Appendix A-5 - Repaired or Removed Sites Sacramento River Bank Protection Project

Site Name	Waterway	River Mile	Levee Mile	Bank	Levee Maintaining Agency	Economic Impact Area	Erosion Status	Year Added	Site Length (ft)	Berm Width (ft)	Erosion Mechanism(s)	Revetment Details	Veg Variance Required?	Encroachment Details	Site History	2017 Field Notes
BER 0.8 L	Bear River	0.8	0	L	RD 1001 - Nicolaus	Rio Oso	Repaired	2006	452	5	Fluvial	Quarry Stone in good condition	Likely	None	2006 - Multiple rotational failures in the berm. Erosion is into the levee toe and lower slope. Tension cracks extensive at top of bank. Cohesive toe creates a bench on which failures occur. 2007 - Still steep bank with some berm with pistolbutted reeds. 2012 - Site extended upstream due to additional slumping. Slopes slightly steeper.	The 2017 floods caused additional damage to the site, however the site was repaired by locals, with a very steep rock riprap slope. The rock slope appears to be less than 1:1, some rock already appears to be failing.
CHC 2.8 L	Cache Creek	0	2.4		DWR Sacramento Maintenance Yard	Yolo	Repaired	2002	209	20	Toe Scour, Whole Bank Failure	None	Unsure	None	2006 - Large new failure. 2008 - Plans for repair currently in the design phase. 2010 - Planned setback levee by CA DWR, 60% design complete, construction planned for 2012. 2011 - Construction delayed to 2013 - 2014. 2016 - Site repaired with a setback levee by CA DWR.	
CHC 3.4 L	Cache Creek	0	3.4	L	DWR Sacramento Maintenance Yard	Yolo	Repaired	2002	487	15	Toe Scour, Whole Bank Failure	None	Unsure	None	2006 - Some significant new erosion, especially fresh upper bank slumping. Still substantial berm. 2010 - Site extended downstream, some new erosion, heavily vegetated and hard to see. Planned setback levee by CA DWR, 60% design complete, construction planned for 2012. 2011 - Construction delayed to 2013 - 2014. 2016 - Site repaired with a setback levee by CA DWR.	
CHK 11.7 R	Cherokee Canal	0	11.7	R	Maintenance Area 13	Unassigned	Removed	2011	34	0	Eddy Scour	None	Unsure	Weir and headwall	2011 - Small erosion pocket likely caused by irrigation diversion structure.	Does not qualify, no erosion in the levee prism.
CHS 15.9 L	Cache Slough	0	15.9	L	RD 501 -Ryer Island	Ryer Island	Removed	2005	377	3	Wave Wash	Quarry stone on part of bank in fair condition	Unlikely	Pipe	2016 - Fresh rock placed on levee slope, site is in good order and removed from inventory.	
CHS 23.6 R	Cache Slough	0	23.6	R	RD 2060 - Hastings Tract	Hasting Tract	Removed	2005	1,149	0	Fluvial	Quarry stone at toe in fair condition	Unlikely	PG&E overhead transmission line	Site added in 1997 and removed in 2003. 2005 - Put back in the inventory. 2006 - Stone repair at the middle of the site. 2011 - Some rock placed at toe in the past year. 2013 - Site extended both upstream and downstream to include new erosion pockets. 2016 - Removed due to maintenance work.	
DEC 2.4 L	Deer Creek	0	2.4	L	Tehama County	Unassigned	Removed	2006	97	20	Fluvial	Cobbles in Fair Condition	Likely	None	2006 - Erosion along outer bank of a meandering bend that is getting close to the projection of the levee toe. Trees are leaning out into the channel and ready to fall. Whole bank in reach is actively eroding. 2011 - New erosion pocket caused by an eddy. The Deer Creek Watershed Conservation Group is planning a reach-wide repair for Deer Creek.	Cobbles have deposited in the eroded section and with the amount berm, the levee is no longer threatened.
DWS 5.0 L	Deep Water Ship Channel	0	5	L	RD 999 - Netherlands	Clarksburg	removed	2006	81	200	Erosion Pocket	None	Unlikely	None	2006 - Slump failure of lower slope. Longitudinal cracks present along the levee slope. 2011 - Difficult to see due to overgrown vegetation. A small section of the levee has slumped. Sties DWS 5.0 and DWS 5.01 were combined.	No erosion evident, removed from inventory.
FHR 50.9 R	Feather River	50.9	0	R	Maintenance Area 7	Live Oak	Repaired	2012	371	15	Whole Bank Failure	Quarry Stone in fair condition	Unsure	Old bridge piers and canal on landside slope	2012 - Oversteepened slope with failing rock (from repair completed in 1954). Likely slope stability issues.	Repaired by state, large quarry stone along entire bank.
LDS 1.9 L	Lindsey Slough	0	1.9	L	RD 2060 - Hastings Tract	Hasting Tract	Repaired	2011	358	0	Wave Wash, Fluvial	Quarry Stone in good condition	Unsure	None	2011 - Multiple erosion pockets. Deep cracks throughout site could lead to further bank failure. 2016 - Site has been repaired by locals.	
LDS 2.4 L	Lindsey Slough	0	2.4	L	RD 2060 - Hastings Tract	Hasting Tract	Repaired	2011	139	0	Wave Wash, Fluvial	None	Unsure	None	2011 - Two erosion pockets from rotational failures. Very soft soil. 2016 - Repaired by locals.	
PUC 0.1 L	Putah Creek	0	0.1	L	DWR Sacramento Maintenance Yard	Davis	Repaired	2011	423	0	Wave wash	Cobbles at toe in fair condition	Unlikely	PG&E utility poles	2011 - Old cobble site is unraveling, likely causing the toe of the bank to become unstable. 2016 - Rock placed in eroding sections by locals.	
SAC 16.8 L	Sacramento River	16.8	0	L	Brannan-Andrus Levee Maintenance District	Brannan Andrus Island	Repaired	2008	591	0			Likely	Pump	2008 - Overstepped levee section with pocket erosion. Plans for repair currently in the design phase. 2010 - Very steep slope with slumps, longitudinal cracking, and overturned trees. 2011 - Upgraded to CRITICAL. Sections of vertical slope with highway on top. Heavy vegetation in front of most of the erosion pockets. 2015 - New rock placed on the levee slope for most of the downstream end, but bad spots still remain. 2016 - Under construction.	Repaired by USACE in 2016.
SAC 18.0 L	Sacramento River	18	0	L	Brannan-Andrus Levee Maintenance District	Brannan Andrus Island	Repaired	2009	444	0			Likely	None	2009 - Large scallop from rotational failure. One fallen tree and one large tree with half of its root structure exposed. 2015 - Large tree expected to pop out within next couple of years, will take very large chunk of le	Repaired by locals with quarry stone.
SAC 21.5 L	Sacramento River	21.5	0	L	RD 556 - Upper Andrus Island	Brannan Andrus Island	Removed	1997	548	5		Quarry Stone in good condition	Likely	Pipe	1999 - Downstream 140 ft repaired with rock. 2010 - Lots of woody debris, but no changes to site. 2015 - Site extended upstream due to erosion pockets.	Site removed, levee is not threatened.
SAC 23.3 L	Sacramento River	23.3	0	L	RD 556 - Upper Andrus Island	Brannan Andrus Island	Removed	1997	584	30	Fluvial, Wave Wash		Likely	None	1997 - Few scallops in berm, some getting close to levee toe. 2005 - Brush boxes present. 2012 - More erosion of the toe since last year.	Erosion is not in levee prism.

Appendix A-5 - Repaired or Removed Sites Sacramento River Bank Protection Project

Site Name	Waterway	River Mile	Levee Mile	Bank	Levee Maintaining Agency	Economic Impact Area	Erosion Status	Year Added	Site Length (ft)	Berm Width (ft)	Erosion Mechanism(s)	Revetment Details	Veg Variance Required?	Encroachment Details	Site History	2017 Field Notes
SAC 26.0L	Sacramento River	26	0	L	RD 556 - Upper Andrus Island	Brannan Andrus Island	Repaired	1997	1,547	0	Fluvial, Wave Wash	Small section of quarry stone in good condition	Likely	Pump and USGS gage station	2002 - Two rocked sections (150 ft long) at the downstream end. 2005 - Lots of old brush boxes, some with established vegetation in the area behind the boxes. 2006 - Some small spots fixed with stone. 2009 - Minimal new erosion, rock in the middle of the reach may be new. 2011 - Minor new erosion. 2015 - Site under construction. 2016 - Site repaired by USACE.	Site repaired by USACE in 2016
SAC 26.3 R	Sacramento River	26.3	0	R	RD 003 - Grand Island	Grand Island	Repaired	2008	418	0			Likely	Boat dock	2009 - Hole left in levee toe from a fallen tree. Could be repaired under maintenance. 2010 - Minor new erosion. 2015 - Minor new erosion at toe.	Repaired by locals.
SAC 31.6R	Sacramento River	31.6	0	R	RD 003 - Grand Island	Grand Island	Repaired	1997	442	0	Fluvial	Quarry Stone in good condition	Likely	Pipes and Pumphouse	1997 - Erosion of supper sandy levee material above the water line, straight reach. 1999 - Small pocket repaired with rock. 2005 - Downstream 400 ft have been repaired. 2011 - Site is overgrown with vegetation. 2015 - Site appears stable, may consider for removal if not change after the next large storm event. 2016 - Repairs made to the worst section, remain site appears stable.	Site repaired by locals in 2016
SAC 35.4 L	Sacramento River	35.4	0	L	RD 755 - Randall Island	Courtland	Repaired	2003	484	5	Wave Wash and Tree Pop-Outs	Quarry Stone in good condition	Likely	None	2003 - Toe and lower slope eroding, rock in water and a few pieces on the slope; rock at upstream and downstream ends. 2005 - Looks a little worse. Two major holes with vertical banks and smaller intermittent pockets in between. Stone is present upstream, downstream, and at toe. 2008 - Repaired at both ends (50 ft of new stone) but middle remains unrepaired. 2011 - Site extended downstream to include new scour. 2013 - At the downstream end, behind tree, there is a new animal burrow. Tree has exposed roots. 2015 - New rock placed at toe in middle of the site, but a hole remains behind the tree. 2016 - Repaired by locals.	Repaired by locals.
SAC 78.3 L	Sacramento River	78.3	0	L	RD 1000 - Natomas	Natomas	Removed	1997	654	15	Fluvial, Wave Wash	None	Likely	Pipes, Power Poles	1997 - Very cohesive toe. 2005 - Site was staked and rock was stockpiled along the top of the bank. 2010 - New adjacent levee under construction. 2011 - New animal burrow.	Site removed. New adjacent levee and the erosion is not longer in the levee prism.
SAC 85.4 R	Sacramento River	85.4	0	R	Yolo County Service Area 6	Knights Landing	Removed	2009	1,025	5	Fluvial	Cobbles in fair condition	Likely	Pipe	2009 - Erosion into the levee toe. Some cobbles have been dumped into the erosion pockets. 2010 - Old cobble site starting to unravel. 2012 - Slope continues to steepen and new animal holes. 2013 - Downstream cobble is unraveling. 2016 - Site removed, bank has stabilized.	
SAC 92.8 L	Sacramento River	92.8	0	L	RD 1500 - Sutter Basin	South Sutter	Removed	1997	834	0	Fluvial, Toe Scour	Cobble at toe in good condition	Unsure	Pipe	1997 - Damage to cobble revetment on top left bank and toe damage. 2004 - Site is pretty minor. 2010 - Cobbles continue to deteriorate. 2011 - Minor new erosion at the toe. 2013 - Might be able to shorten due to deposition. 2015 - Site shortened, downstream end has plenty of berm and deposited material, well vegetated.	Site has remained stable for a few years, levee is no longer being threatened.
SAC 125.8 L	Sacramento River	125.8	0	L	RD 070 - Meridian Farms	North Sutter	Repaired	2008	115	5	Fluvial	Quarry Stone in good condition	Likely	Pipe	2005 - Site was repaired. 2009 - Site is at upstream end of the repair site. 2011 - Still minor erosion. 2012 - Site shortened to remove non-erosding section, minor erosion with failing cobbles. 2016 - Locals dumped rock and bank appears stable. Site removed.	
SAC 130.0 L	Sacramento River	130	0	L	RD 070 - Meridian Farms	North Sutter	Removed	1997	712	0			Unsure	Pump and PG&E power pole	1997 - Critical Site - Erosion of cobble site on outside of a bend. Failure caused by erosion of a material from behind the cobbles and cobbles rolling down the slope. Failure is just above the toe levee. Some repairs had been done at the upstream end. 2004 - Some minor new erosion at the top of the berm. 2005 - Trees look okay and the downstream end has some new rock repair. Site is no longer critical. 2006 - No longer critical, some repairs.	Significant deposition from 2017 storm. Erosion has moved downstream and the levee is no longer threatened.
SAC 136.6 L	Sacramento River	136.6	0	L	RD 070 - Meridian Farms	North Sutter	Removed	1997	616	15	Toe Scour	Cobbles in fair condition	Unlikely	Pump and Pipe	1997 - Toe erosion on a cobble revetment on the outside of a low receding bend. 2012 - Toe appears pretty stable with old cobbles. 2016 - Site is stable and would not benefit from repair. Site removed.	
SAC 151.0 R	Sacramento River	151	0	R	Maintence Area 1	Colusa Basin	Removed	2009	1,748	15		None	Likely	Pipes through levee	2009 - Slump in the middle of the section has left a vertical section on the bank. 2010 - Old cobble site unraveling, site extended downstream.	No longer qualities as a site, removed.

Appendix A-5 - Repaired or Removed Sites Sacramento RIver Bank Protection Project

Site Name	Waterway	River Mile	Levee Mile	Bank	Levee Maintaining Agency	Economic Impact Area	Erosion Status	Year Added	Site Length (ft)	Berm Width (ft)	Erosion Mechanism(s)	Revetment Details	Veg Variance Required?	Encroachment Details	Site History	2017 Field Notes
SAC 168.3 L	Sacramento River	168.3	0	-	LD 3 Glenn County	Butte Basin	Removed	1997	149	0			Unsure	None	1997 - Erosion of top left bank; eroding downstream of rock section where levee is closest to the bank, approximately 40 to 50 ft of bank retreat, some berm left. 1999 - Some new beach sedimentation at the 2.000 - Snags in eddy area could induce bank erosion at higher flows. 2002 - Small bar is gone. 2003 - Bar is present and higher. 2004 - Some new deposition on the bank at the upstream end. 2006 - New sand on bar and bank. 2007 - New sand deposition with vegetation colonizing bars between dikes. 2008 - More eddy sedimentation and vegetation on bar along bank. Bank is healing due to retreat of right bank. 2009 - Additional bar sedimentation. 2010 - some deposition at toe, new erosion on opposite bank. Site continues to heal. 2012 - Majority of site healed but upstream end still needs toe rock.	New deposition on site, river has shifted to opposite bank and levee is no longer threatened.
STM 18.8 R	Steamboat Slough	18.8	0	R	RD 501 -Ryer Island	Ryer Island	Removed	1999	359	0	Fluvial, Wave Wash	None	Likely	Pipe	2000 - Slow erosion of lower and mid-slope with rock bench at the low water line. 2016 - Site removed, stable for years.	
STM 18.9 R	Steamboat Slough	18.9	0	R	RD 501 -Ryer Island	Ryer Island	Removed	2009	330	0	Fluvial, Wave Wash	Quarry stone at toe in fair condition	Likely	Pipe	2009 - Rock is starting to unravel, probably from a tree pop- out, hard toe. 2016 - Site removed, bench has been stable for years.	
SBP 11.1 L	Sutter Bypass	0	11.1	L	DWR Sutter Maintenance Yard	Yuba City	Removed	2011	162	15			Unsure	None	2011 - Small section of the mid levee slope has eroded from wind wave.	Remove, no longer qualities.
STR 27.1 R	Sutter Slough	27.1	0	R	RD 999 - Netherlands	Clarksburg	Removed	2012	255	0			Likely	None	2012 - Slumping of upper levee slope.	Removed, no erosion observed.
STR 28.4 R	Sutter Slough	28.4	0	R	RD 150 - Merritt Island	Merritt Island	Removed	2013	307	0			Likely	Bridge	2013 - Old toe repair unraveling. Bridge at upstream end of site.	Removed, no threat to the levee.
YOL 0.1 R	Yolo Bypass	0	0.1	R	RD 2035 - Conaway Tract	Woodland	Removed	2006	427	0	Fluvial, Wave Wash	None	Unlikely	None	2006 - Wave wash erosion and some saturation slumping occurring. Tension/speparation cracks evident in fine grained levee slope materials. 2011 - Slumping of the lower toe. New slumped section on downstream end. 2016 - Site removed, no erosion evident, possibly repaired.	
YOL 2.6 R	Yolo Bypass	0	2.6	R	Knights Landing Ridge Drainage District	Knights Landing	Removed	2006	827	0			Unsure	None	2006 - Slow wave wash and general fluvial erosion of the toe area under river cobbles. Erosion is creating a scarp and cobble covered wave-cut bench. 2011 - Site appears better than it looked in 2006, but still eroding.	No erosion apparent , possibly fixed by locals, site removed.
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