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Water Resources • Flood Control • Water Rights

MEMORANDUM

DATE: December 27, 2004

TO: File

FROM: Gary Kienlen

SUBJECT: Operation of the Knights Landing Outfall Gates and Knights Landing Ridge Cut

The Knights Landing Outfall Gates (Outfall Gates) were originally constructed as part Reclamation District 108's (R.D. 108) Sacramento River levee project. The Knights Landing Ridge Cut (Ridge Cut) and the Colusa Drain were originally constructed in order to alleviate a drainage problem in the Lower Colusa Basin resulting from return flows from expanding irrigation from the Sacramento River. Together the Outfall Gates and a structure at the lower end of the Ridge Cut, known as the Wallace Weir, serve to control water levels in the lower end of the Colusa Drain and the Ridge Cut during the irrigation season.

The Outfall Gates and the Wallace Weir have the ability to back water up approximately 22 miles to near the town of College City. In doing so, these facilities allow for irrigation of approximately 8,600 acres within the Colusa Drain Mutual Water Company as well as many other acres of agricultural lands, wetlands and habitat. The purpose of this memorandum is to briefly describe the operation of these structures.

<u>Knights Landing Outfall Gates</u>

The Outfall Gates are located at the terminus of the Colusa Drain approximately 0.3 miles northwest of the town of Knights Landing at Sacramento River Mile 34.15; also referred to as the Colusa Basin Drain, Colusa Basin Drainage Canal or RD 2047 Drain. This is the approximate location where the Lower Sycamore Slough joined the Sacramento River. Historically high flows from the Sacramento River would back up into Lower Sycamore Slough and similar channels. R.D.108 was formed in 1870 and immediately began construction of a levee from Knights Landing to Upper Sycamore Slough. The levee, approximately 40 miles in length, was completed in the spring of 1871 and closed or dammed a number of sloughs which provided openings in the natural river bank. Wooden headgates were constructed at Lower Sycamore Slough near Knights Landing which prevented high flows from entering the slough while allowing water to be released to the river at lower flows. Originally constructed in the 1920's, the modern Outfall Gates were rebuilt by the Department of Water Resources (DWR) in 1985. As currently configured the Outfall Gate structure consists of eight 66-inch automated gates and two 48-inch hand-operated gates. Flap gates are installed on the downstream end of the structure in order to block flow from the Sacramento River into the Colusa Drain at times when the water levels in the River are higher than that in the drain. The Outfall Gates are operated and maintained by DWR's Sacramento Maintenance Yard.

The automated gates are controlled by computers based on the water levels in the Colusa Drain and the Sacramento River. The algorithm used to raise and lower these gates limits their operation to one minute per hour. The automated gates are used to maintain the upstream water levels at times when the water surface elevation in the Sacramento River is lower than in the Colusa Drain. The hand-operated gates are used during flood conditions.

DWR began measuring the flow through the Outfall gates in the early 1940's. After the reconstruction of the Outfall Gates in 1985 developed a computer program to calculate the flow through the gates based on the water surface elevations measured at DWR's Colusa Drain at Knights Landing and Sacramento River at Knights Landing gages. All data required to calculate flows through the Outfall Gates can be accessed remotely by DWR. DWR's Sutter Maintenance Yard maintains the facilities to record and calculate the flow through the Outfall Gates.

DWR attempts to operate the Outflow Gates to maintain a water level of not less than 24.5 feet United States Engineering Datum (USED, also known as U.S. Army Corp of Engineers Datum) to facilitate irrigation in the Lower Colusa Drain and Ridge Cut. DWR also is mandated to keep the water level in the Colusa Drain below 25.5 feet USED. Water levels higher than 25.5 feet USED result in flooding of agricultural lands along the west side of the Colusa Drain.

Knights Landing Ridge Cut

The Knights Landing Ridge Drainage District was formed on April 30, 1913 under a special act of the legislature. The purpose of the District was to develop a plan to provide drainage for water that ponded between the back levees of Reclamation Districts 108, 479 and 787 and high ground to the west and south, the Knights Landing Ridge. The Knights Landing Ridge consists of a broad strip of elevated land built up by overflow from Cache Creek. This ridge separates the Colusa Basin from the Yolo Basin. The Ridge Cut was constructed by dredging through the Knights Landing Ridge for a distance of approximately seven miles. As constructed the Ridge Cut is 400 feet wide at its lower end with a maximum flow depth of about 20 feet. The design capacity was estimated to be about 20,000 cfs with water surface elevations

at 39 feet USED at Knights Landing and 34.5 feet USED at the Yolo Bypass. The current capacity of the Ridge Cut is unknown.

Construction of the Ridge Cut was completed prior to September 1915. The initial plans for the Ridge Cut included a structure at the Colusa Drain to control the flow to the south. This structure was never constructed. Water ceases to flow into the Ridge Cut when the water surface falls below about 21 feet USED. Elevations lower than about 23 feet cause problems for irrigators that pump water from the lower Colusa Drain.

As stated above DWR operates the Outfall gates to maintain water levels in the Colusa Drain and the Ridge Cut between 24.5 feet USED and 25.5 feet USED during the irrigation season. When the Ridge Cut was constructed material from the dredging was used to form embankments or small levees on the east and west sides of the cut. The east levee was connected to the west levee of the Yolo Bypass. At this point low dike was constructed and a plug was constructed in the west borrow pit. Leveling pipes equipped with 42-inch Calco gates were installed in the plug to control flows to the Wallace Ditch for irrigation purposes. The easements for the construction of the west levee of the Yolo Bypass and its connection to the eastern embankment of the Ridge cut are contained in an Option and Agreement between the Hershey et. al. and the Sacramento and San Joaquin Drainage District dated July 17, 1937. According to the easement agreement, the dike and plugs at the lower end of the Ridge Cut were to be constructed to maintain water levels at no greater than 25.5 feet USED. The plug in the western borrow channel of the Ridge cut is referred to locally as the Wallace Weir. A similar structure is also installed in the eastern borrow channel at the head of an irrigation ditch leading due east from the Ridge Cut.

The easement Agreement states that once the dike was constructed by the Sacramento and San Joaquin Drainage District it was up to Hershey to maintain. Historically, the dike has removed during the winter months to alleviate flooding problems along the Ridge Cut and Lower Colusa Drain. In recent years the dike at end of the Ridge Cut has remained in place. As identified above, the current capacity of the Ridge Cut is unknown. Growth of vegetation and lack of maintenance within the Ridge Cut and the borrow channels have resulted in more frequent and longer duration of flooding of the lands along western bank of the Ridge Cut and right or south bank of the Lower Colusa Drain.