San Francisco Bay Conservation and Development Commission
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March 6, 2015

Application Summary
(For Commission consideration on March 19, 2015)

Number:	BCDC Permit Application No. 2013.003.00md
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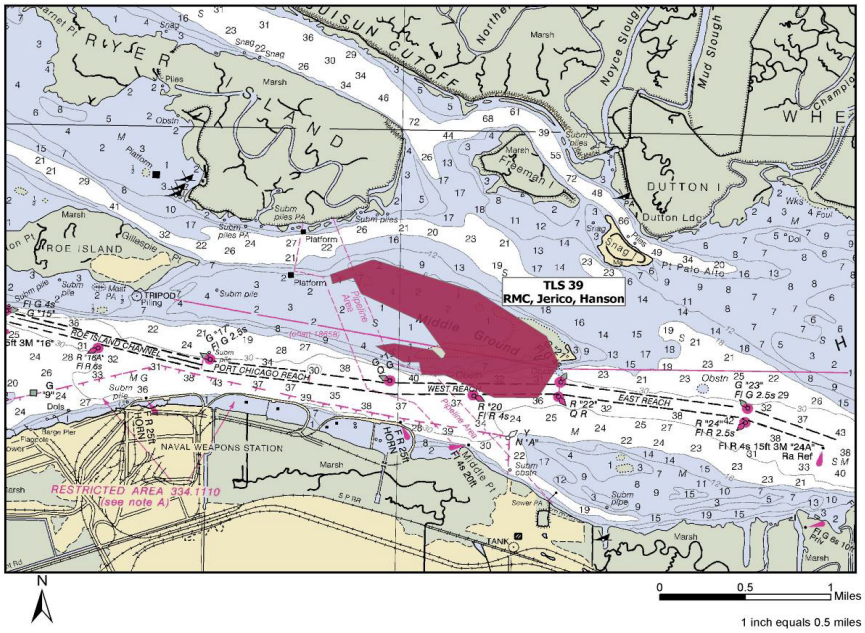
Staff Assigned:	Anniken Lydon (415/352-3624; anniken.lydon@bcdc.ca.gov)

Summary

Applicant: Lind Marine Operations (Lind), formerly Jerico Products, Inc.

Location: Privately owned submerged lands (367-acre Middle Ground Lease) in the Middle Ground Island Sand Shoals near Middle Ground Island in western Suisun Bay within Contra Costa County (Exhibits A and B). Located within the Commission's Bay jurisdiction and primary management area of Suisun Marsh. The project site lies within the Suisun Channel adjacent to the federally maintained navigation channel (Exhibit B).



Project: The proposed project involves mining of up to 1,250,000 cubic yards (cy) of construction grade sand from the Bay floor over a ten-year period from the Middle Ground Island lease area using a hydraulic drag arm dredge. Lind would mine up to about 125,000 cy annually, and in "peak years" mine up to 150,000 cy as long as the ten-year total volume of 1.25 million cy is not exceeded. Sand would be offloaded at various facilities around the Bay (Exhibit C) and sold as aggregate material for construction projects around the San Francisco Bay Area; including use as base material, fill, and in concrete mix for Bay Area commercial and public buildings, residential developments, highway maintenance projects, and beach restoration projects.

Issues Raised: The staff believes that the application raises seven primary issues: (1) whether the proposed level of mining is consistent with Subtidal Area Policy 1 which calls for projects in subtidal areas to be designed to minimize harmful effects to tidal hydrology, sediment movement, and Bay bathymetry; (2) whether the proposed level of mining is consistent with Subtidal Area Policy 1 which calls for projects in subtidal areas to minimize impacts to fish, other aquatic organisms and wildlife; (3) whether there are feasible alternatives to dredging sand from the Bay's sandy deep water areas; (4) whether the sand mining

project has been designed to minimize impacts to water quality; (5) whether the project's unavoidable adverse impacts have been adequately mitigated; (6) whether the project is consistent with the Commission's policies regarding Dredging, Navigation Safety and Oil Spill Prevention; and (7) and whether the project is consistent with the public trust.

Background

Lind Marine Operations. Lind Marine Operations (Lind), formerly Jerico Products, Inc., is a small local company headquartered in Petaluma, California, which has been in operation in the Bay Area for over 100 years. This company mines both sand and oyster shell subtidally from the Bay. For these operations, Lind uses its fleet of tug boats and barges to mine sand, gravel and oyster shell from subtidal Bay deposits in the San Francisco Bay to supply the west coast market with sand. Additionally, this company provides the Bay Area with other marine based services such as dredging, barging and lightering. Lind has local offloading facilities in Petaluma, Napa, and Collinsville (Exhibit C) to serve Bay Area customers. Lind has mined sand from the Middle Ground Shoal in Suisun Bay since the late 1970s.

Sand mining occurs to fill discrete construction orders for specific volumes and grain sizes. Depending on the grain size and chloride content, the sand is used to make concrete and asphalt, or as backfill for utility trenches and general fill. Material is used in roads, bridges, public and commercial buildings, and other construction projects. The Bay Area market demand for sand for these types of projects can be supplied by: land based quarries, imports from other countries shipped in large, ocean going vessels, and by sand mined from two general locations in San Francisco Bay – Central Bay and Suisun Bay Channel.

Demand for aggregate is expected to increase as the State's population continues to grow and infrastructure is maintained, improved, and expanded. The California Geological Survey predicts that the 50-year demand for all aggregate (including sand, crushed stone, and gravel) in the South San Francisco Bay and North San Francisco Bay Regions will be approximately 1,902,000,000 tons.[1] Currently, there is a substantial shortfall in total amount of permitted aggregate reserves to meet this demand; local land-based aggregate reserves contain enough permitted resources to last through 2023 in the North Bay and through 2023 to 2032 in the South Bay. Reserves also exist that are not currently authorized for mining.[2] The projections described above are for supply and demand of all aggregates. Of this total aggregate demand, about 25 percent is forecast for use in high strength concrete (Portland Concrete).[3] To date, the California Geological Survey has not projected market demand specifically for sand, especially the demand for types of sand equivalent to Bay sands.

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[1] Clinkenbeard, *Aggregate Sustainability in California*.
[2] Ibid.; John G. Parrish, *Update of Mineral Land Classification: Aggregate Materials in the North San Francisco Bay Production-Consumption Region, Sonoma, Napa, Marin, and Southwester Solano Counties, California* (California Geological Survey, 2013).
[3] Ibid.

In addition to Bay sand and local land-based reserves, the construction and transportation industries in the Bay Area also purchase aggregate from foreign producers in Mexico and British Columbia. California imported about 3.3 million tons of sand and gravel in 2004 and 2.4 million tons in 2005.[4] With respect to sand in particular, the Bay Area imported 1.7 million tons of British Columbia sand in 2012.[5] The Bay Area is the largest market for British Columbia (BC) sand, which is preferred for major construction projects requiring high-strength concrete due to its high quality.[6] Sand from British Colombia is not competitive with Bay or other locally-produced sand for private housing construction and neighborhood infrastructure projects, road base or subbase fill, or for general fill purposes.[7] Lind does not import sand from outside the Bay Area and uses only Bay sands to meet customer requests.

There are two companies that mine sand from the Middle Ground Shoal lease, Hanson Marine and Lind Marine. The cumulative proposed ten-year mining for both companies from this lease area would be 1.625 million cy.

Middle Ground Island Lease (TLS 39)	Annual Average Permit Volume (cy)	Peak Year Max Volume (cy)	Total 10-year Volume (cy)
Hanson Marine	40,000	50,000	400,000
Lind Marine	125,000	150,000	1,250,000
Total Mining Volume (TLS 39)	165,000	200,000	1,625,000

Bay Sediment Dynamics. Sediment dynamics in the Bay are complex and change over time. The Bay sediment system has been erosional during some periods and accretional in others. In addition to this natural variability, humans have greatly modified sediment dynamics in the Bay and Delta through hydraulic mining and modifications to waterways, including dams and flood control measures. The Gold Rush increased sediment inputs drastically due to hydraulic mining,[8] but by 1999 this pulse of sediments had largely moved into and/or through the watersheds and Bay system. Since that time, suspended sediment inputs into the Bay have decreased markedly and are not expected to increase or return to previous levels.[9] In the early 2000s, suspended sediment concentrations in the Sacramento River were approximately half of the amount entering over the previous half-century.

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[4] Susan Kohler, *California Non-Fuel Minerals, 2005* (California Geological Survey, 2007)
[5] Economic and Planning Systems, Inc., *Assessment of Economic Impacts Associated with Sand Mining in San Francisco Bay*.
[6] Polaris Minerals Corporation, *Management's Discussion and Analysis Year Ending December 31, 2013*, 2013; Economic and Planning Systems, Inc., *Assessment of Economic Impacts Associated with Sand Mining in San Francisco Bay*.
[7] Polaris Minerals Corporation, *Annual Information Form for the Fiscal Year Ended December 31,2012*, March 15, 2013; Economic and Planning Systems, Inc., *Assessment of Economic Impacts Associated with Sand Mining in San Francisco Bay*.
[8] Grove, Karl, *Hydraulic-Mining Debris in the Sierra Nevada*, US Government Printing Office, 1917.
[9] David H. Schoellhamer, "Sudden Clearing of Estuarine Waters upon Crossing the Threshold from Transport Supply Regulation of Sediment Transport as an Erodible Sediment Pool Is Depleted: San Francisco Bay, 1999," *Estuaries and Coasts* 34, no. 5 (2011): 885–99.

Project Description

Commission Jurisdiction: The project site falls within the Commission's "Bay" jurisdiction, under the McAteer-Petris Act, and within the primary management area of the Suisun Marsh, which requires the project obtain a marsh development permit pursuant to the Suisun Marsh Preservation Act. The sand offloading sites are partially within the Commission's shoreline band jurisdiction, but are not the subject of this application.

Location: The Middle Ground Island (MGI) lease area has been mined by Lind (Jerico) since 1979. Currently, both Lind and Hanson Marine Operations (Hanson) hold lease agreements with the Grossi Family to mine sand on the Middle Ground Island tideland parcel (TLS 39). The MGI lease area consists of a 367-acres lease, which includes subtidal lands located adjacent to MGI and near the Suisun Channel within Contra Costa County. Much of the lease area around MGI includes shallow water habitats, less than nine feet in depth, which are too shallow for mining. Equipment limitations and agency depth-restrictions limit mining activity to about 50.4 acres of the lease, which are adjacent to the federal navigation channel (Exhibit B). The mineable area of the lease is about 14 percent of the total lease area. The deeper water habitats include sandy subtidal habitat, mostly consisting of sand shoals within the lease area. Within the lease area, there is a rather steep transition from the shallow water flats near MGI down to the deeper subtidal areas where mining activities would occur (Exhibits B and D).

Project Details: The applicant, Lind Marine Operations, describes the project as follows:

In the Bay:

1. Hydraulically mine up to 125,000 cy of sand annually over a ten-year period from submerged lands located near MGI in the Suisun Channel using a hydraulic stationary pothole dredge. The sand would be offloaded at specific sand yards around the Bay Area (Petaluma, Napa, and Collinsville). Mining activities would occur year-round to meet the needs for sand in the Bay Area. In any given year, the mining could peak at 150,000 cy of sand mining;
2. The total ten-year mining average would not exceed 1,250,000 cy of sand, which includes volume mined during average and peak years;

In the Primary management Area of the Suisun Marsh:

1. Mine up to a total of 1,250,000 cy of sand over a ten-year period from submerged lands near the Middle Ground Island, within the primary management area of the Suisun Marsh. Offload sand from barges at the Collinsville offloading location. Mining in any one year would not exceed 150,000 cy, see above for more detail.

Equipment: Lind uses their tugboats *Trig Lind* or *Petaluma* and hopper barge *J5200*, equipped with suction dredge equipment when mining sand. The hopper barge *J5200* is 200 feet long by 45 feet wide, has a loaded draft of approximately 12 feet and unloaded draft of approximately 3.5 feet and can carry about 1,850 cubic yards of sand. The barge is equipped with a 40-foot long "drag arm" with a 14-inch diameter suction pipe. The end of the drag arm is fitted with a shorter 8 to 10 foot long pipe with a 6-inch "grizzly" attached to its end, which prevents rocks or debris larger than 6-inches from entering the pipe and the barge. The suction pipe also has additional external vent pipes (725 gpm) that pull in water to create the sand-water slurry (25% sand 75% water) when the end of the suction head is in the substrate. In October 2013, Lind installed positive fish barrier screens, with 1.75 mm openings, to these water vent pipes to prevent the entrainment of fish during mining.

Mining Process: Lind uses stationary potholing, in which a site is mined while the barge is anchored in a particular area during the mining event. Mining activity is not uniformly distributed throughout the lease area. Operators typically return to areas where they have found desirable sand deposits in the past. The equipment type used by Lind limits the mining to between the depths of minus 15 feet to minus 40 feet of water around the MGI lease area.

During stationary potholing, the mining barge is positioned over the mining area and maintained in place by a tugboat. The barge is ballasted and filled with Bay water. The drag arm is lowered toward the substrate and the suction pipe is lowered initially about five to eight feet into the sandy substrate. When the suction pipe is inserted into the substrate, vent pipes along the suction pipe allow sand to be pumped, via a 5,000 gallon/minute pump, onto the barge as a sand-water slurry mixture (25 percent sand: 75 percent water). During mining, the drag arm is continually lowered to maintain contact with the substrate as a depression or "pothole" forms and material sloughs in from the sides. The sand slurry is pumped over a grated loading chute running lengthwise atop the barge, which prevents larger material (>¼ - ½ inches) from entering the barge. Larger grain-sized material is discharged back to the Bay through a pipe extending below the barge into the Bay. As the barge fills with sand, the water inside the barge is displaced into troughs on the side of the barge and then discharged through a system of overflow outlets and

weirs, which discharge into the Bay below the barge. This discharge creates a temporary overflow plume around the barge, which could contain aggregates, fine grained sediment, plankton, larvae and other materials that do not settle out in the barge.

Timing and Duration: Generally, the timing and duration of a mining event depends on the equipment used, weather conditions, tidal cycles and sand quality at the selected mining location. Mining activities can occur during at any time of day. The entire mining operation can last 12 to 24 hours depending upon the transit distances between the mining location and the offloading sites, and the actual sand mining activity lasts about 3 to 5.5 hours. Lind's mining activities last on average about 4.7 hours during for excavation of approximately 1,000 to1,850 cy of sand. Due to the time requirements for mining and offloading, a single mining vessel would be unable to return to the same mining site more than twice in a 24-hour period.

Processing Yards: Sand is mined to fill particular customer orders for a desired grain size and in response to market demand for sand around the Bay Area. Although mining can occur at any time of year it can exhibit seasonal variations, peaking in late summer, early fall when construction activity in the region is highest.
Lind Marine has several upland offloading sites located in Collinsville, Napa and Petaluma, which provide sand to customers. Sand is offloaded from the filled barge using a landside conveyor belt and an excavator, which transfers the sand onto a shore-side conveyor system that piles the sand in the yard for further processing and shipment. The Collinsville offloading site is owned by Lind while the Petaluma and Napa offloading sites are customer owned. Sand from these offloading sites may be trucked to Windsor, Vacaville, Vallejo and other locations in Sonoma and Marin counties. Offloading facilities are small and not equipped to stockpile sand and thus sand is largely mined in response to specific orders.

Mitigation: The applicant has purchased 0.11 acres at Liberty Island Conservation Bank in the Delta, a tidal habitat restoration site, to compensate for impacts to salmonids, Delta and longfin smelt. In addition to mitigate for impacts to Essential Fish Habitat, the applicant is proposing to provide equipment and time to assist with CalRecycle's Estuary Clean Up program efforts to remove marine debris, abandoned vessels, and derelict pier pilings from the Bay and Hanson Marine Operations would contribute funds to this effort. It is not clear at this time how the $100,000 for the clean up effort would be split between the two companies. The mitigation described here is the total mitigation proposed by Lind for mining in Suisun Bay at the Middle Ground shoal and in the Suisun Channel.

Priority Use: The proposed project is not located within any Bay Plan Priority Use Areas.

Schedule and Cost: This project would commence in April 2015 and complete activities by April 2025, and would have a total project cost of $3,206,250.

Staff Analysis

The applicant is proposing to mine up to 1,250,000 cy of sand over ten years, with the ability to mine up to 125,000 cy annually, and 150,000 cy in peak years, with a hydraulic dredge as described above.

A. **Issues Raised**: The staff believes that the application raises seven primary issues: (1) whether the proposed level of mining is consistent with Subtidal Area Policy 1 which calls for projects in subtidal areas to be designed to minimize harmful effects to tidal hydrology, sediment movement, and Bay bathymetry; (2) whether the proposed level of mining is consistent with Subtidal Area Policy 1 which calls for projects in subtidal areas to minimize impacts to fish, other aquatic organisms and wildlife; (3) whether there are feasible alternatives to dredging sand from the Bay's sandy deep water areas; (4) whether the sand mining project has been designed to minimize impacts to water quality; (5) whether the project's unavoidable adverse impacts have been adequately mitigated; (6) whether the project is consistent with the Commission's policies regarding Dredging, Navigation Safety and Oil Spill Prevention; and (7) and whether the project is consistent with the public trust.

1. **Relevant Commission Policies on Sand Mining's Effects on Natural Resources.** The San Francisco Bay Plan has several policies regarding the natural resources of the Bay.

   Subtidal Areas Policy 1 states, "[a]ny proposed filling or dredging project in a subtidal area should be thoroughly evaluated to determine the local and Bay-wide effects of the project on: (a) the possible introduction or spread of invasive species; (b) tidal hydrology and sediment movement; (c) fish, other aquatic organisms and wildlife; (d) aquatic plants; and (e) the Bay's bathymetry. Projects in subtidal areas should be designed to minimize and, if feasible, avoid any harmful effects."

   Subtidal Area Policy 2 states, "[s]ubtidal areas that are scarce in the Bay or have an abundance and diversity of fish…and wildlife (…sandy deep water or underwater pinnacles) should be conserved. Filling, changes in use; and dredging projects in these areas should therefore be allowed only if: (a) there is no feasible alternative; and (b) the project provides substantial public benefits."

   Similarly, the Bay Plan policies on Fish, Other Aquatic Organisms and Wildlife policies state, "[t]o assure the benefits of fish, other aquatic organisms and wildlife for future generations, to the greatest extent feasible, the Bay's…tidal flats, and subtidal habitat should be conserved, restored and increased." The policies also state that specific habitats that are needed to conserve, increase or prevent the extinction of any native species, including special status species, should be protected.

Water Quality Policy 2 in the Bay Plan states that "[w]ater quality…should be maintained at a level that will support and promote the beneficial uses of the Bay as identified in the San Francisco Bay Regional Water Quality Control Board's *Water Quality Control Plan, San Francisco Bay Basin*…."

The Bay Plan policies on Tidal Marsh and Tidal Flats also seek to protect both habitat and wildlife. Policy 1 states, in part, that "tidal flats should be conserved to the fullest possible extent" and that "dredging projects that would substantially harm…tidal flats should be allowed only for purposes that provide substantial public benefits and only if there is no feasible alternative." Policy 2 states that "[a]ny proposed…dredging project should be thoroughly evaluated to determine the effect of the project on…tidal flats, and designed to minimize, and if feasible, avoid any harmful effects."

The Bay Plan policies on Recreation state, in part that "[s]andy beaches should be preserved, enhanced, or restored for recreational use…."

The Solano County Policies and Regulations Governing the Suisun Marsh cites similar policies supporting the protection of habitat and species. Its Agricultural and Open Space Land Use Policy 1 states "The County shall preserve and enhance wherever possible the diversity of wildlife and aquatic habitats found in the Suisun Marsh… to maintain these unique wildlife resources."

2. **Background.** Sand mining has the potential to affect two important Bay resources- the sand itself, which forms landforms and substrates (shoals and beaches), both in the Bay and in the outer California coast, and the Bay's biota, some of which use the Bay's sand as habitat.

   The following analysis regarding local and Bay-wide effects is presented in two parts: (a) physical; and (b) biological.

   a. **Physical Resources**. The Bay plan policies direct the Commission to examine potential impacts to tidal hydrology, sediment transport, tidal flats, beaches and Bay bathymetry. It is important to understand the current sediment system in order to put the proposed project in context.

      (1) **Sediment Decline.** Sand is a primary building block of the Bay and its habitats, it is important to understand the context in which the mining would occur. Most sand in San Francisco Bay originates in the Sierra Nevada Mountains and is transported along the riverbeds as bedload or transported in suspension to the through the Delta.[10] A smaller amount of sand originates from local sources, such as Bay watersheds, coastal bluffs and cliffs, and from the Pacific Ocean via the Golden Gate. On the Bay floor, sand shoals make up large underwater dunes, some over two meters tall, particularly in Central Bay, while other shoals are made up of smaller sand "ripples" where less energy is present.

[10] Patrick L. Barnard et al., "Integration of Bed Characteristics, Geochemical Tracers, Current Measurements, and Numerical Modeling for Assessing the Provenance of Beach Sand in the San Francisco Bay Coastal System," *Marine Geology* 336 (2013): 120–45.

System-wide, the sediment supply, and sand supply in particular, has decreased in recent years and is well documented (Figure 1).[11] Furthermore, due to its larger grain size, sand is readily impounded behind dams.[12] Dams and other water control structures also diminish the peak water flows required to move large amounts of sand, further decreasing the amount of sand reaching the Bay.

From 1997 to 2008, the rate of sediment loss in Central Bay was nearly three times higher than during the 1947-1979 period[13]; most of this erosion was from sandy areas. From 1997 to 2008, the sediment composition found at the mouth of the Bay changed; the percentage of sand decreased while the percentage of mud increased.[14] Finally, a recent analysis of bedforms (underwater sand dune formations) found that bedforms are shorter than would be predicted by local water currents and hydrodynamics, indicating that much of the system is erosional.[15]

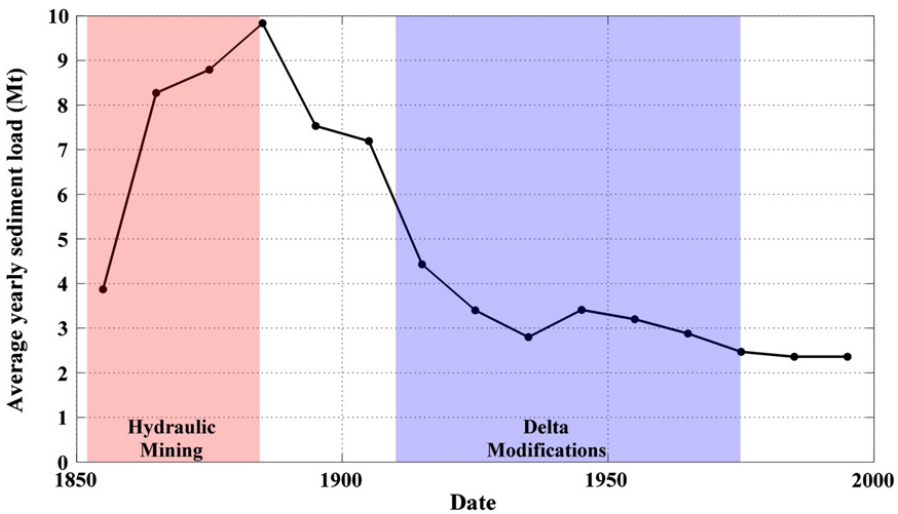

Figure 1. Reconstructed decadal sediment load from the Sacramento and San Joaquin rivers with the major periods of hydraulic mining (1852–1884) and Delta modifications (1910–1975) highlighted.[16]

With less sand in the Bay system, there is potential for increased coastal erosion, as less sand will be supplied to beaches and underwater shoals. Smaller sand bars along the shore, and at the mouth of the Bay are less effective at buffering the coast from wave energy. This has already been

[11] Patrick Barnard and Rick Kvitek, "Anthropogenic Influence on Recent Bathymetric Change in West-Central San Francisco Bay," *San Francisco Estuary and Watershed Science* 8, no. 3 (2010).
[12] Matthew J. Slagel and Gary B. Griggs, "Cumulative Losses of Sand to the California Coast by Dam Impoundment," *Journal of Coastal Research*, 2008, 571–84.
[13] Ibid.; Theresa A. Fregoso, Amy C. Foxgrover, and Bruce E. Jaffe, *Sediment Deposition, Erosion, and Bathymetric Change in Central San Francisco Bay: 1855-1979* (U. S. Geological Survey, 2008).
[14] Patrick L. Barnard, Jeff E. Hansen, and Li H. Erikson, "Synthesis Study of an Erosion Hot Spot, Ocean Beach, California," *Journal of Coastal Research* 28, no. 4 (2012): 903–22.
[15] Patrick L. Barnard et al., "Sediment Transport Patterns in the San Francisco Bay Coastal System from Cross-Validation of Bedform Asymmetry and Modeled Residual Flux," *Marine Geology* 345 (2013): 72–95.
[16] Barnard et al., "Sediment Transport in the San Francisco Bay Coastal System."

observed for the San Francisco Bar with respect to Ocean Beach.[17] However, accretion and erosion patterns for Bay beaches are not well studied. As is the case for sediment in general, sand is increasingly being viewed as an ecological, societal, and economic resource.

(2) **Sand Transport**. Within the Bay there is both sand that was deposited over geologic time (relic sand) and sand that is in transport today. While the primary sand transport pathway has been well defined for the Bay system through mineralogy and biogenic/anthropogenic provenance studies (Figure 2),[18] the volume of sand currently entering the Bay can only be estimated, though available science is providing better information as a basis for these estimates.

In order to better understand the potential volume of sand transport in the Bay, an examination of peer-reviewed papers detailing studies of sediment inputs to the Bay was completed. A continuous long-term data set (Mallard Island 1997-present) detailing sediment inputs from the Delta to Bay was examined[19] and shows that on average the total suspended sediment load to the Bay is three percent sand, or approximately 19,000 cy of sand. Additional work by the USGS, estimated the bedload contribution of sand using data from 1997-2010 from twenty-seven sites within the Delta and found the average volume of sand entering the Bay as bedload to be 58,000 cy (sand makes up 86-90 percent of the total bedload).[20] Combining the volume of suspended sand and bedload, approximate an average of 77,000 cy of sand enters the Bay from the Delta on average annually.

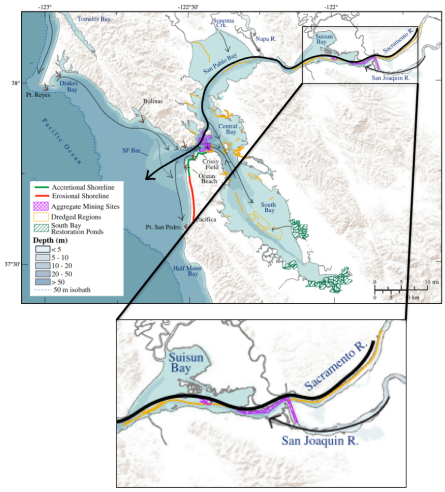

Figure 2. Model of sand transport pathways in the San Francisco Bay Coastal System. Heavier and longer arrows indicate more dominant pathways.[21]

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[17] Dallas and Barnard, "Anthropogenic Influences on Shoreline and Nearshore Evolution in the San Francisco Bay Coastal System."
[18] Barnard et al. 2013; McGann et al. 2013.
19 McKee et al. 2013.
[20] Effects of human alterations on the hydrodynamics and sediment transport in the Sacramento-San Joaquin Delta, California Marineau and Wright, 2014 and Marineau USGS (writ. comm. 2015).
[21] McKee et al. 2013

The other primary source for sand to the Bay is the local tributaries. The information available for these sources is extremely limited. Available empirical data from local tributaries suggests that approximately 20 percent of total suspended sediment, or 300,000 cy of sand is entering the Bay annually from local tributaries.[22] Bedload from the local tributaries is not well described. We do know that sand settles out in flood control structures and is dredged prior to reaching the Bay[23]. Preliminarily work has identified removal of an average of 30,000 cy of coarse grain sediment from flood control channels annually.[24] If the flood control channels were regularly maintained, the sand from these channels would not enter the Bay. Further, local South Bay tributaries (mainly Calaveras Creek and Alameda Creek) deliver smaller amounts of sand that tend to remain in the South Bay.[25] However, there are few other tributaries in the Suisun embayment that can contribute sand to this area and most of the material entering the Suisun Bay comes from the Delta.

There is insufficient information available to estimate the amount of sand entering the Bay from local cliff or bluff erosion, or the outer coast, though these volumes are considered to be minor based on the sand provenance work by USGS and the local geology would suggest that these volumes are minor contributions. While important information is missing, the total annual average volume of sand being transported into the Bay from the Delta and the local tributaries may be on the order of approximately 375,000 to 400,000 cy per year. The volume of sand that cannot be estimated is not likely to be greater than the total volume estimated from the Delta suspended sediment from local tributaries (375,000 -400,000 cy), and would likely be within the same order of magnitude on an average annual basis[26].

(3) **Relic Sand.** Relic sand was likely deposited during the last ice age (Holocene Period) when San Francisco Bay was little more than a river. This sand was likely deposited over thousands of years. The amount of relic sand present in Suisun Bay around Middle Ground Island is unknown. A seismic reflection survey through the Delta around the Kirby Hills Fault zone completed by the USGS identified unconsolidated sediment to about 200 meters depth and did not find a clear underlying basement layer or bedrock down through about three miles of sedimentary deposits[27]. The applicant has stated that a similar sediment configuration to the Kirby Hill Fault likely exists around Middle Ground Island based upon the proximity of Middle Ground to the Kirby Hills Fault Zone. However the composition of the unconsolidated material is not

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[22] *Ibid*.
[23] McKee et al. in progress, 2015
[24] McKee writ. comm. 2015
[25] Barnard et al., "Integration of Bed Characteristics, Geochemical Tracers, Current Measurements, and Numerical Modeling for Assessing the Provenance of Beach Sand in the San Francisco Bay Coastal System."
[26] Schoellhamer and McKee, writ. comm 2015
[27] Parsons et al. 2002

known and the sand composition has not been determined for the Middle Ground lease area. There are no comprehensive surveys or data sets that show the actual depth, grain size or quality of the sediment between the sand shoals and the underlying bedrock at Middle Ground.[28]

Without borings and more specific information regarding the sand resource depths and grain size profiles, the resource availability cannot be clearly defined or estimated. Information regarding resource availability would assist with understanding potential effects of the project on the sediment transport of the Bay and potential habitat changes as sand is removed from the bottom of the Bay. It is likely that millions of cubic yards of sand of varying quality exist between the bedrock and the current Bay bottom. However, once mined, natural processes that exist today are not sufficient to replenish this bedded sand.[29]

(4) **Bay Resources**. Bay Plan policies direct the Commission to thoroughly examine project impacts on the physical processes of the Bay. Potential project impacts include changes to water currents and velocity, salinity, sediment transport patterns and erosion.

In its BCDC permit application, Lind refers to the State Lands Commission Final Environmental Impact Report, 2012 (FEIR) for analysis of potential impacts to tidal hydrology. The cumulative project evaluated in the SLC FEIR was a total of 2.02 million cy of mining activity annually for ten years in both Central and Suisun Bays by both Lind and Hanson. The reduced project alternative was to mine up to 1.426 million cubic yards per year for ten years for all lease areas, which was the average amount of mining performed by both companies in both Central and Suisun Bays between 2002 and 2007.

To assess the potential effects of the project to tidal hydrology, salinity and sediment transport, the FEIR relied on a numerical model. Impacts were evaluated by comparing the existing condition with two project-condition scenarios over 15-day and one-year periods.[30] The first scenario explored the potential impacts of 10 years of mining occurring all at once over the entire lease area, including areas not previously mined with a constant mining thickness. The second scenario limited the mining to only those portions of the lease areas that are actually mined (developed using tracking information from past mining events) using a constant mining thickness.

[28] USGS 1967-68 Acoustic Profiling and 1997 USGS Bathymetry; Chin et al. 2004
[29] SLC FEIR
[30] SLC FEIR pg 4.3 - 28

Regarding the impacts to hydrodynamics, the findings of the model indicate that the current velocity changes caused by Scenario 1 or 2 would affect areas adjacent to the lease areas as wide as the lease areas themselves, but did not provide a description of the changes. The model identified short-term increases in near-bottom salinity within the mining holes, but not outside of the lease areas.

The 15-day simulations indicated that the changes in transport patterns during both ebb and flood currents are limited to areas immediately adjacent to the lease areas. Full-year simulations indicated that the changes in net transport patterns are also limited to the leases and areas immediately adjacent to these lease areas. These model results were the same for Central and Suisun Bay lease areas. Because this modeling was qualitative, it did not describe magnitude of impacts, and therefore it is difficult to analyze the impacts to sediment transport from the project without additional information.

There are few other tributaries in the Suisun embayment that can contribute sand to this area. Mining in both Suisun Channel and Middle Ground Shoal may be capturing much of the sand supply entering the Bay system, except in very high flow years. Coast Harbor Engineering's (CHE) analysis of available bathymetry data and previous mining activities indicates that sand appears to be primarily arriving in the mining areas under transport from the surrounding areas. The large surrounding areas of ongoing sand transport and lack of observed change in surrounding morphology during the study period indicate that deposition in the mining areas is likely to continue at similar rates.[31] However, it should be noted that the information analyzed was primarily from the lease areas themselves. The surrounding area includes the Delta, adjacent sand shoals and the sand transporting through this region to Central Bay. The exception to this observation is the deeper portions of the Middle Ground lease area, where the resource also appears to be limited to the material currently in place and is showing an erosional trend.[32] Modeling showed reductions in sediment availability in the deeper portions of the Middle Ground Lease Area by about one percent per year.[33]

The FEIR also found that since the proposed mining can be expected to further deepen the mining holes within the lease areas, there is the potential that these holes will attract and trap more sediment in the future.[34] CHE suggests that because the mined areas are not being replenished at an appreciable rate, sand transport effects beyond the lease area are minimal.

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[31] Coast Harbor Engineering 2009 [SLC FEIR Appendix G]
[32] SLC FEIR. 2012, pg. 4.2 -10
[33] CHE Study. SLC EIR pg G-16
[34] SLC FEIR. 2012, pg. 4.3 -30

(5) **Bay Beaches.** The Bay Plan Recreation policies state that "[s]andy beaches should be preserved, enhanced, or restored for recreational use…consistent with wildlife protection." Historically, the west side of San Francisco had broad beach and dune systems, and the east side of Central Bay had many beaches as well[35] (Figure 4). Though the Bay shoreline has been altered, some sandy beaches still exist, including Point Pinole, Keller Beach, Crissy Field, Lands End, Candlestick Point and China Camp State Park. These beaches provide shoreline protection, habitat, and recreational opportunities. The BCDC permit application and SLC FEIR lack information regarding the potential impacts to Bay beaches, perhaps because little is known about the transport dynamics of beaches. The applicants provided information describing the East Bay beach sand as being supplied by both local cliff-derived soils and subtidal Central Bay sand.[36] With sea level rise, increasing amounts of sand will likely be needed to prevent erosion and to allow the landward migration of Bay beaches, as well as supplying the outer coast beaches that protect infrastructure and development.[37]

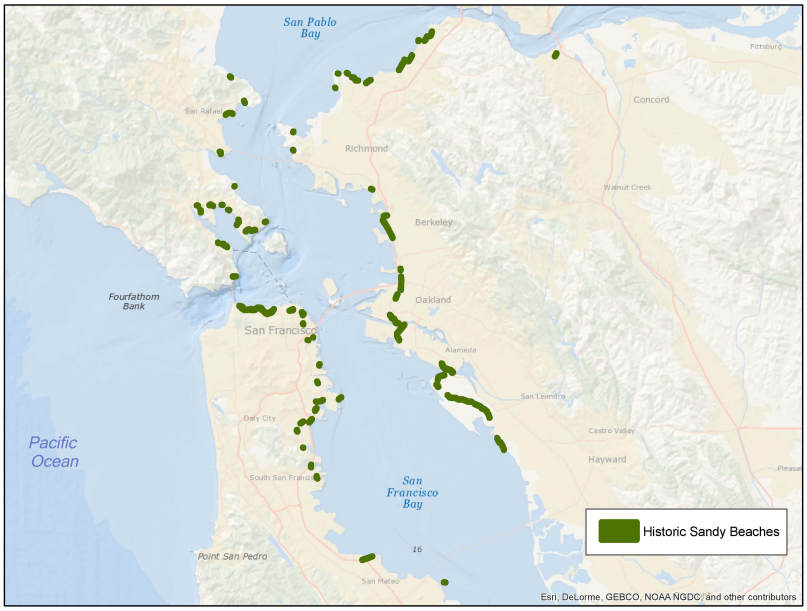

Figure 3. Historic sandy beaches inside of the Golden Gate, c. 1850.[38] Points indicate locations of beaches and do not represent the sizes of individual beaches.

[35] R. Olmstead and N. Olmstead, *Ocean Beach Study: A Survey Of Historic Maps And Photographs* (City of San Francisco, California, February 23, 1979., n.d.); EcoAtlas, California Wetlands Monitoring Workgroup (CWMW), accessed June 27, 2014, http://www.ecoatlas.org.

[36] Hein, Mizell, and Barnard, "Sand Sources and Transport Pathways for the San Francisco Bay Coastal System, Based on X-Ray Diffraction Mineralogy."

[37] Barnard et al., 2013

[38] SFEI EcoAtlas.

(6) **Tidal Flats.** The Bay plan also requires that the Commission thoroughly evaluate dredging projects to determine the effect of a project on tidal flats. Unfortunately, even less is known about the location of the Bay's tidal flats and the sand transport to and from these areas. A review of the available research did not identify tidal flats specifically beyond mudflats adjacent to marshes.

(7) **The Outer Coast.** The McAteer-Petris Act, Section 66605(d) allows the Commission to examine environmental impacts to the Bay Area. Sand transport continues from the Bay to the Outer Coast to feed beaches to the south. As currently understood, sand from the Bay is first deposited on the San Francisco Bar, a large sand bar formed by the ebb tide (Figure 4). From 1873 to 2005, the San Francisco Bar shrunk both in height and diameter, and migrated approximately 1 kilometer towards the shoreline.[39] This likely resulted from reduced tidal flows due to historic filling, diking, and sedimentation of the Bay, and from decreased amounts of sediment leaving the Bay as a result of hydrologic modifications upstream, mining, and dredging.[40] The erosion and contraction of the San Francisco Bar has effectively resulted in more sand being delivered to northern Ocean Beach, and less to southern Ocean Beach, likely exacerbating erosion to the south.[41] Additionally, modeling has demonstrated that changes to the Bar affect wave energy reaching the shoreline, with northern Ocean Beach being protected, and southern Ocean Beach being more exposed.[42] These changes help explain recent accretion at Baker Beach, Crissy Field, and northern Ocean Beach, and partially explain erosion at southern Ocean Beach.

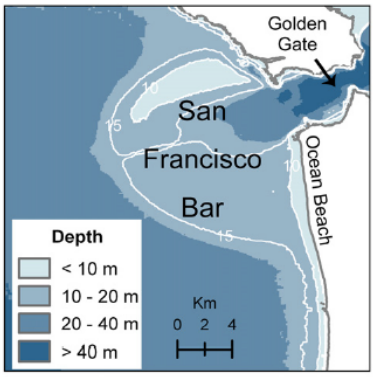

Figure 4. Location of the large underwater sand deposit known as the San Francisco Bar, or ebb-tidal delta.[43]

[39] Kate L. Dallas and Patrick L. Barnard, "Anthropogenic Influences on Shoreline and Nearshore Evolution in the San Francisco Bay Coastal System," *Estuarine, Coastal and Shelf Science* 92, no. 1 (2011): 195–204.
[40] K. L. Dallas and P. L. Barnard, "Linking Human Impacts within an Estuary to Ebb-Tidal Delta Evolution," *Journal of Coastal Research Special*, no. 56 (2009): 713–16.
[41] Jeff E. Hansen, Edwin Elias, and Patrick L. Barnard, "Changes in Surfzone Morphodynamics Driven by Multi-Decadal Contraction of a Large Ebb-Tidal Delta," *Marine Geology* 345 (2013): 221–34.
[42] Dallas and Barnard, 2011
[43] Kate L. Dallas and Patrick L. Barnard, "Anthropogenic Influences on Shoreline and Nearshore Evolution in the San Francisco Bay Coastal System," *Estuarine, Coastal and Shelf Science* 92, no. 1 (2011): 195–204.

The California Coastal Commission, the USGS and Bay Keeper have raised concerns over the potential for sand mining to contribute to reduction in the Bar as well as related impacts to Ocean Beach. Though there are many large and small scale factors affecting sand supply and transport in the Bay system, removing sand from sandy shoals, particularly those along the northwest San Francisco waterfront such as Presidio Shoals that have a net transport to the outer coast, could affect sand supply to the Bar and outer coast beaches.[44] The FEIR modeling study showed that the proposed mining in Central Bay would likely contribute 0.2 to 0.3 percent of the annual observed erosion of the Bar.[45] However, it further stated, "[i]f the overall reduction in sediment supply in the Bay-Delta system is the cause, or a contributing cause, of the erosion of the San Francisco Bar, it would be reasonable to conclude that the [sand mining] Project could make a considerable contribution to this process."

In letters to BCDC, the San Francisco Bay Keeper and the California Coastal Commission expressed concern over the ability of the model to analyze potential impacts of the project due to the limited nature of its application. The public comments call into question whether the model's prediction that the Central Bay shoals likely contribute only 0.2 to 0.3 percent of the annual observed erosion of the Bar. Tracer studies were suggested as a possible way to determine the pathway from the leases to the Bar and Ocean Beach. Additionally, the Coastal Commission requested limiting mining in Central Bay to the existing levels of mining.

(8) **Bay Bathymetry.** The long-term lasting impacts of mining sand from the bottom of the Bay on the Bay's bathymetry are not well known. Natural bedforms and sand waves occur along and within the Suisun Channel (Figure 6). There is some indication that disturbances to bedforms and subtidal areas persist over time in the San Francisco Bay.[46] Changes to the bathymetry of the Suisun Channel from sand mining on the Middle Ground lease area are visible in the multibeam survey conducted in 2014 (Figure 5).

The first multibeam bathymetric survey of the MGI lease was conducted in 2014. Prior to the multibeam survey, Lind conducted bathymetric single beam surveys of the lease area every six months to track changes in the bathymetry of the area. For Middle Ground Shoal, CHE's analysis of the available bathymetric data showed a trend of reduced sediment availability over the last eight years. On average, the available sediment in the Middle Ground Shoal lease area was reduced by approximately one percent per year in the deeper channel area. Some deposition (or replenishment) is apparent in this

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[44] Patrick L. Barnard et al., "Integration of Bed Characteristics, Geochemical Tracers, Current Measurements, and Numerical Modeling for Assessing the Provenance of Beach Sand in the San Francisco Bay Coastal System,"; Patrick L. Barnard et al., "Sediment Transport Patterns in the San Francisco Bay Coastal System from Cross-Validation of Bedform Asymmetry and Modeled Residual Flux."

[45] Scott Fenical et al., *Technical Report: Analysis of Impacts of Sand Mining in the San Francisco Bay on Sediment Transport and Coastal Geomorphology in San Francisco Bay, Suisun Bay, and Outside the Golden Gate*, 2013.

[46] Chin et al. 2004. Shifting Shoals and Shattered Rocks-How Man Has Transformed the Floor of the West-Central San Francisco Bay. USGS Report.

lease area, but the overall trend indicates a fairly consistent depletion of available sediment in the deeper mineable areas of the lease.[47] CHE's modeling showed little transport of sediment to the deeper channel areas and suggests that mining activities are removing material already in place on the lease area. Limited available data and modeling efforts make it difficult to assess impacts of the mining activity on the surrounding and downstream areas. Deepening of the channel may cause material from the sides or channel edge to slump into the mining holes.

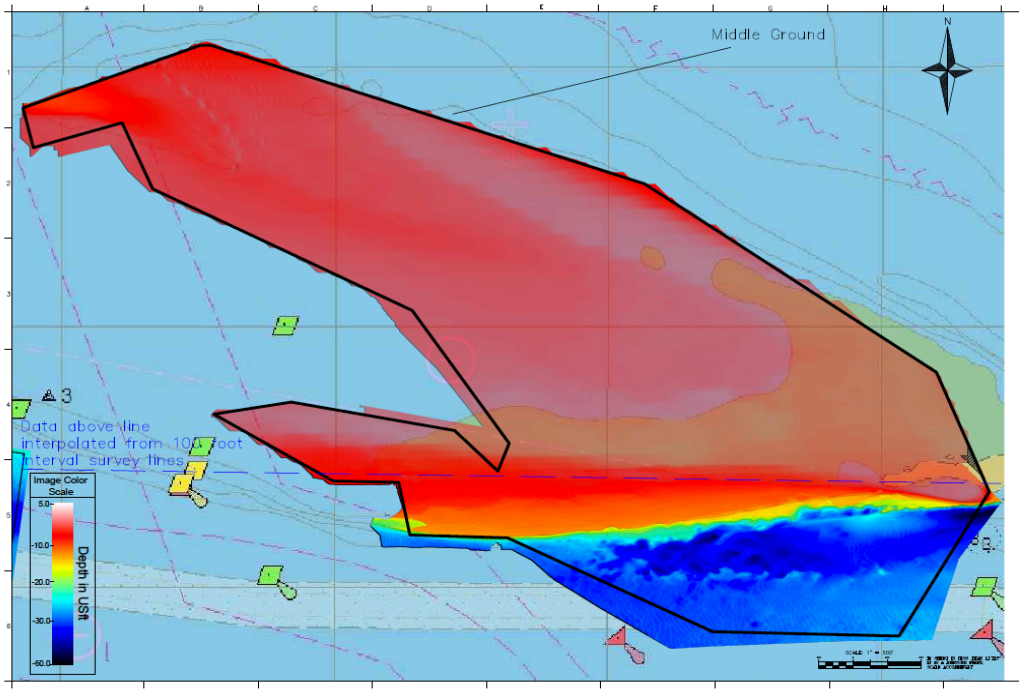

Figure 5. Multibeam bathymetric map of the Middle Ground lease area, survey conducted in 2014. Middle Ground Island is shown as light green in the background. Shallow depths shown in red and deeper areas shown in blue. The federal navigation channel runs through the southern portion of the lease area. Potholing from sand mining is shown in the deepest portions of the lease area, adjacent to the federal navigation channel.

[47] *Ibid*.

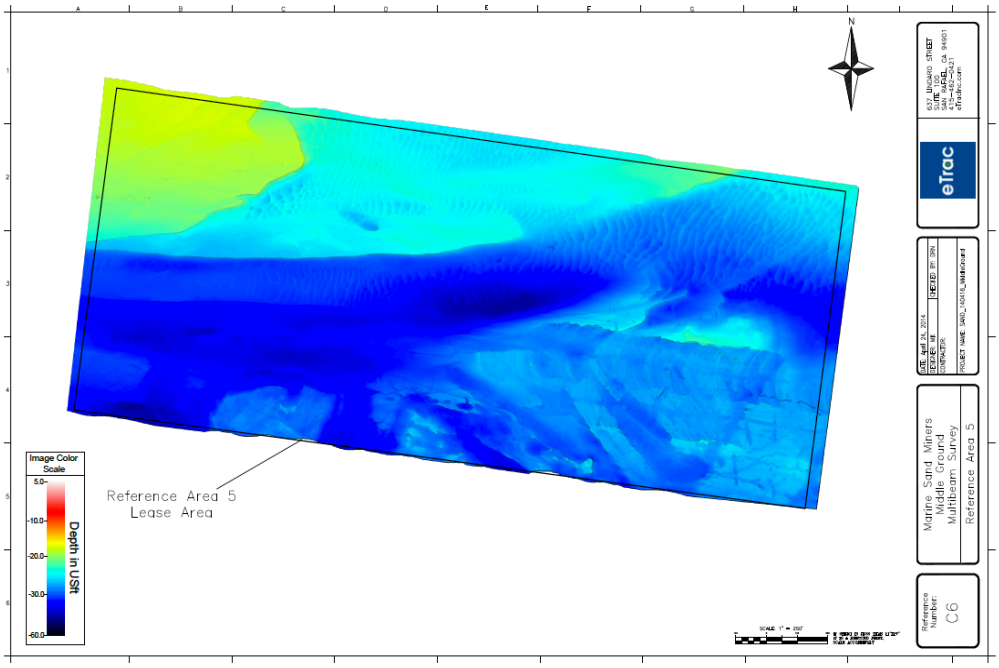

Figure 6. Multibeam survey downstream of Middle Ground Island conducted in 2014. The Channel is shown in dark blue. Note the naturally occurring sand waves in the northeastern portion of the channel. Also, the footprint from dredging of the federal navigation channel is visible in the lower southeastern corner of the image.

(9) **Bed Forms.** Bay bathymetry is not limited to depth of sediment alone. It also speaks to geomorphology, or shape of the Bay bottom and how it relates both to sediment movement and habitat features. Sand shoals can be flat, rippled or waves and can be described as underwater sand dunes that have both crests and troughs (Figure 6). The shape of the sand waves is specific both to grain size of the material and the local hydrology. Bedforms located within Suisun Bay are asymmetric and indicate a net flux of sediment from the Delta to the Bay[48]. Larger features are found in higher energy areas, where calmer waters produce flatter, less distinct shoals. Sand mining activity changes the wave-form and the grain size of the mined area (Figure 5,Figure 7).[49]

[48] Barnard et al. 2013
[49] SLR FEIR

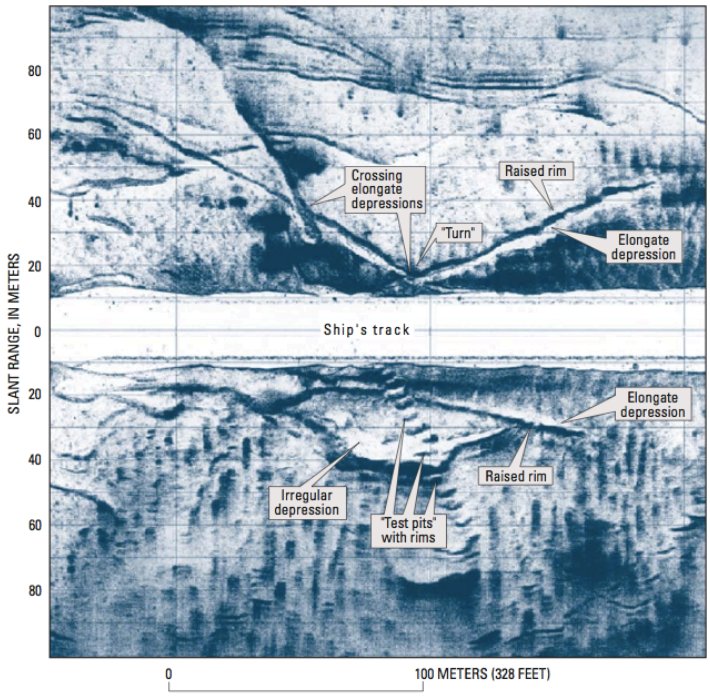

Figure 7 Multibeam images from sand mining activity on Presidio Shoal captured by USGS immediately after a mining event.[50]

The Bay Plan Subtidal Areas policies state, "[p]rojects in subtidal areas should be designed to minimize and, if feasible, avoid any harmful effects." The applicant is requesting to mine up to 125,000 cy of sand annually from the Middle Ground Island lease area, with peak mining years of 150,000 cy, for a total of not more than 1.25 million cubic yards (mcy) over a ten-year period. This volume is reduced from the original volume permitted under BCDC permit No. 16-78(M), which allowed Lind to mine up to 250,000 cy of sand annually at the Middle Ground Island lease area. This is a reduction of between 100,000 and 125,000 cy annually.

The applicant states that the EIR, its appended studies, and additional information documents the lack of harmful effects of sand mining on tidal hydrology. Additionally, the EIR concluded that continued sand mining for ten years will not result in any "measurable" or "detectable" adverse physical harm to these areas or "likely to cause measurable sediment depletion" and would not affect sediment transport outside of the immediately vicinity of the mining leases areas."

Other evidence and opinions suggest that: (1) Suisun, San Pablo Bay and Central Bay are currently in an erosional state; (2) the sediment supply, including sand sized sediment has shown a step decline in supply that scientists have stated is unlikely to be reversed due to human alteration of the system; (3) Central Bay is erosional and there are significant changes in the bathymetry in some lease areas; (5) Central Bay lease areas are replenishing at a rate of only five to fifteen percent of what is being mined; (6) there are changes to the bedforms themselves, which may have impacts

[50] Chin et al. 2004. Shifting Shoals and Shattered Rocks-How Man Has Transformed the Floor of the West-Central San Francisco Bay. USGS Report.

on habitat and species that use them; (7) southern Ocean Beach is erosional, while northern Ocean Beach is accreting, likely due to the change in position of the San Francisco Bar, though these mechanisms are not well defined at this time and (8) the there is not sufficient information to quantify changes to salinity or tidal hydrology resulting from the proposed project.

The Commission should decide if the proposed project has been thoroughly analyzed for impacts to tidal hydrology, sediment transport and Bay bathymetry and if as proposed, the project has minimized harmful effects to the same.

b. **Biological Resources: Fish, Other Aquatic Organisms, and Wildlife, Subtidal Habitats, and Tidal Flats.** The San Francisco Bay Plan contains policies requiring the protection of native and threatened and endangered species of the Bay and the protection of habitat areas essential for the survival of these species. These policies include Subtidal Areas Policy 1, which directs the Commission to thoroughly evaluate any proposed project in subtidal areas and minimize potential harm. The Commission's Bay Plan Fish, Wildlife and Other Aquatic Organisms, Policy 2 directs the Commission to conserve habitats that are important for endangered and threatened species, but also to protect habitats important for the continued existence of native species within the Bay. Policy 4 requires the Commission to consult with the Resource Agencies when a proposed project has impacts to native and more specifically listed species. It also requires that the applicant obtain biological opinions and "take" permits when impacts to listed species could occur. It further directs the Commission to consider the conservation recommendations of the Resource Agencies to avoid adverse impacts to species and wildlife habitat from a proposed project.

   The Bay Plan's Subtidal Policy 2 directs the Commission to conserve sandy deep water habitat, and allow dredging only if there is no feasible alternative and the project provides substantial public benefits. The Bay Plan's policies on Fish and Wildlife and Tidal Marsh and Tidal Flats policies direct the Commission to conserve subtidal habitat and tidal flats to the fullest possible extent (specifically tidal flats). Solano County Policies and Regulations Governing the Suisun Marsh also supports the protection of habitat and species. Its Agricultural and Open Space Land Use Policy 1 states "The County shall preserve and enhance wherever possible the diversity of wildlife and aquatic habitats found in the Suisun Marsh… to maintain these unique wildlife resources." Lastly, the Region's Subtidal Habitat Goals Report has specific protection goals to "Promote no net increase in disturbance to San Francisco Bay soft bottom habitat", which includes sandy subtidal habitat and to "Promote no net loss to San Francisco Bay subtidal and intertidal sand habitats."[51]

[51] San Francisco Bay Subtidal Habitat Goals Report: Conservation planning for the submerged areas of the Bay. 2010. California Coastal Conservancy, NOAA, BCDC, and SFEP.

(1) **Bay Habitat.** The Estuary is a dynamic environment and provides feeding, breeding, spawning and rearing habitat for a number of state and federally listed species, as well as many native species. The San Francisco Estuary has been designated as critical or essential habitat for many species of fish, such as the Chinook salmon and the Delta smelt, under the federal Magnuson-Stevens Act and the state and federal Endangered Species Acts. Species within the San Francisco Estuary have many different life stages that rely to varying degrees on the estuarine system. Some species of anadromous fish only use the estuary for a relatively short period of time during migration to the ocean as juveniles or back to freshwater streams for spawning, while other species live their whole lives in the estuary and rely heavily on Bay ecosystems.

The NOAA National Marine Fisheries Service (NMFS) determined that the proposed project would adversely affect Essential Fish Habitat (EFH) in the San Francisco Bay. The impacts to EFH would include: (1) direct impacts and removal of the substrate (2) destabilization and slumping of shallow water habitat areas adjacent to the mining area, (3) increased depth and grain size in the lease areas (Barnard and Kvitek 2010), (4) removal of potential food prey items for species normally feeding on the benthic organisms, and (5) increased turbidity in the water column[52]. NMFS defines habitats as "those waters or substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." NMFS considers adverse impacts to fish habitat to be those activities that "reduce quality or quantity of EFH [essential fish habitat], and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species, and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH."

Because the proposed project occurs subtidally, "habitat" in this analysis of the project's impacts on Bay species is considered both the sandy-bottom substrate of the Bay floor and the overlying water column. The proposed project would result in the "take" of state and federally listed species as well as native Bay species[53]. Impacts to species living in the estuary as a result of the project may include: (1) impacts to open-water (pelagic) communities resulting from increased turbidity in the discharge plume created during mining activities; and (2) disturbance to bottom-dwelling species through direct entrainment or impingement of species and additional indirect impacts from habitat alteration.

[52] NMFS Biological Opinion. 2015.
[53] SLC FEIR

(2) **Potential Impacts to Open-water (Pelagic) Habitat.** The proposed project activities would result in the creation of a discharge plume with an increased concentration of fine-grained sediment, which can persist around the project area for about 3-4 hours after completion of the mining activity until fully dissipating to background levels. Direct impacts to the open water communities resulting from increased water column turbidity may include impacts to visual foraging, susceptibility to predation and interference with migratory behavior[54], delayed hatching, and physiological impacts, including clogged gills or eroded gill and epithelial tissue[55]. Indirect impacts to important open water species within the Bay may occur from a loss of benthic prey items or decreased productivity resulting from turbidity impacts to the planktonic and aquatic plant communities, which form the base of many food webs in the estuary.

Additionally the locally increased turbidity from the discharge plume may cause direct impacts to phytoplankton[56] and zooplankton, which are important food items for many species in the Bay[57]. However, the overflow plume does not last more than about 9.5 hours (depending on environmental conditions) and the impact of this local reduction in plankton productivity is likely to be minor in relation to the productivity of the entire Bay. In addition, the increased local turbidity in the discharge plume can be similar to ambient turbidity levels in Suisun Bay or similar to the turbidity of large runoff events in Central Bay[58].

NMFS found that the likelihood of fish exposure to the elevated turbidity levels in the overflow plume on any given day would be low since there is one full tidal cycle between mining events. Additionally the size of the overflow plume is relatively small compared to the amount of adjacent open-water areas in Central Bay, Suisun Bay, and the western Delta[59]. The sediment-associated contaminants that may be resuspended are not expected to impact water quality to a level of concern.[60]. This issue is further discussed in the Water Quality section.

Entrainment occurs when an organism cannot swim or escape from the mining equipment and is sucked into the intake equipment. Some planktonic organisms, including larval stages of invertebrate and fish species, may be initially entrained during the ballasting of the hopper barge[61]. These organisms may also be entrained directly through the suction pipe or drag head. However, minimization measures put in place by the resource agencies

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[54] NOAA NMFS. 2015. Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation
[55] SLC FEIR
[56] *Ibid*.
[57] USFWS Biological Opinion. 2014.
[58] NMFS Biological Opinion. 2015
[59] *Ibid*.
[60] *Ibid*.
[61] AMS Fish Entrainment Estimates Study. 2009.

require that hydraulic pumps only be turned on within three feet of the Bay floor, which limits impacts to planktonic organisms and other species within the water column.

The USFWS issued a biological opinion for "take" of Delta smelt, an endangered species, and required mitigation at Liberty Island. The CDFW issued an incidental take permit for longfin and Delta smelt, as well as salmonids, and in it's permit, determined the proposed project would have impacts to state-listed salmonids and smelts. The CDFW's permit required mitigation for "take" based upon the total volume of water pumped during the mining activities under different water year conditions and USFWS and CDFW also required mitigation at Liberty Island, a mitigation bank in the Delta being managed for fish habitat. Additionally, NMFS identified that the proposed project would adversely impact salmonids in the San Francisco Bay, but not jeopardize the continued existence of the species, including the threatened Central Valley steelhead (*Oncorhynchus mykiss*), Central California Coast steelhead (*O. mykiss*), Central Valley Spring-run Chinook (*O. tshawytscha*), the endangered Sacramento River Winter-run Chinook (*O. tshawytscha*), and would additionally have impacts to North American Green Sturgeon (*Acipenser medirostris*). The USFWS determined that the proposed project would have adverse impacts to Delta smelt.

The resource agencies required a number of minimization and monitoring measures to decrease the potential take of listed and native species as a result of the proposed project. One important minimization measure is the installation of positive barrier fish screens on the water intake pipes to exclude the juvenile and adult life stages for many fish species located near the project area[62]. The screens are not able to prevent entrainment of eggs, larvae or plankton, only small and larger fish. The applicant has installed these screens. NMFS is requiring the applicant to monitor and assess performance of the intake fish screens. While CDFW and USFWS expect very low entrainment of eggs from federally and state-listed Delta and state listed longfin smelt, they placed seasonal mining and water pumping volume limits and depth restrictions on Lind's mining in the Suisun Bay during the smelt spawning season from December through June. The depth limits are required to avoid impacts to shallow water spawning grounds. Eggs would not likely occur at mining depths.[63]

(3) **Potential Impact to Benthic (Bottom) Habitat.** Sandy deep water habitat areas only account for about eight percent of the Bay floor, and are thus considered relatively "scarce in the Bay". Bottom-dwelling species may be impacted through entrainment, impingement, or habitat alteration. The direct entrainment of bottom-dwelling species may occur through the drag head or

[62] Technical Memorandum. June 2014.Velocity Testing of Positive Barrier Fish Screen.
[63] USFWS Biological Opinion. 2014.

suction pipe of the mining equipment. Entrainment of bottom-dwelling fish species is less likely with Lind's mining methods where the suction pipe is placed directly into the substrate prior to beginning the mining. Impingement of species against the water intake screens may also occur during mining activities.

The benthic community in Suisun Bay, which is dominated by two species of invasive clam (*Corbula amurensis* and *Corbicula fluminea*)[64]also contains other non-mobile invertebrate species (such as worms) living within the substrate. It is characterized as having relatively low species diversity compared to Central Bay[65]. Organisms living within or on top of the sandy substrate would likely be impacted by the proposed project through direct removal of the top-layer (biologically active layer) of the benthic community, habitat removal and fragmentation, or smothering of organisms by large debris disposed overboard during the mining operations. Disturbance to benthic community organisms and benthic habitat during the proposed project may remove direct prey items important for Bay groundfish species or allow for the introduction of invasive species in disturbed areas.

Sand is often considered a poor habitat for many benthic organisms, but there are some species that are specifically adapted to transitory environments and can survive in these dynamic environments. Some species, such as the commercially important California halibut and the juvenile Dungeness crab, occur on the sandy bottom and utilize subtidal sand wave formations in the Bay. [66] Some bottom-dwelling fish, crabs, shrimps and other organisms may be important prey items for listed species.[67][68] Mechanical changes to the bed formations may lead to impacts to these species[69]. Additionally the scientists participating in BCDC's Sand Mining Science Panel identified that there is little known about how fish and other organisms in the Bay utilize sandy deep water habitats and shoals[70]. Disturbances from mining tracks on the Bay floor persist over time[71] and physically change the habitat available for various species within the Bay by removing habitat, potentially changing the grain size and may lead to localized changes in flow fields over sand sholas[72].

The project would result in the entrainment of a number of different bottom-dwelling species through the drag head during mining operations. The minimization measure requiring priming the pump hydraulic pumps within three feet of the Bay floor, which reduces entrainment of listed fish species, would likely not prevent the entrainment of many small, mobile and non-

[64] BCDC Sand Mining Science Panel. 2014.
[65] BCDC Sand Mining Science Panel. 2014.
[66] *Ibid*.
[67] NMFS Biological Opinion. 2015 pg. 48.
[68] Subtidal Habitat Goals Report. 2010., and NMFS Biological Opinion. 2015
[69] BCDC Sand Mining Science Panel. 2014
[70] *Ibid*.
[71] NMFS Biological Opinion. 2015
[72] BCDC Sand Mining Science Panel. 2014

mobile, bottom-dwelling species living on or near the Bay floor. However, for many species, the number of entrained individuals account for only a small portion of the total population within the Bay and would not likely cause significant reductions in the populations of these bottom-dwelling species[73].

In the Middle Ground Island area there are fifteen dominant fish species inhabiting Suisun Bay, which account for 97% of the bottom dwelling fish community[74]. Entrainment estimates for various species within this area indicate that between one and 2,680 individuals per year would be entrained from sand mining operations in the Middle Ground Shoal lease. "Calculated entrainment estimates indicated that Pacific herring (2,680), striped bass (456), Shokihaze goby (268), yellowfin goby (223), Pacific staghorn sculpin (207), starry flounder (103), longfin smelt (73), and plainfin midshipmen (43) are the most entrained fish species.[75]…Pacific herring entrainment by sand mining could be as much as 7.9% of the regional abundance index for Pacific herring in Suisun Bay. Excluding Pacific herring, the entrainment levels for all other species were estimated to represent between <0.1 % and 0.5% of the total abundance index for each taxa within Suisun Bay." [76]

Along with bottom dwelling fish, the sandy habitat is home to macro invertebrates such as crabs and shrimp. The San Francisco estuary is an important nursery ground for the Dungeness crab, which is an important commercial fishery in North Central California waters[77]. Sand mining activities in San Francisco Bay are estimated to lead to the loss of less than 0.1% of the total annual crab harvest. Entrainment of juvenile Dungeness crabs is predicted to be much higher from Central Bay sand mining than from sand mining around the Middle Ground Shoal or Suisun Associates areas. Bay-wide, an estimated 1.2 million shrimp would be entrained during sand mining activities[78]. In the Central Bay mining lease areas, the Blacktail shrimp is estimated to be the most frequently entrained species, whereas in the Middle Ground Shoal and Suisun Marsh areas, the California Bay shrimp are more heavily entrained[79]. The California Bay shrimp is a commercially important shrimp species in the Bay and sand mining activities have been estimated to entrain about 3 to 6 percent of the commercial landings. These invertebrates are important prey items for fish and other wildlife.

NMFS determined the proposed project would have impacts on Essential Fish Habitat (EFH). The proposed project's long-term impacts on habitat utilization by certain species, recruitment back into the disturbed areas, direct removal of prey items for fish, impacts to foraging behavior and recovery of the

[73] AMS Fish Entrainment Estimates Study. 2009.
[74] *Ibid*.
[75] AMS Fish Entrainment Estimate Study. 2009.
[76] *Ibid*.
[77] *Ibid*.
[78] *Ibid*.
[79] *Ibid*.

benthic community is not well understood[80]. To date, only one study has been conducted to look at the impacts of sand mining on benthic communities in the Bay and recovery after the mining activity. This study found no significant difference in the biological community composition between recently mined sites and those mined in the past [81]. The study conclusions were based upon a small sample size with data points collected over only a few days. Studies from other areas (other than SF Bay) have looked at recovery times after a benthic disturbance and identified that recovery can take months to years and that the disturbance of the biological community and physical changes to the habitat may result in loss of ecological function for the community[82] Additionally, mining events often reoccur within the same areas of the mining leases and thus the temporary impacts from a single mining event would be a chronic impact[83].

NMFS required an additional study of benthic impacts because NMFS considered the study presented in the FEIR as not adequate to determine potential mining effects to Essential Fish Habitat. The project proponent has agreed to form a Technical Advisory Committee (TAC), to design a benthic study that would utilize different methods to sample the benthic community in Central Bay and assess the impacts of these mining events on the benthic community recovery and organisms relying on the benthos. Once designed, the applicants would fund that study. As conservation recommendations for essential fish habitat, NMFS specifically recommended that: (1) an alternative source of sand be developed to minimize sand mining volumes extracted from the Bay to minimize benthic disturbance; (2) that the applicant provide additional support or funding to CalRecycle's efforts to remove anthropogenic debris from the Bay, which restores more natural habitat areas for fish; and (3) that the annual cumulative mining from Hanson and Lind not exceed the SLC FEIR baseline volume (average from 2002-2007) and that no increase in mining above this amount occur to reduce impacts to EFH.

(4) **Potential Impacts to Tidal Flats.** Although most tidal marshes do not contain large amounts of sand, the tidal flats, especially those near the Middle Ground Island, may consist of large amounts of sand and may be important spawning habitat for the endangered species[84]. The USFWS and CDFW recommend that these areas should be conserved to prevent the extinction of both state and federally listed species. The slope between the shallow waters near the Middle Ground Island and the deep-water channel where mining can occur

[80] NMFS Biological Opinion. 2015 pg 47
[81] AMS Fish Entrainment Estimate Study. 2009.
[82] NMFS Biological Opinion. 2015 pg 47
[83] NMFS Biological Opinion. 2015 pg. 51
[84] USFWS Biological Opinion. 2014.

appears rather steep and mining in the deep-water channel may cause the slumping of material from the sides of the channel[85]. This may undermine tidal flat areas or other important shallow water habitats near Middle Ground Island (See aerial image of the lease area above).

The USFWS determined that the proposed project would not likely result in a reduction of the shallow water spawning habitat for the Delta smelt. To minimize impacts to shallow water habitat, the resource agencies (NMFS, USFWS, and CDFW) required that the proposed project activities not occur within 200 feet of any shoreline, including Middle Ground Island, and that no mining occur within 250 feet of areas with depths shallower than nine feet Mean Lower Low Water (MLLW). At Middle Ground Island and the Suisun Channel, mining is not allowed in depths shallower than -25 feet MLLW from December through June and in depths shallower than -15 feet MLLW from July through November. To further assess impacts to shallow water habitat, the applicant has agreed to conduct multi-beam bathymetric monitoring surveys of the Middle Ground Lease Area, including the shallow water areas, every five years. Any significant changes in the bathymetry of both the mined area and the adjacent shallow water habitat should be evident in the bathymetric change analysis.

(5) **Habitat Impacts Minimization Measures.** To minimize impacts to shallow water spawning habitat for smelts and reduce impacts to EFH, the resource agencies (NMFS, USFWS, and CDFW) are requiring depth, volume and seasonal limitations for mining activities in Suisun Bay. The proposed sand mining may not occur within 200 feet of any shoreline and no mining shall occur within 250 feet of areas with depths shallower than nine feet Mean Lower Low Water (MLLW). Mining is also not allowed in depths shallower than -25 feet MLLW from December through June and in depths shallower than -15 feet MLLW from July through November. To further protect Delta smelt larvae in Suisun Bay both Hanson and Lind would limit their mining volumes between December and June of any year. During these months Lind can mine up to a total of 51,000 cy on the Middle Ground Shoal.

(6) **Potential Impacts to Aquatic plants.** The Bay Plan's Subtidal Policy One directs the Commission to evaluate the impacts of the proposed project on the Bay's aquatic plants. The proposed project may result in turbidity impacts to aquatic plants and algae from sedimentation. Additionally, the proposed project may result in the reduction of shallow water habitat for aquatic plants present in the area around Middle Ground, if the mining activity results in the slumping of material from the sides of the channel into the mining lease areas.

[85] NMFS Biological Opinion. 2015.

The Bay is home to a number aquatic plants and algae (seaweeds) native to the area, including eelgrass, pondweeds and seaweeds of different varieties. Both aquatic plants and algae need light to undergo photosynthesis. In addition, seaweeds generally need a hard substrate to attach to in order to withstand tides and currents. These plants and algae are an important habitat for many invertebrates, which provide a food source for many fish species. Due to the deep-water nature, limited light penetration and shifting sands found in the deeper portions of the lease area, it is assumed that there are no aquatic plants or algae living in the deep mineable areas of the lease. However, there appears to be native pondweeds (*Stuckenia sp.*) growing in the shallow subtidal areas around Middle Ground Island (Figure 8)[86]. Localized increased turbidity associated with the overflow plume could have an adverse impact on these algae if the suspended sediment settles on the pondweed blades and prevents or limits photosynthesis activity.

However, as described later in this analysis, the mining activity is limited to areas deeper than minus 15 feet Mean Lower Low Water (MLLW) from July through November, and areas deeper than minus 25 feet MLLW from December through June. Additionally the mining is limited to a distance of 200 feet from the islands' edge and mining is not allowed within 250 feet of waters shallower than minus 9 feet MLLW[87]. Providing these buffer zones in would likely minimize settlement of fine sediments on adjacent pondweed beds and reduce the undermining of shallow water habitat utilized by pondweeds around Middle Ground Island.

The Commission should consider whether the buffer zones around the Middle Ground Island are sufficient to minimize impacts and avoid potential harmful effects to aquatic plants around the lease area.

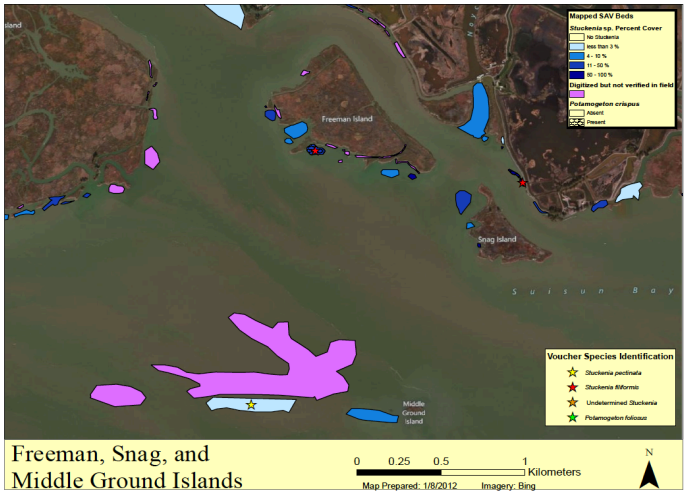

Figure 8. Map of Submerged Aquatic Vegetation (SAV) beds present around the Suisun Bay and Middle Ground Island (Boyer Lab 2012). http://online.sfsu.edu/katboyer/Boyer_Lab/Pondweeds!.html

[86] Subtidal Habitat Goals Report. 2010.; Boyer Lab Subtidal Aquatic Vegetation Maps

[87] CDFW Incidental Take Permit. 2014

(7) **Potential Spread of Invasive Species.** San Francisco Bay is considered one of the most invaded estuaries in the nation.[88] This is largely due to the historic and current shipping industry, commercial fisheries and recreational vessels from all over the world entering the Bay. In addition, accidental and intentional releases from the aquarium trade have added to the invaded nature of the Bay.[89]

There appear to be two mechanisms that could facilitate spread of invasive species though mining activity: transport of invasives by the mining equipment; and through habitat disturbance from the mining activity. According to Lind, the proposed mining activity uses barges and tugs that do not leave the Bay. Sand is mined from the Suisun Bay, which has a highly invaded community, which includes sand colonized by two species of invasive clams, invasive zooplankton and vegetation. There is potential for invasive species to be transported by the equipment as it moves between Suisun and the offloading yards, but no issue has been identified to date from using the equipment in both locations. Most ballast water originally collected in the barge is discharged at the mining site as sand is collected and would not likely contribute to the spread of invasive species. The different salinities between the highly marine environment of Central Bay and the brackish water environments of Suisun may also be a limiting factor for the spread of invasive species.

The practice of mining removes both sand and species living within and on top of the sand. The removal of sandy-bottom habitat and the existing biological communities creates a disturbance area that may be recolonized by invasive species rather than native species[90]. This may be especially true in the Suisun Bay and Channel where the BCDC science panel described the benthic community as mainly dominated by two species of invasive clam (*Corbula amurensis* and *Corbicula* fluminea). Sand mining could increase benthic disturbance and the abundance of invasive species around the mining areas and reduce the prey food items available for fish in the Bay. Although, the proposed project would not likely contribute significantly to the spread of invasive species due to the widespread distribution of invasive species in the Bay[91].

(8) **Potential Impacts to Water Quality.** The Commission's Bay Plan Water Quality policy one states, "Bay water pollution should be prevented to the greatest extent feasible….Fresh water inflow into the Bay should be maintained at a level adequate to protect Bay resources and beneficial uses." Water Quality policy two states, "Water quality in all parts of the Bay should be maintained at a level that will support and promote the beneficial uses of the Bay as identified in the San Francisco Bay Regional Water Quality Control Board's Water Quality Control Plan, San Francisco Bay Basin and should be protected from all harmful or potentially harmful pollutants. The policies, recommendations, decisions, advice and

[88] Cohen and Carlton. 1998.
[89] SLC FEIR
[90] Nature of Invasive species colonization.
[91] NMFS Biological Opinion. 2015.

authority of the State Water Resources Control Board and the Regional Board, should be the basis for carrying out the Commission's water quality responsibilities."

The proposed mining activity would result in an overflow discharge plume of fine-grained material during each mining event, which would temporarily and locally increase concentrations of suspended sediment and water turbidity. Additionally, The proposed project would deepen certain portions of the lease areas during the mining events and the deepening may contribute to intrusion of higher salinity water into the Delta by allowing X2 to move farther up into the Delta.

The waters of the Bay are an important primary element[92] of the habitat for various listed and native species in the San Francisco Estuary. The salinity and turbidity of the water influences the distribution of organisms living in the estuary, as well as those transiting through portions of the Bay along their migratory routes. Different species are adapted to tolerate different salinity ranges and turbidity levels. The water (habitat) quality needs for different Bay species are also dependent upon the turbidity and the presence of contaminants in the water column.

Maintenance of the position of the salinity gradient (X2) in the Delta is important to species inhabiting the estuary, especially those in Suisun Bay. The position of X2 is dependent upon the amount of freshwater Delta outflow. The position of X2 is critical for the distribution of species within the Suisun Bay and the Delta. The proposed project would deepen parts of the lease area, but these impacts do not extend much beyond the lease areas and the level of mining would not likely contribute significantly to the movement of X2 farther upstream into the Delta[93].

The overflow discharge from the mining activities would create elevated turbidity levels in plume, which extends outward from the barge in the direction of tidal flow[94]. The extent and duration of the plume depends upon a number of environmental variables during the mining activity. Typically, the highest sediment concentrations are observed at the surface and at the Bay floor, where material settles[95]. The increased turbidity is present for the duration of the mining activity and takes about an additional 3-4 hours to dissipate to background "normal" levels after the activity is completed. An overflow plume study conducted in Central measured sediment concentrations between 5-100 mg/l above the background levels in the plume. The overflow plume discharged by Hanson's Central Bay mining operations was previously measured to extend about 3,000 feet downstream of the vessel and 300 laterally from the vessel. No previous discharge plume studies have been performed in Suisun Bay and Lind has not performed an overflow plume study to assess the extent of the plume created from mining performed with the equipment utilized by Lind.

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[92] USFWS Biological Opinion. 2014.
[93] USFWS Biological Opinion. 2014.
[94] MEC Analytical Systems Inc. 1993
[95] *Ibid*.

The short-term increased water column turbidity, may have a variety of impacts to species inhabiting the water column. For instance, the increased turbidity may be beneficial for some species during certain activities such as potentially enhancing Delta smelt feeding success. However, high turbidity levels may also lead to physiological and behavioral impacts to other Bay species. There may additionally be impacts to migration, respiration, feeding, etc. In the CEQA analysis, the State Lands Commission found that the potential impacts to species from increased turbidity of the overflow plume would be less than significant[96]. The material that would be mined mostly consists of sandy material, with a small amount of fine-grained material and that is believed to be free of contaminants due to its low carbon content. The material being mined generally contains less than ten percent fines[97], which would greatly reduce the potential concentrations of contaminants found in the sand. However, borings collected in the Central Bay lease have shown that this area contains layers of clay, which may have a high organic content, intermixed with the sandy material in the substrate.

The California Regional Water Quality Control Board, San Francisco Bay Region (Regional Board) reviewed the proposed project and determined that the proposed project is not likely to result in "water quality less than the prescribed policies"[98]. They further found determined that the currently mined shoals would have at lease a 10:1 dilution for any particular "characteristics" of concern and that the discharge would not cause a nuisance to the Bay.[99]

The Water Board issued a Final Order for the Waste Discharge requirements on January 21, 2015, which included a Self-Monitoring and Reporting Program (SMP) and is requiring Lind to perform a study to evaluate the discharge and receiving water quality. The effluent and receiving water study would "characterize the overflow effluent toxicity and composition (suspended sediment, conventional pollutant, and toxic pollutant concentrations), the spatial and temporal extent of the overflow plume in the receiving water based on the magnitude of suspended sediment concentrations within the plume, and would compare overflow plume suspended sediment concentrations to background (ambient) conditions."[100] The study would also be designed to capture the seasonal and tidal variation in the discharge and water quality of the receiving waters. They have provisioned the waste discharge requirements and water quality certification with a reopener clause that would allow the project to be reassessed if the study indicates that there are adverse impacts to water quality or beneficial uses of the receiving waters, or if new regulations or policies, are adopted during the permitted period.

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[96] SLC FEIR
[97] SLC FEIR
[98] SFRWQCB Final Order. 2015.
[99] *Ibid*.
[100] *Ibid*.

The Commission should consider whether the project as proposed and conditioned by the Regional Board is consistent with the Commission's policies on water quality and if the potential impacts from harmful pollutants have been minimized the greatest extent feasible and the beneficial uses of the Bay are protected. Additionally, the Commission should consider whether it would also require the Effluent and Receiving Water Study to gain further understanding of the potential impacts of the discharge plume on Bay species.

3. **Feasibility and Public Benefits**. The Commission's Subtidal Policy 2 states, "Subtidal areas that are scarce in the Bay, or have an abundance and diversity of fish, other aquatic organisms and wildlife (e.g. eelgrass beds, sandy deep water or underwater pinnacles) should be conserved. Filling, … and dredging projects in these areas should therefore be allowed only if: (a) there is no feasible alternative; and (b) the project provides substantial public benefits."

   This policy requires the Commission to evaluate the feasibility of other alternatives of obtaining sand from locations other than "sandy deep water" areas in the Bay. There are other sources of sand than sand dredged from the Bay's sandy deep water sites. Large volumes of sand are imported into the Bay Area from British Columbia. For example, approximately 1.7 mcy of sand were imported into the Bay Area in 2012. Comparatively, approximately 0.25 mcy were mined from the Central Bay that same year. Sands and aggregate from Bay area land quarries also provide sands to the Bay area market. However, obtaining sands from these sources have downsides. Such sands are typically more expensive to produce, cost more to transport, and as a result of both their production and transport, produce more greenhouse gases in getting them to demand sites than obtaining sand from the Bay's deep water sandy sites. Hanson also has stated that the ships importing sand need deep draft berthing areas and that their existing barges are not designed to be top loaded, so additional barges would need to be acquired to offload imports. Transporting sand from local land-based quarries would increase wear and tear on roadways, fuel consumption and traffic congestion.

   In assessing the feasibility of these alternative sources, the Commission must apply the definition of feasibility contained in the CEQA (PRC § 21061.1) and in the CEQA Guidelines (14 CCR § 15364). The definition in CEQA also includes not just physical, technological, economic or legal impossibility, but also public policy consistency. The courts have held that the lead agency could find an alternative to be "infeasible" on the basis of inconsistencies between that alternative and the City's "general plan and other city policy concerns.[101]" An example of the use of public policy concerns as the basis for rejecting a project alternative as infeasible can be found in the FEIR for the project presently before the Commission prepared by the State Lands

[101] *Defend the Bay v. City of Irvine* (2004) 119 Cal.App.4th 1261

Commission. In the FEIR the SLC rejected as "infeasible" any reduction in the volume of sand for which the mining companies were seeking leases on the basis of the increased greenhouse gas emissions in which the transportation of sand from alternative sources would result.

In determining whether the proposed sand mining project is allowable under Subtidal Policy 2, the Commission must determine 1) whether there are alternatives to dredging sand from the Bay's sandy deep water areas, 2) the feasibility of any such alternatives by weighing the adverse impacts associated with these alternatives (largely the production of greenhouse gases and increased cost of sand) against the adverse effects of the proposed activity on a limited Bay resource and its associated biota, as described elsewhere in this application summary, and 3) the public benefits of dredging sand from the Bay.

4. **Mitigation.** The Commission's policies on Mitigation states that "[p]rojects should be designed to avoid adverse environmental impacts to Bay natural resources such as…fish, other aquatic organisms and wildlife habitat, subtidal areas…or tidal flats. Whenever adverse impacts cannot be avoided, they should be minimized to the greatest extent practicable...and mitigation for unavoidable adverse impacts to the natural resources of the Bay should be required."

   The impacts to Bay resources from the proposed mining activity would include those specific to the lease areas as well as potential impacts beyond the lease boundaries. As previously discussed in other sections of this report, the potential unavoidable impacts from this project within the lease include: (1) entrainment of special status and native species through the drag head; (2) entrainment of the eggs or larval stage of special status and native species through the screened water intake pipe; (3) temporary increases in suspended sediment loads; (4) degradation of sandy habitat by removal of prey and benthic invertebrates; and (5) degradation of habitat through bedform removal and modification of substrate, both in reduction of grain size of sand and sand wave formation.

   In addition, potential impacts beyond the lease boundaries include the entrainment of fish, including special status species, eggs, larvae and plankton that move in and out of the lease boundaries as part of their life cycle; temporary increases in suspended sediment concentrations while mining is occurring; and reduction in sand supply to the system, including Bay shoals, the San Francisco Bar and potentially southern Ocean Beach.

   While the applicant has worked to reduce impacts to threatened and endangered species through the installation of a fish screen and reduction in mining volumes, other impacts to EFH cannot be further reduced or minimized due to the nature of the mining activity and therefore mitigation would be required.

When unavoidable impacts are identified, the Bay Plan policies on mitigation provide guidance regarding how those impacts should be mitigated. The mitigation policies state that "individual compensatory mitigation projects should be sited and designed within a Bay-wide ecological context, as close to the impact site as practicable, to compensate for the adverse impacts," ensure success and support the improved health of the Bay ecology. They further state that the Commission should consider benefits to humans from Bay natural resources; that the rationale for the mitigation should be clear; the siting of the mitigation should be in an area where adjacent land uses and connections to other habitats improve the potential for successful outcomes; and that mitigation should be provided prior to or concurrent with the proposed project.

The policies also provide that when compensatory mitigation is necessary, a mitigation program should be reviewed and approved by or on behalf of the Commission as part of the project, and describe the "[p]rovisions for the long-term maintenance, management and protection of the mitigation site, such as a conservation easement, cash endowment, and transfer of title." The mitigation programs are also expanded by the Commission's policies that state that they "…should be coordinated with all affected local, state, and federal agencies having jurisdiction or mitigation expertise to ensure, to the maximum practicable extent, a single mitigation program that satisfies the policies of all the affected agencies."

In response to these policies, the applicants have consulted with NMFS, USFWS, and CDFW in regards to unavoidable impacts to threatened, endangered and native species and their critical habitat, and Essential Fish Habitat due to the mining activity and have incorporated their recommendations into their proposed mitigation plans. In order to compensate for impacts to Delta smelt, longfin smelt and salmonids while mining in Suisun Bay, the applicant purchased 0.11 acres [102] of freshwater habitat mitigation credits at Liberty Island Conservation Bank in Yolo County. The mitigation credits are located at a distance from the mining activity, however, it is the only mitigation bank available for fish impacts, and has been determined to be suitable compensatory habitat for salmonids by both CDFW and NOAA Fisheries. CDFW has also determined this bank is suitable for compensation for incidental take of longfin smelt.

These policies also offer opportunities to combine mitigation efforts and describe the framework necessary to allow flexibility in mitigation types in stating: "To encourage cost effective compensatory mitigation programs…the Commission may extend credit for certain fill removal and allow mitigation banking provided that any credit or resource bank is recognized pursuant to written agreement executed by the Commission. …Mitigation banking should only be considered when no mitigation is

[102] CDFW Incidental Take Permit Amendment One. 2014

practicable on or proximate to the project site." The policies further define when fee based mitigation is a potential option. According to the applicants and the Resources Agencies, mitigation bank credit is the only current option for impacts to these species.

To address the impacts of sand mining to essential fish habitat (EFH) in Central Bay and Suisun Bay, Hanson Marine and Lind Marine together proposed as mitigation to contribute to CalRecycle's Estuary Clean Up Project in an amount not to exceed $100,000 for all mining areas. The Clean Up Project clears debris (old pier pilings, abandoned ships) from the estuary in order to improve fish habitat. Hanson Marine will contribute by providing a portion of the funds and Lind will contribute by conducting the actual debris removal. It is not clear at this time how the $100,000.00 worth of removal will be split between the two companies. CalRecycle will be responsible for the distribution of funds and the performance and completion of these projects.

In addition to mitigation policies, the Commission has several policies that encourage the expansion of scientific knowledge, especially where sufficient information is not currently available. Bay Plan policies on Subtidal Areas, Tidal Marshes and Tidal Flats, as well as dredging mirror the need for increased research and knowledge, as well additional studies of both habitat and impacts of proposed projects. Subtidal Areas Policy 5 states, in part that the Commission should continue to support and encourage expansion of scientific information on the Bay's subtidal areas, including: an inventory and description of the Bay's subtidal areas; the relationship between the Bay's physical regime and biological populations; sediment dynamics, including sand transport; … areas of the Bay used for spawning, birthing, nesting, resting, feeding, migration, among others, by fish, other aquatic organisms and wildlife…"Further, the Tidal Marsh and Tidal Flats policies state that the Commission should support comprehensive Bay sediment research and monitoring to understand sediment processes necessary to sustain and restore wetlands…" Lastly, Dredging Policy 12 states that the Commission should …continue to participate…other initiatives conducting research on Bay sediment movement, the effects of dredging…on Bay natural resources…."

In order to better understand the ecological environment that exists as well as the impacts of mining on the habitat, the applicants have agreed to conduct a benthic study of the Central Bay sandy deep water habitat only, as described previously in this document. It is anticipated the study would take between three to four years to complete. In addition, the applicants have proposed to continue the multibeam surveys and associated change analysis on a five-year basis to assist in ascertaining the changes to the Bay bathymetry as a result of mining activity. Staff has discussed additional potential studies with the applicant to assist in assessing impacts to the San Francisco Bar and Ocean Beach (potentially tracer studies); an analysis of the volume of sand available to bedrock; and assistance in further refining the sand budget and transport into the lease areas an other sandy subtidal habitat. These discussions are ongoing.

The Commission should determine whether the reduced project volumes, the mitigation provided are sufficient given the identified potential impacts and whether the proposed studies are sufficient to support furthering the knowledge regarding this habitat and the mining activity.

5. **Dredging, Navigation Safety and Oil Spill Prevention.** San Francisco Bay Plan Dredging Policy 2 states that "[d]redging should be authorized when the Commission can find: (a) the applicant has demonstrated that the dredging is needed to serve a water-oriented use or other important public purpose, such as navigational safety; (b) the materials to be dredged meet the water quality requirements of the San Francisco Bay Regional Water Quality Control Board; (c) important fisheries and Bay natural resources would be protected through seasonal restrictions established by the California Department of Fish and Game, the U.S. Fish and Wildlife Service and/or the National Marine Fisheries Service, or through other appropriate measures; (d) the siting and design of the project will result in the minimum dredging volume necessary for the project…."

   In its application, Hanson Marine describes sand mining as a water-oriented use in that sand is mined from the Bay and serves the important public purpose of supplying sand to the construction industry from a local source, reducing greenhouse gas emissions, truck traffic, and impacts to Bay Area roadways. The applicant states that using sand from a local source allows for financial savings for public projects, and that obtaining aggregate from farther away increases its cost.

   As described above, the Water Board has issued a Water Quality Certification (WQC) and Waste Discharge Requirements (WDR). The WQC/WDR requires the applicant to comply with specific wastewater dilution ratios, mining of only non-hazardous materials, and does not allow discharge of pollutants or other materials that would cause nuisance or adversely affect beneficial uses, including increased turbidity and deleterious impacts to wildlife.

   Regarding seasonal work windows for this activity, the applicant has requested and received biological opinions and an incidental take permit from the Resource Agencies. In their review of the project, the Resource Agencies did not limit mining activity seasonally in Central Bay.

   In response to the question of whether the siting and design of the project would result in the minimum amount of dredging necessary for the project, the applicant has reduced the amount it proposes to dredge annually and the cap for the total amount dredged over a ten year period. The applicant has requested that it be authorized to exceed the annual limit when demand is high, as long as the total mined over ten years remains under 12.03 million cubic yards over ten years. This would allow them to address market fluctuations. In addition, the applicant states the proposed volume would be mined only if the market demanded such a volume, therefore the applicant has stated that they are minimizing the amount of mining necessary for the project.

The Bay Plan's Navigational Safety and Oil Spill Prevention Policy Two states that the Commission should ensure that marine facility projects are in compliance with oil spill contingency plan requirements of the Office of Spill Prevention and Response, the U.S. Coast Guard and other appropriate organizations. As owners and/or operators of marine vessels operating in regulated waters of the state and often adjacent to or within federal navigational channels, Hanson Marine is required to abide by maritime laws and best safety practices. Specific to their sand mining activities, Provision 10 of the WQC/WDR requires the applicant to maintain and implement a CDFW Office of Oil Spill Prevention and Response-approved plan that demonstrates that adequate measures are in place to prevent and respond to accidental release of hazardous materials. Additionally, the CDFW ITP requires as a mitigation measure that requires the sand miners to follow state and federal laws and regulations in regards to hazardous waste spills and clean up. The ITP also prohibits the storage and handling of hazardous wastes in the project area. These permits and their requirements are intended to insure the applicant would operate in accord with the required navigational safety and oil spill contingency plans.

The Commission should determine whether the project is consistent with its policies regarding Dredging and Navigation Safety and Oil Spill Prevention.

6. **Public Trust.** The Bay Plan policy on Public Trust states that "[w]hen the Commission takes any action affecting lands subject to the public trust, it should assure that the action is consistent with the public trust needs for the area…." The public trust is a common law doctrine that guarantees the right of the public to use the state's waterways for navigation, commerce, fisheries, boating, recreation, natural habitat protection, and to preserve lands in their natural state for protection of scenic and wildlife habitat values. Public trust uses of public lands are generally limited to water dependent or water related uses, with some exceptions for ancillary structures necessary for the water dependent uses. Further, because public trust lands are held in trust for all citizens of the state, they must be used to serve statewide, as opposed to purely local, public purposes.[103]

   The State Lands Commission is responsible for determining if a project proposed on submerged or other sovereign land is consistent with the public trust uses as described above and managing those lands for the public.[104] In its decision granting the leases for the sand mining activity that is now before BCDC, the State Lands Commission did not make specific written public trust findings. However, every lease issued by the State Lands Commission has to be determined to be in the best interests of the State pursuant to Public Resources Code section 6005. Additionally,

[103] State Lands Commission Public Trust Policy: http://www.slc.ca.gov/About_The_CSLC/Public_Trust/Public_Trust_Doctrine.pdf
[104] *Ibid.*

all sovereign lands and resources managed by the State Lands Commission are subject to the common law Public Trust Doctrine, so all decisions made by the Commission include a public trust consideration, even if there are not formal findings.[105]

The FEIR considered public trust resources in detail, though not explicitly referring to the public trust use. In addition, the State Lands Commission staff report regarding the Hanson Marine project stated, "[t]hese mitigation measures [listed in the 2012 FEIR], taken together, will ensure consistency with plans and policies specifying that sand mining operations be conducted in an environmentally sound manner, that agencies protect public trust resources, and that sand mining operations be carried out in a manner that minimizes interference with critical wildlife activities."[106]

In 2014, Bay Keeper challenged the State Lands Commission's finding that the project is consistent with the public trust. Upon review, the Superior Court of the City and County of San Francisco upheld the State Lands Commission's finding. Bay Keeper has appealed this decision to the First District Court of Appeal. The court has not yet heard the appeal.

In completing its independent evaluation of the project, the Commission must determine if the project is consistent with the public trust needs of San Francisco Bay. Public trust needs include the same categories as the uses. Mineral extraction from trust property is an accepted trust use in aid of commerce, much like fishing, which removes natural material from the environment. For Central San Francisco Bay mining areas, the project appears to be consistent with navigational use even though some of the lease areas are overlaid with a federal navigation channel on the western side of Alcatraz Island. Because this area is naturally deeper than the draft needed by the large ships traversing the Bay, the ships can maneuver around the barge and tug without causing a navigation hazard. Similarly, water borne commerce distinct from sand mining and recreational boating would not be inhibited or limited by the mining activity.

It is unclear whether the project is consistent with the public trust as it pertains to natural habitat protection and the preservation of lands in their natural state for protection of scenic and wildlife habitat value needs. As described above, when mining sand, there is likely to be habitat degradation and loss of potential forage species living within and on the sand. In addition, removal of sands in transport may reduce the amount of sand available for outer coast beaches, affecting both recreation and habitat needs. Unfortunately, the volume of sand in transport to the outer coast is not well understood at this time.

[105] Pemberton, State Lands Commission, writ. comm 2015
[106] State Lands Commission October 2012 Staff Report Statement of Overriding Considerations

Regarding statewide purposes, according to the applicant, sand mined from the Bay is used in local construction projects, including residential, commercial and public buildings, as well as roadways. Public buildings, roads, and highways serve a statewide purpose.

The Commission should evaluate the public trust needs and determine whether the project is consistent with its Public Trust policy.

B. **Review Boards**

1. **Science Review Panel.** A science panel of distinguished experts in the fields of geology, engineering, oceanography, marine and benthic ecology convened to discuss the currently available science about the transport of sandy sediment throughout the Bay Area to the outer coast and sandy shoal habitats. This panel discussed a series of management questions proposed by Commission staff regarding the current state of sandy sediment resources in the Bay, replenishment of sand in areas of extraction during mining events, habitat and species impacts, whether disturbance from mining has more of an impact on the biological community recovery than naturally occurring disturbances in the system, and potential monitoring that could be used to enhance understanding of sandy sediment resources, the communities that inhabit them, and the potential impacts of mining on the system. While the discussion was not conclusive, it informed this process and the management measures that could be incorporated into a final permit authorization. An abridged transcript can be found at http://www.bcdc.ca.gov/dredging/SandMiningSciPanAbridged.pdf.

C. **Environmental Review.** The State Lands Commission reviewed the potential project impacts and certified the Final Environmental Impact Report in 2012. The FEIR was challenged in 2013, and the Superior Court of the City and County of San Francisco upheld the State Lands Commission determination. The Court's decision is currently on appeal, at the First District Court of Appeal. The Commission's regulations require that the permitting process continue during a CEQA challenge. In the event that the courts invalidate the CEQA certification, the permit action would be revisited. A summary of that document is attached as Exhibit F.

D. **Relevant Portions of the McAteer-Petris Act**

1. Section 66605 (d)
2. Section 66632
3. Section 66664.4

E. **Relevant Portions of the San Francisco Bay Plan**

1. *San Francisco Bay Plan* Policies on Fish, Other Aquatic Organisms, and Wildlife
2. *San Francisco Bay Plan* Policies on Water Quality
3. *San Francisco Bay Plan Policies on Subtidal Areas*
4. *San Francisco Bay Plan* Policies on Tidal Marsh and Tidal Flats

5. *San Francisco Bay Plan Policies on Dredging*
6. *San Francisco Bay Plan* Policies on Recreation, g. Beaches.
7. *San Francisco Bay Plan* Policies on Mitigation
8. *San Francisco Bay Plan* Policies on Navigational Safety and Oil Spill Prevention
9. *San Francisco Bay Plan* Policies on Public Trust

F. **Relevant Portions of the Suisun Marsh Preservation Act**

1. Section 29401
2. Section 29402
3. Section 29405.5

G. **Relevant Portions of the Suisun Marsh Protection Plan**

1. *Marsh Plan* Policies on Environment
2. *Marsh Plan* Policies on Water Supply and Quality
3. *Marsh Plan* Policies on Land Use and Marsh Management

H. **Relevant Portions of the Solano County Policies and Regulations Governing the Suisun Marsh**

1. Section II Suisun Marsh Policies Contained in the Solano County General Plan

Exhibits

A. **Regional Map**

B. **Project Site Plan**

C. **Sand Offloading Facility Map**

D. **Environmental Review summary**

E. **Sand Transport Background document**