SWANSON HYDROLOGY + GEOMORPHOLOGY
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March 10, 2006

Ms. Julie Thomas
Coastal San Luis Resource Conservation District
545 Main Street, Suite B-1
Morry Bay, Ca 93442

RE: Recommendations for Staged Implementation of Alternative 3a

Dear Ms. Thomas,

On January 31, 2006 Swanson Hydrology and Geomorphology (SH+G) was authorized by the Coastal San Luis Resource Conservation District (CSLRCD) and Flood Control Zone 1/1A Advisory Committee to develop a Recommended Implementation Plan for Alternative 3a (RIPA-3a). The RIPA-3a outlines a potential funding and phasing alternative for implementation of proposed project elements as defined under Alternative 3a in the Arroyo Grande Creek Erosion, Sedimentation, and Flooding Alternatives Study (SH+G, 2006). The elements proposed in Alternative 3a, if implemented, would increase flood protection along the Arroyo Grande and Los Berros Creek flood control channels (Figure 1) from a return period flood of 4.1 years under current conditions (Alternative 1 was implemented in Fall, 2005) to a return period flood of 10 years with 2 feet of freeboard (16.6 year flood protection with no freeboard). Alternative 3a includes the following elements:

- An annual riparian vegetation management program to maintain a composite roughness of 0.040 within the flood control reach. In addition to vegetation management, gaps in the current riparian corridor would be planted with native species and species diversity would be encouraged by planting riparian tree species, such as sycamore and cottonwood, in order to provide creek shading while minimizing roughness,
- An initial sediment removal program would be implemented to create secondary channels that would be self-maintaining (Figure 2). This program includes habitat enhancement measures such as placement of large woody debris to provide cover habitat for aquatic organisms and to encourage pool scour. An annual monitoring program would be implemented to evaluate sediment deposition and the need for periodic maintenance, and
- Levees would be raised throughout the flood control channel to heighten low spots in the levee (Figure 3).

The purpose of developing the RIPA-3a is to provide recommendations to the CSLRCD and Zone 1/1A Task Force on how elements of Alternative 3a will get implemented within the proposed annual budget of the Zone 1/1A Flood Control District. SH+G was asked to analyze potential implementation scenarios given annual budgets of $350,000 and $405,000. Several initial assumptions were made in order to evaluate these two budget scenarios:

- $350,000 and $405,000 were considered to be the first year assessment.
- The assessments would increase at an annual rate of 3%.
- The costs associated with each project element would increase at an annual inflationary rate of 4% based on 2006 cost estimates.
- The assessment would pay for insurance costs annually. Costs provided by the CSLRCD were $135,000 for Years 1-4 (plus inflation)[1]. In Year 5 the insurance cost was estimated to be reduced to $116,986 based on preliminary discussions with potential insurers. The premiums beyond Year 5 would rise with inflation.
- Thinning of riparian vegetation would occur annually given the high rate of growth observed from Fall 2004 to summer 2005.
- Long-term sediment management was not included in the cost analysis due to several factors including 1) it is postulated that the secondary channels will be self-maintaining or low maintenance; 2) unknowns related to the permitting of the project and whether or not long-term maintenance via "bar-ripping" will be permitted. Either way, adequate money should be available to do long-term sediment management given that the larger cost items will be completed by the time sediment management is required.
- Since the elements that involve infrastructure upgrades or improvements would not be implemented in a single effort, increased mobilization costs will be incurred. To account for increased mobilization costs, a premium of $1 per cubic yard of cut/fill was added to the costs for the levee raise and sediment removal elements.
- Cut and fill quantities[2] and associated costs per cubic yard assume that all material excavated will be removed and disposed of off-site and that all fill material will be imported. Although the project has been phased to maximize potential reuse of sediment excavated from the channel, additional information (e.g. – geotechnical evaluation of sediments and existing levee) and engineering would be required to evaluate potential use of these materials.
- Each element of the project includes a 20% contingency and 5% administration/permitting cost. For infrastructure elements, a 15% engineering design cost[3] is added to the year preceding implementation of the project element.

[1] The annual cost of insurance should be considered preliminary and is provided here as a rough placeholder based on a preliminary estimate provided by CSLRCD.

[2] In Fall 2005, the County filled in low spots in the levee between the 22nd Street Bridge and Highway 1 Bridge. An as-built survey was not developed as part of this work. Consequently, the work conducted by the County is not incorporated into our estimates of fill quantities and costs associated with the Alternative 3A levee raise.

[3] The Final Report used a cost of 13% for engineering design. Given the phased approach to implementation, the per unit cost of design would likely increase. Therefore, 15% was used for engineering design.

To adequately manage the phasing and to provide maximum benefit for each element, as it is implemented, the flood control reach was split into three sections. Section A consists of the reach from the Union Pacific Railroad Bridge (UPRR) downstream to River Station 2666 (RS2666). RS2666 was determined to be the approximate upstream edge of tidal influence and is located in the vicinity of Guiton's Crossing. No work would be performed downstream of RS2666. Section B consists of the reach between the UPRR upstream to the Highway 1 crossing. Section C consists of the remaining portion of the flood control channel from Highway 1 upstream on Arroyo Grande and Los Berros Creeks (Figure 4). Consideration was made to split the flood control reach up into smaller sections but it was determined that the overall cost would increase without a time savings on complete implementation of the alternative. The three sections recommended for phasing of Alternative 3a provide reasonable work areas bounded by bridges.

The recommended approach to phasing-in the project elements would be to implement Section A first, followed by Section B, then Section C. The reasoning for this is driven by the sediment removal activities. Since significant quantities of stored sediment currently reside in overbank deposits that will be excavated and removed to increase overall flood capacity, it makes the most sense to remove the downstream deposits first. This approach avoids any potential issues of downstream areas, where sediment has not been removed, backwatering secondary channels upstream. It also creates a locally steepened overbank profile at the upstream end of the excavated section which may encourage natural excavation of existing overbank deposits. In addition, the phasing plan recommends that the sediment removal element occur first within the implemented project section, followed by the levee raise element. This approach will allow for the possibility of using excavated sediments as part of the levee raise element if an appropriate location is identified to temporarily store the excavated material. Use of a temporary storage area is not calculated into the cost.

Table 1 summarizes the Year One costs for each project element for each analysis Section. The cost for each project element was incorporated from the Final Alternatives Analysis Study. These numbers represent an estimate of the cost associated with each project element based on a conceptual-level engineering analysis of Alternative 3a. The highest cost area is Section B where the bulk of the sediment removal and levee raise work is focused. Section B was identified in the Alternative Study as the most likely location of a levee overtop. The 'costs plus contingencies' column represents the cost of each element plus a 20% contingency, 5% for administration and permitting, and 15% for engineering design. The 15% engineering and design cost was only added to infrastructure elements and was not included in the annual maintenance elements.

Based on a phased approach proceeding from downstream to upstream, removal of sediment prior to constructing the levees (Figures 5, 6, and 7), and a pay-as-you-go strategy, the following recommendations were developed for the $350,000 and $405,000 scenarios (Tables 2 and 3). Under the $350K phasing scenario, Alternative 3a could be implemented within a 13 year timeframe. The infrastructure elements under this scenario would be implemented in Years Two, Four, Seven, Eleven, and Thirteen. Under the $405K phasing scenario, Alternative 3a could be implemented within a 9 year timeframe. The infrastructure elements under this scenario would be implemented in Years Two, Three, Five, Seven, and Nine. Tables 4 and 5 provide the cost breakdown for these options.

This analysis represents the consultant's recommendation on how phasing-in of Alternative 3a could be accomplished given the available funding within the Zone 1/1A assessment using a pay-as-you-go strategy. High insurance and maintenance costs limit the accumulation of capital within the Zone 1/1A fund for infrastructure upgrades. Since the insurance and maintenance costs are relatively fixed and consume a similar proportion of the budget each year, the influx of additional funding beyond the $350K speeds up the implementation timeline significantly. An inflation rate of 4%, which in reality may be much higher given increases in transportation and material costs over the last several years, exceeds the modest increase in the Zone 1/1A assessment of 3% per year, pushing infrastructure costs out and limiting the Districts ability to implement projects in a timely manner.

Unfortunately, the level of flood protection for Alternative 3a, as described in the Final Alternatives Analysis Study, is only achieved once the project is completely implemented. Consequently, the pay-as-you-go approach, given the long timeline for implementation, should be weighed against the benefit of securing a loan up front to pay for infrastructure upgrades.

If you have any questions, concerns, or changes to our recommended implementation plan, please feel free to contact me at 503-230-9204.

Sincerely,

John Dvorsky
Senior Associate
Swanson Hydrology and Geomorphology

Table 1: Summary of **Year One** project element costs per section that was used in the phasing evaluation. An inflationary value of 4% annually to these costs if they were implemented in years other than Year One.

Section	Project Element	Cost	Cost plus Contingencies
All	Vegetation Management	$80,000	$100,000
	Inspection & Miscellaneous Maintenance	$8,700	$8,700
A	Sediment Removal	$96,000	$134,000
	Habitat Enhancement	$12,500	$17,500
	Levee Raise	$126,882	$177,635
	Miscellaneous Drainage & Utility Modifications	$10,000	$14,000
	Subtotal	*$245,382*	*$343,135*
B	Sediment Removal	$229,614	$321,460
	Habitat Enhancement	$20,000	$28,000
	Levee Raise	$241,185	$337,659
	Miscellaneous Drainage & Utility Modifications	$30,000	$42,000
	Subtotal	*$520,799*	*$729,119*
C	Sediment Removal	$127,197	$178,076
	Habitat Enhancement	$17,500	$24,500
	Levee Raise	$5,783	$8,096
	Miscellaneous Drainage & Utility Modifications	$10,000	$14,000
	Subtotal	*$160,480*	*$224,672*

Table 2: Recommended phasing plan to implement Alternative 3a within an initial annual budget of $350,000.

$350K Phasing Recommendation		
Year	Section	Project Element
All	A, B, & C	Vegetation Management
		Inspection & Miscellaneous Maintenance
2	A	Sediment Removal
		Habitat Enhancement
4	A	Levee Raise
		Drainage & Utility Modifications
7	B	Sediment Removal
		Habitat Enhancement
11	B & C	Levee Raise
		Drainage & Utility Modifications
13	C	Sediment Removal
		Habitat Enhancement

Table 3: Recommended phasing plan to implement Alternative 3a within an initial annual budget of $405,000.

$405K Phasing Recommendation		
Year	Section	Project Element
All	A, B, & C	Vegetation Management
		Inspection & Miscellaneous Maintenance
2	A	Sediment Removal
		Habitat Enhancement
3	A	Levee Raise
		Drainage & Utility Modifications
5	B	Sediment Removal
		Habitat Enhancement
7	B & C	Levee Raise
		Drainage & Utility Modifications
9	C	Sediment Removal
		Habitat Enhancement

Table 4: $350K annual funding scenario and recommended phasing plan for Alternative 3a. A 3% annual increase is assumed for the assessment. A 4% annual inflation rate is assumed for project element implementation beyond Year 1.

Year	Income[a]	Accumulated Income	Maintenance Expenses	Capital Improvements	Insurance	Engineering Design	End of Year Budget	Infrastructure Upgrades
1	$350,000	$350,000	$108,700	$0	$135,000	$21,275	$85,026	
2	$360,500	$710,500	$113,048	$141,830	$140,400	$0	$50,248	Section A - Sediment Removal & Habitat Enhancement
3	$371,315	$1,081,815	$117,570	$0	$146,016	$28,870	$129,107	
4	$382,454	$1,464,269	$122,273	$192,467	$151,857	$0	$44,965	Section A - Levee Raise and Drainage Modifications
5	$393,928	$1,858,198	$127,164	$0	$116,986	$0	$194,743	
6	$405,746	$2,263,943	$132,250	$0	$121,665	$59,220	$287,353	
7	$417,918	$2,681,862	$137,540	$394,803	$126,532	$0	$46,396	Section B - Sediment Removal & Habitat Enhancement
8	$430,456	$3,112,318	$143,042	$0	$131,593	$0	$202,216	
9	$443,370	$3,555,687	$148,763	$0	$136,857	$0	$359,965	
10	$456,671	$4,012,358	$154,714	$0	$142,331	$79,647	$439,944	
11	$470,371	$4,482,728	$160,903	$530,978	$148,025	$0	$70,409	Section B & C - Leveel Raise and Drainage Modifications
12	$484,482	$4,967,210	$167,339	$0	$153,946	$43,437	$190,170	
13	$499,016	$5,466,227	$174,032	$289,581	$160,103	$0	$65,470	Section C - Sediment Removal & Habitat Enhancement
14	$513,987	$5,980,213	$180,993	$0	$166,508	$0	$231,955	
15	$529,406	$6,509,620	$188,233	$0	$173,168	$0	$399,961	
16	$545,289	$7,054,908	$195,763	$0	$180,095	$0	$569,392	
17	$561,647	$7,616,556	$203,593	$0	$187,298	$0	$740,148	
18	$578,497	$8,195,052	$211,737	$0	$194,790	$0	$912,117	
19	$595,852	$8,790,904	$220,206	$0	$202,582	$0	$1,085,181	
20	$613,727	$9,404,631	$229,015	$0	$210,685	$0	$1,259,208	

a - Assumes a 3% increase in income per year

Table 5: $405K annual funding scenario and recommended phasing plan for Alternative 3a. A 3% annual increase is assumed for the assessment. A 4% annual inflation rate is assumed for project element implementation beyond Year 1.

Year	Income[a]	Accumulated Income	Maintenance Expenses	Capital Improvements	Insurance	Engineering Design	End of Year Budget	Infrastructure Upgrades
1	$405,000	$405,000	$108,700	$0	$135,000	$21,275	$140,026	
2	$417,150	$822,150	$113,048	$141,830	$140,400	$27,760	$134,138	Section A - Sediment Removal & Habitat Enhancement
3	$429,665	$1,251,815	$117,570	$185,064	$146,016	$0	$115,152	Section A - Levee Raise and Drainage Modifications
4	$442,554	$1,694,369	$122,273	$0	$151,857	$54,753	$228,824	
5	$455,831	$2,150,200	$127,164	$365,018	$116,986	$0	$75,488	Section B - Sediment Removal & Habitat Enhancement
6	$469,506	$2,619,706	$132,250	$0	$121,665	$0	$291,078	
7	$483,591	$3,103,297	$137,540	$0	$126,532	$70,806	$439,792	
8	$498,099	$3,601,396	$143,042	$472,038	$131,593	$37,130	$154,087	Section B & C - Leveel Raise and Drainage Modifications
9	$513,042	$4,114,438	$148,763	$247,535	$136,857	$0	$133,974	Section C - Sediment Removal & Habitat Enhancement
10	$528,433	$4,642,871	$154,714	$0	$142,331	$0	$365,362	
11	$544,286	$5,187,157	$160,903	$0	$148,025	$0	$600,721	
12	$560,615	$5,747,772	$167,339	$0	$153,946	$0	$840,051	
13	$577,433	$6,325,205	$174,032	$0	$160,103	$0	$1,083,349	
14	$594,756	$6,919,961	$180,993	$0	$166,508	$0	$1,330,604	
15	$612,599	$7,532,560	$188,233	$0	$173,168	$0	$1,581,802	
16	$630,977	$8,163,537	$195,763	$0	$180,095	$0	$1,836,921	
17	$649,906	$8,813,443	$203,593	$0	$187,298	$0	$2,095,936	
18	$669,403	$9,482,846	$211,737	$0	$194,790	$0	$2,358,812	
19	$689,485	$10,172,332	$220,206	$0	$202,582	$0	$2,625,509	
20	$710,170	$10,882,502	$229,015	$0	$210,685	$0	$2,895,980	

a - Assumes a 3% increase in income per year

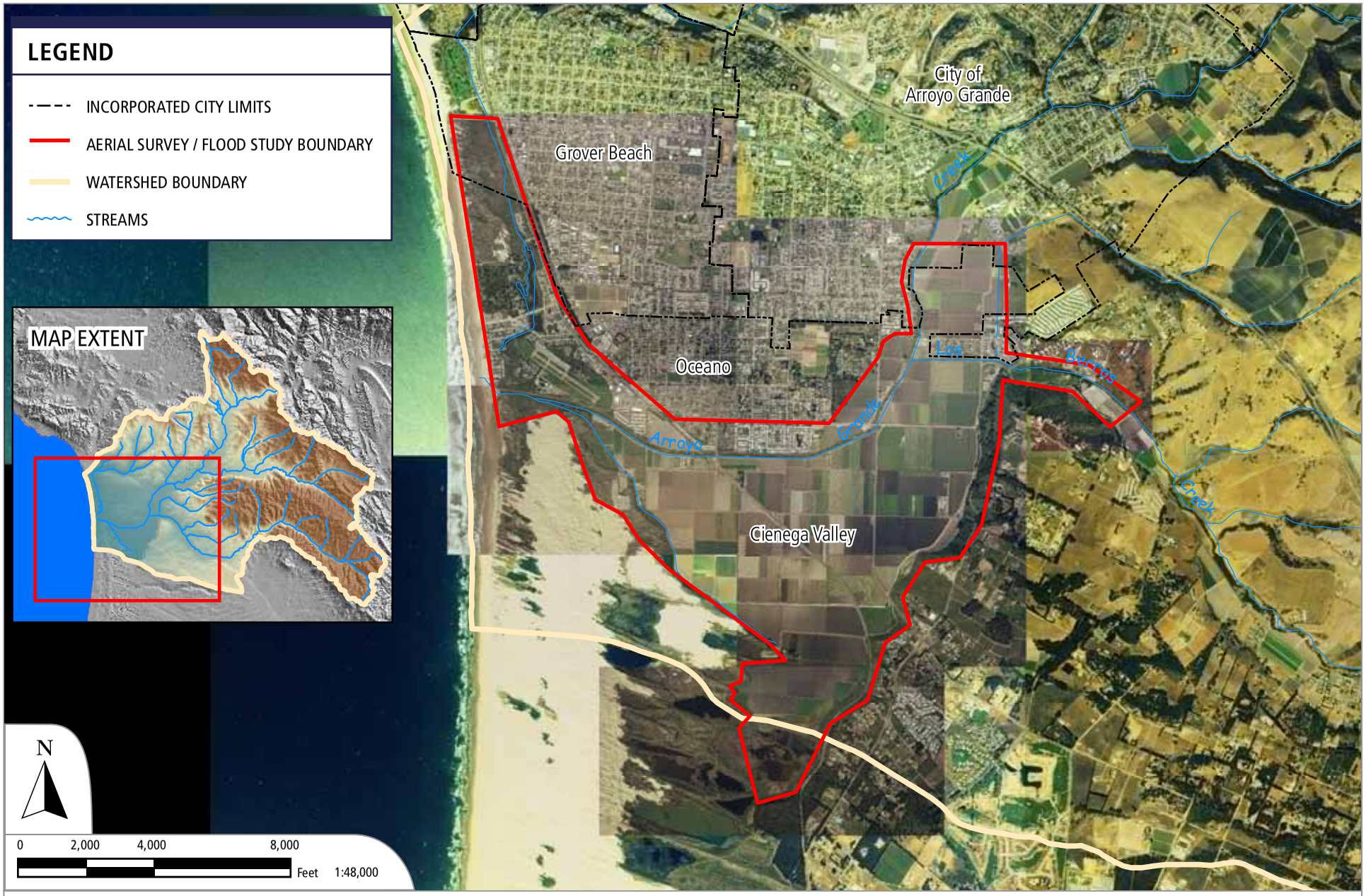

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FIGURE 1: Location map for the Alternative Analysis. The Alternative Analysis focused on hydrologic conditions and impacts on lower Arroyo Grande Creek and lower Los Berros Creek within the Zone 1/1A Flood Control District.

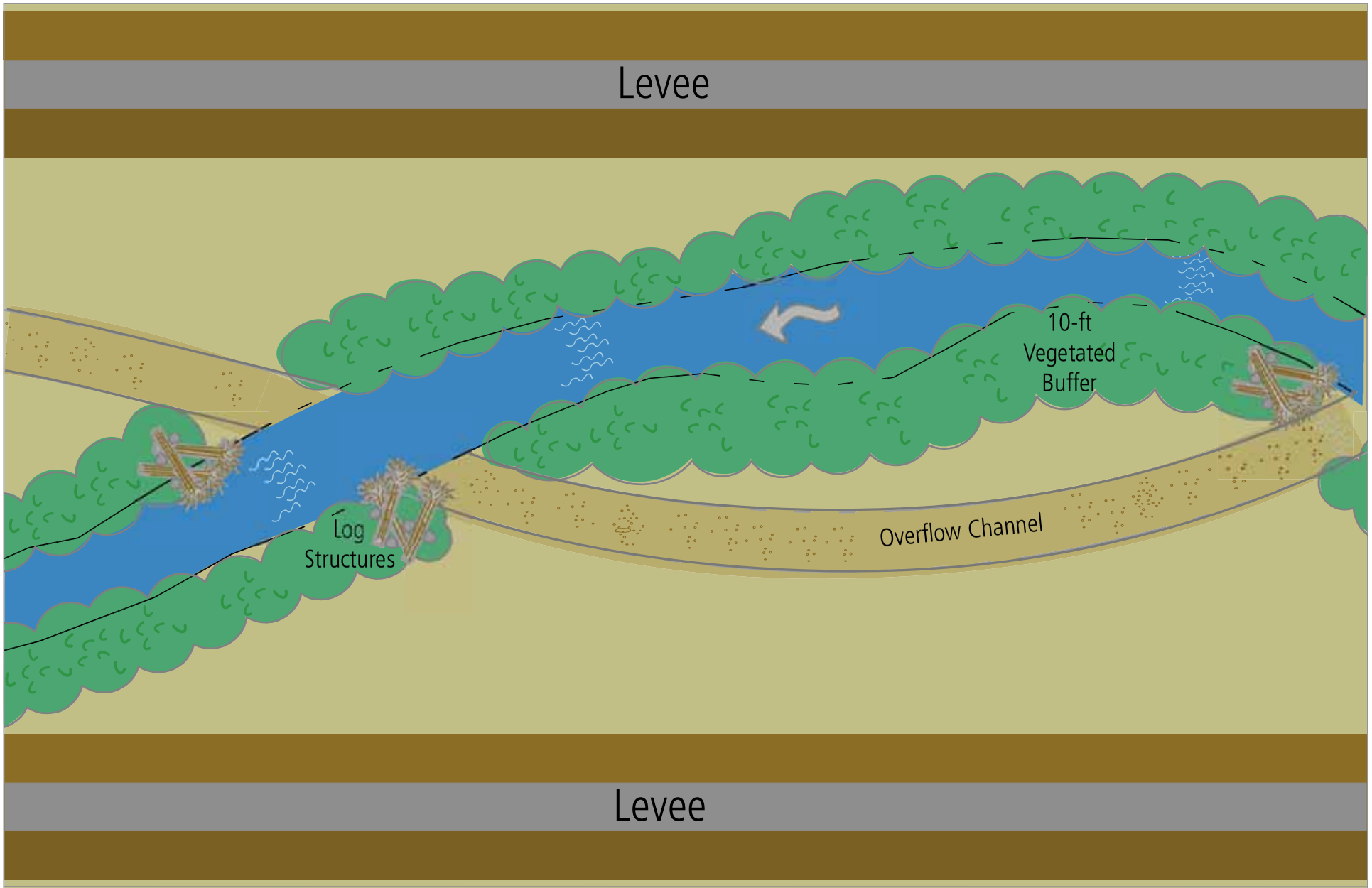

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FIGURE 2: Conceptual diagram of Alternative 2 showing primary and secondary channels following initial sediment management activities. The bottom of the secondary channel would be placed at the bankfull elevation to maintain the stability of the primary channel and provide an overflow channel under high flow conditions. Aquatic habitat enhancement elements, consisting primarily of engineered log structures (LWD), would be placed in strategic locations to encourage pool development and sediment sorting to improve conditions for steelhead.

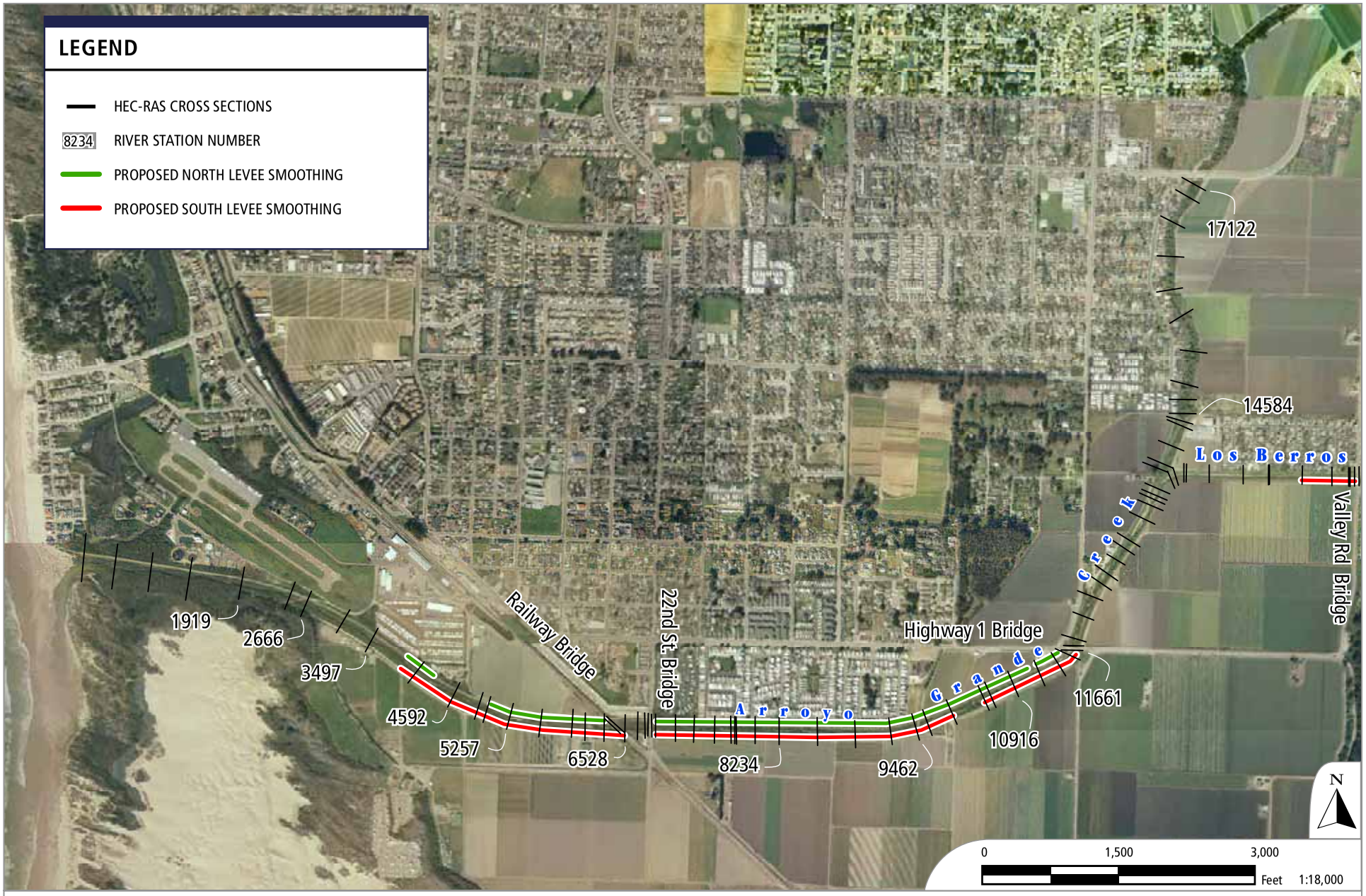

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FIGURE 3: Plan view of levee raise locations for Alternative 3a - Levee Smoothing. Under the levee raise alternatives, the north levee is raised approximately 4-inches above the south levee to provide additional protection to residential areas as compared to the south levee which is dominated by agricultural land uses.

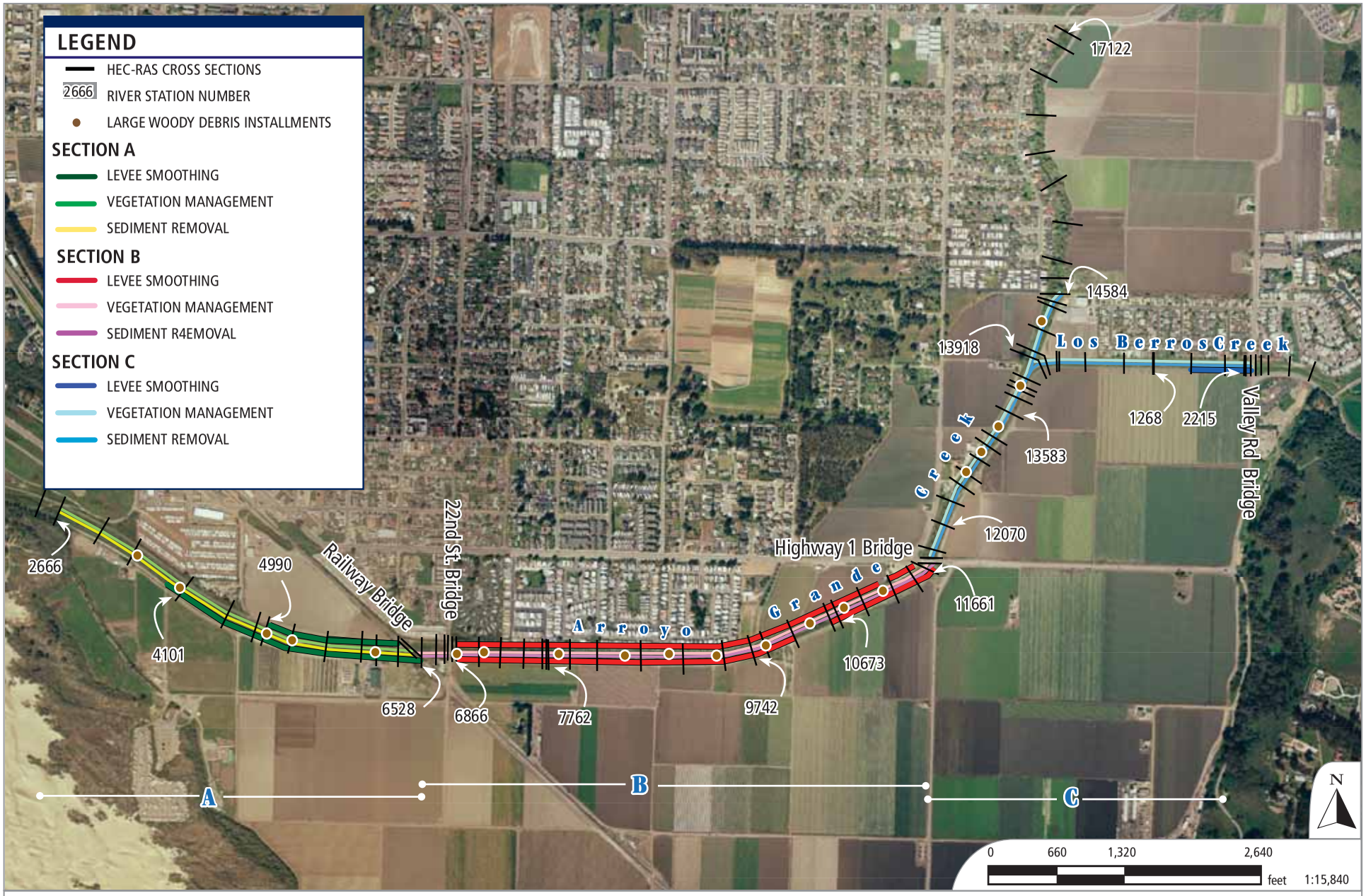

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FIGURE 4: Overview of recommended phasing areas to implement Alternative 3a.

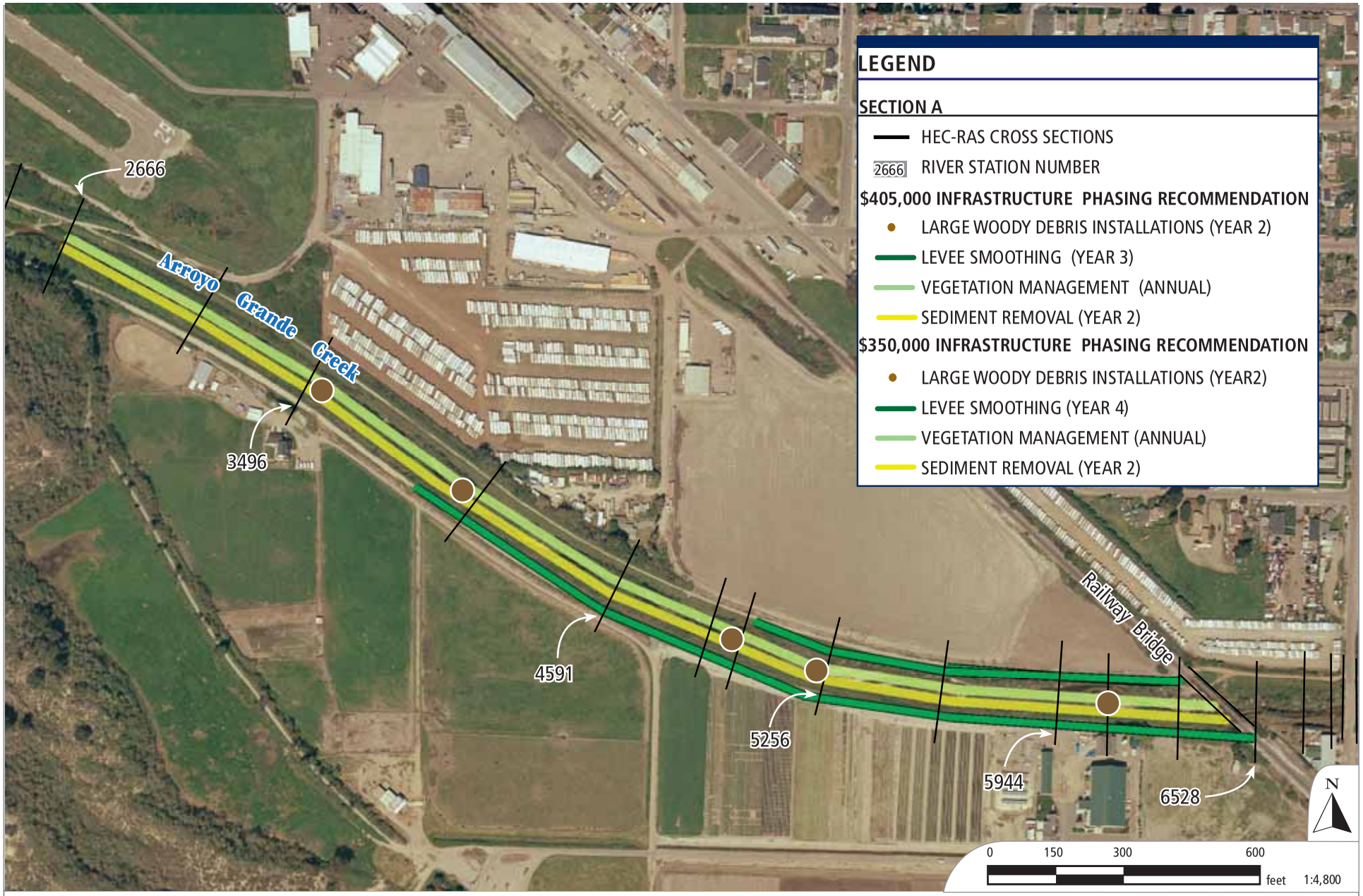

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FIGURE 5

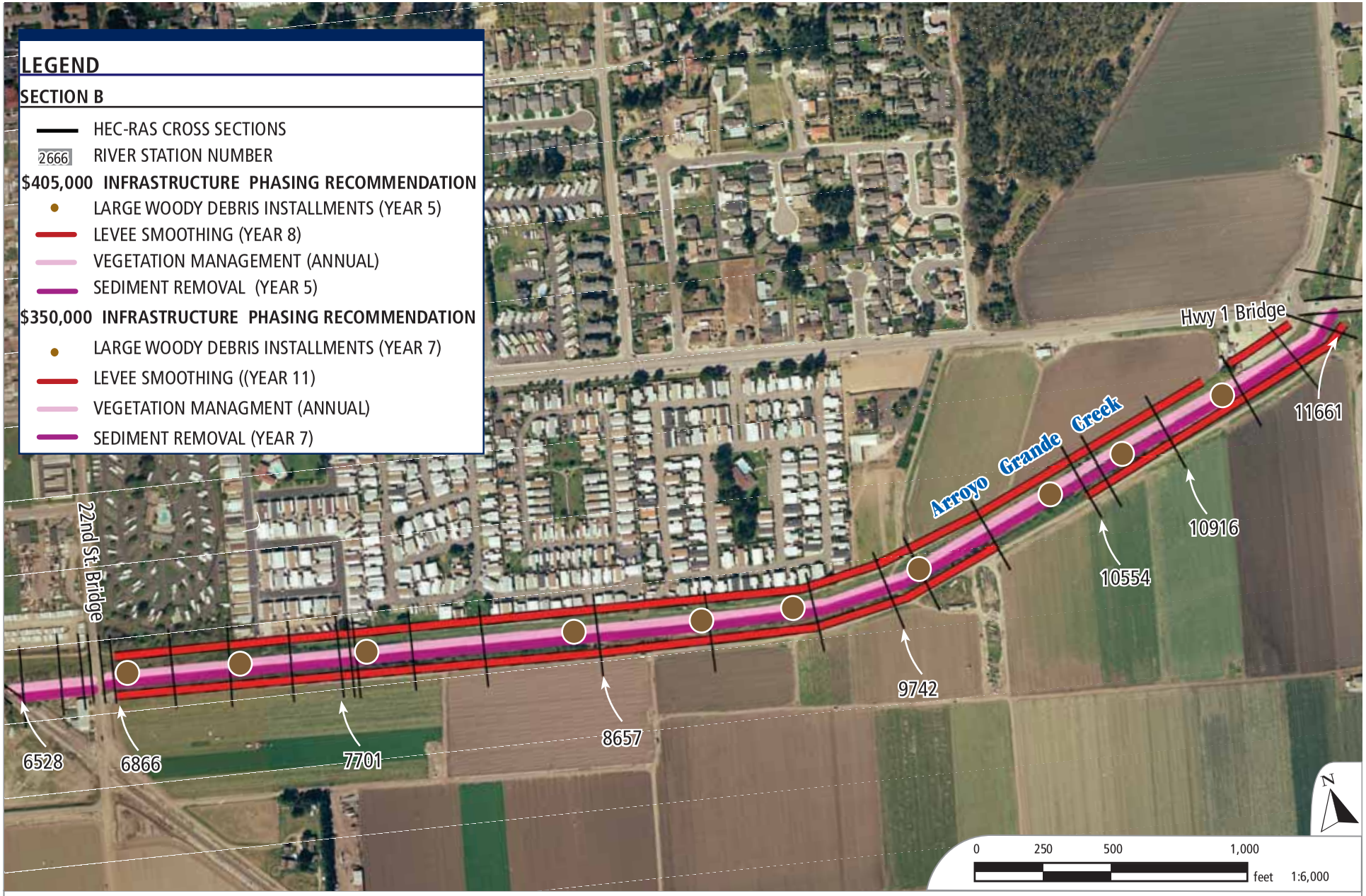

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FIGURE 6

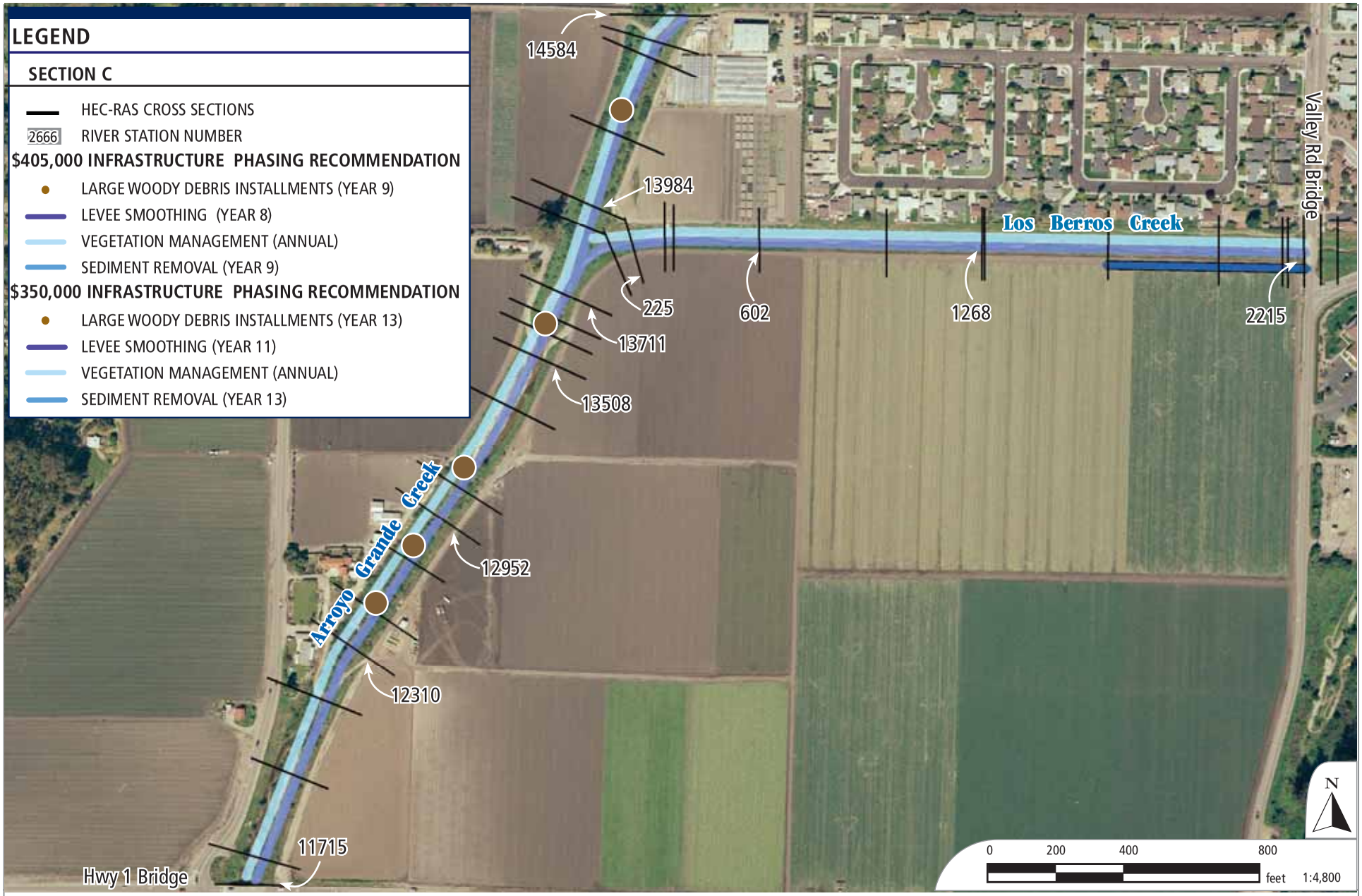

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FIGURE 7