CONTAINS CONFIDENTIAL BUSINESS INFORMATION

WASTE MANAGEMENT PLAN

for

HAWAI'I DAIRY FARMS

MAHA'ULEPU, KAUA'I, HAWAI'I

TMK: (4) 2-9-003: 001 por and 006 por
(4) 2-9-001: 001 por

Prepared for:
Hawai'i Dairy Farms, LLC
P.O. Box 1690
Koloa, Hawai'i 96756-1690

Prepared by:
GROUP 70 INTERNATIONAL
925 Bethel Street, 5th Floor
Honolulu, Hawai'i 96813
(808) 523-5866

May 12, 2014

Farm Name:	HAWAI'I DAIRY FARMS
Facility Location:	Maha'ulepu Road Maha'ulepu, Kaua'i, Hawai'i TMK: (4) 2-9-003: 001 por and 006 por (4) 2-9-001: 001 por
Land Owner:	Maha'ulepu Farms, LLC 3-1850 Kaumuali'i Hwy Lihu'e, Hawai'i 96766
Dairy Owner/Operator:	Hawai'i Dairy Farms, LLC
Contact person:	Kyle Datta (Manager)
Address:	P.O. Box 1690, Koloa, Hawai'i 96756
Phone:	(808) 544-8960
Email:	kdatta@ulupono.com
Operated by:	James Garmatz (Farm Manager)
Address:	P.O. Box 1690, Koloa, Hawai'i 96765
Phone:	(808) 212-5985
Email:	jim@hawaiidairyfarms.com

As the Owner/Operator of Hawai'i Dairy Farms, LLC, I agree to manage the dairy operation in accordance with this waste management plan and maintain those practices described in the plan.

Signature: _____ Date: _____

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1.0 Project Overview

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HDF is submitting this application in support of its Animal Feeding Operation approval.

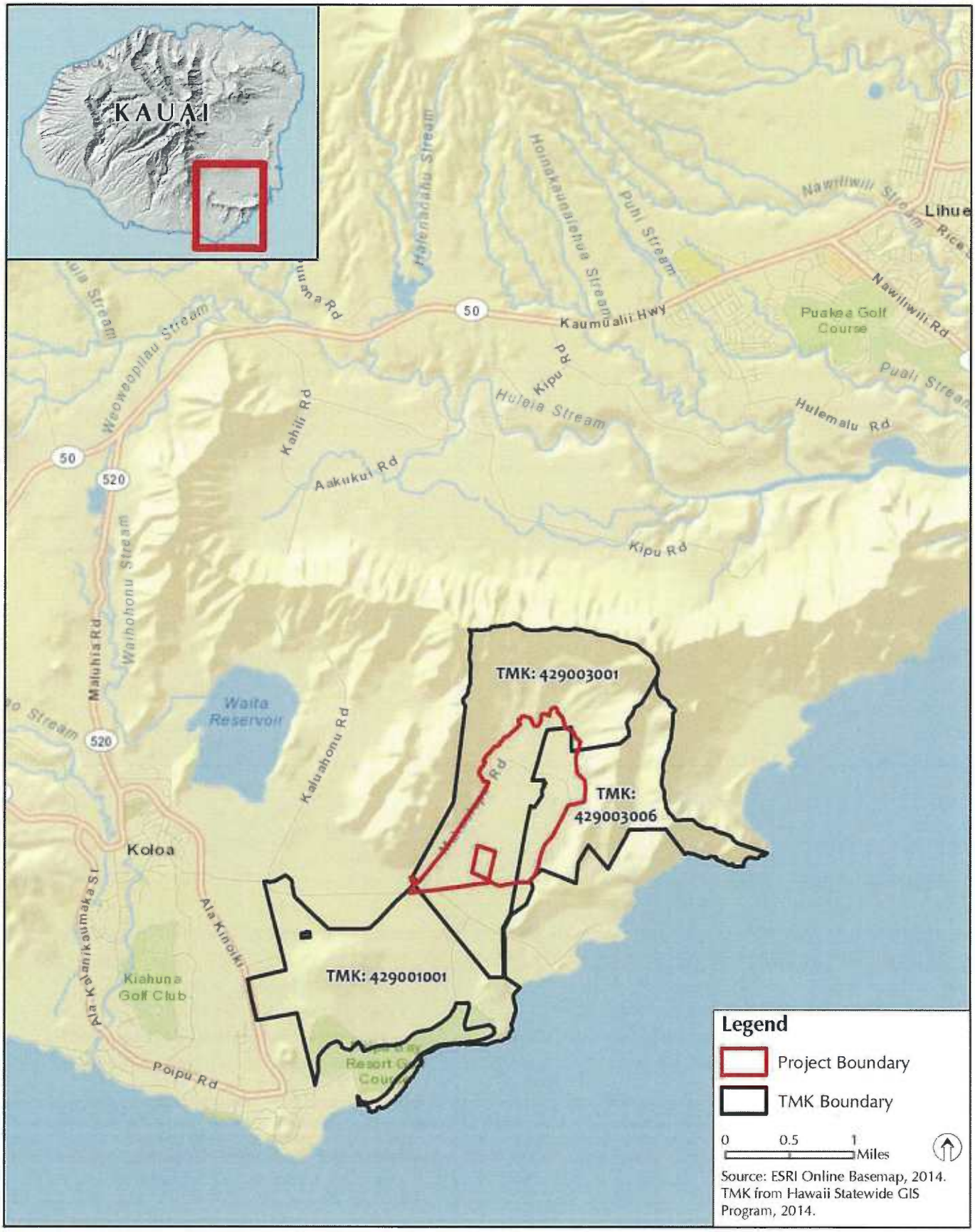


Figure 1 – Vicinity Map

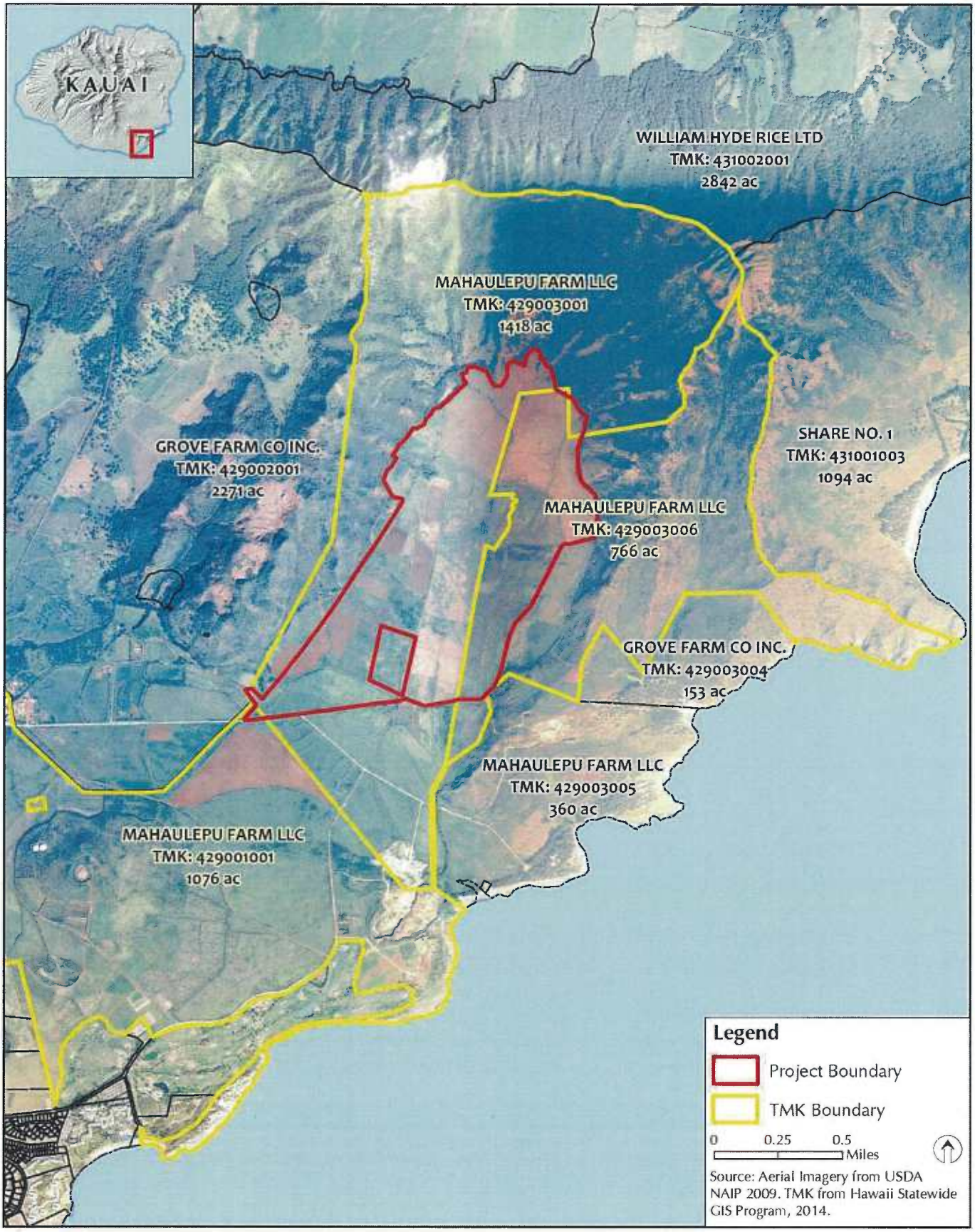


Figure 2 – Project Location Map

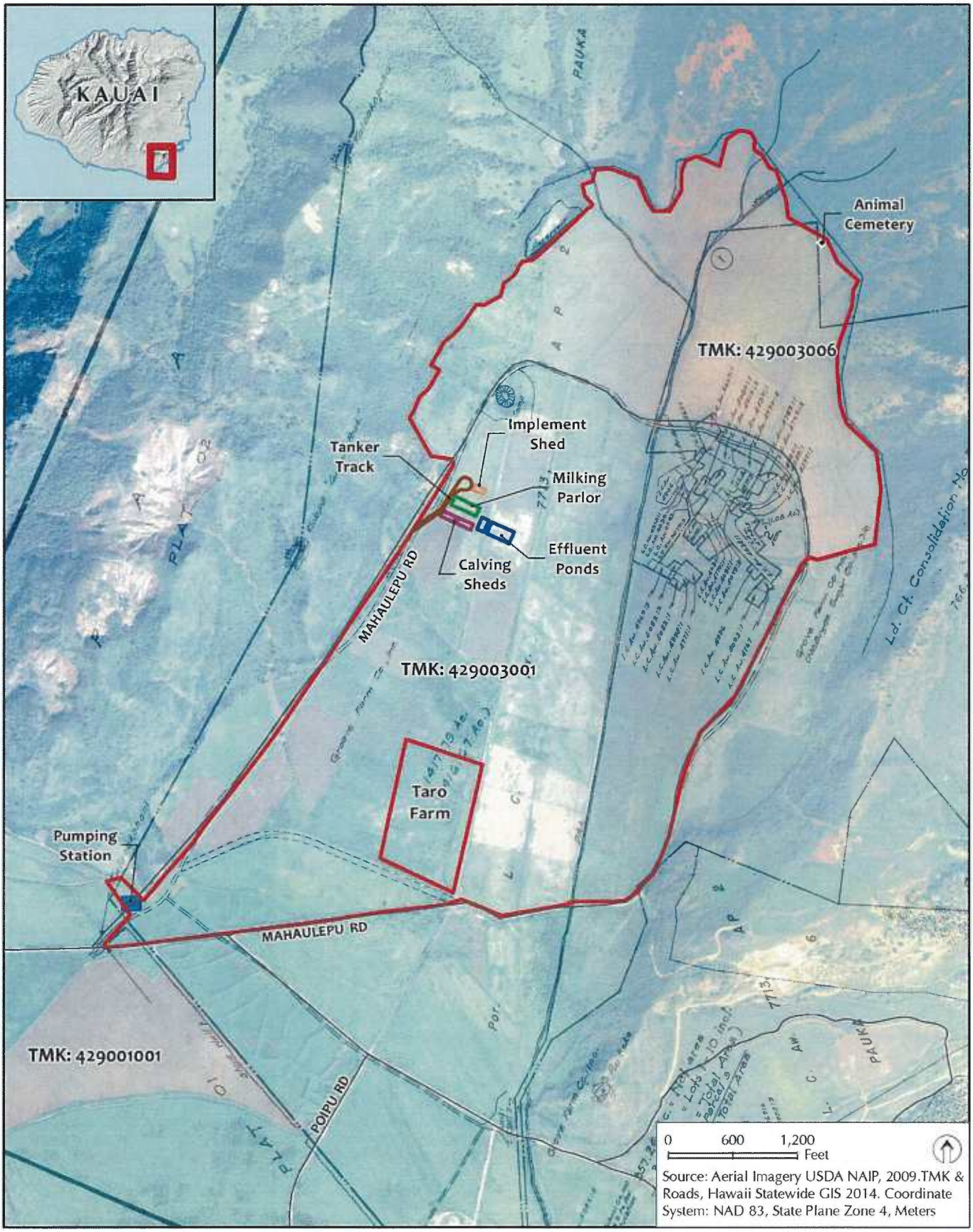


Figure 3 – TMK Map

2.0 Existing Conditions

The project area has historically been used for sugar cane production as part of the Koloa Plantation until the late 1990s when the Koloa Mill closed. Since the mill closed, the project area has been leased to various tenants for ranching and diversified agricultural operations. A small plot of land in the lower center of the valley is currently used for taro lo'i and will continue to be leased and farmed after the dairy and related pastures are in full operation. See Figure 3 - TMK Map.

The original agricultural infrastructure from the sugar plantation is largely still in place and continues to be used for on-going agricultural activities. Much of this existing infrastructure will also be used for the dairy, but with a significant amount of upgrades and improvements. The existing infrastructure in the project area includes: gravel access roads, field roads, water wells, reservoirs, pipelines, pumps, irrigation ditches, drainage ways and culverts.

2.1 Topography

The project site is situated in the Maha'ulepu Valley on the island of Kaua'i. The valley is on the leeward side of the Ha'upu mountain ridge which runs in the east-west direction, and the valley is also flanked by ridge lines on both sides. Mt. Ha'upu is the highest point on the ridge line at the back of the valley at an elevation of 2,297 feet. From this point, the ground drops very quickly down to the bottom of the valley to about an elevation of 150 feet. The base of the valley itself is somewhat gradually sloped from an elevation of 150 feet to an elevation of 60 feet along Maha'ulepu Road on the makai side of the project site near the taro farm. See Figure 4, USGS Map.

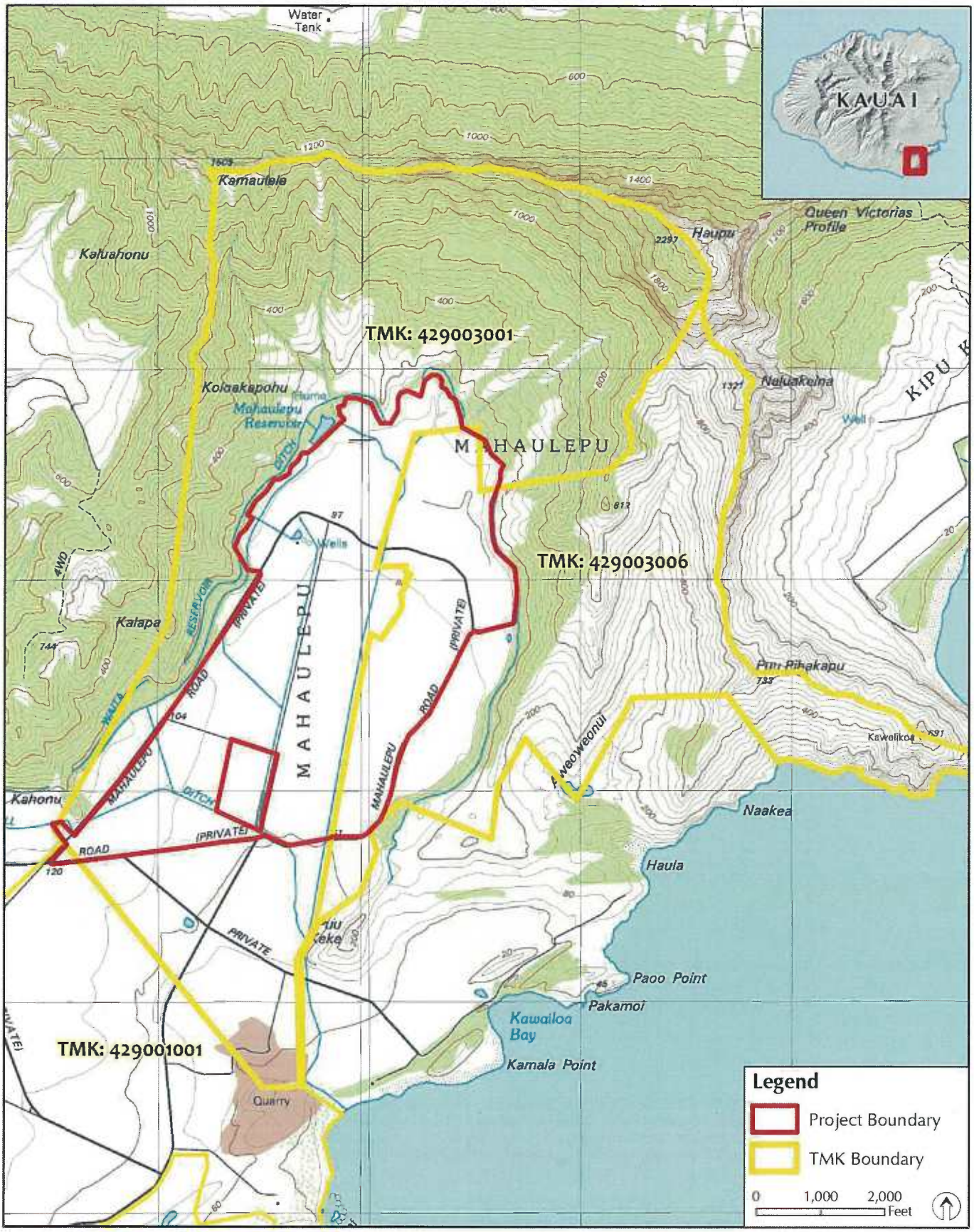


Figure 4 – USGS Map

2.2 Water Resources

The Maha'ulepu Valley has been in agricultural use for a very long time and much of the water resources and infrastructure in the valley are man-made and were constructed to provide irrigation water to the sugar cane lands throughout the valley. Systems of ditches, reservoirs and irrigation pipes and pumps are still in place and are still used to irrigate fields and pasture. Much of this infrastructure is shown on the USGS maps and in other datasets. See Figure 5, Water Resources. Water resources shown in Figure 5 include: canals, ditches, streams and ponds as identified in the National Hydrography Dataset (NHD), water wells from the State of Hawai'i, Department of Land and Natural Resources (DLNR), and wetlands from the National Wetlands Inventory (NWI).

2.2.1 Receiving Water Body State Water Quality

The drainage ways within Maha'ulepu Valley and within the project site are classified by the DOH Clean Water Branch (CWB) to be Class 2 inland waters as defined in Hawai'i Administrative Rules (HAR) Title 11, Chapter 54 (§11-54). These canals and ditches flow in the makai direction beyond the project site across Maha'ulepu Road and into the agricultural lands on the opposite side of the road. The unnamed drainage ways from the valley all converge near Pu'u Keke and are discharged into Class A marine waters along the Maha'ulepu coastline between Kamala Point and Punahoa Point. The Maha'ulepu coastline is classified as Class 1 critical habitat by the State.

2.2.2 Wetlands

According to the United States Fish and Wildlife Service (FWS), the agricultural canals, ditches and ponds within the valley are listed in the National Wetlands Inventory (NWI). There is also a freshwater wetland on the makai side of Maha'ulepu Road outside the project site. FWS classifies the wetlands as follows:

Table 1 - NWI Wetlands Classification

Location (Wetland Code)	System	Sub-System	Class	Sub-Class	Modifiers
R4SBCx	Riverine	Intermittent	Streambed		• Seasonally Flooded • Excavated
PUBHh	Palustrine		Unconsolidated Bottom		• Permanently Flooded • Diked/Impounded
PEM1Hh	Palustrine		Emergent	Persistent	• Permanently Flooded • Diked/Impounded
PEM1Kx	Palustrine		Emergent	Persistent	• Artificially Flooded • Excavated

2.2.3 Water Wells

The State Department of Land and Natural Resources (DLNR) Commission on Water Resource Management (CWRM) manages and tracks water resources in the State including groundwater wells. The State database identifies two primary well sites in the Maha'ulepu Valley. The Koloa F Well is a public drinking water source used by the County of Kaua'i Department of Water Supply. The Maha'ulepu Well site includes up to 14 irrigation wells drilled by the sugar cane plantations. The water wells are shown on Figure 5, Water Resources. The Koloa F well is located over ½ mile away from the dairy facility site.

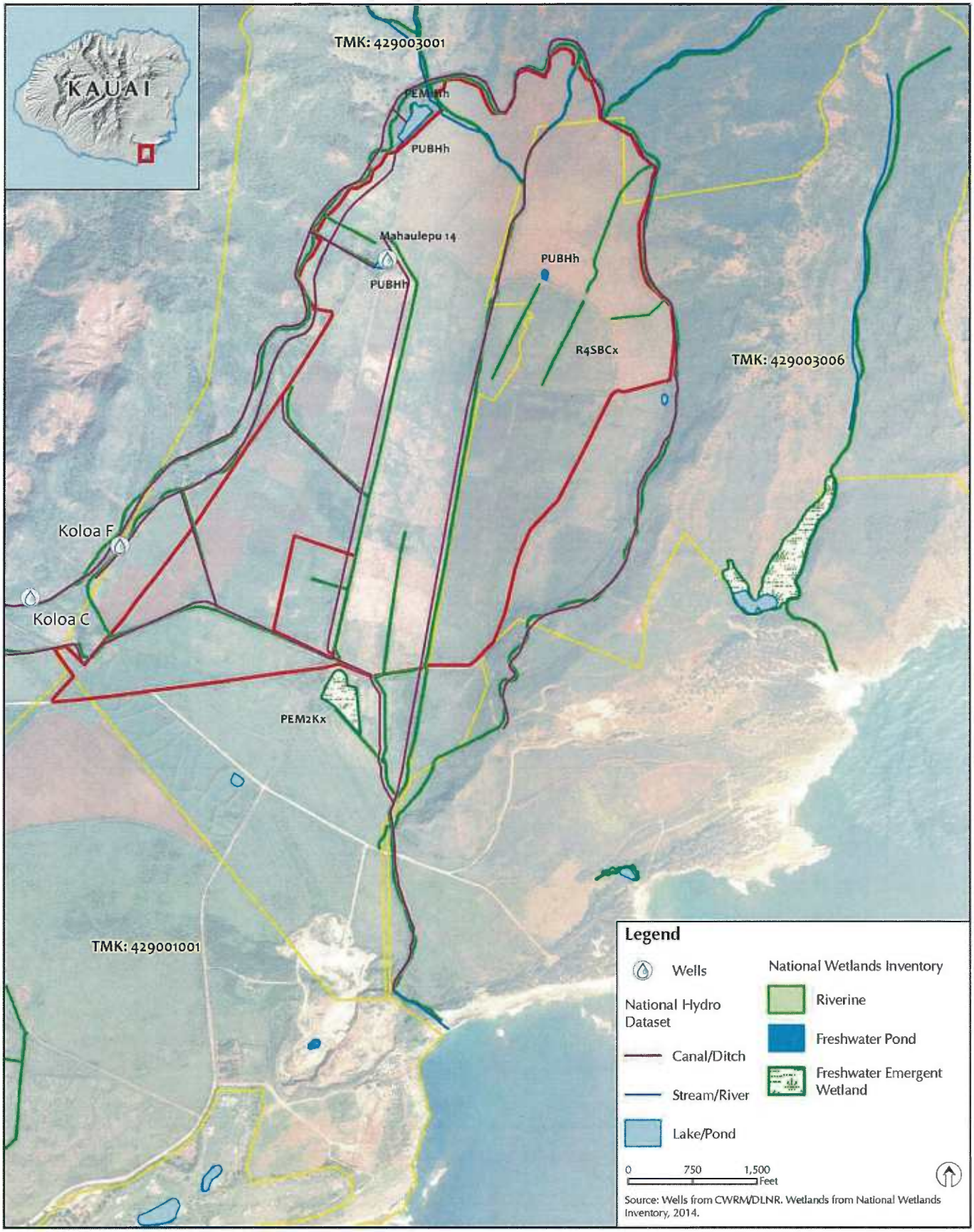


Figure 5 – Water Resources

2.3 Rainfall Data

The data sources used for sizing of the waste management systems and irrigation scheduling of the dairy facility site are described in this section.

2.3.1 Normal Precipitation

Normal monthly precipitation depths were obtained from the University of Hawai'i Rainfall Atlas of Hawai'i (2011). The average monthly precipitation depths will be used for sizing of the waste management systems and irrigation scheduling as required by the standards.

Table 2 - Average Monthly Precipitation Data

Month	Mean Monthly Rainfall (in)
January	4.88
February	4.20
March	5.04
April	3.66
May	3.05
June	2.86
July	3.13
August	3.20
September	3.25
October	4.96
November	6.01
December	5.71
Annual	49.95

2.3.2 NOAA 24-Hour Rainfall

Precipitation depths for various durations and recurrence intervals were obtained from NOAA Atlas 14, Volume 4, Version 3. The 25-year 24-hour precipitation data will be used for sizing of waste management systems as required by the standards.

Table 3 - NOAA 24-Hour Rainfall Data

Storm Event (Recurrence Interval)	Storm Duration	
	1-hour	24-hour
1-year	1.18"	3.47"
2-year	1.55"	4.78"
10-year	2.54"	8.18"
25-year	3.17"	**10.4"**
50-year	3.70"	12.2"
100-year	4.25"	14.1"

2.3.3 NOAA Rain Gauge Data

Rain gauge data was obtained from NOAA National Climatic Data Center for the Maha'ulepu 941.1 rain gauge located on the farm off of Maha'ulepu Road (GHCND:USC00515710 - MAHA'ULEPU 941.1 HI US). The rain gauge is located at: Elevation = 24.4, Latitude = 21.90194, Longitude = -159.42111. The data record analyzed included daily precipitation records from 1/1/1984 to 12/31/2013 for a total of approximately 10,957 days (30 years). The rainfall events were ranked based on days of consecutive rainfall (DAPR) and the corresponding multiday precipitation total (MDPR). The data suggests that having more than a week of consecutive rain is very unusual for Maha'ulepu Valley with this only having occurred 5 times in the last 30 years.

Table 4 - NOAA Rain Gauge Data

GHCND:USC00515710 - MAHA'ULEPU 941.1 HI US			
DATE	**MDPR, in**	**DAPR**	**Occurrence**
19960108	1.90	17	1
19920922	2.60	12	1
19930104	3.70	7	3
19960930	0.20	7	3
19980105	1.48	7	3
19920928	0.02	6	5
19940105	0.03	6	5
19960923	0.03	6	5
19970106	0.05	6	5
20031229	0.20	6	5
19861229	0.04	5	21

MDPR - Multiday precipitation total

DAPR - Number of days included in the multiday precipitation total (MDPR)

Occurrence - number of occurrences in 10,957 day record between 1/1/1984 to 12/31/2013

2.4 Flood Hazards

The entire project area is located within Federal Emergency Management Agency (FEMA) Zone X based on FEMA Flood Insurance Rate Map (FIRM) panels 1500020316E and 1500020318F. Zone X includes areas determined to be outside the 0.2% annual chance floodplain.

2.5 Soils

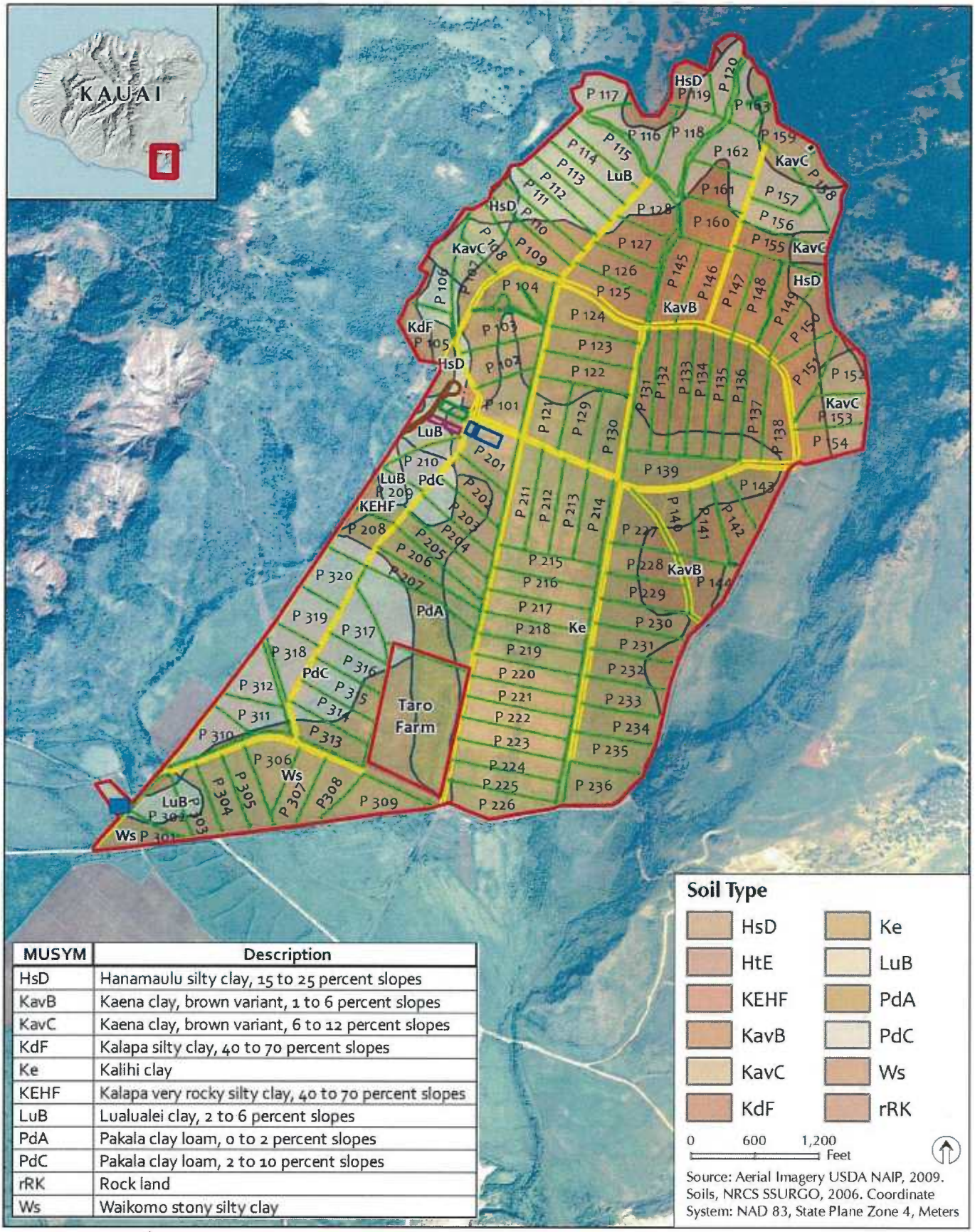
According to the United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) survey data, the project area consists of a variety of soils. Soil characteristics are summarized in the table below. See Figure 6, Soil Map.

Table 5 - Soil Characteristics Summary

Soil Classification	Soil Classification	Slope Range (%)	Hydrologic Soils Group	Drainage Class	Depth to Water Table (inches)	Capacity to transmit water - Ksat (in/hr)	Typical Soil Profile - Layer 1 (depth from surface)	Typical Soil Profile - Layer 2 (depth from surface)	Typical Soil Profile - Layer 3 (depth from surface)
Hanamaulu Silty Clay	HsD	15 to 20%	B	Well Drained	> 80"	0.14 to 1.98	0 to 11" Silty Clay	11 to 36" Silty Clay	36 to 72" Silty Clay Loam
Hanamaulu Stony Silty Clay	HtE	10 to 35%	B	Well Drained	> 80"	0.20 to 2.00	0 to 11" Stony Silty Clay	11 to 36" Silty Clay	36 to 72" Silty Clay Loam
Ka'ena Clay, Brown Variant	KavB	1 to 6%	D	Poorly Drained	24 to 60"	0.00 to 0.20	0 to 10" Clay	10 to 37" Stony Clay	37 to 54" Stony Clay
Ka'ena Clay, Brown Variant	KavC	6 to 12%	D	Poorly Drained	24 to 60"	0.00 to 0.20	0 to 10" Clay	10 to 37" Stony Clay	37 to 54" Stony Clay
Kalapa Silty Clay	KdF	40 to 70%	B	Well Drained	> 80"	0.00 to 0.20	0 to 10" Silty Clay	10 to 60" Clay	
Kalihi Clay	Ke	n/a	D	Poorly Drained	24 to 60"	0.06 to 0.60	0 to 16" Clay	16 to 70" Clay	
Kalapa Very Rocky Silty Clay (Very Rocky)	KEHF	40 to 70%	B	Well Drained	> 80"	0.00 to 0.20	0 to 10" Silty Clay	10 to 60" Clay	
Kalapa Very Rocky Silty Clay (Rock Outcrop)	KEHF	40 to 70%	D			0.00 to 0.06	0 to 60" Bedrock		
Lualualei Clay	LuB	2 to 6%	D	Well Drained	> 80"	0.00 to 0.20	0 to 10" Clay	10 to 60" Clay	

Table 5 – Soil Characteristics Summary (continued)

Soil Classification	Soil Classification	Slope Range (%)	Hydrologic Soils Group	Drainage Class	Depth to Water Table (inches)	Capacity to transmit water – Ksat (in/hr)	Typical Soil Profile - Layer 1 (depth from surface)	Typical Soil Profile - Layer 2 (depth from surface)	Typical Soil Profile - Layer 3 (depth from surface)
Pakala Clay Loam	PdA	0 to 2%	B	Well Drained	> 80"	0.60 to 1.98	0 to 16" Clay Loam	16 to 60" Silty Clay Loam	
Pakala Clay Loam	PdC	2 to 10%	B	Well Drained	> 80"	0.60 to 1.98	0 to 16" Clay Loam	16 to 60" Silty Clay Loam	
Rock Land	rRK	n/a	D	Well Drained	> 80"	0.00 to 0.06	0 to 4" Silty Clay	4 to 8" Silty Clay	8 to 20" Bedrock
Rock Land (Rock Outcrop)	rRK	n/a	D			0.00 to 0.06	0 to 60" Bedrock		
Waikomo Stony Silty Clay	Ws	n/a	D	Well Drained	> 80"	0.00 to 0.06	0 to 14" Stony Silty Clay	14 to 20" Stony Silty Clay Loam	20 to 30" Bedrock



MUSYM	Description
HsD	Hanamaulu silty clay, 15 to 25 percent slopes
KavB	Kaena clay, brown variant, 1 to 6 percent slopes
KavC	Kaena clay, brown variant, 6 to 12 percent slopes
KdF	Kalapa silty clay, 40 to 70 percent slopes
Ke	Kalihi clay
KEHF	Kalapa very rocky silty clay, 40 to 70 percent slopes
LuB	Lualualei clay, 2 to 6 percent slopes
PdA	Pakala clay loam, 0 to 2 percent slopes
PdC	Pakala clay loam, 2 to 10 percent slopes
rRK	Rock land
Ws	Waikomo stony silty clay

Figure 6 – Soils Map

3.0 Land Use Summary

The total dairy farm area inclusive of pasture and dairy facility, but excluding the existing taro farm, is 581.5 acres. The dairy project site has been divided into two land use areas as described in Table 6 (below): Field 1, 567 acres of pasture; and Field 2, 14.5 acres for the dairy facility. See Figure 7, Field Map which was prepared by NRCS Lihu'e Service Center.

Table 6 – Land Use Summary

Land Use	Acres
Field 1	
Paddocks	520.9
Cow Races, Farm Roads, Drainage Ways	46.1
Subtotal	**567.0**
Field 2	
Dairy Facility, Yard, Sheds, Road	4.6
Open Space	9.9
Subtotal	**14.5**
TOTAL	**581.5**

Field 1 is broken up into a total of 119 paddocks which are approximately 4 to 5 acres in size. See Figure 8, Paddock Map and Table 7, Paddock Area Summary. Other land uses within Field 1 include the cow races, walkways, farm roads, drainage ways, animal cemetery, and effluent ponds. The animal cemetery is located on paddock 159, and the effluent ponds are located on paddock 201. Both uses are included in the total paddock area.

Customer(s): HAWAII DAIRY FARMS LLC
District:
Approximate Acres: 581.5
Legal Description: TMK: (4) 2-9-003:001 (portion)

Date: 11/1/2013
Field Office: LIHUE SERVICE CENTER
Agency: USDA-NRCS
Assisted By: BENJAMIN VINHATEIRO
State and County: HI, KAUAI

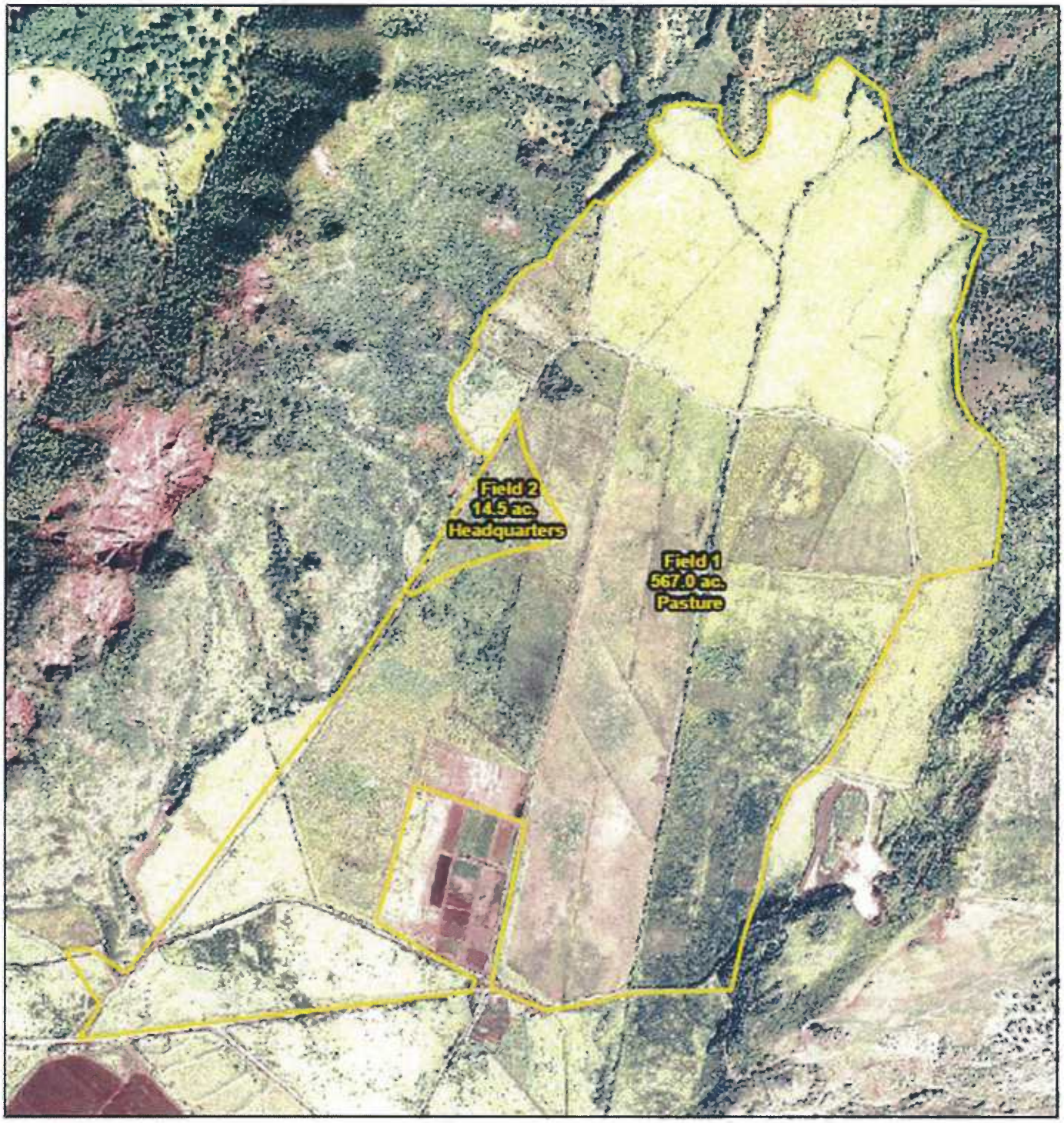


Figure 7 – Field Map

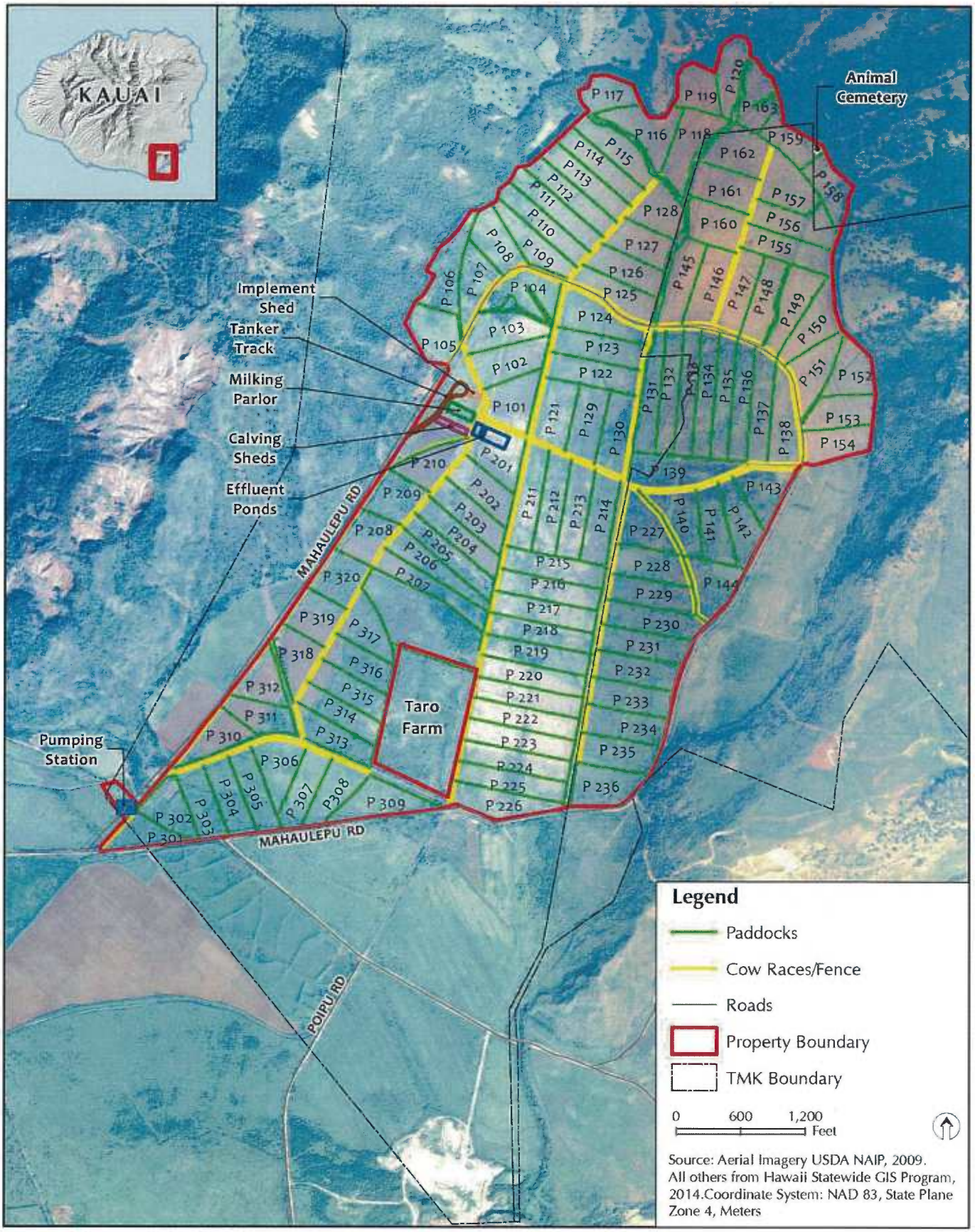


Figure 8 Paddock Map

Table 7 – Paddock Area Summary

Field	Acres	Field	Acres	Field	Acres	Field	Acres
P 101	4.82	P 131	4.35	P 161	4.67	P 228	4.59
P 102	4.82	P 132	4.35	P 162	4.67	P 229	4.59
P 103	4.82	P 133	4.35	P 163	3.58	P 230	4.59
P 104	4.82	P 134	4.35	P 201	4.94	P 231	4.59
P 105	4.69	P 135	4.35	P 202	4.27	P 232	4.59
P 106	4.69	P 136	4.35	P 203	4.27	P 233	4.59
P 107	4.27	P 137	4.45	P 204	4.27	P 234	4.59
P 108	4.27	P 138	4.50	P 205	4.27	P 235	4.59
P 109	4.27	P 139	5.63	P 206	4.27	P 236	4.94
P 110	4.27	P 140	4.30	P 207	4.27	P 301	3.04
P 111	4.27	P 141	4.30	P 208	3.95	P 302	3.95
P 112	4.27	P 142	4.30	P 209	3.95	P 303	4.20
P 113	4.27	P 143	4.30	P 210	3.95	P 304	4.30
P 114	4.27	P 144	4.30	P 211	4.62	P 305	4.05
P 115	4.27	P 145	4.67	P 212	4.62	P 306	4.30
P 116	5.06	P 146	4.67	P 213	4.62	P 307	4.30
P 117	3.24	P 147	4.67	P 214	4.62	P 308	4.20
P 118	5.06	P 148	4.67	P 215	4.59	P 309	4.94
P 119	3.58	P 149	4.67	P 216	4.54	P 310	3.85
P 120	3.58	P 150	4.67	P 217	4.54	P 311	3.85
P 121	4.67	P 151	4.67	P 218	4.54	P 312	3.85
P 122	4.67	P 152	4.08	P 219	4.54	P 313	4.03
P 123	4.67	P 153	4.08	P 220	4.54	P 314	4.03
P 124	4.67	P 154	4.08	P 221	4.54	P 315	4.27
P 125	4.05	P 155	4.67	P 222	4.54	P 316	4.12
P 126	4.05	P 156	4.67	P 223	4.54	P 317	4.03
P 127	4.05	P 157	4.67	P 224	4.54	P 318	4.03
P 128	4.05	P 158	3.58	P 225	4.54	P 319	4.03
P 129	4.67	P 159	3.58	P 226	4.59	P 320	4.03
P 130	4.67	P 160	4.67	P 227	4.64	***Total***	***520.87***

4.0 Farm Description

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The majority of the dairy farm area (i.e. ~90%) is dedicated to pasture. The dairy facility including effluent ponds is contained within a 4.6-acre area in Field 2, which represents less than 1% of the entire dairy farm area. The corresponding building areas are under 0.1% of the total farm area. The dairy building and infrastructure are summarized as follows and are shown on Figure 9, Farm Map:

- Paved Access Road and Truck Turnaround
- Cow Walkways/Races and Farm Roads
- Concrete Holding Yards and Gravel Farm Races
- Milking Parlor
- Implement Shed
- Calf Sheds
- Waste Settling Pond and Storage Pond
- Effluent and Sludge Pumps and Distribution System
- Irrigation Water Storage and Distribution System
- Potable Well and Transmission Main to Milking Parlor
- Potable Water Tank for Milking Parlor and Livestock Consumption
- Livestock Water Distribution System
- Feed Silos
- Milking Parlor - Individual Wastewater System (IWS)
- Animal Cemetery

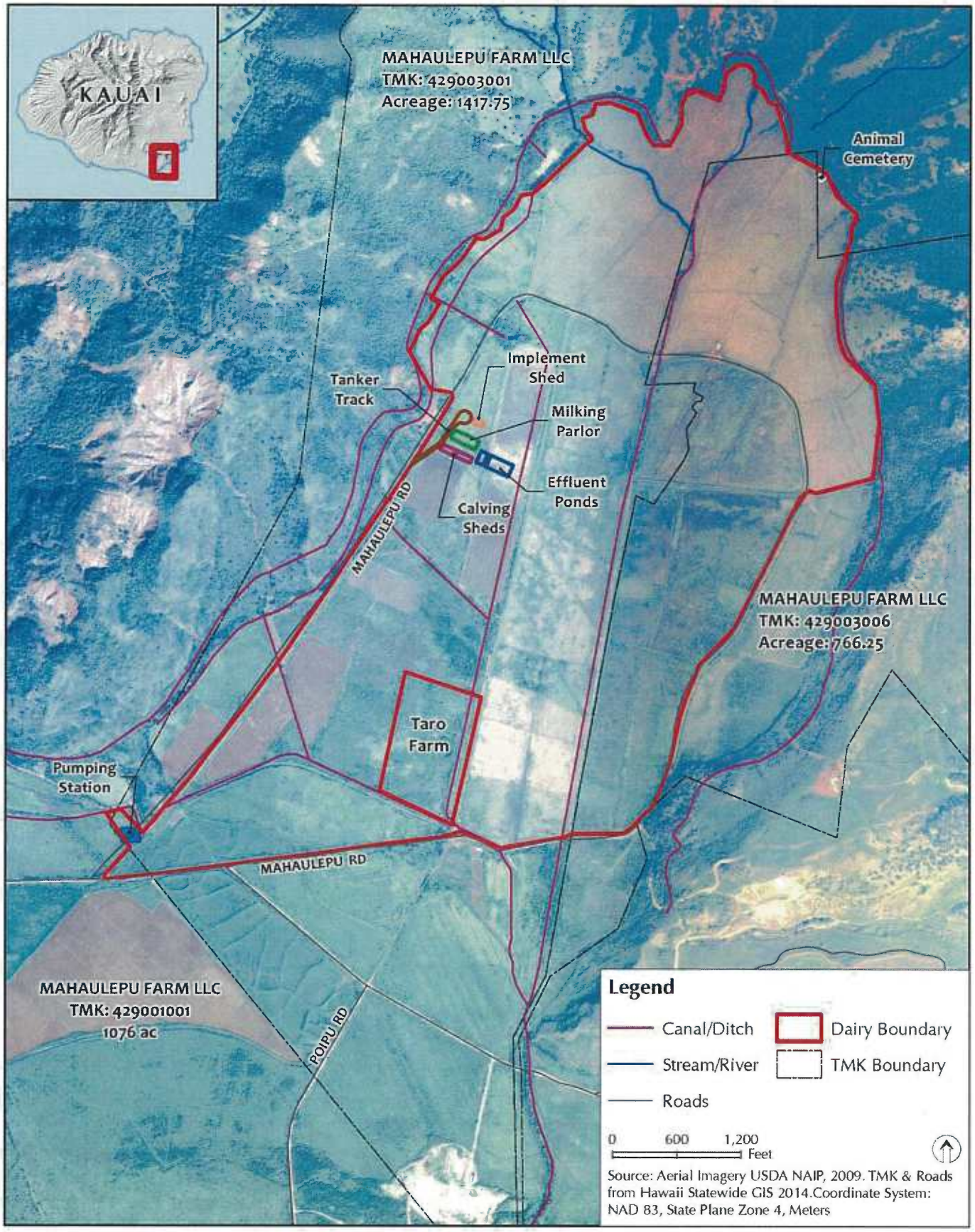

Figure 9 – Farm Map

4.1 Cows Walkways and Races

The dairy farm pasture areas are divided into 4- to 5-acre paddocks as shown on Figure 8, Paddock Map. A network of walkways and races connect the paddocks together and provide access to and from the dairy facility. The walkways and races are generally aligned with existing farm roads where possible, but additional walkways and races will be constructed through the existing fields. See Figure 10, Cow Walkways/Races

The walkways and races are compacted crushed rock access ways that are approximately 16 to 20 feet in width. The cow races allow twice daily movement of the cows from the paddocks to the Milking Parlor. The cow races are not irrigated and are frequently maintained to maximize efficient and rapid movement to and from the dairy with minimal injury to livestock. The races are bordered by 3 wire electrical fencing.

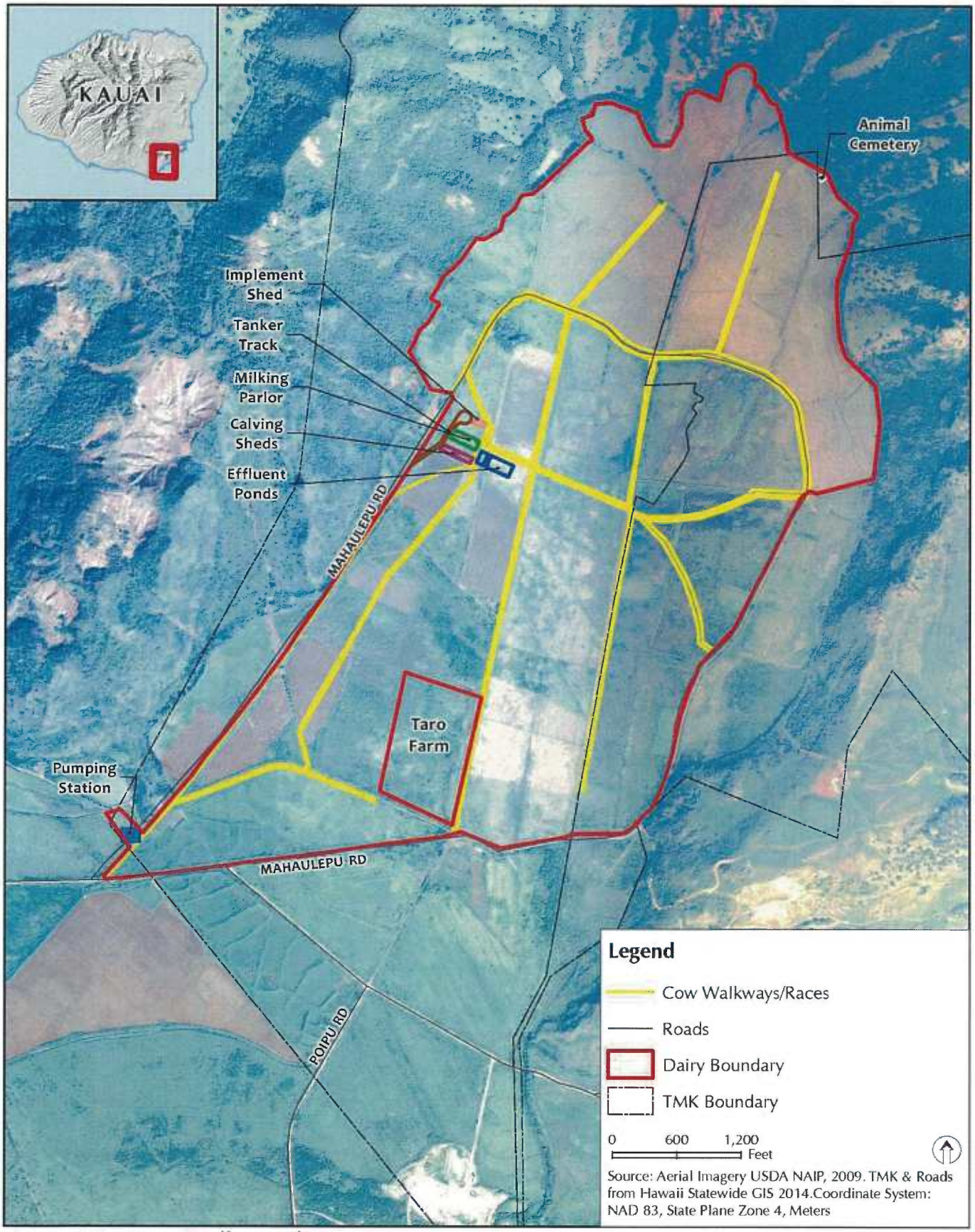

Figure 10 – Cows Walkways/Races

4.2 Dairy Facility

4.2.1 Calf Sheds

Calf sheds will be constructed to provide safe housing to newly born calves. There are two open bay calf sheds, which will be steel structures with metal roofs on concrete slabs. Each shed will be approximately 81 ft. long by 26 ft. wide by 15 ft. tall for a total area of 2,106 sq. ft. each. A minimum 21.52 sq. ft. area is allocated for each calf and 20 calves are kept in one pen (26 ft. x 16 ft.). Each pen is divided in two areas (feeding area and bedding area). The feeding area is washed daily and wastewater is transferred to the effluent ponds. Calf bedding will be constructed of non-skid interlocking plastic tiles. Calves are moved into open paddocks after 3-4 weeks. See Figure 11, Site Plan.

4.2.2 Implement Shed

An implement shed will be constructed for storage of equipment and tools and farm machinery parking. The implement shed will be an open bay steel structure with metal roofs on a concrete slab, similar to the calving sheds. The implement shed will be approximately 65 ft. long by 26 ft. wide by 15 ft. tall for a total area of 1,690 sq. ft. See Figure 11, Site Plan.

4.2.3 Milking Parlor

The Milking Parlor is the single largest structure on the dairy farm with dimensions of approximately 256 ft. long by 88.5 ft. wide by 33 ft. tall. The Milking Parlor contains a highly-automated 60-stall rotary, which completes one rotation of 60 cows in approximately 7-10 minutes. It will operate 365 days a year.

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The Milking Parlor building includes the following components:

- Covered Loading Area
- Milking Area
- Holding Pens
- Mechanical Room and Pump Room
- Office Space
- Veterinary Space and Storage
- Staff Restrooms
- Milk Storage

4.2.4 Milking Parlor Feeding System

In-parlor feeding is offered to the cows to provide additional nutrients, which improve animal health and milk production. Cows are eager to enter into the parlor to be milked so milking time is typically improved. A small portion of feed (6.6 lbs.) is offered to cows during the milking time (8-10 min), which will be stored in two 44-ton – 60-degree cone silos.

4.2.5 Holding Yard

The holding yard is designed to hold a single 330-cow mob at any one time, and is approximately 150 ft. long by 82 ft. wide for a total area of 12,300 sq. ft. Yard area is heavily used by livestock and needs to be cleaned frequently. Manure/contaminated water is transferred to the effluent pond through underground pipes. No feed is offered in the holding yard and each mob spends less than one hour in the yard before entering into the Milking Parlor.

4.2.6 Access Road and Tanker Truck Turnaround

A new 20-foot wide paved access road will be constructed off of Maha'ulepu Road down to the dairy facility. The access road will serve as the primary access to the dairy and will be used by milk tanker trucks for transport of milk off site. A paved truck turnaround is located at the end of the access road and leads up to a covered loading area where milk is pumped directly into the trucks.

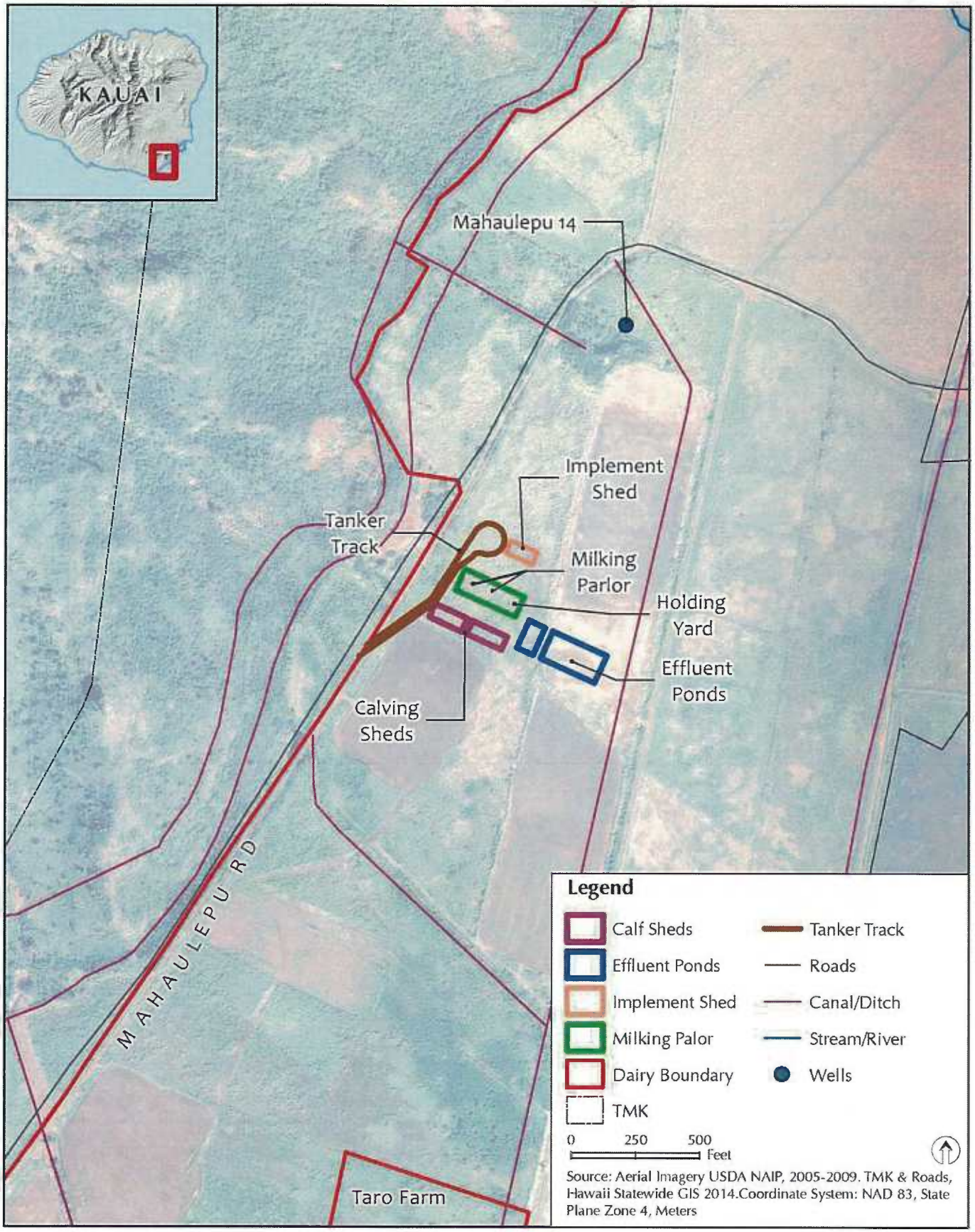

Figure 11 – Site Plan

5.0 Potable Water Systems

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5.1 Water Source and Quality

Potable water for the dairy facility and livestock consumption must be of acceptable quality. Water will either be sourced from the Maha'ulepu Well located within the project site or from a packaged water treatment plant capable of bringing water from the Waita Reservoir up to potable standards. The well site contains up to 14 wells, which were drilled by the sugar plantation. The water source has been tested and is of an acceptable quality. See test results below.

Table 8 – Maha'ulepu Well Water Quality

Sample Type: Aqueous					
Sample Name:		Mahaulepu Palama Well 16-May-2013 2:00 pm		Guideline Value	Maximum Acceptable Values (MAV)
Lab Number:		1140368.1			
Routine Water Profile					
pH	pH Units	7.6	-	7.0 - 8.5	-
Total Alkalinity	g/m³ as $CaCO_3$	171	-	-	-
Free Carbon Dioxide	g/m³ at 25°C	7.8	-	-	-
Total Hardness	g/m³ as $CaCO_3$	250	-	< 200	-
Electrical Conductivity (EC)	mS/m	92.6	-	-	-
Electrical Conductivity (EC)	µS/cm	926	-	-	-
Approx Total Dissolved Salts	g/m³	620	-	< 1000	-
Total Boron	g/m³	0.120	-	-	1.4
Total Calcium	g/m³	55	-	-	-
Total Copper	g/m³	0.00073	-	< 1	2
Total Iron	g/m³	< 0.021	-	< 0.2	-
Total Magnesium	g/m³	27	-	-	-
Total Manganese	g/m³	< 0.00053	-	< 0.04 (Staining) < 0.10 (Taste)	0.4
Total Potassium	g/m³	3.4	-	-	-
Total Sodium	g/m³	101	-	< 200	-
Total Zinc	g/m³	0.041	-	< 1.5	-
Chloride	g/m³	165	-	< 250	-
Nitrate-N	g/m³	1.55	-	-	11.3
Sulphate	g/m³	30	-	< 250	-

The well site has a total capacity of 2 MGD, with redundancy in the form of multiple well heads and potential additional backup source and interconnection with the Waita Reservoir water supply.

The irrigation water supply is an alternative source for potable water. If the well water is not utilized, a water treatment system will be installed to treat the available irrigation water to an acceptable quality for potable consumption in the dairy facility and for livestock.

5.2 Livestock Water Distribution System

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Water from the storage tanks will be distributed into the Milking Parlor and to adjacent buildings for dairy use. Water will also be distributed throughout the paddocks for livestock consumption. Small booster pumps will be used to ensure the required flow is delivered throughout the farm.

Small diameter water mains 2 to 3 inches in size deliver water to the paddocks. Two concrete troughs will be installed in each paddock to give animals free access to drinking water at all times. Troughs are raised and placed on a crushed rock base to provide a firm and stable surface for animal movement around the trough. The trough is high enough for the animal to reach over and in, but will discourage the animal from stepping into the trough. The troughs are also fitted with valves to stop the flow of water into the trough when the trough is full and refill the trough as the water is consumed.

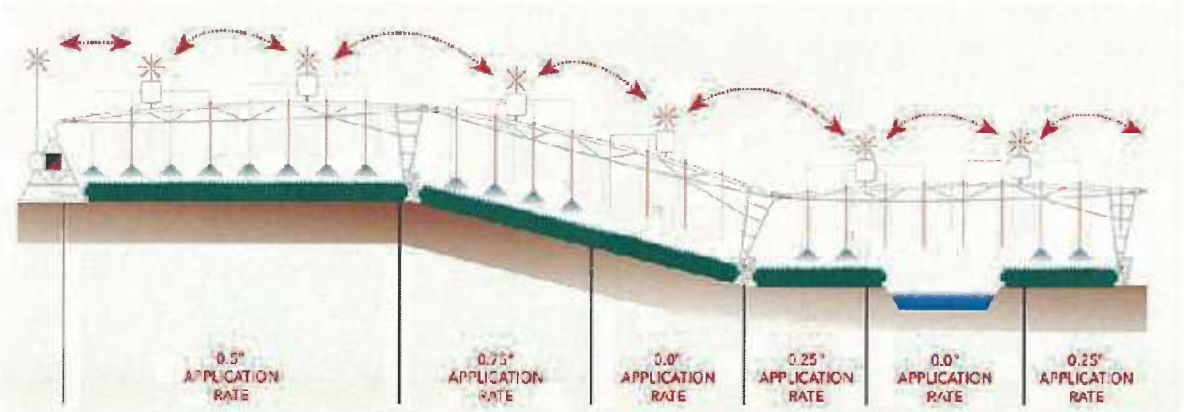
6.0 Irrigation

The total pasture area of the farm is 520.9 acres. The majority of the pastures will be irrigated through either spray or drip irrigation systems. See Figure 12, Irrigation Map.

6.1 Spray Irrigation System

The spray irrigation system will consist of two central pivot irrigation systems. A central pivot irrigation system is an overhead irrigation system, which includes irrigation pipes supported on trusses mounted on wheeled towers that rotate around a central water supply point. The farm will have two pivots; irrigation pivot #1 will be a full circle (FC) pivot and irrigation pivot #2 will be a partial circle (PC) pivot. See Figure 13, Center Pivots. The irrigation system including irrigation application rates and emitters is controlled using computer software and GPS receivers to allow very precise application of irrigation on the pasture.

The various components of the spray irrigation control system are described below:



Precision VRI Controller
Controls the irrigator ground speed and the water outlets including individual sprinklers and the end gun (as an optional extra).

- The Precision VRI controller reads the irrigation plan and uses data from other inputs (such as GPS coordinates) to calculate which valves need to be actuated at any one time.
- Communication within the system is via wireless links from the Precision VRI controller to the wireless nodes. Node control signals are packet-based, thus any form of information desirable for control of the irrigator can be transmitted to the wireless nodes.
- The Precision VRI controller is placed next to the irrigator's main controller (generally

situated at or near the center of the irrigator), operating on 12V DC.

- The Precision VRI controller contains a Windows-based touchscreen panel PC. A large number of plans that can be loaded into the Precision VRI controller if desired.

Wireless Nodes

The wireless nodes consist of a watertight enclosure and a Printed Circuit Board (PCB) containing the wireless transceiver, processor and drivers to individually control four latching relays.

- Each wireless node provides both power and control signals via wired connections to four (or less) valves. The wireless node will either turn the sprinklers on, off or pulse at a duty cycle determined by the Precision VRI controller.
- Each wireless node is powered by a common 24V DC power line.
- Each wireless node also acts as a wireless repeater to send signals further up and down the length of the irrigator.

Wiring Loom

- The looms consist of a power cable that runs between wireless nodes and four wires from the wireless node to control each valve.
- Each loom is pre-wired into the wireless nodes at the factory.

Power Source

- 1 x 90~264VAC input, 24VDC output, 225W switch mode power supply with constant current limiting.
- The system converts power from the high voltage line and provides 24V DC to the power line.
- Three phase power option, 340~550VAC Input, 24VDC 10A Output, 240W fully self-protected switch mode power supply

GPS

The GPS system consists of an industrial grade GPS unit with high receiver sensitivity (waterproof -22°F to +176°F operating temperature range).

- A GPS unit at the end of the pivot (or one GPS unit at each end of a lateral-move) sends a signal back through the wireless node network to notify the Precision VRI controller the position of the irrigator. The Precision VRI controller uses this position to calculate the valve control signals at this point.

PC Software

- Irrigation plans are created in the Field Map farm mapping software.

- The Field Map software takes in to account both source and field information to optimize water application for each irrigation plan.
- Irrigation plans are loaded into the controller either manually via a USB stick or through a wireless connection.

6.2 Drip Irrigation System

The drip irrigation system is a subsurface irrigation system using either drip tubing or tape installed in the ground. Irrigation water will be filtered and pumped at low pressures into the subsurface irrigation system. See Figure 14, Drip Irrigation.

6.3 Non-Irrigated Pasture

Approximately 12% of the pasture area is not irrigated as shown on Figure 15, Non Irrigated Pasture.

6.4 Irrigation Setbacks

Setback distances have been established to limit activity and irrigation within non-irrigated areas within the irrigation pivot areas. The spray irrigation systems are configured with GPS controlled emitters that will turn off so that water is not directly applied to the ditches, cow races and any agricultural or natural water resources. The following setbacks are incorporated into the design and are indicated on Figure 16, Irrigation Setbacks:

- Streams, agricultural water, and natural water resource - 50 feet on both sides.
- Cow walkways and races - 6 feet on both sides
- Existing taro farm - 20 feet on each side

The setback areas will also be re-vegetated with native plants. See example below of a restored setback area along a stream for the AgResearch Tokanui Farm in New Zealand.

6.5 Irrigation Demand

The irrigation areas are summarized in the table below. Irrigation water demand is based on a rate of 6 mm/0.24 inches per day over the irrigated area. The total irrigation demand to irrigate all areas is 2.93 MGD.

Table 9 – Irrigation Demand Summary

Irrigation Area	Acres	Demand, MGD
Irrigation Pivot #1 (FC)	216	1.36
Irrigation Pivot #2 (PC)	162	1.04
Drip Irrigation Area	82	0.53
Subtotal	460	2.93
Non Irrigated Area	61	0
TOTAL	**521**	**2.93**

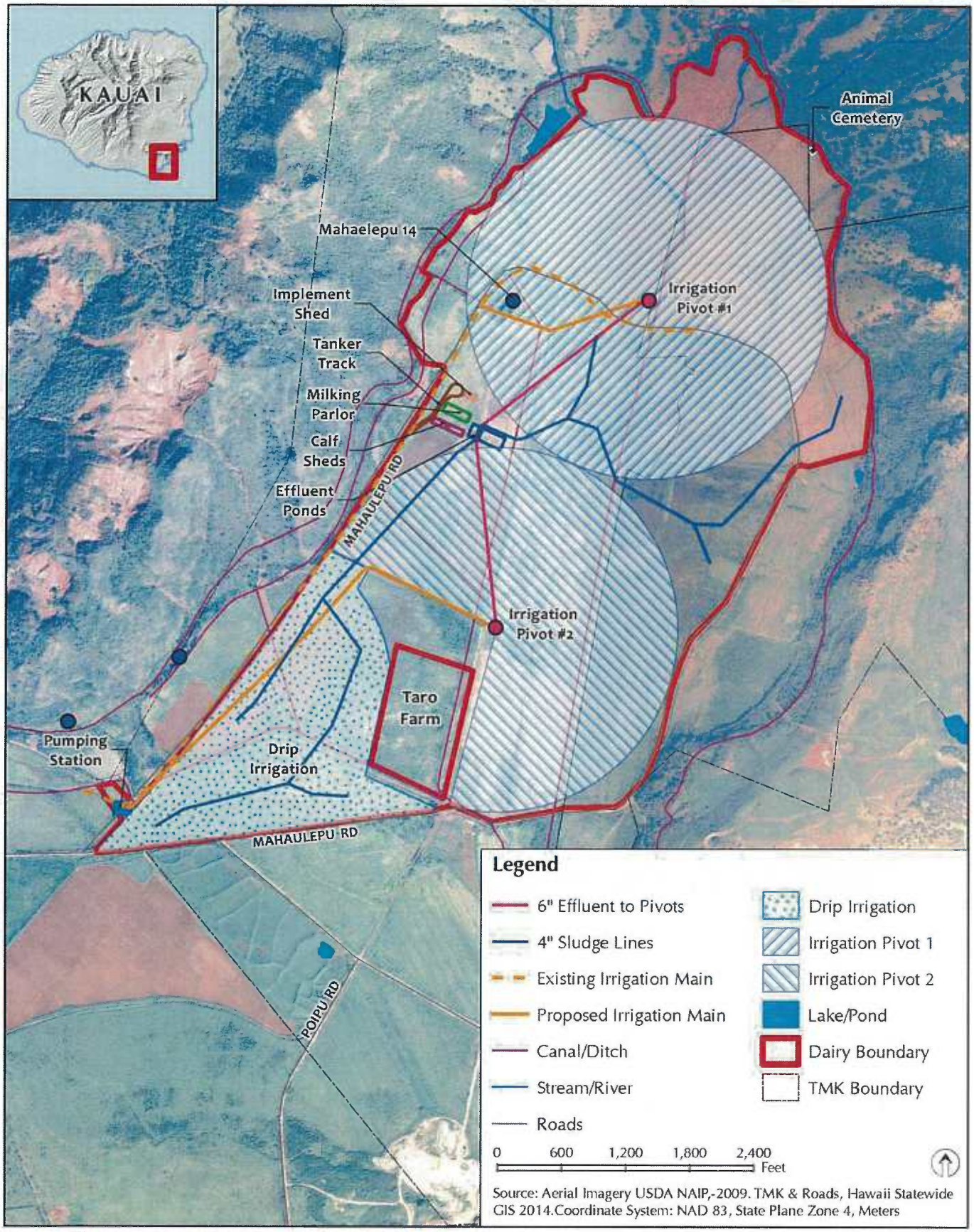


Figure 12 – Irrigation Map

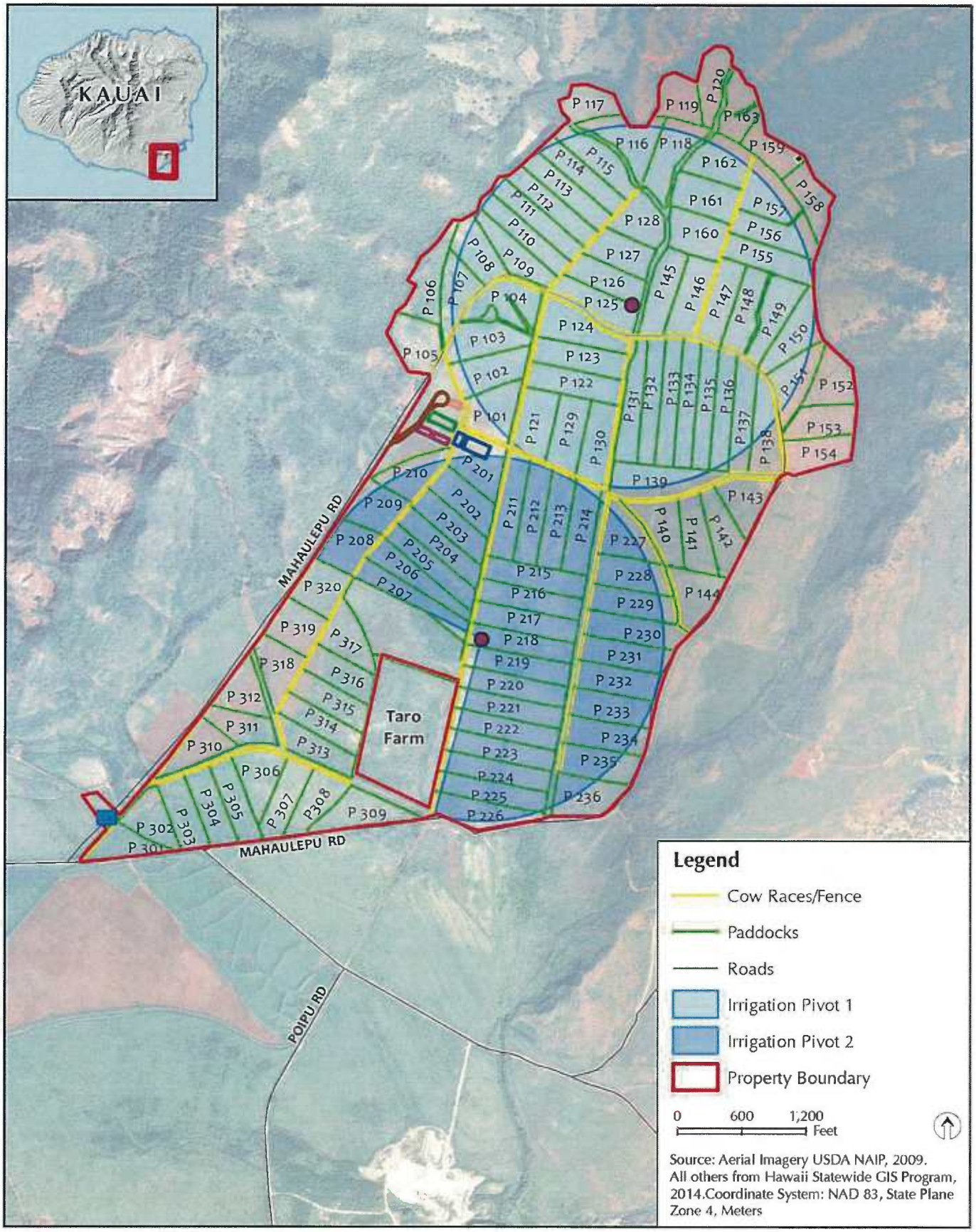


Figure 13 – Center Pivots

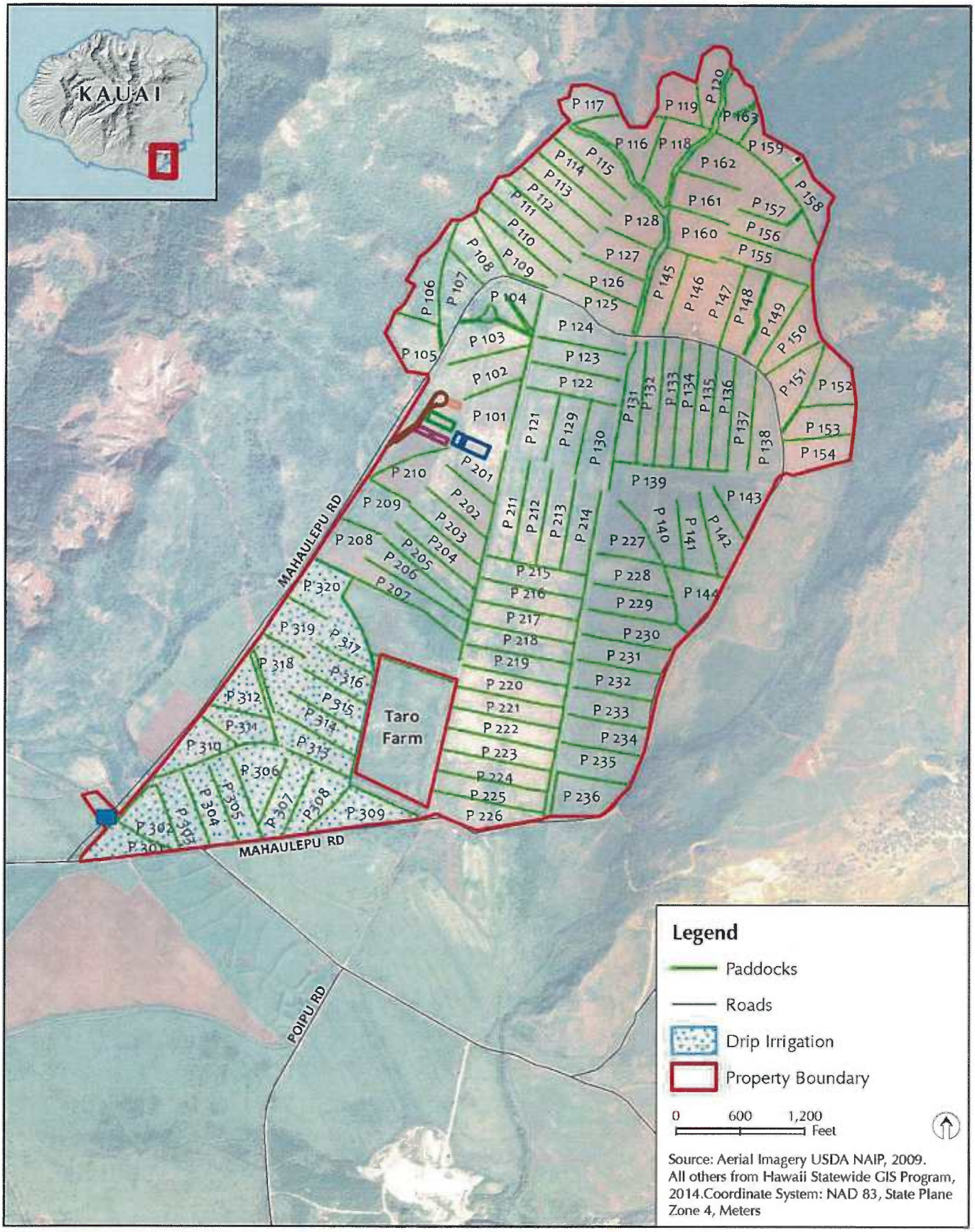


Figure 14 – Drip Irrigation

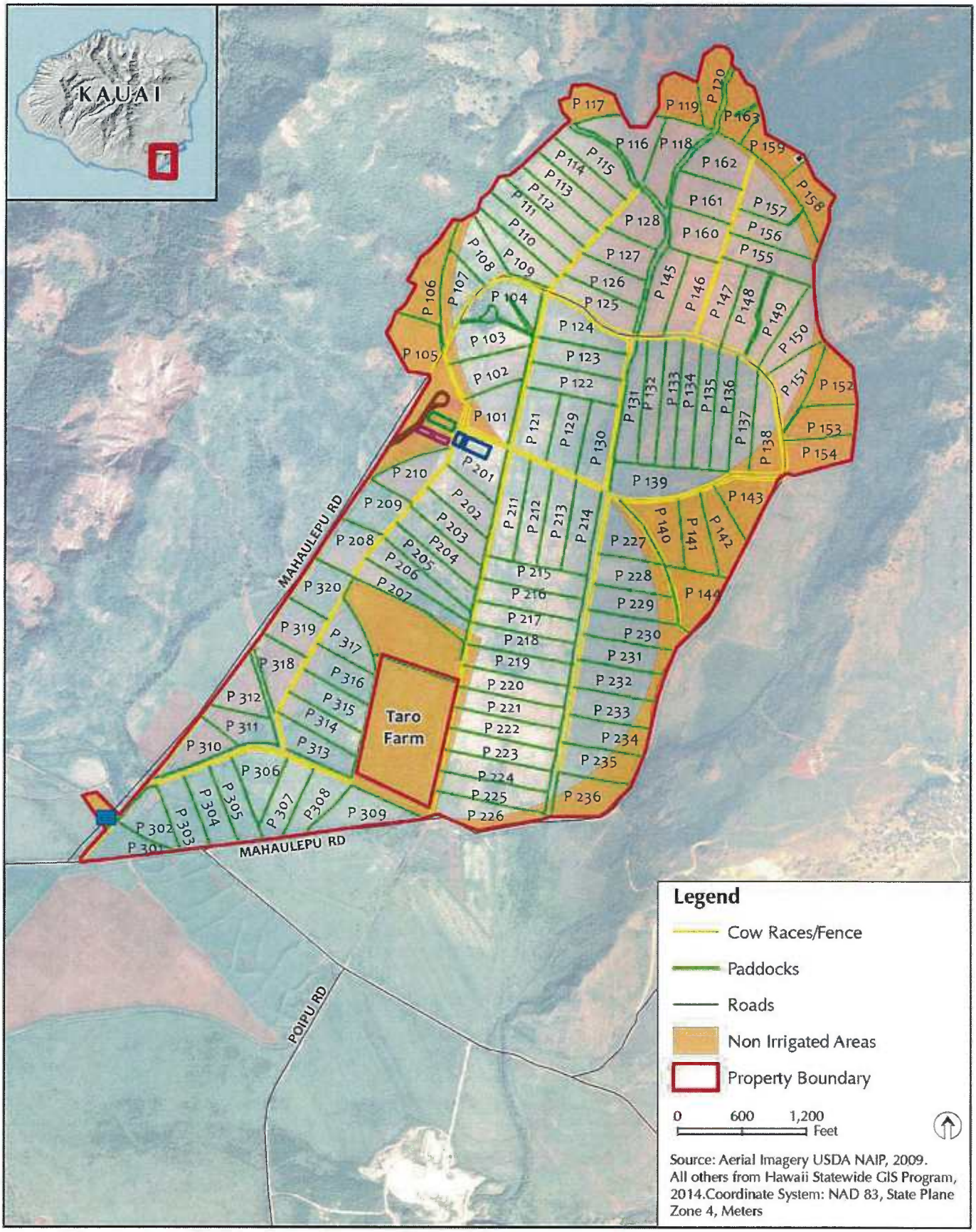


Figure 15 – Non-Irrigated Pasture

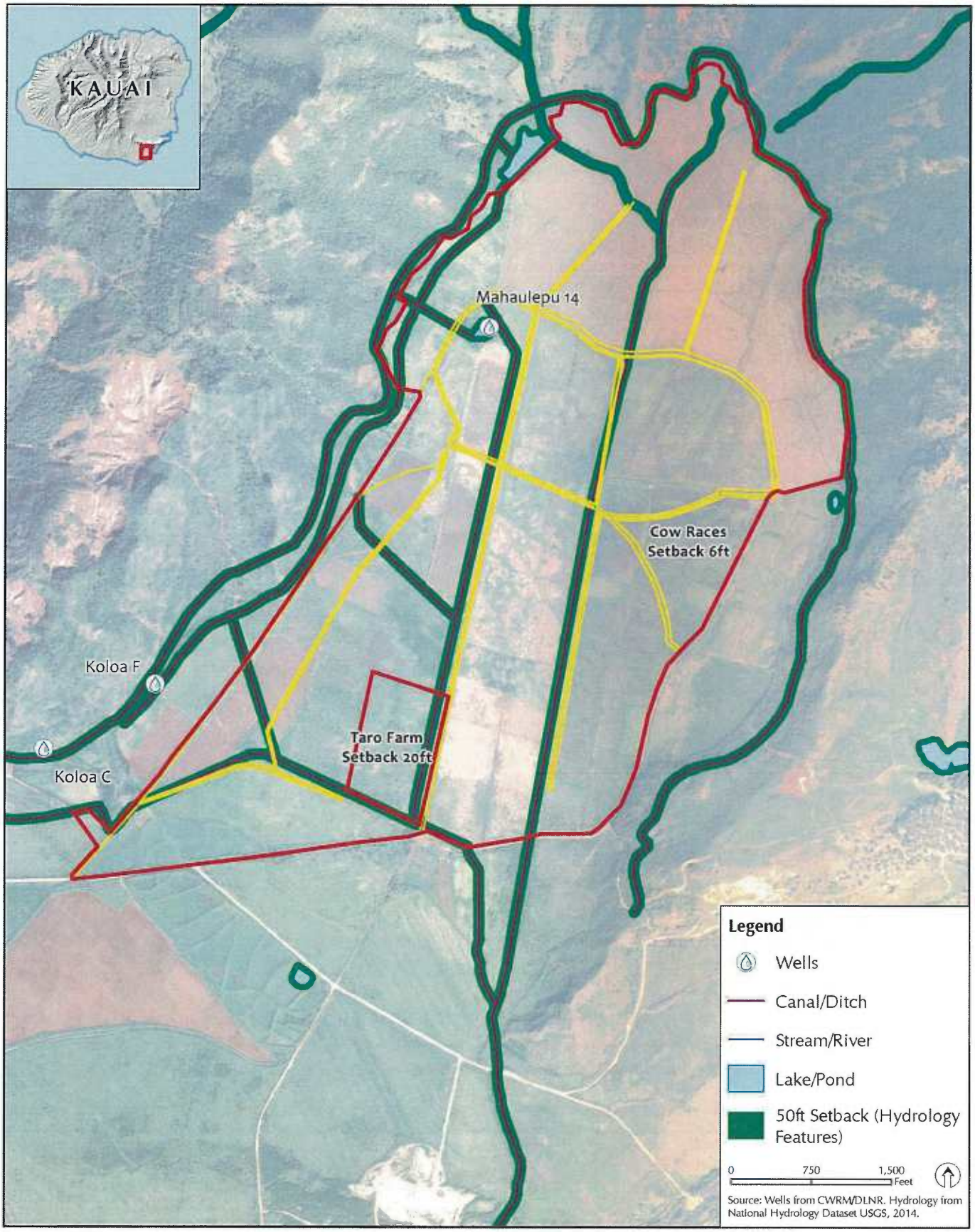


Figure 16 - Irrigation Setback

6.1 Irrigation Schedule

At full irrigation, the pasture will require 2.93 MGD of water per day, to achieve an average application of 6 mm/0.24 inches per acre (over the irrigated area, which includes the areas previously described in Table 9). The actual schedule of irrigation days will depend on the days that it rains. The following discussion and associated tables provide the methodology for determining seasonal irrigation demand and associated number of irrigation days per month.

Table 10 provides the average monthly rainfall and pan evaporation rates which demonstrate a clear deficit in water supply during the spring, summer and fall seasons with only a modest demand for irrigation during the winter season.

Table 10 - Monthly Average Rainfall and Evaporation

Month	Days	Mean Monthly Rainfall (in) UH Rainfall Atlas of Hawai'i 2011 (30 years data)	Evaporation rates per month (in) Weather Station 941-00
January	31	4.88	5.14
February	28	4.2	5.65
March	31	5.04	6.93
April	30	3.66	7.43
May	31	3.05	7.82
June	30	2.86	8.05
July	31	3.13	9.10
August	31	3.2	9.37
September	30	3.25	8.23
October	31	4.96	7.33
November	30	6.01	6.17
December	31	5.71	5.40
Total	365	49.95	86.62

During the wet winter months of November, December and January, the frequency and need of use of the irrigators is significantly lower than other times of the year, but irrigation is still required as there are a number of dry days in those months.

The winter rain pattern is typified by episodic storms followed by several days of no/zero rainfall. Since the fields will need to be irrigated after five days of mostly dry weather, the number of dry days in the winter months was evaluated to gauge irrigation demand. The table below shows the number of days with less than 0.12 inches of rainfall in January, November, and December from 1989-2012.

Table 11 - Dry Days Data (including 0.12 inch (3mm) or less rainfall)

Year/Month	Jan	Nov	Dec
1989	15	18	25
1990	17	16	16
1991	27	14	14
1992	23	18	11
1993	22	14	16
1994	16	21	16
1995	29	16	14
1996	14	9	17
1997	20	19	16
1998	23	16	21
1999	15	17	18
2000	17	14	23
2001	24	20	19
2002	22	18	17
2003	21	16	16
2004	19	17	17
2005	18	18	28
2006	16	16	21
2007	20	21	14
2008	20	19	21
2009	17	14	27
2010	16	17	18
2011	8	21	13
2012	18	14	9
Average Dry Days	19	17	18

We assume irrigation is required approximately every 5 dry days. Therefore, we assume the irrigators will run on average 3 times per month during the wet season (December to February), plus the average difference between rainfall and evaporation. (eg. 4 irrigation days for

November, December and January shown on Table 12). For the other months, we calculate the irrigation days as the differential between the evaporation rate and the mean monthly rainfall divided by the daily demand of 0.24 inches per acre.

Table 12 - Irrigation Days per Month

Month	Number of Irrigation days required at 0.24 inches per day
January	4
February	9
March	8
April	16
May	20
June	22
July	25
August	26
September	21
October	10
November	4
December	4
Total	154

A weather station is already installed on-site, capable of measuring temperature, humidity, rain, wind direction and speed, irradiance and evaporation. Soil moisture meters will also be added to determine the ideal moisture bandwidth for grass growth and support irrigation decisions. It will be sensible to load the soil towards its maximum moisture level before July and August, as little rainfall in these months is possible and during that time the soil could enter into a deficit greater than the rate of available irrigation. It will also be sensible to dry the soil towards its minimum moisture level before November, December and January, as significant rainfall in these months is probable and could cause the soil to exceed capacity from rainfall alone. However, we have modelled the days where it has not rained in these wet months since the irrigators are likely to be needed to run in these dry spells. Furthermore, the evaporation rate will dry the soils if it doesn't rain regularly and affect pasture growth rates after several days without rain.

In addition to the need for irrigation during the dry spell days, the irrigators can run in November, December and January (if no dry spells occur) to distribute only effluent water. In the case of a continuously wet period that keeps soil at capacity, (the longest on 30-year record is 17 days) the irrigators can be programmed to drop effluent water only and at a rate as low as 0.04 inches, and the placement of the effluent water can be targeted to the freest draining soils on the farm. A target zone for an exceptionally wet season application is paddocks 111 - 115, where the Lualualei Clay soil is classified as "well drained" and a raceway (acting as a berm) separates the paddocks from any water ways. The irrigation system will track and plot any such exception placement of effluent and its corresponding nutrient loading. Other "well drained" soil type options are Hanamaulu Silty Clay, Hanamaulu Stony Silty and Pakala Clay Loam.

The upper pivot, irrigation pivot #1 (FC), will irrigate 216 acres under one rotation. It is expected that the upper pivot will do a rotation every 40 hours, applying 0.39 inches/10 mm of water onto 47 paddocks during normal operation.

The bottom pivot, irrigation pivot #2 (PC), will irrigate 162 acres in a similar time period to the upper pivot, but with the addition of a 'fast cycle' for the end of each pass of the pivot. This fast cycle is done at maximum machine speed so that a minimum of water is applied at the end of the run, which reduces the wetness of the ground when the machine reverses direction and then applies a 'normal' amount onto this same area. The whole cycle takes about 40 hours applying 0.39 inches/10 mm water onto 36 paddocks.

Drip Irrigation system will be installed to irrigate 82 acres.

7.0 Wastewater Treatment

The dairy is a pasture-based operation, and livestock spend a limited time in the holding yard and Milking Parlor. Livestock waste and wastewater generated from the dairy facility, including any runoff, will be collected, treated and reused on the farm. Fundamentally, the water treatment system recycles 100% of all wastes with zero point source discharge into State waters. The objectives of the design are:

i. To capture all of the effluent that is produced at the dairy facility
ii. To spread the effluent on the grazing land to meet nutrient demand of the plants/pasture
iii. To control the effluent application rate and spread effluent only on the desired areas within boundaries
iv. To keep effluent completely separate from potable water to prevent contamination
v. To comply with all regulatory requirements under the state and federal laws

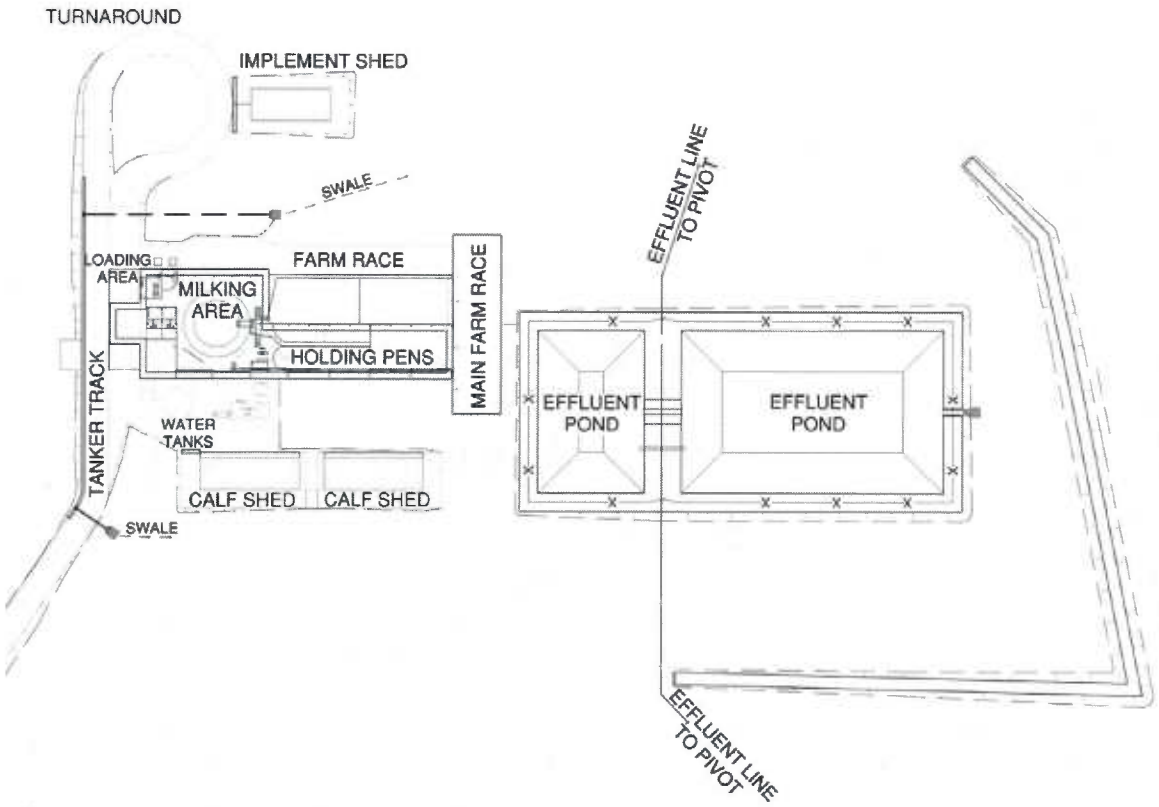


Figure 17 – Dairy Facility Site Plan

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7.1 Effluent/Manure Volume

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All of the manure that is collected from the Milking Parlor and yards is transferred to the settling pond. The settling pond remains full in normal steady state, and any excess liquid overflows into the storage pond through screened overflow pipes. The clear screens are fitted into the overflow pipes and do not allow solids to enter into the storage pond. A stirrer pump is operated two hours per day to break up the solids in the settling pond. The accumulated sludge in the settling pond will be pumped out every 45 days. The minimum settling pond volume will include 45 days of sludge storage plus an appropriate mixing volume of liquid required for stirring and pumping for application to the pastures.

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The minimum required effluent storage volume in the pond shall include the 4 days of effluent required for the typical application schedule and also the additional storage required during periods of rainfall when irrigation application of effluent is not possible. The design effluent storage period includes allowance for the following volumes:

- Effluent volume for 4-day storage period between scheduled irrigation of effluent
- Effluent volume for maximum 17 consecutive rain days based on NOAA rain gauge data, See Table 4 – NOAA Rain Gauge Data
- Effluent volume for 2 days minimum of pasture dry time

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7.2 Effluent Ponds

The effluent ponds will be constructed for effluent collection, management and proper utilization of nutrients available from livestock waste. The pond design is based on a two-step system, which includes a settling pond and storage pond. The settling pond allows for the settlement and accumulation of wastewater sludge with the overflow of liquid effluent entering the storage pond. The ponds will be located outside of wetlands and at a minimum distance of 1,000 feet from public drinking water resources and 50 feet from surface water resources. See Figure 11, Site Plan.

Ponds will have minimal potential impacts from breach of embankment, accidental release, and liner failure. Ponds have been designed to be protected from inundation or damage from a 25-year flood event.

The ponds have the capacity for storage of the following volumes:

- Volume of accumulated sludge for the storage period between sludge removal events
- Volume of manure, wastewater, and other wastes accumulated during the storage period between irrigation application
- Depth of average precipitation for the storage period
- Depth of the 25-year, 24-hour storm precipitation

The pond volume calculations are based on the following assumptions:

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The effluent ponds and concrete holding areas are not covered. All rainfall in these areas, and from any area that could generate contaminated runoff is collected and conveyed to the ponds. Approximately 1.76 acres of area drain to the ponds and are accommodated in the pond sizing

and minimum volume requirements. The areas included are; the calf sheds and concrete gutter, the uncovered holding pens and yards, the uncovered loading areas, and the settling and storage pond areas. The rainfall onto the roofs of the Milking Parlor and implement shed is discharged directly to the pasture areas adjacent to the buildings, and does not enter the effluent system.

7.2.1 Settling Pond

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7.2.2 Storage Pond

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7.2.3 Effluent Pond Design

Ponds will have a minimum of 2-feet bottom elevation above the seasonal high water table. Excavated side slopes will not be steeper than 2 horizontal to 1 vertical. The inlet pipe at the effluent pond will be a concrete pipe with a minimum of 6 inches diameter. A pipe with a minimum diameter of 8 inches will be used for Milking Parlor waste. The pipe terminates a sufficient distance from the shoreline of the pond to ensure good distribution. A cleanout is also provided for removing obstructions. Irrigation intake pipes from the required volume are designed to resist corrosion and plugging. The irrigation system will not automatically pump from the required volume of the pond based on water level. The irrigation system is on a predetermined schedule which can also be manually controlled.

The minimum elevation of the top of the settled embankment shall be 1 foot above the pond's required volume. The combined side slopes of the settled embankment shall not be less than 5

horizontal to 1 vertical, and neither slope shall be steeper than 2 horizontal to 1 vertical unless provisions are made to provide stability.

Safe drawdown of the liquid level in the pond is provided. Embankments and disturbed areas surrounding the pond are treated to control erosion. This includes the inside slopes of the pond as needed to protect the integrity of the liner.

The pond perimeter will be fenced and warning signs posted to prevent children and others from using it for other than its intended purpose. A marker or water level measuring device will be installed in the pond to measure the stored volume and/or storage capacity remaining.

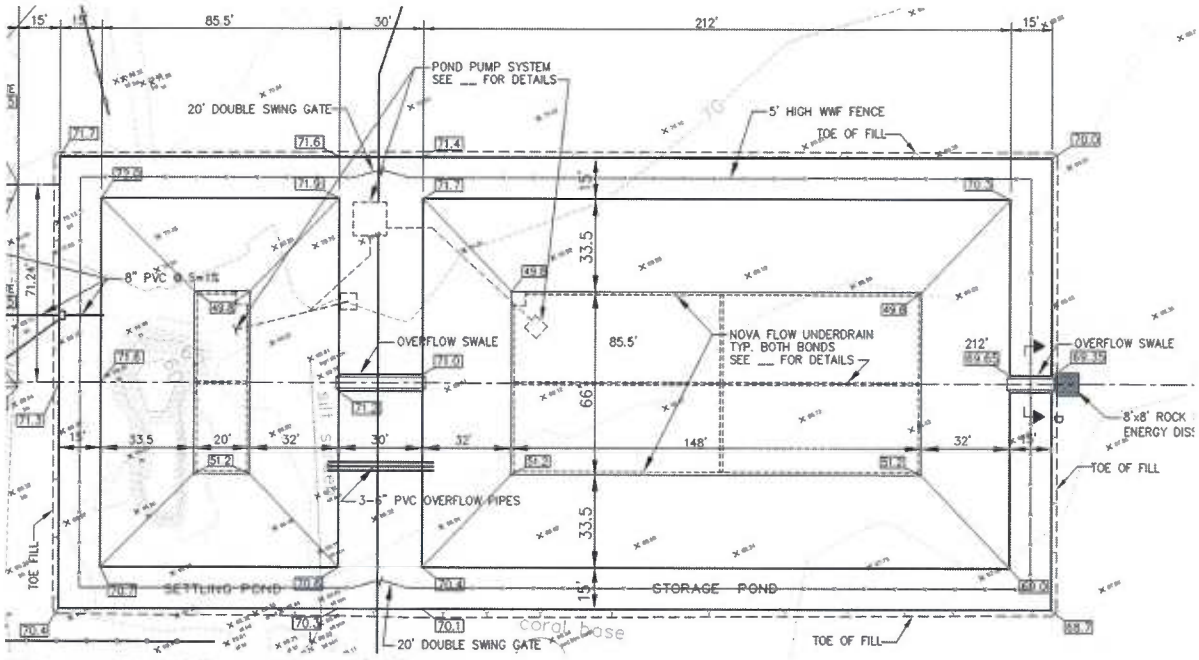

Figure 21 - Effluent Pond Plan

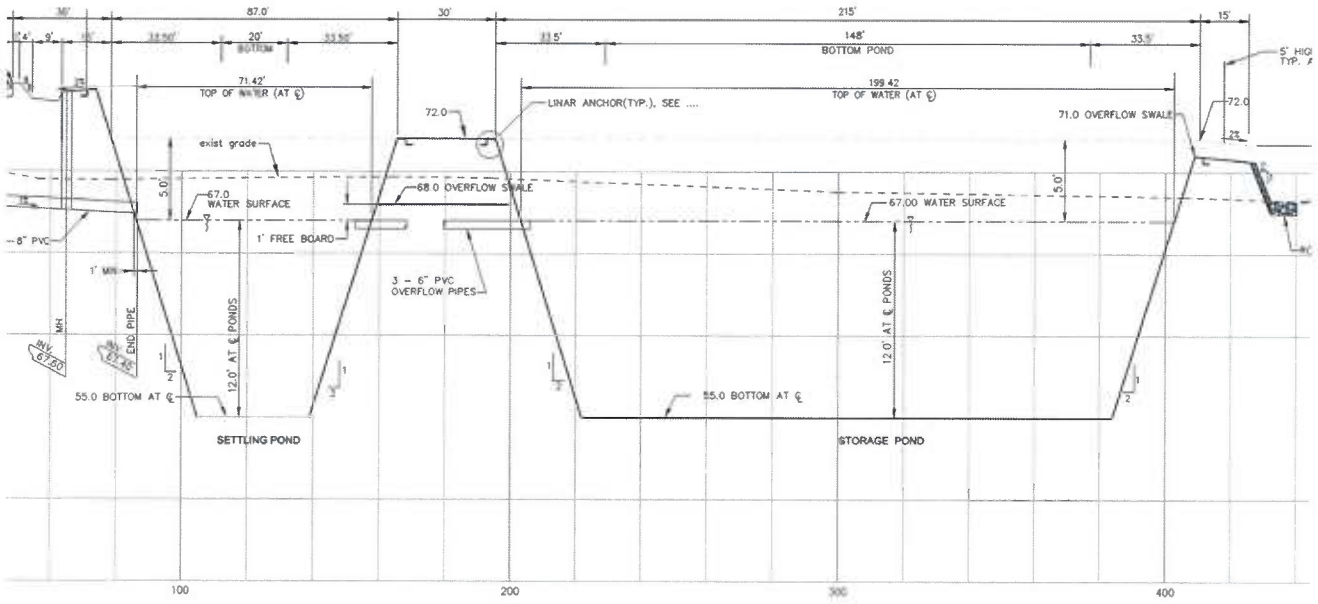

Figure 22 - Effluent Ponds Section

7.2.4 Emergency Spillway

The storage pond will have an emergency spillway that will allow discharge from the pond in the event of a cataclysmic emergency such as a rainfall event greater than the 25-year, 24-hour storm or other natural disaster. A secondary berm will also be constructed downhill of the effluent ponds at the edge of the paddock before the existing drainage way and farm road. Although not required by the guidelines, this secondary containment area will provide a large overflow volume in case of an emergency. The total available volume within the secondary containment area will be roughly equivalent to the total effluent volume over the 30-day storage period.

7.2.5 Effluent Ponds Construction Specifications

The entire pond area will be cleared of all trees, stumps, roots, brush, boulders, sod and debris. Topsoil containing more than 10% organic matter will be removed. All material cleared from the area will be disposed of at sites away from the work area, in accordance to state and county laws.

To establish vegetation, the topsoil and sod will be stockpiled and spread on the completed pond. Foundation surfaces will be sloped no steeper than 1:1. The foundation area will be stripped of all loose material, and thoroughly scarified before placement of the first layer of fill material.

The foundation surface will have moisture added and be compacted prior to fill placement. Required excavations will be cut to the lines and grades shown on the drawings.

Excavated materials could be used to construct the embankment. The material placed in the fill should be free of sod, roots, and stones over 3 inches in diameter. All fill material is obtained from required excavations and designated borrow areas.

Fill will be placed once required excavation and foundation preparation have been completed and the foundation has been inspected and approved. The foundation surface should be scarified and loosened to a depth of not less than 2 inches (51 mm) before placement of the first layer of fill. If the surface of any layer becomes too hard and smooth for proper bond with the succeeding layer, it shall be scarified parallel to the axis of the fill to a depth of not less than 2 inches (51 mm) before the next layer is placed.

The placing and spreading of fill material is started at the lowest point of the foundation. The fill should be brought up in horizontal layers of a maximum thickness as shown in the Compaction section below.

The fill will be constructed in continuous horizontal layers except where openings or sectionalized fills are required. The bonding surface will be treated the same as that specified for the foundation so as to insure a good bond with the new fill.

Embankments shall be constructed in continuous horizontal layers. The distribution and gradation of materials shall be such that no lenses, pockets, streaks, or layers of material differ substantially in texture or gradation from the surrounding material. The complete work will conform to the lines, grades and elevations shown on the drawings or as staked in the field.

Selected backfill material is placed around structures and pipe conduits at about the same rate on all sides of prevent damage from unequal loading. Fill placed around structures will be brought up at approximately uniform height, not to exceed a difference in elevation of 8 inches, on all sides of the structure.

The moisture content of the foundation and fill material should be such that the required compaction can be obtained. The moisture content is as uniform as feasible throughout each

layer. The proper moisture content for compaction will be determined by inspection during the placement operation.

The material should maintain a ball shape when squeezed in the hand.

Construction equipment is operated over the areas of each layer of fill to ensure the required compaction. Fill, adjacent to structures and pipe conduits, shall be compacted to a density equivalent to that of the surrounding fill by means of hand tamping, manually directed power tampers, or plate vibrators. Heavy equipment should not be operated within two feet of any structure.

Hand directed tampers or compactors are used on areas not accessible to heavy compaction equipment, and within 2 feet of any structure. Fills compacted in this manner will be placed in layers not greater than 4 inches in thickness before compaction, and shall meet the same density requirement as for the adjacent area.

Fill not meeting the specified requirements should be reworked or removed and replaced with acceptable fill. Compacting of fill adjacent to structures should not be started until 7 days have elapsed since the placement of the concrete. Once the backfill operations have been completed, the surface area shall be graded to convey any surface runoff away from the structure.

A hazard warning sign will be posted and fence will be constructed around the facility to prevent unwanted entry. Refer to NRCS Waste Storage Structure Practice Code 319 and Practice Code 359 Waste Treatment Lagoon.

7.2.5.1 Pond Sealing, Lining and Flexible Membrane

Pond lining will be installed to control seepage of contamination from waste impoundment structure for water conservation and environmental protection. All inlets, outlets, ramps, and other appurtenances will be installed in a manner that does not damage or impair the proper operation of the liner. To ensure human and livestock safety, warning signs, fences and ladders/ropes will be installed. Manufacturer recommendations will be followed with regard to protection from weather and exposure.

Lining material for ponds will be High Density Polyethylene (HDPE) geomembrane that has 6.5 mm thickness cover (1.5 mm HDPE + 5 mm Bidim). The maximum size of soil cover material will be 3/8-in unless the liner is cushioned by an 8-ounce or greater needle punched, non-woven geotextile padding material. Cover materials will be stable against slippage down the slope under all operational and exposure conditions.

The subgrade will be smooth with no sharp corners or angular stones to avoid damaging the liner or adversely affecting its function. No sharp objects shall protrude through subgrade material. Subgrade material shall be formed with no loose material on or around embankments or floor. Pond construction should have a good Maximum Dry Density (MDD). All surfaces will be of smooth finish.

The area to be lined will be drained and allowed to dry until the surface is firm and will support the men and equipment that must travel over it during installation of the lining. The foundation area for flexible membrane linings shall be smooth and free of projections that might damage the lining. Stumps and roots will be removed. Rocks, hard clods, and other such material will be removed, or rolled so as to provide a smooth surface. No sharp or hard objects larger than 3/8 inches in diameter will allowed in the top 1-inch of the surface to be covered. The surface should provide a firm, unyielding foundation for the membrane. If the subgrade is coarse-textured and open after preparing and compacting, or in rocky soils, geotextile or a 2-inch cushion layer of sand or fine grained soil such as silty clay or silt will be applied.

All lining material should be free of damage or defect. Membranes will be carefully spread over the subgrade so they lie in a relaxed state. Polyethylene film requires about 5% slack for satisfactory results. Backfill in anchor trench will be compacted to a density equivalent to that of the surrounding area. All field splices will be made in accordance with the manufacturer's recommended technique, using materials furnished for the purpose. The joints will be watertight and maintain their integrity through the expected life of the lining.

The maximum particle size of soil cover material will be 3/8-inch unless the liner is cushioned by an 8-ounce or greater needle punched, non-woven geotextile padding material. The cover shall be placed to the specified depth without damage to the membrane.

The liner installation will be complete with product panel placement, seam placement and test results. As the liner is fabricated on site the information is documented post install.

A standard Quality Assurance (QA) is completed post installation. This QA includes:

- Material type/size/date deployed and roll number
- Technician details
- Subgrade material acceptance
- Trial weld log including shear/peel testing and machine settings
- Panel placement log including pipe boots/attachments/appurtenances
- Non-destructive testing reports (seam tested welds)
- Repair report logged in diagram also in panel log
- Completion certificate
- Warranty certificate, refer to NRCS Practice Code 521 A Pond Sealing or Lining, Flexible Membrane

7.3 Effluent Application

Effluent water will be applied through either center pivot, providing a total application area of 378 acres (this area excludes the cow lanes and a 50-ft. setback from drains/watercourses). Although it is possible to apply effluent through both machines at the same time, it is much simpler from a management and control perspective to only apply through one machine at a time – the other machine will either be applying straight irrigation water or not operating. The best time to apply the effluent water is just after the cows have finished grazing, allowing 17 days for the grass to utilize the nutrients before the cows next enter the paddock.

The design allows both pivots to do a rotation every 40 hours. The maximum flow rate from the pump injecting the effluent from the storage pond is 320 gallons per minute (gpm), which is 30% of the total flow capacity of the nozzle package fitted to either centre pivot. Based on the 40-hour cycle mentioned above, this calculates as 0.3x10 mm = 3 mm or 0.12 in. of effluent in an application. There is room to cut back the amount of effluent applied, however 0.12 in. is considered a low figure and even twice this amount at 0.25 in. won't be excessive if the soil moisture levels allow.

Soil moisture will determine the total amount of water and effluent to be applied in an application, with the deficit below field capacity determining the amount that can be applied

(provided that there isn't any rain forecast for the application period). The worst draining soil types will have soil moisture tapes installed to allow real-time monitoring of soil moisture.

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Nonetheless, if a cataclysmic storm was forecast, the time to completely empty the storage pond, if it were full, is around 96 hours. If warranted due to potential impact from the approaching storm event, the settling pond could also be pumped empty within an additional 40 hours. If the forecasted storm is forecast six days prior, then virtually no effluent would remain in storage when the storm arrives. Refer to NRCS Practice Code Standards 430 Irrigation Pipeline, 442 Irrigation System, Sprinkler, 449 Irrigation Water Management.

7.4 De-sludging

The first of the effluent ponds is for the settling of solids. It will normally be full of effluent with the solids content having settled to the bottom, and the liquid component will then flow from the top of this pond into the second pond which is for storage (i.e. the storage pond).

Solids (mostly soft organic matter, but also some sand and mud, etc.) will be applied on a designated area after every 5 weeks (within 45 days), and it will be applied through a 'gun type' application system to areas outside the liquid effluent application.

The solids in the pond are brought into suspension through stirring the pond and then this liquid, along with the suspended solids, is pumped through a 4-inch underground pipe to a number of hydrants which have a 'gun sprinkler' with a 5/8-inch nozzle attached via a length of flexible hose. The guns (and their 65 foot radius of spray area) will be moved around the paddocks after a period of running (2 hours) so that the solids become evenly spread. The application rate is 9mm/hr. Each time solids are applied, the guns will be run for 3 hours. The nutrients within this 3 hour application will be absorbed by the pasture within approximately 3.3 days. Refer to the Appendix A, NRCS Nutrient Management 590 Forms.

The flow from the solids pump will depend on how many guns are being run at the same time. However, in normal circumstances there will be two guns running and the pump will be pumping 158 gpm. At this rate it will take a total of 40 to 50 hours to nearly empty the settling pond depending on the amount of mixing volume.

8.0 Nutrient Management

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8.1 Historical Background

The historical use of the land has been for sugar cane production, terminated in the late 1980s, and after that time, for a beef cattle operation. The historical uses of the farm have left the soils depleted of the essential nutrients required for crop growth. A well-managed pasture-based dairy focused on the application of nutrients will be a benefit to the existing soil structure and composition.

8.2 Pasture-Based Dairy

The pasture-based system enables the dairy cows to spend 22 hours in the paddocks, where a corresponding proportion of their excreted manure will be discharged directly onto the paddocks. The dominant grass is Kikuyu; (Pennisetum clandestinum) a high yielding C4, that (when properly fertilized) will yield more than 20 metric tons (mt) per acre. The perennial grasses can be classified as either C3 or C4 plants. These terms refer to the different pathways that plants use to capture carbon dioxide during photosynthesis. All species have the more primitive C3 pathway, but the additional C4 pathway evolved in species in the wet and dry tropics. These differences are important because the two pathways are also associated with different growth requirements. C3 plants are adapted to cool season establishment and growth in either wet or dry environments. On the other hand, C4 plants are more adapted to warm or

hot seasonal conditions under moist or dry environments. Some C4 grasses are known to produce more than 35 tons of dry matter per acre per year.

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Figure 23 – Nutrient Management Map

Site specific soil moisture will be monitored, in real time, to ensure irrigation water, liquid effluent and cattle are not applied to soils when conditions are suboptimal. HDF will ensure that soils conditions can support Kikuyu growth and are not wet enough to potentially cause pugging (penetration of cow hoofs into the soil), even through the thatch.

The Kikuyu is extremely effective in the tropics and adds significant protection to soils in terms of creating a tight organic thatch, which also reduces hoof compaction via the thatch. Some of the current issues with soil compaction are related directly to the disturbance in the soil structure caused by machine cultivation. Once the Kikuyu thatch is established, the soil itself is not disturbed by cultivation; the thatch will be exposed to grazing pressure and annual mulch.

As the cattle excrete on the Kikuyu thatch, it is incorporated into what is effectively an organic net. Due to the high moisture and moderate temperatures, the microbial activity in the thatch is

very high and the effluent will be largely broken down by microbial activity within 24 hours.

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The project has budgeted 20 metric tons (mt) of dry matter production of Kikuyu per acre. The average local temperature is in the ideal 43 and 70°F range for Kikuyu. Kikuyu yield ranges between 4 mt unfertilized and 20 mt DM/acre/year depending on levels of N fertilization. Kikuyu's response to fertilization is very good and linear combined with irrigation, anticipated growth rates in Maha'ulepu are estimated be some of the best in the world.

The current key hubs of Kikuyu-based dairy farms are Northland of New Zealand, Australia's Hunter Valley and in the Eastern Cape of South Africa (George and Knysnal) where current farmers consistently achieve greater than 20 mt of dry matter production of Kikuyu per acre in the temperature ranges that best match those available in Hawai'i all year round.

Author	**Quoted Metric Tons of Dry Matter per Acre per Year**	**Notes**
Taylor et al (1976)	36.204	Irrigated Kaitaia NZ
Rojas (1999)	20.240	Costa Rica
Murtagh (1988)	34.580	CSIRO Australia

Local Hawai'i data is available for Kikuyu and similar C4 grasses:

Author	Quoted Metric Tons Dry Matter per Acre per Year	Notes
Fukumoto, Lee (2003)	13.450	Unfertilized
Roche (2010)	20.100	Peak Fertilized

The farm will be equipped with state-of-the-art technology, called Ag Hub, to ensure management systems and operational uses achieve optimal growth and environmental sustainability. Ag Hub technology will be deployed at HDF to ensure proper application rates and timing of all irrigation events. Ag Hub is a modular online farm management system that collects and displays automated irrigation data. Ag Hub data capture devices and soil tapes

will provide electronic and GIS mapped proof of placement of nutrients and real time monitoring.

Figure 24 - Example Nutrient Placement Map (Not HDF)

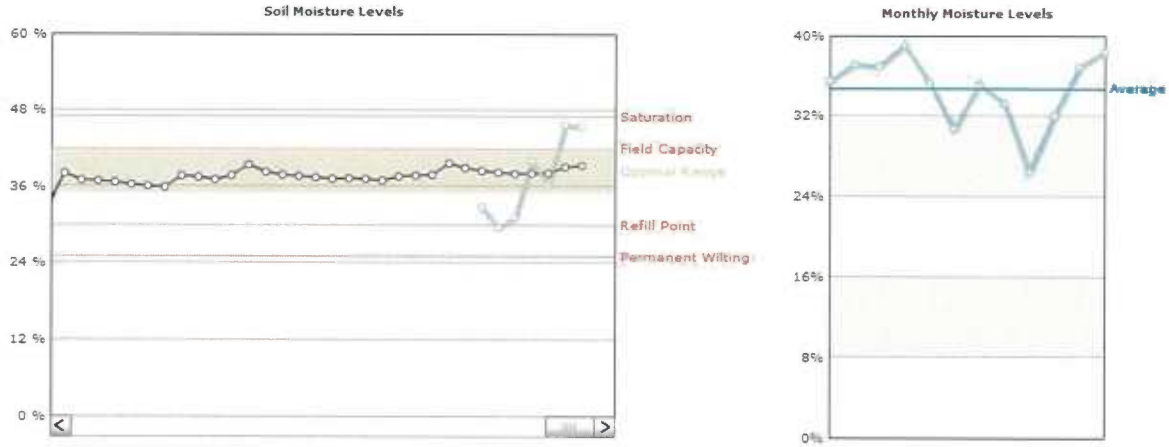

Figure 25 - Example of Field Capacity Monitoring

Animal waste (manure) is applied to the pastures that have a significant deficit from the total grass nutrient requirement. The deficit between grass nutrient requirements and nutrients from cattle effluent, produced either in the paddock or the recovered from the milking platform, will be balanced with supplemental fertilizer. To simplify the management of the recovered cattle effluent, solids from de-sludging the settling pond are only applied to areas outside the pivots in Block H & J. The blocks under the pivot will technically be able to receive water and effluent

water in different application rates to reflect how the soil is responding and grass is growing, i.e. using or not using the water and or nutrients. The nutrient residue or deficit is reflected in the on-going individual soil test data from those blocks, which will be used to refine applications over time to identify where the nutrients are imported and/or recovered. Given the current degraded state of the soils, HDF should add more nutrients and rebuild the soils to normal levels over the coming years.

Manure will be utilized in a manner to avoid any contamination of surface and ground water supplies and records of the use of wastes will be kept for a minimum of five years. The manure will be sampled and analyzed at least once each year to identify nutrient and specification concentrations. Manure application rates will be consistent with legal requirements. The application rate will not exceed the infiltration rate of the soil, and the amount of waste applied will not exceed the moisture holding capacity of the soil profile at the time of application.

8.3 Soils Analysis

The NRCS soils classifications and descriptions provide a good base layer of information to use for nutrient budgeting. However, additional soil testing is required to determine soil nutrient levels to be used in the nutrient budget analysis. Soil samples have been analyzed for pH, phosphorus, nitrogen, potassium, calcium, magnesium, organic matter, salinity, micronutrients and other constituents.

The farm has approximately 521 acres in pasture, which is divided up into 119 total paddocks of about 4- to 5-acres in size. Soil sample grabs were taken at 5 to 10 locations within each paddock and combined into one representative sample per paddock. Soil samples from approximately 5 paddocks were aggregated into Conservation Management Units (CMUs) based on the underlying NRCS soils classification. See Figure 26 – Conservation Map Units. The baseline test results will be used for design and subsequent sampling will occur during operation to monitor nutrient levels so the nutrient budgets can be adjusted during operation. Samples have been tested by Spectrum Analytical and test results are shown in Table 15.

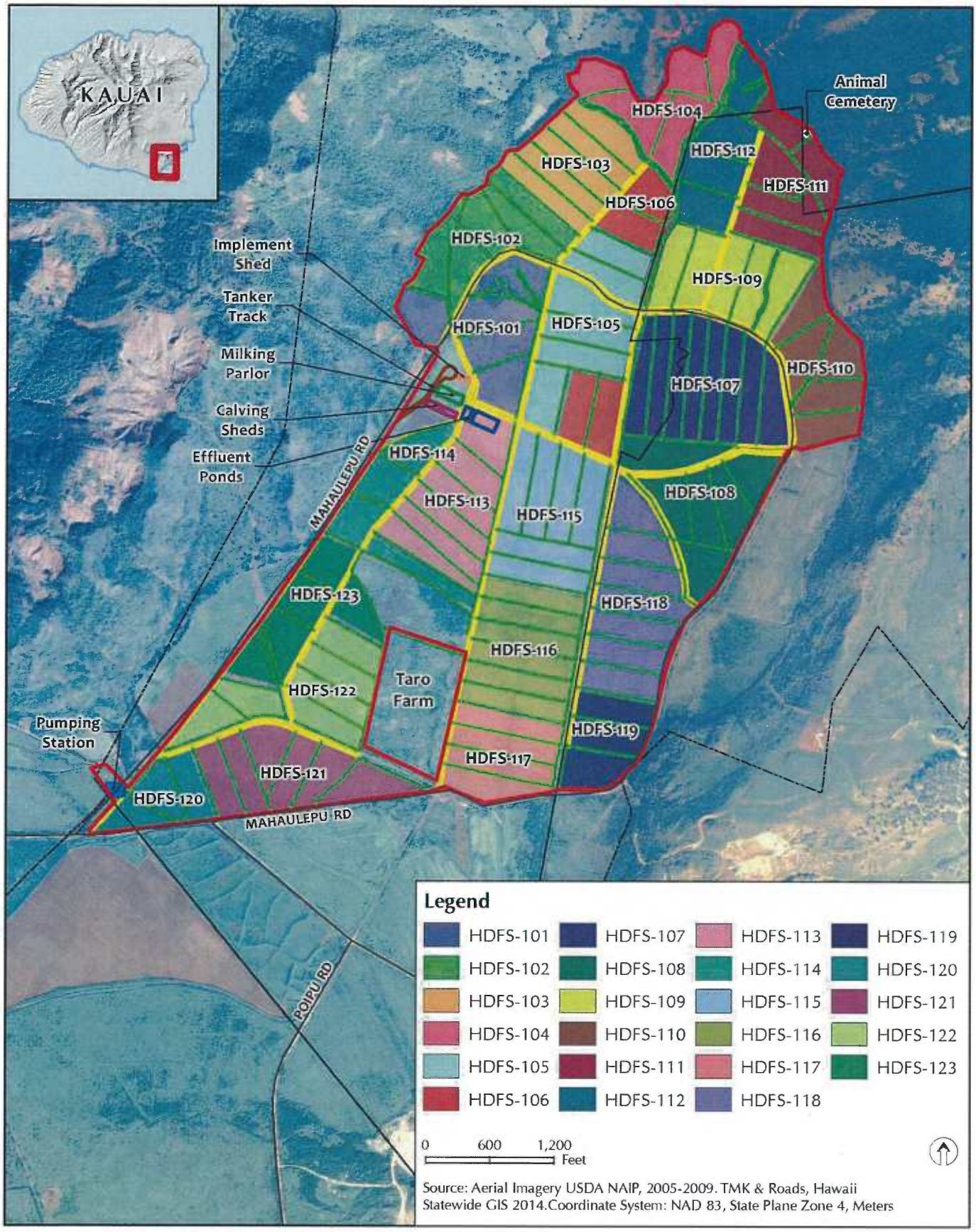

Figure 26 – Conservation Management Unit Map

The Conservation Management Units (CMUs) and related paddocks and NRCS soil types are summarized in the table below.

Table 14 - Conservation Management Units (CMUs)

Paddock Number	Conservation Management Units (CMU)	NRCS Soil Type
101	HDFS-101	KavB, Ke
102		KavB, Ke
103		KavB, Ke
104		KavB
105		KdF, HsD
106	HDFS-102	KavC, KdF
107		LuB, KavC, KavB
108		HsD, KavC , KavB
109		HsD, KavC , KavB
110		HsD, KavC , KavB
111	HDFS-103	KavB, LuB
112		LuB
113		LuB
114		LuB
115		Lub
116	HDFS-104	LuB, HsD
117		LuB, HsD
118		LuB, HsD
119		LuB, HsD
120		LuB, HsD
121	HDFS-105	Ke, KavB
122		KavB
123		KavB
124		KavB
125		KavB
126		KavB
127	HDFS-106	KavB, LuB
128		KavB, LuB
129		KavB, Ke
130		KavB, Ke
131	HDFS-107	KavB, Ke
132		KavB, Ke
133		KavB, Ke
134		KavB, Ke
135		KavB, Ke
136		KavB, Ke
137		KavB, Ke
138		KavB, Ke
139	HDFS-108	KavB
140		KavB
141		KavB
142		KavB
143		KavB
144		KavB
145	HDFS-109	KavB
146		KavB
147		KavB
148		KavB
149		KavB
150	HDFS-110	KavB, Hsd
151		KavB, KavC, Hsd
152		KavC
153		KavB, KavC
154		KavB, KavC
155	HDFS-111	LuB
156		LuB
157		LuB, KavC
158		KavC
159		Kavc

Table 14 – Conservation Management Units (CMUs) (continued)

Paddock Number	Conservation Management Units (CMU)	NRCS Soil Type
160	HDFS-112	KavB
161		KavB, LuB
162		KavB, LuB
163		Lub, KavC
201	HDFS-113	Ke
202		Ke, PdA
203		Ke, PdA, PdC
204		Ke, PdA, PdC
205		Ke, PdA
206		Ke, PdA
207	HDFS-114	Ke, PdA, PdC
208		PdA, PdC, KefH
209		PdA, PdC, KefH,
210		PdC
211	HDFS-115	Ke
212		Ke
213		Ke
214		Ke
215		Ke
216		Ke
217	HDFS-116	Ke
218		Ke
219		Ke
220		Ke
221		Ke
222		Ke
223	HDFS-117	Ke
224		Ke
225		Ke
226		Ke

Paddock Number	Conservation Management Units (CMU)	NRCS Soil Type
227	HDFS-118	Ke, KavB
228		Ke, KavB
229		Ke, KavB
230		Ke, KavB
231		Ke, KavB
232		Ke, KavB
233		Ke, KavB
234	HDFS-119	Ke
235		Ke
236		Ke
301	HDFS-120	LuB, Ws
302		Lub, Ws
303		Lub, Ws
304	HDFS-121	Ws
305		Ws
306		Ws
307		Ws
308		Ws
309		Ws
310	HDFS-122	PdC, PdA
311		Pdc, Pda
313		Pdc, Pda
314		Pdc, Pda
315		Pdc, Pda
316		Pdc, Pda
312	HDFS-123	Pdc
317		Pdc
318		Pdc
319		Pdc
320		Pdc

Table 15 - Spectrum Analytic – Soils Test Results

Spectrum Analytic
1087 Jamison Road NW
Washington Court House, OH 43160-8748
www.spectrumanalytic.com

Report To	Prepared For		
HAWAII DAIRY FARM LLC 3083 AKAHI ST STE 301 LIHUE, HI 96766	HAWAII DAIRY FARM LLC	Sampled Tested	04-04-2014 04-09-2014

Sample Number	Lab Number	pH: Soil pH	pH: Buffer pH	Organic Matter %	Available Phosphorus P	Available Potassium K	Available Magnesium Mg	Available Calcium Ca	CEC	Base Saturation: K %	Mg %	Ca %	Mehlich-3 P/M and Rating: Sulfur S	Boron B	Zinc Zn	Iron Fe	Copper Cu	Manganese Mn	Aluminum Al
HDFS 101	D21097	6.1	6.6	5.2	19 L	108 M	1127 V	1459 M	18.8	1.2	44.0	29.2	16 M	0.6L	5.5 G	152 V	5.5 G	155 H	
HDFS 102	D21098	6.3	6.6	6.3	7 L	128 M	920 V	1466 M	17.3	1.6	39.0	31.7	8 L	0.5L	2.7 M	124 V	5.1 G	139 G	
HDFS 103	D21099	6.1	6.5	5.1	16 L	132 M	975 V	1259 M	18.2	1.6	39.4	26.0	6 L	0.4L	3.3 M	129 V	4.9 G	85 G	
HDFS 104	D21100	5.6	6.4	6.4	5 L	118 M	568 V	718 L	14.3	1.8	29.1	18.8	22 G	0.4L	1.8 M	95 H	3.9 G	142 H	
HDFS 105	D21101	6.4	6.7	6.9	10 L	215 G	962 V	1128 M	15.3	3.0	46.0	27.6	10 M	0.5L	5.8 G	126 V	5.0 G	182 H	
HDFS 106	D21102	6.9	6.9	6.2	9 L	162 M	1016 V	2338 M	19.4	1.8	38.4	45.2	9 L	0.7L	3.0 M	143 V	5.8 G	110 G	
HDFS 107	D21103	6.6	6.9	5.1	6 L	110 M	797 V	3186 G	22.5	1.1	25.9	53.0	28 G	0.6L	3.6 M	104 V	7.0 G	125 G	
HDFS 108	D21104	7.4		5.1	6 L	113 M	988 V	6078 V	22.5	1.1	32.2	66.7	16 M	0.9M	3.1 M	89 H	5.4 G	131 G	
HDFS 109	D21105	5.8	6.3	6.2	5 L	91 L	836 V	1964 M	22.1	0.9	27.8	33.3	9 L	0.4L	4.7 G	112 V	5.8 G	133 H	
HDFS 110	D21106	6.5	6.6	4.6	14 L	147 M	1332 V	1426 M	19.8	1.6	49.5	27.1	8 L	0.5L	3.7 M	156 V	4.5 G	108 G	

*P, K, Mg and Ca are extracted by Mehlich-3 (ICP) and are reported in ppm

Sample Number	Lab Number	Year	Crop	Yield Goal	Acres	Nutrient recommendations expressed in broadcast rates of lbs/A except where noted: CaCO3** Lime	N	P2O5	K2O	Mg	S	B	Cu	Fe Foliar	Mn Foliar	Zn
HDFS 101	D21097	14	Kikuyugrass	0		826 C	176	134	193	0	5	0.25	0	0	0	0
HDFS 102	D21098	14	Kikuyugrass	0		0	176	176	182	0	8	0.50	0	0	0	2
HDFS 103	D21099	14	Kikuyugrass	0		968 C	176	148	181	0	10	0.50	0	0	0	2
HDFS 104	D21100	14	Kikuyugrass	0		2444 C	176	176	182	0	3	0.50	0	0	0	3
HDFS 105	D21101	14	Kikuyugrass	0		0	176	176	100	0	6	0.50	0	0	0	0
HDFS 106	D21102	14	Kikuyugrass	0		0	176	176	164	0	7	0.25	0	0	0	2
HDFS 107	D21103	14	Kikuyugrass	0		0	176	176	195	0	0	0.25	0	0	0	2
HDFS 108	D21104	14	Kikuyugrass	0		0	176	176	194	0	5	0.50	0	0	0	3
HDFS 109	D21105	14	Kikuyugrass	0		2286 C	176	176	203	0	7	0.50	0	0	0	0
HDFS 110	D21106	14	Kikuyugrass	0		0	176	155	177	0	9	0.50	0	0	0	2

**Lime expressed in 100% pure CaCO3. Adjust accordingly. D = Dolomitic Lime. C = Calcitic Lime.

Kikuyugrass: Split apply fertilizer to best match grass growth and nutrient demand. Monitor and adjust nutrient program with annual plant analysis.
D21102 (Kikuyugrass): Apply 40 lbs/A Calcium from gypsum and/or fertilizer sources.
D21106 (Kikuyugrass): Apply 226 lbs/A Calcium from gypsum and/or fertilizer sources.

Spectrum Analytic
1087 Jamison Road NW
Washington Court House, OH 43160-8748
www.spectrumanalytic.com

Report To	Prepared For		
HAWAII DAIRY FARM LLC 3083 AKAHI ST STE 301 LIHUE, HI 96766	HAWAII DAIRY FARM LLC	Sampled Tested	04-04-2014 04-09-2014

Sample Number	Lab Number	pH: Soil pH	pH: Buffer pH	Organic Matter %	Available Phosphorus P	Available Potassium K	Available Magnesium Mg	Available Calcium Ca	CEC	Base Saturation: K %	Mg %	Ca %	Mehlich-3 P/M and Rating: Sulfur S	Boron B	Zinc Zn	Iron Fe	Copper Cu	Manganese Mn	Aluminum Al
HDFS 111	D21107	6.2	6.6	5.0	5 L	84 L	942 V	1121 M	16.1	1.1	42.9	26.1	5 L	0.4L	2.3 M	135 V	4.3 G	84 G	
HDFS 112	D21108	6.4	6.6	6.6	4 L	84 L	880 V	1027 M	15.3	1.2	42.2	25.2	6 L	0.4L	2.6 M	137 V	4.6 G	130 G	
HDFS 113	D21109	7.3		3.3	9 L	322 H	699 V	4128 H	20.8	3.3	24.6	72.0	18 M	0.8M	1.5 L	119 V	3.1 G	113 G	
HDFS 114	D21110	6.6	7.0	4.3	13 L	265 G	727 V	3586 G	24.2	2.4	22.0	55.6	41 H	0.6L	1.9 M	113 V	3.0 G	97 G	
HDFS 115	D21111	7.9		5.0	21 M	144 M	1070 V	5960 V	23.2	1.3	33.9	64.8	24 G	1.1M	3.1 M	111 V	4.5 G	96 M	
HDFS 116	D21112	7.6		4.2	9 L	114 M	1219 V	4370 G	24.2	1.0	37.0	62.0	18 M	0.9M	1.9 M	143 V	3.8 G	105 G	
HDFS 117	D21113	6.3	6.8	4.3	4 L	51 L	409 V	657 M	8.0	1.4	37.6	30.9	10 M	0.5L	1.2 L	145 V	2.2 G	67 G	
HDFS 118	D21114	8.0		3.6	13 L	114 M	875 V	7138 V	21.7	1.1	29.6	69.2	25 G	1.1M	2.3 M	77 H	3.6 M	107 G	
HDFS 119	D21115	8.0		4.2	42 G	210 M	1137 V	7951 V	23.8	1.9	35.0	63.1	32 G	1.6M	2.6 M	84 H	3.6 L	82 M	
HDFS 120	D21116	6.4	6.6	7.6	6 L	380 V	368 H	734 M	11.1	7.4	24.4	24.9	9 L	0.5L	1.9 M	99 H	4.3 G	52 G	

*P, K, Mg and Ca are extracted by Mehlich-3 (ICP) and are reported in ppm

Sample Number	Lab Number	Year	Crop	Yield Goal	Acres	Nutrient recommendations expressed in broadcast rates of lbs/A except where noted: CaCO3** Lime	N	P2O5	K2O	Mg	S	B	Cu	Fe Foliar	Mn Foliar	Zn
HDFS 111	D21107	14	Kikuyugrass	0		431 C	176	176	201	0	10	0.50	0	0	0	3
HDFS 112	D21108	14	Kikuyugrass	0		0	176	176	201	0	8	0.50	0	0	0	2
HDFS 113	D21109	14	Kikuyugrass	0		0	176	176	43	0	5	0.25	0	0	0	5
HDFS 114	D21110	14	Kikuyugrass	0		0	176	154	99	0	0	0.25	0	0	0	4
HDFS 115	D21111	14	Kikuyugrass	0		0	176	116	182	0	880	0.50	2	0	2	4
HDFS 116	D21112	14	Kikuyugrass	0		0	176	174	195	0	663	0.75	0	0	0	6
HDFS 117	D21113	14	Kikuyugrass	0		0	176	176	208	0	9	0.25	0	0	0	5
HDFS 118	D21114	14	Kikuyugrass	0		0	176	157	193	0	936	0.50	2	0	0	6
HDFS 119	D21115	14	Kikuyugrass	0		0	176	56	139	0	971	0.25	2	0	2	5
HDFS 120	D21116	14	Kikuyugrass	0		0	176	176	0	0	6	0.50	0	0	0	3

**Lime expressed in 100% pure CaCO3. Adjust accordingly. D = Dolomitic Lime. C = Calcitic Lime.

Kikuyugrass: Split apply fertilizer to best match grass growth and nutrient demand. Monitor and adjust nutrient program with annual plant analysis.
Sulfur: The S recommendation is the total amount needed to reach the desired soil pH. Do not exceed 218 lb S/acre/application or 436 lb S/acre/year on established turf. Do not exceed 300 lb S/acre/year on sandy soils. Sample soils annually to monitor pH change.

Table 15 - Spectrum Analytic – Soils Test Results (continued)

Spectrum Analytic
1087 Jamison Road NW
Washington Court House, OH 43160-8748
www.spectrumanalytic.com

Report To	Prepared For	
HAWAII DAIRY FARM LLC 3083 AKAHI ST STE 301 LIHUE, HI 96766	HAWAII DAIRY FARM LLC	Sampled 04-04-2014 Tested 04-09-2014

Sample Number	Lab Number	Soil pH	Buffer pH	Organic Matter %	Phosphorus P	Potassium K	Magnesium Mg	Calcium Ca	CEC	K %	Mg %	Ca %	Sulfur S	Boron B	Zinc Zn	Iron Fe	Copper Cu	Mang. Mn	Alum. Al
HDFS 121	D21117	6.5	6.6	7.4	8 L	270 H	632 V	1257 M	12.7	4.6	36.5	37.1	8 L	0.4L	2.0 M	114 V	3.6 G	49 G	
HDFS 122	D21118	6.1	6.7	3.7	5 L	279 H	847 V	1079 M	14.5	4.2	43.0	28.0	14 M	0.4L	1.4 L	111 V	2.9 G	72 G	
HDFS 123	D21119	6.4	6.9	3.6	4 L	368 V	680 V	1440 M	12.4	6.4	40.3	43.6	43 H	0.4L	1.4 L	100 H	2.0 G	71 G	

*P, K, Mg and Ca are extracted by Mehlich-3 (ICP) and are reported in ppm

Sample Number	Lab Number	Year	Crop	Yield Goal	Acres	CaCO3** Lime	N	P2O5	K2O	Mg	S	B	Cu	Fe Foliar	Mn Foliar	Zn
HDFS 121	D21117	14	Kikuyugrass	0		0	176	176	31	0	7	0.50	0	0	0	3
HDFS 122	D21118	14	Kikuyugrass	0		684 C	176	176	37	0	8	0.50	0	0	0	5
HDFS 123	D21119	14	Kikuyugrass	0		0	176	176	0	0	0	0.50	0	0	0	5

**Lime expressed in 100% pure CaCO3. Adjust accordingly. D = Dolomitic Lime. C = Calcitic Lime.

Kikuyugrass: Split apply fertilizer to best match grass growth and nutrient demand. Monitor and adjust nutrient program with annual plant analysis.

D21117 (Kikuyugrass): Apply 81 lbs/A Calcium from gypsum and/or fertilizer sources.

8.4 NMP

590 Summary: The Hawai'i NRCS Nutrient Management 590 Practice Standard was applied to each CMU. Managing the amount, source, placement, and timing of plant nutrients and soil amendments is the purpose of the nutrient management plan. This type of planning minimizes the agricultural nonpoint sources of pollution of surface and groundwater by properly utilizing manure and commercial fertilizers in balance with plant nutrient requirements. There are three risk assessment areas that were completed for each CMU. Each risk assessment identified and scored erosion rates, nitrogen leaching index, and phosphorus index.

8.4.1 Erosion Rates:

The planned CMUs are meeting all soil loss tolerance (T) in accordance with the approved Conservation Plan. Soil Loss T is attainable since the planned system is pasture-based and there is not a significant amount of annual tillage planned.

Nitrogen Leaching Index per Hawai'i NRCS 590 Standard:

Annual Rainfall	Soil Hydrologic Group			
	A	B	C	D
>100"	H	H	M	M
50-100"	H	M	M	L
<50"	M	M	L	L

Low – No additional mitigation required
Mod – Timing of nitrogen applications must be applied to coincide with crop growing season
High – Timing of nitrogen applications must coincide with crop growing season and be split applied to prevent leaching

The nitrogen leaching index was run on each CMU. Below are the results by CMU:

CMU	Predominent Soil Type	Soil Hydrolic Group	Annual Rainfall	Nitrogen Leaching Potential
HDFS 101	KavB	D	<50"	Low
HDFS 102	KavB	D	<50"	Low
HDFS 103	LuB	D	<50"	Low
HDFS 104	LuB	D	<50"	Low
HDFS 105	KavB	D	<50"	Low
HDFS 106	KavB	D	<50"	Low
HDFS 107	KavB	D	<50"	Low
HDFS 108	KavB	D	<50"	Low
HDFS 109	KavB	D	<50"	Low
HDFS 110	KavB	D	<50"	Low
HDFS 111	LuB	D	<50"	Low
HDFS 112	KavB	D	<50"	Low
HDFS 113	Ke	D	<50"	Low
HDFS 114	PdC	B	<50"	Medium
HDFS 115	Ke	D	<50"	Low
HDFS 116	Ke	D	<50"	Low
HDFS 117	Ke	D	<50"	Low
HDFS 118	Ke	D	<50"	Low
HDFS 119	Ke	D	<50"	Low
HDFS 120	LuB	D	<50"	Low
HDFS 121	Ws	D	<50"	Low
HDFS 122	PdC	B	<50"	Medium
HDFS 123	PdC	B	<50"	Medium

Phosphorus Index Interpretation per Hawai'i NRCS 590 Standard:

Risk Assessment	Phosphorus Index Value
Low	<30
Mod	30-90
High	>90

Low - phosphorus can be applied at rates greater than crop requirement not to exceed the nitrogen requirement for the succeeding crop if manure or other organic materials are used to supply nutrients

Mod - phosphorus can be applied not to exceed the crop requirement rate

High - phosphorus can be applied not to exceed the crop removal rate if the following requirements are met: A soil phosphorus drawdown strategy has been implemented, and a site assessment for nutrients and soil loss has been conducted to determine if mitigation practices are required to protect water quality. Any deviation from these high risk requirements must have the approval of the Chief of the NRCS.

The phosphorus index interpretation was run on each CMU. Below are the results by CMU:

CMU	Risk Assessment	Phosphorus Index Value
HDFS 101	Low	18
HDFS 102	Low	18
HDFS 103	Low	12
HDFS 104	Low	18
HDFS 105	Low	18
HDFS 106	Low	18
HDFS 107	Low	18
HDFS 108	Low	18
HDFS 109	Low	10
HDFS 110	Low	18
HDFS 111	Low	18
HDFS 112	Low	18
HDFS 113	Low	10
HDFS 114	Low	10
HDFS 115	Low	10
HDFS 116	Low	10
HDFS 117	Low	10
HDFS 118	Low	10
HDFS 119	Low	10
HDFS 120	Low	10
HDFS 121	Low	10
HDFS 122	Low	10
HDFS 123	Low	10

8.4.2 Block F – Special Management

The Maha'ulepu soils, particularly in the south-central portion of the farm (Block F), are perceived as heavy, flood frequently and difficult to crop. Much of the water from the northern part of the farm runs through Block F. The dominant soils on the lower farm are Ka'ena Clay, Kalapa Silty Clay and Kalihi Clay, which are prone to compaction and are characteristically poor draining. However, less than two days after heavy rain, with rapid removal of the surface water during and after a significant rain event, they are observed as being dry enough to graze, even without a Kikuyu thatch.

The Kikuyu itself doesn't grow as effectively in wet conditions, so the farm is highly motivated to make sure the drainage system is as effective as it can be in the lower farm, particularly Block F. Winter weather may dictate if Block F will receive nutrients at all.

Figure 27 – Special Management Area, Block F

8.5 Application Schedule

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REDACTED

The 18-day rotation for Blocks H and J assume the cattle enter the paddock on day 1, and all of the manure is excreted in the paddock on the first day. This essentially supplies enough N for three days pasture growth. On day 4, the solids are applied, supplying enough N for further days pasture growth. Half the chemical fertilizer is applied on day 5 and is consumed by the grass over the next 6 days, the second application of chemical fertilizer is applied on day 11, and is consumed by the grass just before the cattle enter the paddock to graze again. The impact of the irrigated solids effluent is negligible and can be done at any stage in the rotation without

CONFIDENTIAL BUSINESS INFORMATION

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REDACTED

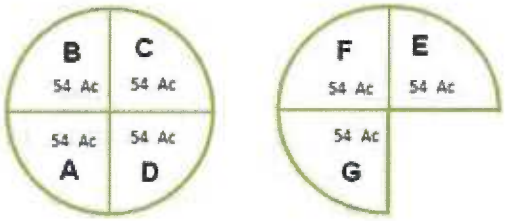
8.6 Effluent Application Schedule

Manure is applied in liquid form with irrigation equipment, and application conditions are documented in the nutrient management plan. All materials will be handled in a manner to minimize the generation of particulate matter, odors and greenhouse gases.

Waste will be applied at a rate significantly less than the crop (Kikuyu) nutrient requirements. Residue management practices will be used for maintenance of soil structure. Manure will be applied on recently grazed paddocks and before pasture re-growth starts.

The whole area of 378 acres where liquid manure will be applied has been divided into 7 blocks of 54 acres each.

Block A:	54 Acres
Block B:	54 Acres
Block C:	54 Acres
Block D:	54 Acres
Block E:	54 Acres
Block F:	54 Acres
Block G:	54 Acres



8.6.1 Effluent Volume:

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8.6.2 Liquid Effluent Application Schedule:

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During the wet months of November, December and January, the frequency and need for use of the irrigators is significantly lower than other times of the year. During the wet season, the effluent will be applied 4 times a month instead of 7 times a month, as it will be in the dry season. In these 4 wet season applications, the effluent water will be spread over twice the area of the dryer months, hence no change to the concentration of the effluent, just the frequency.

Effluent is applied only when conditions are favorable; and the application day can be selected based upon weather and soil conditions to avoid any nutrient overloading or risk of flushing through excess rain.

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CONFIDENTIAL BUSINESS INFORMATION
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REDACTED

Note: Since effluent application occurs every 4th day and days in each month vary, each block receives two applications in certain months as reflected in the table above. The total application per year is the same for all blocks.

CONFIDENTIAL BUSINESS INFORMATION

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REDACTED

Note: Since effluent application occurs every 4th day and days in each month vary, each block receives two applications in certain months as reflected in the table above. The total application per year is the same for all blocks.

CONFIDENTIAL BUSINESS INFORMATION
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REDACTED

At the application rate of 1.87 lb/acre (typically 1x per month per block), the nitrogen will minimally reach the soil surface, and instead will be absorbed through the plant leaves directly into the pasture/grass. The calculation for the nitrogen requirement is based on plant protein containing 16% N. Therefore if pasture is growing at 120.5 lbs. DM/ac/day and contains 23% Crude Protein, then the N requirement will be 4.4 lbs [120.5 X 0.23 X 0.16 = 4.4 lbs].

8.7 De-sludging Application Schedule

Table 17 – De-sludging Application Schedule

Wet solids applictaion schedule		Month/Day	6	7	8	9	10	11	12	13	14	15	21	22	23	24	25	26	27	28	29	30	31
H, J Block 108 acres		January																					
	1st application	February																					
	2nd application	March																					
		April																					
	3rd application	May																					
	4th application	June																					
		July																					
	5th application	August																					
	6th application	September																					
		October																					
	7th application	November																					
	8th application	December																					

CONFIDENTIAL BUSINESS INFORMATION
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REDACTED

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8.8 Soil Sampling Procedures

8.8.1 Soil Testing Frequency

Soils samples and testing will be performed at least every three years. Soil samples will be collected from each field receiving manure as described in the University of Hawai'i CTAHR Cooperative Extension Service publication (SCM-9).

Soil samples will be submitted for analysis to the University of Hawai'i ADSC laboratory or another laboratory accepted in state-certified programs, the North American Proficiency Testing Program (Soil Science Society of America), or laboratories whose tests are accepted by the University of Hawai'i CTAHR Cooperative Extension Service.

Soil samples will be analyzed for pH and phosphorus, nitrogen, potassium, calcium, magnesium, organic matter, salinity, micronutrients, and other constituents pertinent to monitoring or amending the annual nutrient budget.

All soil analyses will be conducted by methods approved by the University of Hawai'i CTAHR. Any other approved laboratory analytical methods used will be identified in the CNMP. See Appendix B for the Nutrient Management (590) Forms for each CMU.

8.9 Manure Analysis

Assumptions for manure volume and nutrient levels used in the nutrient budget analysis have been made based on available industry standards. Manure volume assumptions are based on a grazing system by NZ Genetics, which produces manure at a rate of 17.2 gal per cow per day (Vanderholm, Dale H., 1984). See reference below.

Table 1. Comparing estimated manure production.

	ASAE (1999)	ASAE (2005)	Nennich *et al.* (2005)	Vanderholm (1984)	Victoria [d]	Victoria [d]
Relevance	USA	USA	USA	NZ (pasture)	Victoria (pasture + grain)	Victoria (pasture + protein)
Milk yield (kg·day^{-1})		*16.5*	*16.5*			
Body weight (kg)	*600*	*600*		*600*		
Total manure (faeces + urine) (kg·day^{-1})	52	54	56	65		

The industry standard document "DairyNZ Facts and Figures Guide Book" is created by AgResearch and DairyNZ. This document has provided the basis of all effluent estimates and is the best fit to HDF's system being implemented on Kaua'i. It is based on 10 gal of wash down water per cow. HDF is using 17.4 gal of wash down water per cow. Therefore, the nitrogen concentration in effluent will be 0.025% (10/17.4 x 0.045 = 0.025).

Page 80 extract:

Some measured nutrient concentrations (%) in various effluents compared to farm dairy effluent

Source	%DM	%N	%P	%K
Farm dairy effluent	0.8	0.045	0.006	0.035

Page 81 extract:

Dairy shed and feed pad effluent volumes produced

	Dairy shed (litres) (Includes wash down water)		Feed pad (litres) (Raw manure only, no wash down water) Time on pad			
Herd size	Per cow/day	Herd size x per cow/day	0.5 hr	1.0 hr	1.5 hr	2.0 hr
1	50	50	1.7	3.4	5.1	6.8
150	50	7,500	255	510	765	1,020
250	48	12,000	425	850	1,275	1,700
500	43	21,500	850	1,700	2,550	3,400
750	38	28,500	1,275	2,550	3,825	5,100
1,000	34	34,000	1,700	3,400	5,100	6,800
2,000	23	46,000	3,400	6,800	10,200	13,600

The full DairyNZ Facts and Figures Guide Book is downloadable from the DairyNZ website: http://www.dairynz.co.nz/page/pageid/2145866931/Facts_and_Figures

8.9.1 Manure Sampling Frequency

Manure samples will be collected annually from both (liquid and solid) effluent ponds and the result of manure analyses will be used in determining land application rates of manure.

8.9.2 Liquid (Effluent) Manure Sampling

Effluent samples will be taken at the same depth from five sites around the pond.

Sub-samples will be mixed in a large, clean plastic container and analyzed while the contents are still swirling.

One pint of material will be collected in an unbreakable container that is no more than three quarters full and sent to the laboratory for analysis.

Samples will be transported in a cooler with ice packs, if necessary. Any stored samples will be refrigerated or frozen before being sent for analysis.

8.9.3 Solid Manure Sampling

Samples from five locations from around the settling pond will be taken at the same depth from which the sludge will be removed for application.

Sub-samples will be combined in a clean plastic container and mixed thoroughly.

At least one pint of material will be collected in an unbreakable container, that is no more than three quarters full (a quart-sized freezer bag will be used).

Samples will be transported in a cooler with ice packs. Any stored samples will be refrigerated or frozen before being sent for analysis.

8.10 Feed Management

A feed management plan will be developed and implemented utilizing the USDA NRCS Feed Management 592 Standard. This standard specifies certain criteria that must be followed and will become an essential component of the CNMP. Feed management uses an assortment of tools, including regular analysis of feeds, milk, and manure, to more frequently review nutritional diet formulas and reduce the uncertainties of feed delivery. This process enables maintenance efficiency, improvement in milk production, and/or the improved health of livestock. Decreasing or stabilizing nitrogen and phosphorus nutrient levels in the manure are also key objectives of HDF.

The feed management plan will contain the following information and be developed by a certified animal nutritionist:

- Diets and feed management strategies based upon a benchmark manure sample
- A laboratory analysis completed for the feedstuffs used to formulate the diet to determine nutrient content for the ration
- Feed analysis conducted by an accepted accredited laboratory
- Adjustments to nutritional levels to improve or sustain livestock productivity
- Diet adjustments to reduce (or not exceed) N and P levels in as excreted manure

- Feed management records will be kept on site and reviewed annually along with manure analysis results

8.10.1 Nutritional Requirements

The nutritional requirements are based on an approximately 1,000 lb animal producing 5.3 gal of milk per day. Total intake of 39.7 lbs. DM intake/day is about 4% of body weight. (This will be the maximum and not achievable under average management). The limiting factor for dairy cows is metabolic energy (ME). The example shown below is illustrated in metric units.

ME for maintenance:	60 MJ ME/Day = 60
ME for milk production:	6 MJ ME/Litre x 20 l = 120
ME for Pregnancy:	10 MJ ME/Day = 10
ME for activity:	8 MJ ME/Day = 8
	198 MJ ME/cow/day

Kikuyu @ 10 MJ ME / kg dm x 14 kg dm intake = 140 MJ ME/cow/day

Grain @ 11.5 MJ ME / kg dm x 5.4 kg dm intake = 59.4 MJ ME/cow/day

Total 199.4 MJ ME/cow/day

Protein

Daily requirement. (18 % of 18 kg intake) = 3240 gms

Kikuyu will be 14 kg dm @ 20 % protein so protein intake at +/- 2800 gms/cow/day.

6 kg grain at 90% dm = 5.4 kg dm @ 9% protein = protein intake of +/- 486 gms/cow/day.

Total 3286 gms/cow/day

Starch

Daily requirement. (30 %)

Kikuyu @ 4 % x 14kg = 560

Grain @ 75 % x 6 kg = 4500

Total. 5060 gms/cow/day

Fibre NDF about 35 % of diet

Kikuyu 14 x 40% NDF =5600

Maize Grain 6 x 11% NDF = 660

Total 6260 = +/- 35 % of diet

9.0 Operations and Maintenance

An effective operations and maintenance (O&M) plan is essential for HDF. The O&M Plan for HDF includes the following components:

1) Wastewater System O&M Requirements
    a) Accidental Entry of Waste Storage Emergency
    b) Effluent Storage Ponds
    c) Effluent Sludge Management
2) Manure Sampling Protocol
3) Soil Testing Protocol
4) Animal Mortality Management Plan
5) Water Quality Monitoring Plan
6) Emergency Action Plan Storage Facility Spill, Leak, or Failure
7) Nutrient Management Record Keeping

9.1 Water Quality Monitoring

HDF will implement a plan for water quality monitoring to assess baseline water quality and monitor water quality during operation, as well as assess the effectiveness and adjust HDF irrigation, nutrient management and conservation practices.

Monitoring Goals

- Determine baseline water quality
- Monitor water quality during operation of the dairy
- Evaluate and adjust the frequency and timing of nutrient application and irrigation schedule
- Evaluate and adjust conservation practices
- Detect any potential problems early to allow adjustment of practices before the impacts are significant

9.1.1 Monitoring Stations

Water quality monitoring will be done at several stations located throughout the farm. At a minimum, monitoring points will located upstream of the farm, at multiple drainage ways and water bodies in the farm and at locations downstream of the farm. The initial baseline sampling may be more intensive and evaluate and test water quality from locations further away from the farm both upstream and downstream and possibly near the coastline.

9.1.1.1 Sampling Plan and Procedures

A detailed sampling plan will be developed after baseline test results are available. However, it is anticipated that the sampling plan will include the following components and requirements:

- Regular samples will be taken at a 1- to 3-month intervals
- Specific samples will be taken during and after storm events
- Sampling will also document weather conditions, flow measurement
- Sampling will follow Quality Control and Quality Assurance protocols established in the Sampling Plan

9.1.1.2 Sampling Parameters

Parameters for measurement may include the following:

- Temperature
- Flow
- pH
- Dissolved oxygen
- Turbidity
- Total Suspended Solids
- Bacteria
- Pesticides
- N, P, K

9.1.2 Response Planning

A detailed response plan will be prepared that outlines actions to be taken for problems that arise during farm operation. The response plan will include:

- Contact person
- Discussion of concern
- Outline of action to be taken

- Documentation of action taken and follow-up testing

A variety of actions could be taken to mitigate water quality issues that arise at the site. It is likely that one or more of the following actions would be considered and taken to address typical water quality concerns for this type of agricultural operation:

- Addition/modification to erosion and sediment controls
- Addition/modification to conservation measures
- Adjustment to irrigation application schedules
- Adjustment to effluent and sludge application schedules
- Adjustment to nutrient application
- Adjustment to pasture rotation
- Changes to sampling routines, procedure or scheduling

9.1.3 Record Keeping and Evaluation

The Water Quality Plan and records will be maintained by the Farm Manager onsite, including the following items:

- Emergency contact info
- Laboratory contact info
- Sampling Plan and Procedures
- Baseline sample test results
- Regular sample test results
- Specific sample details and test results
- Graphical depiction of test results and trends
- Response Plan and Actions Taken

Hawai'i Dairy Farm LLC
Operation and Maintenance Worksheet
Accidental Entry of Waste Storage Emergency

For: Lessor/Operator: Hawai'i Dairy Farm LLC
Job Location: Koloa, Hawai'i
County: Kaua'i
SWCD: West Kaua'i Soil & Conservation District
Tax Map Key(s): (4) 2-9-003:001
(4) 2-9-003:006
(4) 2-9-001:001

Prepared By: James Garmatz Date: 4-16-14

Operations and Maintenance Items

Entry into the waste storage area is strictly prohibited by untrained personnel and should never be attempted by management or his employees.

The facility shall be surrounded by a woven wire fence to deter any animals or untrained personal from accidently falling in the waste storage facility. Gates will be located at each end to allow trained and supervised individuals access for maintenance and repairs.

Contact Person	Phone Number
Fire/Rescue	**911**
Primary Emergency Coordinator James Garmatz (Koloa, Hawai'i)	**808-212-5985**
Secondary Emergency Coordinator Adam Killerman (Koloa, Hawai'i)	**808-639-4311**

Action Plan

- Call for Help.
- Locate Emergency Rescue Equipment and attempt to reach the victim. (Grab Pole, Ladder, Flotation Device, Rope)
- Initiate CPR if Necessary.

Hawai'i Dairy Farms LLC
Operation and Maintenance Worksheet
Effluent Storage Ponds

For: Lessor/Operator: Hawai'i Dairy Farm LLC
Job Location: Koloa, Hawai'i
County: Kaua'i
SWCD: West Kaua'i Soil & Conservation District
Tax Map Key(s): (4) 2-9-003:001
(4) 2-9-003:006
(4) 2-9-001:001

Prepared By: James Garmatz Date: 4-16-14

Operation and Maintenance Items

An Effluent Storage Structure is used for temporary storage of liquid effluent. It will be designed, installed, and contain a plastic liner that will meet the supplier's specifications.

At any time this structure is out of service, the Hawai'i Department of Agriculture will be contacted for guidance in decommissioning the structure to avoid environmental concerns.

The estimated life span of a structure is 20 years. This can be assured by developing and executing a suitable "Operation and Maintenance Program". A properly operated/maintained effluent storage structure is an asset to our farm.

This practice will require you to perform periodic operation and maintenance to maintain satisfactory performance. A valuable "Operation and Maintenance Program" will include:

_____ Do not allow equipment that exceeds design loading to operate within 30 feet of the structure.

_____ Continually maintain all pumps, agitators, piping valves and all other electrical and mechanical equipment in good operating condition by following the manufacturer's recommendations.

_____ Continually maintain grounding rods and wiring for all electrical equipment in good condition.

_____ Maintain all fences, gates, railings and/or warning signs to prevent of any humans or animals entrance to the facility.

_____ Repair, immediately all livestock, vehicle and vandalism damage.

_____ Remove all foreign debris within the structure that may cause damage to pumps, agitators and earthen structures.

_____ On a monthly basis inspect all spillways and control gates for proper functioning for their ability to maintain the water level to design elevations. Remove any blockage or obstruction in spillways and maintain a minimum of 1 foot of freeboard from the top of the structure to the maximum water for earthen storage structure.

_____ Maintain a vigorous growth of vegetative covering on earthen structures. This may include the seeding, fertilization, and mowing of this grass. Maintain any weeds that occur and keep eliminated.

_____ Monitor all drains and screens on drains to make sure soil is not being transported thru the drainage system. Maintain screens and rodent guards.

_____ Eradicate all rodents and repair any damage caused by them.

_____ Facility should be low as possible prior to wet weather season.

_____ Immediately empty storage facility if damage to the structure may cause failure and immediately seek a qualified engineer to assess the situation. During de-watering of the structure, ensure that the effluent is spread at minimum rates on permanent pastures. Spread the effluent no closer than 35 feet from open water sources when applying liquid effluent with an effluent gun traveler. Do not reduce the effluent level in the structure more than 1 foot per day when emptying the structure.

_____ Protect the structures liner from erosive forces of filing operation, operating agitators at least 3 feet from the liner. Protect liner by keeping a layer of manure over the liner or keeping the liner moist.

Hawai'i Dairy Farms LLC
Operation and Maintenance Worksheet
Effluent Sludge Management

For:	Lessor/Operator:	Hawai'i Dairy Farm LLC
	Job Location:	Koloa, Hawai'i
	County:	Kaua'i
	SWCD:	West Kaua'i Soil & Conservation District
	Tax Map Key(s):	(4) 2-9-003:001 (4) 2-9-003:006 (4) 2-9-001:001
Prepared By:	James Garmatz	Date: 4-16-14

Operation and Maintenance Items

Ponds will have sludge buildup and will require dredging or pumping regularly. Proper maintenance of a pond, such as quarterly agitating and pumping to remove many of the solids will keep it functioning effectively for many years.

- Sludge cannot be measured or sampled from the edge of the pond, it must be done from a boat.
- For safety reasons, at least 3 people should be present: two in boat and one on pond bank.
- A long, lightweight, rigid pole with measurements should be used.
- Pole is slowly lowered into the pond until the liquid seems to become thicker and denser.
    - The depth on the pole is then recorded.
- The pole is then pushed deeper into the sludge until the bottom of the pond is reached.
    - That depth is recorded also.
- The difference between the two markings is the depth of the sludge.
- Sludge removal can be accomplished by:
    1) Agitating the pond and irrigating/land applying;
    2) Dewatering the pond, agitating the sludge and land applying the sludge;
- When using agitators, care should be taken to prevent damage to liners that are in place.
- More than one agitator may be required for large ponds
- The liquid can then be applied through large-bore irrigation equipment.

Proper maintenance of the pond also protects the environment, complies with regulations and demonstrates an ethics of civil responsibility.

Hawai'i Dairy Farms LLC
Operations and Management Worksheet
Manure Sampling Protocol

For: Lessor/Operator: Hawai'i Dairy Farm LLC
Job Location: Koloa, Hawai'i
County: Kaua'i
SWCD: West Kaua'i Soil & Conservation District
Tax Map Key(s): (4) 2-9-003:001
(4) 2-9-003:006
(4) 2-9-001:001

Prepared By: James Garmatz Date: 4-16-14

Operation and Maintenance Items

Manure Sampling Frequency
Manure samples will be collected annually from both (liquid and solid) effluent ponds and the result of manure analysis will be used in determining land application rates of manure.

Liquid (Effluent) Manure Sampling

- Effluent samples from five sites around the pond will be taken at the depth and from the portion of the pond from which effluent sample is taken.
- Sub samples will be mixed in a large clean plastic container and analyzed while the contents is still swirling.
- One pint of material will be collected in an unbreakable container, no more than three quarters full and send to the lab laboratory for analysis.
- Samples will be transported in a cooler with ice packs, if necessary; any stored samples will be refrigerated or frozen before being sent for analysis.

Solid Manure Sampling

- Samples from five locations around the settling pond will be taken at the same depth from which the sludge will be removed for application..
- Sub samples will be combined in a clean plastic container and mixed thoroughly.
- At least one pint of material will be collected in an unbreakable container, no more than three quarters full (A quart freezer bag will be used)
- Samples will be transported in a cooler with ice packs. Any stored samples will be refrigerated or frozen before being sent for analysis.

Hawai'i Dairy Farms LLC
Operation and Maintenance Worksheet
Soil Testing Protocol

For: Lessor/Operator: Hawai'i Dairy Farm LLC
Job Location: Koloa, Hawai'i
County: Kaua'i
SWCD: West Kaua'i Soil & Conservation District
Tax Map Key(s): (4) 2-9-003:001
(4) 2-9-003:006
(4) 2-9-001:001

Prepared By: James Garmatz Date: 4-16-14

General Information

HDF has a total of 521 acres in pasture. These pastures are divided up into 119 total paddocks that have an average area of 4 to 5 acres per paddock.

The spray irrigation that will apply effluent along with fresh water will only cover approximately 378 acres. 82 acres will have drip irrigation and no effluent will be applied here. The remaining 61 acres will not be irrigated and will only receive precipitation.

Each of the 119 paddocks will have a soil sample taken from 5-10 locations. Five paddock samples will be combined into one sample and mixed together. These composite sample combinations will be linked to the farm map, which is attached, taking into consideration each distinct sub-area found throughout the farm.

The use of clean tools, containers and clean bags to store the samples, is required. The sample will be gathered from the top 8 inches of the soil.

The method of sampling is as follows:

1. Clean surface of any litter or plant growth. Dig a hole about as wide as your spade and as deep as 8 inches.
2. One inch outside the edge of the hole, cut down to remove a slice of one side of the hole wall.
3. Keeping that slice on the blade of the spade, use a trowel to cut away the sides of the slice leaving a center section about 1 inch wide. A 1 x 1 inch vertical section of this soil is your sub-sample.

4. Place the sub-samples in a plastic container, mix them well and remove about 2 cups of this mixture. This is your composite sample, to send to the lab for analysis.
5. Retain equal parts of all samples for retained material in the event further testing is required.

Soil samples should be submitted for analysis to the University of Hawai'i, The Agricultural Diagnostic Service Center (ADSC) Laboratory or another laboratory accepted in state - certified programs, the North American Proficiency Testing Program (Soil Science of America), or laboratories whose test are accepted by University of Hawai'i, College of Tropical Agriculture and Human Resources (CTAHR) Cooperative Extension Services.

Soil samples should be analyzed for pH, Phosphorus, Nitrogen, Potassium, Calcium, Magnesium, Organic Matter, Salinity, Micronutrients and other constituents pertinent to monitoring or amending the annual nutrient budget.

All soil analyses should be conducted using methods approved by CTAHR. If a laboratory other than ADSC Laboratory is used, the laboratory and analytical methods used by that laboratory must be identified in the Nutrient Management Plan.

The fertilizer recommendations associated with these samples should be based upon Kikuyu as the planned crop.

Laboratory choices are as follows:

1. The Agricultural Diagnostic Service Center (ADSC)
   College of Tropical Agriculture and Human Resources
   University of Hawai'i – Manoa
   1910 East-West Road
   Room 134
   Honolulu, Hawai'i 96822
   Raymond Uchida, Lab Director
   808.956.6706

2. Spectrum Analytical Inc.
   1087 Jamison Road NW
   Washington Court House, Ohio 43160-8748
   1.800.321.1562

Hawai'i Dairy Farms LLC
Operations and Management Worksheet
Animal Mortality Management Plan

For:	Lessor/Operator:	Hawai'i Dairy Farm LLC
	Job Location:	Koloa, Hawai'i
	County:	Kaua'i
	SWCD:	West Kaua'i Soil & Conservation District
	Tax Map Key(s):	(4) 2-9-003:001 (4) 2-9-003:006 (4) 2-9-001:001
Prepared By:	James Garmatz	Date: 4-16-14

Operation and Maintenance Items

If on-farm storage or handling of animal mortality is done, NRCS Standard 316, Animal Mortality, will be followed for proper management of dead animals. By following NRCS Standard 316, Animal Mortality, we decrease non-point source pollution of surface and ground water resources, reduce the impact of odors that result from improperly handled animal mortality, and decrease the likelihood of the spread of disease or other pathogens. An approved process shall be implemented in the handling of normal mortality losses.

The following outline describes how normal mortality will be managed in a manner that protects surface and ground water quality:

- Pits will be sized to accommodate appropriate weight to volume conversions.
    - Capacity will be in accordance with state and local regulatory agencies' guidelines.
- The burial pit will be a minimum of 2 feet wide with length necessary to accomplish mortality.
- The maximum size of the burial excavation will be 0.10 acre (about 4,400 sq. ft.)
- Pit bottoms will be level.
- Lengths will be limited to soil suitability and slope.
- Multiple pits must be separated by a minimum of three feet of undisturbed or compacted soil.
- Each carcass will be placed in a one-carcass-thick layer, covered with a minimum of 2 feet of soil.
    - Pits will never go deeper than 8 feet.

- Site consideration will include the following:
    - prevailing winds to neighbors
    - at least a 100 feet from any drainage way
    - at least 200 feet from any natural water course
    - at least 300 feet from any well
    - at least 20 feet from any building to prevent spontaneous combustion
    - as far from a fuel source as practical.
- Uncontaminated runoff must be diverted away from animal mortality facility.
- In soils with a permeability of more than 2 in/hr. a liner must be installed in accordance with NRCS standards
- Vehicular traffic will not be allowed within four feet of the pit edge.
- If the pit is four feet deep, a step or bench 18-inches wide and one foot deep will be dug around the perimeter of the main pit so the remaining vertical wall will not exceed four feet.

Hawai'i Dairy Farm LLC
Operation and Maintenance Worksheet
Emergency Action Plan Storage Facility Spill, Leak or Failure

For:	Lessor/Operator:	Hawai'i Dairy Farm LLC
	Job Location:	Koloa, Hawai'i
	County:	Kaua'i
	SWCD:	West Kaua'i Soil & Conservation District
	Tax Map Key(s):	(4) 2-9-003:001 (4) 2-9-003:006 (4) 2-9-001:001
Prepared By:	James Garmatz	Date: 4-16-14

Operation and Maintenance Items

In Case of an Emergency Storage Facility Spill, Leak or Failure

Implement the following first containment steps:

a. Stop all other activities to address the spill.
b. Stop the flow. For example, use skid loader or tractor with blade to contain or divert spill or leak.
c. Call for help and excavator, if needed.
d. Complete the cleanup and repair the necessary components.
e. Assess the extent of the emergency and request additional help, if needed.

In Case of an Emergency Spill, Leak or Failure during Transport or Land Application

Implement the following first containment steps:

a. Stop all other activities to address the spill and stop the flow.
b. Call for help if needed.
c. If the spill posed a hazard to local traffic, call for local traffic control assistance and clear the road and roadside of spilled material.
d. Contain the spill or runoff from entering surface waters using straw bales, saw dust, soil or other appropriate materials.
e. If flow is coming from a tile, plug the tile with a tile plug immediately.
f. Assess the extent of the emergency and request additional help, if needed.

Emergency Contacts

Department / Agency	Phone Number
Fire	911
Rescue services	911
State veterinarian	Dr. Jason D. Moniz, D.V.M 808-960-8409
Sheriff or local police	911

Nearest available excavation equipment/supplies for responding to emergency

Equipment Type	Contact Person	Phone Number
Waalani Bros	Ryan Waalani	808-645-1683
AJAR Inc	Adam Killerman	808-639-4311
George Kawamura Construction	George Kawamura	808-635-5894

Contacts to be made by the owner or operator within 24 hours

Organization	Phone Number
EPA Emergency Spill Hotline	1-888-ASK-USGS
County Health Department	1-808-586-4400
Other State Emergency Agency	1-888-246-2675

Be prepared to provide the following information:

a. Your name and contact information.
b. Farm location (driving directions) and other pertinent information.
c. Description of emergency.
d. Estimate of the amounts, area covered, and distance traveled.
e. Damage: employee injury, fish kill, or property damage.
f. Current status of containment efforts.

Hawai'i Dairy Farms LLC
Operations and Maintenance Worksheet
Nutrient Management Record Keeping

For: Lessor/Operator: Hawai'i Dairy Farm LLC
Job Location: Koloa, Hawai'i
County: Kaua'i
SWCD: West Kaua'i Soil & Conservation District
Tax Map Key(s): (4) 2-9-003:001
(4) 2-9-003:006
(4) 2-9-001:001

Prepared By: James Garmatz Date: 4-16-14

Operation and Maintenance Items

Nutrient Management record keeping is an essential task that needs to be completed on a daily basis. All applications of Nitrogen, Phosphorus and Potassium is required. The dates and application rates are also required in the record keeping. It also includes the different crops planted and the dates they are planted. The task involves the following methodology:

- Must include farm name on top line identified as Name.
- The field number is required on the second line identified as Field Number.
- Every field will have its own page and must be kept in a binder for easy access.
- When a particular crop is planted, log the crop name and the date planted.
- As fertilizer is applied, log each application with the date applied, application rate, and fertilizer formulation, for each crop.
- It is critical that anytime an activity is completed, the records are updated.
- All lime applications must also be entered.

ENTIRE DOCUMENT IS CONFIDENTIAL BUSINESS INFORMATION

Appendix A
Nutrient Management 590 Forms