Wetlands Mapping in the Vicinity of the Mineral King Valley Cabins and Corral, Sequoia and Kings Canyon National Parks

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Purpose and need

There are 64 permitted cabins in the Mineral King area of Sequoia and Kings Canyon National Parks (SKCNP). These cabins and their associated human waste systems are the personal property of the cabin owners, but the land belongs to the federal government. SKCNP is now preparing a management plan for the Mineral King area, and is gathering the information necessary to prepare that plan.

Wetland definitions, policies, and regulatory authorities

National Park Service (NPS) policies require parks to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance their natural and beneficial values, wherever practicable (NPS 2006, Section 4.6.5). If activities conducted or authorized by the NPS have the potential to have adverse impacts on wetlands, the NPS must comply with wetland protection procedures found in NPS Procedural Manual #77-1 (NPS 2011). Included in these procedures is a requirement (Section 5.6) to inventory existing structures and facilities that are located in or otherwise may be adversely impacting wetlands, and decisions regarding their retention, removal, or management must be recorded and justified in an NPS planning document. An early step in compliance with this requirement is to determine the locations of existing facilities, such as the cabins and corral at Mineral King, in relation to wetland boundaries.

Park managers must also comply with wetland protection requirements of the federal Clean Water Act (Act). Under Section 404 of the Act, the U.S. Army Corps of Engineers (Corps) regulates the placement of fill in wetlands and other waters of the U.S. through the 404 permit program. Implementation of other parts of the Act is delegated to the state of California.

For Section 404 permitting purposes, the Corps defines wetlands as areas that exhibit three parameters: hydric (wetland) soils, hydrophytic (wetland) vegetation, and wetland hydrology.

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The Corps' 1987 Wetland Delineation Manual (Environmental Laboratories 1987) and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual (ACOE 2010) provide procedures for delineating wetlands that meet the Corps definition. The Department of the Interior (including the NPS) defines wetlands slightly differently than the Corps, using the U.S. Fish and Wildlife Service's (USFWS) Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et al. 1979) as its wetland standard. The Cowardin wetland definition includes the three-parameter Corps wetlands described above, but incorporates some additional areas that, though lacking vegetation and/or soils, are still saturated or shallow inundated environments that support aquatic life (e.g., unvegetated shallow streams).

The NPS procedural manual (2011) provides techniques to ensure that wetland delineation and mapping projects on NPS lands will satisfy both the Act's wetland definition and the NPS standard for identifying wetlands. The manual states that for sites with vegetation and soils, wetland delineators should use the most recent version (and any approved regional supplements) of the 1987 Corps manual. For delineating any other naturally unvegetated or non-soil aquatic sites, such as many stream channels or active shorelines, delineators should use the "limits" of these systems as described in Cowardin et al. (1979).

Nearly all the wetlands we mapped at Mineral King were vegetated and had soils, so we followed Corps wetland delineation procedures for those sites. The East Fork of the Kaweah River and a small intermittent channel at the corral location were additional unvegetated areas that are classified as wetlands under the Cowardin system.

Landscape setting, geology, and geomorphology

The study area is situated in the western portion of the upper Mineral King Valley along the East Fork of the Kaweah River. The valley floor elevation is 7,500 feet and the peaks surrounding the valley are generally between 11,000 and 12,500 feet. The mountains and valleys in this region were glaciated and are underlain by marble, slate, schist and granitic rocks.

On the basis of geomorphology, the study area can be divided into three distinct subareas (see Figure 1):

1. Corral subarea a: toe and foot slopes of recent debris slides with a narrow floodplain adjacent to the East Fork of the Kaweah River. Parent material is colluvium derived from marble, slate and schist.
2. North of creek subarea b: toe and foot slopes of an active alluvial/debris fan that has many active, semi-active and abandoned channels, with a narrow floodplain adjacent to the East Fork of the Kaweah River. Parent materials are alluvium and reworked colluvium derived from granitic rocks, marble, slate and schist.
3. South of creek subarea c: foot slope of lower mountain slope and possibly the remains of a lateral moraine, with a narrow floodplain adjacent to the East Fork of the Kaweah River. Parent materials are reworked colluvium and till and scattered alluvium derived from granitic rocks, marble, slate and schist.

Hydrology of the surveyed area

Precipitation in the region follows a very strong seasonal pattern of a wet season (October to May) and a dry season (June to September). The average annual precipitation recorded at NOAA's Ash Mountain, California weather station (CA040343) is 26.6 inches, with 95% falling in the wet season and only 5% (approximately 1.3 inches) falling during the summer dry season. The hydrology of the three study areas shown in Figure 1 is predominantly driven by groundwater that is recharged annually by wet season precipitation and spring snowmelt. Groundwater discharges near the land surface in these foot slope and toe slope locations, and wetlands exist where water

Figure 1. Mineral King Valley and wetland study areas.

tables are close enough to the land surface to create sustained saturated conditions in the upper parts of the soil profiles.

Presence or absence of wetland hydrology is one of the three parameters used by the 1987 Corps manual (along with hydrophytic vegetation and hydric soils) to delineate wetland boundaries. Wetland hydrology exists at a site when it is flooded, ponded, or has a water table within 12 inches of the ground surface for 14 or more consecutive days during the growing season in at least 5 out of 10 years. Wetland hydrology is the most seasonal and transitory of the three parameters. Therefore, the Corps manual describes primary and secondary wetland hydrology "indicators" that allow delineators to evaluate hydrology throughout the growing season, even late in the dry season when saturation in the upper part of the soil may no longer be present.

Vegetation of the surveyed area

Predominance of "hydrophytic" (wetland) vegetation is one of the three parameters used to identify wetlands. According to Corps of Engineers wetland delineation procedures, calls regarding presence or absence of hydrophytic vegetation are based on the "wetland indicator status" of each dominant species in the plant community being evaluated. Reed (1988) classifies plant species into indicator status categories ranked from wettest to driest as follows: obligate (OBL), facultative wetland (FACW), facultative (FAC), facultative upland (FACU), and upland (not listed). Plant communities are considered to be hydrophytic (wetland vegetation) if greater than 50% of the

dominant species are ranked as OBL, FACW, or FAC. Prevalence indexes were calculated and used for hydrophytic vegetation determinations in cases where OBL, FACW, or FAC species comprised exactly 50% of the dominant species (ACOE 2010, 27-32).

Soils of the surveyed area

Soil survey data are not currently available for Sequoia and King Canyons National Parks. In general, soils at the study sites are Aquolls and Cryolls formed in colluvial or alluvial sediments derived from primarily granitic rocks with minor amounts of marble, slate and schist. Soil surface textures were dominantly loams and sandy loams. Subsurface textures were primarily gravelly sandy loams, very gravelly sandy loams to extremely cobbly loamy sands. All soil profiles described have thick, dark, humus-rich surface horizons 15 to 30 inches thick.

Hydric soils are one of the three parameters used to delineate wetland habitats. Hydric soils are soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (SCS 1994). Most hydric soils exhibit characteristic, identifiable morphologies that result from these anaerobic conditions and persist in the soil during both saturated (reduced) and dry (oxidized) conditions. Examples include a mottled color pattern resulting from reduction and re-oxidation of iron or manganese, and accumulation of organic matter due to increased production and slow decomposition rates in saturated environments. The National Technical Committee for Hydric Soils has developed "field indicators of hydric soils" based on these characteristic morphologies (NRCS 2010). These have been incorporated into the Corps wetland delineation manual supplement for this region as a means of confirming the presence or absence of hydric soils.

Of the 23 plots we examined, none exhibited hydric soil field indicators. There are a number of possible explanations for the lack of hydric soil indicators related to oxidation and reduction of iron and/or manganese, including the following:

1. Organic matter (humus) rich mineral soils can mask these indicators.
2. Water has significant dissolved oxygen (soils do not develop redoximorphic features related to iron and manganese until oxygen is depleted).
3. Water and soil temperature may be too low for microbial populations to effectively function to create anaerobic conditions.

This lack of hydric soil indicators, even in sites that clearly met the wetland hydrology and hydrophytic (wetland) vegetation parameters, led us to use the procedures found in the "problematic hydric soils" section of the supplemental Corps manual.

To assist in hydric soil determinations, Indicator of Reduction in Soil (IRIS) tubes were installed at 16 locations (for a total of 20 tubes) along potential wetland boundaries in the study area from June 23 to 25, 2010. The IRIS tubes were removed and read from July 8 to 10, 2010. At each location, IRIS tubes were installed to a depth of 30 cm.

IRIS tubes are coated with an iron (Fe) compound, which will partially or completely dissolve in saturated soil conditions, where microbial populations are active. Removal of the Fe coating provides a visual indicator that hydric soil conditions exist. In well-drained, oxygenated, non-saturated soils, the Fe coating will not be removed. A strong relationship exists between the removal of the Fe coating and the degree of soil saturation and reduction. If 20% or more of the Fe coating is removed within a 4 inch section of tubing over a period of three weeks, there is a high level of confidence (greater than 87% probability) that the soil is reduced and is a hydric soil (Castenson and Rabenhorst 2006).

Hydric soils form under conditions of saturation, flooding, or ponding for long enough during the growing season to develop anaerobic conditions in the upper part. For the Mineral King

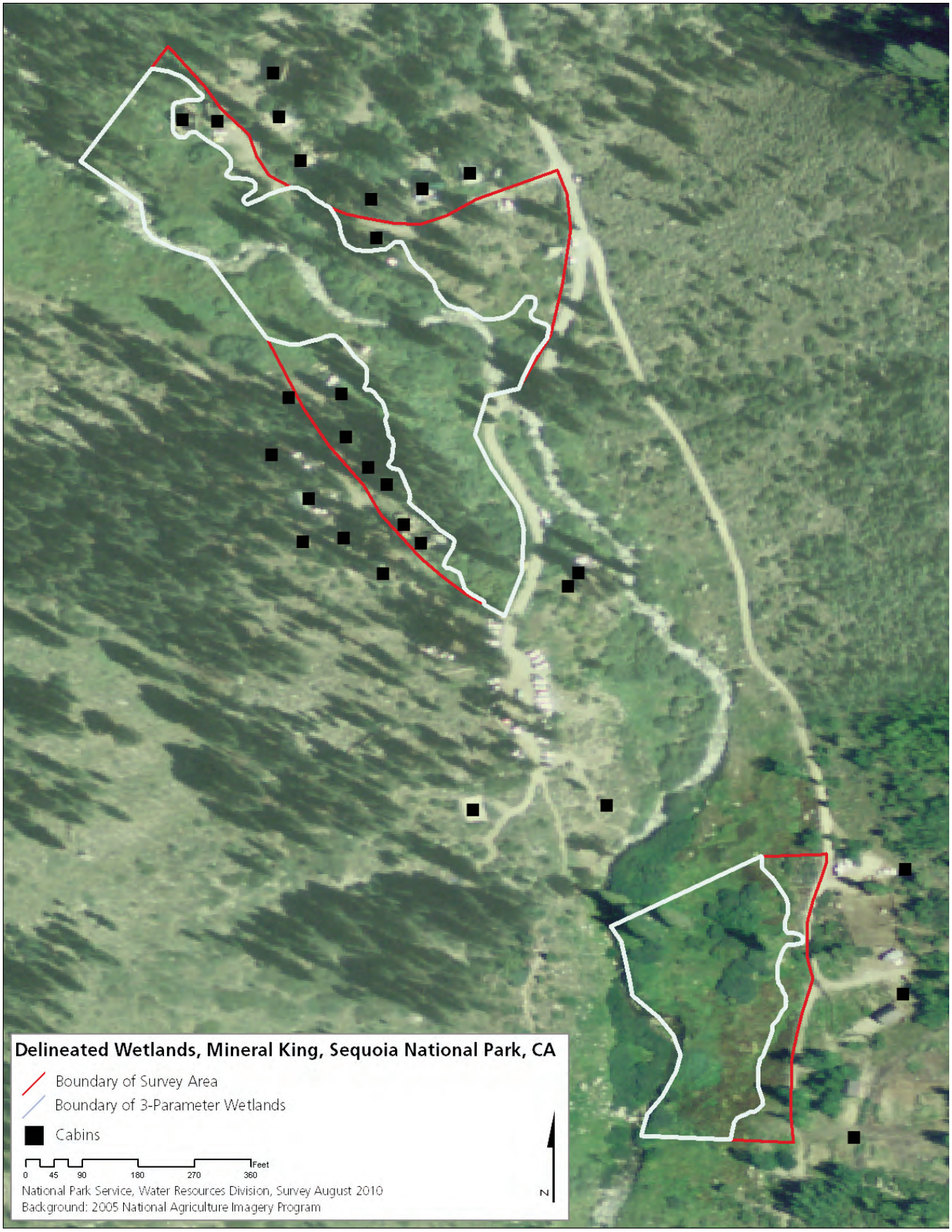

Figure 2. Overview of wetland boundaries delineated at Mineral King.

Site	Location	Hydric soil	Hydric soil indicator	IRIS	IRIS tube response	Technical standard	Surface water	Water table (inches)	Saturation (inches)	Wetland hydrology	Indicator	Vegetation group
1	Corral Area; north of road	no	Na	#1	<20% Fe removed	No	no	no	no	no	na	sedge-grass-forb
2	Corral Area; north of road	no	Na	no	na	na	no	no	no	no	na	corn lily-sedges
3	Corral Area; south of road, 30 ft	yes	F1	#2	>20% Fe removed	Yes	no	8.25	4.7	yes	A2, A3	corn lily
4	Corral Area; south of road, 130 ft	yes	A9, F1	no	na	na	no	10.6	0	yes	A2, A3	sedges-grasses
5	Corral Area; south of road, floodplain	yes	A9, F1	no	na	na	no	9.5	0	yes	A2, A3	sedges-grasses
6	Corral Area; swale near road	yes	None	no	na	na	no	13	9.1	yes	A3	corn lily
7	North of creek; side yard of cabin	no	None	#3	No Fe removed	No	no	16.9	13	no	na	corn lily
8	North of creek; north side of road, sw of cabin	no	Na	no	na	na	no	no	no	no	na	corn lily
9	North of creek; north side of road, nw of cabin	no	None	#4,5	<20% Fe removed	No	no	no	13	no	na	sedges/margin corn lily
10	North of creek; north side of road, channel near cabin	no	Na	#6	<20% Fe removed	No	no	no	no	no	na	corn lily
11	North of creek, 60 ft from creek, margin of depression	yes	F1	#7	>20% bottom 4" Fe removed	Yes	no	11	1.2	yes	A2, A3	sedges/margin corn lily
12	North of creek, 60 ft from creek, 20 ne from site #11	yes	None	#8,9	#8 No, #9 yes >20% Fe rem.	Yes	no	16.9	11.4	yes	A3	sedges-grass-PICO
13	South of creek, 15 ft from cabin, break in slope	no	Na	no	na		no	no	13	no	na	sedges/margin corn lily
14	South of creek, end of road, near trail	no	Na	#10,11	<20% Fe removed		no	no	19.3	no	na	sedge-grass/margin willow
15	South of creek, end of road, 20 ft north of #14	??	None	#12,13	#12 yes >20%; #13 No <20%	Yes?	no	16.9	11.4	yes	A3	sedge-grass/margin willow
16	South of creek, end of road, 20 ft north of #15	yes	F1	#14,15	Fe removed >20%	Yes	no	9.1	11.4	yes	A2, A3	corn lily

Table 1. Results of IRIS tube study. (IRIS tube locations are shown in Figures 2 and 3.)

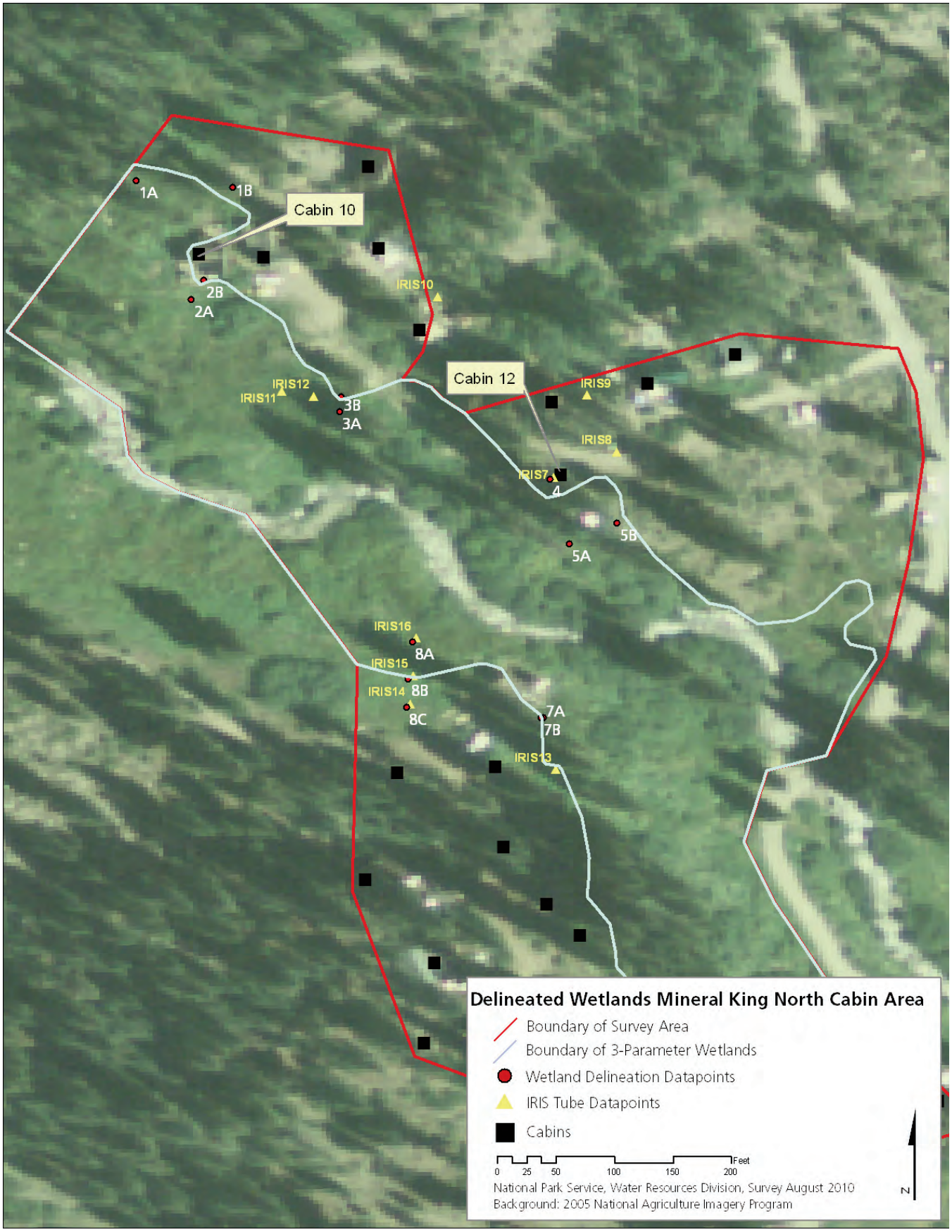

Figure 3. Wetland boundaries, data point locations, and IRIS tube locations for the Mineral King cabin area (northern section).

Basin project area, the growing season is estimated to be June 15 to August 30, or approximately 75 days. In addition, the development of anaerobic conditions in the upper part of the soil is dependent on soil texture. In sandy soils the upper part is the upper 6 inches of soils, and for loamy and clayey soils, the upper part is the upper 12 inches. The installation of IRIS tubes early in the growing season allowed for correlation between seasonally high water tables, soil saturation and reducing conditions, and development of redoximorphic features.

The results of the IRIS tubes corresponded well with water table and soil saturation depth measurements and plant communities found during this study (see Table 1). Of the 23 plots that were set up by the wetland team during the August visit, seven corresponded with IRIS tubes plots that were set up in June. At three of the seven plots, more than 20% of the iron coating was removed from the IRIS tubes, and these were classified as hydric soils. The other four locations where less than 20 percent of the iron coating was removed were classified as non-hydric soils. IRIS tube results were incorporated into the soil sections of the delineation data sheets to support problematic hydric soil calls.

Wetlands within the surveyed area

Within the survey areas (Figure 2; above), a total of 4.8 acres of wetlands were delineated according to Corps of Engineers and NPS procedures. The northernmost wetland polygon in Figure 2 (cabin area) covers 3.29 acres and the wetlands in the corral area total 1.51 acres. Figure 3 (above) is a photo enlargement of a delineated area. The wetland delineation data points shown in these figures correspond to the wetland determination data forms. IRIS tube locations shown in Figures 2 and 3 correspond to the results shown in Table 1 (above).

The vegetated wetlands within these polygons meet the regulatory wetland definitions used by both the Corps and the NPS. According to the Cowardin classification system, the vegetated wetland areas with willow overstory are classified as "palustrine scrub-shrub" wetlands, and areas with herbaceous wetland plant cover (no overstory) are classified as "palustrine emergent" wetlands. Water regimes for these two wetland types range from "semi-permanently flooded" (surface water persists throughout the growing season in most years) in the wettest areas to "saturated" (saturated to the surface for extended periods during the growing season, but surface water may not be present) at sites near the upland boundaries.

We also identified predominantly unvegetated stream channels within the surveyed areas, which are classified as riverine wetlands under the Cowardin et al. (1979) definition. The Kaweah River channel visible in the northernmost polygon in Figure 2 is classified as "riverine, upper perennial," and the tributary channel above and below the corral (Figures 2 and 3) is classified as "riverine, intermittent." These channels are considered wetlands under NPS wetland protection policies and procedures. The Corps does not consider these unvegetated channels to be wetlands, but treats them as other "waters of the U.S." that may still be regulated under sections 401 and 404 of the Act.

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