



The March 3, 2006, Geocon Geotechnical Investigation and Geologic Fault Investigation and June 21, 2006, Ninyo & Moore Preliminary Geotechnical Evaluation and Third-Party Review were used as the basis for the geotechnical evaluation included in the EIR for the current Harbor Island Hotel Project (4-story, 175 room hotel located east of the existing Sunroad Resort Marina building). ICF Jones & Stokes did not conduct any updates to information contained in the reports for purposes of completing the EIR.

The previous geotechnical reports evaluated a 10-story hotel structure encompassing all of East Harbor Island. The current project is a 4-story hotel, with a maximum of 175 rooms. The Port District and ICF Jones & Stokes determined that the Geocon and Ninyo & Moore reports are still appropriate and adequate assessments of the current Project site because the Project site evaluated in the EIR is located within the limits of the area evaluated in the 2006 reports.

**PRELIMINARY  
GEOTECHNICAL EVALUATION  
AND THIRD-PARTY REVIEW  
PROPOSED EAST HARBOR ISLAND  
DEVELOPMENT PROJECT  
SAN DIEGO, CALIFORNIA**

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June 21, 2006  
Project No. 105871001

June 21, 2006  
Project No. 105871001

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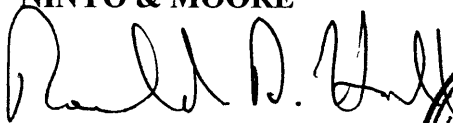
Subject: Preliminary Geotechnical Evaluation  
and Third-Party Review  
Proposed East Harbor Island Development Project  
San Diego, California

Dear Ms. Coppola:

Transmitted herein are the results of Ninyo & Moore's Preliminary Geotechnical Evaluation study and third-party review for the Proposed East Harbor Island Development Project. This study was conducted in accordance with your request and included review and analysis of available geologic and geotechnical background data, and a geologic reconnaissance of the project site area.

We appreciate the opportunity to be of service. Should you have any questions or comments regarding this report, please contact the undersigned at your convenience.

Respectfully submitted,  
**NINYO & MOORE**



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**Figure**

Figure 1 – Site Location Map

## 1. INTRODUCTION

In accordance with your request, Ninyo & Moore has performed a Preliminary Geotechnical Evaluation study and a third-party review of a geotechnical and geologic fault investigation report for the project site. This report presents our preliminary findings and conclusions pertaining to the Proposed Harbor Island Development Project. The purpose of this study was to evaluate geologic and geotechnical conditions using available geologic and geotechnical data and to provide a Preliminary Geotechnical Evaluation report, which we understand will be utilized as part of an Environmental Impact Report (EIR) study. Subsurface exploration and laboratory testing of materials were not included in the scope of this preliminary evaluation.

## 2. SCOPE OF SERVICES

Ninyo & Moore's scope of services has included review of background materials and geologic reconnaissance of the site area. Specifically, we have performed the following tasks:

- Collection and review of pertinent, available geotechnical literature including topographic/bathymetric maps, geologic maps, in-house geotechnical reports, geologic hazards maps, fault hazard maps, historical stereoscopic aerial photographs, and site development plans. Documents reviewed for our site study are listed in the Selected References section of this report.
- Peer review of a geotechnical investigation and geologic fault investigation report prepared by Geocon Incorporated (Geocon, 2006).
- Geologic reconnaissance of the project study area by a California-certified engineering geologist from our firm.
- Compilation and analysis of the data obtained.
- Preparation of this report presenting our findings, and conclusions regarding the adequacy of the proponent's geotechnical report for inclusion in the Geology, Seismic and Coastal Processes section of the Environmental Impact Report. This review discusses the geologic setting, anticipated earth units, soil conditions, faulting and seismicity, seismic parameters, liquefaction, potential geologic hazards, groundwater, and unique geological or physical features.

### **3. SITE DESCRIPTION**

The project site is located on the east side of Harbor Island in the city of San Diego (Figure 1). The project area extends east from the north bound Harbor Island Drive, to the east end of Harbor Island. The site currently consists of a restaurant, retail space, and parking areas. Grassy areas as well as palm and eucalyptus trees are located throughout the project site. Topographically, the site consists of relatively level land. Elevations across the property range from a high of roughly 15 feet above mean sea level (MSL) near the eastern end of the project area to roughly 12 feet above MSL near the western end of the project. Surface drainage is generally to the north.

### **4. PROJECT DESCRIPTION**

Based on our review of preliminary plans and our understanding of the project, the project will include a hotel tower up to 10 stories, a multistory parking garage, restaurant, meeting, recreational, retail, and open space development of the site.

### **5. GEOLOGY**

The following sections present our findings relative to regional geology, site geology, groundwater, and faulting and seismicity.

#### **5.1. Regional Geologic Setting**

The project study area is situated in the western portion of the Peninsular Ranges geomorphic province of southern California. This geomorphic province encompasses an area that extends 125 miles, from the Transverse Ranges and the Los Angeles Basin, south to the Mexican border, and beyond another 795 miles to the tip of Baja California (Norris and Webb, 1990; Harden, 1998). The geomorphic province varies in width from 30 to 100 miles, most of which is characterized by northwest trending mountain ranges separated by subparallel fault zones. In general, the Peninsular Ranges are underlain by Jurassic-age metavolcanic and metasedimentary rocks and by Cretaceous-age igneous rocks of the southern California batholith. The westernmost portion of the province in San Diego County,

including the project area, generally consists of uplifted and incised Upper Cretaceous-, Tertiary-, and Quaternary-age sedimentary rocks.

The Peninsular Ranges are traversed by several major active faults. The Whittier-Elsinore, San Jacinto, and the San Andreas faults are major active fault systems located northeast of the site and the Agua Blanca-Coronado Bank and San Clemente faults are active faults located to the west-southwest. The nearby Rose Canyon fault zone, located east of the site, has also been recognized as active by the State of California. A strand of the Rose Canyon fault zone (Spanish Bight Fault), as mapped in the geotechnical investigation and geologic fault investigation report, passes through the east end of the subject property. Major tectonic activity associated with these and other faults within this regional tectonic framework is right-lateral strike-slip movement. These faults, as well as other faults in the region, have the potential for generating strong ground motions at the project site. Further discussion of faulting relative to the site is provided in the Faulting and Seismicity section of this report.

## **5.2. Site Geology**

Based on our literature review of published geologic maps and geologic reports, the geotechnical investigation and geologic fault investigation report (Geocon, 2006), and our site reconnaissance, the project vicinity is underlain by fill materials, and bay deposits, overlying the Bay Point Formation. A brief description of these units, as described in the cited literature is presented below.

### **5.2.1. Hydraulic Fill**

Based on our review of the Geocon report, approximately 18 to 22 feet of hydraulic fill soil underlie portions of the developed areas of the project vicinity. The hydraulic fill was derived from local dredging operations and was placed with little to no densification or compactive effort below water level, and unknown level of compaction above water level. The fill consists of loose to dense fine sand with varying amounts of shells. These soils are considered susceptible to liquefaction where located below the water table.

### **5.2.2. Quaternary Bay Deposits**

The Pleistocene- to Holocene-age Bay Deposits underlie the fill soils. The bay deposits consist of loose to medium dense fine sand. Numerous shells and shell-hash zones occur in the Bay Deposits. As reported, the unit ranges in thickness from approximately 11 feet in the western portion of the site, to approximately 43 feet in the eastern part. The loose and saturated portions of the bay deposits are considered susceptible to liquefaction.

### **5.2.3. Quaternary Bay Point Formation**

Materials of the Pleistocene-age Bay Point Formation were encountered beneath the bay deposits. The Bay Point Formation, as described in the geotechnical investigation and geologic fault investigation report, consists of dense to very dense silty sand and fine sand.

### **5.2.4. Groundwater**

Seeps and springs were not observed during our site visit. Based on our review of the geotechnical investigation and geologic fault investigation report, shallow groundwater was encountered at depths of approximately 9 to 14 feet below the ground surface.

## **5.3. Faulting and Seismicity**

The project area is considered to be seismically active, as is much of southern California. Based on our review of the Geocon, 2006 report, the eastern portion of the site is underlain by the three splays of the Spanish Bight Fault, a strand of the Rose Canyon Fault zone. According to the fault investigation report, the three faults offset sediments of Holocene-age (i.e., within the last 11,000 years) and are thus considered to be active.

Several portions of the Rose Canyon fault zone in the Mount Soledad, Rose Canyon, downtown San Diego, and San Diego Bay areas have been designated by the State of California (California Geological Survey [CGS], 1991 and 2003b) as being Earthquake Fault (Alquist-Priolo) Zones. The Rose Canyon fault zone is the onshore portion of a more extensive fault zone that includes the Offshore Zone of Deformation and the Newport-Inglewood fault to

the north, and several possible extensions southward, both onshore and offshore (Treiman, 1993). The Rose Canyon fault zone also consists of predominantly right-lateral strike-slip faults that extend south-southeast through the San Diego metropolitan area. Various fault strands display strike-slip, normal, oblique, or reverse components of displacement. The fault zone extends offshore at La Jolla and continues north-northwest subparallel to the coastline. South of downtown, the fault zone splits into several splays that underlie San Diego Bay, Coronado, and the ocean floor south of Coronado (Treiman, 1993; Kennedy and Clarke, 1999). The eastern portion of the subject site is located with an Earthquake Fault (Alquist-Priolo) zone.

In general, hazards associated with seismic activity include ground surface rupture, strong ground motion, liquefaction, seismically induced settlement, and tsunamis. These potential hazards are discussed in the following sections.

### **5.3.1. Ground Surface Rupture and Strong Ground Motion**

Based on our review of the Geocon (2006) geotechnical investigation and geologic fault investigation report, three splays of the active Spanish Bight fault are located on the eastern portion of the site. The potential for ground rupture due to faulting at the site is considered high. Lurching or cracking of the ground surface as a result of local or nearby seismic events is also possible.

A significant seismic event that could affect the proposed project would be a moment magnitude ( $M_w$ ) 7.2 earthquake within the Rose Canyon fault zone (CGS, 2003a). According to the 2001 California Building Code (CBC) and the CGS (1998), the Rose Canyon fault is classified as a “B” seismic source type. The site is within a CBC Near-Source Zone for active faults and is within CBC Seismic Zone 4.

Based on review of the project geotechnical investigation and geologic fault investigation report, unweighted mean site accelerations of 0.31g and 0.46g were calculated for probability of exceedance in 50 and 100 years respectively.

### **5.3.2. Liquefaction, Seismically Induced Settlement, and Lateral Spread**

Liquefaction of cohesionless soils and resultant induced settlement can be caused by strong vibratory motion due to earthquakes. Research and historical data indicate that loose granular soils and non-plastic silts that are saturated by a relatively shallow groundwater table are most susceptible to liquefaction.

The site is underlain by hydraulic fill soils and bay deposits and shallow groundwater. Based on these conditions and review of the Geocon (2006) report, the potential for liquefaction, seismically induced settlement, and lateral spread to occur on the site is considered high. Recommendations for mitigation of potential liquefaction are included in the geotechnical investigation report.

### **5.3.3. Tsunamis**

Tsunamis are long wavelength seismic sea waves (long compared to the ocean depth) generated by sudden movements of the ocean bottom during submarine earthquakes, landslides, or volcanic activity. A seiche is an oscillating wave within an enclosed or semi-enclosed body of water caused by an earthquake or other subsurface disturbance. Based on the location of the site, the potential for damage due to tsunami or seiche is considered to be low to moderate. However the Geocon (2006) report indicates the potential for a very large tsunami or seiche to affect the site is considered to be high.

### **5.3.4. CBC Seismic Design Parameters**

The seismic design parameters for the site as defined in the 2001 edition of the CBC were presented in the project geotechnical investigation and geologic fault investigation report (Geocon, 2006).

## **5.4. Landsliding**

Based on our review of published geologic maps, stereoscopic aerial photographs, the geotechnical investigation report, as well as our site reconnaissance, landslides or indi-

cations of deep-seated slope instability have not been mapped nor were observed underlying the project site.

### **5.5. Geologic Hazards Map**

According to Sheet 18 of the City of San Diego Seismic Safety Study (City of San Diego, 1995), the project site is located in Geologic Hazard Categories 31. This is described as having a high potential for liquefaction. The Seismic Safety Study does not indicate known or suspected landslides as existing on or adjacent to the site.

### **5.6. Expansive Soils**

Expansive soils are soils that undergo volumetric change with change in water content. The soil will swell with increase in moisture content and will shrink with decrease in moisture content. Soils with high shrink-swell potential usually contain high percentages of certain clay minerals and can cause extensive damage to structures and improvements.

The geotechnical investigation and geologic fault investigation report (Geocon, 2006) indicated that hydraulic fill materials on the site range from very low to low expansion potential as defined by UBC Standard No. 18-2 (California Building Standards Commission, 2001).

### **5.7. Flood Hazards**

According to a Federal Emergency Management Agency (FEMA) flood insurance rate maps (FEMA, 1997), the outer edges of Harbor Island are mapped as being within 100-year and 500-year floodplains. However, the majority of the site including the areas being considered for development is mapped as outside the 100-year and 500-year flood zones. Based on review of topographic maps, the site is not located downstream of a dam or within a dam inundation area. Based on this review and our site reconnaissance, the potential for flooding of the developable areas of the project area is considered low.

### **5.8. Mineral Resources**

Our evaluation has indicated that no significant economic mineral resources have been discovered within the limits of the project study area. Therefore the potential for loss of mineral deposits due to further development of the study area is considered low.

## **6. THIRD-PARTY REVIEW OF GEOTECHNICAL AND FAULT INVESTIGATION REPORT**

Based on our review, the geotechnical investigation and geologic fault investigation report (Gecon, 2006) generally addresses the significant geotechnical impacts for the proposed project. The main potential impacts reported are:

- On-site faults
- Seismic shaking
- Liquefaction
- Inundation by tsunami or seiches

Locations of three active strands of the Spanish Bight fault are identified in the subject report. The report recommends a structural setback of 25 feet from the three identified faults. It is our understanding that, based on State of California guidelines, the typical structural setback from active fault strands is 50 feet. Recommended fault setbacks will depend on the quality of data and complexity of the faulting encountered.

The potential impacts from seismic shaking would be addressed through design in accordance with the recommendations of the CBC. The potential impacts from liquefaction would be addressed by following the recommendations for grading and deep foundations included in the report.

The potential impact from inundation due to tsunami or seiche is harder to quantify. The report indicates “. . .the island is within the zone of tsunami maximum projected run-up. Four historic tsunamis have been recorded in San Diego with wave heights ranging from 1.5 to 4.6 feet. Even though it is possible that the site could be affected by waves generated by tsunamis or seiches,

the height and runout length of those waves would have to be very large. Therefore the potential for a very large tsunami or seiche to affect the site is high.” Based on the location of the site within San Diego Bay, we do not consider the potential for direct impact or inundation from a tsunami to be a design consideration. However, the potential for a seiche (an oscillating wave within an enclosed or semi-enclosed body of water caused by an earthquake or other subsurface disturbance) within San Diego Bay is harder to estimate based on the short historic record of southern California. Based on the available historic record and the location and alignment of San Diego Bay to potential seismic sources, we would estimate the potential for inundation at the site due to seiches to be low to moderate. The risk would be comparable to other low-lying sites located along San Diego Bay.

## **7. CONCLUSIONS**

Based on the results of our Preliminary Geotechnical Evaluation, it is our opinion that development within the proposed East Harbor Island Development Project is feasible from a geotechnical perspective. The following sections discuss site specific geologic and geotechnical issues and constraints and potential mitigation measures.

### **7.1. Geologic and Geotechnical Issues and Constraints**

- The reviewed geotechnical investigation and geologic fault investigation report for the site (Geocon, 2006) generally addresses the significant geotechnical impacts for the proposed project.
- Based on our review of the geotechnical investigation and geologic fault investigation report, active fault strands of the Rose Canyon fault zone have been mapped on the eastern portion of the site. The fault investigation report recommends a structural setback of 25 feet from the three identified faults.
- The subject site is located within a State of California Earthquake Fault Zone (Alquist-Priolo Special Studies Zone).
- The potential for strong ground motions to occur at the site is significant. San Diego County is located within Seismic Zone 4 according to the 2001 edition of the CBC. Ac-

cordingly, the potential for relatively strong seismic accelerations will need to be considered in the design of proposed improvements.

- The site has a moderate to high potential for liquefaction and seismically induced settlement. The project geotechnical investigation and geologic fault investigation report includes recommendations for grading, soil improvement, and deep foundations to mitigate the potential for liquefaction and seismically induced settlement.
- Landslides have not been mapped or observed on or adjacent to the project site. Parcels proposed for development should be individually evaluated for slope stability.
- In general, the soils in the area should be excavatable with standard heavy-duty excavation equipment.
- The geotechnical investigation and geologic fault investigation report indicates up to 22 feet of hydraulic fill are present across the site, which is underlain by bay deposits. The report includes recommendations for grading, soil improvement, and deep foundations to mitigate potential settlement of the on-site soils.
- In general, soil materials generated from excavations should be suitable for reuse as backfill, assuming they are free of organic, oversize, or other deleterious materials.

## 8. LIMITATIONS

The field evaluation and geotechnical analyses presented in this report have been conducted in accordance with current engineering practice and the standard of care exercised by reputable geotechnical consultants performing similar tasks in this area. No warranty, implied or expressed, is made regarding the conclusions, recommendations, and professional opinions expressed in this report. Variations may exist and conditions not observed or described in this report may be encountered. Our preliminary conclusions and recommendations are based on an analysis of the observed conditions and the referenced background information.

The purpose of this study was to evaluate geologic and geotechnical conditions within the project site and to provide a geotechnical reconnaissance report to assist in the preparation of environmental impact documents for the project.

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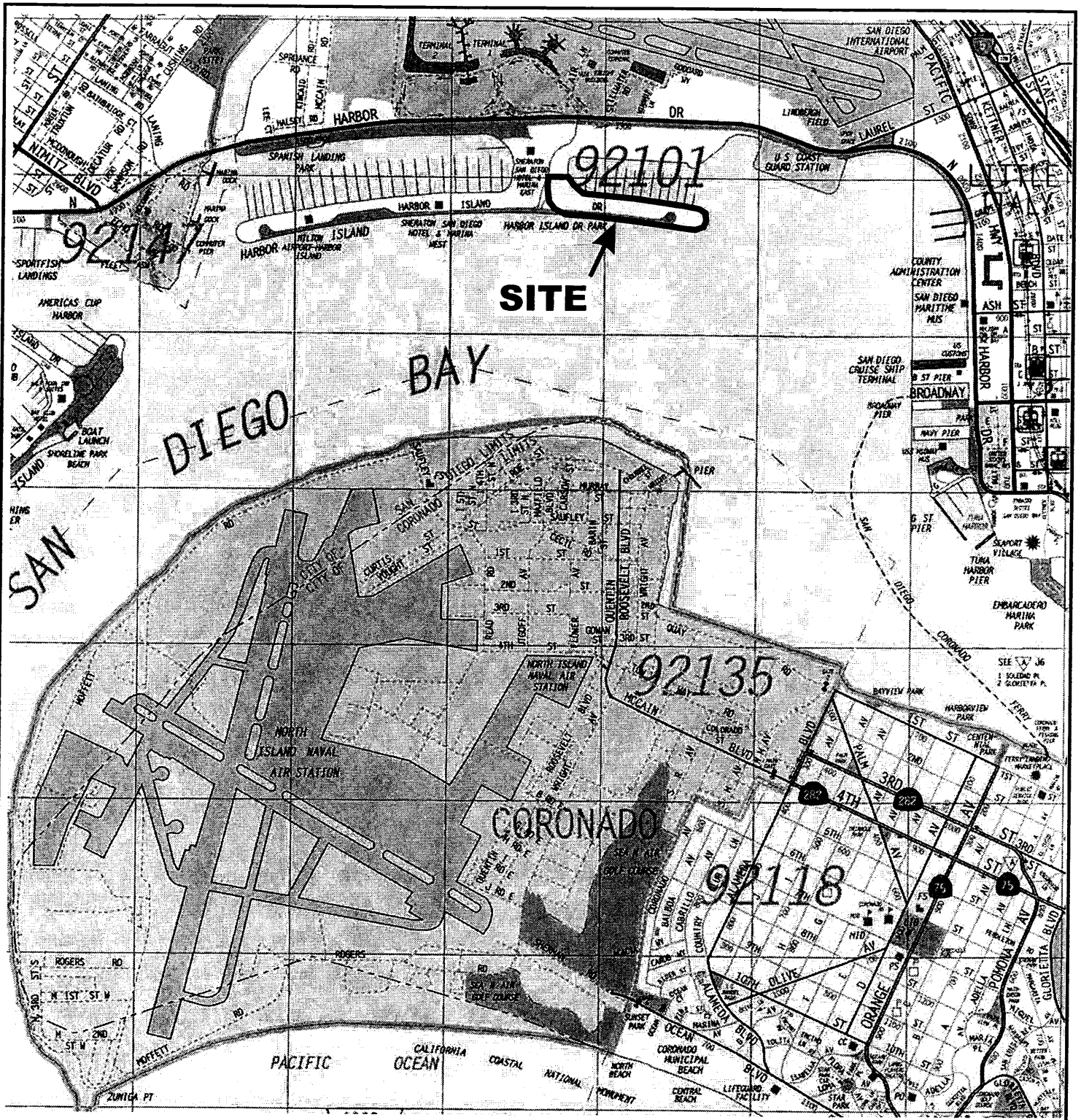
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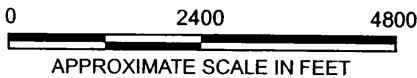
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<b>AERIAL PHOTOGRAPHS</b>				
<b>Source</b>	<b>Date</b>	<b>Flight</b>	<b>Numbers</b>	<b>Scale</b>
United States Department of Agriculture	April 14, 1953	AXN-3M	214 and 215	1:20,000



REFERENCE: 2005 THOMAS GUIDE FOR SAN DIEGO COUNTY, STREET GUIDE AND DIRECTORY.



NOTE: ALL DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

**Ninyo & Moore**

**SITE LOCATION MAP**

FIGURE

PROJECT NO.

DATE

PROPOSED EAST HARBOR ISLAND DEVELOPMENT PROJECT  
SAN DIEGO, CALIFORNIA

105871001

6/06

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