San Francisco Bay Conservation and Development Commission
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April 29, 2026

TO: Design Review Board Members

FROM: Lawrence J. Goldzband, Executive Director (415-352-3653; larry.goldzband@bcdc.ca.gov)
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SUBJECT: **Draft Summary of April 6, 2026, BCDC Design Review Board Meeting**

1. **Call to Order and Meeting Procedure Review.** Design Review Board (DRB) Chair Jacinta McCann called the hybrid meeting to order on Zoom, at approximately 5:00 p.m.

a. **DRB Board Members**. Chair Jacinta McCann, Vice Chair Gary Strang, Patricia Fonseca, Kristen Hall, Tom Leader, and Stefan Pellegrini attended in person.

b. **BCDC Staff**. Ashley Tomerlin, Yuri Jewett, Ben Dorfman, Julie Garren, and Rowan Yelton attended in person.

c. **The project teams**.
(1) Port of San Francisco (Port): David Beaupre and Patrick Foster
(2) East Harbor/Marina Green: Monica Scott, San Francisco Recreation and Parks Department (RPD); Paula Gill, Integral Consulting; Brenda McConathy, PG&E; and Veronica Rivera, Field Operations.

2. **Staff Update**. The Board Secretary noted the following items:
   a. Form 700 filing deadline was Wednesday, April 1.
   b. DRB Recruitment. We will be starting the recruitment process for new DRB members and alternates, aiming for two rounds this year. Over summer, we hope to appoint another coastal engineer, a landscape architect, and urban designer/architect.
   c. 2025 Public Access and Permitting in Review.
   d. The next meeting will be May 11 and a second review of the Berkeley Ferry Pier.
3. **Public Comment for Items Not on the Agenda**. There was no public comment.
4. **Briefing Near and Long-Term Projects at Fisherman's Wharf.** The briefing will present several near- and long-term projects at various stages of design and construction within Fisherman's Wharf at the Port of San Francisco. This area resides along the northernmost reach of the Port of San Francisco's 7.5-mile-long waterfront and is bounded by Pier 39 and the Hyde Street Pier. Staff will also provide an overview of the San Francisco Waterfront Special Area Plan (SFWSAP), a collaborative policy document between BCDC and the Port of San Francisco, and how it relates to the new development in the area. In 2025, BCDC approved an amendment to the SFWSAP

updating allowable redevelopment scenarios at Fisherman's Wharf to align with neighboring Northeastern Waterfront policies.

a. **Staff Presentation**. Ben Dorfman provided a staff introduction to the planning efforts and upcoming projects.

b. **Board Clarifying Questions following Presentations.**

(1) Jacinta McCann noted that the two agencies have been working together for a long time and asked that beyond the planning and policy phase, what are the steps required to identify a development project. Port staff responded that typically development projects come through the Request for Proposal (RFP) process, and occasionally sole source projects are considered. The process is outlined in the San Francisco Waterfront Plan, but typically BCDC is informed ahead of time to flag issues for RFPs and projects are presented to the DRB when ready. The BCDC San Francisco Waterfront Special Area Plan, the Port of San Francisco Waterfront Plan and the City's General Plan are in alignment on that.

c. **Project Presentation.** David Beaupre, Port of San Francisco, provided an overview of the planning efforts and upcoming projects with a slide presentation.

d. **Board Clarifying Questions following Presentations.**

(1) Gary Strang requested clarification regarding visitation and economic recovery for the area. Port staff stated the area is recovering with approximately 14.1 million visitors pre-COVID and 13.5 million for unique visitors in 2025, not including locals. The Port is working toward collecting better numbers, but the generally the area is recovering post pandemic and appears to be attracting more locals.

(2) Gary Strang asked if fishing in the area is still economically viable. Port staff stated that the commercial fishing industry is still very much present and active in Fisherman's Wharf and Pier 45, but has experienced seasonal restrictions and significant challenges in recent years like the temporary closure of the commercial salmon fishery and shortening of the Dungeness crab fishing season. The Maritime department states that the industry tends to be cyclical with waves of highs and lows. He noted that some of the improvements needed to assist the industry, such as a larger and improved ice machine and repairs to the pier apron for example, should help the commercial fishing industry remain viable.

(3) Gary Strang asked if fish processing on Pier 45 is being phased out in favor of other uses. Port staff stated that no, Pier 45 is comprised of four sheds and the Fisherman's Wharf Revitalized project is taking a portion of one shed and is considering integrating the needs of the fishing industry into the program and celebrating this use. He stated that without fishing there is no Fisherman's Wharf, noting the Special Area Plan and Bay Plan also protect commercial fishing areas and uses in Fisherman's Wharf specifically.

(4) Gary Strang asked if the use restriction makes redevelopment or intensification difficult or if it is strictly cost. Port staff stated that there are restricted uses for development. Residential or general office uses in the wharf area are not allowed, but retail, public serving, and other uses that support the maritime industry are being explored but many of them are expensive to build over the water.

(5) Tom Leader requested clarification for the prognosis of Fisherman's Grotto since Alioto's is gone. He would like to understand what the market says about the restaurant/food and beverage industry, and if there is a new alignment in forces and scale to be considered. Port staff confirmed that Fisherman's Grotto is currently vacant and the Port is working to re-tenant a small portion of it. The market wants a more fast casual experience; there is less desire for larger restaurants to host families and big celebrations. Additionally, the tenant improvement costs on top of not having time to amortize the cost of the substructure repair makes this area challenging. The restaurants at this location were not built independently, they share the same structure on different piles and are all tied together. The Port decided to look at the entire area comprehensively to address seismic and sea level rise resilience challenges to inform development of a commercial program. They noted that by removing the Alioto's building, they reduced the weight and load on the pier, which should help improve the lifespan of the overall structure and slightly reduce the seismic threat.

(6) Tom Leader observed that smaller scale is what works better here. Port staff confirmed that brokers advised that the four large vacant restaurants are difficult to re-tenant, while the smaller ones have been filled

(7) Kristen Hall noted that the holistic view and change in local demographic is interesting and asked for additional context regarding the percentage of the Port managed slips represented at this location. Is it a majority or a fraction for example. Port staff clarified that the majority of slips here are commercial fishing slips. The inner lagoon hosts approximately 60 commercial vessels and the outer lagoon has about 40. Hyde Street Harbor has approximately 50-60 slips. So the inner lagoon is approximately one third of the Port's commercial fishing berths. Other areas of the waterfront have recreational slips including South Beach marina which has approximately 460 recreational slips and Pier 39 is a tenant with approximately 350.

(8) Kristen Hall noted that in listening to the public comment on water-oriented public access, it sounds like the overall Port scenario is that commercial vessels are favored here versus recreational vessels. Port staff stated that there is both commercial and recreation, but it is not necessarily something the Port wants to encourage and promote. The size difference between commercial and recreational vessels is significant which affects visibility and life and public safety.

(9) Kristen Hall observed that the next agenda item contemplates the loss of the fuel dock at Gashouse Cove. She asked if the fuel dock could be relocated in this area or if the fuel dock at Gashouse Cove is removed, how it will affect the commercial fishing fleet. Port staff stated that the Port has an existing fuel dock at the end of Hyde Street, but due to a pipeline leak, it is currently offline and they hope to bring it back in operation this year. The Hyde Street Pier fuel dock is diesel only but the Port is in conversation with San Francisco RPD for a new fuel dock and exploring adding gasoline to support harbors around the area.

(10) Kristen Hall asked for clarification for the areas at risk for lateral spread, and if this is due to soil conditions, the seawall, or both. She also inquired where the improvements are planned to occur. Port staff confirmed that it is both the soil

and the condition of the seawall. The area along Jefferson Street has a newer seawall and is at less risk, but the areas where no upgrade has occurred are at a much higher risk. The upgrades are planned to occur along the perimeter of the inner lagoon and the public access areas since this is where people go.

(11) Kristen Hall asked for clarification for the parking areas that are shown in the illustrative plan, noting that transitioning the parking area near Boudins for a plaza is a nice improvement for public access and visitor experience, but asked how parking for the area will be addressed for the project. Port staff confirmed that parking is always a concern, and that reserving parking for the fishing and maritime fleet is most important and the Port has been working with that group. Port staff noted that fish processing happens early in the morning and is typically done by 9am. The industry needs around the clock access to parking but it is seasonal. Tourism also needs around-the-clock parking, and the Port is working with SFMTA to manage both as part of the plan.

(12) Patricia Fonseca requested clarification for the near-term projects and the anticipated life span given that they are meant to be implemented quickly. She asked how they might evolve over time and into the long term. Port staff stated that it varies slightly but the investment for the interim use projects such as the plaza are scheduled for approximately five years before the larger investments on the structure need to occur.

(13) Patricia Fonseca noted that from earlier comments it sounds like there is an interest to increase local users at the site. She asked about the goal of the area in general as it addresses market changes. Port staff stated it is a little bit of everything and that one lesson learned from the Waterfront Planning process is that the public perceives Fisherman's Wharf to only feature Pier 39 or Ghirardelli Square and not include the inner harbor area. The popularity of Fisherman's Wharf stemmed from the ability to watch and experience the fishing industry and maritime activity, this is true for most of the waterfront, the public wants to know and experience what happens in the water.

(14) Stefan Pellegrini inquired about the change in visitor profile for the area, specifically regarding mode splits. He asked how people are getting to this area and if this information will be included in the next phase of study. Port staff stated that they have been working with SFMTA to improve the mode split and recently learned that Fisherman's Wharf is the top destination for the Lime scooter system in San Francisco. The mobility split is leaning toward improving on transit, and they are looking at last mile improvements. They are also working with SFMTA on the area's bike network, including the Bay Trail as well as F line realignment, and possible periodic closure of Jefferson Street in partnership with the Community Benefit District.

(15) Stefan Pellegrini requested clarification for the next phase related to sea level rise resiliency and long-term improvements, specifically if elevation of the public realm will be required to meet the mid-century sea level rise condition, for example. Port staff confirmed that they will be studying that and at the very least the plan will be to elevate the edge as the line of defense. There already has been some study through the Port's resilience program, but more is underway with the

goal that there is a gradual transition and hoping to share ideas at a future meeting.

(16) Jacinta McCann stated that she appreciates the effort for prioritizing the working waterfront and the nature of the fishing industry at this location. She added that while people do enjoy observing the working waterfront, there has always been an interest in viewing the sea lions. She asked if this is still the case and how] they managed within the design framework. Port staff confirmed that the sea lions remain at Pier 39 in significant numbers and they always design with the sea lions in mind in relation to dock improvements and repairs.

(17) Jacinta McCann asked for clarification regarding measuring success of the projects, and if the data is being used to identify visitors and mode splits, for example. She asked if this is collected by the Port or a third party. Port staff noted that the CBD and Pier 39 provide access to the data and SFMTA has data that is primarily picked up through cellphones to track numbers.

(18) Jacinta McCann noted the need for accurate data over the five-year period so that the Port can determine if these projects are effective, emphasizing the importance to see if these spaces are truly working. She also noted that getting to Fisherman's Wharf appears to be a sequence that extends beyond what is being shown this evening. She asked if there is a broader analysis being completed to help inform things like tenancy and temporary uses, something to help articulate the journey that is made to get to this area. Port staff stated that to address the broader work, the Port has initiated a temporary public art installation as part of a larger City art project and has installed 14 pieces along the waterfront to date with another 10 still to be installed. The goal is to create a waterfront walk and continue to add other interest along the way including restaurants, Bay Trail and open space. Beyond Fisherman's Wharf there is work related to the downtown coastal resilience program area between Broadway and Harrison and the South Beach coastal resilience program from Harrison to Townsend. There is also a SFMTA grant funding the Embarcadero Connectivity Plan, which will study how streets feed into Embarcadero roadway and how the Port will operate during construction for all of these projects.

(19) Jacinta McCann asked how the CBD initiatives and the Port's initiatives coalesce and how they maintain effective working relationships. Port staff responded that they have a strong partnership with the CBD and worked with them immediately following the pandemic to increase visitation with temporary installations such as sidewalk stenciling and pergolas and working toward managing the illegal vending in the area. They also worked on hosting pier parties twice a month to bring people to the area. CBD funds the landside programming and the Port provides assistance for the waterside.

e. **Public Comment:**

(1) Bruce Stone – Stated he would like to understand why the fuel dock at Hyde Street Pier is not included in the plan. If the fuel dock does address the need for diesel, it still does not provide gasoline which is needed for smaller boats. He would like to see the fuel dock at Hyde Street Pier included with this project.

(2) Thomas Paul Pier – Stated that while he is the Chair of the Board for the California Division of Boating and Waterways Commission, for this public comment he is speaking as a resident and citizen of San Francisco. His family was disappointed to learn of the deconstruction of Alioto's restaurant and the temporary plaza that would replace this iconic institution.

The following written public comment is included at the end of this summary:

- Nicola Szibbo, MTC/ABAG Bay Trail
- Erin Pang, Save the Bay.

f. **Board Comments.** The Board made the following closing observations:

Chair McCann thanked the public for their comments and agreed that the Bay Trail is a critical connection and noted that a diagram was not included in the meeting materials. She asked that Staff and the Port work together to ensure the connection is provided. She further asked for clarification on the identified Bay Trail gap. Port staff stated the Bay Trail gap was initially identified on Jefferson between Taylor and Leavenworth in 2005, and the Port needs to revisit the Bay Trail connection in this area. BCDC staff clarified that the 2024 Bay Trail Gap Closure Implementation Plan from MTC identifies the segment starting at Pier 45, from Taylor Street to Jefferson Street to Aquatic Park as a Bay Trail Gap improvement project. Chair McCann emphasized that she would like to see the Port work with Staff to address the Bay Trail gap as an action item as it is a very important connection for this part of the city.

5. **San Francisco Marina Improvement & Remediation Project Second Review.** The proposed Marina Improvement and Remediation Project is located at the San Francisco Marina and Marina Green on the northern waterfront of the City, west of Fort Mason. The project will implement renovations and remediation work to the West and East Harbors of the marina. Remediation activities will take place in the East Harbor. Both in-water and landside public access improvements are proposed, including Bay Trail, pedestrian walkways and viewing areas, recreation improvements to Marina Green Triangle, vehicular circulation, and renovation of the restroom.

   a. **Staff Presentation**. Rowan Yelton provided a staff introduction to the project site and context.

   b. **Board Clarifying Questions following Presentations.**

      (1) Jacinta McCann asked if comments from the last review had been used to guide the application process and changes to the project. Staff stated they had.

   c. **Project Presentation.** Monica Scott, San Francisco RPD, and Veronica Rivera, Field Operations, provided an overview of the San Francisco Marina Improvement and Remediation Project with a slide presentation. The team presented the updated project components including waterside and landside improvements.

   d. **Board Clarifying Questions following Presentations.**

      (1) Stefan Pellegrini requested clarification for the background of uses in the shallow water basin, noting that it's available for human powered boating activities but

not for swimming and asking if this is due to the outfall. The project team stated that the shallow water basin has never been promoted for swimming, but they recognize that it is an existing use. The project focuses on improvements to serve small watercraft.

(2) Stefan Pellegrini requested further discussion on the size of the dock and how it accommodates the proposed uses. He asked what can be accommodated in that space. The project team stated that the marina's slip mix between the East and West Harbors ranges from 25 feet to 100 feet. The East Harbor has historically had berths in the 30-35-foot range and that is the berth size in this marina. The project team noted that demand for smaller slips has diminished and smaller boats are now typically trailered. They stated the slip mix was informed by market research and the project components funded by RPD come from marina revenue, so it needs to be economically viable. The project team stated the visitor dock can accommodate the Sea Scouts, noting the fee is based on linear foot, not a flat fee. The project team also stated the Sea Scouts are currently based less than a mile away in Aquatic Park. A building for Sea Scouts was never contemplated as part of this project, the budget is constrained by the settlements, and RPD is not allowed to construct facilities for an exclusive user group but RPD has encouraged the Sea Scouts to work with the Harbormaster. The project team also noted there was a request to expand the dredge area to accommodate motorized and deeper draft boats in the East Harbor.

(3) Noting there is heavy use in this area by many different groups and the adjacency to Fort Mason with opportunity for spill over, Stefan Pellegrini asked how this new version of the waterfront will accommodate the intense needs of the user groups and how that relates to adjacent public uses and the overlap of user groups. The project team stated the main focus of the upland area design has been to accommodate the different site users. They sought to diversify the uses along the waterfront. They received many requests for volleyball courts and additional picnic tables, and the perimeter gardens are included to buffer and frame those experiences. In the Shoreline Band, the orchestration of the program is based on context. The Marina Grove is designed to be a protected and relaxed space, out of the way and avoiding potential conflict with users of the community dock. The nature exploration terrace is a second space for users to experience the waterfront. The incorporation of wayfinding signage and lighting is meant to enhance the connections to Fort Mason and improve flow between the two sites. The addition of interpretive signage for site history and incorporating historic elements will also strengthen those connections.

(4) Patricia Fonseca asked if the eastern shoreline shifted in the updated 2026 plan. The project team confirmed they pulled back the shoreline to accommodate a higher top of slope for the riprap and to retain the amount of proposed planting. The 2:1 slope minimizes the amount of fill while remaining structurally sound.

(5) Patricia Fonseca requested further discussion on the history of the north parking spaces, the decision to continue with the current layout, and whether there are changes to the parking count. The project team stated the modification to this area is the addition of a stormwater garden band but confirmed the rest remains

the same. They also noted there is a new electrical substation that is positioned to align with the existing restrooms to minimize view impacts. The project team stated the community requested to maintain as much of the parking as possible. They explored shifting the parking closer to Marina Blvd and away from the shore but neighbors were not supportive of that change.

(6) Patricia Fonseca asked how much bike parking is proposed and the other options for accessing the shoreline. She asked if there are strategic locations for bike parking and bike share. The project team stated the Fort Mason entry has a bike rental vendor and bike parking is located at all entrances and near the restroom.

(7) Kristen Hall asked if the depth of the East Harbor basin allows for navigation and if RPD anticipates it will silt up over time. The project team stated the basin is at elevation +5 feet at low water and +8 feet during high tide. They stated East Harbor has slower sediment accretion rate than West Harbor and they expect that to decrease further with the addition of the breakwater. With anticipated sea level rise, they expect the basin to remain usable for life of the project.

(8) Kristen Hall observed that she recognizes the hesitation toward swimming and asked if it related to outfall. The project team stated the proximity to the marina and active maritime uses is the issue, stating the outfall is not RPD's concern because the waterboard would monitor water quality.

(9) Kristen Hall asked if a beach was contemplated, observing that many small craft users prefer beaches to docks. The project team stated they explored a beach concept but the amount of Bay fill would result in changes to the permitting with the Army Corp, noting construction would be challenging from that perspective and they were unable to anticipate required mitigation. They also observed that the placement of sand could be installed initially but would require replenishment that would be difficult with the restrictions on boat depth. The project team explained further that the shallow water basin is comprised of soft mud and the installation and maintenance of a beach was generally considered infeasible from the geotechnical perspective.

(10) Kristen Hall asked how the visitor dock would operate: if it's fee based. The project team stated it would be operated with paid reservations and people would need to call ahead similar to other guest docks.

(11) Kristen Hall requested clarification between the visitor dock and community dock and if the visitor dock is publicly accessible. The project team stated small craft would use the community dock and that a gate would separate the community dock from the visitor dock. RPD also proposes to put a landside gate for community and visitor dock to close access during dangerous conditions or in park closure hours.

(12) Kristen Hall asked if public use of the community dock would be reduced if there was a recreational operator. The project team stated there may be an operator in the future, but the community dock will remain a community dock.

(13) Tom Leader stated that in the previous site plan, the volleyball courts were less impactful observing the fall zones around the courts are larger in the updated plan. The project team confirmed the new plan reflects separated fall zones and maximized planting buffer between the courts and Marina Blvd.

(14) Gary Strang asked if court layout was evaluated for wind impacts. The project team stated that the site was analyzed by volleyball organizations, and this location was identified as more desirable than the current locations.

(15) Gary Strang requested the area of lawn. The project team stated the lawn is 20,000 SF.

(16) Gary Strang requested clarification on the parking program and whether it maintains current capacity and the division of permit versus public. The project team stated they are losing a few stalls near the south entry due to keeping an existing tree. They noted with removal of the docks in the shallow water basin, there is less marina demand and a shift to increase the public stalls.

(17) Jacinta McCann asked how this project timeline progresses relative to the fuel dock. The project team stated RPD is meeting with the Port, Fire and Police Departments, and the Mayor's Office to identify a fuel dock location, emphasizing that this is a multi-agency priority. They don't expect there to be downtime for fueling for emergency vessels, noting that while they anticipate the fuel dock going offline in June, there are other existing diesel options along the waterfront. The project team stated they're optimistic for a solution for recreational boating needs by the time East Harbor fuel dock is closed.

(18) Jacinta McCann observed that while it is helpful to hear the possibilities for the Sea Scouts described, noting opportunity to pay to use the visitor dock and that they can use the community dock depending on the draft depth of their vessels, the Sea Scouts seem to be looking for a built facility to replace the Aquatic Park facility. The project team stated that National Park Service has no intention of severing the lease agreement with the Sea Scouts and are expanding the storage options at that location. They reiterated that RPD cannot build a new structure for a single organization's exclusive use.

(19) Jacinta McCann asked if there is a management or reservation plan for the volleyball courts or if it will be first come, first serve. The project team stated that RPD manages one other sand volleyball court at Mission Bay and it is available for informal use, but noted that if popularity increases, they could eventually have reservations similar to soccer fields.

(20) Jacinta McCann requested the width of the Bay Trail as it follows the East Basin. The project team stated it is proposed to stay at the existing 12 feet because of the redundancy with the nearby Marina Blvd. bike path.

e. **Public Comment:**

(1) Bruce Stone observed the reorientation of slips better suits marina berth holders and the removal of the wave attenuator is also desirable. He emphasized there is still opportunity for a community boating facility that could be used by Sea Scouts, BAADS, yacht clubs, and community education. He observed there are opportunities for corporate sponsors to fund this project and noted that the Treasure Island facility is inoperable and unavailable for youth education. The community center was designed by a naval architect and is a platform that reaches into the shallow water basin. He suggested the project team should shift focus from volleyball and other peripheral programs and that the money should

be spent on opportunities for small boat recreation. He also noted that swimming in the marina is prohibited because of the electrical field in the water and emphasized that swimming in the marina should not be encouraged.

(2) Bill Clarke, West Harbor slip holder, stated that while some aspects of the project design have improved, others have not. He notes that the shallow water basin was previously better integrated with the upland improvements but has devolved to become a cordoned pond surrounded by rip rap. The beach at the southern side was removed which diminishes the allure of wanting to recreate there. The cove is now isolated with access via a single access gate connecting to the community dock. He observed that beach entry is preferred for launching nonmotorized boats and the proposed dock is less desirable than the nearby Aquatic Park. RPD agreed to less remediation and the omission of dredging in the basin demonstrates the planned obsolescence of the site. He recommends that a compromise for remediating less should be that RPD dredge and maintain a usable depth to prevent the site becoming a liability. He observed that by moving the fuel dock to West Harbor, the intrusion of commercial activity would diminish the character of that marina, and the ensuing traffic will cause congestion in the narrow channel, adversely affecting sailboats and youth sailing craft that will find it impassable. He recommends keeping the fuel dock at East Harbor. He also encouraged the project to demonstrate the efficacy of the proposed breakwater for the shoaling problem at the mouth of the harbor, recommending the team pursue the previous sand pit option. He asks BCDC to require RPD to post a bond against potential project failure to indemnify taxpayers, noting that for the 2010 harbor project, RPD elected to install suboptimal floats that are deteriorating, creating a water quality issue in the West Harbor.

(3) Dick Robinson, slip holder and member of the harbor tenants association, expressed support for the project and would like BCDC to move this project forward. He observed that as much design that could be done has been done and noting there are questions that are difficult to resolve ahead of time like silting in at the entrance. He stated we must do something with the harbor to ensure its continued availability noting that everyday more sand comes in and docks disintegrate further. He observed that without the proposed improvements, no one can use the harbor. He noted that as an enterprise zone where revenue pays for maintenance, when non marine related improvements are introduced, the ability for the marina to maintain financial viability is diminished.

(4) Stephen Street, resident, showed an image of the current view north from Marina Blvd and stated that anything done to the site needs to respect that view. He observed that new features need to add to the site, not diminish it and that he doesn't believe that volleyball on the Marina Triangle meets that requirement, suggesting there is a better alternative location. He observed that previous comments about wind at the site are valid, noting it blows continuously during the summer. He observed that if volleyball was located at Little Marina Green, they would be protected by the tree wind break and served by restrooms.

(5) Matt Fowler, slip holder at East Harbor. A lot of the project priorities focus on the landside, not the waterside and boaters' perspective. He urges the Board to

review the letter from Ed Tavasieff included in the Public Comments. He notes that Gas House Cove is a unique location in the City; it's a protected cove on a very windy side of the Bay and should be preserved. There have been many questions of whether the shallow water recreation basin is attractive to kayaks and swimmers, but we need to ask if it is attractive to slip holders and boaters. Those berths were remote and hard to get to. The flow of people coming and going to those slips matters. He emphasized the significance of viability of marina, noting that removing the current slip mix is done at the detriment of new and small boaters. Gas House Cove has been a place that allows people new to boating a way to get started.

(6) Thomas Pier, swimmer at Aquatic Park and boat owner in Sausalito. He observed the removal of the many slips with this project. He noted that Aquatic Park is approximately 200 yards away and has all the desirable facilities for launching nonmotorized boats, that the conversion of East Harbor to a small boat basin is a red herring. The removal of the fuel dock will significantly impact the boating community. He stated no swimming will take place in the shallow water area. He emphasized that no one on the Board has commented on the Safeway project to build 850 units across the street observing that the increase in residents will put further strain on this waterfront area and that should be considered.

(7) Maggie Hallanan, mariner and teacher, stated she learned to be a mariner in this location, noting East Harbor was envisioned as an accessible place to start boating, explaining that in the 1960s, the State wanted to build an economically accessible place for people to get out onto the water. She noted that the PGE agreement identifies increasing water recreation as part of this project but observed the project is removing 30 percent of the slips meant to serve the smaller less expensive slips. She stated that there was an active boat lift but that at a 2024 meeting, RPD staff commented that there are no small boats in San Francisco so there is no need to keep the boat lift. She observed this is the only public boat lift in the City. Finally, she recently observed a Coast Guard rescue of a windsurfer where they were brought into the dock that the harbormaster says is not used for emergency response. She requested an ad hoc group be formed for project oversight.

The following written public comment is included at the end of this summary:

- Ed Tavasieff, East Harbor berth holder
- Bruce Stone, berth holder and President, SF Marina Harbor Association
- Dane Ross, Marina Blvd resident
- Natalie Marine Street, Marina Blvd resident

f. **Board Discussion.** The Board discussed the project focusing on the following objectives and questions:

1) The seven objectives for public access are:
   i. Make public access PUBLIC.
   ii. Make public access USABLE.
   iii. Provide, maintain, and enhance VISUAL ACCESS to the Bay and shoreline.

iv. Maintain and enhance the VISUAL QUALITY of the Bay, shoreline, and adjacent developments.
v. Provide CONNECTIONS to and CONTINUITY along the shoreline.
vi. Take advantage of the BAY SETTING.
vii. Ensure that public access is COMPATIBLE WITH WILDLIFE through siting, design, and management strategies

2) Staff questions:

i. Would the proposed project concept provide adequate, usable, and attractive public access that maximizes the public's use and enjoyment of the area?
   a. Would the proposed concepts encourage diverse activities and create a "sense of place," which is unique, enjoyable, and inviting to the public?
   b. Are the program areas distributed and designed to meet and balance the needs of the public? Are there any additional considerations to making the waterfront an inviting space for the public to enjoy?
   c. Is the shallow-water recreation basin attractive to swimmers and kayakers, considering the location of the Laguna Street Outfall, the active adjacent marina, the possibility of large waves and the proximity to similar recreation at Aquatic Park?
   d. Given the Bay Plan states "parking areas should be located away from the shoreline," is the parking area configuration responsive to site needs and constraints and designed in such a way to minimize the perceived presence of vehicles on site?
   e. Have nature-based shoreline features like the planted rip-rap and tidal garden been incorporated to the greatest extent practicable?
ii. Are the connections to and through the public access spaces adequate and appropriate to maximize the public's use and enjoyment of the site?
iii. Are there adequate support facilities proposed for the water-oriented uses, including parking, vehicular circulation, restrooms, and equipment storage for launching and landing hand-powered watercraft?
iv. Does the project design adequately address resilience and future adaptation for sea level rise?

g. **Summary of Key Issues and Board Comments**

Waterside

(1) The Board expressed an understanding that there are limited opportunities along the San Francisco waterfront for boater-oriented recreation, particularly that is available to a more economically diverse community, and the use pressure on this site. The Board emphasized that making boating and water recreation more affordable to the broader community is a regional benefit.

(2) Stefan Pellegrini observed that the general public's access for boating and water recreation is extremely limited in the city, with even fewer opportunities for children, and emphasized that the equity and waterside piece is critical to the project. He expressed support for increasing the availability of youth education in water recreation and stated that outfitters are critical to supporting recreation opportunities to those who don't own a boat or maintain a berth. He observed

that this project's objectives are more about the recreation communities than the needs of the neighborhood and questioned the balance of slips with the public dock and if the public dock meets the needs for the community.

(3) Kristen Hall stated that waterside access requires facilities: it needs slips, fuel docks, and rinsing infrastructure. She commended the team on continuing to explore options for the fuel dock. She observed that the project design seems to have been guided more by the remediation plan noting that from public comment, it seems there's a mismatch of how people use this space and the proposed project. She observed it is best to launch small crafts from beaches, but that nearby Crissy Field is highly exposed which limits water access opportunities along the northern waterfront. She suggested that the dingy dock may be more appropriate for vessels that rely on wind rather than having it limited to non-motorized small boats.

(4) Kristen Hall questioned the location of the outfitter being across the parking lot and how it relates to operations and usability of the community dock.

(5) Tom Leader questioned the adequacy of the community dock and the depiction of anticipated use of the shallow water basin, stating the community boating facility is much more compelling.

(6) Gary Strang also agreed that the dinghy deck should be pursued and encouraged the project team and staff to evaluate all the technical comments presented tonight related to marina infrastructure.

(7) Stefan Pellegrini stated that if future access to East Harbor will be constrained by the current project, then potential future programming or projects should be contemplated now so the current project does not preclude those opportunities.

Landside Programming

(1) The Board universally identified views from and through this space to the water as significant to the site's identity.

a. Stefan Pellegrini observed that as a user, you are presented with expansive views and the experience is that you are exposed to the elements. He commended the project team on the introduction of native species but observed it is a change in the landscape that changes those views and the current experience. He questioned whether the sense of place and openness and the relationship of the water would be maintained with the proposed planting. He suggested that some of the new iterations create a more suburban condition and questioned the efficacy at this site. He commended the project team on reopening the breakwater pedestrian access.

b. Tom Leader emphasized the significance of maintaining views through the site and suggested breaking the design down into smaller rooms.

c. Gary Strang observed that people come to this site to be near the water.

d. Jacinta McCann stated that keeping this site as open as possible is important to maintaining views to the water, noting that many people park along the northern edge and watch the water from their cars. She acknowledged a need to balance out all the competing interests.

(2) Many of the Board members observed that it is unclear what the identity of this space is intended to be, noting there are many current and proposed informal and

formal uses. They identified it as a jewel along the San Francisco waterfront and expressed a desire to see it as a more aspirational destination. They recognize that the space is not Marina Green, and stated there should be an identity that is formally different from Marina Green, that in the grand scheme of things, the use and intensity of the triangle is different but that the triangle could be used more equitably. One Board member expressed concern that the design is trying to do too much and would benefit from a big idea or clear approach to guide it.

(3) The Board was divided on the proposed volleyball courts in the Triangle but acknowledged that the programming is supported by the engagement efforts. Some members felt that volleyball is driving too much of the design and the site could do with fewer courts and a greater mix of uses. They observed that volleyball courts would likely have better wind protection on the west side of Marina Green. Other Board members expressed that volleyball is a vibrant well-organized community and believe this space is under programmed in relation to the rest of Marina Green and would benefit from drawing specific user groups. One Board member stated that if volleyball is the central program, then the design should fully commit and make it a more formal solution, but the space remains unresolved and unclear if it's an active or a passive park.
   a. Jacinta McCann suggested that the collocation of volleyball courts with the exercise pavilion make something more of the space than is currently there, observing both could be draws to passive spectators, encouraging them to come into the space. She suggested exploring grading in the lawn area to create a conceptual upland beach. She observed more articulated grading could facilitate views without dramatically altering the current scheme.

(4) The Board stated that whatever use the space is designed for, it is essential to ensure users are comfortable with the level of exposure.

Landside Circulation

(1) Board members observed that as you arrive at the site from Fort Mason, it is the gateway to the whole Marina Green and the plaza feels like it should be a more celebrated entry point, but the proposed design feels like a small, discovered space. As a gateway to Marina Green, the project is not achieving what it could.
   a. Jacinta McCann responded, observing that there is a narrow historic access point in the wall that is a limiting factor, noting that at the last review, it was requested to make this space more of a gateway. She observed that the concept has evolved, and it seems like they've enhanced the area.

(2) Kristen Hall emphasized the importance of visual connections and accessible wayfinding as someone moves through the parking lot to the shore. As the Bay Trail diverges from the Marina Blvd. sidewalk, it's necessary to have highly visible ways to identify how to get through the space to the waterfront.

(3) Gary Strang noted that the Bay Plan states parking should be sited away from the shoreline. He understands that boaters want nearby parking but observed when cars are parked right at the edge, it's a striking experience. He questioned the reason behind siting parking so close to the shoreline and whether the parking spaces facing north into the East Harbor marina could shift about twenty feet to the south to provide a greater planting buffer. He noted it could expand the

stormwater treatment area, reducing the need for subsurface retaining walls and better integrate with the shoreline planting scheme, making it more substantial.

b. Stefan Pellegrini stated he appreciated the site constraints and need for proposed facilities but suggested there is sufficient space to shift parking and improve the shoreline experience while maintaining a usable triangle that meets user needs.

Shoreline Protection

(1) Stefan Pellegrini questioned the limited application of the shoreline edge planting noting that there's a benefit to walking along the water's edge in an environment that's nice to be in and that the northern reach of the East Harbor feels in need of further investment. He observed that if the northern parking area shifted south, or could be designed to shift south at a later date, you could achieve that naturalized shoreline without needing substantial redevelopment. He encouraged the project team to explore phasing the project, stating creating more of the planted edge condition would be beneficial.

(2) Patricia Fonseca expressed that there is a thoughtful approach to the design and elevations needed for long-term use of this area. She appreciates the incorporation of nature-based solutions and introducing nature where it is not currently.

(3) Gary Strang commended the project team, stating the strategies for the planted shoreline edge are some of the best brought before the Board. He stated that expanding the vegetation is positive and hopes it is implementable.

Chair Summary:

(1) The Board commended the project's treatment of the riprap with the introduction of tidal pools and native planting palette, as well as the inclusion of the community dock, reduction of lawn area, and introduction of signage.

(2) The Board stated the fueling dock needs a resolution, noting its significance for recreation. They stated the project should not move forward until that is resolved.

(3) The Board uniformly requests that the Community Boating Center be sincerely explored including how it could be phased in the future, noting the landside should be adaptable to accommodate future opportunities and needs. In the meantime, the project should also explore enlarging the community dock or other recreational boating facilities in the shallow water basin.

(4) The Board suggested looking at parking needs and determining the minimum essential to have the marina function effectively. They observed parking on the shoreline is an appropriate use here but suggested if it can be decreased, it would be a great benefit to continue the shoreline planting strategy along the north side.

(5) The Board emphasized that views to the north and to the water are defining features of this site.

(6) The Board encouraged big thinking: identifying the essence of this space- whether maximum active programming, formal gateway to Marina Green, or marina uses – and fully commit to the identified objective.

(7) The Board emphasized the site's connection to Fort Mason and underscored the importance of making that transition as effective as possible.

(8) The Board stated they want the project to move forward.

h. **Response by the project team:**

RPD staff noted that the public attending this meeting represent a subsection of the public and stated they have incorporated feedback from disparate users for this treasured waterfront. She stated that this project is constrained by budget and timing, it is led by the Water Board and emphasized they have tried many different alternatives since this project was initiated in 2001.

RPD staff stated she likes the approach of designing now to accommodate a future opportunity but emphasized the need to move forward with the current project, stating any changes will incur significant impacts. She stated the cost estimate for the Community Boating Center was $20 million a few years ago and noted the community dock can be expanded to the south.

She stated they are trying to celebrate the shoreline edge to the water basin and noted the pedestrian access on the breakwater will be an amazing experience. She noted the other opportunities for recreation along the shoreline, observing the Yacht clubs have youth sailing programs and the nature exploration terrace will provide an opportunity for play. The Little Marina Green is not within the project area and RPD is not making any changes to the west.

In response to the recommendation to shift the parking south, she states that would cost money and would conflict with the existing restrooms and likely result in removal of a line of parking. The costs would then cut budget for other improvements. RPD staff also stated that a key finding from community engagement was that people want to maintain the number of parking spaces.

6. **Adjournment.** Tom Leader motioned to adjourn. Gary Strang seconded the motion. Meeting concluded at 9:56 p.m.

Outlook

April 6 DRB Meeting, Item 4 - Near- and Long-Term Projects at Fisherman's Wharf

From Erin Pang <epang@savesfbay.org>
Date Fri 4/3/2026 9:28 AM
To BCDC Public Comment <publiccomment@bcdc.ca.gov>; Tomerlin, Ashley@BCDC <ashley.tomerlin@bcdc.ca.gov>

1 attachment (228 KB)
Fisherman's Wharf Comments_Save The Bay.pdf;

Hi Ashley,
Please find attached Save The Bay's comment letter on the Fisherman's Wharf project on the agenda for the Design Review Board meeting on April 6, 2026. Thank you for the opportunity to comment!

All the best,

Erin Pang
POLICY ASSOCIATE
epang@savesfbay.org | 510-463-6809 | www.saveSFbay.org
Pronouns: she, her

SAVE THE BAY

Protect and Restore San Francisco Bay
For People and Wildlife

April 3, 2026

BCDC Design Review Board
375 Beale Street, Suite 510
San Francisco, CA 94105

Subject: Comments on the Near- and Long-Term Projects at Fisherman's Wharf

Dear BCDC Design Review Board,

Thank you for the opportunity to comment on the Near- and Long-Term Projects at Fisherman's Wharf. I'm writing on behalf of Save The Bay to express the importance of closing the Bay Trail gap in this project area. Save The Bay's mission is to protect the San Francisco Bay for people and wildlife, and our vision for the Bay includes a complete, accessible, and climate-resilient Bay Trail around the entire Bay.

The Fisherman's Wharf project area includes a high-priority gap in the Bay Trail; it is ranked as the 14th most important out of 146 gaps in the entire Bay Area and the fourth most important in San Francisco. The Bay Trail gap runs along Jefferson Street from Hyde Street to Taylor Street and then along Taylor Street to the beginning of Pier 45. Currently, there is no protected bicycle access along this route, and the project materials do not address this gap.

Closing this Bay Trail gap is consistent with SFMTA's Biking and Rolling Plan (2025) which expresses the intention to partner with the Fisherman's Wharf Community Benefit District and the Port of San Francisco to upgrade Jefferson Street into a flexible event space and bikeway. In 2013, the Jefferson Streetscape Improvement Project widened sidewalks and installed new lighting, seating, and bike parking here. At the time, there was strong community support for a proposal to restrict private vehicles along this stretch of Jefferson Street to protect pedestrians and cyclists. We hope such an approach will be considered in the Port's plans for this busy and oftentimes chaotic area.

We believe that closing this Bay Trail gap and enhancing bicycle access to Fisherman's Wharf is crucial for the success of this district. As a major attraction of the Bay Area waterfront, it's important that there are safe and accessible recreation and active transportation routes connecting communities to the shoreline and the planned amenity upgrades at Fisherman's Wharf.

For these reasons, we strongly encourage the project team to engage the community and work with SFMTA, the Bay Trail/Active Transportation Team at MTC/ABAG, Save The Bay, and other stakeholders to create a vision for closing this Bay Trail gap. Thank you for the opportunity to comment, and we look forward to continuing to engage on this important shoreline access project.

Sincerely,

David Lewis
Executive Director
Save The Bay

Outlook

Fw: Bay Trail Comments for BCDC April 6 DRB Meeting: Near- and Long-Term Projects at Fisherman's Wharf: Fisherman's Wharf Forward

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From Tomerlin, Ashley@BCDC <ashley.tomerlin@bcdc.ca.gov>
Date Thu 4/2/2026 2:00 PM
To BCDC Public Comment <publiccomment@bcdc.ca.gov>

Please include this in public comment for item 4: Near- and long-term projects at Fisherman's Wharf. Thanks!

Ashley Tomerlin
San Francisco Bay Conservation & Development Commission
Bay Development Design Analyst
415.352.3657

Upcoming out of office April 23-27

From: Nicola Szibbo <nszibbo@bayareametro.gov>
Sent: Thursday, April 2, 2026 1:32 PM
To: Dorfman, Benjamin@BCDC <benjamin.dorfman@bcdc.ca.gov>; Tomerlin, Ashley@BCDC <ashley.tomerlin@bcdc.ca.gov>
Cc: Toshi Shepard-Ohta <tshepard-ohta@bayareametro.gov>
Subject: Bay Trail Comments for BCDC April 6 DRB Meeting: Near- and Long-Term Projects at Fisherman's Wharf: Fisherman's Wharf Forward

Ben & Ashley:

Thank you for the opportunity to provide comments for BCDC's April 6th DRB meeting.

We are providing the following comments on behalf of the Bay Trail and Active Transportation Team at MTC/ABAG for the DRB review of the Near- and Long-Term Projects at Fisherman's Wharf specific to the Fisherman's Wharf Forward Project. Please provide copies to the project sponsors and the DRB.

Since the project is at a planning and conceptual design stage, our comments are focused on high-level planning and coordination opportunities to create a Bay Trail facility that closely meets the Bay Trail vision for a shoreline trail.

1. **High-Priority Bay Trail Gap/Bay Trail Gap Closure Implementation Plan (BTGCIP):** According to the Bay Trail Gap Closure Implementation Plan (BTGCIP), the project site for both Near-and-Long-Term projects contains designated Bay Trail, specifically Bay Trail Gap 1005.0, which is currently ranked as a high-priority gap for implementation at 14 out of 146 gaps in the entire Bay Trail in the region, and the fourth

most important gap in the county for implementation. Of particular concern is the connection of existing Bay Trail at Pier 45 from Taylor Street down to Jefferson Street and making the connection on Jefferson Street over to Aquatic Park. No mention of Bay Trail circulation or Bay Trail public access is mentioned in the Port Exhibits or the staff report. Port of San Francisco Exhibit 4 acknowledges the SFMTA green bike network but there is a clear gap on the exhibit between Aquatic Park and the planned triangle lot concept and enhanced Pier 45, leaving no plan for bicycle access. We request that the project sponsors complete the 1005 gap or complete it in coordination and partnership with an active transportation implementation agency such as SFMTA.

2. **SFMTA Biking and Rolling Plan (2025), Stakeholder Coordination and Bay Trail Connectivity:** The SFMTA Biking and Rolling Plan states that SFMTA intends to partner with the Fisherman's Wharf CBD and the Port to upgrade Jefferson Street as a flexible event space and bikeway. The Port/project sponsor should coordinate with key stakeholders such as SFMTA and Bay Trail/Active Transportation Team at MTC/ABAG to discuss the opportunities for Bay Trail design and implementation. Coordination meetings would ensure that the Bay Trail is comprehensive and maximizes the shoreline experience. It would also ensure that any proposed implementation maintains connectivity with the overall Bay Trail system between Pier 45 and Aquatic Park.

3. **Public Realm Improvements & Amenities:** There are a variety of trail support facilities that should also be included to enhance this shoreline area. Please consider the need for seating areas, receptacles, drinking fountains and water bottle filling stations, bicycle racks and repair stations, public art, specific elements to support fishing, and others as needed. These Bay Trail amenities should be delineated on all exhibits.

4. **Pedestrian and Bicycle Priority Zones:** The Bay Trail facility should be continuous, uninterrupted along the shoreline and separated from vehicular traffic. The circulation plan currently details tour bus movements along Little Embarcadero and the Triangle Lot Site Concept (Port of San Francisco Exhibit 8) includes a bisecting vehicular access road that reaches up to Taylor Street that could potentially interrupt and impede Bay Trail access. The Plan should detail how contiguous bicycle-pedestrian circulation is maintained, including any permanent or temporary bollards.

5. **Interpretative and Wayfinding Signage:** Bay Trail wayfinding signage should be notated on all Exhibits. Please see the Bay Trail Design Guidelines & Toolkit 2.0 for more information.

6. **Events, Capacity & Width:** As the improvements are currently proposed, there will be significant events on site that will attract large numbers of people and be in high demand. The event spaces and circulation throughout the project site during events should be designed and operated in a manner where it complements rather than impacts any proposed Bay Trail alignments. While a Bay Trail gap closure along the parameters of the Project provides an opportunity to facilitate bicycle and walking to events, it is also critical to design any Bay Trail in the area with sufficient capacity to ensure that the Bay Trail will be able to accommodate both event attendees and general public access and Bay Trail users that are not attending the events.

   The proposed improvements will be a high use and high demand public shoreline and trail area. As such, we request that the DRB consider the width needed for the proposed Bay Trail considering the level of demand that will be created by the proposed public space, retail, museum, special event, visitor center, and beverage garden uses as well as expected future levels of use in the area. We request a 20 to 30-foot-wide Bay Trail corridor with additional trail width to be considered based on the need for greater

capacity to accommodate the expected level of use of the Bay Trail in the future. The new uses will draw many new users to this shoreline area, and it is necessary to plan for this increase.

We appreciate the opportunity to provide comments on this project and look forward to our continued partnership with BCDC and the Port of San Francisco in completing a Bay Trail system that meets the Bay Trail vision of a shoreline trail as an active transportation and recreational opportunity for bicyclists and pedestrians.

Please let us know if you have any questions regarding our comments.

Sincerely,

Nicola Szibbo, MCP, PhD
Principal Engineer/Program Manager, Active Transportation
she/her/hers

Work Cell:415-490-8554
nszibbo@bayareametro.gov

BAY AREA METRO | BayAreaMetro.gov
Association of Bay Area Governments
Metropolitan Transportation Commission
Bay Area Metro Center | 375 Beale Street | Suite 800
San Francisco, CA 94105

My working hours may not be your working hours. Please don't feel the need to respond outside of your working hours.

Summary: Tenants of the San Francisco Marina Remodel express deep concern that proposed changes prioritize aesthetics over a functional working waterfront, risking displacement, reduced affordability, and loss of essential services. Key issues include rising berth costs, limited access, reduced parking, and insufficient consideration of operational needs, alongside fears that relocating critical infrastructure like the fuel dock could compromise emergency response and public safety due to congestion and poor access during major events. Tenants also highlight the importance of maintaining youth programs, small craft access, and marine services, emphasizing that the marina should remain an inclusive, affordable hub for boating rather than becoming a park-like space that excludes long-standing users and undermines financial sustainability through reduced occupancy and engagement.

3/29/2026

To any interested party:

My name is Ed Tavasieff. I have been a tenant in the East Harbor known as Gas House Cove for over 40 years.

Currently there are plans to renovate the East Harbor that include moving the fuel dock to the West Harbor. It is my opinion that doing so, will result in unforeseen difficulties rendering the usefulness of the proposed fuel dock unacceptable.

First, there is the moving of such infrastructure to a new location and the cost involved. These monies could be used more effectively in creating more revenue generating berthing in the East Harbor.

Second, currently the fuel dock is used by emergency personal on a regular basis for fuel, safety operations, homeland security, marine enforcement, injured egress, and event localization for emergency services. Agencies such as The United States Coast Guard, San Francisco Police, San Francisco Fire Dept. etc. depend upon the easy, centrally located access point, that the current fuel dock provides. These services are necessary to carry out essential daily routines that provide for the public safety. Moving the fuel dock to the West Harbor will cause a significant impact to these essential services and public safety in turn. The West Harbor proposal would not allow these essential services to operate at the capacity they provide now, due to overcrowding in the waterway by boat traffic and a never-ending need for dredging. Especially during events.

Third, the West Harbor is host to many events that involve heavy use of the narrow waterway to transit the West Harbor. Events such as the Blue Angles or Big Boat Series, or Sail GP, etc. involve many boats and support vessels transiting the Harbor. Police, fire, other Bay Area agencies trying to get fuel or care for the injured and carry out their jobs would be unable to reach the proposed fuel dock during these times.

Fourth, the West Harbor does not have easy access to marine/ land-based services such as an ambulance during the above-mentioned events. Closed off streets and significant pedestrian

Outlook

Public Comment item 5 - SF Marina Renovation Project - April 6 hearing

From Bruce Stone <bruce@brucestone.com>
Date Tue 3/31/2026 1:38 PM
To BCDC Public Comment <publiccomment@bcdc.ca.gov>
Cc Yelton, Rowan@BCDC <rowan.yelton@bcdc.ca.gov>

5 attachments (7 MB)

Testimony by Yomi Agunbiade at RPC regarding West Harbor project.pdf; Dec 1997 Marina Blvd Seawall Geotechnical Report Appendices.pdf; Dec 1997 Marina Blvd Seawall Geotechnical Report by Treadwell & Rollo.pdf; Dec 1997 Marina Blvd Seawall Geotechnical Report Exec Summary.pdf; Draft Layout of Proposed SF Community Boating Center.pdf;

Dear BCDC – While we support the SF Marina Renovation project, we wish to share several concerns.

The first is regarding the proposed extension to the West Harbor jetty using a sheet pile breakwater. It is conjectured to reduce the silting in of the West Harbor entrance, thereby saving on the expensive annual dredging. From the EIR Amendment 3:

The San Francisco Marina West Harbor Maintenance Dredging project operates annually, and it is possible that maintenance dredging could occur concurrently with construction of the modified project. This project includes maintenance dredging of sediment at the entrance to the West Harbor to maintain navigational access. The amount of maintenance dredging at West Harbor is expected to decrease from the current yearly frequency to the first dredge occurring 10 to 15 years after completion of the modified project. Then, dredging would occur every two years with the installation of the sheet pile breakwater off the north jetty.

We're certainly in favor of this effort and hope it works. However, the original design was for a longer breakwater, but some citizens lobbied the Supervisors to protect a purer view of the Bay, causing a successful vote against it. The short extension now planned is a compromise that's better than not having one but would seem to make the 10-15 years goal rather optimistic.

The second issue is RPD's intention to replace the berths east of Golden Gate YC that were destroyed due the silting of the harbor. Millions of dollars have been lost from prior efforts. We believe the new breakwater extension should be in place for at least two years before they invest in replacing those berths. To help visualize the problem, starting on **page 122 of EIR Amendment 3** you can see the anticipated wave modeling from adding this sheet pile breakwater…a modest improvement that may not deliver the desired results.

The next issue is the planned removal of the fuel dock operated by City Yachts inside East Harbor and installation of a fuel dock at the Scott St mole across from GGYC. A few concerns:

1. We might be without fuel for a few years and need to go to Sausalito, a bad option for those of us with slow boats and/or smaller tanks, as it is not worth the trip. If the Hyde St fueling station reopens, it will need accommodations for small boats.
2. Should there be no alternative to Scott St then we're in favor, despite potential conflicts between commercial boats wanting to refuel and boaters transiting that area, especially those without motors.
3. If the harbor entrance shoals even with the new breakwater, then this refueling station might not be accessible to larger boats. Also, a narrow entrance will add to the conflict between commercial boats and sailboats.
4. Assuming the Scott St mole location is chosen, shoreside fuel tanks will be installed underground at the Marina Green parking area that was called out as seismically unstable – see attached reports from 1997 and testimony by the head of RPD. However, **the EIR amendment 3 does not address this**, and in fact states the opposite starting page 61. We do not know whether the box sewer installed nearby and parallel to the James Fair Seawall mitigates the risk. Do you have information on that?

In the RPD presentation: San Francisco Marina Improvement and Remediation Project - BCDC Design Review Board - April 6, 2026 you will note that the fuel dock design and shoreside infrastructure are not shown as yet to be designed. The presentation focuses mainly on shoreside aspects and little on marina aspects and boaters' needs.

As a global observation, we propose a community boating center be installed in the shallower end of East Harbor, rather than squandering this valuable Bayshore access. This would require some dredging but not to the depths required for the larger boats at the northern end of the harbor. **See attachment for the layout and location.**

The mission is to build participation in watersports for SF school children and the general public, expand harbor facilities for smaller boats, and facilitate storage, launching and coaching of Access Dinghies for disabled sailors. There would be a platform with storage racks, classroom and changing facilities, storage for human powered boats like kayaks and dragon boats, lockers for spart parts, sails, oars, lifejackets and so forth as well as a classroom and changing facilities. Financing of construction costs would be sought from private and corporate contributions including the yacht clubs, while rental income from storage racks and lessons would help cover operating cost of dockmaster and maintenance.

Bruce J. Stone
Berthholder and President, SF Marina Harbor Association
bruce@brucestone.com
917-822-4060

Outlook

SF Marina Green Project- public comment- neighbor

From Dane Ross <dane_ross@yahoo.com>
Date Fri 4/3/2026 11:58 AM
To BCDC Public Comment <publiccomment@bcdc.ca.gov>

Good morning,

We are 20+ year residents of the Marina Blvd block across from the Marina Green Triangle.

We have watched the pattern of usage of the waterfront for over two decades, and we have observed that people enjoy the open space of the Marina Green Triangle— tossing a ball, running around with their kids or dogs, sitting together on the grass. We have the Fitness Station already, and adding anything else is not actually additive. In fact, the enjoyable simplicity that exists is better than what would be built.

If a volleyball installation is desired, it should be built where the existing volleyball nets are often set up at the west end of the larger Marina Green.

Likewise, if a public art installation should be installed, which is highly debatable, then it should be installed at the west end of the larger Marina Green.

Please take our long term observations of actual versus theoretical usage of the waterfront into consideration, as well as our feedback recommendations.

Thank you,

Daniel Ross & Sophie Ross
159 Marina Blvd., SF
415-577-6757

April 2, 2026

Ms. Ashley Tomerlin, Board Secretary
San Francisco Bay Conservation and Development
Commission Design Review Board
375 Beale St., Ste. 510
San Francisco, CA 94105

Re: Public Comment Agenda Item San Francisco Marina Improvement & Remediation Project, San Francisco; Second Review

To Whom It May Concern:

Thank you for soliciting comments from area residents about the plans for the San Francisco Improvement & Remediation Project. This stretch of historic shoreline and open space is one of our city's crown jewels, and it is certainly worth taking the time to carefully consider any proposed changes. As a resident of the Marina for nearly three decades, I am grateful that the city is attending to needed repairs and environmental remediation in this area, and I am generally in favor of the plan prepared by Recs and Parks, but I have several serious concerns that I would like to bring to the attention of the board.

Repair Existing Pathways along Water's Edge of Marina Green

The report does not seem to contemplate repairing the walkways and edging in the West Harbor between Marina Green and the water's edge. These walkways, part of the historic Marina Green promenade, are in desperate need of repairs. (See Figure 1, 2, and 3.) These walkways are a center piece of the Marina, frequently used by residents and visitors alike and a very popular place to view the sunset, take photos, sit on a bench and chat, et cetera. Indeed, residents of the Marina so value this particular space, with its direct, unimpeded proximity to the water and views of the Golden Gate Bridge, that they organized and fought hard to save it from enclosure with additional boat berths. Perhaps this needed repair is so self-evident that it is not obviously called out in the report, but I urge Parks and Rec and the Planning Board to talk about this and amend the plan as needed. It seems that before adding new things we should make sure that the basic existing infrastructure is in top-notch shape.

Figure 1

Figure 2

Figure 3

Recreation Facility Proportions / Installation of Sand Volleyball Courts and Tree Plantings.

I am concerned that about 40 percent of the now wide-open green space of Marina Triangle is to be given over to sand volleyball courts and what seem to be trees or high plantings. While it is nice that a portion of lawn area will be left on the Marina Triangle, installing permanent playing fields on previously open space seems contrary to the goal of this project, which is to provide better access to the water and repair and enhance existing shoreline facilities. Why do we need these facilities that serve a special interest group at the expense of all?

Moreover, it is very difficult to tell from the plans circulated to Marina residents how high the trees and new plantings will be and if they will impede views of the water from Marina Boulevard for motorists, bicyclists, pedestrians, and residents.

The maintenance of open green space for respite is particularly important in this highly trafficked area which, on top of already vibrant casual recreational use, hosts many, many events throughout the year and especially on weekends: the Blue Angels, 4th of July festivities; a popular Sunday Farmers market; numerous festivals, conferences, performances, concerts, and craft fairs at Fort Mason; recreational and youth soccer leagues on Marina Green; sailboat races; and most recently Formula One racing demonstrations. Future re-zoning plans for the immediate neighborhood contemplate an enormous skyscraper at the sight of the current Marina Safeway, bringing thousands of new residents to this already very busy area. The establishment of new, permanent recreational facilities which will draw in organized league play and volleyball tournaments. Please do permanently erase the unique and historic open green space of the Marina Triangle and further burden this densely used area with noise and traffic for the benefit of a few. (See Video Clip 1 of a typical Sunday in the Marina here and Figure 4.)

Figure 4

Trash Cans. It is difficult to tell from the plans circulated to Marina residents where trash receptacles will be located. Despite its heavy weekend use, there are very few trash cans in this area, and every weekend the can at the corner of Marina and Buchanan is filled to overflowing. (See Figure 5) I hope that the new plan will ensure adequate facilities for trash disposal and removal.

Figure 5 Trash Can on Marina and Buchanan on a Typical Sunday. This is minor.

Thank you for your consideration of my comments and for all that you are doing to make our city a great place to live and visit. Please feel free to contact me to discuss.

Sincerely,

Natalie Marine-Street

natalie@streetfamily.com

traffic would prevent prompt medical services to reach an injured person, in a timely manner, who is being transferred from marine emergency services to an ambulance.

The necessity of the current fuel dock in the East Harbor cannot be over emphasized. Its location, ease of access from sea to land, remoteness from the congested event confusion found in the West Harbor and not having to rely on yearly dredging to access fuel etc. highlights its importance.

To realize its importance is easily done just by going down and hanging around and seeing with your own eyes.

On a side note: the boat hoist has been decommissioned for many years much to the loss of mariners who would otherwise have access to the Bay and are now forced to travel far to launch their boats. This hoist was used extensively during its operational period by everyone for fishing, sailing, maintenance, and safety.

What a shame such a strategically located marina is being disregarded and made into a useless park that provides nothing to the boating public and puts further financial burden on the Harbor. We have so many parks in this vicinity such as Aquatic Park, Fort Mason Park, Moscone Park, Crissy Field Park, Tunnel Top Park etc. and hardly any parks for boats.

There was a time, when San Francisco “knew how”, and the East Harbor was enjoyed by all, from Hunters Point to Pacific Heights. Boating was affordable, every berth was occupied, and the waiting list was extensive. Since then berth rates have increased ten-fold, and more, and as a result only a fraction of boating enthusiasts can afford using the harbor anymore. As the rates continue to increase the number of abandoned vessels and empty berths increases putting financial stress on the Harbor.

We recently had a 30% increase in berth rates in order to cover harbor expenses like dredging. As would be expected this forced even more vacancies and loss of revenue. As this revenue continues to decrease it may become necessary to increase berth rates again, causing current berth holders to shoulder harbor expenses or abandon their boats or look for safe harbor elsewhere. More lost revenue and financial suicide for the Harbor is likely.

The solution to this dilemma is creating as many berths as possible in the East Harbor and make it attractive and affordable for everyone. Currently this is not the case. The proposed plan includes one access gate that is remote and often closed during events. Berth rates are going to be almost double what rates are now in the East Harbor. Only a small fraction of the berths will be 25’ eliminating most of the boating public who would rather keep their boats in the water and not have to trailer and launch their boats every time. Parking access is also very limited at the proposed gate access point and will make moving gear back and forth difficult and timely. This area is also very popular for the public to park or sit on the bench and enjoy the activities and views of the Bay, further restricting necessary access to one’s boat.

Several of us made a proposal that would add 65 berths to the current plan and provide 3 more gates to access boats and that would not be impacted by event closures. This was promptly dismissed by the project manager over a very minor technicality. Given the importance of more occupancy to the financial health of the Marina, we were shocked.

The proposed plan also creates a one-way direction for vehicular traffic and eliminates approximately 50 + parking spaces. This action will make access to berths even more difficult. These issues and more could have been addressed and avoided if boaters were just asked. Meetings have proven useless thus far.

Boats are no more a luxury than a set of golf clubs or a horse or tennis racket, or surfboard or any part of any form of recreation one participates in. Boats are just what you need to be a boater.

I am saddened to have to leave the East Harbor after more than 40 years, but I am hopeful that there may yet be a solution to address the financial stability and affordability of the East Harbor. This can happen only if people who are able to bring common sense to this plan will listen and take the necessary action to make the East Harbor a success for all.

Ed Tavasieff

Commercial Fisher

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FINAL REPORT
GEOTECHNICAL INVESTIGATION
Marina Boulevard Seawall
San Francisco, California

City and County of San Francisco
San Francisco, California

12 December, 1997
Project No. 1526.02

Treadwell&Rollo
Environmental and Geotechnical Consultants

Treadwell&Rollo

12 December 1997
Project 1526.02

Mr. Harlan L. Kelly, Jr.
Deputy Director for Engineering and City Engineer
City and County of San Francisco
Department of Public Works
30 Van Ness Avenue, 5th Floor
San Francisco, California 94102

Subject: Final Report
Geotechnical Investigation
Marina Boulevard Seawall
San Francisco, California

Dear Mr. Kelly:

We are pleased to submit 25 copies of our geotechnical investigation report, dated 12 December 1997, for the subject property. Our services were provided in accordance with the City and County of San Francisco, Department of Public Works (DPW) Order No. 169,333 (approved 20 February 1996) and our proposal dated 18 January 1996.

We appreciate the opportunity of serving you on this interesting and challenging project. If you have any questions, please call.

Sincerely yours,
TREADWELL & ROLLO, INC.

Craig S. Shields
Geotechnical Engineer

15260204.CSS

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EXECUTIVE SUMMARY

This report presents the results of the investigation performed by Treadwell & Rollo, Inc. (T&R) to evaluate the potential for liquefaction and lateral spreading to occur behind the Marina Boulevard seawall in San Francisco. The seawall is approximately 1,100 feet long and runs along the northern side of Marina Boulevard between Scott and Baker Streets as shown on Figure E-1. It is a nine-foot-high cantilever concrete wall supported on composite concrete and wood piles. The Marina Boulevard box sewer parallels the seawall near the northern curbline of Marina Boulevard. The box sewer is a buried concrete structure that collects the dry and wet weather flows from the area.

The issue of potential damage to the seawall due to liquefaction and lateral spreading was initially addressed in a report entitled "Final Report, Liquefaction Study, Marina District and Sullivan Marsh Area, San Francisco, California" dated August 1991, by Harding Lawson Associates, et. al., prepared for the City and County of San Francisco, Department of Public Works (DPW). The 1991 report concludes the Marina Boulevard seawall may move significantly toward the yacht harbor during a Richter magnitude 8.3 earthquake and the ground surface between the seawall and sewer may settle because of lateral spreading. The report recommends the seawall be strengthened and the ground improved between the box sewer to mitigate the potential for damage due to lateral spreading. A committee was subsequently appointed by the City and County of San Francisco Board of Supervisors to review the Liquefaction Study report. The committee recommended in a report dated May 1992 that the seawall be strengthened and the ground between the seawall and the box sewer be improved in accordance with the recommendations provided in the Liquefaction Study report.

We previously performed a geotechnical study in 1993-1994 to evaluate whether liquefaction and lateral spreading will occur behind the seawall and to evaluate the risk of earthquake-induced damage to the box sewer and seawall. We concluded there is potential for several feet of horizontal ground movement to occur behind the seawall during a repeat of the 1906 earthquake,

and both the seawall and box sewer behind the seawall would likely experience damage from the lateral spreading. Because the conclusions were based on widely spaced borings and few laboratory test data, however, it was recommended, in a meeting with the Blue Ribbon Committee appointed by DPW, that additional field investigation be performed to confirm the conclusions and to provide recommendations for mitigation measures to reduce the potential for lateral spreading.

To better characterize the liquefiable deposit in the seawall vicinity, a field investigation was performed for the current study. The investigation included drilling test borings, performing cone penetrometer tests and measuring compression and shear wave velocities of the fill soil. During our investigation four distinct types of granular soil were encountered in the vicinity of the seawall: 1) land-tipped sand fill just below the water table, 2) hydraulic fill, 3) gravel and rock fill comprising Fair's seawall, and 4) native sand.

On the basis of our field investigation and our engineering analyses, we conclude the submerged land-tipped fill and most of the hydraulic fill will liquefy during a major earthquake. Because of the high permeability of the gravel and rock fill comprising Fair's seawall, we conclude the potential for this material to liquefy is low. The liquefaction potential of the native sand is also considered to be low except for isolated, non-continuous pockets.

For our lateral spreading analysis, we considered two earthquakes: a moment magnitude 7.9 earthquake on the San Andreas Fault, which would be a repeat of the 1906 (Richter magnitude 8.3) earthquake, and a moment magnitude 7.0 earthquake on either the San Andreas or Hayward Fault. The Working Group on California Earthquake Probabilities (U.S. Geological Survey Circular 1053, 1990) estimates the probability of occurrence by the year 2020 to be 2 and 67 percent for the magnitudes 7.9 and 7.0 events, respectively. Using an empirical relationship developed by Bartlett and Youd (1992) and taking into consideration the positive influence of various existing below-grade features (rockfill, piles, and gravel around the box sewer), we

estimate the lateral movement would be about three feet for the magnitude 7.9 event and six inches for the magnitude 7.0 event. These movements would occur primarily east of Divisadero Street. Significant lateral spreading is not expected to occur west of Divisadero Street, where the soil below the water table primarily consists of medium-dense to dense natural sand (instead of fill).

There are two distinct seismic stability issues to be addressed in the analysis of the Marina Boulevard seawall. They are Local Stability and Area-wide Stability. Local Stability refers to the Marina Boulevard seawall, its foundations, the backfill immediately behind the seawall, and the sidewalk/jogging path and utilities supported by the backfill. Area-wide stability refers to both the Marina and adjacent Fair's seawall, the box sewer, Marina Boulevard, and all of the area south of Marina Boulevard that was reclaimed by hydraulic filling (see Figure E-2). Considering the large mass of ground that is susceptible to movement, and the amount of movement that is anticipated during a major earthquake, it may not be economically feasible to address Area-wide Stability. Improvements to the Marina Boulevard seawall and/or the ground between the seawall and the box sewer will not significantly reduce the amount of Area-wide lateral spreading that is expected to occur.

Local stability is governed by the adequacy of the Marina Boulevard seawall to resist earthquake forces, and the presence of potentially liquefiable material behind the wall and the resulting lateral pressures. Local stability may be addressed by:

1. strengthening the seawall to resist the lateral forces due to seismic loading (Method 1), or

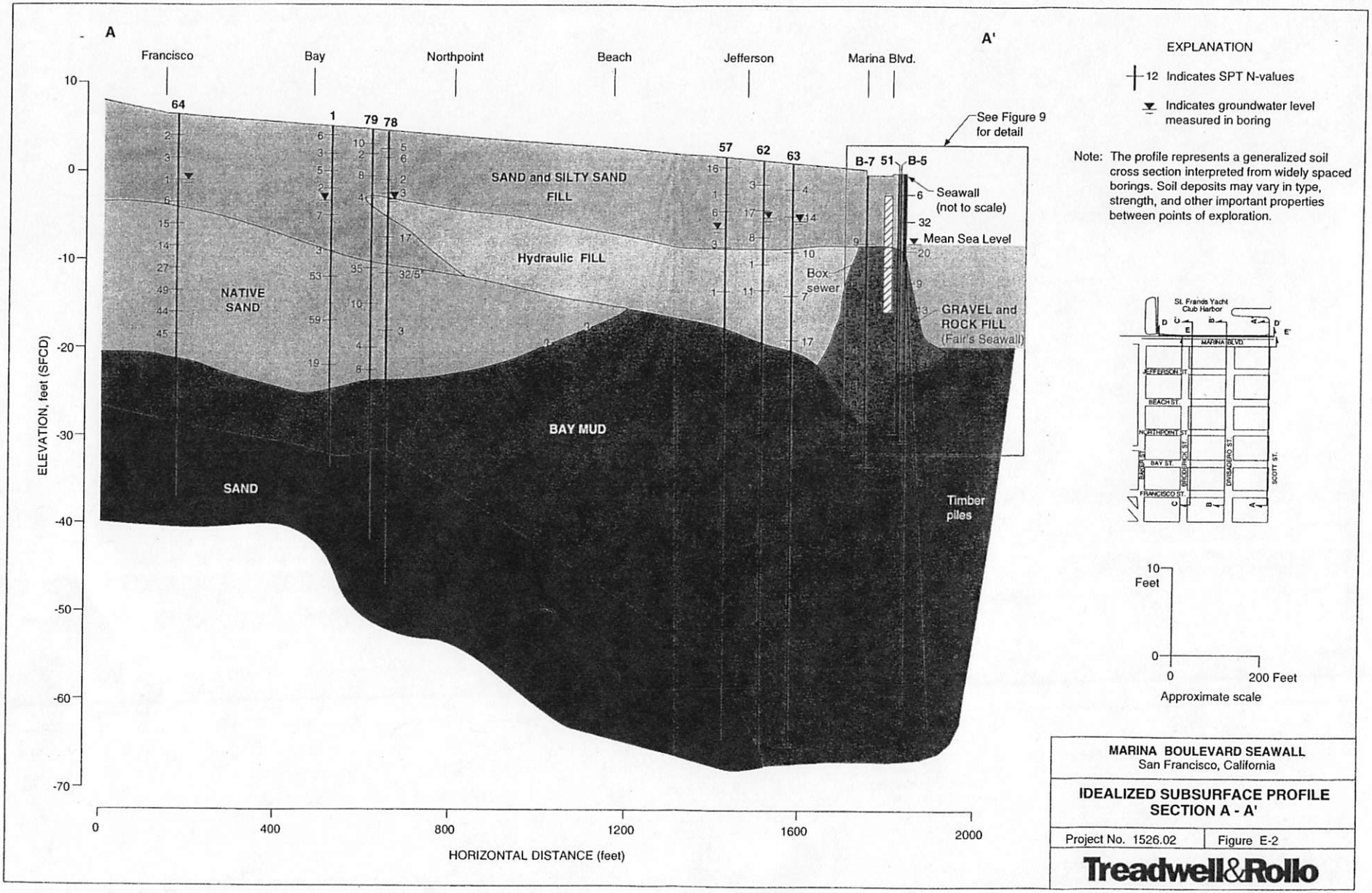
1. reducing the lateral forces on the wall by improving the soil between the wall and the box sewer (Method 2), or
2. doing nothing and repairing the seawall, utilities, and the sidewalk/jogging path behind the seawall after an earthquake.

One solution to strengthen the seawall to resist seismic overturning forces (Method 1) would be to add new piles at the rear of the seawall. We judge prestressed, precast concrete piles would be the most economical pile type. One solution to reduce the lateral forces on the wall (Method 2) would be to strengthen the land-tipped fill behind the seawall. The fill could be strengthened by compaction grouting the submerged land-tipped fill and then installing geogrids in the backfill behind the wall.

Neither Method 1 nor 2 will protect the box sewer and the area south of the box sewer which could move 1/2 to 3 feet during a magnitude 7.0 and 7.9 earthquake, respectively. Further, even if Method 1 or 2 is implemented, the seawall could be irreparably damaged by Area-wide lateral spreading during a magnitude 7.9 earthquake.

Based on our findings, we recommend the following action be taken:

1. Be prepared to repair the box sewer and utilities along Marina Boulevard in the event of an earthquake;
2. Perform an analysis to compare the cost of the measures discussed above for reducing the potential for damage to the Marina Boulevard seawall and adjacent improvements during an earthquake to the cost of repairing the seawall and these improvements after an earthquake (cost/benefit analysis); the analysis should take into account the probabilities of earthquake occurrence.



EXPLANATION

12 Indicates SPT N-values

Indicates groundwater level measured in boring

Note: The profile represents a generalized soil cross section interpreted from widely spaced borings. Soil deposits may vary in type, strength, and other important properties between points of exploration.

10 Feet

0

0 200 Feet

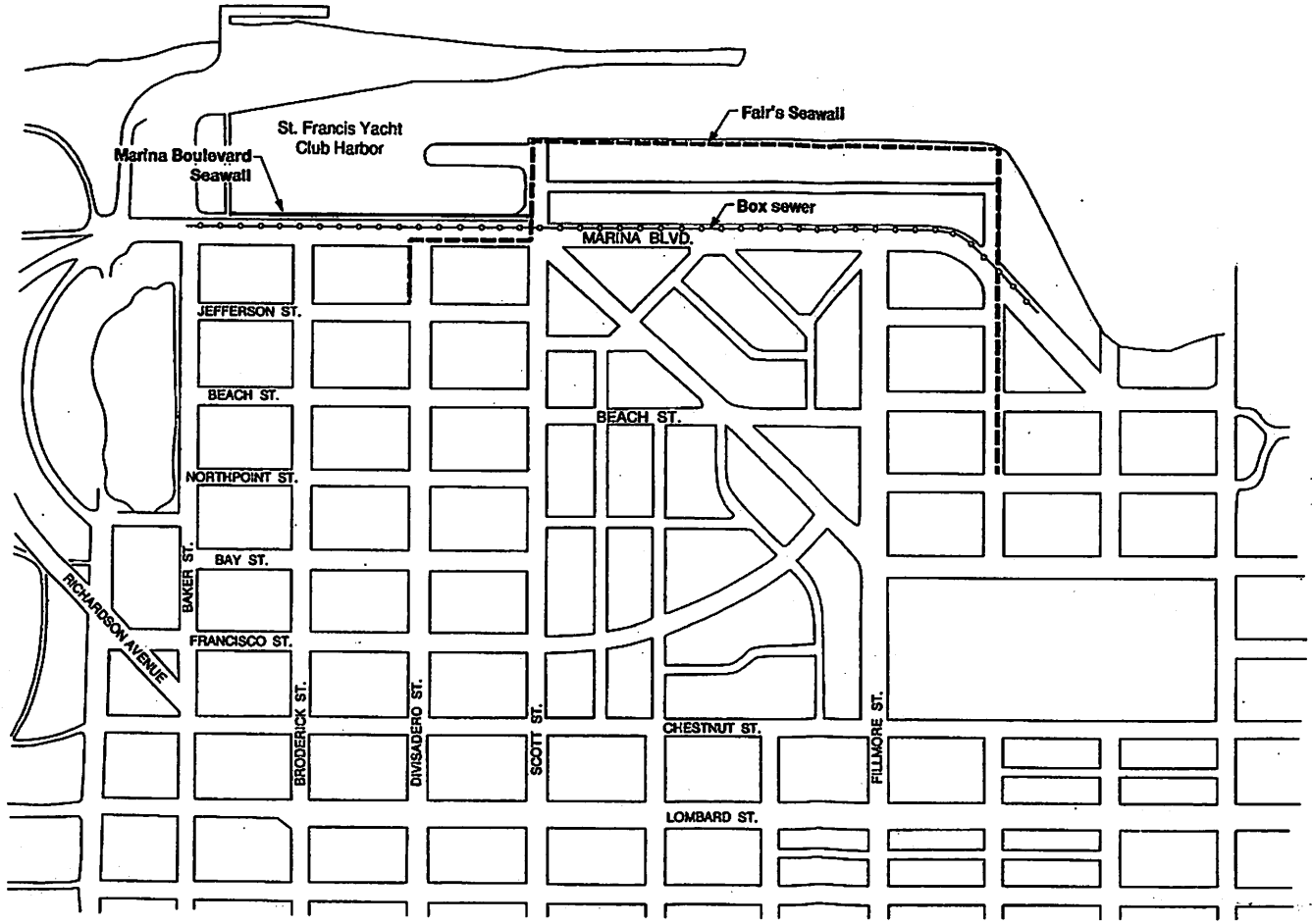
Approximate scale

MARINA BOULEVARD SEAWALL
San Francisco, California

IDEALIZED SUBSURFACE PROFILE SECTION A - A'

Project No. 1526.02 | Figure E-2

Treadwell&Rollo



0 500 Feet

Approximate scale

MARINA BOULEVARD SEAWALL
San Francisco, California

GENERAL SITE PLAN

Project No. 1526.01 | Figure E-1

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FINAL REPORT
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Treadwell&Rollo

TABLE OF CONTENTS

LIST OF FIGURES

GEOTECHNICAL INVESTIGATION
MARINA BOULEVARD SEAWALL
San Francisco, California

1.0 INTRODUCTION

This report presents the results of the investigation performed by Treadwell & Rollo, Inc. (T&R) to evaluate the potential for liquefaction[1] and lateral spreading[2] to occur behind the Marina Boulevard seawall in San Francisco, California. The seawall runs along the northern side of Marina Boulevard between Scott and Baker Streets, as shown on Figure 1. T&R previously performed a geotechnical study for the seawall, the results of which were presented in a draft report dated 26 January 1994.

Our services were provided in accordance with the City and County of San Francisco, Department of Public Works (DPW) Order No. 169,333 (approved 20 February 1996) and our proposal dated 18 January 1996. Our services for this specific assignment were authorized in a DPW Service Order dated 15 February 1996.

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[1] Liquefaction is a phenomenon in which saturated, cohesionless soil experiences a temporary loss of strength because of the buildup of excess pore water pressure, especially during cyclic loading such as that induced by earthquakes. Soil most susceptible to liquefaction is loose, clean, saturated, uniformly graded, fine-grained sand or silt of low plasticity that is relatively free of clay. Sandy gravel of low relative density is also susceptible to liquefaction.

[2] Lateral spreading is a phenomenon in which surficial soil displaces along a shear zone that has formed within an underlying liquefied layer. Upon reaching mobilization, the surficial blocks are transported downslope or in the direction of a free face by earthquake and gravitational forces.

2.0 BACKGROUND

Constructed around 1934, the seawall is approximately 1,100 feet long and consists of a nine-foot-high cantilever concrete wall with basalt rock facing. The wall is supported on vertical and battered, composite concrete and wood piles that reportedly extend 48 to 62 feet below the pile cap. At the base of the seawall extending towards the yacht harbor, there is a gentle slope. The Marina Boulevard box sewer parallels the seawall near the northern curbline of Marina Boulevard. The box sewer is a high capacity, gravity flow, consolidating sewer designed to collect the dry and wet weather flows from all the existing outfall sewers in the northshore area. The plan dimensions of the box sewer increase from west to east, varying from 11 feet wide by 12 feet high at Baker Street to approximately 21 feet wide by 23 feet high at Buchanan Street.

A report entitled "Final Report, Liquefaction Study, Marina District and Sullivan Marsh Area, San Francisco, California" dated August 1991, by Harding Lawson Associates, et. al., was prepared for the City and County of San Francisco, Department of Public Works to evaluate and recommend measures to minimize damage to public facilities during a Richter magnitude 8.3 earthquake. The report concludes the Marina Boulevard seawall may move significantly toward the yacht harbor during this magnitude earthquake and the ground surface between the seawall and sewer may settle because of lateral spreading. In the authors' judgment, the box sewer would be able to retain the soil south of Marina Boulevard; however, movement of the box sewer could occur. Therefore, it was recommended that the seawall be strengthened and the ground improved between the seawall and the box sewer. Preliminary cost estimates for the installation of tensile piles along the seawall and the installation of stone columns between the seawall and box sewer were presented in the report.

A committee was appointed by the City and County of San Francisco Board of Supervisors to review the above-referenced Liquefaction Study report. In a report entitled "Final Report, Marina District Liquefaction Study Task Force, San Francisco, California" dated May 1992, the committee recommended the Marina Boulevard seawall be strengthened and the ground between the seawall and the box sewer be improved in accordance with the recommendations provided in the Liquefaction Study report. The committee estimated the cost of strengthening the seawall to be between $300,000 and $350,000 and the cost of improving the ground by installing stone columns to be $250,000.

The DPW subsequently performed a detailed cost analysis of the proposed seawall strengthening and found the estimated costs to be considerably higher than those presented in both the Liquefaction Study and task force reports. DPW decided to re-evaluate the risk of earthquake-induced damage to the box sewer and seawall and the mitigation measures proposed by the Liquefaction Study. We subsequently performed a geotechnical study using subsurface data from previous investigations by others. In the study, we concluded there is potential for several feet of horizontal ground movement to occur behind the seawall during a repeat of the 1906 Earthquake, and both the seawall and box sewer behind the seawall would likely experience damage from the lateral spreading.

3.0 SCOPE OF SERVICES

The objectives of this study were to better characterize the liquefiable deposit in the seawall vicinity and to confirm the conclusions in the previous studies. As outlined in our proposal dated 18 January 1996, our scope of services included drilling seven test borings, performing compression and shear wave velocity measurements in three of the test borings, performing

laboratory tests on selected soil samples obtained from the test borings, and performing five cone penetrometer tests (CPTs). On the basis of the field and laboratory test results and engineering analyses, we developed conclusions regarding:

- subsurface conditions along the length of the seawall using data from previous investigations, as well as data from this investigation
- the potential for liquefaction and lateral spreading of the fill behind the seawall (on both sides of the box sewer), including the lateral extent of the liquefiable soil to the west and an estimate of the potential amount of lateral spreading
- the potential for deep-seated rotational failure of the outboard slope through the Bay Mud below the liquefiable soil
- the presence of the former Fair's seawall and its effect on lateral spreading
- the potential risk to the box sewer and to the seawall due to liquefaction and lateral spreading

This report also presents alternative mitigation measures to reduce the potential for this lateral spreading.

4.0 HISTORICAL DEVELOPMENT

Much of the Marina District is composed of land that was once submerged and was reclaimed from the Bay by filling between 1851 and 1917. The areas underlain by artificial fill are shown on Figure 2. These areas were determined by superimposing historic maps prepared by the U.S. Coast and Geodetic Survey and the State Harbor Commission. These maps show the Bay's shoreline extending roughly from Blackpoint at Fort Mason southwest to what is now the intersection of Lombard and Divisadero Streets, then turning northwest and following the present

alignment of Richardson Avenue. Along the western boundary of the shoreline was a broad area of beach sand, known as Strawberry Island. The small bay formed by the historic shoreline is referred to as Marina Cove.

To retain the fill placed in Marina Cove, Fair's seawall was built in the 1890s. The seawall, which was completed in 1894, was built by dumping rock from a pile-supported trestle. The approximate alignment of Fair's seawall is shown on Figures 1 and 2. Dune sand, excavated and transported from outside the western boundaries of the Marina District, was dumped adjacent to the seawall; however, filling of the cove was not completed. By 1906, Marina Cove was enclosed, except for a narrow opening to the north.

In 1911, the area of the Marina District was chosen as the site of the 1915 Panama-Pacific International Exposition. To create developable land for the Exposition, the filling of Marina Cove resumed. This fill was largely "hydraulic fill" composed primarily of sand and silty sand. The hydraulic fill was dredged from the Bay and pumped into place without any attempts to densify the material.

Many wood piles were driven to support the Exposition buildings. The pile lengths reportedly varied between 13 and 63 feet. After the Exposition, most of the structures were demolished with dynamite. Records indicate many of the wood piles were cut off a few feet below grade and left in place. Following demolition of the Exposition buildings, low areas were filled by public dumping or mud pumping. In 1924, the land was subdivided into individual lots. The Marina District was subsequently developed during the 1930s.

5.0 FIELD INVESTIGATION

To investigate and sample the soil beneath the seawall alignment, a subsurface investigation was performed on 1 through 4 and 17 and 19 April 1996. The field investigation included drilling test borings, performing cone penetrometer tests and measuring compression and shear wave velocities of the fill soil. Details of the field investigation are discussed in the remainder of this section of the report.

5.1 Test Borings

For this investigation, we drilled seven test borings to depths ranging from about 20 to 40 feet below the ground surface at the locations shown on Figure 3. The test borings were advanced using rotary-wash drilling equipment. Boring locations were chosen to supplement information from previous investigations. Our field engineer logged the soil encountered and obtained samples for laboratory testing. Logs of the borings are presented in Appendix A as Figures A-1 through A-12.

Soil samples were obtained using three samplers:

- Standard Penetration Test (SPT) split-barrel sampler without liners (1.375-inch inside diameter [ID] and 2-inch outside diameter [OD])
- Sprague & Henwood (S&H) split-barrel sampler (2.43-inch ID, 3-inch OD with liners)
- Shelby (thin-walled tubes, 2.8-inch OD, 0.065-inch wall thickness).

The split-barrel samplers were driven with a 140-pound, above-ground safety hammer falling 30 inches. The blow counts required to drive the S&H sampler the final 12 inches of an 18-inch drive were converted to SPT N-values and are presented on the boring logs. Where the SPT sampler was used, the actual blow counts are shown on the logs. Samples of soft soil were obtained by hydraulically pushing 30-inch-long Shelby tubes into the soil. The soil encountered in our borings is classified in accordance with the soil classification system described on Figure A-13.

All borings, except B-4, B-6 and B-7 were backfilled with cement-bentonite grout as required by the City and County of San Francisco, Bureau of Environmental Health Management. Solid, Schedule 40 polyvinyl chloride (PVC) casing, three inches in diameter (ID), was placed in borings B-4 , B-6 and B-7 to depths varying from about 25 to 30 feet below the existing ground surface. Both the bottom and top of the casing were capped. The annulus around the casing was filled with Monterey No. 3 sand. The cased holes were subsequently used for geophysical testing. After the completion of the geophysical testing, the inside of the PVC casing was filled with cement-bentonite grout.

5.2 Cone Penetrometer Tests

The CPTs were performed by hydraulically pushing a 1.4-inch diameter, cone-tipped probe into the ground. The cone on the end of the probe measures tip resistance, and a sleeve behind the cone tip measures frictional resistance. A small, porous stone between the cone and the friction sleeve monitors pore pressures in the soil during penetration. Electrical gauges within the cone measure soil parameters continuously during the entire depth of each probing. Soil data, including tip resistance, frictional resistance, pore water pressure, probe inclination, and surrounding temperature were transferred to a computer during each test. Accumulated data was

processed by computer to provide engineering information, such as the types and approximate strength characteristics of the soils encountered.

The CPTs were advanced to depths of about 8 to 40 feet below the ground surface. The CPT logs, which show tip resistance, local friction and friction ratios, as well as an interpreted soil profile, are presented in Appendix B.

5.3 Geophysical Study

A geophysical study was also performed to measure the compression wave (P-wave) and shear wave (S-wave) velocities of the fill materials behind the seawall. The downhole seismic surveys were conducted at test borings B-4, B-6 and B-7. The seismic velocity data was collected, as described and illustrated in the report prepared by NORCAL Geophysical Consultants, Inc., dated 14 May 1996. NORCAL's report is attached as Appendix C. A summary of the interpreted P- and S-wave velocities are summarized in Table 1.

TABLE 1 - SUMMARY OF DOWNHOLE SEISMIC SURVEYS

Test Boring	Depth (feet)	P-wave velocity (feet/second)	S-wave velocity (feet/second)
TB-4	0 - 23	1,650	550
TB-6	0 - 5	950	450
	5 - 15	2,300	650
	15 -23	2,300	850
TB-7	0 - 5	1,600	750
	5 - 25	3,000	750

6.0 LABORATORY TESTING

Representative soil samples were selected for laboratory testing. Samples were tested to determine moisture content, dry density, grain size distribution, and triaxial shear strengths. The laboratory test results are presented on the boring logs at the appropriate sample depth, and the results of the grain size distribution are presented graphically in Appendix D.

7.0 SUBSURFACE CONDITIONS

To illustrate subsurface conditions, five idealized subsurface profiles were prepared and are presented on Figures 4 through 8. Three of the profiles are perpendicular to the seawall alignment and two are parallel to the alignment. Because lateral spreading during a major earthquake can occur several hundred feet behind a slope face, the profiles extend to Francisco Street, five blocks south of the seawall. The profiles are based on test boring data gathered during this investigation as well as previous investigations. More detailed information concerning subsurface conditions immediately adjacent to the seawall are shown on Figures 9 and 10.

Our test borings, CPTs and other subsurface data indicate the area behind the Marina Boulevard seawall is underlain by approximately 10 to 30 feet of fill. The fill thickness increases toward the seawall. The fill is thinnest west of Broderick Street in the area of the former Strawberry Island. In the seawall vicinity, there are two types of fill:

- land-tipped fill which consists of Dune sand (medium- to fine-grained sand) and rock fill that was end dumped, and

- hydraulic fill which consists of fine-grained sand and silty sand that was dredged and pumped into place.

The rock fill, which was encountered between Divisadero and Scott Streets, was probably placed during construction of Fair's seawall. The fill materials, including the rock fill, are generally loose to medium dense.

West of approximately Divisadero Street, the fill is underlain by a natural sand deposit, which extends to a depth of approximately 35 feet below street grade. The natural sand is generally medium dense to dense. The natural sand deposit is underlain by weak, compressible clay (Bay Mud). East of Divisadero Street, the Bay Mud deposit is directly beneath the fill. The thickness of the Bay Mud layer varies from approximately 45 feet at Baker Street to 75 feet at Scott Street. Below the Bay Mud are dense sand and stiff clay that extend to bedrock. The depth to bedrock along the seawall alignment is estimated to be between 200 and 300 feet below the ground surface.

Because of the proximity to the Bay and the high permeability of the fill materials, groundwater levels in the vicinity of the seawall will fluctuate with tidal changes. Groundwater was encountered at depths ranging from 7 to 9 feet below the ground surface during drilling of previous borings near the seawall.

8.0 SEISMIC SETTING AND PRIOR EARTHQUAKE BEHAVIOR

The seismic setting of San Francisco, including locations of active faults and the probability of future earthquakes, is presented below. In addition, behavior of the Marina district during the 1906 San Francisco and 1989 Loma Prieta Earthquakes is discussed.

8.1 Seismic Setting

The City and County of San Francisco lies within the seismically active California Coast Ranges geomorphic province, which is characterized by a series of northwest-trending, subparallel, and generally linear mountain belts and valleys underlain by a complex series of faulted and folded rocks. Several active northwest-trending, strike-slip faults, which are all part of the San Andreas Fault System, are present in the vicinity of San Francisco. The major active faults in the area and their distances from the site are as follows:

Major Active Fault	Closest Distance (miles)
San Andreas	7 SW
Hayward	12 NE
San Gregorio	15 SW
Calaveras	30 NE

The location of the Marina District relative to these faults is shown on Figure 11.

The San Andreas and Hayward Faults have been the sources of large historical earthquakes. The largest earthquake to affect the Bay Area was the San Francisco earthquake of 18 April 1906, which had a Richter magnitude of 8.3 (moment magnitude 7.9). This earthquake occurred when a 270-mile-long segment of the San Andreas Fault ruptured between Cape Mendocino and San Juan Bautista, including the portion of the fault closest to the Marina District. The Loma Prieta earthquake of 17 October 1989 occurred when a segment of the San Andreas Fault northeast of Santa Cruz ruptured over a length of approximately 28 miles. The epicenter of the earthquake

was approximately 60 miles southeast of the Marina District. The earthquake was assigned a Richter magnitude of 7.1 (moment magnitude 6.9) by the U.S. Geological Survey. The fault rupture was bilateral (in two directions), resulting in only about 10 seconds of strong ground shaking. Its duration was about one-half the duration normally associated with an event of this magnitude. Two other large earthquakes are believed to have occurred on the portion of the San Andreas Fault south of San Francisco in 1838 and 1865. Large earthquakes on the Hayward Fault last occurred in 1836 and 1868. These earthquakes were approximately magnitude 7.

The Working Group on California Earthquake Probabilities (U.S. Geological Survey Circular 1053, 1990) predicts a 67 percent probability of one or more magnitude 7 earthquakes occurring on any one of the major faults within the San Francisco Bay region by the year 2020. The probability of a repeat of the 1906 earthquake, which is considered to be the maximum credible earthquake on the northern portion of the San Andreas Fault, is estimated to be about two percent by the year 2020.

During the Loma Prieta earthquake, the estimated peak ground acceleration in the Marina District was about 0.2 times gravity (g) and the duration of strong ground shaking was about 10 seconds. We estimate the peak ground acceleration due to moment magnitude 7.0 and 7.9 earthquakes occurring on a nearby segment of the San Andreas would be approximately 0.4 and 0.5 times gravity (g), respectively. For the magnitude 7.9 event (a repeat of the 1906 earthquake), it is estimated the duration of ground shaking would be 45 to 60 seconds.

8.2 Performance During Previous Earthquakes

Because the Marina District was relatively undeveloped at the time, little data is available regarding the effects of the 1906 Earthquake on the Marina District; however, the shaking

intensity in the Marina during the 1906 earthquake was in the second highest category on the intensity scale used by Lawson, et. al. (1908). It was reported that between 2 and 3 feet of settlement took place on Bay Street between Webster and Laguna Streets. Evidence of ground displacement was also seen in the Baker Street sewer, north of Northpoint Street.

Ground deformation and soil liquefaction occurred throughout the Marina District as a result of the 1989 Loma Prieta earthquake. Soil liquefaction, as evidenced by the presence of sand boils on the ground surface, occurred on most streets where there was building damage. Most of the sand boils were found at the location of the former Marina Cove, where hydraulic fill was placed. Types of ground deformation observed in the Marina District included differential settlements and lateral displacements. Local differential settlements and lateral displacements of up to four inches were observed at the northwest corner of Beach and Divisadero Streets, at the southwest corner of Divisadero and Jefferson Streets, and on Northpoint Street approximately 200 feet west of Webster. Lateral displacement of seven inches northward over 100 feet was measured in the Winfield School playground, approximately 130 feet east of the intersection of Beach and 1Divisadero. Along the Marina Boulevard seawall, seismic-induced ground settlement varied from about one inch at the west end of the seawall to six inches near the east end. No visible damage or movement of the Marina Boulevard seawall or box sewer was observed for the segment between Scott and Baker Streets. However, east of Scott Street along the Marina Green there was evidence the concrete seawall moved several inches. This portion of the seawall is not pile supported; it is supported by a continuous strip footing.

9.0 LIQUEFACTION AND LATERAL SPREADING ANALYSIS

9.1 Liquefaction Analysis

Soil liquefaction is a phenomenon where loose, saturated, cohesionless soil experiences a temporary reduction of strength during strong cyclic loading such as that produced by earthquakes. Typically, liquefaction potential increases with increased duration and magnitude of the cyclic loading. Soils most susceptible to liquefaction are loose, clean, saturated, uniformly graded, fine-grained sand, and cohesionless silt.

Data from our investigation, as well as previous investigations, indicates there are four distinct types of granular soil in the vicinity of the Marina Boulevard seawall that may be susceptible to liquefaction. These soil types are:

- the land-tipped sand fill just below the water table
- the hydraulic fill
- the gravel and rock fill comprising Fair's seawall
- the native sand.

On the basis of our field observations and laboratory tests, we conclude that the submerged land-tipped sand fill (below a depth of about seven feet) and most of the hydraulic fill will liquefy during a major earthquake. Because of the high permeability of the gravel and rock fill comprising Fair's seawall, we judge that sufficient pore pressures to cause liquefaction would not develop in the rock fill and therefore the potential for liquefaction is low. Finally, we judge that isolated pockets within the native sand may liquefy; however, because these pockets would be non-continuous, the movement associated with liquefaction would be minor (less than a few inches).

9.2 Lateral Spreading Analysis

Lateral spreading is generally the most pervasive and damaging type of liquefaction-induced ground failure generated by earthquakes. During lateral spreading, surficial soil displaces along a shear zone that has formed within an underlying liquefied layer. The surficial soil is transported downslope or in the direction of a free face, such as a channel slope, by earthquake and gravitational forces. Horizontal ground displacement of several feet can occur on gentle slopes (0.3 to 5 percent grade). Ground displacements as large as 15 to 20 feet on a 0.2 percent slope occurred during the 1964 Niigata, Japan, earthquake and displacements as large as three feet occurred on 0.05 to 0.10 percent slopes during the 1964 Alaska earthquake. Horizontal ground movements ranging from 2 to 5 feet occurred in the south of Market Street area of San Francisco during the 1906 earthquake, resulting in damage to many buildings, bridges, roads, and pipelines.

The Hyogo-Ken Nanbu Earthquake, which occurred on 17 January 1995, caused extensive damage to waterfront facilities in Kobe, Japan. Liquefaction-induced settlement and lateral spreading of several feet occurred during the magnitude 6.8 earthquake.

We evaluated the potential for lateral spreading of the soil behind the Marina Boulevard seawall using an empirical relationship developed by Bartlett and Youd (1992). This relationship incorporates the thickness of the liquefiable layer, the fines content and mean grain-size diameter of the liquefiable soil, the magnitude and distance of the earthquake from the site, the slope of the ground surface, and boundary conditions, such as a free face, to estimate the horizontal ground movement.

Using the available soil and topography data, we compared the lateral spreading predicted by the Bartlett and Youd method with the actual deformations observed during the Loma Prieta earthquake. Magnitude of the earthquake and distance from the eausative fault were modified to correct for amplification of the ground motion and duration of shaking. For our analysis, we used a ground slope surface of 0.4 percent and a free face ratio of about 2 percent. Mean grain sizes of 0.2 and 0.3 millimeters (mm) were used for the hydraulic and land-tipped fills, respectively; the fines content of the fill was varied from 5 to 30 percent. Using these parameters, the empirical relationship predicts a few inches of lateral spreading would have occurred during the Loma Prieta earthquake. As discussed above, lateral spreading of 4 to 7 inches occurred only in localized areas of the Marina District during the earthquake.

To model a repeat of the 1906 Earthquake, we used the same soil data, but modified the earthquake magnitude and distance to the fault. The empirical relationship predicts that lateral spreading of 4 to 6 feet toward the yacht harbor will occur east of Divisadero Street during such an earthquake. Significant lateral spreading is not expected to occur west of Divisadero Street, where the soil below the water table consists primarily of medium-dense to dense natural sand (instead of fill). We also analyzed the potential for lateral spreading to occur during a magnitude 7 earthquake on the portion of the San Andreas Fault closest to the site. For this earthquake magnitude, the relationship predicts lateral spreading of several feet east of Divisadero Street.

Bartlett and Youd used this same empirical method to predict several meters of horizontal movement in the South of Market area for the 1906 Earthquake. The actual lateral spread movement, which occurred on gentle slopes of 0.6 to 0.8 percent, was about five feet. They attribute the overprediction to the poor quality of the subsurface data, as well as boundary effects.

There are several conditions in the Marina District that would likely reduce (but not eliminate) the potential lateral spreading that may occur behind the Marina Boulevard seawall. These conditions include: 1) the presence of rock fill along the alignment of Fair's seawall, 2) the reported presence of numerous wood piles that extend through the fill, 3) the presence of vertical and battered wood piles beneath the Marina Boulevard seawall, and 4) the presence of a one-foot-thick layer of gravel beneath the Marina Boulevard box sewer. The gravel reduces uplift pressure that may develop below the box sewer if the underlying fills liquefy during an earthquake. We judge these factors could reduce the amount of lateral spreading south of the box sewer to about three feet.

9.3 Slope Failure Analysis

We checked the stability of the slope outboard of the seawall during a moment magnitude 7 and 7.9 earthquake using two different analyses. For the first analysis we assumed the following:

- the sliding mass (Fair's seawall and the soil above it) is a rigid wedge
- a linear, relatively horizontal failure plane along the interface between Fair's seawall and the Bay Mud
- a lateral load imposed on Fair's seawall by the liquefied hydraulic fill.

Under these conditions, we calculated that a yield acceleration of 0.2g would reduce the safety factor against sliding of the wedge to 1.0. Therefore, if the peak ground acceleration during an earthquake exceeds 0.2g, some movement of Fair's seawall would be expected. Because the anticipated peak ground acceleration during both a magnitude 7 and a magnitude 7.9 earthquake is greater than 0.2g, we performed a deformation analysis of Fair's seawall, using the simplified method developed by Makdisi and Seed (1978). Using this method, we estimate that during a

repeat of the 1906 earthquake there could be up to three feet of lateral movement; for a magnitude 7 on the nearby San Andreas or Hayward Fault, we estimate the lateral movement would be about six inches. This movement would be limited to the section of Fair's seawall that retains the hydraulic fill (east of Divisadero Street).

We also performed a slope stability analysis assuming a circular failure plane. Soil strengths used in the analysis were estimated based on laboratory tests and borings and CPT data. The computer program TSTAB and Janbu's method was used to compute the factor of safety of various circular slip surfaces. The analysis indicates that under static conditions the minimum factor of safety against sliding is about 2.0. To model the effects of an earthquake on a potential slide mass, an equivalent static horizontal force was applied to the mass. The force is the product of the seismic coefficient, which is some fraction of gravity, and the weight of the potential slide mass. This method assumes the sliding mass behaves as a rigid body. Our analysis indicates the seismic coefficient that reduces the factor of safety of the slope to 1.0 is 0.28g for the slip surface with the lowest static factor of safety. Because the yield acceleration for the critical circular slip surface is greater than the yield acceleration computed for Fair's seawall, the potential amount of slope movement during an earthquake would be less than estimated above. Using the Makdisi and Seed method, we estimate the movement of the circular slip surface would be on the order of 1 to 2 feet during an earthquake of similar magnitude to the 1906 Earthquake and a few inches during a magnitude 7 event. These earthquakes have a probability of 2 and 67 percent, respectively, of occurring by the year 2020.

10.0 CONCLUSIONS AND RECOMMENDATIONS

On the basis of this investigation, we conclude there are two distinct seismic stability issues to be addressed in the analysis of the Marina Boulevard seawall. They are Local and Area-wide Stability. Local Stability refers to the Marina Boulevard seawall, its foundations, the backfill immediately behind the seawall, and the sidewalk/jogging path and utilities supported by the backfill. Area-wide Stability refers to both the Marina and adjacent Fair's seawall, the box sewer, Marina Boulevard, and all of the area south of Marina Boulevard that was reclaimed by hydraulic filling.

10.1 Area-wide Stability

Considering the large mass of ground that is susceptible to movement (see Figure 2 for limits of hydraulic fill), and the amount of movement that is anticipated during a major earthquake, it may not be economically feasible to address Area-wide Stability. Our analysis indicates that Fair's seawall, and the ground behind it, may move as much as three feet toward the Bay during a repeat of the 1906 earthquake (moment magnitude 7.9), which is estimated to have a probability of occurrence of 2 percent by the year 2020. The estimated movement during a moment magnitude 7.0 earthquake on either the San Andreas or Hayward Fault, a more likely event, is six inches. Vertical movement up to one foot should also be anticipated. This movement is expected to occur primarily east of Divisadero, where Fair's seawall retains very loose hydraulic fill. Improvements to the Marina Boulevard seawall and/or the ground between the seawall and box sewer will not significantly reduce the amount of area-wide lateral spreading that is expected to occur.

10.2 Local Stability

Local stability, i.e., the area between the seawall and the box sewer, is governed by: the adequacy of the wall to resist earthquake forces; the presence of potentially liquefiable material behind the wall and the resulting lateral pressures.

Local Stability can be addressed by:

1. strengthening the seawall to resist the lateral forces due to seismic loading, **or**
2. reducing the lateral forces by improving the soil between the wall and the box sewer, **or**
3. doing nothing and repairing the seawall, utilities, and the sidewalk/jogging path behind the seawall after an earthquake.

However, neither strengthening the seawall (Method 1) nor reducing the lateral forces (Method 2) will protect the box sewer and the area south of the box sewer which could move 1/2 to 3 feet during a magnitude 7.0 and 7.9 earthquake, respectively. Further, even if Method 1 or 2 is implemented, the seawall could be irreparably damaged by Area-wide lateral spreading during a magnitude 7.9 earthquake.

10.2.1 Method 1 - Strengthening the Seawall

The seawall stability analysis performed for the Liquefaction Study of August 1991 only considered the static and dynamic lateral earth pressures imposed on the seawall by nonliquefied fill. Based on this analysis, it was concluded the connection between the concrete and wood portions of the piles supporting the seawall would fail in tension due to seismic loading during a major earthquake. Because of this potential failure mode, it was recommended that a row of 20-foot-long concrete piles be installed along the rear of the seawall to resist seismic overturning forces.

Our analysis indicates the submerged land-tipped fill behind the seawall will liquefy during a major earthquake. This layer, which generally is limited to about 3 to 5 feet in thickness, appears to be continuous along the alignment of the seawall and for several blocks southward of the seawall. Liquefaction of this layer would result in a larger lateral load on the wall than was estimated for the 1991 Liquefaction Study.

We concur with the Liquefaction Study report that the addition of new piles at the rear of the seawall is one solution to resist the seismic overturning forces on the seawall. If this solution is used, we recommend the tensile piles be designed to resist the lateral earth pressures shown on Figure 12.

We judge that prestressed, precast concrete piles would be the most economical pile type. For design of the piles, we recommend using an allowable skin friction of 300 pounds per square foot (psf) in the Bay Mud and 500 psf in the rockfill above the Bay Mud. These values, which are for temporary loading, include a factor of safety of at about 1.5. We anticipate it may be difficult to drive the piles through the rockfill comprising Fair's seawall and predrilling may be required to achieve the required pile embedment. We expect the excavation for the new pile cap will extend several feet below the groundwater table. Therefore, extensive dewatering should be anticipated.

10.2.2 Method 2 - Soil Improvements Behind the Seawall

In the 1991 Liquefaction Study, the installation of stone columns was recommended between the box sewer and the seawall to improve the overall stability of the area; however, our investigation indicates the liquefaction potential of the fill immediately behind the seawall, other than the

submerged land-tipped fill, is low. Because of the limited depth of soil to be improved (about 7 to 12 feet below the ground surface), we judge that other improvement techniques would be less costly than stone columns.

One solution that may be more economical than the tension piles (Method 1) would consist of strengthening the land-tipped fill behind the seawall to reduce the lateral earth pressures imposed on the seawall. Strengthening the land-tipped fill would consist of two soil improvement measures used in conjunction with one another: 1) compaction grouting the submerged land-tipped fill between the seawall and the box sewer, and 2) installing three layers of geogrids in the backfill behind the wall.

Compaction grouting consists of driving a small-diameter pipe into the loose soil to be improved and injecting a cementitious grout under pressure. The grout displaces the soil and forces it into a denser mass. Compaction grouting is generally performed on a grid pattern with injection points spaced approximately 4 to 6 feet on center; however, the contractor should establish the injection point spacing. The zone of soil improvement should extend between depths of about 7 and 12 feet and may be modified depending upon the field conditions encountered during installation of the injection point. The injection points can readily be moved in the field if a utility line is encountered. To reduce the liquefaction potential of the submerged land-tipped fill, we recommend the "post-grout" CPT tip resistance of this material be improved to at least 100 tons per square foot (tsf).

Geogrids (soil reinforcement) may be installed behind the seawall to minimize static and dynamic lateral earth pressures pressure imposed on the seawall. We compute that three layers of geogrid (Tensar UX1500 or equivalent) placed at depths of 3, 5, and 7 feet below the existing

grade, as shown on Figure 13, will be adequate to reduce the lateral earth pressures such that tension piles would not be required. Each geogrid layer should extend southward at least 15 feet from the seawall. The northern edge of the geogrid layers should be wrapped, encapsulating that end of the fill. Each geogrid layer should be prestressed by stretching prior to being covered with fill. The soil excavated to provide space for the geogrid installment may be reused as engineered fill. The soil, which will consist primarily of sand, should be placed in lifts not exceeding eight inches in loose thickness, moisture-conditioned to near optimum moisture content, and compacted to at least 90 percent relative compaction[3] below a depth of three feet (as measured from the top of pavement) and 95 percent relative compaction above a depth of three feet.

11.0 FUTURE ACTION

Based on the findings in this report, we recommend the following action be taken:

1. Be prepared to repair the box sewer and utilities along Marina Boulevard in the event of an earthquake.
2. Perform an analysis to compare the cost of the measures discussed above for reducing the potential for damage to the Marina Boulevard seawall and adjacent improvements during an earthquake to the cost of repairing the seawall and these improvements after an earthquake (cost/benefit analysis). The analysis should take into account the probabilities of earthquake occurrence.

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[3] Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density of the same material, as determined by the ASTM D1557-91 laboratory compaction procedure.

REFERENCES

Bardet, J.P., and N. Kapuskar, 1991, *Site Investigation of the Marina District of San Francisco in September 1990,* Report to the National Science Foundation, February 1992.

Bartlett, S.F., and T.L. Youd, 1992, *Empirical Analysis of Horizontal Ground Displacement Generated by Liquefaction-Induced Lateral Spreads*, Technical Report NCEER-92-0021, August 1992.

Bennett, M.G., 1990, *Ground Deformation and Liquefaction of Soil in the Marina District,* U.S. Geological Survey Open File Report 90-253, Menlo Park, California.

Bonilla, M.G., 1992, *Geologic and Historical Factors Affecting Earthquake Damage,* U.S. Geological Survey Professional Paper 1551-F.

Bonilla, M.G., 1990, *Natural and Artificial Deposits in the Marina District,* U.S. Geological Survey Open File Report 90-253, Menlo Park, California.

Dames and Moore, 1977, *Supplementary Soils Report, North Shore Outfalls Consolidation Project, Contracts N1, N2, and N4, San Francisco, California.*

Ebeling, R.M., and E.E. Morrison, Jr., 1992, *The Seismic Design of Waterfront Retaining Structures,* U.S. Army, Technical Report, ITL-92-11, November 1992.

Harding Lawson Associates, Dames and Moore, Kennedy/Jenks/Chilton, and EQE Engineering, 1992, *Final Report, Liquefaction Study, Marina District and Sullivan Marsh Area, San Francisco, California.*

Lawson, A.C., et al., 1908, *The California Earthquake of April 18, 1906: Report of the California State Earthquake Investigation Commission,* Publication No. 87, Carnegie Institute, Washington, D.C.

Makdisi, F.I., and Seed, H.B., 1978, *Simplified Procedure for Estimating Dam and Embankment Earthquake-Induced Deformations*, Journal of the Geotechnical Division, ASCE, Vol. 104, No. GT7, pp.849-867.

Mitchell, J.K., T. Masood, R.E. Kayen and R.B. Seed, 1990, *Soil Conditions and Earthquake Hazard Mitigation in the Marina District of San Francisco,* Earthquake Engineering Research Center Report No. UCB/EERC-90/08, Berkeley, California.

REFERENCES
(continued)

Miyajima, M. and M. Kitaura, 1989, *Effects of Liquefaction-Induced Ground Movement on Pipeline,* Proceedings from the Second U.S.-Japan Workshops on Liquefaction, Large Ground Deformation and Their Effects on Lifelines, Grand Island, New York, September, 26-29, 1989.

O'Rourke, T.D., H.E. Stewart, F.T. Blackburn, and T.S. Dickerman, 1990a, *Geotechnical and Lifeline Aspects of the October 17, 1989 Loma Prieta Earthquake in San Francisco,* Technical Report 90-001, National Center for Earthquake Engineering Research, Buffalo, New York.

O'Rourke, T.D., T.E. Gowdy, H.E. Stewart, and J.W. Pease, 1990b, *Lifeline Performance and Ground Deformations in the Marina During the 1989 Loma Prieta Earthquake,* Proceedings from the Third U.S.-Japan Workshop on Earthquake Resistant Design of Lifeline Facilities and Countermeasures for Soil Liquefaction, San Francisco, California, December 1990.

O'Rourke, T.D., J.W. Pease, and H.E. Stewart, 1992, *Lifeline Performance and Ground Deformation During the Earthquake,* U.S. Geological Survey Professional Paper 1551-F.

Sy, A., R.G. Campanella, and R.A. Stewart, *BPT-SPT Correlations for Evaluation of Liquefaction Resistance in Gravelly Soils,* Static and Dynamic Properties of Gravelly Soils, Geotechnical Special Publication No. 56.

Taylor, H.T., J.T. Cameron, S. Vahdani, and H. Yap, 1992, *Behavior of the Seawalls and Shoreline During the Earthquake,* U.S. Geological Survey Professional Paper 1551-F.

Towhata, I., K. Tokida, Y. Tamari, H. Matsumoto, and K. Yamada, 1990, *Prediction of Permanent Lateral Displacement of Liquefied Ground by Means of Variational Principle,* Proceedings from the Third Japan-U.S. Workshop on Earthquake Resistant Design of Lifeline Facilities and Countermeasures for Soil Liquefaction, San Francisco, California, December.

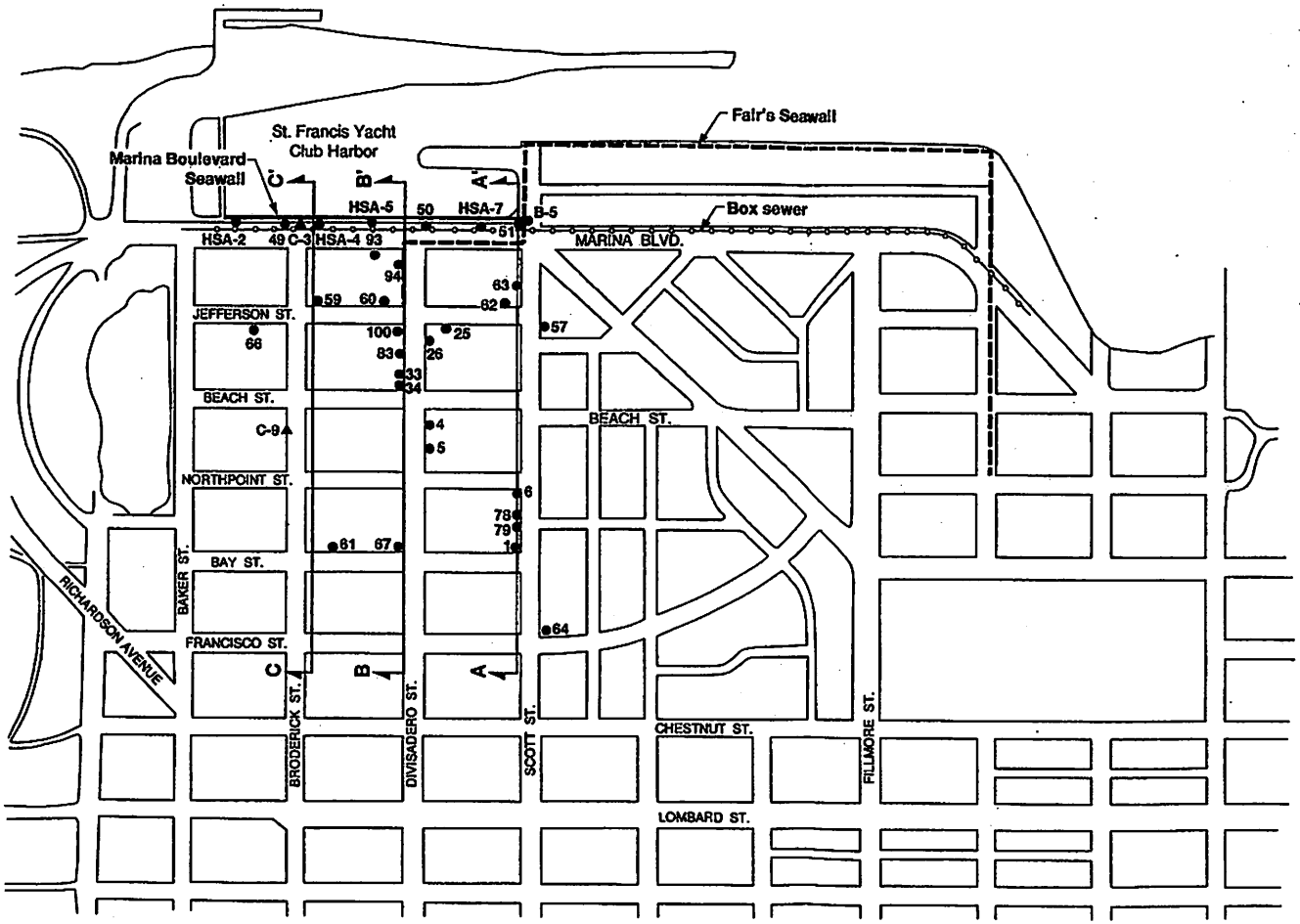
Towhata, I., S. Yasuda, K. Ohtomo, and K. Yamada, 1988, *Experimental Studies on Liquefaction-Induced Permanent Ground Displacement,* Proceedings from the First Japan-U.S. Workshop on Liquefaction, Large Ground Deformation, and Their Effects on Lifeline Facilities, pp. 81-92.

U.S. Geological Survey (1990), *Probabilities of Large Earthquakes in the San Francisco Bay Region, California,* by Working Group on California Earthquake Probabilities, U.S. Geological Survey, Circular 1053.

REFERENCES
(continued)

Whitman, R.V., 1990, *Seismic Design and Behavior of Gravity Walls,* Proceedings from a Conference on Design and Performance of Earth Retaining Structures, Cornell University, Ithaca, New York.

Youd, T.L. and S.N. Hoose, 1978, *Historic Ground Failures in Northern California Triggered by Earthquakes,* Geologic Survey Professional Paper 993, U.S. Government Printing Office, Washington, D.C.



EXPLANATION

1 ● Approximate location of borings drilled for other studies

C-9 ▲ Approximate location of cone penetration test for other studies

A A' Location of idealized subsurface profiles

N

0 500 Feet

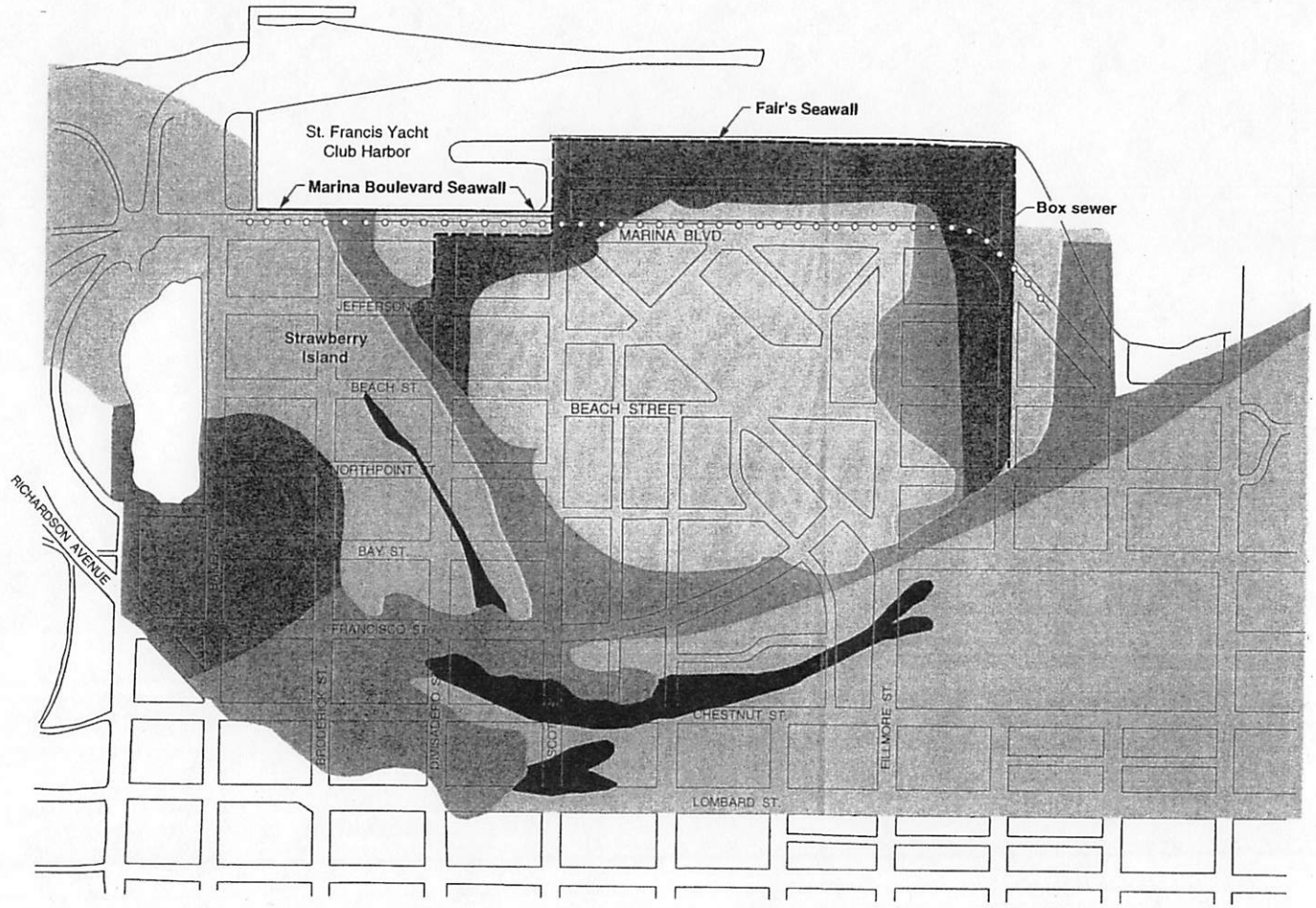
Approximate scale

MARINA BOULEVARD SEAWALL
San Francisco, California

GENERAL SITE PLAN

Project No. 1526.01 | Figure 1

Treadwell&Rollo



EXPLANATION

Artificial Fills

- 1912 - 1917 (Hydraulic Fill)
- 1906 - 1912
- 1895 - 1906
- 1869 - 1895
- 1851 - 1869

Native Deposits

- Sand

0 500 Feet

Approximate scale

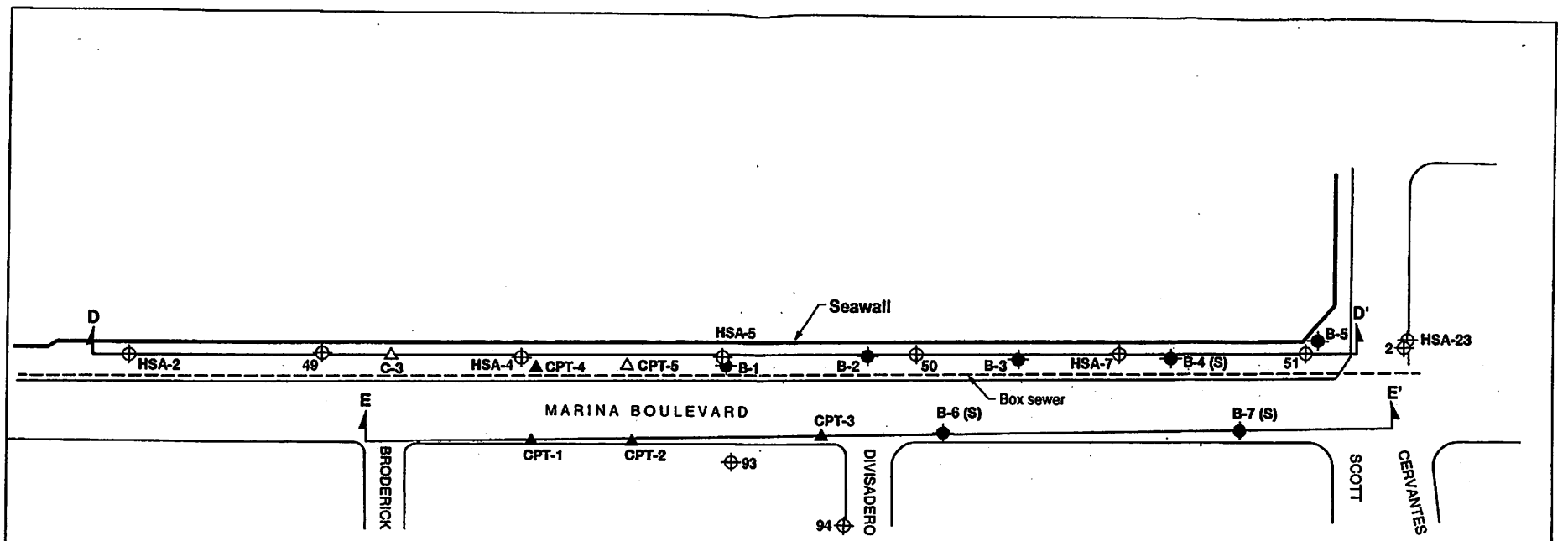
Reference: M.G. Bonilla, 1992; "Geologic and Historical Factors Affecting Earthquake Damage", U. S. Geological Survey Professional paper 1551-F

MARINA BOULEVARD SEAWALL
San Francisco, California

FILL HISTORY

Project No. 1526.02 | Figure 2

Treadwell&Rollo



EXPLANATION

CPT-1 ▲ Approximate location of cone penetration test for this study

B-1 ● Approximate location of test boring for this study; (S) indicates PVC casing installed in borehole for downhole seismic refraction survey

⊕ Approximate location of boring by others

△ Approximate location of cone penetration test by others

D D' Location of idealized subsurface profile

N

0 100 Feet

Approximate scale

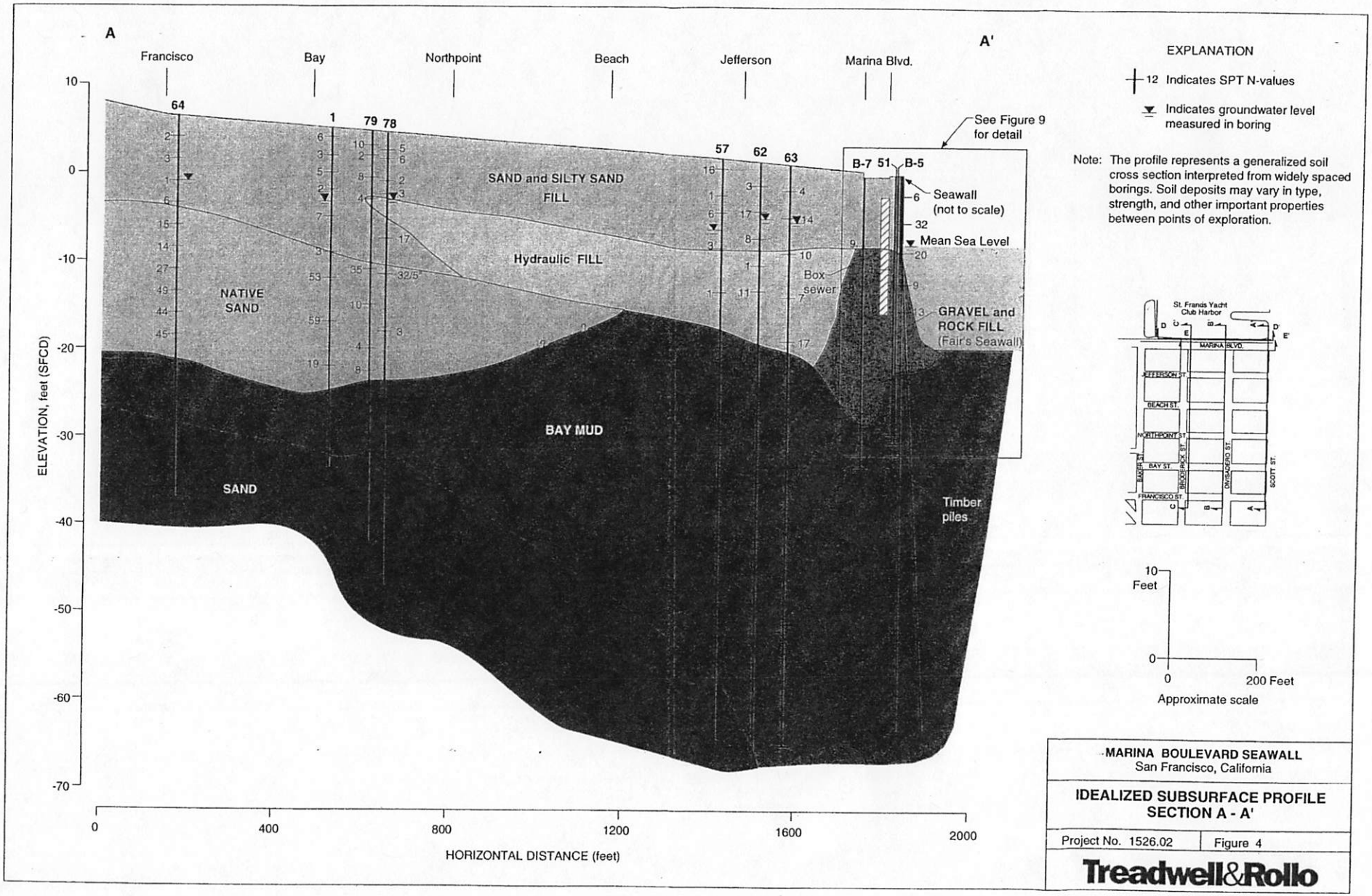
Reference: Plan and Profile, Marina Boulevard: Lyon to Divisadero, Sheet 4 of 68 and Plan and Profile, Marina Boulevard: Divisadero to Cervantes, Sheet 5 of 68

MARINA BOULEVARD SEAWALL
San Francisco, California

DETAILED SITE PLAN

Project No. 1526.02 | Figure 3

Treadwell&Rollo

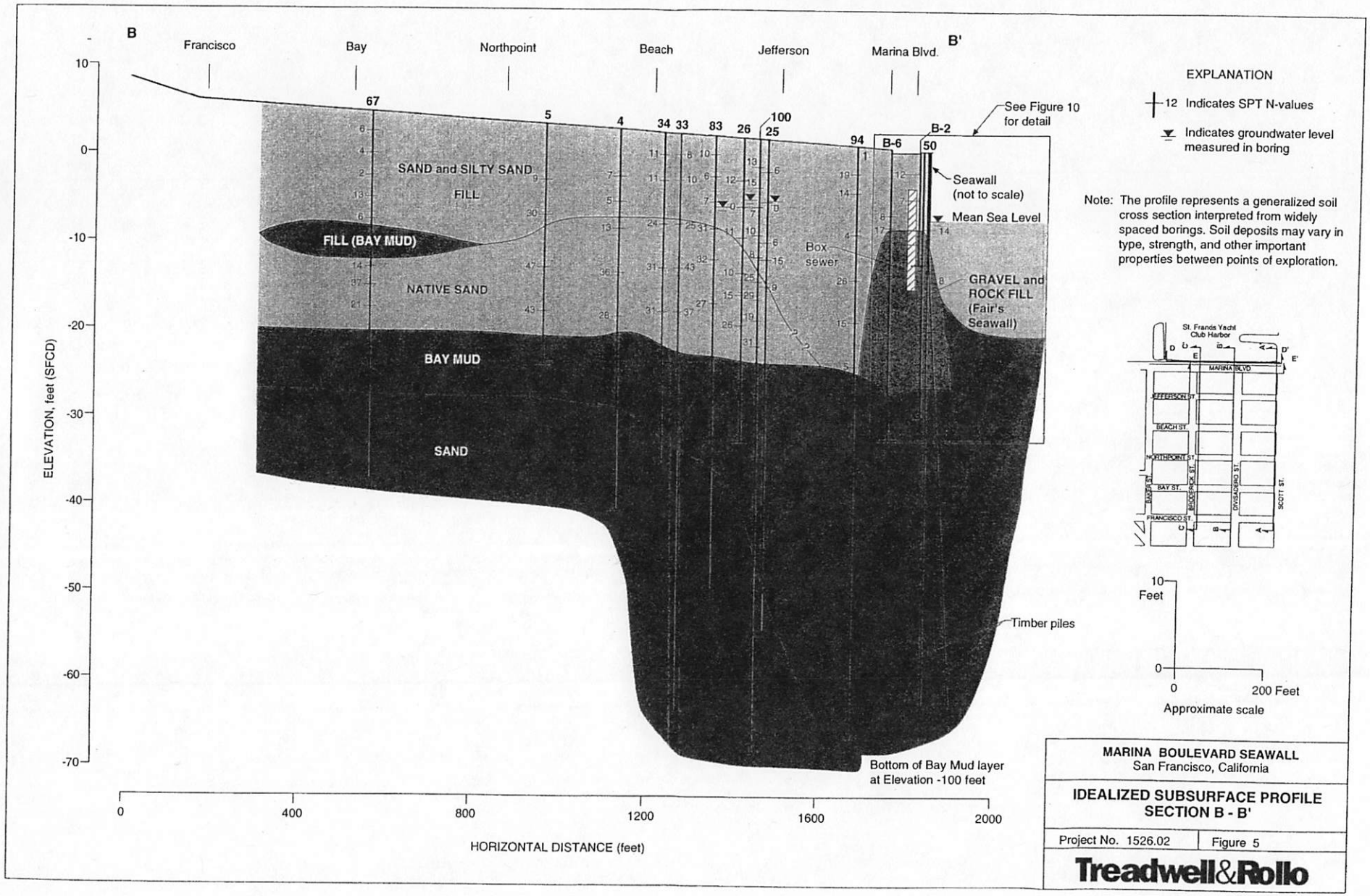


MARINA BOULEVARD SEAWALL
San Francisco, California

IDEALIZED SUBSURFACE PROFILE SECTION A - A'

Project No. 1526.02 | Figure 4

Treadwell&Rollo

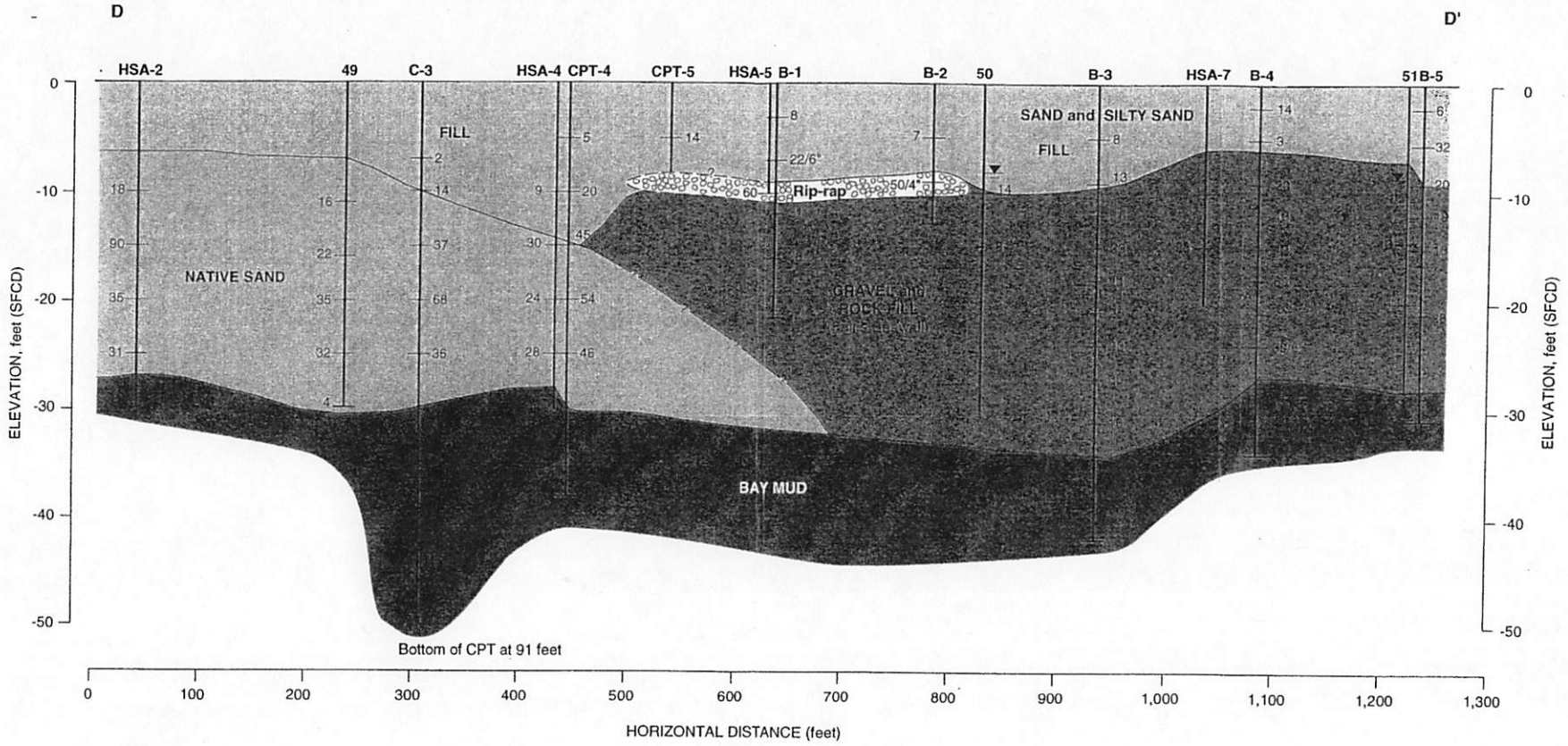


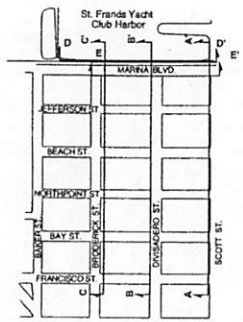
MARINA BOULEVARD SEAWALL
San Francisco, California

IDEALIZED SUBSURFACE PROFILE SECTION B - B'

Project No. 1526.02 | Figure 5

Treadwell&Rollo





EXPLANATION

12 Indicates SPT N-values (at CPT locations, SPT N-values estimated from CPT tip resistances)

Indicates groundwater level measured in boring

Note: The profile represents a generalized soil cross section interpreted from widely spaced borings. Soil deposits may vary in type, strength, and other important properties between points of exploration.

10 Feet

0 100 Feet

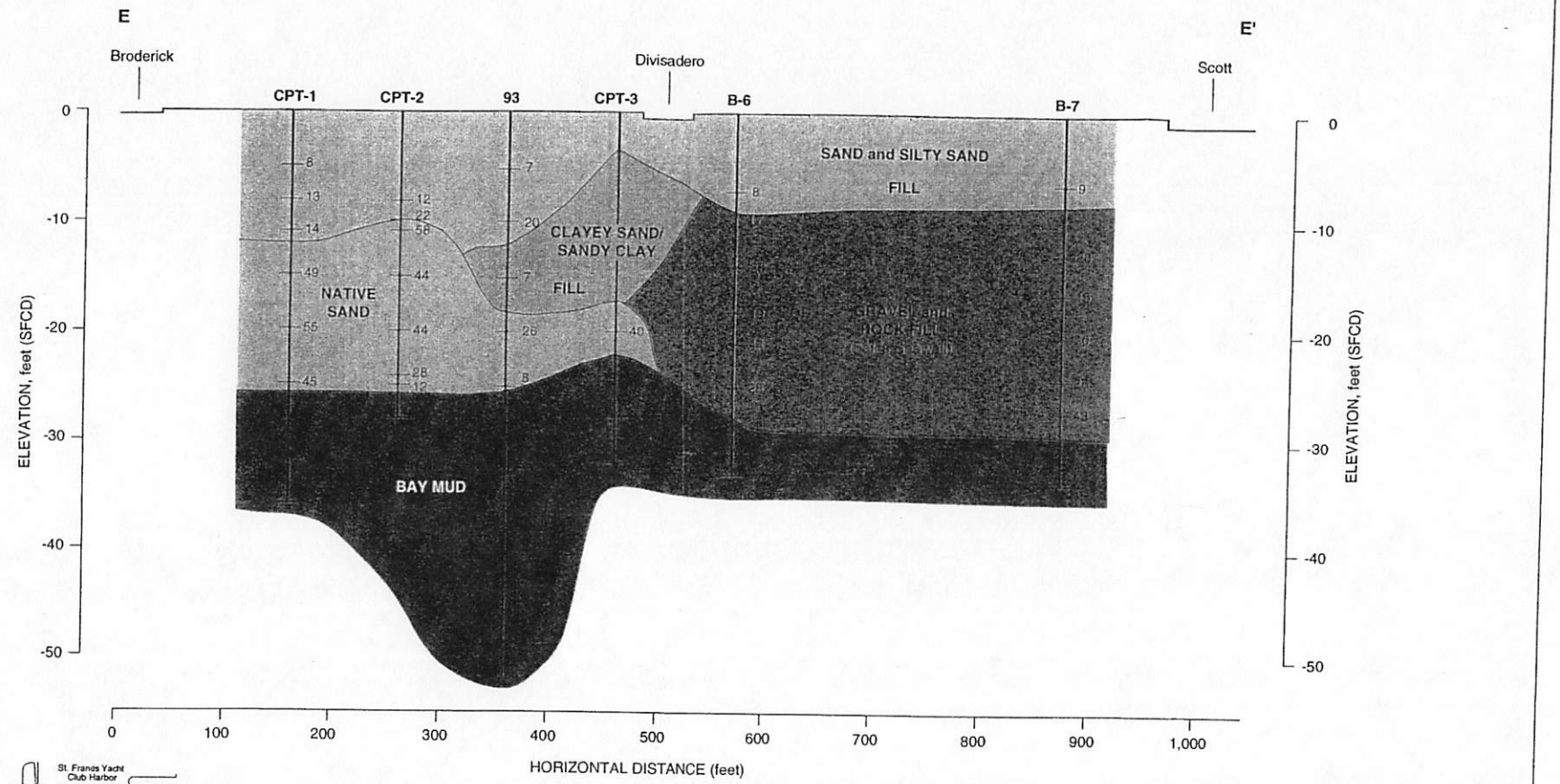
Approximate scale

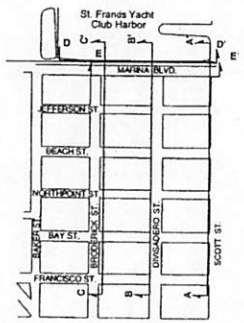
MARINA BOULEVARD SEAWALL
San Francisco, California

IDEALIZED SUBSURFACE PROFILE SECTION D - D'

Project No. 1526.02 | Figure 7

Treadwell&Rollo





EXPLANATION

12 Indicates SPT N-values (at CPT locations SPT N-values estimated from CPT tip resistances)

Note: The profile represents a generalized soil cross section interpreted from widely spaced borings. Soil deposits may vary in type, strength, and other important properties between points of exploration.

10 Feet

0 — 0 — 100 Feet

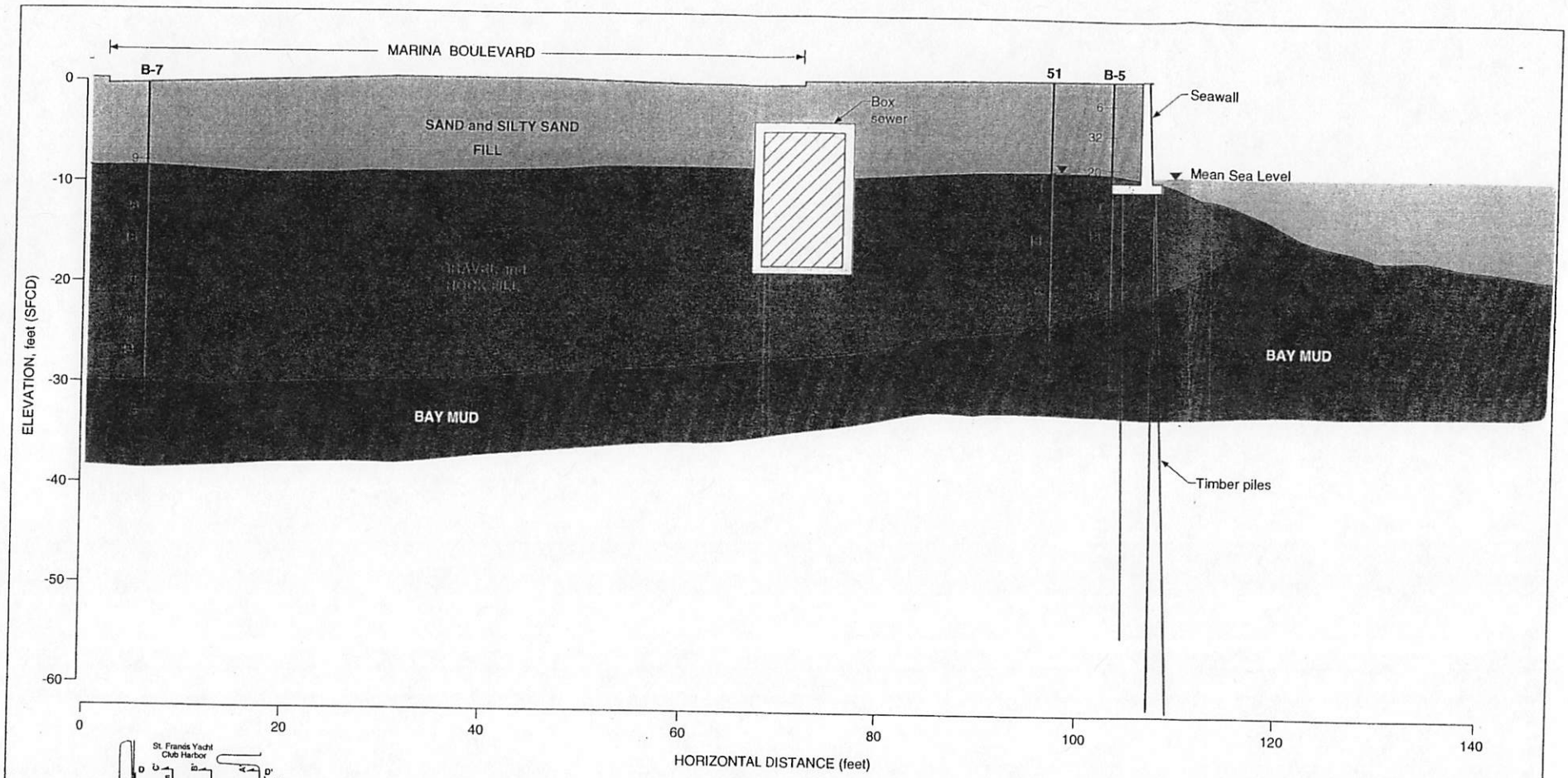
Approximate scale

MARINA BOULEVARD SEAWALL
San Francisco, California

IDEALIZED SUBSURFACE PROFILE SECTION E - E'

Project No. 1526.02 | Figure 8

Treadwell&Rollo

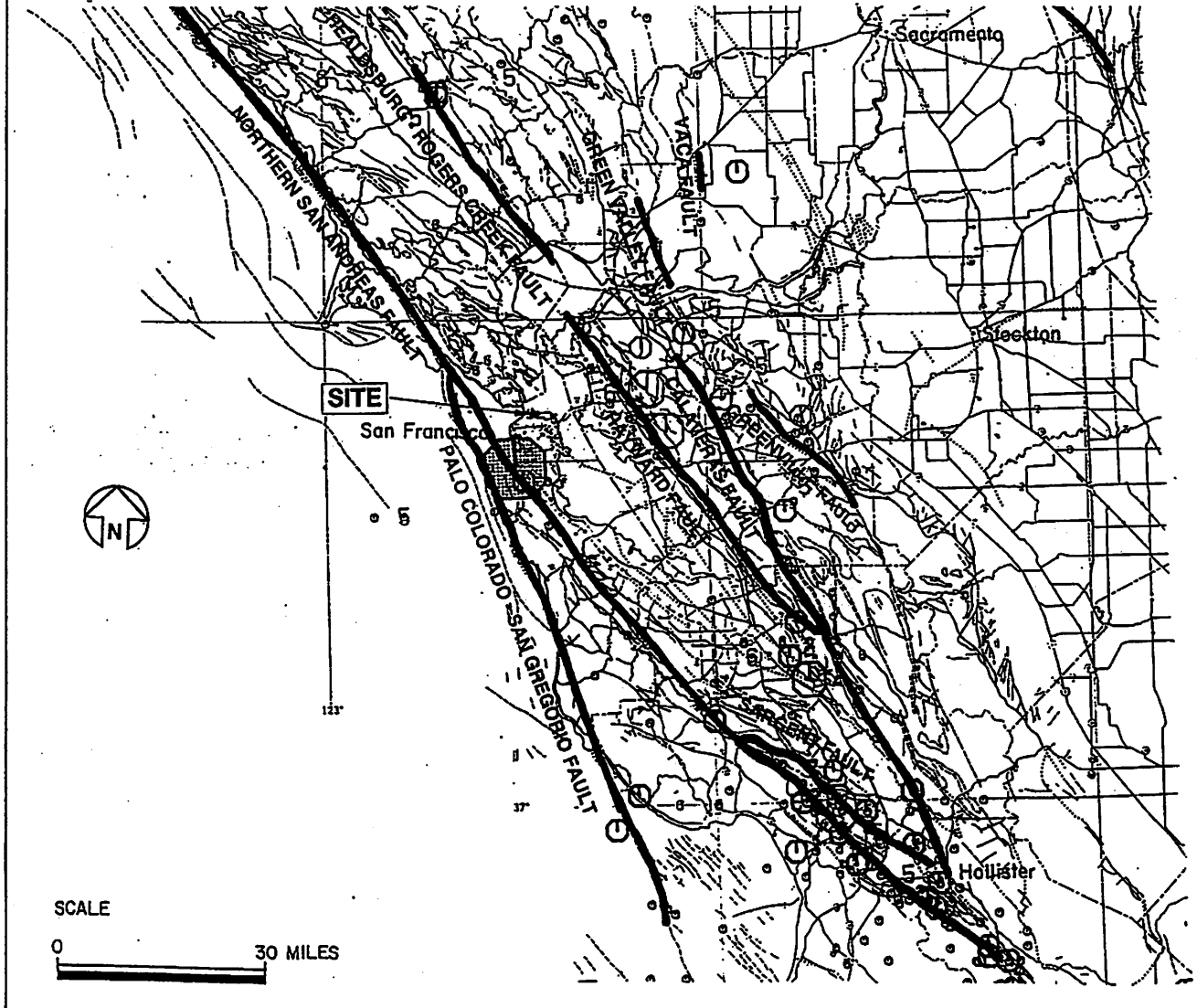


MARINA BOULEVARD SEAWALL
San Francisco, California

IDEALIZED SUBSURFACE PROFILE
DETAIL SECTION A - A'

Project No. 1526.02 | Figure 9

Treadwell&Rollo



MAGNITUDE

- 4.0 TO 4.9
- 5.0 TO 5.9
- 6.0 TO 6.9
- 7.0 TO 7.9
- 8.0 OR GREATER

INTEGER ..... MAXIMUM REPORTED INTENSITY (only for earthquakes of UNKNOWN magnitude)

REFERENCES:

(1) Fault Map of California (1975).

(2) Earthquake Epicenter Map of California, (1978).

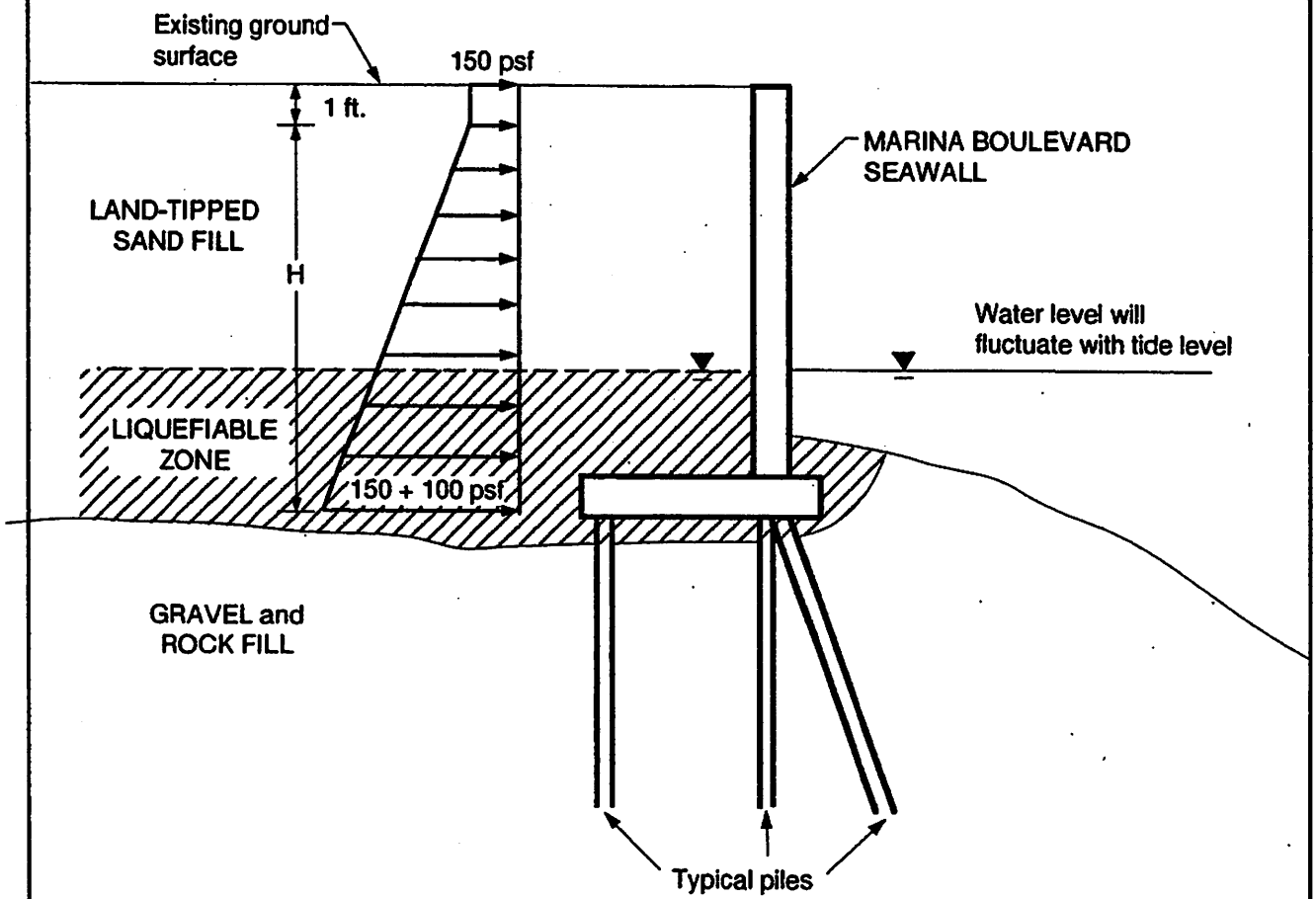
(3) Seismicity of California, 1808-1987 (1988).

MARINA BOULEVARD SEAWALL
San Francisco, California

MAP OF EARTHQUAKE EPICENTERS AND MAJOR FAULTS IN THE BAY AREA, CALIFONRIA

Project No. 1526.02 | Figure 11

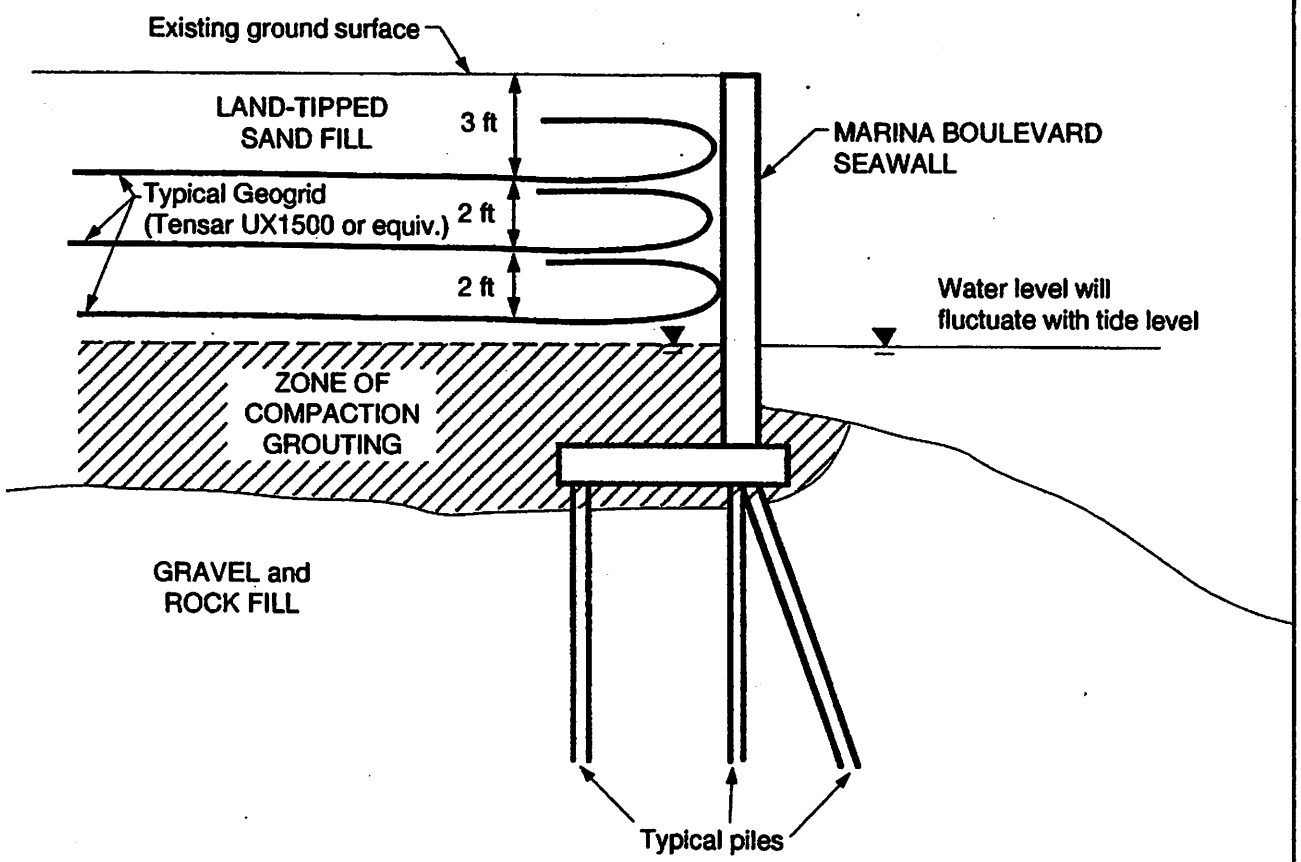
Treadwell&Rollo



Not to scale

Note: All pressures are in pounds per square foot (psf) and H is in feet

MARINA BOULEVARD SEAWALL San Francisco, California	**DYNAMIC LATERAL EARTH PRESSURES**
Treadwell&Rollo	Project No. 1526.02 | Figure 12



Not to scale

Notes:
1. Compaction grouting should be performed prior to placing the geogrid.
2. The geogrid should extend at least 15 feet away from the wall and should overlap at least 5 feet at the seawall face.
3. The geogrid layer should be prestressed by stretching prior to covering with fill.

MARINA BOULEVARD SEAWALL
San Francisco, California

SOIL IMPROVEMENTS BEHIND THE SEAWALL

Treadwell&Rollo

Project No. 1526.02 | Figure 13

Treadwell&Rollo

APPENDIX A

Log of Test Borings

PROJECT: **MARINA BOULEVARD SEAWALL**
San Francisco, California

Log of Boring B-1

Boring location: See Figure 2, Site Plan
Logged by J. Gouchon
Date started: 4/4/96 | Date finished: 4/4/96
Drilling method: Rotary wash
Hammer weight: 140 lbs. | Drop: 30 inches
Sampler: Standard Penetration Test (SPT), Sprague & Henwood (S&H), Shelby tube

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION (Ground Surface Elevation: 0 feet [2])	STRENGTH: Type of Strength Test	STRENGTH: Test Surcharge Pressure Lbs/Sq Ft	DATA: Fines %	DATA: Shear Strength Lbs/Sq Ft	MOISTURE-DENSITY DATA: Natural Moisture Content	MOISTURE-DENSITY DATA: Dry Density Lbs/Cu Ft
1–4	1		8	SP	2 inches Asphalt Concrete over 10 to 12 inches Aggregate Base SAND (SP) brown, loose, moist to wet sieve analysis, see Figure D-1			2.5		3.3	107
7–8	2		27 / 6"								
8–9				GP	GRAVEL (GP) black/gray, wet, angular with rock fragments						
9–11					COBBLES (seawall rip-rap) driller used 4-inch-diameter core barrel from 10 to 11.5 feet FILL						
12–13	3		31	GW	GRAVEL with SAND (GW) brown, medium dense to dense, wet, with rock fragments 1- to 2-inch size sieve analysis, see Figure D-1			4.4		7.3	132
17	4	●	28								
21	5		24								
22					Boring terminated at a depth of 21.5 feet. Boring backfilled with bentonite grout.						

[1] S&H blow counts converted to SPT N-values.

[2] San Francisco City Datum.

PROJECT: **MARINA BOULEVARD SEAWALL**
San Francisco, California

Log of Boring B-2

Boring location: See Figure 2, Site Plan

Logged by M. Oman

Date started: 4/4/96 | Date finished: 4/4/96

Drilling method: Rotary wash

Hammer weight: 140 lbs. | Drop: 30 inches

Sampler: Standard Penetration Test (SPT), Sprague & Henwood (S&H), Shelby tube

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	STRENGTH: Type of Strength Test	STRENGTH: Test Surcharge Pressure Lbs/Sq Ft	DATA: Fines %	DATA: Shear Strength Lbs/Sq Ft	MOISTURE-DENSITY DATA: Natural Moisture Content	MOISTURE-DENSITY DATA: Dry Density Lbs/Cu Ft
					Ground Surface Elevation: 0 feet [2]						
1					2 inches Asphalt Concrete over 6 inches Aggregate Base						
2				SP	SAND (SP) tan, loose to medium dense, moist to wet, with pieces of black mica						
3	1		12	SP						3.0	114
4				SP							
5				SP							
6	2		7	SP						6.1	
7				SP	FILL						
8					COBBLES concrete rubble (seawall rip-rap)						
9	3		50/4"								
10											
11				GP	GRAVEL (GP) brown, medium dense, saturated						
12				GP							
13				GP	refusal at 13 feet						
14					Boring terminated at a depth of 13 feet. Boring backfilled with bentonite grout.						
15					[1]S&H blow counts converted to SPT N-values.						
16					[2]San Francisco City Datum.						
17											
18											
19											
20											
21											
22											
23											
24											
25											
26											
27											
28											
29											
30											

PROJECT: **MARINA BOULEVARD SEAWALL**
San Francisco, California

Log of Boring B-3

Boring location: See Figure 2, Site Plan
Logged by M. Oman
Date started: 4/2/96 | Date finished: 4/3/96
Drilling method: Rotary wash
Hammer weight: 140 lbs. | Drop: 30 inches
Sampler: Standard Penetration Test (SPT), Sprague & Henwood (S&H), Shelby tube

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	STRENGTH: Type of Strength Test	STRENGTH: Test Surcharge Pressure Lbs/Sq Ft	DATA: Fines %	DATA: Shear Strength Lbs/Sq Ft	MOISTURE-DENSITY DATA: Natural Moisture Content	MOISTURE-DENSITY DATA: Dry Density Lbs/Cu Ft
					Ground Surface Elevation: 0 feet [2]						
1					3 inches Asphalt Concrete over 8 inches Aggregate Base						
2	1	X	11	SW	SAND with GRAVEL (SW) tan, loose to medium dense, moist to wet						
3											
4											
5											
6	2		8		sieve analysis, see Figure D-1			2.2		4.5	112
7											
8											
9											
10	3		13	GW	GRAVEL with SAND (GW) brown, medium dense, wet						
11											
12											
13	4		16								
14				GW-GM	GRAVEL with SAND and SILT (GW - GM) red/green, medium dense, wet, with rock fragments up to 2 1/2-inch diameter (serpentine/shale) FILL						
15											
16	5		23								
17											
18					no recovery at 18 feet						
19	6	●	11								
20											
21											
22	7		25							8.4	119
23											
24											
25	8		20		sieve analysis, see Figure D-1			5.1			
26											
27											
28	9		30								
29											
30											

PROJECT: **MARINA BOULEVARD SEAWALL**
San Francisco, California

Log of Boring B-3

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	STRENGTH: Type of Strength Test	STRENGTH: Test Surcharge Pressure Lbs/Sq Ft	DATA: Fines %	DATA: Shear Strength Lbs/Sq Ft	MOISTURE-DENSITY DATA: Natural Moisture Content	MOISTURE-DENSITY DATA: Dry Density Lbs/Cu Ft
31–34	10		16	GW-GM	GRAVEL with SAND and SILT (GW - GM) FILL			3.1		15.6	107
34–43	11		100 psi	CH	CLAY (CH) black, soft, wet, with sand, shells, and trace of organics BAY MUD						
41–42	12		50-75 psi								
43–60					Boring terminated at a depth of 42.5 feet. Boring backfilled with cement grout. [1]S&H blow counts converted to SPT N-values. [2]San Francisco City Datum.						

PROJECT: **MARINA BOULEVARD SEAWALL**
San Francisco, California

Log of Boring B-4

Boring location: See Figure 2, Site Plan
Logged by L. Gilpin
Date started: 4/1/96 | Date finished: 4/1/96
Drilling method: Rotary wash
Hammer weight: 140 lbs. | Drop: 30 inches
Sampler: Standard Penetration Test (SPT), Sprague & Henwood (S&H), Shelby tube

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	STRENGTH DATA: Type of Strength Test	STRENGTH DATA: Test Surcharge Pressure Lbs/Sq Ft	STRENGTH DATA: Fines %	STRENGTH DATA: Shear Strength Lbs/Sq Ft	MOISTURE-DENSITY DATA: Natural Moisture Content	MOISTURE-DENSITY DATA: Dry Density Lbs/Cu Ft
					Ground Surface Elevation: 0 feet [2]						
0					2 inches Asphalt Concrete over 6 inches Aggregate Base						
1–2–3	1	■	14	SW	SAND (SW) brown, medium dense, moist to wet						
4–5–6–7	2	⊠	3	SW	very loose at 5 feet						
8–9–10	3	■	20	GP	GRAVEL (GP) reddish brown, medium dense to very dense, wet, with occasional cobbles and some sand						
11–12–13		●	13	GP	no recovery at 12 feet						
14–15–16	4	■	12	GP	FILL						
17–18–19	5	■	60	GP							
20–21–22	6	■	22	GP	sieve analysis, see Figure D-1			7.7		12.0	117.4
23–24–25	7	■	30/6"	GP							
26–27–28				CH	CLAY (CH) dark gray, soft, wet, with sand and shells						
29–30				CH	BAY MUD						

PROJECT: **MARINA BOULEVARD SEAWALL**
San Francisco, California

Log of Boring B-4

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/foot[1]	LITHOLOGY	MATERIAL DESCRIPTION	STRENGTH: Type of Strength Test	STRENGTH: Test Surcharge Pressure Lbs/Sq Ft	DATA: Fines %	DATA: Shear Strength Lbs/Sq Ft	MOISTURE-DENSITY DATA: Natural Moisture Content	MOISTURE-DENSITY DATA: Dry Density Lbs/Cu Ft
31					CLAY (CH) (continued)						
32					BAY MUD						
33	8		50 - 100 psi	CH							
34											
35					Boring terminated at a depth of 34.5 feet. 3-inch-diameter closed PVC casing installed to 34 feet. Annular space between pipe and casing backfilled with grout from 26 to 34.5 feet. Remainder of annular space backfilled with Monterey No. 3 sand.						
36											
37											
38											
39											
40					[1] S&H blow counts converted to SPT N-values.						
41											
42					[2] San Francisco City Datum.						
43											
44											
45											
46											
47											
48											
49											
50											
51											
52											
53											
54											
55											
56											
57											
58											
59											
60											

PROJECT: **MARINA BOULEVARD SEAWALL**
San Francisco, California

Log of Boring B-5

Boring location: See Figure 2, Site Plan

Logged by L. Gilpin/M. Oman

Date started: 4/1/96 | Date finished: 4/1/96

Drilling method: Rotary wash

Hammer weight: 140 lbs. | Drop: 30 inches

Sampler: Standard Penetration Test (SPT), Sprague & Henwood (S&H), Shelby tube

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	STRENGTH: Type of Strength Test	STRENGTH: Test Surcharge Pressure Lbs/Sq Ft	DATA: Fines %	DATA: Shear Strength Lbs/Sq Ft	MOISTURE-DENSITY DATA: Natural Moisture Content	MOISTURE-DENSITY DATA: Dry Density Lbs/Cu Ft
					Ground Surface Elevation: 0 feet [2]						
1					2 inches Asphalt Concrete over 6 inches Aggregate Base						
2	1		6	SM	SILTY SAND (SM) dark brown, loose, moist to wet, moist, with brick fragments						
3											
4											
5											
6	2		82		bricks and cobbles from 5.5 to 7 feet						
7											
8											
9	3		20	GW	GRAVEL (GW) dark brown, medium dense, wet, with brick fragments and chert						
10											
11											
12	4		19		grading to gray at 12 feet						
13					sieve analysis, see Figure D-1			3.1			
14											
15	5		13								
16											
17											
18											
19											
20											
21											
22	6		23								
23				CH	CLAY (CH) dark gray, soft, wet						
24											
25											
26											
27											
28											
29											
30											

FILL

BAY MUD

PROJECT: **MARINA BOULEVARD SEAWALL**
San Francisco, California

Log of Boring B-5

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/foot[1]	LITHOLOGY	MATERIAL DESCRIPTION	STRENGTH: Type of Strength Test	STRENGTH: Test Surcharge Pressure Lbs/Sq Ft	DATA: Fines %	DATA: Shear Strength Lbs/Sq Ft	MOISTURE-DENSITY DATA: Natural Moisture Content	MOISTURE-DENSITY DATA: Dry Density Lbs/Cu Ft
31	7	■	800 psi (Refusal)	CH	CLAY (CH) (continued) — BAY MUD Boring terminated at a depth of 30.5 feet. [1] S&H blow counts converted to SPT N-values. [2]San Francisco City Datum.						
32											
33											
34											
35											
36											
37											
38											
39											
40											
41											
42											
43											
44											
45											
46											
47											
48											
49											
50											
51											
52											
53											
54											
55											
56											
57											
58											
59											
60											

PROJECT: **MARINA BOULEVARD SEAWALL**
San Francisco, California

Log of Boring B-6

Boring location: See Figure 2, Site Plan
Logged by J. Gouchon
Date started: 4/3/96 | Date finished: 4/3/96
Drilling method: Rotary wash
Hammer weight: 140 lbs. | Drop: 30 inches
Sampler: Sprague & Henwood (S&H), Shelby tube

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	STRENGTH: Type of Strength Test	STRENGTH: Test Surcharge Pressure Lbs/Sq Ft	DATA: Fines %	DATA: Shear Strength Lbs/Sq Ft	MOISTURE-DENSITY DATA: Natural Moisture Content	MOISTURE-DENSITY DATA: Dry Density Lbs/Cu Ft
					Ground Surface Elevation: 0 feet [2]						
1					4 inches Asphalt Concrete over 4 inches Aggregate Base						
2				SM	SILTY SAND (SM) brown, moist, with bricks and gravel						
3											
4				CL	SANDY CLAY (CL) brown, moist, with brick and gravel						
5					SILTY SAND (SM) brown, loose, moist to wet, with brick rubble cobbles and bricks from 5 to 6 feet						
6											
7				SM							
8	1	●	8								
9											
10	2		17		CLAYEY GRAVEL (GC) brown, medium dense, wet, angular, with rock fragments			18.1		13.6	124
11											
12											
13											
14				GC							
15	3		28								
16											
17											
18					GRAVEL (GP) gray, medium dense to dense, wet, 1/2- to 2-inch size gravels						
19	4		19								
20											
21											
22	5		44	GP							
23											
24											
25											
26	6		28								
27											
28											
29	7			CH	CLAY (CH) black/dark gray, soft, wet, with sand and shell fragments						
30											

FILL

BAY MUD

PROJECT: **MARINA BOULEVARD SEAWALL**
San Francisco, California

Log of Boring B-6

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	STRENGTH: Type of Strength Test	STRENGTH: Test Surcharge Pressure Lbs/Sq Ft	DATA: Fines %	DATA: Shear Strength Lbs/Sq Ft	MOISTURE-DENSITY DATA: Natural Moisture Content	MOISTURE-DENSITY DATA: Dry Density Lbs/Cu Ft
31–33	8		100 psi	CH	CLAY (CH) (continued) BAY MUD						
34–60					Boring terminated at a depth of 33 feet. 3-inch-diameter closed PVC casing installed to a depth of 25 feet below ground surface. Annular space backfilled with Monterey No. 3 sand. [1] S&H blow counts converted to SPT N-values. [2]San Francisco City Datum.						

PROJECT: **MARINA BOULEVARD SEAWALL**
San Francisco, California

Log of Boring B-7

Boring location: See Figure 2, Site Plan
Logged by J. Gouchon
Date started: 4/4/96 | Date finished: 4/4/96
Drilling method: Rotary wash
Hammer weight: 140 lbs. | Drop: 30 inches
Sampler: Sprague & Henwood (S&H), Shelby tube

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	STRENGTH: Type of Strength Test	STRENGTH: Test Surcharge Pressure Lbs/Sq Ft	DATA: Fines %	DATA: Shear Strength Lbs/Sq Ft	MOISTURE-DENSITY DATA: Natural Moisture Content	MOISTURE-DENSITY DATA: Dry Density Lbs/Cu Ft
					Ground Surface Elevation: 0 feet [2]						
1					4 inches Asphalt Concrete over 4 inches Aggregate Base						
2				SC	CLAYEY SAND (SC) brown, moist, with brick and rock fragments, and occasional sand lenses						
3											
4											
5				SM	SILTY SAND (SM) brown, loose, moist to wet, with brick rubble grading with cobbles and bricks at 5 feet						
6											
7					▼ 9:30 A.M. 4/4/96						
8	1		9		sieve analysis, see Figure D-1			14.0		9.3	
9				GC	CLAYEY GRAVEL with SAND (GC) brown, loose to medium dense, wet						
10											
11											
12											
13			28								
14	2				FILL						
15											
16											
17	3		15							9.0	135
18											
19				GW	GRAVEL with SAND and SILT (GW) brown, black, and green, medium dense, wet, with rock fragments						
20											
21	4		20							12.3	121
22											
23					cobbles from 23 to 24 feet						
24											
25	5	●	26	GC	CLAYEY GRAVEL (GC) brown, medium dense to dense, wet with some sand and clayey sand lenses						
26											
27											
28	6		43								
29											
30				SC	CLAYEY SAND (SC) dark gray, loose, wet, with sand and shells						
					BAY MUD						

PROJECT: **MARINA BOULEVARD SEAWALL**
San Francisco, California

Log of Boring B-7

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/foot [1]	LITHOLOGY	MATERIAL DESCRIPTION	STRENGTH: Type of Strength Test	STRENGTH: Test Surcharge Pressure Lbs/Sq Ft	DATA: Fines %	DATA: Shear Strength Lbs/Sq Ft	MOISTURE-DENSITY DATA: Natural Moisture Content	MOISTURE-DENSITY DATA: Dry Density Lbs/Cu Ft
31–33	7		100 psi	SC	CLAYEY SAND (SC) (continued) BAY MUD	TxUU	1300	35.5	380	28.3	94
34–60					Boring terminated at a depth of 33.5 feet. 3-inch-diameter closed PVC casing set to depth of 31 feet. Annulus backfilled with Monterey No. 3 sand. Top of casing capped.						

[1] S&H blow counts converted to SPT N-values.

[2] San Francisco City Datum.

Unified Soil Classification System

Major Divisions		Symbols	Typical Names
Coarse-Grained Soils (more than half of soil > no. 200 sieve size)	Gravels (More than half of coarse fraction > no. 4 sieve size)	GW	Well-graded gravels or gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines
		GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
	Sands (More than half of coarse fraction < no. 4 sieve size)	SW	Well-graded sands or gravelly sands, little or no fines
		SP	Poorly-graded sands or gravelly sands, little or no fines
		SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
Fine -Grained Soils (more than half of soil < no. 200 sieve size)	Silts and Clays LL = < 50	ML	Inorganic silts and very fine sands, rock flour, silty fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays LL = > 50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of high plasticity, organic silty clays, organic silts
Highly Organic Soils		Pt	Peat and other highly organic soils

Grain Size Chart

Classification	Range of Grain Sizes	
	U.S. Standard Sieve Size	Grain Size in Millimeters
Boulders	Above 12"	Above 305
Cobbles	12" to 3"	305 to 76.2
Gravel	3" to No. 4	76.2 to 4.76
coarse	3" to 3/4"	76.2 to 19.1
fine	3/4" to No. 4	19.1 to 4.76
Sand	No. 4 to No. 200	4.76 to 0.074
coarse	No. 4 to No. 10	4.76 to 2.00
medium	No. 10 to No. 40	2.00 to 0.420
fine	No. 40 to No. 200	0.420 to 0.074
Silt and Clay	Below No. 200	Below 0.074

Sample Designation

- Sample driven with Sprague & Henwood (3-inch outside diameter) sampler. Darkened area indicates sample obtained
- Classification sample taken with Standard Penetration Test (2-inch outside diameter) sampler
- Undisturbed sample taken with 3-inch outside diameter Shelby tube or Pitcher barrel
- Attempted sample with no recovery

MARINA BOULEVARD SEAWALL
San Francisco, California

CLASSIFICATION CHART

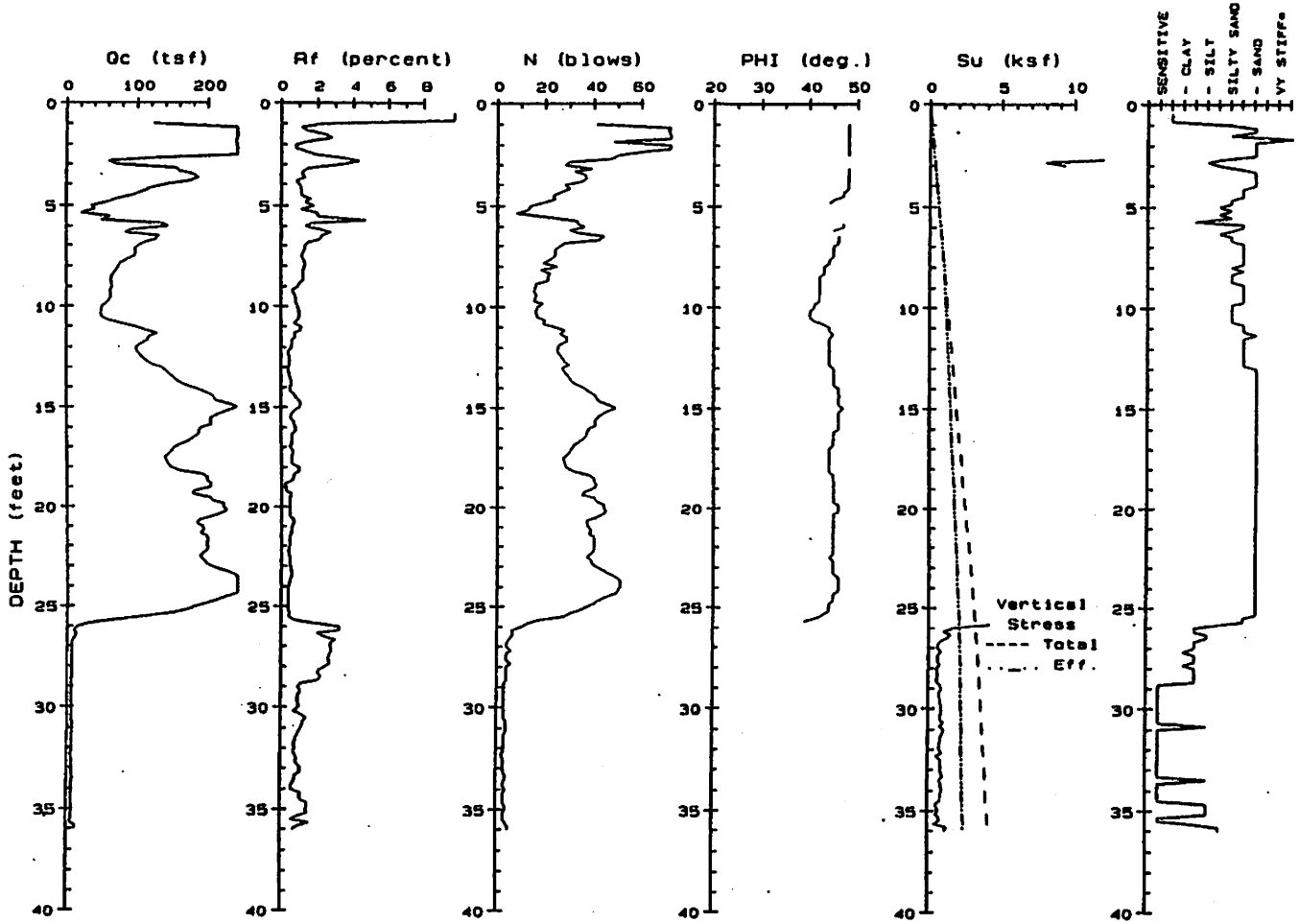
Treadwell&Rollo

Project No. 1526.02 | Figure A-13

Treadwell&Rollo

APPENDIX B

Summary of CPT Results



Date: 4/2/96

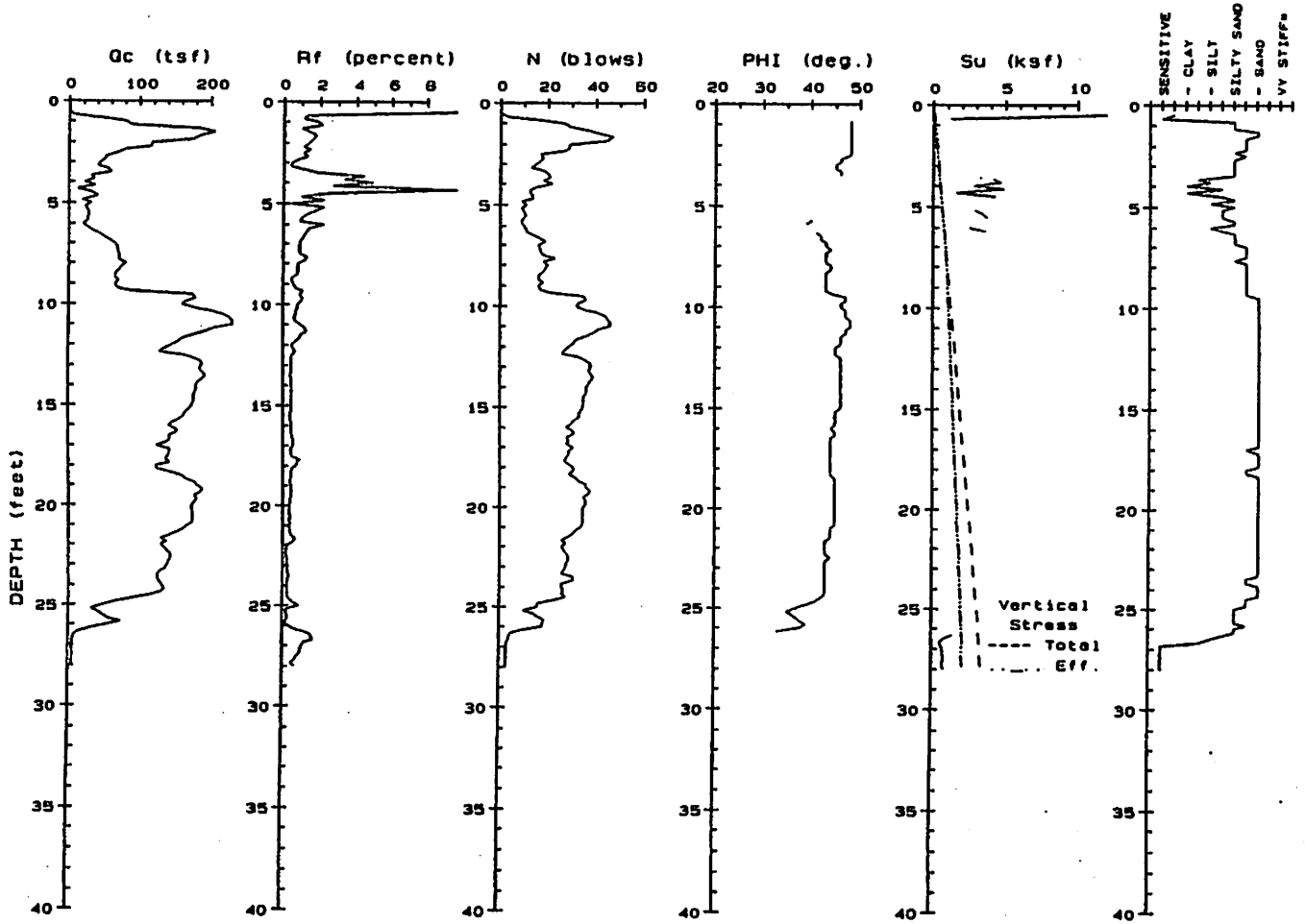
Elevation: 0 feet (San Francisco City Datum)

MARINA BOULEVARD SEAWALL
San Francisco, California

SUMMARY OF CPT RESULTS
CPT-1

Project No. 1526.02	Figure B-1

Treadwell&Rollo



Date: 4/3/96

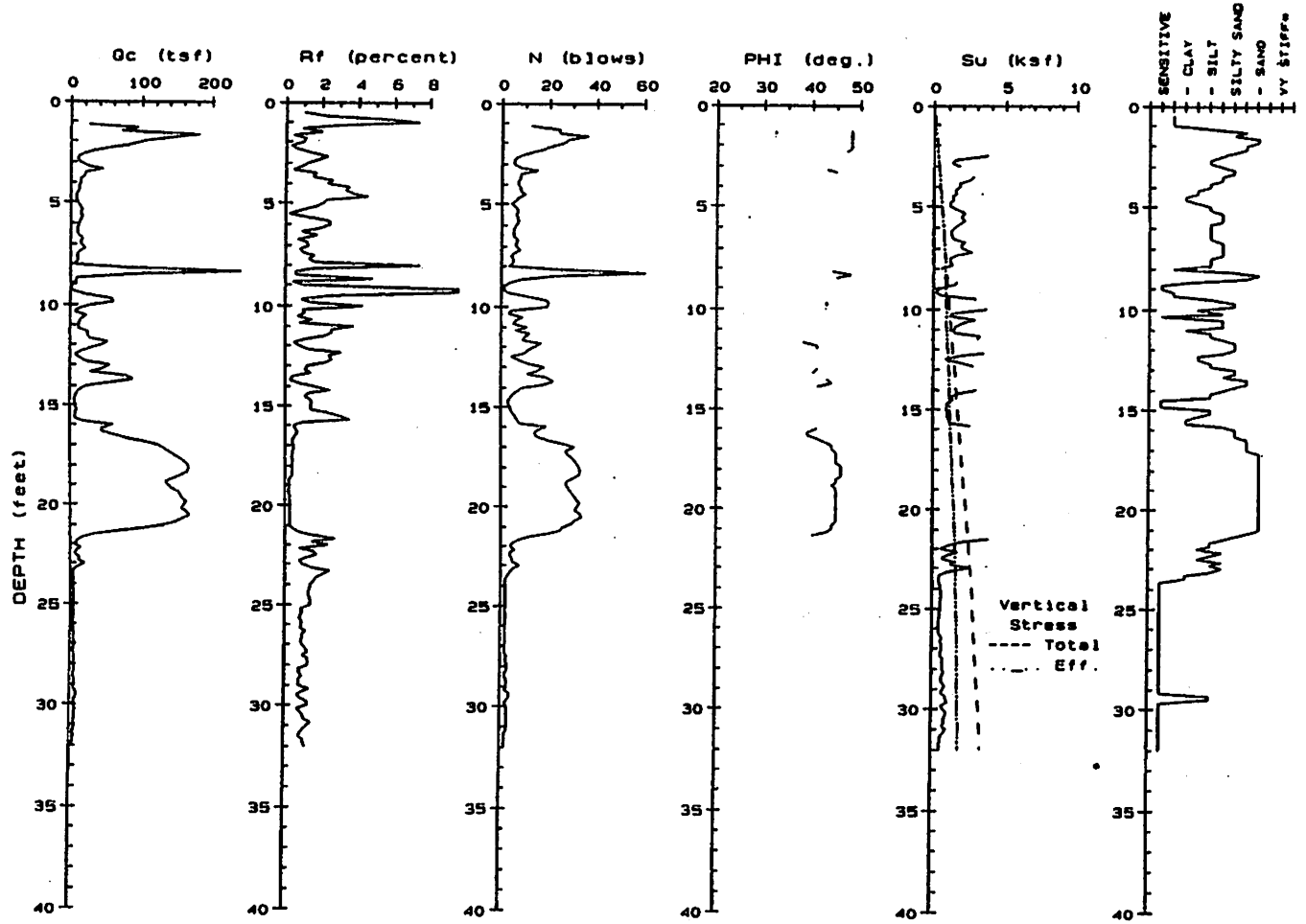
Elevation: 0 feet (San Francisco City Datum)

MARINA BOULEVARD SEAWALL
San Francisco, California

SUMMARY OF CPT RESULTS
CPT-2

Project No. 1526.02 | Figure B-2

Treadwell&Rollo



Date: 4/3/96

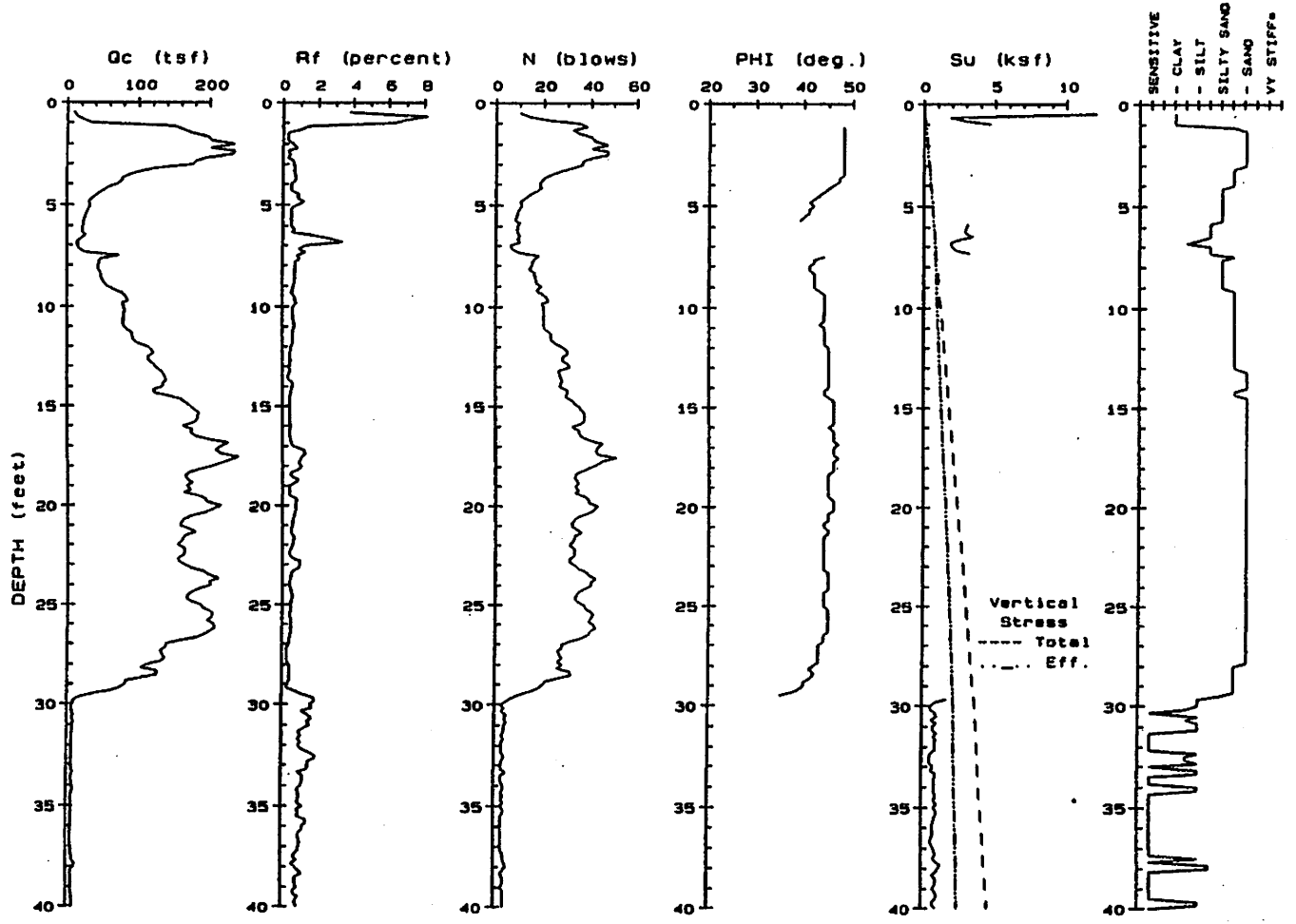
Elevation: 0 feet (San Francisco City Datum)

MARINA BOULEVARD SEAWALL
San Francisco, California

SUMMARY OF CPT RESULTS
CPT-3

Project No. 1526.02 | Figure B-3

Treadwell&Rollo



MARINA BOULEVARD SEAWALL
San Francisco, California

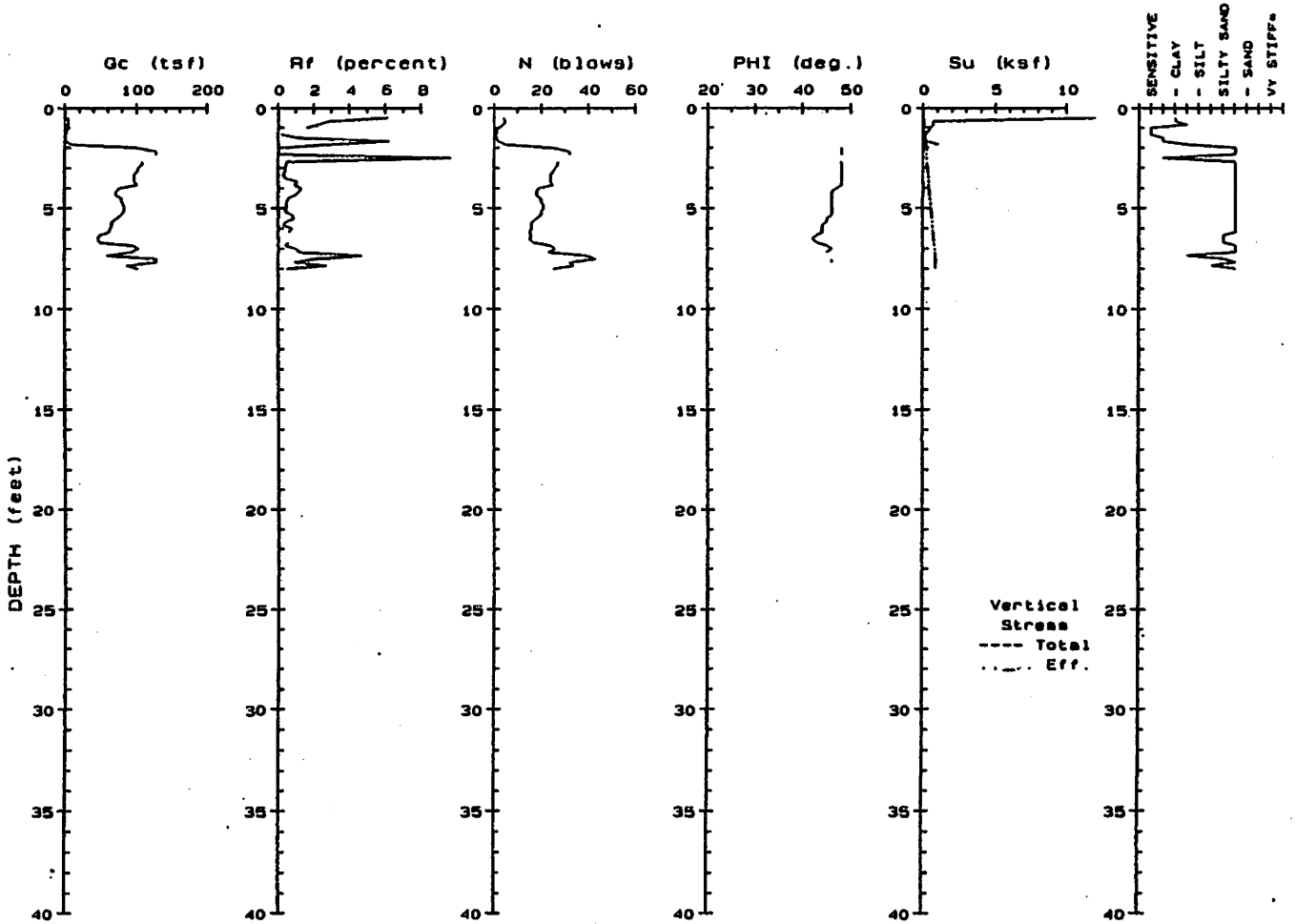
SUMMARY OF CPT RESULTS
CPT-4

Project No. 1526.02	Figure B-4

Date: 4/2/96

Elevation: 0 feet (San Francisco City Datum)

Treadwell&Rollo



Refusal at 8 feet

Date: 4/3/96

Elevation: 0 feet (San Francisco City Datum)

MARINA BOULEVARD SEAWALL
San Francisco, California

SUMMARY OF CPT RESULTS
CPT-5

Project No. 1526.02	Figure B-5

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APPENDIX C

Geophysical Survey Results

NORCAL GEOPHYSICAL CONSULTANTS INC.

May 14, 1996

Treadwell and Rollo
555 Montgomery Street, Suite 1300
San Francisco, California 94111

Attention: Mr. John Gouchon

Gentlemen:

This report presents the findings of a borehole geophysical survey conducted by NORCAL Geophysical Consultants, Inc. in San Francisco, California. The purpose of the survey is to measure the compressional (P) and shear (S) wave velocities of the strata underlying the area of investigation. We are informed that this information will be incorporated with geotechnical and geologic data gathered by others to aid in determining the elastic moduli of subsurface materials. NORCAL geophysicist William E. Black and geophysical technician Joseph M. Martinez gathered the downhole data on April 17 and April 19,1996.

SITE DESCRIPTION

The downhole seismic velocity survey was performed in three borings located along Marina Boulevard between Davisidero and Scott. The borings are designated as Nos. 4, 6 and 7. Boring Nos. 6 and 7 are located on the south side of Marina Boulevard and Boring No. 4 is located on the north side. Each of the borings are cased with 3 inch inside diameter Schedule 40 PVC to depths of 25 feet. The annulus around the casing is backfilled with sand. Since Marina Boulevard is a heavily traveled thoroughfare, it was necessary to perform the downhole surveys at night to minimize interference from traffic induced vibrations.

DATA ACQUISITION

We measured the travel times of P- and S- waves propagating from a source located on the surface, to a motion detector (geophone) placed inside the casing of each boring. Measurements were taken at 5 foot depth intervals, ranging from 5 feet below ground surface to the maximum depth that the boring is open and accessible to the downhole geophone. In Borings 4 and 6 the maximum depth was 23 feet. In Boring 7, the maximum depth was 25 feet.

We produced P- wave energy by striking a 16# sledge hammer against a metal plate placed on the ground surface. We produced S- wave energy by impacting

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either end an 8 foot long timber coupled to the ground by the weight of a vehicle. Both sources were offset 5 to 10 feet from the boring to minimize interference from seismic waves propagating down the pvc casing and/or water column in the borings (tube waves).

We detected the P- and S- wave motion using a Sensor Instruments five-component downhole geophone package coupled to the inside of the casing by an inflatable bladder. The detected waveforms were recorded using a Geometrics, Inc. ES-1225 12-channel engineering seismograph. The data were printed on hard copy records (seismograms) and were also down-loaded to a portable computer for further processing.

At each measurement depth, we impacted the metal plate and both ends of the timber. The resulting wave forms were recorded on separate channels of the seismograph. The P-waves produced by striking the metal plate are the fastest traveling and arrive at the downhole geophone first. The S-waves produced by striking either end of the timber travel more slowly, and arrive at the geophone after the P-waves. Depending on the amount of time that has elapsed between the two arrivals, the geophone may still be registering P-wave motion when the S-wave arrives. In these cases, identification of the S-wave arrival is difficult. This is why we impact both ends of the timber. The reversal in the direction of impact causes a reversal in the phase of the S-waves. By superimposing the wave traces from the opposing directions of impact, this phase-reversal, and consequently the S-wave arrival, can be identified.

DATA ANALYSIS

We examined the seismic records to determine the P- and S- wave travel times. We then corrected the travel times for the source offset (distance from the top of the boring), and plotted the resulting values versus the appropriate geophone depth on time versus depth (T-D) charts. The T-D charts for Borings 4, 6, and 7 are shown on Plates 1 through 3, respectively. Fitting straight line segments to the travel time points resolves the subsurface into seismic layers. The inverse slope of these lines indicates the P-wave velocity (Vp) and S-wave velocity (Vs) of each layer.

RESULTS

Our interpretation of the downhole seismic data resolves the upper 23 - 25 feet of the subsurface into one to three seismic layers. The depth range and seismic velocities of these layers are listed in the following tables:

Table A: Downhole Seismic Velocities, Borings 4

Depth Range (ft)	Vp (fps)	Vs (fps)
0 - 23	1650	550

Table B: Downhole Seismic Velocities in Boring 6

Depth Range (ft)	Vp (fps)	Vs (fps)
0 - 5	950	450
5 - 15	2300	650
15 - 23	2300	850

Table C: Downhole Seismic Velocities in Boring 7

Depth Range (ft)	Vp (fps)	Vs (fps)
0 - 5	1600	750
5 - 25	3000	750

DISCUSSION

The seismic velocity (Vp and Vs) of unconsolidated sediments is directly proportional to their degree of compaction. The more consolidated the sediments are, the higher their velocity. In addition, Vp is also affected by saturation. The Vp of porous sediments is typically much higher when saturated than when unsaturated. However, Vs is not affected by saturation. As a result, the ratio of Vp to Vs is typically much higher in saturated than in unsaturated materials.

We trust that the information provided herein will meet your needs at this time. We appreciate the opportunity to provide our services to Treadwell and Rollo and we look forward to working with you on future projects.

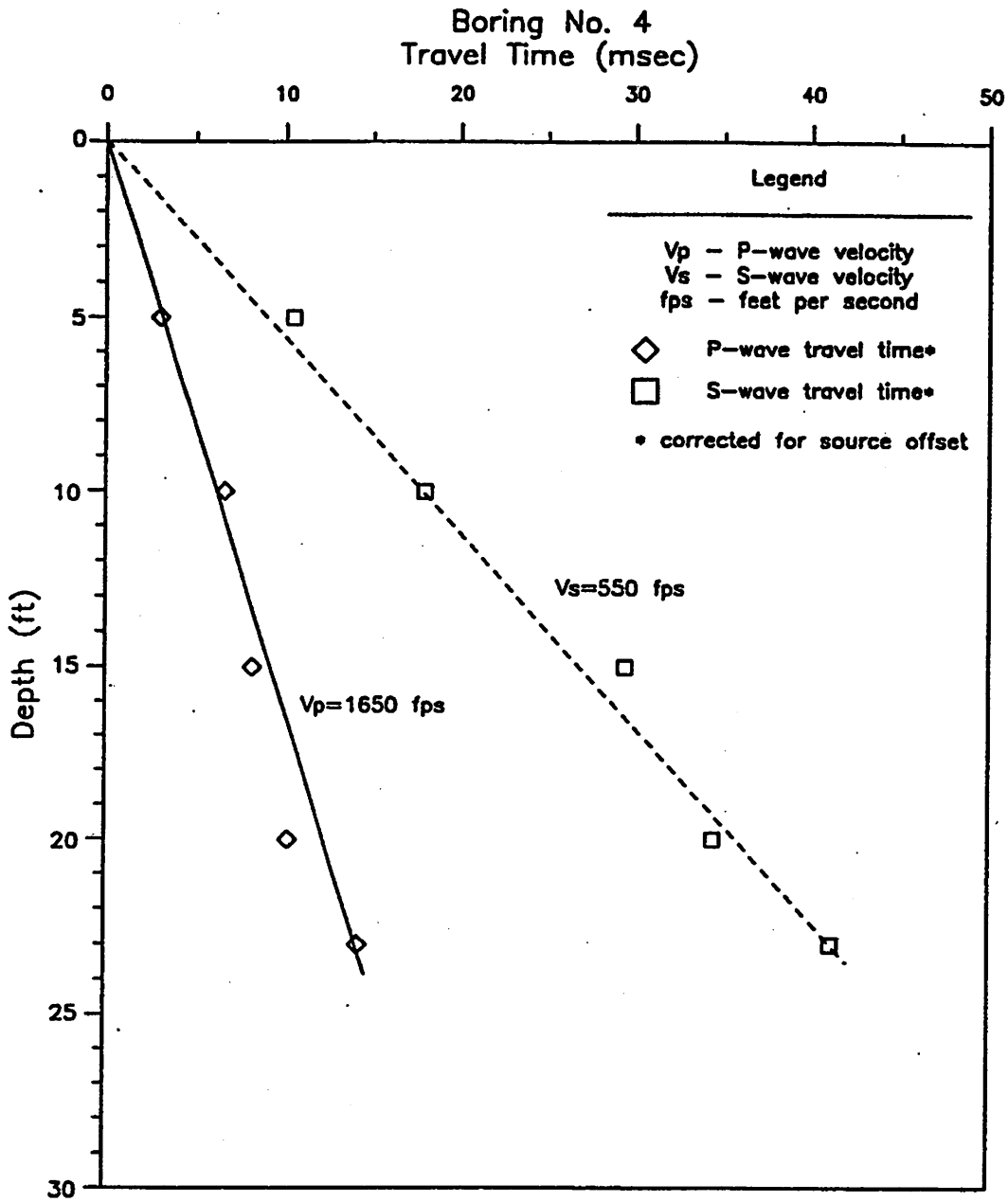
Yours very truly,

NORCAL Geophysical Consultants, Inc.

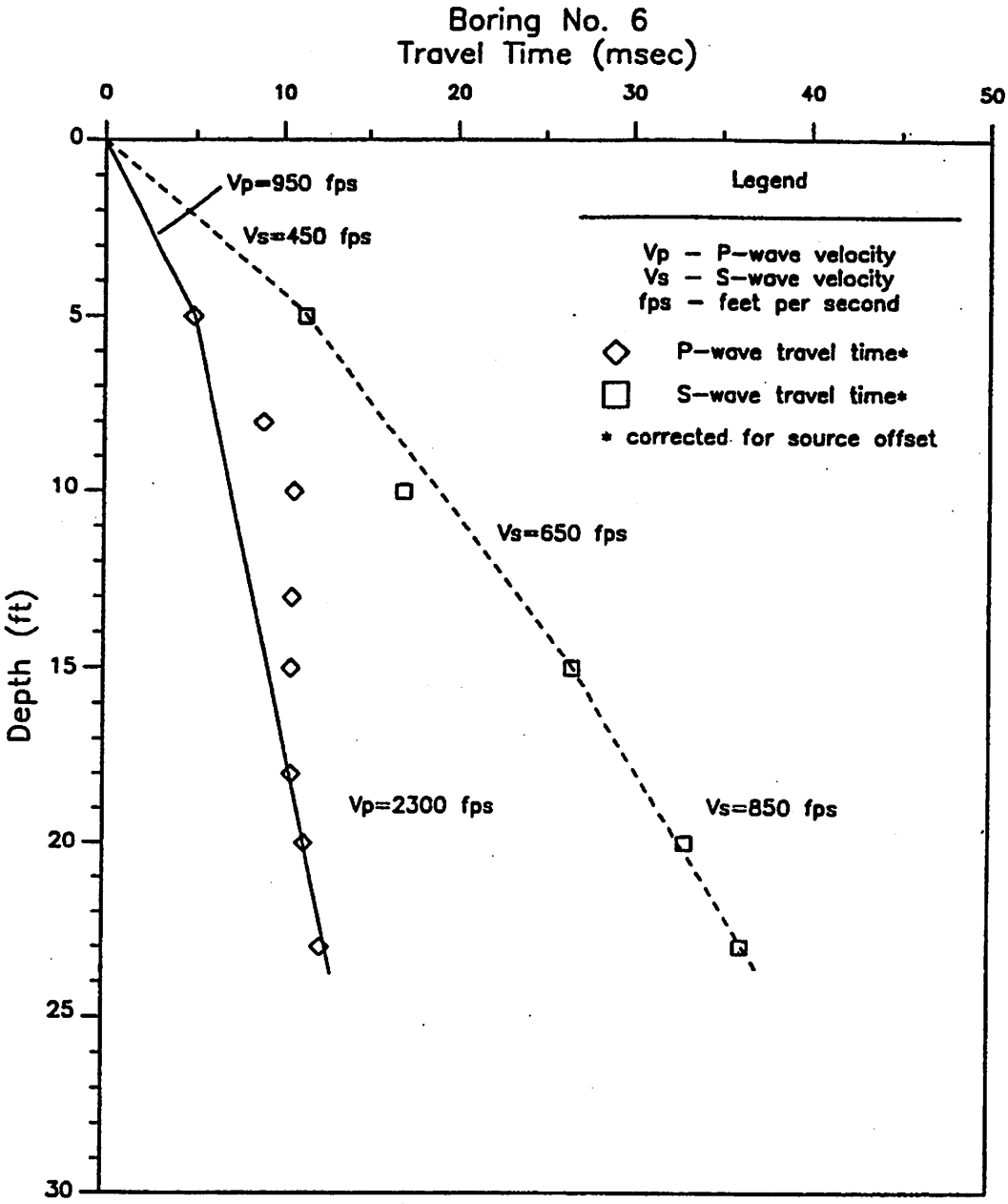
William E Black

William E. Black
Geophysicist GP-843

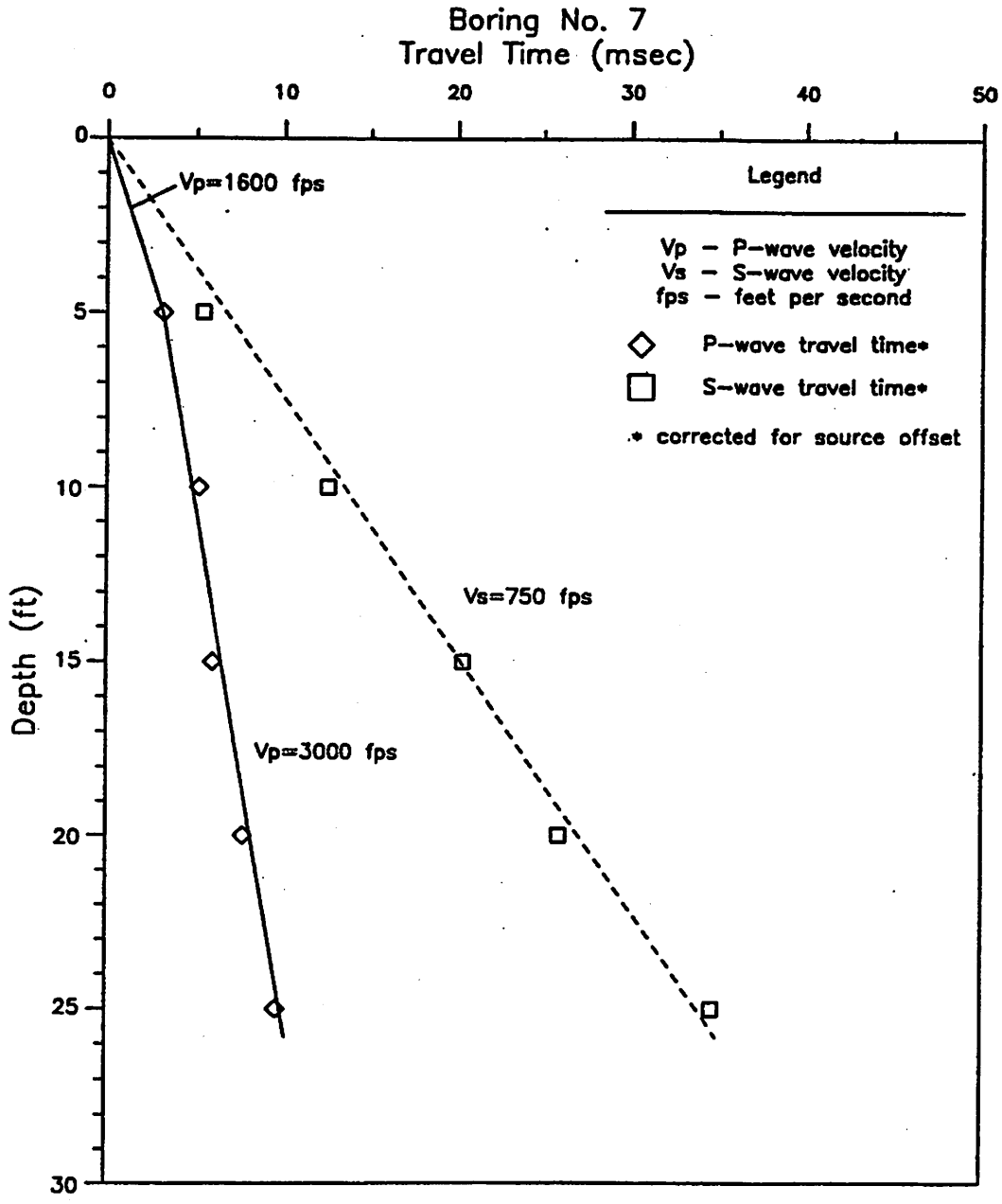
WEB/jh



NORCAL GEOPHYSICAL CONSULTANTS INC. NORCAL			BORING NO. 4 DOWNHOLE SEISMIC SURVEY MARINA BLVD. SAN FRANCISCO, CALIFORNIA	PLATE 1
JOB: 96–243.17	APPR: WEB	DATE: 5/96		



NORCAL GEOPHYSICAL CONSULTANTS INC. NORCAL			BORING NO. 6 DOWNHOLE SEISMIC SURVEY	PLATE 2
JOB: 96–243.17	APPR: WEB	DATE: 5/96	MARINA BLVD. SAN FRANCISCO, CALIFORNIA	



NORCAL GEOPHYSICAL CONSULTANTS INC. NORCAL			BORING NO. 7 DOWNHOLE SEISMIC SURVEY MARINA BLVD. SAN FRANCISCO, CALIFORNIA	PLATE 3
JOB: 96–243.17	APPR: WEB	DATE: 5/96		

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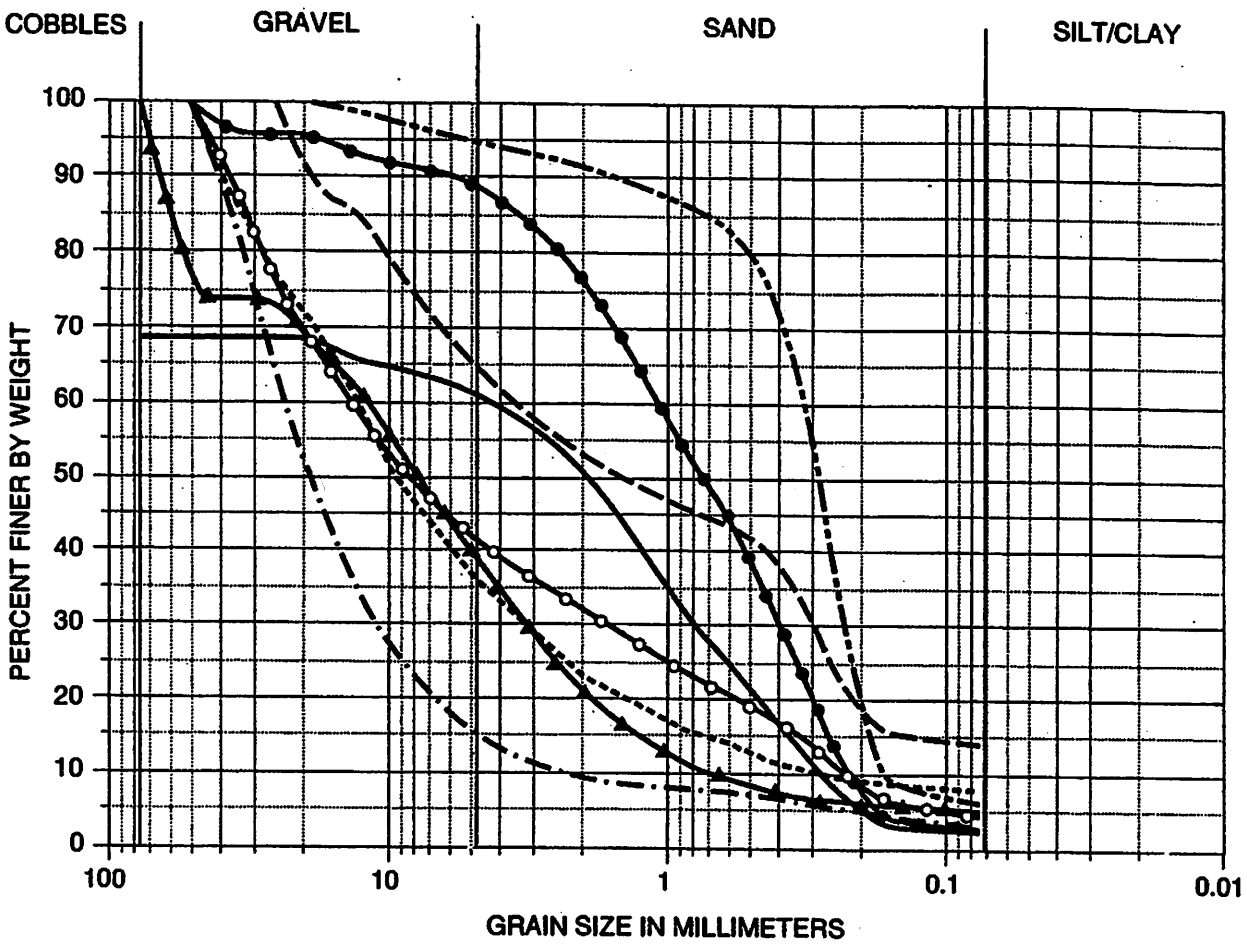
APPENDIX D

Laboratory Test Results



EXPLANATION	SOIL CLASSIFICATION
B-1 at 3.5 feet	SAND (SP)
B-1 at 12 feet	GRAVEL with SAND (GW)
B-3 at 6 feet	SAND with GRAVEL (SW)
B-3 at 24 feet	GRAVEL with SAND and SILT (GW - GM)
B-4 at 21 feet	GRAVEL with CLAY and SAND (GW - GC)
B-5 at 13 feet	GRAVEL (GW)
B-7 at 8 feet	SILTY SAND (SM)
CPT-4 at 10 feet	SAND with SILT (SP - SM)

MARINA BOULEVARD SEAWALL
San Francisco, California

GRAIN-SIZE DISTRIBUTION TEST RESULTS

Treadwell&Rollo

Project No. 1526.02 | Figure D-1

DAMAGING EFFECTS OF LIQUEFACTION AND LATERAL SPREADING ON AN AREA WIDE BASIS.

WE ALSO FOUND THAT, YES, WE COULD STRENGTHEN THE MARINA SEAWALL, AND YES, WE CAN IMPROVE THE SOIL BETWEEN THE MARINA SEAWALL AND THE BOG SEWER. BUT DOING THAT WOULD HAVE NO EFFECT ON THE BEHAVIOR OF THESE GRAY SOILS OR THIS HYDRAULIC FILL THAT IS IN THE MARINA, AND TO THE SOUTH OF THE BOG SEWER. CONSEQUENTLY, WHILE WE COULD IMPROVE THE SEAWALL, THE POTENTIAL STILL EXISTS THAT DAMAGE, IF NOT FAILURE OF THE SEAWALL, WOULD OCCUR. FURTHERMORE, IMPROVING THE SEAWALL DOES NOTHING TO IMPROVE THE STABILITY, LIQUEFACTION POTENTIAL, OR LATERAL SPREADING WITHIN THE GREATER MARINA DISTRICT. I'D BE PLEASED TO ANSWER ANY QUESTIONS. I APOLOGIZE IF I CONFUSED YOU. I'M TRYING TO KEEP IT AS BASIC AS I CAN.

YOMI AGUNBIADE: OKAY, THANK YOU, MR. ROLLO. THAT IS ONE OF THE THINGS THAT IS IMPORTANT TO GET OUT OF THIS. SINCE I'VE BEEN WITH THE DEPARTMENT AND WE'VE HAD ALL THE MEETINGS WITH ALL THE ENGINEERS, BASICALLY THAT IS THE RESULT OF ALL OF THE WORK THAT'S BEEN DONE THUS FAR, THAT THE CONCERNS THAT WE'VE HEARD WHICH HAS TO DO WITH LIQUEFACTION, WHICH HAS TO DO WITH LIQUEFACTION IN THE GRAY AREA THAT WAS PRESENTED THERE, REALLY CAN'T BE ADDRESSED BY ANYTHING THAT WE WOULD DO ON THIS PROJECT OR ANY OTHER PROJECT THAT THE CITY WOULD TAKE ON BASED ON THE ENGINEERING STUDIES THAT HAVE BEEN DONE.

SO, IN CLOSING, FOR ME ONE OF THE THINGS I WANT US TO

REMEMBER HERE IS THAT AS I SAID EARLIER, IS THAT IN 1935 AND LATER IN 1962, THE STATE STATUTE CONVEYED THE WEST HARBOR AND THEN IN 1962, THE EAST HARBOR TO THE CITY AND PORTIONS OF IT SAY THAT ALL OF THE ABOVE DESCRIBE REAL PROPERTY REFERRING TO THE MARINA AS A WHOLE, HERE BY GRANTED SHALL BE FOREVER HELD BY THE CITY AND COUNTY OF SAN FRANCISCO AND BY ITS SUCCESSORS AND TRUSTS FOR USES AND PURPOSES AND UPON THE EXPRESS CONDITIONS FOLLOWING, TO WIT, SAID REAL PROPERTY SHALL BE USED SOLELY FOR AQUATIC RECREATIONAL, BOULEVARD PARK AND PLAYGROUND PURPOSES. ULTIMATELY, IT IS THE CITY'S RESPONSIBILITY TO ADDRESS THESE ISSUES. IN ESSENCE, BY STATUTE. THE STATE GAVE US THIS LAND IN TRUST TO MAINTAIN IT, TO KEEP IT, AND THIS IS PART OF OUR RESPONSIBILITY. AND WHAT WE'RE TRYING TO DO HERE IS TO PRESENT OUR BEST DESIGNS FOR ADDRESSING THAT AND DEALING WITH THE CITY'S RESPONSIBILITY AND WE ARE JUST REALLY LOOKING FOR THE PLANNING DEPARTMENT AND ALL OF OUR CONSULTANTS TO EVALUATE THE EIR HERE BACK FROM THE COMMUNITY. AND AT LEAST GET AN EIR THAT IS APPROVED THAT STATES ALL OF THE MITIGATIONS THAT WE NEED TO DO AND ALL OF THE IMPACTS THAT ARE OUT THERE SO WE CAN FINALLY DEFINE THIS PROJECT AND MOVE FORWARD. MANY PEOPLE IN THE ROOM WILL TELL YOU THAT THIS PROJECT HAS BEEN TALKED ABOUT AND TALKED ABOUT PROBABLY FOR 16 OR 17 YEARS. IT'S TIME FOR US TO SORT OF GET TO THE NEXT PHASE, AT LEAST GET AN EIR ON OUR HANDS. SO I THANK YOU FOR YOUR TIME AND WE CAN ANSWER

PROPOSED MARINA "DINGHY DECK"

CONCEPTUAL LAYOUTS

SAN FRANCISCO

Sheet Title

PROPOSED "DINGHY DECK" - MARINA EAST HARBOR

Scale: AS NOTED

ISSUE / REVISIONS

No.	Date	Description

Sheet No. 1-6A

Date 02-03-22

Project No.	Drawn By:	Checked By:
602-101	CN	-

Owner Approval

Date

NILSEN

ARCHITECTURE · PLANNING

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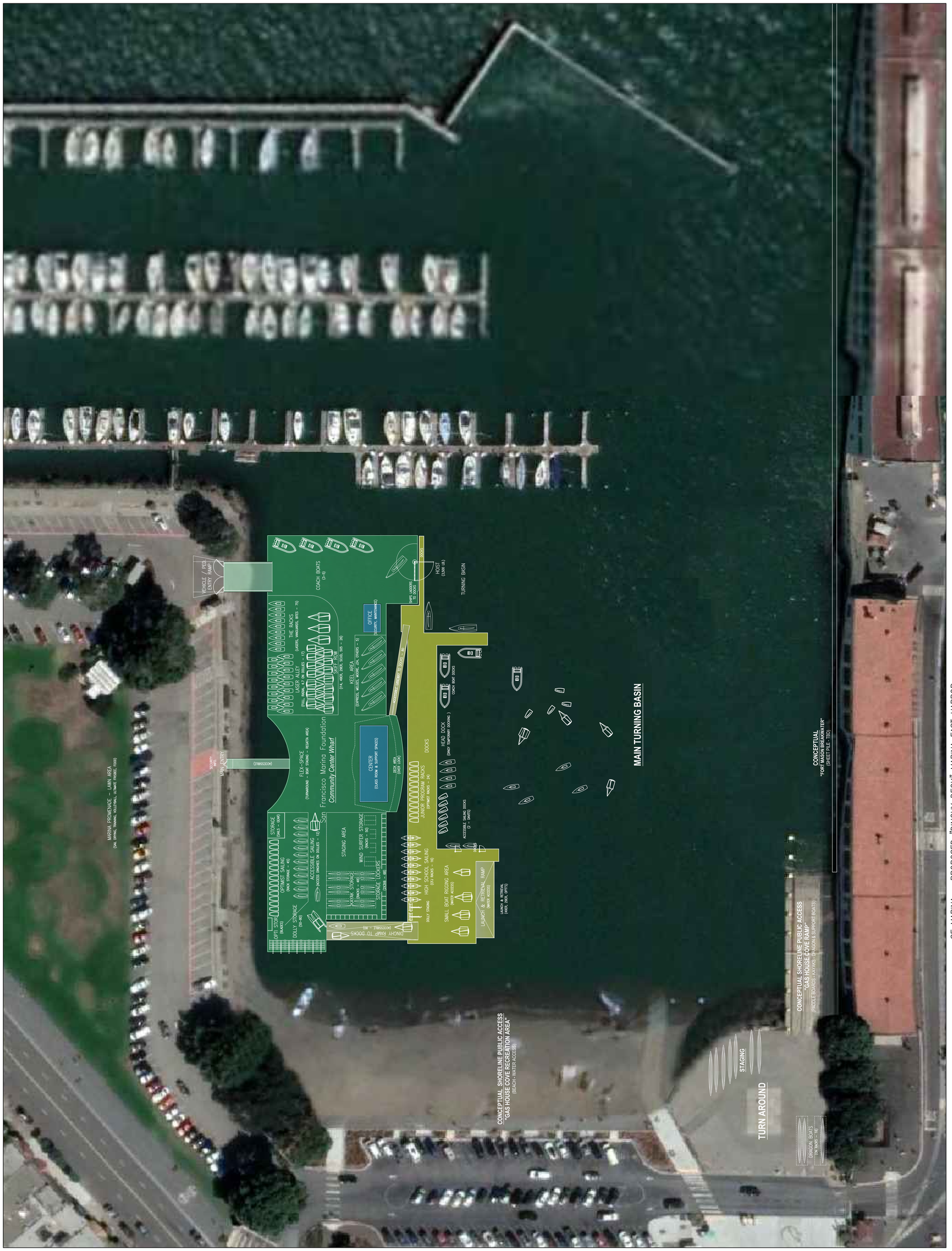

1 SF MARINA – PROPOSED "DINGHY DECK" MARINA EAST HARBOR

SCALE 1"=30'-0"

0 30 60

9.144M 18.288M