

EBMUD DAM GUIDE

DISTRICT DAM DATA AND LOCATION MAPS

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Pages containing sensitive information were redacted



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PREFACE

The purpose of this EBMUD DAM GUIDE is principally to serve as a general reference on EBMUD dams and to use during dam inspections to locate facilities, dam surveillance instrumentation, and appurtenant features. The sketches and information provided in this guide are not intended to be used for design or construction purposes, or to accurately locate dam features. Detailed dam information and as-built drawings are available in District files for such purposes.

Geotechnical Engineering Section

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MOKELUMNE RIVER DAMS





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CAMANCHE RESERVOIR		25800 North McIntire Road, Clements (38.2244, -121.0228)
GENERAL		The Camanche Main Dam is on the Mokelumne River approximately 4 miles northeast of Clements and the reservoir is in San Joaquin, Calaveras, and Amador Counties. The Dam is about 10 miles downstream of Pardee Dam. The reservoir is formed by the Main Dam and Dikes 1 through 6. The reservoir provides flood control protection and water storage for fisheries, agriculture, and population downstream. The Foothill fault system is about 15 km to the east of the Main Dam.
Construction	1964	
Jurisdiction Agencies	DSOD, FERC, USACE	
MAIN DAM		The dam was constructed of roller-compacted earthfill in a 1,200-foot-wide valley carved through a mudflow-capped ridge of the Mehrten Formation. The upstream and downstream shells are founded directly on dredged tailings, but the core trench of the dam is extended to the bedrock by clearing the dredged tailing. Relief wells were constructed in 1964 and 1967 along the downstream toe of the Main Dam to relieve uplift pressures in the underlying bedrock.
Crest Elevation	263 feet	
Crest Width	34.5 feet	
Crest Length	2,640 feet	
Height	171 feet	
Upstream Slope	1.75 - 2.5H:1V	
Downstream Slope	1.75 - 2.25H:1V	
DIKES 1, 2, 3		Dikes 1, 2, and 3 are located to the south and the southeast of the Main Dam. They are mostly founded on the Mehrten and the Valley Springs Formations, with the exception of the Deep Foundation Area (DFA) of Dike 2. An ancient river channel infilled with deep deposits of sandy alluvium underlies the DFA. In 1966, a seepage cutoff slurry trench with a maximum depth of 90 feet was constructed upstream of the upstream toe of Dike 2 DFA to resolve the problem of excessive seepage through the alluvium. In 1984, 13 relief wells were constructed at the downstream toe of the eastern portion of Dike 2 to reduce seepage and uplift pressure in the underlying bedrock.
Crest Elevation	263.2 – 265.8 feet	
Crest Widths	24.5; 24.5; 27 feet (1, 2, 3)	
Crest Lengths	7,530; 5,750; 4,500 feet	
Heights	90; 80; 40 feet	
Upstream Slope	1.25 - 2.5H:1V	
Downstream Slope	1.75 - 2.25H:1V	
DIKES 4, 5, 6		Dikes 4, 5, and 6 are located in isolated saddles northeast of the Main Dam and are founded on Mehrten sandstone/siltstone. Each dike has a core and shells but has no core trench or subdrain system.
Crest Elevation	262.9 – 264.3 feet	
Crest Width	27 feet	
Crest Lengths	500; 1,200; 1,200 ft (4, 5, 6)	
Height	50 feet	
Upstream Slope	2 - 2.5H:1V	
Downstream Slope	2 - 2.25H:1V	
RESERVOIR		The reservoir has a surface area of 5,344 acres. A 10.7 MW power plant at the base of the dam was constructed in 1983.
Capacity	417,120 acre-feet	
Water Level Elevation	180 – 235.5 feet	
SPILLWAY		The spillway is located 1,100 feet south of the Main Dam. It has an ogee-shaped weir crest. The 1,500 feet-long upper portion of the spillway is lined with reinforced concrete slabs and walls with a concrete flip bucket that is then conveyed into an 1,800-foot-long unlined channel within the Merhten formation. The spillway system discharges to the Mokelumne River.
Type	Ogee-crested Chute	
Crest (Freeboard)	235.5 feet (27.5 feet)	
Size	400 feet	
Location	Dike 3	
Capacity	197,000 cu.ft./second	
OUTLET WORKS		The reservoir can be drained in about 57 days through the two 96-inch low-level outlet pipes, encased in concrete conduits at the bottom of the dam, and the 48-inch high-level outlet pipe.
Type	Concrete Tunnels	
High-Level Outlet Elev.	203 feet	
Low-Level Outlet Elev.	104 feet	



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SEEPAGE		
Main Dam:	<p>The total flow of Relief Wells 1 through 12, 14, and 17 is collected in a V-notched weir pond and is automatically measured real-time on-line.</p> <p>A drainage tunnel intercepts groundwater at the left abutment of the Main Dam. Palmer-Bowlus flume measures flow of the seepage field D/S of the Main Dam.</p> <p>Dike 1 seepage flows are measured mostly by volume/time calculations.</p> <p>Parshall flume</p> <p>Dike 2 seepage flows measured by either staff gauge heights or volume/time calculations. Parshall flumes Parshall flume Parshall flume</p> <p>None</p>
Total - Relief Wells 1 - 17	70 - 200 GPM	
High Caution	200 GPM	
High Alarm	205 GPM	
Relief Well 18	0 - 15 GPM	
Left Abutment Tunnel	5 - 20 GPM	
Seepage Field	20 - 30 GPM	
Right Abutment Seepage	0 - 10 GPM	
Dike 1:.....	
STA 152 TOE	0 - 60 GPM	
STA 166 TOE	10 - 60 GPM	
STA 181 TOE	0 - 25 GPM	
STA 181 HWY	20 - 180 GPM	
STA 195 TOE	0 - 20 GPM	
Dike 2:.....	
Relief Wells 3 - 15	0 - 18 GPM	
STA 211 TOE	15 - 100 GPM	
STA 224 TOE	0 - 20 GPM	
STA 250 DEEP FDN	0 - 15 GPM	
D2-RW	15 - 65 GPM	
Dikes 3,4,5, and 6:	
SEISMIC ANALYSES		
Dam and Dike 2 DFA	1981, 1983	Dynamic analyses by Wahler Associates concluded that the Main Dam and Dike 2 DFA are stable, but localized sloughing and slumping may occur at the shell slopes of the Main Dam. Slope protection materials (riprap and geotextile fabric) are stockpiled near the site to enhance the slopes should any slumping or sliding occur.
Dam and Dikes 1-6	2010	Terra/GeoPentech's 2010 comprehensive embankments safety review concludes that liquefaction of the tailing layers at the Main Dam will likely occur under ground motions from Foothills Fault System and a San Andreas event and lead to large deformations of the downstream toe area and damages to the relief wells. However, these deformations will be localized and will not adversely impact the overall safety of the dam.



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PARDEE RESERVOIR		On Camp Pardee Road, 4 miles north of Valley Springs (38.2573, -120.8502)
GENERAL		Originally named Lancha Plana Reservoir, Pardee Reservoir is located on the Mokelumne River in the foothills of the Sierra Nevada Mountains near Valley Springs, California. It lies on top of an irregular hard rock of the Gopher Ridge Volcanics and the weaker Salt Springs Slate. The irregularity of the surface increases the resistance to sliding and shear.
Construction	1929	
Reconstruction (Spillways)	1994 – 2002	
Jurisdictional Agencies	DSOD, FERC	
MAIN DAM		The dam is a concrete gravity structure curved in plan with an upstream radius of 1,200 feet. It has a power plant at the toe with a capacity of 28.7 megawatts. A single interior gallery extends from Elevation 275 feet near the base to Elevation 475 feet on each abutment. A 30-foot grout curtain was placed just downstream of the upstream face of the dam during construction. Drains immediately downstream of the grout curtain were installed in 1968 to relieve uplift pressures.
Crest Elevations	575 Road / 581.5 ft Parapet	
Crest Width	16 feet	
Crest Length	1,337 feet	
Base Width	239 feet	
Height	345 feet	
Upstream Slope	0.013H:1V	
Downstream Slope	0.625H:1V	
AUXILLARY DAM/DIKE		This is an earth and concrete dike formally called the Jackson Creek Spillway and Dike. The concrete spillway structure and its adjacent embankments are now called Pardee Dike Number 1 and the West Dike is now called Pardee Dike Number 2. The original concrete spillway has sixteen siphon barrels, and it is not used as a spillway. It provides for diversion of surplus water into the Jackson Creek drainage basin. The earth dikes were constructed with the upstream face curved and supported by a reinforced concrete slab. Rockfill buttress was constructed in 1994 to stabilize the dike.
Crest Elevation	585.4 feet	
Crest Width	22 feet	
Crest Length	1,360 feet	
Height	37 feet	
Upstream Slope	2H:1V	
Downstream Slope	1.5H:1V	
RESERVOIR		The reservoir storage is used for power generation, as the main water supply for the District, and for recreational use. During seasons of high precipitation and runoff, flood control storage is maintained in Camanche and Pardee Reservoirs.
Capacity	203,795 acre-feet	
Water Level Elevation	552 - 568 feet	
SPILLWAY		The spillway is a concrete-lined channel located in a saddle on the south end of the dam. It has a crest elevation of 567.67 feet and nineteen 2.5 feet bridge piers which reduce the effective length of the ogee weir to 800 feet. Forty-eight post-tensioned anchors were installed in 1996 to increase the sliding stability of the spillway crest. Each anchor is equipped with a vibrating wire load cell to monitor anchor load.
Type	Ogee-crested weir chute	
Crest (Freeboard)	567.67 (13.83) feet	
Size	800-foot wide	
Location	South of Left Abutment	
Capacity	179,400 cu. ft./sec.	
OUTLET WORKS		The Outlet Tower is in the southern arm of Pardee Reservoir, completely independent of the Dam. The tower is accessed by a truss walkway. The gate operation room at the top of the tower contains equipment to operate slide gates at different levels in the tower. There are three gates each at the bottom of the tower, one at Elevation 400 feet, and two at Elevation 395 feet. Gates also exist at Elevation 390 feet, 520 feet, and 550 feet. The reservoir can be drained in about 26 days with two 72-inch and two 42-inch outlet pipes.
Type (Water Supply)	Reinforced Concrete Tower	
Type (Power/Drain)	2x 72-in, 2x 42-in conduits	
SEEPAGE		An access gallery within the dam collects seepage from the dam and the foundation. The gallery seepage flows along the gallery wall and is measured by a flow meter near the entrance to the powerhouse. The left abutment seepage is collected by a discharge pipe and drains into a small basin for measurement. The right abutment seepage is collected through a ditch that goes through a pipe under the powerhouse and discharges to the river below.
Gallery Drain	15 – 50 GPM	
High Caution	100 GPM	
High Alarm	110 GPM	
Right Abutment Drain	0 – 10 GPM	
Left Abutment Drain	0 – 10 GPM	



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SEISMIC ANALYSES	
1962, 1968	Stability analyses performed by Bechtel Corporation concluded that the uplift pressures were excessive beneath the dam. They recommended that a drain curtain be installed beneath the main gallery of the dam. This was done in 1967, and later analyses by Bechtel Corporation in 1968 confirmed the stability of the dam.
1992	Dynamic analyses performed by Dames & Moore concluded that the dam is stable for normal operating, PMF, and MCE loading conditions. FERC has approved the analysis.
2013	A seismic evaluation of the Outlet Tower performed by Jacobs Associates concluded that the tower would perform satisfactorily for the postulated ground motions.
2020	A fault rupture hazard and seismic source characterization performed by Lettis Consultants International concluded that the Walters Peak Fault is inactive per DSOD criteria.