

Debris Removal, Monitoring and Prevention Plan

Maunakea Comprehensive Management Plan
Management Action IM-5

Center for Maunakea Stewardship

DRAFT

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1. PURPOSE AND CONTEXT

The Maunakea Debris Removal, Monitoring and Prevention Plan was developed to address Management Action IM-5, "Develop and Implement a Debris Removal, Monitoring and Prevention Plan," as outlined in the 2022 Comprehensive Management Plan (CMP) Supplement. It specifically targets the management of anthropogenic debris, also referred to as solid waste, litter, or trash, within the University of Hawai'i (UH) managed lands on Maunakea which includes the 19-acre Halepōhaku parcel, the 70-acre Summit Access Road corridor, and the 11,287-acre Mauna Kea Science Reserve.

Anthropogenic debris is identified as a potential threat to resources on Maunakea. Litter and larger debris can impact visual aesthetics, negatively affect cultural resources, and are considered particularly offensive by those who hold Maunakea sacred. Debris may also interfere with the aeolian ecosystem, shade vegetation, leach toxic substances, damage geological resources upon impact; and food waste can provide resources for pest species and predators of native biota (CMP IM-5). Identified sources of solid waste include observatories, support facilities (especially construction materials), recreational users, and cultural practices (offerings) (NRMP 2022). This plan acknowledges that debris removal activities must be conducted carefully to avoid causing more harm to resources, such as crushing cinder in sensitive habitats or altering historic properties (NRMP 2022), than the threats posed by the debris itself.

This document also addresses efforts to collaborate with the Department of Defense to remove military wreckage from remote areas of the UH Management Areas, in accordance with the CMP (Action IM-7). This plan does not address debris generated by land uses such as permitted construction projects; such debris is managed as part of the Best Management Practices related to projects.

The management actions stated in the 2022 CMP that explicitly relate to this plan are identified in the table below, followed by a brief description of the implementation objective and/or method.

Management Action		
Action	Description	Comments
Native Hawaiian Cultural Resources, CR-3	Conduct educational efforts to generate public awareness of the importance of preserving the cultural landscape.	Information about Maunakea's cultural resources is provided through CMS's public brochures, the CMS website, official personnel including the Maunakea Rangers, and the Maunakea User Orientation
CR-5	Develop and adopt guidelines for the culturally appropriate placement and removal of offerings.	This plan will comply with Kahu Kū Mauna guidance and relevant cultural and historic preservation policies.

Management Action		
Threat Prevention and Control: Limit threats to natural resources, NR-1	Limit threats to natural resources through management of permitted activities and uses.	Implementation will be conducted through debris prevention methods including visitor education, debris monitoring and debris removal. These efforts on the UH managed lands will focus on areas of cultural importance, high visitor use, construction sites, and observatory facilities. Other areas adjacent to UH managed lands such as the Department of Land and Natural Resources (DLNR) Forest Reserve and Natural Area Reserve (NAR) will be managed as resources allow.
NR-6	Reduce threats to natural resources by educating stakeholders and the public about Maunakea's unique natural resources.	Onsite signage and oral advisories or reminders will include main concepts regarding trash management and debris prevention.
NR-18	Develop geo-spatial database of all known natural resources and their locations in the UH Management Areas that can serve as baseline documentation against change and provide information essential for decision-making.	Geo-spatial databases will include all permanent, outdoor, trash receptacles; delineate sensitive areas; and identify boundaries used in reporting.

Management Action		
Program Development, Education and Outreach, EO-2	Require orientation of users, with periodic updates and a certificate of completion, including but not limited to visitors, employees, observatory staff, contractors, and commercial and recreational users.	Orientation materials will be periodically updated to incorporate key messages from this plan. As of April 2015, orientation requirements are applicable to all users operating under a permit, and are expected to eventually be extended to all visitors prior to entry.
EO-3	Continue to develop, update, and distribute materials explaining important aspects of Maunakea.	CMS visitor education will include messaging on the importance of preventing litter and proper disposal.
EO-4	Develop and implement a signage plan to improve signage to provide interpretive, safety, rules and regulation information throughout the UH Management Areas.	Signage will incorporate key messages of this plan.
EO-8	Provide opportunities for community members to participate in stewardship activities.	CMS conducts monthly to bi-monthly volunteer events on Maunakea. While the main objective has primarily focused on ecosystem restoration, activities may include trash/debris removal in those areas.

Management Action		
General Management, ACT-1	Continue and update managed access policy of 1995 Management Plan.	A key component of the managed access policy is registering and orienting visitors to ensure that all are aware of Maunakea's unique and sensitive landscape and potential impacts of activities. To this end, an entrance protocol shall be developed that incorporates debris and trash management concepts (particularly as high winds may scatter debris and belongings across the landscape, possibly damaging natural and cultural resources).
Laws and Regulations, P-4	Educate management staff and users of the mountain about all applicable rules and permit requirements.	This plan identifies roles and responsibilities of mountain users.
Routine Maintenance, IM-1	Develop and implement an Operations, Monitoring, and Maintenance Plan (OMMP).	The OMMP is a plan that coordinates all maintenance plans, activities and schedules. The OMMP should address existing maintenance tasks carried out by Maunakea Observatories Support Services (MKSS) and the observatories, as required by Conservation District Use Permit (CDUP), along with revised recommendations presented in the CMP. Once completed, the OMMP will incorporate this Debris Removal, Monitoring and Prevention Plan.

Management Action		
Natural Resources Management Plan Goal TPC-6: Reduce impacts of solid waste.	All outdoor trash cans and dumpsters are required to be covered and secured.	This requirement is included in a Best Management Practices (BMP) template provided to all projects and included on permits.
Objective 1: Minimize fugitive solid waste.	Require best management practices.	
	Other management actions listed under this objective are addressed above.	

2. RESOURCE IMPACTS AND SENSITIVITIES

The UH-managed lands, also known as the Maunakea lands, harbor sensitive resources distinguished by their value to the environment, archaeology, culture, history, and scientific research, and include historic properties, cultural resources, natural resources, and scientific resources. The UH-managed lands also comprise a portion of vast state lands on Maunakea designated Conservation District and protected under regulations including Hawaii Revised Statutes Chapter 183C Conservation District. Human activities on the Maunakea lands can generate refuse materials that require continuous management to minimize impacts to the mountain's sensitive resources and sensitive areas.

- **Historic Properties:** Debris can physically damage or deface historic properties like shrines, burials and the slopes of cinder cones. Debris can also affect the visual integrity of the historic district and individual landscape features, which is particularly significant in the open summit region. Systematic debris removal must be done appropriately to avoid affecting historic properties, which could be damaged if participants are unaware or if collection points are too close. Hundreds of historic properties have been identified, including burial sites, stone quarries, tool workshop complexes, and shrines (AIS 2010). The presence of debris near archaeological resources is offensive to observers and may be seen as a lack of respect for the land (CMP 2022).
- **Cultural Resources:** The entire summit region is regarded by some as the most sacred place in Polynesia. Debris and foreign objects can be perceived as polluting the cultural landscape, and changes to architectural elements of shrines can diminish their integrity. The UH-managed lands includes three designated Traditional Cultural Properties (TCP) listed on the State Inventory of Historic Places: Mauna Kea (from the 6,500 feet elevation to the summit), Kūkahau'ula and Pu'ulilinoe (Pu'u Wāiau is a fourth TCP on Maunakea but outside of UH management). While cultural practices may involve leaving offerings, particularly those with organic materials, this can unintentionally introduce invasive species, attract pests, create inappropriate food sources for endemic species, or become litter (ISMP 2015). Visitors are informed about potential impacts of new offerings, instructed to respect existing offerings without touching or disturbing them, and casual visitors are discouraged from leaving non-traditional offerings.
- **Natural Resources:** Maunakea is home to endangered, threatened, and endemic species. Anthropogenic debris can directly or indirectly harm wildlife, erode or contaminate ground surfaces, and pollute water quality (e.g., Lake Waiau). Subalpine, alpine, and potential permafrost habitats are easily susceptible to human influence.
- **Scientific/Research Resources:** Debris can threaten scientific resources (the physical environment and astronomy) by degrading water and air quality.

3. GOALS OF THE PLAN

The goals of this plan are:

- To **identify actions** that will prevent the introduction of litter and debris,
- To **convey debris-prevention methods** to staff and visitors,

- To **establish standards** for documenting and reporting efforts to monitor the presence of litter and debris,
- To **articulate plans** for removing debris when appropriate, and
- To **minimize impacts** to resources such as historic properties, cultural sites, and native biota.

The goals of this plan will be achieved by 1) increasing education on debris prevention for all Maunakea users, 2) conducting regular maintenance by Maunakea staff, and 3) instituting monitoring efforts by Maunakea staff.

4. EDUCATION AND PREVENTION

Education about the importance of protecting Maunakea's natural and cultural resources is used to communicate concerns and address the impacts of trash and debris. All visitors to the UH managed lands have a responsibility to manage their trash. Educational themes emphasize self-responsibility (CMP Supplement 2022) and a "pack it in, pack it out" ethic ([7 Principles - Leave No Trace](#)).

Key educational efforts include:

- **Informational Brochures** that encourage litter/debris prevention and vigilance (Mauna Kea Historic Preservation Plan 2000). Preventing windblown trash is emphasized as a primary method to avoid debris collection on the mountain, which may itself damage resources or harm collectors.
- An **orientation program or video** ([UH Administrative Rules](#)).
- **Websites** ([CMS](#), IFA, and others).
- **Signage** regarding potential impacts and proper disposal methods, emphasizing prevention and reduction, with preferred disposal below the summit. Signs above Halepōhaku will be minimal and typically on receptacles/toilets.
- Encouragement of **trash reduction through recycling**.
- Information on prohibiting off-road vehicles, removing debris created while hunting, threats of invasive species/erosion, and information on historic properties to avoid disturbance.

Maunakea rangers and VIS staff inform visitors about potential impacts of trash, proper disposal, and noncompliance fines (CMP Supplement 2022). Awareness and responsibility for generated waste and preventing loose/windblown trash are key focuses. Users are informed to control personal belongings by containing or securing trash until proper disposal. Open vehicle beds may be inspected for loose trash.

Personnel working on Maunakea are encouraged to maintain a culture of trash-responsibility through mandatory Maunakea user orientation. Project approvals on the mountain have conditions that often underscore the importance of debris management. Each new project is required to have best management practices associated with the activity that is reviewed by CMS and other external agencies prior to commencement. For example, dumpsters are required to have lids that are locked down to ensure containment of rubbish.

5. REGULAR MAINTENANCE

Routine trash management includes procedures for both indoor and outdoor receptacles and addressing loose litter (CMP 2022):

Indoor Receptacles: Food waste receptacles are emptied daily and washed monthly or as needed. Recycle bins must have signs for rinsing containers and be emptied weekly. Non-food receptacles are emptied monthly and cleaned as needed. These are managed by the operating entity (MKSS or observatory).

- **Outdoor Receptacles:** All outdoor trash cans and dumpsters must have **effective lid closures** designed to withstand gusts of 70 MPH or greater (NRMP 2022). Food/biological material receptacles are emptied daily and washed monthly. Others are emptied monthly and cleaned as needed. These are managed by the operating entity on a case-by-case basis. Public outdoor receptacles are not currently provided in roads, parking lots, trails, or natural/cultural preservation areas but may be recommended based on monitoring data.
- **Windblown litter/debris:** A "[pack it in, pack it out](#)" strategy is used. CMS staff and Rangers remove fugitive trash as it is encountered, documenting this action.
- **Graffiti & Stickers:** CMS staff and Rangers remove graffiti and stickers as they are encountered, documenting the action.
- **Routine Collection:** MKSS employees are responsible for routine trash collection from receptacles and general groundskeeping at mid level facilities, public parking, roads, and the Summit Lunchroom. Facilities and construction sites must conduct external clean-ups throughout the year as necessary to maintain compliance with their respective Conservation District Use Permit(s). CMS Rangers conduct random CDUP inspections twice yearly and notify facilities of potential violations.

6. MONITORING

Regular monitoring is conducted to ensure the plan is implemented, updated, and to inform future planning for receptacles and education. CMS staff monitor the Maunakea lands for trash daily, specifically near facilities, construction sites, roads and parking lots, trails and natural/cultural preservation areas. Rangers are tasked with patrolling portions of the Halepōhaku Parcel, Summit Access Road, Astronomy Precinct, and Summit Region. As resources allow, the Rangers also monitor and collect trash from within the Mauna Kea Ice Age Natural Area Reserve, particularly the popular foot trails to/from Lake Wāiau and parking areas, and around the lake itself. See Figure 2 for a map of the areas that are monitored.

The responsibilities for each monitoring zone are outlined below:

- **Facilities:** Indoor facilities are monitored for invasive species, with trash concerns documented. Outdoor facilities (within 25 yards) are monitored during bi-annual Conservation District Use permit (CDUP) inspections by Rangers, who record debris, location, proximity to cultural sites,

and invasive species concerns. CMS notifies the observatory of any concerns or possible permit violations. Observatories are allowed thirty (30) days to remedy CDUP notifications.

- **Construction Sites:** All projects involving construction are required to provide BMPs that are reviewed and approved by CMS prior to implementation. Receptacles must be securely covered, and containers with biological material (other than lumber) removed daily. Site managers must collect observed debris during CDUP inspections and report within 30 days.
- **Roads & Parking Lots:** Roads and parking lots will be monitored daily for roadside debris/litter. If possible, all observed litter/debris will be safely removed and properly disposed of.
- **Trails and Natural/Cultural Preservation Areas:** Defined trails and areas of natural and cultural significance will be monitored opportunistically and recorded when observed.

While all Maunakea users are responsible for their own trash, specific monitoring duties will be assigned as listed below:

- **MKSS Staff:** All MKSS staff conduct daily sweeps of VIS public areas and facilities; weekly sweeps outside Halepōhaku/Utilities, paved parking lots, vegetated areas, and lower dirt/gravel parking. Semimonthly, MKSS tows a magnetized bar on the lower unpaved road to collect metal fragments. They also clear areas around observatories on request. Data from magnetized collection is not currently recorded.
- **Rangers:** Rangers conduct routine monitoring during patrols in defined zones (gravel road, paved road, Astronomy Precinct, summit region). They record collected trash, noting debris type, quantity, comments, and if collected. They conduct ongoing inspection and removal in active snow play areas during high-use periods. Rangers may also clear areas around observatories using a magnetized bar, depending on manpower availabilities.
- **Observatories:** Observatories are responsible for their leased areas and must remove all debris within a 25-yard perimeter of their respective facility.

7. REPORTING

Monitoring efforts are documented through specific reporting procedures.

- **Ranger Reports:** Summit monitoring is reported daily, including photo documentation. Reports include zone, debris type, number, comments, and whether the item was collected. Daily monitoring of summit roads, parking lots, facilities, and construction sites is documented. Periodic CDUP inspections are reported separately. Blank tables indicate the zone was not visited; zero pieces means monitoring occurred but no trash was observed. See Figure 1 for an example of the ranger report.

	Trash:	
Early a.m.	Summit area: 2x tissue paper, 1x medium plastic piece, 1x candy wrapper. Trash route 8: Numerous plastic pieces, 3x nylon	
	fabric pieces, 1x empty gum wrapper, 1x glass bottle. TS	

Figure 1. An example of a trash removal entry for a Ranger report.

- **Facilities:** No additional facility-specific reporting beyond what is included in Ranger Reports and CDUP inspections is required.
- **CMS Annual Report:** CMS prepares a brief annual report summarizing observations by calendar year. This report synthesizes monitoring data to identify zones, debris sources and quantities, CDUP compliance concerns, and recommendations. Additional discussion on threats (historic properties, cultural practices, invasive species) is encouraged. This information is synthesized in the 5-year CMP status report.

8. RECOMMENDATIONS

Listed below are recommendations for guiding debris management efforts:

1. Conduct a **post-snow-season inspection and clean-up** in high-use areas.
2. Conduct **systematic clean-ups** to remove debris without disturbing historic properties. This includes using routine monitoring to determine when major projects are needed, informing participants about historic properties and restrictions, designating collection points away from sites, and utilizing volunteers for smaller cleanups, preferably with Rangers.
3. Include **approval conditions** when issuing activity or land use permits to address debris, parking, off-road vehicle use, and emergency precautions.
4. Encourage researchers, even without permits, to meet with CMS staff to be fully informed about **historic properties** and the need to avoid disturbing them, emphasizing control/removal of debris, prohibiting off-road vehicles, and discussing emergency procedures.
5. Prepare a **debris control and removal plan for each project** that specifically incorporates protective measures for historic properties.
6. Develop a **staff training program** including site locations, artifact recognition, and integrating relevant regulations/policies to protect historic properties, archaeological resources, and cultural resources.
7. **Coordinate hunting policies with DLNR** to protect historic properties, advising the public on sensitive areas, enforcing off-road vehicle/parking prohibitions, and controlling debris.
8. Prepare a plan, in collaboration with the Department of Defense, to **remove military wreckage found in remote areas** of the UH Management Areas, while ensuring protection of natural and cultural resources (CMP 2022). Known wreckage identified includes partial remains of two military helicopters and a drone found in the Science Reserve. Consultation with appropriate

military authorities will be undertaken for the removal of wreckage from these crash sites, as they have no place in an historic district.

DRAFT

9. REFERENCES

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APPENDIX

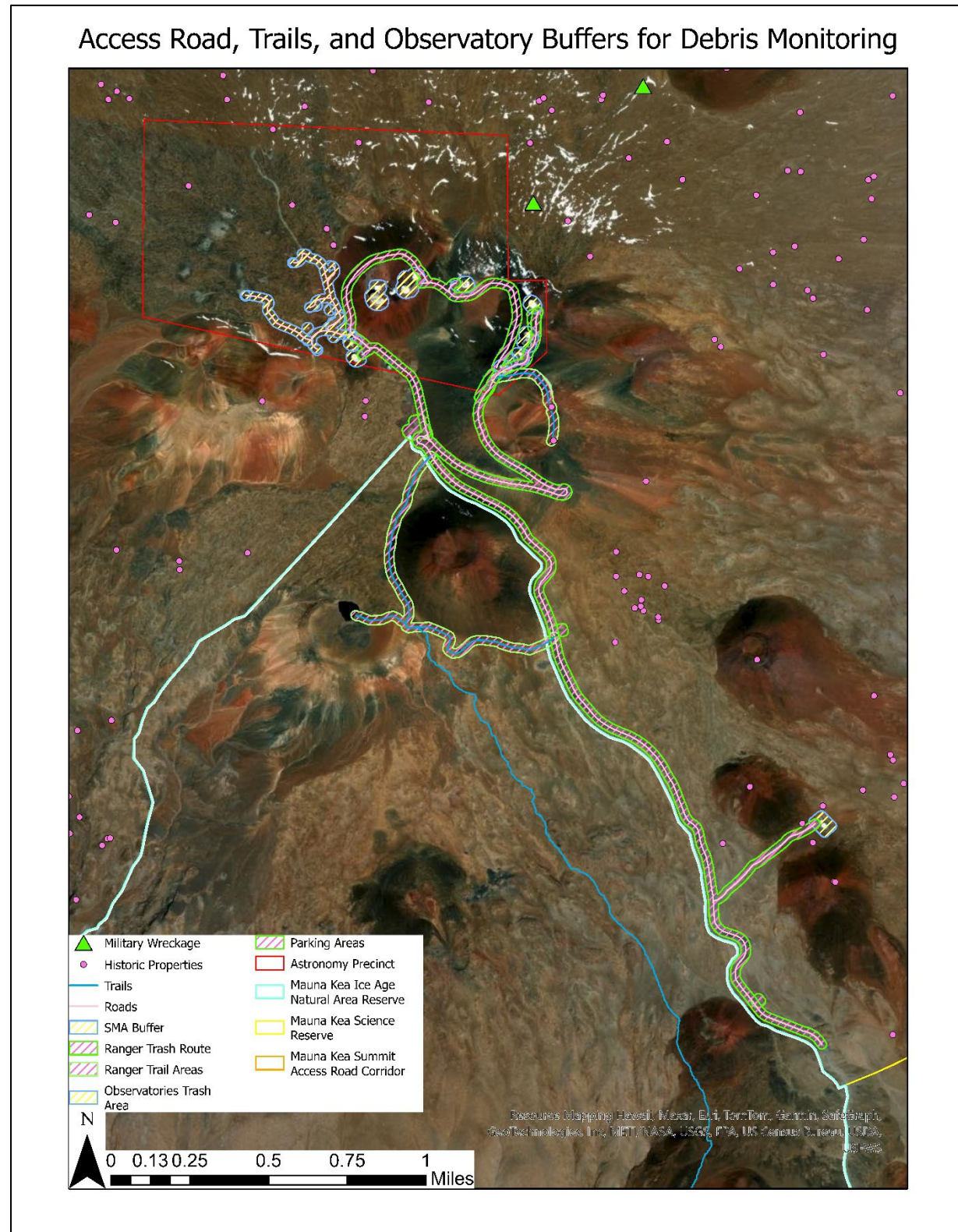


Figure 2 Map of debris buffer areas covered during routine maintenance and monitoring

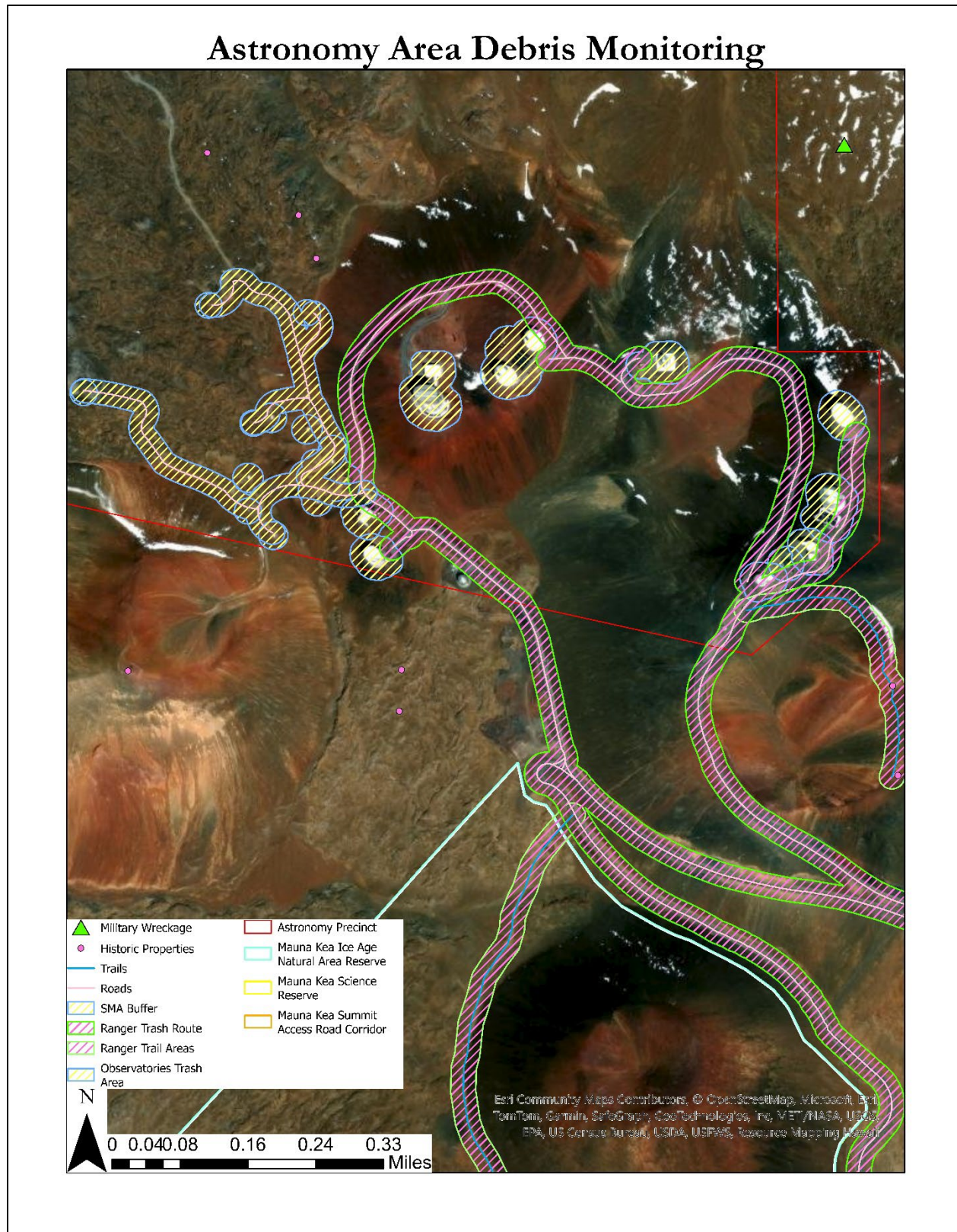


Figure 3 The summit area trash routes and buffers

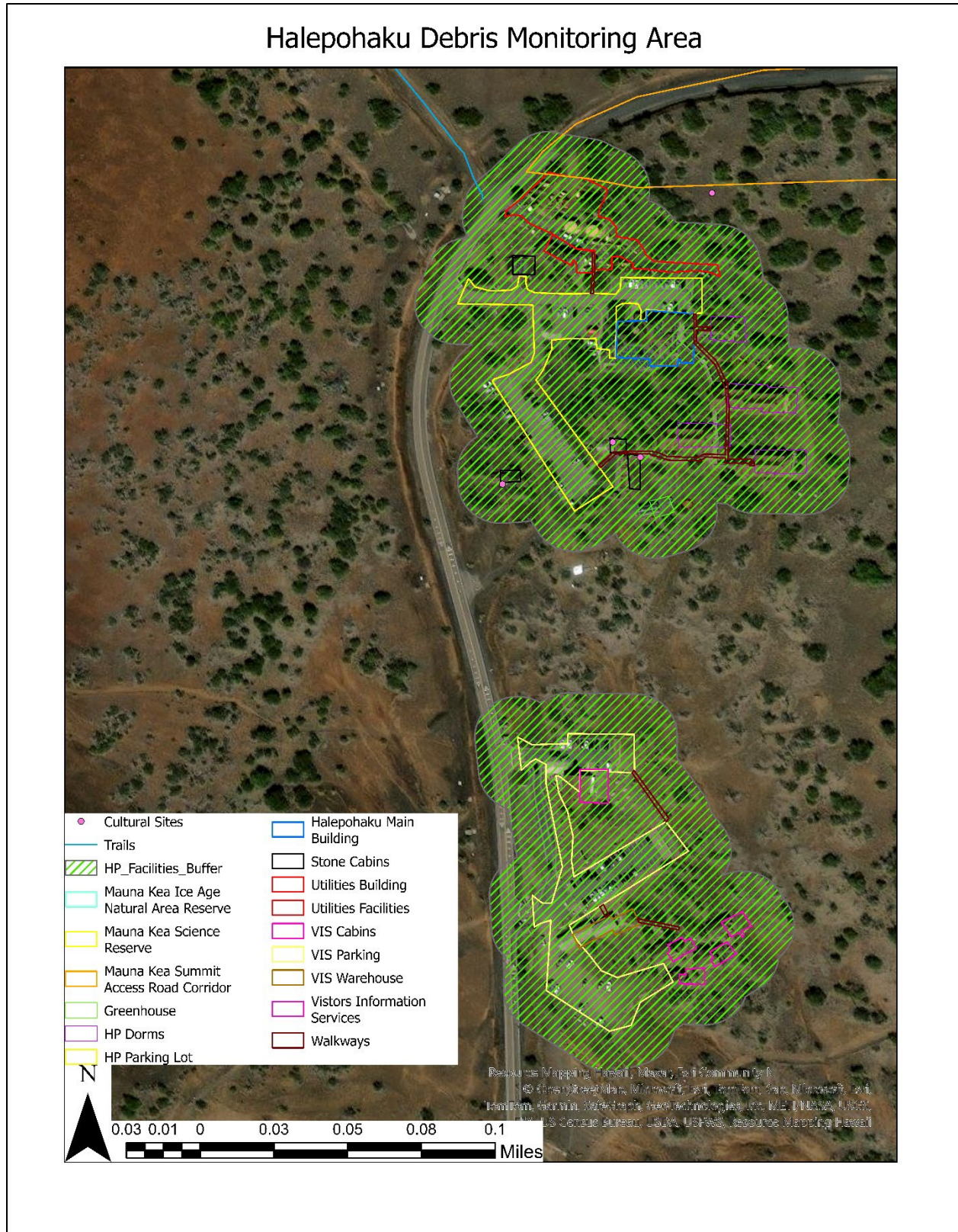


Figure 4 Halepohaku trash areas and facilities