Forensic wetland delineation: A Case Study of Decoding Site History for Successful Restoration

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Forensic Wetland Delineation is an invaluable and cost-effective tool when site history is uncertain or complex.

What is Forensic Wetland Delineation?

Forensic wetland delineation (FWD) is the process of identifying wetland boundaries by reconstructing past conditions. As a specialized application of wetland science, FWD is less commonly used than standard delineation practices but is **increasingly valuable in cases involving environmental violations, significantly altered site conditions, and limited or complex historical data.**

Case Study: California Vineyard

Unauthorized riparian disturbance along an intermittent creek at a California vineyard resulted in notices of violation from multiple agencies. The site was a eucalyptus grove with a poison oak understory.

In 2020, a third-party assessment of the site identified no wetlands and found the creek as the only aquatic resource. Postdisturbance, woodchips and ponding were observed, presenting conditions potentially indicative of a wetland. **An FWD was conducted to assess wetland status and accurately inform riparian restoration at the site.**

The Three Key Pillars of FWD

All three of these parameters must be evaluated and satisfied in order to meet Clean Water Act jurisdictional wetland classification.

Vegetation

- Is dominated by "hydrophytes" (water-loving species)
- Requires evaluation of species composition and dominance
- U.S. Army Corps of Engineers classifies 1,400+ plants by wetland indicator status (Table 1)

Hydrology

- Assesses soil saturation or flooding and mapping of the ordinary high-water mark and top of bank
- Is influenced by climate, soil permeability, and disturbances
- Key markers include surface water presence and duration of saturation

Soil

- Wetland soils ("hydric") form under saturation long enough to develop unique characteristics (ex. redoximorphic features)
- Up to 20 indicators are used to identify hydric soils
- Tools: Soil augers or shovels, Munsell color charts, profile logging

Field Methodology

Precision mapping and standardized protocols ensure reproducible wetland determinations

- **Multiple sample points** representative of the site must be established
- Wetland sample points and aquatic resource boundaries mapped using **Juniper Systems Geode GNSS with submeter accuracy**
- Data imported into **ArcGIS Pro 3.1.2** to develop aquatic resource maps

Vegetation Analysis

Plant communities reveal adaptation to wetland conditions through species composition

- Plant species were identified within 5–30 foot radius of each sample point.
- Wetland indicator status determined using Arid West Region 2022 National Wetland Plant List (NWPL) (Table 1).
- Vegetation in areas included **upland and facultative species,** such as poison oak (FACU), Himalayan blackberry (FAC), saltgrass (FAC), curly dock (FAC), field mustard (FACU), and cheeseweed (upland, not listed) (Figure 1).
- One sample point had **hydrophytic vegetation but no hydric soil indicators.**
- **Finding:** None of the areas exhibiting postdisturbance ponding were dominated by hydrophytic species NOR did they exhibit appreciably different vegetative species compared to the upland sample points.

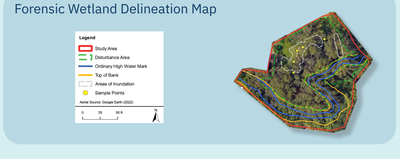
Figure 1. Upland and facultative species found on site

Hydrology Assessment

Distinguishing seasonal ponding from persistent wetland hydrology patterns

- Early 2024 site visits revealed ponded water in **two disturbed areas**:
  - A 0.02 acre topographic low area in historical oxbow channel alignment where woody debris had been placed
  - A 0.1-acre area
- Ponding was shallow and observed in **winter months after rain events**
- Three sample points showed surface hydrology indicators (water marks, biotic crust) but no indications of hydrophytic vegetation or soils
- **Finding:** Recent ponding was likely result of disturbance rather than historical wetland conditions.

Forensic Wetland Delineation Map



Soil Analysis

Hydric soil indicators provide the most reliable evidence of long-term wetland conditions

- Sample points established in locations with wetland potential (e.g., topographic lows)
- Soil was examined to 12-inch depth
- Evaluated texture and color within distinct soil layers
- Munsell soil color chart used for soil description
- Noted redoximorphic features (iron deposits indicating periodic wetness)
- Sites were checked for hydrology indicators like oxidized rhizospheres and soil cracks
- **Finding:** Although sample points may have exhibited either surface hydrology OR hydrophytic vegetation, NONE exhibited hydric soils.

Munsell soil color chart

CALIFORNIA VINEYARD KEY FINDING: Despite observed seasonal ponding, the site does not quality as a jurisdictional wetland.

Table 1. Wetland indicator status ratings used in the NWPL

Indicator Category	Definition
Obligate Wetland (OBL)	Almost always occur in wetlands
Facultative Wetland (FACW)	Usually occur in wetlands, but may occur in nonwetlands
Facultative (FAC)	Occur in wetlands and nonwetlands
Facultative Upland (FACU)	Usually occur in nonwetlands, but may occur in wetlands
Upland (UPL)	Almost never occur in wetlands

Why This Matters

While some indications of wetland hydrology, soils, and vegetation are present at sample points at the site, **they are never present all at the same sample point,** and therefore **do not meet the three parameter definition** of a wetland.

Forensic wetland delineations are critical for:

- Reconstructing the historical ecological conditions of a site, providing a baseline for understanding its predisturbance functionality and ecological capacity
- More accurate understanding of impacts to natural resources associated with disturbances.

Other FWD Case Studies

Disturbed Fallow Field: Site subjected to disking

- FWD revealed site dominated by upland and facultative species

Dam Removal: Effective stream restoration needed to mitigate impacts

- Hydrology of the restoration area was evaluated based on establishment of a low-flow channel and erosion of banks

Stream Restoration: Unauthorized construction impacted ephemeral streams

- FWD entailed field assessment and review of publicly available historical aerial imagery to determine location of predisturbance ordinary high water mark, thalweg, and edge of riparian canopy.

Proper application of FWD can prevent mischaracterization of disturbed sites, ensure appropriate plant species selection, and avoid costly mistakes in restoration planning and implementation.

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