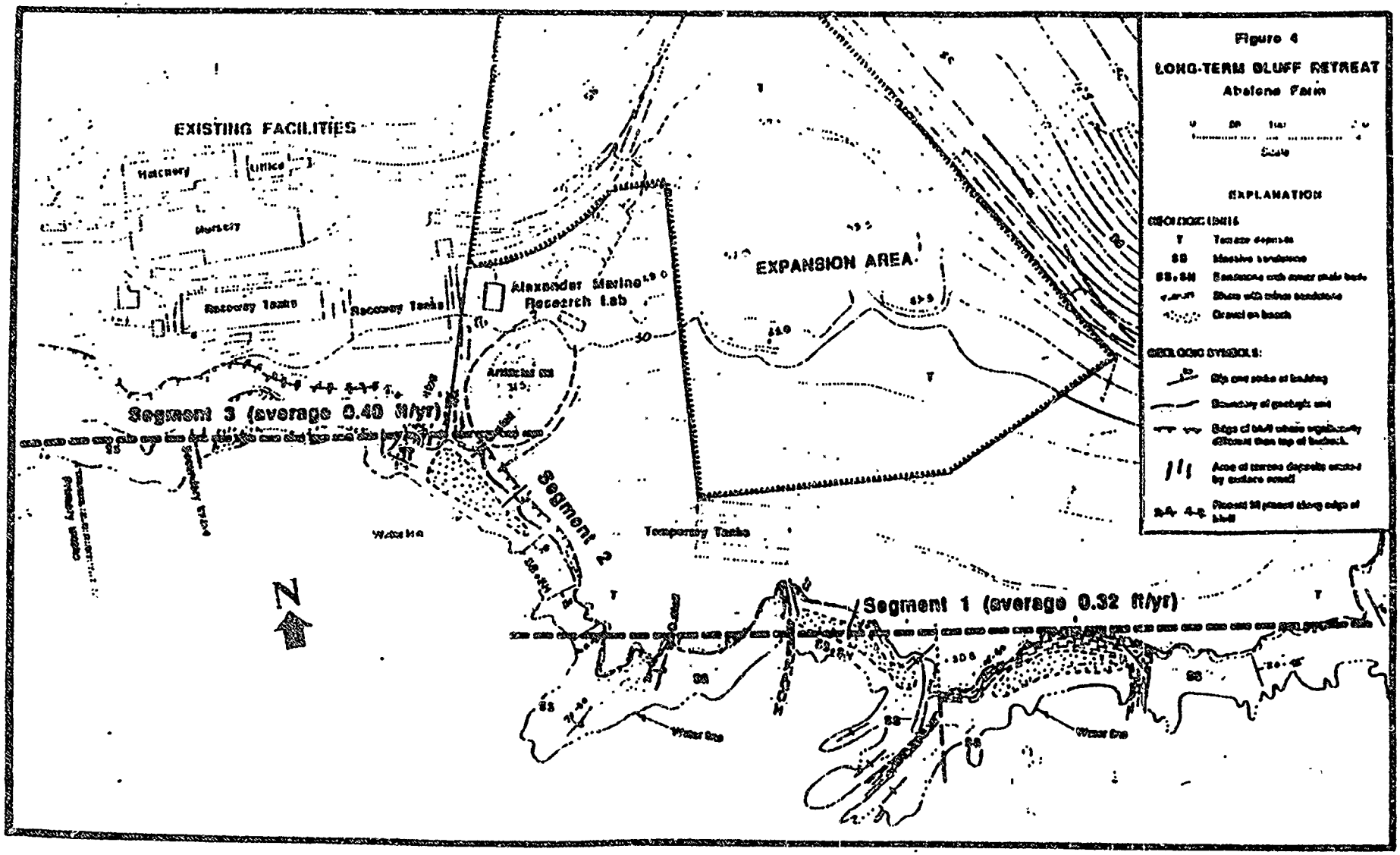

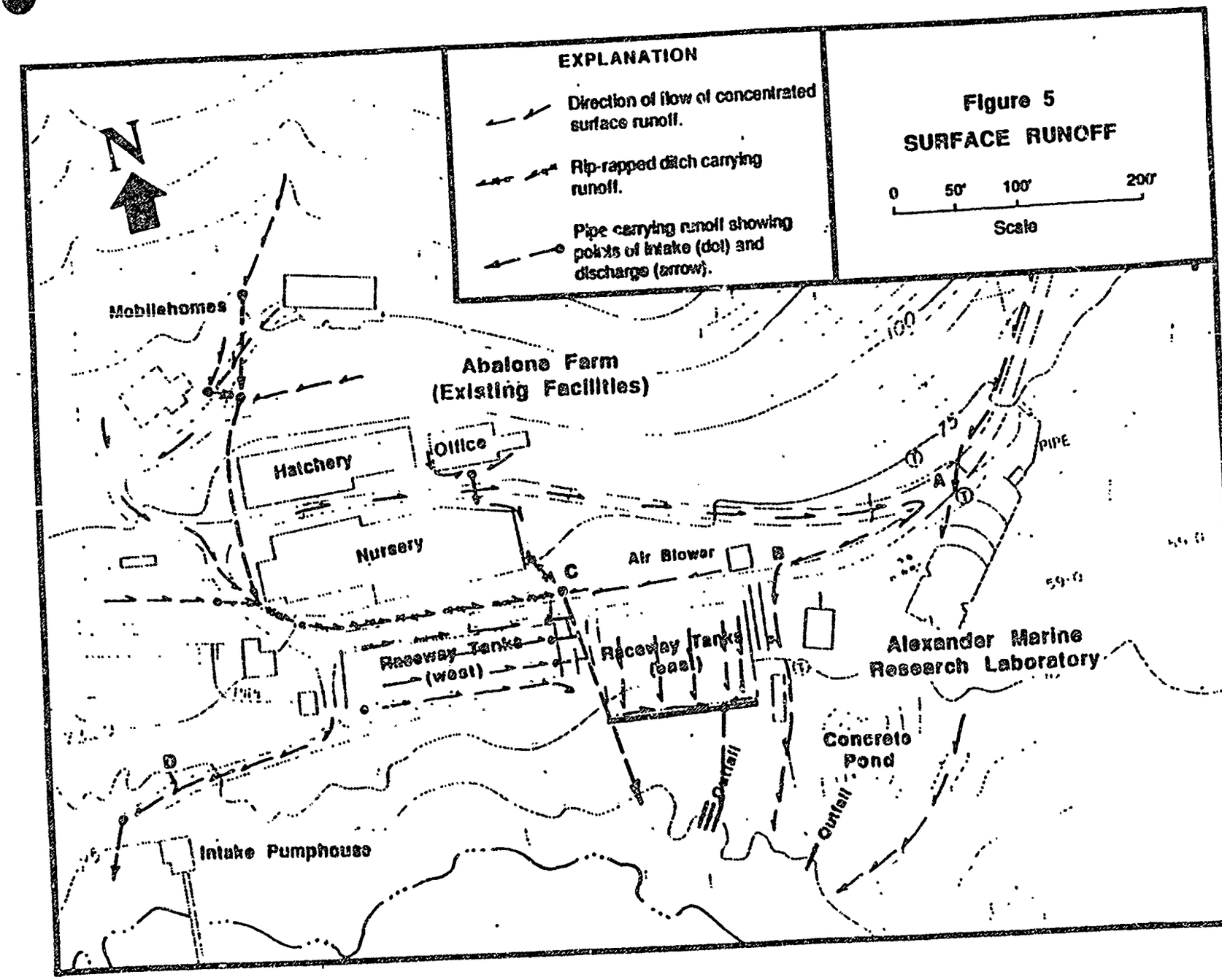
EXPLANATION
Direction of flow of concentrated surface runoff.
Rip-rapped ditch carrying runoff.
Pipe carrying runoff showing points of intake (dot) and discharge (arrow).
Figure 5
SURFACE RUNOFF
0 50' 100' 200'
Scale
N
Mobilehomes
Abalone Farm
(Existing Facilities)
Hatchery
Office
Nursery
Air Blower
Raceway Tanks (west)
Raceway Tanks (east)
Alexander Marine Research Laboratory
Concrete Pond
Outfall
Intake Pumphouse
PIPE
100
75
A
B
C
D

including abalone escaping to the discharge piping and growing to a size that plugs the pipe. As a result, they have been continually modifying the discharge system to utilize more open concrete drains that can be easily cleaned and limit the use of pipe to short sections where open drains are not feasible. This has substantially reduced plugging.

c. Erosion at the Outfalls

Erosion of the bluff resulting from discharge from the outfall pipes at the site does not appear to be a significant problem. The outfall from the existing facility discharges directly to a gravel or rocky beach, and erosion is insignificant. The outfall from the Temporary Tanks discharges onto rock in an area of highly resistant sandstone, and present and future erosion is probably insignificant.

d. Seepage at the Bluff

In addition to erosion from surface runoff, there is a zone of extensive seepage in the bluff seaward from the large concrete pond at the Alexander Marine Research Lab ("artificial fill" on the geologic map). This seepage apparently comes from water leaking from the pond and migrating laterally along the top of the bedrock surface (base of the more permeable terrace deposits) to the face of the bluff where it contributes to the otherwise natural erosion of the bluff.

Sepage is also present at the bluff seaward of the westerly of the two existing blocks of raceway tanks. This seepage is minor, and is not now an erosion problem.

4. Slope Stability

No evidence of past landslide conditions were observed at the site either in the bluff or on the slopes above the site. One small area of out-of-slope dip is present to the south of the westerly of the two existing raceways. This condition has been taken into account in assigning the rate of retreat in this area.

5. Seismic Considerations

No active or potentially active faults are known or suspected at or in the near vicinity of the site, and fault rupture hazards are insignificant.

Earthquakes generated by movement on major active faults in the region consist primarily of the expected magnitude 8.0-8.5 event on the San Andreas fault located approximately 43 miles to the northeast, and an event of considerable question on the Hosgri fault located approximately 5 miles offshore (PG&E, 1988). The maximum credible earthquake magnitude (Mw) for the Hosgri fault is approximately 7.2 (PG&E, 1988), but a much smaller magnitude is more likely. The expected large magnitude event on the San Andreas fault would likely generate maximum ground accelerations at the site in the range of 0.1g, and the questionable magnitude 7.2 event could generate ground accelerations of approximately 0.5g (Campbell, 1981). Lesser events are more likely, but a magnitude 6.0-6.5 earthquake on this fault would still generate accelerations up to approximately 0.3g.

B. PROJECT IMPACTS

1. Bluff Retreat

Estimated rates of bluff retreat based on geologic characteristics of the bluff and experience in other parts of San Luis Obispo County indicate that the project (proposed expansion area) will not be adversely affected by bluff retreat in the next 75 years. The seawater pond constructed at the Alexander Marine Research Laboratory ("Artificial fill" on Figure 2) and the existing Raceway Tanks, however, may be affected by future bluff retreat. These facilities can be removed at such time as bluff retreat becomes a problem as the value of these facilities would not warrant preventive measures.

2. Bluff Erosion

Runoff has been increased and concentrated in the area of the existing facilities, and erosion of the terrace deposits at the top of the bluff has been significant in some areas. The proposed facilities will also concentrate runoff, and measures should be taken to collect and convey this runoff over the bluff in a way that minimizes erosion.

Control of runoff concentrated on the steep access road to the intake pumphouse will also be important. This runoff is now collected in an open 8-inch pipe near the end of the road and discharged onto bedrock near the base of the bluff. The primary problem with this facility is that the terrace deposits erode easily, and the sediment in the runoff may plug this pipe in a heavy storm.

Spills of seawater from the raceway tanks has been reduced by utilizing open concrete drains to the greatest extent feasible. However, future plugging of the discharge system cannot be precluded and precautions should be taken to catch spilled seawater before it reaches the edge of the bluff.

The loose fill at the edge of the bluff southerly of the existing raceway tanks is susceptible to erosion, and should be planted as soon feasible (i.e., at the onset of the wet season).

The seepage of water leaking from the large pond at the Alexander Marine Research Lab is also contributing to erosion of the bluff. It is also possible that this seepage could develop into piping with a major washout of the terrace deposits and the overlying embankment on the seaward side of the pond. The process would be much the same as the failure of the Baldwin Hills Reservoir, but on a much smaller scale.

3. Slope Stability

No slope stability problems have been identified at the site and no impacts resulting from this hazard are expected.

4. Seismic Considerations

The expected large magnitude earthquake on the San Andreas fault 43 miles to the northeast will result in relatively minor groundshaking at the project site, and no significant impacts to the proposed project are expected. Some minor damage to existing structures should be expected, and there may be sloshing of water out of the tanks in the nursery and raceway tanks facilities. These effects should not be significant.

Occurrence of a large (magnitude 6.0-6.5) or major (magnitude 7) earthquake on the Hosgri fault located about 5 miles offshore could cause significant damage to the existing and proposed facilities. However, the actual occurrence of such an event during the life of the project is unlikely, and damage that may occur is not expected to result in significant secondary effects.

C. MITIGATION MEASURES

Potential impacts resulting from erosion by concentrated runoff or spills of seawater from the raceway tanks can be avoided or minimized by implementing the following mitigation measures:

General Recommendations:

- Concentrated runoff from the site should not be allowed to flow over the coastal bluff, but should be intercepted before reaching the bluff and diverted to control devices.
- All areas of recent fill along the edge of the bluff should be planted to fast-growing grasses at the onset of the wet season to minimize first-year erosion, with native, salt-tolerant vegetation (*****) being introduced as rapidly as feasible for long-term stability.
- Facilities to discharge collected runoff and seawater from the tanks on the site should be constructed so that the released water does not impact on the terrace deposits, but is released onto bedrock or the gravel beach. For most locations at the site, piping should extend down the bluff to an elevation of approximately 20 feet above mean sea level.
- Discharge facilities should be constructed so that they can be periodically modified to accommodate changing bluff configurations. The large diameter PVC pipe now in use would appear to be ideal for this purpose.

Specific Recommendations for the Existing Abalone Farm Facilities:

- Drainage control should be improved at Points A and B (Figure 5), north of the Alexander Marine Research Laboratory, so that concentrated runoff is conveyed westerly along the access road to the primary collection point C rather than crossing the road and flowing to the bluff along uncontrolled channels.
- An open concrete "V" ditch, similar to that along the southerly edge of the east raceway tanks, should be installed southerly from the west raceway tanks. This ditch could be located in the center or along the southerly edge of this access road. The ditch should be designed to carry the total seawater flow to these tanks in the event of a spill, or runoff from the local area for a 100-year storm, whichever is greater. The area between this access road and the bluff (now loose fill) should be graded to direct surface flow back to the "V" ditch to the extent that this is feasible.
- Drainage facilities along the road to the intake pumphouse should be revised as follows:
  - The intake to the pipe at the bottom of the road should be improved to include a concrete box configured to minimize sediment clogging (i.e., edges raised above road level but below the level of the berm at the south edge of the road).
  - Concentrated runoff from above the steep segment of this road (easterly of Point D

on Figure 5) should be intercepted and conveyed to the box inlet at the bottom of the road by a pipe buried in the roadway. (This improvement is intended to minimize runoff flowing down the steep segment of the road and consequent erosion and sedimentation at the box inlet.)

- Runoff from the steep segment of the road should be channeled in a non-erosive device located in the center of the road or on the inland side of the road, and conveyed to the box inlet at the bottom end of the road.

- Discharge from the pipe from the box inlet should be onto bedrock and not onto the softer terrace deposits (i.e., at or below elevation approximately 20 feet).

Specific Recommendations for the Abalone Farm Expansion Facilities:

- Control of excess surface runoff or a spill of seawater from the expansion facilities can be controlled by providing an open concrete ditch along the southerly perimeter of the facility.

- Diversion and control of runoff flowing toward the expansion facility should be governed by the General Recommendations above.

Specific Recommendations for the Alexander Marine Research Laboratory:

- Leakage from the concrete pond should be stopped or reduced to a level of insignificance, or the use of this facility should be terminated. Seepage at the bluff is substantial, and piping, with a major increase in the volume of flow and the possible collapse of the terrace underlying the seaward side of the pond, could develop at any time. The result could be a major scar on the coastal bluff.

- If use of this facility is to be terminated, then it should be removed and the site returned to its original configuration to the extent that this is feasible.

- The drainage course along the southeasterly side of the concrete pond should be improved to conform to the general recommendations listed above.

Respectfully submitted,

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Registered Geophysicist, GP-89

REFERENCES

Asquith, D. O., 1983, *Rates of Coastal Bluff Retreat, Pismo Beach, California*: Coastal Zone '83, p. 1195-1207.

Campbell, K.W., 1981, *Near-source attenuation of peak horizontal ground acceleration*: Bull. Seis. Soc. Amer., v. 71, p. 2039-2070.

Hall, C. A., 1974, *Geologic Map of the Cambria Region, San Luis Obispo County, California*: U.S. Geological Survey Map MF-599.

Kuhn, G. G., and F. P. Shepard, 1984, *Sea Cliffs, Beaches, and Coastal Valleys of San Diego County: Some Amazing Histories and Some Horrifying Implications*: University of California Press, 193 p.

PG&E, 1988, *Final Report of the Diablo Canyon Long Term Seismic Program*: prepared for the Nuclear Regulatory Commission, July 1988.

ATTACHMENT A

Copies of Photographs of a Sea Cliff North of Port San Luis in San Luis Obispo County Taken in 1898 and 1945

From Kuhn and Shepard, 1984

Figure 4*a*
Sea cliff north of Port San Luis prior to 1898. *Photo*: George W. Stose.

Figure 4*b*.
View from the same spot, 1945. Note the almost complete absence of erosion in the interim. Numerous rocks can be matched in the two photographs. *Photo*: U. S. Grant IV.

Appendix B

TERRESTRIAL BIOLOGY REPORT

VEGETATION SURVEY OF THE ABALONE FARM PROJECT SITE, CAYUCOS, CALIFORNIA

by
V. L. Holland, Plant Ecologist
David Keil, Plant Taxonomist

28 September 1988

INTRODUCTION

The Cayucos Abalone Farm is located on a marine terrace next to the Pacific Ocean at the western end of Villa Creek Road, north of Cayucos in San Luis Obispo County, California. The eastern portion of the property is bounded by steep hillsides covered by coastal scrub vegetation, and the western boundary is marked by the steep, eroded cliffs of the sea bluff that drops sharply down to a rocky beach along the ocean. The existing facilities of the Abalone Farm have been constructed on the marine terrace and the adjacent sea bluff of the northern half of the property. Much of the southern portion of the subject property located on the marine terrace has been cleared, and some construction activity was started prior to this survey. The steep hillsides to the east are relatively undisturbed.

DESCRIPTION OF THE VEGETATION

Botanical survey work for this project took place in early September, 1988. The botanical survey consisted of canvassing the area on foot, recording all of the plant species in identifiable condition and describing the plant habitats. Within the boundaries of the site, we identified over 100 plant species (see attached species list) and four terrestrial plant communities: (1) coastal valley grassland, (2) coastal scrub, (3) sea bluff coastal scrub and (4) anthropogenic (ruderal). In addition there is a well-developed intertidal and subtidal marine aquatic community along the shoreline to the west of the subject property. We have surveyed in detail the terrestrial communities but not the marine aquatic community, which is outside of our area of expertise.

1. Coastal Valley Grassland

The grassland on the site is dominated by annual, introduced species of grasses and forbs. The perennial, native bunchgrasses, which dominated the grassland prior to Spanish settlement, are found only sporadically on the hillsides. Historically, the changes in the composition of the grassland in this area are mostly a function of the introduction and invasion of alien plant species and changes in the kinds of animals (especially grazing livestock) and their grazing patterns. Cultivation and fire also may have played limited roles.

Grasslands occur on the marine terrace and at the base of the hillsides where finer textured soils tend to develop. These grasslands intergrade with coastal scrub on xeric, steep slopes and with sea bluff scrub along the cliff above the ocean. In transitional areas there are scattered shrubs such as coyote bush and coastal goldenbush in the grassland areas. Many of the grassland species also occur as understory species in the coastal scrub.

For the most part, the grassland area is dominated by species characteristic of other central coast valley grasslands such as *Brachypodium distachyon* (false brome-grass), *Bromus mollis* (soft chess brome), *Bromus diandrus* (ripgut brome), *Bromus rubens* (red brome), *Avena fatua* (wild oats), *Avena barbata* (slender wild oats), *Hordeum leporinum* (foxtail), *Lolium multiflorum* (wild rye), *Plantago lanceolata* (English plantain), *Vulpia myuros* (fescue), *Rumex angiocarpus* (sour dock) and many others (see species list).

A few of the native perennial grasses also occur on the site. *Danthonia californica* (California oat-grass), *Stipa lepida* (slender needle grass), and *Stipa pulchra* (purple needle grass) are bunch grasses that occur commonly along the California coastline in grasslands and grassland—coastal scrub mixed communities. A sod-forming perennial grass, *Distichlis spicata* (saltgrass) is locally common the site and is indicative of a high salt content in the soil that results from salt spray from the nearby beach.

2. Coastal Scrub Community

The coastal scrub community is composed of several species of soft-wooded, wind pruned, low growing shrubs and subshrubs 1–3 feet in height mixed with a variety of herbaceous species. It forms a somewhat open vegetational cover on the steep hillsides east of the existing facilities and marine terrace. The dominant species of the coastal scrub is *Artemisia californica* (California sagebrush). Common associated shrubs are *Baccharis pilularis* (coyote bush), *Mimulus aurantiacus* (bush monkey flower), *Hazardia squarrosa* (sawtooth goldenbush), *Isocoma veneta* (coastal goldenbush), *Lotus scoparius* (deerweed), and *Eriogonum parvifolium* (coastal buckwheat). Some of the understory species are also common in adjacent grasslands. Other species found in the coastal scrub are on the species list.

3. Sea Bluff Coastal Scrub

In the areas along the sea bluffs, the coastal scrub occurs along the rocky headlands just above high tide and along the margins of the erosion face of the bluff. It forms a narrow band of vegetation along the bluff consisting of low growing shrubs, succulents and herbs. At the top of the bluff it grades into the coastal valley grassland of the marine terrace. In some places along the bluff face, the plants in this community cling to nearly vertical rock faces just above the pounding surf.

Plants that grow on sea bluffs must be able to tolerate constant exposure to salt spray and be able to grow on highly eroded soils that are shallow and high in salt content. Common species of this community on the subject property are *Isocoma veneta* (coastal goldenbush), *Atriplex semibaccata* (Australian saltbush), *Atriplex californica* (California saltwort), *Carpobrotus edulis* (ice plant), *Distichlis spicata* (salt grass), *Dudleya caespitosa* (dudleya), and *Sida leprosa* var. *hederacea* (alkali mallow). In addition, some of the species common in the adjacent grassland mix with the sea bluff coastal scrub near the top of the bluff where the soils are better developed and not eroded.

4. Anthropogenic communities

Anthropogenic communities are those dominated by plants introduced by humans or maintained by human disturbance. On the subject property, the disturbance around the roadsides, buildings, holding ponds, cleared areas, etc. has created a habitat for weedy

species which dominate these areas. Common weeds are *Bromus diandrus* (ripgut brome), *Foeniculum vulgare* (fennel), *Plantago lanceolata* (English plantain), *Melilotus indica* (yellow sweet clover), *Bromus mollis* (soft chess brome), *Avena barbata* (slender wild oats), *Carduus pycnocephalus* (Italian thistle), *Brassica geniculata* (perennial mustard), and others listed on the species list. In addition, some of the weedy plants have invaded the surrounding native plant communities and have become occasional to dominant components of these communities.

The weedy plants are almost all alien species introduced to California from other areas of the world. They are characterized by their ability to colonize disturbed sites. Some are very invasive and have displaced native plants. The introduced plants are marked in the species list with an asterisk (*).

Another example of an anthropogenic community is the introduced trees such as the pines and cypresses that have been planted on the hillside and along the fenceline near the southern property boundary. These introduced trees are small at present, but can be expected to have an influence on the associated flora and fauna; however, because there are so few of them, their impact is probably not significant.

5. Marine Aquatic Plant Community

A zone of intertidal and subtidal plants extends westward from the subject property. These communities are composed of one or two species of *Phyllospadix* (surfgrass), which are marine angiosperms, and a wide variety of marine algae. We did not inventory the marine aquatic community offshore from the abalone farm, but this should be done by a qualified algologist. We did note that one or more species of kelps (brown algae) are harvested to use as food for the abalone at the abalone farm. We do not know whether these are kelps growing immediately offshore from the subject property or harvested elsewhere off the California coast. Kelp that is not consumed by the abalone is dumped over a cliff at the abalone farm onto the rocky beach to be swept away by the waves. We do not know whether either the harvesting or the dumping has an impact on the marine aquatic community or on the fauna of the intertidal or subtidal zones.

FLORA OF THE CAYUCOS ABALONE FARM PROPERTY

There is a diversity of plant species in the area as indicated by the extensive species list (Table 1). However, it is important to note that this is by no means a complete list of the plants present on the site. Plant species composition, especially herbaceous cover, varies seasonally. During September, a large number of the species are not present in identifiable condition. Spring flowering ephemerals are represented only by their dry remains. Consequently, the plants listed are only those found in identifiable condition during the fall survey. A thorough survey through the entire year would be necessary for a complete listing of the area's flora.

RARE AND ENDANGERED PLANT SPECIES

We did not encounter any rare and/or endangered plant species in our survey of the Cayucos Abalone Farm. However, because many of the plants were not in identifiable condition during the on-site survey, we cannot state with certainty that none occur there. Some rare species of coastal San Luis Obispo County are spring-flowering ephemerals that generally are withered or shattered by September. Our overall impression is that there

probably are not any endangered or threatened species currently on the subject site, but a spring survey would be necessary for us to state this conclusively.

IMPACTS OF THE PROJECT

The development of the proposed project has or will result in the removal and destruction of most of the existing vegetation on the marine terrace within the project site. The communities that will be affected to the greatest extent are the grasslands and the sea bluff coastal scrub. The disturbance associated with construction activities and operation of the abalone farm can be expected to enhance the opportunities for further invasions of alien weedy species at the expense of the existing communities.

Operation of the abalone farm and construction of additional facilities could also result in increased erosion of the sea bluff. Wave erosion of sea bluffs is a common phenomenon along the California coastline as is gully formation in the marine terraces. Removal of vegetative cover tends to accelerate the rate of erosion. In the areas where facilities of the abalone farm have been developed, erosion of the sea bluff is already a serious problem. There has been a significant loss from the bluff face, and soil is eroding from the terrace. Because of the rapid erosion, vegetation has not kept pace and only a sparse vegetative cover been able to develop on the eroded areas. Even the use of concrete on the bluff tops and along the slopes has not successfully controlled the erosion.

RECOMMENDATIONS

Further development on the site should be situated as far back from the edge of the sea bluff as possible. No disturbance should occur on the bluff itself or on the hillsides found on the eastern portion of the site. These recommendations make economic as well as ecological sense. Relocation of facilities undercut by erosion would be more costly than placing the facilities away from the waves in the first place.

Revegetation of areas that have been disturbed by the construction activities should emphasize use of native species well-adapted to the California coastline. Use of exotic ornamentals should be discouraged. Species known to invade and displace native vegetation should be avoided; e.g., *Cortaderia jubata* (pampas grass), *Carpobrotus* spp. (ice plants).

The marine aquatic communities should be investigated by qualified biologists to determine the project's impact on the algae and other marine life.

REFERENCES

California Department of Fish and Game. 1988. Natural Diversity Data Base. Special Plants. 58 pp.

Holland, V. L. and D. Keil. 1986. California Vegetation. El Corral Publications. 292 pp.

Hoover, R. F. 1970. The Vascular Plants of San Luis Obispo County, California. University of California Press, Berkeley.

Munz, P. A., and D. D. Keck. 1959. A California Flora. University of California Press, Berkeley.

_____. 1968. Supplement to A California Flora. University of California Press, Berkeley.

Smith, J. P., and R. York. 1984. Inventory of Rare and Endangered Vascular Plants of California. California Native Plant Society, Sacramento.

United States Department of the Interior, Fish and Wildlife Service. 1983. Endangered and Threatened Wildlife and Plants; Supplement to Review of Plant Taxa for Listing; Proposed Rule. Federal Register 48 (229):53640-53670.

Table 1

Plant List for Cayucos Abalone Farm Project

Trees

none except ornamentals

Shrubs

	Artemisia californica	Coastal sagebrush
	Baccharis pilularis	Coyote bush
	Eriogonum parvifolium	Coastal buckwheat
	Hazardia squarrosa	Sawtooth goldenbush
	Isocoma veneta	Coastal goldenbush
	Lotus scoparius	Deerweed
	Mimulus aurantiacus	Sticky monkeyflower
*	Nicotiana glauca	Tree tobacco
**	Opuntia ficus-indica	Prickly-pear cactus

Herbs

*	Amaranthus albus	Amaranth
*	Amaranthus hybridus	Amaranth
	Ambrosia acanthicarpa	Ragweed
*	Anagallis arvensis	Scarlet pimpernel
*	Anthemis cotula	Dog-fennel
	Astragalus nuttallianus	Locoweed
	Atriplex californica	California saltwort
*	Atriplex semibaccata	Australian saltbush
*	Avena barbata	Slender wild oats
*	Avena fatua	Common wild oats
*	Brachypodium distachyon	False brome-grass
*	Brassica geniculata	Perennial mustard
*	Bromus diandrus	Ripgut bromegrass
*	Bromus mollis	Soft chess bromegrass
*	Bromus rubens	Red bromegrass
	Calystegia macrostegia	Wild morning-glory
	Calystegia subacaulis	Dwarf morning-glory
*	Carduus pycnocephalus	Italian thistle
*	Carpobrotus chilensis	Ice plant
*	Carpobrotus edulis	Ice plant
*	Centaurea melitensis	Golden star thistle
*	Centaurea solstitialis	Yellow star thistle
*	Chenopodium album	Lamb's quarter
*	Chenopodium ambrosioides	Mexican-tea
*	Chenopodium murale	Goosefoot
**	Chrysanthemum coronarium	Garland daisy
*	Convolvulus arvensis	Field bindweed
*	Conyza bonariensis	Hairy horseweed
*	Conyza canadensis	Horseweed
*	Crypsis schoenoides	Mat grass
*	Cynodon dactylon	Bermuda grass
	Cyperus eragrostis	Umbrella sedge

*	Dactylis glomerata	Orchard grass
	Danthonia californica	California oat-grass
	Dichelostemma pulchellum	Blue dicks
	Distichlis spicata	Salt grass
	Dudleya caespitosa	Dudleya
	Elymus triticoides	Beardless wild-rye
	Eremocarpus setigerus	Turkey mullein
*	Erodium botrys	Storkbill filaree
*	Erodium cicutarium	Redstem filaree
*	Erodium moschatum	Greenstem filaree
	Eschscholzia californica	California poppy
	Filago californica	Filago
*	Foeniculum vulgare	Fennel
*	Gastridium ventricosum	Nitgrass
*	Geranium dissectum	Cutleaf geranium
	Gnaphalium bicolor	Bicolored everlasting
*	Gnaphalium luteoalbum	Cudweed
	Gnaphalium sp.	Everlasting
*	Hedypnois cretica	Hedypnois
	Helianthemum scoparium	Rush-rose
	Hemizonia corymbosa	Tarweed
	Hemizonia increscens	Tarweed
	Hemizonia luzulifolia	Hayfield tarweed
*	Hordeum leporinum	Foxtail barley
	Hypochoeris glabra	Smooth cat's-ear
*	Lactuca serriola	Prickly lettuce
	Lamarckia aurea	Goldentop grass
*	Lavatera cretica	Bush mallow
**	Limonium perezii	Statice
*	Lolium multiflorum	Annual ryegrass
*	Lotus corniculatus	Bird's-foot trefoil
	Lythrum hyssopifolia	Loosestrife
	Madia sativa	Coast tarweed
*	Medicago polymorpha	Bur-clover
*	Melilotus albus	White sweet-clover
*	Melilotus indicus	Yellow sweet-clover
*	Panicum capillare	Witchgrass
	Phyllospadix sp.	Surf-grass
*	Plantago lanceolata	English plantain
*	Polygonum arenastrum	Common knotweed
	Polygonum lapathifolium	Smartweed
*	Polypogon interruptus	Ditch polypogon
*	Polypogon monspeliensis	Rabbitfoot grass
*	Raphanus sativus	Wild radish
*	Rumex angiocarpus	Sour dock
*	Rumex conglomeratus	Knotted dock

*	Rumex pulcher	Fiddle dock
*	Salsola iberica	Russian thistle
	Sida leprosa var. hedericea	Alkali mallow
*	Silene gallica	Windmill pink
	Solanum douglasii	Black nightshade
*	Sonchus oleraceus	Common sow-thistle
	Spergularia macrotheca	Large-flowered sand-spurry
*	Spergularia rubra	Red-flowered sand-spurry
	Stephanomeria sp.	Wire-lettuce
	Stipa lepida	Slender needlegrass
	Stipa pulchra	Purple needlegrass
	Trifolium sp.	Clover
*	Xanthium spinosum	Spiny clotbur
*	Xanthium strumarium	Cocklebur

* Weedy species not native to California.
** Planted as ornamental.

Appendix C

MARINE BIOLOGY REPORT

Report on the Cayucos Abalone Farm and Environs, With Respect to the Marine Environment

Fred L. Clogston

1988

The Cayucos Abalone Farm site is on a coastal terrace of the Franciscan formation with sandstone cliffs, beach and near-shore reefs. Indentations as surge channels cut into the shore and cliffs. The edge of terrace shows natural erosion due to run-off in the winter rain storms. Potentially any development utilizing water on the terrace could exacerbate the erosion process. As the existing system and the proposed addition use a flow through system of sea water such potential for erosion exists. In the existing system, water is channeled from the culture tanks into drain pipes. On the downhill side of the system of tanks, curbing and gutters adjacent to the bluff edge channel overflow water and seasonal rain water into the drainage pipes. This water is released into steep sided declevities in the cliff face to enter the ocean through surge channels. This minimizes erosion due to Man's activities at the site. In the expansion area, a comparable system is proposed to control run-off, overflow and drainage from upwards to 240, 700 gallon growing tanks on five terraces. Errosion of the coastal terraces will occur with or without Man's activities. The system in use and the design for the proposed expansion should minimize additional effects.

The intertidal and near-shore habitat and its biota are naturally subjected to materials from run-off after rains. The wave action and tidal currents in the ocean at such times tends to distribute silt so that a natural, highly diverse assemblage of plants and animals is maintained along this section of coast line. From time to time, isolated incidents of whole-sale slumping and run-off silting as well as temporary build up of over-burdens of algal debris do cause limited and short term deleterious effects on

the biota. Seasonal variations in sea conditions also cause coming and going of sand in intertidal channels in rock reefs. This is a natural cyclic phenomenon on such shore lines. Such areas normally recover quickly with recruitment of developmental stages from nearby unaffected areas.

The typical rocky shore assemblage of intertidal flora and fauna can be found at the site. As the site has very limited reef area with boulders lying on a base of sand, mud or gravel compared to the shore a short distance east toward Cayucos, or up the coast beyond Cambria, there is over-all lower species diversity here. A typical rocky shore assemblage is seen at the site displaying zonal distribution influenced by the tide hieght fluctuations of the area.

In the uppermost horizon of the intertidal area, the limpet, Collisella digitalis and the periwinkle snail, Littorina keenae are common on rock surfaces with scattered dense clumps of the small grey-brown acorn barnacle Chthamalus dalli. In cracks and overhangs at this hieght, the "rock louse" Isopod, Ligia occidentalis, are sometimes lurking to range over the open rocks at twilight. Where irregularities in the rock allow for standing water, the green alga, Enteromropha intestinalis grows and affords a habitat for the Harpacticoid Copepod, Tigriopus californicus.

Lower on this rocky shore, dense populations of the white acorn barnacle, Balanus glandula, appear and occur on rock surfaces through out the rest of the intertidal shore. The perwinkle snail, Littorina scutulata, replaces L. keenae in this region, as does the limpet C. scahra replace C. digitalis. A broad dense band of brown

alga, Endocladia muricata, and the red alga, Gigartina agardhii, nearly black when dry, is characteristic at this tidal horizon. Tufts of the green alga, Ulva taeniata and Cladophora columbiana occur on the upper half of rocky beaches here. The encrusting brown alga Ralfsia pacifica occurs like scattered tar splotches here and downward. The turban snail, Tegula fenebralis is abundant and here and there, especially in tide pools, these black shells house hermit crabs, Pagurus samuelis and P. granosimanus. Dense populations of the aggregate anemone, Anthopleura elegantissima, covered with bits of shell, are found on rock surfaces in this region above mid-tide level. The large green Anemone, A xanthogrammica, occur singly scattered down the remainder of the beach. Dense beds of the California mussel, Mytilis Californianus, is associated with the goose-neck barnacle, Polycipes polymerus. Below mid-tide level, the strap-like brown alga, Egregia menziessi, is common along with the surf grass, Phyllospadix scouleri. Green alga, Ulva lobata, and red "turkish towel", Gigartina spp. are common in the lower horizons along with Iridea cordata. Tide pools contain the coralline red algae, Corallina officianalis, Bossiella spp. and encrusting corallines, Lithothamnion spp. appearing like pink spilled paint. Dorid nudibranch mollusks such as the lemon yellow, Archidoris montereyensis, are occasionly seen among tidepool algae in the lower regions of the shore along with the kelp crab, Pugettia producta and the rock crab, Cancer antennarius. Where boulders are present, infrequent on this shore, young stages of snails such as the black abalone, Haliotus crocherodii, and chitons such as Stenoplax heathiana are found with a variety of encrusting sponges, colonial

ascidians, calcareous tube worms, Spirorbis spp., and the procellain crab, Petrolisthes cinctipes.

In the extreme low intertidal occur stands of the brown alga, Laminaria dentigera. Near shore are beds of kelp, Macrocystis pyrifera, the pea kelp, and, Nereocystis lutkeana, the bull kelp.

STATE OF CALIFORNIA—OFFICE OF THE GOVERNOR

GEORGE DEUKMEJIAN, Governor

OFFICE OF PLANNING AND RESEARCH
1400 TENTH STREET
SACRAMENTO, CA 95814

August 11, 1989

Judy Brown
State Lands Commission
1807 13th Street
Sacramento, CA 95814

Subject: The Abalone Farm Development Plan/SCH# 89071212

Dear Ms. Brown:

The State Clearinghouse submitted the above named environmental document to selected state agencies for review. The review period is now closed and none of the state agencies have comments. This letter acknowledges that you have complied with the State Clearinghouse review requirements for draft environmental documents, pursuant to the California Environmental Quality Act.

Please call Garrett Ashley at 916/445-0613 if you have any questions regarding the environmental review process. When contacting the Clearinghouse in this matter, please use the eight-digit State Clearinghouse number so that we may respond promptly.

Sincerely,

David C. Nunenkamp
Chief
Office of Permit Assistance