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In reply, please refer to:
File: EHA/HEER Office

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2011-682-RB

FROM: Roger Brewer, PhD
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DATE: November 22, 2011

SUBJECT: Review of soil sample data results for former AMFAC Office Building in
Kekaha, Kaua'i

I reviewed the results of soil samples collected by our office October 7, 2011, at the former AMFAC Office Building in Kekaha, Kaua'i. Attached are maps and photos that indicate the location and size of the targeted decision units. Soil samples were tested for the full suite of pesticides potentially associated with past sugar mill operations (HDOH 2009). Sample results were compared to HDOH soil action levels and guidance for unrestricted land use, including use of a property for schools and residences (HDOH 2009a, 2010a, 2010b).

In summary, the reported concentration of arsenic, mercury, dioxins and other pesticides in soil samples collected from the charter school area of the AMFAC building are well below risk-based, HDOH soil action levels for unrestricted land use. Exposure to the soil does not pose a health risk to children or workers. No further action is necessary in this area.

Slightly elevated levels of total arsenic and dioxins were reported for an area along the eastern margin of the AMFAC building property, on the opposite side of the building as the school and adjacent to a swale that could have received runoff from the former pesticide mixing area (see map). Reported levels of bioaccessible arsenic (used for final, decision making purposes) as well as TEQ dioxins are, however, below HDOH action levels for unrestricted land use, including schools and residences. Exposure to the soil does not pose a health risk to children or workers on the AMFAC building property.

Most of the impacted soil identified along the eastern edge of the AMFAC building property (DU-4) is probably restricted to the narrow (three to four feet), swale area and immediately adjacent to DU FHMA-05 in the 2010 investigation (see map). Although no further action is required for the AMFAC building property from a health risk standpoint, soil in the portion of

the swale area that is on the AMFAC building property should be included with remedial actions to be carried out for soil in the portion of the swale area that is on the ADC property, since the arsenic and dioxins almost certainly originated from the former pesticide mixing area.

A more detailed discussion of soil sampling results for each targeted area is provided below. Laboratory reports for the samples are also attached.

Site Investigation Approach

Decision Unit (DU) and Multi-Increment Sample (MIS) approaches were used to investigate the targeted areas (HDOH 2009, referred to as “Incremental Sampling Methodology” on the mainland). A *Decision Unit* (DUs) is an area that is targeted for characterization. This can be an “exposure area” that is frequented by children, residents or workers on a daily basis (“Exposure Area” DU) or a spill area of known or suspected contamination (“Spill Area” DU). Examples of the former include playgrounds, residential yards and open areas on commercial properties. Examples of the latter include former waste storage or disposal area and pesticide mixing areas.

Designation of well-thought-out DUs at a site helps ensure that site investigation objectives and use of the resulting sample data are clearly established ahead of time. A key objective of the subject investigation at the AMFAC building site was to determine if pesticides were present in exposed soil at the western, charter school portion of the building and, if so, the potential long-term health risks posed to children and workers. A second objective was to determine if contamination from an adjacent, former pesticide mixing area had spread onto the eastern margin of the property.

Multi-Increment (MI) soil samples are collected from targeted DUs. An MI sample is in essence a very good “composite” sample that represents soil for the targeted area as a whole. The inclusion of a very large number of sampling points or “increments” from within a targeted area (e.g., 30-50+) helps to ensure that small, isolated “hot spots” of contaminated soil not obvious in the field are incorporated into the overall bulk, MI soil sample that is collected and tested at the laboratory.

Traditional investigation approaches that rely on a small number of discrete soil samples (e.g., less than 20 to 30) run a high risk of missing small “hot spots” within a targeted area and *under reporting* the magnitude and extent of contamination. The USEPA Superfund office recently published guidance that recommends the use of DU-MIS (“ISM”) approaches similar to those used in Hawai‘i to investigate dioxin-contaminated sites (USEPA 2011). HDOH personnel are actively involved in helping to develop nationwide guidance on the use of DU-MIS investigation approaches to improve the reliability and efficiency of site investigations.

AMFAC Building Decision Units

Two areas of the AMFAC building property were targeted for sampling, due to the proximity of the property to a past, pesticide mixing area associated with the former Kekaha sugar mill (see map). A charter school is located in the west wing of the building (see Photos 1-8). The remaining portion of the building is used for commercial purposes. Two Exposure Area Decision Units were designated for testing by the charter school (see figures), one for a grassy area located between the west and central wing of the building (DU-1) and a second in a mostly barren area with picnic tables (DU-2/3, replicate samples collected). A separate, fenced area

with playground equipment and a volleyball area were covered with imported sand with no native soil exposed (see Photos 7-8). These areas were not tested.

A third area for sample collection was designated on the east side of the building (DU-4, see map), adjacent to and slightly overlapping a swale area located at the periphery of the former pesticide mixing area. The swale area was tested in 2010 and identified moderately elevated levels of arsenic and dioxins, both believed to be associated with the past use of arsenic- and pentachlorophenol-based herbicides in the mixing area.

Following is a more detailed description of the designated DUs. Surface soils were targeted for characterization in order to evaluate potential direct-exposure risks posed by residual pesticides in soil.

Charter School Decision Units

A fenced, outdoor area on the back, north side of the AMFAC building is used by the charter school for various activities (see map and Photos 3-6). This area was targeted for sampling due to potential exposure of children to pesticides in exposed soil. Two “Exposure Area” Decision Units (DUs) were designated in this area (see map). A 2,400ft², grassy area between the central and western wings of the building that overlies the building septic system was targeted for sampling (DU-1, see map and photos). A second, approximately 4,000ft² area of barren soil used for picnic tables and storage sheds was targeted separately, due to the increased potential for regular contact with soil (DU-2/3, see map and photos).

Swale Area Decision Unit

A portion of a swale that runs along the eastern margin of the former pesticide mixing area lies within the AMFAC building property. A 2010 investigation of the ADC portion of the swale identified moderate levels of arsenic and dioxin contamination their portion of the swale (Weston, 2010; DU-FHMA-05, see map). As a follow up to the 2010 investigation, the swale area that falls on the AMFCA building property and a narrow area inward of the swale was targeted for sampling (DU-4, approximately 4,500ft²; see map and Photos 9-11).

This area is not frequently used by workers or children at the AMFAC building. The area was instead targeted in order to determine if significant contamination could have spread onto this portion of the AMFAC property due to runoff from the former mixing area (“Spill Area” perimeter DU). The AMFAC building property inward of the swale is slightly raised above the pesticide mixing area and reportedly does not flood during heavy rain events. This suggests that any runoff of contaminated soil from the former pesticide mixing area should be restricted to the swale area.

Soil Sample Collection

A Multi-Increment (MI) soil sample was collected from each Decision Unit in accordance with HDOH site investigation guidance (HDOH 2009). Sample increments were collected from the upper four to six inches of soil. A single, Multi-Increment (MI) sample was collected in DU-1 (total 36 increments). Duplicate MI samples (i.e., one original and one replicate) were collected in DU-2/3 (samples DU-2 and DU-3; 46 increments each), since this was area of highest, potential exposure. The purpose of the second, replicate MI sample was to verify that the data reported for the DU were reproducible. (Checking the reproducibility of sample data is not

carried out in traditional, discrete sample investigations, but is a requirement for DU-MIS investigations.)

Sample Results

Sample results for chemicals that could be associated with past operations at the pesticide mixing area are summarized in the following table:

Table 1. Summary of sample results (mg/kg, key sugarcane pesticides).

Sample ID	Total Arsenic (mg/kg)	*BA Arsenic (mg/kg)	TEQ Dioxins (ng/kg)	Mercury (mg/kg)
DU-1	11	-	30	0.21
DU-2	15	-	29	0.073
DU-3 (rep.)	14	-	36	0.073
DU-4	51	18	110	0.43
HDOH Action Level	20	23	240	4.7

*Bioaccessible arsenic.

A summary of sample data for each investigated DU area is provided below. Note that evaluation of potential health risks posed by arsenic is based on the concentration of bioaccessible arsenic in the fines fraction of the soil (<250 um) rather than total arsenic (HDOH 2010a). Total arsenic data (<2mm soil fraction) are initially compared to a natural background action level of 20 mg/kg. If this is exceeded, indicating the potential presence of pesticide-related arsenic, the fines fraction of the sample is retested for bioaccessible arsenic.

Trace levels of chlordane and dieldrin (used to treat soil for termites) were also reported in some samples but well below HDOH direct-exposure action levels of 16 mg/kg and 0.03 mg/kg, respectively (dieldrin action level to be revised to 1.5 mg/kg in upcoming Fall 2011 updates to guidance).

Charter School Decision Units

The reported concentrations of arsenic and mercury in DU-1 and DU-2/3 are within expected, natural background levels and do not pose a risk to human health. The reported levels of TEQ Dioxin levels in the soil are within or slightly above expected background levels and well below the HDOH soil action level of 240 ng/kg unrestricted land use, including schools and residences. No further action is required for this area.

Swale Area Decision Unit

Slightly elevated levels of total arsenic and dioxins were reported in the MI sample collected from DU-4, along the eastern margin of the AMFAC building property. Levels of arsenic and dioxins above that reported for DU-1 and DU-2/3 are most attributable to runoff of contaminated soil from the former pesticide mixing during heavy rain events. Reported levels of bioaccessible arsenic (used for final, decision making purposes) as well as TEQ dioxins are, however, below HDOH action levels for unrestricted land use, including schools and residences. Exposure to the soil does not pose a health risk to children or workers on the AMFAC building property.

Most of the impacted soil identified along the eastern edge of the AMFAC building property is probably restricted to the portion of the narrow (three to four feet), shallow (six to twelve inches) swale area in the northwest half of DU-4 (see map and Photo 11). Although no further action is required for the AMFAC building property from a health risk standpoint, inclusion of the soil in the swale area with remedial actions to be carried out for the adjacent pesticide mixing area should be considered, since the arsenic and dioxins almost certainly originated from that area.

References

HDOH, 2009a, *Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater* (Summer 2009 and updates): Hawai'i Department of Health, Office of Hazard Evaluation and Emergency Response, www.hawaii.gov/health/environmental/hazard/eal2005.html.

HDOH, 2009b, *Technical Guidance Manual*: Hawai'i Department of Health, Office of Hazard Evaluation and Emergency Response, <http://www.hawaiidoh.org/>

HDOH, 2010a, Update to Soil Action Levels for inorganic Arsenic and Recommended Soil Management Practices (October 2010): Hawai'i Department of Health, Office of Hazard Evaluation and Emergency Response, <http://www.hawaiidoh.org/>

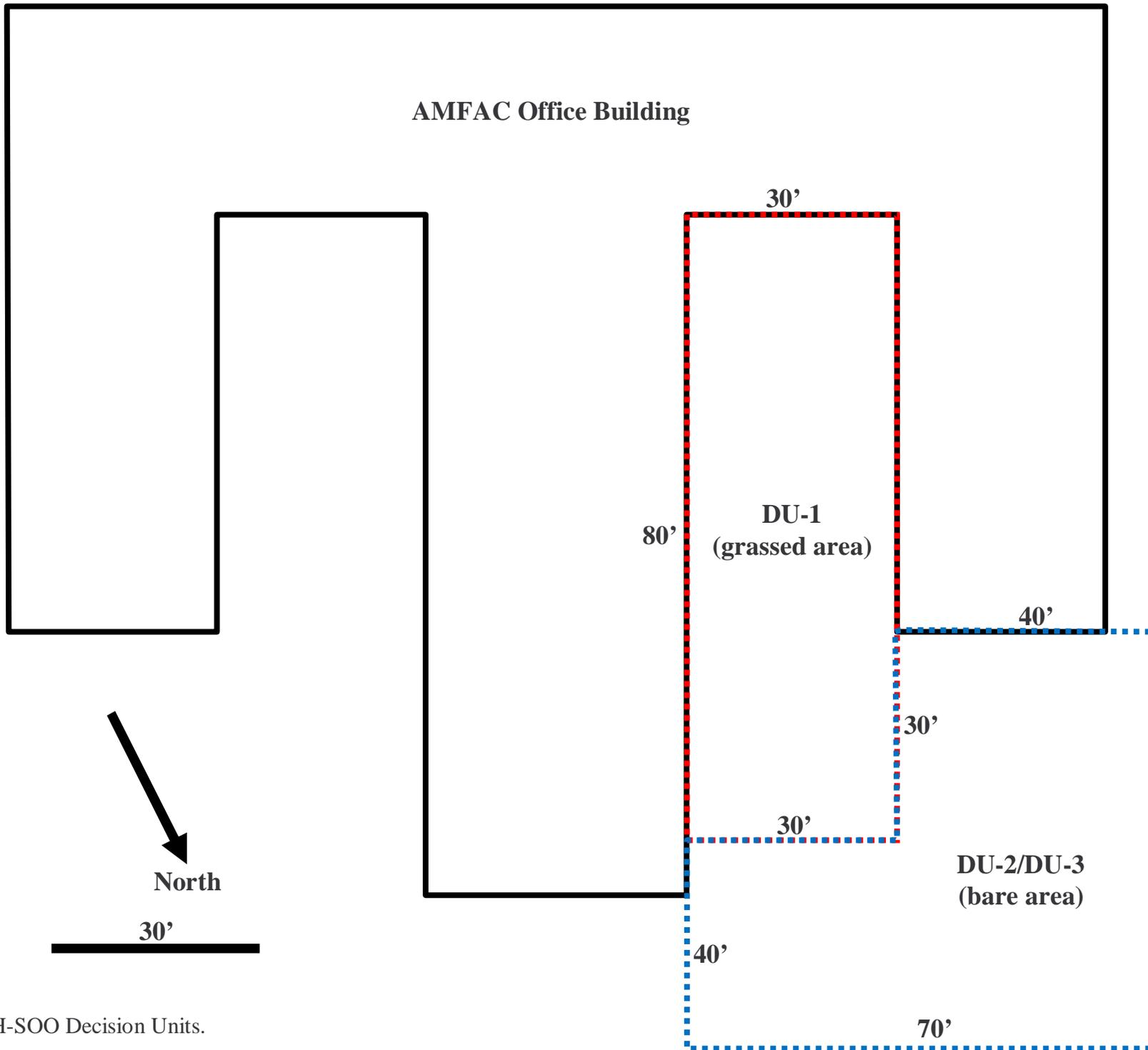
HDOH, 2010b, Update to Soil Action Levels for TEQ Dioxins and Recommended Soil Management Practices (June 2010): Hawai'i Department of Health, Office of Hazard Evaluation and Emergency Response, <http://www.hawaiidoh.org/>

USEPA, 2011, User Guide - Uniform Federal Policy Quality Assurance Project Plan Template For Soils Assessment of Dioxin Sites (September 2011): U.S. Environmental Protection Agency, Office of Superfund Remediation and Technology Innovation, 112pp, <http://www.epa.gov/superfund/health/contaminants/dioxin/pdfs/Dioxin%20UFP%20QAPP%20UserGuide.pdf>

Weston. 2010, *Phase I/II Targeted Brownfields Assessment, Kekaha Sugar Mill, Kekaha, Kaua'i, Hawai'i* (draft February 2011): Weston Solution, Inc., Prepared for: U.S. Environmental Protection Agency Region 9,. USACE Delivery Order Number: W91238-06F-0083, Document Control Number: 12767.063.593.1121.

Kehaka Road

AMFAC Office Building



Kehaka Road

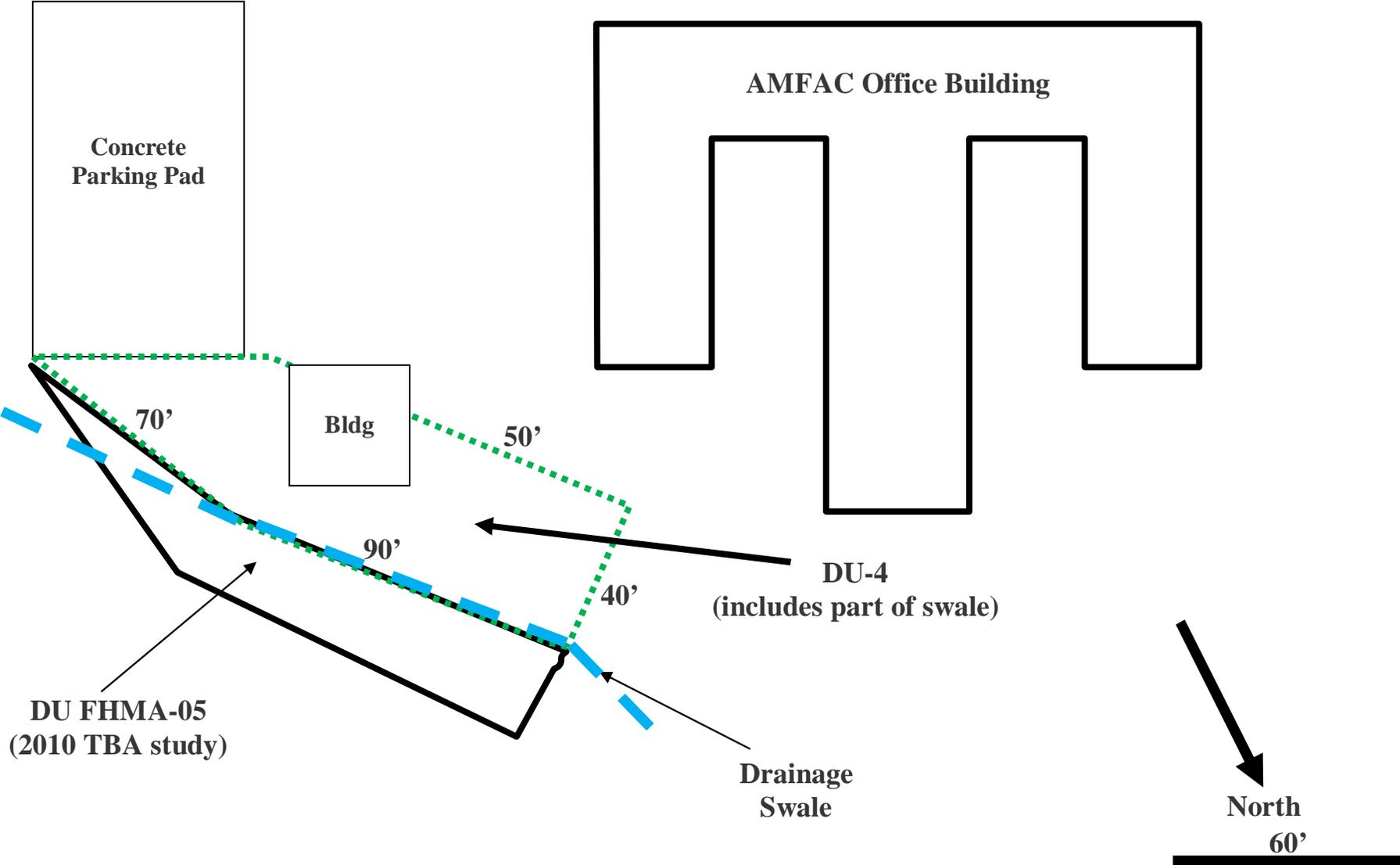




Photo 1. Former AMFAC building, Kekaha.



Photo 2. Charter school in west wing of former AMFAC building.



Photo 3. Entrance to charter school area.



Photo 4. Charter school grassy area (DU-1).



Photo 5. Charter school area with barren soil (DU-2/3).



Photo 6. Charter school area with barren soil (DU-2/3).



Photo 7. Play set area with imported sand (not tested).



Photo 8. Volleyball area with imported sand (not tested).



Photo 9. Eastern edge of AMFAC building property (DU-4).



Photo 10. NE corner of DU-4 (left, FHMA-05 to right of tape and flags).



Photo 11. NW swale area of DU 4 (FHMA-05 to right of flags).