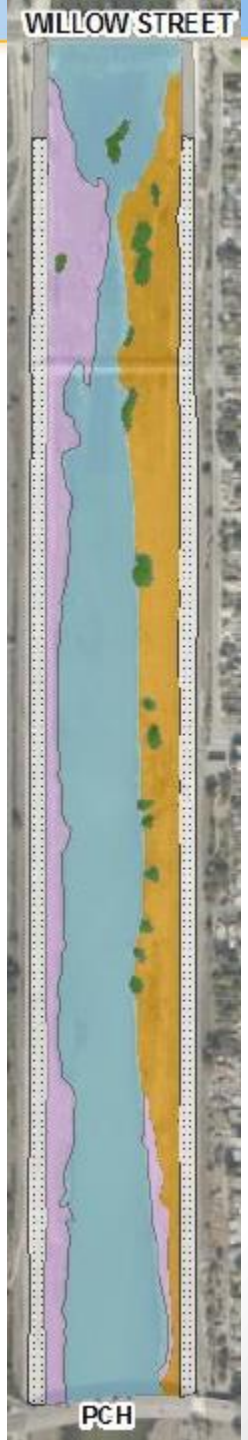
Workshop #5

July 23, 2015

Reach 25 – Lower LA River

No-maintenance Condition

- Allow natural growth of all vegetation



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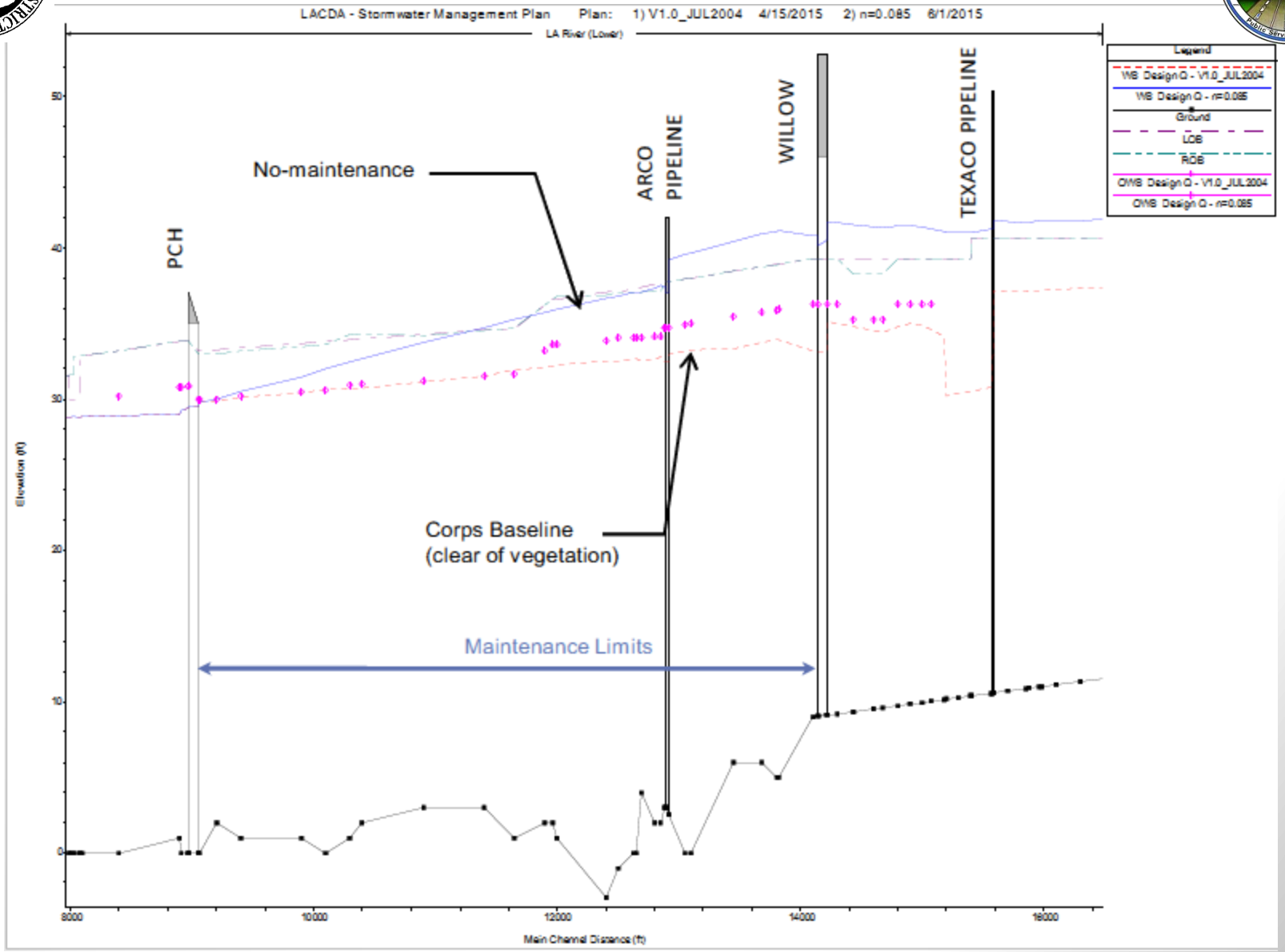
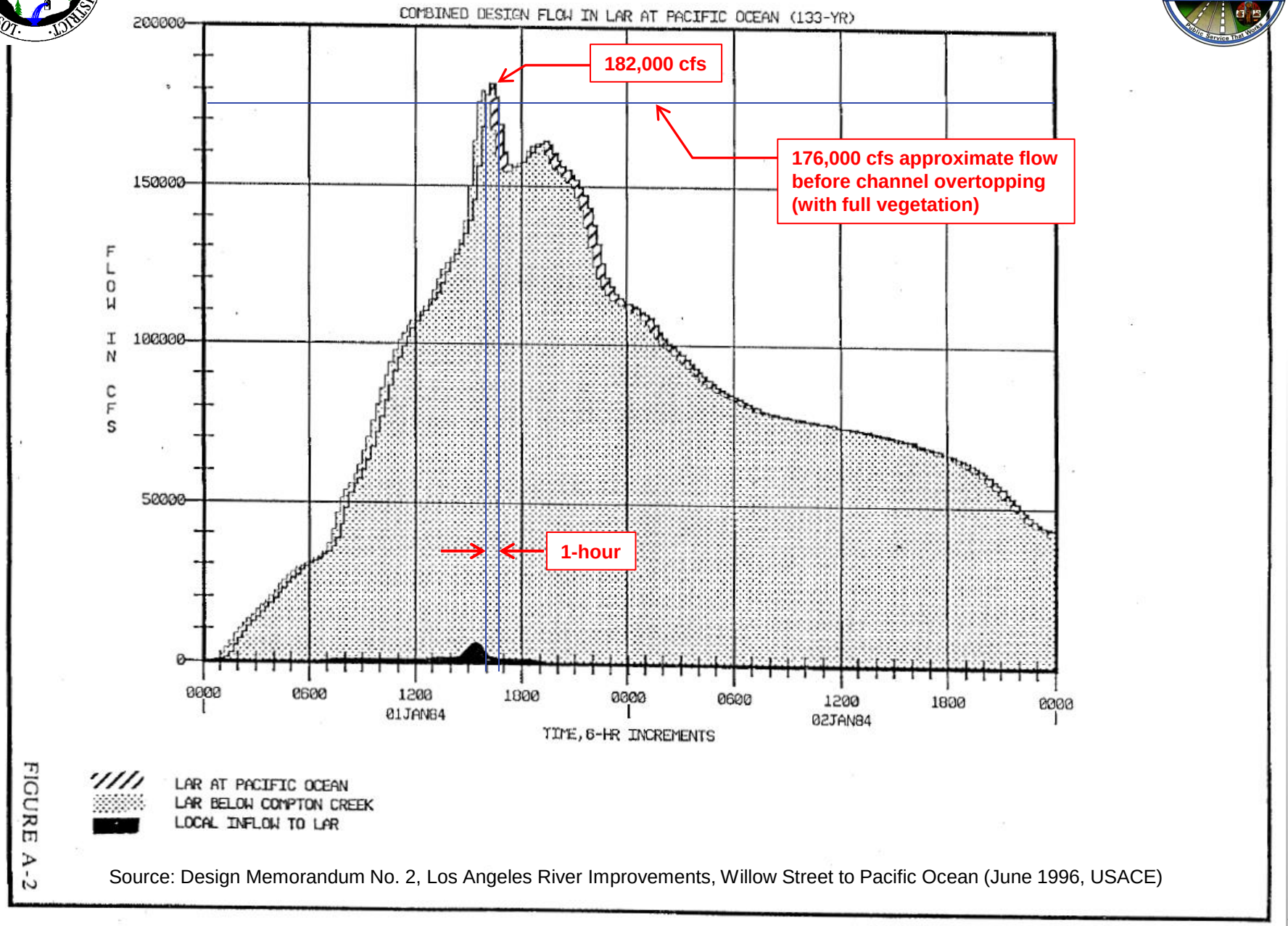
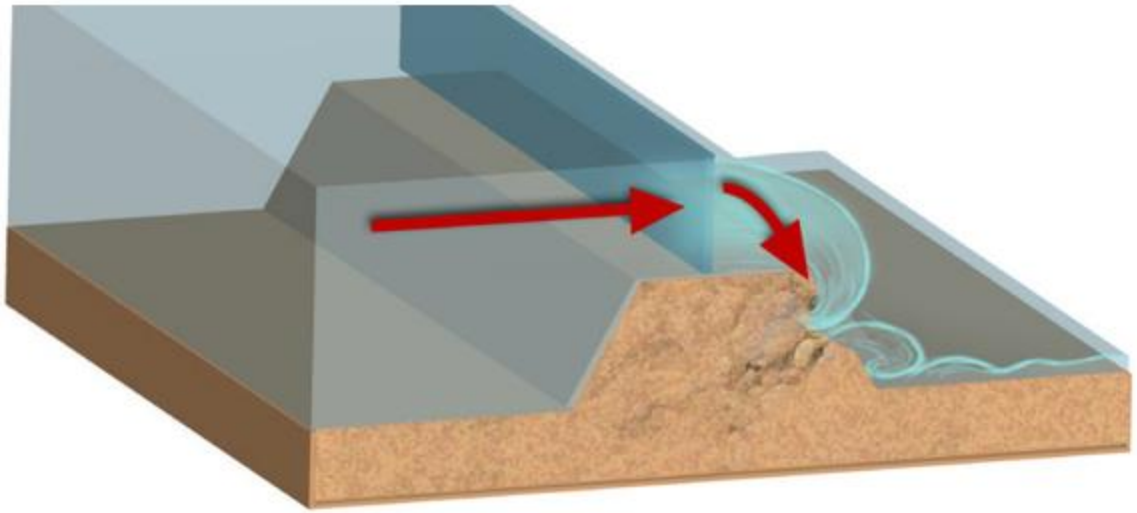


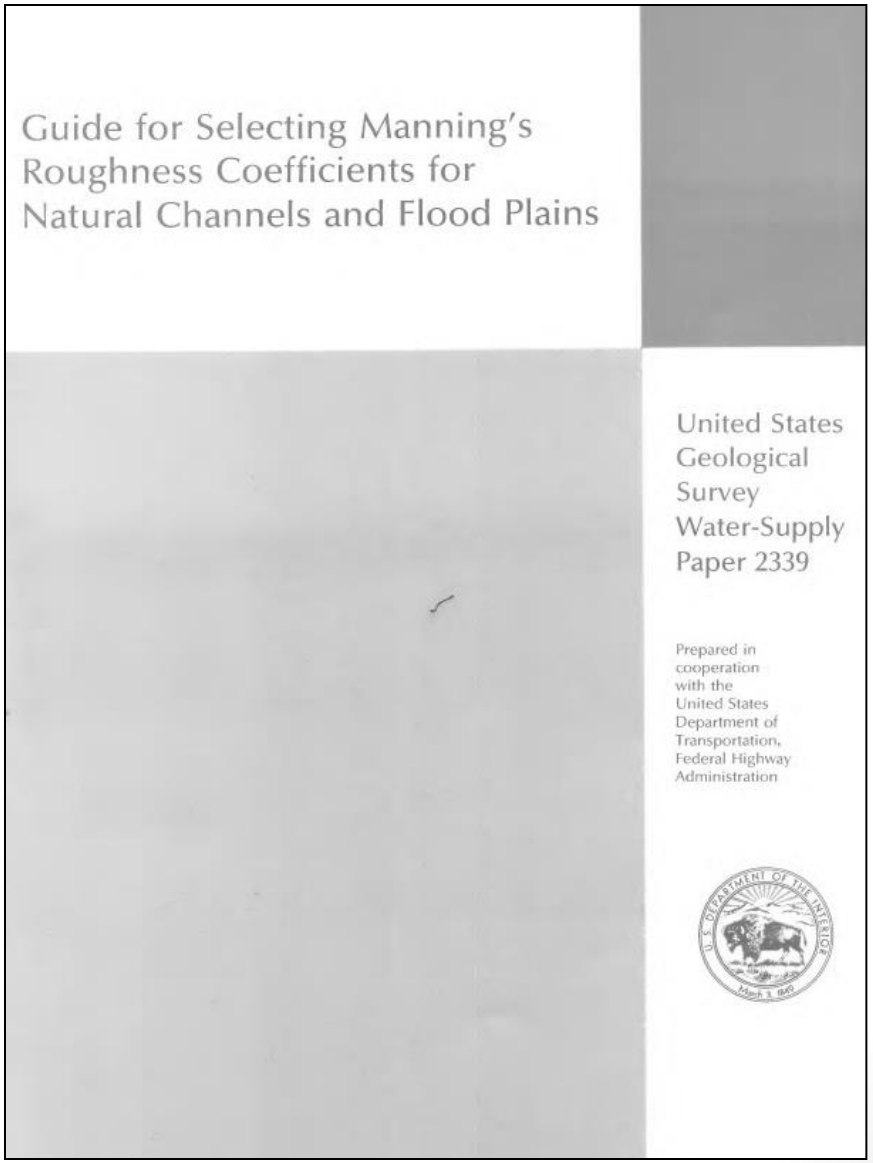


Source: Design Memorandum No. 2, Los Angeles River Improvements, Willow Street to Pacific Ocean (June 1996, USACE)

Levee Overtopping



Manning's Roughness Coefficient



Manning's Roughness Coefficient

- Very significant in computing water surface profiles
- Estimated using formula developed by Cowan (1956)

$$n = (n_b + n_1 + n_2 + n_3 + n_4)m$$

Where:

n_b = a base value of n for a straight, uniform, smooth channel in natural materials,
n_1 = a correction factor for the effect of surface irregularities,
n_2 = a value for variation in the shape and size of the channel cross section,
n_3 = a value for obstructions,
n_4 = a value for vegetation and flow conditions, and
m = a correction factor for meandering of the channel

- Adjustments based on field site observations

Source: Guide for Selecting Manning's Roughness Coefficients for Natural Channels and Flood Plains (USGS, 1984)

Selection of Base Values of Manning's n

Table 1. Base values of Manning's *n*

[Modified from Aldridge and Garrett, 1973, table 1; —, no data]

Bed material	Median size of bed material (in millimeters)	Base *n* value: Straight uniform channel[1]	Base *n* value: Smooth channel[2]
Sand channels			
Sand[3]	0.2	0.012	—
	.3	.017	—
	.4	.020	—
	.5	.022	—
	.6	.023	—
	.8	.025	—
	1.0	.026	—
Stable channels and flood plains			
Concrete	—	0.012–0.018	0.011
Rock cut	—	—	.025
Firm soil	—	0.025–0.032	.020
Coarse sand	1–2	0.026–0.035	—
Fine gravel	—	—	.024
Gravel	2–64	0.028–0.035	
Coarse gravel	—	—	.026
Cobble	64–256	0.030–0.050	—
Boulder	>256	0.040–0.070	—

[1] Benson and Dalrymple (1967).
[2] For indicated material; Chow (1959).
[3] Only for upper regime flow where grain roughness is predominant.

Source: Guide for Selecting Manning's Roughness Coefficients for Natural Channels and Flood Plains (USGS, 1984)

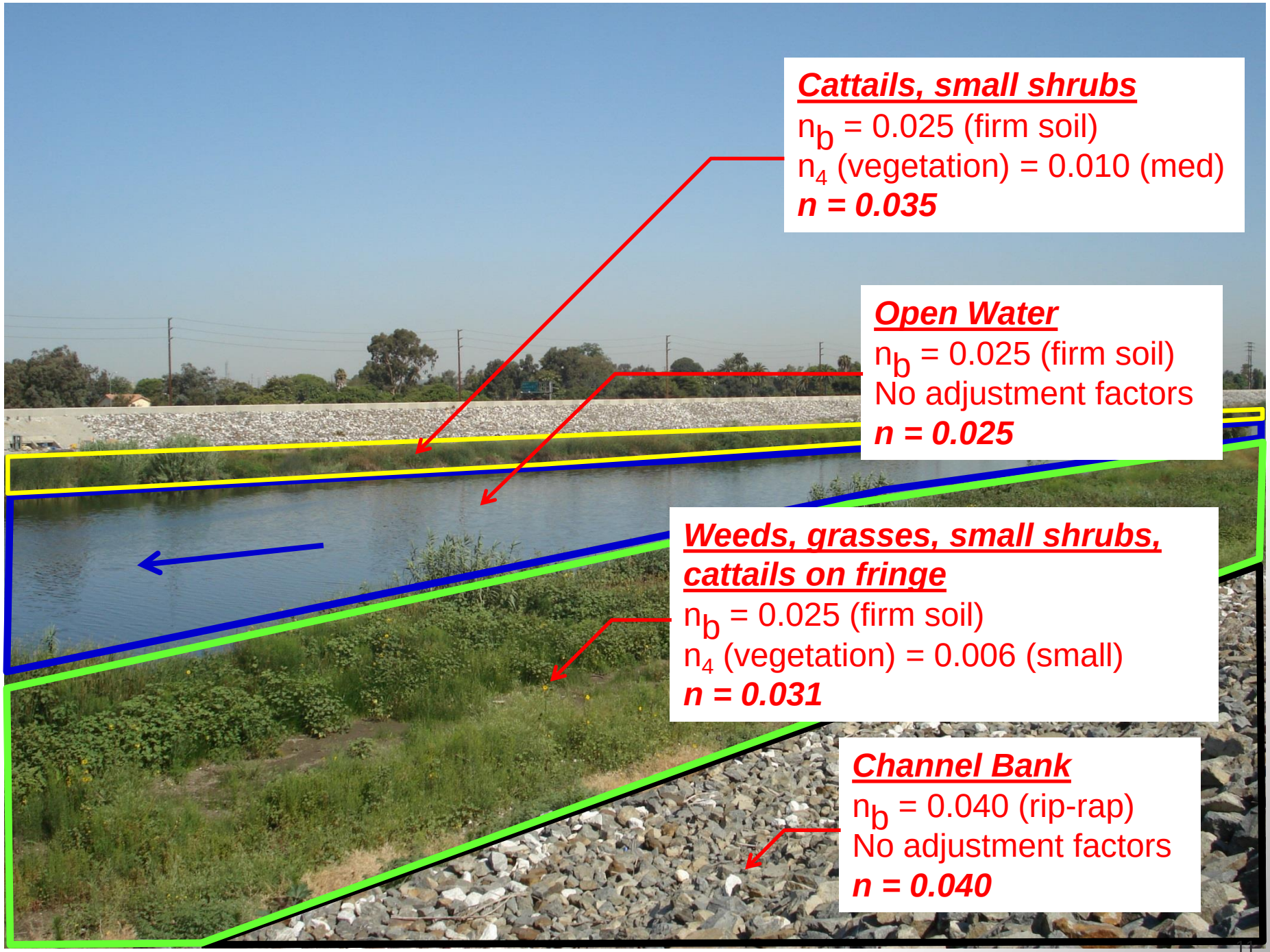
Selection of Adjustment Factor for Vegetation

Amount of vegetation (n_4)	Small	0.002–0.010	Dense growths of flexible turf grass, such as Bermuda, or weeds growing where the average depth of flow is at least two times the height of the vegetation; supple tree seedlings such as willow, cottonwood, arrowweed, or saltcedar growing where the average depth of flow is at least three times the height of the vegetation.
	Medium	0.010–0.025	Turf grass growing where the average depth of flow is from one to two times the height of the vegetation; moderately dense stemmy grass, weeds, or tree seedlings growing where the average depth of flow is from two to three times the height of the vegetation; brushy, moderately dense vegetation, similar to 1- to 2-year-old willow trees in the dormant season, growing along the banks, and no significant vegetation is evident along the channel bottoms where the hydraulic radius exceeds 2 ft.
	Large	0.025–0.050	Turf grass growing where the average depth of flow is about equal to the height of the vegetation; 8- to 10-year-old willow or cottonwood trees intergrown with some weeds and brush (none of the vegetation in foliage) where the hydraulic radius exceeds 2 ft; bushy willows about 1 year old intergrown with some weeds along side slopes (all vegetation in full foliage), and no significant vegetation exists along channel bottoms where the hydraulic radius is greater than 2 ft.
	Very large	0.050–0.100	Turf grass growing where the average depth of flow is less than half the height of the vegetation; bushy willow trees about 1 year old intergrown with weeds along side slopes (all vegetation in full foliage), or dense cattails growing along channel bottom; trees intergrown with weeds and brush (all vegetation in full foliage).

Source: Guide for Selecting Manning's Roughness Coefficients for Natural Channels and Flood Plains (USGS, 1984)

Manning's Roughness Coefficient

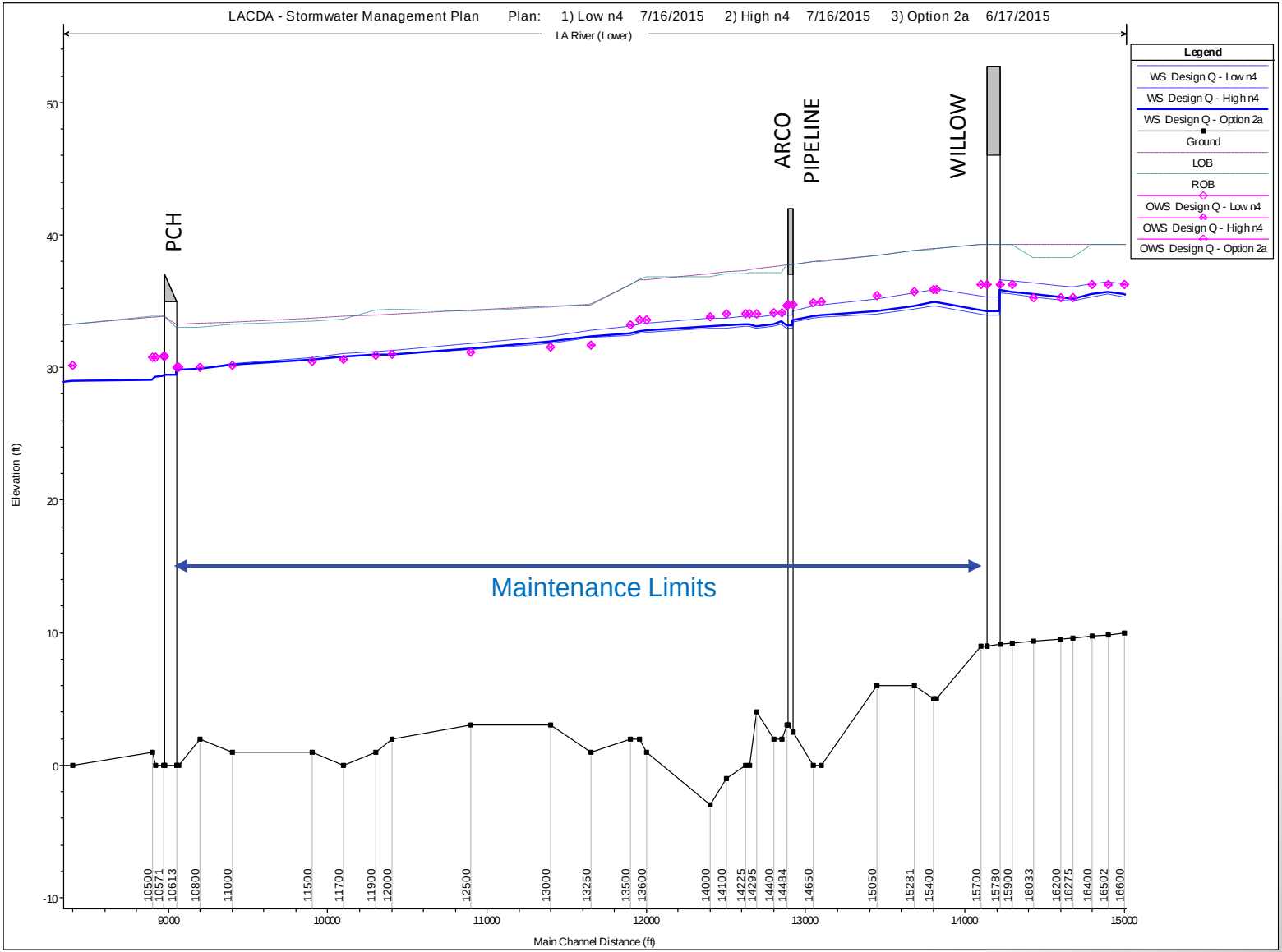
- Adjustment factors range depending on channel conditions
- Depth of flow must be considered
- Adjustment factors are picked from a table, not calculated
- Channel conditions for each reach were discussed and compared


Cattails, small shrubs
n_b = 0.025 (firm soil)
n_4 (vegetation) = 0.010 (med)
n = 0.035
Open Water
n_b = 0.025 (firm soil)
No adjustment factors
n = 0.025
Weeds, grasses, small shrubs, cattails on fringe
n_b = 0.025 (firm soil)
n_4 (vegetation) = 0.006 (small)
n = 0.031
Channel Bank
n_b = 0.040 (rip-rap)
No adjustment factors
n = 0.040

Reach 25 – Lower LA River
Summary of Roughness Coefficients

	n_b					n_4						
	Base "n"					Vegetation						
	0.026 – 0.035	0.025 – 0.032	0.024 – 0.035	0.012 – 0.018	0.03 – 0.07	0.002 – 0.010	0.010 – 0.025	0.025 – 0.050	0.050 – 0.100	Low Range	Total "n"	High Range
Description	Sand	Firm Soil	Gravel	Concrete	Cobble / Boulder	Small	Medium	Large	Very Large			
Firm Soil		0.025				0					**0.025**	
Concrete				0.014		0					**0.014**	
Cattails, small shrubs		0.025					0.010			0.035	**0.035**	0.050
Low weeds and grasses, small shrub, scattered willow trees		0.025				0.006				0.027	**0.031**	0.035
Rip-rap bank slopes					0.04	0				0.040	**0.040**	0.040
Willow Trees		0.025				0			0.06	0.075	**0.085**	0.125

Reach 25 – Lower LA River
N-value Sensitivity Analysis



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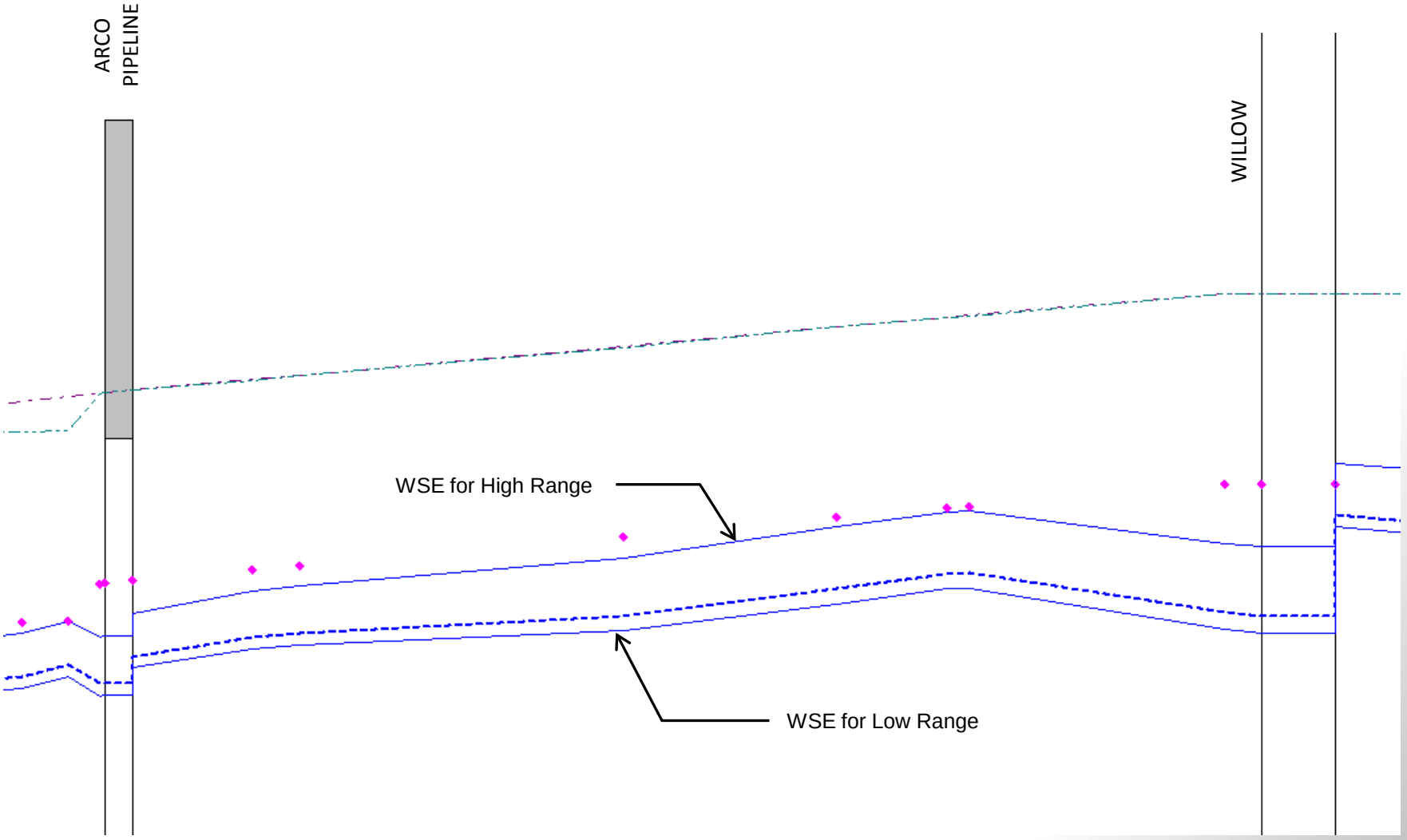

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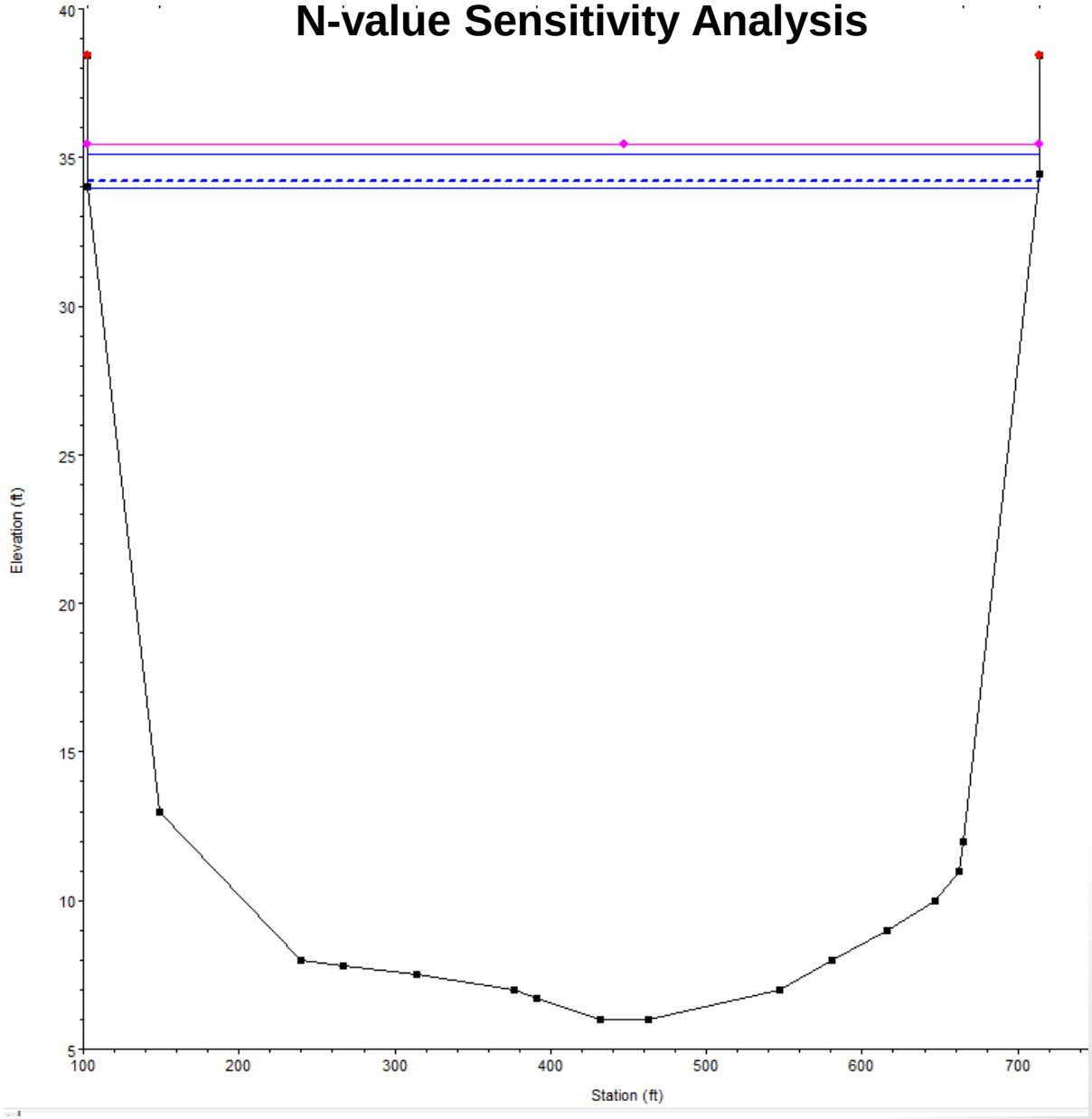


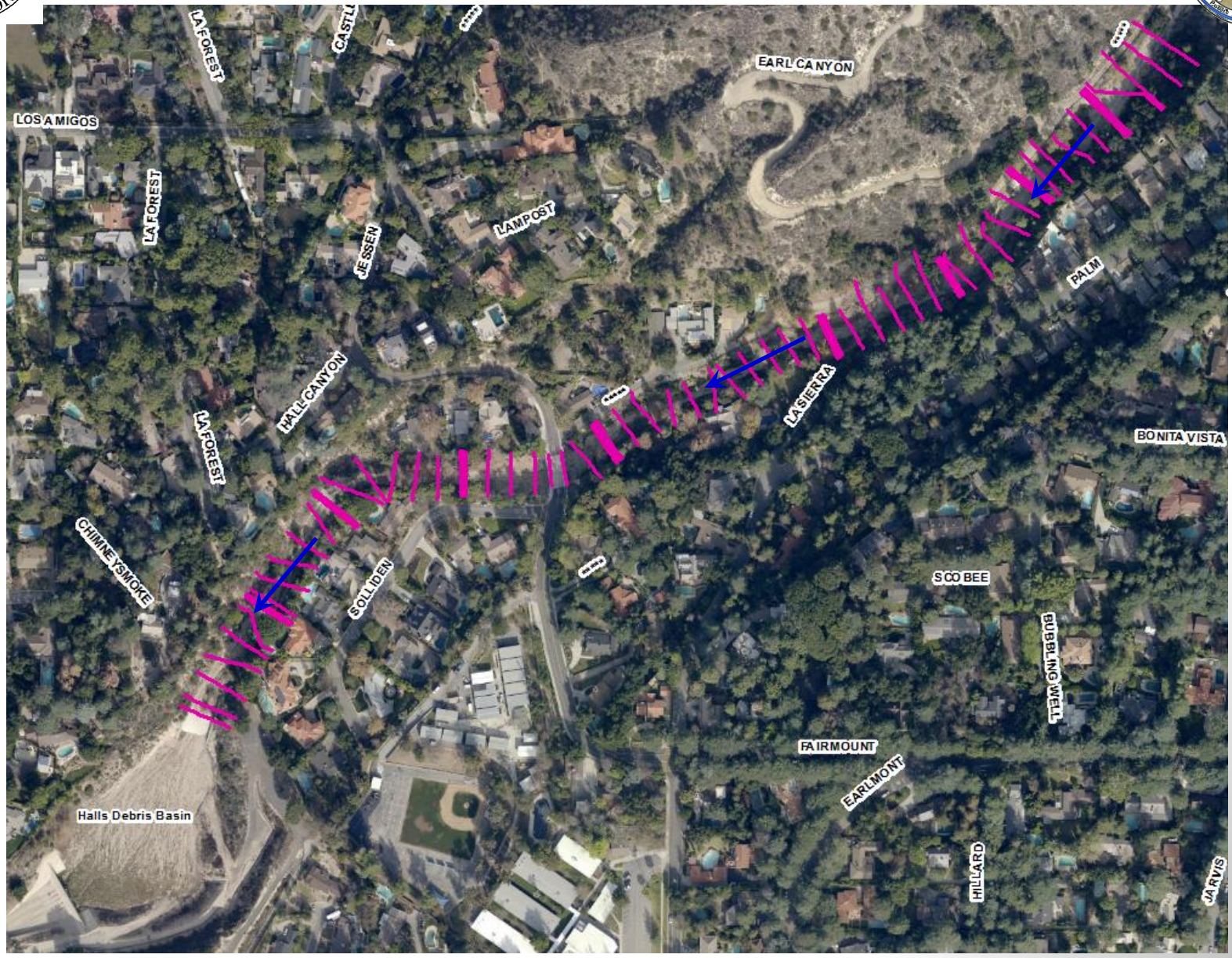
Los Angeles River Watershed Feasibility Study Results

Reach No.	Name	Extra Capacity
1	Bell Creek	Yes
2	Dry Canyon Creek	No
3	Santa Susana Creek tributary to Brown Canyon Creek	No
4	Browns Canyon Creek	No
5	Caballero Creek, West Fork	No
6	Caballero Creek M.C.I., East Fork	No
7	Bull Creek	No
8	Tributary to the Sepulveda Flood Control Basin Project No. 470 outlet	No
9	Tributary to the Sepulveda Flood Control Basin Project No.106	Yes
10	Tributary to the Sepulveda Flood Control Basin Project No. 469	No
12	Haines Canyon Creek	No
13	Tributary to Hansen Lake Project No. 5215 Unit1	No
14	May Canyon Creek	No
15	Pacoima Wash	No
16	Verdugo Wash-Las Barras Canyon channel inlet	No
18	Engleheard Channel, tributary to Verdugo Wash	No
19	Pickens Canyon, tributary to Verdugo Wash	Yes
20	Webber Channel, tributary to Halls Canyon Channel	Yes
21	Webber Channel (main channel inlet at bridge), tributary to Halls Canyon Channel	Yes
22	Halls Canyon Channel	Yes
24	Compton Creek	No
25	Los Angeles River	Yes
96	PD 1591 Calabasas	No
99	Kagel Canyon	No
100	Dry Canyon Calabasas	No

Reach 22 - Halls Canyon Channel

- Located in Los Angeles River Watershed in City of La Cañada Flintridge
- Reach starts 1,370 feet upstream of Jessen Drive to Halls Canyon Debris Basin
- Total reach length is 2,406 feet
- Built by LACFCD
- Contains eight concrete crib structures
- Channel has sufficient capacity
- Recommendation to allow native shrubs to grown on invert of entire channel reach

Reach 22 – Halls Canyon Channel



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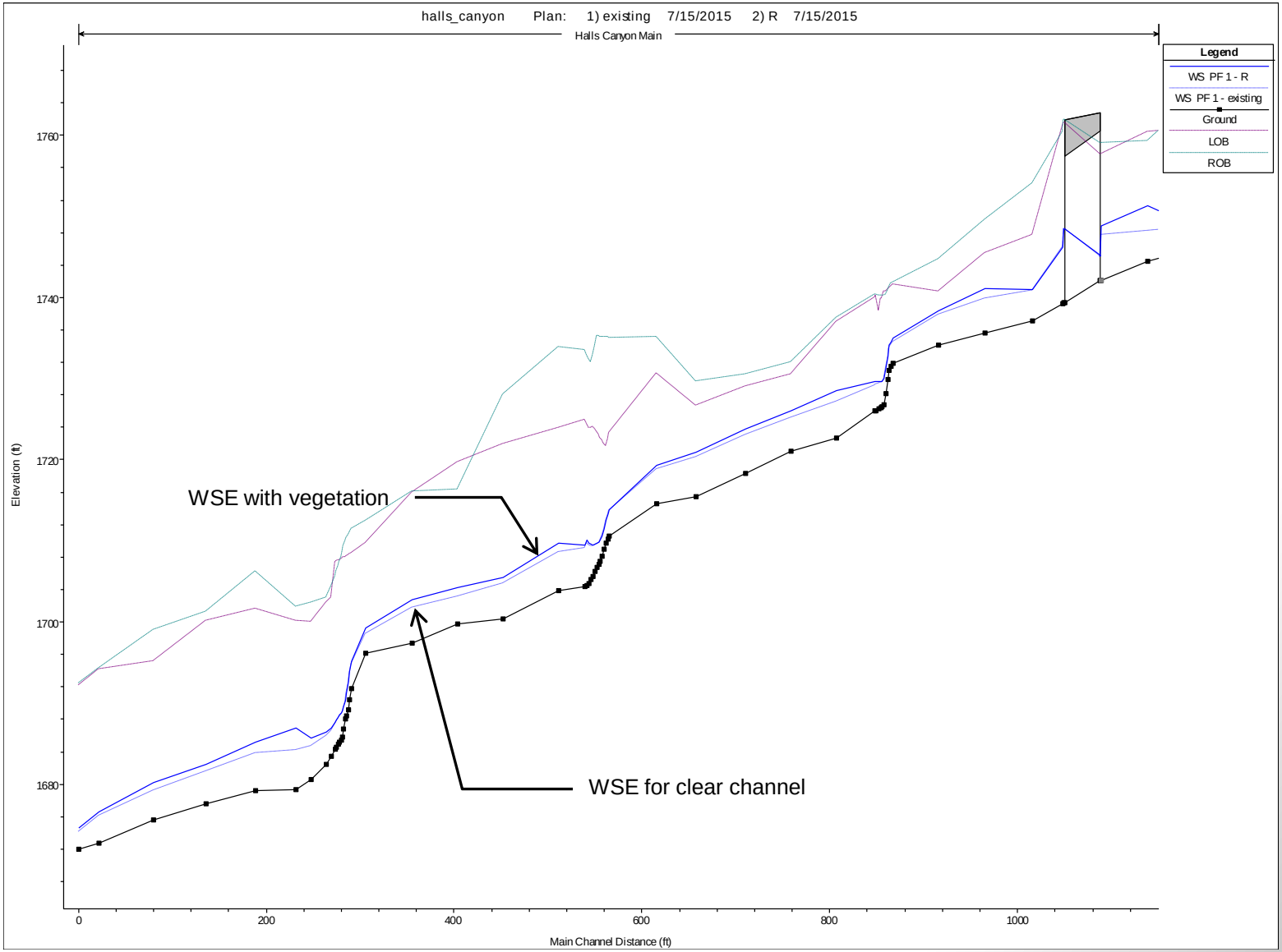

Reach 15 – Pacoima Wash

- Reach extends from Parthenia Street to Marson Street
- Built by LACFCD in 1956
- Total reach length is 4,762 feet
- Contains two bridge structures
- Channel does not have sufficient capacity

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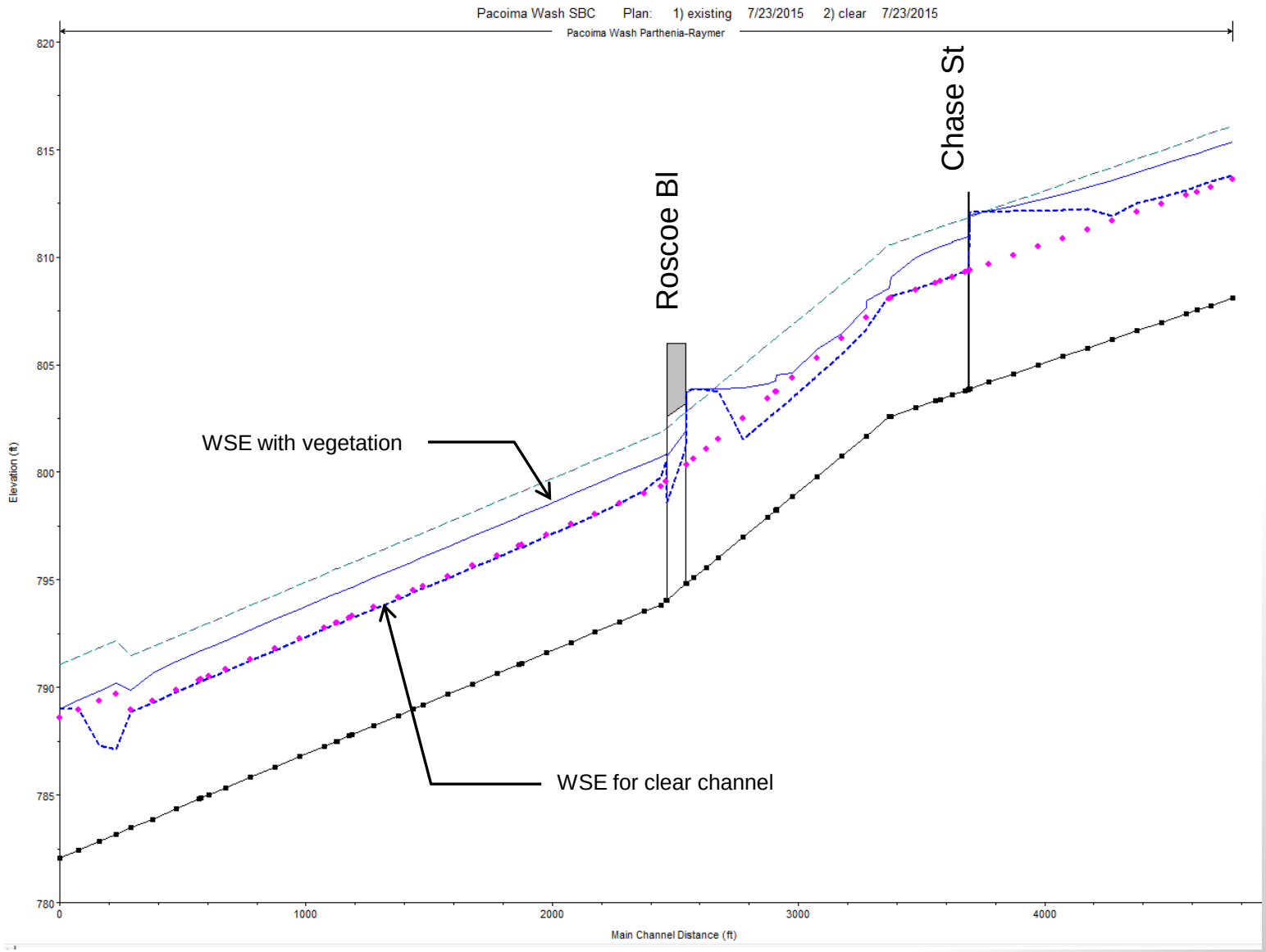
Reach 15 – Pacoima Wash