in the County parcel and in area AP. The shallow soil at WP was never saturated by high groundwater.

Glenn Lukos Associates began soil testing on January 12, 2006 using the chemical alpha, alpha'-dipyridyl, which develops a reddish-purple color in reaction with ferrous (reduced) iron. On January 12, the soil at the sample site at the County parcel was already saturated by ground water at 12-15 inches below the surface and the presence of ferrous iron demonstrated anaerobic, reducing conditions. The soil above 12 inches was not saturated (moist-wet) and was oxygenated. This pattern persisted through March 15, except that from February 15 through at least February 24, the soil was saturated and reduced up to 6 inches below the surface. Since on February 10, the soil at 6 inches was only moist to wet and still oxygenated, this indicates that the soil became saturated and then anaerobic and reduced to the point of iron reduction in fewer than 5 days[23].

The six sample sites at AP showed a more complicated pattern of soil saturation. These sites were first visited on January 12 (AP4,5 & 6) or January 20 (AP1,2 & 3). At that time, the soil from 12-15 inches below the surface was saturated, but did not show iron reduction. The soil at several stations was saturated above 12 inches and several

[20] Vepraskas, M.J. and S.P. Faulkner. 2001. Redox chemistry of hydric soils. Pages 85-105 in J.L. Richardson and M.J. Vepraskas, editors. Wetland Soils. Genesis, Hydrology, Landscapes and Classification. Lewis Publishers, NY.

[21] Highest rainfall on record (23.39 inches) with an estimated return period of 48 years (Jordan, 2006b).

[22] Pacific Soils' wells MW-3, MW-17, and MW-19.

[23] This is very fast and may contain significant sampling error (as could any of these estimates). Since samples were not taken from the exact same location on each date, small scale spatial variability is necessarily confounded with temporal changes. Small scale spatial variability was not formally estimated.

stations also had surface ponding and shallow saturation separated from the deeper saturation by a band of merely moist to wet soil. A plausible explanation is that ground water rising under pressure would generally be confined by the shallow clay layer, but in scattered areas where coarser material was present, water would reach the surface and then spread horizontally above the clay layer (T. Bomkamp, personal communication 06/02/06). There was essentially no evidence of iron reduction at the AP stations during the period January through March. At four of the sample sites, the soil remained saturated until February 8. Saturation was observed for a week or two longer at the other two sample sites (AP1 & AP3). In general, there was no evidence of iron reduction within this depth stratum in the AP area. Although occasional soil samples tested positive for reduced iron, the soil from nearby pits tested negative. In summary, after a period of soil saturation ranging from at least 19 days to at least 35 days, there was no evidence of iron reduction at a depth of 12 to 15 inches at 6 locations in area AP, whereas soil at the same depth at a single site in the County parcel was continuously reduced. Large portions of area AP were also inundated and the shallow soil saturated for long periods. The soil at sample site AP1 appears to have been saturated in the upper 6 inches from about January 20 until about March 6 with no evidence of iron reduction. The soil was moist-wet and presumably oxygenated for 2 to 5 days in early March and then became saturated again. Reduced iron was present 6 to 9 days later and was considered the predominant condition after about 2 weeks.

A partial explanation for the differences observed at the two sample sites may be that the pressurized ground water that caused soil saturation and ponding at AP was oxygenated and did not remain stagnant long enough to result in anaerobic conditions. However, by late February the ground water was receding and ponded surface water should have been stagnant. Nonetheless, after about 2 to 4 weeks of soil saturation no ferrous iron was detected other than at AP1.

About an inch of rainfall on April 1 resulted in extensive ponding both at the County parcel and at AP. This provided another opportunity for examining the time required for iron reduction to occur. Sampling took place on April 21 and on May 2 (AP) or May 5 (County). At the County parcel, the upper 4 to 8 inches of the soil column at most stations showed evidence of reduced iron after 17 days, whereas only 1 of 3 replicates at 1 of 5 stations at AP tested positive for ferrous iron. After 28 days, most stations in both the AP and County areas showed evidence of iron reduction in the upper part of the soil column.

In summary, it apparently requires between 5 and 17 days of soil saturation or inundation for the onset of iron reduction in the near-surface soil in the County parcel. The analogous figures for area AP are 14 and 28 days. No explanation has been proffered for the striking difference in the duration of saturation necessary to result in the reduction of iron between the County parcel and the nearby AP area.

Understanding the mechanisms producing the observed differences at the two sites is important because the definition of hydric soils is not based on iron reduction, but rather on anaerobiosis.[24] Anaerobic conditions are necessary for iron reduction, but the lack

[24]Fontaine (2006) made this point. Josselyn (2006b) responded that the National Committee on Hydric Soils Technical Note 11 requires anaerobic conditions to be demonstrated by documenting iron reduction. However,

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of iron reduction is not evidence that soil is aerobic[25]. There are two concerns. First, there is a lag of unknown duration between the time the soil becomes anaerobic and the initiation of iron reduction. I have not been able to find a discussion of this time course in the literature, but plots of the changes in redox (oxidation-reduction) potential[26] with time in Vepraskas and Faulkner[27] suggest that (at pH 5) it could be at least a few days to 2 weeks from the onset of anaerobic conditions to the initiation of iron reduction. Under favorable conditions,[28] Vepraskas (personal communication 07/26/06) estimates that the lag may be as short as 1 to 5 days. The second concern is that iron reduction may not be apparent despite a low redox potential. This could occur if iron concentrations were low. The soil concentration of iron is much higher at the County parcel (787 ppm) than at AP (225 ppm) or WP (31 ppm). Although alpha, alpha'-dipyridyl appears to be sensitive to extremely low concentrations (<1 ppm) of iron salts in water[29], I have not been able to find literature that quantitatively relates the concentration of iron in the soil to the alpha, alpha'-dipyridyl test. It may be that any of these concentrations are sufficient to produce a positive test under reducing conditions or, given these low concentrations of iron, it may require a longer time to produce a positive chemical test.

Dr. Michael Vepraskas, a wetland soil scientist at the North Carolina State University, studies oxidation-reduction reactions in saturated soils. His work on soils[30] that are always above 5° C (as are California coastal soils) has shown that the time required for a saturated soil to become anaerobic is strongly related to the amount of organic carbon that is present (personal communication, 07-19-06). Where total organic carbon (TOC) is 3% or greater, it generally requires 1-4 days for the soil to become anaerobic. Where TOC is less than 3%, the time required increases rapidly with a decrease in TOC and may range from 3 - 50 days. The time to iron reduction is no doubt also inversely correlated with the amount of organic carbon present.

The percent dry weight organics in Table 8 was estimated by the soil laboratory by multiplying TOC[31] by a conversion factor.[32] I used this factor (1.8) to convert back to TOC (Table 8). Differences in TOC probably explain much of the variability observed in the chemical testing for reduced iron. There also are significant differences among

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Technical Note 11 provides Technical Standards for the development of field indicators of hydric soils (which are generally based on iron reduction) and is not intended to modify the definition. Josselyn also seems to confound aquic conditions (which require iron reduction) with hydric soils (which only require anaerobic conditions).

[25] Vepraskas, M.J. and S.W. Sprecher. 1997. Overview of aquic conditions and hydric soils. Pages 1-22 in M.J. Vepraskas and S.W. Sprecher. Aquic conditions and hydric soils: The problem soils. Soil Science Society of America, Madison, Wisconsin

[26] Redox potential (E_h) is a measure of the tendency of chemical substances to be reduced (i.e., to acquire electons) and is measured in mV. A low Eh indicates a reducing environment, whereas a high E_h is characteristic of an environment that favors oxidation.

[27] Vepraskas and Faulkner, op.cit. 2001.

[28] Carbon levels above 3%, continuous soil saturation, soil pH <7, and low concentrations of nitrate or Mn oxides.

[29] Moss, M.L. and M.G. Mellon. 1942. Colorimetric determination of iron with 2,2'-Bipyridyl and with 2,2',2"-Terpyridyl. Industrial and Engineering Chemistry 14:862-865.

[30] The pH in the soils that were studied varied from about 4.0 to about 5.5 (personal communication, 07-26-06).

[31] Obtained by wet extraction and titration using the Walkely-Black method.

[32] Telephone conversation with Jim West (Soil and Plant Laboratory, Inc.) on July 19, 2006.

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sites. Estimated TOC[33] ranged from 0.8% to 7.1% at the County area and from 1.6% to 5.4% at AP, but was about 1% or less at all the rest of the sample locations, including WP (Table 8). At AP the mean and median were both about 3%. At the northeastern portion of the reference area at the County parcel where surface inundation was observed, TOC varied from 0.8% to 1.2%.

Differences in soil pH may also contribute significantly to the observed variability in iron reduction because soils with higher pH become reducing at a lower redox potential (and therefore after a longer time) than soils with a lower pH. The average soil pH (Table 8) was about 5.7 in the County parcel (range: 4.1 - 7.0), 7.0 at AP (range: 6.1 - 7.5), and 7.5 at WP (range: 7.3 - 7.6). The other wetland areas averaged 6.4 to 7.1. At the northeastern portion of the reference area at the County parcel where surface inundation was observed, pH varied from 6.4 to 6.8.

Although there remains considerable uncertainty in the estimates of the time required for the development of anaerobic conditions, the available evidence suggests that it likely requires more than 7 days of saturation or inundation for anaerobic conditions to develop at AP and WP, probably due to the relatively low organic content of the soil at WP and the relatively high pH at both locations.. Therefore, I conclude that it is more likely than not that during most years areas WP and AP are not ponded for the duration needed to promote the formation of hydric soils at those locations, given the nature of the soils present.

Wetland Vegetation (Atypical Situation)

The agricultural operations on the Shea Homes Parkside property make wetland delineation difficult because they remove all natural vegetation, repeatedly disturb the soil, and supplement rainfall with irrigation during dry periods. Therefore, the standard indicators of wetlands contained in the Corps of Engineers 1987 Manual may be missing or masked and, because of irrigation, the periodic appearance of hydrophytes may sometimes be difficult to interpret. With regard to vegetation, the Corps suggests examining nearby unaltered areas that otherwise appear similar.

I believe such comparisons are appropriate for atypical situations and, at least from a state perspective, the agricultural portion of the Shea Homes property is an atypical situation.[34] At my request, Glenn Lukos Associates (Bomkamp et al. 2005; Bomkamp 2005a) examined the vegetation and soils in nearby areas that were similar in elevation to two depressional areas in the agricultural field. Glenn Lukos Associates compared the depression adjacent to the flood control channel (Wintersburg Pond or WP), the

[33] As percent oxidizable organic carbon (Hess, P.R. 1971. A Textbook of Soil Chemical Analysis. John Murray, London as referenced in Beaudoin, A. 2003. A comparison of two methods for estimating the organic content of sediments. Journal of Paleolimnology 29:387-390.).

[34] From a federal perspective, once an agricultural area is designated as "prior converted cropland," the lack of wetland vegetation is automatically treated as the "normal situation" and thus renders the area not subject to Corps regulation. However, the Corps considers this designation provisional since RGL 90-07 states that if prior converted cropland is abandoned and wetland conditions return, the area is again jurisdictional. In other words, the process of designating an area as prior converted cropland is subject to error.

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western depression (Agricultural Pond or AP[35]) and two areas in the County parcel roughly matched by elevation[36]. The sampling stations and monitoring wells referred to in the text are shown in Figures 9 - 11.

Vegetation was examined along two wetland transects in the County parcel, and visually assessed in the areas that tend to pond water at AP and WP.[37] At the County parcel, the seven sample plots (C1-C7) that were matched with the depression at WP each had a predominance of hydrophytes and were dominated by some combination of pickleweed (OBL), saltgrass (FACW), alkali heath (FACW+) and little seed canary grass (UPL). Similarly, the seven sample plots (D1-D7) matched with area AP were either bare or had a predominance of hydrophytes, including some combination of saltgrass, alkali heath, pickleweed, and Torrey's seablite (FAC+). Although acknowledging that these results suggest that the depressions in the agricultural area could potentially support a predominance of hydrophytes, Bomkamp et al. (2005) then argue that atypical methodology should not be applied because the area is a "prior converted cropland," a jurisdictional appeal that is only germane under federal law. They also argue that such a comparison is deceptive because they believe that wetland hydrology has been eliminated from the agricultural portion of the Shea Homes property as a result of construction of levees, land-leveling, and diversion of water from upstream areas due to residential development. However, the areas on the County parcel that were delineated as wetlands (Sanders 1987, 1994; Huffman 1987; EPA 1989)[38] appear to have suffered similarly severe alterations to hydrology as the City parcel. They have also suffered similar types of soil disturbance, although for many fewer years. Hovore (1997) reported that nearly the entire area was disked in 1997, completely removing all traces of the surface vegetation except in a few small areas. He also characterized the County parcel as "partially filled and entirely graded-over." Photographs taken by Coastal Commission staff in fall 1998 show that the County parcel from the tree line to the toe of the berm for the flood control channel and from the elevated oil pipeline east to the City parcel had been disked, roughly leveled, and 100% of the vegetation removed (Figure 4). By October the area was plowed and from December 1998 through at least April 1999, fill was deposited on the field adjacent to the Eucalyptus trees and a palm tree. Despite these extreme environmental insults, by September 2000, some portions of the site once again supported a predominance of hydrophytes (Harrison 2000) and the site had further developed wetland characteristics by April 2002 (LSA 2002). Although

[35] "WP" and "AP" are simply short-hand designations coined by Glenn Lukos Associates for two general locations for which there is empirical evidence of ponding after rain storms. "AP" is variously used to refer to the general area of the EPA delineation at the western side of the site or to the current depression at the base of the western hillside and does not refer to a pond created for agricultural purposes..

[36] In fact, the low areas that pond water at AP and WP were not quantitatively sampled for vegetation. Transects A and B were west of WP and much higher. Transect E began in the area that ponds water and extended northeast over higher ground. However, the areas sampled at the County parcel for reference were at roughly similar elevations to those areas at AP and WP that pond water.

[37] The three dominant species (brass buttons, FACW+; salt marsh sand spurry, OBL; and rabbitsfoot grass, FACW+) in the WP were all wetland indicators. On April 6, the AP was still inundated and had no emergent vegetation. Later, a few individuals of brass buttons and bristly ox-tongue (FAC) had appeared. However, as pointed out by Bomkamp et al. (2005) observations of wetland plants on the City parcel are difficult to interpret due to the extreme rainfall of 2005.

[38] Referring to EPA (1989), LSA (2002) incorrectly asserts that "…none of the County parcel was included in the wetland determination." Both Sanders (1987; Figure 3) and EPA (1989; Figure 9) map wetlands on the County parcel and Huffman (1987; Figure 6) includes the County parcel as an area "…exhibiting wetland hydrology and vegetation conditions."

wetlands are no longer found where they were delineated in the 1980s, in the absence of soil disturbance they are developing and expanding into existing depressions (Fontaine 2005b) and water tends to pond in depressions (e.g., Figure 5).

I tested the hypothesis that the City parcel has suffered greater hydrological alterations than has the County parcel (and hence that the latter provides a poor comparison for the former). If this hypothesis is true, then the agricultural depressions should be inundated and saturated less frequently and for shorter durations than the County parcel wetlands. I conducted this test by comparing the patterns of inundation and drying in the three areas using photographs from the Bixby (2005) website. There are several series of photographs of the three areas that were taken at about the same time and that allow direct comparisons of actual inundation and drying under identical rainfall conditions. At the County parcel, the area within the photographs is south and west of a palm tree (Figures 4 & 5) that provides a spatial referent and appears to include portions of polygons characterized as "pickleweed/sea-blite scrub" in 2002 (LSA, 2002) and to be adjacent to sample points C1 and C2, which were dominated by pickleweed in 2005 (Bomkamp et al. 2005). I only used photographic series within which the palm tree and a particular pattern of tire ruts was visible (e.g, Figure 5). The results of this analysis are shown in Tables A1-A3 and A8 in Appendix A.

It appears that when the depression near the palm tree in the County parcel is inundated, so are portions or all of the depressions within the agricultural area that are designated AP and WP. Ponding within the depression at the reference area appears to wax and wane with rainfall and drying conditions roughly in the same pattern as at AP. WP seems generally to stay wetter longer. However, in winter 2002-2003, the reference area held water longer than either agricultural area. Some of this year-to-year variability may be related to changes in drainage patterns resulting from agricultural practices. The available data suggest that the wetlands in the County parcel and the potential wetlands in the agricultural area are at approximately the same elevations, are depressions relative to the surrounding topography, have a shallow clay-rich confining layer, and have similar surface hydrology. The available data falsify the hypothesis that the County parcel is a poor reference site because it is significantly wetter than the City parcel due to surface inundation.

A second argument is that the hydrology of the County parcel is qualitatively different from that of WP or AP. LSA (2002) installed 16 monitoring wells in the County parcel in December 1999 and recorded the depth to standing water between December 1999 and May 2000 and between December 2001 and March 2002. Three wells (10, 13, & 14) close to the flood control channel were examined 3 times at 3-hour intervals on a single day and fluctuations in water height suggested some tidal influence. LSA concluded that the hydrological regime within the study area is primarily a function of surface water following rainfall that causes rapid, though generally brief, rises in groundwater. Only wells 10 and 13 had groundwater within one foot of the surface for long duration. However, groundwater also rose to within a foot of the surface immediately following rainfall on one or two occasions at LSA wells 9, 14, 15, and 16, which are all within the County parcel. In general, the depth to groundwater increases with distance from the flood control channel (Table 5).

In order to examine further the degree to which hydrology in the County area is a function of recent rainfall, I correlated the change in the depth of groundwater from the previous (roughly weekly to biweekly) observation with cumulative rainfall during the previous 7 or 30 days (Table 6). There were no significant correlations with 30-day cumulative rainfall. However, change in the depth to groundwater was significantly correlated with 7-day cumulative rainfall for all but 2 wells (6 & 8). However, the proportion of the variability in water depth that is explained by the variability in recent rainfall (r^2) was small for wells 10, 12, and 13. As suggested by LSA, it is likely that the area represented by these wells is affected by water in the flood control channel and that this affect is most pronounced close to the channel berm. It is also clear that ground water is closer to the surface near the channel, as represented by LSA wells 10 and 13 (Table 5). For these reasons, I agree that the wetland area mapped by LSA (2002) and sampled by Bomkamp et al. (2005; Transect D) does not provide a good reference area for vegetation.

However, the area between LSA wells 8 and 9 that supports pickleweed and seablight scrub (LSA 2002; Bombkamp et al. 2005) does not appear to be dependent on high groundwater for hydrology. In fact, although there are few common dates, the depth to water at LSA well 9 appears roughly comparable to or greater than the depth to water at the Pacific Soils well 8 adjacent to area WP (Tables 5 & 6). This portion of the County parcel is the same area that I used to compare to areas AP and WP for timing and duration of inundation. Therefore, I think it is reasonable to conclude that, like this portion of the County parcel, areas AP and WP are inundated or saturated at a frequency and duration sufficient to support the growth of hydrophytes; and, in the absence of farming, would support the growth of hydrophytes.

The applicant's consultants have objected to this conclusion based on differences in soil chemistry (Table 8). They interpret these differences as evidence that the County parcel has been structured by wetland processes, and that AP and WP have seldom been subject to saturated soil conditions. Most of these arguments are presented by Josselyn (2006a) and are based largely on theoretical considerations. For example, Josselyn explains the high soil salinity in the County parcel relative to AP and WP as due to groundwater derived salt being deposited in the soil via high evaporation. Although this mechanism certainly occurs in nature, I think a more parsimonious explanation is that the high salinity is an historical artifact of the period when the entire Parkside property was a tidal salt marsh. Diked salt marsh soils and dredge spoils placed in upland areas may retain their high salinity for many decades and the salinity in the upland soil on the County parcel is also very high. The lower (but still high) salinities in the agricultural field are probably a result of long-term agricultural manipulations. Next, Josselyn points out that the high rates of production and low rates of decomposition due to anaerobic conditions that are characteristic of wetlands result in an accumulation of organic matter. Although acknowledging that soil organics at AP and WP are similar to various reference wetlands, he suggests that the higher concentrations of organics on the County parcel are due to anaerobic conditions. However, confidence in wetland hydrology being the causative mechanism for the high organics is eroded by the fact that soil organics are actually higher in the upland than in the wetland within the County parcel. The patterns in ammonium and nitrate are perhaps most interesting, albeit somewhat confusing. In aerated soils with a pH above 4, nitrate is the most prevalent nitrogen compound and ammonium is generally in low

concentration[39]. The ratio is usually reversed in waterlogged soils due to the reduction of nitrate as described by Josselyn. In this context, the ammonium to nitrate ratio in the County parcel wetland, Los Patos wetland, and Banning Ranch salt marsh is in the direction expected in saturated soils and the ratio in the County parcel upland, WP, AP, and the Fairview freshwater wetland are in the direction expected for aerobic soils. However, if one looks at the ammonium concentrations, they are similar at all the locations except the Fairview wetland and perhaps WP. The most striking differences among the sites are the high levels of nitrate at the County upland, AP, and WP. Although the elevated levels of nitrate at AP and WP could possibly be related to agriculture, the high level[40] at the County upland is puzzling. There is also considerable spatial variability within the County parcel. At sample sites 4-2 and 4-3, which bracket the area of interest between wells 8 and 9, the ammonium to nitrate ratios are 1.2 and 0.6, respectively. The corresponding figures for organic carbon are 1.2 and 0.8 and for pH are 6.4 and 6.8. In summary, the characteristics of the soil samples from AP and WP are similar to those of the hydrologically most appropriate reference area within the County parcel and are within the range of the other wetland sites sampled by Glenn Lukos.

Conclusions

The available data suggest that portions of the agricultural field at the Shea Homes Parkside site that have shown evidence of ponding in recent years are inundated or saturated at a frequency and duration sufficient to support a preponderance of wetland plant species, and that such a preponderance would exist if the current farming activity ceased. Such areas meet the definition of wetlands under the Coastal Act and the Commission's Regulations.

This conclusion is based on two lines of evidence: (1) an examination of the vegetation at a nearby location that is similar in history, physical characteristics, and hydrology to the depressions in the agricultural field, and (2) an estimate of the frequency of continuous inundation for long duration (≥ 7 days). Areas WP and AP were matched with a wetland area on the County parcel that was similar (or higher) in elevation and topography. Inundation in the agricultural areas and at the reference wetland was similar in pattern and the vegetation in neither area appears to be supported by groundwater, further suggesting that the latter area is a good proxy for the former. Therefore, since the dominant vegetation at the reference areas is mostly comprised of wetland species, it is reasonable to expect that the agricultural areas WP and AP could also support a predominance of hydrophytes in the absence of farming. Whether the mix of wetland species that would eventually develop in the agricultural field would be similar to that observed on the County parcel is uncertain. Initially, the vegetation would probably be quite different, consisting mostly of annual species that are good colonizers, since the seed bank for perennial species has probably been destroyed due to the many years of farming. Over a period of decades, I would expect the vegetation in the two areas to become increasingly similar, although the lower salinity at WP and

[39] Brix, H., K. dyhr-Jensen, and B. Lorenzen. 2002. Root-zone acidity and nitrogen source affects *Typha latifolia* L. growth and uptake kinetics of ammonium and nitrate. Journal of Experimental Botany 53:2442-2450.

[40] One of the 3 samples is an outlier (145 ppm); the other 2 have 21 & 24 ppm nitrate with ammonium to nitrate ratios of 0.5.

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especially AP might result in a different mix of species. However, the actual community trajectory and the rate of convergence in wetland cover would depend on many factors, especially whether rainfall during the first several years following the cessation of farming was heavy or light, initially favoring the establishment of wetland or upland species, respectively.

The hydrology of the Shea Homes property has been significantly altered over the years. It was cut off from tidal influence long ago, but the freshwater surface hydrology has also been altered over the years by a reduction in the size of the watershed. Nevertheless, portions of the site probably have been continuously inundated for long duration at least once a year during about 60 percent of the last 47 years. Prior to about 1990, it appears from aerial photographs (Homrighausen 2005) that significant inundation was generally confined to the area delineated by the EPA (1989). Based on his analysis of aerial photographs dating from 1958 to 1985, Homrighausen (2005) concludes that inundation in that area tended to have a different footprint in different years and, based on this observation, he argues that no particular area should be identified as a wetland. However, all his estimated wetland polygons in the western portion of the agricultural field appear to fall within the area delineated by the EPA. In the absence of wetland vegetation, the drawing of wetland boundaries is an approximate exercise based on a small and haphazard collection of aerial photographs or ground observations and estimates of topography. Given the approximate nature of such delineations, I think Homrighausen's (2005) results are actually additional evidence that the EPA delineation was both reasonable and accurate at the time it was made.

From 1958 - 1985, inundation in the depression adjacent to the flood control channel apparently occurred less frequently than in the depression mapped by EPA. None of the investigators in the late 1980s delineated wetlands along the flood control channel, and Homrighausen (2005) found little evidence of ponding at WP prior to the 1980s. Yet, in recent years, there is ample evidence that WP is inundated for long duration following significant rainfall. In addition, ground photographs suggest that the area delineated by the EPA no longer ponds as frequently or as extensively as in earlier years. There appears to have been a state change in the hydrology of the site some time in the last 20 years or so. This change must be due to alterations in drainage patterns resulting from grading, plowing and disking by the agricultural tenants on the site.

One could argue that the EPA delineation should stand because there has been no change in the overall hydrology of the site (i.e., total input and outflow of water) since 1989 and the recent photographic evidence is meager. Despite the paucity of data, I think the most defensible approach is to base the wetland delineation on current conditions as inferred from recent (2003)[41] topography and the available photographs of recent inundation. I estimated the minimum boundary of wetlands in areas AP and WP based on 2003 topography and on the approximate area that each was inundated following a period of modest rainfall in a year of less than median rainfall. The wetland polygon in both area WP and area AP was based on the pattern of inundation during the period February 26 to March 6, 2004, which followed a storm that dropped 1.88

[41] More recently a box plow was used to fill area WP, which is apparent in the 2006 topographic maps.

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inches of rain during a relatively dry year (5.8" total rainfall). A large area at WP was continuously inundated (Figure 6). The wetland polygon at AP was based on the area inundated on February 26 (Figure 7). By March 6, the area was probably smaller, but the available photograph shows only a small portion of the area shown in the February photograph. Unfortunately, there are few photographs of the AP area, except during periods of exceptionally heavy rainfall (e.g., Figure 3). The actual boundary of the wetland polygons (Figure 8) was obtained by following the contour that seemed to approximate the area that was observed to pond following rainfall. For AP this was the 0-foot contour[42]; for WP this was about the 1.2-foot contour. Given the small amount of rainfall during this period, I think the area delineated is reasonable and possibly conservative. The areas of ponding resulting from high groundwater in 2006 all appear to have been within the delineated AP area.

Although the areas delineated in Figure 8 represent the minimum areas that are likely to support wetland vegetation in the absence of farming, even these small areas would probably lose their wetland character if the amount of water from rainfall and local runoff were to be reduced. Therefore, if they are to persist in the absence of farming, either their watershed must be maintained or supplemental water must be provided.

[42] Relative to NAVD88 vertical datum.

Figure 1. Shea Homes property at Bolsa Chica in Huntington Beach. Portions of the property were previously within the unincorporated area of the County of Orange. In the text there is reference to the "City Parcel" and the "County Parcel," although the latter was annexed by the City in 2003.

Figure 2. Wetland area delineated by Bilhorn (1987). The wetland polygon shown in Bilhorn's map was scanned and then positioned on the recent aerial photograph using ArcView. The size, shape and position of the polygon is approximate. The wetland area calculated from the mapped polygon is 7.6 acres, which is the same area estimated by Bilhorn (1987).

Figure 3. Large portions of the Shea Homes property were continuously inundated for over 30 days during the unusually wet winter of 2000 - 2001. Area AP is in the foreground; area WP is in the background adjacent to the flood control channel. Photographs from Bixby (2005).

Figure 4. Former County parcel after wetlands had been disturbed by agricultural activities and fill in 1997 and 1998 (staff photographs). Upper photograph - 10/22/98; lower photograph - 12/05/98. Note palm tree that is also shown in Figure 5.

Figure 5. Former County parcel on 02/26/04 showing developing vegetation following the cessation of agricultural disturbance. Based on observations by Harrison (2000), LSA (2002), Bomkamp *et al.* (2005) and Fontaine (2005a), a variety of wetland species are becoming established and the area with a preponderance of hydrophytes is increasing. The area with standing water typically ponds following significant rainfall. The palm tree and tire ruts created by driving over wet ground provide references when analyzing inundation from a temporal series of photographs. Photograph from Bixby (2005).

Figure 6. Ponding in area WP during February and March, 2004. Photographs from Bixby (2005).

February 26, 2004

March 6, 2004

March 11, 2004

Figure 7. Ponding in area AP during February and March, 2004 following 1.88 inches of rain on February 26 and an additional 0.52 inches on March 2. The March photograph includes only a small portion of the area shown in the February photograph. Photographs from Bixby (2005).

February 26, 2004

March 6, 2004

Figure 8. Estimated size and location of wetland areas that currently would support a preponderance of wetland plant species in the absence of agriculture. A 100-foot wetland buffer is shown in black.

Figure 9. Map of the County parcel (CP) showing the location of monitoring wells and sampling plots for vegetation and soils.

Figure 10. Map of area AP along the western edge of the agricultural field showing the location of monitoring wells and sampling plots for vegetation and soils.

Figure 11. Map of area WP adjacent to the flood control channel within the agricultural field showing the location of monitoring wells and sampling plots for vegetation and soils.

Table 1. Summary of occurrences of long duration ponding at areas WP and AP as assessed from aerial and ground-level photographs and from rainfall data during the period 1985 – 2005. Y = Yes; N=No.

Rainfall Year	Evidence of Ponding From Photographs		Inferred From Rainfall	Estimated Duration of Ponding at WP
	WP	AP		
2004 - 2005	**Y**	**Y**	**Y**	**> 30 days**
2003 - 2004	**Y**	N	**Y***	**7 - 14 days**
2002 - 2003	**Y**	N	**Y**	**7 - 14 days**
2001 – 2002	N	N	N	< 7 days
2000 – 2001	**Y**	**Y**	**Y**	**> 30 days**
1999 – 2000	N	N	N	< 7 days
1998 – 1999	N	N	N	< 7 days
1997 – 1998	**Y**	**Y**	**Y**	**> 30 days**
1996 - 1997	**Y**	**Y**	**Y**	**15 - 30 days**
1995 - 1996	N	N	**Y**	**7 - 14 days**
1994 - 1995	**Y**	**Y**	**Y**	**> 30 days**
1993 - 1994	N	N	N	< 7 days
1992 - 1993	**Y**	**Y**	**Y**	**> 30 days**
1991 - 1992	**Y**	N	**Y**	**15 - 30 days**
1990 - 1991	N	N	**Y**	**7 - 14 days**
1989 - 1990	N	N	N	< 7 days
1988 - 1989	N	N	N	< 7 days
1987 - 1988	N	N	N	< 7 days
1986 - 1987	N	N	N	< 7 days
1985 - 1986	**Y**	**Y**	**Y**	**15 - 30days**

* WP only

Table 2. Summary of occurrences of long duration ponding at areas WP and AP as assessed from aerial photographs and from rainfall data during the period 1958 – 1985. Where the photographic analysis suggested inundation but LSA considered it a "false positive," I entered "N" in columns 3 and 4. An asterisk in column 4 indicates that LSA concluded that ponding was less than 14 days. Y = Yes; N = No. LSA estimated that ponding for more than 14 days occurred at AP during 13 years and at WP during 5 years over the 27-year period of record (Appendix B, Table B28[#]).

Rainfall Year	Evidence of Ponding From Photographs		Ponding Inferred From Rainfall	Estimated Duration of Ponding at AP
	WP	AP		
1984 - 1985	N	N	**Y***	**15 - 30 days**
1983 - 1984	N	N	N	< 7 days
1982 - 1983	N	N	**Y**	**> 30 days**
1981 - 1982	N	N	N	< 7 days
1980 - 1981[#]	**Y**	**Y**	**Y**	**15 - 30 days**
1979 - 1980	N	**Y**	**Y**	**> 30 days**
1978 - 1979	N	N	**Y**	**15 - 30 days**
1977 - 1978	-	-	**Y**	**> 30 days**
1976 - 1977	N	N	N	< 7 days
1975 - 1976	N	N	N	< 7 days
1974 - 1975	**Y**	**Y**	**Y***	**7 - 14 days**
1973 - 1974	N	N	**Y**	**7 - 14 days**
1972 - 1973	N	N	**Y***	**7 - 14 days**
1971 - 1972	N	N	**Y***	**7 - 14 days**
1970 - 1971	N	N	**Y**	**7 - 14 days**
1969 - 1970	N	N	N	< 7 days
1968 - 1969	-	-	**Y**	**> 30 days**
1967 - 1968	-	-	N	< 7 days
1966 - 1967	-	-	**Y**	**7 - 14 days**
1965 - 1966	-	-	**Y**	**15 - 30 days**
1964 - 1965	N	**Y**	**Y**	**7 - 14 days**
1963 - 1964	-	-	N	< 7 days
1962 - 1963	N	**Y**	**Y**	**7 - 14 days**
1961 - 1962	N	**Y**	**Y**	**15 - 30 days**
1960 - 1961	-	-	N	< 7 days
1959 - 1960	N	N	**Y***	**7 - 14 days**
1958 - 1959	N	N	N	< 7 days

[#] Data for 1980-1981 correspond to Appendix B, Table B23; entry in Table B28 is apparently wrong.

Table 3. Number of years during which there was continuous ponding for long duration relative to the total amount of rainfall during the rain year (July - June). Y = ≥ 7 days continuous ponding; N = 0-6 days continuous ponding. Median annual rainfall for the 47-year period from 1958 through 2005 was 9.0 inches (Quartile[43] 1 = 6.5"; Quartile 3 = 12.3"). The shaded area delineates rain years with median rainfall or less. During 1958 - 1985, ponding figures are for area AP; during 1985 - 2005, ponding figures are for area WP. The depression at area WP may not have been present during much of the earlier period. After around 1985, area AP probably generally ponded at the same time as area WP

Total Amount of Rainfall (in)	1958 - 1985		1985 - 2005		1958 - 2005	
	Y	N	Y	N	Y	N
0-2	0	0	0	0	0	0
2-4	0	1	0	1	0	2
4-6	1	3	1	3	2	6
6-8	3	4	1	3	4	7
8-9.0	0	0	1	1	1	1
9.1-10	5	1	0	0	5	1
10-12	2	0	3	0	5	0
12-14	3	0	2	0	5	0
14-16	0	0	0	0	0	0
16-18	3	0	0	0	3	0
18-20	0	0	2	0	2	0
20-22	1	0	1	0	2	0
22-24	0	0	1	0	1	0
Total:	18	9	12	8	30	17

[43] Quartile 1 is the upper bound of the lowest 25% of observations and Quartile 3 is the lower bound of the highest 25% of observations.

Table 4. Relationship between the duration of ponding and the total amount of rainfall during the rain year (July - June). Entries are number of years within each category during the period 1958 - 2005. Median annual rainfall for the 47-year period from 1958 through 2005 was 9.0 inches (Quartile 1 = 6.5"; Quartile 3 = 12.3"). The shaded area delineates rain years with median rainfall or less. During 1958 - 1985, ponding figures are for area AP; during 1985 - 2005, ponding figures are for area WP. The depression at area WP may not have been present during much of the earlier period. After around 1985, area AP probably generally ponded at the same time as area WP.

Total Amount of Rainfall (in)	Estimated Duration of Continuous Ponding			
	0 - 6 days	7 - 14 days	15 - 30 days	> 30 days
0-2	0	0	0	0
2-4	2	0	0	0
4-6	6	2	0	0
6-8	7	3	1	0
8-9.0	1	1	0	0
9.1 - 10	1	4	1	0
10-12	0	1	4	0
12-14	0	2	2	1
14-16	0	0	0	0
16-18	0	0	0	3
18-20	0	0	0	2
20-22	0	0	0	2
22-24	0	0	0	1
Total:	17	13	8	9

Table 5. Water depth below the surface at the LSA monitoring wells in the former County parcel during winters 1999-2000 and 2001-2002. Where the water table is within the upper 1 foot of the soil column, the depth is indicated in bold type.

Station:	LSA 6	LSA 8	LSA 9	LSA 10	LSA 12	LSA 13	LSA 14	LSA 15	LSA 16	Cumulative Rainfall During Prior 7 Days	Cumulative Rainfall During Prior 30 Days
Station Elevation (MSL):	3.3 ft	1.3 ft	0.9 ft	1.3 ft	0.8 ft	1.0 ft	-0.1 ft	-0.4 ft	-0.2 ft		
12/17/1999			-3.95	-2.35	-4.90	-1.80	-3.05		-3.25	0.00	0.00
12/30/1999			-4.10	-2.45	-2.90	-1.90	-3.20		-3.35	0.00	0.00
1/5/2000			-4.05	-2.40	-4.00	-1.90	-3.05		-3.30	0.07	0.07
1/20/2000			-4.10	-2.45	-3.95	-2.00	-3.10		-3.30	0.00	0.07
1/26/2000			-3.85	-1.90	-3.75	-1.40	-2.55	-4.90	-2.90	0.51	0.58
2/1/2000			-3.90	-2.05	-3.70	-1.50	-2.70	-4.90	-2.80	0.41	0.62
2/18/2000			-3.15	**-0.90**	-3.00	**-0.40**	-1.95	-4.25	-2.10	0.85	1.87
2/25/2000		-4.95	**0.00**	**-0.40**	-1.35	**0.00**	**-0.40**	-1.20	**-0.60**	1.95	3.31
3/3/2000			-2.45	**-1.00**	-2.15	**0.00**	-1.20	-2.45	-1.35	0.06	3.26
3/10/2000		-4.35	**-0.10**	**-0.80**	-1.40	**-0.25**	**-0.40**	**-1.00**	**-0.75**	1.33	4.59
3/17/2000		-4.65	-2.40	-1.15	-2.10	**-0.50**	-1.20	-2.10	-1.30	0.00	3.62
3/24/2000		-4.90	-2.60	-1.55	-2.35	**-0.95**	-1.55	-2.60	-1.60	0.00	1.82
3/31/2000		-4.90	-2.60	**-1.05**	-2.35	**-0.45**	-1.55	-2.90	-1.65	0.00	1.33
4/7/2000			-2.85	-1.75	-2.65	-1.15	-1.90	-3.15	-1.95	0.00	0.05
4/20/2000		-4.85	-2.55	-1.30	-2.30	**-0.60**	-1.50	-2.85	-1.65	0.81	0.81
5/3/2000			-2.95	-1.65	-2.75	-1.10	-2.00	-3.50	-2.10	0.00	0.81
12/21/2001	-5.25	-5.45	-3.25	**-0.70**	-3.15	**-0.30**	-2.20	-4.70	-2.55	0.08	1.00
12/31/2001	-5.15	-5.25	-2.90	**-0.65**	-2.80	**-0.25**	-1.70	-4.60	-2.05	0.32	0.94
1/14/2002	-5.30	-5.45	-3.55	-1.40	-3.35	**-0.70**	-2.35	-4.75	-2.65	0.00	0.64
1/28/2002	-5.30	-5.50	-3.45	-1.10	-3.30	**-0.55**	-2.30	-4.80	-2.50	0.00	0.72
1/31/2002	-5.30	-5.55	-3.60	-1.50	-3.40	-1.10	-2.45	-4.85	-2.75	0.29	0.29
2/15/2002	-5.30		-3.70	-1.75	-3.50	-1.15	-2.60	-4.90	-2.60	0.00	0.29
2/18/2002	-5.20		-3.30	-1.40	-3.20	**-0.80**	-2.15	-4.80	-2.50	0.16	0.57
3/4/2002	-5.15		-3.60	-1.85	-3.35	-1.30	-2.55	-4.75	-2.70	0.00	0.28
3/11/2002	-5.15	-5.45	-3.40	-1.50	-3.25	**-0.85**	-2.34	-4.70	-2.60	0.04	0.32
3/19/2002	-5.15		-3.55	-1.80	-3.35	-1.15	-2.40	-4.75	-2.70	0.13	0.29
3/27/2002	-5.20		-3.50	-1.55	-3.30	**-1.00**	-2.40	-4.70	-2.55	0.05	0.22

Table 6. Correlation (r) between cumulative rainfall prior to the date of the observation and the change in the water depth below the surface (WDBS) since the previous observation. Observations were generally made on weekly or biweekly intervals. Statistically significant ($p \leq 0.05$) correlations in bold. The proportion of the variability in water depth explained by rainfall (r^2) in parentheses.

Station	WDBS vs 7-Day Cumulative Rainfall	WDBS vs 30-Day Cumulative Rainfall
LSA 6	0.508	0.221
LSA 8	0.174	-0.325
LSA 9	**0.787** (.62)	0.156
LSA 10	**0.510** (.26)	0.115
LSA 12	**0.588** (.35)	0.120
LSA13	**0.390** (.15)	0.097
LSA 14	**0.822** (.68)	0.209
LSA 15	**0.897** (.80)	0.282
LSA 16	**0.823** (.68)	0.213

Table 7. Water depth below the surface at Pacific Soil's monitoring wells. Where the water table is within the upper 12 inces of the soil column, the depth is indicated in bold type. PS-7 and PS-8 are next to the flood control channel at each end of WP, PS-12 is next to the flood control channel at the County parcel (CP), and PS 16 is on the slope above AP. Data for the 2005-2006 rain year are anomalous due to the lagged effects of the extraordinarily high precipitation of the previous year and are not included.

Date	PS-7 (Elev=1.7 ft)	PS-8 (Elev=1.3 ft)	PS-12 (Elev=1.8 ft)	PS-16 (Elev=3.4 ft)
12/1/1999	4.61	7.10	4.51	10.50
12/2/1999	4.68	5.32	2.87	10.50
12/8/1999	4.68	5.35	2.88	10.50
12/22/1999	4.55	3.59	2.67	10.50
1/25/2000	4.43	3.26	2.56	10.50
3/3/2000	2.88	1.21	**0.21**	10.22
3/31/2000	3.72	1.86	**1.06**	10.20
5/26/2000	3.27	2.53	1.81	10.50
7/19/2000	3.94	2.77	2.48	10.50
8/21/2000	4.07	2.38	2.37	10.30
9/29/2000	4.00	2.19	1.91	10.50
10/16/2000	4.04	2.29	2.47	
11/27/2000	4.18	2.10	2.22	
12/31/2000	4.10	2.18	2.17	
1/30/2001	3.61	1.84	2.08	
3/16/2001	2.05	1.43	1.18	
5/11/2001	3.35	2.22	1.18	
2/8/2002	2.90	3.08	1.69	
10/18/2002		3.79	2.21	
1/24/2003		3.67	2.04	
3/11/2003		2.69		
3/14/2003		8.42		
4/4/2003		5.71	1.31	
5/23/2003		2.80	1.78	
7/25/2003		2.15	2.16	
10/31/2004			2.06	
2/20/2004			1.78	
6/11/2004			1.64	
8/9/2004			1.76	

Table 8. Soil characteristics at potential wetlands within the agricultural field (AP and WP) and at various reference wetlands. CP is the former County parcel. The Upland samples were taken a few feet outside the area of wetland vegetation.

Variate	Descriptive Statistic	CP Upland (n=3)	CP Wetland (n=25)	AP (n=9)	WP (n=9)	Los Patos Seasonal Freshwater Wetland (n=2)	Fairview Seasonal Freshwater Wetland (n=3)	Banning Ranch Salt Marsh (n=3)
Clay (%)	Mean	23.8	28.3	21.0	35.8	30.0	44.8	32.7
	SE	1.0	2.1	1.9	1.0	4.0	1.5	1.9
pH	Mean	5.4	5.7	7.0	7.5	7.1	6.4	7.1
	SE	0.2	0.2	0.1	0.0	0.2	0.1	0.1
NH4 (ppm)	Mean	11.3	14.9	12.8	4.4	11.0	0.9	8.3
	SE	0.3	2.8	3.3	1.0	3.0	0.1	0.3
NO3 (ppm)	Mean	63.3	7.1	41.8	24.7	4.0	10.3	5.7
	SE	40.1	0.8	25.6	4.2	2.0	1.3	1.8
NH4/NO3	Mean	0.4	2.1	0.7	0.3	3.2	0.9	1.8
	SE	0.1	0.2	0.2	0.1	0.8	0.1	0.5
Total Organics (% dry wt)	Mean	9.5	7.1	5.8	1.0	0.7	1.7	2.0
	SE	0.9	0.8	0.8	0.1	0.3	0.2	0.2
TOC (%)	Mean	5.4	4.0	3.2	0.5	0.4	1.0	1.1
	SE	0.5	0.4	0.4	0.2	0.1	0.1	0.1
SAR	Mean	20.4	38.7	30.4	13.6	5.3	2.8	35.1
	SE	0.0	2.9	2.9	0.5	1.2	0.1	7.7
ECe (dS/m)	Mean	24.9	40.6	4.4	11.4	1.9	0.7	29.0
	SE	2.6	3.5	0.4	1.0	0.1	0.0	6.1
SO4 (me/l)	Mean	50.2	76.0	30.4	38.0	5.3	2.3	50.0
	SE	4.9	3.6	2.9	3.0	0.2	0.4	2.6
Fe (ppm)	Mean	810	787	225	31	79	89	160
	SE	84	128	35	2	12	11	54

APPENDIX A.

Tables A1 – A20: Photographic evidence of ponding (=flooding), and rainfall data for the period 1985 – 2000. All rainfall data from Los Alamitos Station (Number 170). There was no rainfall on dates not tabulated during the period October - March of each year. "Long duration" is defined as, "A flooding class in which the period of inundation for a single event ranges from 7 days to 1 month." "Very long duration" is defined as, "A duration class in which the length of a single inundation event is greater than 1 month."[44]

[44] Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1. U.S. Army Engineer Waterways Experiment Stations, Vicksburg, Mississippi.

Table A1. Rainfall and inundation during the 2004-2005 Season. Inundation data from ground-level photographs (Bixby 2005). Extensive areas of WP and AP were continuously ponded during most of the winter (shaded periods). Based on the photographs and on the rainfall pattern and amount, it is likely that both WP and AP were continuously inundated for more than 30 days during the shaded period.

Date	Rainfall	Former County Parcel "Pickleweed/Sea Blite Scrub" Wetland (LSA)	South-Central Depression at Channel Berm (WP)	Western Depression (AP)
10/01/04 – 10/16/04	0.0	-	-	-
10/17/04	2.46	Modest Pond (c. 15' x 25')	Large pond in field (c. 40' x 120'; probably equal area to E out of photo)	Long linear pond in field (c. 25' x 200')
10/18/04	0.12			
10/19/04	0.0	Standing water only in ruts	Large pond in field	Pond much reduced (c. 15' x 20')
10/20/04	1.88	-	-	-
10/21/04	0.31	Modest Pond	Large pond in field	Large linear pond in field (c. 25' x 200')
10/22/04	0.0	-	-	-
10/23/04	0.0	Modest Pond	Large pond in field	Large linear pond in field (c. 15' x 100')
10/24/04 – 10/25/06	0.0	-	-	-
10/26/04	0.0	Pond nearly gone	Large pond in field	Pond much reduced (c. 15' x 20')
10/27/04	1.77	Larger pond (c. 15' x 45')	Large pond in field	Large linear pond in field (c. 40' x 250')
10/28/04	0.20	-	-	-
10/29/04	0.0	-	-	-
10/30/04		Modest pond	Large pond in field	Large linear pond in field (c. 25' x 100')
10/31/04	0.0	-	-	-
11/01/04	0.0	-	-	-
11/02/04	0.0	No standing water	Large pond in field	Pond much reduced (c. 25' x 20')
11/03/04 – 11/30/04	0.43	-	-	-
DEC	2.52	-	-	-
JAN	5.21	Periodically ponded, sometimes extensively	Continuously extensively ponded	Continously ponded, generally extensively
FEB	7.35			
MAR	0.51			

Table A2. Rainfall and inundation during the 2003-2004 season. Shaded rainfall considered "near normal" for January or February. Inundation data from ground-level photographs (Bixby 2005). Shaded period is evidence of long duration inundation during near normal rainfall. Based the photographs, it is likely that WP was continuously inundated for 7 - 14 days during the shaded period. AP may have been ponded for fewer than 7 days.

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Date	Rainfall	Former County Parcel "Pickleweed/Sea Blite Scrub" Wetland (LSA)	South-Central Depression at Channel Berm (WP)	Western Depression (AP)
OCT	0	-	-	-
NOV	0.68	-	-	-
12/01/03 – 12/25/03	0.32	-	-	-
12/26/03	0.42	Modest Pond	Ponded or wet on road; little or no ponding in field	Ponded in furrows near bend in road
12/28/03	0	Pond reduced to ruts	Ponded or wet on road; little or no ponding in field	Ponded in furrows near bend in road
12/30/03	0	Pond reduced to ruts		
12/31/03	0		Ponded or wet on road; little or no ponding in field	No standing water
01/01/04	0	No surface water	Ponded or wet on road; little or no ponding in field	No standing water
01/03/04	0.34	Modest pond	Ponded or wet on road; little or no ponding in field	Ponded in furrows near bend in road
01/10/04	0	No surface water	Ponded or wet on road; little or no ponding in field	No standing water
01/19/04	0.01	-	-	-
02/03/04	0.58	Modest pond	Ponded or wet on road; little or no ponding in field	Ponded in furrows near bend in road
02/07/04	0	No standing water	Ponded or wet on road; little or no ponding in field	Ponded in furrows near bend in road
02/08/04	0	Muddy and glistening at surface	Ponded or wet on road; little or no ponding in field	Less extensive ponding
02/09/04	0	No standing water; not glistening at surface	Ponded or wet on road; little or no ponding in field	Less extensive ponding
02/13/04	0	-	-	-
02/19/04	0.26	Ponded mostly in ruts	Ponded or wet on road; little or no ponding in field	Very shallow surface water
02/22/04	0.31	Modest pond	-	-
02/23/04	0.18	Pond reduced	Ponded or wet on road; little or no ponding in field	No standing water
02/26/04	1.88	Modest pond	Extensive ponding in furrows in field	Large pond
02/28/04	0	Pond reduced	Extensive ponding in furrows in field	Pond reduced in size
03/01/04	0	Ponded in ruts	Extensive ponding in furrows in field	Appears saturated to surface, but not inundated
03/02/04	0.52	Ponded in ruts and depressions	Extensive ponding in furrows in field	Ponded in furrows
03/04/04	0	Ponded in ruts	Extensive ponding in furrows in field	Ponded in furrows but less extensive
03/06/04	0	Ponded in ruts	Extensive ponding in furrows in field	Ponded in furrows but less extensive
03/11/04		-	Minor ponding in furrows in field	-
03/13/04	0	-	Field is muddy & glistening at surface	

Table A3. Rainfall and inundation during the 2002-2003 season. Inundation data from ground-level photographs (Bixby 2005). Shaded period is evidence of long duration inundation during near normal rainfall. Based on the photographs, it is likely that both WP and AP were continuously inundated for 7 - 14 days during the shaded period..

Date	Rainfall	Former County Parcel "Pickleweed/Sea Blite Scrub" Wetland (LSA)	South-Central Depression at Channel Berm (WP)	Western Depression (AP)
OCT	0.11	-	-	-
11/08/02 - 11/10/02	1.07	-	--	-
11/30/02	0.54	-	-	-
12/17/02	1.03	Pond (c. 12' x 15')	Recently plowed. Ponded on (plowed) road and adjacent furrows in area c. 15' x 30'.	Ponded in field at bend (c. 20' x 50')
12/18/02	0.21			
12/19/02	0	Pond (c. 15' x 20')	Mostly wet on surface; standing water in furrows	
12/20/02	0.62	Pond (c. 20' x 30')	Large area (c. 60' x 120') ponded in furrows within field	Ponded in field at bend & toward Eucalyptus (c. 40' x 150')
12/21/02	0.06	Pond (c. 20' x 30')	Large area (c. 60' x 120') ponded in furrows within field	Ponded in field at bend & toward Eucalyptus (c. 40' x 150')
12/22/02	0	Pond (c. 15' x 20')	Large area (c. 60' x 120') ponded in furrows within field	Ponded in field at bend & toward Eucalyptus (c. 40' x 150'); shallow water or glistening at surface
12/23/02	0	-	Inundated area appears much reduced in poor photo	Shallow standing water or glistening at surface in small area (c. 15' x 20') at bend.
12/24/02	0	Pond (c. 12' x 15')	Inundated area appears much reduced in poor photo; muddy and glistening at the surface in some areas	-
12/27/02	0	Shallow standing water mostly in ruts	Wet at surface; little standing water	No standing water
12/28/02	0	Muddy & glistening at surface; water in ruts	Muddy and glistening at the surface; standing water in furrows	Muddy & glistening at surface
12/29/02	0.08	Pond (c. 12' x 15')	Small patch with standing water in furrows	Muddy & glistening at surface; standing water in furrows
JAN	0.00			
01/04/03	0	-	-	Muddy & glistening at surface; standing water in furrows
02/01/03 - 02/10/03	0.00			
02/11/03 - 01/14/03	2.62			
02/15/03 - 02/24/03	0.00			
02/25/03 - 02/28/03	1.16			
03/04/03	0.15	-	-	
03/15/03 - 03/16/03	3.19	-	-	
03/20/03	0	-	Road nearly dry	

Table A4. Rainfall and inundation during the 2001-2002 season. Inundation data from vertical aerial photograph (Homrighausen 2005). Based on rainfall pattern and amount, it is unlikely that WP or AP were continuously inundated for long duration during this season.

Date	Rainfall	Former County Parcel "Pickleweed/Sea Blite Scrub" Wetland (LSA)	South-Central Depression at Channel Berm (WP)	Western Depression (AP)
OCT	0.00	-	-	-
NOV	0.89	-	-	-
DEC	0.94	-	-	-
JAN	0.29	-	-	-
FEB	0.28	-	-	-
MAR	0.22	-	-	-
APR	0.20	-	-	-
05/01/02 – 05/22/02	0.05	-	-	-
05/23/02	0.00	No ponds visible	No ponds visible	No ponds visible

Table A5. Rainfall and inundation during the 2000-2001 season. Inundation data from ground-level photographs (Bixby 2005). Lightly shaded period is evidence of long duration inundation during near normal rainfall. Based on rainfall pattern and amount, it is likely that WP and AP were continuously inundated for more than 30 days during February and March (dark shaded period).

Date	Rainfall	Former County Parcel "Pickleweed/Sea Blite Scrub" Wetland (LSA)	South-Central Depression at Channel Berm (WP)	Western Depression (AP)
OCT	2.71	-	-	-
NOV	0.01	-	-	-
DEC	0	-	-	-
01/01/01 – 01/08/01	0.00	-	-	-
01/09/01 – 1/13/01	2.47	-	-	-
01/14/01 – 01/23/01	0	-	-	-
01/24/01	0.12	-	-	-
01/25/01	0.29	-	-	-
01/26/01	0.21	-	-	-
01/27/01	0.32	-	-	-
01/28/01 – 01/30/01	0	-	-	-
01/31/01	0	No photographs available.	Road and large portion (c. 150' x 200') of adjacent field ponded	No photographs available.
02/01/01 – 02/09/01	0.00	-	-	-
02/10/01 – 02/14.01	2.67	-	-	-
02/15/01 – 02/19/01	0	-	-	-
02/20/01 – 02/28/01	3.62	-	-	-
03/01/01	0.14	-	-	-
03/06/01	0.46	-	-	-
03/07/01	0.07	-	-	-
03/10/01	0.13	-	-	-
03/12/01	0	No photographs available.	Large portion of field ponded	Very large area (c. 200 x 700') ponded
03/14/01	0	No photographs available.	Large portion of field ponded	Very large area (c. 200 x 700') ponded
03/18/01	0	No photographs available.	No photographs available.	Very large area (c. 200 x 700') ponded
03/23/01	0	No photographs available.	No photographs available.	Very large area (c. 200 x 700') ponded
03/28/01	0	No photographs available.	No photographs available.	Previously ponded area appears to be mud with scattered ponds

Table A6. Rainfall and inundation during the 1999-2000 season. Inundation data from ground-level photographs (Bixby 2005). Based on rainfall pattern and amount, it is unlikely that WP or AP were continuously inundated for long duration during this season.

Date	Rainfall	Former County Parcel "Pickleweed/Sea Blite Scrub" Wetland (LSA)	South-Central Depression at Channel Berm (WP)	Western Depression (AP)
OCT	0.00	-	-	-
NOV	0.18	-	-	-
DEC	0.00	-	-	-
JAN	0.69	-	-	-
02/01/00	0.00	-	-	-
02/02/00	0.00	No ponds visible	No ponds visible	No ponds visible
02/03/00 – 02/10/00	0.00	-	-	-
02/11/00	0.40			
02/12/00	0.35			
02/13/00	0.00			
02/14/00	0.16			
02/15/00	0.00			
02/16/00	0.06			
02/17/00	0.28			
02/18/00 – 02/19/00	0.00			
02/20/00	0.15			
02/21/00	0.79			
02/22/00	0.46	-	-	-
02/23/00	0.12	-	-	-
02/24/00	0.43			
02/25/00 – 02/27/00	0.00			
02/28/00	0.06			
03/01/00 – 03/03/00	0.00	-	-	-
03/04/00 – 03/09/00	1.33	-	-	-
03/09/00 – 03/31/00	0.00	-	-	-

Table A7. Rainfall and inundation during the 1998-1999 season. Inundation data from vertical aerial photograph (Homrighausen 2005). Based on rainfall pattern and amount, it is unlikely that WP or AP were continuously inundated for long duration during this season.

Date	Rainfall	Former County Parcel "Pickleweed/Sea Blite Scrub" Wetland (LSA)	South-Central Depression at Channel Berm (WP)	Western Depression (AP)
OCT	0.15	-	-	-
NOV	0.77	-	-	-
DEC	0.78	-	-	-
01/01/99 – 01/04/99	0.00	-	-	-
01/05/99	0.00	No ponds visible	No ponds visible	No ponds visible
01/06/99 – 01/19/99	0.00	-	-	-
01/20/99 – 01/31/99	1.09	-	-	-
FEB	0.79	-	-	-
MAR	1.37	-	-	-

Table A8. Rainfall and inundation during the 1997 – 1998 season. Inundation data from ground-level photographs (Bixby 2005). Lightly shaded period is evidence of long duration inundation during near normal rainfall. Based on rainfall pattern and amount, it is likely that WP and AP were continuously inundated for more than 30 days during this winter season (light and dark shaded periods).

Date	Rainfall	Former County Parcel "Pickleweed/Sea Blite Scrub" Wetland (LSA)	South-Central Depression at Channel Berm (WP)	Western Depression (AP)
OCT	0	-	-	-
11/11/97 – 11/14/97	0.97	-	-	-
11/15/97 – 11/26/97	0	-	-	-
11/27/97	0.62	-	-	-
12/01/97	0.37	-	-	-
12/06/97	1.88	-	-	-
12/07/97	0.23	Large ponded area. Too distant in photograph to estimate size.	Road and large area (c. 150' x 250') in field ponded	No photographs available for this year
12/09/97	0.08	-		-
12/13/97	0	-	Ponding much reduced but still extensive areas of standing water within muddy field	-
12/18/97	0	-	Ponding much reduced but still extensive areas of standing water within muddy field	-
12/19/97	1.14	-	-	-
12/20/97	0	Large ponded area	-	-
12/21/97	0.28	-	-	-
12/22/97	0	-	Large ponds among furrows	-
01/05/98	0.11	-		-
01/06/98	0	-	Many scattered large ponds	-
01/09/98 – 01/11/98	0.85	-	-	-
01/12/98	0	Large ponded area	Large portions of field ponded within larger muddy area	-
01/13/98	0.09	-	-	-
01/14/98	0	-	Large portions of field ponded within larger muddy area	-
01/15/98	0	Pond present	-	-
01/17/98	0	Pond present	-	-
01/18/98	0		Large portions of field ponded within larger muddy area	-
01/19/98	0.14	Pond present		-
01/21/98	0	Scattered areas of standing water in muddy area	Large portions of field ponded within larger muddy area	-
1/30/98 – 1/31/98	0.51	-	-	-
FEB	8.56	Large pond on Feb 7; whole parcel appears inundated on Feb 12, 16, 19, & 26	Very large pond on Feb 1,5,10,16,19 & 26	-
MAR	2.51	-	Large pond on Mar 29	-

Table A9. Rainfall and inundation during the 1996 – 1997 season. Inundation data from oblique aerial photograph (Bixby 2005) and vertical aerial photograph (Homrighausen 2005). Based on the photographs and on rainfall pattern and amount, it is likely that WP and AP were continuously inundated for 15 - 30 days during the shaded period in January.

Date	Rainfall	Former County Parcel "Pickleweed/Sea Blite Scrub" Wetland (LSA)	South-Central Depression at Channel Berm (WP)	Western Depression (AP)
OCT	0.77	-	-	-
11/01/96 – 11/20/96	0.00	-	-	-
11/21/96 – 11/22/96	2.00	-	-	-
11/23/96 – 11/30/96	0.00	-	-	-
12/01/96 – 12/09/96	0.16	-	-	-
12/10/96 – 12/12/96	2.22	-	-	-
12/13/96 – 12/22/96	0.00	-	-	-
12/23/96	0.16	-	-	-
12/24/96 – 12/27/96	0.00	-	-	-
12/28/81	0.42	-	-	-
12/29/96 – 12/31/96	0.00	-	-	-
01/01/97 – 01/03/97	0.43	-	-	-
01/04/97 – 01/05/97	0.00	-	-	-
01/06/97	0.12	-	-	-
01/07/97 – 01/12/97	0.00	-	-	-
01/13/97	1.65	-	-	-
01/14/97 – 01/15/97	0.00	-	-	-
01/16/97	0.85	-	-	-
01/22/97	0.51	-	-	-
01/23/97	0.38	-	-	-
01/24/97 – 01/25/97	0.00	-	-	-
01/26/97	0.81	-	-	-
01/27/97 – 01/28/79	0.00	-	-	-
01/29/97	0.00	Large pond in oblique aerial photograph in vicinity of palm tree	Entire WP area inundated	Not visible in photograph
02/01/97 – 02/13/97	0.12	-	-	-
02/14/97	0.00	-	Ponded	Not Ponded
02/15/97 – 02/28/97	0.00			
MAR	0.00	-	-	-

Table A10. Rainfall and inundation during the 1995-1996 season. Inundation data from vertical aerial photograph (Homrighausen 2005). Based on rainfall pattern and amount, it is likely that WP and perhaps AP were continuously inundated for 7 - 14 days during the shaded period in February.

Date	Rainfall	Former County Parcel "Pickleweed/Sea Blite Scrub" Wetland (LSA)	South-Central Depression at Channel Berm (WP)	Western Depression (AP)
OCT	0.00	-	-	-
NOV	0.04	-	-	-
12/01/95 – 12/14/95	0.69	-	-	-
12/15/95 – 12/22/95	0.00	-	-	-
12/23/95 – 12/24/95	0.59			
12/25/95 – 12/31/95	0.00	-	-	-
01/01/96 – 01/10/96	0.00	-	-	-
01/11/96	0.00	No ponds visible	No ponds visible	No ponds visible
01/12/96 - 01/16/96	0.0			
01/17/96 - 01/22/96	0.82			
01/28/96 - 01/31/96	0.48			
02/01/96 – 02/04/96	0.54	-	-	-
02/05/96 – 02/19/96	0.00	-	-	-
02/20/96 – 02/22/96	2.09	-	-	-
02/23/96 – 02/24/96	0.00	-	-	-
02/25/96 – 02/28/96	0.61	-	-	-
02/29/96	0.00	-	-	-
03/01/96 – 03/04/96	0.00	-	-	-
03/05/96	0.71	-	-	-
03/06/96 – 03/12/96	0.00	-	-	-
03/13/96	0.27	-	-	-
03/14/96 – 03/31/96	0.00	-	-	-

Table A11. Rainfall and inundation during the 1994-1995 season. Inundation data from a vertical aerial photograph (Homrighausen 2005). Based on the photographs and on rainfall pattern and amount, it is likely that WP and AP were continuously inundated for more than 30 days during the shaded period in January and in early February.

Date	Rainfall	Former County Parcel "Pickleweed/Sea Blite Scrub" Wetland (LSA)	South-Central Depression at Channel Berm (WP)	Western Depression (AP)
OCT	0.11	-	-	-
NOV	0.47	-	-	-
DEC	0.85	-	-	-
01/01/95 – 01/02/95	0.00	-	-	-
01/03/95 – 01/05/95	5.32	-	-	-
01/06/95	0.00	-	-	-
01/07/95 – 01/12/95	4.01	-	-	-
01/13/95 – 01/15/95	0.00	-	-	-
01/16/95	0.11	-	-	-
01/17/95 – 01/20/95	0.00	-	-	-
01/21/95	0.30	-	-	-
01/22/95 – 01/23/95	0.00	-	-	-
01/24/95 – 01/26/95	1.99	-	-	-
01/27/95	0.00	-	-	-
01/28/95	0.00	Not Analyzed*	Ponded	Ponded
01/29/95 – 01/31/95	0.00	-	-	-
FEB	0.45	-	-	-
03/01/95 – 03/05/95	0.00	-	-	-
03/06/95	1.40	-	-	-
03/07/95 – 03/10/95	0.00	-	-	-
03/11/95 – 03/12/95	1.72	-	-	-
03/13/95 – 03/20/95	0.00	-	-	-
03/21/95 – 03/22/95	0.78	-	-	-
03/23/95 – 03/26/95	0.00	-	-	-
03/27/95	0.00	Not Analyzed*	Ponded	Ponded
03/28/95 – 03/31/95	0.00	-	-	-
		-	-	-

* LSA did not analyse this portion of the photograph; M.Bixby (2005) interpreted the photographs to show ponding in the County area.

Table A12. Rainfall and inundation during the 1993-1994 season. Inundation data from a vertical aerial photograph (Homrighausen 2005). Based on rainfall pattern and amount, it is unlikely that WP or AP were continuously inundated for long duration during this season.

Date	Rainfall	Former County Parcel "Pickleweed/Sea Blite Scrub" Wetland (LSA)	South-Central Depression at Channel Berm (WP)	Western Depression (AP)
OCT	0.04	-	-	-
NOV	0.51	-	-	-
DEC	0.67	-	-	-
01/01/94 – 01/02/94	0.00	-	-	-
01/03/94	0.00	No ponds visible	No ponds visible	No ponds visible
01/04/94 – 01/27/94	0.00	-	-	-
01/28/94	0.28			
01/29/94 – 01/31/94	0.00			
02/01/94 – 02/03/94	0.00	-	-	-
02/04/94 – 02/05/94	0.56	-	-	-
02/06/94	0.00			
02/07/94 – 02/08/94	1.14			
02/09/94 – 02/16/94	0.00	-	-	-
02/17/94	0.47	-	-	-
02/18/94	1.01			
02/19/94	0.10			
02/20/94	0.97			
02/21/94	0.28	-	-	-
02/22/94 – 02/28/94	0.00			
MAR	0.00	-	-	-

Table A13. Rainfall and inundation during the 1992-1993 season. Inundation data from oblique aerial photograph (Bixby 2005). Based on the photographs and on rainfall pattern and amount, it is likely that WP and AP were continuously inundated for more than 30 days during the shaded period.

Date	Rainfall	Former County Parcel "Pickleweed/Sea Blite Scrub" Wetland (LSA)	South-Central Depression at Channel Berm (WP)	Western Depression (AP)
OCT	0.37	-	-	-
NOV	0	-	-	-
12/01/92 - 12/06/92	0.0			
12/07/92 - 12/08/92	4.33			
12/11/92	0.12			
12/18/92	0.11			
12/28/92 - 12/31/92	0.92			
01/01/93 - 01/02/93	0.34			
01/06/93 - 01/08/93	3.30			
01/11/93 - 01/19/93	4.06			
01/31/93	0.39			
02/01/93 – 02/09/93	1.21	-	-	-
02/10/93	-	Large pond in oblique aerial photograph in vicinity of palm tree	Very large area at WP inundated	Large ponds visible but much less obvious than at WP
02/11/93 – 02/18/93	0.00	-	-	-
02/19/93 – 02/28/93	1.93	-	-	-
03/01/93 - 03/25/93	0.0			
03/26/93 - 03/31/93	1.61			

Table 14. Rainfall and inundation during the 1991-1992 season. Inundation data from an oblique aerial photograph (Bixby 2005). Based on rainfall pattern and amount, WP and probably AP were continuously inundated for 15 - 30 days during the shaded period in February and in early March.

Date	Rainfall	Former County Parcel "Pickleweed/Sea Blite Scrub" Wetland (LSA)	South-Central Depression at Channel Berm (WP)	Western Depression (AP)
OCT	0.00	-	-	-
NOV	0.06	-	-	-
DEC	1.59	-	-	-
01/01/92 - 01/02/92	0.00			
01/03/92 - 01/08/92	1.52			
01/09/92 - 01/31/92	0.00			
02/01/92 – 02/06/92	0.00	-	-	-
02/07/92	1.03	-	-	-
02/08/92 – 02/09/92	0.00	-	-	-
02/10/92 – 02/16/92	3.43	-	-	-
02/17/92 – 02/29/92	0.00	-	-	-
03/01/92	0.00	-	-	-
03/02/92 – 03/03/92	0.51	-	-	-
03/04/92	0.00	Not clear in oblique aerial photograph	Ponding apparent along flood control channel	Not clear in oblique aerial photograph
03/05/92	0.00			
03/06/92	0.18			
03/07/92 - 03//19/92	0.00			
03/20/92 - 03/23/92	1.65			
03/24/92 - 03/26/92	0.00			
03/27/92	1.01			
03/28/92 - 03/31/92	0.00			

Table A15. Rainfall and inundation during the 1990-1991 season. Inundation data from a vertical aerial photograph (Homrighausen 2005). Based on rainfall pattern and amount, it is likely that WP and AP were continuously inundated for 7 - 14 days during March (shaded period).

Date	Rainfall	Former County Parcel "Pickleweed/Sea Blite Scrub" Wetland (LSA)	South-Central Depression at Channel Berm (WP)	Western Depression (AP)
OCT	0.00	-	-	-
NOV	0.32	-	-	-
DEC	0.08	-	-	-
01/01/91 – 01/02/91	0.00	-	-	-
01/03/91 – 01/05/91	1.04	-	-	-
01/06/91 – 01/09/91	0.00	-	-	-
01/10/91	0.35	-	-	-
01/11/91 – 01/13/91	0.00	-	-	-
01/14/91	0.00	No ponds visible	No ponds visible	No ponds visible
01/15/91 – 01/31/91	0.00	-	-	-
02/01/91 – 02/27/91	0.00	-	-	-
02/28/91	1.38	-	-	-
03/01/91 – 03/02/91	1.48	-	-	-
03/03/91 – 03/13/91	0.18	-	-	-
03/14/91	0.32	-	-	-
03/15/91 – 03/18/91	0.00	-	-	-
03/19/91 – 03/21/91	1.35	-	-	-
03/22/91 – 03/24/91	0.00	-	-	-
03/25/91 – 03/28/91	1.71	-	-	-
03/29/91 – 03/31/91	0.00	-	-	-

Table A16. Rainfall and inundation during the 1989-1990 season. Inundation data from a vertical aerial photograph (Homrighausen 2005). Based on rainfall pattern and amount, it is unlikely that WP or AP were continuously inundated for long duration during this season.

Date	Rainfall	Former County Parcel "Pickleweed/Sea Blite Scrub" Wetland (LSA)	South-Central Depression at Channel Berm (WP)	Western Depression (AP)
OCT	0.51	-	-	-
NOV	0.11	-	-	-
DEC	0.00	-	-	-
JAN	1.51	-	-	-
02/01/90 – 02/04/90	0.00	-	-	-
02/05/90	0.33	-	-	-
02/06/90 – 02/16/90	0.00	-	-	-
02/17/90 – 02/18/90	1.39	-	-	-
02/19/90 – 02/28/90	0.00	-	-	-
03/01/90 – 03/03/90	0.00	-	-	-
03/04/90 – 03/05/90	0.04	-	-	-
03/06/90 – 03/10/90	0.00	-	-	-
03/11/90 – 03/12/90	0.08	-	-	-
03/13/90 – 03/14/90	0.00	-	-	-
03/15/90	0.00	No ponds visible	No ponds visible	No ponds visible
03/16/90 – 03/31/90	0.00	-	-	-

Table A17. Rainfall and inundation during the 1988-1989 season. Inundation data from a vertical aerial photograph (Homrighausen 2005). Based on rainfall pattern and amount, it is unlikely that WP or AP were continuously inundated for long duration during this season.

Date	Rainfall	Former County Parcel "Pickleweed/Sea Blite Scrub" Wetland (LSA)	South-Central Depression at Channel Berm (WP)	Western Depression (AP)
OCT	0.00	-	-	-
NOV	0.69	-	-	-
12/01/88 – 12/15/88	0.00	-	-	-
12/16/88 – 12/23/88	0.97	-	-	-
12/24/88	0.00	-	-	-
12/25/88	1.20	-	-	-
12/26/88 – 12/31/88	0.00	-	-	-
12/27/88 – 12/31/88	0.00	-	-	-
01/01/89 – 01/29/89	0.45	-	-	-
01/30/89	0.00	No ponds visible	No ponds visible	No ponds visible
01/31/89	0.00	-	-	-
FEB	0.76	-	-	-
MAR	0.62	-	-	-

Table A18. Rainfall and inundation during the 1987-1988 season. Inundation data from a vertical aerial photograph (Homrighausen 2005). Based on rainfall pattern and amount, it is unlikely that WP or AP were continuously inundated for long duration during this season.

Date	Rainfall	Former County Parcel "Pickleweed/Sea Blite Scrub" Wetland (LSA)	South-Central Depression at Channel Berm (WP)	Western Depression (AP)
OCT	0.48	-	-	-
NOV	1.30	-	-	-
DEC	1.16	-	-	-
01/01/88 – 01/03/88	0.30	-	-	-
01/04/88 - 01/16/88	0.00	-	-	-
01/17/88 - 01/18/88	1.27	-	-	-
01/18/88 – 01/23/88	0.00	-	-	-
01/24/88	0.00	No ponds visible	No ponds visible	No ponds visible
01/25/87 – 01/31/87	0.00	-	-	-
FEB	0.67	-	-	-
MAR	0.27	-	-	-

Table A19. Rainfall and inundation during the 1986-1987 season. Inundation data from a vertical aerial photograph (Homrighausen 2005). Based on rainfall pattern and amount, it is unlikely that WP or AP were continuously inundated for long duration during this season.

Date	Rainfall	Former County Parcel "Pickleweed/Sea Blite Scrub" Wetland (LSA)	South-Central Depression at Channel Berm (WP)	Western Depression (AP)
OCT	0.10	-	-	-
NOV	0.64	-	-	-
DEC	0.45	-	-	-
01/01/87 – 01/03/87	0.00	-	-	-
01/04/87 – 01/07/87	1.57	-	-	-
01/08/87	0.00	-	-	-
01/09/87	0.00	No ponds visible-	No ponds visible	No ponds visible
01/10/87 – 01/20/87	0.00	-	-	-
01/21/87	0.00	No ponds visible	No ponds visible	No ponds visible
01/22/87 – 01/31/87	0.04	-	-	-
FEB	0.79	-	-	-
MAR	0.50	-	-	-

Table A20. Rainfall and inundation during the 1985-1986 season. Inundation data from a vertical aerial photograph (Homrighausen 2005). Based on rainfall pattern and amount, it is likely that WP and AP were continuously inundated for 15 - 30 days during the shaded period of February and March.

Date	Rainfall	Former County Parcel "Pickleweed/Sea Blite Scrub" Wetland (LSA)	South-Central Depression at Channel Berm (WP)	Western Depression (AP)
OCT	0.03	-	-	-
11/01/85 – 11/10/85	0.00	-	-	-
11/11/85 – 11/12/85	0.79	-	-	-
11/13/85 – 11/24/85	0.00	-	-	-
11/25/85	0.83	-	-	-
11/26/85 – 11/28/85	0.00	-	-	-
11/29/85 – 11/30/85	1.47	-	-	-
DEC	0.34	-	-	-
01/01/86 - 01/07/86	0.43			
01/08/86 - 01/29/86	0.00			
01/30/86 - 01/31/86	0.70			
02/01/86	0.53	-	-	-
02/02/86 – 02/07/86	0.00	-	-	-
02/08/86	0.41	-	-	-
02/09/86 – 02/12/86	0.00	-	-	-
02/13/86 – 02/16/86	3.01	-	-	-
02/17/86 - 02/18/86	0.00			
02/19/86 - 02/20/86	0.07			
02/20/86 – 02/28/86	0.00	-	-	-
03/01/86 – 03/08/86	0.05	-	-	-
03/09/86 – 03/18/86	2.60			
03/19/86	0.00	Ponded	Large Pond	Large Pond
03/20/86 – 03/31/86	0.00			

APPENDIX B.

Tables B1 – B27: Photographic evidence of ponding, and rainfall data for the period 1958 – 1985 with LSA's narrative interpretation (from Homrighausen, 2005). Shading and comments added.

Table B1: Rainfall and Inundation during the 1958–1959 Rainfall Season

Date	Rainfall (inches)	WP	AP
Oct 25	1.35		
Nov 12	0.02		
Dec	0.00		
Jan 6	0.71		
Jan 17	photo	Definitely no inundation in photo	Definitely no inundation in photo
Feb 7–12	0.61		
Feb 16–17	1.14		
Feb 19	0.06		
Feb 21–22	1.00		
Mar	0.00		
Mar 24	Photo	Obscured	Probable inundation observed in photo; does not match with rainfall data preceding date of photo
Apr 26	0.66		
Total	5.55		

The only large concentration of rain (2.2 inches) fell over a period of seven days, following a very dry fall and early winter. Photo evidence of inundation one month after this concentration is likely an indication of damp soil rather than inundation. Based on Dixon analysis of similar low rainfall years, inundation for more than 14 days is unlikely in both the WP and AP.

JDD Comment: Based on rainfall pattern and amount, it is unlikely that topographic depressions were continuously inundated for long duration this season.

Table B2: Rainfall and Inundation during the 1959–1960 Rainfall Season

Date	Rainfall (inches)	WP	AP
Oct	0.00		
Nov 2	0.05		
Dec 8–9	0.12		
Dec 21	0.36		
Dec 24–25	1.43		
Jan 10–12	0.92		
Jan 15	0.99		
Jan 26	0.13		
Feb 2	1.09		
Feb 8–9	0.45		
Feb 29	0.81		
Mar 2	0.02		
Mar 29	0.18		
Apr 24	0.10		
Apr 27	1.20		
May 4	00.04		
May 7	Photo	Definitely no inundation	Definitely no inundation
Total	7.89		

Concentrated rain events were relatively light and separated by at least two weeks in most cases. Photo provides evidence that there was no inundation 10 days after the last significant rain of the season. Therefore, inundation in both the WP and AP areas is unlikely.

JDD Comment: Based on rainfall pattern and amount, it is likely that topographic depressions were continuously inundated for long duration during and after the shaded period in January. Following 1.79 inches of rainfall in the last 10 days of December, the 1.91 inches of rainfall from January 10-15 probably resulted in at least 7 days but less than 14 days of inundation.

Table B3: Rainfall and Inundation during the 1960–1961 Rainfall Season

Date	Rainfall (inches)	WP	AP
Oct	0.00		
Nov 4	0.21		
Nov 6–7	0.62		
Nov 13–14	0.26		
Nov 27	0.52		
Dec 2	0.09		
Jan 25–27	0.64		
Feb	0.00		
Mar 15	0.16		
Mar 25	0.18		
Mar 28	0.03		
Apr 23	0.02		
Total	2.73		

No photos were available for this season. The very low rainfall, spread throughout the season, likely did not result in inundation in either the WP or AP.

JDD Comment: Based on rainfall pattern and amount, it is unlikely that topographic depressions were continuously inundated for long duration this season.

Table B4: Rainfall and Inundation during the 1961–1962 Rainfall Season

Date	Rainfall (inches)	WP	AP
Oct	0.00		
Nov 14–15	0.23		
Nov 25–26	0.60		
Dec 2–3	0.95		
Dec 14–15	0.23		
Jan 13	0.25		
Jan 20–23	1.59		
Jan 25	Photo	Photo shows no inundation	Inundation likely
Feb 8–12	3.76		
Feb 14	0.05		
Feb 16	1.27		
Feb 19–22	1.84		
Mar 6	0.29		
Mar 19	0.59		
Mar 21	0.07		
Mar 23	0.06		
May 15–16	0.26		
May 27	0.08		
Total	12.52		

The early part of the season was characterized by low, well-distributed rainfall. One heavy concentration of rain in a 15-day period (6.92 inches) likely produced inundation in the AP area. However, the photo shows no inundation in the WP two days after a significant rain (1.59 inches), and other photos of this period show no inundation in the WP area at any time. Therefore, it is likely that no depression existed.

JDD Comment: Based on rainfall pattern and amount, it is likely that topographic depressions were continuously inundated for 15 - 30 days during the shaded period in February and March.

Table B5: Rainfall and Inundation during the 1962–1963 Rainfall Season

Date	Rainfall (inches)	WP	AP
Oct	0.00		
Nov	0.00		
Dec 17	0.01		
Jan	0.00		
Feb 1–2	0.23		
Feb 9–11	3.78		
Feb 13	0.14		
Mar 15	0.05		
Mar 17–18	0.85		
Mar 20	Photo	Photo indicates no inundation	Inundation likely
Mar 23	0.48		
Mar 28–29	0.90		
Apr 8	0.01		
Apr 15	0.08		
Apr 17	0.11		
Total	7.43		

Extremely low rainfall early in the season, with one large event in mid-February, followed by a month of no rain, and then a series of smaller storms. It is likely that the AP area was inundated for some period but also likely that the inundation dissipated fairly rapidly, based on the well-documented dissipation rate of inundation following a similar amount of rain from 10/17 to 10/21 in 2004. Thus, inundation probably occurred, but the area actually inundated for more than 14 days was likely small. There is evidence that there was no inundated depression in the WP area during this period.

JDD Comment: Based on rainfall pattern and amount, it is likely that topographic depressions were continuously inundated for 7 - 14 days during the shaded period in February and March.

Table B6: Rainfall and Inundation during the 1963–1964 Rainfall Season

Date	Rainfall (inches)	WP	AP
Oct 16	0.28		
Oct 21	0.01		
Nov 7	0.43		
Nov 12	0.01		
Nov 16	0.39		
Nov 20	1.44		
Dec 9	0.01		
Jan 19	0.17		
Jan 21–22	0.51		
Feb	0.00		
Mar 2	0.09		
Mar 13	0.04		
Mar 23–24	0.79		
Apr 1	0.55		
Apr 19	0.02		
May 5	0.05		
Total	4.79		

No photos available, but very low rainfall throughout the season likely resulted in no inundation in either area.

JDD Comment: Based on rainfall pattern and amount, it is unlikely that topographic depressions were continuously inundated for long duration this season.

Table B7: Rainfall and Inundation during the 1964–1965 Rainfall Season

Date	Rainfall (inches)	WP	AP
Oct 20	Photo	Photo shows No Inundation	Photo shows No Inundation
Oct 28–29	0.10		
Nov 9	0.43		
Nov 11–12	0.18		
Nov 17–18	0.60		
Dec 19–21	0.40		
Dec 23	0.02		
Dec 27–29	0.97		
Dec 31	0.02		
Jan 7–8	0.20		
Jan 24	0.24		
Feb 6–7	0.22		
Feb 10	Photo	Photo shows no inundation	Photo shows no inundation
Mar 7	0.28		
Mar 12–13	0.38		
Mar 15	0.58		
Mar 31	0.04		
Apr 1	1.29		
Apr 1	Photo	Photo shows no inundation	Photo clearly shows inundation probably as a result of rain on the same day the photo was taken
Apr 2	0.14		
Apr 3	1.00		
Apr 4	0.67		
Apr 8–10	1.47		
Apr 13	0.11		
Total	9.42		

Rainfall very low through fall and winter, with one concentrated period of 4.69 inches in the last day of March and the first 10 days of April. Due to the lack of previous saturation and the lateness in the season, it is likely that percolation and evaporation dissipated the inundation in the AP area in approximately two weeks. Furthermore, there is no evidence of any depression in the WP area, even during a significant rain event that resulted in clear inundation in the AP area.

JDD Comment: Based on rainfall pattern and amount, it is likely that topographic depressions were continuously inundated for 7 to 14 days during the shaded period in April.

Table B8: Rainfall and Inundation during the 1965–1966 Rainfall Season

Date	Rainfall (inches)	WP	AP
Oct	0.00		
Nov 15–18	2.82		
Nov 22–23	1.83		
Nov 25	0.40		
Dec 9–10	0.91		
Dec 12–16	0.90		
Dec 29–31	1.12		
Jan 30–31	0.94		
Feb 2	0.23		
Feb 6–7	0.93		
Mar 2	0.06		
Mar 25	0.25		
Apr	0.00		
May 9	0.07		
Total	10.46		

No photos available. Over 5 inches of rain fell in the last half of November, followed by 1.8 inches in early December and another inch at the end of December. Therefore, it is likely that some degree of inundation for two weeks took place in the AP area, at least in concentrated lower spots. The only other large storm occurred at the end of January. No depression in the WP area is visible in other photos from the decade, and inundation likely did not occur there.

JDD Comment: Based on rainfall pattern and amount, it is likely that topographic depressions were continuously inundated for 15 - 30 days during the shaded period in November and December.

Table B9: Rainfall and Inundation during the 1966–1967 Rainfall Season

Date	Rainfall (inches)	WP	AP
Oct 3	0.02		
Nov 4	0.02		
Nov 7–8	1.02		
Nov 14	0.02		
Nov 21	0.02		
Dec 3–7	3.83		
Jan 16	0.02		
Jan 22–25	2.90		
Jan 31	0.05		
Feb	0.00		
Mar 4–5	0.16		
Mar 11	0.12		
Mar 13–14	0.44		
Mar 31– Apr2	0.85		
Apr 5	0.27		
Apr 11–12	0.40		
Apr 19–22	1.21		
Apr 24	0.32		
Apr 29	0.05		
Total	11.72		

No photos. Two events were likely to cause short-term inundation in the AP area: 3.8 inches over four days in early December and 2.9 inches over four days in late January. All other significant rain events occurred earlier or later in the season. Based on the documented dissipation of inundation following three inches of rain in four days in the February 2004, the AP area was likely inundated for approximately two weeks following the major events in December or January, since these were approximately 45 days apart. The WP area showed no evidence of ponding during this decade.

JDD Comment: Based on rainfall pattern and amount, it is likely that topographic depressions were continuously inundated for 7 to 14 days during and after the shaded periods in December and January.

Table B10: Rainfall and Inundation during the 1967–1968 Rainfall Season

Date	Rainfall (inches)	WP	AP
Oct	0.00		
Nov 19–22	1.99		
Nov 28–29	0.18		
Dec 1	0.25		
Dec 8	0.06		
Dec 19–20	0.83		
Jan 2	0.02		
Jan 11	0.10		
Jan 27–28	0.23		
Jan 31	0.11		
Feb 10	0.05		
Feb 13–14	0.22		
Feb 17	0.01		
Mar 8	1.97		
Mar 14	0.06		
Mar 17	0.07		
Apr 2	0.59		
May 12	0.02		
Total	6.76		

No photos. There were only two large events during the season; each was less than two inches and were separated by nearly four months. Inundation in either area is highly unlikely.

JDD Comment: Based on rainfall pattern and amount, it is unlikely that topographic depressions were continuously inundated for long duration this season.

Table B11: Rainfall and Inundation during the 1968–1969 Rainfall Season

Date	Rainfall (inches)	WP	AP
Oct	0.21		
Nov	0.35		
Dec	1.11		
Jan 19–22	4.82		
Jan 24–28	3.72		
Feb	5.04		
Mar	0.98		
Apr	0.34		
May	0.07		
Total	17.93		

No photos. Inundation is likely in many areas based on intense rainfall over a nine-day period in January. There is still no evidence of a depression in the WP area, but inundation is presumed.

JDD Comment: February rainfall was as follows: 2/5-7 0.66”; 2/16 0.17”; 2/18-20 0.66”; 2/22-26 3.55”. Based on rainfall pattern and amount, it is likely that topographic depressions were continuously inundated for more than 30 days during the shaded period in January and February.

Table B12: Rainfall and Inundation during the 1969–1970 Rainfall Season

Date	Rainfall (inches)	WP	AP
Sep	0.00		
Oct	0.00		
Oct 4	Photo	Photo shows no inundation	Photo shows no inundation
Nov 7	1.58		
Nov 10	0.03		
Nov 16	0.03		
Dec 2	0.02		
Dec 9	0.04		
Jan 10	0.86		
Jan 12	0.41		
Jan 16–17	0.74		
Jan 24	0.02		
Jan 31	Photo	Photo indicates inundation unlikely	Photo indicates inundation likely
Feb 10–11	0.93		
Mar 1–2	0.87		
Mar 5	0.74		
Total	6.27		

Photos are available, but not definitive. Inundation for long periods is extremely unlikely based on the low amount and wide temporal distribution of rain. These data provide evidence that features identified in aerial photos as potential inundation are more likely darker soils, possibly indicative of somewhat higher soil moisture.

JDD Comment: Based on rainfall pattern and amount, it is unlikely that topographic depressions were continuously inundated for long duration this season.

Table B13: Rainfall and Inundation during the 1970–1971 Rainfall Season

Date	Rainfall (inches)	WP	AP
Sep	0.00		
Oct	0.00		
Nov 25–26	0.28		
Nov 29–30	2.73		
Dec 3	0.17		
Dec 9	0.23		
Dec 14	0.03		
Dec 17–23	3.45		
Jan 2	0.67		
Jan 13–14	0.17		
Feb 17	0.60		
Feb 20	0.01		
Feb 20	Photo	Photo shows evidence of no inundation	Photo obscured
Feb 20	Photo	Photo obscured	No consensus on photo interpretation
Mar 13	0.19		
Apr 5	Photo	Photo shows evidence of no inundation	Photo shows probability of no inundation
Apr 14–15	0.52		
May 7–8	0.29		
May 27–28	0.10		
Total	9.46		

Timing of photos after the largest events in November and December is not helpful. If inundation occurred, it was likely following the late December storm period, since some saturation occurred prior in late November. Although photos do not corroborate this, inundation is assumed in the AP area. Still no evidence of a depression in the WP area.

JDD Comment: Based on rainfall pattern and amount, it is likely that topographic depressions were continuously inundated for 7 to 14 days during the shaded period in December and January.

Table B14: Rainfall and Inundation during the 1971–1972 Rainfall Season

Date	Rainfall (inches)	WP	AP
Oct 16	0.12		
Nov 12	0.14		
Dec 3–4	0.45		
Dec 13	0.27		
Dec 22–29	3.25		
Jan	0.00		
Feb 5	0.03		
Feb 29	0.01		
Mar 1	0.01		
Apr 14	Photo	Photo obscured	Photo obscured
Apr 20	0.08		
Apr 29	Photo	Indicates probable lack of inundation	Indicates probable lack of inundation
Apr 29	Photo	Indicates probable inundation	Indicates probable lack of inundation
May 20	0.01		
Total	4.37		

Timing of photos is not very helpful. Based on very low rainfall total, length of time between large rain events in December, and photos in April, it is very unlikely that inundation was present in April. A probable lack of inundation as indicated by photo interpretation could be considered more conclusive. Some inundation likely occurred in late December, but due to very low rainfall before and after that date it is unlikely that inundation for longer than two weeks occurred in either area. This is the first indication of a depression in the WP area.

JDD Comment: Based on rainfall pattern and amount, it is likely that topographic depressions were continuously inundated for 7 to 14 days during and after the shaded period in December.

Table B15: Rainfall and Inundation during the 1972–1973 Rainfall Season

Date	Rainfall (inches)	WP	AP
Oct 4	0.01		
Oct 19–20	0.14		
Oct 25	0.01		
Nov 8	0.01		
Nov 11	0.35		
Nov 14–17	3.06		
Nov 24	Photo	Photo indicates no inundation	Photo indicates no inundation
Dec 4–5	0.65		
Dec 7–9	0.57		
Jan 6	Photo	Photo indicates no inundation	Photo indicates inundation unlikely
Jan 9–10	0.54		
Jan 17	1.12		
Jan 19	0.43		
Jan 31	0.57		
Feb 4–8	1.54		
Feb 11–13	1.85		
Feb 28	0.48		
Mar	0.00		
Apr 6–9	0.82		
Apr 11–12	0.24		
Apr 20	0.71		
Apr 22	0.21		
Apr 26	0.06		
Total	13.37		

Photo dates are very helpful in this season. Quite conclusive photo evidence that there was no inundation seven days after the end of a seven-day period in November that produced 3.41 inches of rain. The area was likely dry, and rain percolated quickly in the first part of the rainy season. Similar rainfall amounts occurred over a slightly longer period in the first half of February followed by under a half inch in late February and then a completely dry March. Based on this evidence, inundation for more than two weeks following rain events likely did not occur.

JDD Comment: Based on rainfall pattern and amount, it is likely that topographic depressions were continuously inundated for 7 to 14 days during the shaded period in January and February.

Table B16: Rainfall and Inundation during the 1973–1974 Rainfall Season

Date	Rainfall (inches)	WP	AP
Oct 9	0.05		
Oct 17	0.01		
Oct 23	0.07		
Oct 26	Photo	Photo indicates no inundation	Photo indicates no inundation
Nov 17–18	0.95		
Nov 23	0.82		
Dec 2	0.07		
Dec 22	0.18		
Jan 1	0.09		
Jan 4–5	1.47		
Jan 7–10	2.6		
Jan 17	0.16		
Jan 21	0.11		
Jan 31	0.01		
Feb 20	0.01		
Mar 2–5	2.6		
Mar 8–9	1.49		
Mar 27	0.24		
Apr 2	0.22		
Total	9.47		

Timing of photos is not helpful. Rain fell throughout the year, but there were 2 one-week periods (in early January and early March) when just over four inches of rain fell. Inundation may have occurred in both the AP and WP areas, but a determination of the length of the ponding would be very speculative. The existence of a depression in WP area has not been conclusively demonstrated at this time.

JDD Comment: Based on rainfall pattern and amount, it is likely that topographic depressions were continuously inundated for 7 to 14 days during and after the shaded periods in January and March.

Table B17: Rainfall and Inundation during the 1974–1975 Rainfall Season

Date	Rainfall (inches)	WP	AP
Oct 28–29	0.25		
Nov 22	0.01		
Dec 4–5	3.28		
Dec 9	Photo	Probable inundation	Probable inundation
Dec 28–29	0.80		
Jan 31	0.14		
Feb 3–4	0.99		
Feb 9–10	0.63		
Feb 17	Photo	No inundation	Probably no inundation
Mar 5–6	0.63		
Mar 8–11	0.97		
Mar 14	0.10		
Mar 17	0.07		
Mar 22	0.32		
Apr 1	0.02		
Apr 6–7	0.78		
Apr 15–16	0.24		
Apr 25	0.05		
Total	9.28		

Timing of photos is helpful in this season. December 9 photo shows inundation in both areas four days after a major storm event. However, based on a similar situation with strong photographic evidence in 1972–1973, inundation probably did not last for two weeks. The rest of the season likely did not produce sufficient, concentrated rain to cause long-term inundation.

JDD Comment: Based on rainfall pattern and amount, it is likely that topographic depressions were continuously inundated for 7 - 14 days during and after the shaded period in December.

Table B18: Rainfall and Inundation during the 1975–1976 Rainfall Season

Date	Rainfall (inches)	WP	AP
Oct 7	0.07		
Oct 11–12	0.18		
Oct 31	0.05		
Nov 27–29	0.27		
Dec 13	0.04		
Dec 21	0.05		
Feb 4–8	1.26		
Feb 10–11	0.65		
Feb 21	Photo	No Inundation	No Inundation
Mar 1–3	0.58		
Mar 22	Photo	No Inundation	No Inundation
Apr 4–5	0.68		
Apr 12–13	0.34		
Apr 21	0.04		
Jun 4	Photo	No Inundation	No Inundation
Total	4.21		

February 21 photo was taken 10 days after the largest rainy period in the season (1.91 inches from February 4–11) confirming that no inundation occurred this year.

JDD Comment: Based on rainfall pattern and amount, it is unlikely that topographic depressions were continuously inundated for long duration this season.

Table B19: Rainfall and Inundation during the 1976–1977 Rainfall Season

Date	Rainfall (inches)	WP	AP
Oct 4	0.03		
Nov 12	1.20		
Nov 19	0.02		
Dec 28	Photo	No Inundation	No Inundation
Dec 31–Jan 1	0.36		
Jan 3	0.62		
Jan 6–7	1.37		
Jan 21	0.27		
Jan 27	0.09		
Feb 24–25	0.37		
Mar 14	Photo	No Inundation	No Inundation
Mar 16–17	0.60		
Mar 25–26	0.46		
May 8–10	2.00		
May 12–13	0.02		
May 24	0.09		
Total	7.50		

Photos dates relative to rainfall are not very helpful here. Rainfall is relatively low this season with no large events except in May (2 inches), which would have dissipated fairly rapidly. Inundation is unlikely in either area.

JDD Comment: Based on rainfall pattern and amount, it is unlikely that topographic depressions were continuously inundated for long duration this season.

Table B20: Rainfall and Inundation during the 1977–1978 Rainfall Season

Date	Rainfall (inches)	WP	AP
Oct	0.00		
Nov	0.00		
Dec 18	0.26		
Dec 26–29	2.13		
Jan 4–7	2.07		
Jan 10–11	1.59		
Jan 15	1.22		
Jan 17	0.73		
Jan 19–20	0.64		
Jan 31	0.04		
Feb 5–10	4.36		
Feb 13–14	1.37		
Feb 27–28	0.18		
Mar 1–6	3.85		
Mar 10	0.2		
Mar 12	0.21		
Mar 23	0.23		
Mar 31–Apr 2	0.64		
Apr 5	0.14		
Apr 16	0.61		
Apr 25	0.01		
Total	20.48		

No photos. Very heavy rain in the early part of the season likely saturated soils, and large events in February and the first part of March likely resulted in long inundation in both the WP and AP areas.

JDD Comment: Based on rainfall pattern and amount, it is likely that topographic depressions were continuously inundated for more than 30 days during the shaded winter period.

Table B21: Rainfall and Inundation during the 1978–1979 Rainfall Season

Date	Rainfall (inches)	WP	AP
Sept	0.00		
Oct 31	0.06		
Nov 12	0.17		
Nov 14	0.95		
Dec 14	Photo	No Inundation	Probable Inundation
Dec 17–19	0.99		
Jan 5–6	1.42		
Jan 10	0.26		
Jan 15–16	0.96		
Jan 19	0.15		
Jan 31–Feb 3	3.21		
Feb 14	0.72		
Feb 21–23	0.57		
Mar 1–2	0.08		
Mar 13	0.03		
Mar 11–17	0.25		
Mar 19–21	0.60		
Mar 27–29	1.75		
Total	12.17		

Given the relatively low amount of rainfall leading up to the photo date of December 14 and the length of time after the last rain, the indication of probable ponding in the AP is likely a “false positive” due to dark soils. The only large rainfall event at the end of January (3.21 inches) is well-separated from other major events, possibly allowing time for dissipation of any inundation that occurred, similar to the 1972–1973 season, when 3.06 inches dissipated within one week. However, in this case, there was considerably more rain prior to the 3.21 inches, which may have produced higher soil moisture and slowed percolation. Inundation in both areas may have occurred for more than two weeks but probably not significantly more.

JDD Comment: Based on rainfall pattern and amount, it is likely that topographic depressions were continuously inundated for 15 - 30 days during and after the shaded period in January and February.

Table B22: Rainfall and Inundation during the 1979–1980 Rainfall Season

Date	Rainfall (inches)	WP	AP
Oct 20–21	0.20		
Nov 8	0.46		
Dec 21	0.09		
Dec 25	0.18		
Jan 7–14	4.17		
Jan 18	0.06		
Jan 28–30	2.17		
Feb 14–19	5.89		
Feb 21–22	0.85		
Feb 25	Photo	No Inundation	Probable Inundation
Mar 4	0.46		
Mar 6–7	0.91		
Mar 11	0.04		
Mar 27	0.46		
Apr 23	0.32		
Apr 29–30	0.12		
Total	16.38		

Photo of February 25 conclusively shows no inundation in the WP area and suggests that inundation occurred in the AP area for a considerable time, likely two weeks or more, due to the large amount of rain (over 13 inches) that fell in a little over a month leading up to the photo date.

JDD Comment: Based on rainfall pattern and amount, it is likely that topographic depressions were continuously inundated for more than 30 days during the shaded period in January and February.

Table B23: Rainfall and Inundation during the 1980–1981 Rainfall Season

Date	Rainfall (inches)	WP	AP
Oct–Nov	0.00		
Dec 4–5	1.86		
Jan 11–12	0.21		
Jan 31	Photo	No Inundation	Probably No Inundation
Jan 23	0.16		
Jan 28–30	1.36		
Feb 9	0.77		
Feb 26	0.23		
Mar 1–2	1.62		
Mar 5–6	1.27		
March 15	Photo	Probable Inundation	Probable Inundation
Mar 20	0.27		
Apr 18–19	0.22		
May 27	0.01		
Total	7.98		

Inundation for two weeks unlikely due to low amount and relatively wide temporal distribution of rain. March 15 photo indication of probable inundation would be expected due to possible remnants of inundation after nine days and damp soil resulting from 2.9 inches of rain during the first week of the month. Likely at least AP area was ponded for 15 days or more in March.

JDD Comment: Based on rainfall pattern and amount, it is likely that topographic depressions were continuously inundated for 15 - 30 days during the shaded period in March.

Table B24: Rainfall and Inundation during the 1981–1982 Rainfall Season

Date	Rainfall (inches)	WP	AP
Oct 1–2	0.40		
Oct 8	0.08		
Oct 29	0.15		
Nov 4	0.19		
Nov 26–28	2.42		
Dec 21	0.07		
Dec 30–Jan 2	1.14		
Jan 6	0.07		
Jan 7	Photo	No Inundation	Probably No Inundation
Jan 20–22	0.49		
Jan 29	0.06		
Feb 7–8	0.09		
Feb 10–11	0.29		
Mar 2–3	0.16		
Mar 12	0.19		
Mar 14–15	0.16		
Mar 17–18	1.81		
Mar 26–27	0.30		
Mar 29–30	0.47		
Apr 1–2	0.57		
Apr 12	0.07		
May 5	0.07		
Total	9.64		

No very large rain concentration. Any inundation from the largest event in November (2.42 inches) likely dissipated rapidly in the absence of additional rain for nearly a month. Several storms in the last half of March and first two days of April (3.31 inches) likely percolated and evaporated relatively quickly due to lateness in the season.

JDD Comment: Based on rainfall pattern and amount, it is unlikely that topographic depressions were continuously inundated for long duration this season.

Table B25: Rainfall and Inundation during the 1982–1983 Rainfall Season

Date	Rainfall (inches)	WP	AP
Oct	0.21		
Nov	2.28		
Dec	0.84		
Jan	2.06		
Feb 3	0.57		
Feb 6–7	0.47		
Feb 13	0.06		
Feb 19	Photo	Probable Inundation	Probable Inundation
Feb 19	0.01		
Feb 24–28	1.61		
Mar 7	4.08		
Mar 14	0.18		
Mar 17–19	2.28		
Mar 21	0.24		
Mar 23–24	0.46		
Mar 28	0.10		
Apr 11	0.01		
Apr 14	Photo	Inundation Not Likely	Inundation Not Likely
Apr 15–30	1.79		
May 1	0.32		
May 11	Photo	No Inundation	Inundation Not Likely
Total	17.57		

February 19 photo may indicate actual inundation but more likely damp soil from moderate rains in November and January and lighter rain in first week of February. Extremely heavy rain in March (7.34 inches) likely produced extended inundation in both areas but seems to have dissipated by the middle of April.

JDD Comment: Rainfall in January was as follows: 1/19 0.03”; 1/22-23 0.76”; 1/25 0.14; 1/27-29 1.13”. Based on rainfall pattern and amount, it is likely that topographic depressions were continuously inundated for 7 - 14 days during the shaded period in January and February and for more than 30 days during the shaded period in February and March.

Table B26: Rainfall and Inundation during the 1983–1984 Rainfall Season

Date	Rainfall (inches)	WP	AP
Sept	0.00		
Oct 1	1.22		
Oct 5	0.35		
Oct 7	0.07		
Nov 2	0.54		
Nov 11–13	0.91		
Nov 20–21	0.30		
Nov 25	0.63		
Dec 2	0.06		
Dec 4	0.24		
Dec 10	0.14		
Dec 25–28	1.04		
Jan 11	0.01		
Jan 17	0.23		
Mar 6	0.06		
Apr 6	0.67		
Apr 19	0.16		
May 28	Photo	No Inundation	No Inundation
Total	6.63		

Photo date is not helpful for this season, but low rainfall, with only two events greater than one inch, likely produced no inundation in either area.

JDD Comment: Based on rainfall pattern and amount, it is unlikely that topographic depressions were continuously inundated for long duration this season.

Table B27: Rainfall and Inundation during the 1984–1985 Rainfall Season

Date	Rainfall (inches)	WP	AP
Sept	0.00		
Oct 12	0.03		
Oct 17	0.30		
Nov 8	0.14		
Nov 12	0.03		
Nov 17	0.07		
Nov 25	0.62		
Dec 3	0.09		
Dec 8–9	0.65		
Dec 11	0.71		
Dec 16	0.34		
Dec 18–20	1.86		
Dec 27–28	1.26		
Jan 7–8	0.75		
Jan 29	0.54		
Feb 2	0.40		
Feb 9	0.88		
Feb 21	0.01		
Mar 8	0.11		
Mar 19	0.17		
Mar 27	0.12		
Apr 3	Photo	No Inundation	No Inundation
Total	9.04		

Relatively low rainfall year with wide temporal distribution. Total of just over three inches in the last half of December may have produced short-term inundation but likely dissipated before January 7 rain, which was followed by 20 days without rain. Long-term inundation not likely in either area.

JDD Comment: Based on rainfall pattern and amount, it is likely that topographic depressions were continuously inundated for 15 - 30 days during and after the shaded period in December. The 1.70 inches of rain during December 8-16 probably saturated the soil, leading to long duration ponding as a result of the heavy rain in the last half of December.

Table B28: Summary of Inundation for Each Season

Season	Inundation Likely			
	WP		AP	
	Y	N	Y	N
58–59		x		x
59–60		x		x
60–61		x		x
61–62		x	x	
62–63		x	x*	
63–64		x		x
64–65		x	x*	
65–66		x	x	
66–67		x	x*	
67–68		x		x
68–69		x	x	
69–70		x		x
70–71		x	x	
71–72		x		x
72–73		x		x
73–74	x*		x*	
74–75		x		x
75–76		x		x
76–77		x		x
77–78	x		x	
78–79	x*		x*	
79–80		x	x	
80–81		x		x
81–82		x		x
82–83	x		x	
83–84		x		x
84–85		x		x
Subtotal	4	23	12	15
Summary From Dixon Analysis	11	10	11	10
Total	15	33	23	25

*Indicates that total length of likely inundation was approximately two weeks, which means that inundation remaining after two weeks was likely confined to small depressions.

JDD Comment: Based on the data in Table B23 and the associated narrative, the "Yes" columns should have been checked for "80-81," resulting in more than 14 days of continuous inundation during 13 years at AP and during 5 years at WP, as estimated by LSA. For the period 1985 - 2005, my current estimate (Table 1, above) is that continuous inundation for at least 7 days occurred at AP during 11 years and at WP during 12 years.