

Reconnaissance Report on the Ramage Ranch and the Hastings Natural History Reservation Seismic Station Sites

by

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Introduction

BSL has proposed to FEMA to purchase equipment to occupy two of the USArray sites in the general vicinity of the San Simeon earthquake (Mw 6.5; 12/22/2003). Ramage Ranch is the most southern of the three in the general area and Hastings Reserve is the most northerly. On April 22, 2004, Bob Busby and I visited the Ramage Ranch (near Paso Robles) and on the following day I visited the Hastings Natural History Reservation (in Carmel Valley) for a field reconnaissance.

The Ramage Ranch property currently contains a USGS short-period seismic station (PADB) and a PBO geodetic GPS station (site P526) and it is now permitted by IRIS and scheduled for the installation of an USArray broadband station (the permit was signed while we were there). The PBO site, where the USArray station will be located, is on top of a limestone-shale ridge that is easily accessible via vehicle. For reference, the site is 22 km ESE of the San Simeon mainshock epicenter and 45 km SW of the BDSN broadband station at Parkfield (PKD).

The Hastings Natural History Reservation site is a UC owned facility and the Director of the facility (Mark Stromberg; stromber@socrates.berkeley.edu) is enthusiastic over the prospect of having a broadband seismic station on the reservation. Two possible sites were identified, one on a low ridge with easy access during the dry season and nearby mains power and the other on a nearby steep sloped hill (Red Hill) with rock outcroppings (Oligocene Basaltic Andesite flows) but with difficult access (may require a crawler and sled to transport materials). For reference, the reservation is 87 km NNW of the San Simeon mainshock and 43 km SSW of the BDSN broadband station SAO.

Ramage Ranch

I met up with Bob Busby (IRIS, Chief of Operations, Transportable Array; Phone: 1.508.801-7628; E-mail: Busby@iris.edu) in Paso Robles Thursday noon (April 22nd) and we went to the Ramage Ranch (Figure R1) property (located 13 miles west of downtown Paso Robles; Geographical Coordinates: 35.641N, 120.867W; Adelaida Quadrangle 7.5' Series Topographic Map) where we met with Allan Ramage (9725 Adelaida Road, Paso Robles, CA 93446; Phone: 1.805.238.1827) and toured the planned USArray broadband seismic station site. The site is on a ridge with limestone outcroppings and about 10 meters W of the PBO site P526 (Figures R2 and R3) which was installed after the occurrence of the San Simeon mainshock. The limestone beds dip at a steep angle and there are several limestone outcroppings in the vicinity which are approximately 30 feet apart. The location of the permitted USArray site is sited on a limestone outcropping as shown in Figure R5. The site will also require solar power and radio telemetry to the adjacent hill where the Ramage residence is located (about 350 meters towards the NNW and visible in the top background in Figure R5). The station vault and telemetry design are shown in Figures R6 and R7. Access to the site is year around, although it may require a four wheel drive vehicle during the rainy season. The residence has mains power for the satellite telemetry equipment, however Allan indicated that the mains power is not especially reliable and is prone to outages during storms.

After visiting with Allan Ramage, Bob and I drove around the area and we identified two potential alternative broadband station sites, the CDF Las Tablas Fire Station (275 Cypress Mountain Drive, Paso Robles, CA 93446 (located near the junction with Chimney Rock Road); URL: <http://www.cdfslo.org>; Phone: 1.805.238-4592) and the Carmody McKnight Winery (URL: <http://www.carmodymcknight.com>; 11240 Chimney Rock Road, Paso Robles, CA 93446; Phone: 1.805.238-9392). Extensive soil studies of the Carmody McKnight Winery vineyards have been done by Dr. Thomas R. Rice at Cal Poly SLO (Phone: 1.805.756-2420; E-mail: trice@calpoly.edu).



Figure R1. Ramage Ranch entrance gate at 9725 Adelaida Road, approximately 13 miles W of Paso Robles. The gate is on the left and Ramage residence is reached by taking the road to the right after going through the gate and then going left at the fork in the road to reach the Ramage residence which is sited on top of the hill on the left side of the photograph.



Figure R2. PBO site P526 on the Ramage Ranch. The heavy fencing around the geodetic GPS monument is required to avoid damage from grazing cattle.



Figure R3. Solar panel, power supply and telemetry system for the PBO site P526, located on the Ramage Ranch.



Figure R4. Path from permitted USArray site on the Ramage Ranch. A limestone outcropping, on which the seismic vault will be sited, is visible in the foreground. The Ramage residence, on an adjacent hill, is visible at the top of the photograph. The station will be solar powered and the data will be telemetered to a satellite uplink located near the residence.



Figure R5. Proposed site of satellite telemetry dish in from of the new shop at the Ramage residence. The plan is to install the dish so that it will not be visible from the residence.

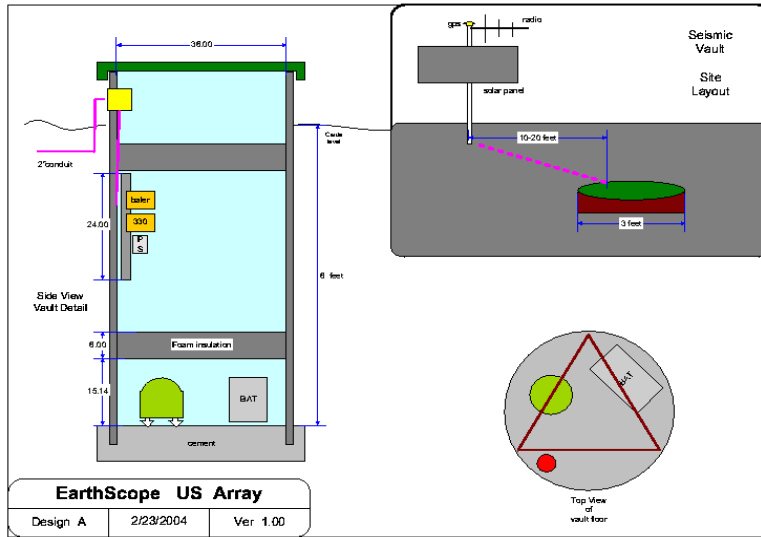


Figure R6. Proposed USArray vault design for Ramage Ranch site, The cylindrical vault containing the seismometers and data logger etc. will be 42 inches inside diameter.

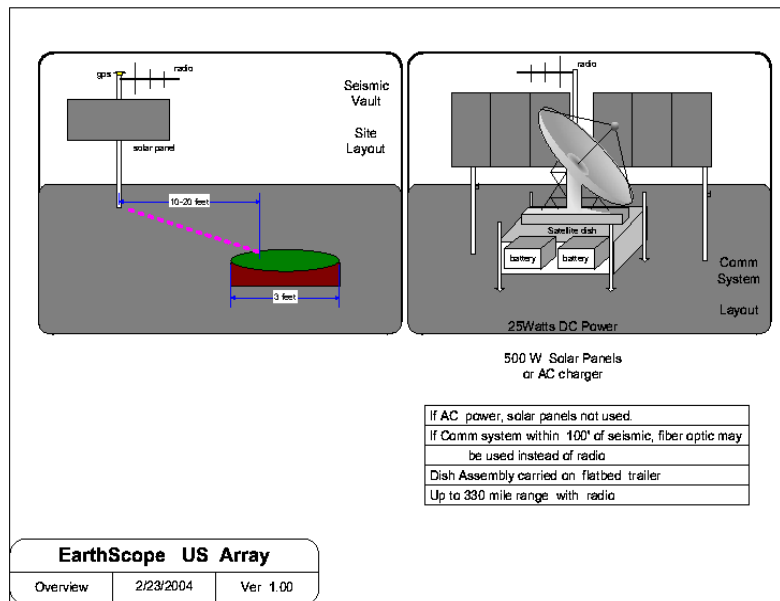


Figure R7. Proposed USArray terrestrial and satellite telemetry links. The satellite link will be sited adjacent to the new shop at the Ramage Ranch residence (see Figure R5).

Hastings Natural History Reservation

On Friday morning (April 23rd), I visited the Hastings Natural History Reservation (HNHR) where I met with Mark Stromberg (Director, HNHR; University of California, 38601 E. Carmel Valley Road, Carmel Valley, CA 93924; Phone: 1.831.659-2664; E-mail: stromber@socrates.berkeley.edu) and we discussed some of the requirements for a broadband seismic station. Detailed driving instructions to HRHN (see Figure H1) are given on their website (URL: <http://www.hastingsreserve.org/Contacts/DrivingInstructions.html>). Be advised that HNHR requires prior notification before visiting the reservation (contact Mark Stromberg; stromber@socrates.berkeley.edu). The electronic entry gate (Figure H2) requires a pass code for access and once through the gate take the first left (just before the mailboxes and drive to the parking area near the office building).

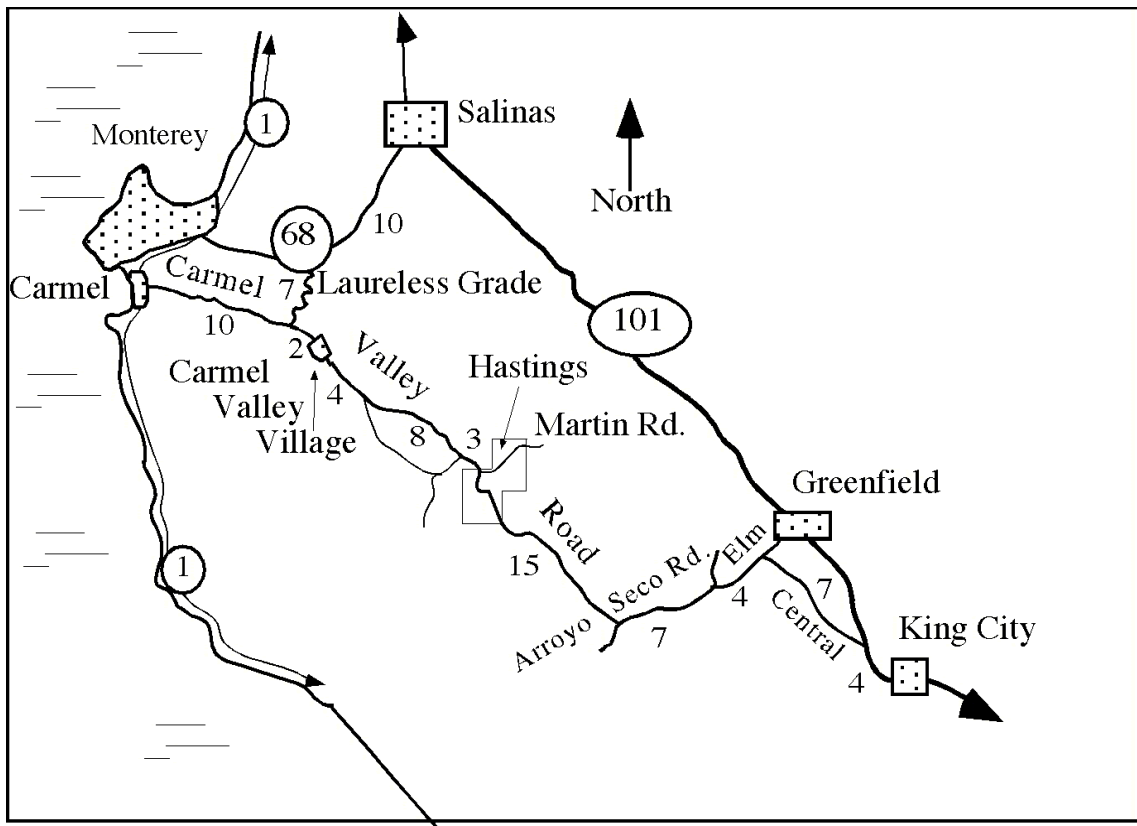


Figure H1. Map showing driving routes and segment mileage to HNHR from the north via Salinas and from the south via Greenfield or King City.

Mark showed me aerial photographs, a topographic maps (Figure H3), and a new geological map (Figure H4) of the of the reservation and he pointed out a ridge north of the office and the prominent Red Hill northeast of the office as potential broadband seismic station sites. For reference, the approximate

geographical coordinates are 36.388N, 121.566W. I hiked around the area and these are indeed viable station sites.

The first site is on ridge with some surface rocks visible between a solar powered CDF weather station (Figure H5) and a group of ground mounted water tanks where mains power is available (Figure H6). This site is within line of sight of the antennas on the office building roof (for radio telemetry) and power can be trenched in (from the nearby water tanks). At this site, however, it is unclear as to the depth to or the competency of the bed rock. Mark indicated that vehicular access to the last couple of hundred meters to the site is not permitted during the rainy season.

The second site is on top of Red Rock hill about 500 meters from the first site. The top of the hill is covered with rock outcroppings (Figure H7) and it would be a potentially better broadband station site. However, the site probably is only accessible via crawler and sled, and then only during the dry season, owing to the steepness of the slope (Figure 3). There are trees on the side of the hill which tend to obscure the direct line of sight of the office building. Mains power could be trenched in from the water tanks (about 400 meters away). The NW side of Red Hill has a relatively clear line of sight (see Figure H8) towards the office where internet access is available.

During my discussions with Mark Stromberg about power and telemetry requirements for the operation of a broadband seismic station, I found out that the office building has a newly installed 100 pair telephone cable and that there are currently plenty of spare cable pairs available for the installation of frame relay telemetry etc. Also, the mains power is prone to frequent disruptions during storms so an UPS and adequate battery capacity is advisable. The reservation currently use a Hughes satellite system for internet connectivity which is configured for a 56kb uplink (expandable to 256kb) and a 1.2Mb downlink. Mark also pointed out that the Reservation is a proposed CENS (Center for Embedded Network Sensors; URL: www.cens.ucla.edu; contact Bernie Dempsey, Chief Administrative Officer, CENS, UCLA, 3563-D Boelter Hall, Los Angeles, CA 90095-1596; Phone: 1.310.206-2613; E-mail: bdempsey@cens.ucla.edu) test site and that we may want to investigate CENS as a potential seismic telemetry alternative.

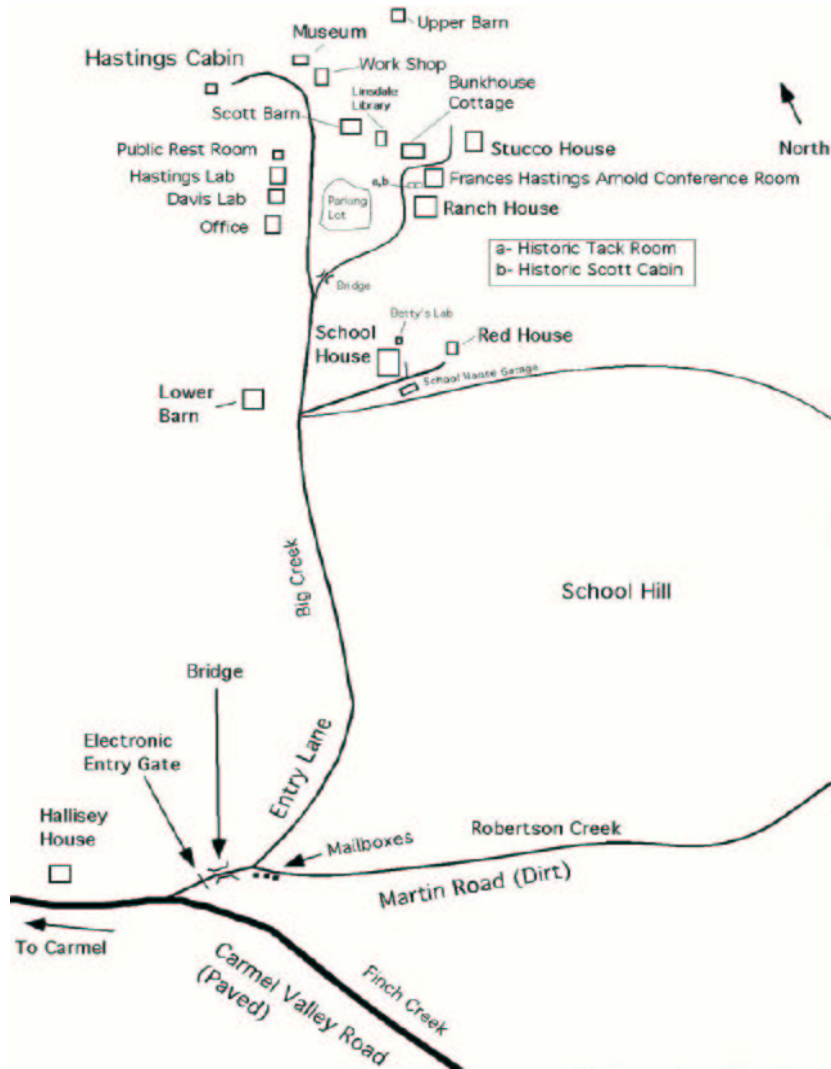


Figure H2. Diagrammatic map of buildings at Hastings. Not drawn to scale. The office and the Hastings Cabin are referred to in the text. The office is about 1 km from the entrance gate.

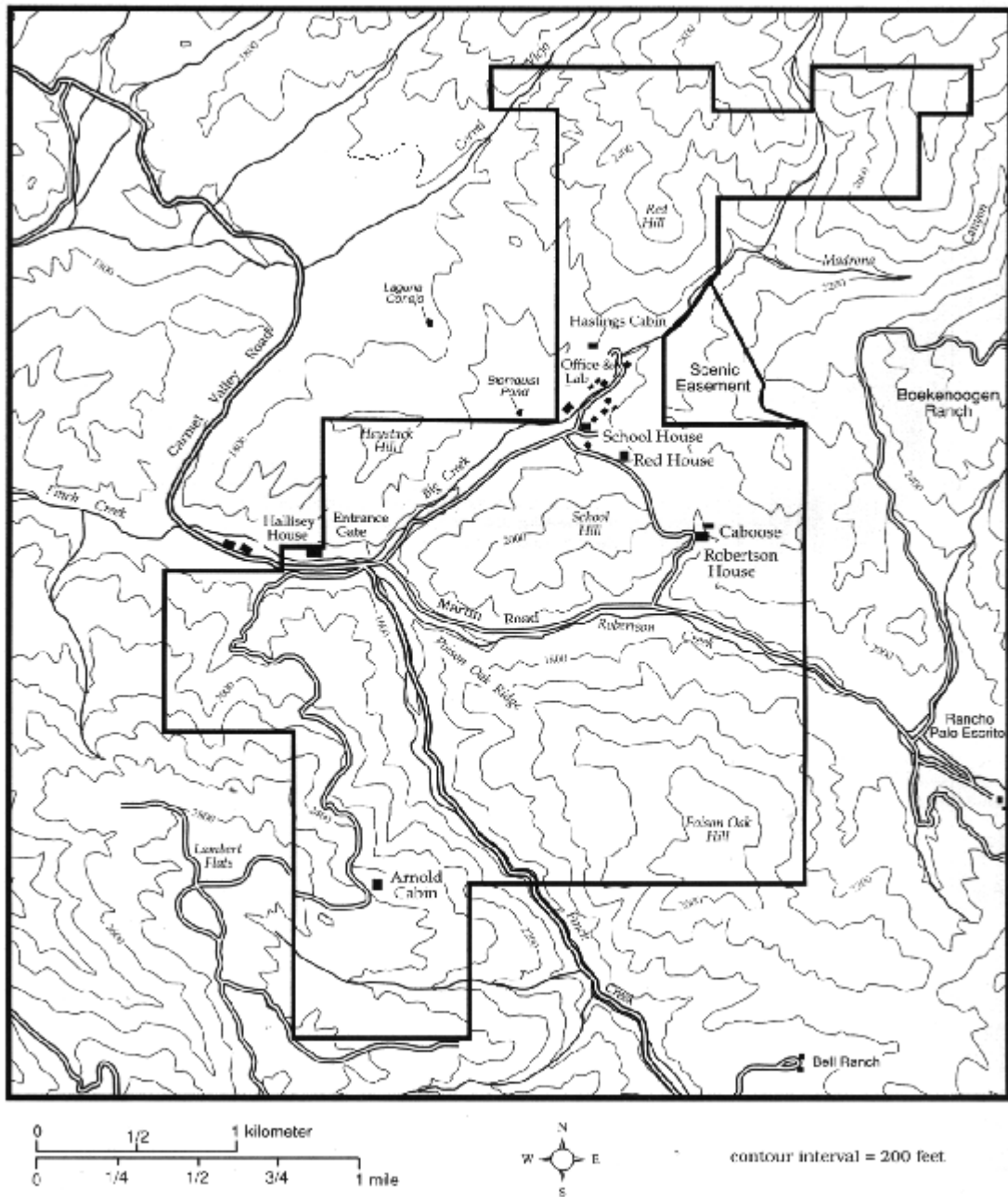


Figure H3. Topographic map of HNHR. The thick black line is the Reservation boundary. Red Hill is located near the top center of the map about 900 meters NNE of the office. The top of Red Hill is about 200 meters above the office elevation and the minimum grade near the top of the hill exceeds 30 percent. Roughly midway along straight contour line, on the SW facing slope of Red Hill, which extends from approximately 200 meters N to 400 meters NE of the Hastings Cabin is one possible location for a broadband seismic station.

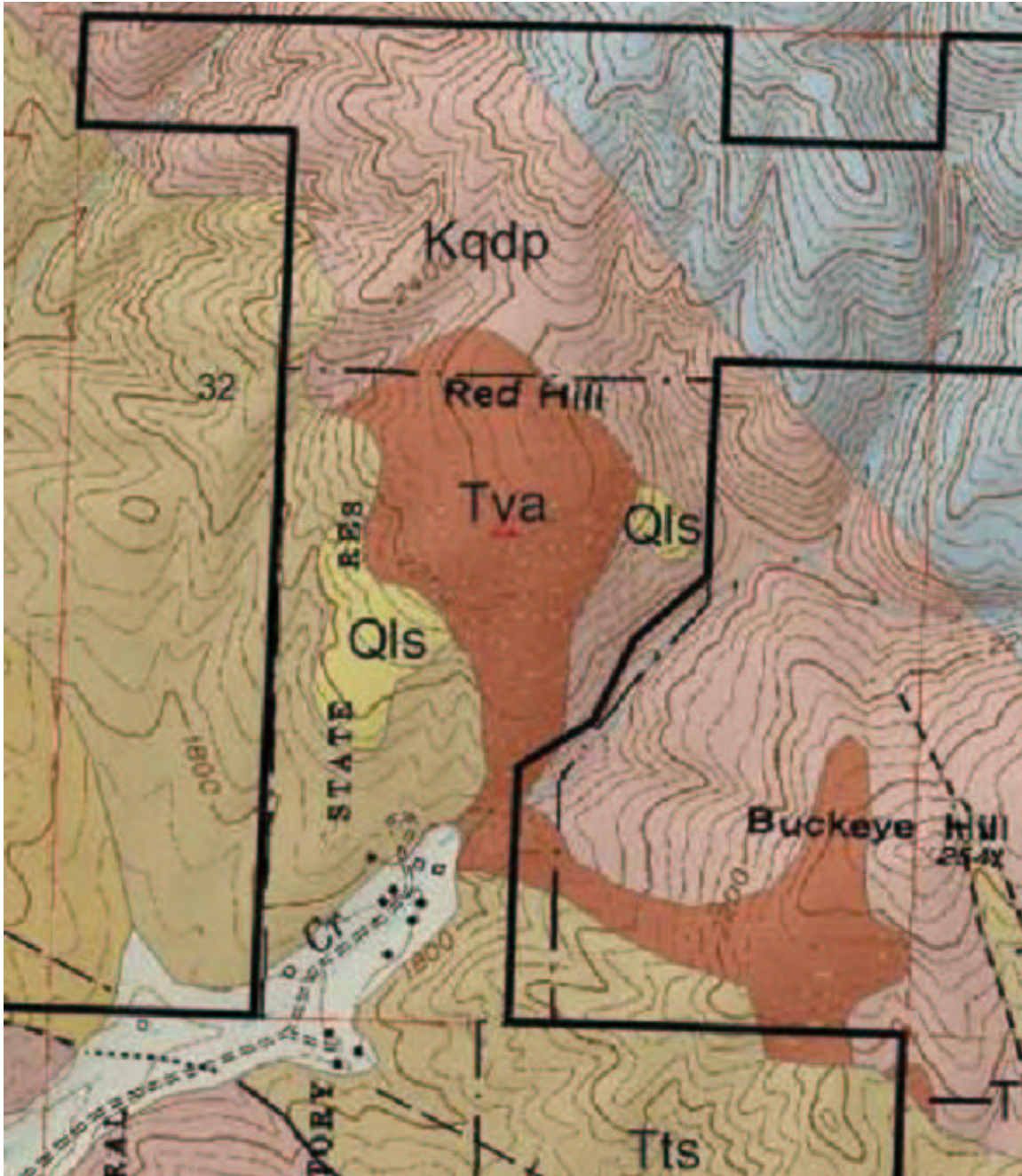


Figure H4. Geological map of Red Hill and vicinity. Tva is Basaltic Andesite flows (Oligocene). Qls is Landslide Deposits (Quaternary), a heterogeneous mixture of deposits ranging from large block slides of indurated bedrock to debris flows in semiconsolidated sand and clay. Kqdp is Hornblend-biotite quartz diorite (Cretaceous). Tts is Marine sandstone (middle Miocene). For scale reference, the thin red grid lines are section boundaries. This figure was extracted from a preliminary geologic map of the Hastings Reserve Area (Lewis I. Rosenberg, 2003).



Figure H5. View from the side of the ridge looking WSW towards the CDF maintained unmanned weather station.



Figure H6. View from the side of the ridge looking NE towards the water tanks. The power panel is visible on the far right and Red Rock hill is in the background.



Figure H7. Rock outcroppings on top of Red Rock hill. View is looking in a northeasterly direction. The top of the hill has scattered trees and the SW side of the hill (facing towards the office) has relatively dense tree coverage.



Figure H8. View looking SW from the NW side of Red Hill. The water tanks and the Hastings Cabin are on the left and the weather station is on the right. The office is nestled in the first group of trees near the left center of the picture.