**Hawaii Biological Survey, Bishop Museum, Observations and Findings from 7 April 2003 Site Visit of Unnamed Stream Flowing into Pila'a Bay, Kaua'i**


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## Introduction

The Hawaii Biological Survey (HBS) of the Bishop Museum was subcontracted by Earth Tech to provide assistance for a biological field reconnaissance of an unnamed stream (Gulch 3) flowing into the Pilaʻa Bay, Kauaʻi area (Figure 1). Personnel from Earth Tech involved in this field reconnaissance included Karl Bromwell and Pan Yucheng, along with Ron Englund from HBS. The objective of this reconnaissance was to evaluate possible mitigative measures related to seven large ponds that were constructed by impounding Gulch 3 on the Pflueger property. The feasibility of pond removal, and restoration of this stream and source springs to their natural flow was investigated, and the suitability of this habitat for native aquatic species was evaluated. An earlier report by Englund et al. (2002) investigated the impacts of the pond construction on the aquatic and riparian community found in other areas of the Pflueger property such as Gulch 2, but the seven-pool area of Gulch 3 was not evaluated during that study.

## Gulch 3 Description

Gulch 3 is a small perennial stream originating as a series of diffuse springs captured by a series of seven impoundments starting at approximately 150 foot elevation (Figure 2). The area surrounding the seven ponds is kept trimmed and is landscaped with cultivated plants. Because of recent heavy rains, the ponds and stream were quite turbid (Photo 1, 2, and 4), which made observations in the lower stream area near the ocean somewhat difficult. The two upper most ponds (Pond 1 and Pond 2) were full of water lilies (*Nymphaea* spp.), while the lower ponds had lesser amounts of lilies. Each pond was connected to the lower pond by either a pvc pipe (Pond 2 and 3) (Photo 3) or small streamlet (Photo 2, 4, and 5). There was significant water flow from the lowest pond that formed an unnamed flowing stream. GPS readings (WGS 84) at the lowest ponds where the *Megalagrion vagabundum* damselfly was observed were N 22.20914°, W 159.36169° (Photo 6). The stream was also examined where it emptied at the ocean. After emerging from a dense hau (*Hibiscus tiliaceus*) thicket (Photo 7) the stream flows for about 15 yards on the beach through rocks and sand to its ocean terminus (Photo 8).

## Results

Table 1 includes a list of aquatic animal species observed during this field reconnaissance. Two species of endangered waterbirds, the Hawaiian Coot (*Fulica americana alai*) and the Common Moorhen (*Gallinula chloropus sandvicensis*) were observed in the ponds in Gulch 3. As noted in Englund et al. (2002), Nēnē

Table 1. Results of Hawaii Biological Survey, Bishop Museum surveys conducted in April 2003 for aquatic species in at Gulch 3 (N 22.20914°, W 159.36169°) in the Pïlaʻa, Kauaʻi area.

| Taxon | Stream near ocean | Gulch 3: seven pond | Geographic Status |
|---|---|---|---|
| Native Birds | | | |
| Common Moorhen | | X | Native – Endangered |
| Hawaiian Coot | | X | Native – Endangered |
| **Amphibians** | | | |
| *Bufo marinus* | | X | Introduced |
| *Rana catesbeiana* | | X | Introduced |
| **Fish** | | | |
| *Sicyopterus stimpsoni* (post-larvae) | X | | Endemic |
| *Kuhlia xenura* | X | | Endemic |
| *Mugil cephalus* | X | | Indigenous |
| *Gambusia affinis* | | X | Introduced |
| *Xiphophorus helleri* | | X | Introduced |
| **Crustaceans** | | | |
| *Macrobrachium grandimanus* | X | | Endemic |
| *Macrobrachium lar* | X | X | Introduced |
| **Aquatic Insects** | | | |
| Aeschnidae | | | |
| *Anax junius* | | X | Indigenous |
| Libellulidae | | | |
| *Crocothemis servilia* | | X | Introduced |
| *Orthemis ferruginea* | | X | Introduced |
| *Pantala flavescens* | | X | Indigenous |
| **Zygoptera (Damselflies)** | | | |
| Coenagrionidae | | | |
| *Ischnura posita* | | X | Introduced |
| *Ischnura ramburii* | | X | Introduced |
| *Megalagrion vagabundum* | | X | Endemic |
| **Heteroptera (True Bugs)** | | | |
| Mesoveliidae | | | |
| *Mesovelia amoena* | | X | Introduced |
| **Trichoptera** | | | |
| *Cheumatopsyche analis* | X | X | Introduced |

(*Nesochen sandvicensis*) remain abundant in the nearby Gulch 2 ponds, and although not observed in the Gulch 3 ponds during our brief visit, Nēnē undoubtedly frequent these ponds as well. All seven ponds contain high densities of the introduced mosquitofish (*Gambusia affinis*), green swordtails (*Xiphophorus helleri*), and bullfrog tadpoles. The Tahitian prawn (*Macrobrachium lar*) was the only crustacean observed in the pond area, although both this species and the native *Macrobrachium grandimanus* were found in the stream near the ocean. Native hīhīwai (*Neritina granosa*) or hapawai (*Neritina vespertina*) were not observed in the lower section of the stream, possibly because near the ocean the stream flows through dense hau growths, and has a thick loamy substrate, not the clean hard rock substrate preferred by these native species. Aquatic habitats currently at the ponds will not support native ‘o‘opu or hīhīwai or crustaceans. Native fish species were observed and collected at the stream mouth (Table 1), although high turbidity due to recent rains made further upstream observations of native fish species difficult.

Overall, the aquatic fauna found in the Gulch 3 seven pool area is a mixture of native and introduced species representative of impoundments. The finding of the scarlet Kauai damselfly (*Megalagrion vagabundum*) in the stream outlet draining the lowest of the seven pools was especially surprising, and at 80 foot elevation is possibly one of the lowest elevation records in recent times for this increasingly rare endemic damselfly. It is possible that this damselfly species continues to inhabit areas that the alien fish species are unable to access in the fast-water velocity spillway below the lowest pond (Photo 6).

## Discussion

The primary objective of this field reconnaissance was to determine if Gulch 3 with its current seven ponds should be restored to its natural channel morphology, and if the seven ponds should be removed and a more natural stream channel put in place. Although surveys were not conducted prior to the construction of the seven ponds in Gulch 3, it can be reasonably assumed that several species of native ‘o‘opu have been eliminated from the lowest pond to the headwater springs located immediately upstream of the highest pond. This is because reservoir habitat is incompatible for native freshwater species of fish, mollusks, and crustaceans; thus, it can be safely stated that these native species have lost habitat where the ponds have been constructed.

Mitigation measures that have been discussed include removal of these seven ponds and restoration of this part of Gulch 3 to the original hydrologic condition. However, in a situation

similar to Gulch 2 (see Englund et al. 2002), the seven ponds in Gulch 3 have provided additional habitat for endangered waterbirds such as the Common Moorhen and Hawaiian Coot. This is a net benefit, and it is quite probable that the rarest of the endangered waterbirds, the Common Moorhen, is breeding at these ponds. With the thick grasses lining the ponds and ample amounts of forage, the ponds provide all the requirements needed (cover/food) for Common Moorhen reproduction. Taking out the ponds that are already in place and attempting to restore the stream to its original geomorphologic condition would provide little net benefit to native stream animals, and would reduce habitat for endangered waterbirds. Because of the preponderance of introduced fish species such as mosquitofish and green swordtails, which are known to parasitize and prey on native ‘o‘opu species, simply restoring the stream channel to a semblance of its natural state will do little to help native ‘o‘opu unless these alien species are also removed.

More importantly, the amount of sediment that could potentially be discharged into the stream and nearshore reef areas during the construction of the stream channel restoration and stabilization would be significant. It would also take some time for the stream channel to stabilize, and during this time sedimentation would adversely impact sensitive native species already found in this stream, such as the island endemic scarlet Kaua‘i damselfly. Therefore, the least environmentally damaging alternative would be to leave the ponds in place, while eliminating sediment runoff from the poorly constructed roads on the Pflueger property that appear to be a primary sediment source. It is not within the scope of this report to provide expert testimony on the source or causes of erosion and sedimentation observed around Gulch 3, but it was obvious that the current erosion control strategies in place, such as the gravel berms on the road to the lowest pond, were ineffective and are leading to increased soil erosion (Photo 9 and 10). An improved erosion control plan needs to be implemented to significantly reduce runoff going into the ponds and the stream in Gulch 3 (Photo 10, 11, and 12). Additionally, if it is deemed to be a flood risk, the removal of the 6” pvc pipes connecting Ponds 2 and 3, and Ponds 3 and 4, and replacing it with a natural rock substrate could have beneficial impacts. Rare native stream species such as the *Megalagrion* damselfly observed in the fast flowing outlet area below the lowest pond would likely take advantage of this new habitat.

Thus, the alternative that will provide the greatest amount of habitat for the most sensitive and rare native Hawaiian species should be one of keeping the ponds in place, and managing them for endangered Hawaiian waterbirds. Mitigation in the form of erosion control should take place, but mitigation could also take the form of improving endangered Hawaiian waterbird habitat. This

could occur through the installation of several small nesting islands in the ponds. If the ponds were removed, few long-term benefits to other native species such as ‘o‘opu or other stream species would accrue because of the prevalence of other introduced fish species in this stream area, and it would also eliminate prime habitat for several Federally endangered waterbird species. Short to medium-term harm by increased sedimentation would occur to stream and reef species while trying to restore the stream channel to its former geomorphology, and could possibly eliminate the native *Megalagrion* damselfly species observed at the lowest pond outlet as well. The caveat for the least harmful to the environment (of not removing the ponds) recommendation option is that effective erosion control techniques need to be implemented. Properly designed, long-term sediment reduction procedures (e.g., road closures, revegetation, proper berms, etc.) and structures need to be put into action. Native plants should be used whenever possible to revegetate hills and closed roads. To ensure effectiveness of this mitigation, long-term monitoring of the new erosion control structures, and sedimentation monitoring should be conducted by a qualified geologist or hydrologist.

**References**

Englund, R.A., C. Imada & D.J. Preston. 2002. Stream and botanical survey of an unnamed tributary flowing into Pu‘u Ka ‘Ele Reservoir and Pila‘a Stream, Pila‘a, Kilauea, Kaua‘i. Report prepared for Max W.J. Graham, Jr., Esq., Belles Graham Proudfoot & Wilson, Lihue, Kaua‘i. 27 pp.

Photo 1. The landscaped areas around Pond 2 and Pond 3 appear to be stable. Note the 6" PVC pipe connecting the ponds under the grassed causeway (Photo 3 shows a different angle of the discharge end).

Photo 2. The banks of Pond 1 appear to be stable. Note turbidity from recent surface flow, water lilies and small streamlet connecting Pond 1 with Pond 2.

Photo 3. Six-inch PVC discharge pipe form Pond 2 into Pond 3.

Photo 4. Pond 4 and streamlet outlet.

Photo 5. The streamlet from Pond 4 to Pond 5 meandering through the topography.

Photo 6. General location at the outlet of Pond 7 where the endemic scarlet Kauai damselfly was sited. The discharge channel of the lowest pond (Pond 7) in Gulch 3 shows signs of erosion.

Photo 7. Lower stream reaches from seven ponds area emerging from Hau Tree thicket

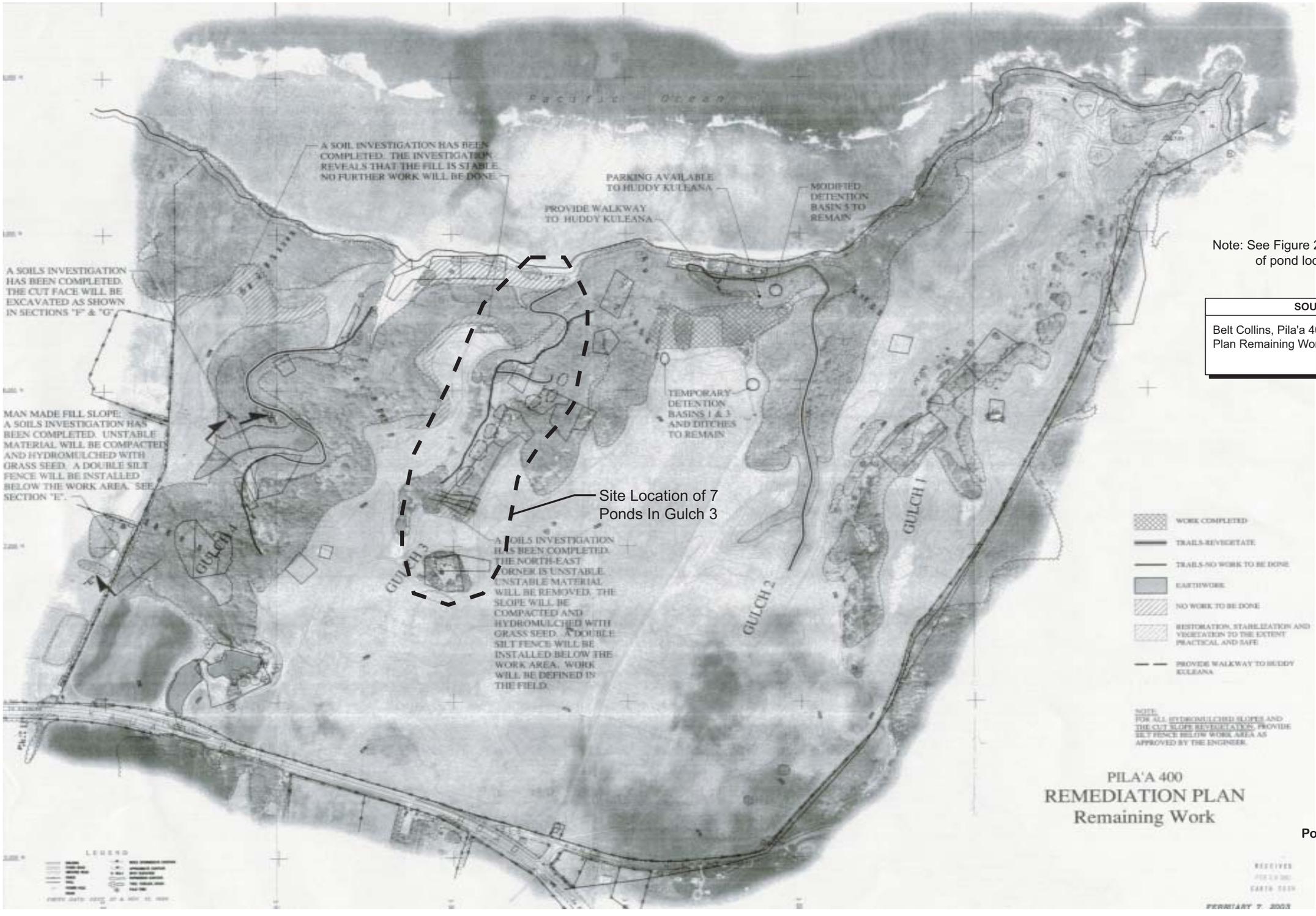
Photo 8. Lower stream reaches from seven ponds area as it enters the ocean.

Photo 9. Erosion on jeep trails in Gulch 3. Note that the rock filter berm is ineffective in preventing erosion and sediment is carried over the berm toward Pond 6 and 7 (Pond 6 is in the background on the right side).

Photo 10. Erosion on jeep trails Gulch 3. Note that the gravel berm is ineffective and has been breached by concentrated runoff along the jeep trail. (Pond 6 is in the background right side).

Photo 11. Erosion on jeep trail in Gulch 3 up gradient of Pond 1. The gravel is ineffective in protecting the trail from erosion, and the 18" CMP culvert under this jeep trail near Pond 1 is ineffective at handling storm flow.

Photo 12. View of erosion on the bare slope close to Ponds 3 and 4 in Gulch 3. Over a half foot of topsoil has been eroded away as indicated by the exposed roots of the shrub in the center of the photo.




Note: See Figure 2 for enlarged plan of pond locations in Gulch 3.

**SOURCE**

Belt Collins, Pila'a 400 Remediation Plan Remaining Work, February 7, 2003.

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NOT TO SCALE

**Figure 1**
**Pond Site Location Map**
**Pila'a, Kauai**

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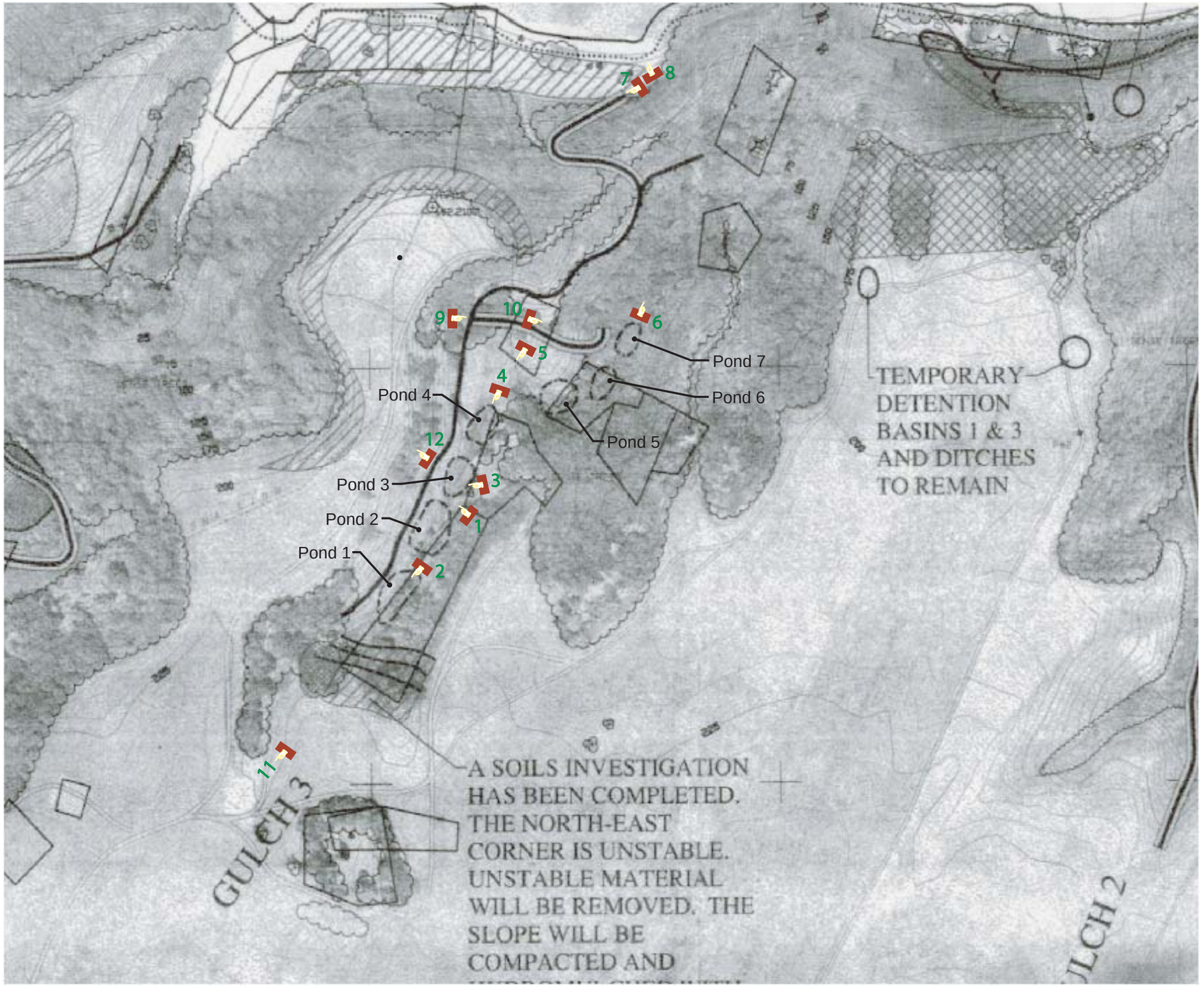


**LEGEND**

Photo Position and Direction

1 Photo Number

**SOURCE**

Belt Collins, Pila'a 400 Remediation Plan Remaining Work, February 7, 2003.

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**Figure 2**
**Pond Locations in Gulch 3**
**Pila'a, Kauai**

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