
Biological and water quality surveys of Kaloko Marsh at Kūhio Highway, Wailua, Kauaʻi



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Prepared by:

AECOS Inc.
45-939 Kamehameha Hwy, Suite 104
Kāneʻohe, Hawaiʻi 96744-3221

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Chad Linebaugh, Eric Guinther, and Reginald David¹
AECOS, Inc.

45-939 Kamehameha Hwy, Suite 104

Kāneʻohe, Hawaiʻi 96744

Phone: (808) 234-7770 Fax: (808) 234-7775 Email: aecos@aecos.com

Introduction

On February 16, March 9, 10, and 11, 2009, AECOS, Inc. biologists conducted water quality and biological reconnaissance surveys of the highway edge of Kaloko Marsh in Wailua, Kauai (Fig. 1). The State Department of Transportation (HDOT) is planning to widen a segment of Kūhio Highway (state Rte. 56) from Kuamoʻo Rd to the Kapaʻa Bypass Road as part of the Kūhio Highway Short Term Improvement Project. This segment of Kūhio Hwy. borders Kaloko Marsh, and connects via culvert under the highway to a drainage swale that originates at nearby Papaloa Road. The culvert crosses under the highway approximately 400 ft (120 m) southwest of the intersection with the Kapaʻa Bypass Road. AECOS, Inc. was contracted by Wilson Okamoto and Associates, Inc. to ascertain biological resources and assess water quality of the waterway for permitting of the construction project. This report details the findings of the surveys.

Waterway Description

The waterway under the highway is part of a drainage swale that extends from Papaloa Road to Kaloko Marsh, a distance of about 400 ft (0.12 km). The drainage swale normally drains into Kaloko Marsh, located on the mauka (west) side of Kūhio Highway. At the proposed project site this ditch or swale is only some 10 ft (3 m) in width and overgrown with grasses and ruderal weeds². It is likely that high water level in the marsh results in water backing up in the opposite direction (mauka to makai) through the culvert structure. Although

¹ Rana Productions, Ltd., Kailua-Kona, Hawaiʻi.

² Because of construction ongoing on the parcel south of the culvert, conditions in the this swale have regularly changed over the period of time of our studies.

not observed, high water could seep seaward (makai direction) since Papaloa Road is on the order of 600-700 ft (0.2 km) inland from the windward shore of Wailua Bay; old dunes may be the reason the land here has a gentle slope downward away from the coast, and dunes are generally highly permeable to groundwater movement.



Figure 1. The proposed project location in Wailua, Kauai.

The marsh itself appears to “naturally” drain to the northeast (roughly parallel to the highway on the mauka side). At least the historical flow was northeast from the project area for some 700 ft (213 m) into the Waipouli Reservoir, and continuing northeast for 2700 ft (820 m), then 1450 ft (440 m) southeast to the Pacific Ocean at Waipouli, some 4250 ft (1.3 km) distant of the project site. However, the culvert pipe beneath Kapa’a Bypass Road has been filled with concrete, preventing outflow in this direction.

It is possible that another outlet for this wetland exists somewhere, perhaps in the southwest direction as there is a drainage ditch beyond Hale’ilio Road in this direction (behind the former Coco Palms Resort), but no such connection was found. The drainage pattern in this area is complicated by the fact that the marsh itself is not a single large depressed area, but is divided by a substantial farm road (old cane haul road) that parallels Kūhio Hwy some 200 ft (0.06 km) inland. A culvert beneath this unimproved road permits the interchange of surface water between the two parts of the marsh.

Methods

AECOS, Inc. biologists took water quality field measurements, collected water samples for laboratory analyses, and identified aquatic biota present at the proposed project site. Field measurements for temperature, dissolved oxygen, and pH were measured directly from the project waterway near the culvert opening on the makai side of Kūhio Hwy (Fig. 2). Samples collected for laboratory analysis were shipped to *AECOS*, Inc. laboratory in Kāneʻohe, Oʻahu (*AECOS* Log Nos. 25067, 25095, 25096). The aquatic resource survey area included observations on both sides of Kūhio Hwy.



Figure 2. Water quality sampling site (Station Hwy) on makai side of culvert under Kūhio Hwy.

Water Quality

Only isolated pools of water were present in the project waterway during the survey. No actual flow was evident. The largest pool of water was located on the southeast (makai) side of Kūhio Highway approximately 10 ft (3 m) from the culvert. A single water quality station, “Hwy,” was established and sampled from this pool on March 9, 10, and 11, 2009. Results are displayed in Table 1.

Table 1. Water quality characteristics of a pool in the project waterway on March 9, 10, and 11, 2009.

| Station | Time | Temp. | pH | Dissolved Oxygen | D.O. % Sat. | Cond. |
|-------------------|-----------|-------------|-------------|-------------------|-------------|------------|
| | hhmm | (°C) | (pH units) | (mg/l) | (%) | (µmhos/cm) |
| Hwy. (3-9-09) | 1515 | 21.5 | 6.41 | 1.60 | 18 | 326 |
| Hwy. (3-10-09) | 1701 | 21.9 | 6.73 | 1.42 | 16 | 311 |
| Hwy. (3-11-09) | 1729 | 21.4 | 6.52 | 2.12 | 24 | 331 |
| Arth. Mean | -- | 21.6 | 6.55 | 1.71 | 19 | 323 |
| | TSS | Turbidity | Ammonia | Nitrate + nitrite | Total N | Total P |
| | (mg/l) | (ntu) | (µg N/l) | (µg N/l) | (µg N/l) | (µg P/l) |
| Hwy. (3-9-09) | 38 | 77.0 | 70 | 374 | 1050 | 165 |
| Hwy. (3-10-09) | 25 | 51.5 | 58 | 206 | 862 | 173 |
| Hwy. (3-11-09) | 24 | 39.0 | 80 | 113 | 714 | 118 |
| Geo. Mean | 28 | 54 | 69 | 206 | 866 | 150 |

Conductivity results indicate fresh water with no influence from brackish groundwater. Dissolved oxygen concentrations in the project waterway were low with saturation averaging 19%. Turbidity levels and total suspended solids (TSS) concentrations were high, reflecting the poor underwater visibility at the time of sampling. Elevated ammonia concentrations, like those found at Sta. Hwy, are typical of waterways with sluggish or stagnant flow due to an accumulation and then decomposition of organic matter. Nitrate-nitrite, total nitrogen and total phosphorus levels were also high here.

Aquatic Biota

The culvert under Kūhio Hwy. opens (on the mauka side) into Kaloko Marsh, which in this area is a depression completely covered by the aggressive, introduced grass known as para or California grass (*Urochloa mutica*; see Fig. 3). The marsh itself shows no open water areas other than at the culvert under the highway and the culvert under the old cane haul road.

The Kaloko wetland was previously surveyed by Char (2003a), but included in the general descriptions of the numerous small and large wetlands that dot this part of the Kaua'i coastal plain. Her report discusses the predominance of California grass in the "fresh water influenced" wetlands of this area (other nearby wetlands are "brackish water influenced"). More specific information appears in Char (2003b), which notes that the "wetland is bisected by a dirt road" and "[t]he makai half by the highway is covered by tall, dense mats of California grass..." and with a "dark, black organic soil."



Figure 3. Kaloko Marsh showing the makai portion overgrown with California grass. Houses in background are along the makai side of Kūhio Highway.

The vertebrate zoologist did not conduct any avian or mammalian surveys within either section of the Kaloko wetland. However, one native avian species, Black-crowned Night-Heron (*Nycticorax nycticorax*), was observed to fly out of the inland portion of the wetland. No aquatic organisms (fishes, invertebrates) were observed in the waterway at the project site on any of the several visits to the culvert area.

Given the highly overgrown state of the makai portion of this wetland feature, it is unlikely that it is currently usable by native wetland avian species. The inland section may provide resources that are used by three listed waterbird species, Hawaiian Coot, (*Fulica alai*), Common Moorhen (*Gallinula chloropus sandvicensis*), and occasionally Hawaiian Duck (*Anas wyvilliana*), on a seasonal

basis, as all three of these species have been recorded in wetland areas found to the north of the site. Char (2003b) noted that the inland portion (that part mauka of the cane haul road) was grazed, whereas the makai portion was not grazed, and thus more overgrown, eliminating any open water.

Assessment

The proposed project waterway is an approximately 800 ft (245 m) long ditch (drainage swale) that typically contains little water except for instances following heavy local precipitation. During these events, water may pond in the vicinity of the Kūhio Highway culvert. Nitrogen (total nitrogen and nitrate-nitrite), ammonia, phosphorus (total phosphorus), turbidity and total suspended solids concentrations were all elevated with respect to State of Hawai'i water quality standards for inland waters and do not meet geometric mean criteria (see Table 2), although given the short span of time samples were collected over, the representativeness of the means may be questionable. On the other hand, except during rainy periods, water may be absent from the makai end of the highway culvert.

Table 2. State of Hawai'i water quality criteria for inland waters/streams during wet season (November 1 through April 30) from HAR §11-54-05.2d (HDOH, 2004).

| Parameter units | TSS (mg/l) | Turbidity (NTU) | Total Nitrogen (µg N/l) | Nitrate + Nitrite (µg N/l) | Total Phosphorus (µg P/l) |
|--|---------------|--------------------|-------------------------------|----------------------------------|---------------------------------|
| Geometric mean not to exceed given value | 20 | 5 | 250 | 70 | 50 |
| Value not to be exceeded more than 10% of the time | 50 | 15 | 520 | 180 | 100 |
| Value not to be exceeded more than 2% of the time | 80 | 25 | 800 | 300 | 150 |

- pH – shall not deviate more than 0.5 units from ambient and not be lower than 5.5 nor higher than 8.0.
- Dissolved oxygen – not less than 80% saturation.
- Temperature – shall not vary more than 1 °C from ambient.

The waterway does not currently support aquatic biota, therefore no federally endangered or threatened species (Federal Register, 2005; USFWS, 2005) were

encountered during the surveys, and none is anticipated to utilize aquatic habitats in the project area. A Best Management Practices (BMP) plan should be designed and implemented to minimize environmental impacts to water quality of the project waterway in the vicinity of the project site.

References

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