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Field Indicators and Literature Summary for an Arid Southwestern Aquatic Resource Delineation at Twentynine Palms, CA

by Robert Lichvar

PURPOSE: In 1994, the U.S. Marine Corps Air-Ground Combat Center (MCAGCC) in Twentynine Palms, CA, requested a delineation of their aquatic resources. MCAGCC is located within the central Mojave Desert, where annual precipitation levels are insufficient to produce the three parameters typical of wetlands (i.e. vegetation, soils, and hydrology). At MCAGCC, two major aquatic resource types other than wetlands regulated under the Clean Water Act (CWA) as "Waters of the United States" (WoUS) were delineated at the planning-level scale. As part of the delineation process, new and unreported hydrology field indicators observed in the field were evaluated within the context of 48 literature citations. These hydrology indicators were used in the delineation process for identifying the Ordinary High Water Mark (OHWM) under Section 404 of the CWA for WoUS. A report was generated as a result of the study conducted at Twentynine Palms. This report can be accessed at:

ftp://ftp.erdc.usace.army.mil/pub/el/WRAP/

INTRODUCTION: MCAGCC is 241,395 ha (596,480 ac) in size and located within the Mojave Block geologic region. This region is defined by a series of fault blocks associated with isolated mountain masses with linear valleys that contain playas. The landscape has topographic differences that range from 1,368 m (4,488 ft) to 183 m (1600 ft) and an average annual precipitation of 7 cm (5.5 in.). The study area has 16 watersheds, 289 dry stream channels, and 14 playas. The playas are situated at the bottom points of the watersheds and are fed by precipitation, groundwater, and ephemeral flows in the dry stream channels.

WATER RESOURCES AND LANDSCAPE FEATURES: The report provides background information on desert aquatic resources and the physical geology and weathering processes (Gray et al. 1972) associated with their development. Some of these weathering processes, such as chemical weathering, influence the distribution patterns of vegetation associated with these aquatic resources. Specially adapted groups of plants associated with desert aquatic systems were encountered; these included halophytes, phraetophytes, and wetland plants. Many of the species included in these groups occur in complex patterns near aquatic resource boundaries and are assigned wetland plant indicator statuses (Reed 1988). These occurrences near the boundaries of water resources represent responses to several edaphic features besides the presence of surface and near-surface hydrology, such as soil salinity or groundwater that is greater than 1 m (3.2 ft.) deep. With an overlap of water resource boundaries with saline and deeper groundwater areas, having members of these groups with heavily weighted wetland plant statuses was problematic. This lack of recognition for adaptations to other edaphic features in arid environments created a less reliable usage of wetland plants in the delineation process since it failed to distinguish the occurrences of surface hydrology from saline soils and deeper groundwater.

Two major aquatic resources (playas and dry stream channels) are discussed in the report, and major literature citations are reviewed. The hydrological classifications of playas are reviewed, as well as the method applied to delineate them (Stone 1956, Motts 1965). Several playa surface features are evaluated for their usefulness for representing OHWM. These include mud cracks (Maizel 1987), drift lines, microrelief, groundwater influence, phraetophytic mounds, and dry or wet playa types (Stone 1956). Supportive information on soils and vegetation is also provided.

Dry stream channels and alluvial fans are reviewed from the literature, and concepts supporting delineation techniques are provided (Hooke 1987, Cooke et al. 1993). Several physical features found in dry channels useful for identifying OHWM and floodplain terraces are presented. Attempted laboratory tests for correlating calcium carbonate and sorting of riparian vegetation are discussed.

The report includes a management plan and discussion of wetland functions. The biological importance of playas is discussed, along with the archeological values associated with old Pleistocene beach edges along the margins. Military uses are identified, and mitigating measures for training purposes are suggested. Similarly, biological and cultural values are identified for dry stream channels. Modifications to military training patterns are suggested.

RESULTS AND DISCUSSION: This report reviews the interactions of climate and landscape features on desert aquatic resources. The supporting literature for the use of select physical features for delineating aquatic resources potentially regulated under Sec. 404 of the CWA is reviewed and delineation methods are discussed. The report includes input and coordination received from the Los Angeles District, Corps of Engineers in regard to delineation methods. This effort identified 14 playas as WoUS, with an area of 3,106 ha (7,674 ac). Also, 289 dry washes and portions of alluvial fans were identified and mapped as WoUS. These dry washes represented an area of 20,432 ha (50,471 ac).

POINT OF CONTACT: This technical note was written by Dr. Robert Lichvar, U.S. Army Engineer Research and Development Center, Hanover, NH. For additional information, contact the Program Manager of the Wetlands Regulatory Assistance Program, Mr. Robert Lazor (601-634-2935, *Bob.L.Lazor@erdc.usace.army.mil*). This technical note should be cited as follows:

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REFERENCES:

Cooke, R.U., A. Warren, and A.S. Goudie. (1993). *Desert geomorphology*. UCL Press, London, UK.

Gray, M., McAfee, and C.L. Wolf., (eds.) 1972. *Glossary of Geology*. American Geologic Institute, Washington, DC.

Hooke, R. (1987). "Mass movement in semi-arid environments and the morphology of alluvial fans." *Slope stability*. M. G. Anderson and K.S. Richards, eds., John Wiley, Chichester, England.

Maizel, R. (1987). "Plio-Pleistocene raised channel systems of western Sharqiya (Wahiba), Oman." *Desert sediments: ancient and modern.* L. E. Frostick and I. Reid, eds., Blackwell Scientific, Oxford, UK, 31-50.

Motts, W.S. (1965). "Hydrologic types of playas and closed valleys and some relations of hydrology to playa geology." *Geology, mineralogy, and hydrology of US playas.* J.T. Neal, ed., US Air Force Cambridge Research Laboratories, Environmental research papers 96: 73-104.

Reed, Jr, P.B. (1988). National list of plant species that occur in wetlands: Southwest (Region 0). Biological Report 88(26.7), U.S. Fish and Wildlife Service.

Stone, R.O. (1956). "A geologic investigation of playa lakes," Ph.D. dis., University of Southern California, Los Angeles, CA.