



APPENDIX **E**

*Botanical Resources Assessment for the
Hawaiian Memorial Park
Expansion Plan – January 2018
Prepared by: Maya LeGrande*

BOTANICAL RESOURCES ASSESSMENT FOR THE
HAWAIIAN MEMORIAL PARK EXPANSION PLAN
KANEEOHE, OAHU

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INTRODUCTION

This report includes the findings of a botanical study conducted at the proposed site for the Hawaii Memorial Park Expansion Project on the island of Oahu, Hawaii. LeGrande Biological Surveys Inc. carried out a botanical field survey of the project area on September 11th, 12th, & 27th of 2017. Results from a previous survey carried out in 2006 in the same general area is summarized as well. The primary objectives of the field studies were to:

- 1) provide a general description of the vegetation on the project site;
- 2) inventory the flora; and
- 3) search for threatened and endangered species as well as species of concern.

The federal and State of Hawaii listed species status follows species identified in the following referenced documents, (Department of Land and Natural Resources (DLNR) 1998, U. S. Fish & Wildlife Service (USFWS 2015).

GENERAL SITE DESCRIPTION

The area proposed for cemetery expansion and cultural preserve includes approximately 43 acres of undeveloped land makai or northeast of the existing Hawaiian Memorial Park in Kaneohe. The survey area is bounded by residential housing to the west and a natural ridgeline to the east. The proposed Cultural Preserve consists of 14.5 acres at the northern end of the project area.

The property consists of relatively steep cliff areas to the east descending from a natural ridgeline that drops in elevation and levels out creating several small drainages that run east to west. The majority of the parcel is characterized by a Lowland Alien Wet Forest dominated by introduced plant species. The subject property is at 420 ft elevation at its highest point and at approximately 200 ft at its lowest elevations at the northwest boundaries. The parcel has been disturbed historically and alteration of native plant habitat has been in place for some time with very few of the natural plant elements remaining. Feral pigs (*Sus scrofa*) continue to degrade the vegetation and understory plants by rooting, resulting in soil disturbance.

SURVEY METHODS

Prior to undertaking the field studies, a search was made of the pertinent literature to familiarize the principal investigator with other botanical studies conducted in the general area. Information from the Hawaii Biodiversity and Mapping Program database was reviewed. Topographic maps were examined to determine terrain characteristics, access, boundaries, and reference points.

A walk-through survey method was used. The parcel was surveyed on foot using GPS to locate boundaries and track transects surveyed. The survey area included the area proposed for the park expansion as well as a buffer that extends into the cultural preserve as well as a buffer outside of the boundaries in all directions of the proposed cemetery expansion. Notes were made on plant associations and distribution, disturbances, topography,

substrate types, exposure, drainage, etc. Plant identifications were made in the field; plants that were not positively identified were collected for later determination, and for comparison with the recent taxonomic literature.

DESCRIPTION OF THE VEGETATION

The entire survey area is a highly disturbed Schefflera/Java Plum Forest. A total of 109 plant species were observed within the survey area. 91 are alien (introduced), seven are Polynesian introductions, eight are indigenous (native to the Hawaiian Islands and elsewhere), and three endemic (native to the Hawaiian Islands and found nowhere else on earth). Therefore, 84% of the plant species observed within the project area are alien, 6% are Polynesian introductions, and 10% native.

An inventory of all the plants observed within the survey site is presented in the species list at the end of the report.

Cemetery Expansion Area

The existing Ocean View section of HMP is dominated by mowed grass and landscaping plantings. The edges of the landscaping consists of weedy sections that are dominated either by tall trees such as Java plum (*Syzygium cumini*), *Falcataria moluccana* and mango (*Mangifera indica*), or smaller shrubs like koa haole (*Leucaena leucocephala*), sourbush (*Pluchea carolinensis*), Hilo holly (*Ardisia crenata*), castor bean (*Ricinus communis*), and golden crown-beard (*Verbesina encelioides*). Grass species include sourgrass (*Digitaria insularis*), broomsedge (*Andropogon virginicus*), molasses grass (*Melinis minutiflora*), and swollen fingergrass (*Chloris barbata*).

The remaining undeveloped section of the survey area is dominated by an alien forest of octopus tree (*Schefflera actinophylla*) and java plum. Some of the shallow gulches are dominated by hau thickets and an area in the eastern portion of the project area is dominated by large mango trees. Other scattered trees include African tulip (*Spathodea campanulata*), date palm (*Phoenix dactylifera*), Chinese banyan (*Ficus microcarpa*), Coconut (*Cocos nucifera*), and Christmas berry (*Schinus terebinthifolius*). Shrub species include slender mimosa (*Desmanthus pernambucans*), shoebutton ardisia (*Ardisia elliptica*), and kolomona (*Senna surattensis*). In open areas vines such as *Ipomoea obscura*, little bell (*I. triloba*), maile pilau (*Paederia foetida*), and ivy gourd (*Coccinea grandis*) were observed climbing along the ground or in trees and shrubs. Groundcover consisted mainly of fern species such as laua'e (*Phymatosorus grossus*) and an alien grass species; basket grass (*Oplismenus hirtellus*). A few small patches of the native fern pala'a (*Sphenomeris chinensis*) were observed along drier ridges.

Cultural Preserve

An area not planned for HMP expansion, but included in the plant survey is 14 acres at the northern end of the survey area that harbors the Kawaewae Heiau (Sterling & Summers, 1988) as well as additional documented cultural sites. The main section of the heiau was cleared of most plant species in 2006. The most recent survey found the area to be overgrown and the heiau itself mostly obscured with vegetation. Some of the plants growing

within the heiau structure include ti (*Cordyline fruticosa*), papaya (*Carica papaya*), Spanish needle (*Bidens pilosa*), and balsam pear (*Momordica charantia*). Two juvenile koa (*Acacia koa*) trees were observed at the southern end of the heiau, they appear to have been planted. The rest of the cultural Preserve area to the east is dominated by thickets of Christmas berry, Java plum, and guava with thick understory of laua`e fern and basket grass.

Native and Polynesian Species

Seven Polynesian introduced plant species were observed within the survey area. They include ti, kalo or taro (*Colocasia esculenta*), niu or coconut (*Cocos nucifera*), kukui (*Aleurites moluccana*), mai`a or banana (*Musa* sp.), noni (*Morinda citrifolia*), and hau (*Hibiscus tiliaceus*). The kukui and hau were observed scattered throughout the survey area especially in the small gulches and ravines. Ti plants were observed along the boundary of the existing memorial park and scrub vegetation as well as along several of the ridges within the area proposed for the new cemetery expansion. A few coconut trees were observed near the gulch bottom at the end of Lipalu Street.

Eight indigenous plant species were observed infrequently in the area; `uhaloa (*Waltheria indica*), hala (*Pandanus tectorius*), pala`a, moa (*Psilotum nudum*), palapalai (*Microlepia strigosa*), `ekaha (*Asplenium nidus*), popolo (*Solanum americanum*), and ka`e`e or sea bean (*Mucuna gigantea*). The three endemic species include the two koa trees observed near the heiau, as well as `akia (*Wikstroemia oahuensis* var. *oahuensis*) and `ohi`a lehua (*Metrosideros polymorpha*) trees which were observed infrequently near the boundary with the existing Ocean View section of the cemetery and the upper elevations on the ridgeline in the south western section of the project area.

DISCUSSION AND RECOMMENDATIONS

None of the plant species observed on the project site is a threatened and endangered species or a species of concern (U.S. Fish and Wildlife Service, 2015; Wagner et. al., 1999).

The vegetation within the area proposed for the cemetery expansion would be highly altered as the plan is to completely regrade the topography in order to create the proposed plans for the expansion, thus removing most if not all of the existing vegetation. The area around the heiau and the proposed cultural preserve would make an appropriate area for outplanting the native and Polynesian introduced plants that are found within the proposed cemetery expansion area as the vegetation will remain undisturbed in this area. This in addition to using native plants in the landscaping of the future memorial park would help to perpetuate extant taxa in the immediate area. Namely, the `ohi`a lehua, `akia, and ka`e`e vine. The first two species mentioned are endemic and seeds and or cuttings from extant plants at the project location could potentially be collected and grown to use in replanting efforts in the cultural preserve. Ka`e`e is an indigenous species with stunning yellowish-green flowers that grows on all the main Hawaiian Islands. Vines of ka`e`e (*Mucuna*) are some of the oldest and largest that the principal botanist has seen on Oahu. The population observed here is robust but is being smothered by other vine species such as maile pilau

and passion fruit. Several of the seed pods were observed to have insect damage and did not appear to be viable. Horticulture experts may be consulted in order to provide the best techniques to propagate the plants either by vegetative cuttings or seed germination.

Large sections of the introduced laua`e fern are found within both the cemetery expansion area as well at the Cultural Preserve. The green fronds are collected for use in lei and other cultural practices. Part of the goal of this recent survey was to attempt to map the existing populations of laua`e. It quickly became evident that the extent of the laua`e populations were too expansive and spread out in order to make mapping each population a reasonable goal. Location points were taken within large patches of laua`e to get a general idea of the areas that contain the majority of the fern populations (see Botanical Map Figure 3.7 for cluster locations of abundant Laua`e populations). Both the proposed cemetery expansion as well as the area to be set aside for the cultural preserve harbor large populations of the fern.

The spring area in the north western section of the project area near Ohaha Place is dominated by introduced plant species such as large patches of laua`e along with some vestiges of kalo plants scattered along the banks or the pools. This area is downslope from the southern section of the cemetery expansion and is planned as a buffer area that will not be disturbed by grading activities.

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APPENDIX A – SITE PHOTOGRAPHS



Figure 1. Project boundary along the existing Ocean View Garden with manicured lawns in the memorial area and large trees such as albizia and fiddlewood in the proposed project area.



Figure 2. Thick forested section of octopus tree and fiddlewood with a sparse understory of *Christella parasitica* fern.



Figure 3. Section of spring area with vegetation such as laua`e fern and kalo surrounding ponding.



Figure 5. Large mango trees with basket grass undertory in the roundabout area of the proposed project.



Figure 5. Thick groundcover of lau'a'e fern in the proposed cultural preserve.



Figure 6. Kukui and monkeypod forest with thick vines of *Mucuna* and passion flower draped in trees and laua`e groundcover.



Figure 7. `Ohi`a lehua tree near “bald spot” along the south western section of the project area.



Figure 8. Large albizia near the existing Kawaewae heiau site.

APPENDIX B – Plant Species List

Hawaii Memorial Park Expansion, Oahu, Hawaii

The following checklist is an inventory of all the plant species observed within the survey site for the proposed Hawaii Memorial Park Expansion (September 2006 & September 2017). The plant names are arranged alphabetically by family and then by species into each of four groups: Gymnosperms, Ferns and Fern Allies (Pteridophytes), Monocots, and Dicots. The taxonomy and nomenclature of the Ferns and Fern Allies follow Palmer (2002), while the gymnosperms and flowering plants, Monocots and Dicots, are in accordance with Wagner *et al.* (1990) and Wagner and Herbst (1999) and Staples and Herbst (2005). Recent name changes are those recorded in the Hawaii Biological Survey series (Evehuis and Eldredge, eds, 1999-2002).

For each species, the following name is provided:

1. Scientific name with author citation.
2. Common English and/or Hawaiian name(s), when known.
3. Biogeographic status. The following symbols are used:

E= endemic= native only to the Hawaiian Islands.

I= indigenous= native to the Hawaiian Islands and elsewhere.

P=Polynesian introduced=species that were introduced by the Polynesian migration to Hawaii, either intentionally or unintentionally, and are now naturalized.

X=introduced or alien = all those plants brought to the Hawaiian Islands by humans, intentionally or accidentally, after Western contact, that is Cook's arrival in the islands in 1778.

HAWAII MEMORIAL PARK PLANT SPECIES LIST
OCTOBER 2017

SCIENTIFIC NAME	COMMON NAME	STATUS
GYMNOSPERMS		
ARAUCARIACEAE		
<i>Araucaria columnaris</i> (G.Forst.) Hook.f.	Cook pine	X
PTERIDOPHYTES		
ASPLENIACEAE		
<i>Asplenium nidus</i> L.	`ekaha	I
BLECHNACEAE		
<i>Blechnum appendiculatum</i> Willd.		X
DENNSTAEDTIACEAE		
<i>Microlepia strigosa</i> (Thunb.) C.Presl	palapalai	I
NEPHROLEPIDACEAE		
<i>Nephrolepis multiflora</i> (Roxb.) F.M. Jarrett ex C.V. Morton		X
LINDSAEACEAE		
<i>Sphenomeris chinensis</i> (L.) Maxon	palaa	I
POLYPODIACEAE		
<i>Phlebodium aureum</i> (L.) J.Sm.	rabbit's foot fern	X
<i>Phymatosorus grossus</i> (Langsd. & Fisch.) Brownlie	lauae	X
PSILOTACEAE		
<i>Psilotum nudum</i> (L.) P. Beauv.	moa, upright whiskfern	I
THELYPTERIDACEAE		
<i>Christella parasitica</i> (L.) Lev.		X
MONOCOTS		
AGAVACEAE		
<i>Cordyline fruticosa</i> (L.) A.Chev.	ti, ki	P
ALOEACEAE		
<i>Aloe vera</i> (L.) N.L.Burm.	aloe	X

ARACEAE		
<i>Anthurium scandens</i> L.	pearl laceleaf	X
<i>Colocasia esculenta</i> (L.) Schott	kalo, taro	P
<i>Epipremnum pinnatum</i> (L.) Engl.	pothos vine	X
ARECACEAE		
<i>Cocos nucifera</i> L.	coconut	P
<i>Phoenix dactylifera</i> L.	date palm	X
COMMELINACEAE		
<i>Commelina diffusa</i> Burm.f,	honohono	X
CYPERACEAE		
<i>Cyperus involucratus</i> Rottb.	umbrella sedge	X
HELICONIACEAE		
<i>Heliconia</i> sp.	heliconia	X
IRIDACEAE		
<i>Trimezia martinicensis</i> (Jacq.) Herbert	Yellow iris	X
MUSACEAE		
<i>Musa</i> sp. L.	banana	P
ORCHIDACEAE		
<i>Arundina graminifolia</i> (D.Don) Hochr.	bamboo orchid	X
<i>Spathoglottis plicata</i> Blume	Philippine ground orchid	X
PANDANACEAE		
<i>Pandanus tectorius</i> Parkinson ex Z	hala	I
POACEAE		
<i>Andropogon virginicus</i> L.	broomsedge	X
<i>Cenchrus ciliaris</i> L.	uffelgrass	X
<i>Chloris barbata</i> (L.) Sw.	swollen fingergrass	X
<i>Cynodon dactylon</i> (L.) Pers	manienie	X
<i>Digitaria insularis</i> (L.) Mez ex Ekman	sourgrass	X
<i>Melinis minutiflora</i> P.Beauv.	molasses grass	X
<i>Oplismenus hirtellus</i> (L.) P.Beauv.	basketgrass, honohono	X
<i>Panicum maximum</i> L.	Guinea grass	X
<i>Paspalum conjugatum</i> P.J.Bergius	Hilo grass	X
<i>Setaria verticillata</i> (L.) P.Beauv.	bristly foxtail	X

ZINGIBERACEAE		
<i>Alpinia purpurata</i> (Vieill.) K.Schum.	red ginger	X
DICOTS		
ANACARDIACEAE		
<i>Mangifera indica</i> L.	mango	X
<i>Schinus terebinthifolius</i> Raddi	Christmas berry	X
APIACEAE		
<i>Centella asiatica</i> (L.) Urb.	Asiatic pennywort	X
ARALIACEAE		
<i>Schefflera actinophylla</i> (Endl.) Harms	octopus tree	X
ASTERACEAE		
<i>Bidens pilosa</i> L.	Spanish needle	X
<i>Crassocephalum crepidioides</i> (Benth.) S.Moore	crassocephalum	X
<i>Emilia fosbergii</i> Nicolson	red pualele	X
<i>Pluchea carolinensis</i> (Jacq.) G. Don	sourbush	X
<i>Sphagneticola trilobata</i> (L.) Pruski	wedelia	X
<i>Synedrella nodiflora</i> (L.) Gaertn.	nodeweed	X
<i>Verbesina encelioides</i> (Cav.) Benth. & Hook	golden crown-beard	X
BIGNONIACEAE		
<i>Spathodea campanulata</i> P. Beauv.	African tulip	X
<i>Tabebuia heterophylla</i> (DC.) Britton	pink tecoma	X
CARICACEAE		
<i>Carica papaya</i> L.	papaya	X
CASUARINACEAE		
<i>Casuarina equisetifolia</i> L.	ironwood	X
CLUSIACEAE		
<i>Clusia rosea</i> Jacq.	autograph tree	X
CONVOLVULACEAE		
<i>Ipomoea cairica</i> (L.) Sweet	koali ai	X
<i>Ipomoea obscura</i> (L.) Ker Gawl.		X
<i>Ipomoea triloba</i> L.	little bell	X
CUCURBITACEAE		
<i>Coccinea grandis</i> (L.) Voigt	ivy gourd	X
<i>Momordica charantia</i> L.	balsam pear	X

EUPHORBIACEAE		
<i>Aleurites moluccana</i> (L.) Willd.	kukui	P
<i>Chamaesyce hypericifolia</i> (L.) Millsp.	graceful spurge	X
<i>Ricinus communis</i> L.	castor bean	X
FABACEAE		
<i>Acacia confusa</i> Merr.	Formosan koa	X
<i>Acacia koa</i> A.Gray	koa	E
<i>Acacia farnesiana</i> (L.) Willd.	klu, aroma, kolu	X
<i>Chamaecrista nictitans</i> (L.) Moench	partridge pea	X
<i>Desmanthus pernambucanus</i> (L.) Thell.	slender mimosa	X
<i>Desmodium tortuosum</i> (Sw.) DC.	Florida beggarweed	X
<i>Desmodium triflorum</i> (L.) DC.	tick clover	X
<i>Falcataria moluccana</i> (Miq.) Barenby & J.W.Grimes		X
<i>Indigofera hendecaphylla</i> Jacq.	creeping indigo	X
<i>Indigofera suffruticosa</i> Mill.	iniko	X
<i>Leucaena leucocephala</i> (Lam.) de Wit	koa haole	X
<i>Mimosa pudica</i> L. var. <i>unijuga</i> (Duchass. & Walp.) Griseb.	sensitive plant	X
<i>Mucuna gigantea</i> (Willd.) DC. ssp. <i>gigantea</i> Ohashi & Tateishi	sea bean, ka`e`e	I
<i>Samanea saman</i> (Jacq.) Merr.	monkeypod	X
<i>Senna surattensis</i> (Burm.f.) H.S.Irwin & Barneby	kolomona	X
<i>Senna pendula</i> (Humb. & Bonpl. ex Willd.) Kunth var. <i>advena</i> (Vogel) H.S.Irwin & Barneby		X
LAMIACEAE		
<i>Hyptis pectinata</i> (L.) Poit.	comb hyptis	X
<i>Leonotis nepetifolia</i> (L.) R.Br.	lion's ear	X
LAURACEAE		
<i>Cinnamomum burmanii</i> (Nees) Blume	Padang cassia	X
<i>Cinnamomum camphora</i> (L.) J.Presl	camphor tree	X
MALVACEAE		
<i>Abutilon grandifolium</i> (Willd.) Sweet	hairy abutilon	X
<i>Hibiscus tiliaceus</i> L.	hau	P
<i>Malvastrum coromandelianum</i> (L.) Garcke	false mallow	X
<i>Sida rhombifolia</i> L.		X
MELASTOMATACEAE		
<i>Clidemia hirta</i> (L.) D.Don. var. <i>hirta</i>	Koster's curse	X

<i>Dissotis rotundifolia</i> (Sm.) Triana		X
<i>Melastoma septemnerium</i> Lour.	melastoma	X
MORACEAE		
<i>Ficus microcarpa</i> L.f.	Chinese banyan	X
MYRSINACEAE		
<i>Ardisia crenata</i> Sims	Hilo holly	X
<i>Ardisia elliptica</i> Thunb.	shoebutton ardisia	X
MYRTACEAE		
<i>Metrosideros polymorpha</i> Gaudich.	ohia lehua	E
<i>Psidium cattleianum</i> Sabine	strawberry guava	X
<i>Psidium guajava</i> L.	common guava	X
<i>Syzygium cumini</i> (L.) Skeels	Java plum	X
OCHNACEAE		
<i>Ochna thomasiona</i> Engl.&Gilg	Mickey mouse	X
OXALIDACEAE		
<i>Oxalis debilis</i> var. <i>corymbosa</i> (DC.) Lourteig	pink wood sorrel	X
PASSIFLORACEAE		
<i>Passiflora edulis</i> Sims	passion fruit	X
<i>Passiflora suberosa</i> L.	huehue haole	X
RUBIACEAE		
<i>Morinda citrifolia</i> L.	Noni	X
<i>Paederia foetida</i> L.	maile pilau	X
<i>Spermacoce assurgens</i> Ruiz. & Pav.	buttonweed	X
SAPINDACEAE		
<i>Filicium decipiens</i> (Whit & Arn.) Thwaites	fern tree	X
SOLANACEAE		
<i>Solanum americanum</i> Mill.	popolo	I?
STERCULIACEAE		
<i>Waltheria indica</i> L.	uhaloa	I
TILIACEAE		
<i>Heliocarpus popayanensis</i> Kunth	white moho	X
THYMELAEACEAE		
<i>Wikstroemia oahuensis</i> (A.Gray) Rock var. <i>oahuensis</i>	akia	E

VERBENACEAE		
<i>Citharexylum caudatum</i> L.	fiddlewood	X
<i>Lantana camara</i> L.	lantana	X
<i>Stachytarpheta jamaicensis</i> (L.) Vahl	Jamaican vervain	X