Technical Memorandum

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FREQUENTLY LOADED LEVEE ANALYSIS

FEATHER RIVER WEST LEVEE

Prepared for: Sutter Butte Flood Control Agency (SBFCA)

Prepared by: Mike Rossiter, E.I.T.

Reviewed by: Dave Peterson, P.E.

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REGISTERED PROFESSIONAL ENGINEER
DAVID A. PETERSON
No. C 043432
Exp. 6/30/12
CIVIL
STATE OF CALIFORNIA

INTRODUCTION

A portion of the Feather River's west levee (FRWL) was studied to determine whether or not it is considered "frequently loaded". According to the California Department of Water Resources' (DWR) Draft *Urban Level Design Criteria*[1], a frequently loaded levee is defined as "a levee that experiences a water surface elevation of one foot or higher above the elevation of the landside levee toe at least once a day for more than 36 days per year on average".

The analyzed portion of the FRWL extends from Thermalito Afterbay in the north to Feather River's confluence with the Sutter Bypass in the south (Figure 1).

DATA SOURCES

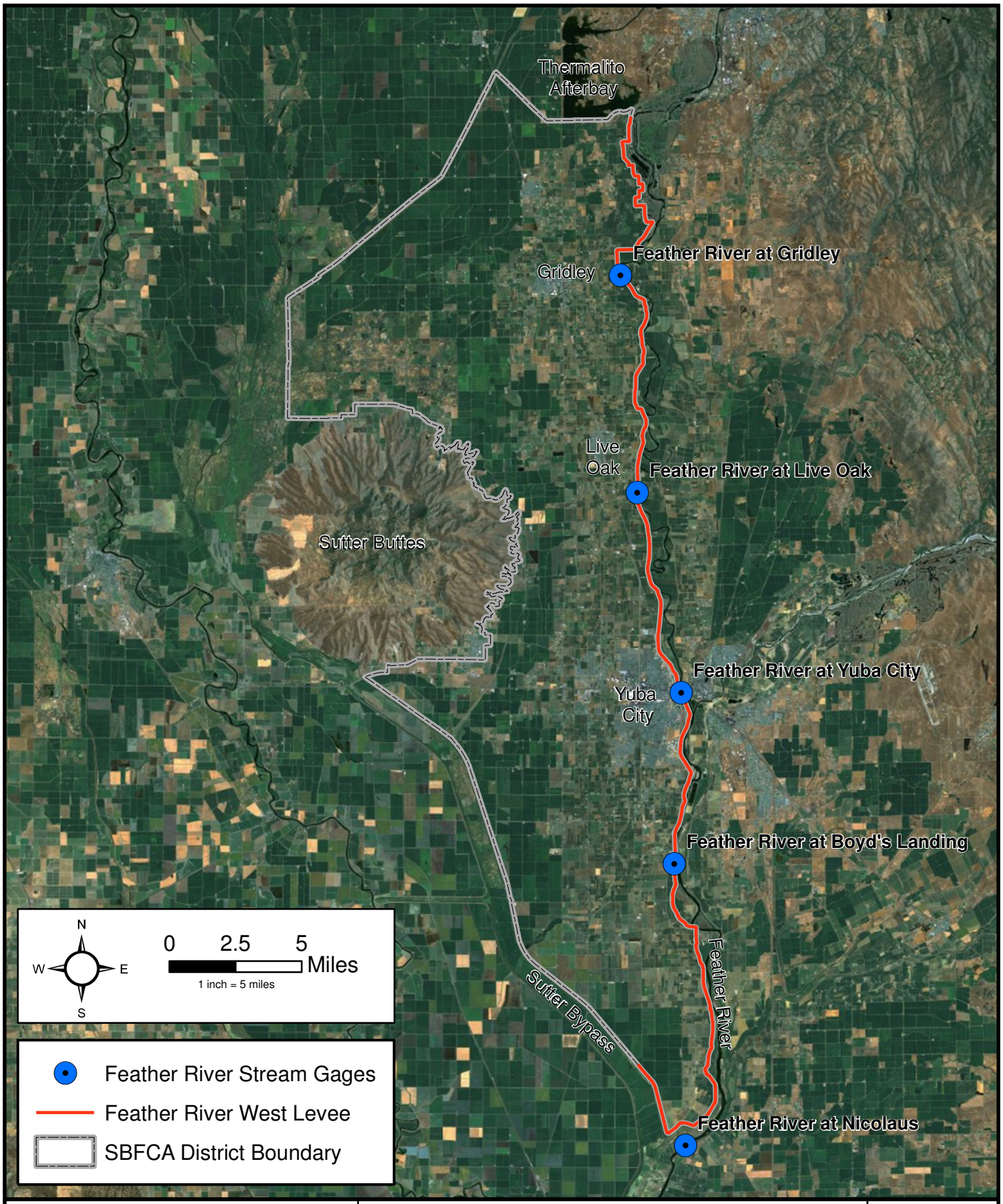
Stage data were acquired from the DWR Water Data Library (WDL)[2] and from the California Data Exchange Center (CDEC)[3] for the following five gaging stations located along the Feather River:

Table 1. Feather River stream gages used in analysis.

Station ID	Station Name	Data Source
A05165	Feather River at Gridley	WDL
FLO	Feather River at Live Oak	CDEC
A05135	Feather River at Yuba City	WDL
FBL	Feather River at Boyd's Landing	CDEC
A05103	Feather River at Nicolaus	WDL

Data from WDL were provided as daily maximum stages whereas data from CDEC were provided as hourly stages and needed to be converted into daily maximum stages.

Landside toe elevations along the FRWL were determined from initial post-processed DWR LiDAR data[4].



PETERSON . BRUSTAD . INC
ENGINEERING . CONSULTING
1180 Iron Point Rd., Suite 260
Folsom, CA 95630
Phone: (916) 608-2212
Fax: (916) 608-2232

SUTTER BUTTE FLOOD CONTROL AGENCY

FEATHER RIVER WEST LEVEE FREQUENTLY LOADED LEVEE ANALYSIS STUDY AREA

FIGURE

1

DATUM CONVERSIONS

All stage data were converted into the North American Vertical Datum of 1988 (NAVD88). Surveyed gage datum conversions were conducted as part of the United States Army Corps of Engineers' (USACE) *American River Common Features Feasibility Study*[5] and are available for the gages at Gridley, Yuba City, and Nicolaus.

CDEC provided guidance for converting the Live Oak and Boyd's Landing gages datums to the National Geodetic Vertical Datum of 1929 (NGVD29). Data from these gages were then converted from NGVD29 to NAVD88 using USACE's Corpscon software[6]. Datum conversions are summarized in Table 2 for each gage location.

Table 2. Vertical datum adjustments.

	Feather River at Gridley	Feather River at Live Oak	Feather River at Yuba City	Feather River at Boyd's Landing	Feather River at Nicolaus
PR-GD to NGVD29	--	-3.00	--	-3.00	--
NGVD29 to NAVD88	--	2.27	--	2.29	--
PR-GD to NAVD88	-0.76	-0.73	-0.70	-0.71	-1.08

PR-GD: Present Gage Datum

Additional information on gage datum conversions is provided in Attachment A.

RESULTS

Daily maximum stages from the last 15 years of record (Water Years 1997-2011) were compiled for each gaging station and compared to the adjacent landside levee toe elevations.

The number of days per year in which water levels reached 1-foot or higher above the adjacent landside levee toe elevations are summarized in Table 3.

Table 3. Days per year in which Feather River water levels were at least 1-foot above the FRWL's landside toe elevation.

Location:	Feather River at Gridley	Feather River at Live Oak	Feather River at Yuba City	Feather River at Boyd's Landing	Feather River at Nicolaus
HEC-RAS River Station:	50.59	38.71	27.952	20.75	8.00
Wood Rodgers Design Station:	190705.90	143106.13	100652.33	64675.51	2528.45
Elev. of Landside Levee Toe [feet- NAVD88]:	93.69	78.24	65.53	53.01	34.57
Water Year	Number of days in which river stages reached 1-foot or higher above landside levee toe				
1997	3	--	6	--	49
1998	0	0	0	0	41
1999	0	0	0	0	23
2000	0	0	0	0	22
2001	0	0	0	0	0
2002	0	0	0	0	0
2003	0	0	0	0	0
2004	0	0	0	0	4
2005	0	0	0	0	3
2006	0	0	4	5	66
2007	0	0	0	0	0
2008	0	0	0	0	0
2009	0	0	0	0	0
2010	0	0	0	0	0
2011	0	0	0	0	16
AVERAGE	0.2	0.0	0.7	0.4	14.9

-- : Insufficient Data

CONCLUSION

Based on stage data from the past 15 years, the FRWL is not considered frequently loaded. In most locations along the FRWL, it is rare for the levee to be "loaded".

The lower segment of the FRWL, where it approaches the Sutter Bypass confluence, is loaded more regularly, however the 14.9 days per year on average that it is loaded is still well below the 36 days per year that defines a "frequently loaded levee" according to DWR *Urban Level Design Criteria*.

REFERENCES

1. California Department of Water Resources (DWR), *Urban Level Design Criteria*, Draft released 15 November 2011.

2. California Department of Water Resources (DWR), *Water Data Library (WDL)*, Accessed 16 December 2011, http://www.water.ca.gov/waterdatalibrary/index.cfm.

3. California Department of Water Resources (DWR), *California Data Exchange Center (CDEC),* Accessed 16 December 2011, http://cdec.water.ca.gov/.

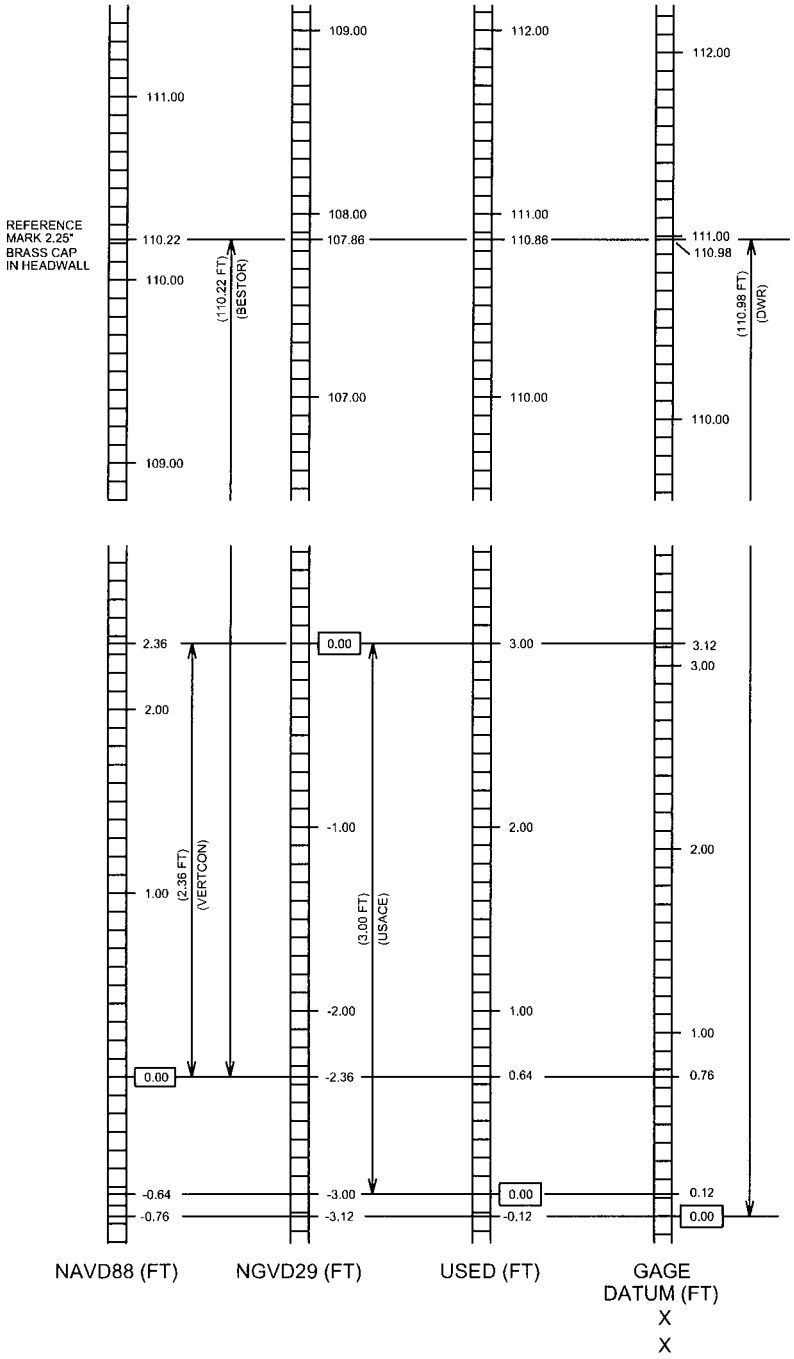
4. California Department of Water Resources, LiDAR Datasets for the Sutter Basin, Central Valley Floodplain Evaluation and Delineation Program (CVFED), March 2010 Deliverable.

5. United States Army Corps of Engineers (USACE), *American River Common Features Feasibility Study*, August 2010.

6. United States Army Corps of Engineers (USACE), *Corpscon Version 6.0*, August 2004.

ATTACHMENT A

GAGE DATUM CONVERSIONS



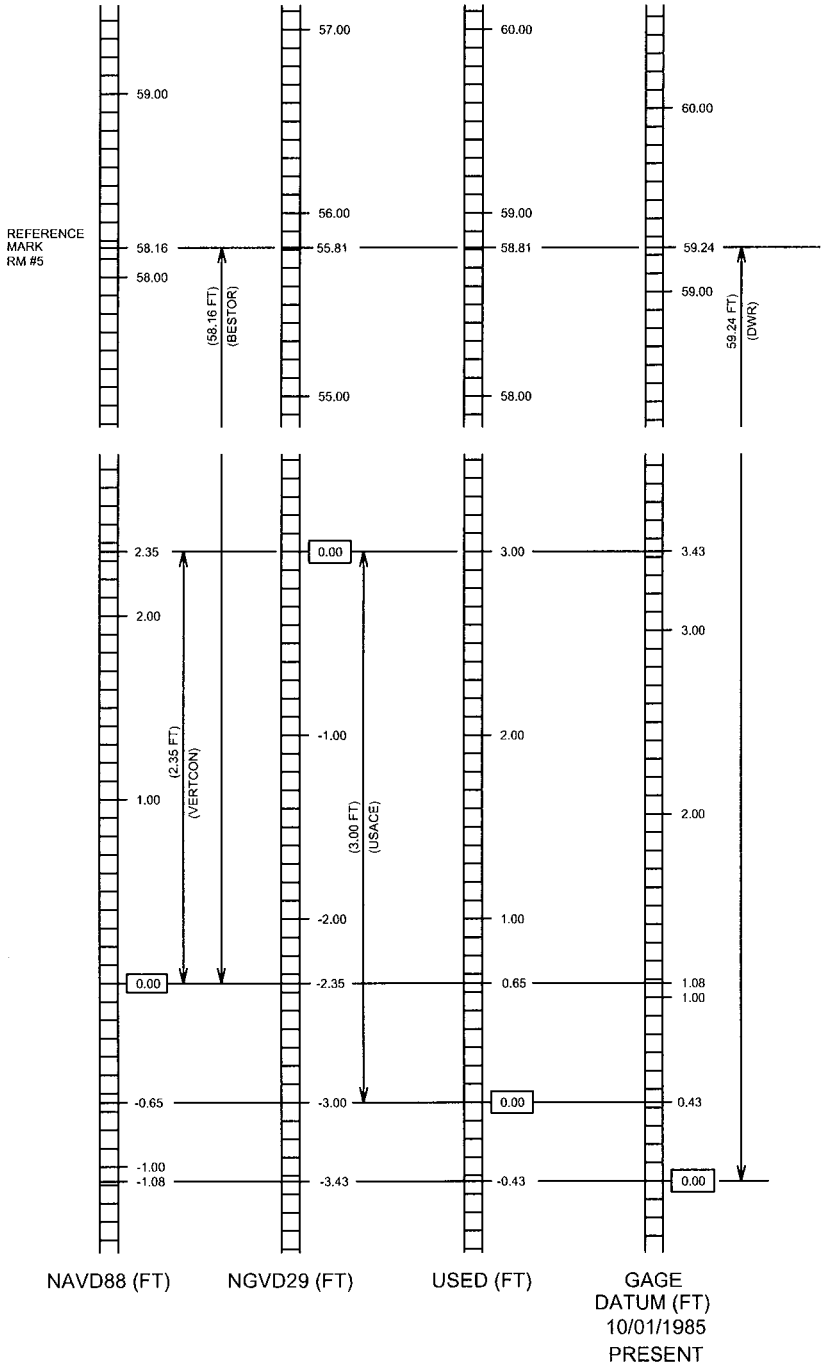
PERIOD	ADD BELOW VALUE (FEET) TO OBTAIN DATA RELATIVE TO:			
	PR-GD	NAVD88	NGVD29	USED
DATE 1 DATE 2	0.00	-0.76	-3.12	-0.12
DATE 2 DATE 3	X	X	X	X
ACCURACY	+/-0.00	+/-0.33	+/-0.37	+/-0.38

NOTES:
1) ESTIMATED ACCURACY RELATIVE TO THE DATUM
2) PR-GD = PRESENT GAGE DATUM

AMERICAN RIVER COMMON FEATURES FEASIBILITY STUDY
SACRAMENTO RIVER BASIN, CALIFORNIA

DATUM CONVERSION VALUES
FEATHER RIVER NEAR GRIDLEY
DWR GAGE NO. A05165

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT



PERIOD	ADD BELOW VALUE (FEET) TO OBTAIN DATA RELATIVE TO:			
	PR-GD	NAVD88	NGVD29	USED
10/01/1985 PRESENT	0.00	-1.08	-3.43	-0.43
ACCURACY	+/-0.00	+/-0.33	+/-0.37	+/-0.38

NOTES:
1) ESTIMATED ACCURACY RELATIVE TO THE DATUM
2) PR-GD = PRESENT GAGE DATUM

AMERICAN RIVER COMMON FEATURES FEASIBILITY STUDY
SACRAMENTO RIVER BASIN, CALIFORNIA

DATUM CONVERSION VALUES FEATHER RIVER AT NICOLAUS DWR GAGE NO. A05103

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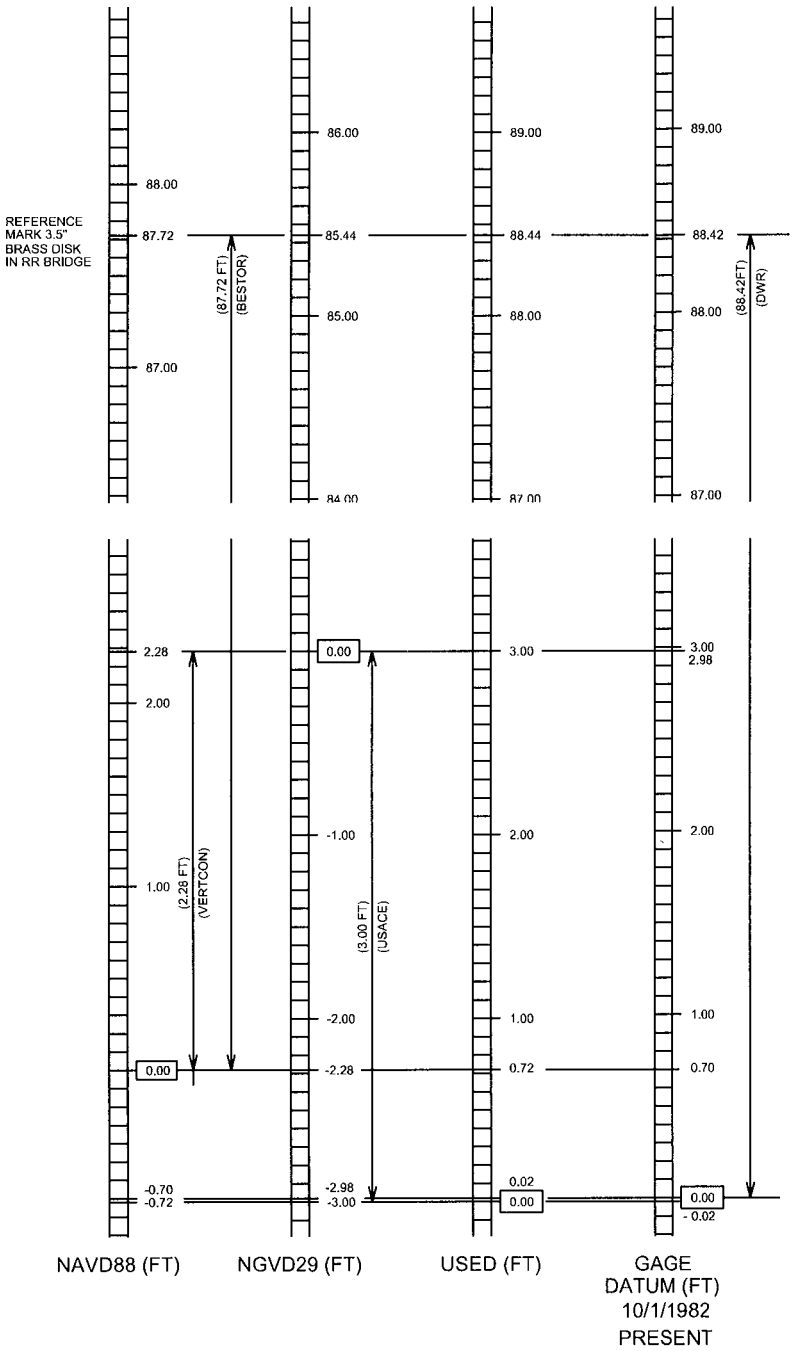
SACRAMENTO DISTRICT



PERIOD	ADD BELOW VALUE (FEET) TO OBTAIN DATA RELATIVE TO:			
	PR-GD	NAVD88	NGVD29	USED
10/1/1982 PRESENT	0.00	-0.70	-2.98	0.02
ACCURACY	+/-0.00	+/-0.33	+/-0.37	+/-0.38

NOTES:
1) ESTIMATED ACCURACY RELATIVE TO THE DATUM
2) PR-GD = PRESENT GAGE DATUM

AMERICAN RIVER COMMON FEATURES FEASIBILITY STUDY
SACRAMENTO RIVER BASIN, CALIFORNIA

DATUM CONVERSION VALUES
FEATHER RIVER NEAR YUBA CITY
DWR GAGE NO. A05135

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

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Vertical Datum Conversions Along the Feather River

14 December 2011

INPUT	OUTPUT
State Plane, NAD83	State Plane, NAD83
0402 - California 2, U.S. Feet	0402 - California 2, U.S. Feet
Vertical - NGVD29 (Vertcon94), U.S. Feet	Vertical - NAVD88, U.S. Feet

FR at Gridley

1/5

Northing/Y:	2259700	**Northing/Y:**	2259700.000
Easting/X:	6661130	**Easting/X:**	6661130.000
Elevation/Z:	0	**Elevation/Z:**	2.277
Convergence:	0 13 18.51460	**Convergence:**	0 13 18.51460
Scale Factor:	0.999926741	**Scale Factor:**	0.999926741
Combined Factor:	0.999931194	**Combined Factor:**	0.999931085

Grid Shift (U.S. ft.): X/Easting = 0.0, Y/Northing = 0.0

FR at Live Oak

2/5

Northing/Y:	2216490	**Northing/Y:**	2216490.000
Easting/X:	6664440	**Easting/X:**	6664440.000
Elevation/Z:	0	**Elevation/Z:**	2.274
Convergence:	0 13 43.70246	**Convergence:**	0 13 43.70246
Scale Factor:	0.999918716	**Scale Factor:**	0.999918716
Combined Factor:	0.999923240	**Combined Factor:**	0.999923132

Grid Shift (U.S. ft.): X/Easting = 0.0, Y/Northing = 0.0

FR at Yuba City

3/5

Northing/Y:	2176640	**Northing/Y:**	2176640.000
Easting/X:	6673210	**Easting/X:**	6673210.000
Elevation/Z:	0	**Elevation/Z:**	2.277
Convergence:	0 14 52.60882	**Convergence:**	0 14 52.60882
Scale Factor:	0.999915110	**Scale Factor:**	0.999915110
Combined Factor:	0.999919689	**Combined Factor:**	0.999919580

Grid Shift (U.S. ft.): X/Easting = 0.0, Y/Northing = 0.0

FR at Boyd's Landing

4/5

Northing/Y:	2142600	**Northing/Y:**	2142600.000
Easting/X:	6671830	**Easting/X:**	6671830.000
Elevation/Z:	0	**Elevation/Z:**	2.293
Convergence:	0 14 40.40303	**Convergence:**	0 14 40.40303
Scale Factor:	0.999914913	**Scale Factor:**	0.999914913
Combined Factor:	0.999919528	**Combined Factor:**	0.999919419

Grid Shift (U.S. ft.): X/Easting = 0.0, Y/Northing = 0.0

Remark: Frequently Loaded Levee Analysis

Corpscon v6.0.1, U.S. Army Corps of Engineers

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Vertical Datum Conversions Along the Feather River

14 December 2011

INPUT	OUTPUT
State Plane, NAD83	State Plane, NAD83
0402 - California 2, U.S. Feet	0402 - California 2, U.S. Feet
Vertical - NGVD29 (Vertcon94), U.S. Feet	Vertical - NAVD88, U.S. Feet

FR at Nicolaus

5/5

Northing/Y:	2086520	**Northing/Y:**	2086520.000
Easting/X:	6674080	**Easting/X:**	6674080.000
Elevation/Z:	0	**Elevation/Z:**	2.352
Convergence:	0 14 56.43655	**Convergence:**	0 14 56.43655
Scale Factor:	0.999920363	**Scale Factor:**	0.999920363
Combined Factor:	0.999925058	**Combined Factor:**	0.999924945

Grid Shift (U.S. ft.): X/Easting = 0.0, Y/Northing = 0.0

Remark: Frequently Loaded Levee Analysis