**Figure 16. Main basin at Feature 1, Site 2273, showing large hand-operated valves (intact at left, ruined at right); view southwest; basalt and mortar walls are 107-108 cm high**

**Figure 17. Smaller water-distribution basin, east side of Feature 1, Site 2273; view west-southwest; scale bar to the right is 80 cm high; portion of siphon (Feature 2, Site 2273) is visible at top of image**

**Figure 18. Detail of basalt and mortar inlet to smaller water-distribution basin, east side Feature 1, Site 2273; view northeast; scale bar (foreground) is 120 cm high (lower 10 cm obscured by grass)**

earthen ditch to the north (upslope). A smaller basin is located on the east side of Feature 1. This, too, grades into an earthen ditch to the north (upslope). Feature 1 occupies an overall area of approximately 10.0 m (NE/SW) by 7.5 m (NW/SE). The main basin is approximately 6.0 m long, 4.0 m wide and 1.0 m deep. The smaller basin to the east is approximately 12.0 m long, 2.0 m wide and 75–85 cm deep. This feature is a relatively complex water-distribution device with connections to at least two upslope siphons, another downslope siphon (the one that is buried on the south side), and two earthen catchment ditches on the upslope side. Most of this feature is in good physical condition.

**Feature 2**, the siphon entering Feature 1, is oriented up- and downslope on the east side of road Feature 1 (Site 2270). The siphon continues south (downslope) out of the project area to the location of an old pumping station; it continues north (upslope) to another formally-constructed water-distribution basin (Feature 22). Its overall length in the project area is 2.0 km. The siphon is constructed of a ferrous-metal pipe (80-cm diameter) riveted together in sections, and consists of three sub-features. Sub-feature A, the main (2.0-km long) siphon pipe, is mounted and stabilized by small concrete pads and ferrous metal brackets (Figure 19) that occur about every 10.0 m. The top of the siphon is about 95 cm above the ground surface; its bottom is about 15 cm above the ground surface. The concrete pad we inspected in detail consists of three levels; its base is rectangular and measures approximately 2.0 m (E/W) by 1.0 m (N/S). The siphon crosses under the road (Feature 1, Site 2270), about two-thirds of the way up the east side of the project area, over to the west side of the road (Figure 20), and continues on top of concrete footings above ground until it terminates just south of Feature 22 (the upper water-distribution basin). This siphon varies from fair to good physical condition.

Sub-feature B, on the upper (north) portion of the main siphon, is a section of vertical siphon constructed of standard, 80-cm diameter pipe (Figure 21). The vertical section is 3.0 m long; its top is 4.0 m above the adjacent ground surface. This section of siphon is welded into an opening in the main siphon line and reinforced by welded ferrous-metal supports atop a small concrete pad. The name “Floyd” is etched (graffiti-style) into the surface of the pipe. This sub-feature is in good condition.

Sub-feature C, located near the lower (south) portion of the main siphon pipe, is another section of vertical siphon, identical in terms of its constituent materials to Sub-feature B (Figure 22). The vertical section is 2.5 m in length; the top of the vertical section is 3.5 m above the adjacent ground surface. This sub-feature is in good condition.

**Feature 3** is another siphon (80-cm pipe) that crosses under road Feature 1 (Site 2270) just north of the Feature 1 water-distribution basin (Figure 23) and continues along (parallel to) the west side of the road. This siphon’s downslope (south) end is at the large water-distribution basin (Feature 1). Its upslope (north) end is at a now-ruined junction with a cross-slope irrigation ditch (Feature 8). The original construction of the upper end of the siphon was designed to catch water coming across slope from Feature 8, but this road intersection has been bulldozed in the recent past. The overall length of this siphon, from its ruined north (upslope) end to its south end where it disappears under road Feature 1 (Site 2270) just north of the Feature 1 water-distribution basin, is approximately 550 m. This feature is in fair to poor physical condition.

**Feature 4** is a long section of prefabricated flume oriented up- and downslope on the east side of the main mauka-makai earthen road (Feature 1, Site 2270) (Figure 24). The flume is constructed of cast concrete sections with a flared, U-shaped cross section. Each section is 33 cm in height. Its base width is 40 cm measured from the exterior and 30 cm on the inside. At the top, its width is 46 cm measured from the exterior and 36 cm inside. These sections are held together by metal clips and sealed with caulking. The side openings (small sluice gates) measure 12 cm high by 9 cm wide, and could be closed by sliding down a piece of fitted sheet metal into the slotted opening. The overall length of this feature is approximately 850 m. This feature is in fair to good physical condition. According to Goodman and Nees (1991), this type of above-ground flume was portable, capable of being moved around the plateau lands to distribute water through its small sluice gates.

**Figure 19. Feature 2, Sub-feature A, Site 2273, showing concrete pad and metal brackets, east side of road, view east; scale bar marked in 10-cm increments; top of siphon is 90 cm above ground surface**

**Figure 20. Feature 2, Sub-feature A, Site 2273, showing concrete pad without ferrous-metal brackets, west side of the road, view north-northwest; scale bar marked in 10-cm increments; top of siphon is 90 cm above ground surface**

**Figure 21. Feature 2, Sub-feature B, Site 2273, view southeast; scale bar is 2 m high**

**Figure 22. Feature 2, Sub-feature C, Site 2273, view east; scale bar is 80 cm high**

**Figure 23. Feature 3, Site 2273, partially-buried (by design) siphon (arrow) under road (Feature 1, Site 2270); view north (this is also depicted in plan map for Feature 1, Site 2273, above)**

**Figure 24. Representative section of Feature 4, Site 2273; view north; scale bars are 40 cm long**

**Feature 5** is a short section of prefabricated flume oriented across the slope (NE/SW) on the south side of a mauka-makai earthen road (Feature 10, Site 2270) leading to the area around Reservoir 3 (Figure 25). The flume is identical to Feature 4 in terms of its constituent materials and cross-section dimensions; it is constructed of cast concrete sections with a flared, U-shaped cross section. The individual sections are held together by metal clips and sealed with caulking. The side openings (small sluice gates) could be closed by sliding down a piece of fitted sheet metal into the slotted opening. The overall length of this feature is 20.5 m. This feature is in fair physical condition. According to Goodman and Nees (1991), this type of above-ground flume was portable, capable of being moved around the plateau lands to distribute water through its small sluice gates. Feature 5 is complete on its west end, which is a constructed opening where water collected into the flume to head east; its east end, however, is broken and incomplete, possibly having been bulldozed to make way for an earthen road into what was once a military storage area to the south. The earthen road can no longer be identified on the ground, but historic maps from the 1930s and 40s indicate its previous presence in this general area.

**Feature 6** is a metal pole on a small concrete footing (approximately 20 cm by 35 cm) with a metal marker at the top (Figure 26) approximately 10 m west of the main mauka-makai earthen road (Feature 1, Site 2270). The pole is approximately 5-m tall and consists of a 3-in. diameter ferrous-metal pipe. This unique feature appears to be a marker of some kind that is visible for some distance from the surrounding landscape. There is an earthen ditch running along parallel to the main road near the base of this pole. Because of soil erosion and modern ground disturbance in this area, the ditch cannot be followed, described or mapped with any precision. However, the most likely functional explanation for Feature 6 is that it once marked the location of this ditch. Feature 6 is in good condition.

**Feature 7** is a cross-slope ditch with cut basalt and mortar sides and a constructed cut basalt and mortar base on the west side of road Feature 1 (Site 2270) (Figure 27). On its west end, Feature 7 originally started at the south end of Reservoir 3; the ditch at this south end of the reservoir has been destroyed, apparently by a combination of civil engineering (flood control) activities and military activities (in the 1940s). Currently, the west end of Feature 7 is the intersection of road Features 26 and 27, south of Reservoir 3. On its east end, this ditch terminates near road Feature 1, but is currently buried by modern sedimentary deposition and cannot be observed on the ground surface. Paralleling this ditch on its upslope (north) side is another earthen road (Feature 2, Site 2270). The interior dimensions of the ditch are 145 cm wide at the base flaring up to 155 cm wide at the top. The depth of this ditch (to its soil-filled bottom) is currently 40 cm, but it was originally approximately 1.0 m deep. Currently, the overall length of the extant portion of this ditch is approximately 970 m.

**Feature 8** is another cross-slope ditch with cut basalt and mortar sides and a constructed cut basalt and mortar base on the west side of the main road (Feature 1, Site 2270) (Figure 28). On its west end, according to historic maps from the 1930s, Feature 8 originally started at the south end of Reservoir 2; the ditch at this west end is visible but partially buried under modern sediment. The east end of the ditch intersects with a ruined section of the top (upslope end) of siphon pipe Feature 3, where a hand-operated siphon valve (manufacturer's stamp includes the word "CRANE") similar to those at Feature 1 is located (Figure 29 and Figure 30) in a bulldozed context. This entire area east of ditch Feature 8 is disturbed by modern road maintenance. Paralleling this ditch on its upslope (north) side is another earthen road (Feature 3, Site 2270). The interior dimensions of the ditch are 135 cm wide at the base flaring up to 145 cm wide at the top. The depth of this ditch is currently 50 cm, but it was originally approximately 1.0 m deep. Currently, the overall length of the extant portion of this ditch is approximately 330 m.

**Figure 25. Representative section of Feature 5, Site 2273, view east; scale bars marked in 10-cm increments**

**Figure 26. Feature 6, Site 2273 (metal pole on small concrete footing with metal marker at top), view west**

**Figure 27. Representative section of cross-slope cut basalt and mortar ditch, Feature 7, Site 2273; view north; horizontal scale bar in the base of the ditch is 120 cm long**

**Figure 28. Representative section of cross-slope cut basalt and mortar ditch, Feature 8, Site 2273; view north; vertical scale bar in the base of the ditch is 80 cm long**

**Figure 29. Bulldozed area at the intersection of Feature 8 (Site 2273) cross-slope ditch and top of Feature 3 (Site 2273) siphon, view southwest; scale bar is 80 cm high**

**Figure 30. Destroyed hand-operated valve at the intersection of Feature 8 (Site 2273) and Feature 3 (Site 2273), view southeast; scale bar is 120 cm high**

**Feature 9** is a 5-m long section of prefabricated flume on the south side of road Feature 10 (Site 2270) leading to Reservoir 3. Feature 9 is similar to Feature 5 in terms of its orientation (NE/SW) and position on the landscape, but the two flumes are distinct from each other. Feature 9 is wider than the others described above (Features 4 and 5), but it is otherwise identical to them in terms of its constituent materials and design. Not including its west end, which is the widest part of this feature, its base is 60 cm (interior) to 70 cm (exterior) wide. At the top, its width is 76 cm (exterior) and 66 cm (interior) (Figure 31). Feature 9, which is in fair physical condition, is complete on its west end, a constructed (flared) opening designed to capture surface water; its east end, however, is broken and incomplete.

**Feature 10** is an earthen ditch lacking constructed materials that begins near the formal cut basalt and mortar water-distribution basin (Feature 1) and heads to the east approximately 530 m before it exits the project area. It ranges from 1.0–1.5 m wide and 50–75 cm deep. This ditch is heavily covered in tall grasses and koa haole and can barely be recognized. It is in fair physical condition (Figure 32).

**Feature 11** is an earthen ditch lacking constructed materials (Figure 33). It begins just downslope (south) of Reservoir 2 and heads west approximately 500 m before it becomes completely unrecognizable and filled in with sediment. It ranges from 1.0–1.5 m wide and 50–75 cm deep. This ditch is heavily covered in tall grasses and koa haole and can barely be recognized. It is in fair physical condition.

**Feature 12** is a prefabricated flume oriented up- and downslope on the east side of road Feature 1 (Site 2270) (Figure 34). The flume's constituent materials and design characteristics are identical to Feature 4. Its overall length is approximately 420 m. At its south end, it empties into a shallow erosional channel whose age (historic or modern) cannot be ascertained. This shallow channel eventually joins up with the earthen ditch Feature 10. Feature 12 is in fair to good physical condition.

**Feature 13** is a cross-slope ditch with cut basalt and mortar sides and a constructed cut basalt and mortar base. The feature is in good to fair physical condition. We identified five sub-features.

Sub-feature A, the main ditch, is oriented across the slope (E/W), starting from Reservoir 1-A in the east and exiting the project area in the west, a distance of approximately 1.5 km. Its eastern half follows along upslope (north) of Gulch B. When in operation, this ditch was fed by Reservoir 1-A. Its maximum exterior width is 185 cm; the interior top of the feature measures 160 cm across; the interior base is 130 cm wide (Figure 35). Depending on the amount of post-abandonment sedimentary deposition within the ditch, its interior height ranges from 60–80 cm. Its depth was originally approximately 1.0 m.

Sub-feature B, a cut basalt and mortar sluice gate (Figure 36 and Figure 37), extends to the southeast approximately 5.0 m and has three separate openings to the northeast, southeast and south. The northeast opening, which has metal brackets framing its sluice gate grooves, appears to have served as a water intake (rather than an outlet) from an earthen ditch just upslope feeding into it. The southeast opening and the south opening, which is the only one with no formal sluice gate grooves or structures, appear to be outlets that send water over the ground surface. Sub-feature B is approximately 65 cm wide and high.

Sub-feature C, another cut basalt and mortar sluice gate (Figure 38), changes into a prefabricated concrete flume (a later modification) as it heads south for another 4.0 m. From the main ditch (Sub-feature A) to the end of the flume, Sub-feature C is approximately 7.5 m long, 55–60 cm wide and 70–75 cm high.

Sub-feature D, another constructed sluice gate opening, shows a more complex design where the diversion channel heads south into a short deflection wall/ T-shaped intersection that distributes water in both east and west directions (Figure 39). From the main ditch (Sub-feature A) to the end of the flume, Sub-feature D is approximately 5.5 m long, 55–60 cm wide and 50–55 cm high.

Sub-feature E, yet another sluice gate variation, interpreted as a later modification to the ditch's original structure (Figure 40), shows a concrete pipe (20-cm diameter) placed into an opening along the top of the cut basalt and mortar wall. Sheet metal was fitted into a slot at the end of the pipe, which distributes water to the downslope side. The concrete pipe is approximately 2.0 m long.

**Figure 31. Feature 9, Site 2273, view northeast; scale bars marked in 10-cm increments**

**Figure 32. Feature 10, Site 2273, earthen ditch, view northwest; scale bar marked in 10-cm increments**

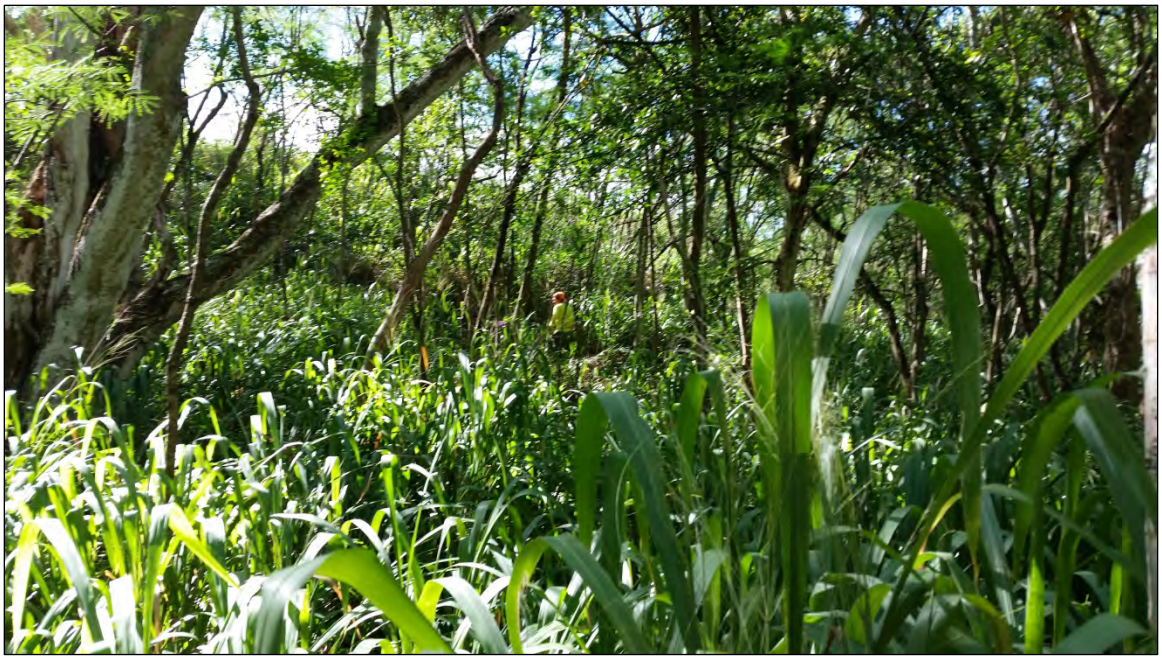

**Figure 33. Feature 11, Site 2273, view southwest; earthen ditch runs through the center of the image to the archaeologist (for scale) in background**

**Figure 34. Feature 12, Site 2273, view east; scale bar marked in 10-cm increments**

**Figure 35. Representative section of Feature 13, Sub-feature A, Site 2273, view northeast; vertical scale bar in foreground is 80 cm high**

**Figure 36. Feature 13, Sub-feature B, Site 2273, view southeast; constructed sluice gate oriented to the southeast off the main ditch (Sub-feature A), foreground; scale bar is 80 cm high**

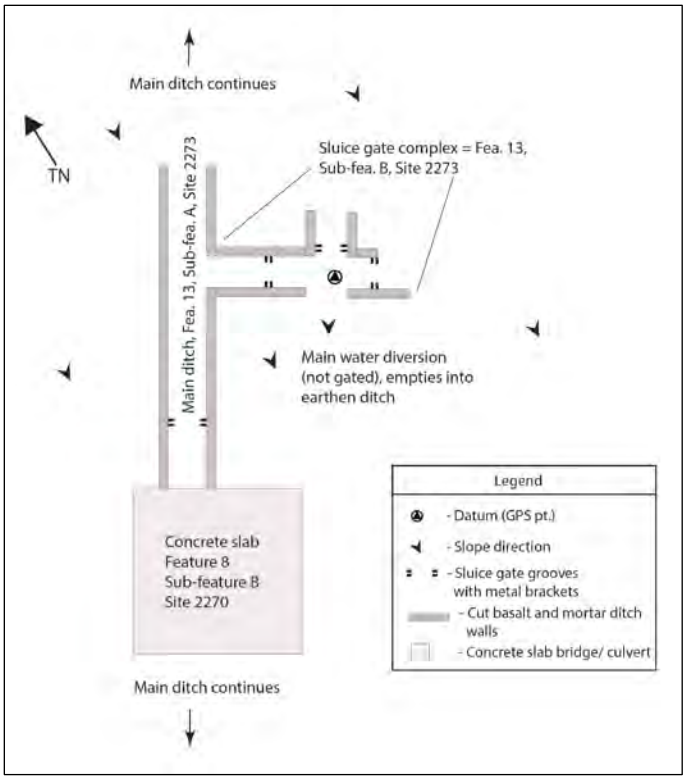


**Figure 37. Plan view—not to scale—of Feature 13, Sub-feature B, Site 2273 as it connects with the main ditch**

**Figure 38. Feature 13, Sub-feature C, Site 2273, view south; sluice gate grooves are in front of scale bar; scale bar is 80 cm high; note, prefabricated concrete flume in background**

**Figure 39. Feature 13, Sub-feature D, Site 2273, view south; sluice gate grooves are in front of the foreground scale bar; cut basalt and mortar opening leads into a short deflection wall/ T-shaped intersection (background); scale bars are 80 cm high**

**Figure 40. Feature 13, Sub-feature E, Site 2273, view south; concrete pipe with a sheet metal sluice gate through its end, placed into opening along the top of ditch; scale bar is 80 cm high**

**Feature 14** is a very long ditch with cut basalt and mortar sides and a constructed cut basalt and mortar base. We identified three sub-features.

Sub-feature A, the main ditch, is oriented (like Feature 13, which is just upslope) generally east to west across the project area, starting from Reservoir 1-A in the east and eventually exiting the project area in the west. Unlike Feature 13, the east end of Feature 14 is more complex as it makes one large "switch back" between Reservoir 1-A and Reservoir 1-B. The eastern portion of Feature 14, from the south end of Reservoir 1-A, then passing by the east side of Reservoir 1-B, eventually meets up with a mauka-makai oriented irrigation ditch (Feature 17) heading down to Reservoir 3. The west end of Feature 14, as it nears the project area boundary, disappears and may be buried under sedimentary deposition. The entire length of Feature 14, as can be currently identified on the landscape, is approximately 3.4 km (0.8 km on the west side of road Feature 6, and 2.6 km on the east side of this road). Portions of Feature 14 follow along parts of the upper (north) edge of Gulch B. When in operation, the Feature 14 ditch connected with both Reservoir 1-A and Reservoir 1-B. Its maximum exterior width is 185 cm; the interior top of the feature measures 160 cm across; the interior base is 130 cm wide. Depending on the amount of post-abandonment sedimentary deposition within the ditch, its interior height ranges from 60–80 cm. Its depth was originally approximately 1.0 m (Figure 41). Other than being partially buried by sediment in some places, this sub-feature is generally in good physical condition.

Sub-feature B is a culvert under the road Feature 6 (Site 2270) and a cut basalt and mortar sluice gate on the south side of the main ditch (Figure 42). The 80-cm (diameter) concrete pipe underneath the road is nearly completely filled in with sediment. The constructed sluice gate heading south extends for approximately 3.0 m then transitions into an earthen ditch. Both the formal sluice gate and the earthen ditch parallel the road (Feature 6, Site 2270). From the main ditch (Sub-feature A) to the end of the cut basalt and mortar sluice gate, Sub-feature B is approximately 3.0 m long, 65–70 cm wide and 80–85 cm high. This sub-feature is in good physical condition. A pair of sluice-gate grooves are located on either side of the north end of the Sub-feature B sluice gate, and the main ditch (Sub-feature A) also has a set of sluice-gate grooves on either side of the opening to the sluice gate.

Sub-feature C is a sluice gate along a "switch back" section of the main ditch traversing the southern edge of Gulch B. This sluice gate structure is unusual in the project area as it diverts water from the main ditch to the *north*, rather than the south; in this case, it empties water into the Gulch B drainage which eventually flowed west-southwest into Reservoir 1-B (Figure 43). This sub-feature is in poor physical condition, having sustained extensive damage from being located on a steep slope (down to the north into Gulch B) that has eroded over time.

*Sub-feature C* consists of three main components. A cut basalt and mortar sluice gate with wooden sluice gates still in place is located at the top of the slope, built off the main ditch (Figure 44). This upper sluice gate is oriented to north to south. It is approximately 1.5 m long, 50 cm wide and 50 cm high. The west side of this constructed sluice gate is badly damaged and falling down the slope. At the bottom of the slope, a lower sluice gate constructed of relatively thin concrete slabs empties into the gulch bottom (Figure 45). This lower sluice gate is approximately 1.5 m long, 75 cm wide and 40 cm high. Between these two sluice gates, there is a concrete deflection wall that functioned to slow down the water pouring out of the upper sluice gate. Some of this water diverted to the west, as evidenced by an earthen erosional ditch, and some of it flowed down to the next (lower) sluice gate. This heavily-damaged deflection wall is approximately 2.5 m long (E/W) by 30–90 cm thick by 160 cm high.

**Figure 41. Representative section of Feature 14, Sub-feature A, Site 2273; view southeast; scale bar is 80 cm high**

**Figure 42. Feature 14, Sub-feature B, Site 2273, view southeast; culvert under road Feature 6 (Site 2270) is to the left, downslope sluice gate (paralleling the road) is to the right; main ditch (Sub-feature A) continues to the west (lower right in this image); scale bar is 120 cm high**

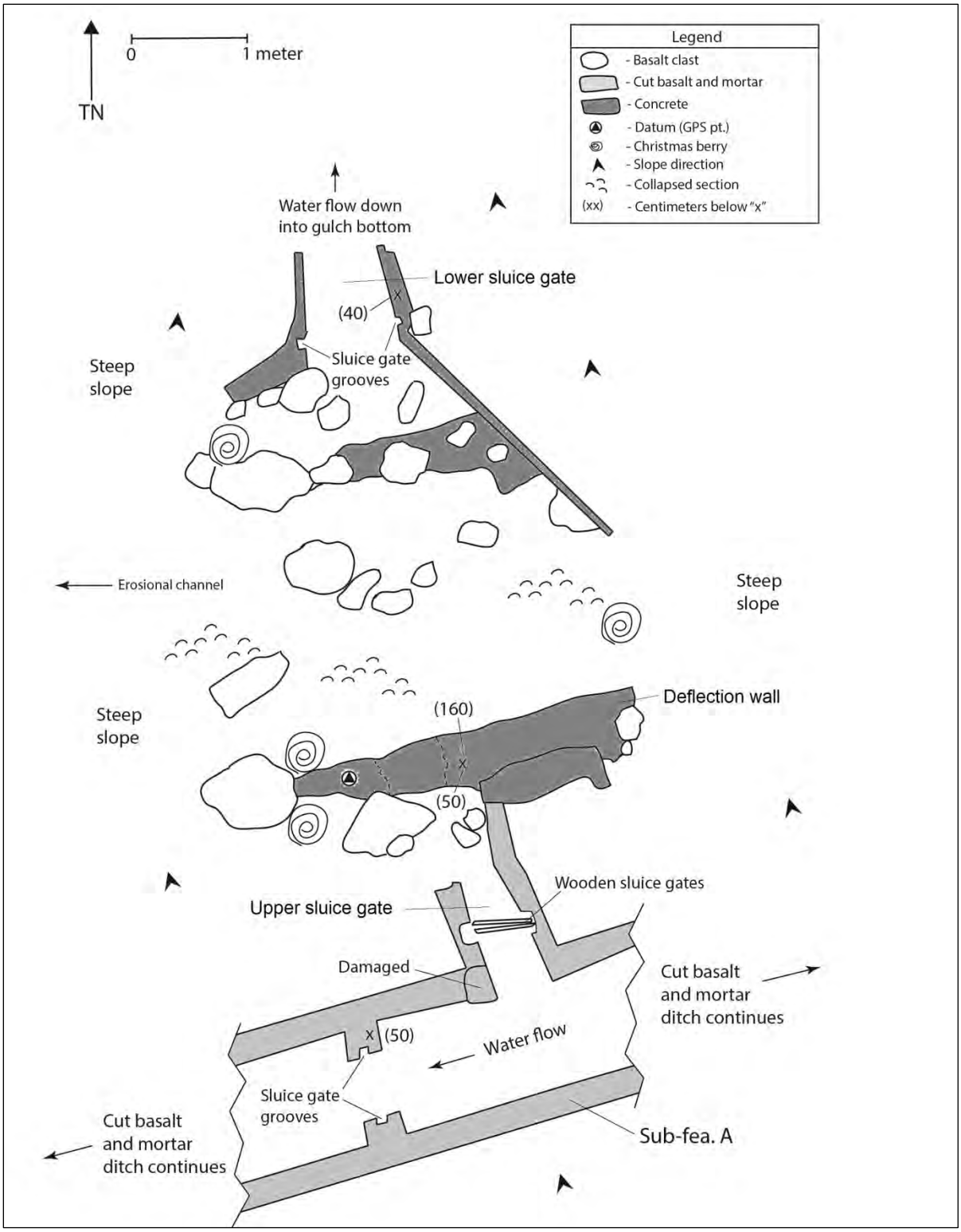


**Figure 43. Plan view Feature 14, Sub-feature C, Site 2273**

**Figure 44. Main ditch (Sub-feature A) and upper (south) portion of Feature 14, Sub-feature C (damaged sluice gate), Site 2273, view east; horizontal scale bar is 120 cm long**

**Figure 45. Lower (north) portion Feature 14, Sub-feature C, Site 2273, view south; vertical scale bar is 120 cm high; damaged deflection wall is in the middle ground (directly behind the vertical scale bar)**

**Feature 15**, an earthen ditch on the north side of a modern (non-historic) earthen road ending at a 4-way sluice structure, consists of two sub-features. Sub-feature A, an approximately 47.0-m long earthen ditch oriented mauka-makai (NE/SW), is 1.0 m wide and 50–75 cm deep. Sub-feature B, a 4-way sluice intersection at the south end of the ditch (Figure 46), is built of concrete slabs with some cut basalt and mortar; it occupies an area of 3.0 m (N/S) by 2.0 m (E/W). Its maximum height is 50–75 cm. In addition to the ditch on the north side of Sub-feature B, shallow earthen channels emanate from its other three sides. The channel to the south-southwest extends only a few meters. To the east and west of Sub-feature B, the channels are shallow and filled with sediment. Because the ditch and channels contain no structural rock work, and due to soil erosion and vegetation growth, it is difficult to determine their original dimensions. Sub-feature B is in poor physical condition.

**Feature 16**, a cross-slope irrigation feature at the south end of Gulch A, is a combination of siphon in its east half and cut basalt and mortar ditch in its west. It extends from Reservoir 2-B on the plateau east of Gulch A to the middle of the project area where it connects with other ditches linked to Reservoir 1-A. The two sub-features combined are approximately 1.2 km long. Feature 16 is two main sub-features. Sub-feature A, the cut basalt and mortar ditch, is typical of others in the project area. It is approximately 920 m long. Its maximum exterior width is 185 cm; the interior top of the feature measures 160 cm across; the interior base is 130 cm wide. Depending on the amount of post-abandonment sedimentary deposition within the ditch, its interior height ranges from 40–60 cm. Its depth was originally approximately 1.0 m. The physical condition of Sub-feature A is good to fair.

Sub-feature B, a siphon oriented east to west, is approximately 300 m long. It is in poor to fair physical condition with damage from flooding in Gulch A. Figure 47, a plan view of a representative section of the siphon where it crosses the drainage bottom, illustrates some of its design features. The ferrous-metal siphon (80-cm diameter), riveted together in sections, was sealed and weatherized with an outer layer of concrete (Figure 48 and Figure 49). The top of the siphon is 170 cm above the ground surface; its bottom is 80 cm above the ground surface. A pair of wooden railroad ties and smaller lumber once nailed together served as a foot bridge across the drainage. The top of the railroad ties, one of which rests atop the siphon, is 190 cm above the ground surface. The drainage channel passing under the siphon was formalized and stabilized with low cut basalt and mortar sides. This ditch, which measures 6.0 m (N/S) by 1.0 m (E/W) by 0.30 m deep, was built to ensure the meandering gulch channel did not undermine the siphon. Four, small concrete footings were placed to support the siphon across the drainage. Each of the four footings is approximately 60 cm high. The west end of the siphon enters a concrete culvert that crosses under the adjacent (to the west and upslope) earthen road (Feature 12, Site 2270).

**Feature 17**, a cut basalt and mortar ditch, starts at the east end of Reservoir 1-A, and continues downslope to Reservoir 3. We documented two sub-features. Sub-feature A, the main ditch, is approximately 1.3 km long, and typical in its constituent materials and design. Its maximum exterior width is 180 cm; the interior top of the feature is 160 cm across; the interior base is 135 cm wide. Depending on the amount of post-abandonment sedimentary deposition in the ditch, its interior height ranges from 40–65 cm. Its depth was originally approximately 1.0 m. The physical condition of Sub-feature A is good to fair.

Sub-feature B is a right angle-shaped cut basalt and mortar ditch connecting the main ditch (Sub-feature A) with the east end of Reservoir 1-A (Figure 50 and Figure 51). The south end of this connector, along road Feature 7 (Site 2270), once had a culvert that went under the road; however, any evidence of a culvert has been destroyed or buried by earth movement associated with the remodeling of the old reservoir for flood-control purposes. The connector ditch extends north from the road 6.0 m where it makes a right-angle turn to the left (west) down another 5.0 m into the old reservoir. The height of this feature, measured from within the ditch, varies from only 30–50 cm at the south end to over 110 cm at the west end (entering the reservoir). The N/S portion of Sub-feature B is wider (100 cm) than the E/W portion (70 cm). Part of the north side wall of the west portion has been repaired with standard kiln-fired (red) bricks and mortar. This sub-feature is in good physical condition.

**Figure 46. Feature 15, Site 2273, 4-way sluice structure built of both cut basalt and mortar and concrete; view northeast; scale bar in foreground is 80 cm high**

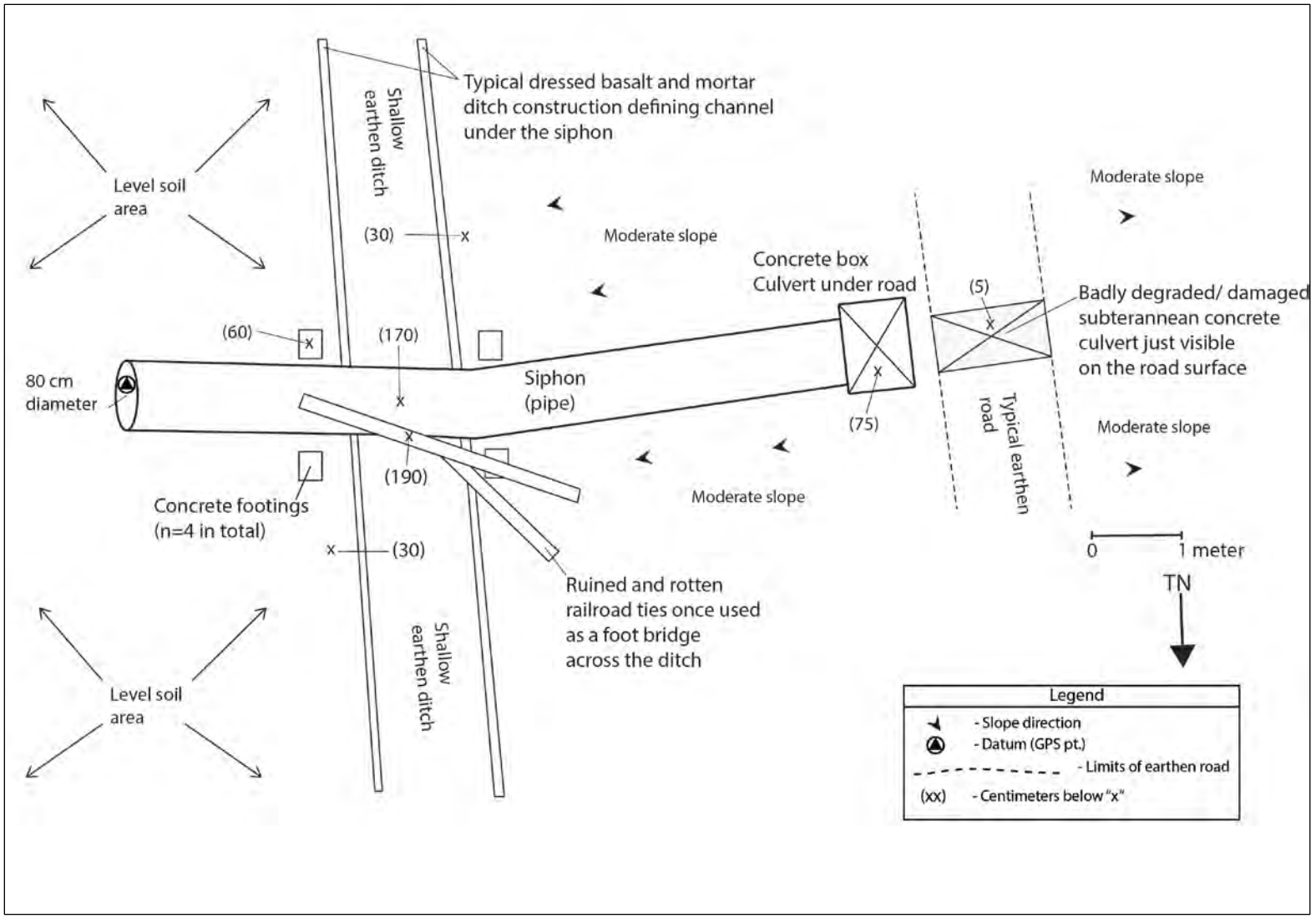


**Figure 47. Plan view of a portion of Feature 16, Sub-feature B, Site 2273, where it crosses the drainage channel in the eastern arm of Gulch A**

**Figure 48. Portion of Feature 16, Sub-feature B, Site 2273, view south-southeast; scale bar is 80 cm high**

**Figure 49. Another view of a portion of Feature 16, Sub-feature B, Site 2273, view south; same scale as above**

**Figure 50. Feature 17, Sub-feature B, Site 2273, road Feature 7 (Site 2270) is red dirt visible in the background (top of the image); view south; scale bar is 1.0 m high**

**Figure 51. Another view of Feature 17, Sub-feature B, Site 2273, view west; vertical scale bar is 1.0 m high; water once flowed to the west (background in this view) directly into Reservoir 1-A (tall grass)**

**Feature 18** is a lithic processing area built and used by irrigation-ditch builders along the east bank of Gulch C, near its north end, on the inside of a large stream meander. This feature, which occupies an area of approximately 26.0 m (N/S) by 14.0 m (E/W), consists of four sub-features that collectively represent the remnants of a basalt boulder storage and reduction area whose primary function was to supply irrigation ditch builders with shaped ("dressed") basalt blocks (Figure 52). Large basalt flakes and debitage litter the Feature 18 area, and some sub-features are partially constructed of this material. The flakes are relatively large; they were produced by direct percussion with metal (presumably iron) bars and chisels. Some of the sub-features are partially constructed of square- and rectangular-shaped blocks of basalt exhibiting flakes scars with right angles and square notches. In general, this feature is in good to fair physical condition with some naturally-collapsed sections but no major damage or disturbance. Like nearly all of the features in Gulch C, this feature is located within an extremely dense ground cover of California grass and koa haole.

Sub-feature A, a small pile of angular basalt boulders and cobbles next to a natural boulder outcrop along the east edge of the Gulch C drainage, measures approximately 4.0 m (N/S) by 2.0 m (E/W) by 0.40–0.45 m high (Figure 53). A scatter of lithic debitage is immediately east of Sub-feature A.

Sub-feature B, a pair of short, parallel rock terraces just above (east of) the toe of slope, occupies an area measuring approximately 8.0 m (N/S) by 4.0 m (E/S) (Figure 54). These terraces, which are built into the natural, gently-sloping (down to the west) ground surface, create a set of steps up the slope (to the east), as well as a level, earthen walkway (parallel to the long axis of the drainage) between them. The lower of the two terraces incorporates a large natural boulder outcrop in its design as well as abundant lithic flakes and debitage. The lower terrace has a height of approximately 50 cm above the adjacent ground surface to the west. The upper terrace includes numerous square- and rectangular-shaped blocks of basalt. Most of the clasts are small boulders and cobbles. The upper terrace has a height of approximately 40 cm above the adjacent ground surface to the west. Both of the terraces exhibit short sections of formal, vertical facing of 1–2 courses high.

Sub-feature C, a large pile of angular boulders against and atop large natural boulder outcrops, measures approximately 10.0 m (N/S) by 4.0 m (E/W) (Figure 55). This pile, which is constructed onto the natural, gently-sloping (down to the west) ground surface about one 1 m (higher in elevation) than the rest of the sub-features at Feature 18, appears to be a stock pile of basalt for future processing into blocks for building irrigation ditches. The pile has a maximum height of approximately 130 cm above the adjacent ground surface to the west.

Sub-feature D, at the north end set back (to the east) a short distance from the edge of the Gulch C drainage, is another basalt stock pile area incorporating large natural boulder outcrops. It measures approximately 7.0 m (N/S) by 7.0 m (E/W), and consists mostly of boulder-sized clasts (Figure 56). The top of the rock pile is approximately 60 cm above the adjacent ground surface to the west.

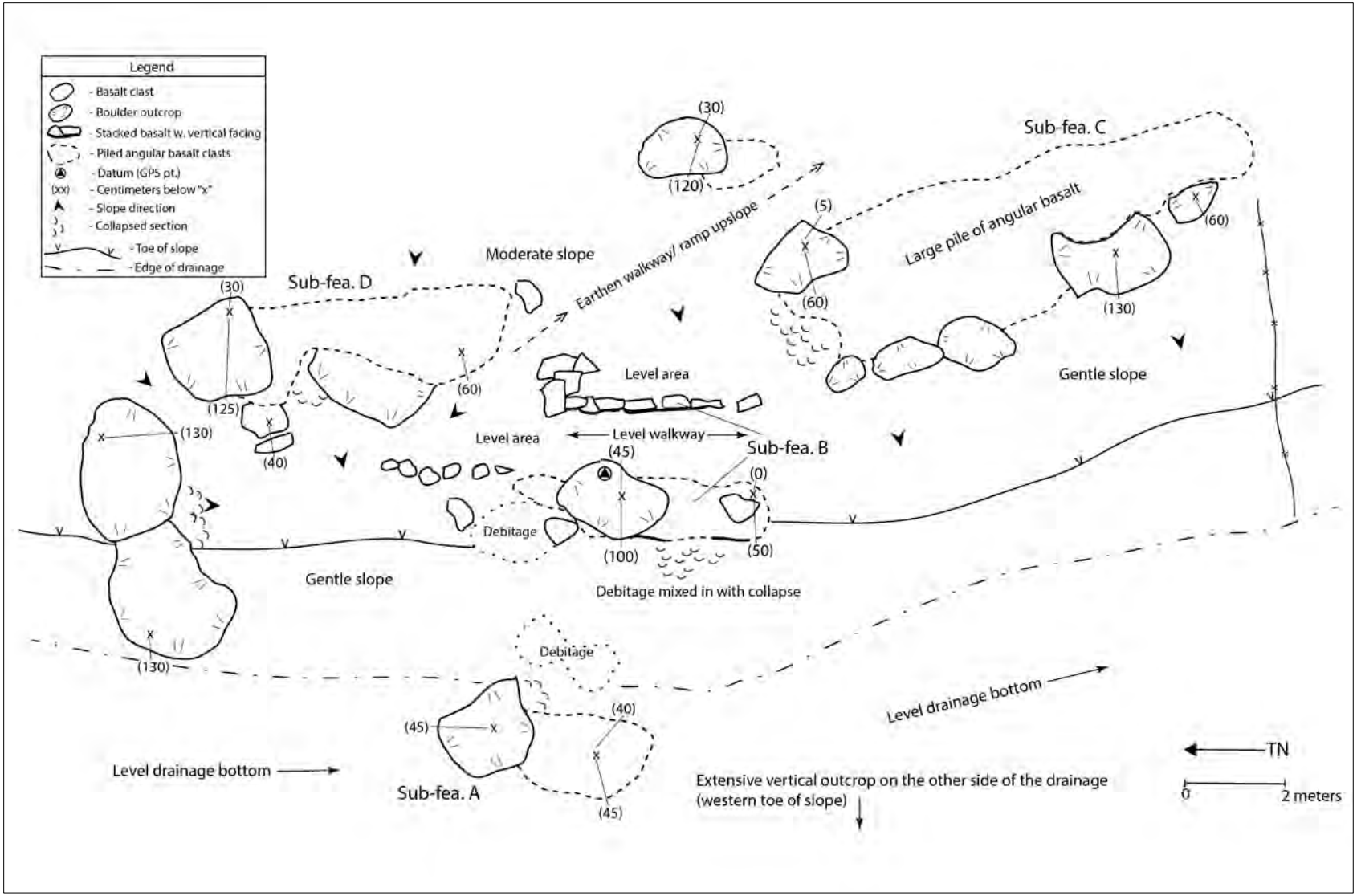


**Figure 52. Plan view Feature 18, Site 2273**

**Figure 53. Feature 18, Sub-feature A (angular boulder pile), Site 2273, view northwest; scale bar is 80 cm high; note, large flakes in the lower right-hand corner**

**Figure 54. Feature 18, Sub-feature B (pair of rock terraces, center of image), Site 2273, view north; scale bar is 120 cm across; note, drainage bottom is to the left**

**Figure 55. North end of Feature 18, Sub-feature C (large pile of angular boulders atop and against natural boulder outcrops), Site 2273, view southeast; vertical scale bar is 120 cm high**

**Figure 56. Feature 18, Sub-feature D (large pile of angular boulders atop and against natural boulder outcrops), Site 2273, view east; vertical scale bar is 120 cm high; note the "wall" of California grass in the background that, prior to clearing, covered the entire feature area**

**Feature 19** is a massive rock retaining structure with a culvert underneath leading to a hand-operated valve and siphon built and used by plantation workers along the south bank of Gulch B, near its west end. The location of this feature corresponds with the south edge of Reservoir 1-B, suggesting it functioned as a type of dam that could be used to control the level of water in the reservoir with an outlet on the south side (i.e., the siphon valve) to send water over the ground surface in that direction. This is one of the most impressive plantation structures in the project area, and certainly *the* most impressive dry-stacked feature.

This feature, which occupies an area of approximately 38.0 m (E/W) by 33.0 m (N/S) and has portions that are 5.0–6.0 m above the ground surface, consists of three sub-features that collectively represent the remnants of a heavy-duty water diversion, collection and redistribution structure (Figure 57 and Figure 58). In general, this feature is in good to fair physical condition with some naturally-collapsed sections. Numerous, large Christmas berry trees growing into the top of the main retaining structure (Sub-feature A) have caused significant damage, which is ongoing. Compared with most other features in the project area, the vegetation at Feature 19 is relatively sparse and ground visibility is good.

Sub-feature A, the main slope-retaining structure and dam, is constructed of large, cut and dressed basalt boulders fitted onto the steep, natural gulch slope as a kind of heavy-duty veneer; our inspection of this feature, which was relatively difficult and dangerous to accomplish given the steep, slippery slope, indicates there is only one layer of fitted boulders directly over the earthen slope. No mortar was used during construction of this sub-feature. Sub-feature A measures approximately 38.0 m (E/W) by 11.0 m (N/S) by 5.0–6.0 m high (Figure 59). As depicted in the schematic profile below, there is a constructed low ridge between the longer, western portion of this structure and the eastern portion. The culvert travels under this low ridge to the south where it eventually emerges near the siphon valve (Sub-feature C).

Sub-feature B, a culvert passing under Sub-feature A from north to south, has an intake/ opening constructed of shaped basalt slabs and a water conduit constructed of a ferrous-metal siphon (pipe) measuring 80 cm in diameter and 22.5 m long (N/S) (Figure 60). The opening of the culvert on the north side of Sub-feature A is a semi-circular, earthen depression measuring approximately 150 cm in diameter and 140 cm deep. This was once a water catchment where excess gulch water drained through the culvert to the other side of the retaining structure where it collected in a small earthen pool to be siphoned further down the plateau south of Feature 19.

Sub-feature C is a large, hand-operated valve that appears to be made of iron (Figure 61). A manufacturer's stamp on this valve reads as follows: "CHAPMAN VALVE M.F.G. CO., BOSTON, U.S.A." The area between this valve and the back (south) side of Sub-feature A is heavily eroded and channelized. A gently-sloping, partially level soil area immediately west of this valve appears to be the remnants of an old bulldozed access road. The area in and around this possible road is heavily eroded and difficult to definitively describe. We did not find the other (south) end of the siphon that goes through this valve; we presume its other end is buried downslope under modern sedimentary deposition in heavy vegetation.

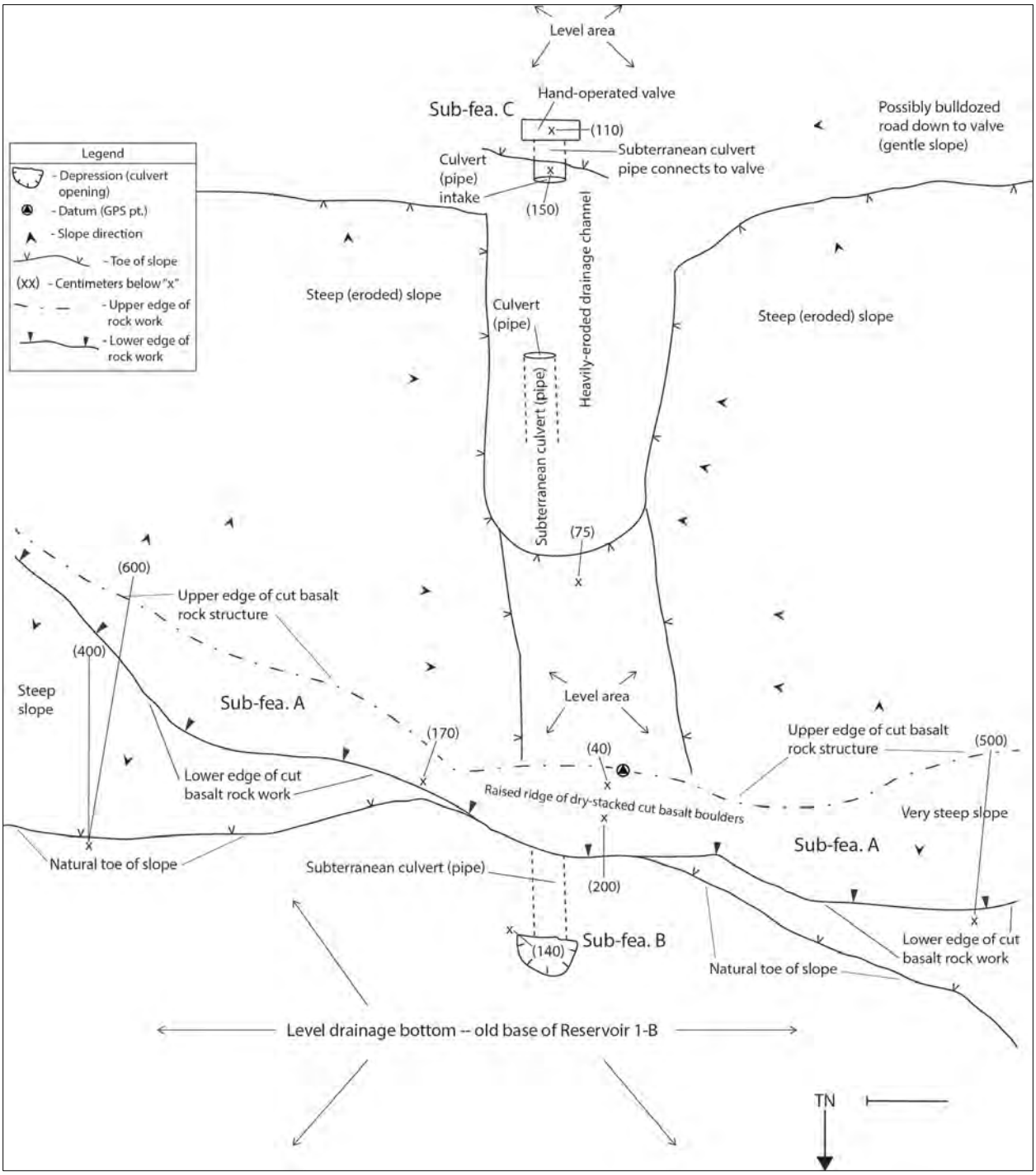


**Figure 57. Plan view Feature 19, Site 2273**

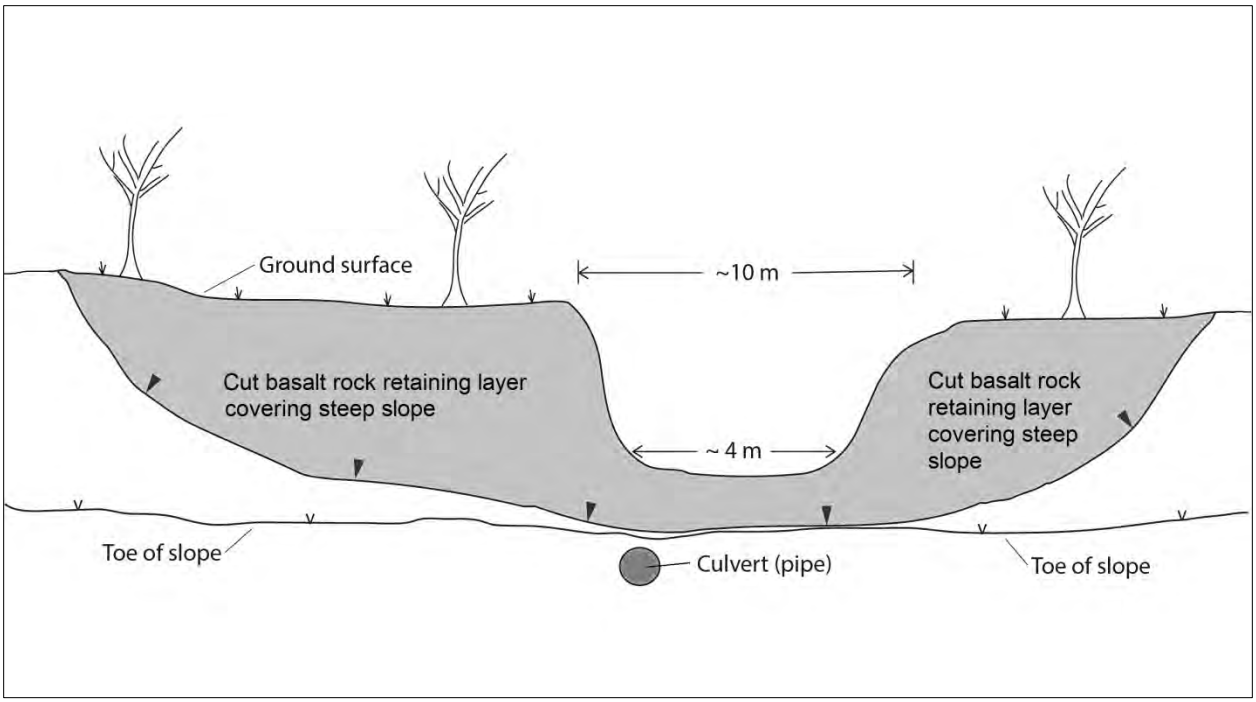


**Figure 58. Schematic--<u>not to scale</u>--profile of Feature 19, Site 2273, view south**

**Figure 59. Portion of west half of Feature 19, Sub-feature A (main retaining structure), Site 2273, view east; scale bar is 120 cm high**

**Figure 60. Feature 19, Sub-feature B (constructed culvert opening), Site 2273, view south; scale bar is 80 cm high**

**Figure 61. Feature 19, Sub-feature C, Site 2273, view south; vertical scale bar is 80 cm high**

**Feature 20** is a short section of prefabricated flume oriented up- and downslope (NNE/SSW) on the south side of a modern (non-historic-age) earthen road in the western project area between two major cross-slope ditches (Features 13 and 14). The north end of the flume appears to have been damaged by clearing for the modern road (Figure 62). From this north end to the south end, which empties into an open field, the flume is approximately 25 m long. The flume, like other light-duty, portable examples in the project area, is typical in terms of its constituent materials and design. Each section is 33 cm in height. Its base width is 40 cm measured from the exterior and 30 cm on the inside. At the top, its width is 46 cm measured from the exterior and 36 cm inside. These sections are sealed together with caulking. The side openings (small sluice gates) measure 12 cm high by 9 cm wide, and could be closed by sliding down a piece of fitted sheet metal into the slotted opening. This feature is in poor to fair physical condition.

**Feature 21** is an abandoned (now empty) reservoir, labelled Reservoir 2-B on historic maps from the 1930s, in the northeast corner of the project area on the ridge separating Gulch A from the Waiawa Stream (which is out of the project area to the east) (Figure 63). The reservoir measures approximately 110 m (N/S) by 30 m (E/S) by 2.0 m (depth). It is roughly rectangular/ oval in plan view; its long axis is oriented NNE/SSW. Road Feature 1 (Site 2270) circumscribes this reservoir as a kind of loop road. Feature 21 is the only reservoir in the project area formally defined on all sides by constructed material (rather than natural sediment): it is sealed around its edges (similar to a swimming pool) with concrete. Its bottom is level sediment with no constructed material. The project area boundary bisects this feature such that its eastern half is actually out of the project area.

**Figure 62. Feature 20, Site 2273, view east-southeast; scale bar is 100 cm long; note, this is north end of flume, which has been dislodged and damaged by a modern (non-historic) road**


**Figure 63. Feature 21, Site 2273 (Reservoir 2-B) on ESRI aerial image showing project area boundary; image is oriented with true north straight up (see text for feature dimensions and description)**

**Feature 22** is a large, formally-constructed water-distribution and -retention basin built of cut basalt and mortar in the northeast corner of the project area, on the elevated plateau east of the drop off into Gulch A and west of a mauka-makai earthen road (Feature 1, Site 2270) (Figure 64). Feature 22 connects with two other major components of the historic-era irrigation system: (1) a cut basalt and mortar ditch (Feature 23) oriented north to south; and (2) a siphon (Feature 2) oriented north to south that traverses nearly the entire east side of the project area. Feature 22 is inscribed with the date "1925," and represents one of the earliest large-scale components put in place to irrigate the project area for commercial sugarcane following the completion of the Waiāhole Ditch in 1916. Feature 22 consists of three sub-features, and occupies a maximum area of 16.0 m (N/S) by 13.0 m (E/W). Feature 22 is in good physical condition, exception for a few areas of minor damage by vegetation growth. Other than California grass and koa haole, vegetation at this feature includes several large Christmas berry trees.

Sub-feature A, a rectangular cut basalt and mortar basin measuring 9.0 m (N/S) by 6.0 m (E/W), is connected with a section of flume (Sub-feature C) on its east side and Feature 23—a cut basalt and mortar ditch oriented north to south—on its west side (Figure 65). The height of this sub-feature's walls is 170 cm above the ground surface. On its east and southeast sides, the wall face is vertical (plumb) and 40 cm thick. The wall flares (tapers out at the base) on the west side, where it is 90 cm thick at the top and 130 cm thick at the base. The southwest wall, where the date "1925" is inscribed in mortar, is 90 cm thick. An old section of displaced ferrous-metal siphon is on the ground surface in the southwest (interior) corner of Sub-feature A, next to an outlet at the base of the wall, now closed up and sealed over with concrete, that once housed the siphon. There is a rectangular sluice-gate opening along the west wall with two sets of sluice-gate grooves (each is 4 cm thick) (Figure 66). These would have controlled water flow between Sub-feature A and the adjacent ditch (Feature 23). Portions of the west wall have been damaged by Christmas berry growth into its constituent rock and mortar. Another set of larger sluice-gate grooves (each is 5 cm thick) is located at the north end of this sub-feature, where Sub-feature B begins.

Sub-feature B, a triangular cut basalt and mortar connector between the rectangular basin (Sub-feature A) and the adjacent ditch (Feature 23), tapers down from a height of 170 cm above the ground surface (at its south end) to 60 cm above ground surface (at its north end), where it opens into the ditch designated Feature 23 (Figure 67). The west wall of Sub-feature B is constructed in a very unique way, tapering down to a sharp point in both plan and profile perspectives. Another inscribed "1925" is located atop this west wall (Figure 68).

Sub-feature C, a relatively narrow and shallow flume section, constructed mainly of vertically-positioned sections of concrete slabs (seams caulked with mortar), is built off the southeast corner of the main retention basin (Sub-feature A), and separated from it by a pair of sluice-gate grooves (each is 3 cm thick), as an overflow device. The far (east) end of this flume is not truncated or damaged by the adjacent earthen road, but, rather, there is a constructed end to this flume; hence, the interpretation that it represents a kind of outlet valve for overflow water. This east end, and the west end around the sluice gate, is partially constructed of cut basalt and mortar as well as the concrete slabs. This sub-feature has a concrete slab bottom; thus, it has a "U"-shaped cross section.

**Feature 23** (Figure 69, and see Figure 65), a typical cut basalt and mortar ditch, is approximately 360 m long from its south end at the large retention basin described above (Feature 22) to where it continues out of the project area to the north. This ditch is relatively narrow, compared with others in the project area; it is approximately 100 cm wide at its interior base, increasing to 130 cm at its interior top. It is currently approximately 80 cm deep, from the top of its structural work to the ground surface in the ditch. When originally constructed, it was about 1.0 m deep. The plan view of its south end (see Figure 64) shows it has been damaged and truncated by a modern earthen road to the south. The plan view also depicts three small flume openings that would have sent water over the ground surface to the west. Two of these flume openings were constructed over (sealed up) by rock work and mortar in the past.

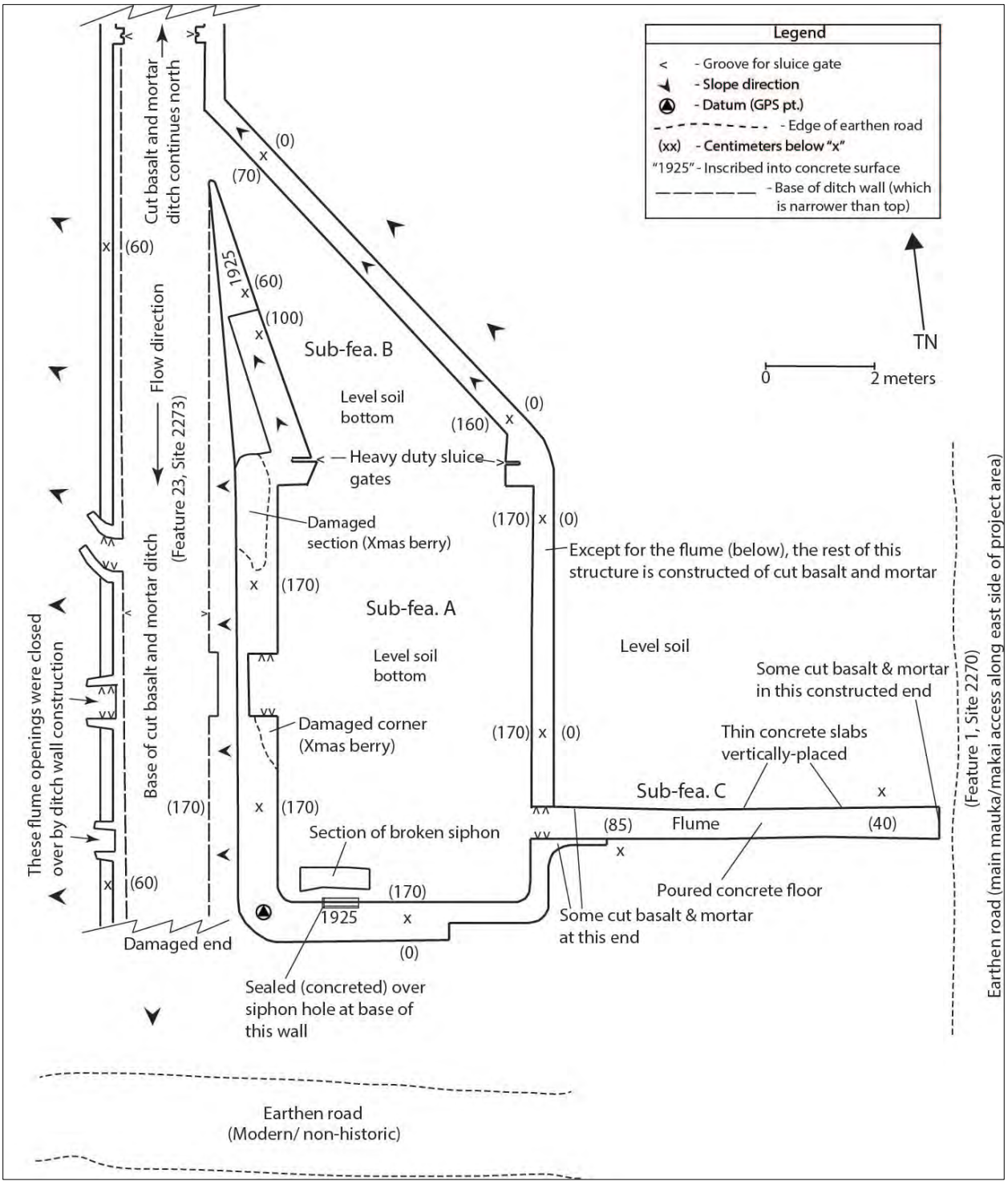


**Figure 64. Plan view Feature 22, Site 2273**

**Figure 65. Cut basalt and mortar ditch (Feature 23, Site 2273) running parallel to Feature 22 and connecting with it by way of the sluice gate at Sub-feature A and the large opening to the left (tall grass) into Sub-feature B, view south; vertical scale bar is 80**

**Figure 66. Portion of the west wall, Feature 22, Sub-feature A, Site 2273, view northwest; measuring tape is 170 cm high**

**Figure 67. Opening to the north end of Sub-feature B, view south-southwest; vertical scale is 80 cm high**


**Figure 68. Inscription on the top of the south wall at Sub-feature A**

**Figure 69. Representative portion of Feature 23, Site 2273, view north; vertical scale bar is 80 cm high, horizontal measuring tape is 100 cm long**

**Feature 24**, a basalt and mortar ditch, starts at the north (upper) end of Reservoir 1-A, and continues upslope towards the area of an old pineapple cannery and camp (Site 2271, Feature 1) before it turns to the northwest and exits the project area. We documented two sub-features.

Sub-feature A, the main ditch, is approximately 550 m long, and somewhat atypical in terms of its constituent materials and design. Unlike other constructed ditches in the project area, this one uses natural, sub-rounded boulders rather than angular (cut and dressed) boulders. Its maximum exterior width is 180 cm; the interior top of the feature measures 160 cm across; the interior base is 135 cm wide. Depending on the amount of post-abandonment sedimentary deposition in the ditch, its interior height ranges from 20–40 cm. Its depth was originally approximately 1.0 m. The physical condition of Sub-feature A is fair to poor. In many places, the ditch is nearly completely buried by recent sedimentary deposition.

Sub-feature B is a section of ditch near the top of the feature, where it takes a sharp turn to the northwest before the area of the old pineapple cannery and camp. At this point, the ditch is almost completely buried by modern sedimentary deposition (Figure 70).

**Feature 25**, a cut basalt and mortar ditch that changes into a simple, earthen ditch, originally started just below the southwest end of Reservoir 3 and continued downslope along the east side of Gulch C where it branched into two tributary lines: one heading southeast and one heading directly south, eventually exiting the project area to the south. The total length of this feature is 2.6 km. We documented three sub-features.

Sub-feature A, the main cut basalt and mortar ditch starting at the south end of Reservoir 3, is currently approximately 1.1 km long, extending from near the old reservoir (which has been completely impacted and transformed by a flood-control project such that the north end of Sub-feature A is no longer extant) to road Feature 27, snaking between these two ends along the east side of Gulch C. A representative photograph of Sub-feature A near the east edge of Gulch C (Figure 71) shows it is nearly completely filled with sediment due to a lack of maintenance. It is approximately 140 cm wide at its interior base, increasing to 150 cm at its interior top. It is currently 35–45 cm deep, from the top of its structural work to the ground surface in the ditch. When originally constructed, it was about 1.0 m deep.

Sub-feature B, at the south end of Sub-feature A, from the east side of road Feature 27, is an earthen ditch that continues across the slope, roughly west to east, ending near the intersection of road Feature 11 (Site 2270) and Feature 26 (Site 2270), a distance of some 800 m. The ditch is heavily vegetated and filled in with sediment along most of its length making it difficult to describe or measure. It measures approximately 1.5 m wide and 75–90 cm deep.

Sub-feature C, also at the south end of Sub-feature A, from the east side of road Feature 27, is another earthen ditch that heads due south along the road shoulder, down to an old reservoir, eventually exiting then re-entering the project area before it ends in a field. Its total length within the project area is approximately 700 m. In qualitative and quantitative terms, the ditch is similar to Sub-feature B.

**Figure 70. Representative portion of mostly buried Feature 24, Sub-feature B, Site 2273 (basalt and mortar ditch section to the right), view south; scale bars in 10-cm increments**

**Figure 71. Representative portion of Feature 25, Sub-feature A, Site 2273, view north; scale bar is in 10-cm increments**

**SIHP # 50-80-09-2270: Roads and Railroad Rights-of-Way**

| | |
|---|---|
| FORMAL SITE TYPE: | Roads and Railroad Rights-of-Way |
| NO. OF FEATURES: | 28 (in the project area)[11] |
| DIMENSIONS: | See Table 4 for individual feature dimensions |
| CONDITION ABOVE GROUND: | Varies from Good to Poor |
| FUNCTIONAL INTERPRETATION: | Transport of Crops, Materials & People |
| AGE INTERPRETATION: | Historic Period— Early to Middle 20th Century |

Site 2270 is an extensive system of roads and railroad infrastructure built, maintained and used by plantation workers to transport commercial crops including pineapple and sugarcane, as well as other materials and equipment for day-to-day operations. During World War II, the military made use of this system as well, and made major improvements to it in the mauka areas north of the current project area around the Waiawa Correctional Facility. According to Goodman and Nees (1991), the main components of this site were originally built in the early 1900s by the Oahu Sugar Company. Operation of this system may have been interrupted altogether or just altered by World War II, when parts of the current project area and its environs were used for military training. After the war, sugarcane agriculture continued up to the 1970s.

Goodman and Nees (1991) observed actively used and abandoned roads, both paved and unpaved; rock retaining walls and culverts; rights-of-way for the old railroad (no actual rails and wooden ties were observed); and other road- and railroad-bed (right-of-way) related structures. The railroad itself was designed as a temporary structure and had been removed long before 1991. As discussed above (Previously-identified Historic Properties in the Current Project Area), Goodman and Nees' (1991) map depiction of the component features of Site 2270 was at least partially based on historic maps from the 1930s rather than field observations. Nearly all of the features identified by Goodman and Nees (1991) were simple "paved and unpaved roads" with no rock or structural work. Goodman and Nees indicate the military paved some of the roads north of the current project area, in the vicinity of the Waiawa Correctional Facility. We found evidence of discontinuous, badly-degraded patches of asphalt on a few roads in the southern portion of the project area; otherwise, there are no paved roads in the project area.

Goodman and Nees (1991) identified 44 features distributed over a much wider (3,600-acre) project area compared with the current (1,395-acre) project area. Our survey resulted in the identification of 28 features, which extend throughout the current project area and continue outside its boundaries to the north, west and south. As documented in more detail below, we observed the following types of features: simple earthen roads, a variety of culverts, railroad rights-of-way converted after the 1940s into earthen roads, a concrete bridge and culvert, a concrete and basalt ford (submerged stream crossing), rock retaining structures supporting earthen roads, and clearing piles to make way (clear areas) for earthen roads.

Because Goodman and Nees (1991) provided feature numbers for 44 features at Site 2270 (see Goodman and Nees 1991:93, Figure 34), but since it is not always clear which of these they actually observed in the field or which numbers correspond to which features, we assigned new feature numbers. Wherever possible, we have included what we believe the corresponding Goodman and Nees feature number is. Table 4 is a summary of Site 2270 features identified by TCP Hawai'i in the current project area.

## Significance Assessment

As described in the Conclusion to this report, Site 2270 is assessed as significant under criterion D for eligibility on the Hawai'i Register of Historic Places.

[11] Additional features of Site 2270 occur outside of the current project area including mauka portions of Waiawa

**Table 4. Site 2270 Features Identified in the Current Project Area**

| Fea. | Other #[1] | Description | Dimensions (Area) | Comments |
|---|---|---|---|---|
| 1 | 37 | Mauka-makai earthen road traversing the entire project area from top to bottom | 3.5 km long from the top of eastern project area to the bottom | Road currently in use but in poor condition |
| 2 | 39 | Cross-slope earthen road paralleling ditch (Feature 7, Site 2273) | Currently 20 m long (originally this road was approximately 850 m long) | Road not in use—totally overgrown with dense vegetation—access from Feature 1 is obliterated by a modern berm |
| 3 | 38 | Cross-slope earthen road paralleling ditch (Feature 8, Site 2273) to and beyond Reservoir 2-A | 850 m long | This road not in use—overgrown with dense vegetation—access from Feature 1 is open (still drivable) |
| 4 | n.a. | Earthen road at southern end of project area | 250 m long | Road currently used to access a kuleana parcel |
| 5 | n.a. | Concrete bridge/ culvert on main upper access road into the property | 6.25 m by 4.0 m | Crosses over irrigation ditch designated Feature 13, Site 2273 |
| 6 | 27 | Mauka-makai earthen road | 1.2 km long | This road is currently in use (cleared of vegetation and open) |
| 7 | 25 | Earthen road south to main cross-slope ditch (Feature 13, Site 2273) and east past Reservoir 1-A | 250 m long | Most of this road has been abandoned and cannot be found; east end is currently open and in use |
| 8 | 41 | Earthen road servicing the west part of irrigation ditch (Feature 13, Site 2273) | 950 m long (in the project area) | This road is overgrown, hard to follow, used occasionally but not often given its current state |
| 9 | 21/24 | Two remnant portions of an earthen road that once went through a plantation camp | Southern portion (Fea. A) is 70 m long oriented E/W; northern portion (Fea. B) can barely be recognized | Southern portion also appears to be part of an old railroad right-of-way |
| 10 | ?34 | Cross-slope earthen road/ railroad right-of-way connecting Reservoir 3 with western portion of the project area | 590 m long (in the project area) | East portion of this road is open and currently in use; short west portion is abandoned and overgrown |
| 11 | 35/40/42 | Two remnants of railroad rights-of-way one of which was turned into an earthen road; long section has asphalt remnants | 870 m long (long section)<br>220 m long (short section) | Long section of road is currently in use; short section of railroad right-of-way totally overgrown/ abandoned |
| 12 | n.a. | Cross-slope earthen road | 650 m long | The east end of this abandoned road is no longer identifiable |
| 13 | 23 | Mauka-makai earthen road connecting old pineapple camp (Site 2271, Feature 1) to area around Reservoir 3 | 1.5 km long | The upper portion of this road to Site 2271 is no longer in use but drivable; the lower section is open and used regularly |
| 14 | n.a. | Long, dry-stacked rock retaining wall supporting earthen road w. boulder stock pile | 90 m (N/S) by 10 m (E/W) | Road once connected east side of Gulch C drainage bottom with upper plateau area |

| Fea. | Other #[1] | Description | Dimensions (Area) | Comments |
|---|---|---|---|---|
| 15 | n.a. | Rock clearing piles (n=4) | 16 m (N/S) by 8.0 m (E/W) | Piles created to clear Gulch C bottom for driving in |
| 16 | n.a. | Long, dry-stacked rock retaining wall with level soil (activity) areas | 70 m (NW/SE) by 5 m (NE/SW) | Retaining wall stabilized the toe of slope (drainage bank) and kept Gulch C open for driving by plantation trucks |
| 17 | n.a. | Short section of dry-stacked retaining wall | 8.5 m (E/W) by 2.0 m (N/S) | Same as above (Feature 16) |
| 18 | n.a. | Large rock (clearing) pile | 55.0 m (N/S) by 6.0 m (E/W) | Plantation-era clearing of Gulch C and stock piling material for ditch building |
| 19 | n.a. | Large rock (clearing) pile and associated level soil area | 35.0 m (N/S) by 9.5 m (E/W) | Plantation-era clearing of Gulch C and stock piling material for ditch building |
| 20 | n.a. | Large rock (clearing) pile | 20.0 m (N/S) by 3.0 m (E/W) | Plantation-era clearing of Gulch C and stock piling material for ditch building |
| 21 | n.a. | Small, dry-stacked rock terrace | 8.0 m (NW/SE) by 2.5 m (NE/SW) | Subsurface testing (TU-1) recovered 3 ferrous-metal nails at the base of the cultural fill layer (Gulch C) |
| 22 | 4 | Large rock (clearing) pile | 62 m (N/S) by 10 m (E/W) | We discovered an old fragment of backhoe bucket “tooth” wedged between constituent boulders at this feature in Gulch A |
| 23 | n.a. | Small, dry-stacked rock terrace | 11.5 m (E/W) by 1.5 (N/S) | Originally part of a retaining feature associated with a bulldozed road in bottom of Gulch A |
| 24 | See text | Boulder alignment associated with earthen road | 18 m (N/S) by 2.0 m (E/W) | Bulldozer scarring on some boulders and extensive flood damage; feature is Barrera’s Site 1469 in Gulch A |
| 25 | n.a. | Concrete ford (submerged bridge crossing) on main lower access road into property | 20 m (E/W) by 12.5 m (N/S) | Feature is in poor (failing) physical condition; crosses Waiawa Stream |
| 26 | ? | Mauka-makai earthen road w. remnant patches of asphalt | 950 m long | Originally connected lower end of road Feature 1 with Reservoir 3 |
| 27 | 33/?34 | Mauka-makai earthen road (upper half is a converted railroad right-of-way) | 2.4 km (in project area) | Originally, the upper (northeast) portion of this feature, the railroad right-of-way, extended even further to the northeast |
| 28 | 3 & 4 | Earthen road through Gulch A down to Reservoir 3 | 400 m long | Road was originally much longer—now only 400 m can be traced on the ground |

[1] Other # – Goodman and Nees (1991) feature number; n.a. = newly-identified feature (not mapped or described in Goodman and Nees); ? = difficult or impossible to determine Goodman and Nees number

Feature Descriptions

**Feature 1** is the long earthen road that traverses the entire east side of the project area from south (downslope) to north (upslope). Like the rest of the roads we identified in the current project area, other than occasional earthen berms along its sides, this road has no other defining structural features such as curbing or alignments (Figure 72). The road is 3.5 km long. Feature 1 is relatively narrow, ranging from 2.0–2.25 m wide. This is an actively used road. It is in fair to poor physical condition as it is washed out and partially eroded in places, particularly in its upper (northern) reaches. The lower end of Feature 1 connects with another mauka-makai road (Feature 27). The upper end of Feature 1 continues out of the current project area to the north after passing by Reservoir 2-B.

**Feature 2** is a cross-slope earthen road heading west-northwest from the main road (Feature 1), paralleling a cut basalt and mortar ditch (Feature 7, Site 2273). When originally constructed and used, this road connected road Feature 1 in the east to another historic road (Feature 26) heading up to Reservoir 3, a distance of approximately 750 m ("as the crow flies") but approximately 850 m along the road route. The road was constructed to build, use and maintain the irrigation ditch (Feature 7, Site 2273). Today, the Feature 2 road is nearly completely overgrown, abandoned and unusable; its entrance along the main (Feature 1) road is obliterated by a berm that was bulldozed sometime after the Feature 2 road was abandoned. The vegetation is extremely dense and this road can only be followed on foot for about 20 m from its east end along Feature 1. Its width is approximately 2.0 m. This feature is in poor physical condition. Figure 73 shows an inscription from the 1920s on part of a road culvert at the original west end of Feature 2.

**Feature 3** is another cross-slope earthen road heading west-northwest from the main road (Feature 1), paralleling a cut basalt and mortar ditch (Feature 8, Site 2273). The road was constructed to build, use and maintain the irrigation ditch. The Feature 3 road is no longer in use, but its entrance along the main (Feature 1) road is open and easy to find (Figure 74). A short distance down this road, it becomes impassable by vehicle due to heavy vegetation, but we were able to follow it on foot approximately 350 m up to the location of Reservoir 2. With great difficulty, this road can be followed on foot another 500 m to the west where it eventually disappears before it reaches another old road. Thus, from its east end at Feature 1 until its west end, it is approximately 850 m long. Its width is 2.0–2.5 m. This feature is in fair to poor physical condition.

**Feature 4**, an earthen road at the extreme southern end of the project area, is a historic-age access road into a kuleana parcel. The kuleana parcel, itself, is located just outside the current project area to the east, but the access road connecting it to a major mauka-makai road (Feature 27) is completely within the project area. This road (Feature 4) is open and currently used by the residents of the kuleana parcel. It is approximately 2.5 m wide and in good physical condition (Figure 52).

**Feature 5** is a small concrete bridge and culvert on the main upper access road into the upper (northwest portion) of the property (Figure 76 and Figure 77). The bridge crosses over a historic-era irrigation ditch (described in this report) designated Feature 13, Site 2273. The culvert consists of a large drainage pipe (concrete siphon) connected to the cut basalt and mortar ditch (Feature 13, Site 2273) on the south side heading back into the project area. On its north side, the culvert and ditch head steeply downslope and out of the project area. There are no inscriptions with dates or other markings on this feature, which must be broadly contemporaneous with the rest of the irrigation system. The bridge is approximately 6.25 m long by 4.5 m wide (measured from one side of the road to the other) by 3.0 m (maximum height measured from the base of the concrete construction to the top, just above the road surface).

**Figure 72. Feature 1, Site 2270, view south; note, Jeep in background for scale**

**Figure 73. Inscription ("192_", last number unreadable) on road culvert, west end of Feature 2, Site 2270; scale bar is 20 cm long; culvert is on west side of intersection of Features 2 & 26 (Site 2270)**