2.0 PROJECT DESCRIPTION

2.1 INTRODUCTION

This Environmental Impact Report (EIR) examines the environmental impacts associated with several proposed governmental actions that together, if approved, would permit mining of construction-grade sand from Central San Francisco Bay (Central Bay), Suisun Bay (the easternmost of the four main basins that make up San Francisco Bay), and the western Sacramento-San Joaquin Delta (Delta). These actions include the issuance of (1) new leases of California sovereign lands by the California State Lands Commission (CSLC) and (2) permits by other agencies for mining of these lease areas and for mining a privately owned parcel in Suisun Bay.

The proposed issuance of the leases by the CSLC would allow Hanson Marine Operations (Hanson) and Jerico Products, Inc./Morris Tug & Barge (Jerico), collectively referred to as the Applicants, and Suisun Associates, a joint venture between Hanson and Jerico, to conduct sand mining operations for a period of 10 years within the CSLC lease areas.[1] The CSLC previously granted these leases for a 10-year period, with an option to apply for new leases for an additional 10 years. The initial 10-year period expired on June 30, 2008;[2] however, pending completion of the environmental review and permitting process, the CSLC is allowing the continuation of sand mining on a month-to-month basis. The San Francisco Bay Conservation and Development Commission (BCDC) also extended its Project-related permits.

Section 2.2, Project History and Location, presents an overview of sand mining operations. Section 2.3, Proposed Project, describes the Applicants' proposal for continuing operations under the proposed leases. The majority of the text, photos, and diagrams in Section 2.3, are taken from information provided by the Applicants in their lease application (Hanson and Jerico 2007). Much of this information, in turn, was based on a 2004 report prepared by Hanson Environmental, Inc. on behalf of the Applicants and RMC Pacific Materials, Inc. entitled, *Assessment and Evaluation of the Effects of Sand Mining on Aquatic Habitat and Fishery Populations in Central San Francisco Bay and Suisun B*ay (Hanson Environmental 2004).

[1] The numbering of the CSLC lease parcels sometimes includes a decimal designation, such as "PRC 709.1." Throughout this EIR, no decimal is used, unless the reference is to the lease document itself.

[2] Since 1998, all of the CSLC sand mining leases in Central Bay, Suisun Bay/Delta, and the Carquinez Strait have been set for terms of 10 years, with a right to seek a new 10-year lease after expiration of the original leases. The right to apply for future leases is only that and carries no implicit or explicit assurances as to future decisions by the CSLC regarding future leases. Any future application for leases would be subject to environmental review under the California Environmental Quality Act (CEQA).

2.2 PROJECT HISTORY AND LOCATION

2.2.1 CSLC Lease Boundary and Regulatory Boundary Areas

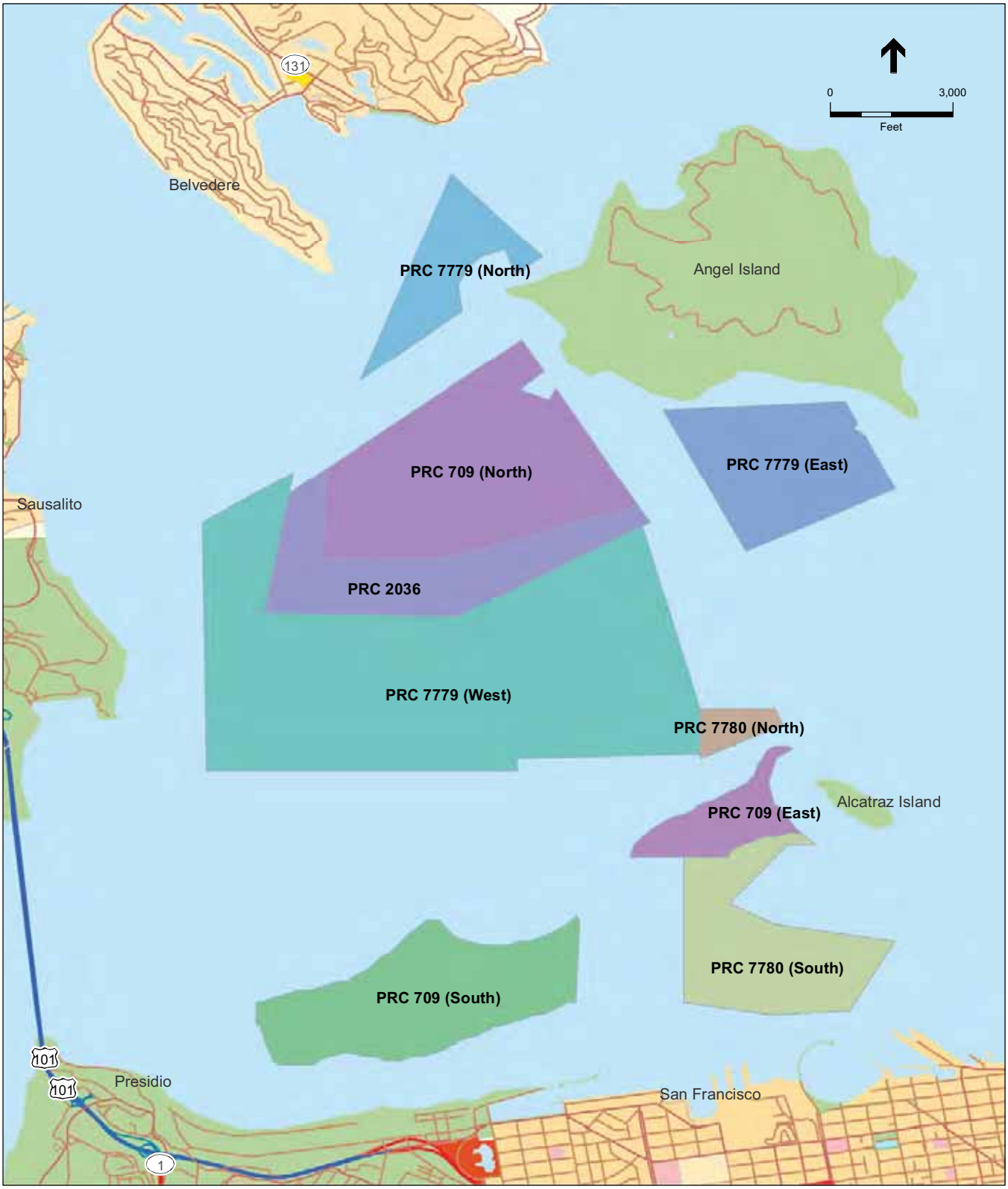
As discussed in Section 1.0, Introduction, in 2011, the boundaries of several Central Bay lease parcels were adjusted slightly to avoid overlapping Federal lands at Angel Island and Alcatraz Island. The boundaries of the CSLC sand mining lease parcels and parcel numbers for which sand mining is proposed are shown in Figures 2-1a and 2-1b. Figure 2-2 shows the location of the private parcel in Suisun Bay, at Middle Ground Shoal (TLS 39), in the channel off of the Concord Naval Weapons Station, which is leased to the Applicants for sand mining. The CSLC has no jurisdiction over this parcel, which is owned by the Grossi family. However, Hanson and Jerico's proposed future sand mining of this parcel is included as part of the Project, as the responsible and trustee agencies have discretionary approval authority over this action. The current leaseholders for each parcel are shown in Table 2-1.

2.2.2 Project History

The mining of sand for use as a construction material has occurred within the Central Bay and Delta for more than seven decades. Channel and harbor dredging to remove sand and other sediment deposits from the Bay began in the 1800s, and construction sand mining within the Bay-Delta estuary began in the 1930s. Previously, three companies were permitted to mine sand from the Bay and Delta: Hanson, Jerico, and RMC Pacific Materials, a wholly owned subsidiary of CEMEX.

Hanson entered the construction sand mining business in 1999 when it acquired two companies that held the construction sand mining leases and permits which Hanson operates under today. Hanson currently owns two barges and three tugboats used in its sand mining operations. In April 2002, Hanson contracted with Foss Maritime Services (Foss) for Foss to mine sand using Hanson's barges and tugboats. Under this arrangement, which is expected to continue under the proposed Project, Foss mines sand for Hanson from sites leased by Hanson from the CSLC and the Grossi family.

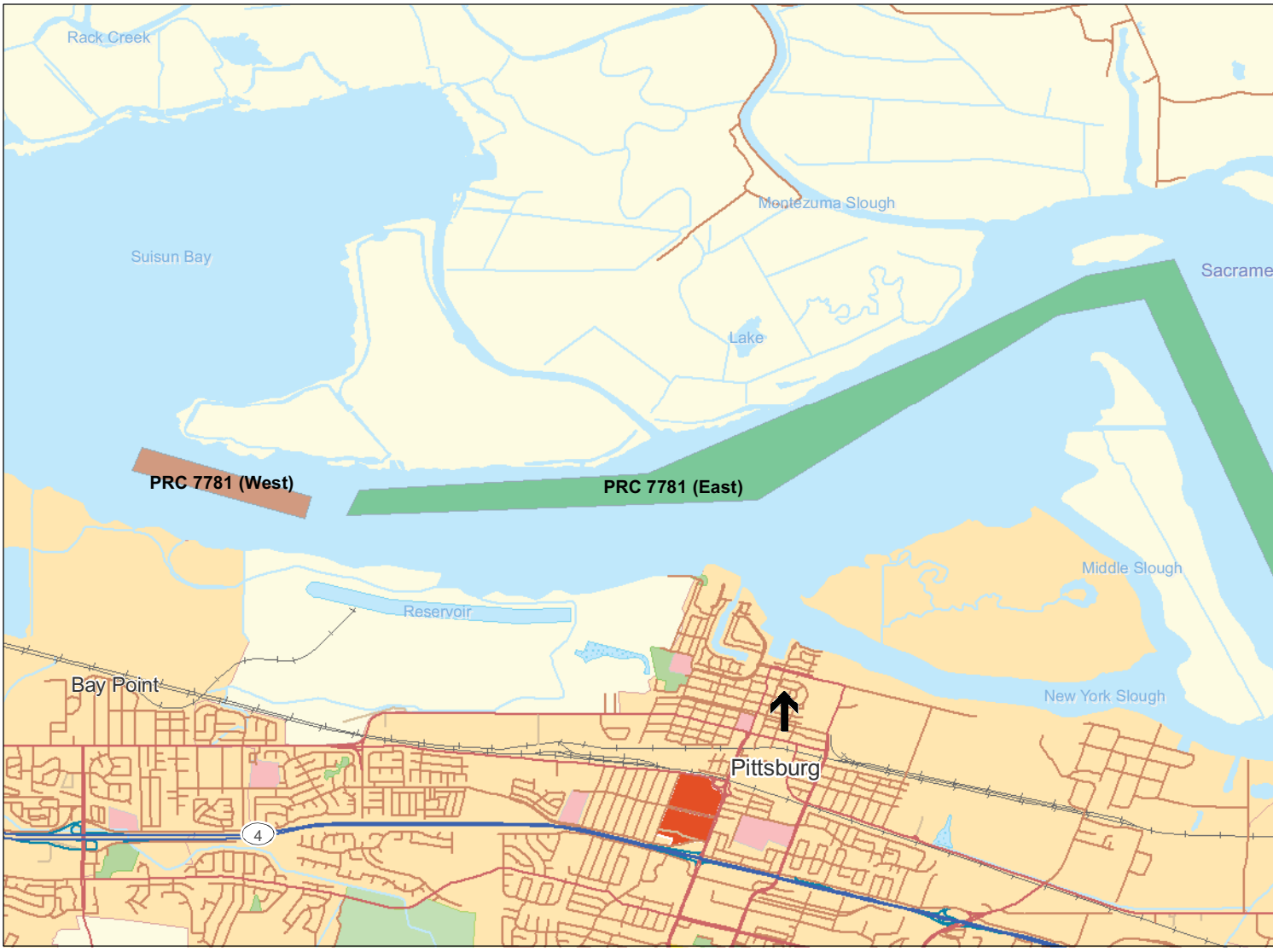
Jerico is headquartered in Petaluma, California. Jerico's corporate history dates back over 100 years, when Pioneer Shell, owned by Hanns Beck, dredged oyster shells with a sail-powered schooner, the *Alma*. In the 1960s, Mike Lind, current owner of Jerico, began working for Pioneer Shell. In the late 1970s, Morris Shell, formerly Pioneer Shell, began sand mining at Middle Ground Shoal in Suisun Bay, Chipps Island, and New York Slough in the Delta. After Mike Lind's acquisition of Morris Shell, he changed the name of the company to Jerico Products, Inc.



San Francisco Bay and Delta Sand Mining EIR . 207475

SOURCE: ESRI 2008; California State Lands Commission 2008, 2011

Figure 2-1a
Lease Areas in the Central Bay



San Francisco Bay a

SOURCE: ESRI 2008; California State Lands Commission 2008

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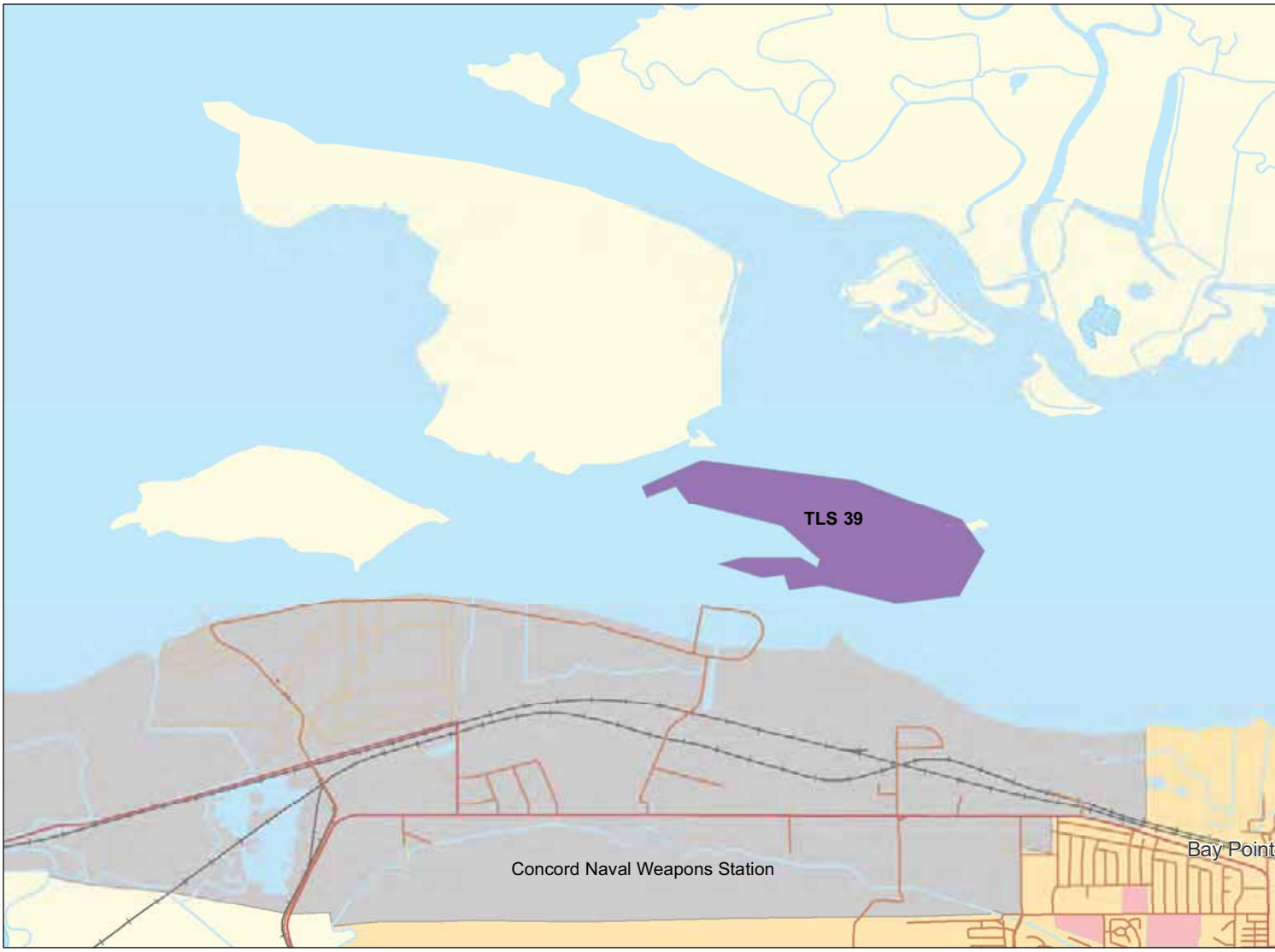


San Francisco Bay a

SOURCE: ESRI 2008; Hanson Marine Operations 2008

Middle Ground Shoal Lease

Table 2-1. Currently Permitted, Baseline, and Proposed Annual Sand Mining Volumes (in cubic yards per year [cy/yr])

	Applicants' Current Permit Limits	Baseline Volume (2002-2007 Average) [1]	Proposed	Difference (Proposed vs. Baseline Volume)	Proposed Increase as Percentage of Baseline Volume
State Lands Commission Central Bay Lease Areas (and Current Leaseholder)					
PRC 709: Presidio, Alcatraz, and Point Knox Shoals (Hanson)	540,000	290,331	340,000	49,669	+ 17%
PRC 2036: Point Knox South (Hanson)	300,000	252,637	450,000	197,363	+ 78%
PRC 7779: Point Knox Shoal (Hanson)	400,000	390,440	550,000	159,560	+ 41%
PRC 7780: Alcatraz South Shoal (Hanson)	150,000	127,248	200,000	72,752	+ 57%
PRC 5871 (CEMEX) [2]	NA	80,383	NA	NA	(- 100%)
Subtotal: State Lands Central Bay Leases [3]	**1,390,000**	**1,141,039**	**1,540,000**	**398,961**[4]	**+ 35%**
State Lands Commission Suisun Bay/Delta Lease Area (and Current Leaseholder)					
PRC 7781: Suisun Bay/ Western Delta (Suisun Associates)	100,000	85,746	300,000	214,254	+ 250%
State Lands Lease Totals: Central Bay & Suisun Bay/Delta [3]	**1,490,000**	**1,226,785**	**1,840,000**	**613,215**	**+ 50%**
Private Suisun Bay Parcel and Current Leaseholder					
Grossi Middle Ground: BCDC Permit 10-90 (Hanson)	500,000	0	50,000	50,000	NA
Grossi Middle Ground: BCDC Permit 16-78 (M) (Jerico)	250,000	199,866	150,000	-49,866	- 25%
Private Lease Totals: Middle Ground [3]	**750,000**	**199,866**	**200,000**	**134**	**0%**
All Lease Totals [3]	2,240,000	**1,426,650**	2,040,000	**613,349**[4]	**+ 43%**

Notes: NA = Not Applicable
[1] Refer to Table 1-1 for mining volumes by year at each parcel.
[2] A new lease is not proposed at this parcel, which therefore is not part of the proposed Project.
[3] Cells may not total exactly due to rounding.
[4] This figure takes into account the 80,383 cubic yards of material mined from PRC 5871 during the baseline period.

Source: CSLC 1998, 2008, 2011; BCDC 2008, 2009a, 2009b

Suisun Associates was originally formed in 1994 as a joint venture of Olin Jones Sand Company and Morris Tug and Barge. The CSLC issued Lease No. PRC 7781.1 to Suisun Associates for its joint mining operation on January 1, 1998. With the acquisition of Olin Jones Sand Co. in late 1999, Hanson became the joint venture partner with Morris Tug and Barge in Suisun Associates. With Jerico Product's acquisition of Morris Tug and Barge, Hanson and Jerico became the joint venture partners in Suisun Associates. Hanson and Jerico currently mine the CSLC Suisun Bay/Delta lease parcel as joint venture partners in Suisun Associates, and each has permits from BCDC for mining the privately owned parcel at Middle Ground Shoal.

Only Hanson and Jerico (including Hanson on behalf of their joint venture, Suisun Associates) have applied for new leases and permits. RMC has not applied for a renewal of its leases (PRC 5871 in the Central Bay and PRC 5733 in the Carquinez Strait, which were formerly leased by CEMEX) and permits, and no sand mining is occurring in these locations. To date, no other party has come forward to propose that the CSLC grant a lease for sand mining on these parcels; therefore, no future mining of sand from these parcels is included or assumed as part of the Project.

2.3 PROPOSED PROJECT

2.3.1 Project Action

As stated above, the CSLC is considering granting new leases of California sovereign lands (at existing parcel sites) to the Applicants for an additional 10-year period. The leases, if granted, would allow the Applicants to continue mining sand within the lease area boundaries up to the annual volumes shown in Table 2-1. Hanson is proposing to lease the following Central Bay parcels, all of which are sovereign lands under the jurisdiction of the CSLC: PRC 709 (Presidio, Alcatraz North, and Point Knox North Shoals); PRC 2036 (Point Knox South); PRC 7779 (Point Knox Shoal); PRC 7780 (Alcatraz South Shoal). See Figure 2-1a for the location of these parcels. On behalf of Suisun Associates, Hanson is proposing to lease PRC 7781 (Suisun Bay/Delta), which is also sovereign land under the jurisdiction of the CSLC, and which is located in Suisun Bay and the western Delta in the San Joaquin and Sacramento River channels upstream of Suisun Bay; see Figure 2-1b.

Issuance of these leases would require discretionary approval of the CSLC. Hanson and Jerico are also proposing to renew permits for mining TLS 39 (Middle Ground Shoal; Figure 2-2), which is privately owned and does not require CSLC approval. In order to continue sand mining, the Applicants also require discretionary approvals of

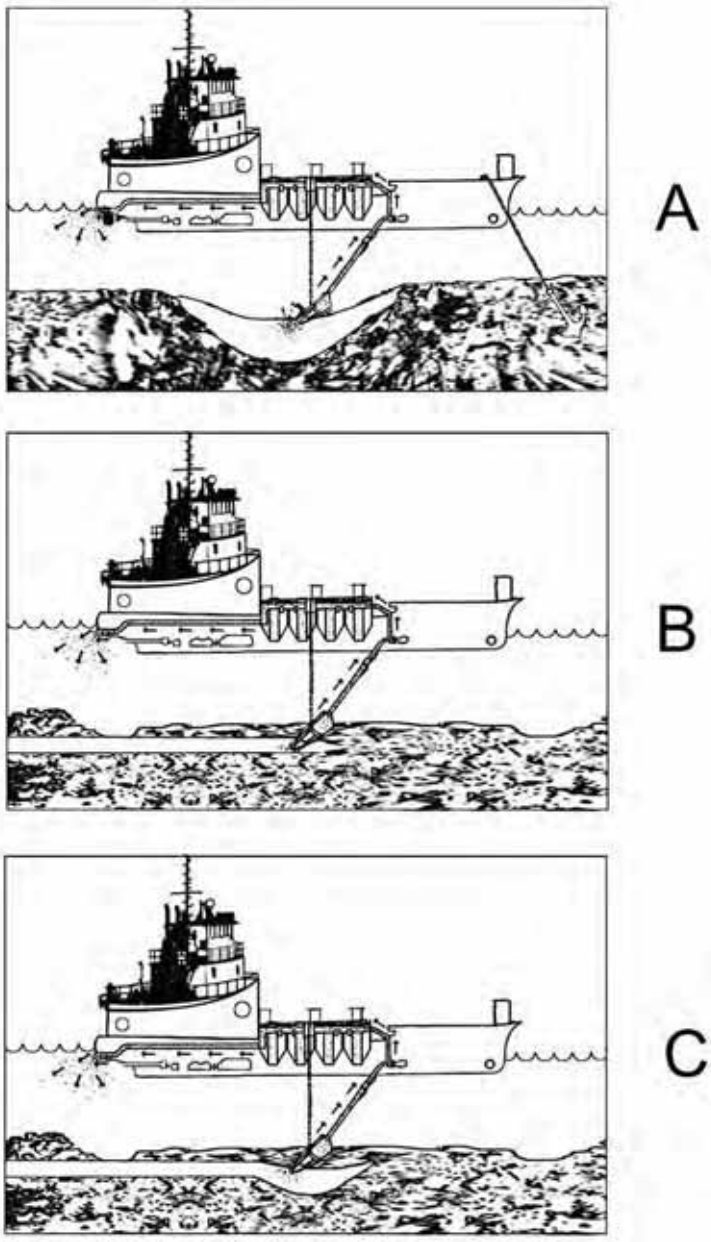
responsible agencies, including the BCDC, San Francisco Bay Regional Water Quality Control Board (SFBRWQCB), and State Mining and Geology Board (SMGB). In addition, approval of the U.S. Army Corps of Engineers (ACOE), in conjunction with required consultation and coordination with the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS), would be necessary. (See Section 1.3, Permits, Approvals, and Regulatory Requirements.)

As Table 2-1 indicates, the Applicants are proposing adjustments to the allowed annual volume of sand that may be mined from each lease area, relative to the permitted annual mining volumes during the previous 10-year lease period. Overall, the Applicants are proposing an increase in permitted mining volume of 350,000 cy/yr from the CSLC lease areas. The Applicants are also proposing a decrease in permitted mining volume of 550,000 cy/yr from the private lease area. The net change from all lease areas, including both the CSLC lease areas and the private lease area, would be a decrease of 200,000 cy/yr in the allowed mining volume. This EIR, however, uses the actual mining volumes based on the years 2002 to 2007 as the baseline for the impact analysis, as discussed in Section 1.0, Introduction.

2.3.2 Description of Sand Mining Methods, Equipment, and Locations

The Applicants propose to continue mining sand within the lease areas described above (Central Bay, Middle Ground Shoal in Suisun Bay, and areas north of the Federal navigation channels of Suisun Bay and the western Delta), using similar methods and equipment to those currently employed. As discussed in more detail below, the two operators use similar equipment for sand mining, including a trailing arm hydraulic suction dredge and barge. The method of mining varies between the two operators: Hanson primarily uses the moving pothole method and Jerico primarily employs the stationary pothole method (Figure 2-3). While Figure 2-3 also depicts the trolling method of sand mining, neither operator uses this method, nor proposes to do so in the future.

Sand mining does not occur uniformly within the region, but rather is clustered in specific areas, typically characterized by high river or tidal velocities and sand deposits that contain a low percentage of fine material (silts, clay, and mud). Mining events typically last approximately 3.0 to 4.5 hours, during which time approximately 1,500 to 2,500 cubic yards of sand are excavated. During mining, water is entrained into the suction head, creating a water and sand slurry that mobilizes the sand and allows it to be pumped into the barge. Hydraulic pump capacity varies among individual sand mining barges from approximately 5,000 to 15,000 gallons per minute.



Source: Hanson and Jerico 2007

Figure 2-3
Schematic Diagrams of Sand Mining Methods:
(A) Stationary Pothole, (B) Trolling, and (C) Moving Pothole

Sand mining within Central Bay typically occurs at water depths ranging from 30 to 90 feet (individual sand mining barges have a maximum operating depth of either 80 or 90 feet). Mining within the navigation channels of Middle Ground Shoal and the Suisun Bay/Delta parcel typically occurs in waters that are 15 to 45 feet deep.

General Methods of Sand Mining

This section generally describes the sand mining techniques and equipment used by the Applicants. More detailed information on the specific vessels used is provided in Appendix H. As depicted in Figure 2-3, the three general methods of hydraulic sand mining are: stationary potholing, trolling, and moving potholing. Stationary potholing involves a type of suction head that allows sand to be mined without moving the drag head. Stationary potholing operations may involve mining more than one specific location during a mining event, and may also involve some movement within a general site. Trolling, which is no longer used by either of the Applicants, involves mining while moving over a site, generally working back and forth. Moving potholing involves partly burying the head of the dredge in the sand, so that the sand is extracted from beneath the substrate surface while moving over a site. The drag head is not completely buried so that water and sand are drawn into the drag head.

Potholing involves an initial search for sand with appropriate characteristics – such as desired sand particle size and a low percentage (e.g., less than 10 percent) of fine-grained sediment – before mining is initiated. Sand is normally defined as material in the size range between 2 millimeters (mm) (0.079 inch) at the large end and 0.074 mm (0.0029 inch) at the small end. In practice, almost all the commercial mined sand is larger than 0.150 mm (150 micrometers [µm] or 0.006 inch). Although the distribution of sand resources is generally well known by the operators, sands of different qualities may be distributed in patches, and operators will initially test a selected site to determine the quality of sand. Tests include visual observations of the slurry (dark color indicates loose or unconsolidated sand) and readings from vacuum gauges. If, at the onset of a mining event, the sand quality is not appropriate, the operator will move to another site and test again. The exact searching and testing process may vary depending on equipment, the judgment of the operator, and the market for which the sand is destined (and therefore the required size or grade of the sand).

The mechanical fundamentals of sand mining are similar for stationary potholing, trolling, and moving potholing operations. All methods involve the use of a tugboat to position and maneuver the hopper barge, in the case of Hanson, or the deck barge in the case of Jerico. Hopper barges may be partially loaded with water prior to mining;

some hold their sand cargo below the water line, requiring them to use nearly their full draft during the entire dredging event. This increase in draft of the vessel thereby limits the depth at which the barges can operate. The sand load is above the water line on a deck barge. Hopper barges are equipped with large suction pumps to harvest the sand from the bottom. The hydraulic suction system used in sand mining (trolling and moving pothole sand mining; Figure 2-3) consists of a drag arm equipped with a drag head (Figures 2-4a and 2-4b), generally mounted on the side of the barge. The drag head is generally fitted with a "grizzly" to screen out oversized material. A typical drag head used in sand mining, fitted with a grizzly, is shown in Figure 2-5.

During sand mining, water is drawn into the drag head by the suction pump either from around the sides of the drag head, as with the drag head (used by Hanson) shown in Figure 2-6a, or through one or more pipes connected to the suction head as with the drag head (used by Jerico) shown in Figure 2-6b. Water entrained into the drag head creates the sand-water slurry that allows the sand to be suspended and pumped into the barge.

During sand mining operations using the moving pothole method, the barge is positioned above the sand shoal, and the suction drag head is lowered by winches into the sand. As a result of the need to create the sand-water slurry, the drag head (which is approximately 4 feet long by 3 feet wide by 4 feet high) is not completely buried, but rather is typically buried approximately 12 to 18 inches into the sand substrate. If the sand is loose, the operator mines the sand using the stationary potholing method. If the sand is of unsuitable grade or is compacted (hard), the operator moves and searches for suitable and looser sand, allowing the drag head to skim along the sand shoal. Water is continually mixed with the sand to create a slurry of approximately 15 percent sand and 85 percent water. The slurry is pumped up through a pipe onto the barge and discharged into a loading chute that runs lengthwise along the centerline of the barge (Figure 2-7).

Hanson uses two different barges in its operations, both equipped with suction dredges. Approximately 7,000 cubic meters (m^3) of water is pumped by one of the barges and 14,000 m^3 of water is pumped by the other barge in a typical mining event (Hanson and Jerico 2007). Applied Marine Sciences (AMS) estimated that approximately 19.2 million m^3 of water is pumped annually during sand mining operations at the Central Bay parcels; 1.6 million m^3 is pumped at Middle Ground Shoal, and 0.9 million m^3 is pumped at the Suisun Bay/Delta parcel (AMS 2009).

Source: Hanson and Jerico 2007

Figure 2-4a
Hydraulic Suction Drag Arm and
Drag Head Assembly in the Retracted Position

Source: Hanson and Jerico 2007

Figure 2-4b
Trailing Drag Arm and Hydraulic Suction Drag Head

Source: Hanson and Jerico 2007

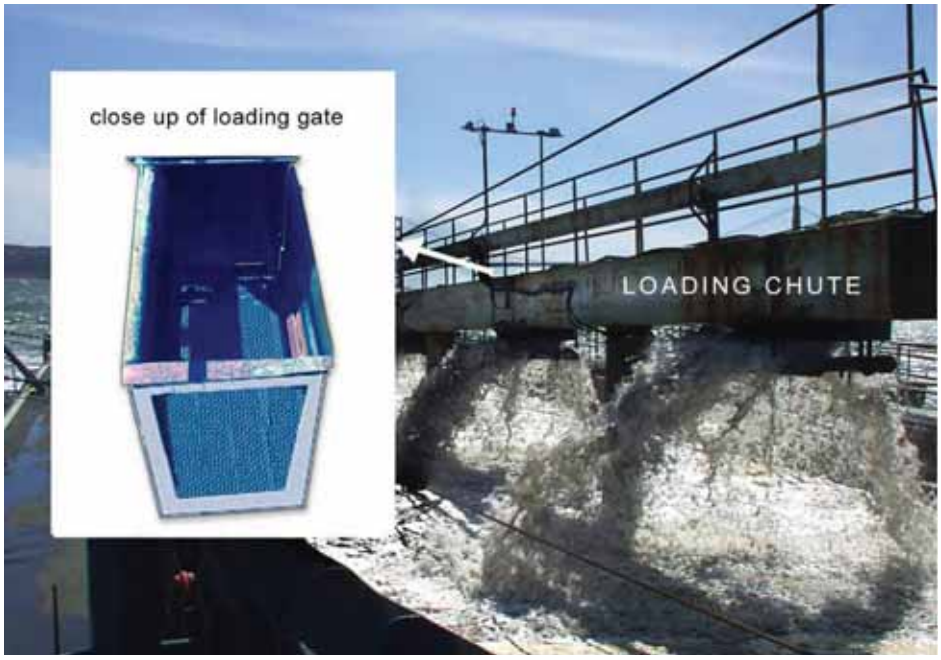
Figure 2-5
Hydraulic Suction Drag Head
Showing "Grizzly" Screen

Source: Hanson and Jerico 2007

Figure 2-6a
Hydraulic Suction Drag Head Used in Moving Pothole Sand Mining (Hanson)

Source: Hanson and Jerico 2007

Figure 2-6b
Hydraulic Suction Drag Head with Water Intake Pipe (Jerico)



Source: Hanson and Jerico 2007

Figure 2-7
Barge Loading Chute and Gate

The loading chute has screened, hydraulically controlled openings (gates) at intervals along its bottom, and the sand-water slurry flows through these gates into the barge. Some of the slurry, including aggregate larger than the openings in the screens, is discharged overboard. This discharge may contain aggregates, fine sediments, aeration bubbles, and plankton. As the sand displaces water in the barge, a visible plume is sometimes created around the barge (Figures 2-8 and 2-9). Cargo hoppers are also fitted with fine mesh screens along the bottom centerline of the barge, where water that has filtered through the sand is also collected and pumped overboard. Based on the equipment and methods used for sand mining within the estuary, commercial sand characteristically ranges in size from approximately 1 mm (0.039 inch) to 12 mm (0.47 inch), with larger and smaller particles discharged overboard. The volume of sediment discharged overboard during a typical mining event within the estuary has not been quantified.

The barges currently used in sand mining in the Bay and Delta have screened overflow outlets. The water displaced by accumulating sand within the barge, in addition to fine-grained sediments and other material, is returned to the receiving waters either through overflow weirs that discharge to the water surface (Figure 2-8), or through subsurface pipes that discharge below the water line (Figure 2-9).

Source: Hanson and Jerico 2007

Figure 2-8
Sand Mining Overflow Plume within Central Bay
Showing Suspended Sediment, Entrained Air Bubbles, and Other Material

Source: Hanson and Jerico 2007

Figure 2-9
Sand Mining Overflow Plume within
Suisun Bay and Middle Ground Shoal

With the stationary pothole method, the anchor is set so the barge is positioned facing into the current over the appropriate sand shoal. The hydraulic suction drag head (approximately 4 feet long by 3 feet wide by 4 feet high) (Figure 2-6b) is lowered into the water using a cable winch. The suction head is placed on the bottom surface and as the sand is excavated, the suction head is lowered, creating a pothole. Once the pothole is created, the sand continues to fall into the hole, and the entire barge can be loaded by moving the suction head up or down, approximately 1 foot or less. A hydraulic pump draws the sand up through the drag head. Water drawn into the drag head through a small water intake pipe located on top of the suction head (Figure 2-6b) is continually mixed with the sand to create a slurry. The sand-water slurry is pumped into a flume equipped with loading gates, which allows the barge to fill. The water pumped on board overflows through mesh screens on the barge located above the water line (Figure 2-9), and is returned to the estuary. Fines, along with aeration bubbles, dissolved materials, and plankton returned to the estuary contribute to formation of an overflow plume.

Once mining is completed, the barge is taken to one of several offloading facilities (Figure 2-10). Offloading may be accomplished by creating a sand-water slurry and pumping the slurry into an onshore dewatering pond or by using a conveyor belt/ conveyor boom system to offload “dry” sand to a storage site (Figures 2-11 and 2-12). Slurry pumped into dewatering ponds is allowed to separate (settle), and water is drained over a weir system and subsequently flows back to the adjacent water body. Most sand must be washed using fresh water before delivery to the customer to produce a sand product with a chloride content appropriate for concrete, generally 0.006 percent chloride or less by weight of cement. Offloading and sand distribution sites are relatively small (typically 2 to 3 acres) and have a limited capability to stockpile or store sand for an extended period. Therefore, sand mining is conducted in response to short-term demand.

For the purpose of this EIR, transportation of sand by the sand miners to offloading facilities and the offloading of the sand mining barges are considered part of the Project; this is consistent with State CEQA Guidelines section 15378, which requires that an EIR examine the “whole of an action, which has a potential for resulting in either a direct physical change in the environment, or a reasonably foreseeable indirect physical change in the environment.” Operations at offloading facilities, including ground transport of materials to and from offloading facilities, are not considered part of the Project, since these facilities operate under their own land use permits, air district permits to operate, stormwater permits, and other entitlements and the Applicants are not seeking any changes to these existing entitlements.

SOURCE: Hanson and Jerico 2007

San Francisco Bay and Delta Sand Mining EIR . 207475

Figure 2-10
Location of Off-Loading Facilities

Source: Hanson and Jerico 2007

Figure 2-11
Unloading Sand with a Boom Conveyor to a Transfer Conveyor

Source: Hanson and Jerico 2007

Figure 2-12
Onshore Conveyor to Stockpile

2.3.3 Characteristics of Mining Events

The Applicants compiled data from mining events that took place between March 2002 and February 2003, and reported this information in the 2004 sand mining study prepared by Hanson Environmental. In general, under the Applicants' proposal, sand mining would continue as described in the following pages, subject to the changes in proposed annual volumes presented in Table 2-1.

From March 2002 through February 2003, Hanson and Jerico conducted 843 individual mining operations: 630 in Central Bay, 155 in Middle Ground Shoal, and 58 in the CSLC Suisun Bay/Delta parcel. Log data on the following items were collected for each mining event and included the following information: date of mining, load number, start time, end time, mining duration, starting Global Positioning System (GPS) location, ending GPS location, type of sand mined, operator, and region of mining.

The number and seasonal timing of mining events are largely dictated by demand for product and the weather. The number of mining events may also be indirectly limited by the maximum cubic yardage allowed under the respective leases and permits. The number of mining events by month and region during the March 2002 through February 2003 study period is shown in Table 2-2 for informational purposes.

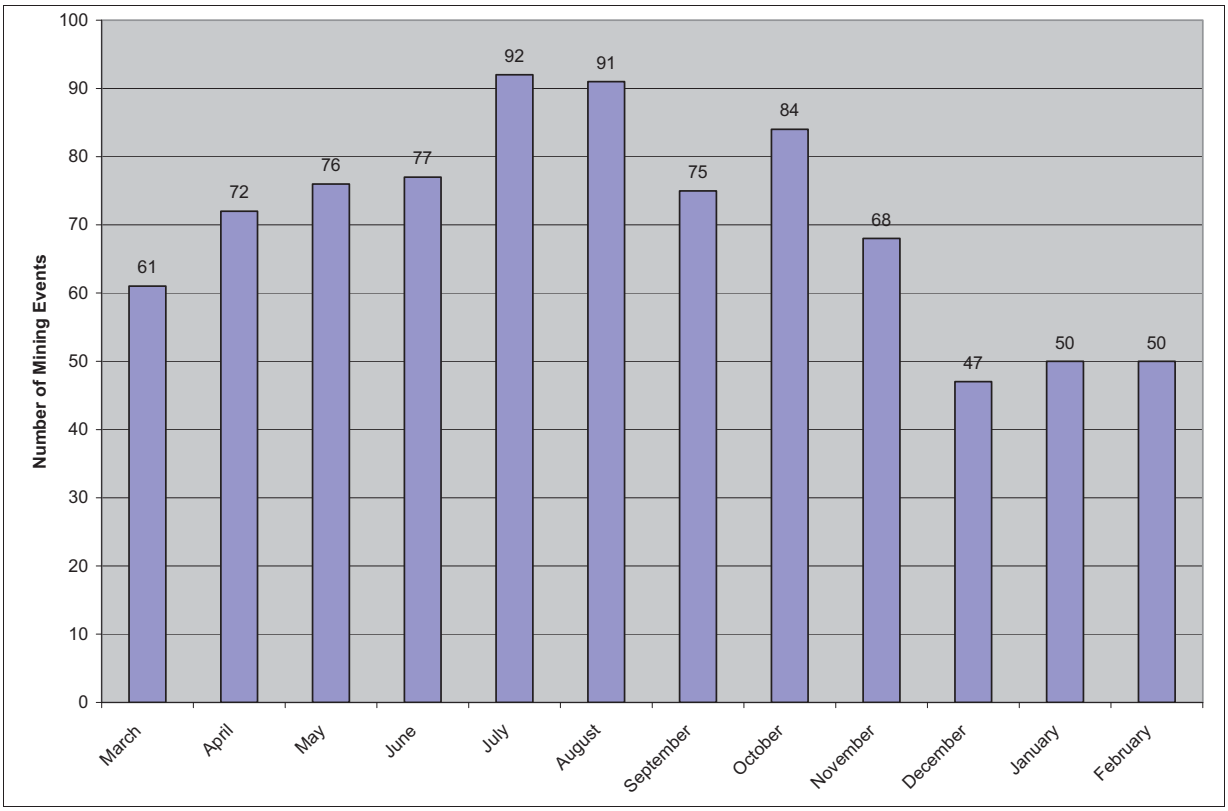
Table 2-2. Number of Mining Events by Region (March 2002 through February 2003)

Month	Central Bay	Middle Ground Shoal	Suisun Bay/Delta	Total
March	43	13	5	61
April	46	14	12	72
May	55	15	6	76
June	58	14	5	77
July	67	20	5	92
August	71	16	4	91
September	54	17	4	75
October	64	16	4	84
November	52	15	1	68
December	43	4	0	47
January	41	0	9	50
February	36	11	3	50
Total	**630**	**155**	**58**	**843**

Note: As discussed previously, the baseline assumed for the environmental analysis is the average mining volume for the years 2002-2007. The mining event data presented in Table 2-2, however, are not available for this entire period.

Source: Hanson and Jerico 2007

Seasonally, sand mining peaks in the summer, when construction activity is also at a peak (Figure 2-13). As shown, mining activity in July and August peaked at about 90 events per month, or about 20 events per month higher than the monthly average of 70 events.



Source: Hanson and Jerico 2007

Figure 2-13
Number of Mining Events for All Regions:
March 2002 through February 2003

Historical Locations of Sand Mining Activities within Project Area

The sand mining locations recorded for Central Bay during the period from April 2007 through June 2008 were provided by Hanson. During this period, sand mining events were predominantly in the area of Point Knox Shoal and Presidio Shoal (Figures 2-14a through 2-14d; see end of Section 2.0, Project Description). Mining locations were not uniformly distributed across the lease areas, but rather were clustered within areas where suitable sand deposits were known to occur. The sand mining locations within the Central Bay lease boundaries were selected based on a number of factors and include areas with suitable water depths for mining, areas where sand is known from historical observations to accumulate, and areas where moderately high water velocities result in frequent sand movement, replenishment, and scour of fines from sand deposits.

Sand mining locations within the Middle Ground Shoal private lease area during the period of July 2007 through September 2008 occurred within the deeper waters in the vicinity of the main shipping channel upstream of the Concord Naval Weapons Station (Figure 2-15; see end of Section 2.0, Project Description).

Within the CSLC Suisun Bay/Delta parcel, sand mining from July 2007 to April 2008 occurred in two general areas (Figure 2-16; see end of Section 2.0, Project Description). At both sites, mining was focused on the northern portion of the main channel, generally at depths of 30 to 40 feet, and along the "inside" edge of the channel curve, where sediments would be expected to drop out of suspension.

The data presented in Figures 2-14a through 2-14d, 2-15, and 2-16 are consistent with the Applicants' general objectives to find sands with a low percentage of fines, and to mine in areas compatible with the operating depth constraints of the equipment used. Figures 2-14a through 2-14d, 2-15, and 2-16 show a pattern of operations, with operators returning frequently to general areas where they have found appropriate sand deposits in the past. There is some scatter to the pattern of sand mining in Central Bay, but mining in the Suisun Bay/Delta and Middle Ground Shoal areas is concentrated in main channel locations (generally away from side channels) that would be expected to contribute significant amounts of fines to the substrate.

Mining Durations and Volumes

The duration of individual mining events reflects differences in equipment, equipment malfunctions, weather, availability of sand at the selected mining site, and other factors. Sand mining events generally last from 3.0 to 5.5 hours, with a range of 1.0 hour to over 11.0 hours. The range in mining duration reflects, in part, mining events that may have been curtailed by equipment failure, extended for equipment repair, or for other reasons.

Water Depth

In Central Bay, sand mining typically occurs in relatively deep water (from 30 to 90 feet deep). Within the region of Middle Ground Shoal and Suisun Bay, sand mining typically occurs in waters 15 to 45 feet deep. Due to equipment constraints, such as the barge and tug draft and the minimum operation depth of the suction drag head (due to pipe length and angle during operation), sand mining cannot occur in shallow-water areas. For instance, Hanson cannot practically mine in areas with less than 20 feet of water. In addition, mining cannot occur in areas with water depths greater than approximately 90 feet. Jerico does not typically mine in areas less than 15 feet of water or greater than 40 feet of water.

In addition to equipment constraints, all recently issued ACOE mining permits prohibit sand mining within 200 feet of any shoreline. The permits also prohibit sand mining within 250 feet of any water having a depth of 4 feet or less mean lower low water (MLLW) in Suisun Bay, or 30 feet MLLW in Central Bay.

Historic Sand Volumes Mined by Area

The volume of sand mined from each of the lease areas over the last 10-year lease period, from July 1, 1998 through June 30, 2008, is shown in Table 2-3. In addition to the total volume, the table shows the average volume mined per year over this period and the amount mined from July 1, 2002 through June 30, 2007, the baseline period for analysis of the proposed Project. The Central Bay lease areas account for the majority of material mined. Mining events and volume tend to peak during the summer months, and to be lower during the winter.

Table 2-3. Mined Volume, 1998-2008 (cubic yards)

Lease Area	Total Volume Mined, 1998-2008	Average Mined per Year 1998-2008	Permitted Annual Mining Volume	Average Mined per Year 2002-2007 (Project Baseline)
Central Bay Lease Areas				
PRC 709 Presidio, Alcatraz, and Point Knox Shoals	3,893,438	389,344	540,000	290,331
PRC 2036 Point Knox South	2,740,993	274,099	300,000	252,637
PRC 7779 Point Knox Shoal	3,782,012	378,201	400,000	390,440
PRC 7780 Alcatraz South Shoal	1,049,252	104,925	150,000	127,248
Subtotal: Central Bay	**11,465,695**	**1,146,570**	**1,390,000**	**1,141,039** [1]
Middle Ground Shoal and Suisun Bay/Delta Lease Areas				
PRC 7781 Suisun Associates	1,039,868	103,987	100,000	85,746
TLS 39 Middle Ground Shoal	2,275,750	227,575	750,000	199,866
Subtotal: Middle Ground Shoal and Suisun Bay/Delta	**3,315,618**	**331,562**	**850,000**	**285,612**
Total	**14,781,313**	**1,478,131**	**2,240,000**	**1,426,650**

[1] The Central Bay baseline includes 80,383 cy/yr that was mined from PRC 5871 during the baseline period; a new lease is not proposed at this parcel which therefore is not part of the proposed Project.

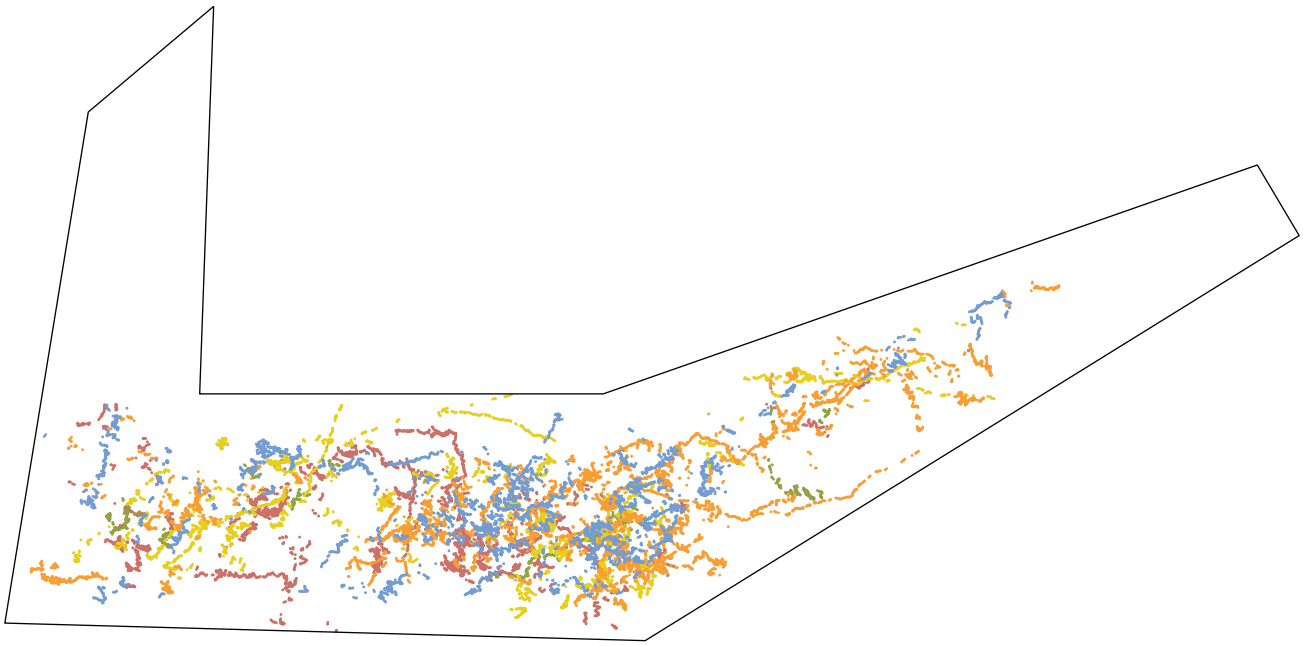
Source: CSLC 1998, 2008, 2011; BCDC 2008, 2009a, 2009b; ESA

Data on sand mining harvest are typically reported as a volume (cubic yards) at the time of offloading. Since the grain size of sand differs among areas, the actual quantity of sand (weight) and density vary by sand type. In general, coarse sand is assumed to have a mass of 1.5 tons per cubic yard, and blend sand has a mass of 1.3 tons per cubic yard. Blend sand can be either a medium-grain size sand or a sand that is blended with another sand to make a third product. Since sand on the bottom may be compacted, and the process of mining may reduce sand density (as a result of agitation during mining), the density of sand on the estuary bottom is not the same as the sand density at the time of offloading.

Daily and Seasonal Schedule of Operations

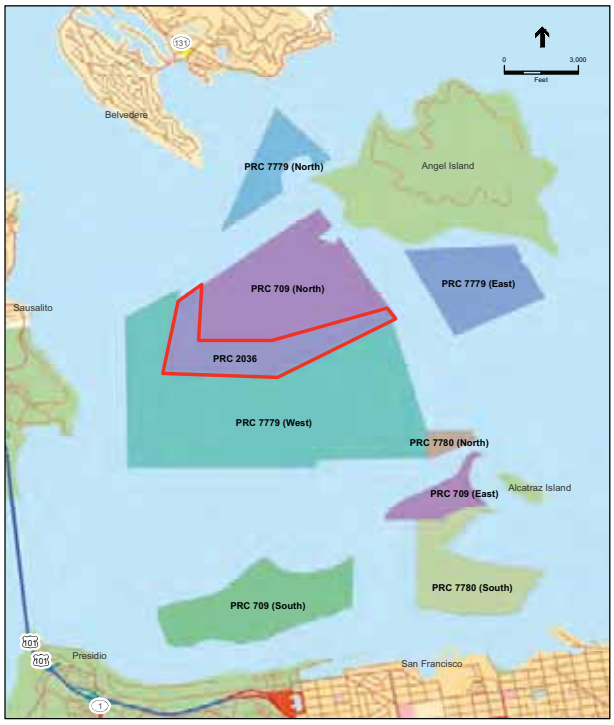
Sand mining activity may occur up to 24 hours per day, during peak periods of mining. Once the barge is loaded, it travels to an offloading location. Depending on the mining and offloading locations, an entire mining operation can take 8 to 24 hours to travel to the mining location, mine, travel to the offload location, and offload. Tidal conditions further limit the frequency of sand mining operations and disturbance of the sand shoals. For example, the onset of low tide at the time a barge is available to return to the sand shoal could delay the sand mining activity.

Mining typically occurs throughout the entire year. The number and intensity of mining events may vary throughout the year, however, depending on demand for the materials. During periods of more intensive mining, more than one mining event may occur in a 24-hour period. These multiple-event days are much less frequent in the Suisun Bay and western Delta areas, reflecting the generally lower level of mining activity there.



2Q 2007
3Q 2007
4Q 2007
1Q 2008
2Q 2008

LOCATION MAP



SOURCE: Hanson Marine Operations 2009

San Francisco Bay and Delta Sand Mining EIR . 207475

Figure 2-14a
Location of Sand Mining Events within Parcel PRC 2036,
2nd Quarter 2007-2nd Quarter 2008