SBFCA, Feather River West Levee Project, Approach to Improve the Geometry of the Feather River West Levee | Wood Rodgers | January 18, 2012

WOOD RODGERS

MEMORANDUM – DRAFT

TO: Mr. Mike Inamine, Sutter Butte Flood Control Agency

FROM: Jonathan Kors, P.E., PMP
Peter Blum, P.E.

DATE: January 18, 2012

SUBJECT: SBFCA, Feather River West Levee Project, Approach to Improve the Geometry of the Feather River West Levee

INTRODUCTION

In 2010, the Sutter Butte Flood Control Agency (SBFCA) embarked on the Feather River West Levee (FRWL) Project. The Project seeks to rehabilitate 44 miles of existing levee along the west bank of the Feather River through Sutter and Butte counties. A geotechnical assessment of the levees has been completed and the potential mitigation measures to address the deficiencies in each reach have been analyzed by the design team. These alternatives are outlined in detail in the Project Pre-design Formulation Report (PFR) (Reference 1). The design of the Project is currently approaching the 65 percent level.

Throughout the FRWL Project, the predominant levee deficiencies are susceptibility to underseepage and through seepage. To correct these issues, in most reaches, a soil-bentonite cutoff wall will be constructed through the levee prism and into the levee foundation. This will be accomplished by degrading the levee to one half of its height (as measured from the landside toe) to create a working platform for cutoff wall construction. Other reaches will be rehabilitated by installing relief wells, flattening levee slopes, or constructing seepage berms. In general, for those areas where a cutoff wall is to be constructed, the installation of the cutoff wall will correct the deficiency and modification of the levee slopes will not be required. Therefore, the levee crown will be reconstructed to match the pre-construction levee slopes and the geometry of the levee prism above the working platform will not be modified. Similarly, where measures other than cutoff walls are constructed, the existing levee geometry will not be modified to meet minimum criteria unless the slopes present a levee stability problem. It is noted that the FRWL has significant freeboard through most of its reach, and in most cases, a theoretical levee prism meeting the Department of Water Resources (DWR) and the U.S. Army Corps of Engineers (USACE) criteria can be identified within the existing levee geometry.

The existing crown width of the levee varies from less than 10 feet to greater than 30 feet, as shown on Figure 1 and Figure 2 (Figure 1 representing the south half of the Project; Figure 2 representing the north). Similar to the slope steepness approach referenced above, SBFCA has determined that unless the existing levee has a minimum crown width of less than 12 feet, it will not be modified to increase its width. Any area of the existing levee with a crown width of less than 12 feet will be modified to increase the width to at least 12 feet.

The purpose of this Memorandum is to outline the approach that the design team will employ to identify areas of the levee that potentially contain slope stability problems, and the areas of the levee where the crown width does not meet the minimum 12 foot width requirement.

REFERENCES

1. HDR, Wood Rodgers, URS, and MHM, "Pre-design Formulation Report, Feather River West Levee – Segments 1 through 7, Sutter Butte Levee Rehabilitation Program, Sutter and Butte Counties, California," February 2011.

2. DWR, "Draft Urban Levee Design Criteria," November 15, 2011.

3. USACE, Engineer Manual EM 1110-2-1913, "Design and Construction of Levees," 30 April 2000.

4. DWR, Central Valley Floodplain Evaluation and Delineation LiDAR, October 2010.

APPROACH TO SCREENING LEVEE FOR GEOMETRY ISSUES

For topographic mapping, the Project is using LiDAR generated topography developed by the DWR (Reference 4). A surface model of the terrain was created using AutoCAD Land Development Desktop. Using Geographic Information System (GIS) tools, break lines were created at all grade breaks running longitudinal to the levee centerline. Cross sections were then cut electronically at 100-foot intervals. At locations where the cross section intersected the break lines, GIS was used to place a reference point (node) and to provide offset and elevation information from the beginning of the cross section to each node. The slope between nodes and the distance between nodes representing the levee crown hinge points was calculated. Figure 3 provides an example of the cross sectioning and node points used to generate the output.

The slope and width information generated in GIS was exported into a Microsoft Excel spreadsheet to tabulate the existing levee slopes and crown widths. To identify slopes that are potentially too steep and crown widths that are two narrow, the values listed in Table 1 were used as the threshold for identifying potential problem areas.

Table 1
Minimum Crown Width and Slope Steepness Criteria for Screening

Minimum Crown Width	Maximum Waterside Slope	Maximum Landside Slope
12 Feet	2.5:1	2.0:1

The levee sections not meeting the minimum requirements will be sent to the geotechnical engineers for slope stability analyses. In addition to the geotechnical review, the existing levee sections will be analyzed to determine whether a theoretical levee prism consisting of a 3:1 waterside slope, 20-foot levee crown, and a 2:1 landside slope is contained within the existing levee prism while providing a minimum of 3 feet of freeboard from the design water surface. If it is determined that the existing levee slopes are unstable or the theoretical levee prism is not contained within the existing levee, the existing levee geometry will be modified as part of the design and as described below.

RESULTS OF INITIAL LEVEE GEOMETRY SCREENING

GIS identified 874 cross sections where the calculated levee slope did not meet the minimum requirement. These sections were reviewed to determine if the slopes identified were a part of the levee prism or part of an adjacent feature. Slopes that were not a part of the levee section were filtered to create a spreadsheet listing only those sections that contained levee section geometry problems (Table 2). Table 2 includes 568 locations which require further analysis to determine whether the existing levee slopes are stable and if a theoretical levee prism is contained within the existing levee geometry.

In addition to the cross sections not meeting the minimum slope requirements, 81 cross sections in the southern half of the Project and 69 cross sections in the northern half do not meet the minimum levee crown width requirement. These locations will require the existing levee geometry to be modified as part of the levee reconstruction.

LEVEE RECONSTRUCTION FOLLOWING CUTOFF WALL INSTALLATION

For the areas that do not require geometry modification, the Project specifications will require the contractor to perform field surveys of the levee prior to the start of construction, after completing levee degrading operations, and after completing levee reconstruction. This field survey will include cross sections of the levee at 100-foot intervals. Each cross section will capture major changes in levee grades, including the levee toes, degraded levee surface, crown hinge points, and crown centerline. These field surveys will be used to ensure that the reconstructed levee restores the original levee geometry in areas where the levee slopes are sufficiently stable and where the crown width provides adequate operation and maintenance access.

At locations where the existing levee slopes are not stable, or where there is not enough crown width to provide adequate operation and maintenance access, the construction plans will contain specific instruction on the modifications to be made to meet the minimum requirements. This reconstruction will be accomplished by holding the existing waterside toe point and performing all levee slope flattening and crown widening toward the landward side of the levee. The levee sections will be reconstructed to provide a minimum of a 3:1 waterside slope, a 20-foot levee crown, and a 2:1 landside slope (Figure 4).

CONCLUSIONS AND RECOMMENDATIONS

The sections identified in Table 2 will be sent to URS and/or Blackburn Consulting to determine whether the existing slopes of the sections identified require adjustments in their geometry. URS and/or Blackburn should also confirm the screening criteria outlined in Table 1. The final version of this Memorandum will include the final listing of cross sections requiring adjustment.

Attachments

TABLE 2

TABLE 2
SUTTER BUTTE FLOOD CONTROL AGENCY
FEATHER RIVER WEST LEVEE PROJECT
SLOPE ANALYSIS FOR FRWL PROJECT

CROSS SECTION STATION	SIDE OF LEVEE	POINT NUMBER	POINT OFFSET	POINT ELEV	PREVIOUS POINT OFFSET	PREVIOUS POINT ELEV	SLOPE RUN[1]	NOTES
3900	WS	38886	309.37	38.92	292.51	46.13	2.34	Slope at base of levee.
9900	WS	37462	263.79	54.67	259.96	56.53	2.06	Slope above waterside ramp.
9900	WS	37488	311.61	41.88	289.62	50.98	2.41	Slope below waterside ramp at base of levee.
10300	WS	37317	321.02	41.02	314.61	43.70	2.39	Slope below waterside ramp at base of levee.
10400	WS	37319	313.75	41.99	293.19	51.89	2.08	Slope below waterside ramp at base of levee.
10800	LS	37203	229.44	56.66	198.66	40.05	1.85	Slope below minimum standard.
10900	LS	37205	236.64	56.83	201.10	38.21	1.91	Slope below minimum standard.
12100	LS	36963	231.92	57.69	197.48	40.20	1.97	Slope below minimum standard.
12400	LS	36969	237.26	58.60	210.79	43.50	1.75	Slope below minimum standard.
12500	LS	36971	211.94	57.95	181.13	40.61	1.78	Slope below minimum standard. Wide levee crown.
12600	WS	36884	305.64	44.28	268.19	60.22	2.35	Slope below minimum standard.
12800	WS	36887	310.28	42.01	264.47	60.67	2.45	Slope below minimum standard.
12900	LS	36979	237.43	60.61	208.14	44.85	1.86	Slope above landside ramp.
12900	WS	36889	304.45	42.98	263.03	60.56	2.36	Slope below minimum standard.
13000	WS	36891	310.04	41.41	265.78	59.17	2.49	Slope below minimum standard.
14700	WS	36247	315.21	42.28	276.93	59.07	2.28	Slope below minimum standard. Wide levee crown.
14800	WS	36249	308.36	43.29	267.90	60.41	2.36	Slope below minimum standard.
15800	WS	35947	316.13	43.56	279.08	58.82	2.43	Slope below minimum standard. Wide levee crown.
16100	WS	35953	309.98	44.06	273.68	59.57	2.34	Slope below minimum standard. Wide levee crown.
16200	WS	35955	314.63	43.81	278.25	58.97	2.40	Slope below minimum standard. Wide levee crown.
16500	WS	35961	313.13	43.51	271.55	60.37	2.47	Slope below minimum standard.
16700	WS	35964	307.11	46.38	272.97	60.82	2.36	Slope below minimum standard.
16800	WS	35966	308.16	47.09	278.70	61.40	2.06	Slope below minimum standard. Wide levee crown.
18400	WS	35997	277.80	56.84	266.56	61.45	2.44	Slope above waterside ramp.
18400	WS	35468	312.56	43.76	295.36	53.61	1.75	Slope below waterside ramp at base of levee.
18500	WS	35470	322.97	42.80	287.10	58.25	2.32	Slope below beginning of ramp.
19400	LS	36421	238.57	62.36	213.51	49.25	1.91	Slope below minimum standard.
19500	WS	35283	307.91	44.13	263.81	61.91	2.48	Slope below minimum standard.
21400	WS	35041	306.56	43.75	264.69	62.07	2.29	Slope below minimum standard.
21600	WS	35027	291.05	52.96	268.33	62.07	2.49	Slope below minimum standard.
21700	WS	35047	306.67	45.95	266.46	62.38	2.45	Slope below minimum standard.
22000	WS	34834	317.90	41.62	272.82	59.77	2.48	Slope below minimum standard.
23200	WS	34502	312.00	43.90	269.02	61.36	2.46	Slope below minimum standard.
23500	LS	36579	234.42	62.11	196.52	42.48	1.93	Slope below minimum standard.
24400	LS	36599	236.33	62.53	204.56	46.11	1.93	Slope below minimum standard.
24500	LS	36601	237.06	62.48	204.97	45.66	1.91	Slope below minimum standard.
24600	LS	36603	236.52	62.64	203.28	45.79	1.97	Slope below minimum standard.
24700	LS	36605	234.39	62.95	198.80	43.42	1.82	Slope below minimum standard.
24800	LS	36607	235.24	62.99	202.38	44.08	1.74	Slope below minimum standard.
24900	LS	36609	234.79	62.69	202.27	44.13	1.75	Slope below minimum standard.
25100	LS	36613	235.86	62.58	199.29	43.62	1.93	Slope below minimum standard.
25200	LS	36615	234.83	63.51	196.65	44.11	1.97	Slope below minimum standard.
25300	LS	36617	236.81	63.35	198.59	44.08	1.98	Slope below minimum standard.
25400	LS	36619	236.09	63.30	197.73	43.97	1.98	Slope below minimum standard.
25500	LS	36621	235.16	63.62	198.90	44.44	1.89	Slope below minimum standard.
25600	LS	36623	235.49	63.68	198.93	44.01	1.86	Slope below minimum standard.
25700	LS	36626	237.10	63.69	198.04	43.59	1.94	Slope below minimum standard.
25800	LS	36628	228.76	64.44	193.94	44.31	1.73	Slope below minimum standard.
25900	LS	36630	234.34	64.47	196.27	45.10	1.97	Slope below minimum standard.

1 Slope run equals the horizontal distance in feet required for 1-foot of vertical change.

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CROSS SECTION STATION	SIDE OF LEVEE	POINT NUMBER	POINT OFFSET	POINT ELEV	PREVIOUS POINT OFFSET	PREVIOUS POINT ELEV	SLOPE RUN[1]	NOTES
26000	LS	36632	236.87	63.74	221.26	53.96	1.60	Slope above landside ramp.
26100	LS	33940	227.28	63.23	198.47	46.35	1.71	Slope below minimum standard.
26500	LS	33947	235.86	63.77	202.08	46.21	1.92	Slope below minimum standard.
26600	LS	33949	237.08	63.82	204.62	46.29	1.85	Slope below minimum standard.
26700	LS	33951	237.34	64.10	203.39	46.28	1.91	Slope below minimum standard.
26800	LS	33953	237.19	64.37	203.00	46.13	1.87	Slope below minimum standard.
26900	LS	33955	237.25	64.20	203.71	45.07	1.75	Slope below minimum standard.
27000	LS	33957	237.41	64.17	202.66	44.51	1.77	Slope below minimum standard.
27100	LS	33959	238.83	64.52	201.53	44.34	1.85	Slope below minimum standard.
27200	LS	33961	239.10	65.42	201.61	43.97	1.75	Slope below minimum standard.
27300	LS	33963	240.15	64.82	203.05	43.81	1.77	Slope below minimum standard.
27400	LS	33965	238.32	64.36	201.12	43.91	1.82	Slope below minimum standard.
27500	LS	33967	237.68	64.24	200.14	44.13	1.87	Slope below minimum standard.
27600	LS	33969	238.84	63.96	201.14	44.56	1.94	Slope below minimum standard.
27700	LS	33971	239.76	64.20	202.15	45.26	1.99	Slope below minimum standard.
30300	LS	33601	230.99	61.88	198.31	43.90	1.82	Slope below minimum standard.
30400	LS	33047	212.38	54.26	194.34	44.54	1.86	Slope below landside ramp.
31300	LS	32918	207.86	57.88	177.22	42.18	1.95	Slope below minimum standard. Levee overbuilt on landside.
31300	WS	33027	375.55	27.41	332.72	47.53	2.13	Channel bank slope below patrol road.
31400	LS	32920	202.88	56.88	175.67	42.21	1.85	Slope below minimum standard. Levee overbuilt on landside.
31400	WS	33029	372.15	30.16	358.63	39.71	1.42	Channel bank slope near levee toe.
31500	WS	33031	367.08	31.67	330.34	51.75	1.83	Channel bank slope near levee toe.
31700	WS	32873	349.14	32.35	293.11	57.40	2.24	Slope below patrol road.
32000	LS	33634	241.08	63.31	201.52	43.36	1.98	Slope below minimum standard.
32100	LS	33636	240.91	63.16	202.49	43.42	1.95	Slope below minimum standard.
32200	WS	32807	354.45	30.17	312.22	52.13	1.92	Slope below patrol road.
32600	WS	32823	356.30	29.10	283.62	58.23	2.50	Slope below minimum standard.
32700	WS	32827	355.45	29.18	291.08	57.25	2.29	Slope below minimum standard.
32800	WS	32831	356.94	28.73	290.16	57.61	2.31	Slope below minimum standard.
32900	WS	32835	356.57	29.27	283.96	58.57	2.48	Slope below minimum standard.
33000	WS	32838	354.08	29.78	310.09	49.73	2.21	Slope below minimum standard.
33100	WS	32840	371.47	30.41	304.03	57.63	2.48	Slope below minimum standard. Levee overbuilt on waterside.
33200	WS	32842	347.72	33.08	301.61	57.44	1.89	Slope below minimum standard. Levee overbuilt on waterside.
33700	WS	32639	354.14	33.39	292.32	58.84	2.43	Slope below minimum standard. Levee overbuilt on landside and waterside.
34100	WS	32475	357.32	32.18	303.02	56.88	2.20	Slope below minimum standard. Levee overbuilt on waterside.
34300	LS	32462	215.64	57.79	196.79	47.96	1.92	Slope below landside ramp.
34400	WS	32481	366.85	31.59	336.79	46.71	1.99	Channel bank slope at levee toe. Flat levee slope above channel bank.
35400	WS	32537	336.77	37.05	288.10	59.29	2.19	Slope below minimum standard. Levee overbuilt on waterside.
36500	LS	32093	204.51	53.47	184.78	42.45	1.79	Slope below landside ramp.
36600	WS	32006	271.12	60.07	261.37	64.11	2.41	Slope below minimum standard.
36700	WS	32007	269.03	60.72	261.46	64.01	2.30	Slope below minimum standard.
37500	WS	31783	360.51	30.88	293.19	59.29	2.37	Channel bank slope at levee toe.
37600	WS	31785	363.08	30.83	310.32	54.66	2.21	Channel bank slope at levee toe.
37800	WS	31789	369.61	30.57	322.14	54.06	2.02	Channel bank slope at levee toe.
38200	WS	31797	365.98	30.52	314.02	51.84	2.44	Channel bank slope at levee toe.
38400	WS	31801	357.56	30.85	336.87	45.19	1.44	Channel bank slope at levee toe.
38500	WS	31803	358.78	30.37	327.01	47.97	1.80	Channel bank slope at levee toe.
38700	WS	31807	367.73	30.23	336.29	46.88	1.89	Channel bank slope at levee toe.
38900	WS	31811	364.50	30.06	298.19	59.84	2.23	Channel bank slope at levee toe. Levee overbuilt on waterside.

1 Slope run equals the horizontal distance in feet required for 1-foot of vertical change.

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CROSS SECTION STATION	SIDE OF LEVEE	POINT NUMBER	POINT OFFSET	POINT ELEV	PREVIOUS POINT OFFSET	PREVIOUS POINT ELEV	SLOPE RUN[1]	NOTES
39000	WS	31813	365.92	30.70	294.64	59.80	2.45	Channel bank slope at levee toe. Levee overbuilt on waterside.
40300	WS	31531	375.72	32.75	333.93	51.84	2.19	Channel bank slope at levee toe.
40400	WS	31535	379.45	32.79	334.13	51.73	2.39	Channel bank slope at levee toe.
41100	WS	31319	384.45	31.60	323.08	57.38	2.38	Channel bank slope at levee toe.
41200	WS	31321	386.50	30.34	318.59	57.95	2.46	Channel bank slope at levee toe.
43300	LS	30907	234.53	66.13	202.73	49.46	1.91	Slope below minimum standard.
44800	LS	30937	238.20	66.24	205.04	49.42	1.97	Slope below minimum standard.
45000	LS	30940	213.46	62.25	191.16	50.32	1.87	Slope below landside ramp.
45900	LS	30376	241.00	66.46	207.89	49.87	1.99	Slope below minimum standard.
47700	LS	29986	236.49	67.58	216.05	57.24	1.98	Slope above landside ramp.
51500	LS	29432	240.93	68.55	205.20	49.86	1.91	Slope below minimum standard.
51600	LS	29434	239.07	68.80	202.99	50.04	1.92	Slope below minimum standard.
52100	WS	29344	333.86	47.45	322.86	52.03	2.40	Slope below minimum standard.
54000	WS	29373	334.23	49.30	318.80	56.01	2.30	Slope above waterside ramp.
54100	WS	29375	305.75	56.43	293.34	63.48	1.76	Slope above waterside ramp.
54100	WS	28832	331.17	51.56	329.50	52.55	1.69	Slope below waterside ramp.
54200	WS	29376	280.77	64.01	278.49	65.39	1.66	Slope above waterside ramp.
54300	WS	28834	338.21	48.90	334.58	50.55	2.21	Slope below minimum standard.
54400	WS	28835	325.70	47.50	283.33	65.44	2.36	Slope below minimum standard.
55900	WS	28612	333.22	49.29	326.74	51.92	2.46	Slope below minimum standard.
56500	WS	28208	332.87	48.15	295.70	64.29	2.30	Slope below minimum standard.
56600	WS	28209	323.28	47.04	287.21	64.75	2.04	Slope below minimum standard.
56700	WS	28210	342.03	48.87	315.75	60.45	2.27	Slope below minimum standard.
57300	WS	28217	324.05	50.44	297.40	62.91	2.14	Slope below minimum standard.
57500	WS	28030	322.22	51.15	289.21	64.70	2.44	Slope below minimum standard.
58000	WS	28039	324.62	49.92	314.69	54.03	2.41	Slope below minimum standard.
58300	LS	28460	238.29	69.36	197.57	48.44	1.95	Slope below minimum standard.
58500	WS	27865	309.40	58.50	302.15	61.85	2.17	Slope above excavation in levee slope.
58500	WS	28047	343.17	50.99	333.10	56.28	1.90	Slope below excavation in levee slope.
58600	WS	27866	295.79	66.81	295.04	67.28	1.61	Slope above excavation in levee slope.
59300	LS	28480	238.56	69.82	222.92	61.85	1.96	Slope below minimum standard.
59500	WS	27780	351.71	47.23	319.00	60.47	2.47	Slope below minimum standard. Levee overbuilt on waterside.
60600	WS	27417	369.13	44.40	362.22	47.24	2.43	Channel bank slope at levee toe. Flat levee slope above channel bank.
64500	WS	26779	328.26	52.18	285.31	71.50	2.22	Slope below minimum standard. Wide levee crown.
64700	WS	26783	321.17	52.74	296.72	63.33	2.31	Slope below waterside ramp at base of levee.
68300	WS	25994	344.34	57.71	335.33	61.98	2.11	Slope above patrol road. Flat slopes prior to this slope.
68500	WS	25998	339.07	56.38	328.34	60.96	2.34	Slope above patrol road. Flat slopes prior to this slope.
78100	WS	23977	378.89	42.37	345.52	55.87	2.47	Channel bank slope at levee toe. Levee slopes flatter than 3:1 above channel.
78200	WS	23979	376.85	41.49	344.60	55.79	2.26	Channel bank slope at levee toe. Levee slopes flatter than 3:1 above channel.
78900	WS	23994	378.28	41.68	354.39	55.08	1.78	Channel bank slope at levee toe. Levee slopes flatter than 3:1 above channel.
79000	WS	23766	304.54	64.33	282.85	73.38	2.40	Slope below minimum standard.
79100	WS	23747	365.44	45.88	347.10	53.69	2.34	Channel bank slope at levee toe.
79400	WS	23754	357.25	46.61	345.72	53.05	1.79	Channel bank slope at levee toe. Levee slopes flatter than 3:1 above channel.
84900	WS	23064	276.68	73.21	259.57	80.16	2.46	Slope below minimum standard.
86300	WS	22772	328.13	59.44	297.52	72.49	2.35	Slope below waterside ramp.
93100	WS	21909	371.88	53.75	329.54	70.96	2.46	Slope below minimum standard. Levee overbuilt on waterside.
93800	WS	21412	398.98	52.67	365.71	67.50	2.24	Slope below minimum standard. Levee overbuilt on waterside.
94200	WS	21362	402.86	49.72	362.06	69.17	2.10	Slope below minimum standard. Levee overbuilt on waterside.
94300	WS	21366	410.94	49.58	373.56	68.67	1.96	Slope below minimum standard. Levee overbuilt on waterside.

1 Slope run equals the horizontal distance in feet required for 1-foot of vertical change.

TABLE 2
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SLOPE ANALYSIS FOR FRWL PROJECT

CROSS SECTION STATION	SIDE OF LEVEE	POINT NUMBER	POINT OFFSET	POINT ELEV	PREVIOUS POINT OFFSET	PREVIOUS POINT ELEV	SLOPE RUN[1]	NOTES
94400	WS	21368	424.78	48.55	380.16	68.25	2.26	Slope below minimum standard. Levee overbuilt on waterside.
94500	WS	21370	434.85	48.97	392.50	66.74	2.38	Slope below minimum standard. Levee overbuilt on waterside.
95000	WS	21322	412.37	53.19	374.78	68.58	2.44	Slope below minimum standard. Levee overbuilt on waterside.
95400	WS	21248	398.92	48.66	345.41	70.74	2.42	Slope below minimum standard. Levee overbuilt on waterside.
95600	WS	21252	404.80	49.60	365.37	67.89	2.16	Slope below minimum standard. Levee overbuilt on waterside.
96600	WS	21123	274.04	75.15	259.52	81.00	2.48	Slope above waterside ramp.
96900	LS	21018	236.85	80.55	230.53	77.05	1.81	Slope above landside ramp.
97000	LS	21020	237.00	80.70	214.58	69.39	1.98	Slope above landside ramp.
97100	LS	21022	238.80	80.57	213.14	66.78	1.86	Slope below minimum standard.
97600	LS	20939	237.91	81.12	208.14	66.09	1.98	Slope below minimum standard.
98000	WS	20909	360.62	55.30	345.36	62.54	2.11	Slope above patrol road. Prior slopes flatter than 3:1.
98300	WS	20915	353.97	57.18	337.77	64.48	2.22	Slope above patrol road. Prior slopes flatter than 3:1.
98700	LS	20700	205.17	70.72	204.41	70.27	1.69	Slope below minimum standard. Slope in residential backyard.
98800	LS	20963	236.57	81.32	217.94	69.97	1.64	Slope below minimum standard.
99300	LS	20972	233.43	81.64	203.31	65.62	1.88	Slope below minimum stnadard. Overbuilt levee section.
99300	WS	20650	335.70	57.26	288.71	79.61	2.10	Slope below minimum standard. Levee overbuilt on waterside.
99400	WS	20652	335.34	57.32	291.90	77.99	2.10	Slope below minimum standard. Levee overbuilt on waterside.
99500	WS	20656	350.17	52.37	294.79	78.01	2.16	Slope below minimum standard. Levee overbuilt on waterside.
99600	WS	20657	345.74	54.44	299.73	76.79	2.06	Slope below minimum standard. Levee overbuilt on waterside.
99900	LS	20479	194.07	64.59	190.52	62.74	1.92	Slope below landside ramp. Levee encroached on by building.
100000	LS	20480	201.64	66.58	198.09	63.03	1.00	Slope below landside ramp. Levee encroached on by building.
100100	LS	20442	193.74	69.71	182.93	62.39	1.48	Slope below landside ramp. Levee encroached on by parking area.
100200	LS	20444	208.14	74.88	185.49	62.89	1.89	Slope below landside ramp. Levee encroached on by structures.
100400	LS	20448	237.36	81.61	200.00	62.68	1.97	Slope below minimum stnadard.
100600	LS	20455	242.19	82.73	225.62	73.38	1.77	Slope below minimum standard.
100800	WS	20321	334.41	63.47	309.67	74.95	2.15	Slope below waterside patrol road.
101000	WS	20298	349.99	57.30	334.48	67.07	1.59	Slope below waterside ramp.
101200	LS	20370	240.87	82.98	202.93	62.11	1.82	Slope below minimum standard.
101300	LS	20372	240.73	83.07	201.12	62.85	1.96	Slope below minimum standard.
101400	LS	20376	240.07	83.46	194.79	60.24	1.95	Slope below minimum standard.
101900	WS	20157	309.12	67.97	284.45	78.21	2.41	Slope between waterside patrol road and waterside ramp.
102200	WS	20150	320.90	63.57	278.41	81.69	2.35	Slope below waterside patrol road.
102300	WS	20101	268.89	81.76	263.46	84.11	2.31	Slope between levee crown and waterside patrol road.
102300	WS	20082	314.95	65.50	282.44	80.02	2.24	Slope below waterside patrol road.
102400	WS	20103	274.79	79.01	268.35	82.38	1.91	Slope between levee crown and waterside patrol road.
102500	LS	20126	234.62	90.50	184.25	62.87	1.82	Slope below minimum standard.
102500	WS	20086	359.33	63.05	328.62	75.55	2.46	Slope below waterside patrol road. Located at Hwy 20 crossing. Section skewed to slope.
102600	WS	20087	395.97	62.95	368.04	76.80	2.02	Slope below waterside patrol road. Located at Hwy 20 crossing. Section skewed to slope.
103000	WS	19975	340.79	61.71	315.34	73.08	2.24	Slope below waterside ramp.
103200	WS	19979	339.49	62.89	299.55	79.55	2.40	Slope below minimum standard. Levee overbuilt on landside and waterside.
103400	WS	19984	346.06	61.60	305.16	78.27	2.45	Slope below minimum standard. Levee overbuilt on landside and waterside.
103600	WS	19987	336.92	63.30	303.63	78.10	2.25	Slope below minimum standard. Levee overbuilt on landside and waterside.
104000	WS	19610	330.78	61.95	290.38	78.74	2.41	Slope below minimum standard. Levee overbuilt on landside and waterside.
104100	WS	19583	331.43	60.75	290.20	77.92	2.40	Slope below minimum standard. Levee overbuilt on landside and waterside.
104500	WS	19394	308.29	70.18	294.65	77.85	1.78	Slope above waterside ramp. Levee overbuilt on landside and waterside.
104600	WS	19396	335.69	64.19	327.24	68.07	2.18	Slope above waterside ramp. Levee overbuilt on landside and waterside.
104800	WS	19351	272.11	81.50	265.08	84.39	2.43	Slope below minimum standard. Levee overbuilt on landside and waterside.
104900	WS	19353	274.64	80.87	265.99	84.38	2.47	Slope below minimum standard. Levee overbuilt on landside and waterside.
104900	WS	19325	344.76	58.83	333.17	65.26	1.80	Slope above waterside patrol road. Levee overbuilt on landside and waterside.

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TABLE 2
SUTTER BUTTE FLOOD CONTROL AGENCY
FEATHER RIVER WEST LEVEE PROJECT
SLOPE ANALYSIS FOR FRWL PROJECT

CROSS SECTION STATION	SIDE OF LEVEE	POINT NUMBER	POINT OFFSET	POINT ELEV	PREVIOUS POINT OFFSET	PREVIOUS POINT ELEV	SLOPE RUN[1]	NOTES
105800	WS	19116	281.32	78.94	266.30	85.37	2.33	Slope below minimum standard.
108200	LS	18595	183.51	66.41	177.73	62.32	1.41	Slope below landside ramp.
109800	WS	18862	351.94	55.88	343.36	59.91	2.13	Slope below minimum standard.
110200	WS	18870	348.28	57.04	347.36	57.50	1.99	Slope below minimum standard.
112900	WS	18134	283.51	79.68	270.67	84.97	2.43	Slope adjacent to railroad tracks.
113000	WS	18136	260.53	82.21	255.15	84.56	2.29	Slope adjacent to railroad tracks.
113000	WS	18109	300.89	86.81	293.26	81.54	1.45	Slope adjacent to railroad tracks.
113100	LS	18799	207.37	75.34	191.81	67.11	1.89	Slope below landside ramp.
113100	WS	17954	261.12	83.21	258.50	81.67	1.70	Slope adjacent to railroad tracks.
113200	LS	17956	232.86	83.41	227.98	80.82	1.88	Slope adjacent to railroad tracks.
113300	LS	17958	236.15	83.84	213.28	71.99	1.93	Slope below minimum standard.
113400	LS	17960	240.16	85.33	208.41	68.11	1.84	Slope below minimum standard.
116100	LS	17609	212.99	81.58	185.85	67.90	1.98	Slope below landside ramp.
116300	LS	17613	238.15	86.07	202.10	67.78	1.97	Slope below minimum standard.
116700	LS	17621	236.50	86.02	200.81	67.73	1.95	Slope below minimum standard.
116800	LS	17623	238.09	86.34	203.14	67.72	1.88	Slope below minimum standard.
116900	LS	17625	239.17	86.16	206.40	67.52	1.76	Slope below minimum standard.
117400	LS	17635	236.81	86.27	208.65	70.32	1.77	Slope below minimum standard.
117500	LS	17637	239.20	86.56	204.16	68.76	1.97	Slope below minimum standard.
118100	WS	17578	361.61	59.40	349.27	65.01	2.20	Channel bank slope at levee toe.
122000	LS	16857	219.88	84.50	189.91	69.42	1.99	Slope below landside ramp.
122300	WS	16810	327.45	69.23	315.44	74.15	2.44	Slope below waterside ramp.
123800	LS	16927	236.58	86.80	204.36	70.53	1.98	Slope below minimum standard.
125100	LS	16979	234.58	86.50	204.60	70.47	1.87	Slope below minimum standard.
125200	LS	16983	236.24	86.46	205.73	70.45	1.91	Slope below minimum standard.
125500	LS	16995	237.49	86.62	206.51	70.57	1.93	Slope below minimum standard.
125600	LS	16999	238.58	86.80	207.31	70.61	1.93	Slope below minimum standard.
125700	LS	17003	237.85	86.83	209.32	70.71	1.77	Slope below minimum standard.
126100	LS	17019	240.34	87.06	206.66	69.75	1.95	Slope below minimum standard.
126300	LS	17027	240.63	87.69	208.74	70.65	1.87	Slope below minimum standard.
126400	LS	17031	238.46	87.16	205.96	70.34	1.93	Slope below minimum standard.
126500	LS	17035	239.52	87.55	206.77	70.03	1.87	Slope below minimum standard.
126600	LS	17039	241.33	87.28	210.62	69.80	1.76	Slope below minimum standard.
126700	LS	17043	238.69	86.96	204.96	69.29	1.91	Slope below minimum standard.
126800	LS	17046	239.33	87.92	204.74	69.56	1.88	Slope below minimum standard.
126900	LS	17049	241.60	87.93	207.14	69.60	1.88	Slope below minimum standard.
127000	LS	17053	241.22	87.76	208.27	69.49	1.80	Slope below minimum standard.
127000	WS	16564	330.80	68.10	323.92	70.92	2.44	Slope below waterside ramp.
127100	LS	17057	242.67	87.65	209.43	69.47	1.83	Slope below minimum standard.
127200	LS	17061	243.32	87.87	209.39	69.79	1.88	Slope below minimum standard.
127300	LS	17065	242.06	87.74	209.42	70.04	1.84	Slope below minimum standard.
127400	LS	17068	241.81	87.62	207.53	69.74	1.92	Slope below minimum standard.
127500	LS	17072	240.43	87.62	205.43	69.47	1.93	Slope below minimum standard.
127600	LS	17076	238.73	87.25	205.44	69.47	1.87	Slope below minimum standard.
127700	LS	17077	240.92	86.98	207.44	69.69	1.94	Slope below minimum standard.
127800	LS	17081	240.51	86.84	207.29	69.43	1.91	Slope below minimum standard.
127900	LS	17085	241.17	87.36	209.02	69.94	1.85	Slope below minimum standard.
128400	LS	17105	240.73	87.64	205.52	70.02	2.00	Slope below minimum standard.
129500	WS	16225	270.30	85.47	264.94	87.67	2.44	Slope above waterside ramp.

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SLOPE ANALYSIS FOR FRWL PROJECT

CROSS SECTION STATION	SIDE OF LEVEE	POINT NUMBER	POINT OFFSET	POINT ELEV	PREVIOUS POINT OFFSET	PREVIOUS POINT ELEV	SLOPE RUN[1]	NOTES
129800	LS	17157	240.40	87.73	208.68	71.83	1.99	Slope below minimum standard.
133900	WS	15757	332.40	67.03	305.26	78.21	2.43	Slope below waterside ramp.
135100	LS	15925	238.55	88.24	206.82	71.92	1.94	Slope below minimum standard.
137600	LS	15972	238.02	88.17	221.47	79.71	1.96	Slope below minimum standard.
138000	LS	15980	237.56	88.07	221.11	79.82	1.99	Slope below minimum standard.
138100	LS	15982	236.54	87.87	220.80	79.86	1.96	Slope below minimum standard.
138900	LS	15081	239.36	88.22	222.56	79.54	1.94	Slope below minimum standard.
139300	LS	15097	239.57	88.29	222.43	79.55	1.96	Slope below minimum standard.
140900	LS	15156	237.69	89.43	220.58	80.23	1.86	Slope below minimum standard.
143500	LS	13842	207.19	78.22	200.36	74.32	1.75	Right bank of Sutter Butte Canal. Toe of levee at top of right bank.
143900	LS	13810	203.83	79.89	194.99	75.11	1.85	Right bank of Sutter Butte Canal. Toe of levee at top of right bank.
144100	LS	13713	206.10	82.51	190.49	73.71	1.78	Right bank of Sutter Butte Canal. Toe of levee at top of right bank.
144200	LS	13714	204.25	80.68	193.64	74.65	1.76	Right bank of Sutter Butte Canal. Toe of levee near top of right bank.
144300	LS	13716	206.08	81.01	194.21	74.25	1.76	Right bank of Sutter Butte Canal. Toe of levee near top of right bank.
144400	LS	13718	206.58	81.27	196.01	74.50	1.56	Right bank of Sutter Butte Canal. Toe of levee near top of right bank.
144500	LS	13720	208.28	80.91	197.16	74.71	1.80	Right bank of Sutter Butte Canal. Toe of levee near top of right bank.
144600	LS	13721	208.53	81.40	197.01	74.61	1.70	Right bank of Sutter Butte Canal. Toe of levee near top of right bank.
144700	LS	13722	209.78	82.06	196.77	74.37	1.69	Right bank of Sutter Butte Canal. Toe of levee near top of right bank.
144800	LS	13723	211.74	83.04	199.25	75.47	1.65	Right bank of Sutter Butte Canal. Toe of levee near top of right bank.
144900	LS	13248	203.24	82.69	189.17	74.69	1.76	Right bank of Sutter Butte Canal. Toe of levee near top of right bank.
145500	LS	13480	235.03	89.48	215.64	78.58	1.78	Slope below minimum standard.
145600	LS	13484	235.10	89.80	215.48	78.55	1.74	Slope below minimum standard.
146800	LS	13534	240.47	90.36	219.92	79.70	1.93	Slope below minimum standard.
147000	WS	13430	303.29	75.88	267.01	90.68	2.45	Slope below minimum standard.
149000	LS	13601	238.13	90.06	222.41	81.84	1.91	Slope below minimum standard.
150300	LS	13645	238.45	90.42	220.49	81.32	1.97	Slope below minimum standard.
151400	LS	13667	236.37	90.35	223.69	83.47	1.84	Slope below minimum standard.
151500	LS	13669	237.69	90.36	224.02	83.21	1.91	Slope below minimum standard.
151600	LS	13671	238.36	90.56	223.46	83.05	1.98	Slope below minimum standard.
153600	WS	11920	298.97	75.38	260.79	91.21	2.41	Slope below minimum standard.
153700	LS	12009	237.29	91.07	223.63	83.24	1.75	Slope below minimum standard.
153800	LS	12011	237.99	91.44	224.10	83.86	1.83	Slope below minimum standard.
154100	LS	12017	237.74	91.49	225.00	84.68	1.87	Slope below minimum standard.
154200	LS	12019	237.03	91.31	223.67	83.77	1.77	Slope below minimum standard.
154300	LS	12021	238.38	91.56	224.22	84.04	1.88	Slope below minimum standard.
154400	LS	12023	238.71	91.09	225.62	83.81	1.80	Slope below minimum standard.
154500	LS	12025	238.68	91.34	225.36	84.13	1.85	Slope below minimum standard.
154600	LS	12026	239.64	91.51	224.67	83.51	1.87	Slope below minimum standard.
154700	LS	12028	238.50	91.47	226.85	84.74	1.73	Slope below minimum standard.
154800	LS	12030	238.20	91.64	224.31	84.56	1.96	Slope below minimum standard.
158100	LS	11268	238.17	91.92	229.09	86.87	1.80	Slope below minimum standard.
160100	LS	11349	238.75	92.67	227.81	87.15	1.98	Slope below minimum standard.
160300	LS	11357	239.47	92.39	231.06	87.85	1.85	Slope below minimum standard.
161000	WS	10654	280.41	88.39	270.13	93.07	2.20	Slope below minimum standard.
161100	LS	11390	235.31	92.71	214.42	81.46	1.86	Right bank of Sutter Butte Canal and landside slope of levee.
161700	LS	10422	219.39	88.37	207.69	82.03	1.85	Right bank of Sutter Butte Canal. Toe of levee at top of right bank.
161900	LS	10391	218.83	88.56	210.01	81.48	1.25	Right bank of Sutter Butte Canal. Toe of levee at top of right bank.
162200	LS	11412	236.48	93.37	213.35	81.57	1.96	Right bank of Sutter Butte Canal and landside slope of levee.
162300	LS	10341	203.27	87.41	189.76	79.82	1.78	Right bank of Sutter Butte Canal. Toe of levee near top of right bank.

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FEATHER RIVER WEST LEVEE PROJECT
SLOPE ANALYSIS FOR FRWL PROJECT

CROSS SECTION STATION	SIDE OF LEVEE	POINT NUMBER	POINT OFFSET	POINT ELEV	PREVIOUS POINT OFFSET	PREVIOUS POINT ELEV	SLOPE RUN[1]	NOTES
163700	LS	11442	237.20	93.87	224.56	86.93	1.82	Slope below minimum standard.
163700	WS	10234	306.15	83.57	286.15	92.69	2.19	Slope below waterside ramp.
163800	WS	10236	298.43	82.62	294.11	84.39	2.43	Steep slope caused by farming against levee.
164100	LS	11449	238.62	93.45	223.44	85.75	1.97	Slope below minimum standard.
164200	LS	11451	234.59	93.33	222.38	86.34	1.75	Slope below minimum standard.
164300	LS	11453	236.05	94.03	220.80	85.75	1.84	Slope below minimum standard.
164400	LS	11455	238.17	94.28	225.21	86.33	1.63	Slope below minimum standard.
164600	LS	11459	236.80	93.83	223.65	86.51	1.80	Slope below minimum standard.
164700	LS	11461	238.19	94.08	224.52	85.99	1.69	Slope below minimum standard.
164800	LS	11463	238.00	93.61	223.94	86.50	1.98	Slope below minimum standard.
164900	LS	11465	238.99	93.85	223.83	86.17	1.97	Slope below minimum standard.
165100	WS	9870	335.35	79.05	327.14	83.27	1.95	Slope below waterside ramp. Overbuilt section waterward of ramp.
167500	LS	11519	236.81	94.73	219.77	84.74	1.71	Right bank of Sutter Butte Canal and landside slope of levee.
167600	LS	11521	238.50	94.89	224.70	85.11	1.41	Right bank of Sutter Butte Canal and landside slope of levee.
167700	LS	11523	239.09	94.31	221.14	84.47	1.82	Right bank of Sutter Butte Canal and landside slope of levee.
167800	LS	11525	239.03	95.24	224.29	85.61	1.53	Right bank of Sutter Butte Canal and landside slope of levee.
167900	LS	11527	238.61	94.92	226.97	85.71	1.26	Right bank of Sutter Butte Canal and landside slope of levee.
168000	LS	11529	239.21	95.22	224.29	85.49	1.53	Right bank of Sutter Butte Canal and landside slope of levee.
168100	LS	11531	238.27	95.37	219.24	84.25	1.71	Right bank of Sutter Butte Canal and landside slope of levee.
168200	LS	11533	237.84	95.56	225.38	85.62	1.25	Right bank of Sutter Butte Canal and landside slope of levee.
168300	LS	11535	237.62	95.21	227.35	85.87	1.10	Right bank of Sutter Butte Canal and landside slope of levee.
168400	LS	11537	238.43	94.96	225.28	84.87	1.30	Right bank of Sutter Butte Canal and landside slope of levee.
168500	LS	11539	239.30	95.60	225.30	85.18	1.34	Right bank of Sutter Butte Canal and landside slope of levee.
168600	LS	11541	238.57	95.61	226.45	85.87	1.24	Right bank of Sutter Butte Canal and landside slope of levee.
168700	LS	11543	238.61	95.30	226.99	86.14	1.27	Right bank of Sutter Butte Canal and landside slope of levee.
168800	LS	11545	238.04	95.37	226.13	86.26	1.31	Right bank of Sutter Butte Canal and landside slope of levee.
168900	LS	11547	239.20	95.72	225.00	86.21	1.49	Right bank of Sutter Butte Canal and landside slope of levee.
169000	LS	11549	241.07	95.05	229.13	86.87	1.46	Right bank of Sutter Butte Canal and landside slope of levee.
169100	LS	11551	239.17	95.00	226.33	85.49	1.35	Right bank of Sutter Butte Canal and landside slope of levee.
169200	LS	11553	237.79	95.11	225.61	86.58	1.43	Right bank of Sutter Butte Canal and landside slope of levee.
169300	LS	11555	237.63	95.19	221.80	84.74	1.52	Right bank of Sutter Butte Canal and landside slope of levee.
169400	LS	11557	237.70	95.11	222.47	85.13	1.53	Right bank of Sutter Butte Canal and landside slope of levee.
169500	LS	11559	238.22	95.55	223.02	85.38	1.49	Right bank of Sutter Butte Canal and landside slope of levee.
169600	LS	11561	238.01	95.83	222.93	86.35	1.59	Right bank of Sutter Butte Canal and landside slope of levee.
169700	LS	11563	238.38	95.62	224.35	86.28	1.50	Right bank of Sutter Butte Canal and landside slope of levee.
169800	LS	11565	238.28	95.93	224.50	86.34	1.44	Right bank of Sutter Butte Canal and landside slope of levee.
169900	LS	11567	239.04	95.72	225.40	86.70	1.51	Right bank of Sutter Butte Canal and landside slope of levee.
170000	LS	11569	238.60	95.43	225.16	86.38	1.49	Right bank of Sutter Butte Canal and landside slope of levee.
170100	LS	11571	237.66	95.38	224.89	86.96	1.52	Right bank of Sutter Butte Canal and landside slope of levee.
170200	LS	11573	239.57	95.25	226.25	86.67	1.55	Right bank of Sutter Butte Canal and landside slope of levee.
170300	LS	11575	240.08	95.62	225.17	87.08	1.75	Right bank of Sutter Butte Canal and landside slope of levee.
170400	LS	11577	238.90	95.69	225.47	88.56	1.88	Right bank of Sutter Butte Canal and landside slope of levee.
170500	LS	11579	236.32	94.97	224.91	87.00	1.43	Right bank of Sutter Butte Canal and landside slope of levee.
170600	LS	11582	237.42	95.74	221.58	86.44	1.70	Right bank of Sutter Butte Canal and landside slope of levee.
170700	LS	11584	237.90	95.49	221.52	85.67	1.67	Right bank of Sutter Butte Canal and landside slope of levee.
170800	LS	11586	236.85	96.06	221.17	86.63	1.66	Right bank of Sutter Butte Canal and landside slope of levee.
170900	LS	11588	237.60	95.95	222.21	85.70	1.50	Right bank of Sutter Butte Canal and landside slope of levee.
171000	LS	11590	238.35	95.57	224.80	86.67	1.52	Right bank of Sutter Butte Canal and landside slope of levee.
171100	LS	11592	237.82	95.78	223.53	86.53	1.55	Right bank of Sutter Butte Canal and landside slope of levee.

1 Slope run equals the horizontal distance in feet required for 1-foot of vertical change.

TABLE 2
SUTTER BUTTE FLOOD CONTROL AGENCY
FEATHER RIVER WEST LEVEE PROJECT
SLOPE ANALYSIS FOR FRWL PROJECT

CROSS SECTION STATION	SIDE OF LEVEE	POINT NUMBER	POINT OFFSET	POINT ELEV	PREVIOUS POINT OFFSET	PREVIOUS POINT ELEV	SLOPE RUN[1]	NOTES
171200	LS	11594	236.53	95.93	221.85	86.93	1.63	Right bank of Sutter Butte Canal and landside slope of levee.
171300	LS	11596	237.75	95.85	222.65	86.70	1.65	Right bank of Sutter Butte Canal and landside slope of levee.
171400	LS	11598	237.34	95.93	223.55	87.19	1.58	Right bank of Sutter Butte Canal and landside slope of levee.
171500	LS	11600	238.52	95.86	225.45	87.55	1.57	Right bank of Sutter Butte Canal and landside slope of levee.
171600	LS	11602	238.88	96.21	225.53	87.99	1.62	Right bank of Sutter Butte Canal and landside slope of levee.
171700	LS	11604	237.48	96.20	224.69	87.74	1.51	Right bank of Sutter Butte Canal and landside slope of levee.
171800	LS	11606	237.88	95.98	223.26	87.33	1.69	Right bank of Sutter Butte Canal and landside slope of levee.
171900	LS	11608	238.38	96.06	223.28	86.63	1.60	Right bank of Sutter Butte Canal and landside slope of levee.
172000	LS	11610	238.08	96.47	222.23	86.98	1.67	Right bank of Sutter Butte Canal and landside slope of levee.
172100	LS	11612	239.76	95.61	222.10	86.32	1.90	Right bank of Sutter Butte Canal and landside slope of levee.
172200	LS	11613	238.54	95.77	223.69	86.71	1.64	Right bank of Sutter Butte Canal and landside slope of levee.
172300	LS	11615	237.37	95.02	223.92	87.00	1.68	Right bank of Sutter Butte Canal and landside slope of levee.
172400	LS	11617	239.52	95.23	224.80	87.06	1.80	Right bank of Sutter Butte Canal and landside slope of levee.
172500	LS	11619	239.04	95.76	226.22	88.00	1.65	Right bank of Sutter Butte Canal and landside slope of levee.
172600	LS	11622	236.36	95.85	221.10	86.38	1.61	Right bank of Sutter Butte Canal and landside slope of levee.
172700	LS	11624	239.44	96.20	224.69	86.74	1.56	Right bank of Sutter Butte Canal and landside slope of levee.
172800	LS	11626	238.64	96.47	223.85	86.99	1.56	Right bank of Sutter Butte Canal and landside slope of levee.
172900	LS	11628	238.71	96.65	224.05	87.23	1.56	Right bank of Sutter Butte Canal and landside slope of levee.
173000	LS	11630	239.02	96.05	225.52	87.79	1.63	Right bank of Sutter Butte Canal and landside slope of levee.
173100	LS	11632	239.18	96.36	225.53	87.85	1.60	Right bank of Sutter Butte Canal and landside slope of levee.
173200	LS	11634	238.60	95.92	225.53	87.54	1.56	Right bank of Sutter Butte Canal and landside slope of levee.
173300	LS	11636	239.56	96.45	224.74	87.97	1.75	Right bank of Sutter Butte Canal and landside slope of levee.
173400	LS	11638	236.12	96.18	224.55	88.46	1.50	Right bank of Sutter Butte Canal and landside slope of levee.
173500	LS	11640	238.56	96.24	222.44	87.04	1.75	Right bank of Sutter Butte Canal and landside slope of levee.
173600	LS	11642	236.70	96.22	222.71	87.56	1.62	Right bank of Sutter Butte Canal and landside slope of levee.
173700	LS	11644	237.84	96.28	223.81	87.50	1.60	Right bank of Sutter Butte Canal and landside slope of levee.
173800	LS	11646	235.90	96.37	220.62	86.76	1.59	Right bank of Sutter Butte Canal and landside slope of levee.
173900	LS	11648	236.06	96.24	223.18	87.26	1.43	Right bank of Sutter Butte Canal and landside slope of levee.
174000	LS	11650	236.22	96.55	219.41	86.48	1.67	Right bank of Sutter Butte Canal and landside slope of levee.
174000	WS	8561	273.69	93.06	266.06	96.28	2.37	Slope below minimum standard.
174100	LS	11652	235.29	96.32	220.72	87.19	1.60	Right bank of Sutter Butte Canal and landside slope of levee.
174200	LS	11654	238.07	96.82	220.08	86.90	1.81	Right bank of Sutter Butte Canal and landside slope of levee.
174300	LS	11656	237.90	96.89	223.27	87.78	1.61	Right bank of Sutter Butte Canal and landside slope of levee.
174300	WS	8567	271.41	94.64	266.62	96.63	2.40	Slope below minimum standard.
174400	LS	11658	237.08	97.31	220.34	87.28	1.67	Right bank of Sutter Butte Canal and landside slope of levee.
174500	LS	11660	236.87	97.33	221.64	87.75	1.59	Right bank of Sutter Butte Canal and landside slope of levee.
174600	LS	11662	236.40	97.47	223.64	88.17	1.37	Right bank of Sutter Butte Canal and landside slope of levee.
174700	LS	11664	237.19	97.38	224.23	88.11	1.40	Right bank of Sutter Butte Canal and landside slope of levee.
174800	LS	11666	238.55	97.93	224.10	87.81	1.43	Right bank of Sutter Butte Canal and landside slope of levee.
174900	LS	11668	235.43	97.55	219.80	86.97	1.48	Right bank of Sutter Butte Canal and landside slope of levee.
175000	LS	11670	236.48	97.75	223.44	87.79	1.31	Right bank of Sutter Butte Canal and landside slope of levee.
175100	LS	11672	236.15	97.78	217.42	88.19	1.95	Right bank of Sutter Butte Canal and landside slope of levee.
175200	LS	11674	235.20	97.70	222.74	88.20	1.31	Right bank of Sutter Butte Canal and landside slope of levee.
175300	LS	11676	234.71	97.81	221.97	88.56	1.38	Right bank of Sutter Butte Canal and landside slope of levee.
175400	LS	11678	235.65	97.69	220.65	88.11	1.57	Right bank of Sutter Butte Canal and landside slope of levee.
175500	LS	11680	239.22	97.74	223.28	88.41	1.71	Right bank of Sutter Butte Canal and landside slope of levee.
175600	LS	11682	237.38	97.77	223.59	88.25	1.45	Right bank of Sutter Butte Canal and landside slope of levee.
175700	LS	11684	234.60	97.55	219.10	88.91	1.79	Right bank of Sutter Butte Canal and landside slope of levee.
175700	WS	8336	279.12	92.03	265.47	97.63	2.44	Slope below minimum standard.

1 Slope run equals the horizontal distance in feet required for 1-foot of vertical change.

TABLE 2
SUTTER BUTTE FLOOD CONTROL AGENCY
FEATHER RIVER WEST LEVEE PROJECT
SLOPE ANALYSIS FOR FRWL PROJECT

CROSS SECTION STATION	SIDE OF LEVEE	POINT NUMBER	POINT OFFSET	POINT ELEV	PREVIOUS POINT OFFSET	PREVIOUS POINT ELEV	SLOPE RUN[1]	NOTES
175800	LS	11686	234.64	97.23	220.05	88.38	1.65	Right bank of Sutter Butte Canal and landside slope of levee.
175800	WS	8337	276.92	92.12	264.16	97.67	2.30	Slope below minimum standard.
175900	LS	11688	235.32	97.56	221.66	88.16	1.45	Right bank of Sutter Butte Canal and landside slope of levee.
175900	WS	8339	277.90	92.19	265.38	97.76	2.25	Slope below minimum standard.
176000	LS	11690	235.52	97.72	221.79	87.71	1.37	Right bank of Sutter Butte Canal and landside slope of levee.
176000	WS	8341	276.48	92.32	265.06	97.98	2.02	Slope below minimum standard.
176100	LS	11692	235.43	98.03	219.95	87.84	1.52	Right bank of Sutter Butte Canal and landside slope of levee.
176100	WS	8343	276.57	92.63	264.70	97.84	2.28	Slope below minimum standard.
176200	LS	11694	236.72	98.16	222.13	88.11	1.45	Right bank of Sutter Butte Canal and landside slope of levee.
176200	WS	8345	276.68	92.60	264.67	97.83	2.30	Slope below minimum standard.
176300	LS	11696	236.81	98.19	222.73	88.65	1.47	Right bank of Sutter Butte Canal and landside slope of levee.
176300	WS	8347	274.25	92.79	263.90	98.08	1.96	Slope below minimum standard.
176400	LS	11698	236.90	98.30	220.08	88.64	1.74	Right bank of Sutter Butte Canal and landside slope of levee.
176400	WS	8348	271.01	93.32	264.93	98.21	1.24	Slope below minimum standard.
176500	LS	11700	234.78	98.58	225.43	90.88	1.21	Right bank of Sutter Butte Canal and landside slope of levee.
176500	WS	8350	278.24	93.03	263.68	98.89	2.49	Slope below minimum standard.
181100	WS	7755	273.18	95.82	263.58	100.39	2.10	Slope below minimum standard.
181200	WS	7757	271.98	95.49	261.84	100.15	2.17	Slope below minimum standard.
181300	WS	7759	271.82	95.65	263.39	100.18	1.86	Slope below minimum standard.
181400	WS	7761	268.38	95.89	260.64	100.38	1.73	Slope below minimum standard.
181500	WS	7763	272.23	95.85	263.35	100.36	1.97	Slope below minimum standard.
181900	WS	7681	333.16	82.74	314.40	90.86	2.31	Slope below waterside access road. Is this part of the levee prism?
182100	LS	7664	158.88	86.68	147.52	80.65	1.88	Slope below landside access road. Is this part of the levee prism?
182200	LS	7666	155.94	86.31	145.55	80.93	1.93	Slope below landside access road. Is this part of the levee prism?
183900	LS	7312	239.06	102.74	222.46	94.21	1.95	Slope below minimum standard.
184100	LS	7316	238.43	101.98	224.43	94.57	1.89	Slope below minimum standard.
184200	LS	7318	239.16	102.37	222.59	94.02	1.98	Slope below minimum standard.
185400	WS	7160	292.65	94.84	274.20	102.49	2.41	Slope below minimum standard.
185600	WS	7164	283.26	94.80	263.23	102.91	2.47	Slope below minimum standard.
186500	LS	7044	237.89	103.26	220.77	94.63	1.98	Slope below minimum standard.
188500	WS	6796	302.25	96.72	294.24	99.93	2.49	Slope below waterside ramp.
188600	LS	7086	225.56	104.68	210.43	97.07	1.99	Slope below minimum standard.
188600	WS	6798	288.00	96.84	268.28	104.80	2.48	Slope below minimum standard.
189300	WS	6730	292.42	97.07	275.46	103.97	2.46	Slope below minimum standard.
190200	WS	6873	351.13	73.70	274.99	111.00	2.04	Waterside slope under East Gridley Road Bridge.
190300	WS	6138	293.20	101.66	285.46	105.37	2.09	Slope below minimum standard.
190400	WS	6139	292.05	101.88	281.82	106.03	2.46	Slope below minimum standard.
190400	WS	6876	347.26	75.18	301.24	100.06	1.85	Channel slope at toe of waterside levee slope.
190500	WS	6060	318.66	89.04	278.85	106.11	2.33	Slope below minimum standard.
190500	WS	6878	342.48	74.52	325.58	87.67	1.28	Channel slope at toe of waterside levee slope.
190600	WS	6879	350.85	73.86	280.36	108.15	2.06	Waterside levee slope and channel bank below minimum standard.
190700	LS	6036	203.66	100.79	193.07	94.06	1.57	Right bank of Sutter Butte Canal. Toe of levee near top of right bank.
190700	WS	6881	344.48	73.70	285.29	102.19	2.08	Waterside levee slope and channel bank below minimum standard.
190800	LS	6038	205.01	101.10	192.15	93.91	1.79	Right bank of Sutter Butte Canal. Toe of levee near top of right bank.
190800	WS	6883	326.13	74.43	259.33	106.85	2.06	Waterside levee slope and channel bank below minimum standard.
190900	WS	6885	321.37	75.62	279.77	104.65	1.43	Waterside levee slope and channel bank below minimum standard.
191000	WS	6886	341.76	74.29	279.74	102.97	2.16	Waterside levee slope and channel bank below minimum standard.
191100	WS	6888	350.12	74.00	308.63	94.49	2.02	Channel slope at toe of waterside levee slope.
191300	WS	6892	352.69	74.41	323.97	88.77	2.00	Channel slope at toe of waterside levee slope.

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TABLE 2
SUTTER BUTTE FLOOD CONTROL AGENCY
FEATHER RIVER WEST LEVEE PROJECT
SLOPE ANALYSIS FOR FRWL PROJECT

CROSS SECTION STATION	SIDE OF LEVEE	POINT NUMBER	POINT OFFSET	POINT ELEV	PREVIOUS POINT OFFSET	PREVIOUS POINT ELEV	SLOPE RUN[1]	NOTES
191400	WS	6894	352.70	73.97	327.88	88.84	1.67	Channel slope at toe of waterside levee slope.
191900	LS	5884	201.16	102.43	190.18	93.97	1.30	Right bank of Sutter Butte Canal. Slope is near landside toe of levee.
192000	LS	5880	207.25	100.39	197.36	94.65	1.73	Right bank of Sutter Butte Canal. Slope is near landside toe of levee.
192100	LS	5882	205.44	100.55	194.69	94.49	1.77	Right bank of Sutter Butte Canal. Slope is near landside toe of levee.
192100	WS	6907	364.44	73.70	342.77	83.69	2.17	Channel slope at toe of waterside levee slope.
192200	LS	6568	237.00	107.34	228.74	103.13	1.96	Slope below minimum standard.
192500	LS	5813	207.59	100.85	194.78	94.37	1.98	Right bank of Sutter Butte Canal. Slope is near landside toe of levee.
192600	LS	5801	206.06	102.16	199.51	95.17	0.94	Right bank of Sutter Butte Canal. Slope is near landside toe of levee.
192700	LS	5802	210.10	102.07	202.78	95.10	1.05	Right bank of Sutter Butte Canal. Slope is near landside toe of levee.
192800	LS	5804	210.45	100.29	200.62	95.15	1.91	Right bank of Sutter Butte Canal. Slope is near landside toe of levee.
192900	LS	5806	211.18	101.46	199.82	94.62	1.66	Right bank of Sutter Butte Canal. Slope is near landside toe of levee.
193000	LS	5808	208.49	100.39	197.78	94.77	1.90	Right bank of Sutter Butte Canal. Slope is near landside toe of levee.
193100	LS	5809	202.54	101.49	191.27	93.89	1.48	Right bank of Sutter Butte Canal. Slope is near landside toe of levee.
193200	LS	5811	198.28	103.43	183.70	93.21	1.43	Right bank of Sutter Butte Canal. Slope is near landside toe of levee.
193300	LS	5778	196.86	102.39	186.08	94.52	1.37	Right bank of Sutter Butte Canal. Slope is near landside toe of levee.
193400	LS	5769	201.77	102.81	195.10	94.76	0.83	Right bank of Sutter Butte Canal. Slope is near landside toe of levee.
193500	LS	5770	211.06	101.07	199.44	93.47	1.53	Right bank of Sutter Butte Canal. Slope is near landside toe of levee.
193600	LS	5772	209.43	100.27	200.59	94.28	1.48	Right bank of Sutter Butte Canal. Slope is near landside toe of levee.
193700	LS	5774	205.46	99.08	201.06	95.06	1.09	Right bank of Sutter Butte Canal. Slope is near landside toe of levee.
193800	LS	5744	207.88	100.09	201.38	94.63	1.19	Right bank of Sutter Butte Canal. Slope is near landside toe of levee.
194000	LS	5725	208.17	101.90	192.97	93.60	1.83	Right bank of Sutter Butte Canal. Slope is near landside toe of levee.
194000	LS	6603	237.71	108.34	228.15	103.45	1.95	Slope below minimum standard.
194100	LS	5727	215.66	105.24	203.32	94.97	1.20	Right bank of Sutter Butte Canal. Slope is near landside toe of levee.
194300	LS	5564	216.31	105.27	203.49	96.36	1.44	Right bank of Sutter Butte Canal. Slope is near landside toe of levee.
194400	LS	5565	220.39	105.35	203.92	95.97	1.76	Right bank of Sutter Butte Canal. Slope is at landside toe of levee.
194600	LS	6615	232.09	107.81	209.76	96.02	1.89	Right bank of Sutter Butte Canal and landside slope of levee.
194700	LS	5496	217.83	104.41	208.04	95.58	1.11	Right bank of Sutter Butte Canal. Slope is at landside toe of levee.
194800	LS	5494	218.96	103.82	208.37	95.61	1.29	Right bank of Sutter Butte Canal. Slope is at landside toe of levee.
194900	LS	6620	228.51	107.66	209.40	96.16	1.66	Right bank of Sutter Butte Canal. Slope is at landside toe of levee.
195000	LS	5492	229.43	107.85	207.79	95.53	1.76	Right bank of Sutter Butte Canal. Slope is at landside toe of levee.
195100	LS	5490	223.28	105.94	208.98	96.31	1.49	Right bank of Sutter Butte Canal. Slope is at landside toe of levee.
195200	LS	5488	226.36	107.54	206.66	95.35	1.62	Right bank of Sutter Butte Canal. Slope is at landside toe of levee.
195300	LS	5483	218.20	105.89	206.41	95.56	1.14	Right bank of Sutter Butte Canal. Slope is at landside toe of levee.
195400	LS	5478	222.44	106.58	207.41	95.86	1.40	Right bank of Sutter Butte Canal. Slope is at landside toe of levee.
195500	LS	5480	221.99	106.47	207.49	96.08	1.40	Right bank of Sutter Butte Canal. Slope is at landside toe of levee.
195600	LS	5482	227.09	108.02	206.61	96.39	1.76	Right bank of Sutter Butte Canal and landside slope of levee.
195700	LS	5469	196.39	106.21	179.05	96.64	1.81	Right bank of Sutter Butte Canal and landside slope of levee.
196100	LS	5393	238.26	109.76	205.18	90.04	1.68	Slope below minimum standard.
196100	WS	5475	311.35	89.57	303.02	94.83	1.58	Headwall structure at toe of levee.
196100	WS	5459	312.15	88.76	311.35	89.57	0.98	Headwall structure at toe of levee.
197300	LS	5101	196.89	94.03	192.12	90.99	1.57	Slope below bench in landside slope.
197500	LS	5103	196.48	93.24	192.82	91.26	1.85	Slope below bench in landside slope.
197500	LS	5272	237.57	109.30	210.97	95.58	1.94	Slope below minimum standard.
197600	LS	5104	197.70	93.64	194.07	91.68	1.85	Slope below bench in landside slope.
197600	LS	5274	238.34	109.40	211.77	95.71	1.94	Slope below minimum standard.
197700	LS	5105	200.60	94.30	195.36	91.60	1.94	Slope below bench in landside slope.
197700	LS	5276	237.04	109.47	212.70	96.79	1.92	Slope below minimum standard.
198200	WS	5437	292.49	98.97	269.88	109.24	2.20	Slope below minimum standard.
199400	LS	5310	232.87	110.48	213.52	99.13	1.70	Slope below minimum standard.

1 Slope run equals the horizontal distance in feet required for 1-foot of vertical change.

TABLE 2
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FEATHER RIVER WEST LEVEE PROJECT
SLOPE ANALYSIS FOR FRWL PROJECT

CROSS SECTION STATION	SIDE OF LEVEE	POINT NUMBER	POINT OFFSET	POINT ELEV	PREVIOUS POINT OFFSET	PREVIOUS POINT ELEV	SLOPE RUN[1]	NOTES
201500	LS	4972	237.08	112.36	221.44	104.48	1.99	Slope below minimum standard.
201500	WS	4877	287.27	104.16	273.22	110.51	2.21	Slope below minimum standard.
202000	WS	4887	289.60	103.26	268.63	111.76	2.47	Slope below minimum standard.
202900	WS	4785	287.35	104.67	274.47	110.06	2.39	Slope below minimum standard.
205000	WS	4374	292.48	104.67	271.94	113.36	2.36	Slope below minimum standard.
206000	LS	4624	234.46	116.64	210.80	104.55	1.96	Slope below minimum standard.
207200	LS	4672	240.15	116.75	221.15	106.65	1.88	Slope below minimum standard.
209300	WS	4075	297.87	108.63	271.94	119.05	2.49	Slope below minimum standard.
210700	LS	3819	237.82	118.99	221.87	110.62	1.90	Slope below minimum standard.
210900	LS	3823	239.92	119.79	220.39	109.84	1.96	Slope below minimum standard.
211300	LS	3884	214.77	112.47	208.75	107.41	1.19	Slope below minimum standard.
211900	LS	3843	238.56	119.60	218.15	108.97	1.92	Slope below minimum standard.
212300	LS	3851	233.53	119.60	211.56	108.59	1.99	Slope below minimum standard.
213900	LS	3236	236.95	122.17	215.48	109.93	1.75	Slope below minimum standard.
214000	LS	3238	237.56	122.18	215.36	110.41	1.89	Slope below minimum standard.
214100	LS	3240	236.87	122.09	214.75	110.69	1.94	Slope below minimum standard.
214200	LS	3242	237.47	122.39	214.80	110.74	1.95	Slope below minimum standard.
214300	LS	3244	237.46	122.46	215.56	110.83	1.88	Slope below minimum standard.
214400	LS	3246	238.50	122.14	216.39	111.02	1.99	Slope below minimum standard.
214500	LS	3248	236.22	121.91	216.02	111.45	1.93	Slope below minimum standard.
215600	LS	3271	239.02	122.19	217.47	111.30	1.98	Slope below minimum standard.
215700	LS	3273	239.41	122.71	217.10	111.46	1.98	Slope below minimum standard.
215900	LS	3276	236.82	122.45	217.27	112.05	1.88	Slope below minimum standard.
216100	LS	3280	237.97	123.14	217.29	111.80	1.82	Slope below minimum standard.
216300	LS	3284	239.52	123.12	217.27	111.62	1.93	Slope below minimum standard.
216400	LS	3286	236.82	122.67	217.06	111.95	1.84	Slope below minimum standard.
216500	LS	3288	236.48	122.71	216.26	111.86	1.86	Slope below minimum standard.
217500	LS	3309	239.12	123.31	216.34	111.75	1.97	Slope below minimum standard.
217900	WS	2626	288.97	122.78	285.66	124.19	2.35	Slope in cobble against levee.
220200	WS	2503	344.99	98.31	328.39	105.99	2.16	Channel bank at toe of levee.
227900	WS	1712	342.61	105.70	317.61	116.92	2.23	Slope below minimum standard.
228000	WS	1714	338.62	106.64	314.00	118.52	2.07	Slope below minimum standard.
228400	LS	1663	208.18	124.04	198.00	117.97	1.67	Slope below landside ramp.
228500	WS	1579	340.90	110.02	294.86	129.37	2.38	Slope below waterside ramp.
229100	LS	1362	232.59	132.34	207.50	118.74	1.85	Slope below minimum standard.
229200	WS	1419	286.11	124.06	266.74	131.89	2.47	Slope below minimum standard.
229500	LS	1370	232.37	132.31	208.85	120.50	1.99	Slope below minimum standard.
229600	WS	1400	275.26	127.97	265.39	132.43	2.21	Slope below minimum standard.
229800	LS	1233	191.02	124.00	181.73	118.89	1.82	Slope below landside ramp.
229900	LS	1382	183.35	123.16	175.99	117.71	1.35	Slope below landside ramp.
229900	LS	1304	233.67	133.38	221.85	126.98	1.85	Slope below minimum standard.
230000	LS	1306	233.68	133.43	215.71	124.34	1.98	Slope below minimum standard.
230500	WS	1138	319.24	119.19	284.17	134.04	2.36	Slope below minimum standard. Overbuilt levee section.
230600	WS	1140	329.70	112.45	283.97	134.13	2.11	Slope below minimum standard. Overbuilt levee section.
230700	WS	1142	325.47	113.93	284.32	133.82	2.07	Slope below minimum standard. Overbuilt levee section.
230800	WS	1144	323.83	113.17	285.02	133.95	1.87	Slope below minimum standard. Overbuilt levee section.
230900	WS	1146	322.91	113.53	284.87	133.76	1.88	Slope below minimum standard. Overbuilt levee section.
231000	WS	1026	307.61	122.32	284.74	133.57	2.03	Slope below minimum standard. Overbuilt levee section.
231100	WS	1028	305.51	122.44	287.59	132.95	1.71	Slope below minimum standard. Overbuilt levee section.

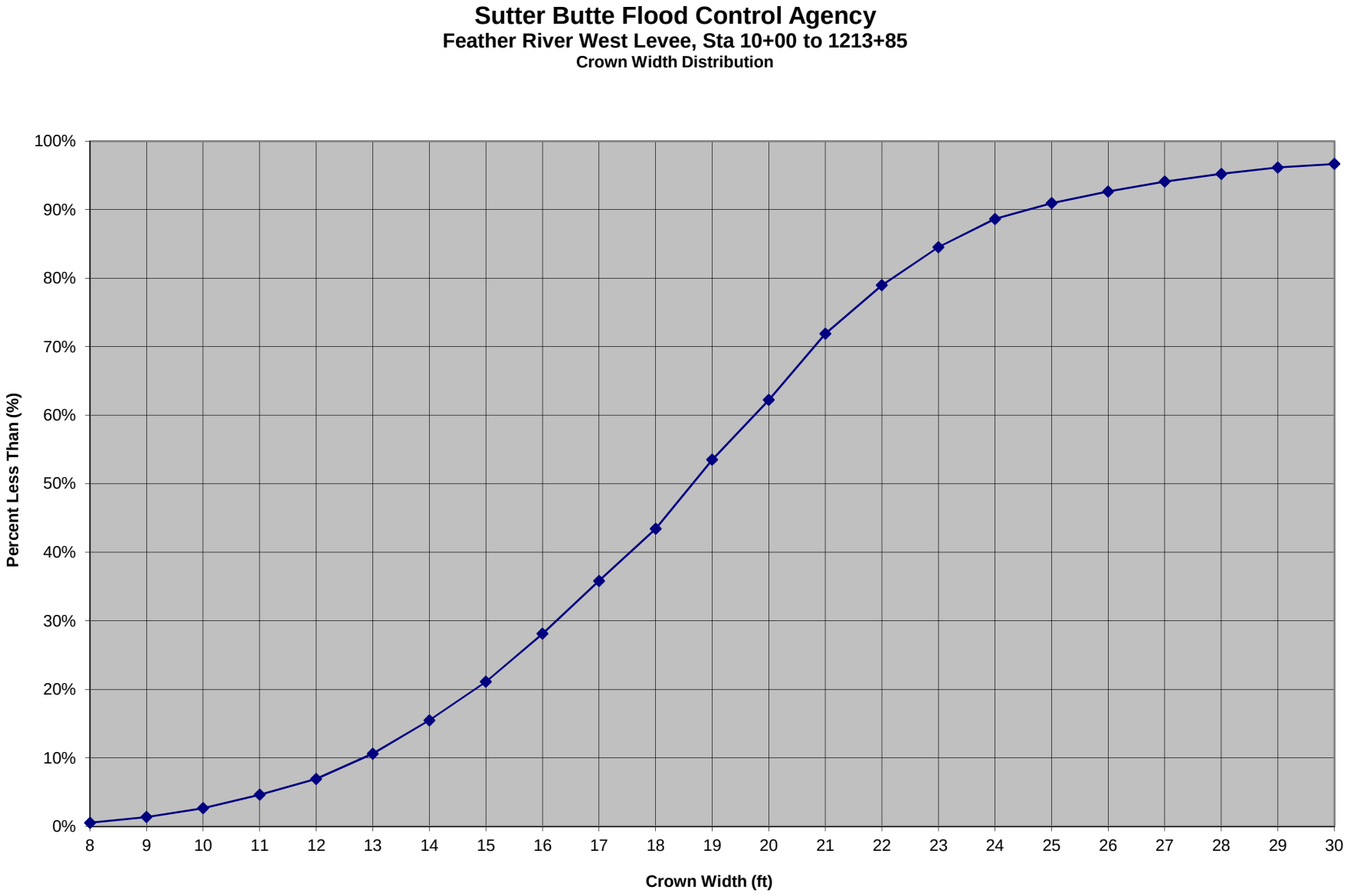
1 Slope run equals the horizontal distance in feet required for 1-foot of vertical change.

TABLE 2
SUTTER BUTTE FLOOD CONTROL AGENCY
FEATHER RIVER WEST LEVEE PROJECT
SLOPE ANALYSIS FOR FRWL PROJECT

CROSS SECTION STATION	SIDE OF LEVEE	POINT NUMBER	POINT OFFSET	POINT ELEV	PREVIOUS POINT OFFSET	PREVIOUS POINT ELEV	SLOPE RUN[1]	NOTES
231200	WS	1030	300.68	127.01	284.72	133.61	2.41	Slope below minimum standard. Overbuilt levee section.
231400	WS	1033	301.93	126.67	283.61	134.36	2.38	Slope below minimum standard. Overbuilt levee section.
231500	WS	1035	297.53	128.14	281.72	134.61	2.44	Slope below minimum standard. Overbuilt levee section.
231600	WS	1037	294.19	130.68	287.50	134.46	1.77	Slope below minimum standard. Overbuilt levee section.
231700	WS	1039	296.94	130.35	287.97	134.76	2.04	Slope below minimum standard. Overbuilt levee section.
231800	WS	1041	295.67	128.72	281.54	134.72	2.35	Slope below minimum standard. Overbuilt levee section.
232000	WS	1045	297.74	128.96	283.28	134.92	2.42	Slope below minimum standard. Overbuilt levee section.
232100	WS	885	342.72	120.09	322.26	130.98	1.88	Slope below waterside ramp. Overbuilt levee section.
232500	WS	788	299.66	137.43	296.54	135.76	1.87	Slope in cobble against levee.
232600	WS	783	357.20	112.73	315.08	134.77	1.91	Slope in cobble against levee.
232700	WS	765	324.30	131.89	318.61	134.76	1.98	Slope in cobble against levee.
233000	WS	722	335.00	129.83	323.67	135.23	2.10	Slope in cobble against levee.
233200	WS	686	290.94	130.66	281.90	136.08	1.67	Slope below minimum standard.
233200	WS	670	332.04	119.61	310.17	128.39	2.49	Slope in cobble against levee.
233300	WS	688	289.57	130.80	281.05	136.41	1.52	Slope below minimum standard.
233300	WS	672	335.25	115.77	307.02	129.45	2.06	Slope in cobble against levee.
233400	WS	690	302.34	131.70	293.88	136.44	1.79	Slope below minimum standard.
233500	LS	632	110.16	117.19	103.32	113.63	1.93	Slope in cobble against levee.
233500	LS	630	129.29	122.15	124.54	119.62	1.88	Slope in cobble against levee.
233600	WS	693	294.75	130.43	286.06	134.32	2.23	Slope below minimum standard.
233700	LS	571	137.16	130.67	113.17	116.08	1.64	Slope in cobble against levee.
233800	LS	549	214.55	133.71	209.60	130.80	1.71	Slope below minimum standard.
233900	LS	550	210.69	133.31	200.42	128.14	1.99	Slope below minimum standard.
235800	WS	232	308.41	130.46	299.38	134.49	2.24	Slope below minimum standard.
235900	WS	198	321.73	112.55	264.22	135.56	2.50	Section through headworks.
236400	WS	140	279.22	130.24	260.10	138.10	2.43	Slope below minimum standard.
236500	LS	171	236.68	137.59	209.79	124.09	1.99	Slope below minimum standard.
236600	LS	175	237.70	138.28	210.09	124.29	1.97	Slope below minimum standard.
236600	WS	61	312.53	127.54	293.47	136.13	2.22	Slope below access road.

1 Slope run equals the horizontal distance in feet required for 1-foot of vertical change.

FIGURES


Sutter Butte Flood Control Agency
Feather River West Levee, Sta 10+00 to 1213+85
Crown Width Distribution
Percent Less Than (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
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29
30
Crown Width (ft)

Figure 1

Sutter Butte Flood Control Agency
Feather River West Levee, Sta 1213+85 to 2368+00
Crown Width Distribution

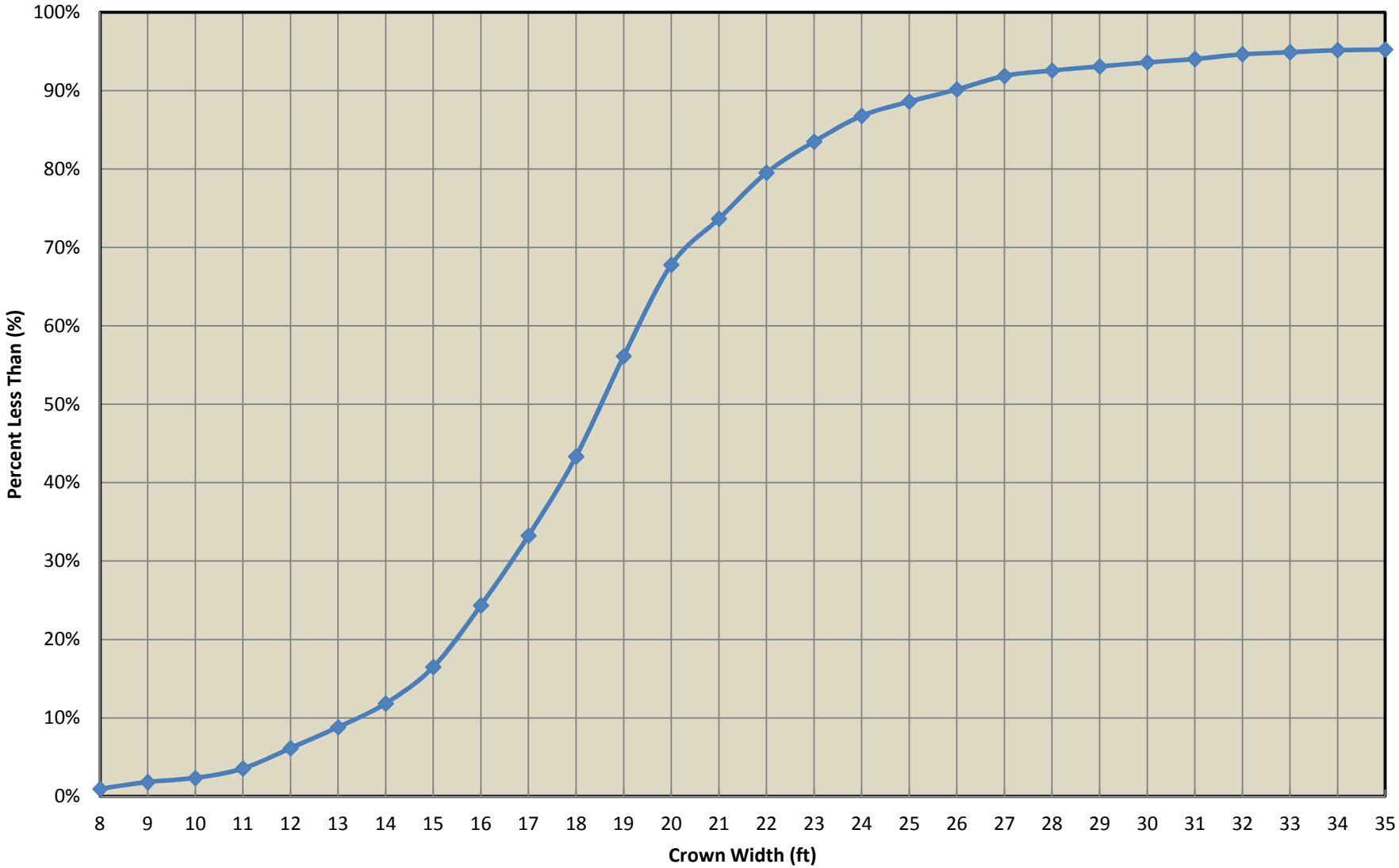
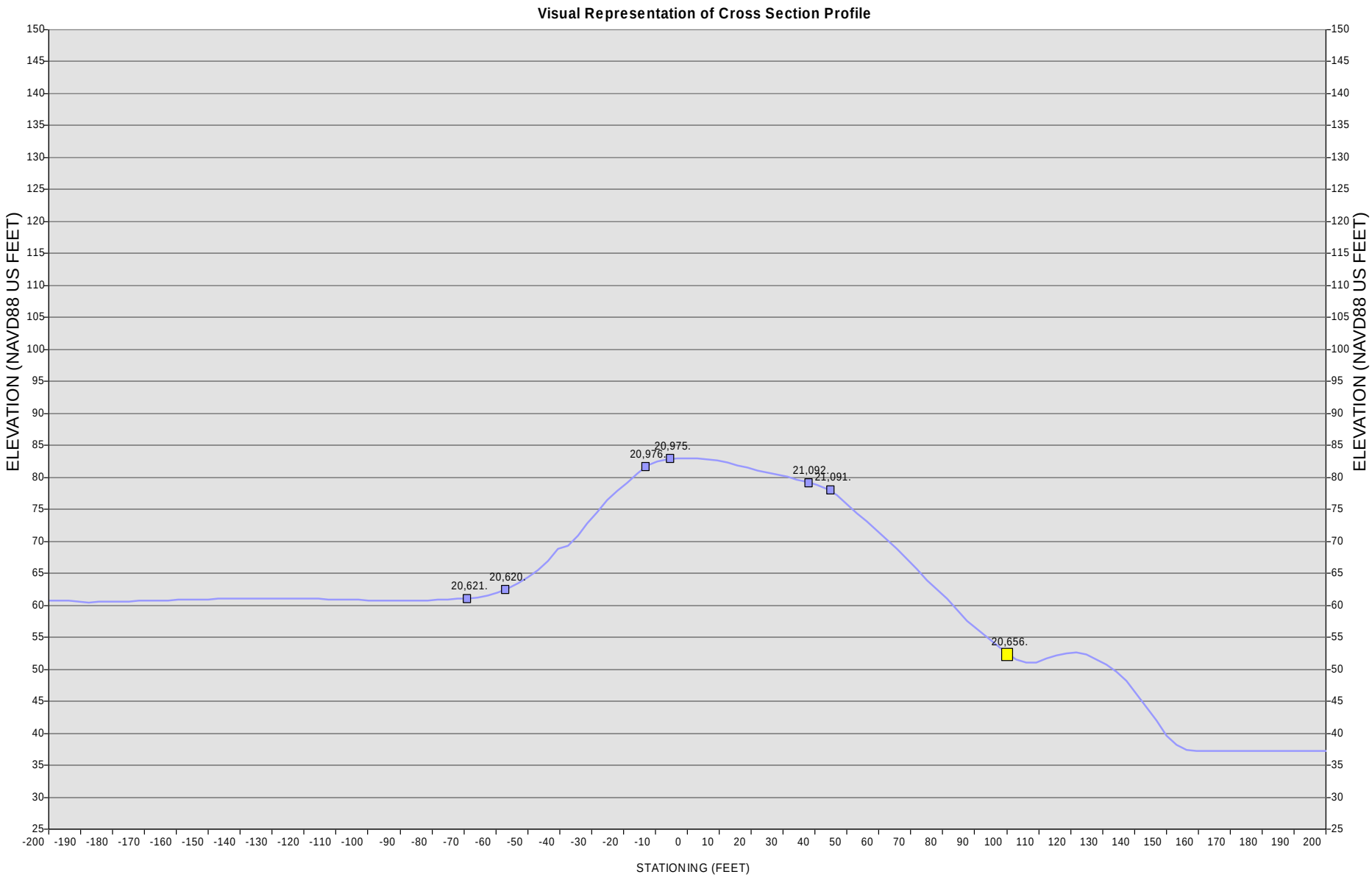
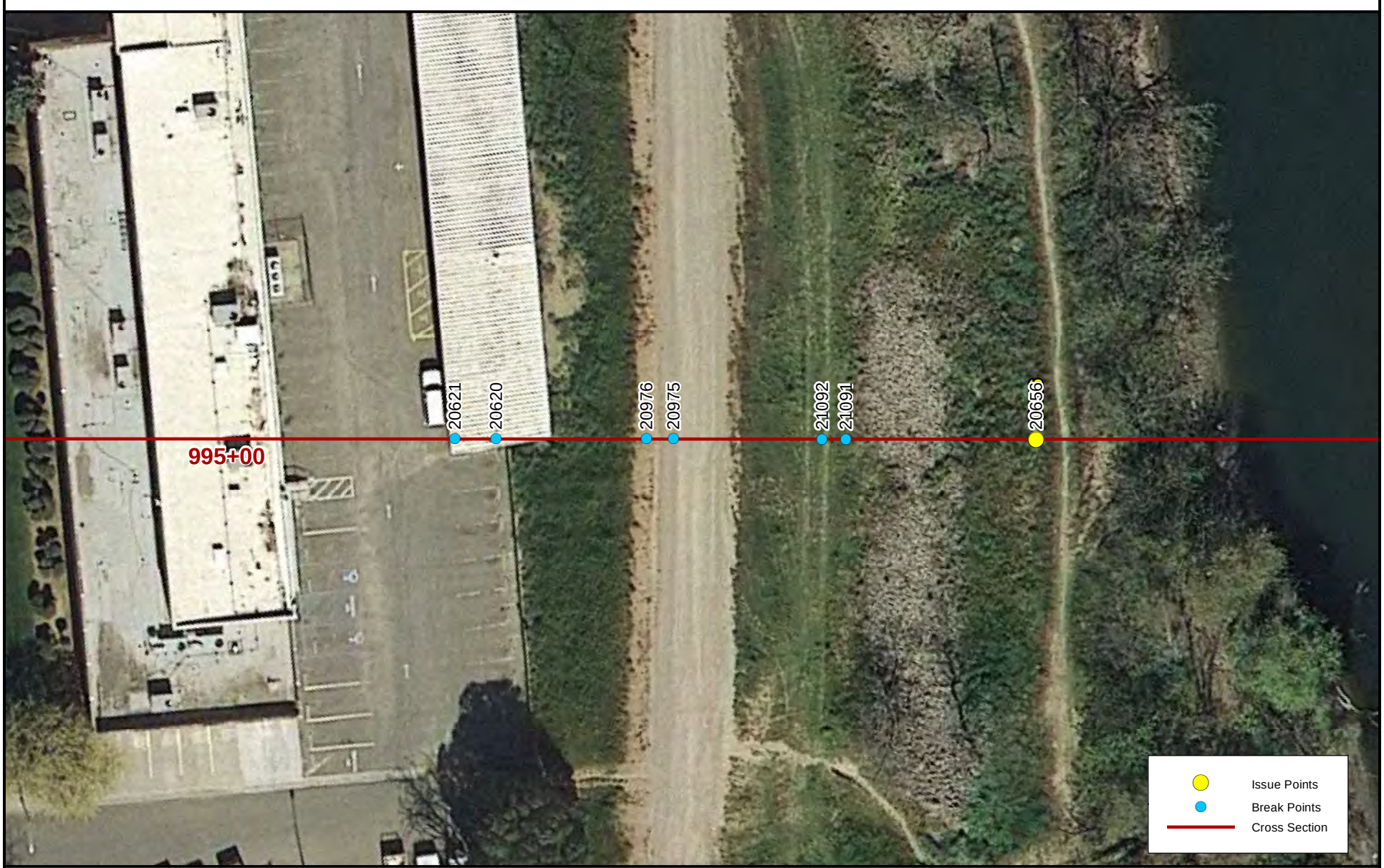


Figure 2

Cross Section: 995+00





SLOPE ANALYSIS
FEATHER RIVER WEST LEVEE
CALIFORNIA
DECEMBER, 2011

NOTES

NORTH
0 20 40
FEET

PRELIMINARY

WOOD RODGERS
DEVELOPING INNOVATIVE DESIGN SOLUTIONS
3301 C Street, Bldg. 100-B Tel: 916.341.7760
Sacramento, CA 95816 Fax: 916.341.7767

J:\Jobs\8455_HDR_Sutter_Butte_FCA\8455.001_FeatherRiverLevee_EIP\GIS\Tasks\Slope_Analysis\Slope_Analysis_20111202_V10.mxd 12/15/2011 1:55:20 AM stan

Figure 3

TYPICAL LEVEE GEOMERTY MODIFICATION EXHIBIT

FEATHER RIVER WEST LEVEE

SUTTER BUTTE FLOOD CONTROL AGENCY

JANUARY, 2012

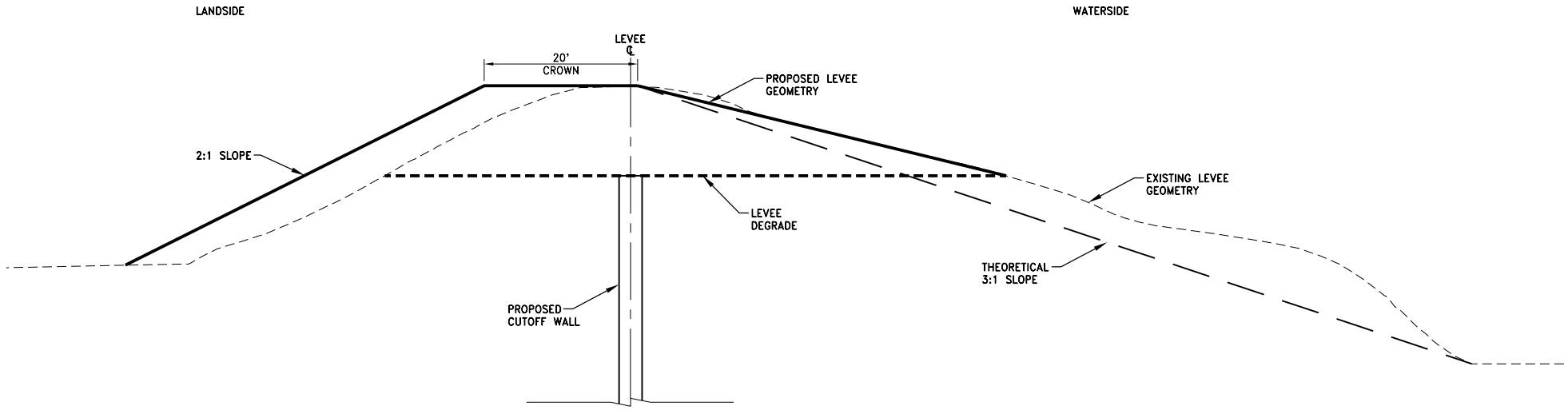


FIGURE 4

WOOD RODGERS
DEVELOPING INNOVATIVE DESIGN SOLUTIONS
3301 C St, Bldg. 100-B Tel 916.341.7760
Sacramento, CA 95816 Fax 916.341.7767