

State of Hawaii
DEPARTMENT OF LAND AND NATURAL RESOURCES
Division of Aquatic Resources
Honolulu, Hawaii 96813

October 13th, 2023

Board of Land
and Natural Resources
Honolulu, Hawaii

Request for Authorization and Approval to Issue a Special Activity Permit (SAP 2024-60) for David McInroy of the British Geological Survey, Principal Marine Geoscientist, for the Collection of Fossilized Reef Cores from Submerged Lands in State Waters off of Hawaii Island, for the Purposes of Climate Research

Submitted herewith for your consideration and approval is a request to authorize the Board of Land and Natural Resources (BLNR) Chairperson to authorize a Special Activity Permit (SAP) for the British Geological Survey (BGS), in association with the International Ocean Discovery Program (IODP, www.iodp.org), to conduct a scientific coring project on a series of fossilized, non-living coral reefs at five sites that surround Hawaii Island. The research conducted at these five sites is part of a larger project conducted by the IODP to progress global research on historic sea level change and climate variability during several poorly understood periods of geological history over the last 500,000 years.

The entire project, including activities subject to federal permit requirements and therefore outside the scope of the present submittal, began on August 31 and is scheduled to take place over no more than sixty (60) days, and in no case will it persist beyond October 31, 2023, so as not to interfere with humpback whale migration to Hawaii. Due to unforeseen delays with the permitting approval process across multiple State agencies and divisions, the BGS now has eighteen (18) days from the date of this submittal to complete its coring project across three (3) sites off Hawaii Island, with each coring anticipated to take five (5) full days.

THE APPLICANT(S):

BGS was established in 1835 and is the oldest geological survey in the world. It is a research center of the Natural Environment Research Council which, in turn, is a member agency of United Kingdom Research and Innovation, a non-departmental government body sponsored by the British Department for Science, Innovation and Technology. BGS supports the UK government in achieving its net zero carbon emissions target, meeting the United Nations' Sustainable Development Goals in the UK and abroad, and making communities safer and more resilient to natural disasters.

BLNR Item F-1

BGS has conducted two previous scientific reef coring projects under IODP: IODP Expedition 310 in Papeete, Tahiti, French Polynesia (2005) and IODP Expedition 325 at the Great Barrier Reef, Australia (2010).

International Ocean Discovery Program (IODP) is an international marine research collaboration that explores Earth's history and dynamics using ocean-going research platforms to recover data recorded in seafloor sediment and rocks and to monitor seafloor environments. IODP receives its primary funding through the U.S. National Science Foundation; Japan's Ministry of Education, Culture, Sports, Science, and Technology; and The European Consortium for Ocean Research Drilling. In all, IODP's partner agencies represent 21 countries in North America, Western Europe, Asia, and Oceania. Each partner funds specific projects for IODP, and IODP Expedition 389: Hawaii Drowned Reefs is being exclusively funded by the European Consortium for Ocean Research Drilling.

One participant from University of Hawaii - School of Ocean and Earth Science and Technology (SOEST) is participating in this expedition: Professor Kenna Rubin (<http://www.soest.hawaii.edu/krubin/>).

LEGAL REFERENCE:

Section 187A-6, Hawaii Revised Statutes (HRS), as amended (Special Activity Permit)

§187A-6 Special activity permits. (a) Notwithstanding the provisions of any other law, the department may take aquatic life or possess or use any fishing gear for scientific, educational, management, or propagation purposes, for removal of aquatic species, or for implementing the powers and duties as described by section 187A-2; subject to chapter 195D. The department shall consider using chemicals or electrofishing devices only when it has determined that no other reasonable alternative would be appropriate. The application of chemicals or operation of electrofishing devices shall be in accordance with established procedures and with the proper training to ensure that the intended results are achieved.

(b) Notwithstanding the provisions of any other law, *the department may issue permits*, not longer than one year in duration, *to any person to take aquatic life*, possess or use fishing gear, or engage in any feeding, watching, or other such non-consumptive activity related to aquatic resources, *otherwise prohibited by law, in any part of the State, for scientific, educational, management, or propagation purposes*, subject to chapter 195D* and subject to those restrictions the department deems desirable. The department may revoke any permit for any infraction of the terms and conditions of the permit. Any person whose permit has been revoked shall not be eligible to apply for another permit until the expiration of one year from the date of revocation (*emphasis added*).

***Note** – HRS §195D relates to the taking of endangered or threatened species. It is not anticipated that any taking of endangered or threatened species will occur throughout the

duration of this activity. The aquatic life expected to be taken will be a select amount of centimeters of live rock at each borehole location, the possible incidental disturbance of live rock located at the contact point of each of the three retractable tripod “legs” that support the coring drill and parts/products of non-living stony coral or “fossilized reef” (fossilized reef cores collected from seafloor).

LOCATIONS:

The Applicants have requested access to 5 sites in State marine waters: 3 primary sites and 2 alternate sites to be used if one or more primary sites are inaccessible or inappropriate for boring. The present submittal requests access to all five proposed sites for a period of five days at each site, representing a total of 25 permitted days.* Living coral reefs are not expected to be present at any of the requested sites and, as the goal of the project is to gather long-term historical data on reef evolution over the past half-million years, core and sediment samples will be taken only from fossilized reefs.

***Note** – Although the Applicant originally requested 25 days for the permit duration, Applicant understands that due to humpback whale migration season, they must cease all activity after October 31, 2023, which results in approximately 18 days of permitted activity from the date of this submittal.

Portions of State submerged lands consisting of five (5) sea floor sites under State marine waters surrounding Hawaii Island are identified as follows and at the following locations:

1. Primary site KAW-01B (Kawaihae Bay): Located approximately 1.68 miles seaward of TMK: (3) 6-9-003:002;
2. Alternate site KAW-02B (Kawaihae Bay): Located approximately 2.1 miles seaward of TMK: (3) 6-9-001:002;
3. Alternate site KAW-03B (Kawaihae Bay): Located approximately 2.14 miles seaward of TMK: (3) 6-9-005:003;
4. Primary site KON-01A (Kailua - Keauhou Fish Replenishment Area - “FRA”): Located approximately 2.24 miles seaward of TMK: (3) 7- 7-024:003; and
5. Primary site HIL-01A (outside Hilo Bay): Located approximately 2.22 miles seaward of TMK: (3) 2- 1-019:009. (**Exhibit 1 – “IODP Drilling Locations”**)

CURRENT USE STATUS:

1. Sites KAW-01B, KAW-02B, and KAW-03B are located within the Hawaiian Islands Humpback Whale National Marine Sanctuary (16 U.S.C. 1431 et seq.; 15 C.F.R. 922);
2. Site KON-01A is located within the Kailua - Keauhou Fish Replenishment Area (“FRA”) (Sections 13-60.4-1 through 13-60.4-9, Hawaii Administrative Rules);
3. Site HIL-01A is unencumbered.

OBJECTIVES:

The objective of this activity is for the British Geological Survey (BGS) to research sea-level change and climate variability by studying changes in atmospheric and oceanic conditions recorded in the fossil reef. Surrounding the island of Hawaii are a series of twelve fossil coral reefs that formed as the reef communities successively grew and were drowned by rising sea-levels and/or the near constant subsidence of the crust around the ever-growing volcanic archipelago of Hawaii. When combined with Hawaii's location away from the influence of any of the large Quaternary ice-sheets, or strong boundary ocean currents that can mask the sea-level and paleoclimate signals, this location presents a unique succession of expended reef sequences, key for the recovery of high-resolution climate and reef response records. As corals grow, they trap environmental clues within their structure, becoming unique records of ocean temperature and acidity as well as capturing evidence of the atmosphere within their structure. Looking back into these records from now-dead coral reef systems can help scientists reconstruct changes in the Earth's climate in the past. Coral communities also grow in known patterns - some prefer a quieter back-reef position to grow whilst other species prefer the more turbulent fore-reef position. They also like certain depths and light conditions. By looking at how the fossil communities have grown, scientists can reconstruct what sea-level was doing at the time, and link it to the changes in atmospheric and oceanic conditions recorded by the corals. Data collected can also help inform or predict future changes to coral reef ecosystems.

The research conducted in this area is part of a larger project conducted under the auspices of the International Ocean Discovery Program (IODP) and aims to progress global research on historic sea-level change and climate variability during several poorly-understood periods over the last 500,000 years.

The seafloor sites surrounding Hawaii were selected as research sites because of the Hawaiian Islands' geologically rapid but nearly constant subsidence, which has led to the formation of a thick and unique succession of drowned fossil coral reefs now found at 129 to 1,234 meters below sea level (sites in both state and federal waters). These reefs span important periods in the Earth's climate history and are generally not represented anywhere else in the world.

The scientific team will analyze the cores with the aim to address questions on four main themes:

1. To reconstruct sea-level change in the central Pacific over the last 500,000 years.
2. To reconstruct the variability in climate over the last 500,000 years, as recorded in the fossil corals, and better understand the differences in response between a seasonal - inter-annual variation in climate against what represents a more permanent shift in sea surface temperature, rainfall and storm tracks.
3. To understand how coral reef systems respond both geologically and biologically to rapid changes in sea-level and climate -for example can reefs turn on and off when they reach certain limits, and how do they recover from disturbances in the system.
4. To explain the subsidence and volcanic history of Hawaii.

In addition to recovering cores, logging the drilling data and curating the cores, some preliminary scientific measurements are made on the cores at sea. These are:

- Initial lithological description;
- Pore-water geochemistry;
- Sampling for microbiology studies;
- Physical properties using a whole-core multi-sensor core logger (MSCL)

METHODS:

The research to be conducted primarily involves deployment of a mobile seafloor coring rig from the MMA Valour, a 90-meter multi-purpose platform supply vessel. The coring rig is a Benthic Geotech Portable Remotely Operated Drill (PROD) that is mounted on a crash frame and supported by three retractable legs, which are the primary point of contact between the PROD and the seafloor. The total potential footprint of the PROD crash frame and legs is approximately 879.4 square feet (81.7 square meters).

At each of the sites, the PROD will drill 2 to 3 boreholes, the number of boreholes reflecting the total depths to be reached at each site, which are between 80 m and 110 m (262 ft and 361 ft) below sea floor (see Table 1).

Site	Priority	Water Depth (m)	Estimated penetration (mbsf)	Number of holes required at each site	Dive 1 (Hole A)	Dive 2 (Hole B)	Dive 3 (Hole C)
KAW-03B	Pri	-154	80	2	Core to 60 mbsf	Open drill to 60 mbsf Core between 60-80 mbsf	NA
KAW-01B	Alt	-129	80	2	Core to 60 mbsf	Open drill to 60 mbsf Core between 60-80 mbsf	NA
KAW-02B	Alt	-132	90	2	Core to 60 mbsf	Open drill to 60 mbsf Core between 60-90 mbsf	NA
KON-01A	Pri	-145	80	2	Core to 60 mbsf	Open drill to 60 mbsf Core between 60-80 mbsf	NA
HIL-01A	Pri	-134	110	3	Core to 60 mbsf	Open drill to 60 mbsf Core between 60-90 mbsf	Open drill to 90 mbsf Core between 90-110 mbsf

Table 1. Summary of IODP Expedition 389 sites within 3 nautical miles of the coast.

The borehole diameter is 100 mm (3.9 inches), from which cores of diameter 74 mm (2.9 inches) will be taken. The total volume of rock that will be removed from all 100 mm-diameter boreholes required at the three primary sites will be 4.2 cubic meters (148 cubic feet). This material will consist of the actual cores, and the cuttings created by the coring action. The total volume of the 74 mm-diameter cores from all holes required at the three primary sites that will be recovered to the vessel for scientific analysis (assuming a recovery of 80%) is estimated to be 0.9 cubic meters (32 cubic feet). Each boring operation will take up to five days to complete. The PROD will remain stationary on the seafloor for the entire time and the research vessel will remain stationary over the PROD without anchoring using GPS, dynamic positioning through the vessel’s thrusters, and continuous operator watch.

Multiple landing attempts may be required depending on ocean and seabed conditions. Underwater cameras will be used to guide landings and to ensure that the site is clear of obstacles, living reef, or marine life before landing is attempted. The offshore science team includes coral specialists with expertise in both fossil and modern coral taxonomy, including modern mesophotic reef systems. This group can confidently identify hard and soft corals at the project’s working water depths and avoid them. Additionally, DAR will share example images of hard and soft corals of concern, to aid the project team’s identification and avoidance strategy. Already for the first part of the project outside state waters, the PROD onboard cameras have been proven to visualize the seabed very well.

See Draft Special Activity Permit Attached for more information.

BLNR REVIEW:

This permit is being brought before the board due to a requirement for applicants to go before the board for review, when requesting Special Activity Permits (“SAP”), if they are not categorized as recognized Hawaiian institutions, whose permits are of a perennial nature (continuous, year after year) for scientific research purposes.

BENEFITS TO THE STATE OF HAWAII:

The benefits to the State of Hawaii from these collections include a greatly enhanced understanding of historic sea-level changes and climate variability throughout the Hawaiian archipelago. Applicant has assured the Department that all data gathered throughout the duration of this project will be publicly accessible and shared with the State.

KA PA`AKAI ANALYSIS:

On September 11, 2000, the Hawaii Supreme Court ruled in *Ka Pa`akai O Ka `Āina vs. Land Use Commission, State of Hawai`i* that the State and government agencies have an obligation to protect Native Hawaiian constitutionally protected rights and that an appropriate analytical framework was needed to assess whether these rights were unduly violated. The Court developed a three-pronged test, and this test is triggered when government agencies consider proposed uses of land and water resources that may impact the exercise of Hawaiian traditional and customary rights (e.g., determining the approval of permits). The test includes the following:

1. The identity and scope of Native Hawaiian traditional and customary rights affected by the **agency action**, if any;
2. The extent to which those resources, including traditional and customary Native Hawaiian rights, will be affected or impaired by the proposed agency action;
3. Whether the proposed **agency action** reasonably protects Native Hawaiian traditional and customary rights, if they are found to exist, **as balanced with the State’s own regulatory right**.

A traditional or customary Native Hawaiian right that could be affected by the proposed project would be fishing activity near or adjacent to the boring sites. Because each of the proposed sites will drill into submerged lands at depths of over 100 meters (approx. 330 feet), it is not anticipated that the disturbance of these submerged lands will affect any traditional or customary Native Hawaiian right as they pertain to the submerged lands themselves.

Besides the physical presence of the research vessel, DAR has relayed concerns about potential noise and acoustic impacts from the project’s drilling activities that could affect

traditional fishing activities. BGS is aware of these concerns and has communicated to DAR what the project's anticipated acoustic impacts will be. The acoustic impacts of the research vessel itself should not be greater than normal vessel traffic noise. The acoustic impacts of the drilling operations may initially be higher during the first meter of drilling at each borehole, but as the drill makes its way downward into the substrate, acoustic impacts in the area should lessen significantly as the sound will be dampened by the increasing density of the seabed.

To reasonably protect Native Hawaiian fishing rights in this area, DAR has instructed BGS to conduct outreach to various community leaders, community groups, and fishing organizations on Hawaii Island that could potentially be affected by the proposed activities. This outreach consists of (but is not limited to):

1. Explanation of the project's scope, aims, and research objectives;
2. Notification of dates/times when drilling operations are anticipated to occur so that fishers are able to temporarily modify their fishing activities; and
3. A commitment to share all data gathered with community leaders, community groups, and fishing organizations in an expedited manner.

The BGS has reached out to all contacts provided by DAR and has fielded, and is continuing to field, enquiries from various community members on Hawaii Island. The project's outreach team is organizing the first of possibly several live video sessions from the vessel for any interested individuals or groups to attend. The sessions will describe the project's aims, objectives, and activities, and will offer a 2-way Q&A session for participants. The offshore project team is keen to hold discussions with community leaders and groups in advance of coring within state waters on, for example, how to avoid interfering with fishing practices, and how the project can be conducted in a culturally respectful way. The first of these sessions will be arranged for the beginning of October, with the help of the West Hawaii Fishery Council.

HRS CHAPTER 343 – COMPLIANCE WITH ENVIRONMENTAL LAW:

In accordance with Hawaii Administrative Rules ("HAR") § 11-200.1-15 and -16 and the Exemption List for the Department of Land and Natural Resources, reviewed and concurred on by the Environmental Council on November 10, 2020, DAR has determined that the subject request is exempt from the preparation of an environmental assessment pursuant to General Exemption Type 5, which applies to "[b]asic data collection, research, experimental management, and resource and infrastructure testing and evaluation activities that do not result in a serious or major disturbance to an environmental resource." Specifically, the subject request is primarily exempt under Item 7, which exempts permits to "[c]onduct subsurface investigations (borings) provided the average surface area disturbed is less than one square foot and the implementing division consults with the State Historic Preservation Division on exempting such borings or investigations." As

mentioned in the previous section, the drilling and subsequent core samples retrieved will have a diameter of approximately 2.91 inches (74 millimeters), less than one square foot.

DAR has also determined that the subject request may be exempt from the preparation of an environmental assessment pursuant to General Exemption Type 5, Items 1 and 13. Item 1 exempts surveys or data collection that purports to increase understanding of existing environmental conditions while Item 13 exempts research that can be used to monitor, conserve, or enhance native species or native species' habitat. Although the proposed research is not explicitly designed to "monitor, conserve, or enhance native species or native species' habitat," DAR believes that a genuine nexus exists between the project's goal of gaining a better understanding of historic sea-level change and climate variability and the protection of native species and native species' habitat, such as nearshore waters and coastlines.

General Exemption Type 5:

Basic data collection, research, experimental management, and resource and infrastructure testing and evaluation activities that do not result in a serious or major disturbance to an environmental resource.

PART 1:

#1: Conduct surveys or collect data on existing environmental conditions (e.g., noise, air quality, water flow, water quality, etc.).

#7: Conduct subsurface investigations (borings) provided the average surface area disturbed is less than one square foot and the implementing division consults with the State Historic Preservation Division on exempting such borings or investigations.

#13: Research that the Department declares is designed specifically to monitor, conserve, or enhance native species or native species' habitat.

#15: Game and non-game wildlife surveys, vegetation and rare plant surveys, aquatic life surveys, inventory studies, new transect lines, photographing, recording, sampling, collection, culture, and captive propagation.

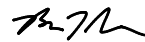
It is expected that the subject request will have minimal or no significant effect on the environment and therefore should be declared exempt from the preparation of an environmental assessment and the requirements of § 11-200.1-17, HAR (**Exhibit 2 – "Exemption List for the Department of Land and Natural Resources"**).

RECOMMENDATIONS:

Based on the above and attachments, DLNR-DAR requests that the Board DECLARES, FINDS, and DECIDES:

- 1) That the actions covered by this permit will have little or no significant effect on the environment and is therefore exempt from the preparation of an environmental assessment;
- 2) To delegate the Chairperson to sign the declaration of exemption on behalf of the Board, for purposes of recordkeeping requirements of chapter 343, HRS, and chapter 11-200.1, HAR; and
- 3) To approve and execute, with stated conditions, the proposed Special Activity Permit.

Respectfully submitted,



Brian J. Neilson, Administrator
Division of Aquatic Resources

APPROVED FOR SUBMITTAL



Dawn N. S. Chang, Chairperson
Board of Land and Natural Resources

Attachments:

- 1) Draft Special Activity Permit (SAP 2024-60)
- 2) Exhibit 1 – IODP Drilling Locations
- 3) Declaration of Exemption (“DE”) from the Preparation of an Environmental Assessment under the Authority of Chapter 343, HRS & Chapter 11-200.1 HAR
- 4) Exhibit 2 – Exemption List for the Department of Land and Natural Resources
- 5) Research Proposal / Project Summary

Department of Land & Natural Resources
DIVISION OF AQUATIC RESOURCES
1151 Punchbowl Street, Room 330
Honolulu, Hawaii 96813

Date Issued: 10/13/2023

Valid not longer than: 10/12/2024

SPECIAL ACTIVITY PERMIT

The Department of Land and Natural Resources hereby grants permission for certain activities involving aquatic organisms belonging to the people of Hawaii, under Section 187A-6, Hawaii Revised Statutes, and other applicable laws.

The Permittee is

Name:	David McInroy BSc, MSc	Address:	British Geological Survey (BGS)
Affiliation:	BGS/ECORD		The Lyell Centre
Title:	Principal Marine Geoscientist/Science Manager, ECORD Science Operator (ESO)		Research Avenue South Edinburgh EH14 4AP United Kingdom
Email:	dbm@bgs.ac.uk		

This permit is issued, subject to the general and special conditions, for the collection of and incidental impact to regulated resources (live rock and parts/products of non-living stony coral - “fossilized reef”) through the temporary deployment of a scientific instrument (seafloor corer - Benthic Geotech Portable Remotely Operated Drill) to collect fossilized reef cores/borings, in regulated areas (West Hawai‘i Regional Fishery Management Area – “WHRFMA”: Kailua - Keauhou Fish Replenishment Area – “FRA” and Kawaihae Bay) and non-regulated areas (East Hawaii: outside of Hilo Bay) in the waters of Hawaii Island, for the purposes of researching sea-level change and climate variability by studying changes in atmospheric and oceanic conditions recorded in the fossil reef.

This permit, signed by authorized representative of the Department of Land and Natural Resources (the Department), authorizes the permittee, and assistants designated on the final page(s) of, or attachments to, this permit, to engage in activities otherwise prohibited by law, subject to the conditions, which **Take (via footprint of scientific instrument), Collection, Possession and/or Transport** certain aquatic life from waters of the State, as follows below in Table 1:

Non-Regulated Species							
Sp. Code	Sp. Description	Sp. Amt.	Morphology	Sp. Size	Island	Location	Comments
<i>Regulated organisms/resources</i>							
25550	Live rock Collection of fossilized reef cores/borings will consist of live rock surfaces	84.4	inches ² (area)	Area of live rock surface per each fossilized reef core collected = ≈ 12.2 in. ² (78.5 cm ²) 12.2 in. ² x 7 cores (2 cores x two sites; 3 cores x one site) for a total of up to 84.4 inches ² (549.5cm ²) live rock surface area collected	Hawaii	Kawaihae Bay (sites KAW01B, KAW02B & KAW03B); Kailua - Keauhou Fish Replenishment Area (sites: KON01A) Hilo Bay - outside area (sites: HIL-01A)	Up to three (3) sites out of five (5) potential sites will have fossilized reef cores collected from the sea floor; activity will occur between ≈ (October 14 th 2023 to October 31 st 2023); *Note: Total maximum footprint area on live rock will only occur if all deployments of the corer/drill occur on live rock; some deployments of the corer/drill may occur on sand and will not have a footprint on live rock

25550	Live rock Potential incidental take of live rock may occur via deployment / footprint corer/drill	6156	ft ² (area)	Area of potential incidental take of live rock surface take per each deployment of corer = ≈ 879.4 ft ² / 81.7 m ² 81.7 m ² x 7 cores (2 cores x two sites; 3 cores x one site) for potential total of up to 6156 ft ² / 571.9 m ² (area)	Hawaii	Kawaihae Bay (sites KAW01B, KAW02B & KAW03B); Kailua - Keauhou Fish Replenishment Area (sites: KON01A) Hilo Bay - outside area (sites: HIL-01A)	*Note: Total maximum footprint area on live rock will only occur if all deployments of the corer/drill occur on live rock; some deployments of the corer/drill may occur on sand and will not have a footprint on live rock
25500	Parts/products of non-living stony coral or “fossilized reef” (fossilized reef cores collected from seafloor)	148	ft ³ (volume)	≈ 21.1 ft ³ per core; 2 cores collected at two sites (i.e. 4 cores) and 3 cores collected at one site for a total of 7 cores collected for a total of 148 ft. ³ /4.2 meters ³ (volume)	Hawaii	Kawaihae Bay (sites KAW01B, KAW02B & KAW03B); Kailua - Keauhou Fish Replenishment Area (sites: KON01A) Hilo Bay - outside area (sites: HIL-01A)	Note: \approx volume per core may vary depending on depth of core collected or percentage of success rate of recovered core

I. SPECIAL CONDITIONS

A. Location

Research activities will be conducted in regulated areas (West Hawai‘i Regional Fishery Management Area – “WHRFMA”: Kailua - Keauhou Fish Replenishment Area – “FRA” [site: KON01A] and Kawaihae Bay [sites KAW01B, KAW02B & KAW03B]) and non-regulated areas (East Hawaii: outside of Hilo Bay [sites: HIL-01A]) in the waters of Hawaii Island (see maps in Appendix). Fossilized coral cores will be transported to British Geological Survey (BGS) (The Lyell Centre, Edinburgh, United Kingdom) for research and analysis. Research activities under this permit is limited to waters of State of Hawaii and is expressly prohibited at the following locations listed in table below unless listed above and in **bold** font below:

<u>Island of MAUI</u> Kahului Harbor FMA ¹ Honolulu-Mokuleia MLCD ² Ahihi-Kinau NAR ³ Molokini Shoal MLCD Kahekili Herbivore FMA <u>Island of LANA‘I</u> Manele Harbor FMA Manele-Hoopoe MLCD <u>Island of MOLOKA‘I</u> Kaunakakai Harbor FMA <u>Island of KAHO‘OLAWA</u> Restricted 2 nautical mile boundary Zone A and Zone B surrounding	<u>Island of KAUA‘I</u> Ahukini Pier FMA Hanamaulu Bay FMA Kapaa Canal FMA Nāwiliwili Harbor FMA Port Allen FMA Waikaena Canal FMA Waimea Pier & Bay FMA Hā‘ena CBSFA ⁸ <u>Island of HAWAI‘I</u> <u>Areas within the West Hawaii Regional Fishery Management Area:</u> Hilo Bay FMA Kailua Bay FMA Kawiahae Harbor FMA Kealakekua Bay MLCD	<u>Island of HAWAI‘I</u> <u>Areas within the West Hawaii Regional Fishery Management Area (continued):</u> (1) Ka‘ūpūlehu Marine Reserve (2) North Kohala Fish Replenishment Area (FRA ⁶) (3) Puakō-‘Anaeho‘omalū FRA (4) Kaloko-Honokōhau FRA (5) Kailua-Keauhou FRA (6) Red Hill FRA (7) Nāpo‘opo‘o-Hōnaunau FRA (8) Ho‘okena FRA (9) Ka‘ohe Beach FRA (Pebble Beach)
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<p>Kaho’olawe</p> <p><u>Island of O’AHU</u></p> <p>Ala Wai Canal FMA Coconut Island MLR Hanauma Bay MLCD Heiea Kea FMA Honolulu Harbor FMA Kapalama Canal FMA Paiko Lagoon Wildlife Refuge Pōka’i Bay FMA Pūpūkea MLCD Waialua Bay (Hale’iwa Harbor) Waikīkī-Diamond Head SFMA Waikiki MLCD Wahiawā Public Fishing Area</p>	<p>Keauhou Bay FMA Kiholo Bay FMA Kona Coast FMA Old Kona Airport MLCD Lapakahi Bay MLCD Papawai Bay FMA Puako FMA Waiakea PFA⁵ Wailea Bay MLCD Wailuku River FMA Wailoa River FMA Wawāloli FMA</p>	<p>(10) Miloli’i CBSFA (including Miloli’i FRA) (11) Kikaua Point-Mākole’ā Point Netting Restricted Area (NRA⁷) (12) Nenua Point-Kealakekua Bay NRA (13) Hanamalo Point-Kanewa’a Point NRA (Part of Miloli’i CBSFA) (14) Kanonone-Kalīpoa NRA</p> <p><u>Island of HAWAI’I</u> <u>West Hawaii Regional Fishery Management Area (WHRFMA)</u></p> <p>Areas in the WHRFMA outside of all smaller FMA, MLCD, FRA and NRA</p>
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Table 2 – Regulated Areas – Definitions: FMA¹ = Fisheries Management Area, MLCD² = Marine Life Conservation District, NAR³ = Natural Area Reserve (DOFAW), MLR⁴ = Marine Laboratory Refuge, PFA⁵ = Public Fishing Area, FRA⁶ = Fish Replenishment Area, NRA⁷ = Netting Restricted Area, CBSFA⁸ = Community-Based Subsistence Fishing Area

B. Activity. Permittee is authorized for the collection of and incidental impact to regulated resources (live rock and parts/products of non-living stony coral - “fossilized reef”) through the temporary deployment of a scientific instrument (seafloor corer - Benthic Geotech Portable Remotely Operated Drill) to collect fossilized reef cores/borings, in regulated areas (West Hawai’i Regional Fishery Management Area – “WHRFMA”: Kailua - Keauhou Fish Replenishment Area – “FRA” and Kawaihae Bay) and non-regulated areas (East Hawaii: outside of Hilo Bay) in the waters of Hawaii Island, as listed in Table 1. The objective of this activity is for the British Geological Survey (BGS) to research sea-level change and climate variability by studying changes in atmospheric and oceanic conditions recorded in the fossil reef. Surrounding the island of Hawaii are a series of twelve fossil coral reefs that formed as the reef communities successively grew and were drowned by rising sea-levels and/or the near constant subsidence of the crust around the ever-growing volcanic archipelago of Hawaii. When combined with Hawaii's location away from the influence of any of the large Quaternary ice-sheets, or strong boundary ocean currents that can mask the sea-level and paleoclimate signals, this location presents a unique succession of expended reef sequences, key for the recovery of high-resolution climate and reef response records. As corals grow, they trap environmental clues within their structure, becoming unique records of ocean temperature and acidity as well as capturing evidence of the atmosphere within their structure. Looking back into these records from now-dead coral reef systems can help scientists reconstruct changes in the Earth's climate in the past. Coral communities also grow in known patterns - some prefer a quieter back-reef position to grow whilst other species prefer the more turbulent fore-reef position. They also like certain depths and light conditions. By looking at how the fossil communities have grown, scientists can reconstruct what sea-level was doing at the time, and link it to the changes in atmospheric and oceanic conditions recorded by the corals. Data collected can also help inform or predict future changes to coral reef ecosystems.

The scientific team will analyze the cores with the aim to address questions on four main themes:

1. To reconstruct sea-level change in the central Pacific over the last 500,000 years.
2. To reconstruct the variability in climate over the last 500,000 years, as recorded in the fossil corals, and better understand the differences in response between a seasonal - inter-annual variation in climate against what represents a more permanent shift in sea surface temperature, rainfall and storm tracks.

3. To understand how coral reef systems respond both geologically and biologically to rapid changes in sea-level and climate -for example can reefs turn on and off when they reach certain limits, and how do they recover from disturbances in the system.
4. To explain the subsidence and volcanic history of Hawaii.

In addition to recovering cores, logging the drilling data and curating the cores, some preliminary scientific measurements are made on the cores at sea. These are:

- Initial lithological description;
- Pore-water geochemistry;
- Sampling for microbiology studies;
- Physical properties using a whole-core multi-sensor core logger (MSCL)

Background. BGS was established in 1835 and is the oldest geological survey in the world. It is a research center of the Natural Environment Research Council which, in turn, is a member agency of United Kingdom Research and Innovation, a non-departmental government body sponsored by the British Department for Science, Innovation and Technology. The International Ocean Discovery Program (IODP) an international marine research collaboration that explores Earth’s history and dynamics using ocean-going research platforms to recover data recorded in seafloor sediment and rocks and to monitor seafloor environments. IODP is the latest phase of an international scientific ocean drilling project that has been in existence since the 1960s and has drilled hundreds of boreholes worldwide. The USA, Japan and Europe are the lead members of IODP. Europe’s contribution is via a consortium that includes 14 European countries and Canada. This European consortium is called the European Consortium for Ocean Research Drilling (ECORD). IODP is funded by the science foundations and councils of partner countries, and is therefore wholly funded by the public. ECORD has commissioned the British Geological Survey (BGS), UK, to coordinate the ECORD Science Operator (ESO), a group of research institutes that implement scientific drilling expeditions under the auspices of IODP. BGS has conducted two previous scientific reef coring projects under IODP: IODP Expedition 310 in Papeete, Tahiti, French Polynesia (2005) and IODP Expedition 325 at the Great Barrier Reef, Australia (2010). Previous expeditions were planned with a strong emphasis on minimizing environmental impact, and were successfully carried out with no environmental incidents. It is proposed to use similarly environmentally sound methodologies, described below, to conduct scientific drilling around Hawaii, which aims to recover a unique archive of sea-level, climate change and reef response over the last 500,000 years.

One participant from University of Hawaii - School of Ocean and Earth Science and Technology (SOEST) is participating in this expedition: Professor Kenna Rubin (<http://www.soest.hawaii.edu/krubin/>).

Note: Deployment of the seafloor corer (Benthic Geotech Portable Remotely Operated Drill or “PROD”) is also permitted under a Site Plan Approval “SPA” (HA-23-74) from the Office of Conservation and Coastal Lands (OCCL).

Methods. The permittee and authorized assistants will collect seven (7) fossilized reef cores through the temporary deployment a seafloor corer (a Benthic Geotech Portable Remotely Operated Drill – “PROD”; see Appendix – Figure 1 & 2) at three (3) locations in depths between 129 - 154 m in waters off Hawaii Island; cores will be drilled to a depth of up to 110 m below the seafloor and each deployment / coring activity will occur for a duration of approximately five (5) days per location between (≈ October 14th 2023 to October 31st 2023). Up to three (3) sites out of five (5) potential sites will have fossilized reef cores collected from the sea floor; collections will occur in Kawaihae Bay (sites KAW01B, KAW02B & KAW03B), Kailua - Keauhou Fish Replenishment Area (sites: KON01A) and/or Hilo Bay - outside area (sites: HIL-01A). Coring will occur intermittently through the five days – continuous coring at a site could occur for multiple consecutive hours at a time (e.g. 3-5 hours at a time), with breaks that occur in between to bring the PROD back up to the surface to recover the core segments already collected. Note: Cores are collected in segments and cached adjacent to or

within the PROD; after a certain amount have been collected the PROD is returned to the surface in order to empty the cache of core segments on the vessel so that the PROD can be sent back down to the sea floor to continue collecting cores.

Collections. Permittee and authorized assistants will collect the following: **Live Rock Surface:** $\approx 12.2 \text{ in.}^2$ (78.5 cm^2) area of live rock surface per each fossilized reef core collected for a total area of up to 84.4 inches^2 / 549.5 cm^2 live rock surface collected (12.2 in.^2 x 7 cores: two (2) cores x two (2) sites and three (3) cores x one (1) site) and; **Parts/products of non-living coral or “fossilized reef”:** $\approx 21.1 \text{ ft}^3$ / 0.6 m^3 volume collected per core of stony coral (parts/products of non-living coral or “fossilized reef”; fossilized reef cores collected from seafloor) for a total volume of 148 ft.^3 / 4.2 meters^3 (21.1 ft^3 x 7 cores: two (2) cores x two (2) sites and three (3) cores x one (1) site). This material will consist of the actual cores, and the cuttings created by the coring action. Note: \approx volume per core may vary depending on depth of core collected or percentage of success rate of recovered core (researchers predict 80% success rate). The total volume from all bore holes required at the three primary sites that will be recovered to the vessel for scientific analysis may be less due to cuttings from the bore holes left on sea floor or if assuming a recovery of 80% (estimated to be 0.9 m^3 / 32 ft.^3). **Live Rock Surface (incidental take):** In addition, incidental take of live rock may potentially occur as a result of the deployment/footprint of the PROD (corer/drill) – if deployed on live rock: $\approx 879.4 \text{ ft}^2$ / 81.7 m^2 area of live rock (incidental take) per each deployment of drill/corer for a potential total area of $\approx 6156 \text{ ft}^2$ / 571.9 m^2 (81.7 m^2 x 7 cores: two (2) cores x two (2) sites and three (3) cores x one (1) site). *Note: Certain length or depth of cores collected will require either two or three deployments of the drill; the landing site of the drill with each new deployment will be adjacent to the first landing site with an overlapping section – i.e. the total potential footprint (81.7 m^2) of the core/drill from cores where two deployments of the drill occur will be almost doubled (minus the shared overlapping portion) and cores where three deployments of the drill occur will be almost tripled (minus the shared overlapping portion). Total maximum footprint area on live rock will only occur if all deployments of the corer/drill occur on live rock; some deployments of the corer/drill may occur on sand and will not have a footprint on live rock.

Conducting Educational Outreach and Dissemination of Research Results. DAR requests that the project conduct educational community outreach before and after the proposed activity. Request have been made for the project to reach out to various community members in East and West Hawaii (including Kona, Miloli'i, Ho'okena, Honaunau, Kealakekua, Kahalu'u Bay, Kaupulehu and Kiholo), Aha Moku, West Hawai'i Fishery Council and Makahanaloa fishing association. Applicant has assured the Department that all data gathered throughout the duration of this project will be publicly accessible and shared with the State and have also indicated educational briefings or presentations about the vessel and fossil reef core collections can be provided before and after the activity.

Mitigative Measures Implemented to Avoid Impact.

Use of ROV/AUV with cameras or seafloor corer-mounted cameras to pre-survey drill sites to avoid deep-water corals: At each site, existing autonomous underwater vehicle data (where available) will be used to choose the initial site within 125 m-radius buffer zones and seafloor corer-mounted cameras will be used to guide landings and to ensure that the site is clear of obstacles, living reef, or marine life before landing is attempted. The final coring site location will be checked by the science team/coral specialists onboard the vessel for live coral/biota cover using seafloor corer-mounted cameras prior to the seafloor corer being landed on the seabed. The onboard science team includes coral specialists with expertise in both fossil and modern coral taxonomy, including modern mesophotic reef systems. depths and avoid them. The science team/coral specialists onboard the vessel have been provided a reference guide with representative photos to aid in the identification of any deep sea corals that may potentially be encountered at certain sites. On previous expeditions the seafloor corer-mounted cameras have been proven to visualize the seabed effectively and allow for avoidance strategies to be implemented.

Operations of Vessel and PROD. BGS will conduct coring operations responsibly, following good practice successfully used in previous BGS-led scientific reef coring projects: IODP Expedition 310 Tahiti1 (2005) and IODP Expedition 325 Great Barrier Reef2 (2010). The seafloor coring rig will be deployed only when weather

conditions permit and can be recovered to deck in a few minutes should the need arise in an emergency situation. The project vessel operator will ensure maintenance of position during corer deployment using GPS and dynamic positioning, and continuous operator watch. The operator will have a backup means of positioning should the primary dynamic positioning system fail (either a secondary dynamic positioning system, or a switch to manual positioning to enable safe recovery of the seafloor corer).

Observance of Protected Species. DAR recommends utilizing a spotter onboard the vessel to observe for any approaching protected species in order to prevent or mitigate any potential interactions that may be avoidable. DAR requests information to be provided on any observances or any interactions with protected species during the activity.

Entanglement Prevention. Efforts will be made by researcher and authorized assistants to utilize best management practices to eliminate any potential for entanglement of any unintended marine organisms (invertebrates, fish, turtles, monk seals, sharks, rays and other protected species) if using or deploying/placing any marine instruments or structures. Entanglement prevention practices will include but are not limited to: checking the marine instruments or structures regular intervals to ensure that protected spp. or non-target spp. have not been entangled, ensuring that any ropes or lines remain taut with no slack at all times and ensuring that there are no structures or components that may potentially cause entanglement to unintended marine organisms (invertebrates, fish, turtles, monk seals, sharks, rays and other protected species). Researcher will immediately notify DAR (catherine.a.gewecke@hawaii.gov or DLNR.aquatics@hawaii.gov) and the appropriate federal agency (NOAA Fisheries Hotline at (888) 256-9840) to report the entanglement of any protected species if incidental entanglement occurs.

Prevention of Spread Invasive Species, Disease and Parasites on corer/drill or AUV/ROV. DAR requests that the project implement an Aquatic Invasive Species (AIS) inspection and disinfection protocol for attachment of organisms when the drill or AUV/ROV is brought back to the surface after the final dive at a site (before moving to a new location), including inspecting and dislodging/returning any unintended attached organisms back to the ocean, and disinfecting/sterilizing any component/surfaces (to the extent practicable) which may come into contact with the sea floor or surrounding organisms, before conducting activities in a new location. If disinfecting/sterilizing is not possible DAR requests that the drill or AUV/ROV be sprayed down vigorously with fresh or salt water hoses in order to dislodging any unintended attached organisms that may not be observed during the initial inspection.

Note: See research proposal included in BLNR submittal for more environmental management, risks and mitigation strategies.

Distribution of Samples/Invasive Species, Disease and Parasites. The permittee will mitigate for the spread of invasive species, disease and parasites between sampling areas (if sampling in environmentally different areas) by utilizing best management practices, including but not limited to, ensuring that all organisms, hand tools or collection bags/containers are inspected and absent of any non-natives or invasive organisms before transportation to lab aquariums (not applicable where invasive species, disease and parasites are target species for collections) or before collection in a new area, and ensuring that all gear is disinfected or sterilized between collection areas (see **General Conditions O. Other Collection Guidelines: Aquatic Invasive Species for more guidelines and conditions**). Efforts will be made by permittee and authorized assistants to ensure that collection of samples is conducted in such a manner as the process does not result in any additional harm to surrounding organisms or environment. **Permittee and authorized assistants will implement collection/sampling design that removes a sustainable proportion from the local population of target organisms and make efforts to distribute collection activities across shoreline/reef flat/benthic areas, so as not to consolidate the impacts of collection in one location (if applicable/if collecting samples).** Note: In select cases, the permittee and authorized assistants may need to collect all the corals and/or live rock from an area (e.g. areas that are subject to anticipated impact such as harbor renovation projects or other types of marine construction projects or similar projects with anticipated impacts to coral and/or live rock). Discretion should be used to avoid conflicts with fishers and others during authorized activities. Efforts will be made by permittee and authorized assistants to communicate with the public that have inquiries about the collection activities or methodology. Permittee and authorized assistants will clearly state the overall objective of the project, that these activities require permits, and that the methods the permittee and

authorized assistants are employing are not approved for recreational fishing but research, education, management or propagation ONLY.

C. Gear and Methods. This permit authorizes the following use of non-regulated gear and methodology:

Non-regulated Gear: Seafloor corer - Benthic Geotech Portable Remotely Operated Drill (“PROD”)

D. Transportation, Preservation and/or Analysis.

Full analysis of the cores and the subsequent scientific reporting takes place in the months and years following the offshore drilling phase. The following is a typical timeline for events after drilling:

- After the offshore phase ends, the core material will be transported to the IODP Bremen Core Repository in Bremen, Germany.
- ~4 months after the offshore phase, a scientific workshop to analyze the cores will be convened in Bremen. There, the cores will be split and a team of international scientists will work to produce an initial set of results from the cores. At the end of the workshop, a one-year moratorium on the core material begins.
- The cores are then shipped to the IODP Gulf Coast Repository at Texas A&M University, where they will be permanently archived.
- 2 months after the workshop, a Preliminary Report is published online and is free to the public.
- 1 year after the workshop, a full Expedition Report is published online and is free to the public. At this time, a moratorium on the core material ends and anyone can apply for samples from the cores for scientific research.
- Associated scientific papers are published by the scientific team in peer-reviewed journals within ~3 years.

E. Annual Report: Upon 90 days post expiration of the permit or 30 days prior to expiration of the permit (depending on **renewal** or **non-renewal** status), the permittee must provide to DAR a final written report summarizing the results of the collection activity carried out under this permit and (if available/applicable) analysis of the data.

1. The annual report should provide a written description of the activity and objective and a written explanation as to how the collection of or activity with a fully protected or regulated marine species for scientific, education, management or propagation purposes is benefiting the State of Hawai’i in general and specifically, the improved management of the species or related species.
2. The annual report must describe the following, in form specified by the Department; access to reporting template on the DAR Permitting Portal can be found at: <https://inforps-dp.hawaii.gov/dlnraquaticpermitting/#/research-spreadsheet> or via email from permit coordinator (for info from #2. a. & c. and #3) – include all other info (#1, #2 b. & d. into a PDF report) – **consult permit coordinator for most up-to-date reporting template (if necessary):**
 - a. **Species name and total quantities and sizes** of all regulated and non-regulated specimens collected under this permit.
 - b. **Results of chemical, genetic, physiological, histological, pathological, statistical or other analysis of data** (if possible/applicable) and **PDFs or links to any publications associated with the research.**

- c. **GPS coordinates (decimal degrees) of location of each sample taken or action conducted and associated geographic location** (e.g. windward side or east side of Patch Reef 8, or north side of Lilipuna Pier). Multiple samples collected in one single area can be geo-referenced by a single GPS point and associated geographic location.

If GPS is not available: Make accurate note of your sampling location in field and obtain GPS location from Google Earth after field sampling (**Note: Instructions are for the downloaded program - Google Earth Pro, not web version**):

- i. Click “Tools” in the top line menu and open Options.
- ii. In the “3D View” tab, **find** the “Show Lat/Long” section. Change the default from Degrees, Minutes, Seconds to **Decimal Degrees**.
- iii. Next, click the pushpin icon in the menu; click and drag the pushpin that appears to the point on the map from which you wish to obtain a GPS coordinate:

(e.g.: Lat: 21.441646, Long: -157.799076)

- iv. Enter GPS coordinate into spreadsheet with associated sampling information (species, amount, size).

- d. **Photo-documentation** of a representative example of organisms collected, methodology, and gear:

- i. Photo-documentation of the **seafloor corer - Benthic Geotech Portable Remotely Operated Drill (“PROD”) and AUV/ROV utilized during the Hawaii expedition**. Photo-documentation of a **representative example of benthic photos captured during pre-surveys of the fossil reef core sites**. Photo-documentation of a **representative examples of fossil reef cores collected**.
- ii. Each representative example should include the following photos: For example of seafloor corer - Benthic Geotech Portable Remotely Operated Drill (“PROD”) and AUV/ROV utilized during the Hawaii expedition: one (1) photo of each seafloor corer - Benthic Geotech Portable Remotely Operated Drill (“PROD”) and each AUV/ROV utilized during the Hawaii expedition (with scale for size); For example of benthic photos captured during pre-surveys of the fossil reef core sites: photos captured at each fossil reef core site during pre-survey (with scale for size); For example of fossil reef cores collected: photos of examples of fossil reef cores collected from each site (with scale for size) .

3. An inventory (species list) of organisms (dead or alive) present at the facility or with the permittee the end of the report period, in form acceptable to the Division, must accompany the annual report;
4. The annual report is due at the Division's Honolulu office one month (30 days) before expiration of the permit if renewal is needed or within three months (90 days) after expiration of the permit if renewal is not needed or as otherwise instructed by the Division.

F. Use of Organisms, Parts of Organisms, Tissue Samples or other Aquatic Resources. The permittee may not convey in any fashion (including, but not limited to, selling, trading, or giving) any organisms, parts of organisms, tissue samples or other aquatic resources to any person or party in Hawai'i that does not already have a permit from the Department authorizing possession of same and without written approval from DAR. Organisms taken under authority of this permit may be used for scientific study or educational purposes **ONLY**, except as authorized by prior written approval of DAR.

1. This permit authorizes the permittee and authorized assistants to transport regulated or non-regulated organisms, as listed in Table 1, within or outside of Hawai'i to the following institutions (pending appropriate import permits) and authorizes the following institutions to receive regulated or non-regulated organisms, as listed in Table 1, from the permittee and authorized assistants:
 - i. British Geological Survey (BGS), The Lyell Centre, Edinburgh, United Kingdom
 - ii. IODP Bremen Core Repository, Bremen, Germany
 - iii. IODP Gulf Coast Repository at Texas A&M University, College Station, Texas
 - iv. Other institutions/labs to be specified on final annual report (Lab/Institution Name, City, State); researcher will notify DAR for review/approval (via email) of other institutions/labs where samples may be sent during the year

II. GENERAL CONDITIONS:

- A. This permit does not make the Department of Land and Natural Resources or the State of Hawaii liable in any way for any claim of personal injury or property damage to the permittee or assistants which may occur during any activity conducted under this permit; moreover, the permittee and all assistants agree to hold the State harmless against any and all claims of personal injury, death or property damage resulting from activities of the permittee or any assistant.
- B. This permit conveys a privilege to engage in only those activities under the jurisdiction of the Department of Land and Natural Resources. The permittee is responsible for complying with all applicable County, State, and Federal requirements. The permit does not convey any privilege of access over or through private property.
- C. The permittee and each assistant are individually responsible and accountable for their actions while conducting activities authorized under this permit; additionally, the permittee is responsible and accountable for the actions of the permittee's assistants.
- D. This permit is not transferable or assignable. Any person whose name does not appear on this permit and is conducting any activity described herein is subject to prosecution for violation of State laws.
- E. The permittee may request changes to the permit. Any such request to make changes to the permit must be made in writing and received by the Department at least thirty days prior to the change. The addition of new assistants will require each individual to sign the Attachment on page 14, 15 or 16 stating that they have read, understood, and agree to abide by all general and special permit conditions. No change may be implemented without written approval from the Department.
- F. The permittee may request to:
 1. Add assistants to the permit;
 2. Add another permittee or replace an existing permittee in the manner stated above; and
 3. Change the activities authorized under this permit.
- G. The permittee or their assistant(s) must have with them a copy of this permit while conducting activities authorized by this permit.

- H. This permit authorizes collection of organisms protected by Federal law only with prior appropriate Federal authority, which must be described on Page 1 of this permit (if applicable).
- I. This permit does not authorize the sale of any collected organism.
- J. This permit expires on the date indicated on Page 1. **If no renewal is needed**, the permittee must email a PDF of this permit with all signature sheets and additionally email a **PDF version of a final report** (to catherine.a.gewecke@hawaii.gov) with complete information on all activities authorized under this permit (see Special Conditions, **Section E. Annual Report**) within **three months (90 days) after** the expiration date. **If renewal is needed**, permittee must submit a **PDF version of a final report** to the Division **one month (30 days) prior** to the expiration date for DAR biologists to review, in addition to turning in expired permit with signatures no later than the regular **three months (90 days) after expiry date**. If complete report cannot be submitted **one month (30 days) prior** to the expiration date, the permittee will submit a short synopsis of research conducted (PDF version- **one month (30 days) prior** to the expiration date) in past year including information on quantities, genus species and activities conducted, and submit full report no later than the regular **three months (90 days) after expiry date**.
- K. The permittee and assistants agree to provide access to data obtained under authority of this permit upon request of the Division of Aquatic Resources, and to provide to the Division a copy of each report, published for distribution, prepared with data obtained under this permit. The permittee agrees to provide the Division of Aquatic Resources access to organisms obtained and held under this permit for on-site inspection.
- L. The permittee agrees to notify the island office of the Division of Conservation and Resources Enforcement (DOCARE – Oahu Central Office: 808-643-3567) at least 24 hours prior to any authorized activity being conducted in the field under this permit. See section **O. Other Collection Guidelines** (below) for additional requirements.
- M. A violation of any terms or condition of this permit or any violation of State law not covered by this permit may result in revocation of the permit and other penalties as provided by law. In addition, the Department may consider any such violation as grounds for denying any future application for this or any other permit issued by the Department.
- N. Coral Activities: Activities under this permit shall abide by the following conditions.
1. Coral - the Permittee must notify DAR Oahu (dar.sap@hawaii.gov) within 24 hours of:
 - i. Any instance of major damage caused to coral or other marine natural resources, because of collection or other research activities conducted under this permit.
 2. Fragmentation - This permit **does not authorize** fragmentation of coral colonies.
 3. Rare Species - The following *Porites* species require special permission from the Division prior to collection under this permit: *Porites pukoensis*, *Porites duerdeni*, *Porites studeri*. The following *Montipora* species require special permission from DAR prior to collection under this permit: *Montipora dilitata*. The following *Pocillopora* species require special permission from DAR prior to collection under this permit: *Pocillopora ligulata*, *Pocillopora molokensis*.
 4. **No impact-causing activities will be conducted on (or immediately adjacent to) any intact, attached coral colony measuring larger than 1 m x 1 m x 1 m. Specific efforts will be made to avoid damage to any large colonies of living coral.**

O. Other Collection Guidelines:

1. Collecting generally - the Permittee must give notice, in form specified by the Department (email or phone call), to DAR (catherine.a.gewecke@hawaii.gov) and to the Department's Division of Conservation and Resources Enforcement (Central Office DOCARE: 808-643-3567), at least 24 hours prior to initial commencement of any series of collection activities taken place under this permit or on a schedule agreed to by DOCARE and the permittee (i.e. one call notifying of a period of time sampling that will occur across different locations throughout the year). **Researcher will provide the following info when DOCARE is notified:** SAP #, researcher name/institution, date/time/location (or range of dates/times/locations if collecting throughout the year), activity description (e.g. collecting samples or data in specific location), including gear type, description of boat being used (color, size, type of boat)(if applicable), description of vehicle on shore (if applicable), number of people involved in activity and contact information.
2. An **Aquatic Invasive Species (AIS) Mitigation Plan** will be filed with the Division prior to conducting any collection under this permit. The Plan will include methods and protocols to minimize AIS or disease movement through gear, supplies and activities of the permittee. Permittee must take actions to verify that collection tools have been disinfected before use if previously used in collection activities.

Invasive Species/Disease/Parasites: All collection gear deployed must be visually checked for invasive species/disease/parasites and disinfected with 10% bleach solution for 10 minutes before deployment in alternate location if collecting between multiple watersheds/distinct reef areas/islands. If collection gear cannot be bleached, gear must be thoroughly rinsed with fresh water and dried in sun for 24 hours before deployment in alternate location, sterilized with another viable method or alternate sampling gear should be utilized. If sampling disease or anomalous growth specimens, gear should be sterilized between each specimen or new collection gear should be used. **If collecting in Kaneohe Bay or Maunalua Bay:** Kaneohe Bay: All collection gear utilized in Kaneohe Bay must be visually checked for invasive species/disease/parasites (e.g. *Kappaphycus spp.*, *Eucheuma denticulatum*, *Gracilaria salicornia* and *Mycale grandis/armata*) and disinfected with 10% bleach solution for 10 minutes before deployment in alternate location other than Kaneohe Bay. Maunalua Bay: All collection gear deployed in Maunalua Bay must be visually checked for invasive species/disease/parasites (e.g. *Avrainvillea amadelpha/lacerata* and *Gracilaria salicornia*) and disinfected with 10% bleach solution for 10 minutes before deployment in alternate location other than Maunalua Bay. The following species remain a concern to the division: Alien invasive algae (*Kappaphycus spp.*, *Eucheuma denticulatum*, *Gracilaria salicornia*, *Acanthophora spicifera*, *Hypnea musciformis* and *Avrainvillea amadelpha/lacerata*), Coral disease (*Montipora White Syndrome*, *Porites trematodiasis*, *Montipora black band disease*, *Porites tissue loss syndrome*, and *Porites spp.* and *Montipora spp.* tumors, *Montipora spp.* growth anomaly), Orange keyhole sponge (*Mycale armata/grandis*).

(If applicable) Permittee will mitigate for the spread of invasive species/disease/parasites by ensuring that all organisms (e.g. coral colonies, fragments or live rock) collected from Kaneohe Bay are absent of any algae fragments or basal attachments of the invasive alga *Kappaphycus spp.*, *Eucheuma denticulatum*, *Gracilaria salicornia*, or other invasive species/disease/parasites (unless collecting these non-native species specifically) before transporting organisms to alternative location for research.

(If applicable) Permittee will mitigate for the spread of invasive species/disease/parasites by ensuring that all organisms (e.g. coral colonies, fragments or live rock) collected in Maunalua Bay are absent of any algae fragments or basal attachments of the invasive alga *Avrainvillea amadelpha/lacerata*, *Gracilaria salicornia*, or other invasive species/disease/parasites (unless collecting these non-native species specifically) before transporting organisms to alternative location for research.

Quarantine Protocol. If transporting and holding live organisms (including live rock) in an aquarium/tank: After inspection, organisms transported to other locations on island must have a quarantine protocol involving either closed-system tanks for the entire research period or closed-system tanks for a select amount of quarantine time followed by flow-through tanks with UV lights on outfall. Organisms will be placed in placed into flow-through tanks only if observations indicate that no invasive species are present. Permittee will sacrifice any AIS/disease/parasites if found at this stage, and keep host organisms in closed system tanks for research. Length of quarantine time and type of holding tank (closed-system or open-system) will be determined based on location of collection/location of holding and type of organism collected, after consultation with DAR. Exceptions (after consultation with DAR): If quarantine process is not possible (due to capacity/lack of available closed-system tanks), quarantine process may not be required for researchers working with fish and invertebrates (other than coral) collected from areas outside of area where research tanks are located, if researchers are able to conduct an initial inspection of organisms for AIS/disease/parasites before transporting organisms back to open-system (flow-through tanks) at research location. DAR will work with researchers on a case by case basis, that work with coral and live rock collected from areas outside of outside of the area where research tanks are located, but which may have limited quarantine capacity (lack of available closed-system tanks), to determine if the quarantine process is necessary.

Transport out of Kaneohe Bay/Maunaloa Bay. Any specimens collected in Kaneohe Bay should not be transported outside of Kaneohe Bay unless being moved to a closed-system aquarium, preserved or verified to be free of non-native organisms (e.g. *Kappaphycus spp.*, *Eucheuma denticulatum*, *Orange keyhole sponge (Mycale armata/grandis)*) after undergoing quarantine treatment. Any specimens collected in Maunaloa Bay should not be transported outside of Maunaloa Bay unless being moved to a closed-system aquarium, preserved or verified to be free of non-native organisms (e.g. *Avrainvillea amadelpa/lacerata*) after undergoing quarantine treatment.

3. No organism other than those listed on this permit will be collected or impacted by any activities conducted under this permit.
4. Collecting and transport activities under authority of this permit must be supervised directly, on site, by either the permittee or their authorized assistants (who must be a signatory of this permit).
5. Gear and Methods: Use of any chemical substances pursuant to Section 188-23, Hawai'i Revised Statutes, electrical shocking devices, or explosives remains expressly prohibited.
6. Use of Organisms: Organisms collected under authority of this permit may not be used for personal consumption or sale; organisms collected under this permit may not be traded, bartered or loaned to other individuals, institutions or entities;
 - a. Written approval must be obtained from the Division prior to:
 - i. Purchasing or any other acquisition of regulated organisms (regardless of origin) from any other party,
 - ii. Exchanging or donating any organisms collected under this permit to any other person, party or organization (unless authorized by this permit);

7. **Sampling Moratoriums:** The Division may request a voluntary sampling moratorium, or in some cases, implement a mandatory sampling moratorium, for certain organisms authorized for collection under any current permit, during times of ecosystem pressure caused by natural or anthropogenic stressors. Example of ecosystem pressure may include coral bleaching events, which have occurred most recently in Hawaii during the months of July/August to November. Please take this into consideration when applying for a permit, plan your collections accordingly and be prepared to take a sampling hiatus (if necessary) until the stressor event is determined to have ended. Exemptions may be provided for studies or projects that have a research objective directly related to the naturally or anthropogenically caused stressors, which require collecting data or samples during this period, or select projects that are evaluated to not cause additional pressure during this period.

P. **OWNERSHIP OF BIOGENETIC RESOURCES.** The State holds legal title to the natural resources and biogenetic resources gathered from state lands, including submerged lands. See Haw. Op.Atty.Gen. Opinion No. 03-03 ([April 11, 2003](#)). Biogenetic resources refer to the genetic material or composition of the natural resources and other things connected to, or gathered from public lands. See Davis v. Green, 2 Haw. 327 (1861); United States v. Gerber, 999F.2d 1112 (7th Cir. 1993).

DAWN N. S. CHANG, Chairperson
Department of Land and Natural Resources

cc: (x) DOCARE
(x) DAR – Hawaii (Kona and Hilo)

SIGNATURES AND AGREEMENT

By my signature below, I acknowledge receipt and understanding of the general and special conditions of this Special Activity Permit. Further, I agree to abide by all of these conditions when conducting activities authorized by this permit.

PRINCIPAL PERMITTEES: _____

David McInroy BSc, MSc

DESIGNATED ASSISTANTS:

Signature:	_____	Signature:	_____
Print Name:	_____	Print Name:	_____
Signature:	_____	Signature:	_____
Print Name:	_____	Print Name:	_____
Signature:	_____	Signature:	_____
Print Name:	_____	Print Name:	_____

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Print Name:	_____	Print Name:	_____
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Print Name:	_____	Print Name:	_____

Appendix. Figures and Maps.

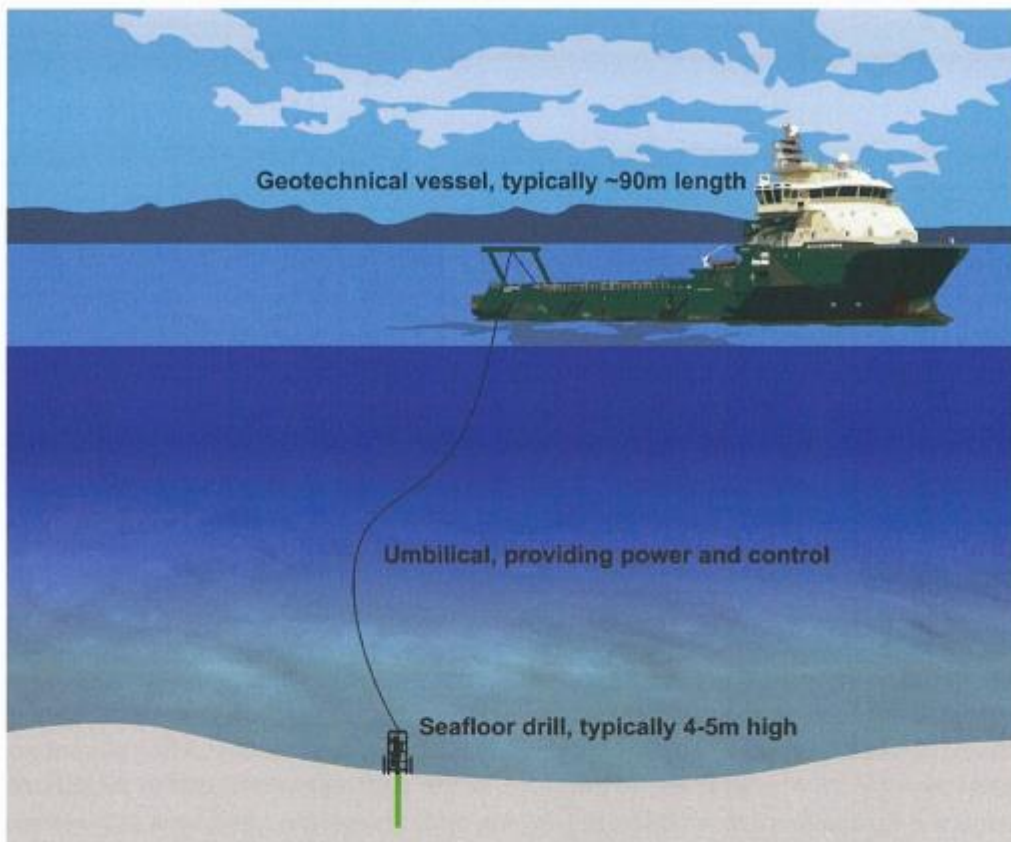


Figure 1. Schematic illustration of seafloor drill deployment from a project vessel.

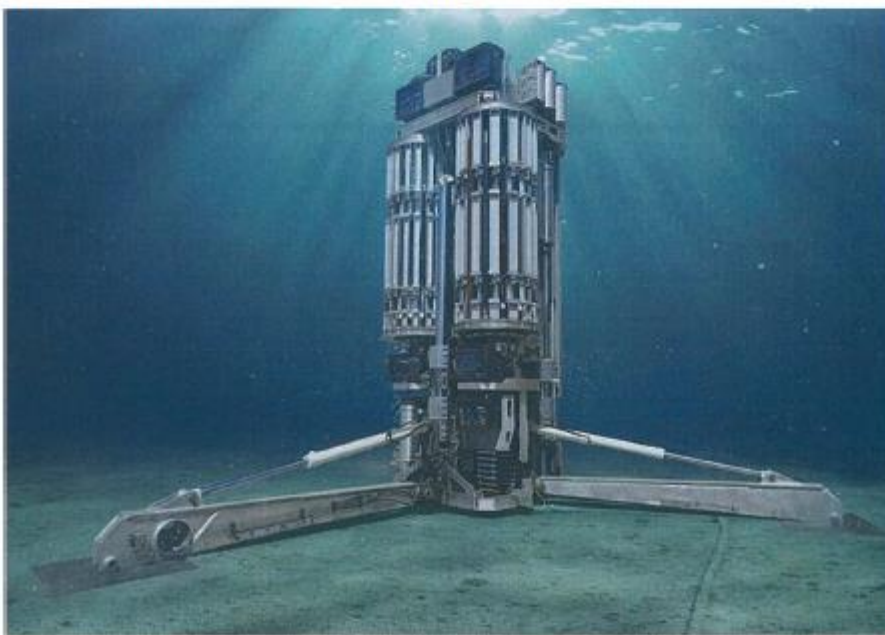
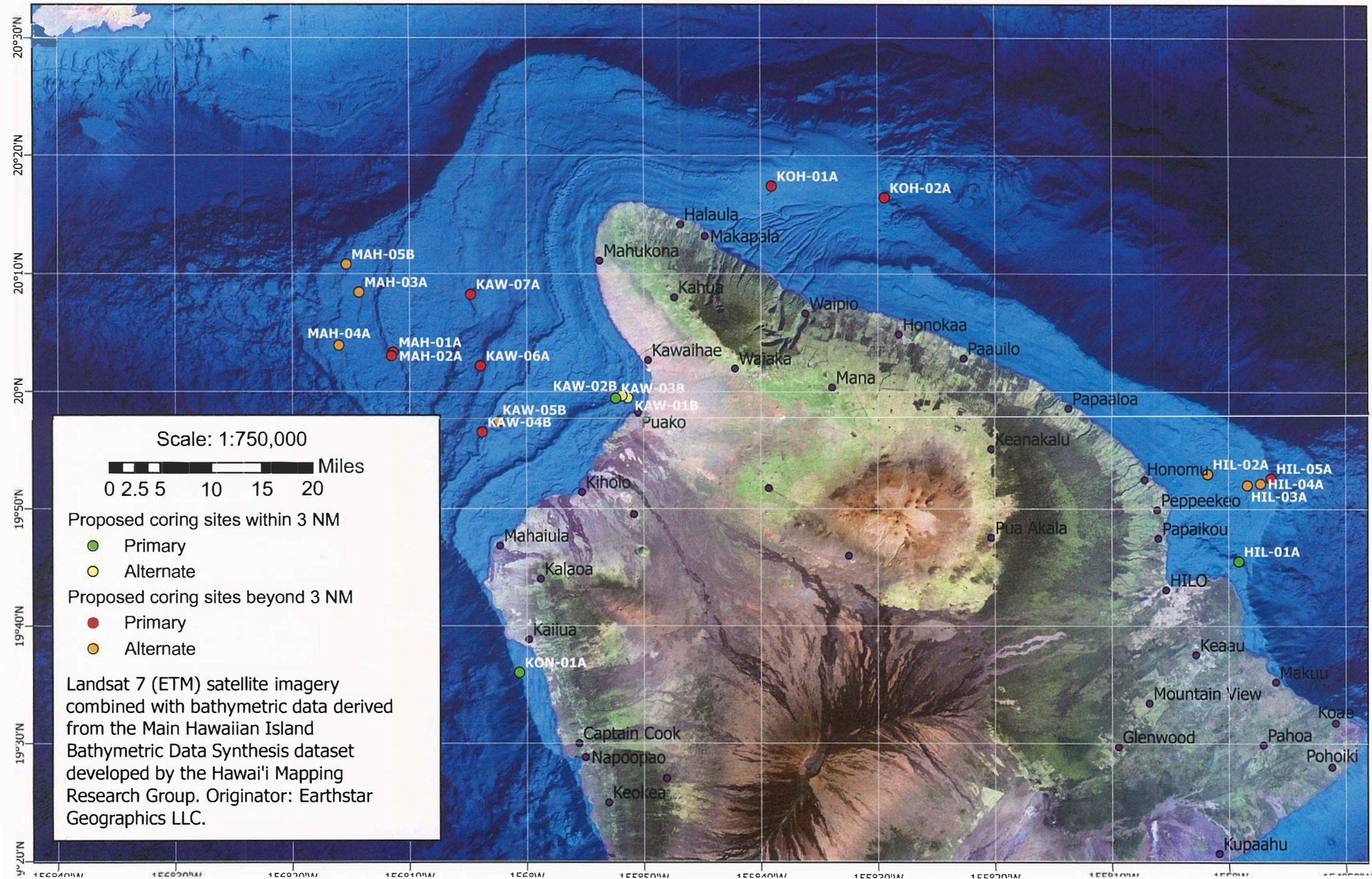


Figure 2. The Benthic Geotech PROD (Portable Remotely Operated Drill).

IODP Expedition 389: Hawaiian Drowned Reefs

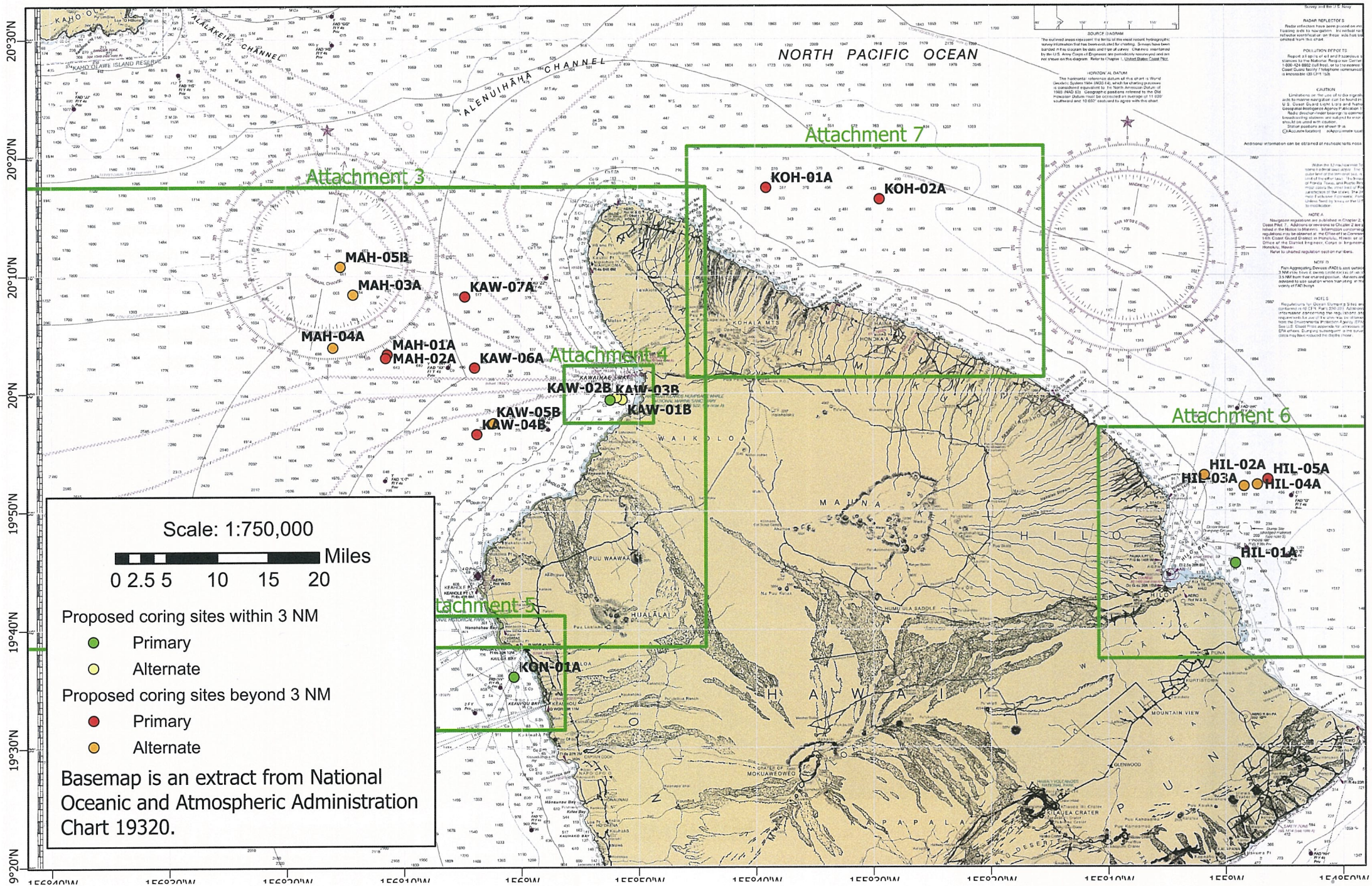
Attachment 1 - Overview Map (Landsat and Bathymetry)

Exhibit 1 – IODP Drilling Locations



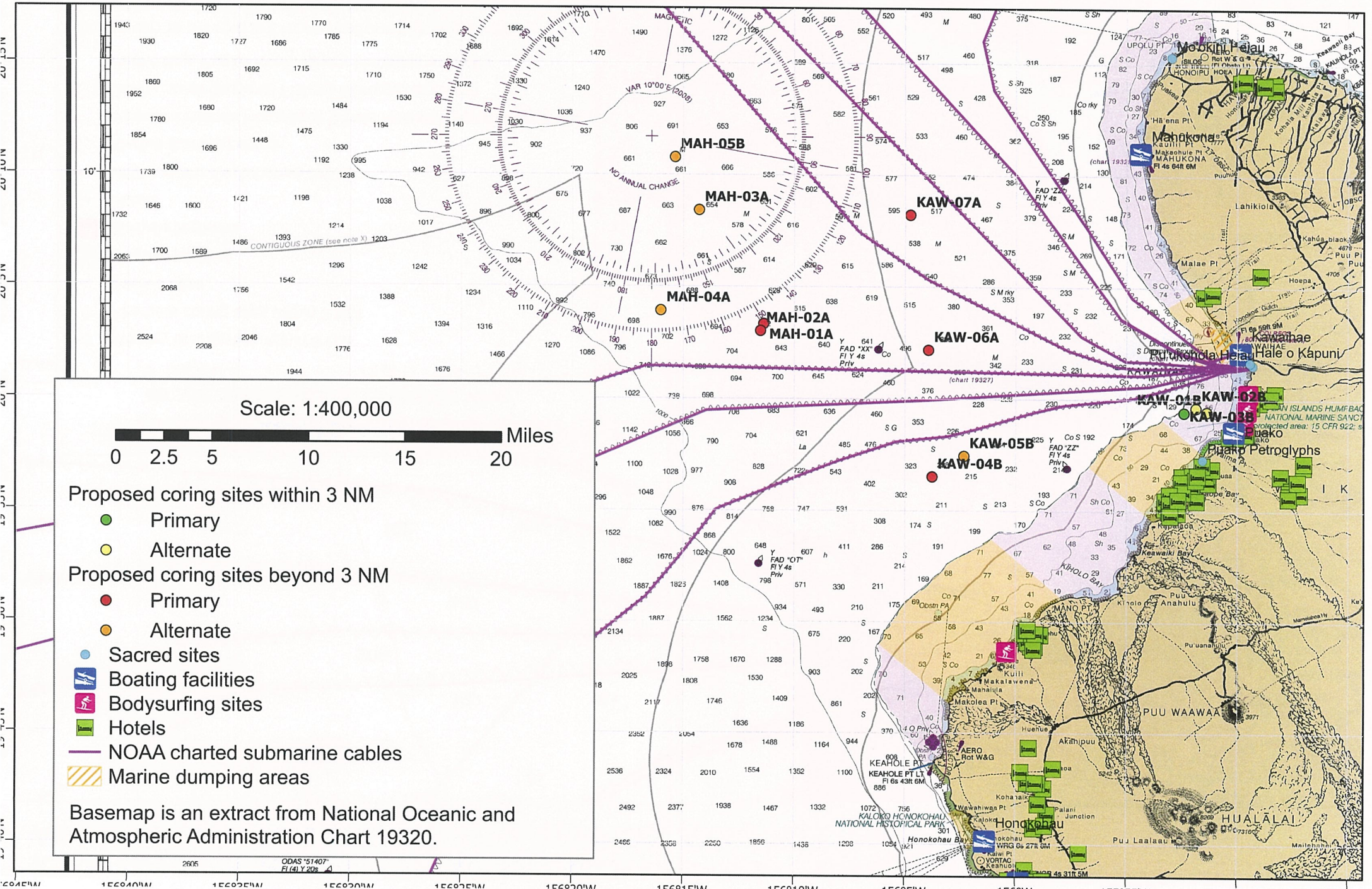
IODP Expedition 389: Hawaiian Drowned Reefs

Attachment 2 - Overview Map (National Oceanic and Atmospheric Administration Chart 19320)



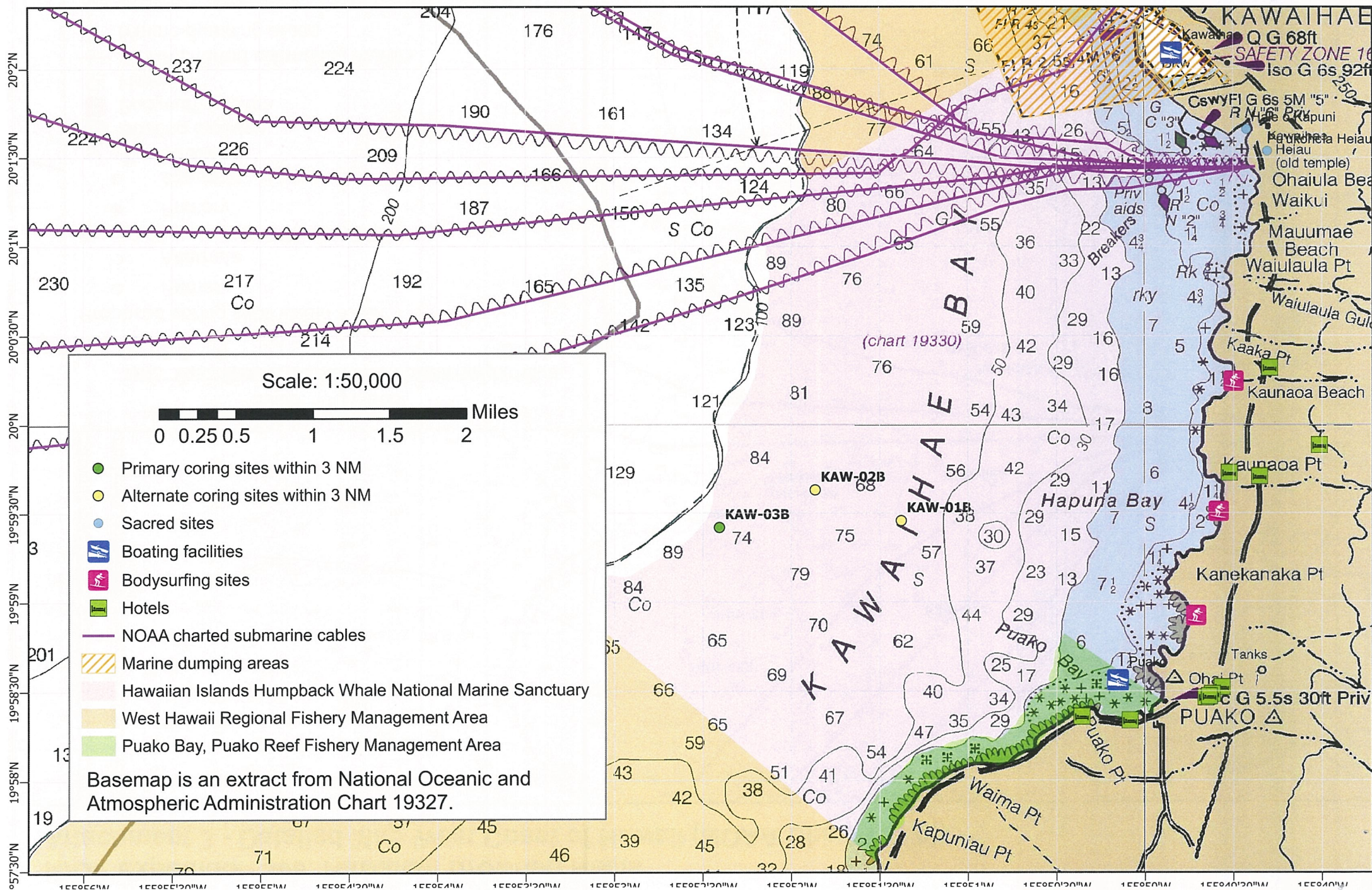
IODP Expedition 389: Hawaiian Drowned Reefs

Attachment 3 - Detailed Map West Coast of Hawaii (NOAA Chart 19320)



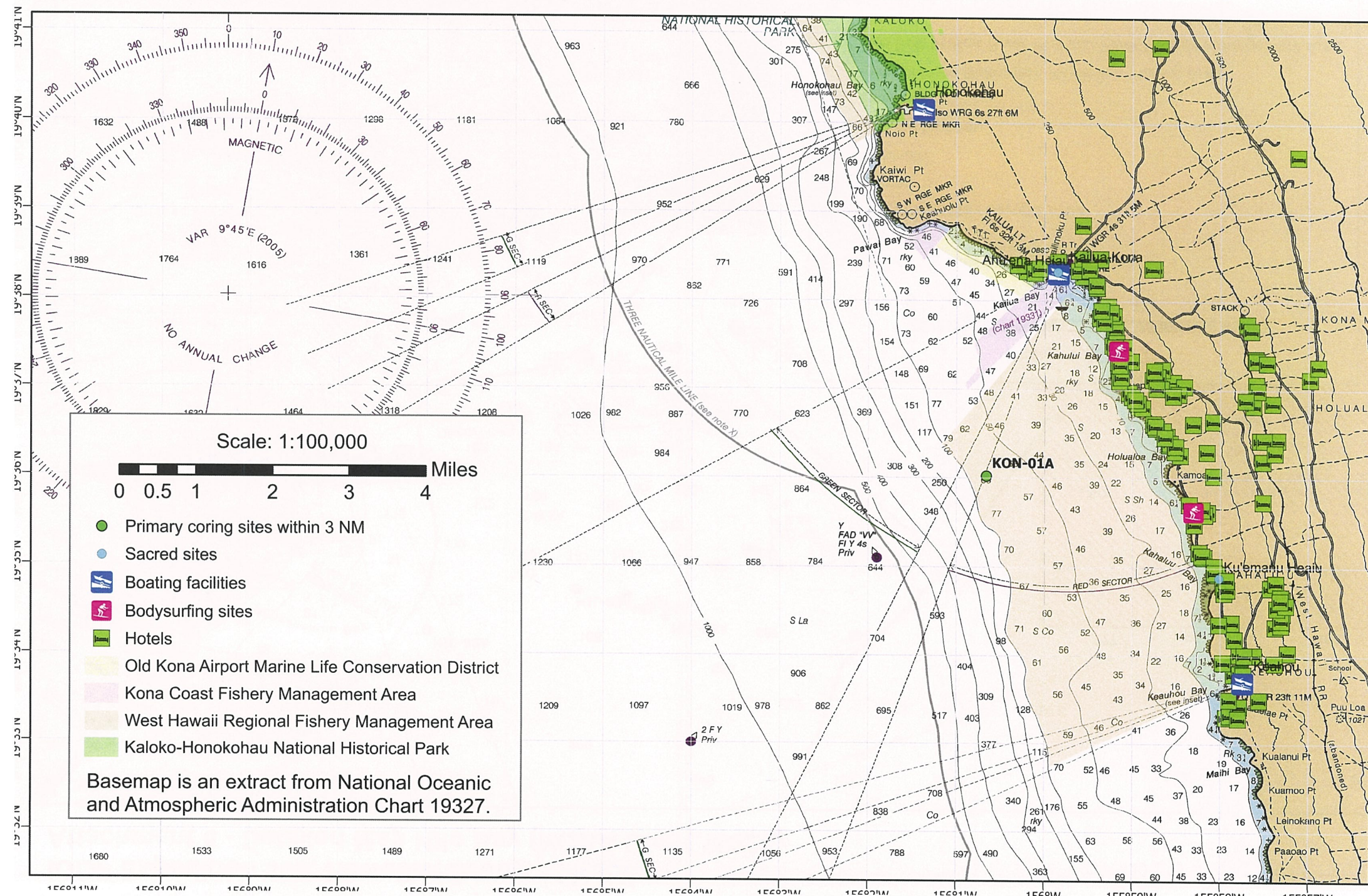
IODP Expedition 389: Hawaiian Drowned Reefs

Attachment 4 - Detailed Map Kawaihae Bay (NOAA Chart 19327)



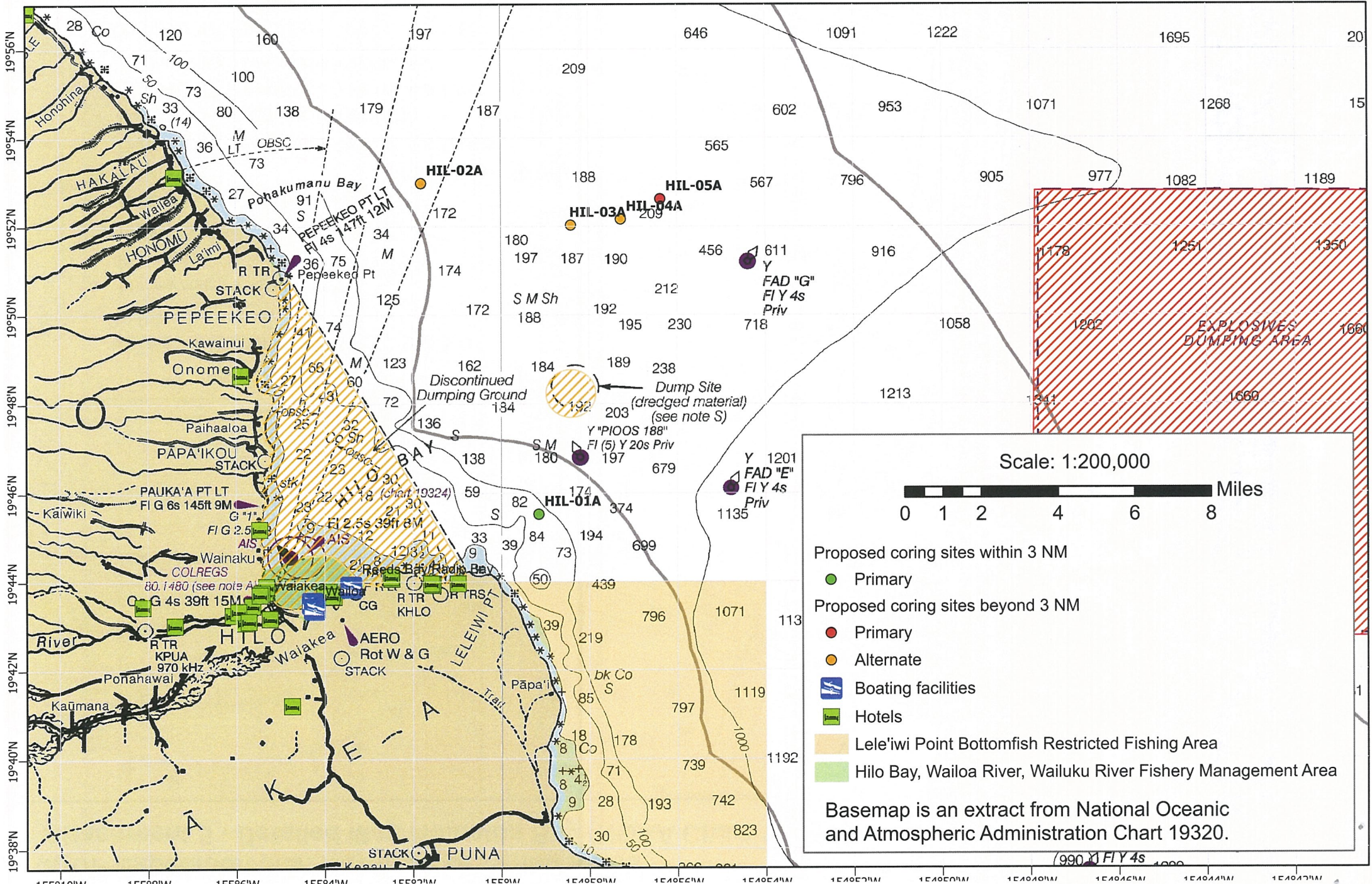
IODP Expedition 389: Hawaiian Drowned Reefs

Attachment 5 - Detailed Map Holualoa Bay (NOAA Chart 19327)



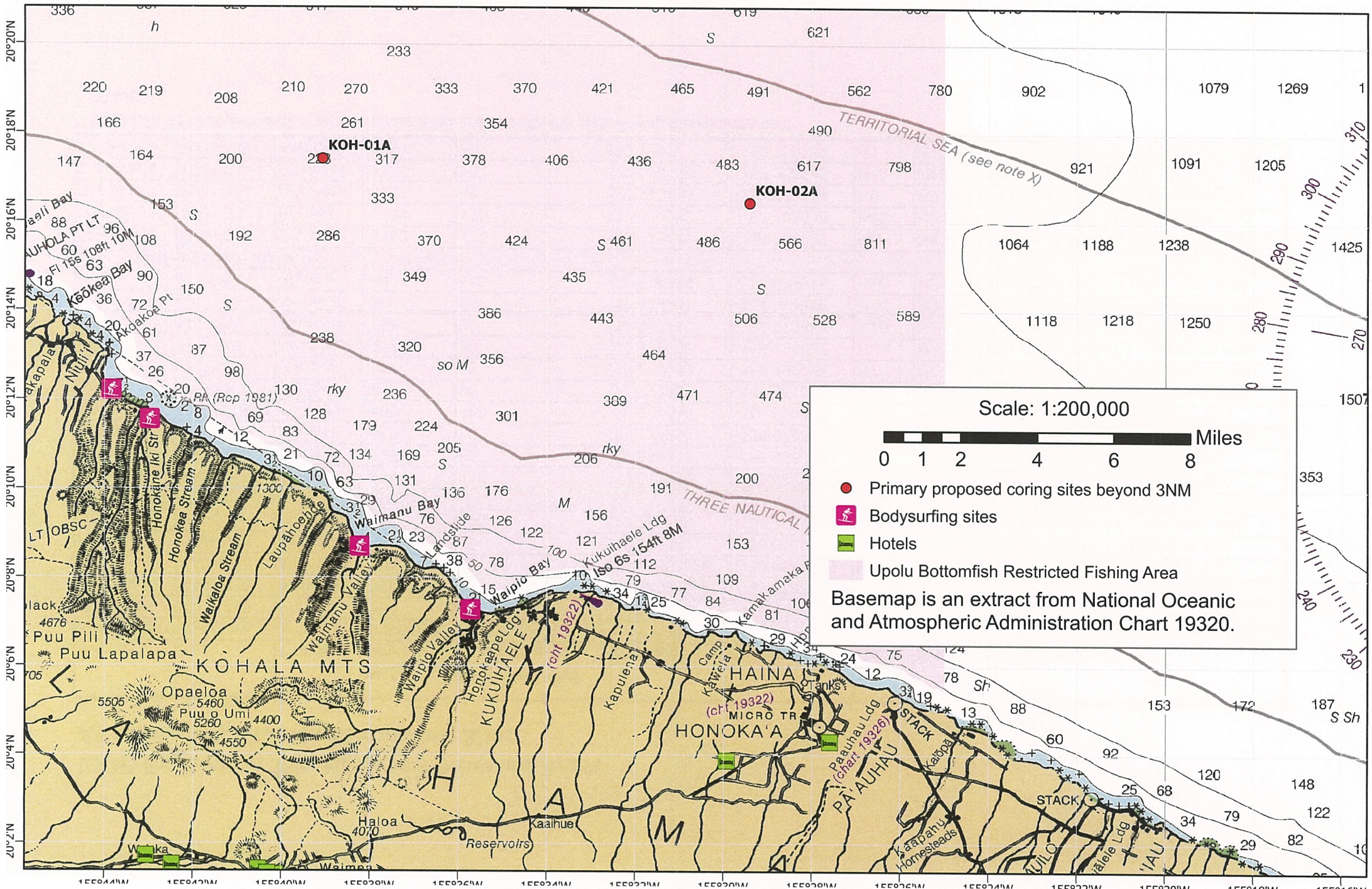
IODP Expedition 389: Hawaiian Drowned Reefs

Attachment 6 - Detailed Map Hilo Bay (NOAA Chart 19320)

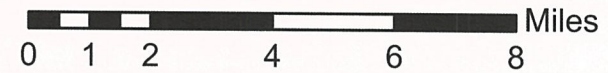


IODP Expedition 389: Hawaiian Drowned Reefs

Attachment 7 - Detailed Map Kohala (NOAA Chart 19320)



Scale: 1:200,000



- Primary proposed coring sites beyond 3NM
 - ♣ Bodysurfing sites
 - Hotels
 - Upolu Bottomfish Restricted Fishing Area
- Basemap is an extract from National Oceanic and Atmospheric Administration Chart 19320.

IODP Expedition 389: Hawaiian Drowned Reefs

Attachment 8 - Table of Proposed Sites

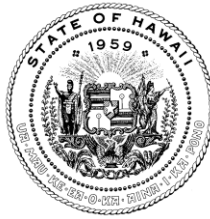
Region	Site	Priority	Water Depth (m)	Estimated Reef penetration ¹ (m)	Latitude ²	Longitude ²	Reef	Brief Site-specific Objectives
Sites within 3 NM of the coast (subject of CDUA)								
Kawaihae	KAW-03B	Primary	-154	80	19.990308	-155.873431	H1D	H1d reef that spans MIS 1-5 (leeward, dry)
Kawaihae	KAW-01B	Alternate	-129	80	19.99093302	-155.8563025	H1B	H1b reef that spans MIS 1-5 (leeward, dry)
Kawaihae	KAW-02B	Alternate	-132	90	19.99383926	-155.8644029	H1C	H1c reef that spans MIS 1-5 (leeward, dry)
Kona	KON-01A	Primary	-145	80	19.600341	-156.010975	H1D	H1d reef that spans MIS 1-5 (leeward, dry)
Hilo	HIL-01A	Primary	-134	110	19.758805	-154.985708	H1D	H1d reef that spans MIS 1-5 (windward, wet)
Sites 3 to 12 NM of the coast								
Kawaihae	KAW-04B	Primary	-414	110	19.942109	-156.062876	H2D	H2d reef that spans MIS 6-7 (leeward, dry)
Kawaihae	KAW-06A	Primary	-737	65	20.036417	-156.065696	H4	H4 reef that spans MIS 8-9 (leeward, dry)
Kawaihae	KAW-07A	Primary	-988	70	20.137266	-156.079341	H6	H6 reef that spans MIS 10-11 (leeward, dry)
Kawaihae	KAW-05B	Alternate	-463	100	19.957553	-156.039013	H2D	H2d reef that spans MIS 6-7 (leeward, dry)
Kohala	KOH-01A	Primary	-410	80	20.290268	-155.651218	H2D	H2d reef that spans MIS 6-7 (windward, wet)
Kohala	KOH-02A	Primary	-931	45	20.273958	-155.490294	H7	H7 reef that spans MIS 10-11 (windward, wet)
Hilo	HIL-02A	Alternate	-271	90	19.883005	-155.029932	H2A	H2a reef that spans MIS 4?-7 (windward, wet)
Hilo	HIL-03A	Alternate	-338	90	19.867141	-154.973387	H2B	H2b reef that spans MIS 5a?-7 (windward, wet)
Hilo	HIL-04A	Alternate	-354	90	19.869407	-154.954576	H2C	H2c reef that spans MIS 5a?-7 (windward, wet)
Hilo	HIL-05A	Primary	-402	110	19.876999	-154.939618	H2D	H2d reef that spans MIS 6-7 (windward, wet)
Sites outside 12 NM of the coast								
Mahukona	MAH-01A	Primary	-1102	110	20.055411	-156.189697	H8A	H8a reef that spans MIS 12-13 (leeward, dry)
Mahukona	MAH-02A	Primary	-1154	110	20.050262	-156.192035	H8B	H8b reef that spans MIS 12-13 (leeward, dry)
Mahukona	MAH-03A	Alternate	-1213	50	20.140405	-156.238194	H9	H9 reef that spans MIS 14-15? (leeward, dry)
Mahukona	MAH-04A	Alternate	-1234	50	20.065165	-156.266945	H10	H10 reef that spans MIS 14-15? (leeward, dry)
Mahukona	MAH-05B	Alternate	-1203	70	20.1797	-156.256232	H11	H11 reef that spans MIS 14-15? (leeward, dry)

¹ Sites with <110 m penetration will penetrate a few metres into the underlying basalt basement

² WGS84

JOSH GREEN, M.D.
GOVERNOR | KE KIA'ĀINA

SYLVIA LUKE
LIEUTENANT GOVERNOR | KA
HOPE KIA'ĀINA



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

DAWN N. S. CHANG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

LAURA H. E. KAAKUA
FIRST DEPUTY

M. KALEO MANUEL
ACTING DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

October 13, 2023

TO: Division of Aquatic Resources File

THROUGH: Dawn N. S. Chang, Chairperson

FROM: Brian J. Neilson, Administrator
Division of Aquatic Resources

SUBJECT: Declaration of Exemption from the Preparation of an Environmental Assessment under the Authority of Chapter 343, HRS, and Chapter 11-200.1, HAR, for a Special Activity Permit to David McInroy, British Geological Survey, Principal Marine Geoscientist.

The following permitted activities are found to be exempted from preparation of an environmental assessment under the authority of Chapter 343, HRS and Chapter 11-200.1, HAR:

Project Title: Request for Authorization and Approval to Issue a Special Activity Permit (SAP 2024-60) for David McInroy of the British Geological Survey, Principal Marine Geoscientist, for the Collection of Fossilized Reef Cores from Submerged Lands in State Waters off of Hawaii Island, for the Purposes of Climate Research

Permit Number: SAP 2024-60

Project Description: The research permit, as described below, would allow for the collection of and incidental impact to regulated resources (live rock and parts/products of non-living coral - "fossil reef") through the temporary deployment of a scientific instrument (seafloor corer - Benthic Geotech Portable Remotely Operated Drill) to collect fossilized reef cores/borings, in regulated areas (West Hawai'i Regional Fishery Management Area - "WHRFMA": Kailua - Keauhou Fish Replenishment Area - "FRA" and Kawaihae Bay) and non-regulated areas (East Hawaii: outside of Hilo Bay) in the waters of Hawaii Island, from October 13, 2023, through October 12, 2024, for the purposes of researching sea-level change and climate variability by studying changes in atmospheric and oceanic conditions recorded in the fossil reef. The taking of corals and live rock is prohibited under section 13-95-70 and 13-95-71, Hawaii Administrative Rules, the taking of regulated aquatic life from the West Hawai'i Regional Fishery Management Area (WHRFMA) may be regulated or prohibited under

chapter 60.4, Hawaii Revised Statutes (HRS), unless all activities are authorized by a permit issued under section 187A-6, Hawaii Revised Statutes.

Location. Research activities will be conducted in regulated areas (West Hawai'i Regional Fishery Management Area – “WHRFMA”: Kailua - Keauhou Fish Replenishment Area – “FRA” [site: KON01A] and Kawaihae Bay [sites KAW01B, KAW02B & KAW03B]) and non-regulated areas (East Hawaii: outside of Hilo Bay [sites: HIL-01A]) in the waters of Hawaii Island (see maps in Appendix). Fossilized coral cores will be transported to British Geological Survey (BGS) (The Lyell Centre, Edinburgh, United Kingdom) for research and analysis. Research activities under the permit are limited to waters of State of Hawaii and are expressly prohibited at the locations listed in table in the permit unless listed above and in **bold** font in the table.

Activity. Permittee is authorized for the collection of and incidental impact to regulated resources (live rock and parts/products of non-living stony coral - “fossilized reef”) through the temporary deployment of a scientific instrument (seafloor corer - Benthic Geotech Portable Remotely Operated Drill) to collect fossilized reef cores/borings, in regulated areas (West Hawai'i Regional Fishery Management Area – “WHRFMA”: Kailua - Keauhou Fish Replenishment Area – “FRA” and Kawaihae Bay) and non-regulated areas (East Hawaii: outside of Hilo Bay) in the waters of Hawaii Island, as listed in Table 1. The objective of this activity is for the British Geological Survey (BGS) to research sea-level change and climate variability by studying changes in atmospheric and oceanic conditions recorded in the fossil reef. Surrounding the island of Hawaii are a series of twelve fossil coral reefs that formed as the reef communities successively grew and were drowned by rising sea-levels and/or the near constant subsidence of the crust around the ever-growing volcanic archipelago of Hawaii. When combined with Hawaii's location away from the influence of any of the large Quaternary ice-sheets, or strong boundary ocean currents that can mask the sea-level and paleoclimate signals, this location presents a unique succession of expended reef sequences, key for the recovery of high-resolution climate and reef response records. As corals grow, they trap environmental clues within their structure, becoming unique records of ocean temperature and acidity as well as capturing evidence of the atmosphere within their structure. Looking back into these records from now-dead coral reef systems can help scientists reconstruct changes in the Earth's climate in the past. Coral communities also grow in known patterns - some prefer a quieter back-reef position to grow whilst other species prefer the more turbulent fore-reef position. They also like certain depths and light conditions. By looking at how the fossil communities have grown, scientists can reconstruct what sea-level was doing at the time, and link it to the changes in atmospheric and oceanic conditions recorded by the corals. Data collected can also help inform or predict future changes to coral reef ecosystems.

The scientific team will analyze the cores with the aim to address questions on four main themes:

1. To reconstruct sea-level change in the central Pacific over the last 500,000 years.
2. To reconstruct the variability in climate over the last 500,000 years, as recorded in the fossil corals, and better understand the differences in response between a seasonal - inter-annual

variation in climate against what represents a more permanent shift in sea surface temperature, rainfall and storm tracks.

3. To understand how coral reef systems respond both geologically and biologically to rapid changes in sea-level and climate -for example can reefs turn on and off when they reach certain limits, and how do they recover from disturbances in the system.
4. To explain the subsidence and volcanic history of Hawaii.

In addition to recovering cores, logging the drilling data and curating the cores, some preliminary scientific measurements are made on the cores at sea. These are:

- Initial lithological description;
- Pore-water geochemistry;
- Sampling for microbiology studies;
- Physical properties using a whole-core multi-sensor core logger (MSCL

Background. BGS was established in 1835 and is the oldest geological survey in the world. It is a research center of the Natural Environment Research Council which, in turn, is a member agency of United Kingdom Research and Innovation, a non-departmental government body sponsored by the British Department for Science, Innovation and Technology. The International Ocean Discovery Program (IODP) an international marine research collaboration that explores Earth's history and dynamics using ocean-going research platforms to recover data recorded in seafloor sediment and rocks and to monitor seafloor environments. IODP is the latest phase of an international scientific ocean drilling project that has been in existence since the 1960s and has drilled hundreds of boreholes worldwide. The USA, Japan and Europe are the lead members of IODP. Europe's contribution is via a consortium that includes 14 European countries and Canada. This European consortium is called the European Consortium for Ocean Research Drilling (ECORD). IODP is funded by the science foundations and councils of partner countries, and is therefore wholly funded by the public. ECORD has commissioned the British Geological Survey (BGS), UK, to coordinate the ECORD Science Operator (ESO), a group of research institutes that implement scientific drilling expeditions under the auspices of IODP. BGS has conducted two previous scientific reef coring projects under IODP: IODP Expedition 310 in Papeete, Tahiti, French Polynesia (2005) and IODP Expedition 325 at the Great Barrier Reef, Australia (2010). Previous expeditions were planned with a strong emphasis on minimizing environmental impact, and were successfully carried out with no environmental incidents. It is proposed to use similarly environmentally sound methodologies, described below, to conduct scientific drilling around Hawaii, which aims to recover a unique archive of sea-level, climate change and reef response over the last 500,000 years.

One participant from University of Hawaii - School of Ocean and Earth Science and Technology (SOEST) is participating in this expedition: Professor Kenna Rubin (<http://www.soest.hawaii.edu/krubin/>).

Note: Deployment of the seafloor corer (Benthic Geotech Portable Remotely Operated Drill or “PROD”) is also permitted under a Site Plan Approval “SPA” (HA-23-74) from the Office of Conservation and Coastal Lands (OCCL).

Methods. The permittee and authorized assistants will collect seven (7) fossilized reef cores through the temporary deployment a seafloor corer (a Benthic Geotech Portable Remotely Operated Drill – “PROD”; see Appendix – Figure 1 & 2) at three (3) locations in depths between 129 - 154 m in waters off Hawaii Island; cores will be drilled to a depth of up to 110 m below the seafloor and each deployment / coring activity will occur for a duration of approximately five (5) days per location between (\approx October 14th 2023 to October 31st 2023). Up to three (3) sites out of five (5) potential sites will have fossilized reef cores collected from the sea floor; collections will occur in Kawaihae Bay (sites KAW01B, KAW02B & KAW03B), Kailua - Keauhou Fish Replenishment Area (sites: KON01A) and/or Hilo Bay - outside area (sites: HIL-01A). Coring will occur intermittingly through the five days – continuous coring at a site could occur for multiple consecutive hours at a time (e.g. 3-5 hours at a time), with breaks that occur in between to bring the PROD back up to the surface to recover the core segments already collected. Note: Cores are collected in segments and cached adjacent to or within the PROD; after a certain amount have been collected the PROD is returned to the surface in order to empty the cache of core segments on the vessel so that the PROD can be sent back down to the sea floor to continue collecting cores.

Collections. Permittee and authorized assistants will collect the following: **Live Rock Surface:** \approx 12.2 in.² (78.5 cm²) area of live rock surface per each fossilized reef core collected for a total area of up to 84.4 inches² / 549.5cm² live rock surface collected (12.2 in.² x 7 cores: two (2) cores x two (2) sites and three (3) cores x one (1) site) and; **Parts/products of non-living coral or “fossilized reef”:** \approx 21.1 ft³ / 0.6 m³ volume collected per core of stony coral (parts/products of non-living coral or “fossilized reef”; fossilized reef cores collected from seafloor) for a total volume of 148 ft.³/4.2 meters³ (21.1 ft³ x 7 cores: two (2) cores x two (2) sites and three (3) cores x one (1) site). This material will consist of the actual cores, and the cuttings created by the coring action. Note: \approx volume per core may vary depending on depth of core collected or percentage of success rate of recovered core (researchers predict 80% success rate). The total volume from all bore holes required at the three primary sites that will be recovered to the vessel for scientific analysis may be less due to cuttings from the bore holes left on sea floor or if assuming a recovery of 80% (estimated to be 0.9 m³ / 32 ft.³). **Live Rock Surface (incidental take):** In addition, incidental take of live rock may potentially occur as a result of the deployment/footprint of the PROD (corer/drill) – if deployed on live rock: \approx 879.4 ft² / 81.7 m² area of live rock (incidental take) per each deployment of drill/corer for a potential total area of \approx 6156 ft² / 571.9 m² (81.7 m² x 7 cores: two (2) cores x two (2) sites and three (3) cores x one (1) site). *Note: Certain length or depth of cores collected will require either two or three deployments of the drill; the landing site of the drill with each new deployment will be adjacent to the first landing site with an over lapping section – i.e. the total potential footprint (81.7 m²) of the core/drill from cores where two deployments of the drill occur will be almost doubled (minus the

shared overlapping portion) and cores where three deployments of the drill occur will be almost tripled (minus the shared overlapping portion). Total maximum footprint area on live rock will only occur if all deployments of the corer/drill occur on live rock; some deployments of the corer/drill may occur on sand and will not have a footprint on live rock.

Conducting Educational Outreach and Dissemination of Research Results. DAR requests that the project conduct educational community outreach before and after the proposed activity. Request have been made for the project to reach out to various community members in East and West Hawaii (including Kona, Miloli'I, Ho'okena, Honaunau, Kealakekua, Kahalu'u Bay, Kaupulehu and Kiholo), Aha Moku, West Hawai'i Fishery Council and Makahanaloa fishing association. Applicant has assured the Department that all data gathered throughout the duration of this project will be publicly accessible and shared with the State and have also indicated educational briefings or presentations about the vessel and fossil reef core collections can be provided before and after the activity.

Mitigative Measures Implemented to Avoid Impact.

Use of ROV/AUV with cameras or seafloor corer-mounted cameras to pre-survey drill sites to avoid deep-water corals: At each site, existing autonomous underwater vehicle data (where available) will be used to choose the initial site within 125 m-radius buffer zones and seafloor corer-mounted cameras will be used to guide landings and to ensure that the site is clear of obstacles, living reef, or marine life before landing is attempted. The final coring site location will be checked by the science team/coral specialists onboard the vessel for live coral/biota cover using seafloor corer-mounted cameras prior to the seafloor corer being landed on the seabed. The onboard science team includes coral specialists with expertise in both fossil and modern coral taxonomy, including modern mesophotic reef systems. depths and avoid them. The science team/coral specialists onboard the vessel have been provided a reference guide with representative photos to aid in the identification of any deep sea corals that may potentially be encountered at certain sites. On previous expeditions the seafloor corer-mounted cameras have been proven to visualize the seabed effectively and allow for avoidance strategies to be implemented.

Operations of Vessel and PROD. BGS will conduct coring operations responsibly, following good practice successfully used in previous BGS-led scientific reef coring projects: IODP Expedition 310 Tahiti1 (2005) and IODP Expedition 325 Great Barrier Reef2 (2010). The seafloor coring rig will be deployed only when weather conditions permit and can be recovered to deck in a few minutes should the need arise in an emergency situation. The project vessel operator will ensure maintenance of position during corer deployment using GPS and dynamic positioning, and continuous operator watch. The operator will have a backup means of positioning should the primary dynamic positioning system fail (either a secondary dynamic positioning system, or a switch to manual positioning to enable safe recovery of the seafloor corer).

Observance of Protected Species. DAR recommends utilizing a spotter onboard the vessel to observe for any approaching protected species in order to prevent or mitigate any potential interactions that may be avoidable. DAR requests information to be provided on any observances or any interactions with protected species during the activity.

Entanglement Prevention. Efforts will be made by researcher and authorized assistants to utilize best management practices to eliminate any potential for entanglement of any unintended marine organisms (invertebrates, fish, turtles, monk seals, sharks, rays and other protected species) if using or deploying/placing any marine instruments or structures. Entanglement prevention practices will include but are not limited to: checking the marine instruments or structures regular intervals to ensure that protected spp. or non-target spp. have not been entangled, ensuring that any ropes or lines remain taut with no slack at all times and ensuring that there are no structures or components that may potentially cause entanglement to unintended marine organisms (invertebrates, fish, turtles, monk seals, sharks, rays and other protected species). Researcher will immediately notify DAR (catherine.a.gewecke@hawaii.gov or DLNR.aquatics@hawaii.gov) and the appropriate federal agency (NOAA Fisheries Hotline at (888) 256-9840) to report the entanglement of any protected species if incidental entanglement occurs.

Prevention of Spread Invasive Species, Disease and Parasites on corer/drill or AUV/ROV. DAR requests that the project implement an Aquatic Invasive Species (AIS) inspection and disinfection protocol for attachment of organisms when the drill or AUV/ROV is brought back to the surface after the final dive at a site (before moving to a new location), including inspecting and dislodging/returning any unintended attached organisms back to the ocean, and disinfecting/sterilizing any component/surfaces (to the extent practicable) which may come into contact with the sea floor or surrounding organisms, before conducting activities in a new location. If disinfecting/sterilizing is not possible DAR requests that the drill or AUV/ROV be sprayed down vigorously with fresh or salt water hoses in order to dislodging any unintended attached organisms that may not be observed during the initial inspection.

Note: See research proposal included in BLNR submittal for more environmental management, risks and mitigation strategies.

Distribution of Samples/Invasive Species, Disease and Parasites. The permittee will mitigate for the spread of invasive species, disease and parasites between sampling areas (if sampling in environmentally different areas) by utilizing best management practices, including but not limited to, ensuring that all organisms, hand tools or collection bags/containers are inspected and absent of any non-natives or invasive organisms before transportation to lab aquariums (not applicable where invasive species, disease and parasites are target species for collections) or before collection in a new area, and ensuring that all gear is disinfected or sterilized between collection areas (see General Conditions O. Other Collection Guidelines: Aquatic Invasive Species for more guidelines and conditions). Efforts will be made by permittee and authorized assistants to ensure that collection of samples is conducted in such a manner as the process does not result in any additional harm to surrounding organisms or environment. **Permittee and authorized assistants will implement collection/sampling design that removes a sustainable proportion from the local population of target organisms and make efforts to distribute collection activities across shoreline/reef flat/benthic areas, so as not to consolidate the impacts of collection in one location (if applicable/if collecting samples).** Note: In select cases, the permittee and authorized assistants may need to collect all the corals and/or live rock from an area (e.g. areas that are subject to anticipated impact such as harbor renovation projects or other types of marine construction projects or similar projects with anticipated impacts to coral and/or live rock). Discretion should be used to avoid

conflicts with fishers and others during authorized activities. Efforts will be made by permittee and authorized assistants to communicate with the public that have inquiries about the collection activities or methodology. Permittee and authorized assistants will clearly state the overall objective of the project, that these activities require permits, and that the methods the permittee and authorized assistants are employing are not approved for recreational fishing but research, education, management or propagation ONLY.

Gear and Methods. This permit authorizes the following use of non-regulated gear and methodology:

Non-regulated Gear: Seafloor corer - Benthic Geotech Portable Remotely Operated Drill (“PROD”)

Transportation, Preservation and/or Analysis.

Full analysis of the cores and the subsequent scientific reporting takes place in the months and years following the offshore drilling phase. The following is a typical timeline for events after drilling:

- After the offshore phase ends, the core material will be transported to the IODP Bremen Core Repository in Bremen, Germany.
- ~4 months after the offshore phase, a scientific workshop to analyze the cores will be convened in Bremen. There, the cores will be split and a team of international scientists will work to produce an initial set of results from the cores. At the end of the workshop, a one-year moratorium on the core material begins.
- The cores are then shipped to the IODP Gulf Coast Repository at Texas A&M University, where they will be permanently archived.
- 2 months after the workshop, a Preliminary Report is published online and is free to the public.
- 1 year after the workshop, a full Expedition Report is published online and is free to the public. At this time, a moratorium on the core material ends and anyone can apply for samples from the cores for scientific research.
- Associated scientific papers are published by the scientific team in peer-reviewed journals within ~3 years

Consulted Parties: Michael Caine, Administrator, OCCL (Oahu), Brian Neilson, Administrator, DAR (Oahu), David Sakoda, Program Manager, DAR (Oahu), Troy Sakihara, Aquatic Biologist, DAR (Hawaii - Hilo), Chris Teague, Aquatic Biologist, DAR (Hawaii - Kona), Kendall Tucker, Aquatic Biologist, DAR (Oahu), Charles Taylor, Legal Research Specialist, DAR (Oahu) and Catherine Gewecke, Aquatic Biologist, DAR (Oahu).

Exemption Determination: After reviewing §11-200.1-15, HAR, including the criteria used to determine significance under §11-200.1-13, HAR, DLNR has concluded that the activities under this

permit would have minimal or no significant effect on the environment and that issuance of the permit is categorically exempt from the requirement to prepare an environmental assessment based on the following analysis:

1. All activities associated with this permit have been evaluated as a single action. Since this permit involves an activity that is precedent to a later planned activity, i.e., the same methodology used throughout the permit period, the categorical exemption determination here will treat all planned activities as a single action under §11-200.1-10, HAR.

2. The General Exemption Type #5 for Basic Data Collection, Research and Experimental Management with no Serious or Major Environmental Disturbance Appears to Apply. §11-200.1-16 (a) (1) and §11-200.1-16 (a) (2), HAR, exempts the class of actions that involve “basic data collection, research, experimental management, and resource evaluation activities which do not result in a serious or major disturbance to an environmental resource.” This exemption type has been interpreted to include the collection of fossilized reef cores/borings for the purposes of researching sea-level change and climate variability by studying changes in atmospheric and oceanic conditions recorded in the fossil reef, such as those being proposed.

The proposed activities here appear to fall squarely under the general exemption type identified under HAR §11-200.1-16 (a) (1) and §11-200.1-16 (a) (2), as described under the revised 2020 DLNR Exemption List (Concurred on by the Environmental Council on November 10, 2020), under the general exemption type #5 (Part 1), items #1, #7, #13 and #15, which includes, respectively, “conducting surveys or collecting data on existing environmental conditions (e.g., noise, air quality, water flow, water quality, etc.)”, “conducting subsurface investigations (borings) provided the average surface area disturbed is less than one square foot and the implementing division consults with the State Historic Preservation Division on exempting such borings or investigations”, “research that the Department declares is designed specifically to monitor, conserve, or enhance native species or native species' habitat” and “game and non-game wildlife surveys, vegetation and rare plant surveys, aquatic life surveys, inventory studies, new transect lines, photographing, recording, sampling, collection, culture, and captive propagation”.

As discussed below, no significant disturbance to any environmental resource is anticipated. Thus, so long as the below considerations are met, the general exemption types should include the action now contemplated.

3. Cumulative Impacts of Actions in the Same Place and Impacts with Respect to the Potentially Particularly Sensitive Environment Will Not be Significant. Even where a categorical exemption appears to include a proposed action, the action cannot be declared exempt if “the cumulative impact of planned successive actions in the same place, over time, is significant, or when an action that is normally insignificant in its impact on the environment may be significant in a particularly sensitive environment.” §11-200.1-15 (d), HAR. To gauge whether a significant impact or effect is probable, an exempting agency must consider every phase of a proposed action, any expected primary and secondary consequences, the long-term and short-term effects of the action, the overall and

cumulative effect of the action, and the sum effects of an action on the quality of the environment. §11-200.1-13, HAR.

Significant cumulative impacts are not anticipated as a result of this activity, and numerous safeguards further ensure that the potentially sensitive environment of the project area will not be significantly affected. All activities will be conducted in a manner that does not diminish marine resources, qualities, and ecological integrity, or have any indirect, secondary, cultural, or cumulative effects.

Since no significant cumulative impacts or significant impacts with respect to any particularly sensitive aspect of the project area are anticipated, the categorical exemptions identified above should remain applicable.

4. Overall Impacts will Probably have a Minimal or No Significant Effect on the Environment. Any foreseeable impacts from the proposed activity will probably be minimal, and further mitigated by general and specific conditions attached to the permit. Specifically, all research activities covered by this permit will be carried out with strict safeguards for the natural, historic, and cultural resources, other applicable law and agency policies and standard operating procedures.

Conclusion. Upon consideration of the permit to be approved by the Chairperson, being delegated signatory authority on behalf of the Board of Land and Natural Resources at its meeting of October 24, 2008, the potential effects of the above listed project as provided by Chapter 343, HRS, and Chapter 11-200.1, HAR, have been determined to be of probable minimal or no significant effect on the environment and exempt from the preparation of an environmental assessment.

Dawn N. S. Chang, Chairperson
Board of Land and Natural Resources

Date

EXEMPTION LIST FOR THE DEPARTMENT OF LAND AND NATURAL RESOURCES

Concurred on by the Environmental Council on November 10, 2020

GENERAL NOTES

This exemption list for the Department of Land and Natural Resources (“Department” or “DLNR”) is a technical, non-substantive revision of the version reviewed and concurred on by the Environmental Council on March 3, 2020. The revision from the March 3, 2020 version is to rename the categories to be consistent with 2019 revisions to Hawaii Administrative Rules (“HAR”) §11-200.1-15.

The March 3, 2020 list was prepared to comply with 2019 revisions to the Hawaii Administrative Rules (“HAR”) §11-200.1. This revision separates exemption lists into categories listed in §11-200.1-16 (a)(1) and (2). Activities categorized as “Part 1” will fall under §11-200.1-16 (a) (1). Activities categorized as “Part 2” will require an exemption notice and fall under §11-200.1-16 (a) (2). Additionally, the qualifiers limiting the actions to state lands or Department facilities were removed to cover the activities being permitted in the Conservation District as well as Department-initiated actions occurring on partner lands. This list supersedes all previous exemption lists of the DLNR and its Divisions, including the following: (1) December 4, 1991 DLNR Department-wide list (2) January 19, 1976 DLNR Division of Fish and Game list (3) September 19, 1984 DLNR Division of Water and Land Development list (4) April 28, 1986 DLNR Division of Land Management list (5) December 4, 1991 DLNR State Parks list (6) March, 1995 DLNR Division of Boating and Ocean Recreation list (7) June 12, 2008 DLNR Division of Forestry and Wildlife list (8) July 13, 2011 DLNR additions to Department-wide list (9) May 17, 2012 DLNR addition to Department-wide list, and (10) June 5, 2015 DLNR Department-wide list.

Hawaii Revised Statutes (“Haw. Rev. Stat.”) Chapter 343 authorizes the Environmental Council to establish procedures to exempt specific types of action from the preparation of an environmental assessment because the action will have minimal or no significant effect on the environment. The Department, through time and experience, developed the following exemption list identifying particular activities that fall within the exempt classes described in Hawaii Administrative Rules (“HAR”) §11-200.1 subchapter 8. All exemptions under subchapter 8 are inapplicable when the cumulative impact of planned successive actions in the same place, over time, is significant, or when an action that is normally insignificant in its impact on the environment may be significant in a particularly sensitive environment.

General Exemption Type 1

Operations, repairs or maintenance of existing structures, facilities, equipment, or topographical features, involving minor expansion or minor change of use beyond that previously existing.

PART 1

1. Removal of boulders, rocks, hazardous trees, marine debris, and other similar hazards necessary to maintain lands and waters in a safe condition.
2. Rescue of threatened or endangered species.
3. Maintenance dredging of small quantities of material from existing launching ramps, navigation channels, and berthing areas, not to exceed their originally designed depths and as permitted by the U.S. Army Corps of Engineers, Honolulu District, under a Nationwide Permit 35 (Maintenance Dredging

of Basins), with disposal of dredged material at approved landfill sites or the placement of sand on adjacent areas in accordance with Haw. Rev. Stat. § 205A-44.

4. Operation, repair and maintenance, of existing structures and facilities, including baseyards, offices, cabins, sheds, and fencing.
5. Repair or maintenance of existing signs, buoys, markers, and aids to navigation.
6. Operation, repair and maintenance of existing fisheries facilities, involving capture, containment, sustaining, experimentation, and husbandry of various freshwater, estuarine, and marine fishes, invertebrates, and other aquatic organisms.
7. Operation, repair and maintenance of existing fish aggregating devices and artificial reefs.
8. Operation, repair and maintenance of existing nurseries, arboreta, and captive propagation facilities.
9. Operation, repair and maintenance of existing loading docks, piers, piles, boat launch ramps, offshore mooring facilities, and other similar support structures, as permitted by the U.S. Army Corps of Engineers, Honolulu District, under a Nationwide Permit.¹
10. Operation, repair and maintenance of existing recreational facilities, such as campsites, cabins, shelters, and other similar structures, and the appurtenant support facilities and structures.
11. Operation, repair or maintenance of existing fire tool caches, fuel breaks, and helispots.
12. Repair and maintenance of existing bollards, walls, gates, fences, lighting, and other similar items necessary for the security or continued operation of a facility or structure.
13. Repair and maintenance of existing utilities and drainage systems.
14. Repairs to existing ground water, surface water, or climatological monitoring equipment, and other similar monitoring and data collection equipment, and the structures that house or protect them.
15. Repairs necessary to maintain existing electrical, telemetry or communications systems and the structures that house or protect them.
16. Repair and maintenance of existing bridges and flumes.
17. Repair and maintenance of existing water diversions and intake structures, including valves, gates, intake boxes, and lines, in order to collect or improve the collection at the location of the existing water source diversion works.
18. Repair and maintenance of existing water tanks, water catchment basins, water units, pumps and controls, pipes, channels, dikes, and moats.
19. Repair and maintenance of existing dam or reservoir structures and appurtenant features, including outlet works repair, gate replacements, ditch clearing, replacement of catwalk and access ways, spillway

¹ The previous exemption list limited this action to permit #3 "Maintenance," which was removed in this version to be consistent with the other categorical permits issued that would fall under this type of activity.

modifications to safely pass anticipated flood waters, and spillway reconstruction to mitigate possible failures.

20. Repair, maintenance, or relining of conveyance structures associated with existing dam or reservoir structures.

21. Repair and maintenance work on or the breaching of existing dam or reservoir structures of an emergency nature due to storm, earthquake, or other natural disaster or other forms of damage, latent defects in construction, and conditions not previously observed during routine inspections that results in a condition that poses a significant hazard to public safety and the environment. The work necessary to mitigate the danger posed to the environment and public safety includes emergency clearing and grading for breaching or stabilization work, installation and operation of siphons and pumping systems to discharge water from the reservoir, construction of seepage drains, and the construction of seepage monitoring berms.

22. Repair and maintenance of historic and archaeological sites to maintain the integrity of historic structures, archaeological features and sites in compliance with Chapter 13-275, Hawaii Administrative Rules, "Rules Governing Procedures for Historic Preservation Review for Governmental Projects Covered Under Section 6E-7 and 6E-8, Hawaii Revised Statutes" which requires review by the State Historic Preservation Division for agency actions that may affect historic properties.

23. Maintenance of existing boardwalks, trails and unpaved roads.

24. Maintenance of rights-of-way other than public rights-of-ways.

25. Repair and maintenance of existing roadways, roadway shoulders, road structures and signage, parking areas, walkways, bikeways, multi-use pathways, driveways, and boat launch ramps (includes grading, resurfacing, infilling, sealing, grooving, cleaning, chipping, painting and patching).

26. Maintenance of existing landscaping, including planting, trimming, mowing, and irrigation.

27. Maintenance of lands and waters to remove weeds, brushes, grass and other unwanted vegetation.

28. Routine pruning, trimming, thinning, and removal of trees, excluding commercial logging.

29. Termite and pest control treatment using Environmental Protection Agency and State Department of Agriculture approved pesticides under the supervision of certified applicators provided that treatment is limited to existing structures, facilities, or equipment.

30. Repair and maintenance of existing machinery, equipment, vessels, and vehicles used to support Departmental operations.

31. Removal and disposal of rubbish and debris from lands and waters.

32. Removal of silt, debris, sand and limu from above high water mark, from river and stream mouths, and from boat launching ramps.

33. Clearing of shoreline areas and submerged lands of non-natural hazardous objects and materials such as sunken/derelict craft remnants, oil spill residues, etc.

34. Storage of construction equipment and materials for a limited period of time as necessary to support planned or existing construction or repair.
35. Law enforcement, regulation compliance, resources and environmental monitoring, debris or property removal, and other administrative measures.
36. Transfer of management authority over state-owned land, such as setting aside of state lands to or from other government agencies through a Governor's executive order.
37. Transfer of title to land.
38. Acquisition of land or interests in land.
39. Creation or termination of easement, covenants, or other rights in structures or land.
40. Leases of state land involving negligible or no expansion or change of use beyond that previously existing.
41. Subdivision or consolidation of lots not previously subdivided.
42. The award of grants under Haw. Rev. Stat. Chapter 173A provided that the grant does not fund an activity that causes any material change of use of land or resources beyond that previously existing.
43. Conduct public meetings and hearings for the purpose of the collection and dissemination of public information, to discuss matters under the jurisdiction of the Department, to develop administrative rules, guidelines or other public policy, and other similar purposes.
44. Permits, licenses, registrations, and rights-of-entry issued by the Department that are routine in nature, involving negligible impacts beyond that previously existing.
45. Use of lands and waters by those exercising traditional and customary practices for minor non-commercial purposes or for the gaining of traditional ecological knowledge.
46. Granting to a person the privilege to conduct operations involving the provision of goods, wares, merchandise, or services to the general public including, but not limited to, tours, food and beverage operations, retail operations, rental operations, or communications and telecommunications services in or on an existing building, facility, or area.

PART 2

1. Mitigation of any hazardous conditions that present imminent danger as determined by the Department Director and that are necessary to protect public health, safety, welfare, or public trust resources.
2. Upon determination by the Department Director that an emergency exists, emergency mitigation and restoration work to prevent damage from continuing to occur and to restore the topographical features and biological resources.

General Exemption Type 2

Replacement or reconstruction of existing structures and facilities where the new structure will be located generally on the same site and will have substantially the same purpose, capacity, density, height, and dimensions as the structure replaced.

PART 1

1. Replacement or reconstruction of existing structures and facilities, including baseyards, offices, cabins, sheds, and fencing.
2. Replacement or reconstruction of existing signs, markers, buoys, or aids to navigation.
3. Replacement or reconstruction of existing fisheries facilities.
4. Replacement or reconstruction of existing recreational facilities, such as campsites, cabins, shelters, and other similar structures, and the appurtenant support facilities and structures.
5. Replacement or reconstruction of existing bollards, walls, gates, fences, lighting and other similar items necessary for the security or continued operation of a facility or structure.
6. Minor upgrades or replacement of existing utilities and drainage systems. Drainage improvements will generally consist of the installation of culverts, pipes, and construction of gutters or other similar infrastructure where minor flooding occurs.
7. Replacement of cesspools with individual wastewater systems located generally on the same site with substantially the same purpose and capacity.
8. Replacement or reconstruction of existing sewage and water pumping stations and treatment facilities to maintain established codes and standards, provided that reconstructions that expand the capacity or geographical service area of existing facilities shall not be exempt.
9. Replacement or reconstruction of existing ground water, surface water, or climatological monitoring equipment, and other similar monitoring and data collection equipment, and the structures that house or protect them.
10. Replacement or reconstruction of existing electrical, telemetry, or communications systems and the structures that house or protect them.
11. Replacement or reconstruction of existing bridges and flumes.
12. Replacement or reconstruction of existing water diversions and intake structures, including valves, gates, intake boxes, and lines, in order to collect or improve the collection at the location of the existing water source diversion works.
13. Replacement or reconstruction of existing water tanks, water catchment basins, water units, pumps and controls, pipes, channels, dikes, and moats, in a size commensurate with existing system and source capacities and requirements to provide service in existing water systems.
14. Replacement or reconstruction of existing drainageways and waterways.

15. Replacement or reconstruction of existing dam or reservoir structures and appurtenant features, including outlet works repair, gate replacements, ditch clearing, replacement of catwalk and access ways, spillway expansion or improvements, and spillway reconstruction to mitigate possible failures.
16. Rehabilitation and restoration of existing structures and features at historic and archaeological sites in compliance with Chapter 13-275, Hawaii Administrative Rules, "Rules Governing Procedures for Historic Preservation Review for Governmental Projects Covered Under Section 6E-7 and 6E-8, Hawaii Revised Statutes" which requires review by the State Historic Preservation Division for agency actions that may affect historic properties.
17. Replacement or reconstruction of existing boardwalks, trails, and unpaved roads.
18. Replacement or reconstruction of existing roadways, roadway shoulders, road structures and signage, parking areas, walkways, bikeways, multi-use pathways, driveways, and boat launch ramps.
19. Replacement or renovation of existing landscaping or vegetation.
20. Re-vegetate burned or eroded areas to encourage the succession of selected plant species to prevent soil erosion and promote the goals of the Department.
21. Replacement or reconstruction of existing machinery, equipment, vessels, or vehicles used to support Departmental operations.
22. Minor alterations and repairs required to bring existing buildings, structures, facilities, and equipment into compliance with current building codes and applicable federal and state regulations.
23. Replacement or reconstruction of existing nurseries, arboreta, and captive propagation facilities.
24. Repairs and modifications to existing sewage and water pumping stations and treatment facilities to maintain established codes and standards, provided that modifications that expand the capacity or geographical service area of existing facilities shall not be exempt.

PART 2

1. Replacement or reconstruction of fish aggregating devices or artificial reefs.
2. Replacement or reconstruction of existing loading docks, piers, piles, boat launch ramps, offshore mooring facilities, and other similar support structures, not to exceed the footprint of the existing facility, as permitted by the U.S. Army Corps of Engineers, Honolulu District, under a Nationwide Permit.²

General Exemption Type 3

Construction and location of single new, small facilities or structures and the alteration and modification of the facilities or structures and installation of new, small, equipment and facilities and the alteration and modification of the equipment or facilities, including but not limited to: (A) Single family residences less than 3,500 square feet, as measured by the controlling law under which the proposed action is being considered, if not in conjunction with the building of two or more such units; (B) Multi-unit structures

² The previous exemption list limited this action to permit #3 "Maintenance," which was removed in this version to be consistent with the other categorical permits issued that would fall under this type of activity.

designed for not more than four dwelling units if not in conjunction with the building of two or more such structures; (C) Stores, offices and restaurants designed for total occupant load of twenty individuals or fewer per structure, if not in conjunction with the building of two or more such structures; and (D) Water, sewage, electrical, gas, telephone, and other essential public utility services extensions to serve such structures or facilities; accessory or appurtenant structures including garages, carports, patios, swimming pools, and fences; and acquisition of utility easements.

PART 1

1. Improvement of existing trails and construction or improvement of boardwalks on existing trails for recreation, education, and management.
2. Construction of security features, including fencing, gates, cameras, and other similar items.
3. Installation of weatherports and radio repeaters and other similar communications equipment and related infrastructure for natural resource management purposes or for emergency response.
4. Construction of drainage swales and structures and other similar surface runoff management techniques with minimal or no effect on the environment.
5. Re-burial of previously identified or inadvertently discovered remains over fifty (50) years old, with Department and landowner approval and according to guidelines provided in HAR Chapter 13-300.
6. Installation and removal of irrigation systems.
7. Utility service connection and installation.
8. Construction and location of new, small facilities or structures necessary to support or enhance safe and effective management of lands and waters, such as utility sheds, storage buildings, nurseries, trash containers, fire caches, tollbooths, gates, safety enhancements (e.g., handrails, guard rails, ramps), covered or open areas for endangered species, game birds and mammals, auxiliary buildings for food or equipment storage, incubators and brooders, open-top breeding and release pens, field aviaries, and hacking boxes, and for watershed and native forest management and restoration, and other similar structures.
9. Construction and location of new, small facilities or structures necessary to support or enhance public recreational use of lands and waters, such as outdoor showers, signage, interpretive kiosks, viewing platforms, tables, grills, lifeguard stations, improvements necessary for compliance with the Americans with Disabilities Act, and other similar structures.
10. Construction, placement or installation of signage, pavement markings, buoys, or other similar structures.
11. Placement of aerators for increasing the dissolved oxygen content for fish populations in reservoirs, nurseries, ponds.
12. Installation and operation of automatic feeding devices in reservoirs, ponds or other impoundments.
13. Installation of glare screens, bollards, guard rails, vehicular access barriers, and other similar appurtenances designed to protect the public.

14. Construction or placement of utilities (telecommunications, electrical, solar panels, drainage, waterlines, sewers) and related equipment (such as transformers, poles, cables, wires, pipes) accessory to existing facilities.
15. Installation of alarm systems, camera systems, and similar surveillance items for security and safety purposes.
16. Construction of walls, fencing, or screens around buildings, structures, facilities, or equipment.
17. Construction of water tanks with less than 20,000 gallon capacity.
18. Installation of water catchment systems, lines, and faucets.
19. Placement or construction of gas tanks for fueling cooking stoves installed in or near existing structures.
20. Placement or construction of accessory structures such as office trailers, trash enclosures, bus shelters, picnic shelters, parking and fee collection facilities, checking stations, dock boxes, mooring cleats, bumpers, and mooring buoys, blocks and piles, and other similar structures accessory to existing facilities.
21. Installation of hurricane or wind protection devices and other minor structural accessories that will facilitate resistance to damaging effects of natural hazards.
22. Interior alterations and renovations to offices, buildings or structures that do not increase the floor area or change the maximum occupancy to include: a. installation of office partitions, utility outlets or connections, air conditioning, lighting, and security systems; b. renovations required to bring existing structures into compliance with current building codes and applicable health, safety, and access regulations; c. renovations that will result in energy or other operational/cost savings; or d. other similar interior alterations.
23. Expand utilities as need dictates in existing structures.
24. Construction required to maintain or upgrade existing utilities.

PART 2

1. Natural resource management actions that the Department declares are designed specifically to monitor, conserve, or enhance the status of native species or native species' habitats, such as fences around or to manage rare, threatened or endangered plants. Fences shall contain step-overs or other features that permit pedestrian access for cultural and recreational use.
2. Construction and location of new, small facilities or structures necessary to support or enhance safe and effective management of lands and waters, such as baseyards, caretaker's residences, work cabins and shelters, sanitation facilities, and other similar structures.
3. Construction and location of new, small facilities or structures necessary to support or enhance public recreational use of lands and waters, such as comfort stations and related individual wastewater

disposal systems, sanitation facilities, pavilions, shelters, cabins, campgrounds, and other similar structures.

4. Construction of roadways with distances less than 1,000 yards (excluding access roads) and walkways.
5. Construction of off-street parking facilities having capacities of up to 25 passenger vehicle stalls.
6. Installation of automatic fish feeding devices in reservoirs, ponds, or other impoundments and fish aggregating devices within pre-approved sites.
7. Installation of marine vessel sewage pump out stations and supporting facilities.
8. Construction of irrigation ditches, flumes and structures having less than 200 gpm.
9. Construction of Civil Defense emergency system facilities.
10. Installation of rearing pens for cage culture of fishes and aquatic organisms.
11. Construction or placement of lighting systems for street lights, and outdoor security lighting.
12. Construction of interior roadways, driveways, parking areas, sidewalks, pathways, aisles, curbs, gutters, and other similar items.
13. Rearing pens for cage culture of various freshwater, estuarine, and marine fishes, invertebrates, and other aquatic organisms.

General Exemption Type 4

Minor alterations in the conditions of land, water, or vegetation.

PART 1

1. Improvements of previously existing graded parking and storage yard areas, including paving, infilling, grading and compacting.
2. Minor vegetation clearing and management, including mowing, pruning, trimming, and application of federal and state approved herbicides in conformance with label instructions.
3. Removal of invasive vegetation utilizing cutting, mowing, application of federal and state approved herbicides in conformance with label instructions, distribution of biocontrol agents already approved and permitted by the State of Hawaii, and other approved methods. This exemption would not apply to issuing permits for initial releases of biocontrol of invasive species which are regulated and permitted by the Department of Agriculture or commercial logging.
4. Vegetation clearing and removal work to mitigate rockfall or on or near the embankment, spillway, or outlet works of a dam facility of vegetation that could pose a threat to the embankment or impede inspection of the facility.
5. Establish temporary or permanent vegetative cover including trees, shrubs, grasses, and sod for landscaping, reforestation, soil stabilization, watershed protection, native wildlife habitat, native ecosystem restoration, and rare plant preservation; provided, however, that this exemption shall not

apply to vegetation that is likely to be invasive or for tree plantings for which harvesting is planned or is reasonably foreseeable.

6. Gathering plant seed, cuttings, or other vegetative matter for propagation.
7. Minor ground adjustments (e.g., grading, grubbing, cutting, clearing, or filling) that do not require grading permits.
8. Minor alterations in waters, including restoration of native species and control of invasive weeds, algae, invertebrates, fishes or other invasive aquatic organisms.
9. Control of pests utilizing federal and state approved pesticides, herbicides, fungicides, and toxicants in conformance with label instructions; traps, snares, lures, and repellents; and other approved methods.
10. Management of surface water runoff, including installation of minor drainage ditches and implementation of other stormwater best management practices and low impact development techniques (e.g., bioretention areas, permeable pavers, etc.).
11. Minor alteration of retaining walls, excluding seawalls.
12. Removal or filling of unused or unusable cesspools pursuant to federal and state regulations.
13. Construction, in accordance with established state standards, required to seal production, monitoring, and geothermal wells, that have been permanently discontinued, that are unsealed, leaking, polluting, deteriorating in quality, uncontrollable, buried, or that are in such a state of disrepair that continued use is impractical or unsafe.
14. Fire management activities, including prevention and restoration measures, when conducted in accordance with Departmental and Division procedures.
15. Captive propagation of birds, mammals, invertebrates, or aquatic organisms; cultivation of plants. Housing, care, feeding, veterinarian examination, breeding (pairing, hatching, brooding, fledgling, rearing), cross fostering, double clutching nests, and experimental studies of native species (including those which are rare, threatened or endangered), game birds and game mammals.
16. The reintroduction or supplementation (e.g., stocking) of native, formerly native, or established species into suitable habitat within their historic or established range, where no or negligible environmental disturbances are anticipated.
17. Establishment of helispots for fire control, natural resource management, and rescue.
18. Repair, modify, and clear existing drainageways and waterways to maintain in safe working condition.

PART 2

1. Upon determination by the Department Director that an emergency exists, emergency mitigation and restoration work to prevent further damage from occurring and to restore the topographical features and biological resources.

2. Clearing of new fuel breaks and other similar fire pre-suppression actions to reduce fire potential and minimize fire severity.
3. Controlled burning of vegetation less than ten (10) acres in size to improve wildlife habitat where non-native vegetative cover constitutes greater than 75% of the area.
4. Beach restoration, sand dune restoration, and sand pushing activities of less than 10,000 cubic yards of beach quality sand.
5. Conduct removal of unexploded ordnance.
6. Grading work to stabilize existing slopes and mitigate rockfall, including work required to mobilize equipment.
7. Construction of walkways and pathways and other similar items.

General Exemption Type 5

Basic data collection, research, experimental management, and resource and infrastructure testing and evaluation activities that do not result in a serious or major disturbance to an environmental resource.

PART 1

1. Conduct surveys or collect data on existing environmental conditions (e.g, noise, air quality, water flow, water quality, etc.).
2. Non-destructive data collection and inventory, including field, aerial and satellite surveying and mapping.
3. Conduct topographic, sounding, wave, littoral transport, bathymetric, and location surveys.
4. Periodic collection of data by the State Office of Conservation and Coastal Lands ("OCCL") for the purpose of monitoring existing beaches to include identification, mapping, and analysis of offshore sand deposits, bathymetry mapping, sub-bottom profiling (to measure the thickness of existing sand deposits), vibracore sampling (to conduct grain size analysis to determine suitability of a sand source for beach restoration), deposit depth probing (jet probing of sand depths), and marine biological and water quality surveys to identify sensitive resources or areas of concern.
5. Installation of new, small groundwater, surface water, or climatological monitoring and data collection equipment, structures that house or protect this equipment, and installation of electrical, telemetry, or communications systems to service this equipment.
6. Construct or rehabilitate groundwater monitoring stations in accordance with established state standards, install groundwater monitoring equipment, and collect data.
7. Conduct subsurface investigations (borings) provided the average surface area disturbed is less than one square foot and the implementing division consults with the State Historic Preservation Division on exempting such borings or investigations.
9. Installation of staff gages, water monitoring and reporting equipment at dam facilities and appurtenant works to include trenching work and construction of supporting features such as

equipment sheds, transmitting devices, solar panels, and minimal site grading and improvements for the safe operations and installation of these features.

10. Phase II Investigation work on a dam or reservoir, including soil sampling and drilling, water monitoring, and/or test pit excavations. This may include clearing or construction of site improvements needed to mobilize equipment or personnel to accomplish the task.

11. Conduct geothermal exploration activity that involves non-invasive geophysical operations for testing and analysis. Activities conducted under this exemption shall comply with all applicable federal, state and county laws, rules, regulations, guidelines and standards. This exemption would not apply in Urban or Conservation land use districts or in sensitive environments.

12. Conduct terrestrial and marine archaeological surveys.

13. Research that the Department declares is designed specifically to monitor, conserve, or enhance native species or native species' habitat.

14. Implanting transponders and affixing tags, transmitters, markers, or other similar devices to birds, mammals, invertebrates, or aquatic organisms to record movement, longevity, growth, distribution, behavior, and other activities; taking disease or blood samples from birds, mammals, invertebrates, or aquatic organisms; and placing remote monitoring devices (to determine animal movement), cameras, equipment and feeders.

15. Game and non-game wildlife surveys, vegetation and rare plant surveys, aquatic life surveys, inventory studies, new transect lines, photographing, recording, sampling, collection, culture, and captive propagation.

16. Research to identify, monitor, control, or eradicate introduced species.

17. Conduct assessment and survey of unexploded ordnance.

18. Appraisal of real property for land exchange proposals, determination of acquisition/sales price, rental establishment or the establishment of royalties.

19. Conduct planning and feasibility studies.

20. Permission to enter lands for the purpose of conducting those activities listed above.

PART 2

1. Construction of test wells with casing diameter of not more than 12 inches to provide ground truth for water resources investigations, the suggested size will enable the aquifer to be tested for its physical, chemical, biological qualities, as well as providing a pumping test to determine the specific capacity of the aquifer. Test wells shall not be developed to serve water unless an EIS or negative declaration is prepared.

2. Research or experimental wildlife and plant management actions, including controlled grazing or burning as a management tool.

3. Experimental management actions to identify, monitor, control, or eradicate introduced species.

4. Experimental management actions that the Department declares are designed specifically to monitor, conserve, or enhance native species or native species' habitat.

General Exemption Type 6

Demolition of structures, except those structures that are listed on the National Register or Hawaii Register of Historic Places.

PART 1

1. Construction, in accordance with established state standards, required to seal wells, that have been permanently discontinued, that are unsealed, leaking, polluting, deteriorating in quality, uncontrollable, buried, or that are in such a state of disrepair that continued use is impractical or unsafe.
2. Demolition and removal of existing structures, facilities, utilities, and other improvements, except those structures located on any historic site as designated in the National Register or Hawaii Register as provided for in the National Historic Preservation Act of 1966, 16 U.S.C §§470 et. seq., as amended, or Haw. Rev. Stat. Chapter 6E.
3. Demolition and removal of experimental devices or other equipment, when such devices or equipment are no longer used or needed.
4. Demolition and removal of abandoned private property.
5. Demolition and removal of unauthorized improvements.

General Exemption Type 7

Zoning variances except shoreline setback variances.

PART 1

1. Application for zoning variance for use of state lands disposed to private parties or to governmental agencies, except shoreline setback variances.

General Exemption Type 8

Continuing administrative activities.

PART 1

1. Purchase of supplies, equipment, materials, motor vehicles, boats, and services.
2. Contracts for small purchases, professional services, competitive sealed proposals, competitive sealed bidding, or purchase of goods and services which are exempt from Haw. Rev. Stat. Chapter 103D.
3. Requests for federal, state, county or private assistance grants to support ongoing operations or implement programs of the Department.
4. Personnel-related actions.
5. Training, environmental interpretation, public safety efforts and other educational activities.

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IODP
INTERNATIONAL OCEAN
DISCOVERY PROGRAM

Summary of IODP Expedition 389

Drowned corals reefs around Hawaii: unique archive of sea-level, climate change and reef response over the last 500,000 years

January 2023

Produced for interested agencies and community groups

by

The ECORD Science Operator (ESO)



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1 Introduction

1.1 Purpose of this document

This document summarizes a proposal to conduct scientific ocean drilling around Hawaii by the ECORD Science Operator. It is intended to provide the appropriate authorities, other interested agencies and community groups with background information prior to formal permit application submission. The ECORD Science Operator is soliciting input and advice from any government or non-government agencies and community groups across Hawaii, to assist with project planning.

1.2 Background of IODP and ESO

The International Ocean Discovery Program (IODP¹) is a multinational program of scientific research in the oceans which uses drilling and logging to undertake research on earth system processes. IODP is the latest phase of an international scientific ocean drilling project that has been in existence since the 1960s and has drilled hundreds of boreholes worldwide.

The USA, Japan and Europe are the lead members of IODP. Europe's contribution is via a consortium that includes 14 European countries² and Canada. This European consortium is called the European Consortium for Ocean Research Drilling (ECORD³). IODP is funded by the science foundations and councils of partner countries, and is therefore wholly funded by the public.

ECORD has commissioned the British Geological Survey (BGS), UK, to coordinate the ECORD Science Operator (ESO), a group of research institutes that implement scientific drilling expeditions under the auspices of IODP. The other members of ESO are the University of Bremen, Germany, and the European Petrophysics Consortium (EPC). The EPC is a partnership between the University of Leicester, UK, and the University of Montpellier, France.

ESO was created to implement scientific drilling expeditions in specific environments where the larger IODP vessels, the US-operated *JOIDES Resolution*⁴ and the Japanese-operated *Chikyu*⁵, cannot operate. To do this, ESO charters platforms on a mission-specific basis, and to date ESO has carried out operations in the Arctic ice, on the coral reefs around Tahiti and on the Great Barrier Reef, and within the shallow waters of the Baltic Sea.

The Tahiti and Great Barrier Reef expeditions studied sea level and environmental changes over the last 20,000 years in the South Pacific. The work is of direct societal relevance at a time of global climate change and predicted changes to coral reef ecosystems. The Tahiti and Great Barrier Reef expeditions were planned with a strong emphasis on minimizing environmental impact, and were successfully carried out in October to November 2005

¹ www.iodp.org (see also [Appendix A - Useful Internet Links and Contacts](#))

² Austria, Denmark, Finland, France, Germany, Ireland, Italy, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom.

³ www.ecord.org

⁴ https://iodp.tamu.edu/publicinfo/ship_history.html

⁵ <http://www.iamstec.go.jp/chikyu/e/about/>

(Tahiti⁶) and February to April 2010 (GBR⁷) with no environmental incidents. It is proposed to use similarly environmentally sound methodologies, described below, to conduct scientific drilling around Hawaii, which aims to recover a unique archive of sea-level, climate change and reef response over the last 500,000 years.

ESO anticipates carrying out the Hawaii Expedition in September and October 2023. Our methodology will be based on the methods successfully used for the Tahiti and Great Barrier Reef expeditions, which will minimize impact on the local reef environment and wildlife. Furthermore, it is recognized that any social, cultural and economic impacts of this expedition need to be considered and openly addressed.

1.3 The Hawaii Drowned Reef Proposal

The proposal to conduct scientific drilling around Hawaii was submitted to IODP in April 2008 by a group of coral reef, paleoclimate and microbiology specialists led by Prof. Jody Webster⁸, University of Sydney, and co-proposed by Dr Charles Fletcher⁹, University of Hawaii (IODP Proposal 716¹⁰). Prof. Webster will serve as the Co-chief Scientist for this expedition, alongside Prof. Ana Christina Ravelo¹¹ (University of California, Santa Cruz, USA).

The proposal has passed through the IODP Science Advisory Structure, a series of panels which assess the scientific rationale, site surveys, environmental protection and safety measures, and was transferred to ESO for scoping in August 2009. ESO are currently compiling information for permitting requirements, and are refining the methodology for implementing the scientific drilling operation off Hawaii.

The expedition is provisionally scheduled for September to October 2023. Initial estimates for the duration of the offshore phase is a maximum of 60 days, although the exact duration will be controlled by the balance of available budget and costs.

1.4 Scientific Objectives

Surrounding the island of Hawaii are a series of twelve fossil coral reefs that formed as the reef communities successively grew and were drowned by rising sea-levels and/or the near constant subsidence of the crust around the ever-growing volcanic archipelago of Hawaii. When combined with Hawaii's location away from the influence of any of the large Quaternary ice-sheets, or strong boundary ocean currents that can mask the sea-level and paleoclimate signals, this location presents a unique succession of expended reef sequences, key for the recovery of high-resolution climate and reef response records.

⁶ <http://publications.iodp.org/proceedings/310/310toc.htm>

⁷ <http://publications.iodp.org/proceedings/325/325toc.htm>

⁸ Prof. Jody Webster, Geocoastal Research Group, School of Geosciences, University of Sydney, Australia. <https://sydney.edu.au/science/people/jody.webster.php>

⁹ Dr Charles Fletcher, University of Hawai'i at Mānoa, Honolulu
<https://www.soest.hawaii.edu/soestwp/about/directory/chip-h-fletcher/>

¹⁰ https://docs.iodp.org/Proposal_Cover_Sheets/716-Full2_Webster_cover.pdf

¹¹ Prof. Ana Christina Ravelo, Institute of Marine Sciences, University of California, Santa Cruz, USA.
<https://oceansci.ucsc.edu/faculty/index.php?uid=acr>

As corals grow, they trap environmental clues within their structure, becoming unique records of ocean temperature and acidity as well as capturing evidence of the atmosphere within their structure. Looking back into these records from now-dead coral reef systems can help scientists reconstruct changes in the Earth's climate in the past. Coral communities also grow in known patterns – some prefer a quieter back-reef position to grow whilst other species prefer the more turbulent fore-reef position. They also like certain depths and light conditions. By looking at how the fossil communities have grown, scientists can reconstruct what sea-level was doing at the time, and link it to the changes in atmospheric and oceanic conditions recorded by the corals.

However, our understanding of the links and mechanisms that control sea-level and global climate changes has been significantly hampered by a lack of appropriate fossil coral records over the last 500,000 years - particularly into and out of the glacial periods. This expedition proposes to address this problem directly by drilling a unique succession of drowned, non-living coral reefs around Hawaii now found at 129 to 1234 m below today's sea level (Figure 1). These reefs span important periods in Earth climate history and are generally not represented anywhere else in the world.

Abundant observational and numerical modeling data indicate that the internal stratigraphy and tops of these reefs were highly sensitive to sea-level and climate changes, thereby providing a firm template with which to conduct these operations. As a direct result of Hawaii's rapid but nearly constant subsidence, a thick (100-200m) expanded sequence of shallow coral reef dominated facies is preserved within the reefs. These reefs span important periods in Earth climate history, either not available or highly condensed on stable (Great Barrier Reef, Tahiti) and uplifted margins (Papua New Guinea, Barbados) due to a lack of accommodation space and/or unfavorable shelf morphology.

Specifically, these data show that the reefs grew (for 90,000-100,000 years, albeit episodically) into, during and out of the majority of the last five to six glacial cycles. Therefore, scientific drilling through these reefs will generate a new record of sea-level and associated climate variability during several controversial and poorly understood periods over the last 500,000 years.

The scientific team will core at up to eleven locations, to a depth of up to 110 m below the seafloor, with the aim to address questions on four main themes:

1. To reconstruct sea-level change in the central Pacific over the last 500,000 years.
2. To reconstruct the variability in climate over the last 500,000 years, as recorded in the fossil corals, and better understand the differences in response between a seasonal – inter-annual variation in climate against what represents a more permanent shift in sea surface temperature, rainfall and storm tracks.
3. To understand how coral reef systems respond both geologically and biologically to rapid changes in sea-level and climate – for example can reefs turn on and off when they reach certain limits, and how do they recover from disturbances in the system.
4. To explain the subsidence and volcanic history of Hawaii.

Region & priority	Site Name	Reef ID	Reef Age	Water Depth (mbsl)	Latitude ²	Longitude ²	Sediment penetration (m)
Primary							
Kona	KON-01A ¹	H1D	MIS 1-5	-145	19.600341	-156.010975	80
Kawaihae	KAW-03B ¹	H1D	MIS 1-5	-154	19.990308	-155.873431	85
Kawaihae	KAW-04B ²	H2D	MIS 6-7	-414	19.942109	-156.062876	110
Kawaihae	KAW-06A ²	H4	MIS 8-9	-737	20.036417	-156.065696	65
Kawaihae	KAW-07A ²	H6	MIS 10-11	-988	20.137266	-156.079341	70
Mahukona	MAH-01A ³	H8A	MIS 12-13	-1102	20.055411	-156.189697	110
Mahukona	MAH-02A ³	H8B	MIS 12-13	-1154	20.050262	-156.192035	110
Kohala	KOH-01A ²	H2D	MIS 6-7	-410	20.290268	-155.651218	80
Kohala	KOH-02A ²	H7	MIS 10-11	-931	20.273958	-155.490294	45
Hilo	HIL-01A ¹	H1D	MIS 1-5	-134	19.758805	-154.985708	110
Hilo	HIL-05A ²	H2D	MIS 6-7	-402	19.876999	-154.939618	110
					Total (primary)		975
Alternate							
Kawaihae	KAW-01B ¹	H1B	MIS 1-5	-129	19.99093302	-155.8563025	80
Kawaihae	KAW-02B ¹	H1C	MIS 1-5	-132	19.99383926	-155.8644029	90
Kawaihae	KAW-05B ²	H2D	MIS 6-7	-463	19.957553	-156.039013	100
Hilo	HIL-02A ²	H2A	MIS 4-7	-271	19.883005	-155.029932	90
Hilo	HIL-03A ²	H2B	MIS 5a?-7	-338	19.867141	-154.973387	90
Hilo	HIL-04A ²	H2C	MIS 5a?-7	-354	19.869407	-154.954576	90
Mahukona	MAH-03A ³	H9	MIS 14-15?	-1213	20.140405	-156.238194	50
Mahukona	MAH-04A ³	H10	MIS 14-15?	-1234	20.065165	-156.266945	50
Mahukona	MAH-05B ³	H11	MIS 14-15?	-1203	20.1797	-156.256232	70
					Total (alternate)		710

Table 1. Summary of proposed primary and alternate drill sites around Hawaii. There are 20 sites in total; ¹5 sites within 3 NM of the coast, ²15 sites within 12 NM of the coast, ³5 sites beyond 12 NM of coast. Note that 975 m of core recovery at the primary sites can only be achieved with 100% core recovery. A realistic recovery estimate could be ~80%, giving a total length of ~780 m (corresponding to a cored volume of less than 3.5 m³ for the entire project). In practice, a mixture of primary and alternate sites may be cored, as well as duplicate boreholes on occasion. However, the total number of boreholes is unlikely to exceed 11.

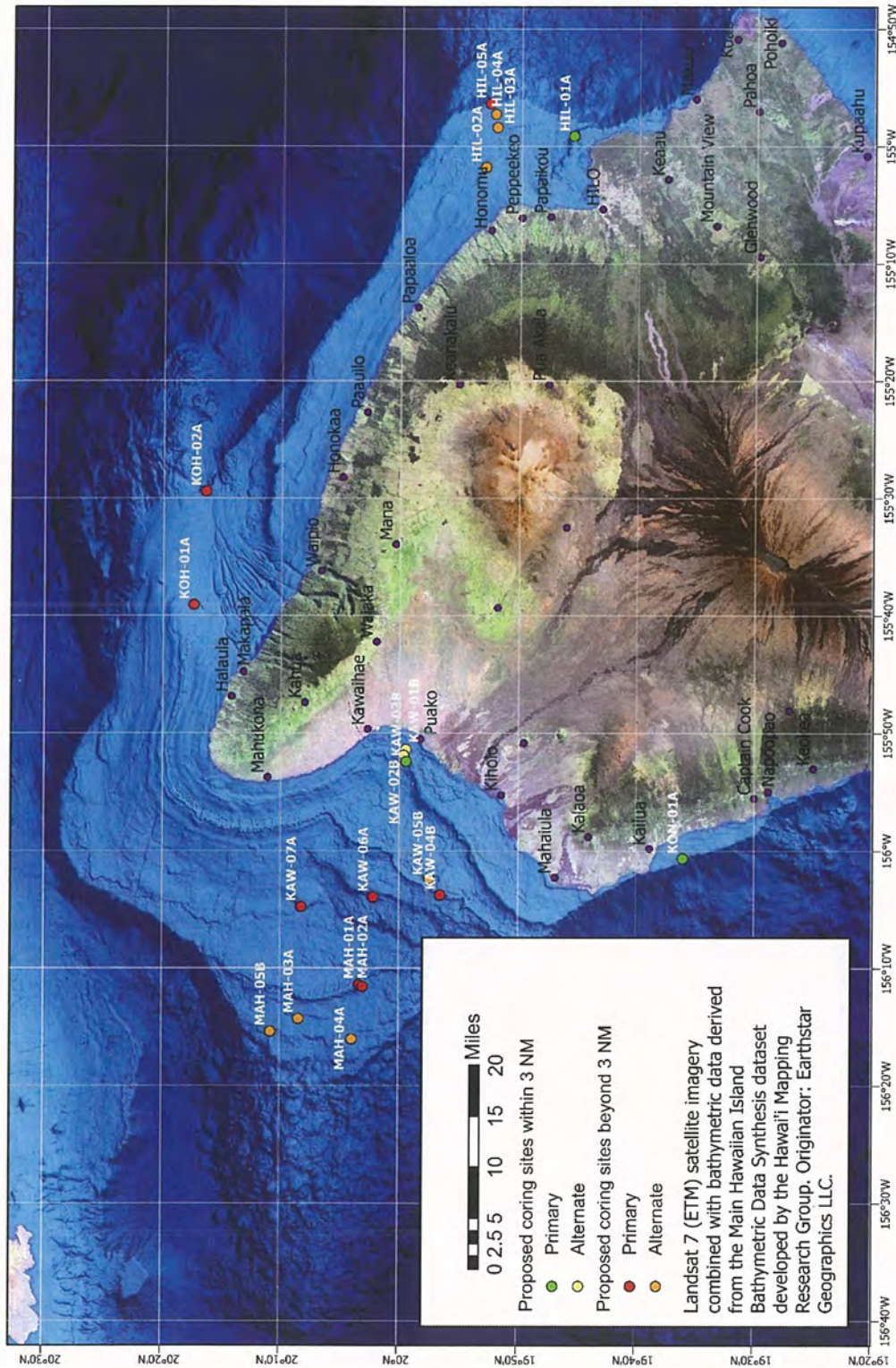


Figure 1. Map showing the location of the proposed IODP drill sites (see also Table 1).

2 Coral Reef Drilling

Living reefs are very sensitive ecosystems. For that reason, any scientific drilling in reef environments must be undertaken with great care to exclude, or at least minimise, the impact of drilling on the reefs.

Unpublished observations and published monitoring studies concerning drilling in coral reef environments have demonstrated that, *without adequate safeguards*, physical destruction of the seabed, which provides a substratum for settling organisms, can occur and result in local ecological perturbations. Without adequate care, impacts might include crushing of live corals by drilling equipment, anchor scars, and local smothering of seabed wildlife by borehole cuttings and drilling mud. The main risks of scientific coring on coral reefs are summarized in later sections.

2.1 Previous scientific drilling of coral reefs

Scientific drilling around Hawaii is not a new activity. Researchers at the University of Hawaii School of Ocean and Earth Science and Technology have drilled fringing reefs and deeper platforms on Oahu, Kauai, Molokai, and Maui for over 20 years. This drilling, permitted by DLNR, involved a team of divers served by an anchored small boat. Often returning to the same spot 2-5 days in a row, many efforts were made to minimize damage to the adjacent benthic community. In most cases coral reef cores ~3-15 m in length were obtained for later analysis. A number of advances were made in understanding the structure of Hawaii coral reef ecosystems, the local and global history of sea level change, and the natural history of the carbonate platforms that surround each island. Research advances resulting from this drilling are summarized in Fletcher *et al.*, 2008¹².

2.2 Proposed operating methodologies

A brief operating methodology is provided here, based on past ESO experience in Tahiti and on the Great Barrier Reef. The drilling platform will be a geotechnical vessel, from which a seabed coring device will be lowered to the seabed using an umbilical, analogous to a large Remotely Operated Vehicle (ROV) used for seafloor and submarine infrastructure surveying.

2.2.1 Vessel

We propose to utilize the multipurpose vessel *MMA Valour* (Figure 2) which is capable of working in the water depths beyond that required for the Hawaii Expedition. The vessel will have Dynamic Positioning (DP), a system that uses GPS and a series of thrusters to keep the vessel at a fixed position without the need for anchoring to the seabed. No ancillary vessels will be required, although some staff exchange by boat may take place and there may be some resupplying required.

¹² Fletcher, C.H., Bochicchio, C., Conger, C.L., Engels, M., Feirstein, E.J., Grossman, Grigg, R., E.E., Harney, J.N., Rooney, J.J., Sherman, C.E., Vitousek, S., Rubin, K., Murray-Wallace, C.V. (2008) *Geology of Hawaii Reefs. Chapter 11 in "Coral Reefs of the U.S.A.", Springer, p. 435-488.*



Figure 2. Multipurpose Vessel MMA Valour, the proposed project vessel. A seafloor corer will be launched over the starboard side the vessel, slightly forward of midship.
<https://www.mmaoffshore.com/vessel-fleet/mma-valour>.

2.2.2 Seafloor drills

The seafloor corer will be the Benthic Geotech Portable Remotely Operated Drill (PROD), a relatively small, mobile, 3-legged device that is remotely controlled from a vessel (Figure 3 and Figure 4). The PROD system has 3 pads in contact with the seabed (each $\sim 9 \text{ m}^2 / 97 \text{ ft}^2$), with the extremities of the pads contained within a circle of radius 4.8 m. Seafloor corers operate sub-sea, and remove the need for a tall, vessel-mounted, highly visible drilling derrick at the sea surface. Seafloor corers also operate independently of ship movements due to waves, wind or currents, and so minimize the potential for impact on the surrounding seabed. Additionally, due to the relatively small size of the seabed corers, less flushing of the borehole is required to clear cuttings compared to traditional coring from a vessel-mounted derrick.

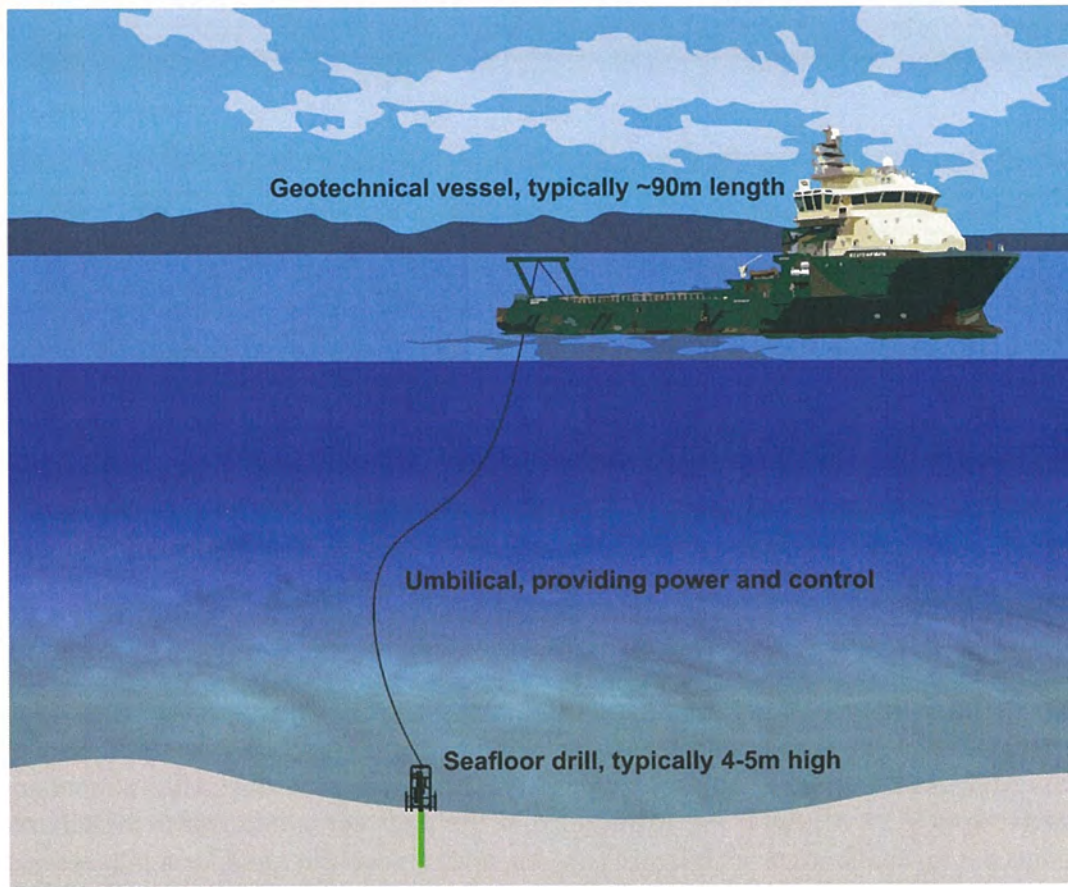


Figure 3. Schematic illustration of seafloor drill deployment from a project vessel.

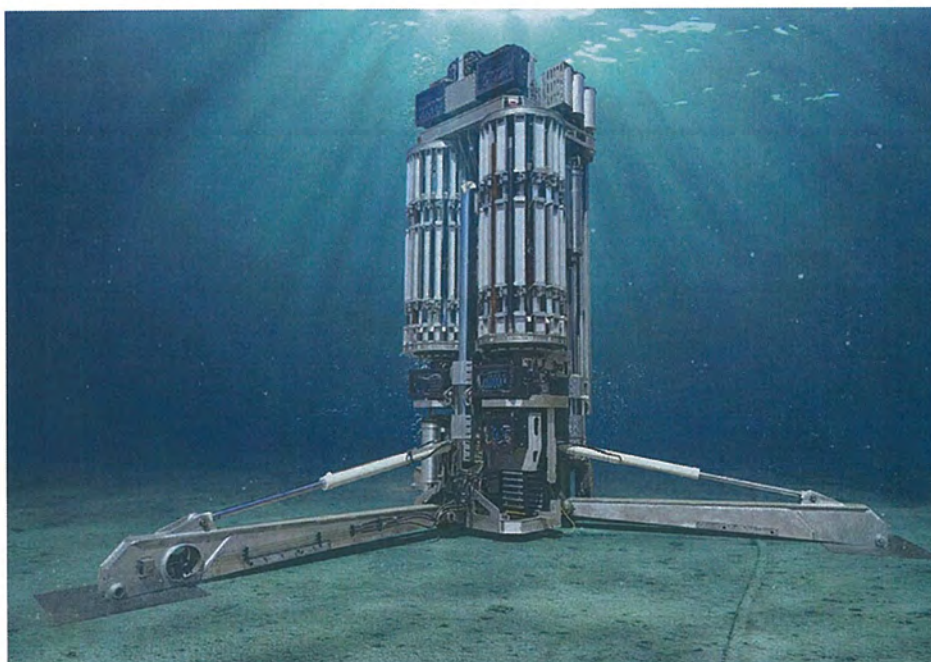


Figure 4. The Benthic Geotech PROD (Portable Remotely Operated Drill).

2.2.3 Impact on the seabed

The water depths involved in the proposed action range from 129 to 1234 m. Typically, reef-building corals are sparse to absent in water depths below 30 m around Hawai'i. At each site, existing autonomous underwater vehicle data (where available) will be used to choose the initial site within 125 m-radius buffer zones. The final coring site location will be checked for live coral/biota cover using seafloor corer-mounted cameras prior to the seafloor corer being landed on the seabed. For the Tahiti and Great Barrier Reef expeditions, a camera mounted within the drill pipe was used to observe the seafloor prior to landing any equipment (Figure 5), and used to survey the vicinity on completion of the borehole (Figure 6 and Figure 7). For the Great Barrier Reef Expedition, a separate ROV was used to monitor coring activity on the seabed (Figure 8). These images demonstrate the impact on the seafloor of traditional scientific coring methods. Using a seafloor coring system for the proposed action should have less impact, since the diameter of the drill pipe is narrower and less sediment and rock will be removed in order to cut the core.



Figure 5. Examples of images taken during the IODP Tahiti Expedition. The left photograph shows where coring was not attempted due to coral fauna. The site was positioned within the right photograph.

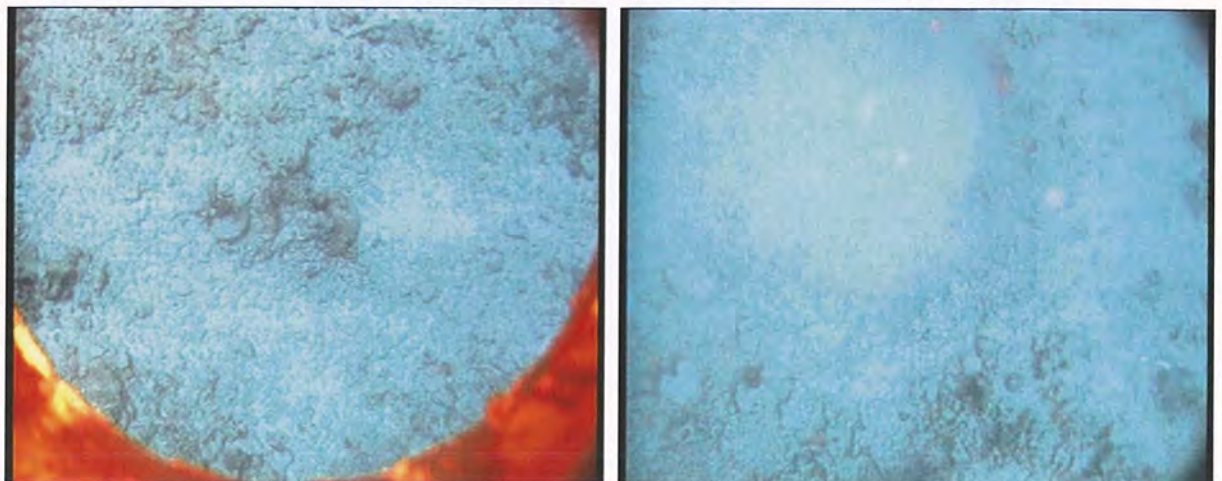


Figure 6. Examples of before-and-after photographs taken during the IODP Tahiti Expedition. The photograph on the right was taken after drilling and shows the small accumulation of cuttings. This cuttings accumulation is essentially confined to the 1.8m-diameter of the seabed template skirt.

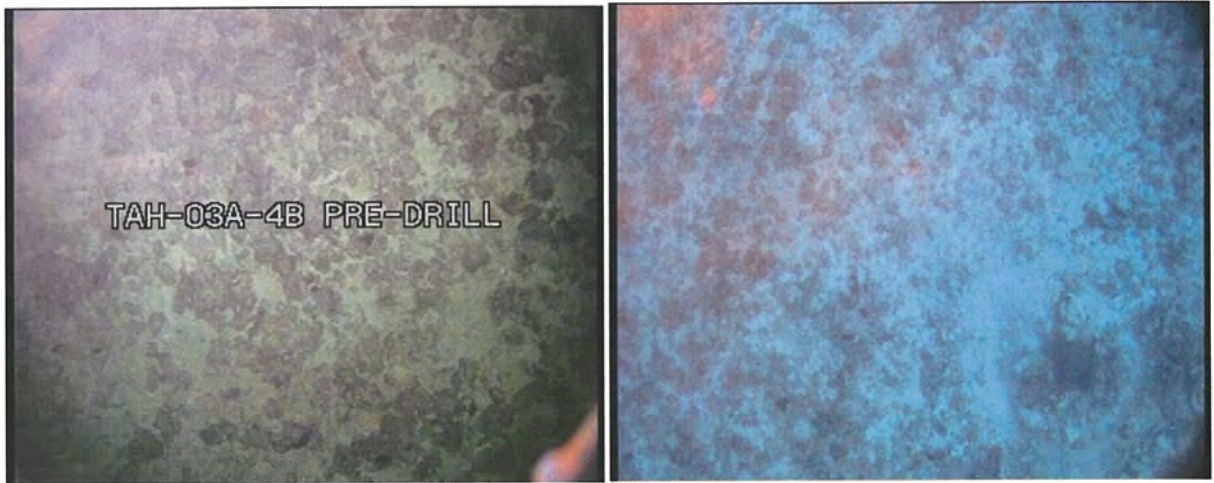


Figure 7. Examples of before-and-after photographs taken during the IODP Tahiti Expedition. The photograph on the left covers a much smaller area than that on the right, which shows the hole and the mark of the 1.8 m-diameter template skirt. There are few cuttings at the seabed, as most of the cuttings were pushed into the porosity of the formations down in the borehole.



Figure 8. Image of bottom conditions during coring during the Great Barrier Reef Expedition, which shows the drill pipe coming down from the vessel-mounted rig. Rock cuttings are visible around the borehole. The coring debris is thickest in the immediate vicinity of the borehole (within a metre or two), and then tail off with distance from the borehole. Fine cuttings are generally dispersed by currents. Note that this image demonstrates coring using traditional drilling methods. Coring using a seafloor drill will produce less volume of cuttings in comparison.

2.2.4 *Scientific measurements and downhole wireline logging*

In addition to recovering cores, logging the drilling data and curating the cores, some preliminary scientific measurements are made on the cores at sea. These are:

- Initial lithological description;
- Pore-water geochemistry;
- Sampling for microbiology studies;
- Physical properties using a whole-core multi-sensor core logger (MSCL).

3 Environmental Management and Risks

3.1 Background to mitigation strategies

This section introduces the main risks of scientific drilling coral reefs and ESO's mitigation strategies.

All operations offshore Hawaii will be carried out in such a way as to minimize the impact on the reef environment. The IODP Environmental Principles¹³ form the baseline for all offshore work. The conduct of the Hawaii operation shall be in line with [Appendix C - IODP Legacy Reef Drilling Guidelines](#), which were revised following the reef drilling in Tahiti in 2005.

The vessel will operate under:

- The International Safety Management (ISM) Code, an international standard for the safe operation of ships and for pollution prevention;
- The International Convention for the Safety of Life at Sea (SOLAS), an international maritime treaty which sets minimum safety standards in the construction, equipment and operation of ships.

The vessel will additionally have its own approved Health, Safety and Environment (HSE) system in operation as required by the ISM Code. Coring, logging and curation operations, although they will have their own specific guidelines, will be interfaced to those of the drilling vessel, as will those of contractors.

All drilling operations should be completed within a period of less than 60 days, and it is not anticipated that any one site will be occupied for more than 3-5 days. Any influence on the ecosystem or on other reef users at any one location will therefore be brief.

The water depths for the proposed drilling sites range from about 129 to 1234 m and require the use of a dynamically positioned vessel in order to minimise the seabed footprint of the drilling (i.e. no anchors will be used). During the Tahiti Expedition, the vessel kept station within a 3 m-diameter circle, even when large swells were incoming.

Detailed site surveys have been conducted, and the information collected has been used in detailed planning for each site. If required, a representative or representatives from local agencies can have the opportunity to sail on the vessel for all or part of the Hawaii Expedition to observe the operation and ensure compliance with procedures.

¹³<https://www.iodp.org/top-resources/program-documents/policies-and-guidelines/501-iodp-environmental-principles-may-2018/file>

3.2 Potential risks

Most of the risks identified for the Tahiti and GBR Expeditions are directly applicable to scientific drilling offshore Hawaii (Table 2). The results show that, as a result of mitigation strategies introduced above and detailed below, the environmental risks posed by the expedition are low with scores generally less than 6. **Please note that this section is not a final risk assessment for the Hawaii Expedition.** It is acknowledged that risks may differ from past expeditions, and new risks may be identified as local groups are solicited, in which case these risks will be added to the full risk assessment for the Hawaii Expedition.

It is recognized that ensuring a public understanding of the beneficial scientific nature of the expedition presents a very significant risk unless there is good outreach and media relations. Also, the provision of good information to other users is important, as is effective interaction with these groups.

As standard practice, ESO will produce a risk assessment document for all aspects of the operation, and this document will be aligned to the vessel's documentation. The ESO risk assessment is a live document and is completed after project mobilization when all laboratories are in place.

A range of both issue-based and activity-based elements have been identified from the risk assessment.

		Consequence				
		Negligible 1	Minor 2	Moderate 3	Major 4	Severe 5
Likelihood	Almost certain 5	Noise and vibration Solid and liquid discharge			Perception	
	Likely 4		Weather hazard			
	Reasonably possible 3	Mud usage	Loss of equipment	Vessel positioning		
	Unlikely 2	Marine mammal interaction Shipping	Fuels and chemicals			
	Rare 1	Disturbance of marine wildlife Radioactive source Hydrology	Man-made seabed hazards		Tsunami	

Table 2. A summary of the main risks identified for the Hawaii Expedition (based on risks identified for the Great Barrier Reef Expedition). Highlights show risk ranking: Green 1-5, Yellow 6-10, Orange 11-15, Red >15.

3.2.1 Perception – Risk ranking 20

Inaccurate perception of the nature of this expedition could lead to concern or protest from local communities, NGOs, or environmental pressure groups, which could delay or halt the scientific operation and lead to loss of public funds.

ESO will ensure that the public are aware of the purely scientific nature of the expedition, that it is publicly funded, and that it is entirely free of industry connections. The chosen vessel will show a banner reading 'Scientific Research' and the permit number if applicable. ESO will explain the conservational and reef management benefits to be gained from an improved understanding of reef growth over the last 500,000 years during times of sea level change. At this present time of global warming and melting ice-sheets, ESO will explain the public benefit of an improved knowledge of the rates in sea-level rise that occurred during previous deglaciations. In particular, good media relations will be critical.

ESO will devise and implement an outreach plan, possibly in co-operation with other community groups, interested agencies, or institutes which will include an educational element. The key element of the information program would be to allay concerns about the purpose of the drilling activity, giving accurate details about its scientific worth and how the findings may be valuable for the long-term conservation and management of the marine environment around Hawaii.

3.2.2 Vessel positioning – Risk ranking 9

The loss of positioning by the vessel during drilling operations could result in damage to the seabed through dragging of the seafloor drill, and damage to, or loss of, the seafloor drill itself. This risk is related to temporary loss of positioning while drilling, and not to a more extreme loss of positioning which is considered under weather hazard.

The contracted vessel operator will ensure maintenance of position during operations using GPS and dynamic positioning (DP), and continuous operator watch. The operator will have a backup means of positioning should the primary DP system fail (either a secondary DP system, or a switch to manual positioning to enable safe recovery of the seafloor drill). High-performance dynamic positioning is essential to the operation and any malfunction would receive immediate attention and appropriate action taken.

3.2.3 Weather hazards – Risk ranking 8

Adverse weather may cause extreme vessel movement, loss of power, propulsion or positioning. Grounding, seabed damage, equipment and/or vessel damage, pollution and injury to personnel could result.

To avoid danger to the vessel, its personnel and equipment, coring will be conducted such that it can be stopped at short notice, allowing the vessel to take appropriate avoiding action. Normal seafaring precautions regarding weather and drilling will be taken, and operations will not begin if prevailing conditions are unsuitable. Twice daily weather reports with standard graphs and five-day extension forecasts will be sought, with increased frequency as appropriate, and used to identify periods for safe operations.

3.2.4 Loss of equipment – Risk ranking 6

The potential loss of equipment to the seabed is in part related to loss of position or weather hazards, although other reasons may be responsible.

ESO, the drilling contractor and vessel operator will take all precautions to avoid loss of equipment and take due care to ensure compliance with health and safety documentation. If feasible and deemed necessary, action will be taken to recover any lost equipment.

3.2.5 Noise and vibration – Risk ranking 5

Noise will be emitted from the ship's engines and the generators that will power the seafloor drill. The ship's thrusters will be continuously used to maintain position while coring. The noise level is not expected to be greater than any other kind of vessel of the size being proposed, however the vessel will be stationary for 3-5 days at a time. Marine wildlife in some areas may be disrupted, however mobile species are expected to leave if they are affected.

The closest proposed sites to the shore are 1.6 miles off Kanekanaka Point, 1.9 miles off Leleiwi Point and 2 miles off Holualoa (Figure 1), and it is possible the vessel could be heard from the shore. ESO, the drilling contractor and vessel operator will aim to minimise noise production, as noise has health and safety implications as well as environmental implications. ESO will observe any detrimental influences caused by noise, and take action if possible.

The proposed project does not include any seismic operations, or any activity that emits high amplitude sound energy into the water column. The only sound sources of note are the generators on the vessel and the small hydraulic power packs on the seafloor corer on the seabed. Coring itself does not produce significant noise, the main noise source being the coring action at the bit face which takes place at the seabed initially, but diminishes as the corer penetrates into the seabed.

3.2.6 Solid and liquid discharge – Risk ranking 5

The vessel will operate under the ISM Code, including International Maritime Organization (IMO) and SOLAS regulations, and release of waste water and sewage will be in accordance with the law. Any breakdown in the ship's waste storage systems will be repaired.

3.2.7 Fuels and chemicals – Risk ranking 4

The vessel will have diesel engines and the drilling rig will employ hydraulic fluids. Only minor quantities of laboratory chemicals will be on board. Pollution of the sea may occur if there is a leakage or accidental spillage. Generally, any such spills or leaks would be limited in scope (of the order of litres) and would be contained on the vessel.

ESO, the drilling contractor and vessel operator will act to minimise the effect of any accidental loss of oil. For diesel spillages, the vessel will operate under the ISM Code, including IMO and SOLAS regulations, and will have its own approved HSE system in operation as required by the ISM Code. These documents can be provided. Any spillages on deck will be addressed with absorbent granules.

Detailed risk assessments are made for use of chemicals in the containerized laboratories. These chemicals are very low in volume, and their use contained within a series of laboratory containers. Spillages will be addressed following standard laboratory procedures, and absolutely no chemicals will be disposed of overboard.

3.2.8 Tsunami – Risk ranking 4

A tsunami will endanger the vessel in shallow water, most probably through strong currents. ESO and the vessel operator will aim to minimise the effect of any tsunami by monitoring tsunami warnings from the appropriate authorities and taking avoiding action. The warnings would be sufficiently advanced to allow recovery the seafloor drill and allow the vessel to move.

3.2.9 Mud usage– Risk ranking 3

It is intended that only sea water will be used as a fluid to aid the coring action and lift cuttings out of the borehole. It is envisaged that there may be some circumstances, such as when there is a significant thickness of loose sediments, where the use of a viscosifier (thickener) may be needed to help ensure that the hole is kept open and for extra lubrication to avoid the drill string becoming stuck in the seabed. In such cases, and only when required, sea water will be slightly dosed with a water-soluble liquid polymer or biopolymer viscosifier. This fluid mixture will be cycled through the borehole, will be emitted from the top of the borehole and released into the marine environment along with ground-up limestone cuttings.

Any effects of the viscosifiers will be short-lived. Biopolymer-based viscosifiers, if used, are biodegradable through bacterial action. Before bacterial action occurs, marine wildlife may be attracted to the viscosifiers as a food source. The polymer-based viscosifiers, if used, will be diluted and dispersed into the surrounding sea water, and are unlikely to bioaccumulate. The seafloor corer has the capacity to carry a maximum of 20 litres of liquid viscosifier, and so this is the maximum volume that could be released into the marine environment per borehole cored.

3.2.10 Marine mammal interaction – Risk ranking 2

Although drilling will be scheduled outside whale season, some interaction with marine mammals may occur. Mammals commonly display natural curiosity in respect to shipping or other marine activity, and provided they are not in danger there may be no requirement for action. If approaching mammals indicate any signs of distress, drilling operations will be stopped for a period, and the mammal's activity monitored. No activity will be started if marine mammals are in the vicinity of intended operations, and will only start once the area is clear of mammal activity.

3.2.11 Man-made seabed hazards – Risk ranking 2

Man-made objects on the sea bed may be damaged or cause damage to the drilling equipment. ESO will aim to avoid any man-made hazards on the seabed by identifying any hazards in the vicinity of sites on navigation charts, GIS layers or other sources. Pre-drilling camera inspections will also provide a method for avoiding undocumented objects. If any hazards are seen on camera, the vessel will move until a suitable site is identified.

3.2.12 Shipping/fishing disturbance – Risk ranking 2

There may be some minor influence on shipping traffic and other marine users. The presence of the project vessel, which will be largely immobile during coring activities, may present a minor navigational hazard to other marine users. Disruption will be minimized by normal seafaring practice, which will include the vessel liaising with the relevant marine authorities to disseminate information about vessel activities and movements.

3.2.13 Disturbance of marine wildlife- Risk ranking 1

Any activity in the water column and on the seabed has the potential to impact marine wildlife. Impacts on the seabed may include crushing of benthic wildlife cover by drilling or other equipment, and local smothering of benthic wildlife by borehole cuttings and drilling mud.

Impact on the seabed will be minimised by:

- 1) Avoiding seafloor drill deployment at sites with dense benthic wildlife cover by only operating in water depths greater than 100m where light levels at the seabed are low to zero. Typically, reef-building corals are sparse to absent in water depths below 30 m around Hawaii.
- 2) Avoiding seafloor drill deployment at sites with dense benthic wildlife cover by using drill-mounted cameras to survey the seabed before landing. The precise location of the seafloor drill can be readily adjusted using the vessel's dynamic positioning system to ensure that an appropriate location is found. If benthic wildlife is observed, the vessel will move (within permit parameters) until a suitable site with less or no cover is identified.
- 3) Minimising the extent of equipment contact with the seabed. No anchoring will be used (the vessel will be dynamically positioned using thrusters), and contact with the seabed will be confined to the landing pads of the seafloor drill, and the drillstring at the center of the seafloor drill.

Wildlife in the water column will be largely unaffected. Wildlife will move clear of the seafloor drill as it is lowered, and is expected to move away from any short-lived cuttings plumes that may occasionally emit from the borehole. Cuttings plumes are essentially short-lived, mobilized sediment, composed of the ground-up natural products of the reef (limestone) and thus are not toxic to either the reef or other marine wildlife. The cuttings are similar to sediments mobilized by natural processes such as storms and currents. We calculate that approximately 0.8m³ of cuttings will be produced for every 100m of borehole cored, with most of the cuttings remaining sub-seabed within the pore spaces of the reef formation surrounding the borehole.

3.2.14 Hydrology – Risk ranking 1

There is a minor possibility that drilling a permeable reef will temporarily influence the hydraulic regime. Studies indicate that while drilling may influence hydraulic circulation in the vicinity of the borehole, the impact is very small in relation to the overall circulation in a highly permeable and widespread carbonate reef structure. Any effect will be time-limited, as the borehole will naturally close within days through sidewall collapse, and will fill up with sediment washing in from above.

3.2.15 Radioactive source – Risk ranking 1

A GEOTEK¹⁴ Multi-Sensor Core Logger (MSCL¹⁵) system, housed in a containerised laboratory, with a Caesium-137 source (Activity 370 MBq) will be used to enable a suite of geophysical measurements to be obtained from the sediment cores after they have been recovered to the vessel.

The shielding around the Caesium-137 source has been designed so that the levels of radiation at the surface of the shield are less than 3uSv/hr. For comparison, this is the same as levels of radiation received during a commercial passenger airline flight. The source is securely housed inside a 150mm diameter lead-filled, 3mm wall stainless steel container. When the ship is in transit the source will be stored in the specially-designed storage box which will be secured within the container.

The source will never come in to contact with the marine environment unless the vessel itself is endangered, and the source housing and its transport storage unit are compromised.

Potential risks of using the source are radiation dosage to expedition personnel through mis-use, and injury to expedition personnel when handling the heavy lead-shielded source.

Operation of the MSCL will be only be carried out by experienced trained personnel and radiation levels will be monitored.

A separate permit to use the MSCL source will be submitted to the relevant authorities.

4 After the drilling phase

The offshore drilling phase is the first stage of the Expedition. Full analysis of the cores and the subsequent scientific reporting takes place in the months and years following the offshore drilling phase. A typical timeline for events after drilling is given below.

- After the offshore phase ends, the core material will be transported to the IODP Bremen Core Repository in Bremen, Germany.
- ~4 months after the offshore phase, a scientific workshop to analyze the cores will be convened in Bremen. There, the cores will be split and a team of international scientists will work to produce an initial set of results from the cores. At the end of the workshop, a one-year moratorium on the core material begins.
- The cores are then shipped to the IODP Gulf Coast Repository at Texas A&M University, where they will be permanently archived.
- 2 months after the workshop, a Preliminary Report is published online and is free to the public.

¹⁴ Geotek Ltd. (UK) <http://www.geotek.co.uk/>

¹⁵ <http://www.geotek.co.uk/geotek-core-analysis-systems/mscl-s/>

- 1 year after the workshop, a full Expedition Report is published online and is free to the public. At this time, a moratorium on the core material ends and anyone can apply for samples from the cores for scientific research.
- Associated scientific papers are published by the scientific team in peer-reviewed journals within ~3 years.

Appendix A - Useful Internet Links and Contacts

ECORD Science Operator (ESO) <http://www.eso.ecord.org/>

International Ocean Discovery Program (IODP) <http://www.iodp.org/>

Reef-related Expeditions implemented by ESO

Expedition 310 (Tahiti Sea Level), 2005, Expedition Report
<http://publications.iodp.org/proceedings/310/310title.htm>

Expedition 325 (Great Barrier Reef), 2010, Preliminary Report
http://publications.iodp.org/preliminary_report/325/index.html

Other Expeditions implemented by ESO

Expedition 302 (Arctic Coring Expedition), 2004, Expedition Report
<http://publications.iodp.org/proceedings/302/302title.htm>

Expedition 313 (New Jersey Shallow Shelf), 2009, Expedition Report
<http://publications.iodp.org/proceedings/313/313title.htm>

Expedition 347 (Baltic Sea Paleoenvironment), 2013, Expedition Report
<http://publications.iodp.org/proceedings/347/347title.htm>

Expedition 357 (Atlantis Massif Serpentinization and Life), 2015, Expedition Report
<http://publications.iodp.org/proceedings/357/357title.html>

Expedition 364 (Chicxulub: Drilling the K-Pg Impact Crater), 2016, Expedition Report
<http://publications.iodp.org/proceedings/364/364title.html>

Expedition 381 (Corinth Active Rift Development), 2017, Expedition Report
<http://publications.iodp.org/proceedings/381/381title.html>

Expedition 386 (Japan Trench Paleoseismology), 2021, Scientific Prospectus
http://publications.iodp.org/scientific_prospectus/386/

Useful Contacts

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Appendix B - List of Acronyms

BGS	British Geological Survey, UK
DLNR	Department of Land and Natural Resources, Hawaii
DP	Dynamic positioning
EA	Environmental Assessment
ECORD	European Consortium for Ocean Research Drilling
ESO	ECORD Science Operator
EPC	European Petrophysics Consortium
GBR	Great Barrier Reef
GIS	Geographic Information System
GPS	Global Positioning System
HSE	Health, Safety and Environment
IMO	International Maritime Organization
IODP	International Ocean Discovery Program
ISM	International Safety Management
JOIDES	Joint Oceanographic Institutions for Deep Earth Sampling
MARUM	Center for Marine Environmental Sciences - University of Bremen
MBARI	Monterey Bay Aquarium Research Institute
MSCL	Multi-Sensor Core Logger
NOAA	National Oceanic and Atmospheric Administration
ROV	Remotely operated vehicle
SOLAS	International Convention for the Safety of Life at Sea

Appendix C - IODP Legacy Reef Drilling Guidelines

Integrated Ocean Drilling Program¹⁶

Environmental Protection and Safety Panel

Reef Drilling Guidelines

December 2006

The Integrated Ocean Drilling Program (IODP) has defined a Health, Safety and Environment policy¹⁷ that applies to all its operations in a range of marine environments. All sites scheduled for drilling in IODP are scrutinized by the IODP Environmental Protection and Safety Panel in order to ensure that the holes can be safely drilled and that all necessary steps are taken to protect the environment.

Reefs are fragile environments for which specific operational guidelines are necessary.

Three basic principles guide IODP reef drilling operations:

1. Ecological perturbations to the reef ecosystem should be minimized.
2. Damage to the sea floor, and the accumulation of drilling-related detritus on the sea floor, should be minimized.
3. A pre-drilling environmental assessment of the reef drill sites should be made, and also a post-drilling examination of the sites.

General guidelines have been developed to aid in the implementation of these principles. While reviewing each drill site, EPSP will consider operational plans to ensure that IODP's basic principles are not violated and that the environmental impact is minimized.

1. Environmental Impact Assessment (EIA)

An environmental impact assessment of coring on the reef should be submitted to EPSP as part of the approval process. The assessment is the responsibility of the Implementing Organization and should be specific to the drilling platform, drilling procedures and operational plan.

¹⁶ Note that IODP changed its name from 'Integrated Ocean Drilling Program' to 'International Ocean Discovery Program' in 2013.

¹⁷ Superseded by IODP Environmental Principles <https://www.iodp.org/top-resources/program-documents/policies-and-guidelines/501-iodp-environmental-principles-may-2018/file>

The EIA should address all relevant issues, including morphology, physiography, wave action, tides, currents and biological associations. It should also consider the potential impact of the drilling and describe the proposed operational practices to be adopted to minimize impact. The drilling operation should take place within the over-arching framework of this assessment.

2. Mechanical Damage

IODP should adopt drilling practices that limit physical destruction of both live and dead reefs, wherever and whenever possible. Mechanical damage can be caused by:

1. Drilling the hole, including the impact of the drilling tools and the casing or liner that may be left behind. Actions to minimize impact include:
 - The selection of spud-in locations outside any “nest” of corals. This requires a visual inspection of the proposed spud-in site using cameras either deployed from the vessel or on an ROV. Pre-site diving expeditions may also be a possibility in shallow water. In order to provide the operational flexibility to avoid such coral ‘nests’, EPSP will provide approval within a defined circle centered on the requested drilling site.
 - Contact with the sea bed must be over as small an area as possible. It is recommended that any sea-bed template used should have as small a footprint as possible and be sited following the visual sea-bed survey.
 - The borehole diameter should be no larger than necessary to meet the scientific objectives.
 - It is recommended that if liners or casing are used, they should remain in place at the completion of a hole as removal of the liners could cause significant further damage.

2. The anchoring of the drilling platform.
 - It is recommended that the drilling platform should not require anchoring. A dynamically positioned drilling platform is preferred. However, if a dynamically positioned platform is not selected, a floating platform using cemented anchor bolts should be considered. The US Navy has developed such an anchoring system, but it will seriously restrict the operational radius of the drilling platform.

As well as the pre-drilling visual survey, observations should be performed after drilling in order to document what, if any, physical disturbance has occurred. As far as is possible, all visual observations should be archived.

3. Cuttings and Drilling Mud

The introduction of cuttings and drilling mud may inhibit photosynthesis of symbiotic algae and directly stress the reef.

Any cuttings and mud that are returned to the seafloor are normally dispersed by currents and wave actions. The effects of the cuttings and their method(s) of dispersal should be considered as part of the EIA.

- The hole diameter currently employed by IODP, approximately 100 mm, produces only minimal amounts of cuttings, and, even if the total volume were to reach the seabed, should not impact the reef. Furthermore these drill cuttings will be composed of the natural products of the reef and thus should not be toxic to the reef.
- Studies have shown that most cuttings and mud disappear into the reef due to the porosity and cavities inherent in the reef structure. However if any cuttings reach the seabed, the use of a conductor pipe to the vessel will allow for any returns reaching the seabed to be taken on board the vessel for later or immediate disposal depending on the circumstances.
- To minimize the effects of drilling fluids on the reef it is emphasized that, wherever possible, seawater be the primary drilling fluid. If some other drilling fluid is to be used, the operator should consider the use of biodegradable vegetable-based fluids (for example, a guar gum drilling fluid) and should also consider using a circulating system to capture or at least control the drilling fluid pathway.

4. Leaks of Hydraulic Fluids

Accidental leaks or spills of hydraulic fluids and other petroleum products may occur during routine operations, and should they escape to sea may have a negative impact on the ecosystem. Generally any such spills or leaks would be limited in scope (of the order of litres) and would be contained on the vessel. The program will make every effort to contain spills as prescribed in the IMO regulations. Plans should be defined for containment and dispersal both by the Implementing Organization and its sub-contractors.

5. Noise and Vibrations

Vibrations and noise from drilling and support vessels will be continuous during drilling operations, and may impact both life associated with the reef and the adjacent onshore area if the drilling is close to land. Although there is no documented evidence to suggest this, it should be considered that life on some areas of reef may be disrupted and that mobile species could leave. Care should be taken that sites are located where they will cause least disturbance, and that efforts are made to minimize the amount of time spent at a site.

6. Changes to Reef Circulation

Changes in fluid circulation over and through a reef may be deleterious to reef organisms or the physical integrity of the reef. The borehole may negatively impact on reef organisms or undermine reef integrity through the introduction of 'alien species'.

In order to minimize hydrologic effects it is suggested that the borehole be of the minimum acceptable diameter commensurate with obtaining core of acceptable dimension to meet the scientific objectives, and that, preferably, no casings or liners be utilized. However if liners are used, they should be left in-place as their removal is expected to be more damaging than the potential influence of a change to the reef hydrology.

7. Down-hole logging

Down-hole logging to obtain petrophysical data using a variety of tools will be a standard activity during reef drilling. However, tools requiring radioactive sources should not be deployed.

8. Post-Coring Documentation

The operations report needs to contain details of the site survey work carried out during the operation. Any sea-bed photo coverage should be archived with as much peripheral information as possible in order to build up a picture for any later reef analysis or future biological assessments.