2018 UPDATE:

MAUI INLAND SAND RESOURCE QUANTIFICATION STUDY

Prepared For:

County of Maui

Department of Public Works

Engineering Division

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November 2018

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1.1.1 STUDY PURPOSE

As recently as the 1970's, sand from Central Maui was a relatively easy commodity to attain. Over thousands of years of prevailing tradewinds, this area had collected and contained vast inland sand dunes considered a unique geological feature within Maui. However, Maui's inland sand is a finite resource and today's development pressures necessitate its appropriate management to protect and balance its economic, cultural, and natural values.

Maui's inland sand has long been a key ingredient for high quality concrete and generally meets the highest quality standards for sand used in concrete production. This sand resource, based on lab testing, was found to produce a high quality concrete product because the natural sand particles are very smooth and round in shape. These qualities made the concrete produced with Maui sand desirable among the construction and concrete production industry. This sand resource is also an important natural commodity that is desired for dune restoration, beach nourishment, and emergency coastal management responses on Maui since it is carbonate beach sand of local origin.

In contrast to being a valuable economic resource, these sand dunes are a valuable cultural resource. They contain known historical, archaeological, and cultural resources protected under Federal and State laws and regulations. Ancient Hawaiian burial sites containing *iwi kupuna* (ancestral bones) have been discovered in association with construction and grading. The high potential for more undiscovered iwi kupuna to exist in these areas has been well documented in modern archaeological surveys and monitoring efforts. These are sacred places to the Native Hawaiians and their lineal descendants that populated these areas. Proper treatment and protection of this cultural resource is necessary and governed by State law.

Finally, sand dune areas are generally prime areas for development given their low agricultural value and proximity to Central Maui, and as such have been zoned and used as residential, commercial, and institutional use for decades.

These competing values associated with Central Maui's sand dunes are the primary considerations in determining the appropriate resource management decisions and tools affecting what remains of the resource. In 2006, the *Maui Inland Sand Resource Quantification Study* (hereafter referred to as the "2006 Study") estimated that there was a five to seven year supply of sand remaining in Central Maui that could be excavated with appropriate cultural and environmental measures followed. In the decade prior to 2006, an estimated 3,000,000 tons of sand had been excavated with the vast majority of that sand originating from Central Maui. Today, most of Central Maui's remaining inland sand dunes are unavailable for excavation due to existing development that covers the underlying sand dunes and archaeological and cultural protections that prevent ground disturbance from occurring.

1.1.2 STUDY OBJECTIVES

In 2018, the County of Maui, Department of Public Works, Engineering Division commissioned an update of the 2006 Study (hereafter referred to as the "2018 Update"). Objectives of this update aim to quantify how much supply of inland sand remains in Central Maui; where any possible new sources exist on Maui; what external factors affect the need for sand; and what quantity of sand is needed for future beach replenishment.

The 2018 Update methodology involved the following specific objectives:

1. Determine if there are any additional parcels of land within Central Maui (not identified in the 2006 Study) with the potential of significant sand deposits.
2. Contact land owners of parcels identified in the 2006 Study with significant sand deposits and obtain information if sand has already been excavated from the properties and the volume of sand deposits that could possibly be excavated in the future.
3. Provide an estimate of the total volume of sand excavated from the Central Maui dune system since 2006, by parcel.
4. Provide an estimate of volume and the destination of sand which has been exported off-island since 2006.
5. Determine the total estimated remaining volume of construction-quality sand with potential excavation. This does not include areas identified as significant burial sites, cultural sites, sites that are otherwise protected from disturbance, areas that have already been developed, or areas where excavation is not and will not be possible.
6. Determine the approximate quantity of existing stockpiled sand and estimate rate of usage.
7. Evaluate external factors that may affect the need for sand, such as associated costs, availability of alternate materials, and new technology.
8. Identify properties with significant quantities of beach-quality (grade A) sand deposits that may be available for purchase by the County of Maui, including the estimated quantity of sand needed for current and future beach replenishment. For the purposes of this report, the sand inventories described further in this update are clean grade "A" sand[1] suitable for concrete or for placement on a beach, and does not include grade "B" sand.

[1] "Grade A sand" is defined as the type used in concrete or for beach replenishment. Beach quality sand is defined as naturally occurring carbonate beach, dune, lithified sand dune, or inland sand that contains no more than 6% silt, clay, or fines. "Grade B sand" is defined as the type used for trench backfill and conforms to the Hawai‘i State Standard Specifications for trench backfill material.

1.2 MAUI INLAND DUNE SAND – LOCATION AND DESCRIPTION

The 2018 Update study area matches the areas covered in the 2006 Study. Sand dune location descriptions are repeated below for definition purposes:

> *Inland sand deposits start downwind of the mouth of Waiheʻe Stream, and run parallel along the Waiehu coastline, and fan out towards Maʻalaea generally between Kahekili Highway and Honoapiʻilani Highway on the west side, and Kuihelani Highway on the east side. Waiko Road demarcates the generally southerly boundary of the dunes, though which is a sand layer under the more or less level lands towards Ma'alaea. This update includes an assessment of the potential for sand extractions in that section between Ma'alaea and Waiko Road.*
>
> *In general, the largest sand deposits today remain visible along Waihe'e and Waiehu, and in Wailuku. These larger dunes may exceed one hundred feet (100') in depth. The Waihe'e dune runs along lands that are owned by the Maui Coastal Land Trust, along the Waiehu Golf Course, and into the Leisure Estates Subdivision. The Waiehu Heights Subdivision also sits on top of a substantial sand dune.*
>
> *The largest dune in Wailuku runs immediately south of Lower Main Street and east of Waiʻale Drive, also referred to locally as "Sand Hills". There is another large dune in the area upon which Mahalani Street and the Maui Memorial Medical Center are located.*
>
> *The dunes located south of the Mahalani Street dune in the area of Maui Lani are generally lower in height when compared to the larger dunes to the north. However, the sand deposits from Maui Lani to the south towards Ma'alaea do cover a large area.*

The description of Maui inland sand dune soil composition from the 2006 Study is repeated below for definition purposes:

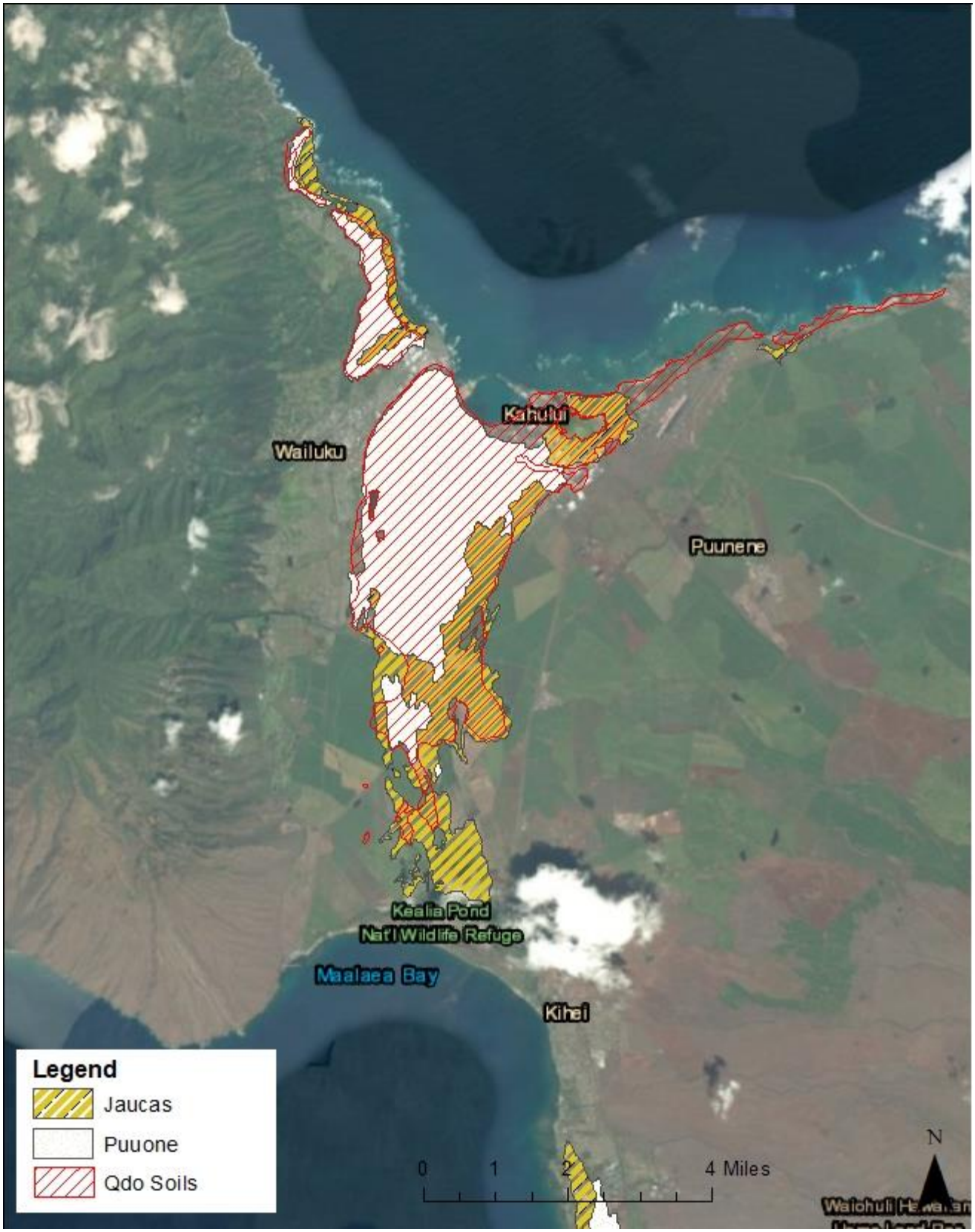
> *The "Soil Survey of the Islands of Kauaʻi, Oʻahu, Maui, Molokaʻi, and Lānaʻi, State of Hawaii", 1972, published by the United States Department of Agriculture, Soil Conservation Service, describes two types of soil in the central valley of Maui which consists of calcareous sand. Calcareous sand is composed mainly of calcium carbonate derived from shells or the skeletal remains of marine organisms.*
>
> *One type found often along narrow strips of beach, is called Jaucas Sand, 0 to 15 percent slopes. It is described as a single grained sand, pale brown to very pale brown in color, and more than 60 inches deep. The water erosion hazard is slight, but wind erosion is a severe hazard where vegetation has been removed. It is generally found in elevations from sea level to 100 feet.*
>
> *The other type is called Puuone sand, 7 to 30 percent slopes. This soil is very similar to the Jaucas sand as both are derived from coral and seashells. However, this type of sand is found at elevations from 50 feet to 350 feet which is higher in elevation than the Jaucas sand locations. The Puuone sand is the type that comprises most of the Central Maui inland dunes.*

> *These sand deposits were built up over thousands of years when the central valley was covered by the ocean and also through conveyance by the winds. The sand granules in the inland dunes are finer in gradation than generally found in the sand on most beaches. This is due to the wind- blown nature of these deposits, since the lighter particles are the ones that are most likely to be picked up and carried by the winds.*
>
> *Most of the sand deposits are generally sitting on hard pan composed of clay or they may be on a rocky substrata. In most cases, the surface of the dunes has a thin layer of organic material consisting of decomposed vegetation that has grown over the years. Once the organic material is removed, the sand under the surface is generally fairly clean.*

In 2017, an additional soil definition was introduced in the County Moratorium on Sand Mining of Central Maui Inland Sand (County of Maui, 2017). The U.S. Geological Survey (USGS), Geologic Map of the State of Hawai‘i, Sheet 7 Island of Maui identifies “Qdo” soils within the Island of Maui. This soil type is defined as older dune deposits (Holocene and Pleistocene) and are only found in areas within Central Maui.

Figure 1 on the following page shows the boundaries of the three soil types associated with Central Maui sand dunes. In general, the Qdo soils consistently overlap with the Jaucas and Pu‘uone soils locations. The boundaries used for Qdo soils were accessed through the USGS website and downloaded as a Geographic Information Systems (GIS) shapefile.

Figure 1: SOIL TYPE BOUNDARIES AND 2018 UPDATE STUDY AREA



1.3 TIMELINE OF NOTABLE NEWS AND EVENTS SINCE 2006

June 2006: The *Maui Inland Sand Resource Study* (Hanzawa, 2006) was completed.

April 2007: Maui Planning Commission recommended approval of Hawaiian Cement's State Special Use Permit for sand-mining operations on a 58.8-acre site on Waiko Road in Waikapu. Mining activities were expected to occur in 15-acre increments over a period of 5 to 10 years. Hawaiian Cement noted that the company's sand barge exports were decreasing from 24 barges in 2004, to 10 in 2006, and 1 in 2007 (through April). Hawaiian Cement agreed to keep the sand that was mined from this parcel on Maui (San Nicolas, 2007).

August 2007: Hawaiian Cement began importing sand from Canada (Gomes, 2007).

June 2008: The *Maui Beach Management Plan*, Second Edition (June 2008), published by affiliates within the University of Hawai'i Sea Grant Program and the County of Maui Department of Planning, described the value of inland sand for Maui beach replenishment and provided recommendations to protect inland sand. These recommendations included a moratorium on sand exports and a requirement that sand excavators stockpile a percentage of excavations for beach replenishment.

2009: Sand mining from the 435-acre parcel owned by Alexander & Baldwin stopped. A 281-acre portion of this parcel is now part of the Wai'ale planned growth area as proposed in the *Maui County General Plan 2030*. Wai'ale is the largest proposed town on the island, and the largest planned growth area proposed for the Wailuku-Kahului community plan region. Preservation areas were established to protect Hawaiian burials and intact sand dunes.

May 2012: A report by USGS and the University of Hawai'i studying coastal change over the last century found that 70% of beaches on the islands of Kaua'i, O'ahu, and Maui are undergoing long-term erosion. Of the three islands studied, Maui beaches were noted as experiencing the highest rates of beach erosion with 85% of its beaches actively eroding (USGS, 2012).

June 2014: Hawaiian Cement began using Sandvik Technology to produce sand to supply badly-needed aggregates and cement products for Oahu's construction industry; this decreased reliance upon sand imports from British Columbia (ABI, 2014).

2015: The Small-Scale Beach Nourishment project at Sugar Cove in Spreckelsville Beach in Pā'ia began. The source of inland sand used for the project was extracted from Tax Map Key (TMK) (2) 3-8-007:153, purchased from Ameron Hawai'i. The application requested up to 3,500 cubic yards of sand placement over a period of 5 years. See Table 4 for estimated cumulative sand placement totals from 1995-2017.

November 2015: Ameron Hawai'i changed its name to Honolulu Construction & Draying Company (HC&D).

2016: The USACE performed maintenance at five (5) Hawai'i commercial harbors, removing more than 300,000 cubic yards of dredged sediment. All of the dredged materials were disposed of at an EPA approved offshore ocean dredged material disposal site located approximately 13 miles directly north of Kahului Harbor at coordinates 21° 04' 42" N, 156° 29' 00" W. Dredging was performed by Essayons, a hydraulic hopper dredge vessel based in Portland, Oregon.

Approximately 57,000 cubic yards of material was extracted from Kahului Deep Draft Harbor (Chow, 2018). Since this time, the County of Maui has been coordinating with USACE for additional studies to determine if there is beach quality sand that could be targeted for beneficial use, rather than disposal, in association with future dredging cycles.

September 2016: The *Kahana Beach Regional Beach Nourishment Feasibility Study* was completed on behalf of the County of Maui, which identified two offshore sand deposits near Kahana Beach containing sand volumes exceeding 275,000 cubic yards (County of Maui, 2016).

April 2017: Mayor Arakawa sent a letter dated April 27 to the County Council to examine the possibility of sand mining for export moratorium, referring back to the 2006 Study findings as the impetus for action.

May 2017: HC&D reported that sand extracting activities from Maui Lani's Phase 9 site (TMK (2) 3-8-007:153) ceased following an email and hand-delivered letter from the Planning Department's Zoning Administration and Enforcement Division. HC&D was informed that "resource extraction" activities require an approved County Special Use Permit (Tanji, 2018).

July 2017: A lawsuit was filed with Maui's Environmental Court seeking to stop ground disturbing activities at the Maui Lani Phase 9 site on claims that the work is in violation of Hawaii's historic preservation regulations and County regulations (Osher, 2017).

October 2017: Resolution No. 17-148 was passed by the County Council urging the Mayor and Department of Public Works to update the 2006 Study.

November 2017: Maui Lani Partners Grading Permit for their Phase 9 site (TMK (2) 3-8-007:153) is extended by the Department of Public Works for grading activities on a 9-acre portion of this 62-acre parcel.

December 2017: Bill 117-2017 to establish 6-month moratorium on mining of sand in portions of Central Maui passed its first Council reading.

January 2018: Amendment to Chapter 20.40 "Moratorium on Sand Mining of Central Maui Inland Sand" in Bill 117-2017 passed. This amendment suspended sand mining activities on 58 parcels in Central Maui for a period of six-months while 1) the update to the 2006 Study could be completed and 2) Council was afforded time to assess potential regulations to prevent disturbance to Native Hawaiian Burials, in addition to protecting limited natural resources. The amendment focuses on parcels containing "Qdo" sands within Central Maui, which are defined by USGS as older sand dune deposits.

March 2018: The County issued warnings to HC&D & Maui Lani Properties, Phase 9, noting that work conducted in this month is under review for compliance with the grading permit and County zoning laws on resource extraction (Mangieri, 2018)

April 2018: HC&D received its first shipments of sand imported from British Columbia. HC&D states that the company will be relying on imported sand for cement production on O'ahu instead of exporting sand from Maui. HC&D begins phasing out their last sand stockpile on Sand Island on O'ahu and says the company has no plans for further shipments of sand from Maui (Mangieri, 2018).

July 2018: An Environmental Impact Statement Preparation Notice is published for the Ka‘anapali Beach Restoration and Berm Enhancement project. This project proposes beach restoration back to 1988 shoreline conditions for the section of Ka‘anapali Beach between Hanakao’o Beach Park and Hanakao’o Point. Approximately 75,000 cubic yards of sand is needed for the proposed project. The sand would be recovered from an 8.5-acre sand deposit, located approximately 150 feet offshore of Pu‘u Keka‘a in 28 to 56 feet water depth (Sea Engineering, 2018).

1.4 CONVERSION FACTORS AND COMPARISONS

The following conversion factors and quantity comparisons are provided for reference below. These follow the same factors used by the 2006 Study:

1 cubic yard of sand	**=**	**1.25 tons**
1 acre	**=**	**43,560 square feet**
1 acre	**=**	**4,046 square meters**
1 short ton	**=**	**2,000 pounds**
A football field goal line to goal line	**=**	**1.1 acres**
1-acre of sand x 1-foot deep	**=**	**43,560 cubic feet or 1,600 cubic yards**
1-acre of sand x 1-foot deep	**=**	**2017 tons**
A typical barge of sand	**=**	**4,000 tons**
A standard tandem dump truck holds	**=**	**15 cubic yards or 19 tons of sand**
A semi-trailer end dump truck holds	**=**	**24 cubic yards or 30 tons**
A 4,000 ton sand barge load	**=**	**133 semi-trailer end dump loads**

1.5 HISTORICAL AND CURRENT USAGE

An objective of the 2018 Update is to 1) estimate the volume and the destination of sand exported from Maui since 2006 and 2) estimate the total volume of sand excavated from the Central Maui dune system since 2006, broken down by parcel.

As it was in 2006, today the two main producers of concrete in Maui and in Honolulu are HC&D (formerly Ameron Hawai‘i) and Hawaiian Cement. In 2006, both companies' ratios of sand stock remaining on Maui (for concrete production) and sand stock being sent to O‘ahu were in the range of approximately 70% (3.3 to 1). The split share of barges leaving Maui between the two companies were generally evenly split in the 2006 Study, but has since changed. By August 2007, Hawaiian Cement phased out exporting sand to O‘ahu from Maui, and instead began importing sand from British Columbia, Canada to send to Honolulu (ABI, 2014). Today, Hawaiian Cement estimates they are importing 50,000 tons of sand from Canada, two to three times annually. The sand imported from Canada supplements the sand aggregate generated at their Hawai‘i quarries for concrete production.

According to testimony submitted during a Maui Planning Commission hearing on Hawaiian Cement's State Special Use Permit in 2007, a representative from Hawaiian Cement noted that their company alone sent 24 barges of sand from Maui to O‘ahu in 2004, then 29 barges in 2005, and 10 barges in 2006, and was projected to send even less barges to Oahu in 2007. Hawaiian Cement stopped exporting sand from Maui in 2007.

Between 2006 and 2017, HC&D continued to export sand and sand aggregate to O‘ahu from their supply stocks on Maui. The source of sand contained in these supply stocks were assumed to have been mostly excavated from Central Maui locations, but may have included a mix of sand aggregate from other locations. HC&D stopped exporting sand and sand aggregate from Maui in 2018. Furthermore, since 2008, all of the sand and sand aggregate barges departing Maui for O‘ahu were ordered by HC&D. Table 1 and Figure 2 provide an estimate of sand and sand aggregate exported off Maui since 2006 based on barge records maintained by the State of Hawai‘i, Department of Transportation, Harbors Division. Time periods are broken down into 10-year intervals between 1956 and 2015.

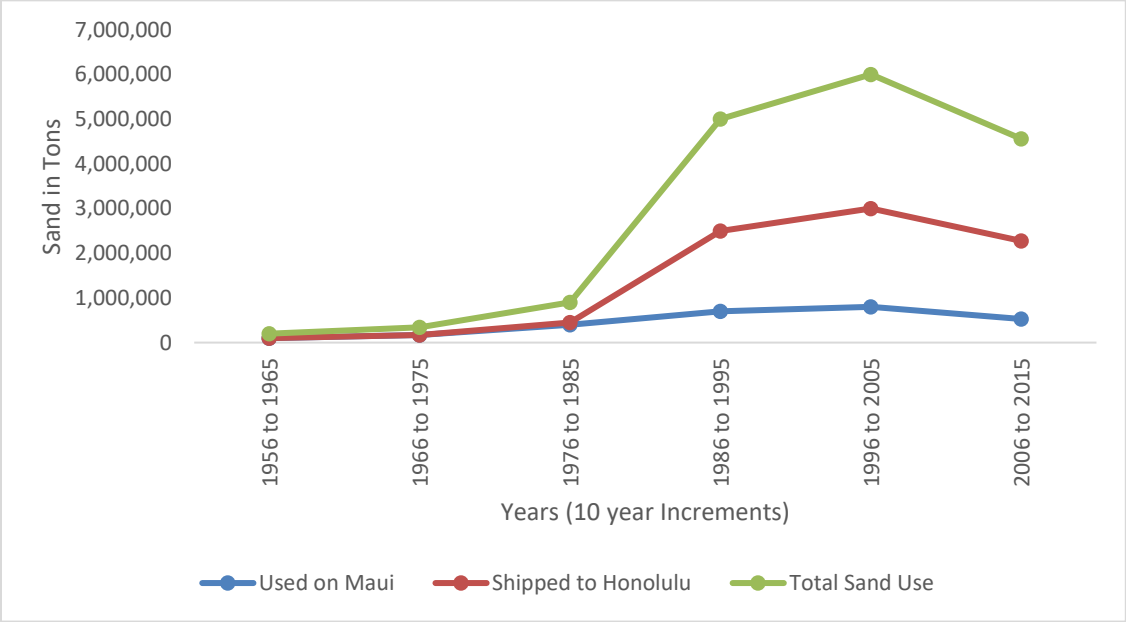
Table 1: HISTORICAL SAND EXTRACTION AND EXPORTS (TONS)

Timeframe	Used on Maui	To Honolulu	TOTAL
1956 to 1965	100,000	0	100,000
1966 to 1975	170,000	0	170,000
1976 to 1985	400,000	50,000	450,000
1986 to 1995	700,000	1,800,000	2,500,000
1996 to 2005	800,000	2,200,000	3,000,000
2006 to 2015*	**530,000****	**1,748,000***	**2,278,000**
2016 to 2017 (2 years only)	**120,000****	**400,000***	**520,000**

* Based on actual HDOT sand/sand aggregate barge totals (See Appendix A).

** Based on a historical ratio (3.3 to 1) of extracted sand quantities which left for O‘ahu on barges versus sand quantities remaining on Maui (Hanzawa, 2006).

Figure 2: GRAPH OF HISTORICAL SAND EXTRACTION AND EXPORTS (TONS)



Between 2006 and 2015, 437 sand/sand aggregate barges departed Maui bound for O‘ahu. Between January 2016 and September 2017, 98 sand aggregate barges departed Maui for O‘ahu.

Between October 2017 and May 2018, 12 sand aggregate barges departed Maui for O‘ahu indicating a significant decrease in the frequency of sand aggregate barge departures. The ratio of barges per month decreased from 4.6 barges per month to 1.5 barges per month.

Two large master planned development parcels were identified in the 2006 Study as the last remaining sites with significant sand reserves that could be extracted. The first site included the Maui Lani Partners property at Tax Map Key (TMK) (2) 3-8-007:131, an approximate 350-acre parcel that has since been subdivided into smaller parcels. Maui Lani's Phase 9 development parcel, TMK (2) 3-8-007:153 is one of the subdivided parcels and is about 62 acres. Maui Lani held an approved Grading Permit from the County to extract up to 214,000 cubic yards of material from a 9-acre portion of this parcel, equivalent to about 270,000 tons of sand aggregate. Noted in the 2006 Study, HC&D had plans to stockpile about 600,000 tons of sand from a separate 50-acre portion of Maui Lani's original 350-acre parcel. The stockpile location was situated just north of and adjacent to the Old Waikapu Landfill Site (TMK (2) 3-8-007:092). Per a telephone discussion in May 2018 with a representative from Maui Lani, sand excavation activities at this parcel ceased in 2018 following receipt of County of Maui warnings to HC&D & Maui Lani Properties, noting that work conducted under their Phase 9 grading permit was under review for compliance with the grading permit and county zoning laws on resource extraction. Figure 3 shows the past and current TMK boundaries for parcels described in this section.

The second site included an Alexander and Baldwin (A&B) owned property at TMK (2) 3-8-007:101, an approximate 435-acre parcel, also subdivided since 2006. This is the current site of A&B's proposed Wai‘ale master planned community. Hawaiian Cement and HC&D had separate agreements in place with A&B to excavate from a 235-acre and a 200-acre portion of this site, respectively. The estimated combined total of sand that was available for extraction from A&B's parcel was 1,954,000 tons. This would have amounted to an approximate five to seven year remaining supply of sand for both Hawaiian Cement and HC&D based on their usage in 2006. In 2007, Hawaiian Cement received a State Special Use Permit to extract sand from a portion of this property consisting of 56 acres. Following the 2006 Study assumption that the depth of sand layer available on this site was 4 feet, an estimated 451,000 tons of sand remained available for excavation at this portion of the property. This estimate is included in Table 2 with the assumption that all the sand extracted from this 56-acre site would stay on Maui since it was a condition of approval connected with the State Special Use Permit.

There have been 60+ of Native Hawaiian burials discovered on the Wai‘ale site. An Archaeological Inventory Study (AIS) conducted for the Wai‘ale identified 54 inadvertent burial features which contain articulated, *in situ* human remains and/or were likely to contain *in situ* burial features, as well as an assemblage of scattered human remains from a minimum of 35 individuals represented (Tome and Dega, 2016).

The 2006 Study noted that Ameron Hawai‘i (now HC&D) had an existing agreement in place to excavate and remove sand from a 200-acre portion of A&B's property located on the eastern side fronting Kuihelani Highway. However, later in 2006 an A&B representative testified before the Maui Planning Commission on the issue of a State Special Use Permit for Hawaiian Cement and stated that no agreement was in place between Ameron Hawai‘i and A&B for use of the 200-acre parcel. Since then, an approximate 65 acre parcel was subdivided out of the original 435-acre parcel and has now become a regional public park. Per a telephone discussion with an A&B representative in May 2018, all sand mining activities on their Wai‘ale development lands had ceased in 2009 and they expect the remainder of sand material left onsite would be needed to balance cut and fill during future grading activities.

Figure 3: TAX MAP KEY BOUNDARIES (2006 AND 2018)

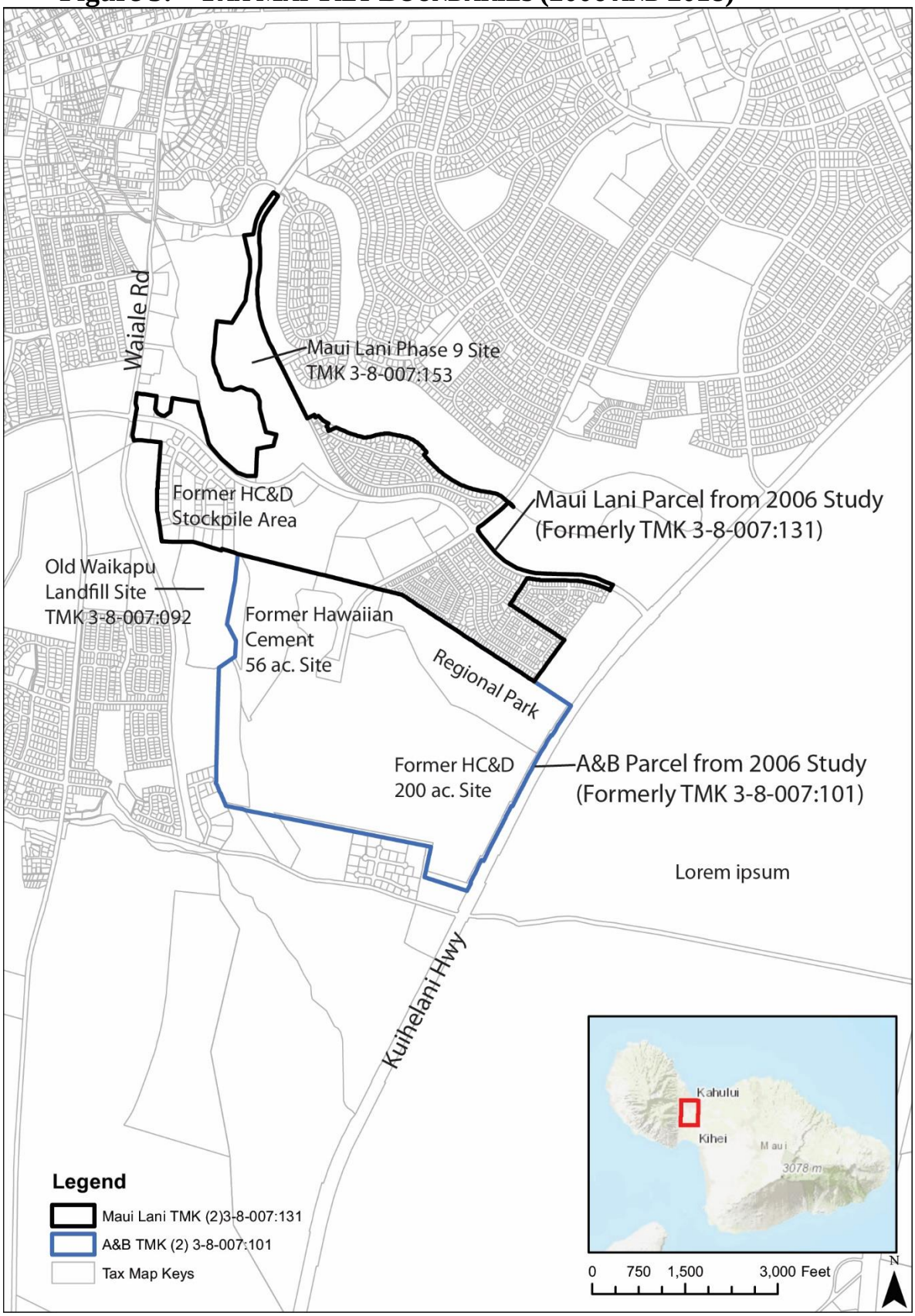


Table 2 provides estimates for the volume of sand supply that was planned for removal from the A&B and Maui Lani parcels within Central Maui dune system since 2006.

Table 2: SAND EXCAVATED (TONS) FROM MAUI LANI AND A&B PARCELS

Parcel Description	Used on Maui	To Honolulu*	TOTAL Per Parcel/Lot
Hawaiian Cement A&B Lot-12A (56 ac.) (Formerly TMK (2) 3-8-007:101)	451,000	0	451,000
HC&D Maui Lani (Formerly TMK (2) 3-8-007:131 por.)	0	600,000	600,000
HC&D Maui Lani Phase 9 (Currently TMK (2) 3-8-007:153)	0	270,000	270,000
HC&D A&B (200 ac.) (Formerly TMK (2) 3-8-007:101)**	0	0	0
TOTAL (tons)	**451,000**	**870,000**	**1,321,000**

* Based on estimated quantities of sand available from Maui Lani development and A&B development (Lot 12-A) parcels in Central Maui.

** The 2006 Study identified approximately 970,000 tons of sand available on 200 acres of A&B lands per an agreement with Ameron Hawai‘i to extract it, however later that year A&B reported no such agreement was in place.

Since 2006, an estimated 451,000 tons of sand has been removed from A&B's Wai‘ale development parcel. In 2009, A&B ceased sand mining operations noting that the remainder of sand supply onsite would be needed to balance the cut and fill of the development. An estimated 870,000 tons of sand has been removed from Maui Lani's parcel (formerly TMK (2) 3-8-007:131).

In total, an estimated 1,321,000 tons of sand has been removed from Central Maui sand dunes since 2006. Factoring the half million tons of sand from A&B, the total would have reached approximately 1.8 million tons. This total is very close to the 2006 Study estimate of 1.95 million tons (970,000 + 984,000), implying that the stock of Central Maui sand which existed in 2006 is either depleted or would be depleted beyond the year 2018.

1.6 AVAILABLE INVENTORY

An objective in this 2018 Update is to identify any additional parcels of land (not identified in the 2006 Study) within Central Maui with the potential for significant sand deposits and determine whether future excavation activities are possible or anticipated.

Two (2) related study objectives are: 1) estimate the total remaining volume of construction-quality sand with potential for excavation, excluding areas that have been identified as burial sites, cultural sites, sites that are otherwise protected from disturbance, areas that have already been developed, or areas where excavation is not and will not be possible; and 2) determine the approximate quantity of existing stockpiled sand and estimate rate of usage.

To identify any additional parcels of land (not identified in the 2006 Study) within the Central Maui study area, a review of the Qdo lands and parcels identified in the County moratorium was conducted using GIS software. There are 58 parcels listed in the moratorium with a total combined area of approximately 8,000 acres. These parcels were likely selected on the shared quality of being primarily open lands within the Qdo subsurface soil designation. The boundaries of each parcel were compared against the Qdo layer to calculate how much of each parcel fell within the Qdo layer. Of the 8,000 acre total, approximately 2,300 acres are situated on lands where the underlain soil type is Qdo. That is equivalent to about 29% coverage (see Figure 4).

Based on a review of each parcel, noting existing uses and site constraints, the potential for future sand excavation was identified and the estimated tonnage of Qdo sand available was calculated with the following assumptions:

1) If a parcel had an existing use, including any permanent structures, it was not included. Aerial photography was used to determine whether sites contained structures or other impediments to sand extraction, such as roads or drainage basins.

2) If a parcel was vacant and undeveloped, it was included, unless it was located along the shoreline or in a shoreline area. Parcels abutting the shoreline were not included.

3) Known burial sites, cultural sites, sites that are otherwise protected from disturbance, or areas where excavation is not and will not be possible were excluded. This includes also the recent Important Agricultural Lands (IAL) designation for A&B's land east of Kuihelani Highway (see Figures 5 and 6).

For parcels that were included, the following assumptions were made:

4) Only the portions of the parcel that were classified as Qdo soils were included in the calculation to develop available sand stock. Of those qualifying lands, 50% of the area was assumed not to include recoverable sand. The 50% assumption is conjecture due to the lack of detailed geotechnical boring information or other sub-surface soil data.

5) Available sand layer depths were assumed at 4 feet for calculation purposes because a majority of the lands included consisted of relatively flat topography. Applying the 4-foot depth assumption, for calculation purposes, is consistent with the assumption used in the 2006 Study for similar flat areas. Ground level observations were used to determine if an area was considered "flat" or to contain a visible sand dune.

Figure 4: MORATORIUM PARCELS IN QDO SOILS

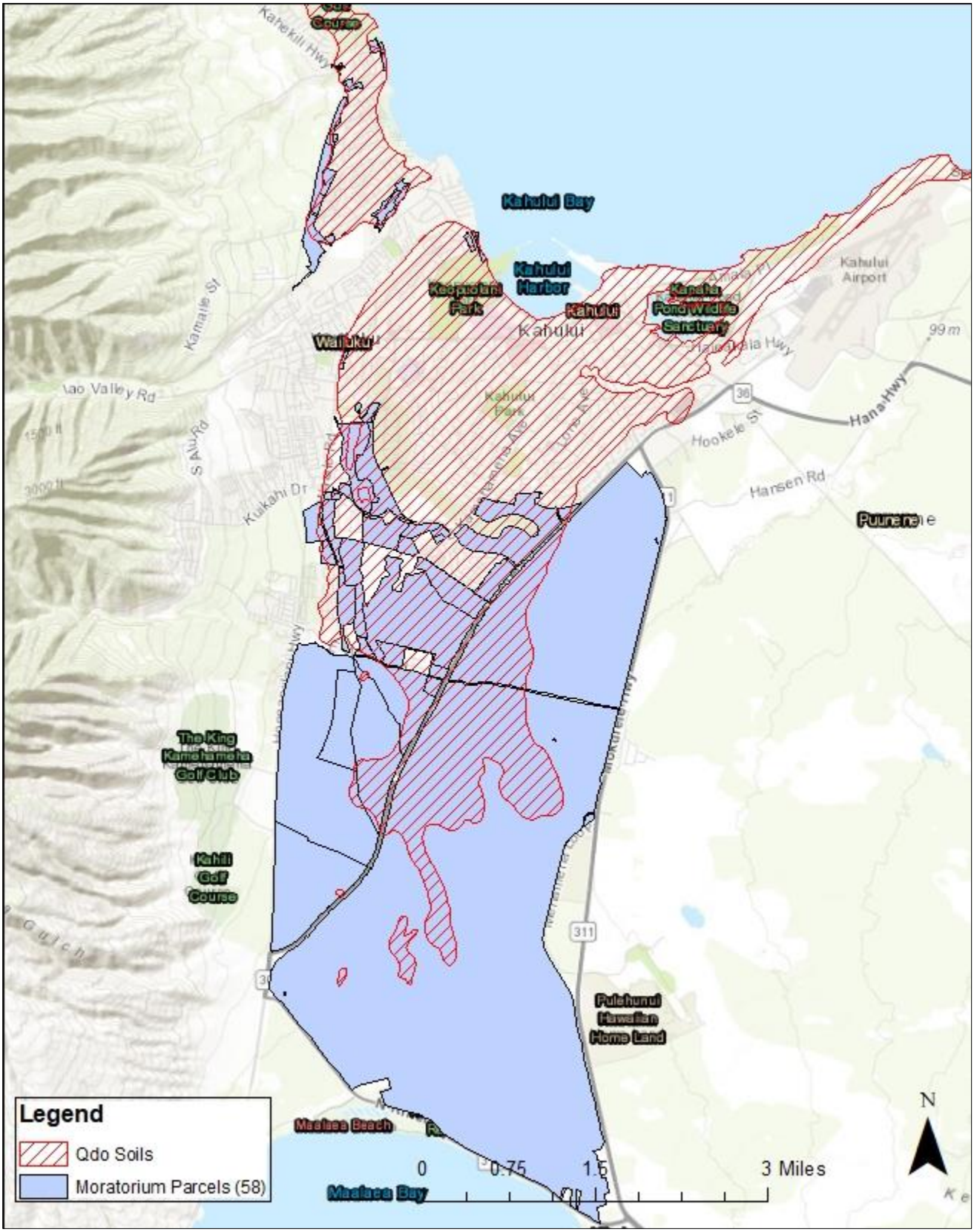
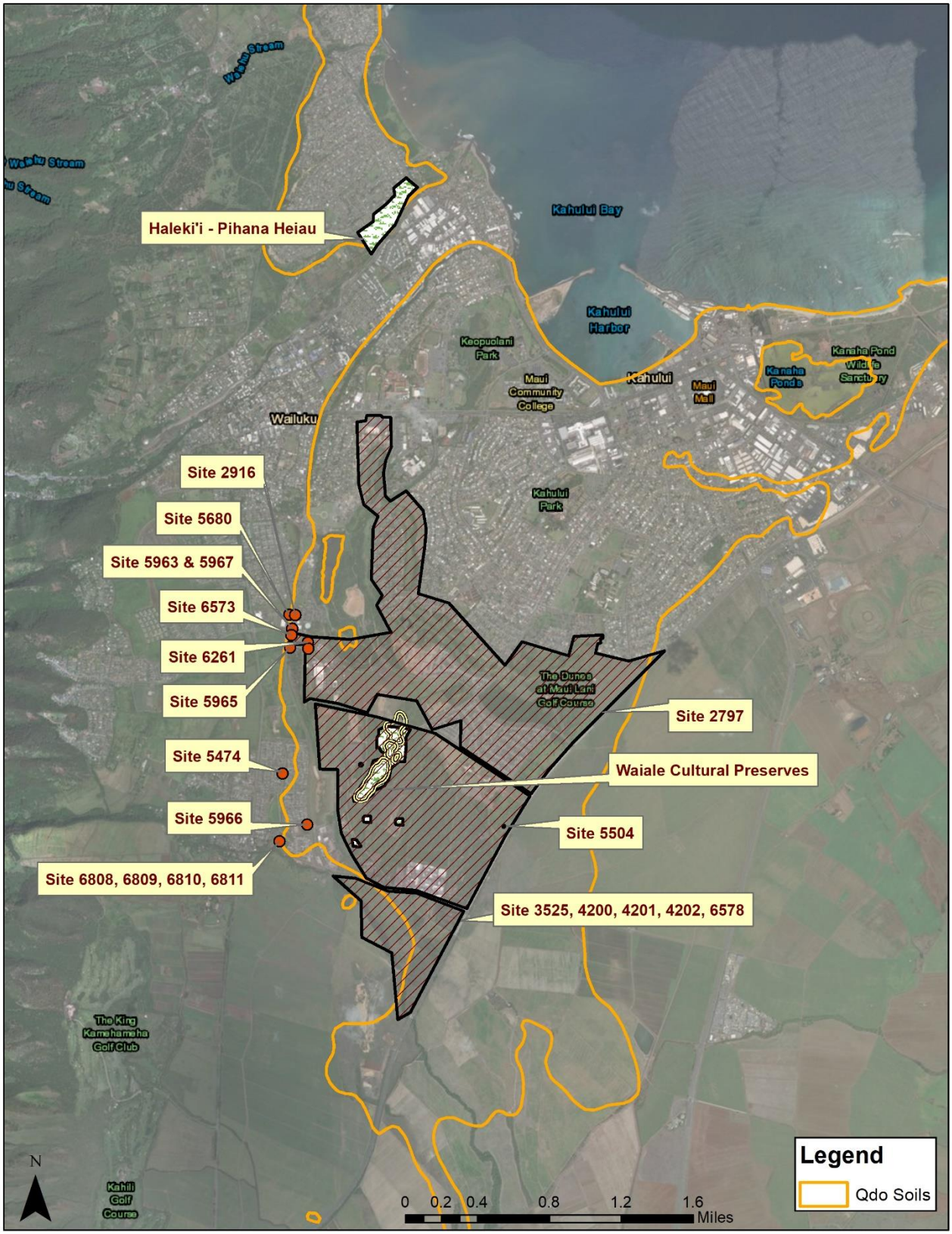


Figure 5: IMPORTANT AGRICULTURAL LAND DESIGNATION

Figure 6: KNOWN CULTURAL RESOURCES MAP



The following list of project references were reviewed to identify any known cultural, archaeological, and historic resources within the study area (see Figure 6).

- An Archaeological Inventory Survey of Approximately 607-acres of Land in Wai‘ale, Wailuku, and Waikapu Ahupuaa. Prepared in 2010 by Scientific Consultant Services, Inc.
- Maui Lani Land Use Plan Update & Related Project District Amendments. Final Environmental Assessment prepared in 2005 by Munekiyo Hiraga, Inc.
- Maui Lani Shopping Center. Final Environmental Assessment prepared in 2010 by Munekiyo Hiraga, Inc.
- Wailuku Apartment Rental Housing Project. Final Environmental Assessment prepared in 2018 by Munekiyo Hiraga, Inc.
- Modification to the 'Iao Stream Flood Control Project. Final Environmental Assessment prepared in 2017 by GSI Pacific, Inc.
- Waikapu Light Industrial Project. Final Environmental Assessment prepared in 2014 by Munekiyo Hiraga, Inc.
- Archaeological Assessment Survey of a 31.222-acre Parcel Located along Waiko Road. Prepared in 2011 by Xamanek Researches, LLC
- Wai'ale Final Environmental Impact Statement prepared in 2011 by PBR Hawaii & Associates, Inc.
- Central Maui Regional Park. Final Environmental Assessment prepared in 2013 by R.M. Towill, Corporation.

Based on the review above, the following sites were identified as culturally significant or potentially significant within the 2018 Update study area.

Table 3: LIST OF KNOWN CULTURAL RESOURCES IN STUDY AREA

Mapped Site No.	**Site Description/ Information:**
2797	Multiple traditional pre-contact Native Hawaiian burials
3525, 4200, 4201, 4202, 6578	Burials, terraces, subsurface fire pit/imu, historic period sites
5966	Area of isolated human remains
6808, 6809, 6810, 6811	cemetery, historic period cistern associated with a piggery, historic period overflow ditch, at least 2 traditional Native Hawaiian burials
5474	Historic Kama Ditch
6261	Native Hawaiian burial preserve with human skeletal remains
5965	Secondarily deposited human remains in disturbed soil
6573	Native Hawaiian burial preserve with human skeletal remains
5963, 5967	Historic Road Bed, Sugarcane Flume

Table 3: Continued.	
5680	*In Situ* Burial
2916	Human skeletal remains
5504	Human burial site
6578	Traditional imu
1508	Spreckels Ditch section
Haleki'i-Pi'ihana Heiau	Two Heiau

Based on these assumptions, out of a total of approximately 2,300 acres of lands on Qdo soils, about 1,800 acres were in areas that are undeveloped and assumed to have the potential for sand excavations. If 50% of the 1,800 acres contained an average of 4 feet of sand layer that could be extracted, then approximately 3.2 million tons of sand potentially exists in those lands. Assuming a sand layer of 1 foot, then the estimate would be 650 thousand tons of sand. (See table in Appendix B).

The two (2) major sand export companies on Maui (HC&D and Hawaiian Cement) have both stopped exporting Grade A quality sand from Maui and have started to receive sand from other sources, such as from Canada.

1.7 EXTERNAL FACTORS

An objective of this 2018 Update is to identify any new external factors that may affect the need for sand, such as associated costs, availability of alternate materials, and new technology.

The use of natural sand in concrete continues to be a preferred choice in local concrete mixes due to various factors such as improved quality and costs. The 2006 Study identified several alternatives of sand which are discussed briefly below. These alternatives are still considered for use today, however only when appropriate, available, and cost effective.

Mansand (short for manufactured sand) is used to provide the fines in concrete and is produced by crushing basaltic rock to meet the requirements of the applicable aggregate and concrete specifications. Mansand is less fluid and workable and requires more cement when compared to sand mixes.

Portland cement is a fine powder, available from out of state sources, made by heating and mixing various materials such as limestone and clay. When mixed with water, the cement becomes the binding agent in concrete.

Recycled glass is another possible alternative to natural sand. However, in Hawai‘i processing recycled glass for use in concrete is not currently done and is limited by fluidity and workability issues. With the large amount of recycled glass being collected on Maui island and the high cost of shipping materials off island, the potential for its use and feasibility could be explored in more detail in the future by concrete manufacturers.

Fly ash is commonly used as a cheaper replacement for Portland cement as an ingredient in concrete mixes. Hawai‘i concrete manufacturers currently do not rely on fly ash because the material is less available than other options. Fly ash is a naturally-occurring product of the coal

combustion process. When mixed with calcium hydroxide, it has many of the same properties as cement. Replacing a portion of the cement with fly ash creates a cementitious material that, when used as an input with aggregates, water and other compounds, produces a concrete mix that is well-suited to road, airport runway, and bridge construction.

Sandvik Manufactured Sand is a new technology being explored by Hawaiian Cement since 2012 which uses a CV229 impact crusher from Sandvik Construction to produce the required materials for concrete production.

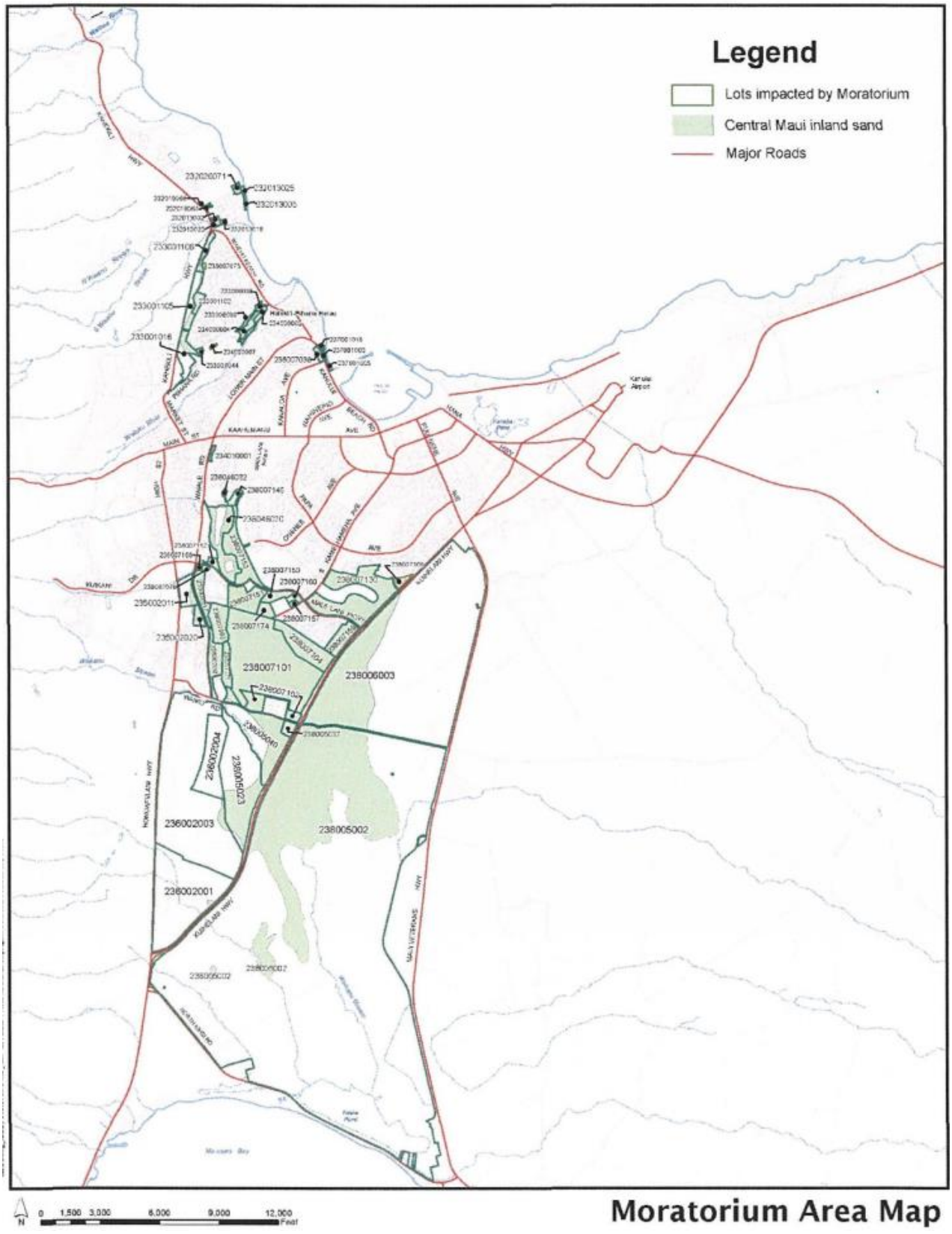
Sand Imports from Canada first arrived on O‘ahu in 2007 and have been increasing since. This is due to the understanding that the sand supply on Maui (and throughout Hawai‘i) is limited, and subject to restrictions related to the environmental and cultural protections. However, this increases the cost of concrete prices and in turn increases the State’s dependency on foreign suppliers of construction commodities, which are subject to global market changes in fuel, demand, and availability.

Other factors that may affect the demand for sand include the strength of the construction industry, and the costs involved in the excavating and hauling of sand.

The Maui County Council passed a moratorium on sand mining within Central Maui in 2017. Bill No. 117 (2017) amended the Maui County Code (Title 20) with a new Chapter 20.40 titled “Moratorium on Sand Mining of Central Maui Inland Sand”. The intent of the moratorium is to conduct further analysis required to establish regulations for mining inland sand with emphasis on protecting Maui’s environment and limited natural resources and prevent the disturbance of Hawaiian historical, cultural, or archaeological sites, and unmarked human burial sites. The ordinance found that it was necessary to limit and regulate the mining of inland sand given the finite nature of sand as an important natural resource.

As stated in the ordinance, the moratorium would exist for 6-months, and has subsequently been extended for an additional 6-months through December 2018, until: 1) an ordinance regulating the mining, extracting, or removing of inland sand is adopted, and 2) the *Maui Inland Sand Resource Quantification Study* (2006) is updated. There are 58 parcels subject to the requirements and restrictions of the moratorium. The map attached to the adopted Bill is reproduced in Figure 7.

Figure 7: MORATORIUM PARCEL MAP



1.8 SAND FOR BEACH REPLENISHMENT

An objective of this 2018 Update is to identify properties with significant quantities of beach-quality (Grade A) sand deposits that may be available for purchase by the County of Maui and estimate the quantity of sand needed for current and future beach replenishment on Maui.

In Hawai‘i, beach nourishment plays an increasingly important role in the management of beach resources around the state. Coastal erosion and flooding on Maui is primarily the result of sea level rise and threatens the island's coastal communities with flood and erosion damage. Higher sea surfaces, resulting in higher tides and stronger storm surges, further compound the impacts on coastal development and structures. Restoration of beaches is one tool to mitigate the impacts of sea level rise on Maui's coastal communities.

A recent study found that 70% of beaches on O‘ahu, Kaua‘i, and Maui are all undergoing a trend of long-term erosion (Fletcher et al., 2012). Additionally, Maui's beaches experienced the highest rates of long-term beach erosion with 85% of its beaches actively eroding (Fletcher et al., 2012). The 2017 *State of Hawai‘i Sea Level Rise Vulnerability and Adaptation Report* discusses potential impacts to the state's coastal areas based on 3.2 feet of sea level rise. Impacts include erosion, flooding, and storm surge which have consequences of displacing or permanently inundating coastal development. These rising seas threaten coastal communities in multiple ways, including: Increasing the vulnerability of urbanized coastal areas to flooding during high tide, high wave surge events, and heavy storm events; loss of land due to coastal erosion; saltwater intrusion in streams, wetlands, low-lying agricultural areas and utility infrastructure; and increased wave energy at the shoreline.

The *Beach Management Plan for Maui* (2nd Edition, 2008), is an update to the original 1997 publication. The plan identifies thirteen (13) areas to focus on in order to be more effective in managing Maui's beaches and shorelines. Focus area No. 4, relating to Beach Nourishment defines beach replenishment (also known as nourishment) as "a technique used to restore an eroding or lost beach, involves the placement of sand fill with or without supporting structures along the shoreline to widen the beach." It further states that it is "the only management tool which serves the dual purpose of protecting coastal lands and preserving beach resources".

The objective of the Beach Nourishment focus area is to:

> *To promote beach nourishment by more effectively managing the limited sources of readily available sand, providing financial incentives for beach nourishment projects, and building capacity to tap new, currently unavailable (offshore) sources of sand.*

Recommendations:

> *4.1a) Earmark beach-quality sand that is periodically removed from Maui's harbors for nourishment projects.*
>
> *4.1b) Restrict the export of Maui's dune sand resources, perhaps by introducing new legislation.*
>
> *4.1c) Require a percentage of inland sand excavations to be stockpiled for beach replenishment.*

4.1d) Limit sand mining to quarries or sites designated free of cultural sites versus from sand dunes that may contain burial sites

4.1e) Identify, map, and sample potential offshore borrow sites.

4.1f) Establish a County fund for cost matching private beach nourishment projects.

4.1g) Purchase a community offshore pump system for rent by private nourish partners.

4.1h) Provide tax incentives to community and commercial associations that participate in beach nourishment projects.

The recommendations in the Beach Management Plan speak directly to protecting the existing sand supply on Maui and encourage strong measures to restrict sand exports from Maui. The Beach Nourishment section (No.4) of the plan suggests new legislation should be considered to protect and allow for sand reserves for beach nourishment. Alternatives might include a moratorium on sand exports or a requirement that sand excavators stockpile a certain percentage of their sand for beach replenishment.

Identifying and securing offshore sand sources is another way to cultivate sand for beach replenishment projects. The Corps of Engineers, Honolulu District has embarked upon a Coastal Management Program that promotes project resilience and maintenance of Corps projects. For navigation projects, this involves adopting a 10-year cycle for maintenance dredging and may make dredged material availability more predictable. It is recommended that close coordination be maintained with the local Corps of Engineers on the timing and funding of this program.

The State Department of Land and Natural Resources (DLNR) and the Office of Planning, Coastal Zone Management Program (OP-CZM) actively encourage the development of beach nourishment projects, as illustrated by their funding of beach nourishment studies and support for appropriate Small Scale Beach Nourishment (SSBN) projects. The SSBN program has a maximum volume of 10,000 cubic yards of sand. The DLNR Office of Conservation and Coastal Lands (OCCL) is currently drafting a new programmatic EA for a new Small Scale Beach Restoration (SSBR) program.

Beach nourishment can utilize both inland and offshore sand resources. Hawai‘i Sea Grant Coastal Hazards specialist, Ms. Tara Owens, estimates there are approximately nine (9) past or proposed beach nourishment projects on Maui, excluding some very small scale dune restoration projects (see Table 4). These include projects at the following locations: Kaanapali Beach (proposed project), Kahana Bay (proposed project), Napili Bay (proposed project), Stable Road Beach, Sugar Cove, Maalaea Beach (Kanai A Nalu Condominiums), Maui Bay Villas, Kamaole III Beach Park, and Laulea Cove. Other notable beach nourishment projects utilizing offshore sand resources in Hawai‘i include Waikīkī Beach, Lanikai Beach, and Iroquois Point Beach on O‘ahu Island.

Table 4: PAST AND POTENTIAL SAND DEMAND FOR BEACH NOURISHMENT PROJECTS

Name	Volume of Sand (cy)	Sand Source
Kaanapali Beach (proposed project)	75,000 cy	Proposed Offshore
Kahana Bay (proposed project)	50,000 to 75,000 cy	Proposed Offshore
Napili Bay (proposed project)	10,000 cy	Proposed Offshore
Stable Road Beach	3,000 cy	Completed Offshore
Sugar Cove	Approximately 30,000 cy cumulatively from 1995-2017 (Periodic single placements ranging from 75 cy to 6,000 cy)	Completed Inland
Maalaea Beach (Kanai A Nalu Condominiums)	3,000 cy	Completed Inland
Maui Bay Villas	Up to 6,000 cy	Proposed sand backpassing from Kalepolepo Beach Park
Kamaole III Beach Park	Up to 4,500 cy	Completed with Dredged sand from Kihei Boat Ramp
Laulea Cove	Up to 11,000 cy (2-3 times per year since 2007)	Completed Inland
Totals	**Approximately 160,500 cy (approximately 158,000 tons) in the next 5 to 10 years from offshore sand sources**	

The estimated quantities of sand required for beach replenishment on Maui is currently 158,000 tons of sand. It is anticipated that nearly all of the sand used for future beach replenishments projects on Maui would have to come from offshore resources because of the lack of availability of high-quality inland sand resources. The demand and need for beach replenishment is expected to increase in the future with rising sea-levels, therefore it is recommended that the County take steps to identify and stockpile high grade inland sand through an appropriate program, which may involve allowing over excavation where appropriate or purchasing lands that have remaining sand stock.

1.9 GENERAL CONCLUSION

This 2018 Update presents a planning-level document to aid decision makers in follow-on efforts to determine appropriate actions to manage Maui's limited supply of inland sand from the Central Maui region. Eleven (11+) years have passed since the 2006 Study estimated sand dune reserves in Central Maui would run out for HC&D and HC in five to seven years. A conclusion of this 2018 Update confirms that the previous estimate was accurate to the degree that sand reserves from Maui Lani and A&B lands have been depleted and both landowners have ceased sand resource extraction activities as of 2018.

Since 2006, an estimated 451,000 tons of sand has been removed from A&B's Waiʻale development parcel (approximately 533,000 less than anticipated in 2006) until 2009 when A&B ceased sand mining operations noting that the remainder of sand supply onsite would be needed to balance the cut and fill of the development. Since 2006, an estimated 870,000 tons of sand has been removed from Maui Lani's Central Maui properties (formerly TMK (2) 3-8-007:131). Maui Lani has ceased sand extraction activities. It is not known however if Maui Lani intends to continue sand extraction activities from their lands in the future.

In total, an estimated 1,321,000 tons of sand has been removed from Central Maui sand dunes since 2006. Factoring the half million tons of sand from A&B, the total would have reached approximately 1.8 million tons. This total is close to the 2006 Study estimate of 1.95 million tons (970,000 + 984,000), implying that the stock of Central Maui sand which existed in 2006 is either depleted or would be depleted beyond the year 2018.

The number of barge departures decreased steadily for six years following 2006, at a rate of about half of what it was during 2004 to 2006. In this time, the two major concrete and aggregate suppliers (Hawaiian Cement and HC&D) had started to decrease their reliance on Maui sand and sought alternative sources for sand, such as importing sand from Canada and using alternatives for sand in cement mixes, such as Mansand, Sandvik, and Flyash. These alternatives do come with a higher cost due to shipping and processing.

With the moratorium on sand exports in place since January 2018, sand aggregate exports have decreased significantly. Based on HDOT sand aggregate barge totals, twelve (12) sand barges left Maui for Oʻahu between October 2017 and May 2018, indicating a significant decrease in the frequency of sand barge departures.

A review of potential new sources of Grade A sand, otherwise referred to as "Qdo sands" in this 2018 Update, resulted in an estimated range of about 650 thousand to 3.2 million tons. The high range is based on a recoverable depth of 4-feet and the low range is based on 1-foot. In both estimates, 50% of the total areas within the Qdo soil designation was assumed recoverable. This estimate should be considered only as a planning tool since actual geotechnical soil data was not available. The estimated totals also do not take into account feasibility of sand extractions which can be affected by a variety of environmental and cultural protection issues. Known cultural sites were identified in this 2018 Update, but additional undiscovered cultural sites are very likely to exist in many areas within the undeveloped moratorium parcels.

The estimated quantities of sand required for beach replenishment on Maui is currently 158,000 tons of sand. It is anticipated that nearly all of the sand used for future beach replenishment

projects on Maui would have to come from offshore resources because of the lack of availability of high-quality inland sand resources. The demand and need for beach replenishment is expected to increase in the future with rising sea-levels. Therefore, it is recommended that the County take steps to identify and stockpile high grade inland sand through an appropriate program, which may involve allowing over excavation where appropriate or purchasing lands that have remaining sand stock.

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Appendix A: HDOT Summary of Sand/Sand Aggregate Barges (Kahului Harbor)

SUMMARY
SAND / SAND AGGREGATE BARGES
PORT OF ORIGIN: KAHULUI HARBOR

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
JANUARY	1	3	2	4	2	2	4	2	2	3	3	2
FEBRUARY	3	4	4	4	3	2	1	3	2	5	4	2
MARCH	3	4	6	2	1	2	5	5	6	6	5	4
APRIL	5	4	4	3	4	2	1	6	5	7	4	1
MAY	5	4	0	1	1	3	1	6	4	6	8	1
JUNE	4	4	0	3	5	1	4	2	2	4	5	
JULY	5	3	5	2	0	2	4	5	4	3	5	
AUGUST	5	4	4	3	3	4	4	2	3	6	4	
SEPTEMBER	3	6	5	2	2	1	6	3	3	1	3	
OCTOBER	5	6	4	3	4	3	6	3	3	5	1	
NOVEMBER	4	3	3	2	2	3	2	4	4	8	1	
DECEMBER	2	2	2	2	2	3	4	4	3	3	0	
TOTALS	45	47	39	31	29	28	42	45	41	57	43	10

IMPORTED SAND	1	2	3	4	5	6	7	8	9	10	11	12
2017	01/16/17	04/15/17	06/03/17	08/09/17	08/19/17	08/26/17	09/27/17	09/30/17	10/19/17			
2018	01/24/18	02/07/18	02/22/18	03/21/18								

DOT Harbors Maui 06.07.18

Appendix B: Available Inventory Estimates Table

TMK	Landowner	Total Parcel Area (acres)	Portion of Parcel Within Qdo (acres)	Potential for Sand at 4 ft Depth (tons)	Potential for Sand at 1 ft Depth (tons)	Current Use/Reason
238007101	ALEXANDER & BALDWIN	281.43	281.70	NA	NA	2006 Study
237001005	A&B HAWAII INC.	1.98	3.20	NA	NA	Existing shoreline lot
237001016	A&B HAWAII INC.	1.28	1.27	NA	NA	Existing shoreline lot
232013005	COUNTY OF MAUI	2.08	2.42	NA	NA	Waiehu Beach Park, Shoreline
232013025	COUNTY OF MAUI	1.65	0.51	NA	NA	Waiehu Beach Park, Shoreline
232020071	COUNTY OF MAUI	4.02	1.61	NA	NA	Leisure Estates Park, Coastal Area
238046032	COUNTY OF MAUI	1.58	1.58	NA	NA	Existing Tank onsite
238007092	COUNTY OF MAUI /etal	37.45	37.15	NA	NA	Old Waikapu Landfill
238007038	HAWAIIAN ISLANDS LAND TRUST	4.04	4.05	NA	NA	Shoreline area
235002001	HEONA INVESTMENTS LLC	34.36	32.63	NA	NA	Existing stormwater basin
232013002	KA HOME MAHA MAU CEMETERY	3.47	3.31	NA	NA	Existing Cemetary
235002017	KIHEI GARDENS & LANDSCAPING COMPANY, LLP	24.98	25.27	NA	NA	Existing Commercial Use
238007071	KULAKANE LLC	20.92	20.42	NA	NA	Existing Use
233001044	MAHALANI CEMETERY ASSN	2.62	2.16	NA	NA	Existing Cemetary
233001106	MAUI ECONOMIC OPPORTUNITY, INC.	11.48	3.79	NA	NA	Ke Kahua Farm
232013033	MAUI ELECTRIC CO LTD	0.74	1.00	NA	NA	MECO facility
238007152	MAUI LANI 100, LLC	7.54	7.44	NA	NA	Per Maui Lani
238007174	MAUI LANI 100, LLC	12.11	12.09	NA	NA	Per Maui Lani
238007145	MAUI LANI PARTNERS	6.84	6.85	NA	NA	Per Maui Lani
238007157	MAUI LANI PARTNERS	2.57	2.61	NA	NA	Per Maui Lani
238007168	MAUI LANI VILLAGE CENTER INC	2.07	2.27	NA	NA	Per Maui Lani
238097076	MAUI LANI VILLAGE CENTER INC	2.21	2.22	NA	NA	Per Maui Lani
234030004	STATE DEPT. OF LAND & NATURAL RESOURCES	10.23	9.86	NA	NA	Halekii-Pihana Heiau State Monument vicinity
237001003	STATE OF HAWAII	0.12	0.11	NA	NA	Shoreline area
238007062	STATE OF HAWAII	0.00	0.01	NA	NA	Shoreline area
238007104	STATE OF HAWAII	65.38	65.85	NA	NA	Regional Park
238005002	ALEXANDER & BALDWIN	4,388.77	858.43	NA	NA	Ag use/IAL designation
238006003	ALEXANDER & BALDWIN	1,199.06	278.78	NA	NA	Ag use/IAL designation
234010001	A&B HAWAII INC.	2.64	2.64	10,670	2,667	Undeveloped
238007105	ABC DEVELOPMENT COMPANY, LLC	8.55	6.69	27,005	6,751	Undeveloped
238005040	ALEXANDER & BALDWIN	131.50	71.75	289,455	72,364	Undeveloped
238046020	ALEXANDER & BALDWIN	76.93	54.57	220,149	55,037	Undeveloped
233007073	CJ PARK ENTERPRISES LLC	1.15	1.15	4,647	1,162	Undeveloped
234030007	COUNTY OF MAUI	0.82	0.76	3,053	763	Undeveloped
236002004	COUNTY OF MAUI	100.00	0.69	2,803	701	Undeveloped
238005023	COUNTY OF MAUI	209.04	84.20	339,677	84,919	Undeveloped
238007150	COUNTY OF MAUI	14.44	14.38	58,017	14,504	Undeveloped
235002011	EMMANUEL LUTHERAN CHURCH OF MAUI	25.26	5.90	23,809	5,952	Undeveloped
238007151	GENTRY MAUI DEVELOPMENT LLC	46.70	46.56	187,823	46,956	Undeveloped
233001102	GOODFELLOW BROS INC /etal	8.51	8.84	35,659	8,915	Undeveloped
234030002	HALLER,MICHELE L TRUST /etal	6.36	7.63	30,767	7,692	Undeveloped
238007109	HRT REALTY LLC	6.73	5.21	21,035	5,259	Undeveloped
238007130	HRT REALTY LLC	148.63	149.74	604,038	151,010	Undeveloped
238007159	HRT REALTY LLC	30.89	31.05	125,252	31,313	Undeveloped
238007160	HRT REALTY LLC	5.75	5.81	23,439	5,860	Undeveloped
232013018	KOREAN BENEVOLENT SOC	1.63	1.66	6,698	1,674	Undeveloped
232019066	LEISURE LAND CORP	0.96	0.65	2,604	651	Undeveloped
232019067	LEISURE LAND CORP	0.51	0.52	2,083	521	Undeveloped
238007153	MAUI LANI PARTNERS	62.58	62.63	252,650	63,162	Last remaining parcel for Maui Lani
233001016	RCFC PIIHANA LLC	28.10	10.82	43,659	10,915	Undeveloped
233001105	RCFC PIIHANA LLC	25.06	8.47	34,171	8,543	Undeveloped
233006098	STATE DEPT. OF HAWAIIAN HOME LANDS	3.28	3.28	13,250	3,313	Undeveloped
233006099	STATE DEPT. OF HAWAIIAN HOME LANDS	3.58	3.58	14,442	3,610	Undeveloped
236002001	WAIALE 905 PARTNERS LLC	284.83	1.46	5,886	1,472	Undeveloped
236002003	WAIALE 905 PARTNERS LLC	521.40	9.71	39,162	9,791	Undeveloped
235002020	WAIALE ROAD 201 LLC	10.37	8.84	35,659	8,915	Undeveloped
238007102	WAIKO INDUSTRIAL INVESTMENT,LLC	31.22	31.06	125,304	31,326	Undeveloped
	TOTALS	7,928.38	2,308.83	3,228,583	645,717	
	ROUNDED TOTALS	**8,000.00**	**2,300.00**	**3.2 million**	**650 thousand**	