



Parks Recreation & Waterfront

Waterfront Specific Plan for the City of Berkeley Public Tidelands Area

Supporting Infrastructure, Revenue, Parking, and Sea Level Rise Studies (as of March 2023)

The following studies were produced as part of *Waterfront Specific Plan* (formerly “Berkeley Marina Area Specific Plan”) process, with the exception of the “Berkeley Marina Sea Level Rise AB 691 Assessment Study”. These studies are not final and continue to be updated by City staff, Hargreaves Jones, and the consultants associated with each study.

The *Waterfront Specific Plan* process began in the spring of 2020, just as the global pandemic emerged, which extended the anticipated duration of the effort and has required several updates and revisions to data and analysis included in these documents. These studies have informed the development of the *Waterfront Specific Plan* to date, and will continue to be referenced and revised as this process continues.

Final versions will be released in coordination with the final *Waterfront Specific Plan* – following an upcoming environmental review process, further community and stakeholder engagement, and ongoing City Council review.

1. **Infrastructure Assessment DRAFT** (May 2021)
Hargreaves Jones, Moffatt & Nichol, Nelson\Nygaard, Bkf Engineering
2. **Existing Amenities and Operations Assessment DRAFT** (March 2021)
Keyser Marston Associates
3. **Implementation Strategy DRAFT** (April 2021)
Keyser Marston Associates
4. **Hotel Food and Beverage Revenue Potential DRAFT** (September 2022)
Keyser Marston Associates
5. **Dredging Needs Technical Memo DRAFT** (April 2021)
Moffatt & Nichol
6. **Slip Mix Study DRAFT** (August 2022)
Moffatt & Nichol
7. **Parking & Mobility Framework DRAFT** (January 2022)
Nelson Nygaard
8. **Berkeley Marina Sea Level Rise AB 691 Assessment Study DRAFT** (August 2019)
NCE

TASK 2.1: BERKELEY MARINA DREDGING NEEDS TECHNICAL MEMO

Written by: Moffatt & Nichol

BERKELEY MARINA AREA
specific plan

April 21, 2021

1 EXECUTIVE SUMMARY

The Berkeley Marina was constructed in the 1960's by dredging a basin in the shallow flats fronting the eastern margins of Central San Francisco Bay. The original dredged depths were significantly deeper than required for vessel use so that the dredged material would be used to create the upland areas of the marina. Since the construction of the marina in the 60's, there have been occasional instances of minor dredging at the entrance and certain locations within the harbor.

The average rate of sediment accumulation in the Harbor Basin is approximately 0.05' per year and the rate at the harbor entrance is approximately 0.1' per year. There are some locations at the harbor entrance which accumulate sediment at a faster rate – closer to 0.2' per year. The South Sailing Basin has accumulated the most sediment deposits over the years with its current bay bottom elevation near 0.0' on the Mean Lower Low Water (MLLW) datum. In the short-term future, dredging will not be pursued at the South Sailing Basin in order to preserve funds for other projects at the marina.

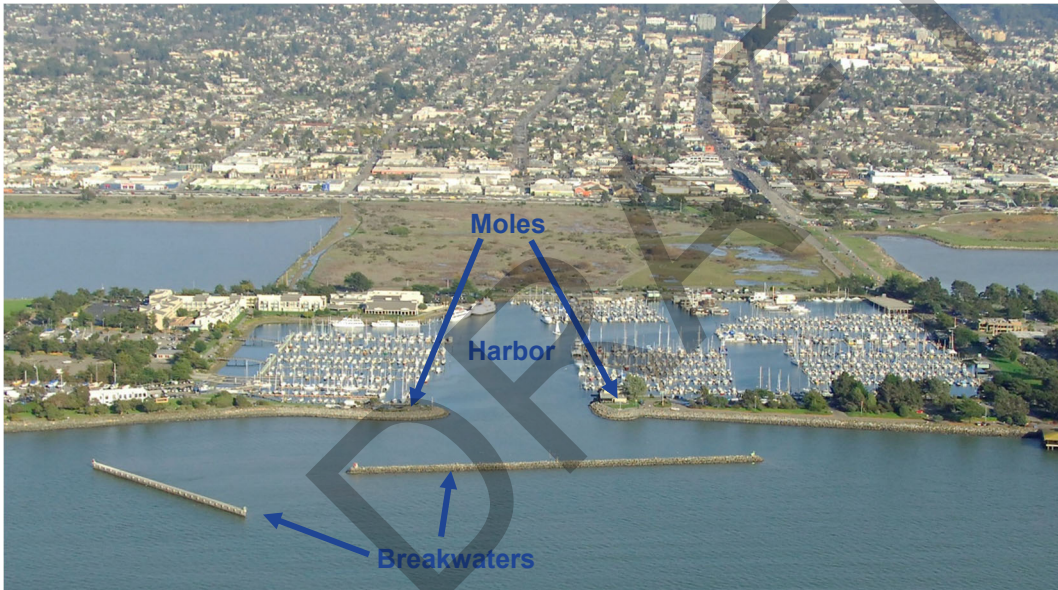
Dredging is needed at both the Harbor Entrance Channel and Harbor Basin. Estimated dredging quantities, costs, and maintenance schedule for these two areas are as follows:

- Harbor Entrance Channel
 - Quantities
 - Initial: 86,000 CY (includes 1' overdredge of 24,000 CY)
 - Recurring: 24,000 CY
 - Costs
 - Initial: \$2,300,000 - \$2,700,000
 - Schedule
 - Initial: 2022
 - Recurring: Every 10 Years
- Harbor Basin
 - Quantities
 - Initial: 79,000 CY (includes 1' overdredge of 31,000 CY)
 - Recurring: 31,000 CY
 - Costs
 - Initial: \$2,500,000 to \$2,800,000
 - Schedule
 - Initial: 2022
 - Recurring: Every 20 years

2 BACKGROUND

Marina Description

The Berkeley Marina is located on the shallow subtidal flats on the eastern shoreline of central San Francisco Bay facing the Golden Gate. The origins of a harbor at the marina site can be traced back more than a century. The Marina in its current form dates to the late 1960's when the City of Berkeley proceeded with the development of a recreational boat harbor on the tidelands granted to the City by the State of California. The harbor was created by dredging a boat basin in the shallow flats and used the dredged material to create the upland area required to support the marina operation. The southern half of the Harbor Basin was dredged to -20' MLLW at its creation. It appears that the dredging was conducted not only to provide the required navigable water depths, but significant "over-dredging" was required in certain areas with relatively good material for use as fill to create the desired amount of upland area. The harbor is protected from damaging wave action by the north and south moles (breakwaters which separate two bodies of water and prevent water from flowing beneath) that allow a relatively narrow entrance. The offshore breakwaters provide wave sheltering for the entrance and reduce wave penetration into the harbor, see Photograph 1. Within the protected harbor, berthing for about 1,000 small craft was constructed along with a host of boater support facilities to offer a full-service marina with numerous amenities to the region's water sport recreationists.



Photograph 1: Harbor Entrance at Berkeley Marina. Source: Marinas.com

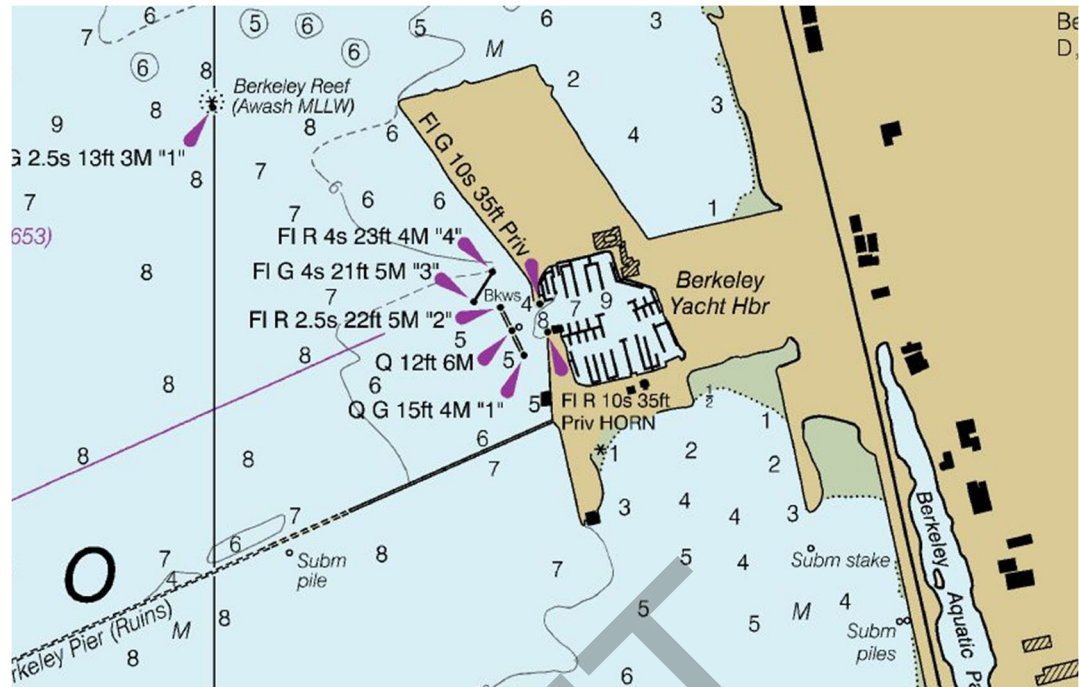


Figure 1: Water depths at and near the Berkeley Marina. Source: NOAA Office of Coast Survey

Marina Sedimentation and Maintenance Dredging The protected harbor of the Marina provides good conditions for deposition of sediment. Sediment accumulates over time and eventually requires removal by maintenance dredging to restore depth. Given the more than 50 year history of the current harbor it should be possible to develop a good estimate of the rate of sediment build-up in various parts of the harbor based on comparison of the as-built dredging plan and a recent hydro-survey of the harbor, adjusted for any maintenance dredging that has taken place during the interval. Unfortunately, the as-built plans have not been found and the most recent hydro-survey of the marina dates to 2008 so accumulation estimates will not be as accurate as desired. Rough order of magnitude estimates can still be made using the limited amount of information available, and engineering judgement.

Maintenance Dredging Permits A search of the web for permits issued to the City of Berkeley for maintenance dredging of the marina produced the following results:

- 02/1973 dredging 5,000 Cubic Yards (CY)
- 08/1991 dredging 73,000 CY apparently from the harbor entrance
- 02/2005 dredging < 500 CY Dock H-I apparently to repair revetment
- 04/2006 dredging < 8,750 CY Dock A-C associated with dock replacement

The permit authorizations for the projects listed above indicated that the disposal site for the dredged material was the USACE SF-11 (Alcatraz in-bay disposal site). The total volume of dredging authorized during the 33-year period amounted to less than 90,000 CY. The possibility exists that permits earlier than 1973 could have been missed, as well as undiscovered permits during the covered period, but this seems remote. Even more remote is the possibility that permits issued from 2006 to present were missed. Considering the period, the total volume dredged seems minimal. However, the information suggests a clear dredging need. The need is not distributed uniformly around the harbor but concentrated at the entrance, which must be maintained to the required depth to support the marina operation.

Dredging was also performed to the harbor's main channel after the 1989 Loma Prieta Earthquake to allow for emergency FEMA ferry service. Permits could not be obtained for this dredge, but Parks Commissioner Paul Kamen stated that the dredged material was

placed along the north side of the Berkeley Pier. Maintenance dredging was performed during the replacement of Docks F and G and Docks H and I, but permits for these projects could not be located and therefore we are not able to determine where the dredged material was placed.

Historic Shoaling PatternAn effort to better understand the shoaling pattern was based on a comparison of 2 hydro-surveys, the most recent 2008 survey and a 2000 hydro-survey provided by the Harbormaster, who also provided some spot soundings of current depths in the entrance. The hydro-survey comparison clearly documents the variable shoaling rate alluded to in the previous paragraph – a rough order of magnitude estimate of the shoaling rate in the Harbor Basin is 0.05' per year with some "hot spots" amounting to 0.1' per year. The corresponding estimate for the entrance area, while highly variable (some spots appeared to erode rather than accumulate), is about 0.1' per year with some spots exceeding 0.2' per year.

Furthermore, the shoaling rate may not be constant over time. Even though the supply of sediment available for transport to the marina is limitless, the vagaries of the weather that give rise to sediment transport can vary considerably from year to year and can exhibit long term trends such as those associated with climate change. In general, increased storminess can be expected to increase the shoaling rate – and vice-versa. Also, shoaling rates typically exhibit a declining rate as the water depth decreases over time, but the decrease would not be significant for the range of depths required to maintain navigation.

The possible explanation for the observed rate and the rate differences follows. Although a beach once existed on the Berkeley shoreline, the beach sand has long disappeared, and in its place are extensive inter-tidal mud flats whose subtidal bottom appears to consist of soft bay mud. These huge deposits of fine sediment are suspected as the source of the shoaling in the marina because the fine mud particles can be agitated and suspended by prevailing wind and wave action in the shallow areas of bay. The sediment is subsequently transported by the combined action of wave orbital motions and tidal currents. As the sediment laden water enters the marina on a rising tide, it first encounters the breakwater protected channel. The largest suspended particles tend to settle out here due to the sudden dissipation of wave energy by the breakwaters. The particles remaining in suspension can enter the harbor basin and will continue to deposit at areas where wave energy is further reduced. The slack tide (time of weakest tidal currents that occurs between flood and ebb currents) creates the best opportunity for deposition. On the ebbing tide, the particles remaining in suspension are drawn out of the harbor, but the "damage" has been done. Unfortunately, the low magnitude of the tidal currents in this case and the "sticky" nature of the deposited sediment (mud) are such that current scour alone is unable to remove the deposited material, which continues to build with each tide cycle. The purpose in describing all this is to set the stage for the proposed dredging needs assessment.

In addition to the facilities described above, the City's recreational infrastructure at the marina includes the South Sailing Basin, located outside the Harbor Basin, consisting of small sailing docks primarily for human powered craft and dinghy sailors. The South Sailing Basin is formed and protected from wave action by the marina's southern peninsula. Due to heavy sedimentation experienced at this location, the floating launch docks currently 'ground out' at low tide, as seen in Photograph 2. While there is a need to restore depths in this area to permit users to safely navigate at all tide levels, the scale of the sedimentation problem is such that the required maintenance dredging commitment would become a major burden and is not being pursued at this time. Alternatives solutions to the sedimentation issue could be to extend the current length of the existing docks in the South Sailing Basin, such that the ends of the dock do not ground out at low tide or adding another small sailing dock at a different location in the marina that can be used at low tides.



Photograph 2: Middle Dock Grounded at South Sailing Basin at 0' MLLW.

3 DREDGING NEEDS ASSESSMENT

Required Depths for Navigation

The required depths for navigation of marinas are provided in the State of California Division of Boating & Waterways (DBW) publication "Layout and Design Guidelines for Marina Berthing Facilities". It is not known if the original marina design conformed with the current guidelines, but the permit drawings provided with the USACE Docks A-E Replacement Application followed these guidelines. The depths are relative to "design low water" (DLW), which was given as -2.0' on the MLLW datum for the Berkeley Marina. In addition, an allowance for dredging tolerance and for future sediment deposition to accumulate should be added to define the required dredge depth with the over-dredge included. This will allow sediment to accumulate for several years without the need to dredge again to meet the required depths specified in the DBW guidelines. Table 1 presents the required marina dredge depths for sailboats, which generally require greater depth than a power boat of similar length. To the right of the required minimum depth is the proposed depth of dredge and the depth with a 1' allowance for paid overdredge.

Table 1: Minimum and Proposed Marina Dredge Depths

Location	DBW Guideline Minimum Depth (ft)	Proposed Dredge Depth (ft, MLLW)	Proposed Dredge Depth with 1' Overdredge (ft, MLLW)
Channels			
Entrance	Deepest Vessel Draft + 3' Clearance	8*	9
Interior	Deepest Vessel Draft + 2' Clearance	10	11
Berths			
Vessel Length < 45'	6	8	9
45' < L < 55'	8	10	11
Vessel Length > 55'	10	13	14

* Dredge depth is limited at the harbor entrance by the existing water depths in the Bay outside the harbor entrance, as dredging an access channel across the flats to the deeper waters of the Bay is not part of the project. If the waters outside the marina are at -8, there is no point in dredging to deeper than -8 outside the Harbor Basin because vessels are going to have to traverse waters of this depth regardless. Deeper draft vessels can be accommodated at their berth during extreme low tides without grounding but transiting the entrance may be subject to the tide.

Marina Condition and Dredging Need

The condition of the marina is represented by the most recent hydro-survey (2008) as shown in Appendix A. It is worth noting that depths in the entrance are likely about 1' less due to shoaling since the 2008 survey (as much as 2' less in some hot spots per recent soundings taken by the Harbormaster) and 0.5' less within many areas of the basin. The Harbor Basin remains in relatively good condition with respect to depths thanks in large part to the overdredge provided when the basin was originally dredged. The harbor entrance on the other hand has been compromised by the relatively high shoaling rate and its existing depths are below the guideline depth at 'zero' tide, and well below at minus tides.

To restore required depths in the marina, the estimated quantity of material to be dredged is:

- In the entrance: 62,000 CY + 1' allowable overdredge of 24,000 CY
- In the basin: 48,000 CY + 1' allowable overdredge of 31,000 CY

This estimate is based on the proposed depths shown in Figure 2, adjusted for over-dredge per Table 1, and the 2008 hydro-survey adjusted for shoaling since 2008 per the above paragraph. Figure 3 below shows the areas to be dredged and not dredged based on the design depths in Figure 2 and the 2008 survey data.



Figure 2: Proposed Dredge Depths

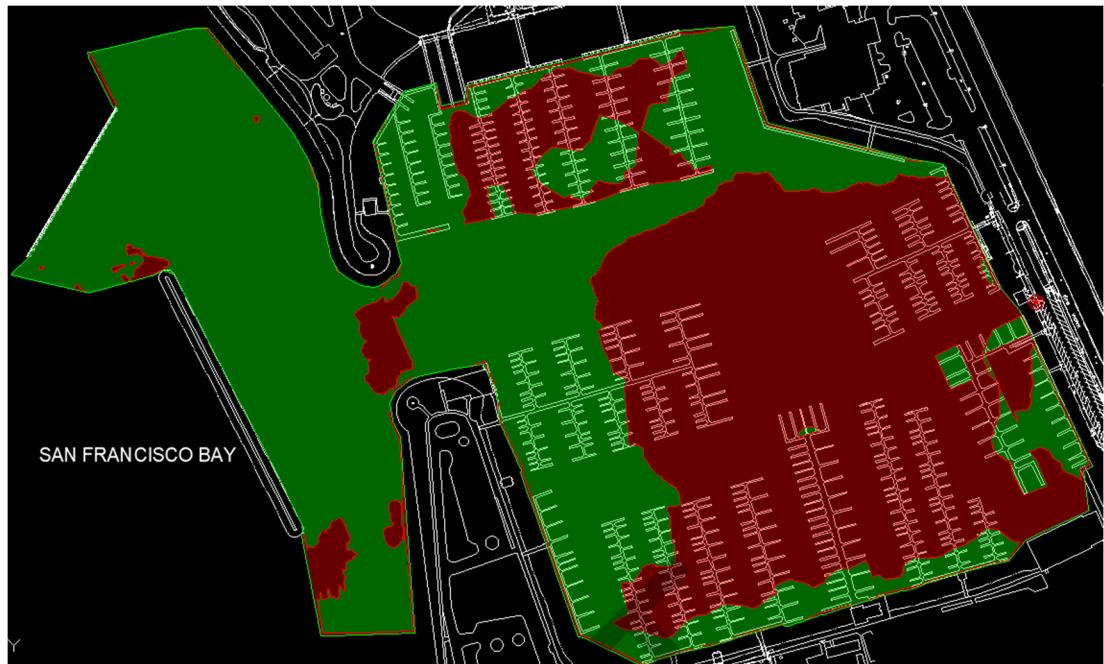


Figure 3: Areas to be Dredged in Green. Areas Not to be Dredged in Red.

The need for dredging, particularly the entrance, has been discussed at the recent Berkeley Marina Area Specific Plan Community Workshop 01 (as noted in the presentation PowerPoint dated January 28, 2021). The subject was previously discussed in the 2003 Berkeley Marina Master Plan that had identified the following actions related to dredging:

- Restore the -8' design depth in the Dock A-E Replacement including disposal of up to 9,000 CY of dredged material at Alcatraz by 2018
- Dredge Harbor Entrance Channel at a cost of \$1,000,000 for 2012
- Dredge the Harbor Basin at a cost of \$1,475,000 for 2005
- Dredge the South Sailing Basin at a cost of \$1,000,000 for 2010

The subject was also presented in the marina's 1999 Berthing Facility and Infrastructure Assessment. However due to the lack of a hydro-survey at the time the report recommended only that the hydro-survey and preparations including permitting for an unspecified maintenance dredging episode need to proceed for which \$25,000 was included in the proposed budget.

4 MAINTENANCE DREDGING

Maintenance Dredging Plan

The maintenance dredging requirement includes the following scope (specific limits of work for each item to be determined upon completion of a current hydro-survey of the marina) in order of highest priority:

1. Dredge the Harbor Entrance Channel to restore required depths for both North and South reaches.
 - Estimated quantity (Initial/Recurring episodes) – 86,000 CY / 24,000 CY
 - Estimated Cost (Initial Episode) – \$2,300,000 to \$2,700,000
 - Estimated Timing – 2022 and every 10 years thereafter
2. Dredge the Harbor Basin to restore required depths
 - Estimated quantity (Initial/Recurring episodes) – 79,000 CY / 31,000 CY
 - Estimated Cost (Initial Episode) – \$2,500,000 to \$2,800,000

- Estimated Timing – 2022 and every 20 years thereafter

3. Dredge the South Sailing Basin

- TBD at a later time. Potentially cheaper alternatives to dredging this basin include extending the existing small sailing docks in the basin to deeper waters or adding a new dock for small sailing vessels at a location that won't ground out at low tide.

The estimated dredging quantities include the initial episode (removal of several decades of accumulated sediments) and recurring episodes every timing interval (removal of future accumulated sediments). The estimated costs are based on a unit dredging cost of \$27 to \$31 per CY (2021 dollars) at the harbor entrance and \$31 to \$35 per CY within the Harbor Basin. The cost assumes the dredged material is suitable for in-bay disposal at the SF 11 Alcatraz site. The cost includes an allowance for the sampling/testing of the material and permitting. Architect/engineer support services are not included. The recurrence dredge timing assumes the over-dredge allows for sediment accumulation without exceeding the proposed water depths in Figure 2. Alternative timing and over-dredge depths may be considered.

It is good practice to not break the scope items into smaller dredge phases because typically there are increased costs when this is done. An argument could be made to combine the entrance and basin dredging into a single project when the respective dredging episodes coincide to decrease the overall costs. There is also an advantage to limiting the interval between dredging episodes to no more than 20 years because that is a recognized threshold for maintenance dredging for removal of recent accumulations. Any interval longer than 20 years may be considered as new work, with far reaching implications for permitting the work.

There is a potential for beneficial reuse of the dredged material for wetlands restoration projects in San Francisco Bay. This factor has not been considered in the planning, as the SF 11 Alcatraz site has been preferred by previous dredgers to dispose of material suitable for in-bay disposal. However, the environmental and permitting benefits of reuse may be considered by the City, although it may come at a higher cost. Potential locations for wetland restoration include both the north and south shores of the McLaughlin Eastshore State Park.

Maintenance Dredging Permitting

Permitting of maintenance dredging follows protocols of the LTMS Program “Dredger’s Handbook”(ref 12) .

REFERENCES / DOCUMENTS REVIEWED

1. Dredging Lease, City of Berkeley for Dock H-I to Maintain Navigation; State Lands Commission, Feb. 2005.
2. Amendment of Dredging Lease, City of Berkeley for Dock A-E Replacement to increase volume to be dredged and extend term; State Lands Commission, Apr. 2006.
3. Dredging Permit, Portions of Berkeley Marina in Berkeley, Alameda County, City of Berkeley W9475, PRC 4731.9; State Lands Commission, Feb. 1973.
4. Amendment of Dredging Permit, City of Berkeley to increase volume to be dredged and Extend term; State Lands Commission, Jan. 1992.
5. Approval of Map of Grant to City of Berkeley, Alameda County CA. w.o.4073; Apr. 1962.
6. Findings of Statutory Compliance with Substantive Improvement Clause, Granted Lands, Alameda County, City of Berkeley Grant 1-3d; State Lands Commission, Aug. 1972.
7. Berthing Facilities and Infrastructure Assessment for the Berkeley Marina, City of Berkeley, prepared by Winzler & Kelly, Apr. 23, 1999.
8. Hydrographic Survey of the Berkeley Marina - April 2000, prepared by unknown; from the web:
<https://people.well.com/user/pwwaterfront/hydrography/hydrography.html>.
9. Hydrographic Survey of the Berkeley Marina – Sept. 2008, City of Berkeley, prepared by Environmental Data Solutions.
10. Berkeley Marina Master Plan, City of Berkeley prepared by Wolf-Mason Associates Inc. June 2003.
11. Berkeley Marina Area Specific Plan -Community workshop 01, presentation prepared by Hargreaves-Jones, Jan. 28, 2021.
12. Dredger's Handbook, LTMS Program Agencies, Jan. 2021.
13. Layout and Design Guidelines for Marina Berthing Facilities, California Resources Agency Division of Boating and Waterways, July 2005.
14. Aerial Photo of Berkeley Marina – Date Unknown, Marinas.com
<https://marinas.com/view/harbor/5gtwm Berkeley Marina Harbor Berkeley CA United States>

**APPENDIX A – 2008 HYDROGRAPHIC SURVEY
PERFORMED BY ENVIRONMENTAL DATA SOLUTIONS**

DRAFT

HYDROGRAPHIC SURVEY NOTES:

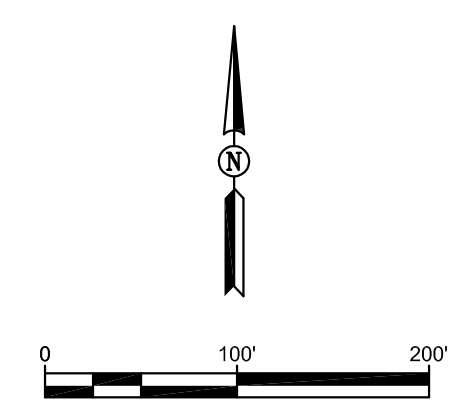
1. SOUNDINGS ARE IN FEET BELOW MEAN LOWER LOW WATER (MLLW).
2. BATHYMETRY SURVEYED BY EDS ON SEPTEMBER 25TH AND 26TH, 2008 AND REPRESENT SEAFLOOR CONDITIONS ON THOSE DATES.
3. SOUNDINGS ARE REFERENCED TO NOAA TIDAL BM 941 4816 "YACHT 1947", REPORTED AT 10.987 FT MLLW.
4. HORIZONTAL POSITIONS ARE REFERENCED TO THE CALIFORNIA STATE PLANE COORDINATE SYSTEM, ZONE 3, FEET (NAD 83).
5. HORIZONTAL POSITIONS WERE COLLECTED USING A LEICA SYSTEM 1200 REAL-TIME KINEMATIC GPS.
6. SOUNDINGS WERE MEASURED AND COLLECTED USING AN ODOM HYDROTRAC SURVEY-GRADE FATHOMETER USING A 3" 200 KHZ TRANSDUCER CENTER MOUNTED IN A SEA CHEST IN CONJUNCTION WITH AN IN-SITU MINI TROLL VENTED PRESSURE TRANSDUCER.
7. BATHYMETRIC DATA CONFORM TO CLASS 1 SPECIFICATIONS OUTLINED IN THE U.S ARMY CORPS OF ENGINEERS SURVEY MANUAL (EM1110-2-1003, JANUARY, 2002).
8. THE LOCATIONS OF SHORELINE FEATURES, PIERS, DOCKS AND OTHER HARD STRUCTURES SHOWN ON THE PHOTOGRAPHS ARE APPROXIMATE IN NATURE AND WERE PROVIDED BY THE CITY OF BERKELEY.
9. FIELD DATA COLLECTION WAS PERFORMED UNDER THE SUPERVISION OF TIMOTHY HOLDENER, PLS 7636.



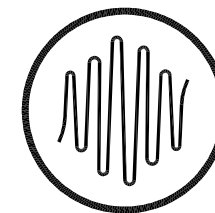
SAN FRANCISCO BAY

HYDROGRAPHIC SURVEY

SCALE: 1"=100'



REVISION	DESCRIPTION	BY	DATE



Environmental Data Solutions
 818 5th Street
 Suite 208
 San Rafael, California 94901

DSGN	DR	CHK
JOB NO.	SUBMITTED BY	TITLE

BERKELEY MARINA
 BERKELEY, CALIFORNIA

**CONDITIONS SURVEY
 SEPTEMBER 25 & 26, 2008**

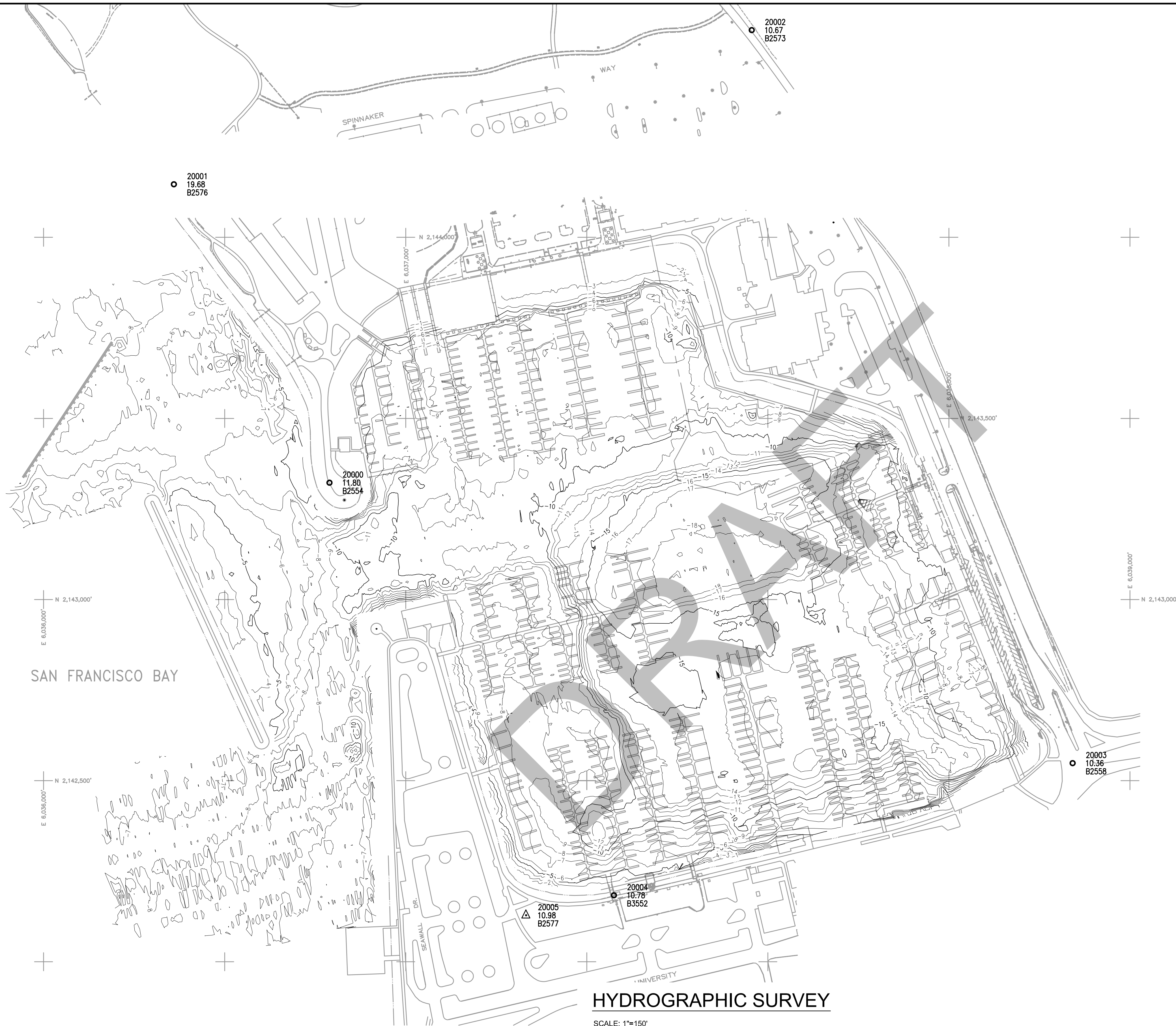
DATE 9/26/08

SHEET 1 OF 2

C1

HYDROGRAPHIC SURVEY NOTES:

1. SOUNDINGS ARE IN FEET BELOW MEAN LOWER LOW WATER (MLLW).
2. BATHYMETRY SURVEYED BY EDS ON SEPTEMBER 25TH AND 26TH, 2008 AND REPRESENT SEAFLOOR CONDITIONS ON THOSE DATES.
3. SOUNDINGS ARE REFERENCED TO NOAA TIDAL BM 941 4816 "YACHT 1947", REPORTED AT 10.987 FT MLLW.
4. HORIZONTAL POSITIONS ARE REFERENCED TO THE CALIFORNIA STATE PLANE COORDINATE SYSTEM, ZONE 3, FEET (NAD 83).
5. HORIZONTAL POSITIONS WERE COLLECTED USING A LEICA SYSTEM 1200 REAL-TIME KINEMATIC GPS.
6. SOUNDINGS WERE MEASURED AND COLLECTED USING AN ODOM HYDROTRAC SURVEY-GRADE FATHOMETER USING A 3" 200 KHZ TRANSDUCER CENTER MOUNTED IN A SEA CHEST IN CONJUNCTION WITH AN IN-SITU MINI TROLL VENTED PRESSURE TRANSDUCER.
7. BATHYMETRIC DATA CONFORM TO CLASS 1 SPECIFICATIONS OUTLINED IN THE U.S ARMY CORPS OF ENGINEERS SURVEY MANUAL (EM1110-2-1003, JANUARY, 2002).
8. THE LOCATIONS OF SHORELINE FEATURES, PIERS, DOCKS AND OTHER HARD STRUCTURES SHOWN ON THE PHOTOGRAPHS ARE APPROXIMATE IN NATURE AND WERE PROVIDED BY THE CITY OF BERKELEY.
9. FIELD DATA COLLECTION WAS PERFORMED UNDER THE SUPERVISION OF TIMOTHY HOLDENER, PLS 7636.

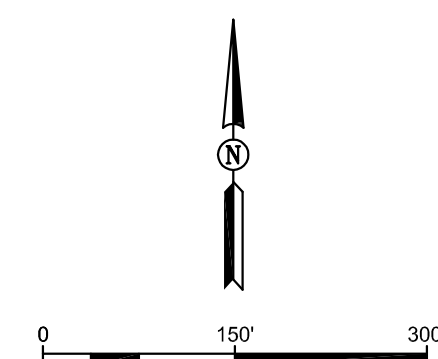


POINT TABLE					
#	ELEV.	NORTHING	EASTING	DESC.	TYPE
20000	11.80	2143322.55	6036789.43	B2554	HORIZONTAL CONTROL POINT
20001	19.68	2144146.40	6036359.80	B2576	HORIZONTAL CONTROL POINT
20002	10.67	2144572.07	6037955.48	B2573	HORIZONTAL CONTROL POINT
20003	10.36	2142548.33	6038841.65	B2558	HORIZONTAL CONTROL POINT
20004	10.78	2142183.54	6037574.90	B3552	HORIZONTAL CONTROL POINT
20005	10.98			B2577	VERTICAL CONTROL POINT

COORDINATES AND ELEVATIONS FOR THE HORIZONTAL CONTROL POINTS ARE FROM THE EDS FIELD SURVEY

LEGEND:

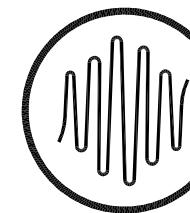
- HORIZONTAL CONTROL POINT
- △ VERTICAL CONTROL POINT



HYDROGRAPHIC SURVEY

SCALE: 1"=150'

REVISION	DESCRIPTION	BY	DATE



Environmental Data Solutions
818 5th Street
Suite 208
San Rafael, California 94901

DSGN	DR	CHK
JOB NO.	SUBMITTED BY	TITLE

BERKELEY MARINA
BERKELEY, CALIFORNIA

**CONDITIONS SURVEY
CONTOUR MAP & CONTROL POINTS
SEPTEMBER 25 & 26, 2008**

DATE 9/26/08
SHEET 2 OF 2
C2