CHAPTER 6
EVALUATION AND COMPARISON OF FINAL PLANS

Cache Creek upstream of I-5 near town of Yolo in 1995.

CHAPTER 6

EVALUATION AND COMPARISON OF FINAL PLANS

Based on the evaluation of the preliminary plans, three plans, the No-Action Plan, the Lower Cache Creek Flood Barrier (LCCFB) Plan, and the Setback Levee Plan, were evaluated in greater detail. To maximize the acceptability, refinements were evaluated for the LCCFB Plan (three options: Plans *A, B, C*) and several setback levee alignments were developed for the Setback Levee Plan (three options: Narrow Setback Levee (NSL) Plan, Wide Setback Levee (WSL) Plan, and Modified Wide Setback Levee (MWSL) Plan). The first setback plan, the Narrow Setback Plan, concentrated on minimizing effects to landowners and agricultural operations in the study area. Due to the increased flow velocities and potential erosion for this plan, an extensive amount of rock slope protection would be necessary, which have severe environmental effects. A second setback plan, the Wide Setback Plan was developed to reduce the environmental effects of the Narrow Setback Plan. However, it was deemed that, due to the extensive amount of environmental mitigation required for the rock slope protection at the bridges and the number of residences proposed for relocation, a third setback plan was necessary. The third setback plan, the Modified Wide Setback Plan, minimizes environmental effects even further by lengthening the bridges with viaducts, eliminating the need for rock slope protection at the bridges.

While the project description, design, cost and graphics reflect a 12-foot levee crown/patrol road width, the crown may vary in width up to 20 feet for ease and safety of maintenance operations. Crown widths between 12 and 20 feet have the same level of significance in potential environmental effects, as increases in width can be accommodated by corresponding reductions in the size of the temporary construction easement that parallels the base of the levee, without a change in the width of the project footprint. Related refinements in the project cost for a levee crown up to 20 feet wide are within the currently estimated contingency costs (less than $0.8 million, or 2 percent for the LCCFB Plan or $3.3 million, or 2 percent for the MWSL Plan). Crown widths will be refined for the selected plan.. Analyses of the effects of levee crown widths up to 20 feet are included in Appendixes F and K and in the Draft EIS/EIR.

EVALUATION OF NO-ACTION PLAN

The No-Action Plan is assumed to have the same conditions as for the without-project future conditions, which are described in Chapter 2. This plan serves as the baseline against which the effects and benefits of the action plans are evaluated. The Federal Government would take no action to implement a specific plan that would reduce flooding in Woodland, and the existing Cache Creek levee system would continue to provide the current level of performance. Historically, the system has passed flows with between a 1 in 10 and 1 in 20 chance of occurring in any given year.

Table 6-1. Estimated Present-Worth Costs of Future Repairs of the Existing Cache Creek Levee System

Year	Feature	Location	Unit Price per Linear Foot ($)	Total Cost ($)	Present Worth Factor	Present Worth of Costs ($)
2009	1,400 Lineal Feet of Slope Protection	Through I-5 Bridges	2,000	2,800,000	0.84	2,342,600
2009	700 Lineal Feet of Slope Protection	Bend near town of Yolo	2,000	1,400,000	0.84	1,171,300
2011	6,500 Lineal Feet of 150-foot Setback Levee	Upstream from I-5 on Left Bank	500	3,250,000	0.74	2,414,300
2024	1,500 Lineal Feet of 150-foot Setback Levee	Downstream from I-5	500	750,000	0.34	257,200
2024	4,000 Lineal Feet of 150-foot Setback Levee	Downstream from I-5	500	2,000,000	0.34	686,000
2024	3,000 Lineal Feet of 150-foot Setback Levee	Upstream from SH113	500	1,500,000	0.34	514,500
2024	6,000 Lineal Feet of 150-foot Setback Levee	Downstream from SH113	500	3,000,000	0.34	1,029,000
2024	1,000 Lineal Feet of 150-foot Setback Levee	Upstream from County Road 102	500	500,000	0.34	171,500
2044	8,750 Lineal Feet of 150-foot Setback, Extend Project Levee Upstream	Upstream from I-5 and existing project on right bank	500	4,375,000	0.10	457,000
					Total	$9,043,400

Notes:

Present worth is back to year 2006, and the period of analysis is 50 years.
Interest rate is 6.125 percent.
Unit prices include environmental mitigation.
Unit prices do not include price escalations.

Without a flood damage reduction project, average annual damages to real property from overflows from Cache Creek would be expected to be about $12 million. Other adverse effects and losses would continue to include the potential for flood-related loss of life, contamination from sanitary sewage and hazardous materials, and the extended closure of sections of I-5 both north and east of Woodland.

This plan would include the stabilization of Cache Creek in areas of concern determined by a study team that includes a geomorphologist and the Department of Water Resources. (See Appendix I.) Over the 50-year period of analysis, rehabilitation of the existing levee system using rock slope protection and setback levees for erosion areas would likely be required to maintain the design functions of the system. Table 6-1 shows these repairs over time. Operation and maintenance of the existing levee system and subsequent need for environmental mitigation would also be necessary. The total present worth of the rehabilitation is $9.0 million, which equals an annualized cost of approximately $600,000/year, not including operation and maintenance.

EVALUATION OF THE LOWER CACHE CREEK FLOOD BARRIER

NEED FOR REFINEMENT

The preliminary Lower Cache Creek Flood Barrier (LCCFB) Plan in Chapter 5 included breaching the west levee of the Cache Creek Settling Basin to allow the overflow from Cache Creek to enter the settling basin northeast of Woodland (Plate 8). However, the preliminary plan would allow backwater from the settling basin to flood lands west of the settling basin whenever flow occurred over the existing settling basin outlet weir. This condition would occur annually for several days at a time, and the 1 in 10 chance flood would pond water 5 to 10 feet deep in this area. Due to the frequency and duration of flooding, Yolo County opposes this preliminary plan. Country Road (CR) 102, a major arterial road, would be inundated with floodwaters, resulting in the road being closed for long periods of time. Consequently, the preliminary plan was refined to reduce the frequency of flooding of CR 102 associated with the LCCFB Plan.

REFINEMENTS CONSIDERED

Three additional options of the LCCFB Plan that differed by the method of connection of the levee to the Cache Creek Settling Basin and by the associated flooding of CR 102 were investigated. The west end of the project was also modified to eliminate excessive turns in the LCCFB levee and to avoid homes. The new west end levee alignment begins at the intersection of CR 96B and CR19B and reaches east along CR 19B to the intersection of CR 97A and CR19B. From this intersection, the LCCFB levee has the same alignment as the preliminary alignment. (See Plates 11, 12, and 13 for the new alignments and plans.) These plans were evaluated for three different design flows at the ultimate outlet weir elevation of the settling basin (41 feet msl [NAVD88]). The plans are described below.

Plan *A*

The LCCFB Plan *A* reflects constructing an inlet weir in a section of the west levee of the settling basin (Plate 11) and removing a portion of the settling basin training levee. The proposed inlet weir varies in length from 2,000 to 3,000 feet, depending on the design flow. The inlet weir crest elevation was set at 45 feet msl (NAVD88), preventing water originating in the settling basin from flooding lands west of the settling basin. Floodflows would enter the settling basin by flowing through culverts in the west levee and by flowing over the inlet weir. Hydraulic analysis has shown that this inlet weir would be submerged given high enough flow conditions (higher than the current design flow).

Plan *B*

With the LCCFB Plan *B* the impact to CR 102 would be reduced by reconstructing CR 102 at a higher elevation on an embankment (Plate 12). CR 102 would be raised 10 feet for approximately 9,000 feet and would essentially function as the new west levee of the settling basin. Under this plan, the lands to the west of CR 102 would have a similar level of protection as existing conditions. The lands east of CR 102 would essentially become a part of the settling basin. Floodflows from the flood plain would enter the settling basin by flowing through culverts under CR 102 and by overtopping CR 102. A 4,000-foot section of the west levee and 5,250 feet of training levee would be breached to allow flows from the flood plain into the settling basin.

Plan *C*

The LCCFB Plan *C* is identical to Plan *B* except that the entire west levee from where the LCCFB levee intersects the west levee of the settling basin to approximately 9,000 feet north of this intersection would be breached (Plate 13). The hydraulic analysis shows no significant differences from breaching the entire west levee of the settling basin as compared to breaching the 4,000-foot section. The materials from the existing west levee of the settling basin would be used for the construction of the LCCFB levee. The entire training levee of the settling basin (approximately 12,000 feet) would also be removed under this plan.

COMPARISON OF COSTS

Table 6-2 summarizes the total investment costs and total annual costs for the three alternative LCCFB Plans. The estimates are for comparison of the plans and are not intended for budgetary purposes.

Table 6-2. Comparative Cost Estimates for Three Alternative Lower Cache Creek Flood Barrier Plans

Plan Variation	Option	Design Peak Flow (X 1,000 cfs)	Total Investment Cost	Total Annual Cost
Plan *A*				
Lower Cache Creek Flood Barrier Plan with the provision of an inlet weir to the settling basin	1	53	$38,444,600	$3,190,900
	2	70	$40,544,600	$3,357,900
	3	91	$42,775,600	$3,527,200
Plan *B*				
Lower Cache Creek Flood Barrier Plan with the provision of raising CR 102 and breaching 4,000-foot section of west levee of the settling basin	1	53	$44,332,200	$3,645,400
	2	70	$45,261,800	$3,716,000
	3	91	$46,463,200	$3,807,200
Plan *C*				
Lower Cache Creek Flood Barrier Plan with the provision of raising CR 102 and breaching entire west levee of the settling basin	1	53	$41,944,000	$3,464,100
	2	70	$42,873,500	$3,534,700
	3	91	$44,428,200	$3,652,700

The comparative costs show that the LCCFB Plan *A*, which has an inlet weir to the settling basin, is the lowest cost plan and therefore is selected as the refined plan.

DESCRIPTION OF REFINED LCCFB PLAN

The LCCFB Plan with an inlet weir in the west levee of the settling basin (Plan A) was selected as the refined plan (Figure 6-1 and Plate 11). This plan eliminates overflow from the settling basin onto the lands west of the settling basin and has a lower construction cost. A more in-depth evaluation to further evaluate costs (including real estate and mitigation costs), slope protection, drainage, and environmental effects follows.

This section describes the features, accomplishments, and effects of the final plan for the LCCFB Plan. This plan was analyzed in greater detail for the three design flows of 53,000, 70,000, and 91,000 cubic feet per second (cfs) (the 1 in 50, 1 in 200 and 1 in 1,000 chance flood events, respectively). The design flow of 78,000 cfs was also analyzed based on these three more detailed analyses. This range of design flows provides the basis to (1) determine the economic feasibility of the plan, (2) optimize the benefits, and (3) identify the National Economic Development (NED) Plan.

PHYSICAL FEATURES

The proposed LCCFB Plan would include constructing a levee along the northern urban limit line of Woodland. The LCCFB levee would be approximately 6 miles in length, originating near the intersection of CR 19B and CR 96B and extending to the Cache Creek Settling Basin, just north of the city of Woodland (Figure 6-1). At the west end, the levee would be outflanked by floods having a peak flow greater than 70,000 cfs.

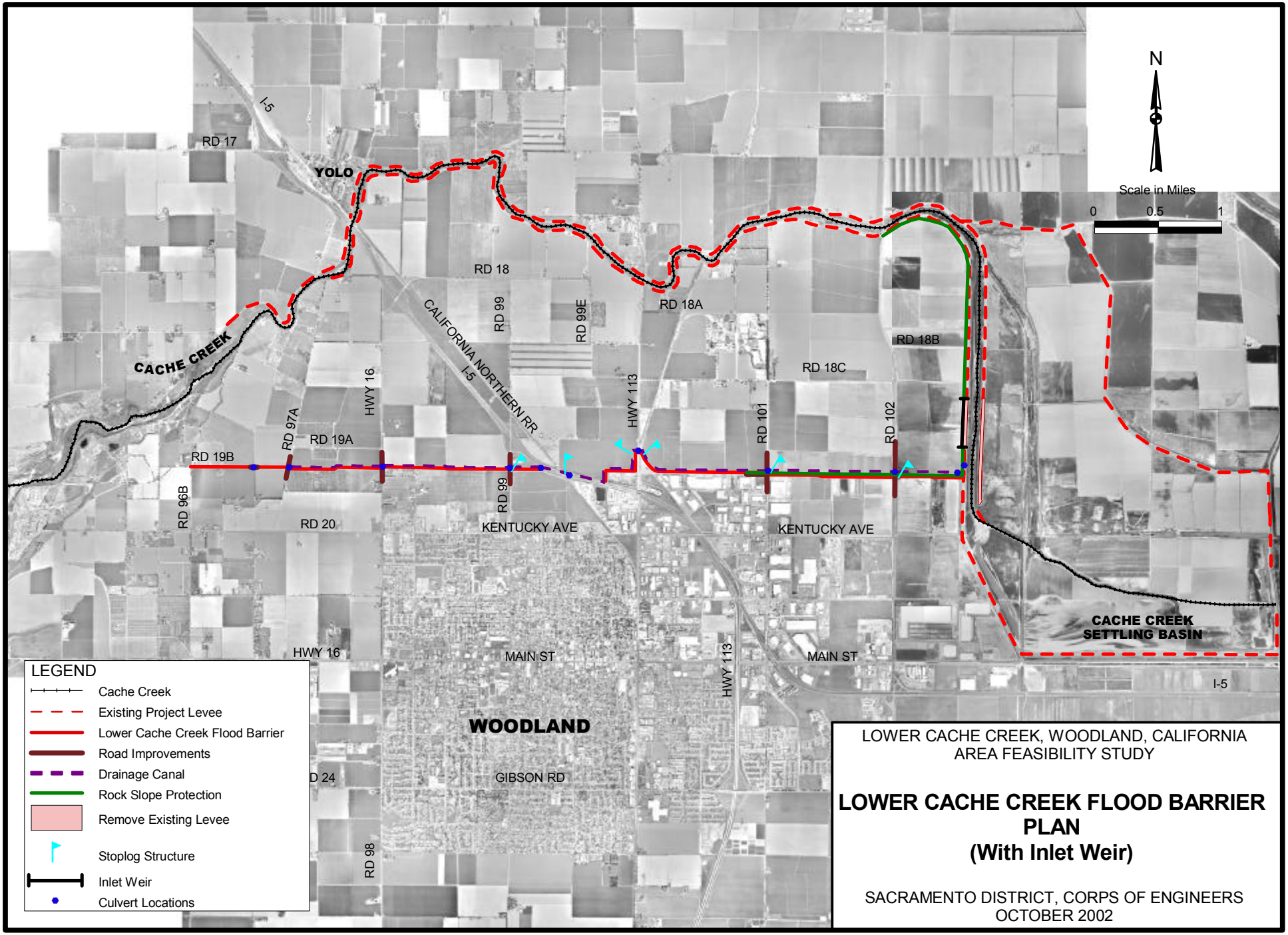
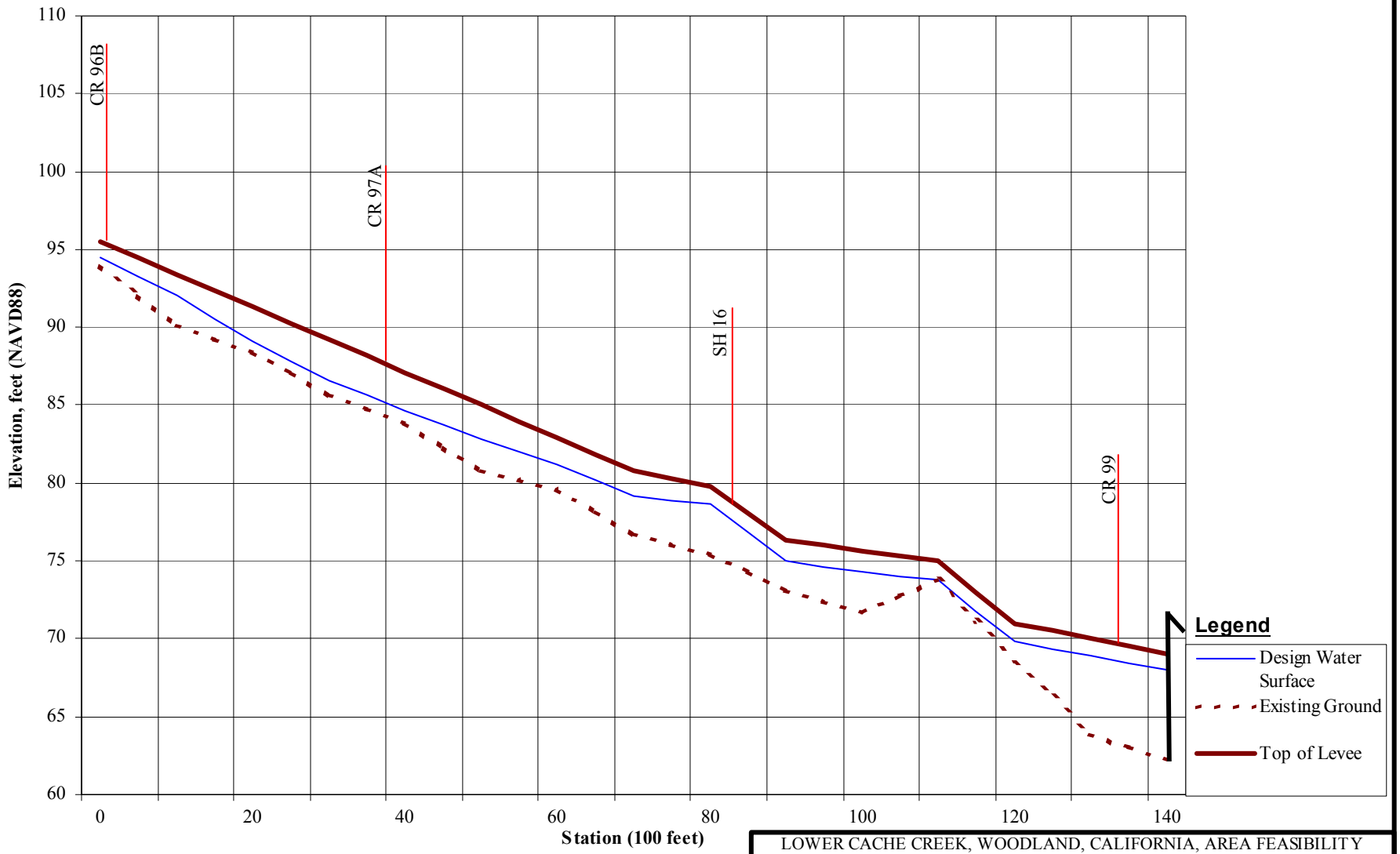

N
Scale in Miles
0
0.5
1
I-5
RD 17
YOLO
RD 18
RD 99
RD 99E
RD 18A
RD 18B
RD 18C
CACHE CREEK
CALIFORNIA NORTHERN RR
I-5
HWY 16
HWY 113
RD 97A
RD 19A
RD 19B
RD 101
RD 102
RD 96B
RD 20
KENTUCKY AVE
KENTUCKY AVE
CACHE CREEK
SETTLING BASIN
HWY 16
MAIN ST
MAIN ST
HWY 113
I-5
WOODLAND
D 24
GIBSON RD
RD 98
LEGEND
Cache Creek
Existing Project Levee
Lower Cache Creek Flood Barrier
Road Improvements
Drainage Canal
Rock Slope Protection
Remove Existing Levee
Stoplog Structure
Inlet Weir
Culvert Locations
LOWER CACHE CREEK, WOODLAND, CALIFORNIA
AREA FEASIBILITY STUDY
LOWER CACHE CREEK FLOOD BARRIER PLAN
(With Inlet Weir)
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
OCTOBER 2002

FIGURE 6-1

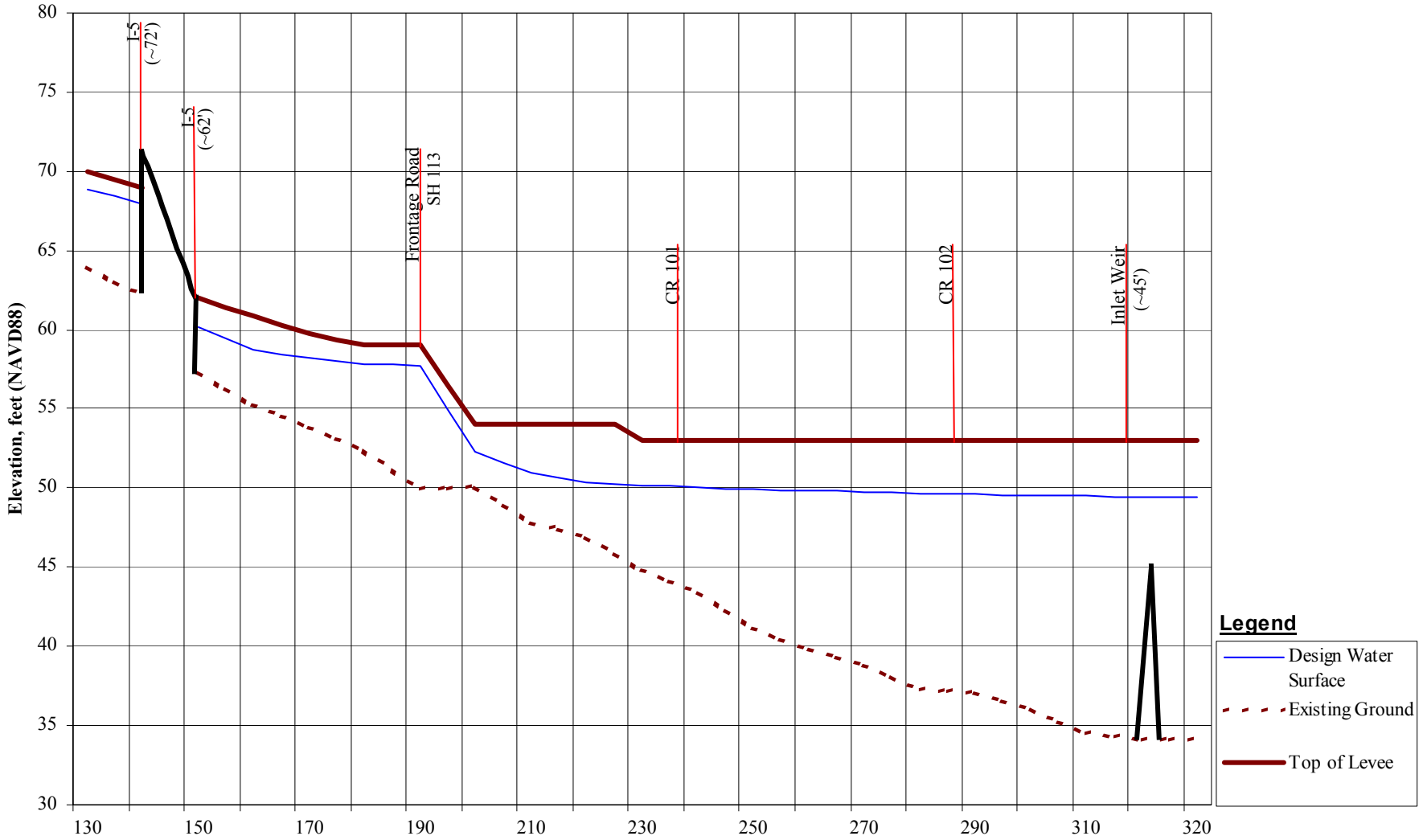


LOWER CACHE CREEK, WOODLAND, CALIFORNIA, AREA FEASIBILITY

LOWER CACHE CREEK FLOOD BARRIER LEVEE PROFILE

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
OCTOBER, 2002

Figure 6-2

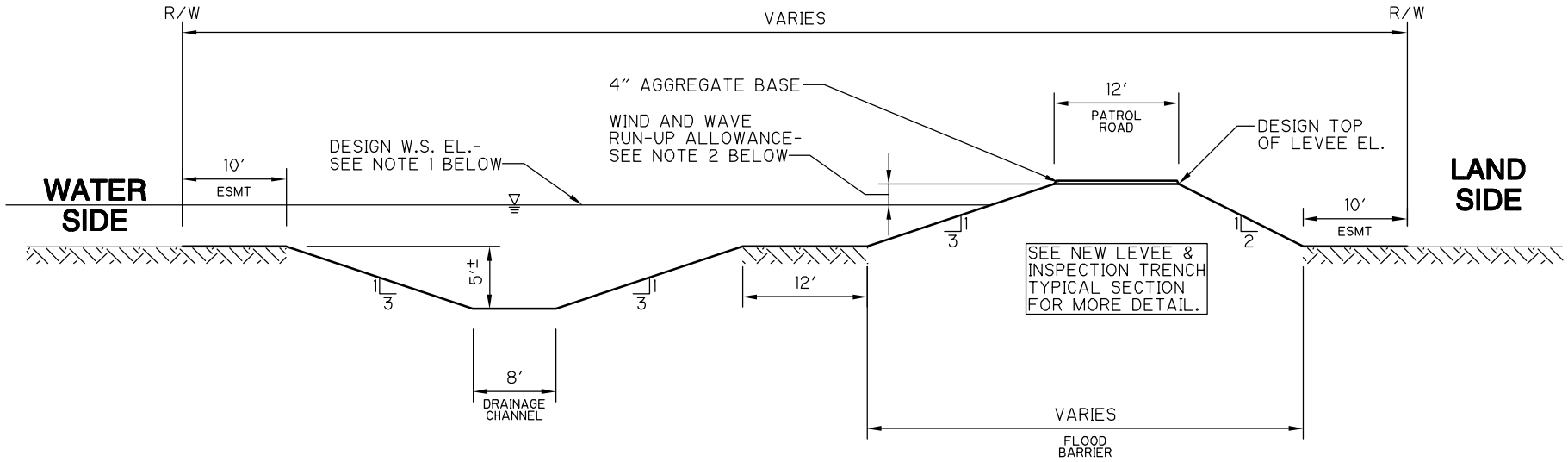


LOWER CACHE CREEK, WOODLAND, CALIFORNIA, AREA FEASIBILITY STUDY

LOWER CACHE CREEK FLOOD BARRIER LEVEE PROFILE (continued)

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
OCTOBER, 2002

Figure 6-2 (continued)



LOWER CACHE CREEK
FLOOD BARRIER

NOT TO SCALE

NOTES

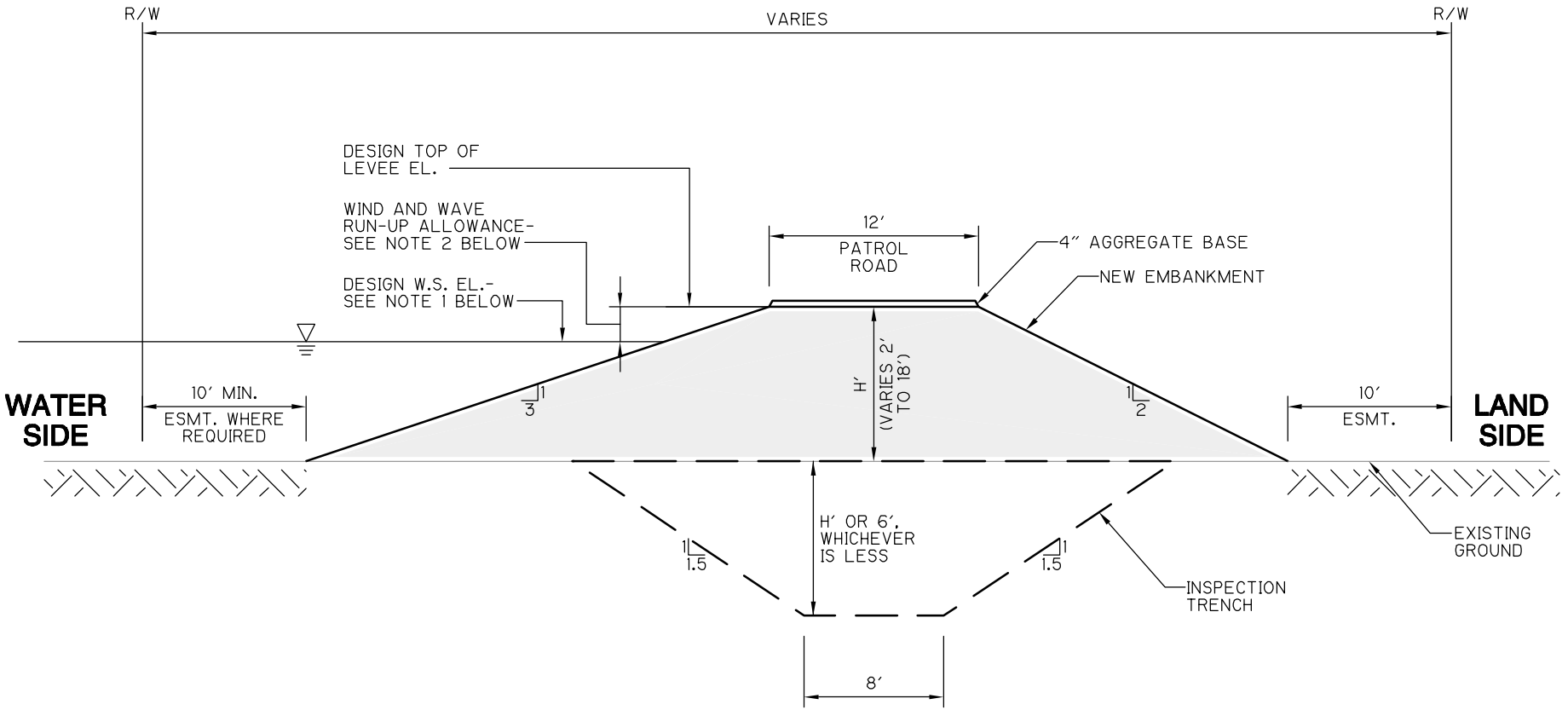
1. REFLECTS A RISK AND UNCERTAINTY APPROACH TO DESIGN.
2. VARIES 1 TO 2.5 FEET.

LOWER CACHE CREEK
FLOOD DAMAGE REDUCTION STUDY EIS/EIR

TYPICAL SECTION
LOWER CACHE CREEK
FLOOD BARRIER

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
OCTOBER 2002

FIGURE 6-3



NEW LEVEE & INSPECTION TRENCH

NOT TO SCALE

NOTES

1. REFLECTS A RISK AND UNCERTAINTY APPROACH TO DESIGN.
2. VARIES 1 TO 2.5 FEET.

LOWER CACHE CREEK, WOODLAND, CALIFORNIA, AREA FEASIBILITY STUDY

TYPICAL SECTION NEW LEVEE AND INSPECTION TRENCH

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
OCTOBER 2002

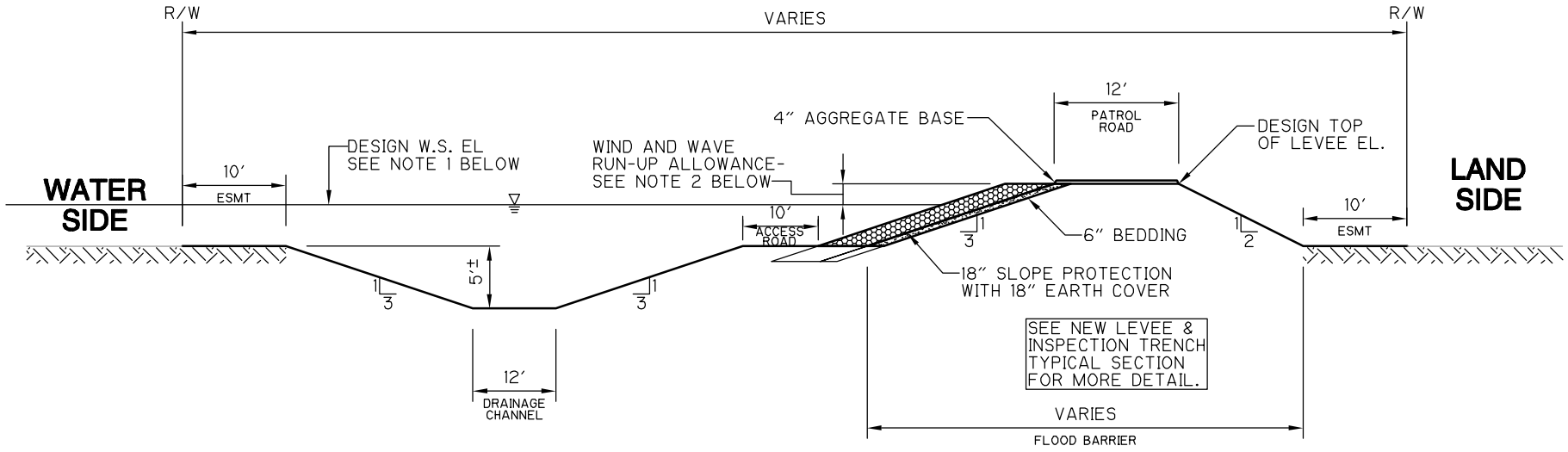
FIGURE 6-4

The height of the LCCFB levee varies from 2 feet in height near CR 96B to 18 feet in height at the west levee of the Cache Creek Settling Basin. Figure 6-2 shows the profile of the LCCFB. A 350 cfs drainage canal would be constructed on the waterside of the LCCFB to provide drainage of floodwaters ponded along the LCCFB. A 12-foot bench would separate the drainage channel from the LCCFB. Cross sections of the drainage canal and levee are provided on Figures 6-3 and 6-4. Culverts would be constructed under all roads, including I-5, SH 113, and railroads to facilitate drainage of the flood plain.

Where possible, existing roads would be raised to match the top-of-levee elevation of the LCCFB. In locations where the roads could not be raised sufficiently, stoplog structures would be constructed to close the gap in the levee. A stoplog structure would also be provided at the California Northern Railroad opening in the I-5 embankment. Stoplogs can usually be installed in 2 to 3 hours.

The portion of the west levee of the settling basin starting at the settling basin inlet south to the new inlet weir would be improved. The sideslope on west side of this levee would be flattened from 2H:1V to 3H:1V. Rock slope protection would be added north of the intersection with the LCCFB along the western slope of the west levee of the settling basin approximately 12,000 feet, continuing along the existing Cache Creek levee to CR 102. The rock slope protection would be placed on the landside of these levees for protection against wave damage. Additionally, rock slope protection, as shown in Figure 6-5, would be placed on the LCCFB (waterside only) from CR 101 to the intersection with the west levee of the settling basin for protection against wave damage during periods of ponding. Rock slope protection would also be added to the embankment of I-5 where overtopping occurs. A 40-foot-deep slurry wall was also assumed to be needed for 15 percent of the LCCFB between CR 101 and the west levee of the settling basin. Slurry walls were assumed for cost estimating purposes because geotechnical investigations/soil borings have not been completed. These investigations would be performed during the design phase of the project; see Appendix B for information on the geotechnical investigations conducted for the feasibility study.

A section of the west levee of the settling basin would be removed for the construction of a concrete weir (3,000-foot-long weir for the 78,000 cfs alternative). These facilities would drain the agricultural area west of the levee into the settling basin. Additionally, the southern 5,250-foot portion of the training levee in the settling basin would be removed to enhance the conveyance of the overflow from the flood plain through the settling basin. The height of the inlet weir would be set at elevation 45 feet msl (NAVD88) to prevent backflow from the settling basin (Plate 14). Water levels above the weir crest elevation would drain into the settling basin over the inlet weir. Water below the weir crest elevation would drain into the settling basin though a low-level drainage structure (culverts). Flapgates would be installed on the culverts to prevent backflow from the settling basin into the area west of the settling basin. Gated culverts would also be installed through the LCCFB levee to convey water to Woodland's pumping station. The amount of water flowing through this culvert would be controlled



LOWER CACHE CREEK FLOOD BARRIER WITH SLOPE PROTECTION

(FROM CR 101 TO WEST LEVEE)

NOT TO SCALE

NOTES

1. REFLECTS A RISK AND UNCERTAINTY APPROACH TO DESIGN.
2. VARIES 1 TO 2.5 FEET.

LOWER CACHE CREEK, WOODLAND, CALIFORNIA, AREA FEASIBILITY STUDY

TYPICAL SECTION LOWER CACHE CREEK FLOOD BARRIER WITH SLOPE PROTECTION

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
OCTOBER 2002

FIGURE 6-5

by the City of Woodland. Additional information regarding the ponding of water and drainage durations is discussed under "Operation of the Pond Outlet Facilities" later in this section.

Borrow material for construction of the LCCFB would be developed from four sources: the excavation of the proposed drainage canal, the removal of the training levee in the settling basin, the removal of a portion of the west levee of the setting basin, and a small borrow area in the settling basin. Staging areas would be required for the construction of the LCCFB. A staging area at each road crossing of the LCCFB would be required for the construction of the levee.

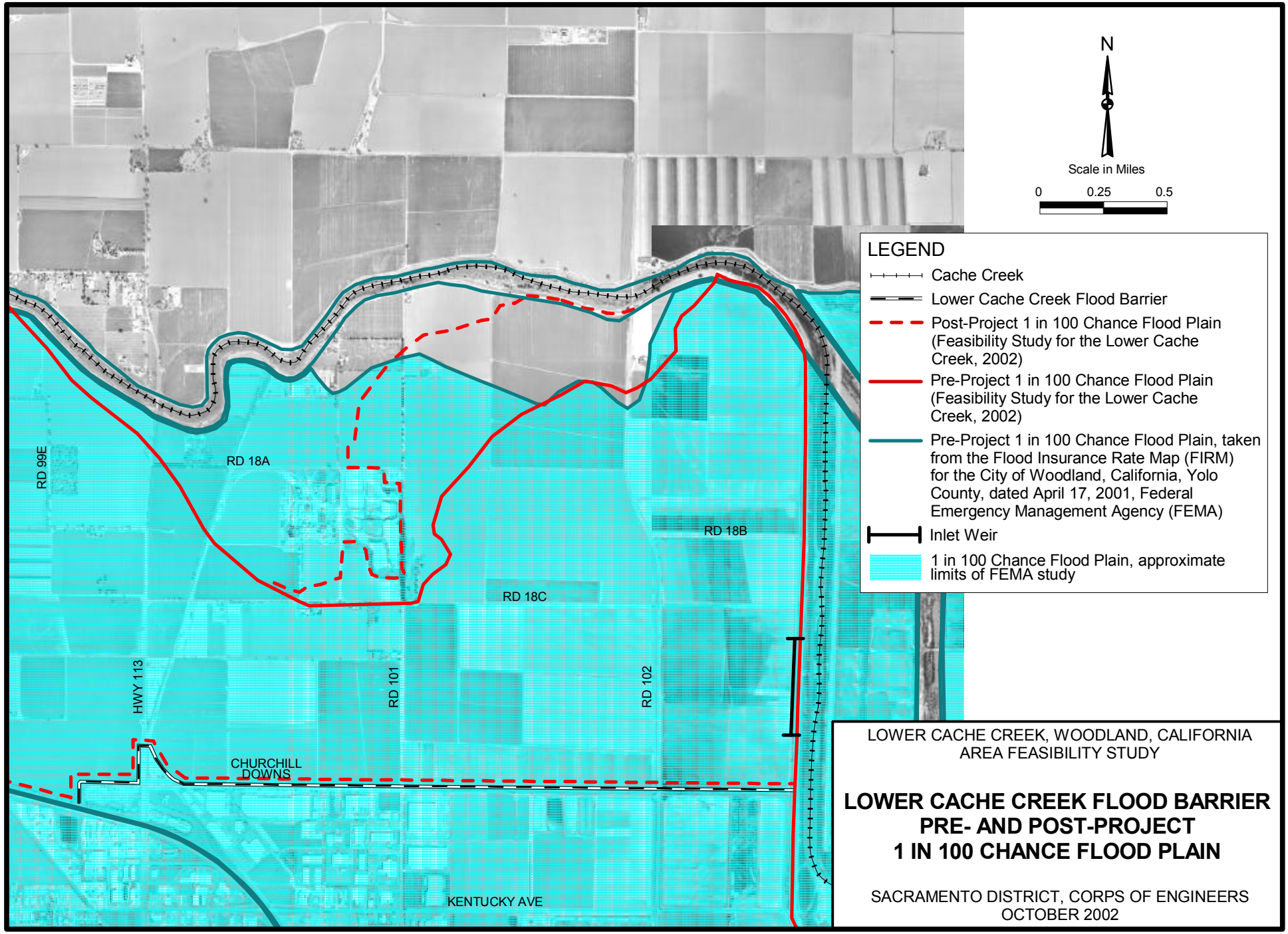
Real estate requirements for the LCCFB would be based on the footprint of the levee, the drainage canal, plus 20 feet for maintenance access (Figure 6-3). Furthermore, a flowage easement would be required for an area west of the west levee of the settling basin due to the increased depth and duration of flooding in this area; see the Real Estate Plan (Appendix F), Exhibit C.

Additionally, flowage easements would be acquired for lands that are not currently within the Cache Creek flood plain but would be subject to flooding induced by the LCCFB. Additional information on real estate requirements is discussed in the Real Estate Plan (Appendix F).

Existing homes and structures on the south Cache Creek flood plain could be damaged by flood flows escaping from Cache Creek under both existing conditions and post-project conditions associated with the LCCFB Plan. Pre- and post-project depth duration curves were developed for all groups of structures within the post-project LLCFB flood plain and used to identify homes and structures that may require floodproofing measures or other remedies; see Appendix D for depth duration curves at selected locations.

Areas that are not presently within the Cache Creek flood plain but would be within the flood plain of the proposed project are shown on Figure 6-6. This figure shows the pre-project (existing conditions) 1 in 100 chance flood plain and the post-project flood plain for the LCCFB Plan for the area east of I-5. For comparison, the FEMA 1 in 100 chance flood plain is also shown. The post-project flood plain west of I-5 and north of the LCCFB would not be significantly changed from pre-project conditions.

Gross costs for floodproofing up to 25 homes have been included in the LCCFB Plan cost estimates (Appendix K, Tables K-1 to K-3). A building would be floodproofed only if floodproofing is determined to cost less than the compensation to the owner that would be required as the result of a "taking." During detailed design of the project, elevations of individual structures will be surveyed and a takings analysis will be performed to determine which structures, if any, would be subject to a taking as a result of additional flooding. A comparison of compensation costs versus floodproofing costs



LOWER CACHE CREEK, WOODLAND, CALIFORNIA
AREA FEASIBILITY STUDY

LOWER CACHE CREEK FLOOD BARRIER PRE- AND POST-PROJECT 1 IN 100 CHANCE FLOOD PLAIN

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
OCTOBER 2002

FIGURE 6-6

will then be performed to determine whether floodproofing is appropriate for a particular building.

ACCOMPLISHMENTS OF PLAN

The LCCFB Plan could accomplish the flood damage reduction goals of the City of Woodland by protecting the city and areas south of the LCCFB from large flood events on Cache Creek. Most of the lands north of the LCCFB are currently in the flood plain. The LCCFB would divert a portion of the floodflows that flow southeast toward Woodland and east toward the settling basin. These flows would pond temporarily against the west levee of the settling basin until drained into the settling basin. Plate 14 indicates proposed drainage facilities.

Pre-project conditions show that I-5 and SH 113 are subject to flooding. Although flooding would still occur north of the LCCFB, I-5 and SH 113 would be protected south of the LCCFB. Pre- and post-project flood plains are shown on Plate 9.

A flood warning system would be provided to increase the time to prepare for flood fighting, to evacuate citizens from flood areas, and to close the openings in the LCCFB. A river forecast at the Yolo stream gage would provide additional reliability to the flood warnings for the residents of Yolo County and Woodland . The acquisition of a storm watch system and a reverse “911” system by the local agencies would save several hours in notifying and evacuating the general public.

HYDRAULIC MITIGATION

The hydraulic effects from the LCCFB modeling indicate there would be an increase in water depths (in comparison between pre- and post-project conditions) on the flood plain north of the LCCFB and south of Cache Creek. Increases in depths range from zero to 7 feet (Plate 15). Flood depths and durations increase the most in the vicinity of the west levee of the settling basin (Plate 16). The LCCFB would also cause some additional areas south of the creek to be flooded. Plate 17 indicates the FEMA and the Corps pre- and post-project flood plains on the west side of the project. Flows in Cache Creek would not be affected by this plan. Effects to the settling basin include an increase of water depths from 0.8 foot to 2.1 feet. Hydraulic effects are presented in more detail in Appendix D.

The LCCFB Plan would involve structural changes to the settling basin. A 3,000-foot weir and low level outlet facility would be installed in the west levee. These facilities would drain floodwaters from the agricultural land to the west of the basin into the settling basin and would change flow patterns southwesterly in a portion of the settling basin.

Based on some preliminary analysis with the FLO 2D model, the impact of large, rare flood flows into the basin via the inlet weir do not appear to generate severe enough scour velocities to remove much sediment from the basin. Regarding the removal of the training levee though, there will be some impact on the deposition of sediment over the life of the basin, such as changes in the spatial deposition of sediment. Also, only a relatively small portion of suspended sediment would actually enter the settling basin via the proposed weir because most of the sediment load of flows escaping from Cache Creek would be deposited on the flood plain. Thus, the LCCFB Plan would not significantly change the sediment loading into or out of the basin.

However, because the LCCFB Plan would remove a portion of the training levee in the settling basin, the pattern of sediment deposition could be altered. The purpose of the training levee is to maintain flow velocities to prevent the premature deposition of sediments and clogging of the inlet area. The existing settling basin operations and maintenance plan already provides for the incremental removal of the training levee for the purpose of directing the deposition of sediments in the settling basin. During the planning, engineering, and design phase, the effects of the LCCFB Plan to these functions would be analyzed. Modifications to operation and maintenance requirements may be necessary to mitigate for any effects of the project. It is expected that there would not be sufficient impact to substantially change the conclusions of this feasibility study.

An analysis was also performed to determine whether the increase in peak flows exiting the settling basin could potentially affect flooding on the Yolo Bypass. A peak flow coincidence analysis was performed to determine the likelihood of simultaneous peak flows in these two bodies of water (Appendix C). The analysis compares the 10 largest floods of record for the Yolo Bypass gage near the settling basin and shows that in all 10 events, the peak flow on Cache Creek occurred 1 to 3 days prior to the peak flow in the bypass. In conclusion, the LCCFB Plan would result in a higher volume of water reaching the bypass over the length of a flood event, but should not cause an increase in the peak stage.

OPERATION AND MAINTENANCE

Once the LCCFB is completed, ownership would be transferred to the non-Federal sponsor, The Board, which would transfer this obligation to the City of Woodland. Operation, maintenance, and rehabilitation of the LCCFB would be in accordance with the operation and maintenance manual to be provided by the Corps. The Corps would have the responsibility to make certain the non-Federal entity inspects, maintains, and rehabilitates the project according to this manual to protect the Federal investment. Maintenance of the levees would include grading and graveling roadways, weed control, rodent control, drainage inspection, maintenance of slope protection, and maintenance of project mitigation features.

The LCCFB Plan would require minor changes to the operation and maintenance of the settling basin. DWR is currently operating the settling basin under an operations

and maintenance manual provided by the Corps. If and when a new project is authorized, this manual and any other reports and agreements would be updated at that time.

Under the LCCFB Plan, the operation and maintenance of the existing Cache Creek levee system is expected to continue. Although it is not a part of the LCCFB Plan, by State law, operation and maintenance of the existing levee system is the responsibility of DWR.

OPERATION OF THE POND OUTLET FACILITIES

The existing Cache Creek Settling Basin, located adjacent to the Yolo Bypass, was constructed to prevent sediment being carried by Cache Creek from being deposited in the Yolo Bypass and adversely affecting the hydraulic capacity of the bypass. Flows in Cache Creek enter the northwest corner of the settling basin and exit the settling basin via structures located in the southeast corner of the settling basin.

These structures consist of a 1,740-foot concrete outlet weir and a gated, double box culvert. The crest elevation of the outlet weir is currently at approximately elevation 35 feet msl (NAVD88); therefore, when the basin fills with sediment such that the trap efficient decreases to less than 30 percent, the crest elevation of the outlet weir will be raised 6 feet to elevation 41 feet msl (NAVD88).

Floodflows escaping from Cache Creek on the south bank currently flow to the east and southeast both north of and through Woodland, eventually ponding against the west levee of the settling basin and the Yolo Bypass levees north and east of Woodland. Under post-project conditions (LCCFB Plan), Woodland would be protected by a levee along its northern urban limit line, and floodflows that overtop the existing levees or channel banks of Cache Creek on the south side would flow east and pond against the west levee of the Cache Creek Settling Basin. Figure 6-7 shows a portion of the 1 in 100 chance flood plain boundary established by FEMA and the extent of ponding under post-project conditions for various lesser flood events. The extents of ponding for each chance flood event was approximated from the hydraulic modeling presented in Appendix D. Figure 6-8 shows the depths of post-project ponding, after the floodwaters would have ceased flowing over the road embankments and the proposed settling basin inlet weir. At this point, the floodwaters would be drained primarily through the low-flow culverts, which would take a relatively long time. The depths shown are the water-surface elevations at the low point in the top of the road embankments and at the crest of the inlet weir. These depths would decrease slowly as the pond drains through the culverts. Figure 6-9 shows duration of flooding at CR 101 and 102 as a function frequency of flood event, and Figure 6-10 shows the stage hydrograph of flooding in the ponding area for the 1 in 100 chance flood event. The extent and depth of ponding, in addition to the drainage duration along the LCCFB and the west settling basin levee, depends on the hydrologic event, hydraulic capacity of the pond outlet structures, water levels in the settling basin, and the available pumping capacity of the city's North Canal Pump Station.

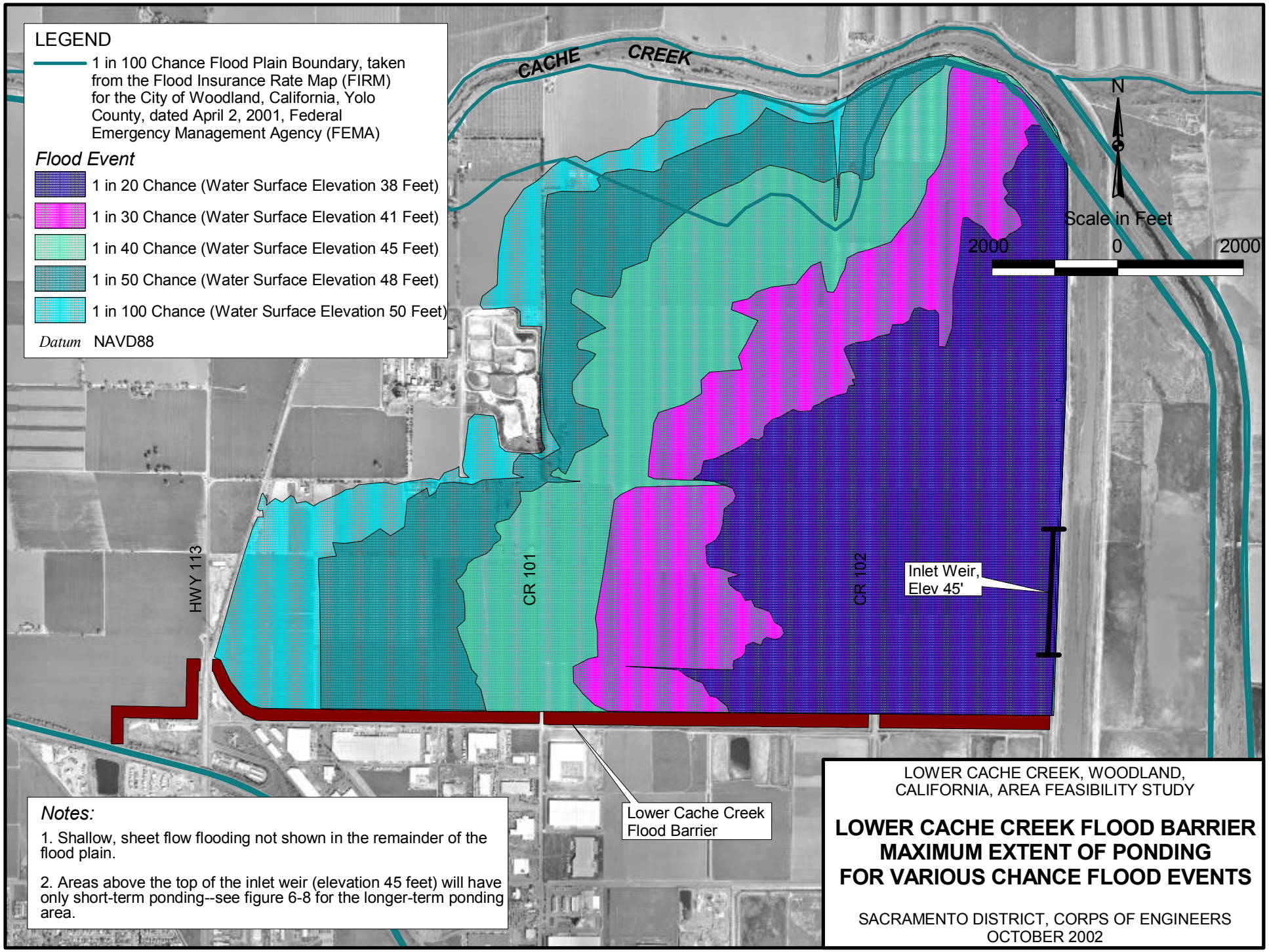
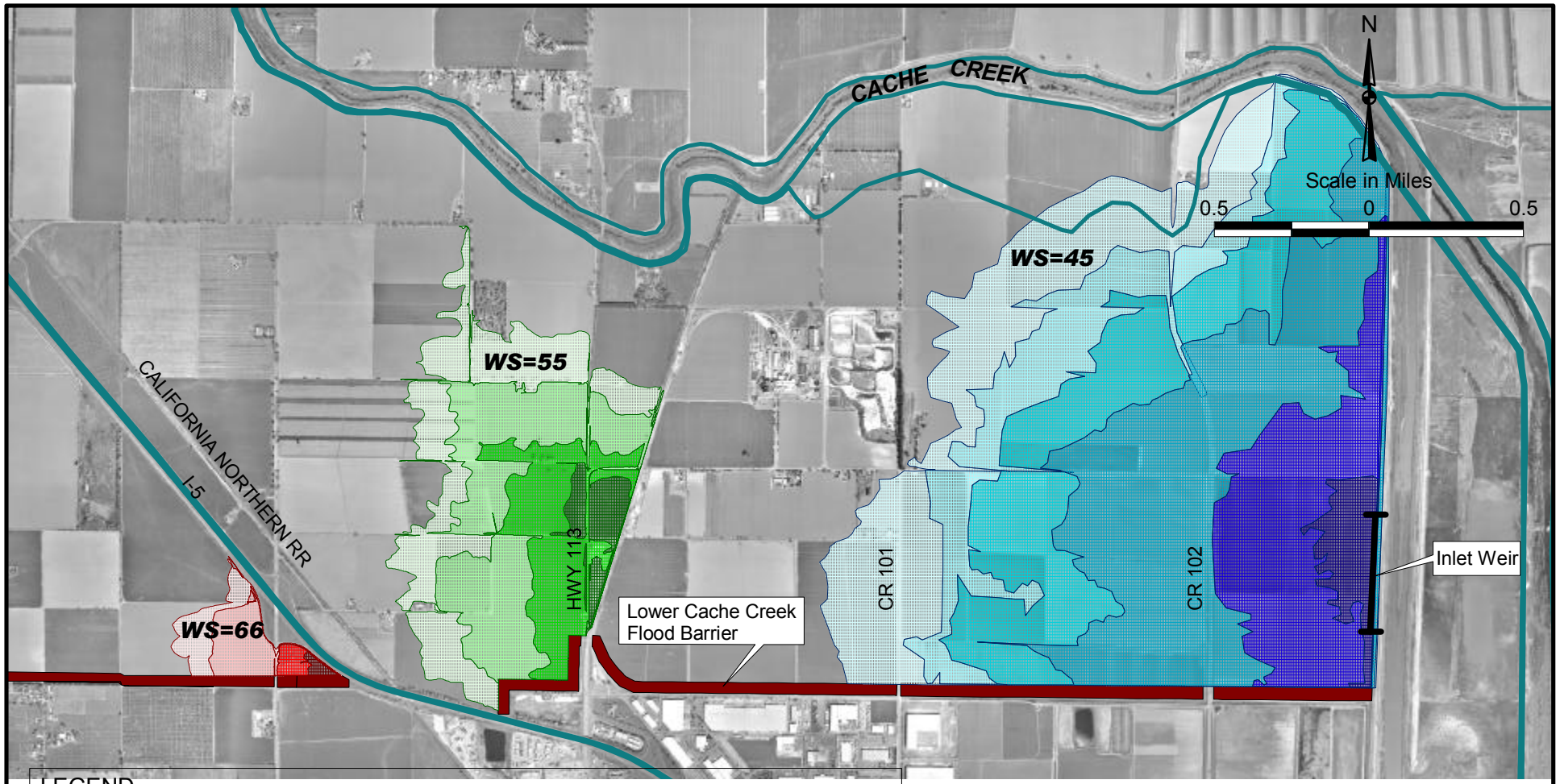

LEGEND
1 in 100 Chance Flood Plain Boundary, taken from the Flood Insurance Rate Map (FIRM) for the City of Woodland, California, Yolo County, dated April 2, 2001, Federal Emergency Management Agency (FEMA)
Flood Event
1 in 20 Chance (Water Surface Elevation 38 Feet)
1 in 30 Chance (Water Surface Elevation 41 Feet)
1 in 40 Chance (Water Surface Elevation 45 Feet)
1 in 50 Chance (Water Surface Elevation 48 Feet)
1 in 100 Chance (Water Surface Elevation 50 Feet)
Datum NAVD88
CACHE CREEK
N
Scale in Feet
2000 0 2000
HWY 113
CR 101
CR 102
Inlet Weir, Elev 45'
Lower Cache Creek Flood Barrier
Notes:
1. Shallow, sheet flow flooding not shown in the remainder of the flood plain.
2. Areas above the top of the inlet weir (elevation 45 feet) will have only short-term ponding--see figure 6-8 for the longer-term ponding area.
LOWER CACHE CREEK, WOODLAND, CALIFORNIA, AREA FEASIBILITY STUDY
LOWER CACHE CREEK FLOOD BARRIER
MAXIMUM EXTENT OF PONDING
FOR VARIOUS CHANCE FLOOD EVENTS
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
OCTOBER 2002

Figure 6-7



LEGEND

1 in 100 Chance Flood Plain Boundary, taken from the Flood Insurance Rate Map (FIRM) for the City of Woodland, California, Yolo County, dated April 17, 2001, Federal Emergency Management Agency (FEMA)

WS Pond water surface elevation (Feet above mean sea level, NAVD88)

Ponding Depths

I-5	SH113	Northeast Corner
Approx. 6 Feet	Approx. 5 Feet	Approx. 11 Feet
4-6 Feet	3-5 Feet	9-11 Feet
2-4 Feet	1-3 Feet	7-9 Feet
<2 Feet	<1 Feet	5-7 Feet
		3-5 Feet
		< 3 Feet

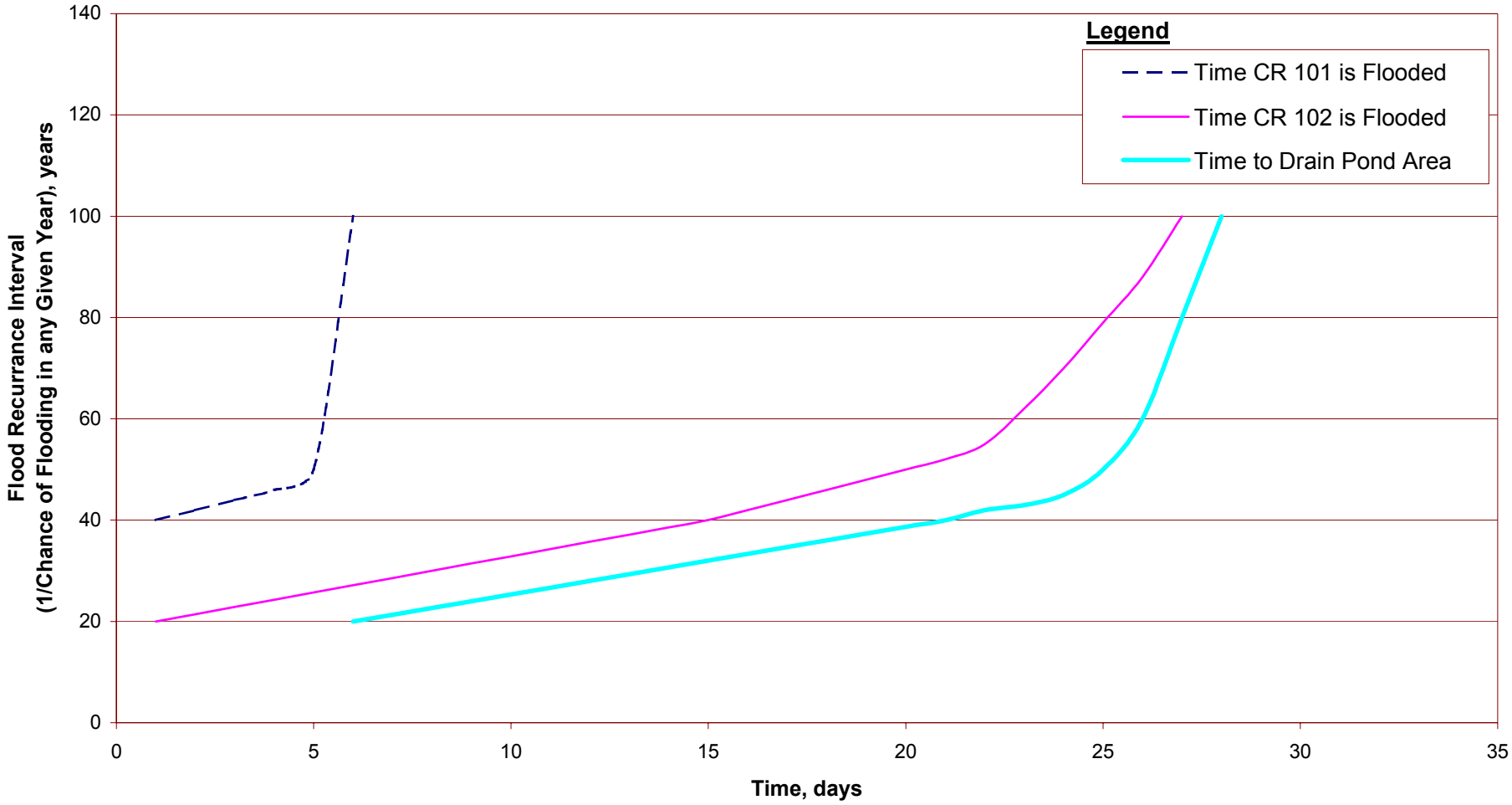
NOTE: This figure only applies to flows larger than approximately a 1 in 40 chance flood.

LOWER CACHE CREEK, WOODLAND, CALIFORNIA, AREA FEASIBILITY STUDY

LOWER CACHE CREEK FLOOD BARRIER LONG-TERM FLOODWATER DEPTHS IN PONDING AREAS

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
OCTOBER 2002

Figure 6-8



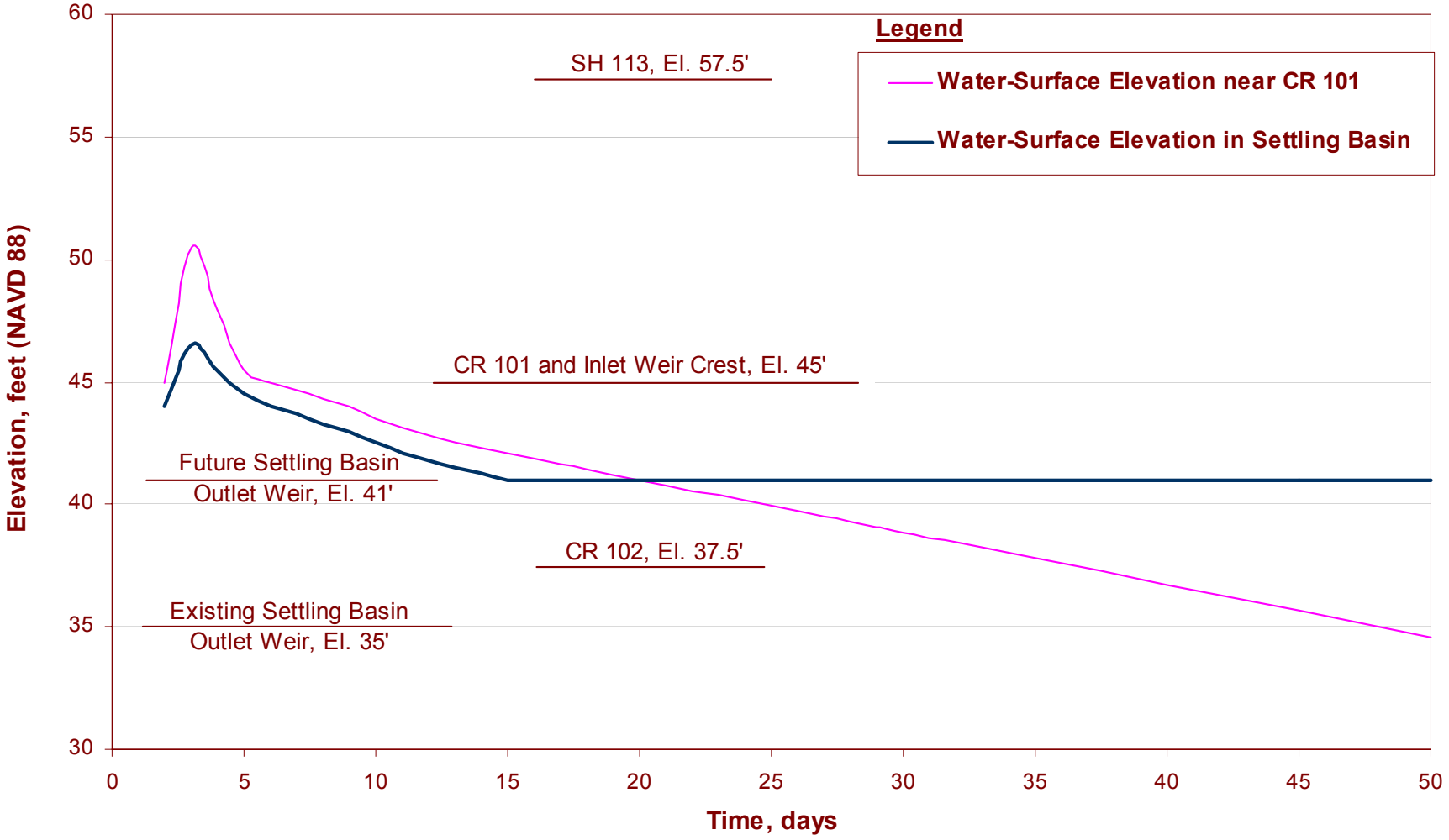
Note: Drain times are based on an outflow rate of 500 acre-feet /day.
Assumptions:
1. No additional rainfall on the south floodplain.
2. The settling basin water surface is 1 foot below the water surface of the pond.
3. The average available pump capacity is 200 acre-feet/day (North Canal Pump Station).

LOWER CACHE CREEK, WOODLAND, CALIFORNIA AREA, FEASIBILITY STUDY

DURATIONS OF FLOODING FOR VARIOUS CHANCE FLOOD EVENTS IN THE PONDING AREA AND IN THE SETTLING BASIN FOR THE LOWER CACHE CREEK FLOOD BARRIER PLAN

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
OCTOBER, 2002

Figure 6-9



Notes:
Lowest elevation west of the settling basin west levee is approximately elevation 34.5 feet.

LOWER CACHE CREEK, WOODLAND, CALIFORNIA, AREA FEASIBILITY STUDY

STAGE HYDROGRAHS FOR THE 1 IN 100 CHANCE FLOOD EVENT IN THE PONDING AREA AND IN THE SETILING BASIN FOR THE LOWER CACHE CREEK FLOOD BARRIER PLAN

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
OCTOBER, 2002

Figure 6-10

Proposed facilities to drain the pond into the settling basin consist of the removal of a 3,000-foot section of the west levee of the settling basin and the construction of a 3,000-foot-long concrete inlet weir and a multi-barrel gated box culvert. The inlet weir would have a crest at elevation 45.0 feet msl (NAVD88) (10 feet above that of the existing settling basin outlet weir). The new inlet weir would have the capability of draining the "pond" between the settling basin and CR 101 down to approximately elevation 45 feet in a few days (about 3 days for the 1 in 100 chance event). At this water surface elevation, the pond would have a volume of about 10,500 acre-feet, and water depths would vary from zero to about 11 feet (Figure 6-8).

The proposed low-level outlet facilities (culverts) would drain the pond (below elevation 45 feet) into either the settling basin or into the North Canal and eventually to the North Canal Pump Station. The hydraulic capacity of the low-level outlet facilities would be a function of the size of the culverts provided and the water level differential ("head") across the facility. The proposed facility into the settling basin consists of a triple 3-foot by 3-foot concrete box culvert with flap gates on the east end of the culvert and slide gates in the middle of the culvert. This facility would have a hydraulic capacity of approximately 150 cfs or 300 acre-feet per day at a head differential of 1 foot.

The proposed outlet facility leading to the pump station consists of a reinforced concrete pipe culvert with a slide gate in the middle or at the upstream end of the culvert. The culvert would have a maximum hydraulic capacity of 170 cfs (the same capacity as the pump station). The slide gate would be used to control the flow to the pump station to match the available capacity of the station. If approximately 100 cfs (200 acre-feet per day) of the capacity of the pump station is available, it would take approximately 50 days to drain the pond using only this facility and assuming no additional inflow into the pond (Cache Creek flows are less than 20,000 cfs).

Under existing conditions, floodflows escaping Cache Creek will also pond against the west levee of the settling basin; however, both the depth and duration of this ponding would be less than under post-project conditions. Under existing conditions for the 1 in 100 chance event, the maximum water surface level at CR 101 (the upstream end of the pond) would be about elevation 45 feet msl (NAVD88) for the 1 in 100 chance flood event. Under post-project conditions, the maximum water level at CR 101 would be approximately elevation 50.5 feet. Under post-project conditions, the duration of this flooding is discussed above and is estimated to be 26 to 55 days (depending on hydrologic factors, described above, occurring after the flood event).

The low point of the crown of CR 101 is approximately elevation 45 feet msl (NAVD88); under post-project conditions for the 1 in 100 chance event, the duration of flooding at this location would be approximately 3 to 4 days. The low point of the crown of CR 102 is about elevation 37.5 feet in the ponding area; the duration of flooding at this location would be an additional 2 to 5 weeks. Flooding duration estimates are based on the assumption that no additional rain falls in the Woodland area during this period, that the pump station drains the pond at a rate that averages 200 acre-feet per day, and that the

water levels in the settling basin are 1 foot below and drop at the same rate as the pond water level until it reaches the elevation of the outlet weir to the Yolo Bypass.

Under post-project conditions, a flood event with a peak greater than the capacity of the existing levee system would be conveyed in the following manner:

- A large flood event in lower Cache Creek either overtops the channel banks upstream from the existing levee system, flowing onto the Cache Creek flood plain, or fails a section of the existing levee system (either by overtopping or structurally failing the levee), or both. When a levee fails, it is assumed that the existing levee will be eroded down to original ground and that flows above original ground would escape through the breach onto the flood plain. Floodwaters escaping from Cache Creek on the south bank would initially flow primarily east towards the settling basin and some floodwater would flow southeast toward Woodland. Much of the floodwater flowing towards the settling basin, would be intercepted by road/railroad embankments, as described below, some of which would be diverted towards Woodland. These floodwaters flowing towards Woodland would be diverted by the LCCFB east and would eventually pond against the west levee of the settling basin until it is drained into the settling basin or to the North Canal Pump Station. Alternatively, a levee failure on the north side of the creek would flow northeast away from Woodland. If the north levee fails upstream from a break in the south levee, ponding against the settling basin would be less.

- The depth and duration of ponding (between CR 101 and the settling basin) depends on a number of factors, including the elevation of the flood event, the magnitude of the flood peak, the volume of water that escapes unto the flood plain, and if there is weir flow (events with greater flow than the 1 in 40 chance flow event). Figure 6-7 indicates pond limits for various Cache Creek flood events in the 1 in 30 to 1 in 100 chance range. Flood extents for flow events with greater chance of occurring than 1 in 50 in any given year were determined by estimating the volume escaping from the channel and calculating the area that would be flooded by this volume. Cache Creek hydrographs and flood peak frequency at CR 94B are included in Appendix C. Flow events with less of a chance than 1 in 50 were calculated by routing overbank and channel flows through the system using the FLO-2D model. (See Appendix D for additional information and for flood depths and durations at various locations and structure groups on the south flood plain.)

- Between the location where the floodwaters escape from the channel (Appendix D, Plates 12 through 15) and the settling basin, floodwaters must be conveyed over, under, or around various embankments and/or obstructions that have been constructed on or across the flood plain.

- The major embankments obstructing overbank flows are Interstate 5 and State Highway 113. When floodwaters reach an existing embankment, they pond and are diverted until the accumulated water either overtops the embankment or is conveyed under the embankment by existing and new cross drainage facilities (the drainage channel and culverts along the LCCFB).

- At I-5, floodwaters escaping from Cache Creek flow southeast along the embankment to the LCCFB. If the volume is sufficient, the water would pond in the CR 99/I-5 area and eventually overtop the freeway in one or more locations if the magnitude and duration of the event is sufficiently large.

- Any floodwaters that do not overtop flood plain obstructions (freeway, railroad, or roadway embankments) would be drained under these embankments via existing and new cross drainage facilities.

In addition to flood events that result from a levee failure or bank overtopping, local flooding along various flood plain embankments, roadways, and against the west levee of the settling basin can occur. This flooding is primarily due to insufficient capacity of the internal drainage system of the southern Cache Creek flood plain. The proposed LCCFB Plan would improve the existing internal drainage system east of I-5 by increasing the capacity of the system in this reach. West of I-5, capacity is also being increased; however, under existing conditions where floodwaters would flow into Woodland, the LCCFB would divert these flows east via the drainage channel system to the settling basin or the City pump station. Because the capacity of the flood plain's internal drainage system is being increased and the source of this flooding is not from Cache Creek, improving these existing flooding problems is not an objective of this study. These existing flooding problems have not been evaluated or specifically addressed by the LCCFB Plan and may continue to be problems.

ENVIRONMENTAL EFFECTS AND MITIGATION

The potential effects of the LCCFB Plan on environmental resources in the project area are evaluated in detail, and the results are presented in detail in the *Lower Cache Creek, Yolo County, CA, City of Woodland and Vicinity, Draft Environmental Impact Statement/Environmental Impact Report for Potential Flood Damage Reduction Project, (EIS/EIR)*, under separate cover. Potential adverse effects of the plan are identified and quantified when possible, and measures to avoid, reduce, or mitigate these effects to less than significant are presented.

Based on the results of the environmental studies, resources not affected by the LCCFB Plan are climate; topography; geology; soils; recreation; hazardous, toxic, and radiological waste; public health vectors and vector control; and fisheries. The potentially affected resources include social and economic resources, land use, agriculture, prime

and unique farmlands, transportation, noise, air quality, water quality, sedimentation and the settling basin, vegetation and wildlife, special-status species, cultural resources, and esthetic and visual resources. The potential effects, mitigation, and significance for these affected resources are summarized below.

Project-induced flooding north of the LCCFB would cause a potential decrease in the value of some lands, therefore affecting social and economic resources. In addition, one home would need to be acquired. Agricultural landowners would be compensated for takings to the extent required by law, and the homeowner would be compensated for the land and home value. Implementation of these mitigation measures would reduce the potentially significant effect to less than significant.

Land use effects of the LCCFB Plan would be the conversion of 100 acres of row crop, 2 acres of orchard, and 2 acres of agricultural support lands for flood damage reduction purposes. This effect represents an incompatible land use change and is a significant effect that cannot be mitigated.

Effects on prime and unique farmland due to the LCCFB would be a loss of 100 acres of prime farmland and 2 acres of statewide-important farmland. The acreage of prime farmland converted cannot be mitigated since the qualities that distinguish prime farmland cannot be re-created. The conversion of prime and statewide-important farmland represents a significant effect.

Temporary direct transportation effects would include lane closure during road repair, roadway safety hazards, and an increase in traffic volume. The lead agency would provide a traffic management plan as a mitigation measure. Additionally, contractors would use construction easements as much as feasible when hauling materials to the construction site; traffic would be rerouted when necessary to avoid construction areas; and flaggers would be stationed to slow or stop approaching vehicles to avoid conflicts with construction vehicles or equipment. With the implementation of these mitigation measures, the effects on transportation would be reduced to less than significant.

Indirect transportation effects would include increased depth and duration of flooding on roadways traversing the project area. CR 101 would be flooded for about 1 week, and CR 102 would be flooded for 3 weeks during floods with a greater than 1 in 40 chance of occurring. These road closures could cause lengthened response times for emergency vehicles traveling to residents northeast of Woodland. However, there are several county roads close to CR 102 that could be used as alternative routes to circumvent the flooded portions of CR 102. This mitigation measure would reduce the indirect transportation effect, but not to a less-than-significant level.

Construction-related effects on noise would consist of temporary decibel levels above the significance threshold for some sensitive receptors during construction. Construction equipment would be outfitted and maintained with noise-reduction devices such as mufflers, and construction would be limited to daytime hours. The

implementation of these mitigation measures would lessen the effects, but not to a less-than-significant level.

Construction-related effects on air quality would consist of temporary increases in pollutant emissions. NOx and PM_{10} emissions would exceed the significance thresholds established by the Yolo-Solano Air Quality Management District (AQMD). Sensitive receptors would also be exposed to the high levels of fugitive dust emissions. NOx mitigation measures would be incorporated into construction plans and specifications, and the lead agency would provide a dust suppression plan to lessen the effects of PM_{10}. The mitigation measures would reduce the air quality effects, but not to a less-than-significant level.

The removal of the training levee could alter the distribution of sedimentation in the settling basin. The design of the LCCFB Plan would incorporate the existing function of the settling basin, reducing any potential effects to less than significant.

Potential project-related effects on water quality would include pollutants from construction equipment and erosion at the construction site that could temporarily degrade the water quality of local runoff during construction. The lead agency would prepare a stormwater pollution prevention plan. A portion of this plan would specifically address erosion and sediment control. The lead agency would also prepare a Hazardous Substance Control and Emergency Response Plan and would comply with all requirements of the Clean Water Act. In addition, appropriate best management practices and monitoring would be implemented to preserve the quality of surface runoff. Implementation of these mitigation measures would reduce the effects on water quality to less than significant.

Project-related effects on vegetation and wildlife, as determined by the USFWS in its draft Coordination Act Report (CAR), would include the loss of 122 acres of agricultural habitat, 100 native and nonnative trees, 0.52 acre of upland habitat, and 0.28 acre of scrub shrub. Recommended mitigation for habitat loss has been outlined by the USFWS in its CAR, which is included as Appendix A with the Draft EIS/EIR. Construction-related effects would include disturbance from equipment and crews and potential disturbance of species. Mitigation for these effects include limiting construction crews to the right-of-way and confinement of disturbance to as small an area as possible and conducting nest surveys prior to the removal of any trees or scrub shrub to ensure migratory birds would not be lost during construction, pursuant to the Migratory Bird Treaty Act. Implementation of mitigation measures would reduce project-related and construction-related effects to less than significant.

Project-related effects to special-status species (Swainson's hawk, giant garter snake, northwestern pond turtle, chinook salmon, and steelhead) would include temporary and permanent loss of habitat. Construction-related effects would include disturbance from equipment and crew and potential take of species. Mitigation for effects to special-status species would be determined through formal consultation with the

USFWS and NMFS and outlined in their Biological Opinion. Mitigation for effects to State special-status species would also be determined through formal consultation with the California Department of Fish and Game. Adherence to the mitigation measures outlined by the resource agencies would reduce the effects on special-status species to less than significant.

Appendix I of the Draft EIS/EIR includes a Habitat Mitigation Alternatives Analysis that considers alternative sites and measures to provide mitigation of project effects for both endangered species and general habitat. A habitat mitigation alternatives analysis was performed, rather than an incremental cost analysis, because it is expected that nearly all the general habitat impacts will be offset by the non-discretionary incidental take conditions resulting from formal consultations for endangered species, or by project design features. Only minimal additional measures would be required to fully mitigate the remaining general habitat impacts as recommended by USFWS. Therefore, a habitat mitigation alternative analysis was performed to identify the least-cost mitigation plan that would effectively meet both the anticipated incidental take conditions and the minor remaining general habitat mitigation recommendations. The extent to which the beneficial habitat features of the LCCFB offset its adverse impacts was considered in the analysis. The overall conclusion of the mitigation alternatives analysis is that the least cost mitigation plan would be to purchase credits at a mitigation bank to compensate for the project's net adverse effects.

Increased flooding may occur at cultural resource sites between the creek and the LCCFB, affecting the quality of the resource. Mitigation measures would be developed in consultation with the State Historic Preservation Officer and could include floodproofing some structures. If previously unidentified cultural materials and/or features are discovered during construction, all work in the immediate area would cease, and a cultural resources specialist would be immediately contacted for identification and evaluation. Additionally, if human remains are encountered, a cultural resources specialist and county coroner would be contacted in compliance with State law. Adherence to these mitigation measures would reduce potentially significant effects on cultural resources to less than significant.

The LCCFB Plan would have effects on esthetic and visual resources. The LCCFB would create a linear feature and a view block to residents. The LCCFB would be reseeded with grasses and forbs; however, this would not reduce the overall effect to a less-than-significant level.

COSTS

Construction, environmental, and real estate costs for the LCCFB Plan are shown in Tables 6-3A and 3B. The cost reflects design flows of 70,000 cfs and 78,000 cfs, respectively. The costs for the full range of design flow options are discussed below under the heading "Comparison of Plans."

Table 6-3A. Total Project Cost Summary for the LCCFB Plan, 70,000 cfs Design Flow

Feature		Cost[1] $1,000
Construction Costs (excludes environmental mitigation costs)[2]		23,028
Environmental Mitigation		
Trees		159
Scrub Shrub		2
Elderberry		0
Shaded Riparian Aquatic Habitat		0
Giant Garter Snake Habitat		1,192
	Subtotal	1,353
	+18% Contingency	**1,597**
Real Estate		
Levee Footprint (Flood Protection Levee Easement)		807
Ponding Area (Permanent Flowage Easement)[5]		2,265
Constructions Easements (Temporary Work Area Easements)		55
Environmental (Fee Title)[4]		0
Channel Improvements (Channel Improvement Easement)		0
Roads (Roads and Road Easements)		12
Borrow Area (Borrow Easement)		0
Structures		50
Severance		319
Contingencies (25%)		1,754
Relocation Costs		23
Non-Federal Administrative Costs		2,765
Federal Administrative Review Costs		529
	Subtotal	8,577
Equipment		1,200
Cultural, Engineering and Construction Mgmt @ 21.5%		5,294
Total First Costs [3]		**39,697**
Interest During Construction		**2,701**
TOTAL INVESTMENT COST		**42,398**

[1]Includes a contingency, construction 20 percent, real estate 25 percent, and environmental 25 percent.
[2]For the 70,000 cfs design flow plan.
[3]Maintenance of the existing levees is not included.
[4]Not available at printing. Expected to be a relatively small cost.
[5]Includes some areas with a temporary work easement.

Table 6-3B. Total Project Cost Summary for the LCCFB Plan, 78,000 cfs Design Flow

Feature		Cost[1] $1,000
Construction Costs (excludes environmental mitigation costs)[2]		24,079
Environmental Mitigation		
Trees		159
Scrub Shrub		2
Elderberry		0
Shaded Riparian Aquatic Habitat		0
Giant Garter Snake Habitat		1,192
	Subtotal	1,353
	+18% Contingency	**1,597**
Real Estate		
Levee Footprint (Flood Protection Levee Easement)		807
Ponding Area (Permanent Flowage Easement)[5]		2,265
Constructions Easements (Temporary Work Area Easements)		55
Environmental (Fee Title)[4]		0
Channel Improvements (Channel Improvement Easement)		0
Roads (Roads and Road Easements)		12
Borrow Area (Borrow Easement)		0
Structures		50
Severance		319
Contingencies (25%)		1,754
Relocation Costs		23
Non-Federal Administrative Costs		2,765
Federal Administrative Review Costs		529
	Subtotal	8,577
Equipment		1,200
Cultural, Engineering and Construction Mgmt @ 21.5%		5,520
Total First Costs [3]		**40,973**
Interest During Construction		**2,787**
TOTAL INVESTMENT COST		**43,760**

[1]Includes a contingency, construction 20 percent, real estate 25 percent, and environmental 25 percent.
[2]For the 78,000 cfs design flow plan.
[3]Maintenance of the existing levees is not included.
[4]Not available at printing. Expected to be a relatively small cost.
[5]Includes some areas with a temporary work easement.

EVALUATION OF SETBACK LEVEE PLANS

DESCRIPTION OF NARROW SETBACK LEVEE PLAN

The preliminary Setback Levee Plan was modified and developed into the Narrow Setback Levee (NSL) Plan. The NSL Plan was developed to minimize effects to landowners and agricultural operations along Cache Creek while still satisfying engineering design requirements. The plan was also developed to maximize the use of existing project facilities levees where possible.

The primary objective of the NSL Plan was to avoid houses and farm support structures (Figure 6-11 and Plate 18). The secondary objective of the NSL Plan was to reduce channel velocities, minimize the need for rock slope protection measures, and minimize hydraulic effects to the existing bridges.

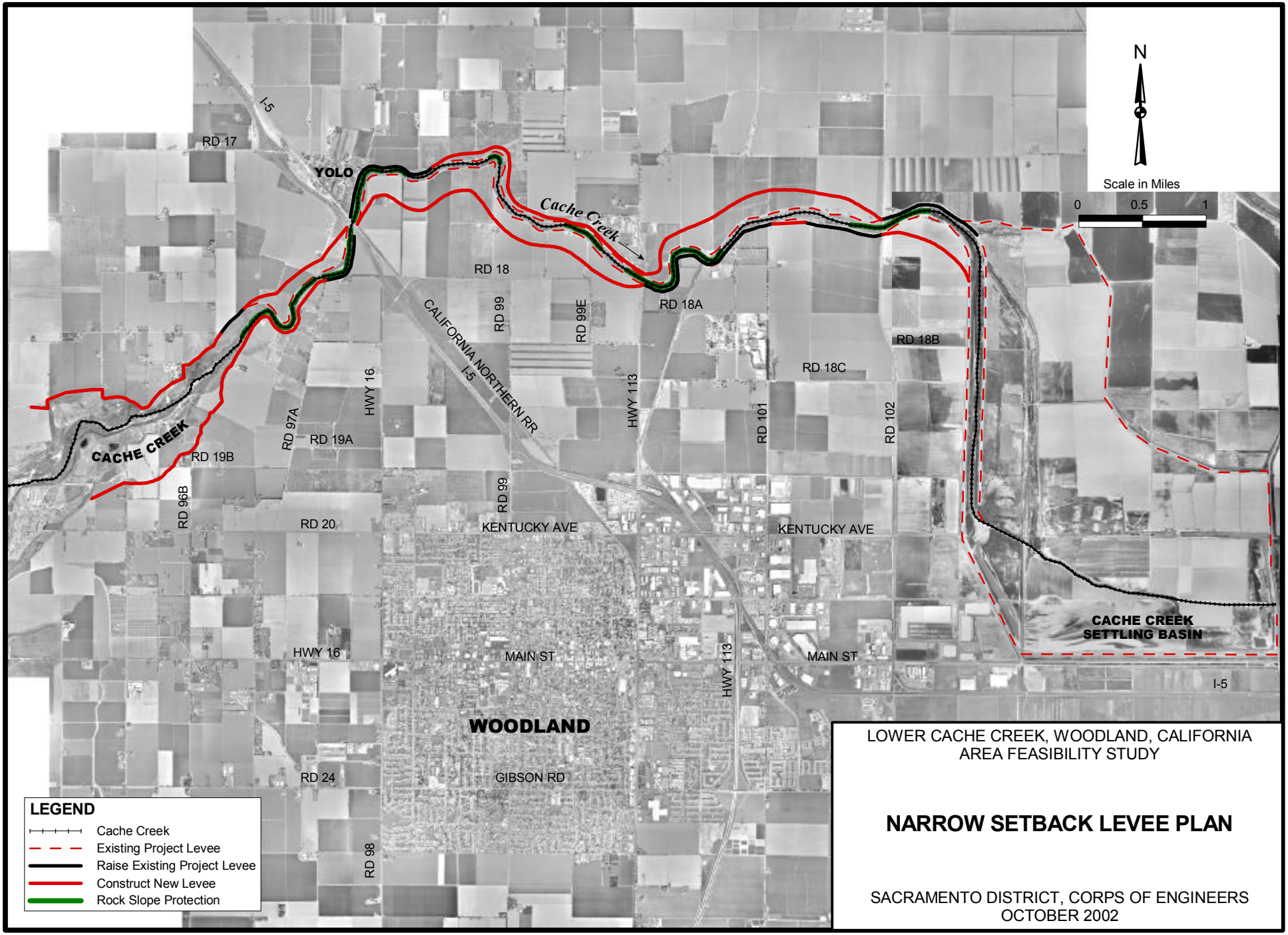
The plan was designed to protect against bank erosion and channel instability of the creek. Traditional methods of slope/erosion protection such as riprap and gabions were used to protect those bank areas subject to scouring velocities under current condition and to protect areas with bank erosion and instability problems at the existing bridges.

The NSL Plan was analyzed in detail for the three design flow rates of 50,000 cfs, 70,000 cfs, and 90,000 cfs. Other design flows of interest were also analyzed based on these more detailed analyses. This flow range provided the basis to determine the economic feasibility of the plan and to optimize the net benefits.

PHYSICAL FEATURES

The major feature of the NSL Plan would involve the construction of about 19 miles of new setback levees and modifications to the existing levees on Cache Creek. The levee system would extend from the settling basin inlet to high ground near CR 94B. Levee design, construction, and use of portions of the existing levee system would vary between the right (southern) and left (northern) levees. Typical cross sections of setback levees are shown on Figures 6-12 to 6-15, and representative modified cross sections are given on Figure 6-16.

Design levee profiles and other project features were developed based for flow rates of 50,000 cfs, 70,000 cfs, and 90,000 cfs. Maximum levee heights for levees upstream from CR 102 would be approximately 12, 15, and 16 feet for the 50,000 cfs, 70,000 cfs, and 90,000 cfs flows, respectively. Downstream from CR 102, finished levee heights would have a maximum height of approximately 18 feet for all design levels.

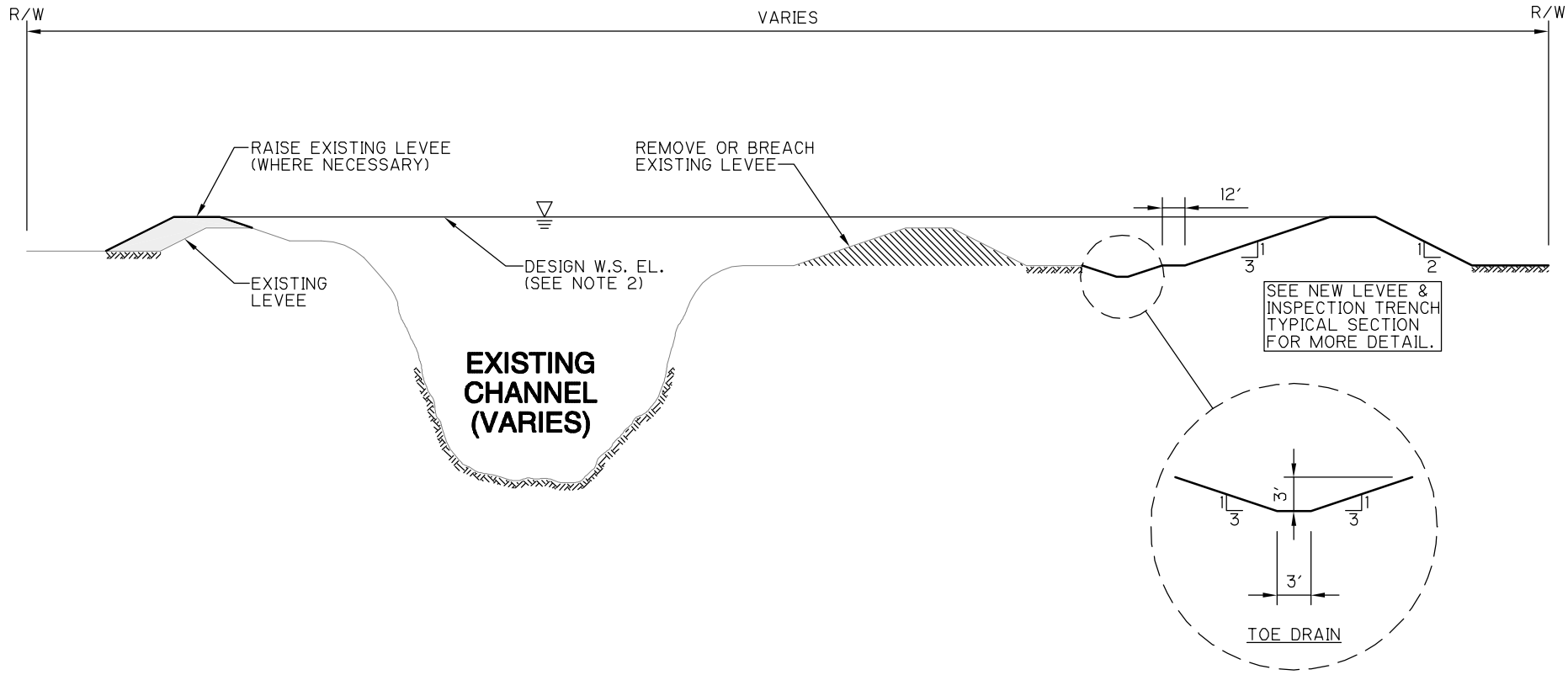


LOWER CACHE CREEK, WOODLAND, CALIFORNIA
AREA FEASIBILITY STUDY

NARROW SETBACK LEVEE PLAN

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
OCTOBER 2002

FIGURE 6-11



SETBACK LEVEE

NOT TO SCALE

NOTES

1. SLOPE PROTECTION IS REQUIRED ALONG REACHES WITH VELOCITIES GREATER THAN EXISTING-CONDITIONS VELOCITIES FOR TOP-OF-LEVEE FLOWS.

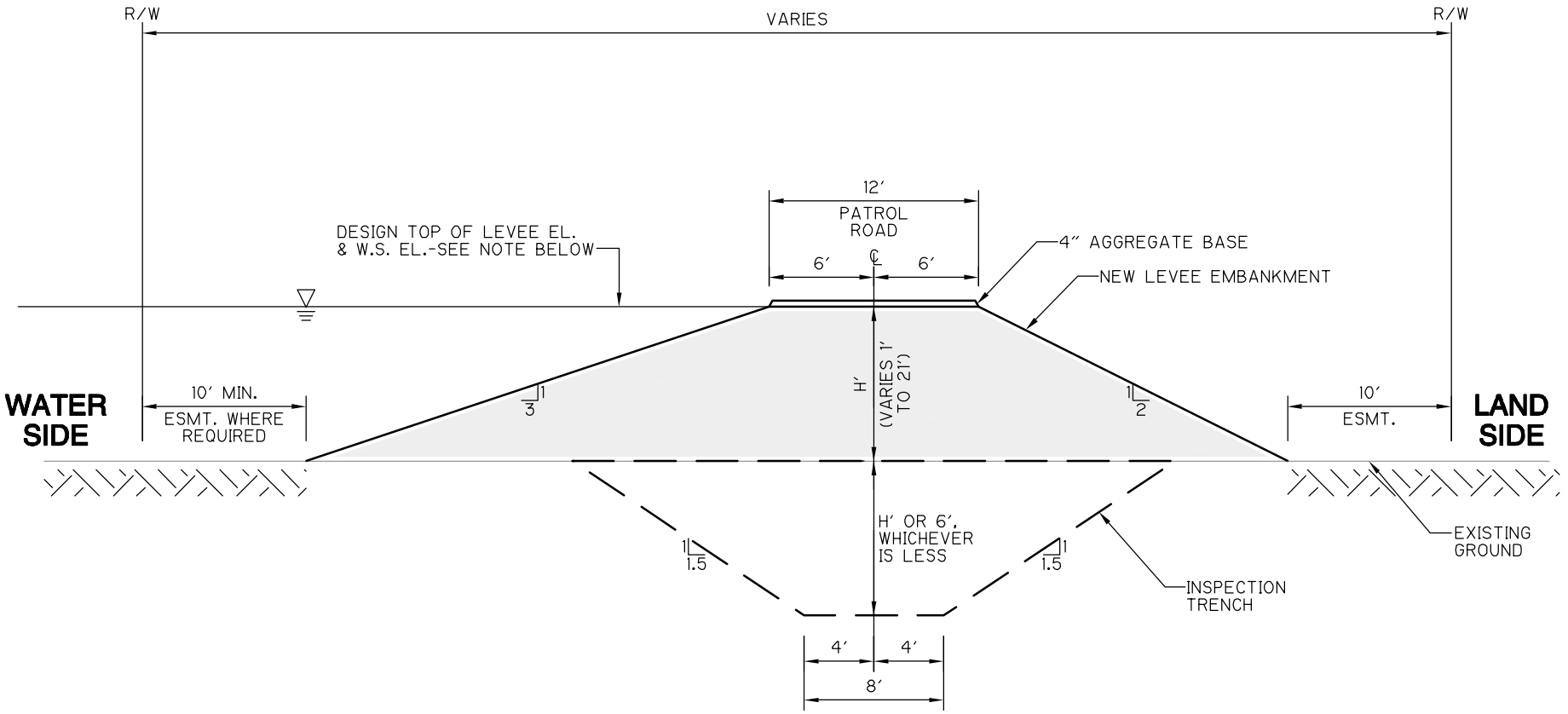
2. REFLECTS A RISK AND UNCERTAINTY APPROACH TO DESIGN.

LOWER CACHE CREEK, WOODLAND,
CALIFORNIA, AREA FEASIBILITY STUDY

TYPICAL SECTION
SETBACK LEVEE

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
OCTOBER 2002

FIGURE 6-12



NEW LEVEE & INSPECTION TRENCH

NOT TO SCALE

NOTE

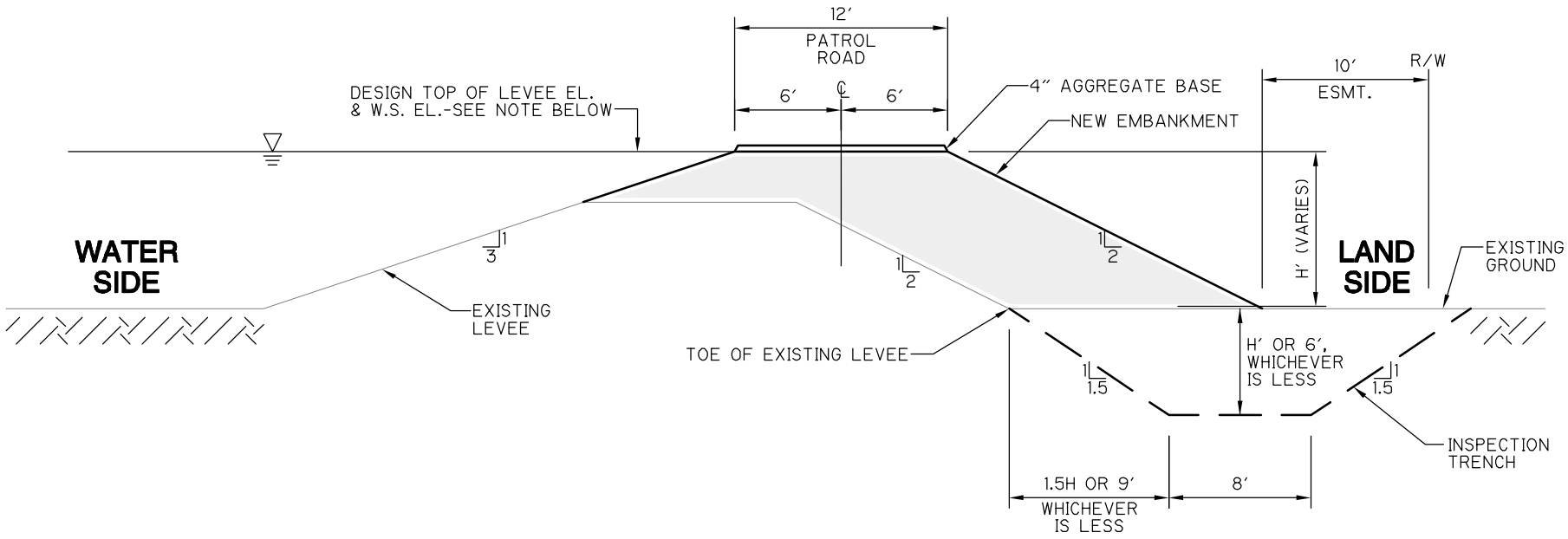
REFLECTS A RISK AND UNCERTAINTY APPROACH TO DESIGN.

LOWER CACHE CREEK, WOODLAND, CALIFORNIA, AREA FEASIBILITY STUDY

TYPICAL SECTION NEW LEVEE AND INSPECTION TRENCH

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
OCTOBER 2002

FIGURE 6-13



RAISED LEVEE & INSPECTION TRENCH

NOT TO SCALE

NOTE

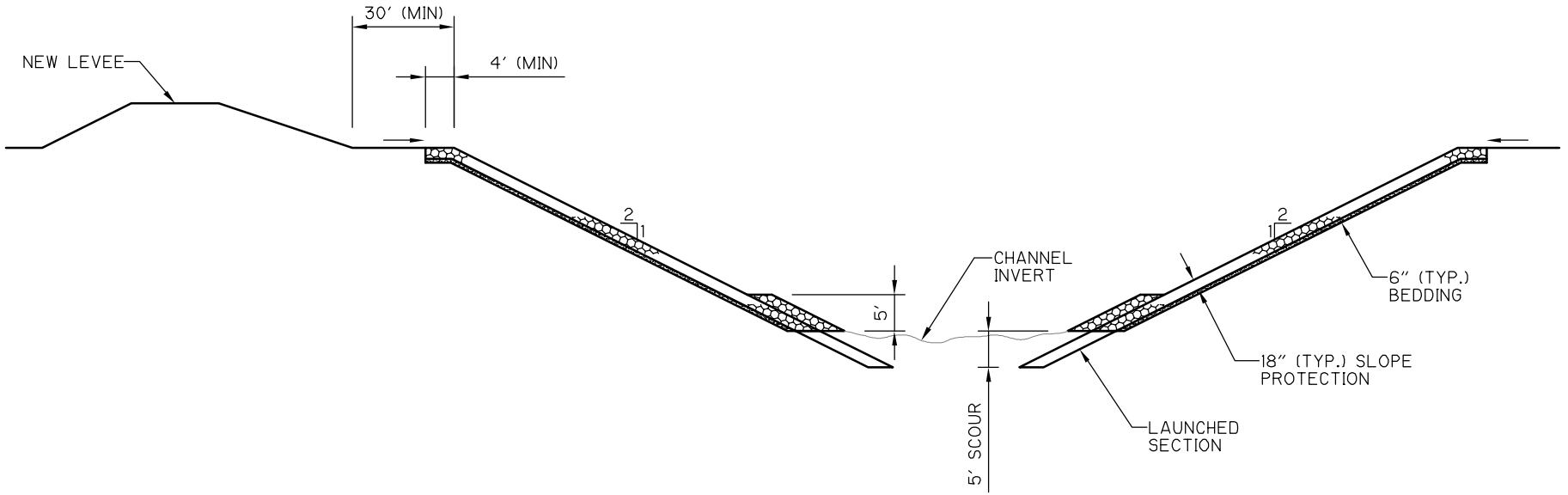
REFLECTS A RISK AND UNCERTAINTY APPROACH TO DESIGN.

LOWER CACHE CREEK, WOODLAND, CALIFORNIA, AREA FEASIBILITY STUDY

TYPICAL SECTION RAISED LEVEE AND INSPECTION TRENCH

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
OCTOBER 2002

FIGURE 6-14



NOTE

1. SET RIPRAP SLOPE PROTECTION ON A MINIMUM CHANNEL SIDE SLOPE OF 2H:1V.

2. THE EXTENT OF RIPRAP SLOPE PROTECTION WOULD BE PROVIDED UP TO THE DESIGN TOP OF LEVEE AT PREDETERMINED UPSTREAM AND DOWNSTREAM REACHES OF THE BRIDGES AT I-5, SH 113, AND CR 102.

SETBACK LEVEE WITH
SLOPE PROTECTION

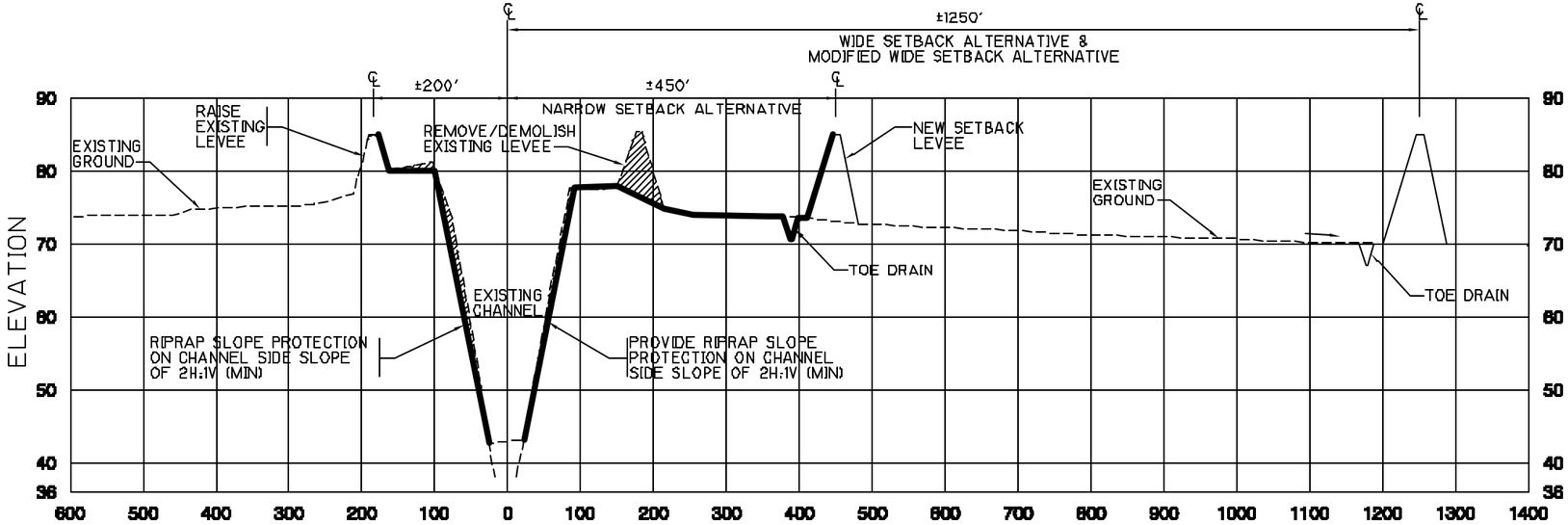
NOT TO SCALE

LOWER CACHE CREEK, WOODLAND,
CALIFORNIA, AREA FEASIBILITY STUDY

TYPICAL SECTION
SETBACK LEVEE WITH
SLOPE PROTECTION

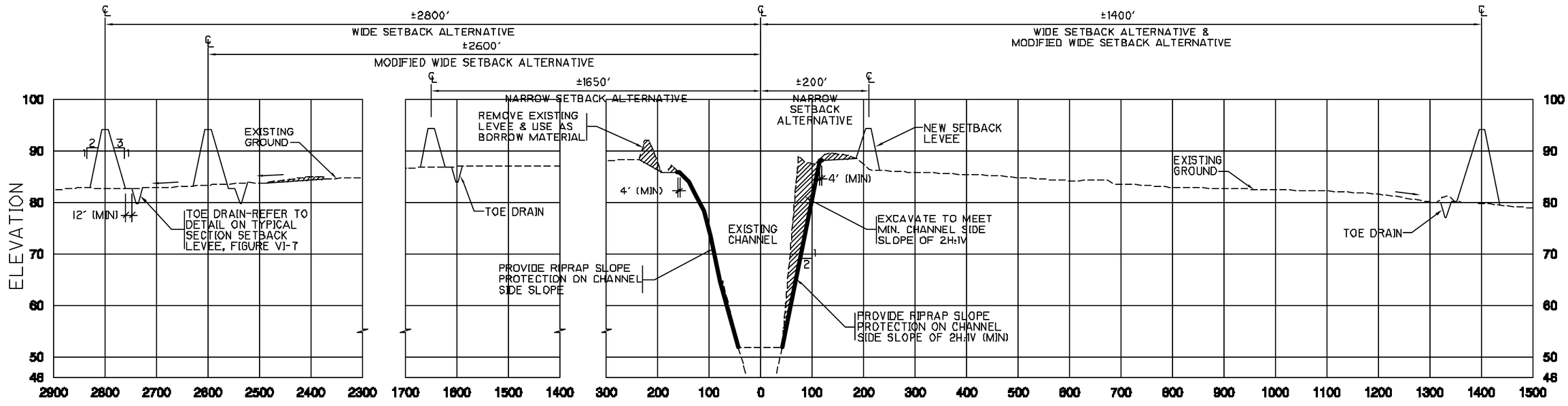
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
OCTOBER 2002

FIGURE 6-15



MODIFIED CROSS SECTION
APPROX. 400' DOWNSTREAM OF BRIDGE I-5

NOTE
USE THIS DRAWING IN CONJUCTION WITH THE TYPICAL SECTIONS SHOWN ON FIGURES 6-7, 6-8, 6-9, AND 6-10, IN SECTION 6.



MODIFIED CROSS SECTION
AT U-BEND CHANNEL MEANDER REACH,
APPROX. 5600' UPSTREAM OF BRIDGE I-5

VERT.
10 0 20

HORIZ.
100 0 200

LOWER CACHE CREEK, WOODLAND, CALIFORNIA
AREA FEASIBILITY STUDY

REPRESENTATIVE MODIFIED CROSS SECTIONS FOR THE SETBACK LEVEE PLANS

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SEPTEMBER 2002

FIGURE 6-16

Existing levees that are incorporated into the 50,000 cfs NSL Plan would meet or exceed the design water-surface elevations and would not need to be raised. The existing levee system for the 70,000 cfs plan would need to be raised approximately 2 feet and for the 90,000 cfs design approximately 4.5 feet.

The placement of the new setback levees is in general 500 feet north and south of the creek centerline to minimize existing and future channel instability problems. Exceptions to this generalization are made at major structures, at significant topographical features, and to reduce channel velocities and the need for slope protection. In the vicinity of bridges, levees were aligned to match existing bridge openings.

A toe drain along the waterside levee toe of a newly constructed setback levee would be provided to drain the area between the creek and the levee, as shown on Figure 6-12.

Other major features of this plan include 28,500 feet of slope protection, 10,000 feet of slurry wall, and 4,000 feet of sheet piling (Plate 18). These features were included where high velocities were unavoidable, where erosion problems are known to exist, and where structures are located adjacent to the existing levee. Most of the slope protection would consist of stone revetment and gabion structures along the channel banks. A total of 700 linear feet of concrete lining would be provided through the bridges. Because geotechnical investigations have not been completed, a 40-foot slurry wall was assumed necessary for 15 percent of the total length of levees (10,600 feet). In areas with space constraints, levees would be raised with about 3,600 and 4,200 feet of sheet pile for the 70,000- and 90,000 cfs designs, respectively.

None of the existing bridges would need to be replaced for design capacities less than 70,000 cfs. The SH 113 and CF 102 bridges would need to be replaced and lengthened for design flows greater than 71,000 cfs. The railroad bridge would need to be replaced at design flows of 78,000 cfs and greater. All of the bridges, I-5 North, I-5 South, CR 99W, and California Northern Railroad, would need to be replaced and/or lengthened for the 90,000 cfs design flow.

The 70,000 and 90,000 cfs design flows include demolition of the settling basin training levee because the training levee was designed for 30,000 cfs with 2 feet of freeboard. Also, the increased design flow would cause backwater on the CR 102 bridge, requiring the bridge to be replaced. For the 90,000 cfs design, the settling basin levees would be raised a maximum of 0.9 foot.

Real estate requirements for the NSL Plan would be based on the footprint of the levee and toe drain, plus 20 feet for maintenance access (Figure 6-13). A flowage easement would be required on all lands between the levees. In addition, a temporary 40-foot-wide construction easement and a 40-foot-wide drainage easement would be

necessary on the waterside of the levee. The temporary construction easement would be acquired for the duration of the construction contracts.

ACCOMPLISHMENTS OF PLAN

The main benefit of the NSL Plan is the reduced frequency of flooding from Cache Creek to Woodland. In contrast to the LCCFB Plan, this plan would also have the benefit of decreasing the frequency of flooding to lands within the county both north and south of the creek. Flooding of major interstate and State transportation routes would also be reduced.

The NSL Plan minimizes the costs of real estate because least amount of land is required. However, this plan requires extensive environmental mitigation due to slope protection required to protect existing bridges and structures.

HYDRAULIC MITIGATION

The hydraulic effects of the NSL Plan are project-induced increases in flood risk in adjacent, upstream, or downstream areas. The hydraulic effects of all the setback levee plans were evaluated for the peak floodflows of approximately 50,000 cfs, 70,000 cfs, and 90,000 cfs.

Properties on the landside of the setback levees would be protected from flooding up to the design flow. Properties on the waterside of the new levees (between the existing levees and setback levees) that are currently protected from flood events with a 1 in 10 chance in any given year would be inundated by less frequent storm events. However, the increase in flooding frequency of the affected areas would be compensated with a flowage easement.

Hydraulic effects upstream from the study area may need to be mitigated. The water-surface elevations for the peak floodflows of 50,000 cfs, 70,000 cfs, and 90,000 cfs increase from 0.4 foot to 2.3 feet just downstream from the CR 94B bridge (upstream end of the project) compared to existing conditions. These increases in water-surface elevations would cause water-surface elevations upstream from the bridge to increase as well. These effects have not been evaluated and may not increase flooding because of the large conveyance capacity upstream. These effects will need to be evaluated further if the setback levee plan is selected. Costs have been included in the real estate plan to acquire flowage easements on affected areas between the levees downstream from CR 94B.

Hydraulic effects downstream from the study area were also evaluated. The existing Cache Creek levee system was designed to contain flows of up to 30,000 cfs with 3 feet of freeboard and could potentially convey flows as great as 35,000 cfs within the existing levees. Under this existing system, flows that exceed the design flow result in a risk of levee failure and flooding in the surrounding area. Under these existing

conditions, large floodflows (greater than the existing design flow) that cause levee failures, only about 25,000 cfs will be contained within Cache Creek and reach the settling basin. Under post-project conditions of this plan, flows reaching the settling basin would be substantially increased. These increased floodflows at the settling basin would cause increased water-surface elevations ranging from 1.5 feet to 3.4 feet. (See Appendix D for further information.) Consequently, at the 90,000 cfs design peak flow, the settling basin levees would need to be raised approximately 1 foot.

The NSL Plan could potentially affect the lifespan of the settling basin by containing flows up to the new design flow (greater than the existing design flow of 30,000 cfs). These higher flows would be conveyed directly into the settling basin, resulting in a higher sediment load for the storm event as compared with the existing levee system that would fail and allow overflow of sediment-laden flow onto adjacent farmland. Because the chance of these high flows is relatively low, this impact would likely not be significant when considering the 50-year lifetime of the settling basin. In terms of scour, the results from the geomorphology study indicated that the 1 in 200 chance storm would not increase the velocities to the point that significant scour would be observed.

For design flows of 70,000 cfs and higher, the training levee would need to be removed because it was only designed for 30,000 cfs with 2 feet of freeboard and because the increased design flow rates would cause backwater on the CR 102 bridge, requiring the bridge to be replaced. One of the purposes of the training levee is to maintain flow velocities near the inlet of the settling basin and to prevent premature deposition of sediments and clogging near the inlet. Also, the training levee and its incremental removal helps to direct the deposition in the basin. During the planning, engineering, and design phase, the effects of the project to these functions would be analyzed, and potential modifications and/or operation and maintenance requirements would be determined to address any effects.

An analysis was also performed to determine whether the increase in peak flows exiting the settling basin under the NSL Plan could potentially affect flooding in the Yolo Bypass. A peak flow coincidence analysis was performed to determine the likelihood of simultaneous peak flows in these two bodies of water (Appendix C). The analysis compares the 10 largest floods of record for the Yolo Bypass gage near the settling basin and shows that, in all 10 events, the peak flow on Cache Creek occurred 1 to 3 days prior to the peak flow in the bypass. In conclusion, the NSL Plan would result in a higher volume of water reaching the bypass over the length of a flood event, but should not cause an increase in the peak stage.

OPERATION AND MAINTENANCE

Ownership of the NSL project, once completed, would be transferred to the non-Federal sponsor. Operation, maintenance, and rehabilitation of the NSL project would be in accordance with the operation and maintenance manual to be provided by the Corps.

The Corps would have the responsibility to make certain that the non-Federal sponsor inspects, maintains, and rehabilitates the project according to this manual to provide an operational and a safe project.

ENVIRONMENTAL EFFECTS AND MITIGATION

A preliminary evaluation of the potential effects of the NSL Plan on environmental resources was conducted during the plan formulation process. Severe environmental effects associated with the plan were identified, which made the plan undesirable due to potentially high costs and extensive mitigation requirements. As a result, further environmental analysis on the NSL Plan was discontinued, and the setback levee plan was modified to reflect these results as discussed below.

Based on the preliminary environmental studies, resources not affected by the NSL Plan are climate; topography; geology; soils; recreation; hazardous, toxic, and radiological waste; public health vectors and vector control; and fisheries. The potentially affected resources include social and economic resources, land use, agriculture, prime and unique farmlands, transportation, noise, air quality, water quality, sedimentation and the settling basin, vegetation and wildlife, special-status species, cultural resources, and esthetic and visual resources. At the time that the NSL Plan was eliminated, analysis had been completed on the following resource categories: social and economic resources, land use, prime and unique farmlands, and special-status species. The potential effects, preliminary mitigation, and significance for these resources are summarized below.

Social and economic resources would be affected due to the relocation of 10 residences and farm support structures. Agricultural landowners would be compensated for land value effects/takings, and the homeowners would be compensated for the land and home values. Implementation of these mitigation measures would reduce the potentially significant effect to less than significant.

Land use effects of the NSL Plan would be the conversion of 161 acres of row crop, 62 acres of orchard, 123 acres of riparian, and 22 acres of agricultural support lands for flood damage reduction purposes. There is a potential conversion of an additional 1,487 acres confined by the levees. This effect represents an incompatible land use change and is a significant effect that cannot be mitigated.

Effects of prime and unique farmland due to the NSL Plan would be a loss of 223 acres of prime farmland. A total of 718 acres of prime farmland confined by the levee system has the potential of conversion due to indirect effects (inability to farm due to size, accessibility, or other factors). The acreage of prime farmland converted cannot be mitigated since the qualities that distinguish prime farmland cannot be re-created. The conversion of prime farmland represents a significant effect.

The use of rock slope protection and grading of the stream channel would cause permanent habitat loss including shaded riverine aquatic (SRA) habitat. The loss of SRA habitat would likely not be possible to mitigate due to the extent of required mitigation, 20.23 miles of SRA habitat. In-channel construction would also reduce habitat for the bank swallow, giant garter snake, northwestern pond turtle, chinook salmon, and steelhead, including designated critical habitat for the steelhead. The loss of bank swallow habitat cannot be mitigated due to the difficulty in purchasing and/or re-creating such habitat. Mitigation for the loss of snake, turtle, salmon, and steelhead habitats would be required. The overall effect on special-status species would be significant.

Onsite surveys of elderberry shrubs were conducted near road-levee intersections, where the greatest number of effects would be expected. These surveys indicated large numbers of plants with valley elderberry longhorn beetle presence. Mitigation would include transplanting shrubs with beetle presence and planting additional shrubs (approximately 286 transplanted elderberry clumps and 27,408 planted elderberry seedlings). Based on preliminary estimates, including the purchase of new plants and transporting existing plants, these mitigation measures would cost approximately $7 million.

COSTS

Construction, environmental, and real estate costs for the NSL Plan are shown in Table 6-4. The costs are for the 78,000 cfs design flow option. The costs for the full range of design flow options are discussed below under the heading “Comparison of Plans.”

Table 6-4. Total Project Cost Summary for the Narrow Setback Levee Plan, 78,000 cfs Design Flow

Feature		Cost[1] $1,000
Construction Costs (excludes environmental mitigation costs)[2]		51,819
Environmental Mitigation		
Scrub		0
Orchard		5,300
Native Trees		0
Nonnative Trees		0
Riparian		4,700
Emergent Marsh		0
Upland/Agricultural Land		0
Shaded Riparian Aquatic		10,700
Elderberry		7,100
	Subtotal	27,800
	+25% Contingency	**34,800**
Real Estate[1]		
Levee Footprint (Flood Protection Levee Easement)		1,209
Flowway Between Levees (Permanent Flowage Easement)[3]		8,374
Constructions Easements (Temporary Work Area Easements)		683
Environmental (Fee Title)		0
Channel Improvements (Channel Improvement Easement)		191
Roads (Roads and Road Easements)		9
Borrow Area (Borrow Easement)		677
Structures		742
Severance		1,191
Contingencies (25%)		3,274
Relocation Costs		225
Non-Federal Administrative Costs		7,513
Federal Administrative Review Costs		1,377
	Subtotal	25,485
Cultural, Engineering, and Construction Mgmt @ 21.5%		18,623
Total First Costs		**130,727**
Interest During Construction		**8,893**
TOTAL INVESTMENT COST		**139,620**

[1]Includes a contingency, construction 20 percent, real estate 25 percent, and environmental 25 percent.
[2]For the 78,000 cfs design flow plan.
[3]Includes some areas with a temporary work easement.

DESCRIPTION OF WIDE SETBACK LEVEE PLAN

In contrast to the NSL Plan, where rock slope protection was required to preserve the stability of the system, the objective of the Wide Setback Levee (WSL) Plan was to further reduce environmental effects (compared to the NSL Plan) by reducing the amount of rock slope protection (Figure 6-17 and Plate 19). A second objective was to avoid affecting and replacing existing bridges. This objective was determined to be feasible only if rock slope protection could be used upstream and downstream from the bridges.

The WSL Plan was designed without any engineered rock slope protection except to protect the existing bridges. Without rock slope protection and with excessive channel velocities, channel migration would continue and most likely increase. This migration of the channel could eventually encroach into the levee prism and cause failure. To protect against this occurrence, the alignments of the levees of the WSL Plan was set 1.5 times as wide as the meander of the existing channel. Minimizing the taking of homes and land was not a primary objective in the selection of the levee alignment.

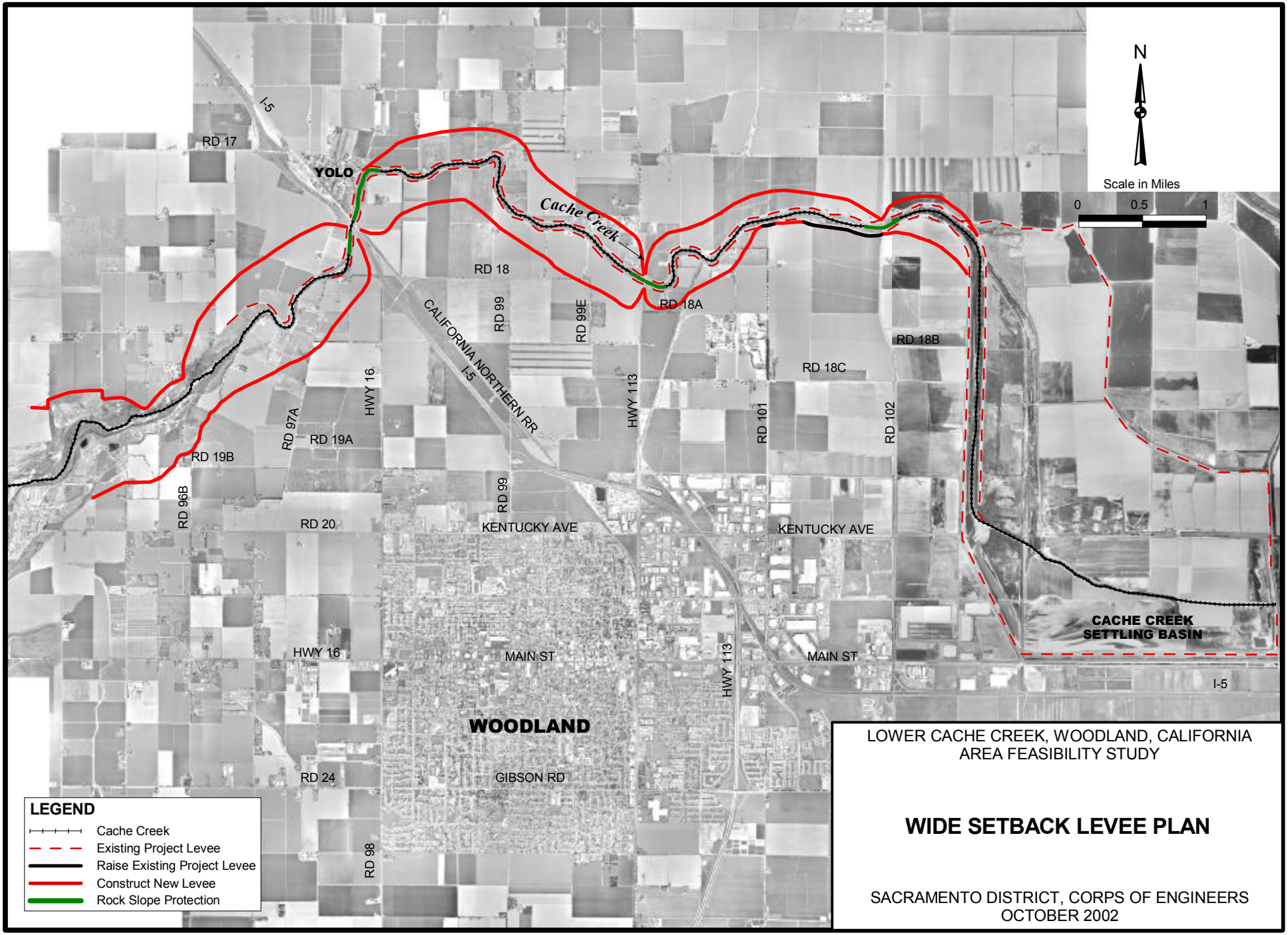
The WSL Plan was also analyzed in detail for three design flow rates of 50,000 cfs, 70,000 cfs, and 90,000 cfs. Other design flows of interest were also analyzed based on these three more detailed analyses. This flow range provided the basis to determine the size of the project that would optimize net benefits.

PHYSICAL FEATURES

Many of the features of the WSL Plan are similar to those features of the NSL Plan. The major features of the WSL Plan are described below. For other features, refer to the section under the heading “Physical Features” under the description of the NSL Plan.

The major feature of the WSL Plan is the construction of about 19 miles of levees consisting of a combination of new setback levees and the modifications to the existing levees on Cache Creek. The levees would extend from the settling basin inlet to high ground near CR 94B. Levee design, construction, and use of portions of the existing flood damage reduction system would vary between the right (southern) and left (northern) banks of Cache Creek. Typical cross sections of setback levees are shown on Figures 6-12 to 6-15, and representative modified cross sections are shown on Figure 6-16.

Flow rates of 50,000 cfs, 70,000 cfs, and 90,000 cfs were analyzed for optimization of the project. Design levee profiles and other project features were developed based on these three flow rates. Maximum levee heights would be approximately 18 feet for 50,000 cfs and 70,000 cfs flows and 21 feet for 90,000 cfs



LOWER CACHE CREEK, WOODLAND, CALIFORNIA
AREA FEASIBILITY STUDY

WIDE SETBACK LEVEE PLAN

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
OCTOBER 2002

FIGURE 6-17

flows. A portion of the right existing levee between SH 113 and CR 102 would need to be raised 2 feet for the 70,000 cfs flow and 3 feet for the 90,000 cfs flow. The 50,000 cfs flow requires a small segment only 500 feet long to be raised 3 feet between SH 113 and CR 102.

The placement of the levees of the WSL Plan west of I-5 is in general 1,000 to 1,500 feet north and south of the creek centerline, except at the bridges. East of I-5, the setback levees would both incorporate same existing levees and be closer to the creek. The levees pinch in at the vicinity of the bridges to match bridge openings. This configuration protects the roadways and bridges from flooding during most storm events. However, the 90,000 cfs design requires the replacement of CR 102, SH 113, and I-5 southbound bridges. For all three design flows, the channels would be concrete-lined under the bridges, and rock slope protection would be provided both upstream and downstream from these bridges to provide protection. To accommodate the rock slope protection, channel slopes steeper than 2H:1V would be cleared and regraded to a slope of 2H:1V. In some areas, this would be a combination of both excavation and embankment fill or rock fills.

Real estate requirements for the WSL Plan would be based on the footprint of the levee and toe drain, plus 20 feet for maintenance access (Figure 6-13). A flowage easement would be required on all lands between the footprints of the levees. In addition, a temporary 40-foot-wide construction easement and a 40-foot-wide drainage easement would be necessary on the waterside of the levee. The temporary construction easement would be acquired for the duration of the construction contracts.

ACCOMPLISHMENTS OF PLANS

The main benefit of the WSL Plan is the reduced chance of flooding in Woodland. In contrast to the LCCFB Plan, this plan would also have the benefit of decreasing the frequency of flooding to the land within the county both north and south of the creek. Flooding of major interstate and State transportation routes would also be reduced.

Compared to the NSL Plan, the amount of rock slope protection required for the WSL Plan is reduced, decreasing the amount of required streambank mitigation. However, the wide setback option would increase the real estate costs, entailing the taking of a much greater amount of agricultural land and residences.

HYDRAULIC MITIGATION

The hydraulic effects of the WSL Plan are project-induced increases in flood risk in adjacent, upstream, or downstream areas. The hydraulic effects of all the setback levee plans were evaluated for the peak floodflows of approximately 50,000 cfs, 70,000 cfs, and 90,000 cfs.

Properties on the landside of the setback levees would be protected from flooding up to the design flows, but those properties on the waterside of the new levees (between the existing levees and setback levees) that are currently protected from a 1 in 10 chance flood would be inundated by more frequent flooding events (1 in 2 annual chance of occurrence) of these areas. The increase in flooding frequency of the affected areas would be compensated with a flowage easement.

Hydraulic effects upstream from the study area may need to be mitigated. The water-surface elevations for the peak floodflows of 50,000 cfs, 70,000 cfs, and 90,000 cfs increase from zero to 0.8 foot just downstream from the CR 94B bridge as compared to existing conditions. These increases in water-surface elevations would cause water-surface elevations upstream from the bridge to increase as well. These effects have not been evaluated and are not expected to aggravate flood conditions because of the large conveyance capacity of the channel in this area. These effects will need to be evaluated if the WSL Plan is selected.

Hydraulic effects downstream from the study area were also evaluated and are discussed in the section "Hydraulic Mitigation" under the description of the NSL Plan.

OPERATION AND MAINTENANCE

Operation and maintenance of this plan would be the same as for the NSL Plan.

ENVIRONMENTAL EFFECTS AND MITIGATION

A preliminary evaluation of the potential effects of the WSL Plan on environmental resources was conducted during the plan formulation process. Severe environmental effects associated with the plan were identified, which made the plan undesirable due to potentially high social and economic effects and extensive mitigation requirements. As a result, further environmental analysis on the WSL Plan was discontinued, and the setback levee plan was modified to reflect these results.

Based on the preliminary environmental studies, resources not affected by the WSL Plan are climate; topography; geology; soils; recreation; hazardous, toxic, and radiological waste; public health vectors and vector control; and fisheries. The potentially affected resources include social and economic resources, land use, agriculture, prime and unique farmlands, transportation, noise, air quality, water quality, sedimentation and the settling basin, vegetation and wildlife, special-status species, cultural resources, and esthetic and visual resources. At the time that the WSL Plan was eliminated, analysis had been completed on the following resource categories: social and economic resources, land use, prime and unique farmlands, and special-status species. The potential effects, preliminary mitigation, and significance for these resources are summarized below.

Social and economic resources would be affected due to the relocation of 56 residences and farm support structures. Agricultural landowners would be compensated for land value effects/takings, and the homeowners would be compensated for the land and home values. Implementation of these mitigation measures would reduce the potentially significant effect to less than significant.

Land use effects of the WSL Plan would be the conversion of 246 acres of row crop, 51 acres of orchard, 51 acres of riparian, and 27 acres of agricultural support lands for flood damage reduction purposes. There is a potential conversion of an additional 2,440 acres confined by the levees. This effect represents an incompatible land use change and is a significant effect that cannot be mitigated.

Effects of prime and unique farmland due to the setback levee would be a loss of 297 acres of prime farmland. A total of 1,539 acres of prime farmland confined by the levee system has the potential of conversion due to indirect effects (inability to farm due to size, accessibility, or other factors). The acreage of prime farmland converted cannot be mitigated since the qualities that distinguish prime farmland cannot be re-created. The conversion of prime farmland represents a significant effect.

The use of rock slope protection and grading of the stream channel would cause permanent habitat loss including shaded riverine aquatic (SRA) habitat. Although the loss of SRA is substantially less than for the NSL Plan, the amount required for mitigation, 5.83 miles, may be difficult to mitigate. There would be no effects to bank swallows under the WSL Plan due to the reduction in rock slope protection as compared to the NSL Plan. In-channel construction around the bridges would impact giant garter snake, northwestern pond turtle, chinook salmon, and steelhead habitat, including designated critical habitat for the steelhead. Mitigation for the loss of these habitats would be required. The overall effect on special-status species would be significant.

Onsite surveys of elderberry shrubs were conducted near road-levee intersections, where the greatest number of effects would be expected. These surveys indicated large numbers of plants with valley elderberry longhorn beetle presence. Mitigation would include transplanting shrubs with beetle presence and planting additional shrubs (approximately 123 transplanted elderberry clumps and 22,496 planted elderberry seedlings). Based on preliminary estimates including the purchase of new plants and transporting existing plants, these mitigation measures would cost approximately $5 million.

COSTS

Construction, environmental, and real estate costs for the WSL Plan are shown in Table 6-5. The costs are for the 78,000 cfs design flow option, which corresponds to the project that has approximately the highest net benefits. The costs for the full range of design flow options are discussed below under the heading “Comparison of Plans.”

Table 6-5. Total Project Cost Summary for the Wide Setback Levee Plan, 78,000 cfs Design Flow

Feature		Cost[1] $1,000
Construction Costs (excludes environmental mitigation costs)[2]		41,780
Environmental Mitigation		
Scrub		0
Orchard		4,500
Native Trees		0
Nonnative Trees		0
Riparian		3,500
Emergent Marsh		0
Upland		0
Shaded Riparian Aquatic		3,100
Elderberry		5,300
	Subtotal	16,400
	+25% Contingency	**20,500**
Real Estate[1]		
Levee Footprint (Flood Protection Levee Easement)		1,632
Flowway Between Levees (Permanent Flowage Easement)[3]		22,106
Constructions Easements (Temporary Work Area Easements)[4]		0
Environmental (Fee Title)		0
Channel Improvements (Channel Improvement Easement)		62
Roads (Roads and Road Easements)		13
Borrow Area (Borrow Easement)		677
Structures		8,344
Severance		3,283
Contingencies (25%)		9,029
Relocation Costs		1,300
Non-Federal Administrative Costs		9,503
Federal Administrative Review Costs		1,666
	Subtotal	57,612
Cultural, Engineering and Construction Mgmt @ 21.5%		13,390
Total First Costs		**133,283**
Interest During Construction		**9,067**
TOTAL INVESTMENT COST		**142,350**

[1]Includes a contingency, construction 20 percent, real estate 25 percent, and environmental 25 percent.
[2]For the 78,000 cfs design flow plan.
[3]Includes some areas with drainage, borrow, and temporary work easements.
[4]Temporary work easements coincide with the permanent flowage easement and are therefore included in the flowway between levees.

DESCRIPTION OF MODIFIED WIDE SETBACK LEVEE PLAN

Because the WSL Plan would require a significant amount of rock slope protection at the constrictions of the bridge, the Modified Wide Setback Levee (MWSL) Plan was developed to further reduce environmental effects at the bridges and, where possible, reduce the effects on homes that were near the proposed levee alignment. (See Figure 6-18 and Plate 20.)

Eliminating the need for rock slope protection near the bridge requires decreasing the high velocities and shear stresses caused by containing the design flows through the existing bridges. To accomplish this goal, the conveyance area must be increased through the bridge area.

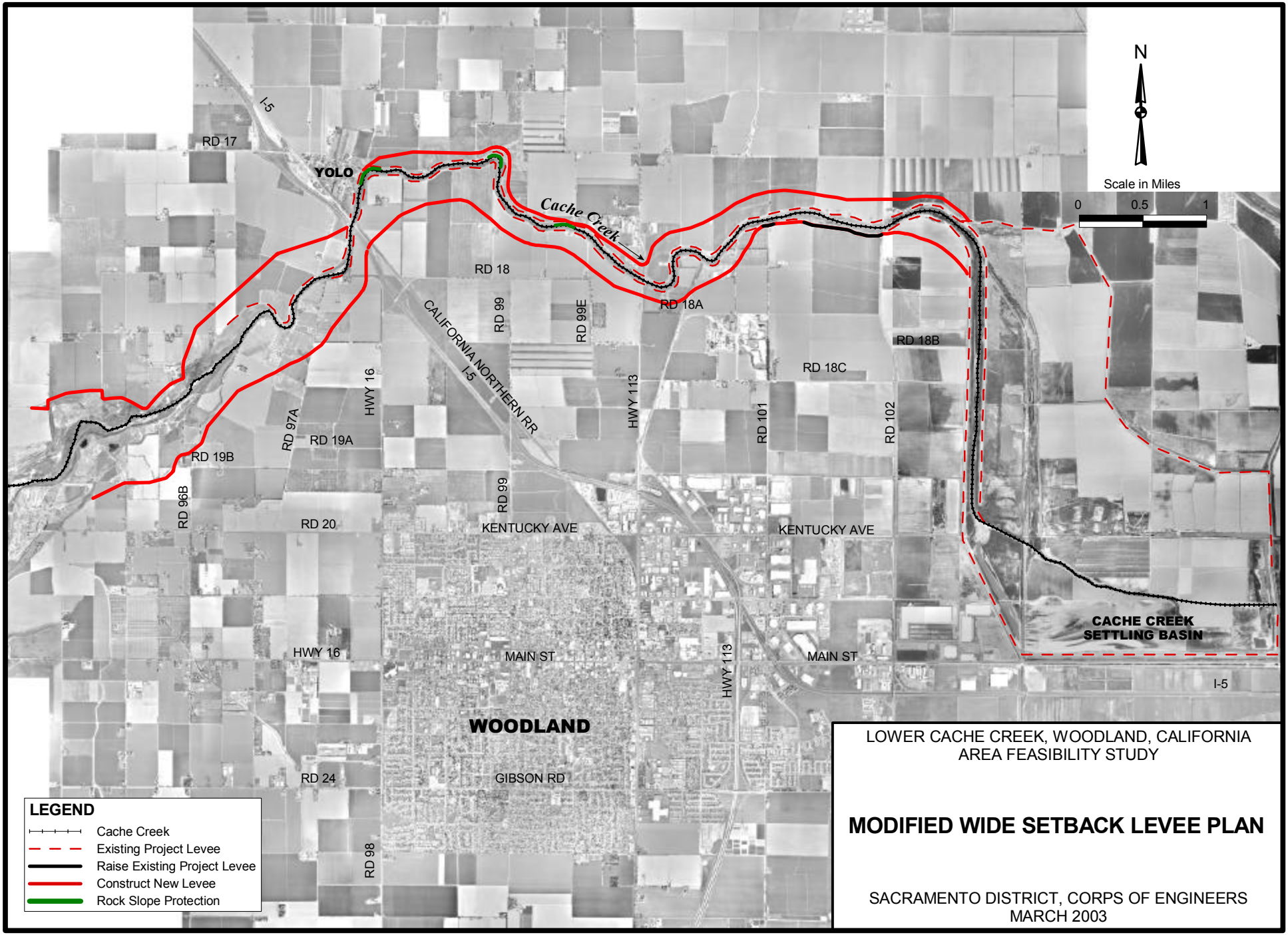
One way to increase the conveyance area is to divert some flow around the bridge opening and over the bridge approaches. This overflow could be contained by closure of the roads with closure structures. Because the existing levees would be removed and the new setbacks would tie into the road where the road ramps down, the existing approaches would need to be raised to prevent overflow of the roads by events more frequent than for existing conditions. The difference between the proposed bridge ramp elevation and the bridge soffit elevation would only be a few feet allowing for a very small hydraulic head over this overflow area. Therefore, the overflow approaches would need to be several thousand feet long to pass the high overflows and would not be practical.

Another way to increase the conveyance area of the bridge is with viaducts in the flood plain. The road in the overbank area would be raised with piles, and the overbank flow would flow under the road, like a causeway. Viaducts were incorporated into this plan.

This plan requires the modification of all the bridges (I-5 South, I-5 North, California Northern Railroad, SH 113, and CR 102) for each of the three design flows (50,000 cfs, 70,000 cfs, and 90,000 cfs), enhancing the flow capacity of the bridges with the provision of viaducts. This modification eliminates the rock slope protection that would be required at the bridges for the NSL and WSL Plans. Rock slope protection would be provided at problem locations along the left bank close to the town of Yolo. Due to the geomorphology of the stream channel configuration, riprap, gabions, and hard points would be necessary to ensure bank stability at these locations. Except for the left bank reach between I-5 and SH 113, levee alignments of this plan are similar to the WSL Plan.

PHYSICAL FEATURES

Many of the features of the MWSL Plan are similar to those features of the NSL Plan and the WSL Plan. The major features of the MWSL Plan are described below. For other



LOWER CACHE CREEK, WOODLAND, CALIFORNIA
AREA FEASIBILITY STUDY

MODIFIED WIDE SETBACK LEVEE PLAN

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
MARCH 2003

FIGURE 6-18

features, refer to the section under the heading “Physical Features” under the description of the NSL Plan.

This description of the physical features for the MWSL Plan pertains to the 78,000 cfs design flow, which corresponds to a flood damage reduction level of a 1 in 500 chance flow. The basic features for design flows of 50,000 cfs and 90,000 cfs would be similar. The plan consists of approximately 19 miles of levees. Levee improvements would begin at the west levee of the settling basin and terminate upstream near CR 94B. Levee design, construction, and use of portions of the existing levee system would vary.

Typical cross sections of setback levees are shown on Figures 6-12 to 6-15, and representative modified cross sections are shown on Figure 6-16. The maximum levee height would be approximately 18 feet. A portion of the right existing levee between SH 113 and CR 102 would need to be raised 2 feet.

In general, the proposed alignments of the levees of the MWSL Plan are similar to the WSL Plan. A major difference in levee alignments of this plan is on the north and south banks between I-5 and SH 113. These changes in the levee alignments were made to reduce the environmental mitigation associated with the location of elderberry plants and also to reduce effects to homes and farm structures. The alignments for all three setback plans and locations of surveyed elderberry plants are represented on Plate 21. Modifications to the bridges would consist of rebuilding the bridge approaches and replacing the existing embankment approaches with viaduct approaches. These viaducts would substantially increase bridge openings and flow capacity, reducing the flow velocities and eliminating the need for rock slope protection and subsequent environmental mitigation. Concrete linings would still be necessary under bridges in the main channel for erosion and scour prevention.

Although rock slope protection is reduced at the bridges, riprap and a series of gabions would be required on a small portion of the left bank downstream from I-5. Furthermore, hard points (stone fills) would be installed at the outer bend near the vicinity of the town Yolo. Due to the geomorphology of Cache Creek in these locations, bank protection would be necessary to ensure lateral channel stability. Toe drains, acting as lateral drainage channels, would also be installed on the waterside of the levees to facilitate overbank drainage. Additionally, approximately 70 percent of the existing levee system would be removed to allow water to flow back and forth from the channel and overbank area. The other 30 percent is expected to naturally degrade over time, minimizing disturbance to the nearby elderberry shrubs, substantially reducing environmental effects.

Borrow material for construction of the new levees would be developed from several sources: the removal of the training levee in the settling basin, the removal of portions of the existing Cache Creek levees, a borrow area in the northwest corner of the settling basin, and from various borrow areas located along and adjacent to the water side of the setback levees. The five potential borrow areas along the setback levee have been

tentatively selected for the purposes of preparing the Real Estate Plan and for identification of environmental effects. Construction staging areas would be located at the west end of CR 18 near the I-5/SH 16 interchange and at Highway 16 and Cache Creek. Staging areas would be located between the setback levee and the existing levee on lands being acquired as permanent flowage easements.

Real estate requirements for the MWSL Plan would be based on the footprint of the levee and toe drain, plus 20 feet for maintenance access (Figure 6-13). A flowage easement would be required on all lands between the levees. In addition, a temporary 40-foot-wide construction easement and a 40-foot-wide drainage easement would be necessary on the waterside of the levee. The temporary construction easement would be acquired for the duration of the construction contracts.

ACCOMPLISHMENTS OF PLANS

The main benefit of the MWSL Plan is the reduced flood frequency in Woodland. In contrast to the LCCFB Plan, this plan would also have the benefit of decreasing the frequency of flooding to lands within the county both north and south of the creek. Flooding of major interstate and State transportation routes would also be reduced.

Compared to both the NSL and WSL Plans, the amount of rock slope protection required for the MWSL Plan would be reduced even further, decreasing the amount of required streambank mitigation. Due to the alignment modifications from the WSL, real estate costs would be less than for the WSL Plan. However, this plan would still entail the taking of a much greater amount of agricultural land and residences than the NSL Plan. Real estate costs would be lower than the WSL Plan, yet more expensive than the NSL Plan.

HYDRAULIC MITIGATION

Properties on the landside of the setback levees would be protected from flooding up to the design flows, but those properties on the waterside of the new levees (between the existing levees and setback levees) that are currently protected from a 1 in 10 chance flood would be inundated by more frequent flood events (1 in 2 annual chance of occurrence) of these areas. The increase in flooding frequency of the affected areas would be compensated with a flowage easement.

Hydraulic effects upstream from the study area may need to be mitigated. The water-surface elevations for the peak floodflows of 50,000 cfs, 70,000 cfs, and 90,000 cfs increase from zero to 0.8 foot just downstream from the CR 94B bridge compared to existing conditions. These increases in water-surface elevations would cause water-surface elevations upstream from the bridge to increase as well. These effects have not been evaluated and may not induce flooding because of the large conveyance capacity upstream. These effects would need to be evaluated if the MWSL Plan is selected.

Hydraulic effects downstream from the study area were also evaluated and are discussed in the section "Hydraulic Mitigation" under the description of the NSL Plan.

OPERATION AND MAINTENANCE

Operation and maintenance of this plan would be the same as for the NSL Plan.

ENVIRONMENTAL EFFECTS AND MITIGATION

The potential effects of the MWSL Plan on environmental resources in the project area are evaluated in detail, and the results are presented in detail in the EIS/EIR. Potential adverse effects of the plan are identified and quantified when possible, and measures to avoid, reduce, or mitigate these effects to less than significant are presented.

Based on the results of the environmental studies, resources not affected by the MWSL Plan are climate; topography; geology; soils; recreation; hazardous, toxic, and radiological waste; public health vectors and vector control; and fisheries. The potentially affected resources include social and economic resources, land use, agriculture, prime and unique farmlands, transportation, noise, air quality, water quality, sedimentation and the settling basin, vegetation and wildlife, special-status species, cultural resources, and esthetic and visual resources. The potential effects, mitigation, and significance for these affected resources are summarized below.

Social and economic resources would be affected due to the relocation of 32 residences and up to 182 farm structures. Agricultural landowners would be compensated for land value effects/takings, and the homeowners would be compensated for the land and home values. Implementation of these mitigation measures would reduce the potentially significant effect to less than significant.

Land use effects of the MWSL Plan would be the conversion of 123 acres of row crop, 35 acres of orchard, 11 acres of riparian, and 47 acres of agricultural support lands for flood damage reduction purposes. There is a potential conversion of an additional 2,135 acres confined by the levees. This effect represents an incompatible land use change and is a significant effect that cannot be mitigated.

Effects of prime and unique farmland due to the MWSL Plan would be a loss of 158 acres of prime farmland. A total of 1,254 acres of prime farmland confined by the levee system would have the potential of conversion due to indirect effects (inability to farm due to size, accessibility, or other factors). The acreage of prime farmland converted cannot be mitigated since the qualities that distinguish prime farmland cannot be re-created. The conversion of prime farmland represents a significant effect.

Temporary direct transportation effects would include lane closure during road repair, roadway safety hazards, and an increase in traffic volume. The lead agency would

provide a traffic management plan as a mitigation measure. Additionally, contractors would use construction easements as much as feasible when hauling materials to the construction site; traffic would be rerouted when necessary to avoid construction areas; and flaggers would be stationed to slow or stop approaching vehicles to avoid conflicts with construction vehicles or equipment. With the implementation of these mitigation measures, the effects on transportation would be reduced to less than significant.

Construction-related effects on noise would consist of temporary decibel levels above the significance threshold for some sensitive receptors during construction. Construction equipment would be outfitted and maintained with noise-reduction devices such as mufflers, and construction would be limited to daytime hours. The implementation of these mitigation measures would lessen the effects, but not to a less-than-significant level.

Construction-related effects on air quality would consist of temporary increases in pollutant emissions. NOx and PM_{10} emissions would exceed the significance thresholds established by the Yolo-Solano AQMD. Sensitive receptors would also be exposed to the high levels of fugitive dust emissions. NOx mitigation measures would be incorporated into construction plans and specifications, and the lead agency would provide a dust suppression plan to lessen the effects of PM_{10}. The mitigation measures would reduce the air quality effects, but not to a less-than-significant level.

The removal of the training levee could alter the distribution of sedimentation in the settling basin. The design of the MWSL Plan would incorporate the function of the settling basin, reducing any potential effects to less than significant.

Potential project-related effects on water quality would include pollutants from construction equipment and erosion at the construction site that could temporarily degrade the water quality of local runoff during construction. The lead agency would prepare a stormwater pollution prevention plan. A portion of this plan would specifically address erosion and sediment control. The lead agency would also prepare a Hazardous Substance Control and Emergency Response Plan and would comply with all Clean Water Act requirements. In addition, appropriate best management practices and monitoring would be implemented to preserve the quality of surface runoff. Implementation of these mitigation measures would reduce the effects on water quality to less than significant.

Project-related effects on vegetation and wildlife, as determined by the USFWS in its draft Coordination Act Report (CAR), would include the loss of 174 acres of agricultural habitat, 49 acres of orchard trees, 9.01 acres of riparian habitat, and 0.69 acre of shaded riverine aquatic habitat. Mitigation for habitat loss has been outlined by the USFWS in its CAR, which is included as Appendix A with the EIS/EIR. Construction-related effects would include disturbance from equipment and crews and potential disturbance of species. Mitigation for these effects include limiting construction crews to the right-of-way and confinement of disturbance to as small an area as possible, and

conducting nest surveys prior to the removal of any trees or scrub shrub to ensure migratory birds would not be lost during construction, pursuant to the Migratory Bird Treaty Act. Implementation of mitigation measures would reduce project-related and construction-related effects to less than significant.

Project-related effects to special-status species (valley elderberry longhorn beetle, Swainson's hawk, giant garter snake, northwestern pond turtle, chinook salmon, and steelhead) would include temporary and permanent loss of habitat. Construction-related effects would include disturbance from equipment and crew and potential take of species. Mitigation for effects to special-status species would be determined through formal consultation with the USFWS and NMFS and outlined in their Biological Opinion. Mitigation for effects to State special-status species would also be determined through formal consultation with the California Department of Fish and Game. Adherence to the mitigation measures outlined by the resource agencies would reduce the effects on special-status species to less than significant.

Archeological and historic sites could be affected by levee construction, degradation of the present levee, and accelerated erosion. Mitigation measures could consist of avoidance; data recovery; and, for structures, recordation under the Historic American Buildings Survey/Historic American Engineering Recordation criteria. If previously unidentified cultural materials and/or features are discovered during construction, all work in the immediate area would cease, and a cultural resources specialist would be immediately contacted for identification and evaluation. Additionally, if human remains are encountered, a cultural resources specialist and county coroner would be contacted in compliance with State law. Adherence to these mitigation measures would reduce potentially significant effects on cultural resources to less than significant.

The MWSL Plan would have effects on esthetic and visual resources. The plan would include the extension of bridges and the presence of a new viewblock to numerous rural residences. Mitigation measures would include reseeding the new levees with grasses and forbs; however, this would not reduce the overall effect to a less-than-significant level.

COSTS

Construction, environmental, and real estate costs for the MWSL Plan are shown in Table 6-6. The costs are for the 78,000 cfs design flow option, which corresponds to the project that has approximately the highest net benefits. The costs for the full range of design flow options are discussed below under the heading "Comparison of Plans."

Table 6-6. Total Project Cost Summary for the Modified Wide Setback Levee Plan, 78,000 cfs Design Flow

Feature		Cost[1] $1,000
Construction Costs (excludes environmental mitigation costs)[2]		75,652
Environmental Mitigation		
Trees		1,150
Scrub Shrub		0
Elderberry		3,600
Shaded Riparian Aquatic Habitat		146
Giant Garter Snake Habitat		3,025
	Subtotal	7,921
	+25% Contingency	**9,901**
Real Estate[1]		
Levee Footprint (Flood Protection Levee Easement)[3]		1,808
Flowway Between Levees (Permanent Flowage Easement)[4]		19,447
Constructions Easements (Temporary Work Area Easements)		534
Environmental (Fee Title)		0
Channel Improvements (Channel Improvement Easement)		0.559
Roads (Roads and Road Easements)		9
Borrow Area (Borrow Easement)		677
Structures		5,445
Severance		2,792
Contingencies (25%)		6,980
Relocation Costs		718
Non-Federal Administrative Costs		8,713
Federal Administrative Review Costs		1,524
	Subtotal	48,647
Cultural, Engineering, and Construction Mgmt @ 21.5%		18,394
Total First Costs		**152,594**
Interest During Construction		**10,381**
TOTAL INVESTMENT COST		**162,975**

[1]Includes a contingency, construction 20 percent, real estate 25 percent, and environmental 25 percent.
[2]For the 78,000 cfs design flow plan.
[3]Includes some areas with a temporary work easement.
[4]Includes some areas with drainage, borrow, and temporary work easements.

COMPARISON OF PLANS

BENEFITS

Benefits are defined as the reduction in flood damages due to the implementation of the proposed project. The without-project (No-Action Plan) damages for Lower Cache Creek are $12 million annually. The without-project flood damages represent the average annual damages that are expected under existing conditions and with the continued operation and maintenance of the existing levee system. With-project benefits are the reduction in flood damages that are expected to result from the implementation of a specific flood damage reduction project. The total annual damages and benefits estimated for the final plans are listed in Table 6-7 for the design flows of 1 in 50, 1 in 100, 1 in 200, 1 in 500, and 1 in 1,000 chance flows, approximately 53,000, 64,000, 70,000, 78,000, and 91,000 cfs, respectively.

COSTS

Costs were estimated for the four plans (NSL, WSL, MWSL and the LCCFB Plans). Three design flows for each plan were analyzed to determine the project size that would maximize the net benefits for each plan. These design flows correspond to design flows in lower Cache Creek of approximately 50,000 cfs, 70,000 cfs, and 90,000 cfs, approximately 1 in 50, 1 in 200, and 1 in 1,000 chance flows, respectively. Other design flows of interest were also analyzed based on these more detailed analyses. The estimated total investment and annual costs are listed in Table 6-8. Detailed cost estimates are presented in Appendix K.

Costs for replacing existing bridges were included in the estimate for the NSL Plan as listed in Table 6-7. Existing bridges would require replacement when peak floodflows exceed about 71,000 cfs to 81,000 cfs, approximately 1 in 200 and greater than 1 in 500 chance flows, respectively. The bridges at CR 102 and S 113 would need replacement when flows exceed 71,000 cfs, the railroad bridge would need replacement at 78,000 cfs (1 in 500 chance flow), and CR 99W and both I-5 bridges would need lengthening at 81,000 cfs.

Estimated costs for the WSL Plan for design flows requiring bridge replacement or lengthening at about 71,000, 74,000 (approximately a 1 in 350 chance flow) and 88,000 cfs (approximately a 1 in 900 chance flow) are shown in Table 6-8. These refinements were done to reflect the large increase in costs associated with replacing or lengthening a bridge and to more accurately identify the optimal design level.

Cost estimates for the MWSL in Table 6-8 included the additional design storm of 78,000 cfs and modifications to all the existing bridges for all of the design levels.

NET BENEFITS

Each plan was evaluated in terms of the costs and benefits associated with different design flows to determine the optimal design flow for each plan. The annual costs and benefits are shown in Table 6-9 and plotted on Figure 6-19 for each plan. Some of the points were interpolated from the costs and benefits curves. The net benefits were computed as the difference between the benefits and costs and are shown in Tabble 6-9 and plotted on Figure 6-20.

Table 6-7. Estimated Project Annual Damages and Benefits for Various Design Flows of the No-Action Plan, the Lower Cache Creek Flood Barrier Plan, and the Setback Levee Plans[1]

PLAN	Design Peak Flow (x 1,000 cfs)	Occurrence Frequency (chance per year)	Residual Damages ($1,000)	Annual Benefits ($1,000)
No-Action Plan—Rehabilitation of Cache Creek Levee System[2]	30	1 in 10	12,429	—
Lower Cache Creek Flood Barrier Plan	53	1 in 50	1,815	10,614
	63	1 in 100	1,269	11,160
	70	1 in 200	1,029	11,400
	78	1 in 500	888	11,541
	91	1 in 1,000	822	11,607
Narrow, Wide, and Modified Wide Setback Levee Plans[3]	53	1 in 50	6,050	6,745
	63	1 in 100	2,452	10,720
	70	1 in 200	1,347	11,940
	78	1 in 500	794	12,550
	91	1 in 1,000	323	13,070

[1]The period of analysis is 50 years, and the Federal discount rate is 6 1/8 percent. All costs are expressed in October 2001 (fiscal year 2002) price levels.
[2]No-Action Plan—The existing system operation and maintenance is a DWR responsibility. If a Setback Levee Plan is built, existing system operation, maintenance, repair, rehabilitation, and replacement would not be needed, and this would be a cost savings, or benefit.
[3]The Setback Levee Plan has essentially the same benefits for all three options.

Table 6-8. Estimated Project Investment and Annual Costs for Various Design Flows of the No-Action Plan, the Lower Cache Creek Flood Barrier Plan, and the Setback Levee Plans[1]

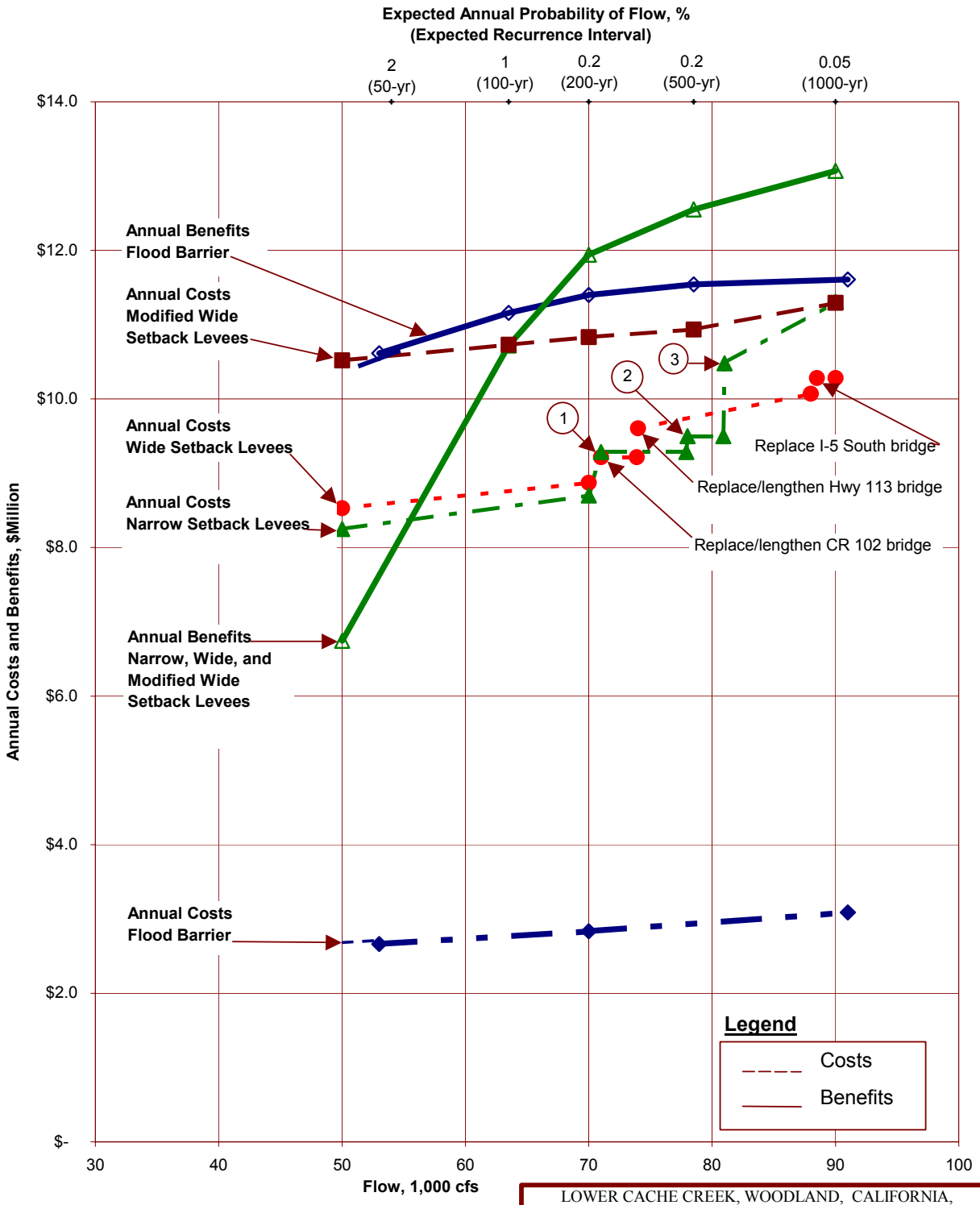
PLAN	Design Peak Flow (x 1,000 cfs)	Occurrence Frequency (chance per year)	Total Investment Cost[2] ($1,000)		Interest & Amortization ($1,000)	Operation & Maintenance Cost ($1,000)	Total Annual Cost ($1,000)
No-Action Plan—Rehabilitation of Cache Creek Levee System[3]	30	1 in 10	$9,043		$583	$350	$934
Lower Cache Creek Flood Barrier Plan	53	1 in 50	39,725		2,564	98	2,662
	70	1 in 200	42,398		2,737	98	2,835
	78	1 in 500	43,761		2,825	98	2,923
	91	1 in 1,000	46,332		2,991	98	3,089
Narrow Setback Levee Plan	50	~ 1 in 50	120,251		7,763	485	8,248
	70	1 in 200	127,287		8,217	485	8,702
Replace CR102 and SH. 113 Bridges[4]	71	~ 1 in 200	136,300		8,799	485	9,284
Replace Railroad Bridge[4]	78	1 in 500	139,620		9,013	485	9,498
Lengthen CR 99W and both I-5 Bridges[4]	81	~ 1 in 600	154,795		9,993	485	10,478
	90	~ 1 in 1,000	167,660		10,823	485	11,308
Wide Setback Levee Plan	50	~ 1 in 50	125,709		8,115	415	8,530
	70	1 in 200	131,032		8,459	415	8,874
Replace CR102 Bridge[4]	71	~ 1 in 200	136,299		8,799	415	9,214
Replace SH. 113 Bridge[4]	74	~ 1 in 350	142,350		9,189	415	9,604
Replace I-5 South Bridge[4]	88	~ 1 in 900	149,558		9,655	415	10,070
	90	~ 1 in 1,000	152,859		9,868	415	10,283
Modified Wide Setback Levee Plan	50	~ 1 in 50	156,514		10,104	415	10,519
	70	1 in 200	161,356		10,416	415	10,831
	78	1 in 500	162,975		10,521	415	10,936
	90	~ 1 in 1,000	168,508		10,878	415	11,293

[1]The period of analysis is 50 years, and the Federal discount rate is 6 1/8 percent. All costs are expressed in October 2001 (fiscal year 2002) price levels.
[2]Includes Total First Cost plus interest during 2-year construction schedule. See Appendix K for additional cost information and details.
[3]No-Action Plan—The existing system operation and maintenance is a DWR responsibility. If a Setback Levee Plan is built, existing system operation, maintenance, repair, rehabilitation, and replacement would not be needed, and this would be a cost savings, or benefit.
[4]Bridge replacements and lengthening apply to all design flows greater than the one specified.

Table 6-9. Project Costs and Benefits for Various Design Flows of the No-Action Plan, the Lower Cache Creek Flood Barrier Plan, and the Setback Levee Plans[1]

PLAN	Design Peak Flow (x 1,000 cfs)	Occurrence Frequency (chance per year)	Total Annual Costs ($1,000)	Flood Damage Reduction Annual Benefits ($1,000)	Avoided Existing System Rehab Annual Benefits ($1,000)	Total Annual Benefits ($1,000)	Net Annual Benefits ($1,000)	Benefit-to-Cost Ratio
No-Action Plan—Rehabilitation of Cache Creek Levee System[4]	30	1 in 10	934		—	—		—
Lower Cache Creek Flood Barrier Plan	53	1 in 50	2,662	10,614	—	10,614	7,952	4.0
	63	1 in 100	2,769[2]	11,160	—	11,160	8,391	4.0
	70	1 in 200	2,835	11,400	—	11,400	8,565	4.0
(NED Plan)	78	1 in 500	2,923	11,541	—	11,541	8,618	3.9
	91	1 in 1,000	3,089	11,607	—	11,607	8,518	3.8
Narrow Setback Levee Plan[6]	50	~ 1 in 50	8,248	5,811	934	6,745	(1,503)	0.8
	63	1 in 100	8,555[2]	9,786	934	10,720	2,166	1.3
	70	1 in 200	8,702	11,006	934	11,940	3,238	1.4
Replace CR102 and SH. 113 Bridges[5]	71	~ 1 in 200	9,284	11,078[3]	934	12,012	2,728	1.3
Replace Railroad Bridge[5]	78	1 in 500	9,498	11,616	934	12,550	3,052	1.3
Widen CR 99W and both I-5 Bridges[5]	81	~ 1 in 600	10,478	11,729[3]	934	12,663	2,185	1.2
	90	~ 1 in 1,000	11,308	12,136	934	13,070	1,762	1.2
Wide Setback Levee Plan	50	~ 1 in 50	8,530	5,811	934	6,745	(1,800)	0.8
	63	1 in 100	8,762[2]	9,786	934	10,720	1,958	1.2
	70	1 in 200	8,874	11,006	934	11,940	3,066	1.3
Replace CR102 Bridge[5]	71	~1 in 200	9,214	11,078[3]	934	12,012	2,798	1.3
Replace SH 113 Bridge[5]	74	~1 in 350	9,604	11,293[3]	934	12,227	2,623	1.3
	78	1 in 500	9,754[2]	11,616	934	12,550	2,796	1.3
Replace I-5 South Bridge[5]	88	~ 1 in 900	10,283	12,068[3]	934	13,002	2,719	1.3
	90	~ 1 in 1,000	10,283	12,136	934	13,070	2,787	1.3
Modified Wide Setback Levee Plan	50	~ 1 in 50	10,519	5,811	934	6,745	(3,774)	0.6
	63	1 in 100	10,730[2]	9,786	934	10,720	(10)	1.0
	70	1 in 200	10,831	11,006	934	11,940	1,109	1.1
	78	1 in 500	10,936	11,616	934	12,550	1,614	1.2
	90	~ 1 in 1,000	11,293	12,136	934	13,070	1,777	1.2

[1]The period of analysis is 50 years, and the Federal discount rate is 6 1/8 percent. All costs and benefits are expressed in October 2001 (fiscal year 2002) price levels.
[2]Interpolated/extrapolated from costs curve.
[3]Interpolated/extrapolated from benefits curve.
[4]No-Action Plan—The existing system operation and maintenance is a DWR responsibility. If a Setback Levee Plan is built, existing system operation, maintenance, repair, rehabilitation, and replacement would not be needed, and this would be a cost savings, or benefit.
[5]Bridge replacements and lengthening apply to all design flows greater than the one specified.
[6]The Narrow Setback Levee Plan at a design flow of 70,000 cfs has the highest net benefits for all of the Setback Levee Plans, however, it has severe adverse environmental effects and mitigation costs are expected to be prohibitive.



Notes:

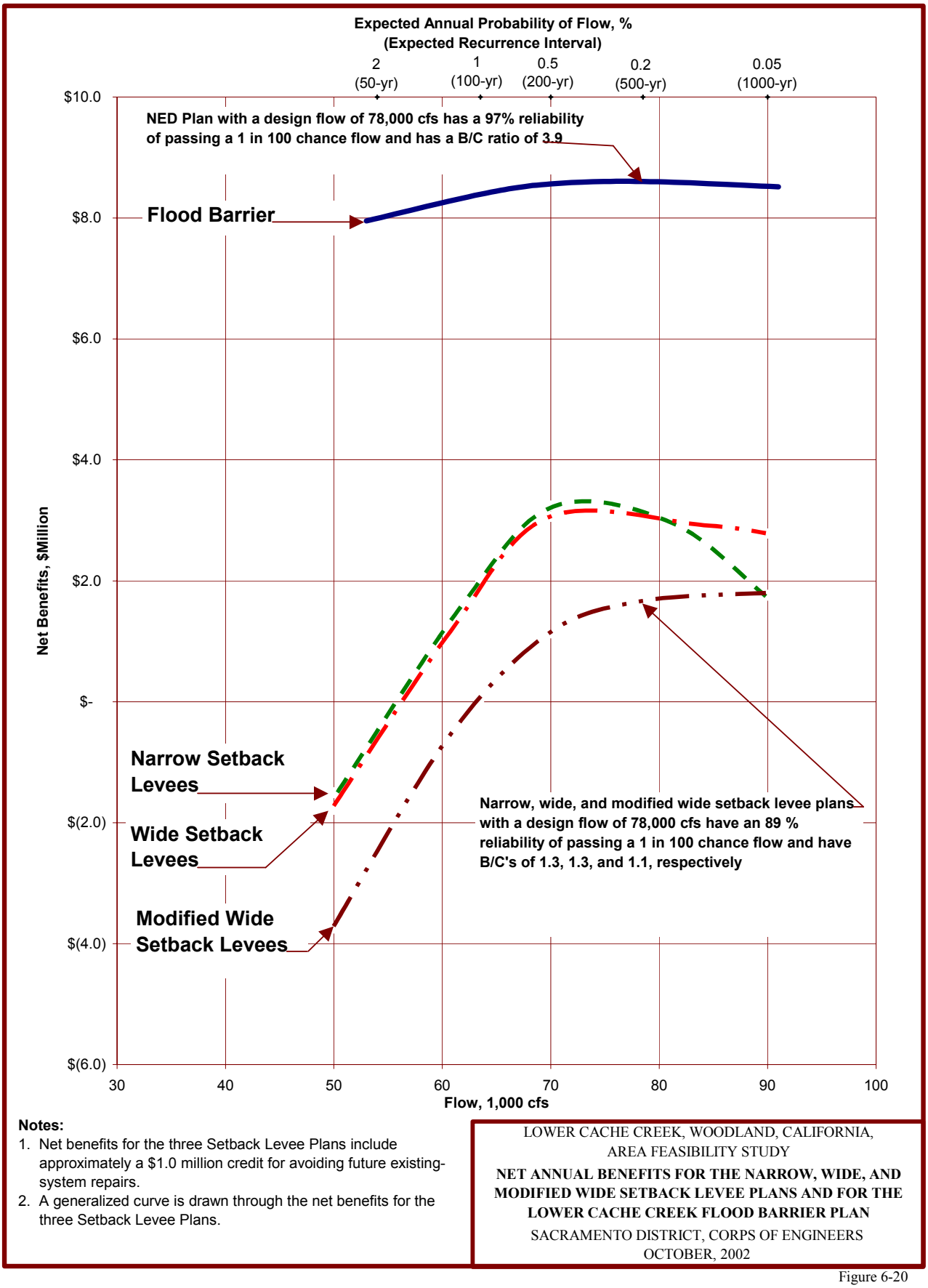
1. Replace and lengthen CR 102 and SH 113 bridge.
2. Replace railroad bridge.
3. Lengthen CR 99W and both I-5 bridges.
4. Annual benefits for the three Setback Levee Plans include approximately a $1.0 million credit for avoiding future existing-system repairs.

LOWER CACHE CREEK, WOODLAND, CALIFORNIA, AREA FEASIBILITY STUDY

ANNUAL COSTS AND BENEFITS FOR THE NARROW, WIDE, AND MODIFIED WIDE SETBACK LEVEE PLANS AND FOR THE LOWER CACHE CREEK FLOOD BARRIER PLAN

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
OCTOBER, 2002

Figure 6-19



Notes:

1. Net benefits for the three Setback Levee Plans include approximately a $1.0 million credit for avoiding future existing-system repairs.
2. A generalized curve is drawn through the net benefits for the three Setback Levee Plans.

LOWER CACHE CREEK, WOODLAND, CALIFORNIA,
AREA FEASIBILITY STUDY

NET ANNUAL BENEFITS FOR THE NARROW, WIDE, AND MODIFIED WIDE SETBACK LEVEE PLANS AND FOR THE LOWER CACHE CREEK FLOOD BARRIER PLAN

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
OCTOBER, 2002

Figure 6-20

Figure 6-20 indicates that the net benefits for all three of the Setback Levee Plans are substantially less than those associated with the LCCFB Plan. The NSL Plan and the WSL Plan have higher net benefits than the MWSL Plan. However, as discussed previously, there would be potentially severe adverse environmental effects associated with the NSL and WSL Plans and mitigation requirements are expected to be prohibitive.

The Modified Wide Setback Levee Plan was selected as the Setback Levee Plan. The MWSL Plan optimizes at a design flow of 91,000 cfs (1 in 1,000 chance flow). However, the MWSL Plan selected for further analysis is the 78,000 cfs plan (1 in 500 chance event), with a benefit-to-cost ratio of 1.1, because the substantial increase in the total project cost for the 91,000 cfs plan is not warranted by the relatively small increase in net benefits. Also since the LCCFB Plan optimizes at a design flow of 78,000 cfs it is believed that the public would view selecting a much larger design flow for the Setback Levee Plan is an unfair portrayal of the cost of this plan.

The LCCFB Plan optimizes at a design flow of 78,000 cfs (1 in 500 chance flood event), with a benefit-to-cost ratio of 3.9, and was identified as the NED Plan because it has the highest net benefits.

The net benefits for the LCCFB Plan are relatively constant. The reason is that the LCCFB Plan provides very reliable flood protection to Woodland where most of the damages would occur, in any size flood event. Due to the large flood plains remaining under the LCCFB Plan, there are relatively small differences in flood stages/levee heights between different chance flood events. Thus, both cost and net benefit curves are relatively flat.

POTENTIAL ENVIRONMENTAL EFFECTS

The LCCFB and MWSL Plans would have significant effects on some of the existing resources in the study area. The draft CAR's habitat evaluation procedure and the Special-Status Species Technical Appendix Impact assessment provided the acreages of affected wildlife and special-status species habitat. Mitigation alternatives for the LCCFB Plan were developed based upon this information, and a Habitat Mitigation Alternatives Analysis was prepared to identify the most cost-effective alternative, which is the basis for the mitigation cost estimate. The EIS/EIR provides further detail on the effects of the proposed plans and describes mitigation measures that could be used to minimize or offset adverse effects. Effects for the LCCFB and MWSL Plans are listed in the following paragraphs:

LCCFB Plan

Significant effects include:

- A loss of 100 acres of prime farmland and 2 acres of statewide important farmland due to construction of the levee and drainage ditch.
- Indirect transportation effects would include increased depth and duration of flooding on roadways traversing the Cache Creek floodplain. CR 101 would be flooded for about 1 week and CR 102 would be flooded for 3 weeks. Flooding would result in road closures and would lengthen response times for emergency vehicles traveling north of Woodland.
- Construction of the LCCFB Plan would temporarily produce decibel levels above the significance threshold for some sensitive receptors during construction.
- NO_x and PM_{10} emissions would exceed the significance thresholds established by the Yolo-Solano Air Quality Management District. The exceedence would be a temporary effect during construction.
- The LCCFB levee would create a new linear feature and a view block to residents.

Effects that would be reduced to less than significant with mitigation include:

- Loss of land value due to effects/takings.
- Traffic effects associated with road closures during road repair, roadway safety hazards, and increased traffic volume.
- Pollutants from construction equipment and erosion at the construction site could temporarily degrade the water quality of local runoff during construction.
- Loss of 122 acres of agricultural habitat, 100 native and nonnative trees, 0.52 acre of upland habitat, and 0.28 acre of scrub shrub.
- Project-related effects to special-status species (Swainson's hawk, giant garter snake, northwestern pond turtle, chinook salmon, steelhead) would include temporary and permanent loss of habitat.
- Increased flooding may occur at cultural or historic sites between the creek and LCCFB.

Modified Wide Setback Levee Plan

Significant effects include:

- A loss of 158 acres of orchard and row crop farmland (all prime farmland) as a result of the levee footprint, and potential isolation of up to 1,254 acres of farmland between the levees (all prime farmland).
- Construction of the setback levees would temporarily produce decibel levels above the significance threshold for some sensitive receptors during construction.
- NO_x and PM_{10} emissions would exceed the significance thresholds established by the Yolo Solano Air Quality Management District. The exceedence would be a temporary effect during construction.
- The extension of bridges and the presence of a new viewblock to numerous rural residences.

Effects that would be reduced to less than significant with mitigation include:

- Loss of land value due to effects/takings, including loss of 32 residences and up to 182 farm structures.
- Traffic effects associated with road closures during road repair, roadway safety hazards, and increased traffic volume.
- Pollution from construction equipment and erosion related to construction activities could potentially degrade the water quality of local runoff.
- Loss of 174 acres of agricultural habitat, 49 acres of orchard trees, 9.01 acres of riparian habitat, and 0.69 acre of shaded riverine aquatic habitat.
- Project-related effects to special-status species (valley elderberry longhorn beetle, Swainson's hawk, giant garter snake, northwestern pond turtle, chinook salmon, steelhead) would include loss of habitat.
- Archeological and historic sites could be affected by levee construction, degradation of the present levee, and accelerated erosion.

ACCOMPLISHMENTS OF PLANS

All flood damage reduction plans could reduce flood damages to Woodland. Other accomplishments are as follows:

The LCCFB Plan:

- Provides a high degree of flood damage reduction to Woodland and has the highest net benefits.

- Is a very reliable system due to the amount of storage that is available on the flood plain. Larger flood events only cause a small increase in flood stages.
- Meets the FEMA 95 percent reliability criteria for the 1 in 100 chance flood event.
- Meets 90 percent reliability criteria for the 1 in 200 chance event for the 78,000-cfs design flow plan.
- Reduces peak floodflows entering the settling basin.

The MWSL Plan:

- Meets the FEMA 90 percent reliability criteria for the 1 in 100 chance flood event.
- Has 78 percent reliability for the 1 in 200 chance event for the 78,000-cfs design flow plan.
- Protects the area between the setback levee and the LCCFB levee.
- Protects areas north of Cache Creek that would not be protected by the LCCFB Plan.
- Protects roadways on the flood plain that are not protected by the LCCFB Plan.

TENTATIVELY RECOMMENDED PLAN

Based on currently available data, it appears that the LCCFB Plan with the 1 in 500 chance event, 78,000-cfs design flow is the NED Plan and the Tentatively Recommended Plan. Table 6-10 summarizes how well each plan meets the objectives of the feasibility study. The benefits and costs indicated in this table also show that the net benefits for the LCCFB Plan are significantly higher than for all of the Setback Levee Plans.

RATIONALE FOR SELECTION OF RECOMMENDED PLAN

The LCCFB Plan was selected as the recommended plan on the basis that this plan is the least environmentally damaging plan and the plan with the highest net benefits.

Table 6-10. Comparison of Ability of the No-Action Plan, the Lower Cache Creek Flood Barrier Plan, and the Setback Levee Plans to Meet the Objectives and Constraints of the Feasibility Study

	No-Action	LCCFB Plan	Narrow Setback Levee Plan	Wide Setback Levee Plan	Modified Wide Setback Levee Plan
OBJECTIVES/CONSTRAINTS					
Protect Woodland	Poor	Good	Good	Good	Good
Protect Agricultural Areas North of Woodland	Poor	Poor	Good	Good	Good
Protect Major Transportation Facilities	Poor	Moderate	Good	Good	Good
Minimize Project Impact on Homes	N/A	Good	Good	Poor	Poor
Minimize Biological Effects	N/A	Good	Poor	Poor	Good
Minimize Effects on Agricultural Operations	N/A	Moderate	Moderate	Poor	Poor
FLOOD DAMAGE REDUCTION BENEFITS[1] (Average Annual, $ Millions)	N/A	$11.5	$11.6	$11.6	$11.6
PROJECT COSTS[1] ($ Millions)					
Total Investment Cost	N/A	$43.8	$139.6	$142.4	$163.0
Annual Operation and Maintenance		$0.1	$0.5	$0.4	$0.4
O&M and Rehab. of Existing Cache Creek System by DWR	$0.94	$0.94	$0	$0	$0
BENEFIT-TO-COST RATIO[1]	N/A	3.9	1.3	1.3	1.1
NET BENEFITS ($ Millions)	N/A	$8.6	$3.0	$2.8	$1.6

[1]Costs and benefits are presented for the 78,000-cfs design flow.