File: Redwood Creek

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UNITED STATES GOVERNMENT

memorandum

Date: October 15, 1987

To: Files

From: DKH, RNP Geologist

Subject: Channel conditions between levees, Lower Redwood Creek at Orick

This memo is intended to document the present channel condition of the lower one and three/quarters (1 3/4) miles of Redwood Creek at Orick as of October 1, 1987. This summer approximately 100,000 yd^3 of sand and gravel was mined from the stream bed from downstream of the U.S. Highway 101 Bridge at Orick to near the mouth. Gravel extraction on this scale or larger is proposed to occur again during the summers of 1988 and 1989 to facilitate major highway construction around Prairie Creek State Park, north of Orick.

National Park Service geologists have conducted detailed surveys to document pre-and post-excavation channel configuration and topography, as well as to monitor channel bedform (bar) recovery during the winter of 1987/1988. Prior to the excavation, low flow channel of Redwood Creek alternated from levee to levee separated by large longitudinal gravel bars. With extensive, high gravel bars present, fish passage through the lower 1 3/4 miles of Redwood Creek is protected and governed by minimum stream flow requirements established by California Department of Fish and Game. As fall rainstorms cause a rise in river discharge, river bars concentrate the stream flow in a narrow channel (70-90 ft wide) thereby increasing water depth and providing cover and passage for migrating anadromous fish.

Following gravel extraction, Redwood Creek has a single low flow channel 20-25 feet wide by 1 to 2 feet deep and is incised in a flat "bowling alley" like plain along the lower 1 3/4 miles of Redwood Creek. As fall storms increase river discharge, streamflow depth can never exceed approximately 3 feet in the thalweg before flows will spread out and over the flat, newly excavated plain.

Redwood Creek is no longer in a normal streamflow dependent condition for fish passage. Instead, adequate fish passage conditions (i.e. channel depth and suitable cover and resting areas) are dependent on gravel recruitment from upstream areas in volumes sufficient to redeposit gravel bars. Until this occurs, no channel definition will be present in lower reaches of Redwood Creek.

An analysis of U.S.G.S. sediment transport and hydrologic data collected since 1954 further serves to refine the above conclusions. Average annual bedload transport at the Orick gaging station (located at the U.S. Hwy 101 bridge at Orick is 110,000 yd^3 or roughly the equivalent of gravel extracted this summer. Streamflow at Orick as of 10/1/87 was estimated to be 3-4 cfs, or the lowest one day low flow since 1954 (John Palmer, U.S.G.S., personal communication). The abnormally low flow conditions this summer permitted a greater depth of excavation throughout the levee reach. Average October streamflows over the last 32 years were 100-200 cfs. These flows transport

very minimum volumes of bedload. With gravel bars present to confine stream flow, these low flows are normally suitable for fish passage. Significant quantities of bedload are entrained when stream flows rise to 1000-2000 cfs. These flows generally first occur mid to late November. When flows of this magnitude occur, only then will the stream begin to reconstruct gravel bars. The bars will presumably form at the upstream extent of the excavation (Orick bridge) and develop downstream as a migrating "dune" front when successive flows greater than 2000 cfs occur. For comparison purposes, the one-year return interval flow at Orick is 3950 cfs, and the effective discharge is 15000 cfs. The effective discharge is that discharge which transports the greatest sediment over the long-term record. It is our opinion, that flows of these magnitudes are necessary to transport sufficient quantities of bedload from upstream areas into the excavated reach to rebuild channel bars. This opinion is supported by the fact that total annual bedload transport is equivalent to the amount of gravel extracted. Therefore, numerous moderate flows are required to totally reconstruct bars.

Channel hydraulics have likewise been significantly modified by gravel extraction and this makes it difficult to predict channel recovery and gravel recruitment. The broad, 250 ft. wide excavated plain will greatly increase relative channel roughness and thereby decrease stream velocity/stream power as discharge increases. This will complicate and probably reduce the rate at which gravel recruitment occurs. Redwood National Park monitoring will yield a more accurate prediction of channel recovery rates following this winter's flows.

In summary, the National Park Service recommends the lower 1 3/4 miles of Redwood Creek (from the Orick bridge to the mouth) be closed to all sport fishing until gravel recruitment and gravel bar formation occur in sufficient quantities and heights to provide adequate fish passage. Based on our analysis of present channel morphology and U.S.G.S. sediment transport data, we believe the channel should be closed into early 1988, or until at least a one year return interval flow occurs at Orick. The National Park Service supports the extraction of gravel from between the flood levees at Orick. However, an analysis of channel conditions this year, and in future years when extraction occurs, argues for special management regulations in order to ensure the marginal health of Redwood Creek anadromous fisheries resources.

DKH

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