APPENDIX A
REGULATORY SETTING

This page intentionally left blank

Appendix A: Regulatory Setting

The Marine Corps has prepared this Environmental Assessment (EA) based upon federal and state laws, statutes, regulations, and policies pertinent to the implementation of the proposed action:

- American Indian Religious Freedom Act (42 United States Code [U.S.C.] 1996)
- Archeological and Historic Preservation Act (54 U.S.C. §§ 312501–312508)
- Archaeological Resources Protection Act (16 U.S.C §§ 470aa–470mm)
- Chapter 344, State Environmental Policy
- Clean Air Act (42 U.S.C. §§ 7401–7671q)
- Clean Water Act (33 U.S.C. section 1251 et seq.)
- Coastal Zone Management Act (16 U.S.C. section 1451 et seq.)
- Comprehensive Environmental Response, Compensation, and Liability Act (42 U.S.C. section 9601 et seq.)
- Council on Environmental Quality National Environmental Policy Act Regulations, 40 CFR §§ 1500-1508
- Endangered Species Act (16 U.S.C. section 1531 et seq.)
- Energy Independence and Security Act, United Facilities Criteria 3-210-10
- Executive Order (EO) 11988, Floodplain Management (42 Federal Register 26951)
- EO 11990, Protection of Wetlands (42 Federal Register 26961)
- EO 12088 as amended, Federal Compliance with Pollution Control Standards
- EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations
- EO 13045, Protection of Children from Environmental Health Risks and Safety Risks
- EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds, and the Migratory Bird Treaty Act (66 Federal Register 3853, 16 U.S.C. §§ 703–712)
- EO 13423, Strengthening Federal Environmental, Energy, and Transportation Management (72 Federal Register 3919)
- EO 13990, Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis (86 Federal Register 7037)
- EO 14008, Tackling the Climate Crisis at Home and Abroad (86 Federal Register 7619)
- EO 14057, Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability (88 Federal Register 70935)
- EO 14096, Revitalizing Our Nation's Commitment to Environmental Justice for All (88 Federal Register 25251)
- Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. section 136 et seq.)
- Hawai‘i Coastal Zone Management Program
- Hawai‘i State Plan
- Marine Corps Environmental Compliance and Protection Program (Marine Corps Order 5090.2)
- Migratory Bird Treaty Act (16 U.S.C. section 703 et seq.)
- National Environmental Policy Act (NEPA), 42 U.S.C. §§ 4321-4370h
- National Environmental Policy Act (NEPA); Council on Environmental Quality (CEQ) NEPA implementing regulations; Navy procedures for implementing NEPA (42 U.S.C. § 4331; 40 CFR parts 1500–1508; 32 CFR part 775)
- National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions and Climate Change (88 Federal Register 1196)
- National Historic Preservation Act of 1966, as amended (54 U.S.C. 100101 et seq.)

- Native American Graves Protection and Repatriation Act (25 U.S.C. §§ 3001-3013)
- Noise Control Act (42 U.S.C. §4901 et seq.)
- Oʻahu General Plan
- Policies and Responsibilities for Implementation of the National Environmental Policy Act Within the Department of the Navy (32 Code of Federal Regulations [CFR] part 775)
- Pollution Prevention Act (NPA), 42 U.S.C. §§ 13101-13109
- Protection of Historic Properties, 36 CFR Part 800
- Resource Conservation and Recovery Act (42 U.S.C. section 6901 et seq.)
- Safe Drinking Water Act (42 U.S.C. section 300f et seq.)
- State of Hawaiʻi Energy Goal
- Toxic Substances Control Act (15 U.S.C. sections 2601 et seq.)

APPENDIX B
PUBLIC COMMENTS AND RESPONSES

To Be Provided in Final EA

This page intentionally left blank.

APPENDIX C
NATIONAL HISTORIC PRESERVATION ACT
SECTION 106 CONSULTATION

This page intentionally left blank.

UNITED STATES MARINE CORPS
MARINE CORPS BASE HAWAII BOX 63002
KANEOHE BAY HAWAII 96863-3002

5090
LFE/141-23
1 Nov 2023

Dr. Alan Downer
Deputy State Historic Preservation Officer
Department of Land and Natural Resources
Kakuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, HI 96707

Dear Dr. Downer:

SUBJECT: **EXPEDITED REVIEW:** CONTINUING SECTION 106 CONSULTATION (ARCHAEOLOGY) FOR HICRIS PROJECT 2023PR01113 GROUND-BASED FORCES MODERNIZATION ABOARD MARINE CORPS BASE HAWAII, DISTRICT OF KOʻOLAUPOKO, AHUPUAʻA OF KANEOHE, ON THE ISLAND OF OʻAHU, TMK 1-4-4-008:001.

Marine Corps Base Hawaii (MCBH) is continuing consultation with your office in compliance with Section 106 of the National Historic Preservation Act (NHPA) regarding the proposed Ground-based Forces Modernization (GFM) aboard MCBH identified as HICRIS Project 2023PR01113. Based on consulting party comments received in response to the 12 September 2023 MCBH initial Section 106 letter (LFE/117-23) for this project, MCBH is expanding the project's area of potential effects (APE) to include training areas at MCBH Kaneohe Bay, Marine Corps Training Area Bellows (MCTAB), and Puuloa Range Training Facility (RTF) as well as the eight (8) projects described in our initial letter. This letter also describes our expanded efforts regarding identification of historic properties. In accordance with the NHPA Section 106 Implementing Regulations at 36 CFR 800.4, we have reviewed the existing information about subsurface archaeological resources within the APE and determined that additional steps are needed to identify potential subsurface historic properties.

PROJECT DESCRIPTION

The proposed undertaking is the modernization of equipment, infrastructure, and training for Marine Corps ground-based forces in Hawaii to enhance the combat capability of these Hawaii-based ground forces by enabling them to meet United States (U.S.) Marine Corps responsibilities set forth in Title 10 United States Code (USC) Section 8063 in support of the U.S. Indo-Pacific Command (USINDOPACOM). This proposed undertaking is subject to an Environmental Assessment (EA) under the National Environmental Policy Act (NEPA) that addresses (1) equipment modernization, (2) facilities construction/renovation, and (3) training for Marine Corps ground-based forces in Hawaii at MCBH and associated training ranges in Hawaii. There would be no change in the number of Marine Corps ground forces personnel in Hawaii because of this proposed undertaking. Of these three components, the upgrade, renovation, and construction of support facilities at the Kaneohe Bay installation has the potential to cause effects on historic properties, assuming such historic properties are present. The first and third components, equipment modernization and training at the associated training ranges in Hawaii, has the potential to cause effects on historic properties assuming such historic properties are present. Our continuation of Section

106 consultation, therefore, has been expanded to include equipment modernization and military training at MCBH Kaneohe Bay, MCTAB, and Puuloa RTF in addition to the upgrade, renovation, and construction of support facilities included in GFM projects at the Kaneohe Bay installation.

The proposed changes in equipment are evolutions of existing equipment with operational characteristics similar to those historically used by Marine Corps ground forces in Hawaii. The modernized equipment would be stored and maintained at MCBH. Such equipment includes the Navy-Marine Expeditionary Ship Interdiction System (NMESIS), a type of joint light tactical vehicle (JLTV) consisting of a chassis with different options for modules built on top that would provide the Marine Corps with an anti-ship missile capability fired from land. For training events, this equipment and personnel would transit over base and public roadways (depending on the location of the Range and Training Area) from MCBH to the training area and then back to base. Other JLTVs are currently in use on all Hawaii military training ranges. The modernized equipment also includes the Marine Air Defense Integrated System (MADIS) and Light MADIS (L-MADIS), both of which are similar to current anti-armor weapons systems and would attach to an ultralight tactical vehicle (ULTV) similar to a commercial off-road vehicle. The MADIS and LMADIS are replacing the UTV's currently in use on Hawaii training ranges.

The NMESIS and MADIS are mounted on JLTVs, and these new systems first began production in 2016 and entered the Marine Corps inventory in 2019. The JLTV is smaller and lighter than the legacy High Mobility Multipurpose Wheeled Vehicle (HMMWV), and both vehicles are currently used on Oahu ranges. The L-MADIS system is mounted on an ULTV, which is similar to a commercial off-road utility vehicle. The L-MADIS is smaller and lighter than the Utility Task Vehicle (UTV) currently used on Oahu ranges. The L-MADIS system would operate in a similar manner to the existing anti-aircraft training previously conducted by equipment mounted on the Marines' existing UTV. While the Ground/Air Task-Oriented Radar (G/ATOR) is a new piece of equipment, it is mounted and towed on vehicles currently used in training on Oahu.

Modernized equipment would be utilized on all existing Marine Corps training areas on Oahu [enclosure 1] where existing ground-based training currently occurs. Because these systems replace and upgrade legacy equipment, the operational employment of the NMESIS, MADIS, L-MADIS and G/ATOR would be similar to the tactics employed by legacy equipment. Established vehicle paths and approved areas would be used to set up and employ the equipment within the ranges; no new or expanded training areas are proposed in this action. Units training with the NMESIS would engage in setup and employment tactics similar to those used by current cannon batteries, with the important distinction that the proposed NMESIS units would not engage in live fire. MADIS and L-MADIS systems would be employed similar to current JLTV and UTV-mounted anti-aircraft systems in maneuver, targeting and simulated firing. The G/ATOR would replace a family of radars currently in use and used daily on Oahu and would not require additional spectrum clearance. All modernized vehicles are wheeled (not tracked) and would operate on existing trails and roadways currently used for ground-based training.

The training area aboard MCBH Kaneohe Bay has a total of 15 ranges, located in the Ulupau Crater, that support individual and small unit live-fire training. Training activities include wheeled vehicle maneuver and foot

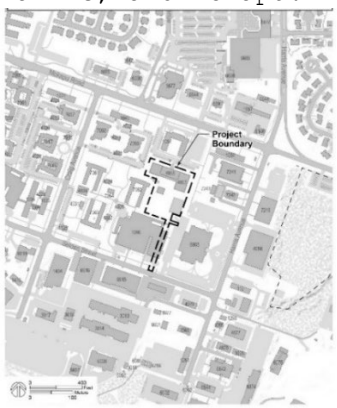
patrols that occur year-round. A concrete pad inside the Pyramid Rock Training Area (PRTA) will be re-used for G/ATOR system training activities, which would include occasional operation of the radar system for maintenance purposes. As stated in the table below, the existing concrete pad has a small non-structural wall built atop its surface, and this wall would be demolished to allow for the G/ATOR system equipment to sit flush atop the pad. The non-structural wall sits atop the concrete pad, so demolishing it will not result in any ground disturbance.

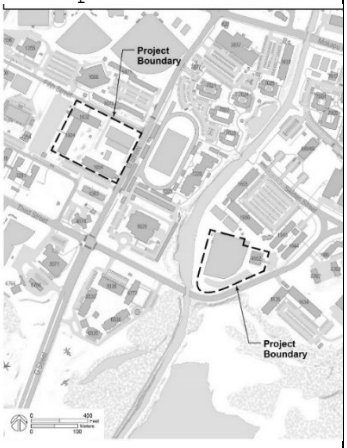
MCTAB encompasses 1,072 acres approximately 8 miles south of MCBH Kaneohe Bay and adjacent to Bellows Air Force Station (BAFS) and between the communities of Kailua and Waimanalo. MCTAB is the primary Marine Corps training area on Oahu and provides maneuvering space company and below unit level non-live-fire amphibious, helicopter, and urban training, and motorized exercises in conjunction with troop land maneuver training.

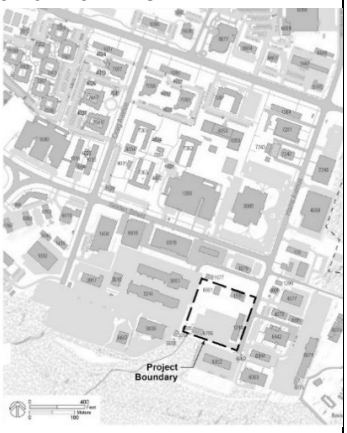
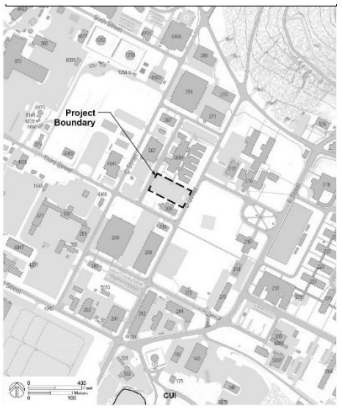
Puuloa RTF supports live-fire training for small arms training, qualification, and requalification. It is regularly used not only by the Marine Corps, but also other Department of Defense services and local law enforcement agencies.

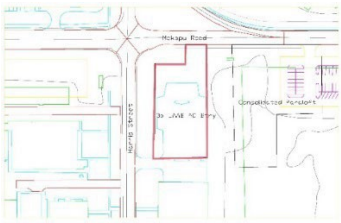
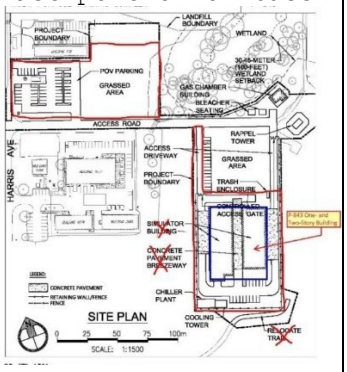
At all MCBH training ranges, the proposed new training would comply with existing avoidance area requirements and would not disturb surface soils below six inches. Existing mitigation measures are contained in the *Update to the Integrated Cultural Resources Management Plan (ICRMP), Marine Corps Base Hawaii, 2021-2026*, as well as the MCBH Order 1500.9C, Standard Operating Procedures (SOP) for Marine Corps Base Hawaii Ranges and Training Areas (Range SOP).

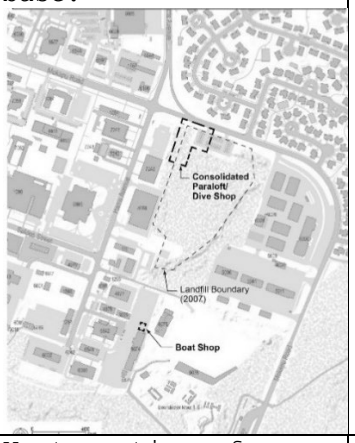
The upgrade, renovation, and construction of GFM support facilities includes new administrative, armory, and operational facilities at the Kaneohe Bay installation. Construction would occur on previously developed, paved, and landscaped areas. All areas, except the proposed replacement ballfield, would require barbed wire security fencing. Below is a table of the projects including maps and known historic properties in the project APE at the Kaneohe Bay installation.

Project	**Area of Potential Effects (APE)**	**Facilities**	**Historic Properties**
3d Marine Littoral Regiment (MLR) Armory Expansion. This project expands the existing armory to accommodate weapons stored in mobile armories. It includes construction of an access driveway and staging area. This requires demolition of basketball court 5024. Water, sewer, and electrical utilities would be improved within the construction footprint.	East portion of base; Selden, Craig, Harris, and Mokapu. 	4053 Armory built 1986. 5024 basketball court built 1987.	4053 is not eligible for the National Register of Historic Places (NRHP) (Wil Chee Planners et al.2014). 5024 is not 50 years old or eligible for NRHP.

Project	Area of Potential Effects (APE)	Facilities	Historic Properties
1st Low Altitude Air Defense (LAAD) Headquarters & Service (H&S) Battalion Compound. This project reuses and expands the existing armory B4052, consolidates the MACG-18 armory into the expanded B4052, and constructs a new LAAD Battalion compound. Water, sewer, and electrical utilities would be improved within the construction footprint. Location #1: Reuse and expand existing armory B4052. Includes demolition of ballfield 1528, 6523, 6689, 6690. Location #2: Construct new Ballfield. Demolish 1604, 1632, 1654, 3029 former basketball court, currently paved parking, 1616, 6661, 3006.	East portion of base 	Location #1: 4052 Armory built 1986; 1528 Softball Field built 1957; 6523 Press Booth and 6689, 6690 Baseball Dugouts built in 1990s. Location #2: 1604 BEQ built 1972; 1632 BEQ built 1974; 1654 BEQ built 1976; 1616 Medical Equip. built 1975; 3006 Weather Shelter built 1980; 3029 Basketball Court built 1981; 6661 Personnel Weather Shelter built 2003	1528, 4052, 1616 are not NRHP-eligible (Wil Chee Planners et al.2014). 6523, 6689, 6690 are not 50 years old or NRHP-eligible. 1604, 1632, 1654 fall under the Program Comment for Cold War Era Unaccompanied Personnel Housing, 1946-1974. 3006, 3029, 6661 are not 50 years old or NRHP-eligible.

Project	Area of Potential Effects (APE)	Facilities	Historic Properties
NMESIS Facility. This project constructs a three-building compound within an existing compound and expands B3013. Requires demolition of 1284, 1565, 6001, 6085 rinse pad; 6786 wash pad; and relocation of 6765C3 prefab structure. Water, sewer, and electrical utilities would be improved within the construction footprint.	East portion of base; corner Selden and Harris 	3013 Maintenance Building built 1980. 1284 Maintenance Shop built 1965; 1565 Shed built 1958. 6001 Vehicle wash pad built 1990; 6085 rinse pad built 1992; 6786 wash pad; 6765C3 prefab structure.	3013, 1284, 1565 are not NRHP-eligible (Wil Chee Planners et al.2014). 6001, 6085, 6786, 6765C3 are not 50 years old or NRHP-eligible.
Consolidated Communications, Information, and Intelligence Facility. This project constructs a 2-story consolidated secure facility including exterior covered area for equipment. Displaces existing private vehicle parking. Water, sewer, and electrical utilities would be improved within the construction footprint.	Central portion of base/D St. 	No buildings	

Project	Area of Potential Effects (APE)	Facilities	Historic Properties
3d Littoral Anti-Air Battalion (LAAB) Air Control Battery Compound. This project constructs Battery Headquarters, Maintenance Shop, and Vehicle Staging Area. It expands B4053 for reuse as the new Administrative Headquarters. Houses transport vehicles for G/ATOR. Water, sewer, and electrical utilities would be improved within the construction footprint.	East portion of base; Mokapu and Harris 	4053 Armory built in 1986. The remaining structures are either trailers, tension fabric structures, or temporary metal shelters that are all Class 3 structures and not Real Property.	4053 is not eligible for the NRHP (Wil Chee Planners et al.2014).
Live-Virtual Constructive Training Environment Complex. This project involves construction of classroom, simulators and operations trainers, and other interior support elements. May include demolition and/or renovation of 6006 and 6075. Water, sewer, and electrical utilities would be improved within the construction footprint. The blue outline shows the proposed building. The red area around it is for access/paving. The other red area near Harris Ave shows the existing temporary Class 3 structures used for training.	East portion of base 	6006 Gas Chamber built 1991 6075 Leadership Recreation Course built 1991. Remaining structures are either trailers, tension fabric structures, or temporary metal shelters that are Class 3 structures and not Real Property.	6006, 6075 are not eligible for the NRHP (Wil Chee Planners et al. 2014)

Project	Area of Potential Effects (APE)	Facilities	Historic Properties
Consolidated Paraloft/ Dive Shop Boat Shop. This project constructs a paraloft facility (drying tower and packing area for parachutes) and a boat/dive shop. The boat shop would be adjacent to Building 6874. Water, sewer, and electrical utilities would be improved within the construction footprint.	East portion of base. 	6874 3rd Radio Battalion Command Post built c. 2018.	6874 is not 50 years old or NRHP-eligible.
G/ATOR Climate Controlled Warehouse and Pad. This project reuses and modifies an existing concrete pad (3055X) inside the Pyramid Rock Training Area (PRTA) for periodic G/ATOR mobile equipment. At a separate location, this project demolishes Building 1180 to construct a Controlled Humidity Warehouse and Maintenance Facility for G/ATOR equipment storage. G/ATOR equipment inside the PRTA can use Portable Generator power. Modifications to Pad include removal of small non-structural walls that sit on the pad (no ground disturbance); installation of 6-8 tie downs in the pad (no ground disturbance); and resurfacing pad with an application of non-stick coating.	West portion of base. Location #1: B1180 site including adjacent parking area.  Location #2: Existing Pad in the PRTA for periodic G/ATOR use. 	1180 Ordnance Operations Building built 1959. Circular pad 3055X, pad for former Radome radar (no longer extant).	NRHP-eligible Mokapu House Lots Archaeological District at Pali Kilo, encompasses 1180, but 1180 is not a contributing historic property. B1180 was built in 1959 and is not NRHP-eligible (2014 Wil Chee Planners et al.) NRHP-listed Mokapu Burial Area (Site 1017), includes the concrete remnant of former 3055 Radome facility, but this is not a contributing historic element.

AREA OF POTENTIAL EFFECTS

The overall GFM APE includes the footprint of the eight (8) GFM projects as described and shown on the maps in the table above including the proposed location of the G/ATOR location at the PRTA, and the training ranges at MCBH Kaneohe Bay, MCTAB, and Puuloa RTF that are shown in enclosure 1.

IDENTIFICATION OF HISTORIC PROPERTIES

In accordance with the NHPA Section 106 Implementing Regulations at 36 CFR 800.4, MCBH has reviewed the existing information on the potential subsurface archaeological resources within the overall GFM APE and determined that additional steps are needed to identify subsurface historic properties at MCBH due to the absence of existing subsurface archaeological information [enclosure 2]. Accordingly, we have initiated the additional effort to identify any potential subsurface archaeological resources within the GFM APE and have enclosed the "Revised Work Plan, Subsurface Archaeological Testing, MCBH Kaneohe Bay" [enclosure 3]. The Revised Work Plan has been edited based on consulting party comments received and now includes a detailed description of mechanical trench excavations that is consistent with the methodology included in the MCBH Home Basing Memorandum of Agreement (2022), among other changes. Pursuant to 36 CFR 800.4(b), this archaeological subsurface investigation will include background research, sample field investigation, field survey, as well as consultation. The investigation will be carried out by qualified preservation professionals and in accordance with the Secretary of the Interior's Standards and Guidelines for Identification.

Known historic properties in the project APE at the MCBH Kaneohe Bay, MCTAB, and Puuloa RTF training areas are listed below.

SIHP Site No. 50-80-11-	**District/Area**	**Period[1]**	**Site Description**	**NRHP Status[2] (Significance Criterion)[3]**
MCBH Kaneohe Bay				
4626	N/A	TH	Modified outcrop	R-yes (D)
1017	N/A	TH	Mokapu Burial Area	NRHP-Listed
MCTAB				
511	Bellows Field Archaeology Area	TH	Area of habitation and burials encompassing the entire coastal area of the present Bellows AFS and MCTAB	NRHP-Listed

SIHP Site No. 50-80-11-	District/Area	Period[1]	Site Description	NRHP Status[2] (Significance Criterion)[3]
3309	Waimanalo Archaeological District (Noncontributing)	NM	Agricultural water catchment system	NRHP-Eligible (D)
3311	Waimanalo Archaeological District (Noncontributing)	NM	Irrigation ditch	NRHP-Eligible (D)
3312	Waimanalo Archaeological District (Noncontributing)	NM	Waimanalo Japanese Cemetery	NRHP-Eligible (A, D)
4850	Waimanalo Archaeological District	TH	Discontinuous subsurface cultural deposit near and may extend into MCTAB	NRHP-Eligible (D)
4851	Waimanalo Archaeological District	TH	Pre-Contact and post-Contact subsurface deposits, 15+ intact burials	NRHP-Eligible (D)
4852	N/A	TH	Subsurface deposits outside of MCTAB, includes Bellows Dune Site (O18); 3 areas of excavation	NRHP Listed
4853	Waimanalo Archaeological District	TH	Subsurface cultural deposits, possibly contains burials	NRHP-Eligible (D)
4858	Waimanalo Archaeological District	TH	Stone structures, lithic scatter, subsurface deposits, possibly burials	NRHP-Eligible (D)

SIHP Site No. 50-80-11-	District/Area	Period[1]	Site Description	NRHP Status[2] (Significance Criterion)[3]
4861	N/A	M	Concrete foundation, artifact scatter	Not evaluated
4862	N/A	M	Artifact scatter	Not evaluated
5716	N/A	TH	Cultural deposit in HIARNG RTI	R-yes (D)
5799	N/A	TH	Surface lithic scatters	Not evaluated
Puuloa RTF				
N/A	N/A	TH	Area of limestone sinkholes	Not evaluated

Notes: [1]Probable period of use: TH=traditional Hawaiian pre-Contact/19th century; NM=non-military 19th/20th century; M=military 20th century
[2]Status of nomination to the NRHP:
NRHP-listed=Listed in the NRHP
NRHP-eligible= determined eligible for NRHP with SHPD concurrence
Not eligible = determined not eligible for the NRHP with SHPD concurrence
R-yes=recommended eligible for the NRHP, SHPD concurrence not yet received
Not evaluated= no eligibility recommendation has been made to date
[3]NRHP significance criteria:
A=associated with events that have made a significant contribution to the broad patterns of our history;
D=yielded, or may be likely to yield, information important in prehistory or history

Legend: HIARNG = Hawaii Army National Guard; MCB = Marine Corps Base; MCTAB = Marine Corps Training Area Bellows; N/A = Not Applicable; NRHP = National Register of Historic Places; RTF = Range Training Facility; RTI = Regional Training Institute; SIHP = State Inventory of Historic Places

SCOPE OF IDENTIFICATION EFFORTS

The "Revised Work Plan, Subsurface Archaeological Testing, MCBH Kaneohe Bay" incorporates all consulting party comments received to date. Therefore, MCBH will proceed with the archaeological testing project as described in the "Revised Work Plan, Subsurface Archaeological Testing, MCBH Kaneohe Bay" on 8 November 2023, unless objections are received prior to that date.

After completion of the archaeological investigation, MCBH will submit the findings to your office, Native Hawaiian Organizations, and other consulting parties and consult as stipulated at 36 CFR 800.4(b) through 800.6, including evaluations of eligibility for any newly discovered subsurface archaeological deposits or sites and our proposed effect determinations. We anticipate providing this submittal in January 2024. MCBH is also forwarding a copy of this letter to the consulting parties listed below as part of the Section 106 consultation process for this undertaking, reiterating from above that we will proceed with the archaeological testing project described in the Revised Work Plan (enclosure 3) on 8 November 2023

unless any objections are received. Should you or your staff have any questions or concerns please contact the MCBH Cultural Resources Management team, Ms. June Cleghorn at 257-7126 or via email at june.cleghorn@usmc.mil, or Ms. Jessica Leger at 257-4218 or via email at jessica.leger@usmc.mil, or Dr. Wendy Wichman at 257-7134 or via email at wendy.wichman@usmc.mil.

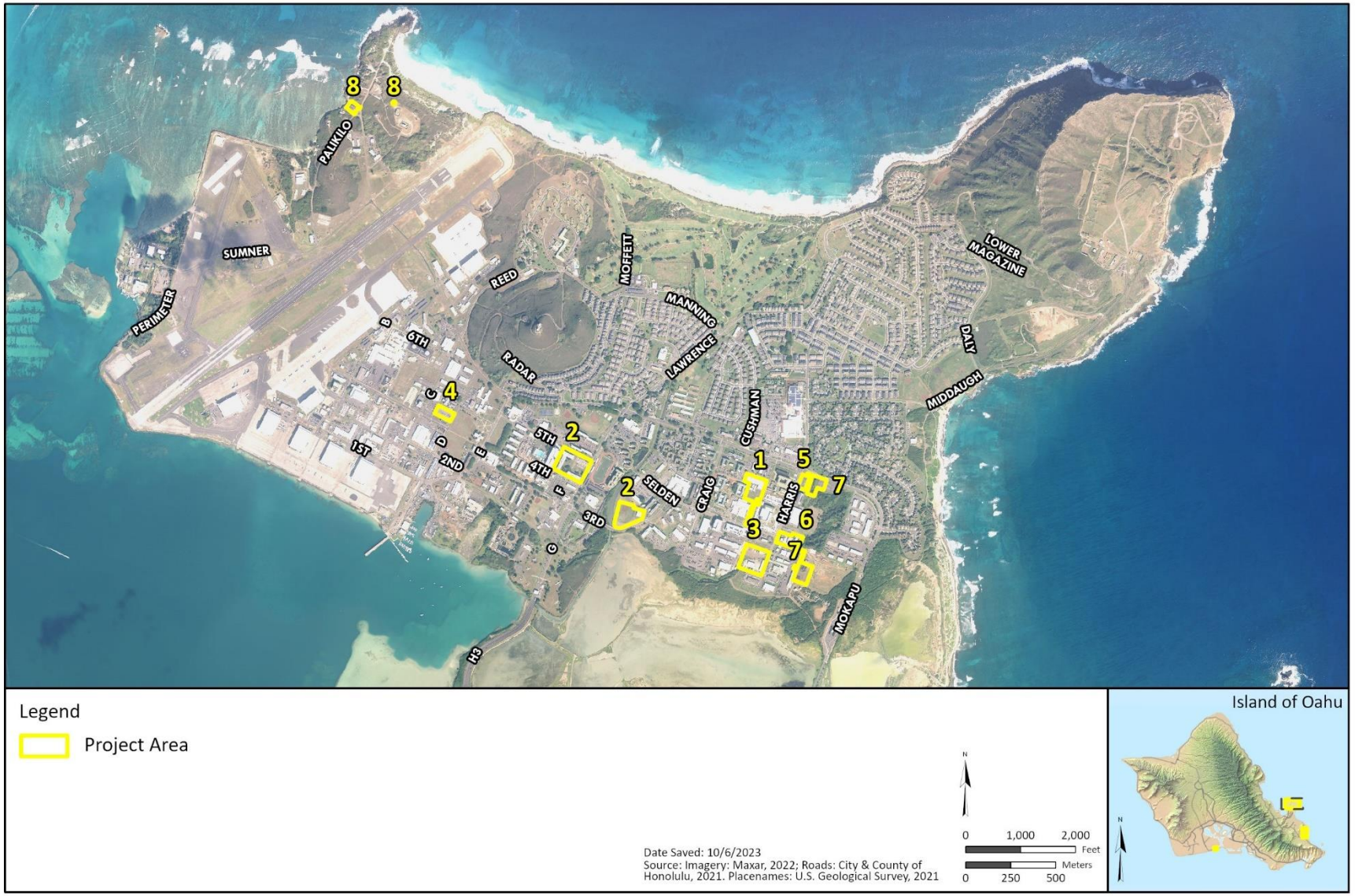
Sincerely,

J. P. Hart
Major, U.S. Marine Corps
Director, Environmental Compliance and Protection Division
By direction of the Commanding Officer

Enclosure: 1. Locations of Area of Potential Effects.
2. Revised MCBH Subsurface Survey Coverage Map.
3. "Revised Work Plan, Subsurface Archaeological Testing, Marine Corps Base Hawaii, Kaneohe Bay, Oahu, Hawaii."

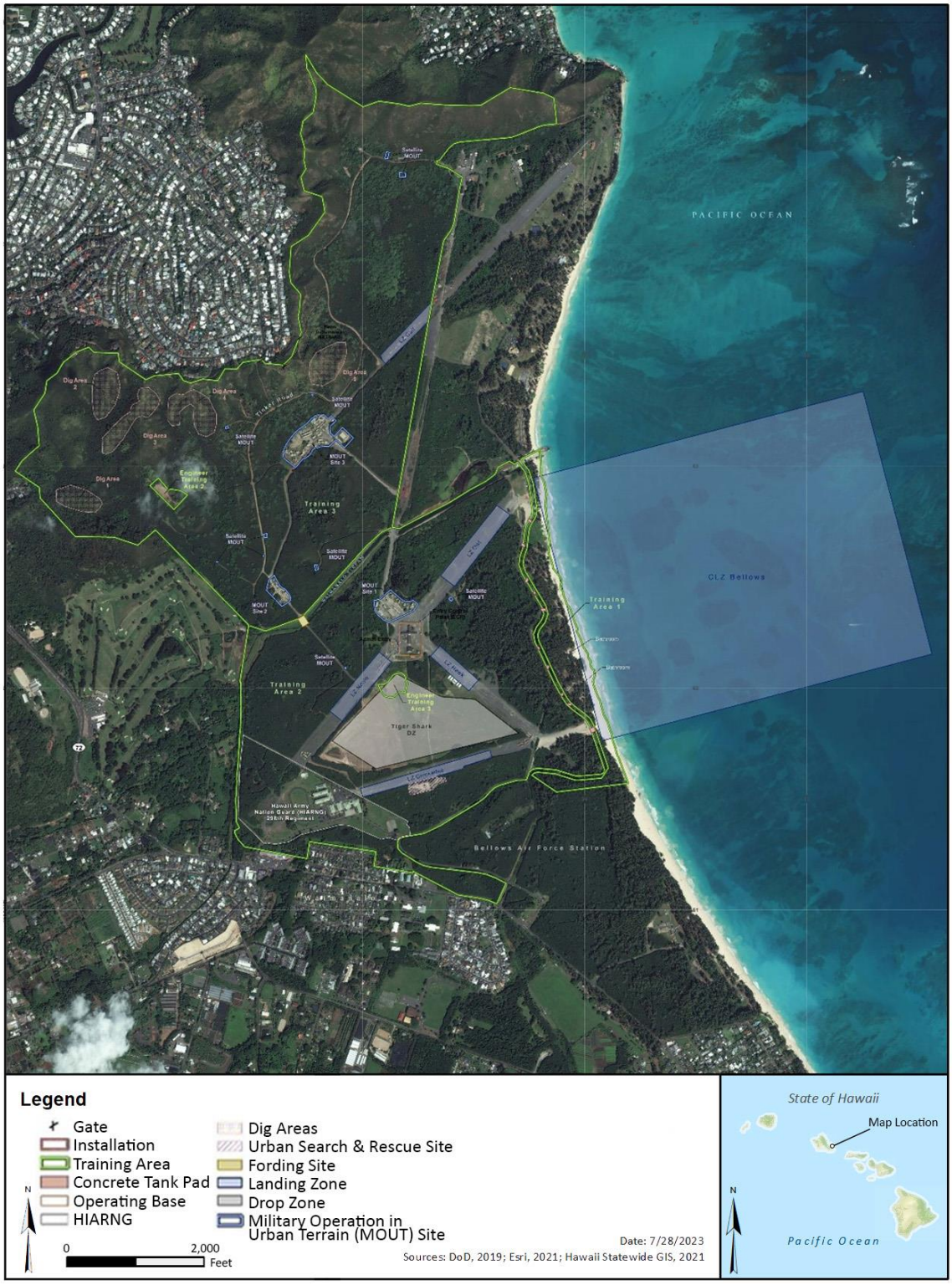
Copy to:

Ms. Anuhea Diamond, Kaulamealani Diamond; Diamond ʻOhana
Ms. Skye Razon-Olds, Kulamanu Napoleon, Kaleleonalani Napoleon; Olds ʻOhana
Ms. Emalia Keohokalole, Mr. Adrian Keohokalole, Mr. Dennis Ka`imi Keohokalole; Mr. Jerome Keohokalole; Keohokalole ʻOhana
Ms. Na`u Kamali`i; Boyd ʻOhana
Ms. Donna Ann Camvel; Paoa Kea Lono ʻOhana
Mr. Cy Harris; Kekumano ʻOhana
Ms. Terrilee Napua Kekoolani Raymond; Keko`olani ʻOhana
Ms. Malia Newhouse, Ko`olauloa Hawaiian Civic Club
Mr. Clive Cabral; Temple of Lono
Chair; Office of Hawaiian Affairs
Chair; Oahu Island Burial Council
Ms. Kiersten Faulkner, Historic Hawaii Foundation
Ms. Elizabeth Merritt, National Trust for Historic Preservation

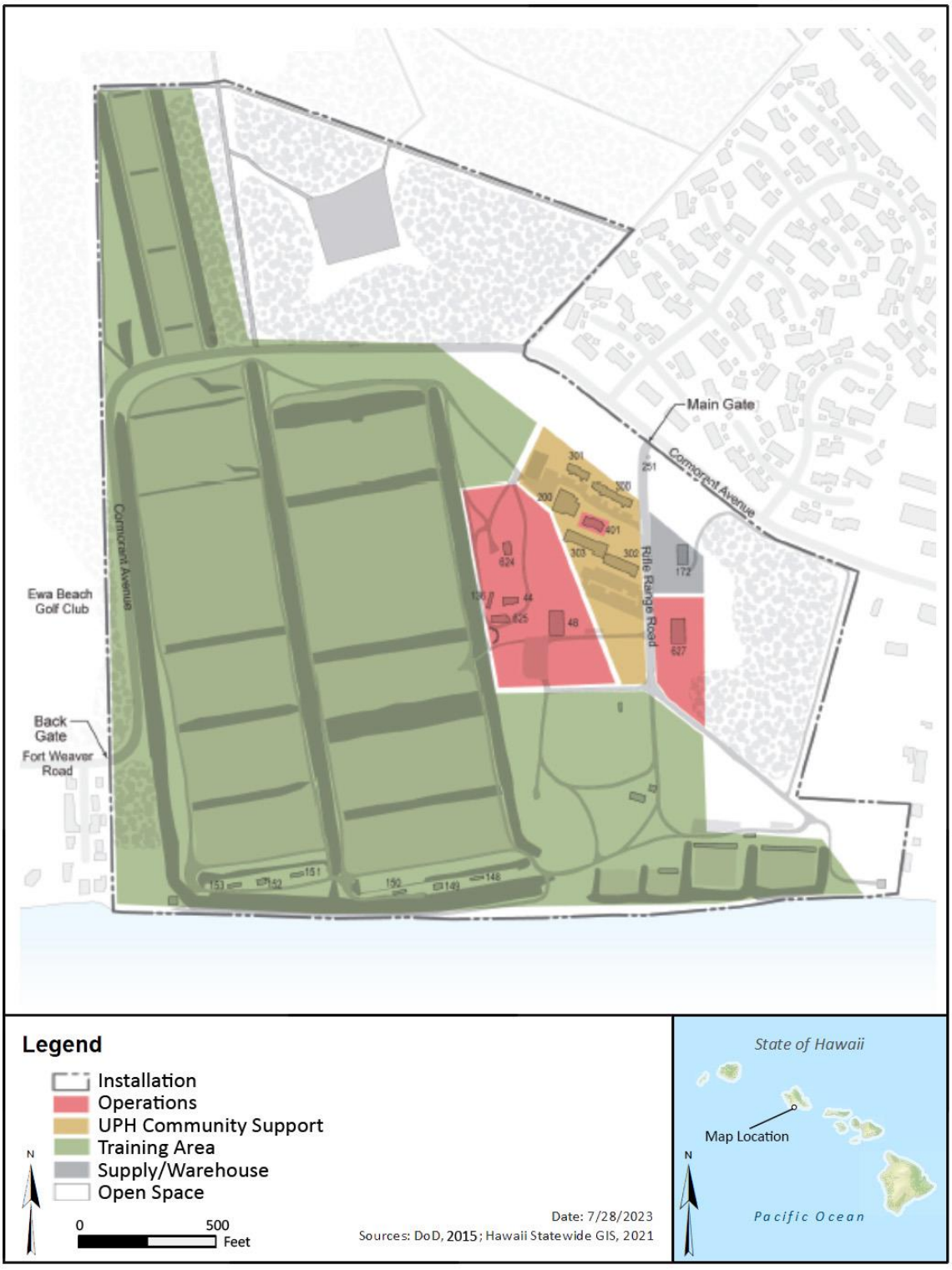


Enclosure 1a. MCB Hawaii Kaneohe Bay Footprints of the Eight GFM Projects
(Please note Project 8 is located in the Pyramid Rock Training Range)

Enclosure 1b. MCB Hawaii Kaneohe Bay Training Areas



Enclosure 1c. Marine Corps Training Area Bellows



Enclosure 1d. Puuloa Range Training Facility

Enclosure 2. Proposed Trench Locations within Project Areas Superimposed on Map of Previous Subsurface Investigations across Mōkapu Peninsula

STATE OF HAWAII | KA MOKU‘ ¯INA ‘O HAWAI‘I
DEPARTMENT OF LAND AND NATURAL RESOURCES
KA ‘OIHANA KUMUWAIWAI ‘ ¯INA

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD., STE 555
KAPOLEI, HI 96707

October 10, 2023

IN REPLY REFER TO:
Project No.: 2023PR01113
Doc. No.: 2310SH01
Archaeology

Major J. P. Hart, Director
Environmental Compliance and Protection Department
United States Marine Corps
Marine Corps Base Hawai‘i Box 63002
Kaneohe Bay, Hawai‘i 96863-3002
Email: Jeffry.Hart@usmc.mil
Electronic Transmittal Only, No Hard Copy to Follow

Dear Major J. P. Hart:

SUBJECT: **National Historic Preservation Act (NHPA) Section 106 Review –
Initiation of Consultation and “Subsurface Archaeological Testing Draft Work Plan”
Ground-Based Forces Modernization Aboard Marine Corps Base Hawai‘i
Ref. No. 5090 LFE/117-23
Kaneohe Ahupua‘a, Ko‘olaupoko District, Island of O‘ahu
TMK: (1) 4-4-008:001**

The State Historic Preservation Division (SHPD) received a letter dated September 12, 2021 from the Marine Corps Base Hawai‘i (MCBH) to initiate the Section 106 historic preservation consultation process with the State Historic Preservation Officer (SHPO) for the Ground-Based Forces Modernization project at MCBH on the island of O‘ahu. The SHPD received this submittal on September 13, 2023 which includes proposed identification efforts within a Draft Work Plan for Subsurface Archaeological Testing (HICRIS Submission No. 2023PR01113.001).

The proposed project is a federal undertaking as defined in 36 CFR 800.16(y) and is therefore subject to Section 106 of the National Historic Preservation Act.

MCBH’s letter states the proposed undertaking is to modernize the existing Marine Corps ground-based forces in Hawai‘i. The project is subject to an Environmental Assessment (EA) that addresses the modernization of (1) equipment, (2) infrastructure, and (3) training for Marine Corps ground-based forces in Hawai‘i at MCBH and associated training ranges in Hawai‘i. The MCBH asserts that of these three components, only the upgrade, renovation, and construction of support facilities at the Kaneohe Bay installation has the potential to cause effects on historic properties, assuming such historic properties are present. MCBH therefore, focused the Section 106 consultation on the upgrade, renovation, and construction of support facilities by Ground-based Forces Modernization (GFM) projects at the Kaneohe Bay installation. There are eight GFM projects described as part of this undertaking.

Modernized equipment would be stored and maintained at MCBH. For training events, this equipment and personnel would transit over base and public roadways (depending on the location of the Range and Training Area) from MCBH to the training area or range and then back to base. The MCBH determined in accordance with 36 CFR 800.3(a)(1), these modernized types of equipment and training are types of activities that do not have the potential to cause effects on historic properties, assuming such historic properties are present, and in accordance with 36 CFR 800.3(a)(1) MCBH has no further obligations under Section 106 for these activities. **The SHPO does not agree** these activities meet the conditions of 36 CFR 800.3(a)(1), further **the SHPO does not agree** with the practice of

removing certain actions in a scope of work from Section 106 consultation; Section 106 consultation should include and consider all components of the undertaking. Therefore, **the SHPO recommends** the Area of Potential Effects (APE) include areas related to the activities associated with the modernized equipment and vehicle operations.

The upgrade, renovation, and construction of GFM support facilities includes new administrative, armory, and operational facilities at the Kaneohe Bay installation. Construction would occur on previously developed, paved, and landscaped areas. All areas, except the proposed replacement ballfield, would require barbed wire security fencing. A list of the proposed actions is within MCBH's letter.

The MCBH notes that the plan titled, *Draft Work Plan, Subsurface Archaeological Testing, Marine Corps Base Hawaii, Kaneohe Bay, Oahu, Hawaii*, also includes (five or six) additional areas for subsurface archaeological testing that are not part of the eight GFM construction projects. These additional testing areas were chosen during early review of future notional projects due to the absence of existing subsurface archaeological information in these areas. MCBH will initiate Section 106 consultation on these projects when the decision has been made to proceed with them. **The SHPD notes** that while the additional areas where future projects may occur may be tested, it will be determined during Section 106 consultation specific to the notional projects whether the identification efforts are adequate.

Please see attached with the HICRIS Submission 2023PR01113.001 response, the SHPD's review comments in track changes on the proposed identification efforts and the document titled, *Draft Work Plan Subsurface Archaeological Testing Marine Corps Base Hawaii, Kāneʻohe Bay, Oʻahu, Hawaiʻi* (September 2023). **The SHPO does not agree** with the proposed archaeological testing being carried out using a backhoe or mini excavator to excavate 1,040 meters of trenches. Mechanical trenching can be very destructive to archaeological deposits and can result in loss of data, especially as the plan does not stipulate screening the excavated materials unless there is a potential find nor does it stipulate precautions to mitigate destruction caused from the mechanical excavator such as scraping the surface at controlled depths at a time using a flat blade.

The SHPD opines backhoe trenching poses a threat to archaeological resources and any data that may be present and implores the MCBH to reconsider the proposed excavation method and using standard archaeological methods of hand excavation in an effort to responsibly investigate the subsurface for archaeological resources. All excavated materials should be screened through quarter inch screen.

Further, the plan should include targeted research goals to add to the current known archaeological data for Mokapu Peninsula. The SHPD suggests the identification efforts include an attempt to locate the boundaries of previously documented archaeological sites for which the extent is currently unknown. Specialized analyses should be included within the plan to answer questions about the context of previously documented sites for which modest data currently exists.

Further, the SHPO requests copies or summaries of any responses received from other consulting parties, especially Native Hawaiian organizations, regarding the proposed testing and how MCBH may have incorporated the comments into the work plan.

The SHPO does not agree with the work proposed to collect archaeological data under the *Draft Work Plan Subsurface Archaeological Testing Marine Corps Base Hawaii, Kāneʻohe Bay, Oʻahu, Hawaiʻi* (September 2023).

The SHPO looks forward to continuing Section 106 consultation for the proposed project.

Please submit all forthcoming information and correspondence related to the subject project to SHPD via HICRIS under Project No. 2023PR01113 using the Project Supplement option.

The MCBH is the office of record for this undertaking. Please maintain a copy of this letter with your environmental review record for this undertaking.

Please contact Stephanie Hacker, Historic Preservation Archaeologist IV, at Stephanie.Hacker@hawaii.gov or at (808) 692-8046 for matters regarding archaeological resources or this letter.

Aloha,

Alan Downer

Alan S. Downer, PhD
Administrator, State Historic Preservation Division
Deputy State Historic Preservation Officer

cc: June Cleghorn, MCBH (june.cleghorn@usmc.mil)
Wendy Wichman, MCBH (wendy.wichman@usmc.mil)

UNITED STATES MARINE CORPS
MARINE CORPS BASE HAWAII
BOX 63002
KANEOHE BAY HAWAII 96863-3002

5090
LFE/117-23
12 Sept 2023

Dr. Alan Downer
Deputy State Historic Preservation Officer
Department of Land and Natural Resources
Kakuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, HI 96707

Dear Dr. Downer:

SUBJECT: **EXPEDITED REVIEW:** SECTION 106 CONSULTATION(ARCHAEOLOGY)FOR GROUND-BASED FORCES MODERNIZATION ABOARD MARINE CORPS BASE HAWAII, DISTRICT OF KOʻOLAUPOKO, AHUPUAʻA OF KANEOHE, ON THE ISLAND OF OʻAHU, TMK 1-4-4-008:001.

Marine Corps Base Hawaii (MCBH) is consulting with your office in compliance with Section 106 of the National Historic Preservation Act (NHPA) regarding the proposed Ground-based Forces Modernization (GFM) aboard MCBH. This letter initiates our Section 106 consultation on the area of potential effects (APE) and efforts regarding identification of historic properties. In accordance with the NHPA Section 106 Implementing Regulations at 36 CFR 800.4, we have reviewed the existing information about subsurface archaeological resources within the APE and determined that additional steps are needed to identify potential subsurface historic properties.

EXPEDITED REVIEW

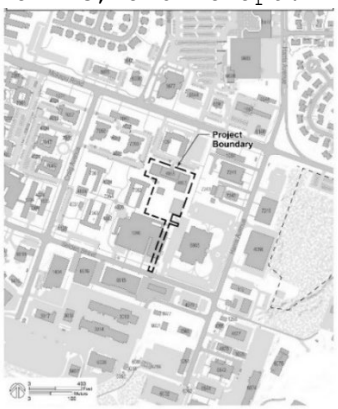
MCBH requests an expedited review period of 21 calendar days for review and comments from your office, from Native Hawaiian organizations (NHO), and from other consulting parties regarding the proposed scope of identification efforts under Section 106 Implementing Regulations at 36 CFR 800.4(a)(1-4). Upon completion of these identification efforts, MCBH will proceed with this consultation as stipulated at 36 CFR 800.4(b) through 800.6.

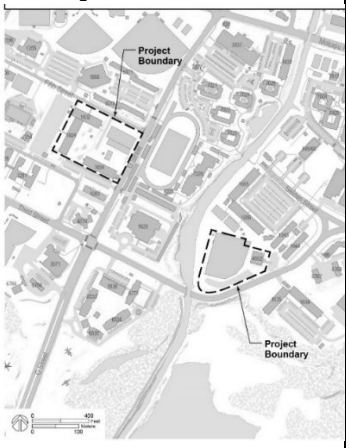
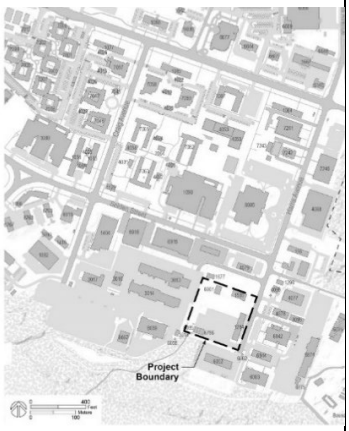
PROJECT DESCRIPTION

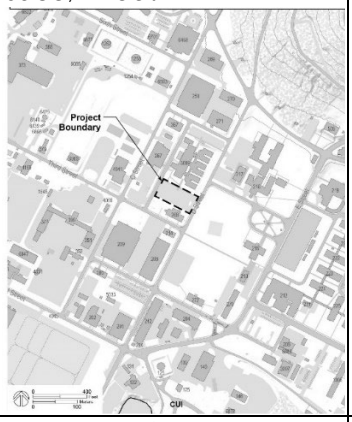
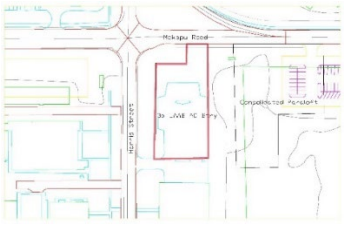
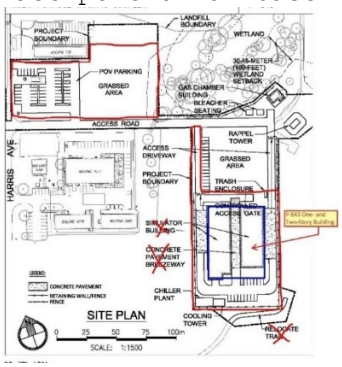
The proposed undertaking is to modernize the existing Marine Corps ground-based forces in Hawaii to enhance the combat capability of Hawaii-based Marine Corps ground forces by enabling them to meet U.S. Marine Corps responsibilities set forth in Title 10 United States Code (USC) Section 8063 in support of the U.S. Indo-Pacific Command (USINDOPACOM). It is subject to an Environmental Assessment (EA) that addresses the modernization of (1) equipment, (2) infrastructure, and (3) training for Marine Corps ground-based forces in Hawaii at MCBH and associated training ranges in Hawaii. There would be no change in the number of Marine Corps Hawaii ground forces personnel because of this proposed undertaking. Of these three components, only the upgrade, renovation, and construction of support facilities at the Kaneohe Bay installation has the potential to cause effects on historic properties, assuming such historic properties are present. Our Section 106 consultation, therefore, focuses on the upgrade, renovation, and construction of support facilities by GFM projects at the Kaneohe Bay installation.

The proposed changes in equipment are evolutions of existing equipment with operational characteristics similar to those historically used by Marine Corps ground forces in Hawaii. The modernized equipment would be stored and maintained at MCBH. Such equipment includes the Navy-Marine Expeditionary Ship Interdiction System (NMESIS), a type of joint light tactical vehicle (JLTV) consisting of a chassis with different options for modules built on top that would provide the Marine Corps with an anti-ship missile capability fired from land. For training events, this equipment and personnel would transit over base and public roadways (depending on the location of the Range and Training Area) from MCBH to the training area and then back to base. The JLTV are currently in use on all Hawaii military training ranges. The modernized equipment also includes the Marine Air Defense Integrated System (MADIS) and Light MADIS, which is similar to current anti-armor weapons systems and would attach to an ultralight tactical vehicle (ULTV) similar to a commercial Polaris off-road vehicle. Training would consist of driving the vehicle to and on the range. Thirdly, the modernized equipment includes the Ground/Air Task-Oriented Radar (G/ATOR), consisting of a radar towed on a trailer by a Medium Tactical Vehicle Replacement (MTVR) vehicle commonly used by the Marine Corps in Hawaii; a generator mounted on the MTVR; and communications equipment mounted on a High Mobility Multi-Wheeled Vehicle (HMMWV), another vehicle commonly used by the Marine Corps in Hawaii. Training would consist of vehicle maneuvers on an existing training range, with the majority of the actual G/ATOR training occurring entirely digitally. Therefore, in accordance with 36 CFR 800.3(a)(1), these modernized types of equipment and training -- NMESIS, MADIS and Light MADIS, and G/ATOR – are types of activities that do not have the potential to cause effects on historic properties, assuming such historic properties are present, and MCBH has no further obligations under Section 106 for these activities.

The upgrade, renovation, and construction of GFM support facilities includes new administrative, armory, and operational facilities at the Kaneohe Bay installation. Construction would occur on previously developed, paved, and landscaped areas. All areas, except the proposed replacement ballfield, would require barbed wire security fencing. Below is a table of the projects including maps and known historic properties in the project APE.

Project	**Area of Potential Effects (APE)**	**Facilities**	**Historic Properties**
3d Marine Littoral Regiment (MLR) Armory Expansion. This project expands the existing armory to accommodate weapons stored in mobile armories. It includes construction of an access driveway and staging area. This requires demolition of basketball court 5024. Water, sewer, and electrical utilities would be improved within the construction footprint.	East portion of base; Selden, Craig, Harris, and Mokapu. 	4053 Armory built 1986. 5024 basketball court built 1987.	4053 is not eligible for the National Register (NR) (Wil Chee Planners et al.2014). 5024 is not 50 years old or eligible for NR.

1st Littoral Anti-Air Detachment (LAAD) Battalion Compound. This project reuses and expands the existing armory B4052, consolidates the MACG-18 armory into the expanded B4052, and constructs a new LAAD Battalion compound. Water, sewer, and electrical utilities would be improved within the construction footprint. Location #1: Reuse and expand existing armory B4052. Includes demolition of ballfield 1528, 6523, 6689, 6690. Location #2: Construct new Ballfield. Demolish 1604, 1632, 1654, 3029 former basketball court, currently paved parking, 1616, 6661, 3006.	East portion of base 	Location #1: 4052 Armory built 1986; 1528 Softball Field built 1957; 6523 Press Booth and 6689, 6690 Baseball Dugouts built in 1990s. Location #2: 1604 BEQ built 1972; 1632 BEQ built 1974; 1654 BEQ built 1976; 1616 Medical Equip. built 1975; 3006 Weather Shelter built 1980; 3029 Basketball Court built 1981; 6661 Personnel Weather Shelter built 2003	1528, 4052, 1616 are not NR-eligible (Wil Chee Planners et al.2014). 6523, 6689, 6690 are not 50 years old or NR-eligible. 1604, 1632, 1654 fall under the Program Comment for Cold War Era Unaccompanied Personnel Housing, 1946-1974. 3006, 3029, 6661 are not 50 years old or NR-eligible.
NMESIS Facility. This project constructs a three-building compound within an existing compound and expands B3013. Requires demolition of 1284, 1565, 6001, 6085 rinse pad; 6786 wash pad; and relocation of 6765C3 prefab structure. Water, sewer, and electrical utilities would be improved within the construction footprint.	East portion of base; corner Selden and Harris 	3013 Maintenance Building built 1980. 1284 Maintenance Shop built 1965; 1565 Shed built 1958. 6001 Vehicle wash pad built 1990; 6085 rinse pad built 1992; 6786 wash pad;	3013, 1284, 1565 are not NR-eligible (Wil Chee Planners et al.2014). 6001, 6085, 6786, 6765C3 are not 50 years old or NR-eligible.

		6765C3 prefab structure.	
III MEF Consolidated Communications Intel-Facility. This project constructs a 2-story consolidated secure facility including exterior covered area for equipment. Displaces existing private vehicle parking. Water, sewer, and electrical utilities would be improved within the construction footprint.	Central portion of base/D St. 	No buildings	
3d Littoral Anti-Air Battalion (LAAB) Air Control Battery Compound. This project constructs Battery Headquarters, Maintenance Shop, and Vehicle Staging Area. It expands B4053 for reuse as the new Administrative Headquarters. Houses transport vehicles for G/ATOR. Water, sewer, and electrical utilities would be improved within the construction footprint.	East portion of base; Mokapu and Harris 	4053 Armory built in 1986. The remaining structures are either trailers, tension fabric structures, or temporary metal shelters that are all Class 3 structures and not Real Property.	4053 is not eligible for the NR (Wil Chee Planners et al.2014).
Live Virtual Constructive Training Environment. This project involves construction of classroom, simulators and operations trainers, and other interior support elements. May include demolition and/or renovation of 6006 and 6075. Water, sewer, and electrical utilities would be improved within the construction footprint.	East portion of base 	6006 Gas Chamber built 1991 6075 Leadership Recreation Course built 1991. Remaining structures are either trailers, tension fabric structures, or temporary	6006, 6075 are not eligible for the NR (Wil Chee Planners et al. 2014)

The blue outline shows the proposed building. The red area around it is for access/paving. The other red area near Harris Ave shows the existing temporary Class 3 structures used for training.		metal shelters that are Class 3 structures and not Real Property.	
Consolidated Paraloft and Dive Shop and 3d Radio Battalion Boat Shop. This project constructs a paraloft facility (drying tower and packing area for parachutes) and a boat/dive shop. The boat shop will be adjacent to Building 6874. Water, sewer, and electrical utilities would be improved within the construction footprint.	East portion of base. 	6874 3rd Radio Battalion Command Post built c. 2018.	6874 is not 50 years old or NR-eligible.
G/ATOR Climate Controlled Warehouse & Pad. This project reuses and modifies an existing concrete pad (3055X) inside the Pyramid Rock Training Area (PRTA) for periodic G/ATOR mobile equipment. At a separate location, this project demolishes Building 1180 to construct a Controlled Humidity Warehouse and Maintenance Facility for G/ATOR equipment storage. G/ATOR equipment inside the PRTA can use Portable Generator power. Modifications to Pad include removal of small non-structural walls that sit on the pad (no ground disturbance); installation of 6-8 tie downs in the pad (no ground disturbance);	West portion of base. Location #1: B1180 site including adjacent parking area.  Location #2: Existing Pad in the PRTA for periodic G/ATOR use. 	1180 Ordnance Operations Building built 1959. Circular pad 3055X, pad for former Radome radar (no longer extant).	NR-eligible Mokapu House Lots Archaeological District at Pali Kilo, encompasses 1180, but 1180 is not a contributing historic property. B1180 was built in 1959 and is not NR-eligible (2014 Wil Chee Planners et al.) NR-listed Mokapu Burial Area (Site 1017), includes the concrete remnant of former 3055 Radome facility, but

and resurfacing pad with an application of non-stick coating.			this is not a contributing historic element.

AREA OF POTENTIAL EFFECTS

The overall GFM Area of Potential Effects (APE) has been determined to include the footprint of the eight (8) GFM projects as described and shown on the maps in the table above.

IDENTIFICATION OF HISTORIC PROPERTIES

In accordance with the NHPA Section 106 Implementing Regulations at 36 CFR 800.4, MCBH has reviewed the existing information on the potential subsurface archaeological resources within the overall GFM APE and determined that additional steps are needed to identify subsurface historic properties in the APE due to the absence of existing subsurface archaeological information [enclosure 1]. Accordingly, we have initiated the additional effort to identify any potential subsurface archaeological resources within the GFM APE and have enclosed our "Subsurface Archaeological Testing Draft Work Plan" for your review and comment [enclosure 2]. Pursuant to 36 CFR 800.4(b), this investigation will include background research, sample field investigation, field survey, as well as consultation. The investigation will be carried out by qualified preservation professionals and in accordance with the Secretary of the Interior's (SOI) Standards and Guidelines for Identification. The archaeologists carrying out the investigation would like to begin in mid-October 2023.

Please note that the "Draft Work Plan, Subsurface Archaeological Testing, Marine Corps Base Hawaii, Kaneohe Bay, Oahu, Hawaii," also includes five (5) additional areas for subsurface archaeological testing that are not part of the eight (8) GFM construction projects. These five additional testing areas were chosen during early review of future notional projects due to the absence of existing subsurface archaeological information in these areas. MCBH will initiate Section 106 consultation on these five projects when the decision has been made to proceed with them. In the meantime, MCBH will have completed more extensive archaeological identification efforts across the Kaneohe Bay installation.

SCOPE OF IDENTIFICATION EFFORTS

As stated above, MCBH requests an expedited review period of 21 calendar days for comments regarding the scope of our proposed identification efforts in the "Draft Work Plan, Subsurface Archaeological Testing, Marine Corps Base Hawaii, Kaneohe Bay, Oahu, Hawaii," pursuant to Section 106 Implementing Regulations at 36 CFR 800.4(a)(1-4). After completion of the archaeological investigation, we will submit the findings to your office, NHOs, and other consulting parties and consult as stipulated at 36 CFR 800.4(b) through 800.6, including evaluations of eligibility for any newly discovered subsurface archaeological deposits or sites and our proposed determination of effect. We anticipate providing this submittal in January 2024. MCBH is also forwarding a copy of this letter to the consulting parties listed below as part of the Section 106 consultation process for this undertaking. Thus, MCBH requests comments from these consulting parties regarding the above

determination within 21 days of receipt of this letter. Should you or your staff have any questions or concerns please contact the MCBH Cultural Resources Management team, Ms. June Cleghorn at 257-7126 or via email at june.cleghorn@usmc.mil, or Ms. Jessica Leger at 257-4218 or via email at jessica.leger@usmc.mil, or Dr. Wendy Wichman at 257-7134 or via email at wendy.wichman@usmc.mil.

Sincerely,

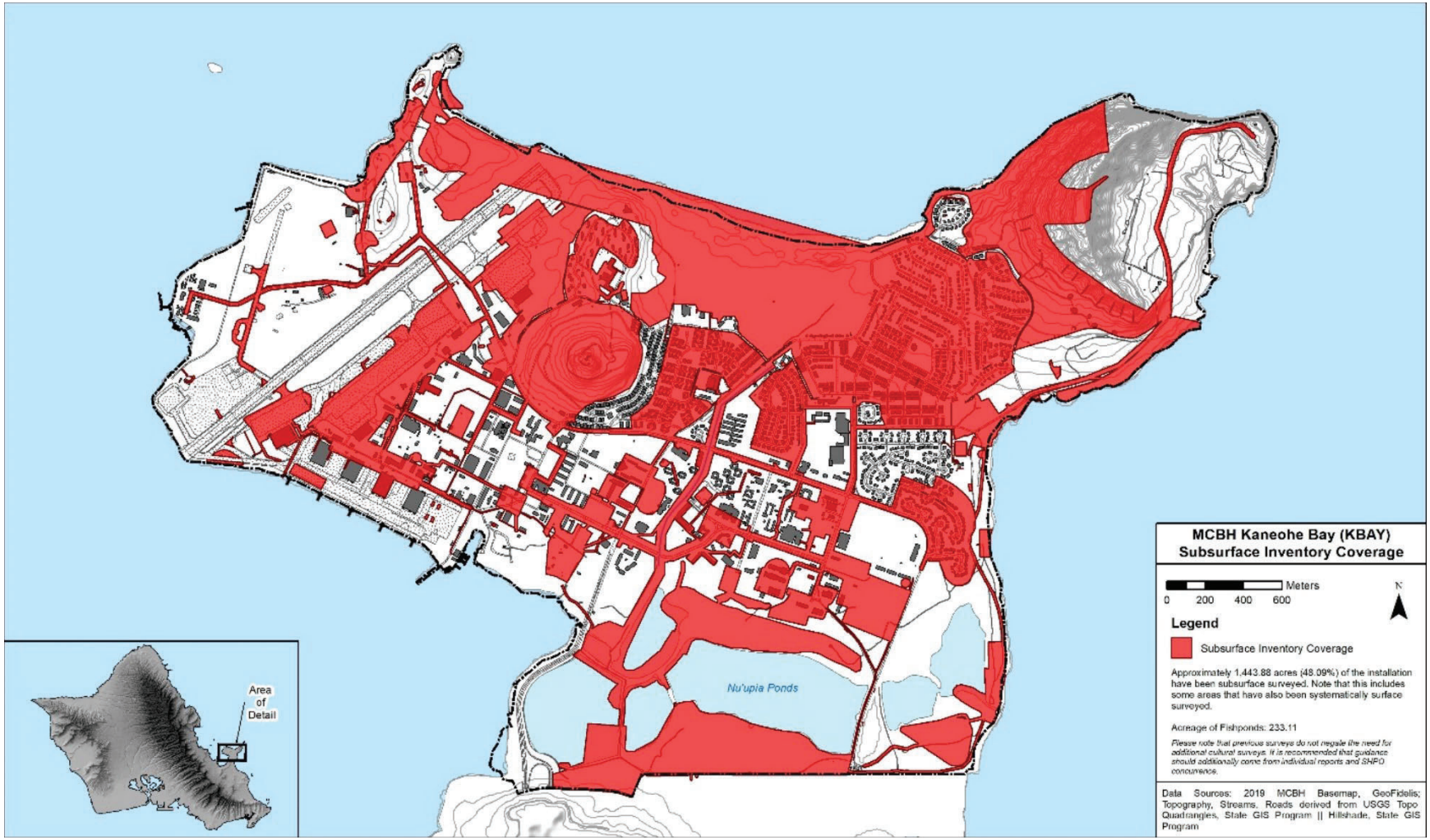
HART.JEFFRY.P.1242350568 Digitally signed by HART.JEFFRY.P.1242350568 Date: 2023.09.13 08:12:49 -10'00'

J. P. Hart
Major, U.S. Marine Corps
Director, Environmental Compliance and Protection Division
By direction of the Commanding Officer

Enclosure: 1. MCBH Subsurface Survey Coverage Map.
2. "Draft Work Plan, Subsurface Archaeological Testing, Marine Corps Base Hawaii, Kaneohe Bay, Oahu, Hawaii."

Copy to:

Ms. Anuhea Diamond, Kaulamealani Diamond; Diamond ʻOhana
Ms. Skye Razon-Olds, Kulamanu Napoleon, Kaleleonalani Napoleon; Olds ʻOhana
Ms. Emalia Keohokalole, Mr. Adrian Keohokalole, Mr. Dennis Ka`imi Keohokalole; Mr. Jerome Keohokalole; Keohokalole ʻOhana
Ms. Na`u Kamali`i; Boyd ʻOhana
Ms. Donna Ann Camvel; Paoa Kea Lono ʻOhana
Mr. Cy Harris; Kekumano ʻOhana
Ms. Terrilee Napua Kekoolani Raymond; Keko`olani ʻOhana
Ms. Malia Newhouse, Ko`olauloa Hawaiian Civic Club
Mr. Clive Cabral; Temple of Lono
Chair; Office of Hawaiian Affairs
Chair; Oahu Island Burial Council
Ms. Kiersten Faulkner, Historic Hawaii Foundation
Ms. Elizabeth Merritt, National Trust for Historic Preservation



Enclosure 1. MCBH Subsurface Survey Coverage Map

APPENDIX D
ENDANGERED SPECIES ACT SECTION 7 CONSULTATION

To Be Provided in Final EA

This page intentionally left blank.

APPENDIX E
COASTAL ZONE MANAGEMENT ACT COORDINATION

This page intentionally left blank.

Peer Amble

From: Mendes, Debra L <debra.l.mendes@hawaii.gov>
Sent: Thursday, November 30, 2023 4:17 PM
To: Santos CIV Thomas E
Cc: Bomar CIV Jacquelyn C; Hart Maj Jeffry P; Nihipali, Justine W; Peer Amble; Bigay, John C CIV USN (USA); McWhirter Maj Travis E; Crawford LtCol Christiana R; Glover CTR Rachel K
Subject: RE: Notification of Proposed Marine Corps Ground Forces Modernization at Marine Corps Base (MCB) Hawaii, Navy/Marine Corps De Minimis Activities under CZMA

Aloha Mr. Santos,

Thank you for the additional information. This acknowledges receipt of the notification by the U.S. Marine Corps of the CZMA De Minimis List for the subject Proposed Marine Corps Ground Forces Modernization at Marine Corps Base Hawaii, Kaneohe Bay. This Hawaii CZM Program acknowledgment of receipt does not represent an endorsement of the proposed activity.

Thank you.
Debra

~ * ~ * ~ * ~ * ~ * ~ * ~ * ~ * ~ * ~ * ~
Debra L. Mendes
Hawaii Coastal Zone Management Program
PO Box 2359
Honolulu, HI 96804-2359
Ph: 808.587.2840
Email: Debra.L.Mendes@hawaii.gov
~ * ~ * ~ * ~ * ~ * ~ * ~ * ~ * ~ * ~ * ~

> **From:** Santos CIV Thomas E <thomas.e.santos.civ@usmc.mil>
> **Sent:** Thursday, November 30, 2023 10:04 AM
> **To:** Mendes, Debra L <debra.l.mendes@hawaii.gov>
> **Cc:** Bomar CIV Jacquelyn C <jacquelyn.bomar@usmc.mil>; Hart Maj Jeffry P <jeffry.hart@usmc.mil>; Nihipali, Justine W <justine.w.nihipali@hawaii.gov>; Peer Amble <Peer.Amble@cardno-gs.com>; Bigay, John C CIV USN (USA) <john.c.bigay.civ@us.navy.mil>; McWhirter Maj Travis E <travis.mcwhirter@usmc.mil>; Crawford LtCol Christiana R <christiana.crawford@usmc.mil>; Glover CTR Rachel K <rachel.glover.ctr@usmc.mil>
> **Subject:** [EXTERNAL] RE: Notification of Proposed Marine Corps Ground Forces Modernization at Marine Corps Base (MCB) Hawaii, Navy/Marine Corps De Minimis Activities under CZMA
>
> Good Morning Ms. Mendes,
>
> There will not be any changes/alterations to the training dates/times as the type of training and associated activities would be consistent with historic Marine Corps range utilization in Hawaii.
>
> V/R
>
> *Thomas Santos*
> NEPA Program Manager

Environmental Compliance and Protection Division
Marine Corps Base Hawaii
Kaneohe Bay, HI
DSN: 315-496-7139
Commercial: 1-808-496-7139
Cell: 808-272-5549
E-mail: Thomas.e.santos.civ@usmc.mil

From: Mendes, Debra L <debra.l.mendes@hawaii.gov>
Sent: Wednesday, November 29, 2023 2:26 PM
To: Santos CIV Thomas E <thomas.e.santos.civ@usmc.mil>
Cc: Bomar CIV Jacquelyn C <jacquelyn.bomar@usmc.mil>; Hart Maj Jeffry P <jeffry.hart@usmc.mil>; Nihipali, Justine W <justine.w.nihipali@hawaii.gov>; Peer Amble <Peer.Amble@cardno-gs.com>; Bigay, John C CIV USN (USA) <john.c.bigay.civ@us.navy.mil>; McWhirter Maj Travis E <travis.mcwhirter@usmc.mil>; Crawford LtCol Christiana R <christiana.crawford@usmc.mil>; Glover CTR Rachel K <rachel.glover.ctr@usmc.mil>
Subject: [Non-DoD Source] RE: Notification of Proposed Marine Corps Ground Forces Modernization at Marine Corps Base (MCB) Hawaii, Navy/Marine Corps De Minimis Activities under CZMA

Aloha Mr. Santos,
Will there be any changes/alterations to training dates/times (i.e. additional days or hours)?
Thank you.

~ * ~ * ~ * ~ * ~ * ~ * ~ * ~ * ~ * ~ * ~ *
Debra L. Mendes
Hawaii Coastal Zone Management Program
PO Box 2359
Honolulu, HI 96804-2359
Ph: 808.587.2840
Email: Debra.L.Mendes@hawaii.gov
~ * ~ * ~ * ~ * ~ * ~ * ~ * ~ * ~ * ~ * ~ *

From: Santos CIV Thomas E <thomas.e.santos.civ@usmc.mil>
Sent: Wednesday, November 29, 2023 11:17 AM
To: Mendes, Debra L <debra.l.mendes@hawaii.gov>
Cc: Bomar CIV Jacquelyn C <jacquelyn.bomar@usmc.mil>; Hart Maj Jeffry P <jeffry.hart@usmc.mil>; Peer Amble <Peer.Amble@cardno-gs.com>; Bigay, John C CIV USN (USA) <john.c.bigay.civ@us.navy.mil>; McWhirter Maj Travis E <travis.mcwhirter@usmc.mil>; Crawford LtCol Christiana R <christiana.crawford@usmc.mil>; Glover CTR Rachel K <rachel.glover.ctr@usmc.mil>
Subject: [EXTERNAL] Notification of Proposed Marine Corps Ground Forces Modernization at Marine Corps Base (MCB) Hawaii, Navy/Marine Corps De Minimis Activities under CZMA

Aloha Ms. Mendes,

The U. S. Marine Corps is preparing an Environmental Assessment (EA) in accordance with the National Environmental Policy Act of 1969 (NEPA), as implemented by the Council on Environmental Quality regulations, Department of the Navy Regulations, and Marine Corps Order 5090.2 for implementing NEPA. The proposed action is the modernization of equipment, infrastructure, and training for Marine Corps ground forces in Hawaii.

The purpose of the proposed action is to modernize existing Marine Corps ground forces in Hawaii. The need for the proposed action is to enhance the combat capability of Hawaii-based Marine Corps ground forces, enabling them to meet U.S. Marine Corps responsibilities set forth in Title 10 United States Code (USC) Section 8063 in support of the U.S. Indo-Pacific Command (USINDOPACOM).

The proposed action would occur at MCB Hawaii and associated training ranges in Hawaii. The proposed action has three components: (1) modernize equipment; (2) upgrade, renovate, and construct support facilities; and (3) conduct training activities with the modernized equipment. There would be no change in the number of Marine Corps Hawaii ground forces personnel because of the proposed action.

The proposed action falls within the Navy/Marine Corps De Minimis Activities Under CZMA, Item 1: New Construction, Item 2: Utility Line Activities, Item 10: Studies and Data Collection and Survey Activities, Item 11: Demolition, and Item 12: Military Testing and Training.

> Item 1. Construction of new facilities and structures wholly within Navy/Marine Corps controlled areas (including land and water) that is similar to present use and, when completed, the use or operation of which complies with existing regulatory requirements.
>
> Item 2. Acquisition, installation, operation, construction, maintenance, or repair of utility or communication systems that use rights of way, easements, distribution systems, or facilities on Navy/Marine Corps controlled property. This also includes the associated excavation, backfill, or bedding for the utility lines, provided there is no change in preconstruction contours.
>
> Item 10. Studies, data and information-gathering, and surveys that involve no permanent physical change to the environment. Includes topographic surveys, wetlands mapping, surveys for evaluating environmental damage, engineering efforts to support environmental analyses, core sampling, soil survey sampling, and historic resources surveys.
>
> Item 11. Demolition and disposal involving buildings or structures when done in accordance with applicable regulations and within Navy/Marine Corps controlled properties.
>
> Item 12. Routine testing and evaluation of military equipment on or over military [land or water areas], or an established range, restricted area or operating area or training conducted on or over military land or water areas in which the impact is not significant.

The relevant project mitigation/general conditions under the De Minimis agreement for New Construction, Utility Line Activities, Repair and Maintenance, Studies and Data Collection and Survey Activities, Demolition, and Military Testing and Training actions are: 1, 2, 3, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16:

> 1. Navy/Marine Corps controlled property refers to land areas, rights of way, easements, roads, safety zones, danger zones, ocean and naval defensive sea areas under active Navy/Marine Corps control.
>
> 2. If any listed species enters the area during conduct of construction activities, all activities should cease until the animal(s) voluntarily depart the area.
>
> 3. Turbidity and siltation from project related work will be minimized and contained to within the vicinity of the site through appropriate use of effective silt containment devices and the curtailment of work during adverse tidal and weather conditions.

6. No project-related materials (fill, revetment, rock, pipe, etc.) will be stockpiled in the water (intertidal zones, reef flats, stream channels, wetlands, etc.).

8. No contamination (trash or debris disposal, alien species introductions, etc.) of adjacent marine/aquatic environments (reef flats, channels, open ocean, stream channels, wetlands, etc.) shall result from project-related activities.

9. Fueling of project-related vehicles and equipment should take place away from the water and a contingency plan to control petroleum products accidentally spilled during the project shall be developed. Absorbent pads and containment booms shall be stored on-site, if appropriate, to facilitate clean-up of accidental petroleum releases.

10. Any under-layer fills used in the project shall be protected from erosion with stones (or core-loc units) as soon after placement as practicable.

11. Any soil exposed near water as part of the project shall be protected from erosion (with plastic sheeting, filter fabric, etc.) after exposure and stabilized as soon as practicable (with vegetation matting, hydroseeding, etc.).

12. Section 106, of the National Historic Preservation Act (NHPA), consultation requirements must be met. Also, follow guidelines in the area-specific Integrated Cultural Resources Management Plan (ICRMP) if applicable.

13. Project-related activities will not affect federally listed endangered/threatened plan species.

14. The National Environmental Policy Act (NEPA) review process will be completed.

15. The training, testing and evaluation will be conducted in accordance with applicable standard operating procedures protective of the environment.

16. Navy or Marine Corps staff shall notify State CZM of de minimis list usage for projects which require an Environmental Assessment (EA).

The attached document highlights proposed facilities and locations that this EA will cover.

If you have any questions or would like more information, you can reach me by e-mail at Thomas.e.santos.civ@usmc.mil or by phone at (808) 496-7139.

Thank you.

V/R

Thomas Santos
NEPA Program Manager
Environmental Compliance and Protection Division
Marine Corps Base Hawaii
Kaneohe Bay, HI
DSN: 315-496-7139
Commercial: 1-808-496-7139
Cell: 808-272-5549

E-mail: Thomas.e.santos.civ@usmc.mil

APPENDIX F
AIR EMISSIONS CALCULATIONS

This page intentionally left blank.

TAB A. **CONSTRUCTION EMISSIONS Alternative 1**

Production rates from MDOT:
https://mdotwiki.state.mi.us/images_construction/a/a4/MDOT_Production_Rates.pdf

Basic Conversions

453.59	grams per pound (lbs)
43,560	Conversion from acre to square feet (SF)
0.03704	Cubic feet to cubic yards (CY)
0.1111	SF to square yards (SY)
2000	lbs per ton
145	lbs/cubic feet (ft^3) density of Hot Mix Asphalt (HMA)
12	CY haul truck capacity
9	CY concrete truck capacity
1	ft excavation depth
0.5	ft (6 in) gravel
0.5	ft (6 in) concrete/asphalt

Table 1.1 **Demolition** 176,391 SF 59 days

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO_2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	CO_2 g/hp-hr
Dozer	470	145	0.58	0.38	1.41	4.17	0.12	0.30	0.29	536
Loader/Backhoe	470	87	0.21	1.43	7.35	6.35	0.15	1.06	1.03	692
Small Backhoe	470	55	0.21	1.43	7.35	6.35	0.15	1.06	1.03	692

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Dozer	32.85	123.35	363.98	10.05	25.81	25.04	46,719
Loader w/integral Backhoe	27.13	139.25	120.29	2.82	20.14	19.54	13,104
Small backhoe	17.15	88.03	76.04	1.78	12.73	12.35	8,284
Subtotal in lbs	77	351	560	15	59	57	68,107
Demo Total in Tons	**0.04**	**0.18**	**0.28**	**0.01**	**0.03**	**0.03**	
Demo Total in Metric Tons							**31**

2,156 Truck trips

Table 1.2 **Demolition - Hauling** 10 miles per trip

On-road Equipment	Miles	Engine HP	VOC lb/mile	CO lb/mile	NOx lb/mile	SO_2 lb/mile	PM10 lb/mile	PM2.5 lb/mile	CO_2 lb/mile
Dump Truck (12 CY)	21,559	230	0.0015	0.0080	0.0361	0.0000	0.0015	0.0015	3.4385

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Dump Truck (12 CY)	32.80	173.38	777.63	0.39	32.43	31.43	74,131
Subtotal in lb:	33	173	778	0	32	31	74,131
Demo Hauling Grand Total in Tons	**0.02**	**0.09**	**0.39**	**0.00**	**0.02**	**0.02**	
Demo Hauling Total in Metric Tons							**34**

Table 1.3 **Site Prep**

Site Prep - Excavate/Fill (CY) 13,602 CY 9 days 1,134 truck trips
Grading (SY) 40,803 SY 20 days

Off-road Equipment	Hours	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO_2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	CO_2 g/hp-hr
Excavator	73	243	0.59	0.34	1.21	4.03	0.12	0.22	0.22	536
Skid Steer Loader	163	160	0.23	0.38	1.47	4.34	0.12	0.31	0.30	536
Dozer (Rubber Tired)	163	145	0.59	0.38	1.41	4.17	0.12	0.30	0.29	536
Compactor	163	103	0.58	0.40	1.57	4.57	0.12	0.32	0.31	536
Grader	163	285	0.58	0.34	1.21	4.07	0.12	0.23	0.22	536

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Excavator	7.89	27.73	92.40	2.64	5.11	4.96	12,286
Skid Steer Loader	5.07	19.46	57.45	1.53	4.04	3.92	7,093
Dozer (Rubber Tired)	11.59	43.54	128.47	3.55	9.11	8.84	16,490
Compactor	8.49	33.76	98.15	2.48	6.86	6.65	11,514
Grader	20.45	71.84	242.08	6.86	13.42	13.01	31,868

Excavation - Hauling 20 miles RT

On-road Equipment	Miles	Engine HP	VOC lb/mile	CO lb/mile	NOx lb/mile	SO_2 lb/mile	PM_{10} lb/mile	$PM_{2.5}$ lb/mile	CO_2 lb/mile
Dump Truck	22,671	230	0.0015	0.0080	0.0361	0.0000	0.0015	0.0015	3.4385

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Dump Truck	34.49	182.32	817.73	0.41	34.11	33.05	77,953

	VOC	CO	NOx	SO2	PM10	PM2.5	CO_2
Subtotal in lb:	88	379	1,436	17	73	70	157,204
Site Prep Grand Total in Tons	**0.04**	**0.19**	**0.72**	**0.01**	**0.04**	**0.04**	
Site Prep Grand Total in Metric Tons							**71**

Table 1.4 **Gravel Work** 6,801 CY 68 days 567 truck trips

Off-road Equipment	Hours	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO_2 g/hp-hr	PM_{10} g/hp-hr	$PM_{2.5}$ g/hp-hr	CO_2 g/hp-hr
Dozer	544	185	0.59	0.34	1.21	4.08	0.12	0.23	0.22	536
Wheel Loader for Spreading	544	87	0.59	0.35	1.25	4.23	0.12	0.24	0.23	536
Compactor	544	103	0.43	0.36	1.34	4.45	0.12	0.26	0.25	536

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Dozer	45.01	158.07	534.21	15.09	29.60	28.71	70,150
Wheel Loader for Spreading	21.47	76.86	260.65	7.10	14.70	14.26	32,988
Compactor	19.10	71.12	236.50	6.12	13.66	13.25	28,462

20 miles RT

On-road Equipment	Miles	Engine HP	VOC lb/mile	CO lb/mile	NOx lb/mile	SO_2 lb/mile	PM_{10} lb/mile	$PM_{2.5}$ lb/mile	CO_2 lb/mile
Dump Truck	11,335	230	0.0015	0.0080	0.0361	0.0000	0.0015	0.0015	3.4385

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Dump Truck	17.24	91.16	408.86	0.20	17.05	16.52	38,977
Subtotal (lbs):	**103**	**397**	**1,440**	**29**	**75**	**73**	**170,577**
Gravel Work Grand Total in Tons	**0.05**	**0.20**	**0.72**	**0.01**	**0.04**	**0.04**	
Gravel Work Grand Total in Metric Tons							**77**

Table 1.5 **Concrete Work** 6,801 CY 68 days 756 truck trips

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO_2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	CO_2 g/hp-hr
				Emission Factors						
Concrete Mixer	544	3.5	0.43	0.69	3.04	6.17	0.13	0.54	0.52	588
Concrete Truck	544	300	0.43	0.38	1.75	6.18	0.11	0.27	0.26	530

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
	Annual Emissions						
Concrete Mixer	1.24	5.50	11.14	0.23	0.98	0.95	1,062.02
Concrete Truck	58.73	270.14	956.66	17.64	41.58	40.33	81,994.97
Subtotal (lbs):	**60**	**276**	**968**	**18**	**43**	**41**	**83,057**
Concrete Work Grand Total in Tons	**0.03**	**0.14**	**0.48**	**0.01**	**0.02**	**0.02**	
Concrete Work Grand Total in Metric Tons							**38**

20 miles RT

On-road Equipment	Miles	Engine HP	VOC lb/mile	CO lb/mile	NOx lb/mile	SO_2 lb/mile	PM_{10} lb/mile	$PM_{2.5}$ lb/mile	CO_2 lb/mile
Concrete Truck	15,114	230	0.0015	0.0080	0.0361	0.0000	0.0015	0.0015	3.4385

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Concrete Truck	22.99	121.54	545.15	0.27	22.74	22.03	51,969
Subtotal (lbs):	**23**	**122**	**545**	**0**	**23**	**22**	**51,969**
Concrete Truck Travel Grand Total in Tons	**0.01**	**0.06**	**0.27**	**0.00**	**0.01**	**0.01**	
Concrete Truck Travel Grand Total in Metric Tons							**24**

Table 1.6 **Construction Year 1** 181,199 SF 230 days

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO_2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	CO_2 g/hp-hr
				Emission Factors						
Crane	1,840	330	0.58	0.25	1.22	5.26	0.11	0.21	0.20	530
Concrete Truck	1,840	300	0.43	0.19	1.45	4.32	0.12	0.21	0.20	536
Diesel Generator	1,840	40	0.43	0.26	1.41	3.51	0.11	0.23	0.22	536
Telehandler	920	99	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595
Scissors Lift	920	83	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595
Skid Steer Loader	1,840	67	0.59	1.69	7.97	6.70	0.15	1.19	1.15	691
All Terrain Forklift	920	84	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
	Annual Emissions						
Crane	190.77	946.85	4,083.80	88.57	161.28	156.44	411,734
Concrete Truck	98.17	761.15	2,260.99	60.37	109.93	106.63	280,622
Diesel Generator	18.32	98.30	244.78	7.53	16.18	15.69	37,412
Telehandler	60.37	466.74	583.94	15.15	61.74	59.89	70,444
Scissors Lift	50.61	391.31	489.57	12.70	51.76	50.21	59,059
Skid Steer Loader	271.38	1,277.65	1,074.04	23.83	190.69	184.96	110,784
All Terrain Forklift	51.22	396.02	495.46	12.86	52.38	50.81	59,771
Subtotal (lbs):	**741**	**4,338**	**9,233**	**221**	**644**	**625**	**1,029,827**
Year 1: Building Construction Grand Total in Tons	**0.37**	**2.17**	**4.62**	**0.11**	**0.32**	**0.31**	
Year 1: Building Construction Grand Total in Metric Tons							**467**

Construction Year 2 53,161 SF 200 days

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO_2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	CO_2 g/hp-hr
				Emission Factors						
Crane	1,600	330	0.58	0.25	1.22	5.26	0.11	0.21	0.20	530
Concrete Truck	1,600	300	0.43	0.19	1.45	4.32	0.12	0.21	0.20	536
Diesel Generator	1,600	40	0.43	0.26	1.41	3.51	0.11	0.23	0.22	536
Telehandler	800	99	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595
Scissors Lift	800	83	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595
Skid Steer Loader	1,600	67	0.59	1.69	7.97	6.70	0.15	1.19	1.15	691
All Terrain Forklift	800	84	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
	Annual Emissions						
Crane	165.88	823.35	3,551.13	77.02	140.24	136.04	358,030
Concrete Truck	85.37	661.87	1,966.08	52.49	95.59	92.72	244,019
Diesel Generator	15.93	85.48	212.85	6.55	14.07	13.65	32,532
Telehandler	52.49	405.86	507.77	13.18	53.68	52.07	61,256
Scissors Lift	44.01	340.27	425.71	11.05	45.01	43.66	51,356
Skid Steer Loader	235.98	1,111.00	933.95	20.72	165.81	160.84	96,334
All Terrain Forklift	44.54	344.37	430.84	11.18	45.55	44.18	51,975
Subtotal (lbs):	**644**	**3,772**	**8,028**	**192**	**560**	**543**	**895,502**
Year 2: Building Construction Grand Total in Tons	**0.32**	**1.89**	**4.01**	**0.10**	**0.28**	**0.27**	
Year 2: Building Construction Grand Total in Metric Tons							**406**

Construction Year 3 18,070 SF 100 days

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO_2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	CO_2 g/hp-hr
				Emission Factors						
Crane	800	330	0.58	0.25	1.22	5.26	0.11	0.21	0.20	530
Concrete Truck	800	300	0.43	0.19	1.45	4.32	0.12	0.21	0.20	536
Diesel Generator	800	40	0.43	0.26	1.41	3.51	0.11	0.23	0.22	536
Telehandler	400	99	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595
Scissors Lift	400	83	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595
Skid Steer Loader	800	67	0.59	1.69	7.97	6.70	0.15	1.19	1.15	691
All Terrain Forklift	400	84	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
	Annual Emissions						
Crane	82.94	411.67	1,775.56	38.51	70.12	68.02	179,015
Concrete Truck	42.68	330.94	983.04	26.25	47.79	46.36	122,010
Diesel Generator	7.96	42.74	106.42	3.27	7.03	6.82	16,266
Telehandler	26.25	202.93	253.89	6.59	26.84	26.04	30,628
Scissors Lift	22.00	170.13	212.85	5.52	22.50	21.83	25,678
Skid Steer Loader	117.99	555.50	466.97	10.36	82.91	80.42	48,167
All Terrain Forklift	22.27	172.18	215.42	5.59	22.78	22.09	25,987
Subtotal (lbs):	**322**	**1,886**	**4,014**	**96**	**280**	**272**	**447,751**

Year 3: Building Construction Grand Total in Tons	**0.16**	**0.94**	**2.01**	**0.05**	**0.14**	**0.14**	
Year 3: Building Construction Grand Total in Metric Tons							**203**

Construction Year 4 20,285 SF 100 days

				Emission Factors						
Off-road Equipment	**Hours of Operation**	**Engine HP**	**Load Factor**	**VOC** g/hp-hr	**CO** g/hp-hr	**NOx** g/hp-hr	**SO_2** g/hp-hr	**PM10** g/hp-hr	**PM2.5** g/hp-hr	**CO_2** g/hp-hr
Crane	800	330	0.58	0.25	1.22	5.26	0.11	0.21	0.20	530
Concrete Truck	800	300	0.43	0.19	1.45	4.32	0.12	0.21	0.20	536
Diesel Generator	800	40	0.43	0.26	1.41	3.51	0.11	0.23	0.22	536
Telehandler	400	99	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595
Scissors Lift	400	83	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595
Skid Steer Loader	800	67	0.59	1.69	7.97	6.70	0.15	1.19	1.15	691
All Terrain Forklift	400	84	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595

	Annual Emissions						
	VOC lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Crane	82.94	411.67	1,775.56	38.51	70.12	68.02	179,015
Concrete Truck	42.68	330.94	983.04	26.25	47.79	46.36	122,010
Diesel Generator	7.96	42.74	106.42	3.27	7.03	6.82	16,266
Telehandler	26.25	202.93	253.89	6.59	26.84	26.04	30,628
Scissors Lift	22.00	170.13	212.85	5.52	22.50	21.83	25,678
Skid Steer Loader	117.99	555.50	466.97	10.36	82.91	80.42	48,167
All Terrain Forklift	22.27	172.18	215.42	5.59	22.78	22.09	25,987
Subtotal (lbs):	**322**	**1,886**	**4,014**	**96**	**280**	**272**	**447,751**
Year 4: Building Construction Grand Total in Tons	**0.16**	**0.94**	**2.01**	**0.05**	**0.14**	**0.14**	
Year 4: Building Construction Grand Total in Metric Tons							**203**

Construction Year 5 34,974 SF 100 days

				Emission Factors						
Off-road Equipment	**Hours of Operation**	**Engine HP**	**Load Factor**	**VOC** g/hp-hr	**CO** g/hp-hr	**NOx** g/hp-hr	**SO_2** g/hp-hr	**PM10** g/hp-hr	**PM2.5** g/hp-hr	**CO_2** g/hp-hr
Crane	800	330	0.58	0.25	1.22	5.26	0.11	0.21	0.20	530
Concrete Truck	800	300	0.43	0.19	1.45	4.32	0.12	0.21	0.20	536
Diesel Generator	800	40	0.43	0.26	1.41	3.51	0.11	0.23	0.22	536
Telehandler	400	99	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595
Scissors Lift	400	83	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595
Skid Steer Loader	800	67	0.59	1.69	7.97	6.70	0.15	1.19	1.15	691
All Terrain Forklift	400	84	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595

	Annual Emissions						
	VOC lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Crane	82.94	411.67	1,775.56	38.51	70.12	68.02	179,015
Concrete Truck	42.68	330.94	983.04	26.25	47.79	46.36	122,010
Diesel Generator	7.96	42.74	106.42	3.27	7.03	6.82	16,266
Telehandler	26.25	202.93	253.89	6.59	26.84	26.04	30,628
Scissors Lift	22.00	170.13	212.85	5.52	22.50	21.83	25,678
Skid Steer Loader	117.99	555.50	466.97	10.36	82.91	80.42	48,167
All Terrain Forklift	22.27	172.18	215.42	5.59	22.78	22.09	25,987
Subtotal (lbs):	**322**	**1,886**	**4,014**	**96**	**280**	**272**	**447,751**
Year 5: Building Construction Grand Total in Tons	**0.16**	**0.94**	**2.01**	**0.05**	**0.14**	**0.14**	
Year 5: Building Construction Grand Total in Metric Tons							**203**

Construction Year 6 16,088 SF 100 days

				Emission Factors						
Off-road Equipment	**Hours of Operation**	**Engine HP**	**Load Factor**	**VOC** g/hp-hr	**CO** g/hp-hr	**NOx** g/hp-hr	**SO_2** g/hp-hr	**PM10** g/hp-hr	**PM2.5** g/hp-hr	**CO_2** g/hp-hr
Crane	800	330	0.58	0.25	1.22	5.26	0.11	0.21	0.20	530
Concrete Truck	800	300	0.43	0.19	1.45	4.32	0.12	0.21	0.20	536
Diesel Generator	800	40	0.43	0.26	1.41	3.51	0.11	0.23	0.22	536
Telehandler	400	99	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595
Scissors Lift	400	83	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595
Skid Steer Loader	800	67	0.59	1.69	7.97	6.70	0.15	1.19	1.15	691
All Terrain Forklift	400	84	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595

	Annual Emissions						
	VOC lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Crane	82.94	411.67	1,775.56	38.51	70.12	68.02	179,015
Concrete Truck	42.68	330.94	983.04	26.25	47.79	46.36	122,010
Diesel Generator	7.96	42.74	106.42	3.27	7.03	6.82	16,266
Telehandler	26.25	202.93	253.89	6.59	26.84	26.04	30,628
Scissors Lift	22.00	170.13	212.85	5.52	22.50	21.83	25,678
Skid Steer Loader	117.99	555.50	466.97	10.36	82.91	80.42	48,167
All Terrain Forklift	22.27	172.18	215.42	5.59	22.78	22.09	25,987
Subtotal (lbs):	**322**	**1,886**	**4,014**	**96**	**280**	**272**	**447,751**
Year 6: Building Construction Grand Total in Tons	**0.16**	**0.94**	**2.01**	**0.05**	**0.14**	**0.14**	
Year 6: Building Construction Grand Total in Metric Tons							**203**

Construction Year 7 36,606 SF 100 days

				Emission Factors						
Off-road Equipment	**Hours of Operation**	**Engine HP**	**Load Factor**	**VOC** g/hp-hr	**CO** g/hp-hr	**NOx** g/hp-hr	**SO_2** g/hp-hr	**PM10** g/hp-hr	**PM2.5** g/hp-hr	**CO_2** g/hp-hr
Crane	800	330	0.58	0.25	1.22	5.26	0.11	0.21	0.20	530
Concrete Truck	800	300	0.43	0.19	1.45	4.32	0.12	0.21	0.20	536
Diesel Generator	800	40	0.43	0.26	1.41	3.51	0.11	0.23	0.22	536
Telehandler	400	99	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595
Scissors Lift	400	83	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595
Skid Steer Loader	800	67	0.59	1.69	7.97	6.70	0.15	1.19	1.15	691
All Terrain Forklift	400	84	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595

	Annual Emissions						
	VOC lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Crane	82.94	411.67	1,775.56	38.51	70.12	68.02	179,015
Concrete Truck	42.68	330.94	983.04	26.25	47.79	46.36	122,010
Diesel Generator	7.96	42.74	106.42	3.27	7.03	6.82	16,266
Telehandler	26.25	202.93	253.89	6.59	26.84	26.04	30,628
Scissors Lift	22.00	170.13	212.85	5.52	22.50	21.83	25,678
Skid Steer Loader	117.99	555.50	466.97	10.36	82.91	80.42	48,167
All Terrain Forklift	22.27	172.18	215.42	5.59	22.78	22.09	25,987
Subtotal (lbs):	**322**	**1,886**	**4,014**	**96**	**280**	**272**	**447,751**
Year 7: Building Construction Grand Total in Tons	**0.16**	**0.94**	**2.01**	**0.05**	**0.14**	**0.14**	

Year 7: Building Construction Grand Total in Metric Tons										203

Construction Year 8 6,878 SF 100 days

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO_2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	CO_2 g/hp-hr
				Emission Factors						
Crane	800	330	0.58	0.25	1.22	5.26	0.11	0.21	0.20	530
Concrete Truck	800	300	0.43	0.19	1.45	4.32	0.12	0.21	0.20	536
Diesel Generator	800	40	0.43	0.26	1.41	3.51	0.11	0.23	0.22	536
Telehandler	400	99	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595
Scissors Lift	400	83	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595
Skid Steer Loader	800	67	0.59	1.69	7.97	6.70	0.15	1.19	1.15	691
All Terrain Forklift	400	84	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
	Annual Emissions						
Crane	82.94	411.67	1,775.56	38.51	70.12	68.02	179,015
Concrete Truck	42.68	330.94	983.04	26.25	47.79	46.36	122,010
Diesel Generator	7.96	42.74	106.42	3.27	7.03	6.82	16,266
Telehandler	26.25	202.93	253.89	6.59	26.84	26.04	30,628
Scissors Lift	22.00	170.13	212.85	5.52	22.50	21.83	25,678
Skid Steer Loader	117.99	555.50	466.97	10.36	82.91	80.42	48,167
All Terrain Forklift	22.27	172.18	215.42	5.59	22.78	22.09	25,987
Subtotal (lbs):	**322**	**1,886**	**4,014**	**96**	**280**	**272**	**447,751**
Year 8: Building Construction Grand Total in Tons	**0.16**	**0.94**	**2.01**	**0.05**	**0.14**	**0.14**	
Year 8: Building Construction Grand Total in Metric Tons							**203**

Table 1.7 **Paving** 19,246 ft3 1395 tons 5 days

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	CO_2 g/hp-hr
Grader	40	145	0.59	0.38	1.41	4.16	0.12	0.30	0.29	536
Roller	40	401	0.59	0.34	2.46	5.53	0.12	0.34	0.33	536
Paving Machine	40	164	0.59	0.38	1.44	4.25	0.12	0.30	0.29	536
Asphalt Curbing Machine	40	130	0.59	0.40	1.57	4.57	0.12	0.32	0.31	536

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Grader	2.84	10.65	31.39	0.87	2.23	2.16	4,041
Roller	7.12	51.38	115.48	2.40	7.07	6.85	11,179
Paving Machine	3.24	12.31	36.28	0.98	2.56	2.48	4,571
Asphalt Curbing Machine	2.67	10.62	30.88	0.78	2.16	2.09	3,623

On-road Equipment	Hours of Operation	Engine HP	Productivity based Speed	VOC lb/mile	CO lb/mile	NOx lb/mile	SO2 lb/mile	PM10 lb/mile	PM2.5 lb/mile	CO_2 lb/mile
Dump Truck	40	230	17	0.001521	0.008042	0.036070	1.80E-05	0.001504	0.001458	3.438541
Water Truck	40	230	10	0.001521	0.008042	0.036070	1.80E-05	0.001504	0.001458	3.438541

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Dump Truck	1.03	5.47	24.53	0.01	1.02	0.99	2,338.21
Water Truck	0.61	3.22	14.43	0.01	0.60	0.58	1,375.42

Hot Mix Asphalt (HMA)	Volume of HMA (ft^3)	Weight of HMA (tons)	VOC lb/ton	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Standard Hot Mix Asphalt	19,246	1,395	0.04	55.81	-	-	-	-	-	-
Subtotal (lbs):				73	94	253	5	16	15	27,128
Year 1 only: Paving Grand Total in Tons				**0.04**	**0.05**	**0.13**	**0.00**	**0.01**	**0.01**	
Year 1 only: Paving Grand Total in Metric Tons										**12**

260 work days per year (5/day work week)
76 trips per day (max workers per day, all years)

Table 1.9 **Construction - Worker Trips (Annual)** 15 miles RT (based on estimated distance from center of MCBH to Kaneohe per Google maps)

On-road Equipment	Miles	Engine HP	VOC lb/mile	CO lb/mile	NOx lb/mile	SO_2 lb/mile	PM_{10} lb/mile	$PM_{2.5}$ lb/mile	CO_2 lb/mile
Light-duty Truck	296,804	230	0.0015	0.0080	0.0361	0.0000	0.0015	0.0015	3.4385

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Light-duty Truck	451.54	2386.89	10705.75	5.36	446.53	432.67	1,020,574
Subtotal (lbs):	452	2,387	10,706	5	447	433	1,020,574
Construction Worker Trips Grand Total in Tons	**0.23**	**1.19**	**5.35**	**0.00**	**0.22**	**0.22**	
Construction Worker Trips Grand Total in Metric Tons							**463**

4 trips per day

Table 1.10 **Material Deliveries (Annual)** 1,040 trips per year 15 miles RT (based on estimated distance from center of MCBH to Kaneohe per Google maps)

On-road Equipment	Miles	Engine HP	Speed (mph)	VOC lb/mile	CO lb/mile	NOx lb/mile	SO2 lb/mile	PM10 lb/mile	PM2.5 lb/mile	CO_2 lb/mile
Delivery Truck	15,600	265	-	0.0015	0.0080	0.0361	0.0000	0.0015	0.0015	3.4385

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Delivery Truck	23.73	125.45	562.69	0.28	23.47	22.74	53,641.24
Material Deliveries Grand Total in Tons	**0.01**	**0.06**	**0.28**	**0.00**	**0.01**	**0.01**	
Material Deliveries Grand Total in Metric Tons							**24**

Table 1.11 **Fugitive Dust Emissions**

Year	PM_{10} tons/acre/mo	acres	days of disturbance	PM_{10} Total	PM2.5/PM_{10} Ratio	$PM_{2.5}$ Total
ALL	0.42	7	29	4.5	0.1	0.4

Table 1.12 **Total Emissions**

Year	VOC Tons	CO Tons	NOx Tons	SO2 Tons	PM10 Tons	PM2.5 Tons	CO_2 Metric Tons
Year 1	0.73	3.82	11.62	0.13	2.84	0.83	1,086
Year 2	0.59	3.28	10.09	0.10	1.19	0.59	936
Year 3	0.41	2.26	7.82	0.05	0.61	0.40	707
Year 4	0.41	2.24	7.79	0.05	0.63	0.40	704
Year 5	0.42	2.28	7.92	0.05	0.68	0.42	717
Year 6	0.41	2.27	7.84	0.05	0.58	0.39	710

Year 7	0.42	2.29	7.94	0.05	0.84	0.42	719
Year 8	0.40	2.22	7.71	0.05	0.46	0.38	697

TAB B. **CONSTRUCTION EMISSIONS Alternative 2**

Basic Conversions

453.59 grams per pound (lbs)
43,560 Conversion from acre to square feet (SF)
0.03704 Cubic feet to cubic yards (CY)
0.1111 SF to square yards (SY)
2000 lbs per ton
145 lbs/cubic feet (ft^3) density of Hot Mix Asphalt (HMA)
12 CY haul truck capacity
9 CY concrete truck capacity
1 ft excavation depth
0.5 ft (6 in) gravel
0.5 ft (6 in) concrete/asphalt

Production rates from MDOT:
https://mdotwiki.state.mi.us/images_construction/a/a4/MDOT_Production_Rates.pdf

Table 1.1 **Demolition** 117,494 SF 39 days

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO_2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	CO_2 g/hp-hr
Dozer	313	145	0.58	0.38	1.41	4.17	0.12	0.30	0.29	536
Loader/Backhoe	313	87	0.21	1.43	7.35	6.35	0.15	1.06	1.03	692
Small Backhoe	313	55	0.21	1.43	7.35	6.35	0.15	1.06	1.03	692

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Dozer	21.88	82.16	242.45	6.69	17.19	16.68	31,119
Loader w/integral Backhoe	18.07	92.75	80.12	1.88	13.42	13.01	8,729
Small backhoe	11.42	58.64	50.65	1.19	8.48	8.23	5,518
Subtotal in lbs	51	234	373	10	39	38	45,366
Demo Total in Tons	**0.03**	**0.12**	**0.19**	**0.00**	**0.02**	**0.02**	
Demo Total in Metric Tons							**21**

Table 1.2 **Demolition - Hauling** 1,436 Truck trips; 10 miles per trip

On-road Equipment	Miles	Engine HP	VOC lb/mile	CO lb/mile	NOx lb/mile	SO_2 lb/mile	PM10 lb/mile	PM2.5 lb/mile	CO_2 lb/mile
Dump Truck (12 CY)	14,360	230	0.0015	0.0080	0.0361	0.0000	0.0015	0.0015	3.4385

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Dump Truck (12 CY)	21.85	115.49	517.98	0.26	21.60	20.93	49,379
Subtotal in lb:	22	115	518	0	22	21	49,379
Demo Hauling Grand Total in Tons	**0.01**	**0.06**	**0.26**	**0.00**	**0.01**	**0.01**	
Demo Hauling Total in Metric Tons							**22**

Table 1.3 **Site Prep**

Site Prep - Excavate/Fill (CY) 1,979 CY 1 days 165 truck trips
Grading (SY) 5,936 SY 3 days

Off-road Equipment	Hours	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO_2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	CO_2 g/hp-hr
Excavator	11	243	0.59	0.34	1.21	4.03	0.12	0.22	0.22	536
Skid Steer Loader	24	160	0.23	0.38	1.47	4.34	0.12	0.31	0.30	536
Dozer (Rubber Tired)	24	145	0.59	0.38	1.41	4.17	0.12	0.30	0.29	536
Compactor	24	103	0.58	0.40	1.57	4.57	0.12	0.32	0.31	536
Grader	24	285	0.58	0.34	1.21	4.07	0.12	0.23	0.22	536

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Excavator	1.15	4.03	13.44	0.38	0.74	0.72	1,787
Skid Steer Loader	0.74	2.83	8.36	0.22	0.59	0.57	1,032
Dozer (Rubber Tired)	1.69	6.33	18.69	0.52	1.33	1.29	2,399
Compactor	1.24	4.91	14.28	0.36	1.00	0.97	1,675
Grader	2.97	10.45	35.22	1.00	1.95	1.89	4,636

Excavation - Hauling 20 miles RT

On-road Equipment	Miles	Engine HP	VOC lb/mile	CO lb/mile	NOx lb/mile	SO_2 lb/mile	PM_{10} lb/mile	$PM_{2.5}$ lb/mile	CO_2 lb/mile
Dump Truck	3,298	230	0.0015	0.0080	0.0361	0.0000	0.0015	0.0015	3.4385

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Dump Truck	5.02	26.52	118.96	0.06	4.96	4.81	11,340

	VOC	CO	NOx	SO2	PM10	PM2.5	CO_2
Subtotal in lb:	13	55	209	3	11	10	22,869
Site Prep Grand Total in Tons	**0.01**	**0.03**	**0.10**	**0.00**	**0.01**	**0.01**	
Site Prep Grand Total in Metric Tons							**10**

Table 1.4 **Gravel Work** 989 CY 10 days 82 truck trips

Off-road Equipment	Hours	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO_2 g/hp-hr	PM_{10} g/hp-hr	$PM_{2.5}$ g/hp-hr	CO_2 g/hp-hr
Dozer	79	185	0.59	0.34	1.21	4.08	0.12	0.23	0.22	536
Wheel Loader for Spreading	79	87	0.59	0.35	1.25	4.23	0.12	0.24	0.23	536
Compactor	79	103	0.43	0.36	1.34	4.45	0.12	0.26	0.25	536

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Dozer	6.55	23.00	77.71	2.20	4.31	4.18	10,205
Wheel Loader for Spreading	3.12	11.18	37.92	1.03	2.14	2.07	4,799
Compactor	2.78	10.35	34.40	0.89	1.99	1.93	4,140

20 miles RT

On-road Equipment	Miles	Engine HP	VOC lb/mile	CO lb/mile	NOx lb/mile	SO_2 lb/mile	PM_{10} lb/mile	$PM_{2.5}$ lb/mile	CO_2 lb/mile
Dump Truck	1,649	230	0.0015	0.0080	0.0361	0.0000	0.0015	0.0015	3.4385

	VOC	CO	NOx	SO2	PM10	PM2.5	CO_2

	lb	lb	lb	lb	lb	lb	lb
Dump Truck	2.51	13.26	59.48	0.03	2.48	2.40	5,670
Subtotal (lbs):	**15**	**58**	**210**	**4**	**11**	**11**	**24,814**
Gravel Work Grand Total in Tons	**0.01**	**0.03**	**0.10**	**0.00**	**0.01**	**0.01**	
Gravel Work Grand Total in Metric Tons							**11**

Table 1.5 **Concrete Work** 989 CY 10 days 110 truck trips

				Emission Factors						
Off-road Equipment	**Hours of Operation**	**Engine HP**	**Load Factor**	**VOC** g/hp-hr	**CO** g/hp-hr	**NOx** g/hp-hr	**SO_2** g/hp-hr	**PM10** g/hp-hr	**PM2.5** g/hp-hr	**CO_2** g/hp-hr
Concrete Mixer	79	3.5	0.43	0.69	3.04	6.17	0.13	0.54	0.52	588
Concrete Truck	79	300	0.43	0.38	1.75	6.18	0.11	0.27	0.26	530

	Annual Emissions						
	VOC lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Concrete Mixer	0.18	0.80	1.62	0.03	0.14	0.14	154.49
Concrete Truck	8.54	39.30	139.17	2.57	6.05	5.87	11,927.89
Subtotal (lbs):	**9**	**40**	**141**	**3**	**6**	**6**	**12,082**
Concrete Work Grand Total in Tons	**0.00**	**0.02**	**0.07**	**0.00**	**0.00**	**0.00**	
Concrete Work Grand Total in Metric Tons							**5**

20 miles RT

On-road Equipment	**Miles**	**Engine HP**	**VOC** lb/mile	**CO** lb/mile	**NOx** lb/mile	**SO_2** lb/mile	**PM_{10}** lb/mile	**$PM_{2.5}$** lb/mile	**CO_2** lb/mile
Concrete Truck	2,199	230	0.0015	0.0080	0.0361	0.0000	0.0015	0.0015	3.4385

	VOC lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Concrete Truck	3.34	17.68	79.30	0.04	3.31	3.21	7,560
Subtotal (lbs):	**3**	**18**	**79**	**0**	**3**	**3**	**7,560**
Concrete Truck Travel Grand Total in Tons	**0.00**	**0.01**	**0.04**	**0.00**	**0.00**	**0.00**	
Concrete Truck Travel Grand Total in Metric Tons							**3**

Table 1.6 **Construction Year 1** 26,359 SF 100 days

				Emission Factors						
Off-road Equipment	**Hours of Operation**	**Engine HP**	**Load Factor**	**VOC** g/hp-hr	**CO** g/hp-hr	**NOx** g/hp-hr	**SO_2** g/hp-hr	**PM10** g/hp-hr	**PM2.5** g/hp-hr	**CO_2** g/hp-hr
Crane	800	330	0.58	0.25	1.22	5.26	0.11	0.21	0.20	530
Concrete Truck	800	300	0.43	0.19	1.45	4.32	0.12	0.21	0.20	536
Diesel Generator	800	40	0.43	0.26	1.41	3.51	0.11	0.23	0.22	536
Telehandler	400	99	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595
Scissors Lift	400	83	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595
Skid Steer Loader	800	67	0.59	1.69	7.97	6.70	0.15	1.19	1.15	691
All Terrain Forklift	400	84	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595

	Annual Emissions						
	VOC lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Crane	82.94	411.67	1,775.56	38.51	70.12	68.02	179,015
Concrete Truck	42.68	330.94	983.04	26.25	47.79	46.36	122,010
Diesel Generator	7.96	42.74	106.42	3.27	7.03	6.82	16,266
Telehandler	26.25	202.93	253.89	6.59	26.84	26.04	30,628
Scissors Lift	22.00	170.13	212.85	5.52	22.50	21.83	25,678
Skid Steer Loader	117.99	555.50	466.97	10.36	82.91	80.42	48,167
All Terrain Forklift	22.27	172.18	215.42	5.59	22.78	22.09	25,987
Subtotal (lbs):	**322**	**1,886**	**4,014**	**96**	**280**	**272**	**447,751**
Year 1: Building Construction Grand Total in Tons	**0.16**	**0.94**	**2.01**	**0.05**	**0.14**	**0.14**	
Year 1: Building Construction Grand Total in Metric Tons							**203**

Construction Year 2 7,733 SF 100 days

				Emission Factors						
Off-road Equipment	**Hours of Operation**	**Engine HP**	**Load Factor**	**VOC** g/hp-hr	**CO** g/hp-hr	**NOx** g/hp-hr	**SO_2** g/hp-hr	**PM10** g/hp-hr	**PM2.5** g/hp-hr	**CO_2** g/hp-hr
Crane	800	330	0.58	0.25	1.22	5.26	0.11	0.21	0.20	530
Concrete Truck	800	300	0.43	0.19	1.45	4.32	0.12	0.21	0.20	536
Diesel Generator	800	40	0.43	0.26	1.41	3.51	0.11	0.23	0.22	536
Telehandler	400	99	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595
Scissors Lift	400	83	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595
Skid Steer Loader	800	67	0.59	1.69	7.97	6.70	0.15	1.19	1.15	691
All Terrain Forklift	400	84	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595

	Annual Emissions						
	VOC lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Crane	82.94	411.67	1,775.56	38.51	70.12	68.02	179,015
Concrete Truck	42.68	330.94	983.04	26.25	47.79	46.36	122,010
Diesel Generator	7.96	42.74	106.42	3.27	7.03	6.82	16,266
Telehandler	26.25	202.93	253.89	6.59	26.84	26.04	30,628
Scissors Lift	22.00	170.13	212.85	5.52	22.50	21.83	25,678
Skid Steer Loader	117.99	555.50	466.97	10.36	82.91	80.42	48,167
All Terrain Forklift	22.27	172.18	215.42	5.59	22.78	22.09	25,987
Subtotal (lbs):	**322**	**1,886**	**4,014**	**96**	**280**	**272**	**447,751**
Year 2: Building Construction Grand Total in Tons	**0.16**	**0.94**	**2.01**	**0.05**	**0.14**	**0.14**	
Year 2: Building Construction Grand Total in Metric Tons							**203**

Construction Year 3 2,629 SF 100 days

				Emission Factors						
Off-road Equipment	**Hours of Operation**	**Engine HP**	**Load Factor**	**VOC** g/hp-hr	**CO** g/hp-hr	**NOx** g/hp-hr	**SO_2** g/hp-hr	**PM10** g/hp-hr	**PM2.5** g/hp-hr	**CO_2** g/hp-hr
Crane	800	330	0.58	0.25	1.22	5.26	0.11	0.21	0.20	530
Concrete Truck	800	300	0.43	0.19	1.45	4.32	0.12	0.21	0.20	536
Diesel Generator	800	40	0.43	0.26	1.41	3.51	0.11	0.23	0.22	536
Telehandler	400	99	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595
Scissors Lift	400	83	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595

Skid Steer Loader	800	67	0.59	1.69	7.97	6.70	0.15	1.19	1.15	691
All Terrain Forklift	400	84	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595

	Annual Emissions						
	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Crane	82.94	411.67	1,775.56	38.51	70.12	68.02	179,015
Concrete Truck	42.68	330.94	983.04	26.25	47.79	46.36	122,010
Diesel Generator	7.96	42.74	106.42	3.27	7.03	6.82	16,266
Telehandler	26.25	202.93	253.89	6.59	26.84	26.04	30,628
Scissors Lift	22.00	170.13	212.85	5.52	22.50	21.83	25,678
Skid Steer Loader	117.99	555.50	466.97	10.36	82.91	80.42	48,167
All Terrain Forklift	22.27	172.18	215.42	5.59	22.78	22.09	25,987
Subtotal (lbs):	**322**	**1,886**	**4,014**	**96**	**280**	**272**	**447,751**
Year 3: Building Construction Grand Total in Tons	**0.16**	**0.94**	**2.01**	**0.05**	**0.14**	**0.14**	
Year 3: Building Construction Grand Total in Metric Tons							**203**

Construction Year 4 2,951 SF 100 days

				Emission Factors						
Off-road Equipment	**Hours of Operation**	**Engine HP**	**Load Factor**	**VOC** g/hp-hr	**CO** g/hp-hr	**NOx** g/hp-hr	**SO_2** g/hp-hr	**PM10** g/hp-hr	**PM2.5** g/hp-hr	**CO_2** g/hp-hr
Crane	800	330	0.58	0.25	1.22	5.26	0.11	0.21	0.20	530
Concrete Truck	800	300	0.43	0.19	1.45	4.32	0.12	0.21	0.20	536
Diesel Generator	800	40	0.43	0.26	1.41	3.51	0.11	0.23	0.22	536
Telehandler	400	99	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595
Scissors Lift	400	83	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595
Skid Steer Loader	800	67	0.59	1.69	7.97	6.70	0.15	1.19	1.15	691
All Terrain Forklift	400	84	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595

	Annual Emissions						
	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Crane	82.94	411.67	1,775.56	38.51	70.12	68.02	179,015
Concrete Truck	42.68	330.94	983.04	26.25	47.79	46.36	122,010
Diesel Generator	7.96	42.74	106.42	3.27	7.03	6.82	16,266
Telehandler	26.25	202.93	253.89	6.59	26.84	26.04	30,628
Scissors Lift	22.00	170.13	212.85	5.52	22.50	21.83	25,678
Skid Steer Loader	117.99	555.50	466.97	10.36	82.91	80.42	48,167
All Terrain Forklift	22.27	172.18	215.42	5.59	22.78	22.09	25,987
Subtotal (lbs):	**322**	**1,886**	**4,014**	**96**	**280**	**272**	**447,751**
Year 4: Building Construction Grand Total in Tons	**0.16**	**0.94**	**2.01**	**0.05**	**0.14**	**0.14**	
Year 4: Building Construction Grand Total in Metric Tons							**203**

Construction Year 5 5,088 SF 100 days

				Emission Factors						
Off-road Equipment	**Hours of Operation**	**Engine HP**	**Load Factor**	**VOC** g/hp-hr	**CO** g/hp-hr	**NOx** g/hp-hr	**SO_2** g/hp-hr	**PM10** g/hp-hr	**PM2.5** g/hp-hr	**CO_2** g/hp-hr
Crane	800	330	0.58	0.25	1.22	5.26	0.11	0.21	0.20	530
Concrete Truck	800	300	0.43	0.19	1.45	4.32	0.12	0.21	0.20	536
Diesel Generator	800	40	0.43	0.26	1.41	3.51	0.11	0.23	0.22	536
Telehandler	400	99	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595
Scissors Lift	400	83	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595
Skid Steer Loader	800	67	0.59	1.69	7.97	6.70	0.15	1.19	1.15	691
All Terrain Forklift	400	84	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595

	Annual Emissions						
	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Crane	82.94	411.67	1,775.56	38.51	70.12	68.02	179,015
Concrete Truck	42.68	330.94	983.04	26.25	47.79	46.36	122,010
Diesel Generator	7.96	42.74	106.42	3.27	7.03	6.82	16,266
Telehandler	26.25	202.93	253.89	6.59	26.84	26.04	30,628
Scissors Lift	22.00	170.13	212.85	5.52	22.50	21.83	25,678
Skid Steer Loader	117.99	555.50	466.97	10.36	82.91	80.42	48,167
All Terrain Forklift	22.27	172.18	215.42	5.59	22.78	22.09	25,987
Subtotal (lbs):	**322**	**1,886**	**4,014**	**96**	**280**	**272**	**447,751**
Year 5: Building Construction Grand Total in Tons	**0.16**	**0.94**	**2.01**	**0.05**	**0.14**	**0.14**	
Year 5: Building Construction Grand Total in Metric Tons							**203**

Construction Year 6 2,340 SF 100 days

				Emission Factors						
Off-road Equipment	**Hours of Operation**	**Engine HP**	**Load Factor**	**VOC** g/hp-hr	**CO** g/hp-hr	**NOx** g/hp-hr	**SO_2** g/hp-hr	**PM10** g/hp-hr	**PM2.5** g/hp-hr	**CO_2** g/hp-hr
Crane	800	330	0.58	0.25	1.22	5.26	0.11	0.21	0.20	530
Concrete Truck	800	300	0.43	0.19	1.45	4.32	0.12	0.21	0.20	536
Diesel Generator	800	40	0.43	0.26	1.41	3.51	0.11	0.23	0.22	536
Telehandler	400	99	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595
Scissors Lift	400	83	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595
Skid Steer Loader	800	67	0.59	1.69	7.97	6.70	0.15	1.19	1.15	691
All Terrain Forklift	400	84	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595

	Annual Emissions						
	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Crane	82.94	411.67	1,775.56	38.51	70.12	68.02	179,015
Concrete Truck	42.68	330.94	983.04	26.25	47.79	46.36	122,010
Diesel Generator	7.96	42.74	106.42	3.27	7.03	6.82	16,266
Telehandler	26.25	202.93	253.89	6.59	26.84	26.04	30,628
Scissors Lift	22.00	170.13	212.85	5.52	22.50	21.83	25,678
Skid Steer Loader	117.99	555.50	466.97	10.36	82.91	80.42	48,167
All Terrain Forklift	22.27	172.18	215.42	5.59	22.78	22.09	25,987
Subtotal (lbs):	**322**	**1,886**	**4,014**	**96**	**280**	**272**	**447,751**
Year 6: Building Construction Grand Total in Tons	**0.16**	**0.94**	**2.01**	**0.05**	**0.14**	**0.14**	
Year 6: Building Construction Grand Total in Metric Tons							**203**

Construction Year 7 5,325 SF 100 days

				Emission Factors						
	Hours of			**VOC**	**CO**	**NOx**	**SO_2**	**PM10**	**PM2.5**	**CO_2**

Off-road Equipment	Operation	Engine HP	Load Factor	g/hp-hr	g/hp-hr	g/hp-hr	g/hp-hr	g/hp-hr	g/hp-hr	g/hp-hr
Crane	800	330	0.58	0.25	1.22	5.26	0.11	0.21	0.20	530
Concrete Truck	800	300	0.43	0.19	1.45	4.32	0.12	0.21	0.20	536
Diesel Generator	800	40	0.43	0.26	1.41	3.51	0.11	0.23	0.22	536
Telehandler	400	99	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595
Scissors Lift	400	83	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595
Skid Steer Loader	800	67	0.59	1.69	7.97	6.70	0.15	1.19	1.15	691
All Terrain Forklift	400	84	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595

	Annual Emissions						
	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Crane	82.94	411.67	1,775.56	38.51	70.12	68.02	179,015
Concrete Truck	42.68	330.94	983.04	26.25	47.79	46.36	122,010
Diesel Generator	7.96	42.74	106.42	3.27	7.03	6.82	16,266
Telehandler	26.25	202.93	253.89	6.59	26.84	26.04	30,628
Scissors Lift	22.00	170.13	212.85	5.52	22.50	21.83	25,678
Skid Steer Loader	117.99	555.50	466.97	10.36	82.91	80.42	48,167
All Terrain Forklift	22.27	172.18	215.42	5.59	22.78	22.09	25,987
Subtotal (lbs):	**322**	**1,886**	**4,014**	**96**	**280**	**272**	**447,751**
Year 7: Building Construction Grand Total in Tons	**0.16**	**0.94**	**2.01**	**0.05**	**0.14**	**0.14**	
Year 7: Building Construction Grand Total in Metric Tons							**203**

Construction Year 8 1,001 SF 100 days

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	Emission Factors: VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO_2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	CO_2 g/hp-hr
Crane	800	330	0.58	0.25	1.22	5.26	0.11	0.21	0.20	530
Concrete Truck	800	300	0.43	0.19	1.45	4.32	0.12	0.21	0.20	536
Diesel Generator	800	40	0.43	0.26	1.41	3.51	0.11	0.23	0.22	536
Telehandler	400	99	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595
Scissors Lift	400	83	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595
Skid Steer Loader	800	67	0.59	1.69	7.97	6.70	0.15	1.19	1.15	691
All Terrain Forklift	400	84	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595

	Annual Emissions						
	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Crane	82.94	411.67	1,775.56	38.51	70.12	68.02	179,015
Concrete Truck	42.68	330.94	983.04	26.25	47.79	46.36	122,010
Diesel Generator	7.96	42.74	106.42	3.27	7.03	6.82	16,266
Telehandler	26.25	202.93	253.89	6.59	26.84	26.04	30,628
Scissors Lift	22.00	170.13	212.85	5.52	22.50	21.83	25,678
Skid Steer Loader	117.99	555.50	466.97	10.36	82.91	80.42	48,167
All Terrain Forklift	22.27	172.18	215.42	5.59	22.78	22.09	25,987
Subtotal (lbs):	**322**	**1,886**	**4,014**	**96**	**280**	**272**	**447,751**
Year 8: Building Construction Grand Total in Tons	**0.16**	**0.94**	**2.01**	**0.05**	**0.14**	**0.14**	
Year 8: Building Construction Grand Total in Metric Tons							**203**

Table 1.7 **Paving** 0 ft3 0 tons 0 days

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	CO_2 g/hp-hr
Grader	0	145	0.59	0.38	1.41	4.16	0.12	0.30	0.29	536
Roller	0	401	0.59	0.34	2.46	5.53	0.12	0.34	0.33	536
Paving Machine	0	164	0.59	0.38	1.44	4.25	0.12	0.30	0.29	536
Asphalt Curbing Machine	0	130	0.59	0.40	1.57	4.57	0.12	0.32	0.31	536

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Grader	0.00	0.00	0.00	0.00	0.00	0.00	0
Roller	0.00	0.00	0.00	0.00	0.00	0.00	0
Paving Machine	0.00	0.00	0.00	0.00	0.00	0.00	0
Asphalt Curbing Machine	0.00	0.00	0.00	0.00	0.00	0.00	0

On-road Equipment	Hours of Operation	Engine HP	Productivity based Speed	VOC lb/mile	CO lb/mile	NOx lb/mile	SO2 lb/mile	PM10 lb/mile	PM2.5 lb/mile	CO_2 lb/mile
Dump Truck	0	230	17	0.001521	0.008042	0.036070	1.80E-05	0.001504	0.001458	3.438541
Water Truck	0	230	10	0.001521	0.008042	0.036070	1.80E-05	0.001504	0.001458	3.438541

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Dump Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Hot Mix Asphalt (HMA)	Volume of HMA (ft^3)	Weight of HMA (tons)	VOC lb/ton	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Standard Hot Mix Asphalt	0	0	0.04	0.00	-	-	-	-	-	-
Subtotal (lbs):				0	0	0	0	0	0	0
Year 1 only: Paving Grand Total in Tons				**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	
Year 1 only: Paving Grand Total in Metric Tons										**0**

260 work days per year (5/day work week)
11 trips per day (max workers per day, all years)
15 miles RT

Table 1.9 **Construction - Worker Trips (Annual)**

On-road Equipment	Miles	Engine HP	VOC lb/mile	CO lb/mile	NOx lb/mile	SO_2 lb/mile	PM_{10} lb/mile	$PM_{2.5}$ lb/mile	CO_2 lb/mile
Light-duty Truck	43,176	230	0.0015	0.0080	0.0361	0.0000	0.0015	0.0015	3.4385

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Light-duty Truck	65.69	347.22	1557.38	0.78	64.96	62.94	148,464
Subtotal (lbs):	66	347	1,557	1	65	63	148,464
Construction Worker Trips Grand Total in Tons	**0.03**	**0.17**	**0.78**	**0.00**	**0.03**	**0.03**	
Construction Worker Trips Grand Total in Metric Tons							**67**

4 trips per day

Table 1.10 **Material Deliveries (Annual)** 1,040 trips per year 15 miles RT

On-road Equipment	Miles	Engine HP	Speed (mph)	VOC lb/mile	CO lb/mile	NOx lb/mile	SO2 lb/mile	PM10 lb/mile	PM2.5 lb/mile	CO_2 lb/mile
Delivery Truck	15,600	265	-	0.0015	0.0080	0.0361	0.0000	0.0015	0.0015	3.4385
				VOC lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
			Delivery Truck	23.73	125.45	562.69	0.28	23.47	22.74	53,641.24
			Material Deliveries Grand Total in Tons	**0.01**	**0.06**	**0.28**	**0.00**	**0.01**	**0.01**	
			Material Deliveries Grand Total in Metric Tons							**24**

Table 1.11 **Fugitive Dust Emissions**

Year	PM_{10} tons/acre/mo	acres	days of disturbance	PM_{10} Total	PM2.5/ PM_{10} Ratio	$PM_{2.5}$ Total
ALL	0.42	7	4	0.7	0.1	0.1

Table 1.12 **Total Emissions**

Year	VOC Tons	CO Tons	NOx Tons	SO2 Tons	PM10 Tons	PM2.5 Tons	CO_2 Metric Tons
Year 1	0.22	1.26	3.33	0.05	0.52	0.23	320
Year 2	0.22	1.23	3.20	0.05	0.29	0.20	307
Year 3	0.21	1.20	3.13	0.05	0.22	0.19	301
Year 4	0.21	1.19	3.10	0.05	0.22	0.18	298
Year 5	0.21	1.21	3.14	0.05	0.11	0.19	302
Year 6	0.21	1.21	3.15	0.05	0.22	0.19	303
Year 7	0.21	1.21	3.15	0.05	0.25	0.19	303
Year 8	0.21	1.19	3.09	0.05	0.20	0.18	297

TAB C. Operational Emissions

NMESIS

Baseline

On-road Equipment	Miles	VOC g/VMT	CO g/VMT	NOx g/VMT	SO_2 g/VMT	PM_{10} g/VMT	$PM_{2.5}$ g/VMT	CO_2 g/VMT	CH4 g/VMT	N2O g/VMT	CO2e g/VMT
SUSH Truck	7,303	0.31	1.7382	3.1896	0.0033	1.3723	0.3327	972.7910	0.0146	0.0024	973.846
		VOC lb	**CO lb**	**NOx lb**	**SO2 lb**	**PM10 lb**	**PM2.5 lb**	**CO_2 lb**			
	Light-duty Truck	4.94	27.99	51.36	0.05	22.10	5.36	15663.15	0.23	0.04	15680.14
	Subtotal (lbs):	5	28	51	0	22	5	15,663	0	0	15,680
Travel to training areas - Annual Grand Total in Tons		**0.00**	**0.01**	**0.03**	**0.00**	**0.01**	**0.00**				
Travel to training areas - Annual Grand Total in Metric Tons								**7**	**0**	**0**	**7**

Alternative 1

On-road Equipment	Miles	Duration (kw-hr/hp-hr)	VOC g/VMT	CO g/kW-hr	NOx g/kW-hr	SO_2 g/VMT	PM_{10} g/hp-hr	$PM_{2.5}$ g/hp-hr	CO_2 g/kW-hr	CH4 g/VMT	N2O g/VMT	CO2e g/VMT
JLTV	18,258	11,592	0.31	2.00	6.30	0.0033	0.0707	0.0707	679.6800	0.0146	0.0024	-
			VOC lb	**CO lb**	**NOx lb**	**SO2 lb**	**PM10 lb**	**PM2.5 lb**	**CO_2 lb**			
		JLTV	12.34	51.11	161.00	0.13	1.81	1.81	17369.98	0.59	0.10	17403.91
		Subtotal (lbs):	12	51	161	0	2	2	17,370	1	0	17,404
Travel to training areas - Annual Grand Total in Tons			**0.01**	**0.03**	**0.08**	**0.00**	**0.00**	**0.00**				
Travel to training areas - Annual Grand Total in Metric Tons									**8**	**0**	**0**	**8**

Alternative 2

On-road Equipment	Miles	Duration (kw-hr/hp-hr)	VOC g/VMT	CO g/kW-hr	NOx g/kW-hr	SO_2 g/VMT	PM_{10} g/hp-hr	$PM_{2.5}$ g/hp-hr	CO_2 g/kW-hr	CH4 g/VMT	N2O g/VMT	CO2e g/VMT
JLTV	21,910	13,910	0.31	2.0000	6.3000	0.0033	0.0707	0.0707	679.6800	0.0146	0.0024	-
			VOC lb	**CO lb**	**NOx lb**	**SO2 lb**	**PM10 lb**	**PM2.5 lb**	**CO_2 lb**			
		JLTV	14.81	61.33	193.20	0.16	2.17	2.17	20843.98	0.70	0.11	20896.10
		Subtotal (lbs):	15	61	193	0	2	2	20,844	1	0	20,896
Travel to training areas - Annual Grand Total in Tons			**0.01**	**0.03**	**0.10**	**0.00**	**0.00**	**0.00**				
Travel to training areas - Annual Grand Total in Metric Tons									**9**	**0**	**0**	**9**

MADIS and L-MADIS, G/ATOR

Baseline

On-road Equipment	Miles	VOC g/VMT	CO g/VMT	NOx g/VMT	SO_2 g/VMT	PM_{10} g/VMT	$PM_{2.5}$ g/VMT	CO_2 g/VMT	CH4 g/VMT	N2O g/VMT	CO2e g/VMT
SUSH Truck/HMMWV	33,271	0.31	1.7382	3.1896	0.0033	1.3723	0.3327	972.7910	0.0146	0.0024	973.846
		VOC lb	**CO lb**	**NOx lb**	**SO2 lb**	**PM10 lb**	**PM2.5 lb**	**CO_2 lb**			
	Light-duty Truck	22.49	127.50	233.95	0.24	100.66	24.40	71354.37	1.07	0.17	71431.75
	Subtotal (lbs):	22	127	234	0	101	24	71,354	1	0	71,432
Travel to training areas - Annual Grand Total in Tons		**0.01**	**0.06**	**0.12**	**0.00**	**0.05**	**0.01**				
Travel to training areas - Annual Grand Total in Metric Tons								**32**	**0**	**0**	**32**

Alternative 1

On-road Equipment	Miles	Duration (kw-hr/hp-hr)	VOC g/VMT	CO g/kW-hr	NOx g/kW-hr	SO_2 g/VMT	PM_{10} g/hp-hr	$PM_{2.5}$ g/hp-hr	CO_2 g/kW-hr	CH4 g/VMT	N2O g/VMT	CO2e g/VMT
JLTV	33,271	11,592	0.31	2.00	6.30	0.0033	0.0707	0.0707	679.6800	0.0146	0.0024	-
			VOC lb	**CO lb**	**NOx lb**	**SO2 lb**	**PM10 lb**	**PM2.5 lb**	**CO_2 lb**			
		JLTV	22.49	51.11	161.00	0.24	1.81	1.81	17369.98	1.07	0.17	17431.80
		Subtotal (lbs):	22	51	161	0	2	2	17,370	1	0	17,432
Travel to training areas - Annual Grand Total in Tons			**0.01**	**0.03**	**0.08**	**0.00**	**0.00**	**0.00**				
Travel to training areas - Annual Grand Total in Metric Tons									**8**	**0**	**0**	**8**

Alternative 2

On-road Equipment	Miles	Duration (kw-hr/hp-hr)	VOC g/VMT	CO g/kW-hr	NOx g/kW-hr	SO_2 g/VMT	PM_{10} g/hp-hr	$PM_{2.5}$ g/hp-hr	CO_2 g/kW-hr	CH4 g/VMT	N2O g/VMT	CO2e g/VMT
JLTV	39,925	13,910	0.31	2.0000	6.3000	0.0033	0.0707	0.0707	679.6800	0.0146	0.0024	-
			VOC lb	**CO lb**	**NOx lb**	**SO2 lb**	**PM10 lb**	**PM2.5 lb**	**CO_2 lb**			
		JLTV	26.99	61.33	193.20	0.29	2.17	2.17	20843.98	1.28	0.21	20938.96
		Subtotal (lbs):	27	61	193	0	2	2	20,844	1	0	20,939
Travel to training areas - Annual Grand Total in Tons			**0.01**	**0.03**	**0.10**	**0.00**	**0.00**	**0.00**				
Travel to training areas - Annual Grand Total in Metric Tons									**9**	**0**	**0**	**9**

TOTALS

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb	CH4 lb	N2O lb	CO2e lb
Baseline	27.42	155.49	285.31	0.30	122.75	29.76	87017.52	1.30	0.21	87111.89
Subtotal (lbs):	27	155	285	0	123	30	87,018	1	0	87,112
Travel to training areas - Annual Grand Total in Tons	**0.01**	**0.08**	**0.14**	**0.00**	**0.06**	**0.01**				
Travel to training areas - Annual Grand Total in Metric Tons							39	0	0	40

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb	CH4 lb	N2O lb	CO2e lb
Alternative 1	34.83	102.22	322.01	0.38	3.61	3.61	34739.97	1.65	0.27	34835.70
Subtotal (lbs):	35	102	322	0	4	4	34,740	2	0	34,836
Travel to training areas - Annual Grand Total in Tons	**0.02**	**0.05**	**0.16**	**0.00**	**0.00**	**0.00**				
Travel to training areas - Annual Grand Total in Metric Tons							16	0	0	16

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb	CH4 lb	N2O lb	CO2e lb
Alternative 2	41.79	122.67	386.41	0.45	4.34	4.34	41687.96	1.98	0.32	41835.06
Subtotal (lbs):	42	123	386	0	4	4	41,688	2	0	41,835
Travel to training areas - Annual Grand Total in Tons	**0.02**	**0.06**	**0.19**	**0.00**	**0.00**	**0.00**				
Travel to training areas - Annual Grand Total in Metric Tons							19	0	0	19

TAB D. GHG Analysis

Construction GHG Emissions Alt 1	*CO2e (metric tons)*	GHG Social Cost (3%)	Social Cost-GHG 95th Percentile
Year 1 (2025)	1,086	$ 61,258	$ 183,655
Year 2 (2026)	936	$ 53,827	$ 161,664
Year 3 (2027)	707	$ 41,427	$ 124,634
Year 4 (2028)	704	$ 41,995	$ 126,554
Year 5 (2029)	717	$ 43,528	$ 131,381
Year 6 (2030)	710	$ 43,823	$ 132,476
Year 7 (2031)	719	$ 45,229	$ 136,988
Year 8 (2032)	697	$ 44,670	$ 135,547
Total	6,277	$ 375,755	$ 1,132,899

Alt 1

Activity	*CO2e (metric tons)*
Baseline Annual Operational GHG Total	39.5
25-year lifecycle emissions	988
Alt 1 Annual Operational GHG Total	15.8
25-year lifecycle emissions	395.0
Annual GHG Net Change After Construction	-23.7
25-year net change lifecycle emissions	-593

Alt 2

Activity	*CO2e (metric tons)*
Baseline Annual GHG Total	39.5
25-year lifecycle emissions	988
Alt 2 Annual GHG Total	19.0
25-year lifecycle emissions	474.4
Annual GHG Net Change After Construction	-20.5
25-year net change lifecycle emissions	-513

Alt 1			
	CO2		
2025	$56		$889
2050	$85	16	$1,334
2025	$169		$2,666
2050	$260	16	$4,096
	CH4		
2025	$1,720		$1
2050	$3,067	0.001	$2

2025	$4,548		$3
2050	$8,175	0.001	$6
	N2O		
2025	$20,591		$3
2050	$32,989	0.0001	$4
2025	$54,295		$7
2050	$88,166	0.0001	$11
	CO2e		
2025			$893
2050			$1,340
2025			$2,676
2050			$4,113

Alt 2

	CO2		
2025	$56		$1,067
2050	$85	19	$1,601
2025	$169		$3,199
2050	$260	19	$4,915
	CH4		
2025	$1,720		$2
2050	$3,067	0.001	$3
2025	$4,548		$4
2050	$8,175	0.001	$7
	N2O		
2025	$20,591		$3
2050	$32,989	0.0001	$5
2025	$54,295		$8
2050	$88,166	0.0001	$13
	CO2e		
2025			$1,071
2050			$1,608
2025			$3,211
2050			$4,936