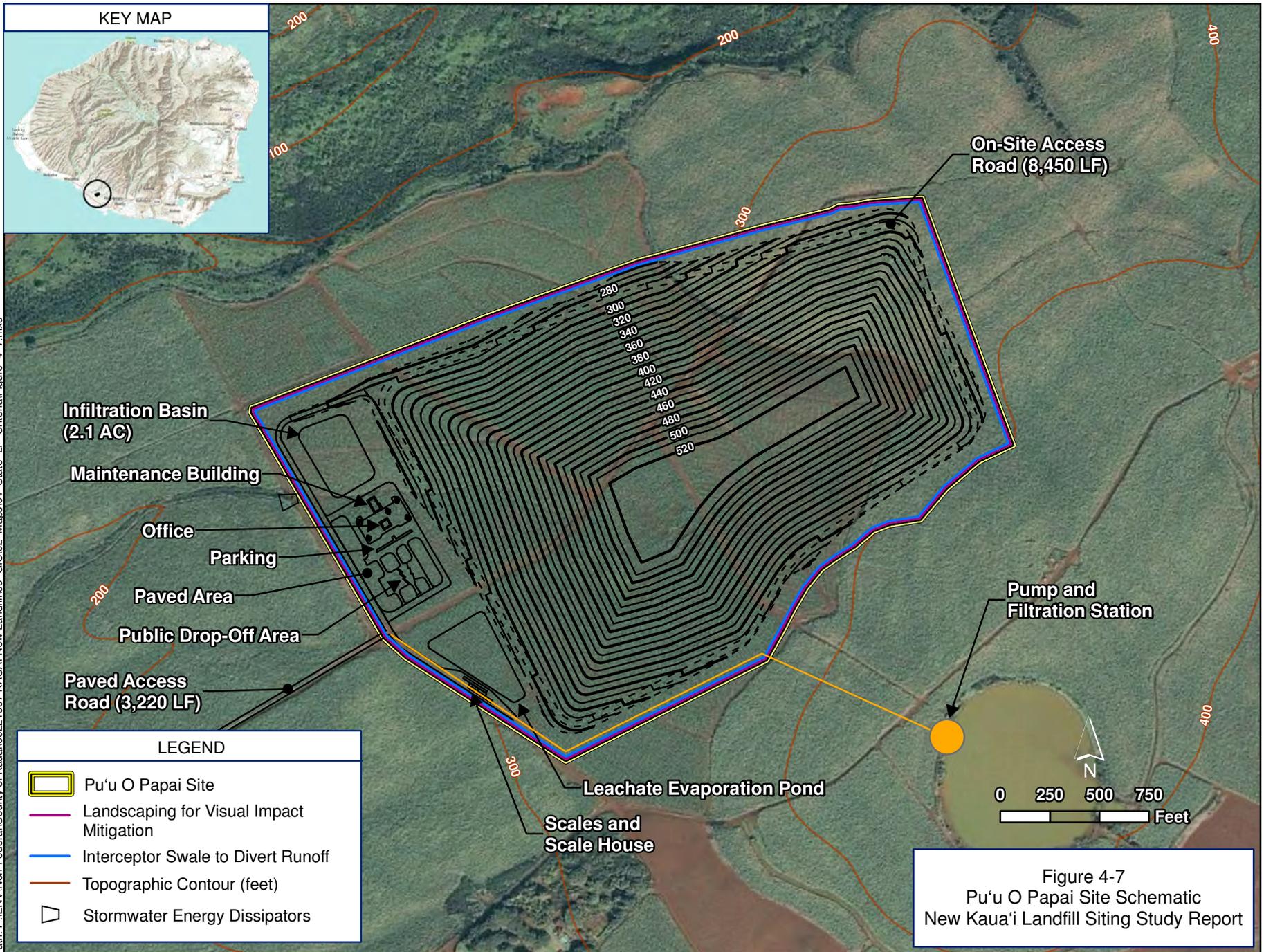


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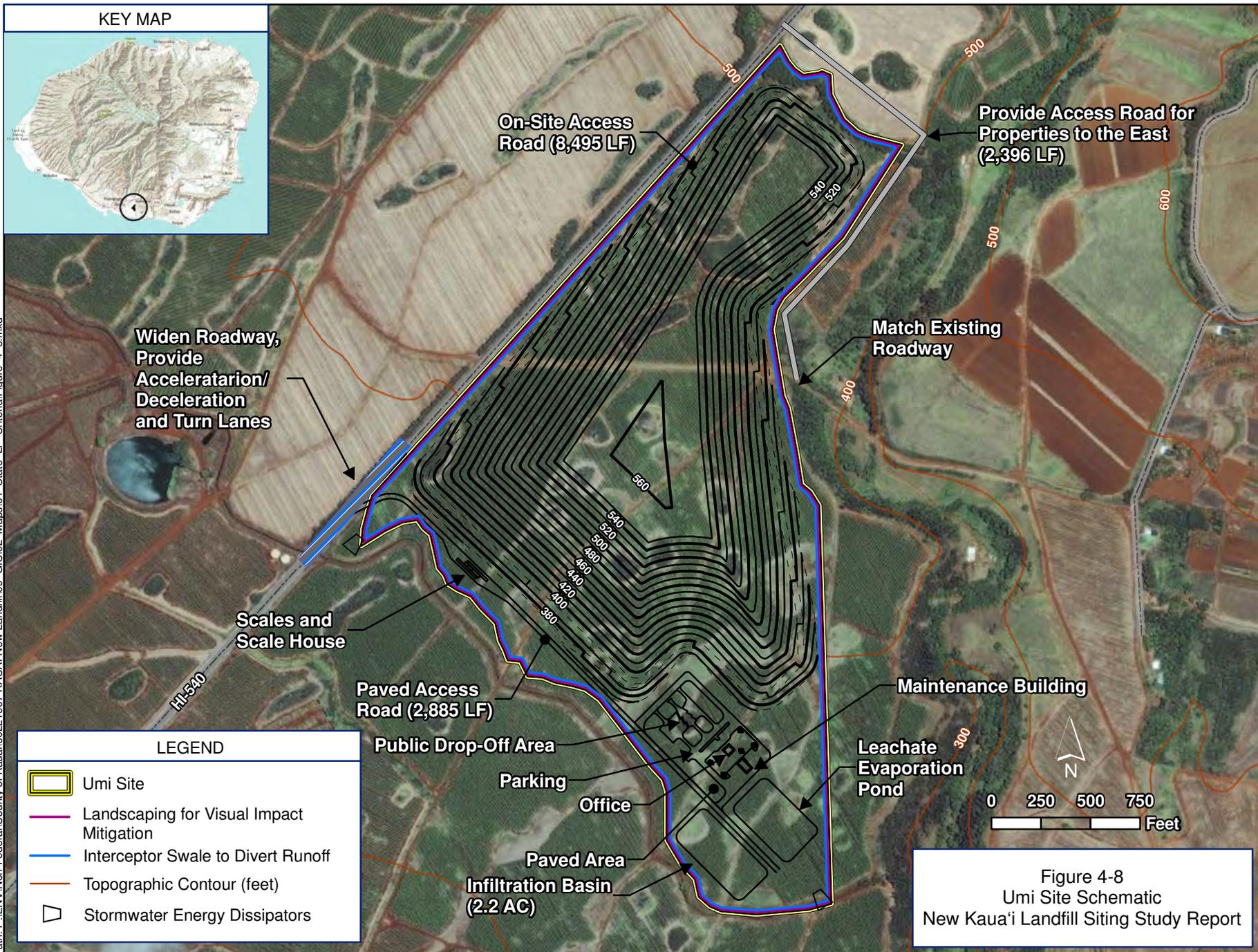


Figure 4-8
Umi Site Schematic
New Kauai Landfill Siting Study Report

Table 4-1: Preliminary Engineering Evaluation – Conceptual Design Data

Parameter	Kalepa	Kekaha Mauka	Kipu	Koloa	Kumukumu	Ma'alo	Pu'u O Papai	Umi
Total Property Area (Ac.)	77.6	175.9	145.8	125.4	172.9	270.2	145.7	126.7
Limit of Waste (LOW) Area (Ac.)	49	86	73	77	102	194	96	72
Below Grade Depth (ft)	10	5	10	10	10	10	10	10
Volume for Waste Mass + Daily Cover Below Grade (cy)	710,000	686,000	1,178,000	1,226,000	1,646,000	3,130,000	1,549,000	1,162,000
Volume for Waste Mass + Daily Cover Above Grade (cy)	3,322,323	8,568,828	7,526,858	9,413,682	14,518,268	37,834,455	13,245,854	7,020,034
Total Available Airspace (cy)	4,032,323	9,254,828	8,704,858	10,639,682	16,164,268	40,964,455	14,794,854	8,182,034
Maximum Waste Mass Elevation (ft MSL)	417	150	480	423	421	585	529	560
On-site Access Road (lf)	7,800	17,600	14,600	12,500	17,300	28,040	14,600	12,700
Paved Access Roads (lf)	9,504	-	-	10,560	-	8,448	3,160	-
Utility (lf)	17,304	17,600	14,600	23,060	17,300	36,488	17,760	12,700
Daily Cover Soil Volume (cy)	806,000	1,851,000	1,741,000	2,128,000	3,233,000	8,193,000	2,959,000	1,636,000
Cover Soil Required (cy)	129,000	1,245,000	616,000	972,000	1,640,000	4,933,000	1,574,000	564,000
Waste Mass Volume (cy)	3,226,323	7,403,828	6,963,858	8,511,682	12,931,268	32,771,455	11,835,854	6,546,034
Site Life (years)	26	60	56	69	104	264	95	53
Ranking (1–8)^a	8	5	6	4	2	1	3	7

Ac. Acre
 LOW Limit of Waste
^a Ranking shown is based on site life only.

Assumptions:

Waste to Soil Ratio (X:1): 4
 Annual Waste Quantity (tons): 82,000 (projected)
 Annual Waste Quantity (lbs): 164,000,000
 Waste Mass Density (lbs/cy): 1,320 (waste only, in-place density)
 Annual Airspace Consumed by Waste (cy): 124,000
 Annual Daily Cover Soil Volume (cy): 31,000

4.3 CONCEPTUAL LANDFILL DEVELOPMENT DESIGN

Each landfill site will require site development, resulting in costs that are both independent of and dependent on location. Some site features will need to be constructed prior to operation (e.g., the liner for the first cell and much of the infrastructure, such as the scales, shop, and infiltration and leachate ponds), while others will be constructed during the years of operation (e.g., cells constructed after the first cell, intermediate cover, etc.), or after site operations have ceased (e.g., final cover). Additionally, some features and costs will be the same for each proposed site, such as the leachate evaporation pond, an office building, shop, scale, and scalehouse. Other features and costs will be different at each proposed site, such as site grading, landfill liner extents, site drainage features, leachate collection, surface water management, gas extraction systems, highway improvements, and visual impact mitigation.

While a detailed development plan is beyond the scope of this report, the following sections detail the conceptual model for development at each site, both at final buildout and at the initial phase, prior to initiation of landfill operations. Figure 4-1 through Figure 4-8 show the final conceptual schematic for each site, after all waste has been placed. The initial phase of site development includes those improvements required to begin operations at each landfill, as shown in the initial development model for each site on Figure 4-9 through Figure 4-16. Section 5.0 of this report presents the corresponding cost estimates for initial development and for final conditions. Once a proposed site has been selected for further development, its design will be further developed in the next task of this project, the Detailed Conceptual Design.

4.3.1 General Development Features

Following is a brief description of the major site development features, and the basis for the development cost estimates in Section 5.0 of this report.

- Clearing and Grubbing – It is assumed that the gross acreage of each site requires clearing and grubbing as shown in the schematics.
- Excavation – For each site, the LOW acreage will be excavated to 10 feet bgs, except Kekaha Mauka, which will only be excavated to 5 ft bgs, due to the close proximity of the groundwater table to the existing ground surface. This soil is assumed to be available for use as daily cover.
- Temporary Erosion Control, Dust Control, & Best Management Practices (BMP) Maintenance during construction – Each site will require features similar to those used during development of the existing Kekaha Phase II landfill.
- Subgrade Prep, Install Liner, LFG, Leachate Systems – For each site, the LOW acreage will eventually require these construction items prior to operation. While each site has a different final acreage, each site is assumed to be initially developed with a 5-year “Cell 1”. Therefore, the total lifetime cost will be different for each site, but each site is assumed to have the same initial cost for Cell 1 preparation, liner, and leachate systems.
- Construction Management/Construction Quality Assurance (CM/CQA) – Construction of a landfill requires specialized CM/CQA.
- Leachate Evaporation Pond – Because leachate generation and handling requirements are primarily a function of the County’s landfilling rate (rather than site-specific factors), we anticipate that leachate can be treated at each site using a leachate evaporation pond similar to that present at the existing Kekaha Phase II landfill.
- Drainage Improvements – Each site will require drainage improvements to the active and closed landfill areas, as well as to manage run-on and runoff, including such features as diversion berms, grass-lined channels, and riprap energy dissipation outfalls.

- Infiltration Basin – Each site is assumed to require an infiltration basin similar to that present at the existing Kekaha Phase II landfill, which has been used as a baseline. For preliminary analysis, the capacity of the infiltration basin for each site has been calculated by scaling the area of the existing Kekaha Landfill infiltration basin upwards using site-specific storm intensity data (CCE criterion number 16).
- Office Building – Each site will have an office building half the size of that present at the existing Kekaha Phase II landfill.
- Shop – Each site will have a shop the size of that present at the existing Kekaha Phase II landfill.
- Scale and Scalehouse – Each site will have a scale and scalehouse similar to that present at the existing Kekaha Phase II landfill.
- Public Dropoff Facility – Each site will have a public dropoff facility the size of that present at the existing Kekaha Phase II landfill.
- Site Work – Each site will have features such as driveways, minor landscaping and irrigation, parking lots, utility connections at the buildings, drainage, and site lighting at the locations and quantities shown in the schematics. Grasses will be planted along site peripheries and portions of the sites not in active use to provide for erosion control and limited stormwater control. Drought tolerant grasses that require minimal maintenance will be recommended.
- Access Road – Paved roads with curbs and drainage, but no lighting, will be developed from major infrastructure to the existing County or State roadways, and on-site non-paved roads are also included for access to various portions of the landfill. Length of the access roads for each site is shown in the schematics.
- Utilities – Water supply may need to be developed for irrigation, fire fighting, and potable water needs; electrical service may need to be provided; and sewage will need to be managed at each site. Different sites may have different sources (especially for water needs), and will require different distances to be developed. It is assumed that telephone landlines will not be required. Each site would require a relatively small septic system for office and shop water disposal. Site specific utility requirements are described in Section 4.3.2, below, and shown on Figure 4-1 through Figure 4-8, where applicable.
- Visual Impact Mitigation – Each site is assumed to require landscaping for visual impact mitigation, similar to that currently being planned at the existing Kekaha Phase II landfill, and to the extents shown in the drawings. Hedges and taller trees will be planted on a site-specific basis, to mitigate the visual impacts of a landfill. Small trees that require low maintenance include Hala, variegated Hala, Hoawa, Alahe'e, Ohia Lehua, and K ohio Keokeo. Large canopy trees will be avoided as root systems can destroy underground infrastructure.
- Traffic Flow – Site-specific features have been developed, and may include deceleration/acceleration lanes, a left turn lane, and traffic signals, as appropriate for each site. For the site chosen for treatment in the upcoming EIS, a detailed traffic analysis will be conducted during the EIS, which may result in different recommendations or mitigation measures.
- Noise Mitigation – Sound walls are recommended for some sites.
- Heavy Equipment Purchase – It is assumed that most equipment costs will be borne by the site operator, as is currently done at the existing Kekaha Phase II landfill; however a uniform contingency cost item has been added for additional equipment, for planning purposes.

Additional location-specific site development needs are discussed in detail below. Detailed costs are provided in Section 5.0 of this report.

4.3.2 Site-Specific Development Features

Features common to each site will be developed as described above, with costs as shown in Section 5.0. Following is a description of the site-specific planning level development model for each site. The site chosen for further evaluation will receive more detailed evaluation and design in the next phase of this project.

4.3.2.1 KALEPA

Kalepa is adjacent to the Ma'alo site, and involves several of the same considerations. Kalepa is located relatively close to a residential community to the south, and is the site closest to a significant residential population. The Okinawa Reservoir is a short distance mauka of the Kalepa site. The access road to the Kalepa site would pass close to, and behind, the nearby residential area (as shown in Figure 4-1).

Figure 4-9 shows the initial development of the Kalepa site, and provides some of the corresponding quantities and distances upon which the cost estimate is based. Site-specific assumptions include:

- Drainage Improvements – Drainage improvements at the Kalepa site would include extending the existing Lihī ditch, located makai of the site border, to divert run-on.
- Utilities and Access Road – The access road, potable water, and an electrical connection would need to be brought in a significant distance from Ma'alo Road.
- Visual Impact Mitigation – Landscaping is recommended along the south, west, and north borders of the site.
- Traffic flow – A signalized intersection as well as acceleration, deceleration, and left turn lanes at the Ma'alo Road/Kuhio Highway intersection is recommended.
- Noise – Sound walls are recommended along the access road near the residential community.

4.3.2.2 KEKAHA-MAUKA

The site currently contains irrigated crop fields on a relatively flat parcel with an irrigation canal system along its perimeter. The Kekaha-Mauka site is across the street from the existing Kekaha Landfill, which offers potential savings due to re-use of infrastructure, as described below. The Kekaha-Mauka site would be the easiest and quickest site to bring online and begin operations, from a logistical, technical, financial, operational and possibly zoning perspective.

The Kekaha-Mauka site would use an existing, relatively non-congested route (Kaumuali'i Highway) between the landfill site and waste-generating areas centered at the Lihue corridor and would not require the introduction of a new waste-hauling route. Kaumuali'i Highway is a county designated scenic route and heavily traveled by tourists, therefore a commitment to landscaping will be required for visual impact mitigation.

Figure 4-10 shows the initial development of the Kekaha Mauka site, and provides some of the corresponding quantities and distances upon which the cost estimate is based. Site-specific assumptions include:

- Office Building – The existing Kekaha Landfill Office will be used. A small cost has been allocated for minor restoration (painting, etc.).
- Shop – The existing Kekaha Landfill Shop will be used, and no cost is allocated.
- Utilities – A new non-potable water supply system is being developed for the existing Kekaha Landfill, and can be used to supply the irrigation and fire-control needs at Kekaha-

Mauka. Potable water would still be delivered to the site for domestic water use, including toilets. An electrical connection would need to be brought in from Kaumuali'i Highway.

- Visual Impact Mitigation – Landscaping is recommended at the south, east and west sides of the landfill.
- Traffic flow – Acceleration/deceleration and turn lanes are required. Signalization has not been budgeted at this stage, but might ultimately be recommended, pending the traffic analysis conducted as part of the EIS if this site is selected.
- Noise – Based on surrounding land uses, sound walls are not recommended.

Also worth noting, the Kekaha-Mauka site is under provisions of the Energy Act of 2005 and the Energy Independence and Security Act of 2007. The Department of Defense (DoD) must therefore reach certain energy, waste, and water efficiency mandates within designated timeframes for all its base installations, which includes the nearby PMRF facility. The County may wish to engage the DoD to discuss possible use of landfill gas (LFG), waste-to-energy, or other innovative ventures to assist the DoD in meeting their efficiency mandates and the County in realizing cost savings. Active LFG recovery for power generation has not been budgeted at this stage, but may be an attractive possibility.

4.3.2.3 KIPU

The Kipu site is located close to Lihue, near Kaumuali'i Highway off a smaller access road (Hulemalu Road). The site is currently fallow, but contains remnants of an irrigation system with a non-potable water supply at the site. Visual impacts would need to be addressed by plantings along the roadway to screen the view coming from both the east and west directions.

The Kauai County General Plan discusses the possible re-designation of the Hulemanu Plateau for future urban use as it is a “logical extension of the Puakea master-planned community. Puakea is close to Lihue, jobs and shopping”. These future development areas are a few miles east of the Kipu parcel, but long-term urban growth patterns trending towards the Kipu location might need to be evaluated in the EIS should this site be selected for the new landfill.

Figure 4-11 shows the initial development of the Kipu site, and provides some of the corresponding quantities and distances upon which the cost estimate is based. Site-specific assumptions include:

- Utilities and Access Road – Site access, potable water, and an electrical connection are assumed to be available at the adjacent Hulemalu Road.
- Visual Impact Mitigation – Landscaping is recommended along Hulemalu Road at the eastern site border, and also along the northern site border to shield the view from the highway.
- Traffic flow – The roadways around Lihue are highly congested compared to other areas of the island. Waste-hauling vehicles will likely be subject to traffic delays entering and exiting from the access road onto Kaumuali'i Highway, especially during rush hours. This area of the highway is slated for upgrading from two lanes to four lanes, which should decrease through-traffic bottlenecks. However, even with the proposed widening, the volume of traffic along the highway will likely still make left turns from Hulemalu Road difficult. Therefore, signalization and a left turn lane are recommended.
- Noise – Based on surrounding land uses, sound walls are not recommended.

4.3.2.4 KOLOA

Of all of the sites, the Koloa site is the furthest distance from the nearest State-designated highway (Kaumuali'i). While the site is relatively removed visually and geographically from the town of Koloa,

landfill traffic would pass close to a residential area along Ala Kinoiki Road on the way to its intersection with Maluhia Road. The State is in the process of designating Koloa Road as the *Holo Holo Koloa National Scenic Byway* under a federal program. The landfill site would likely not impact the Koloa visual corridor, although, an enhanced landscaping plan could ultimately be recommended. Maluhia Road between the project site and Kaumuali'i Highway is designated a County Scenic Corridor in the Kauai County General Plan. The Waita Reservoir is located just northeast of the site.

Figure 4-12 shows the initial development of the Koloa site, and provides some of the corresponding quantities and distances upon which the cost estimate is based. Site-specific assumptions include:

- Access Road – It is assumed that the existing access road is sufficiently wide, but would require repaving.
- Utilities – A non-potable water supply usable for irrigation and fire-fighting needs is assumed to be available at the site entry. A water filtration system and a pump station have been budgeted for. An electrical connection is available at the major KIUC transformer located at the site entry.
- Visual Impact Mitigation – Landscaping is recommended along south and west site borders.
- Traffic flow – Based on the expected traffic in the vicinity, traffic flow improvements are not anticipated. This assumption would be verified during traffic analysis conducted as part of the EIS (if this site is selected).
- Noise – At this stage, it is assumed that the existing sound walls along the Ala Kinoiki Road corridor are sufficient. Should this site be chosen for further consideration, this assumption would be verified during the EIS phase; therefore, it is possible that the existing sound walls could be recommended to be enhanced or extended as a mitigation measure to neighborhood noise concerns.

4.3.2.5 KUMUKUMU

The Kumukumu site is located mauka of Kuhio Highway. A large-lot residential development is under construction on the makai side of Kuhio Highway, and the landfill may be visible from some of the proposed residences. Although the County is not required to preserve private views, landowners in this development will likely raise view preservation as a concern. Besides anticipated visual impacts, the presence of a landfill, its associated truck traffic and any real or perceived impacts to the surrounding community, may also result in this site approval process being contentious.

Another issue with the Kumukumu site is the natural drainage corridor at the base of the gulch in the proposed landfill location. At minimum, a rerouting of the drainage around the landfill would be required. Consultation has been initiated with the U.S. Army Corps of Engineers, who may determine that the site is a jurisdictional wetland under Section 404 of the Clean Water Act. Therefore, there could be additional wetlands-related costs associated with this site which cannot be estimated at this stage. Alternatively, it is possible that the site borders could be realigned in order not to affect the potential wetland.

Figure 4-13 shows the initial development of the Kumukumu site, and provides some of the corresponding quantities and distances upon which the cost estimate is based. Site-specific assumptions include:

- Drainage Improvements – Drainage improvements at the Kumukumu site would be somewhat more extensive than most of the other sites, due to the existing waterway and potential wetland.

- Utilities and Access Road – Site access, potable water, and an electrical connection are assumed to be available at the adjacent Kuhio Highway.
- Visual Impact Mitigation – Landscaping is recommended along the entire site perimeter.
- Traffic flow – The speed limit along this stretch of Kuhio Highway is posted at 50 mph. An acceleration/deceleration and left turn lane for northbound trucks entering the site is recommended. Signalization has not been budgeted at this stage, but may ultimately be recommended, pending traffic analysis conducted as part of the EIS (if this site is selected).
- Noise – Based on surrounding land uses, sound walls are not recommended.

4.3.2.6 MA'ALO

Ma'alo is the largest of the landfill parcels with by far the longest useful lifetime and is relatively close to the urbanized Lihue area of Kaua'i. The site is not proximate to residential/developed areas, but Ma'alo Road, which connects the landfill site to Kuhio Highway, is located somewhat near a residential community. Kuhio Highway in this section of the island has a significant amount of traffic since it provides a link between Lihue and the Kapa'a-Wailua area. The Ma'alo Road intersection with Kuhio Highway is at the base of a ravine and at the midpoint of a curve. Ma'alo Road is the main tourist road to Wailua Falls Park. It is also part of a potential future mauka bypass road network that the County is considering to provide relief to Kuhio Highway. Ma'alo Road is designated scenic in the Kauai County General Plan.

Figure 4-14 shows the initial development of the Ma'alo site, and provides some of the corresponding quantities and distances upon which the cost estimate is based. Due to its size, and the desire to allow current occupants to continue using portions of the land until they are required for landfill operations, the Ma'alo site is proposed to be developed in three Phases. Table 4-2 summarizes the preliminary estimated phasing of the Ma'alo site.

Table 4-2: Ma'alo Site Phasing

Phase	Cumulative Values		
	Gross Volume (cy)	Site Life (Years)	Total Site Area (ac)
1	16,859,707	109	158
2	30,396,999	196	245
3 (final)	41,940,051	271	270

Note: Estimated durations assume that waste is deposited at current rates. Operation of the RRP could result in extending these phased end dates.

Site-specific assumptions include:

- Drainage Improvements – Drainage improvements at the Ma'alo site would be somewhat more extensive than most of the other sites, due to existing canals being refurbished (including the existing Lihi ditch, located makai of the site border,), replaced, or re-aligned. A study may be required to design the run-on and runoff control features to be compatible with the nearby wetlands.
- Utilities and Access Road – The access road and an electrical connection would need to be extended a significant distance from Ma'alo Road. During initial discussions with the landowner, the landowner has requested that the County investigate installing a water supply and irrigation line, the details of which are to be determined. For initial planning purposes, it is assumed that the irrigation system described in the Study of the East Kauai Water Systems on State of Hawaii Lands (ITC 2001) may be implemented, pending further studies and evaluation. The cost was estimated to be \$3,500,000 in 2001. Applying a

3% annual escalation (per the ISWMP), this cost amounts to approximately \$ 4,850,000 in 2012 dollars.

- Visual Impact Mitigation – Landscaping is recommended along the south, west, and north borders of the site, and can be phased along with the overall landfill phasing.
- Traffic flow – A signalized intersection as well as acceleration, deceleration, and left turn lanes at the Ma'alo Road/Kuhio Highway intersection is recommended. It is assumed at this stage that the width and geometry of Ma'alo road is sufficient, but that the road requires repaving. Should this site be selected, a detailed traffic study will be conducted as part of the EIS, which will reevaluate these assumptions, and might recommend additional improvements.
- Noise – Based on surrounding land uses, sound walls are not recommended.

4.3.2.7 PU'U O PAPA'I

The Pu'u O Papa'i site is elevated on a ridge, resulting in visibility from Kaumuali'i Highway. Sections along Kaumuali'i Highway have steep side embankments, and therefore, adding a turning lane and widening the highway may prove difficult. Furthermore, an access road would need to be cut from the highway, which may involve excavation and earthworks. There is an existing, rutted dirt road leading to the landfill site that would require improvement to be utilized for landfill operations. While an irrigation and non-potable water system is available, potable water will be difficult or expensive to bring to the site from the highway.

Figure 4-15 shows the initial development of the Pu'u O Papa'i site, and provides some of the corresponding quantities and distances upon which the cost estimate is based. Site-specific assumptions include:

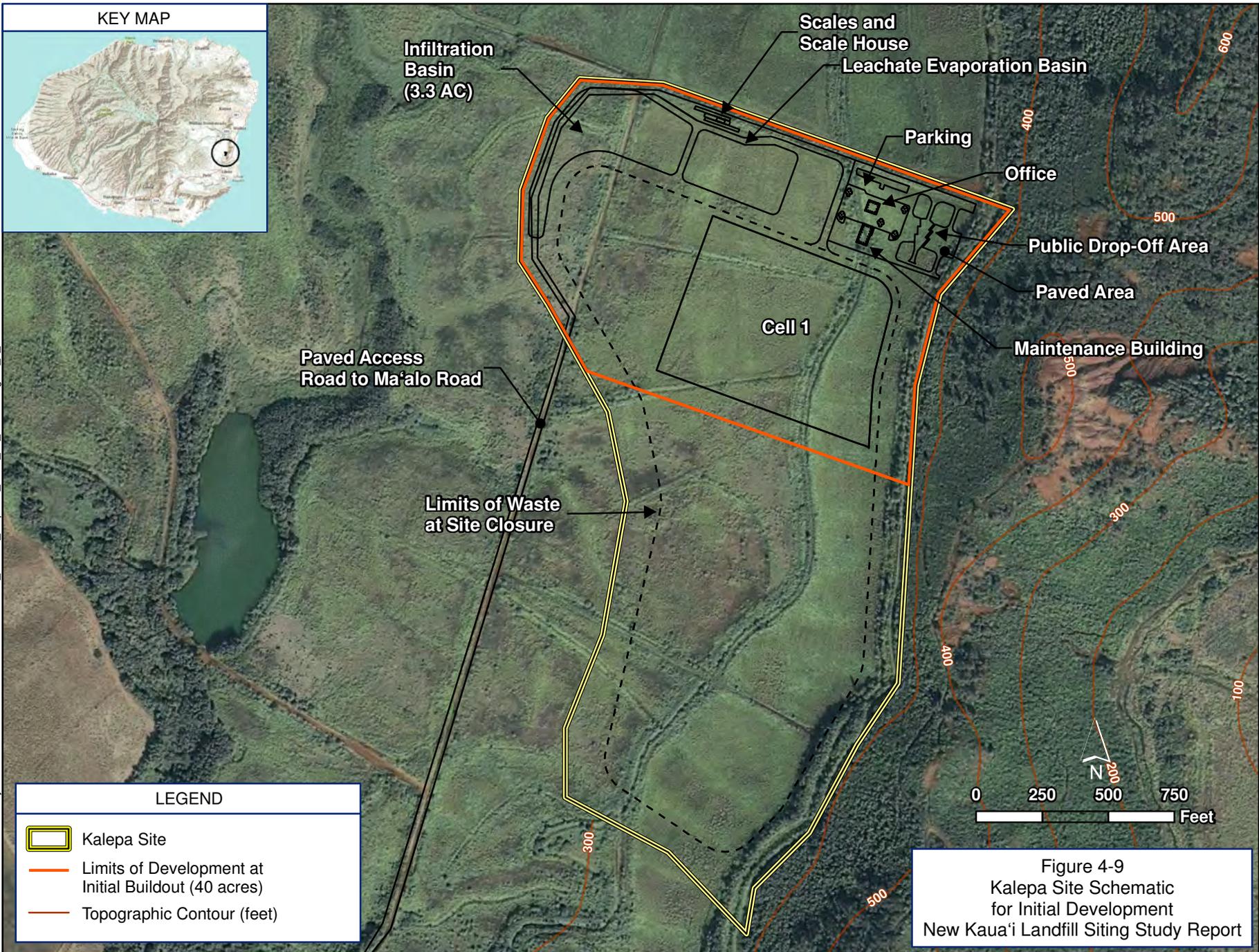
- Utilities – Non-potable water is assumed to be available from the nearby reservoir. A pump station and water filtration system have been budgeted. Electricity would be brought onsite from Kaumuali'i Highway.
- Visual Impact Mitigation – Landscaping is recommended at the south, east, and west sides of the landfill.
- Traffic flow – Acceleration/deceleration, turn lanes, and signalization are recommended.
- Noise – Based on surrounding land uses, sound walls are not recommended.

4.3.2.8 UMI

Development of the Umi site for use as a landfill would require removal of the current coffee operations, and relocation of the existing access road which runs through the center of the site providing access to properties to the east. The adjacent Halewili Road is designated a scenic corridor in the Kauai County General Plan. The nearest residential area is approximately one-half mile away on a ridge to the east of the site, therefore the landfill site would have visual impacts to the community. During the site visit, vehicles along Halewili Road were seen traveling at fast speeds. Unlike Kaumuali'i Highway in this area, Halewili Road contains numerous curves and dips with limited sight distances and shoulders. Additionally, if the DOW proceeds with its potential plans to develop groundwater in the area, additional controls and monitoring may be required (but are not developed or costed here).

Figure 4-16 shows the initial development of the Umi site, and provides some of the corresponding quantities and distances upon which the cost estimate is based. Site-specific assumptions include:

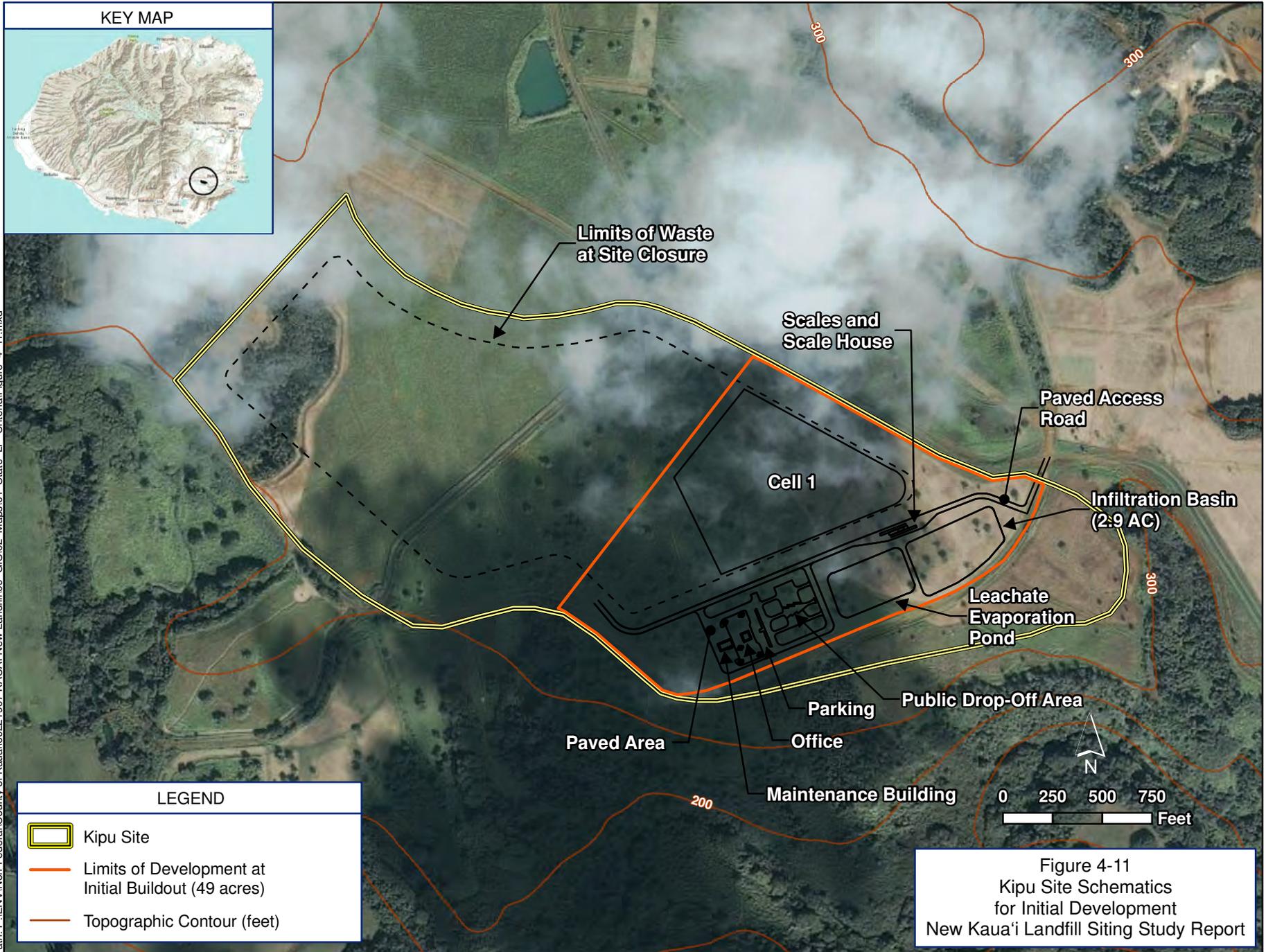
- Drainage Improvements – Due to natural flow patterns, drainage improvements at the Umi site would be minimal.
- Access Road – Access to the site is available from the adjacent Halewili Road. In addition, the existing access road to properties east of the Umi site would need to be relocated outside the site's northern border.
- Utilities – Water and electricity are assumed to be readily available at Halewili Road.
- Visual Impact Mitigation – Landscaping is recommended along all site borders.
- Traffic flow – Acceleration/deceleration and turn lanes are recommended. Due to potential safety concerns associated with the speed and lines of sight at Halewili Road, signalization is recommended.
- Noise – Based on surrounding land uses, it is assumed that sound walls are not required; this assumption would be subject to review during the EIS process, should this site be selected.



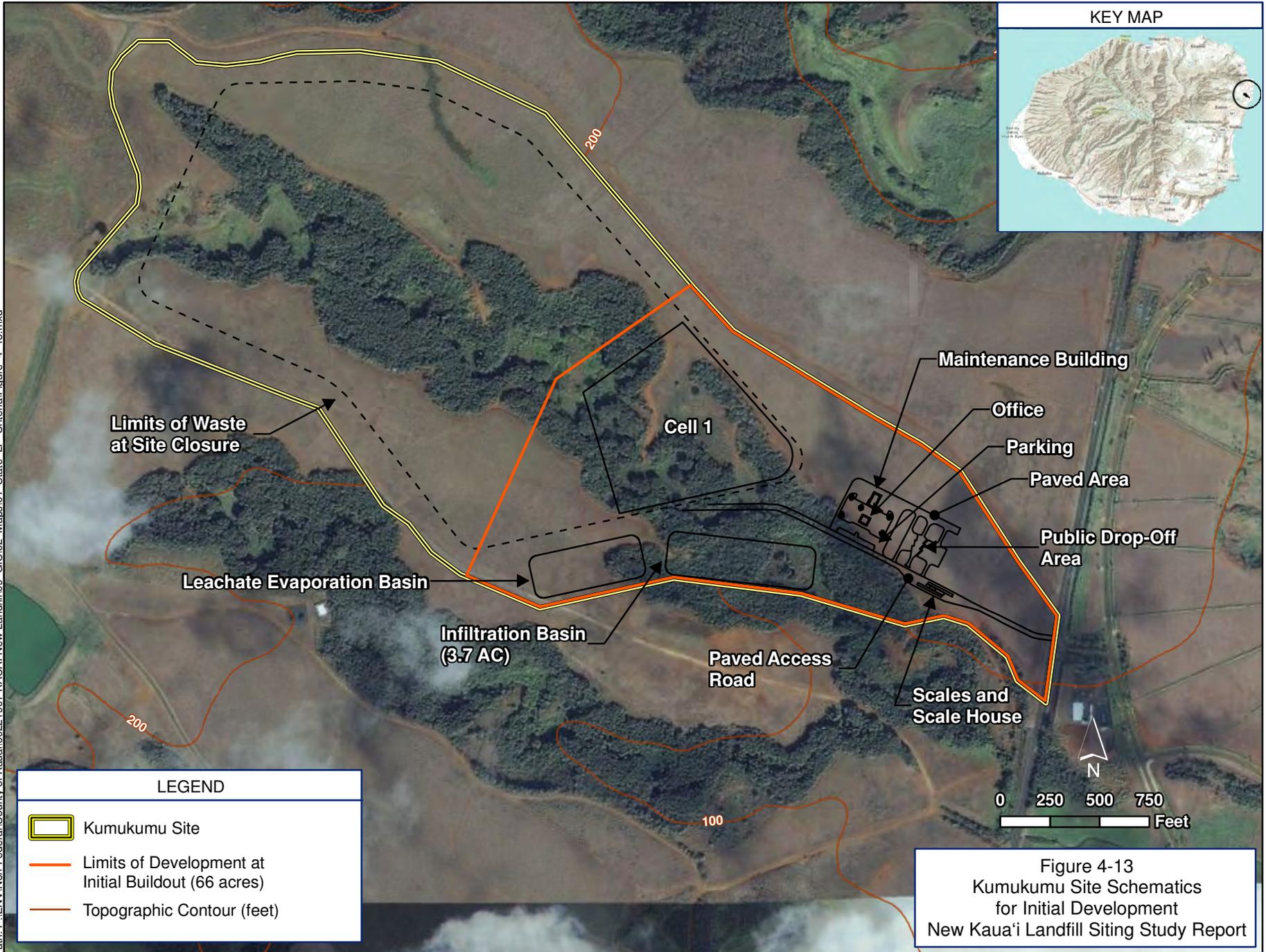


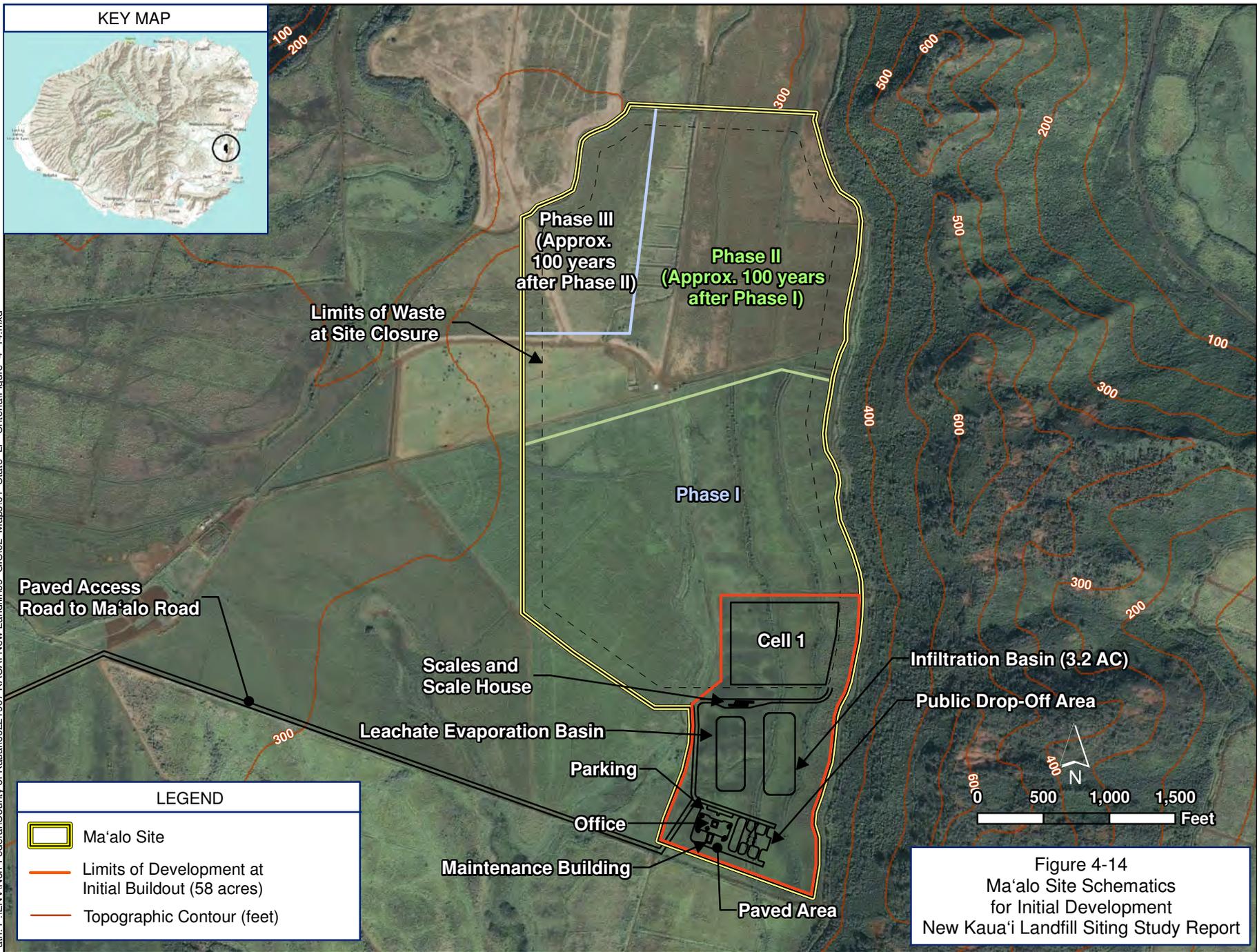
LEGEND	
	Kekaha Mauka Site
	Limits of Development at Initial Buildout (70 acres)

Figure 4-10
Kekaha Mauka Site Schematics
for Initial Development
New Kauai Landfill Siting Study Report









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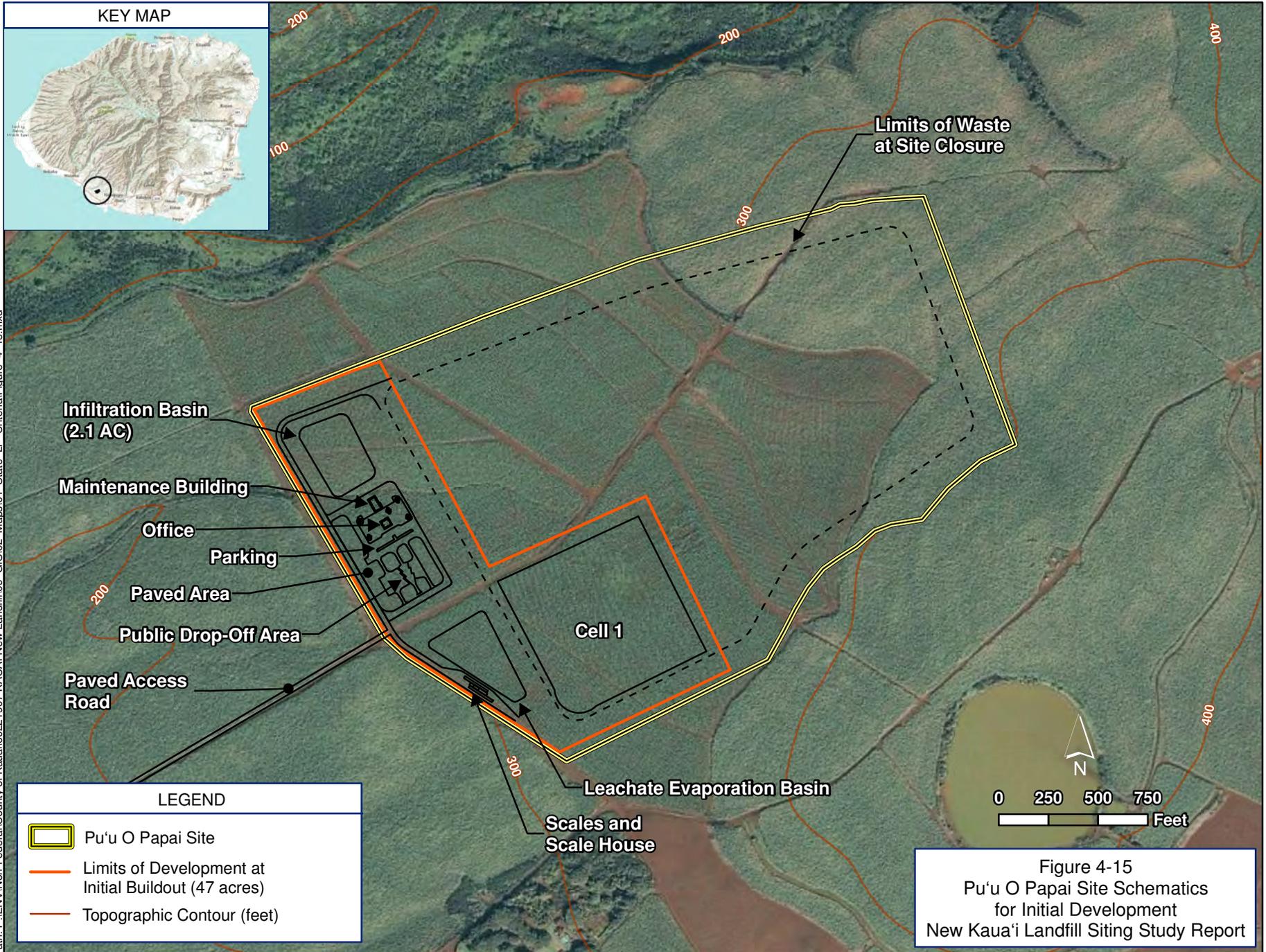
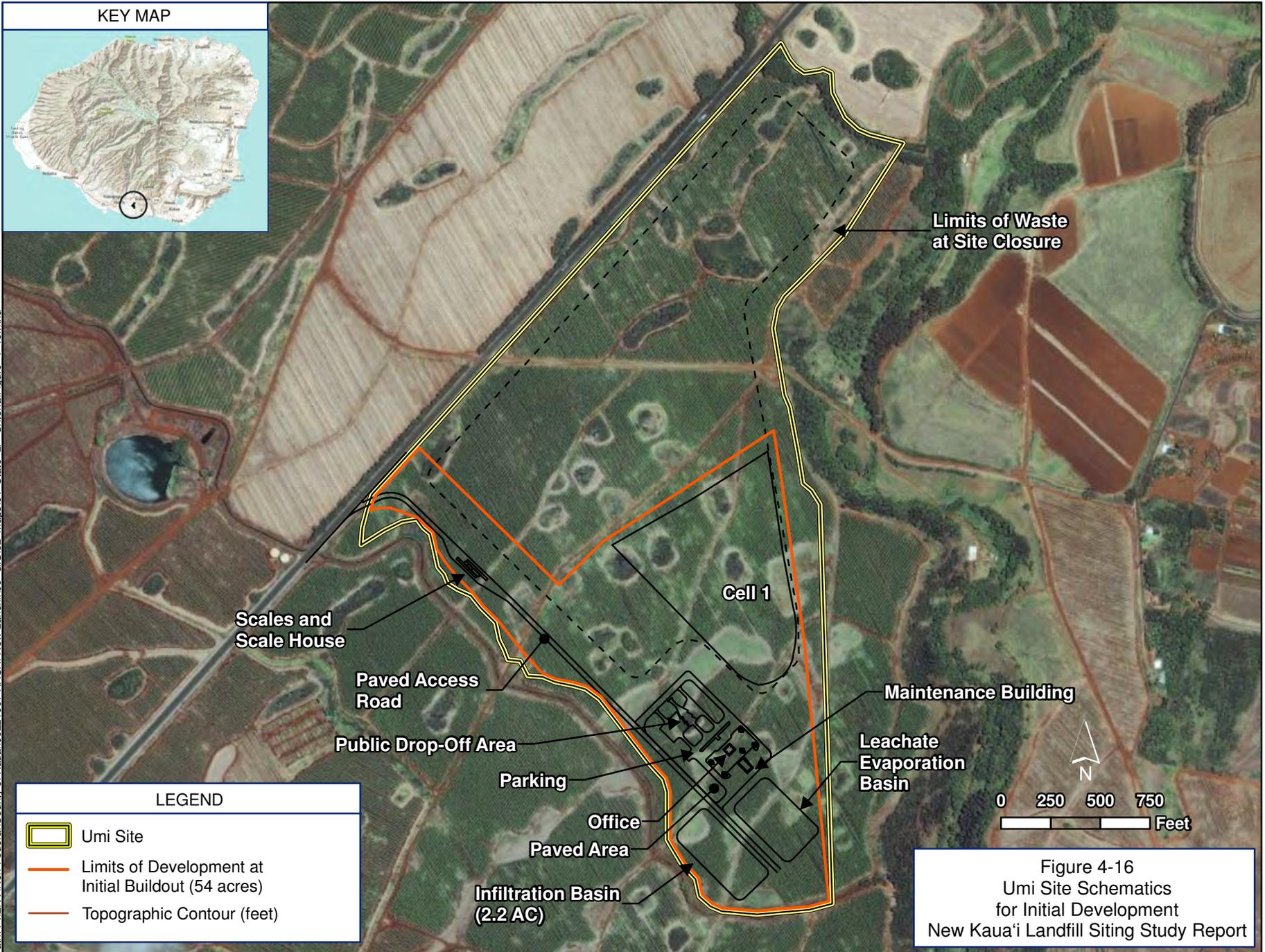


Figure 4-15
Pu'u O Papai Site Schematics
for Initial Development
New Kaua'i Landfill Siting Study Report



4.4 MACLS STUDY DATA

The PREE also resulted in updating the raw scores for the following five CCE criteria, which were identified in the MACLS report (RMTC 2009) as requiring more detailed quantification or engineering evaluation. The numbering system used is retained from the MACLS list of 26 criteria:

- 7. Site Distance from Major Highway
- 19. Adequacy of Site Drainage
- 22. Availability of Utilities
- 24. Availability of Existing Access Roadway from Major Highway or Collector Street/Road
- 26. Landfill Capacity or Site Life

These criteria have been quantified for each of the eight sites, based on the site layouts and the conceptual design. The new data are in turn incorporated into the Planning Level Cost Estimates (Section 5.0) and the Community Criteria Evaluation (Section 6.0), which updates the MACLS report (RMTC 2009). Attachment B presents the analyses used to quantify each set of data criteria, and the resulting raw and CCE scaled scores.

