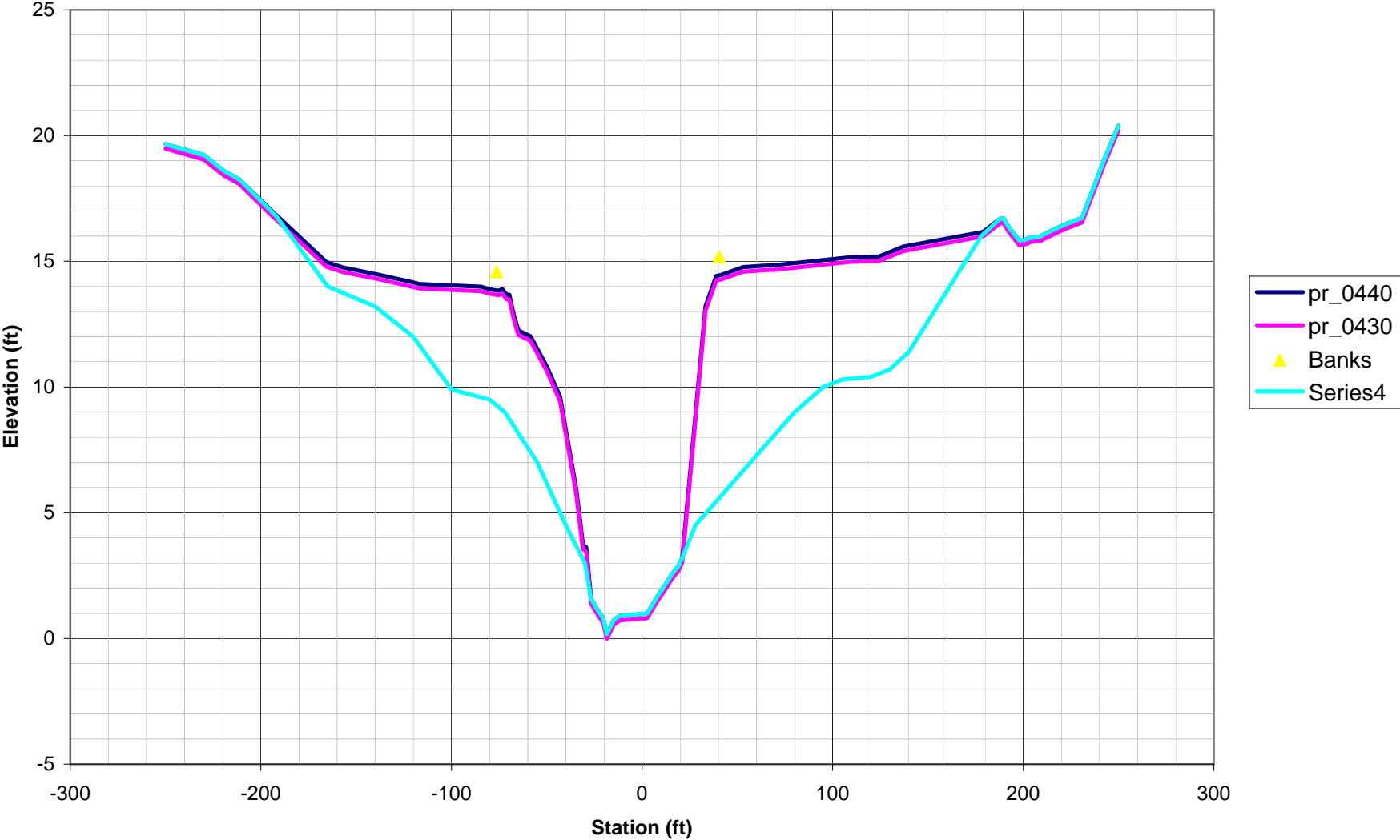


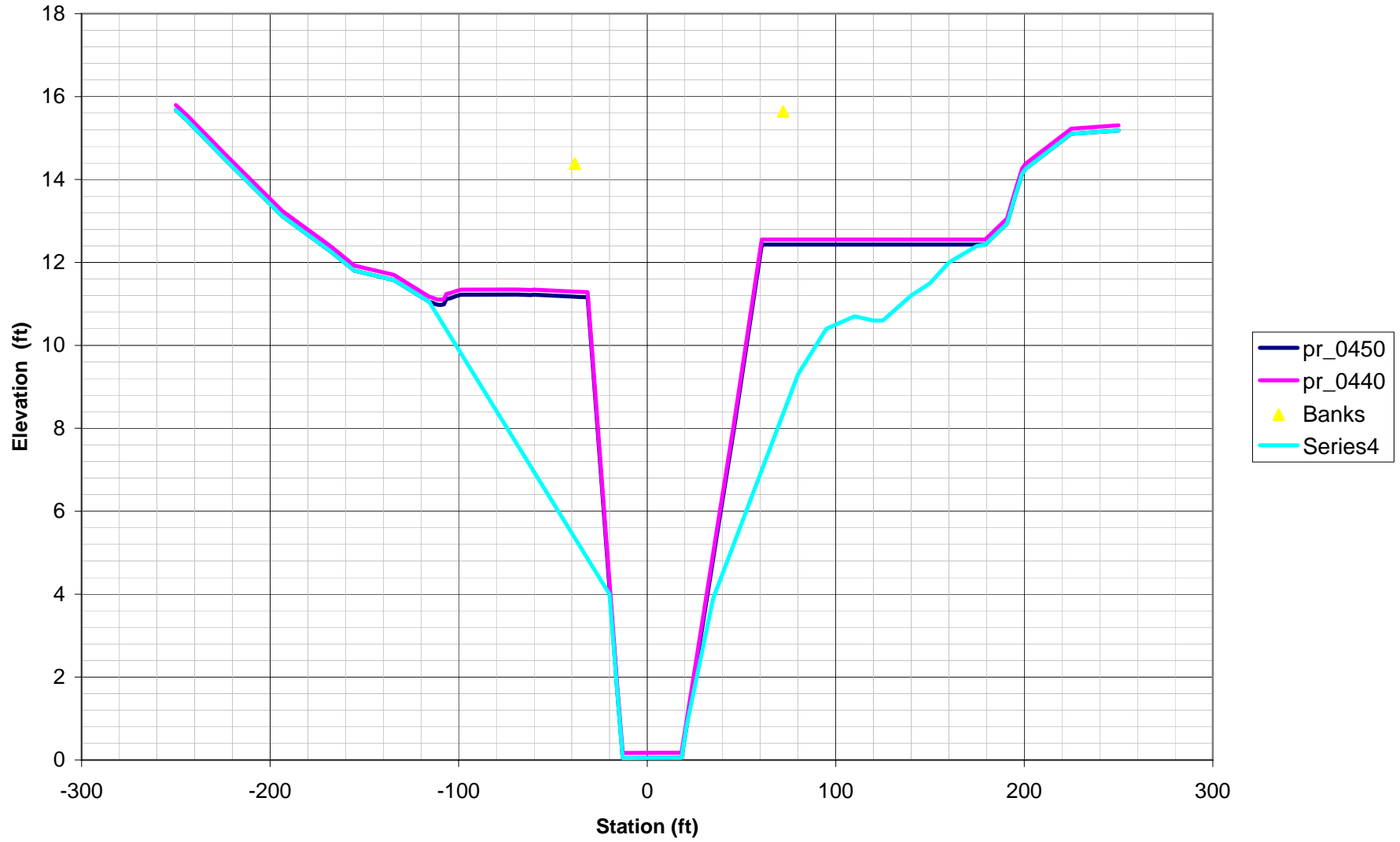
**Attachment 1**  
**Cross Section Terracing Edits**

DRAFT

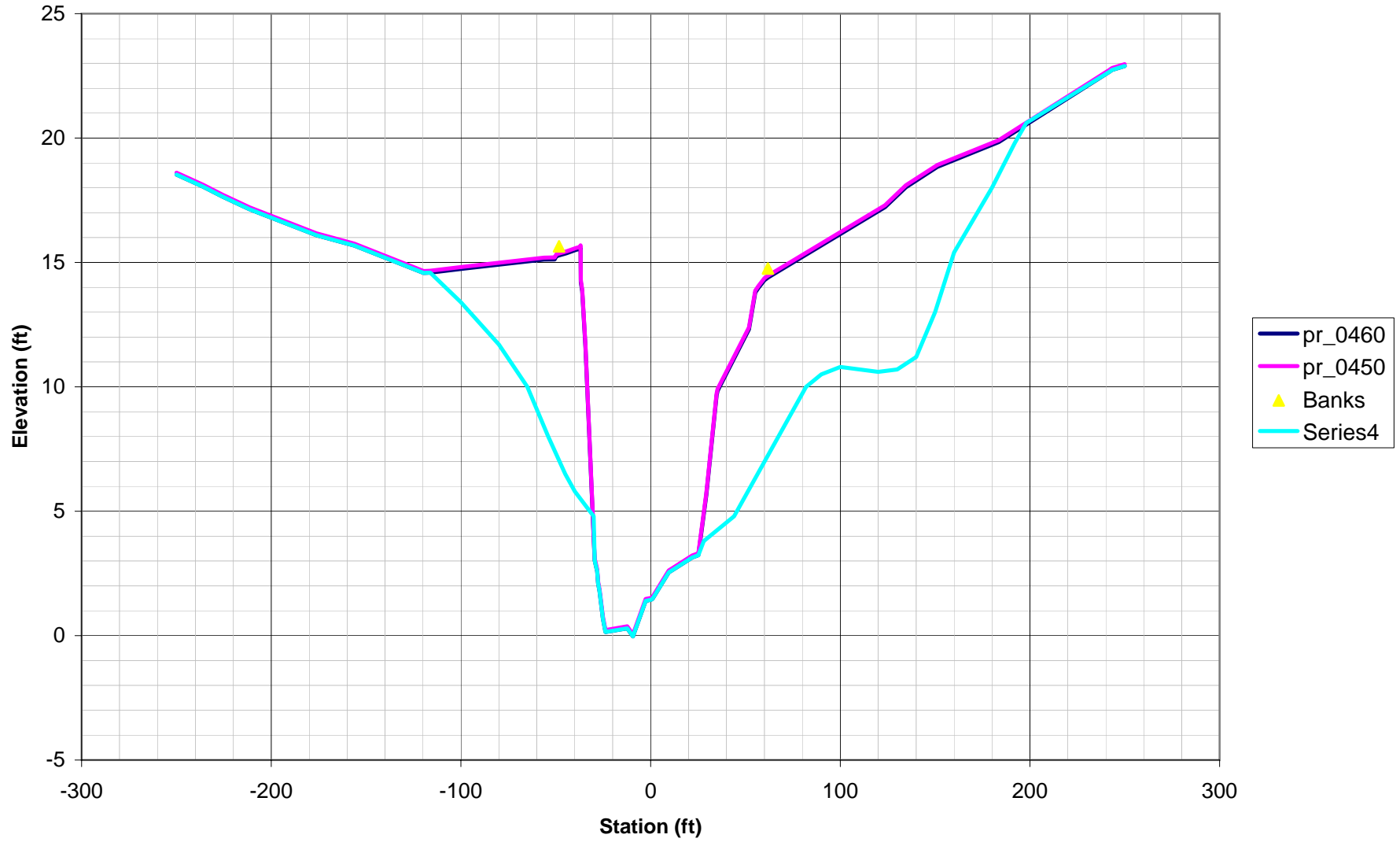
Nodes pr\_0440 to pr\_0430



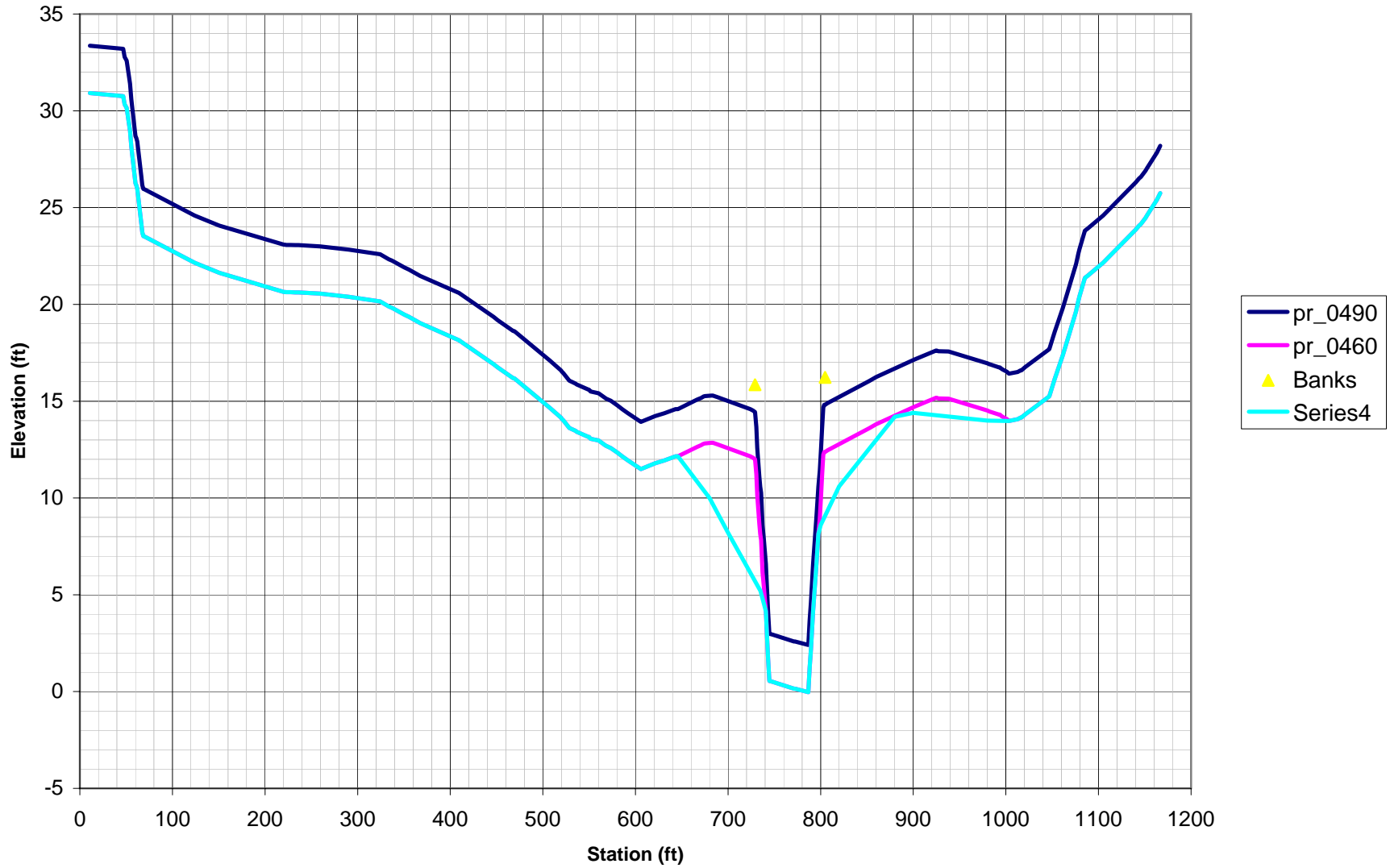
### Node pr\_0450 to pr\_0440



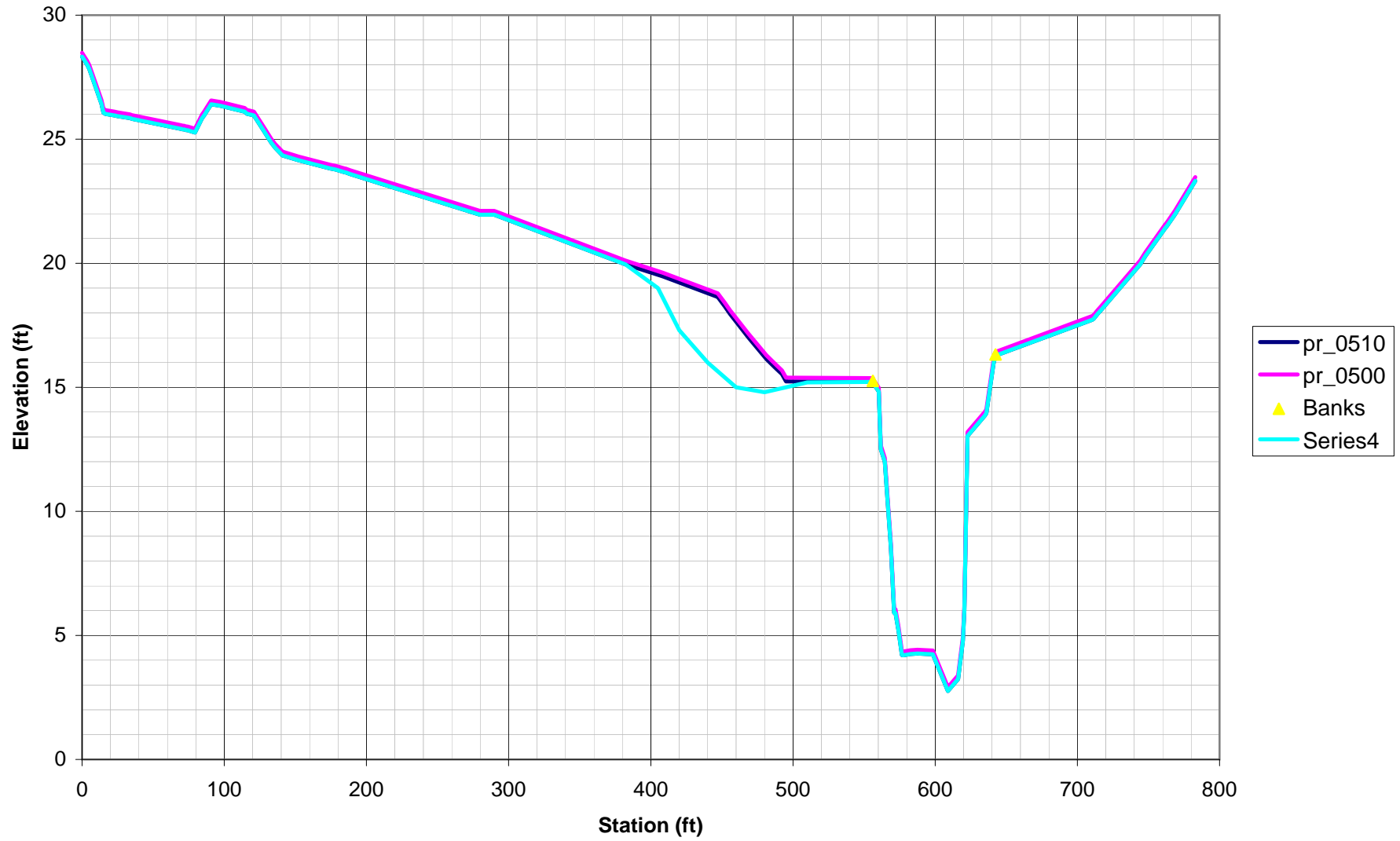
### Node pr\_0460 to pr\_0450



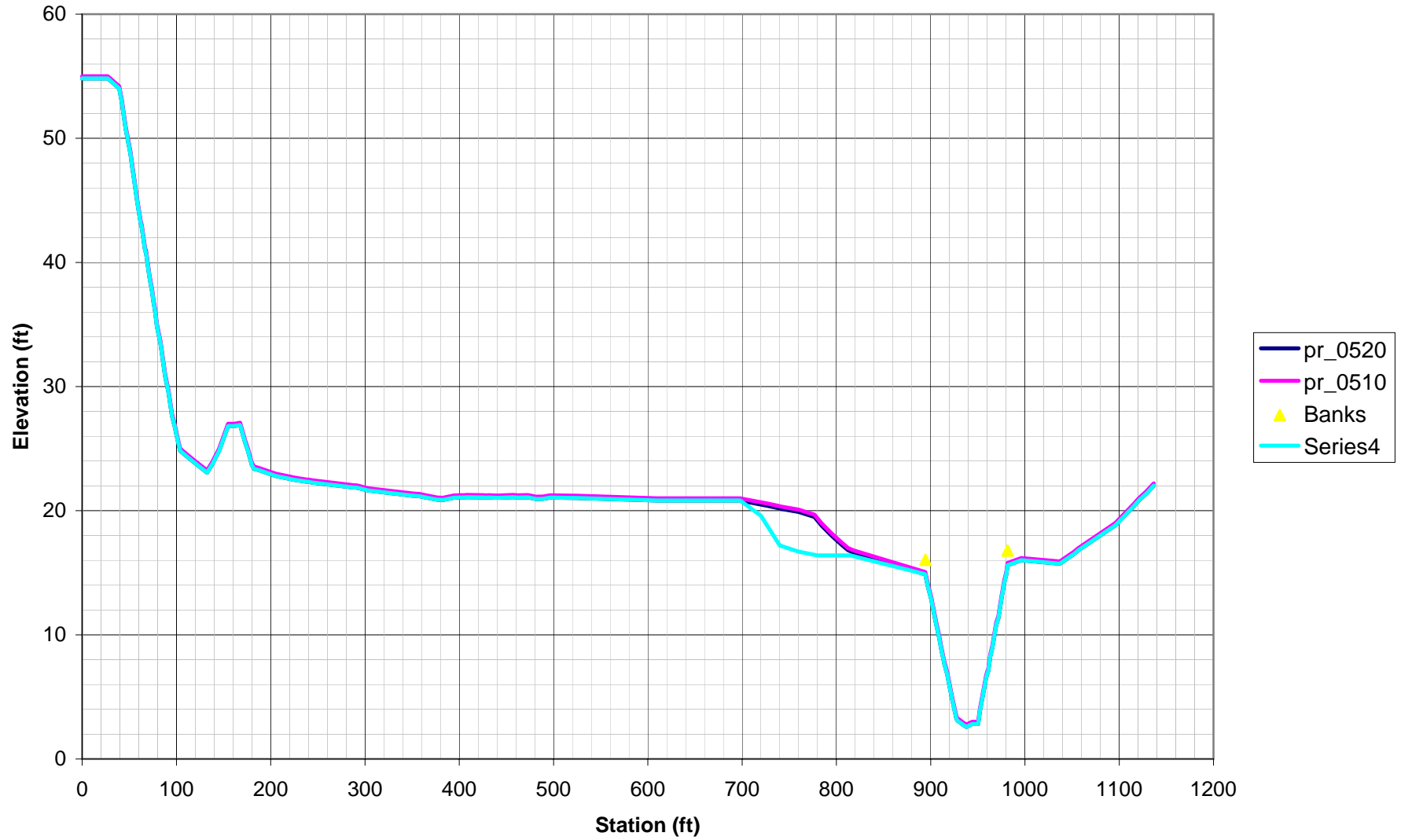
### Node pr\_0490 to pr\_0460



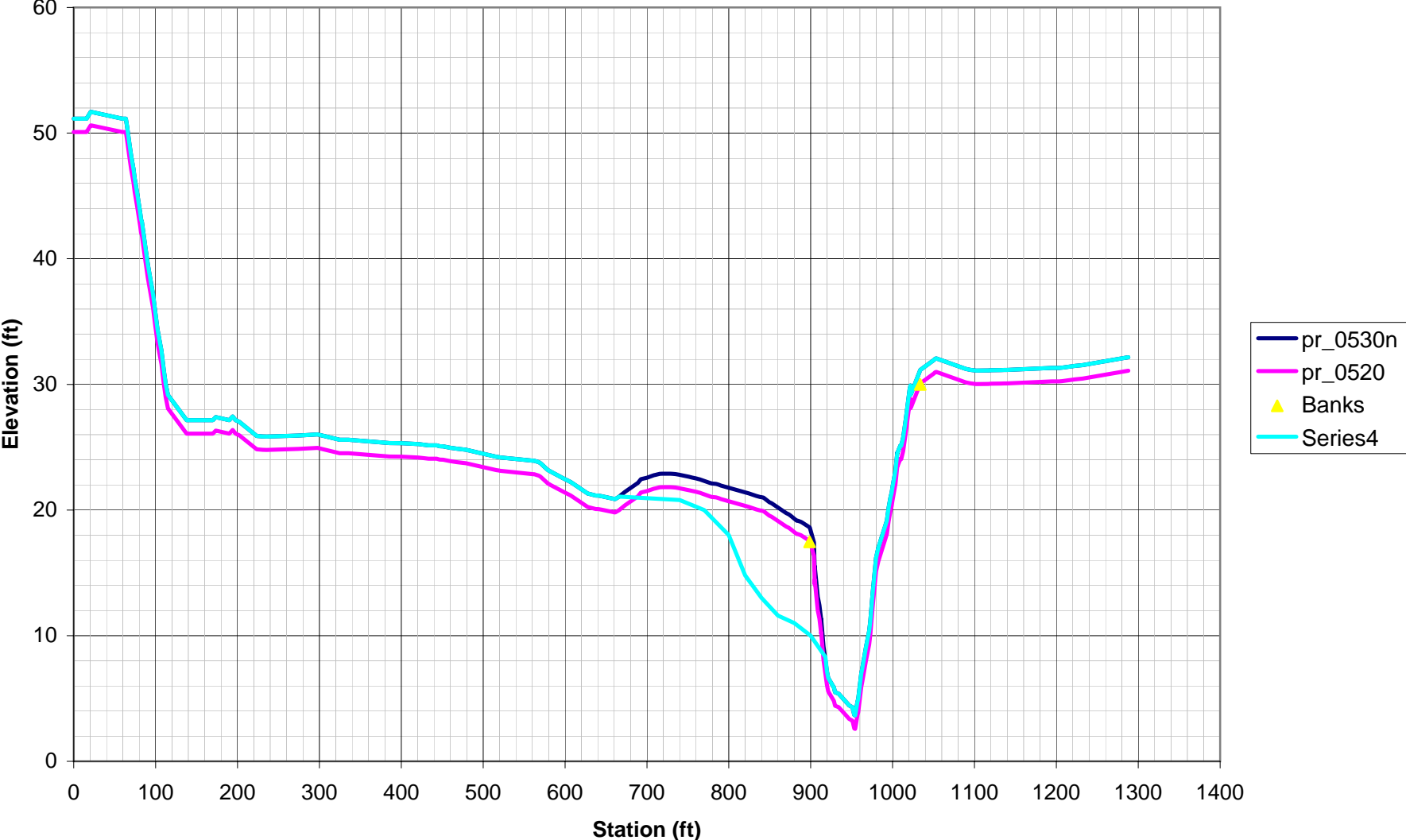
### Node pr\_0510 to pr\_0500



### Node pr\_0520 to pr\_0510

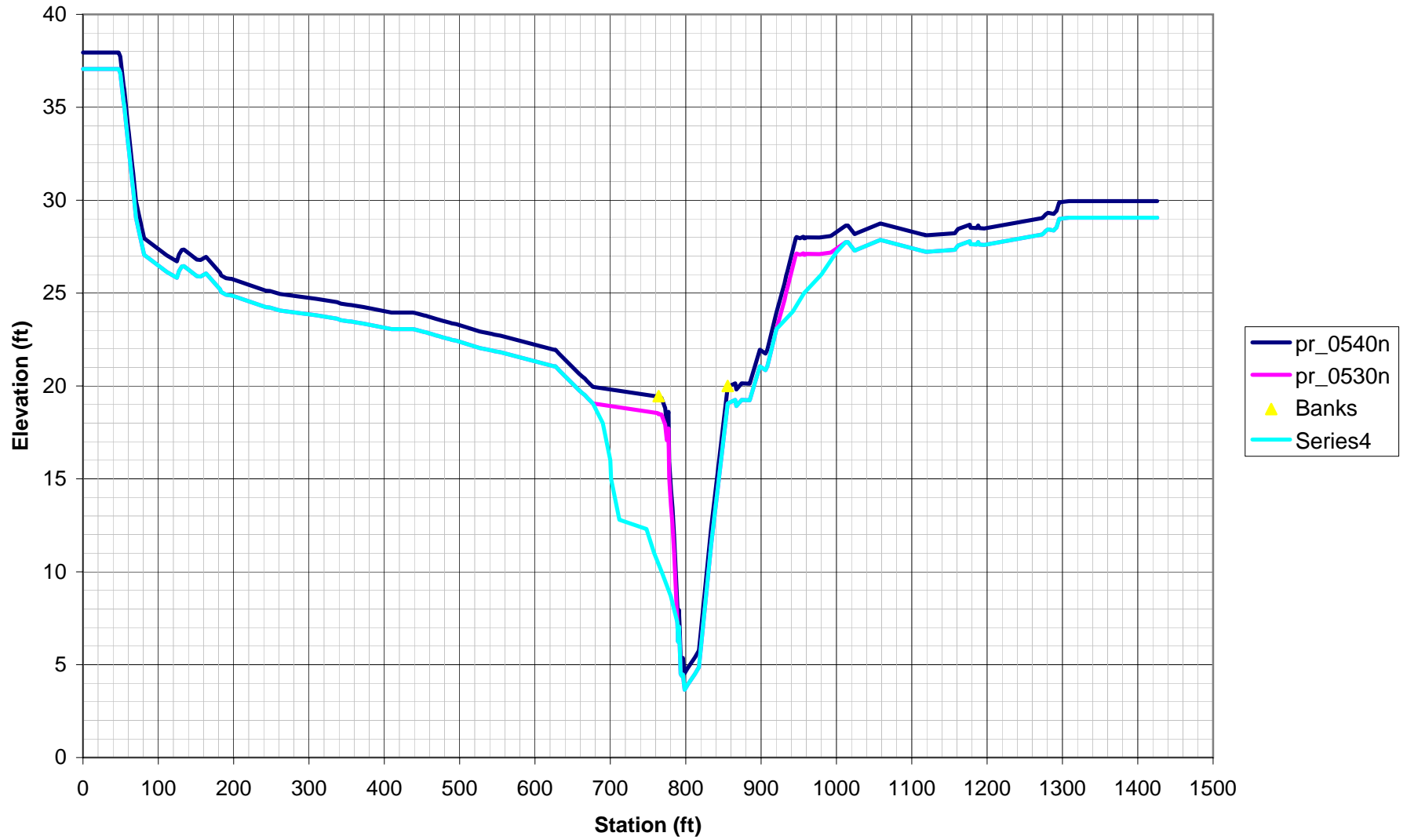


Node pr\_0530n to pr\_0520

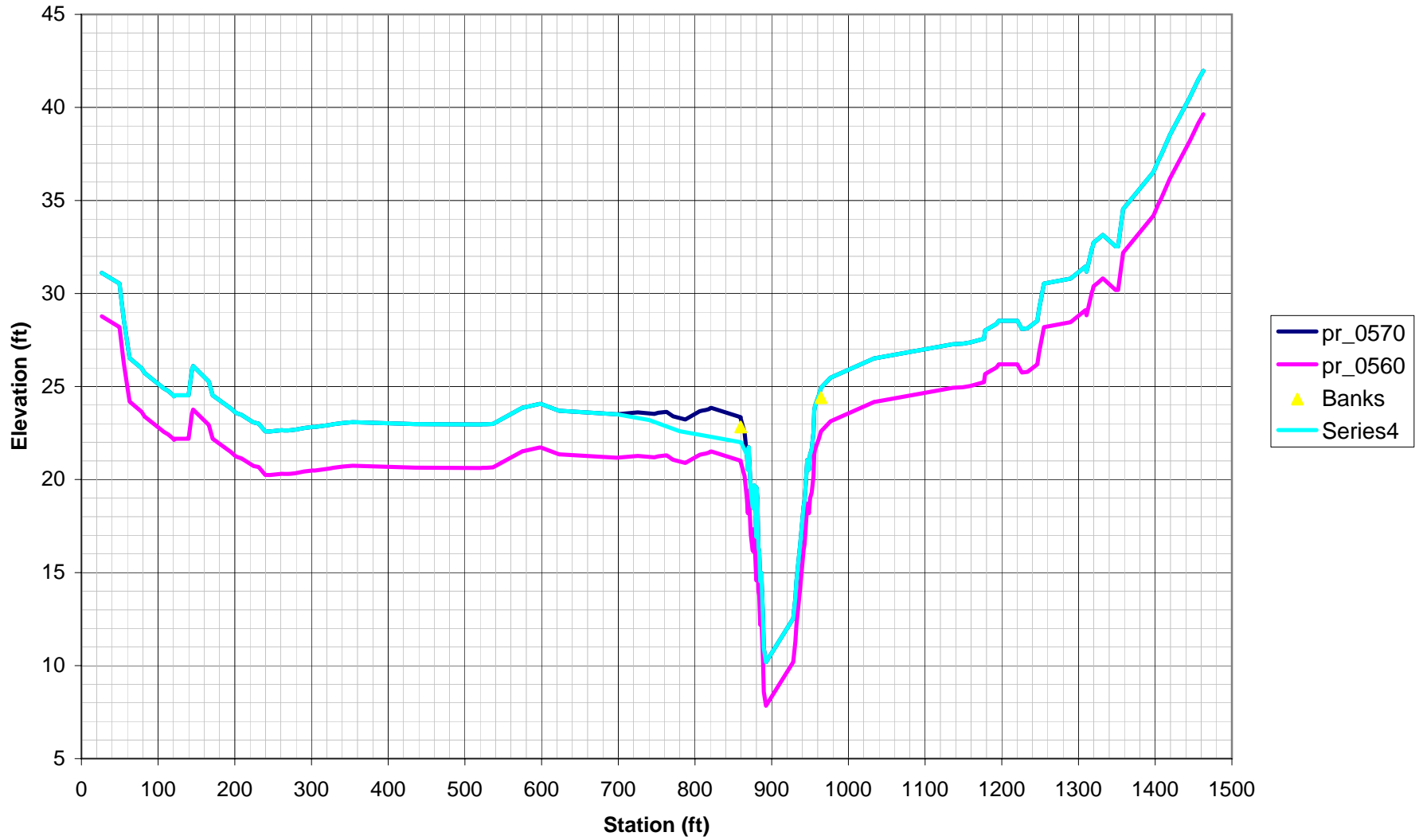




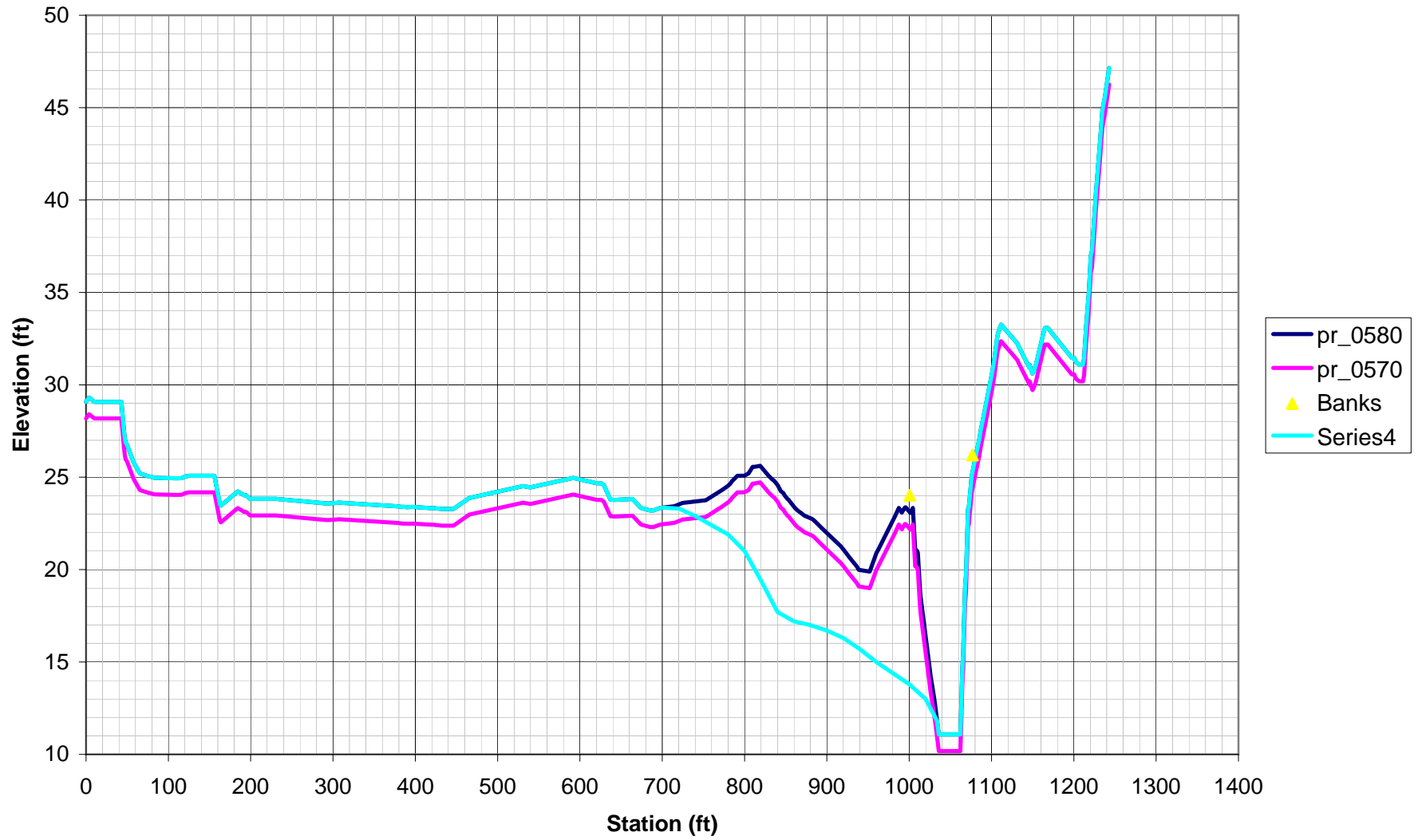
### Node pr\_0540n to pr\_0530n



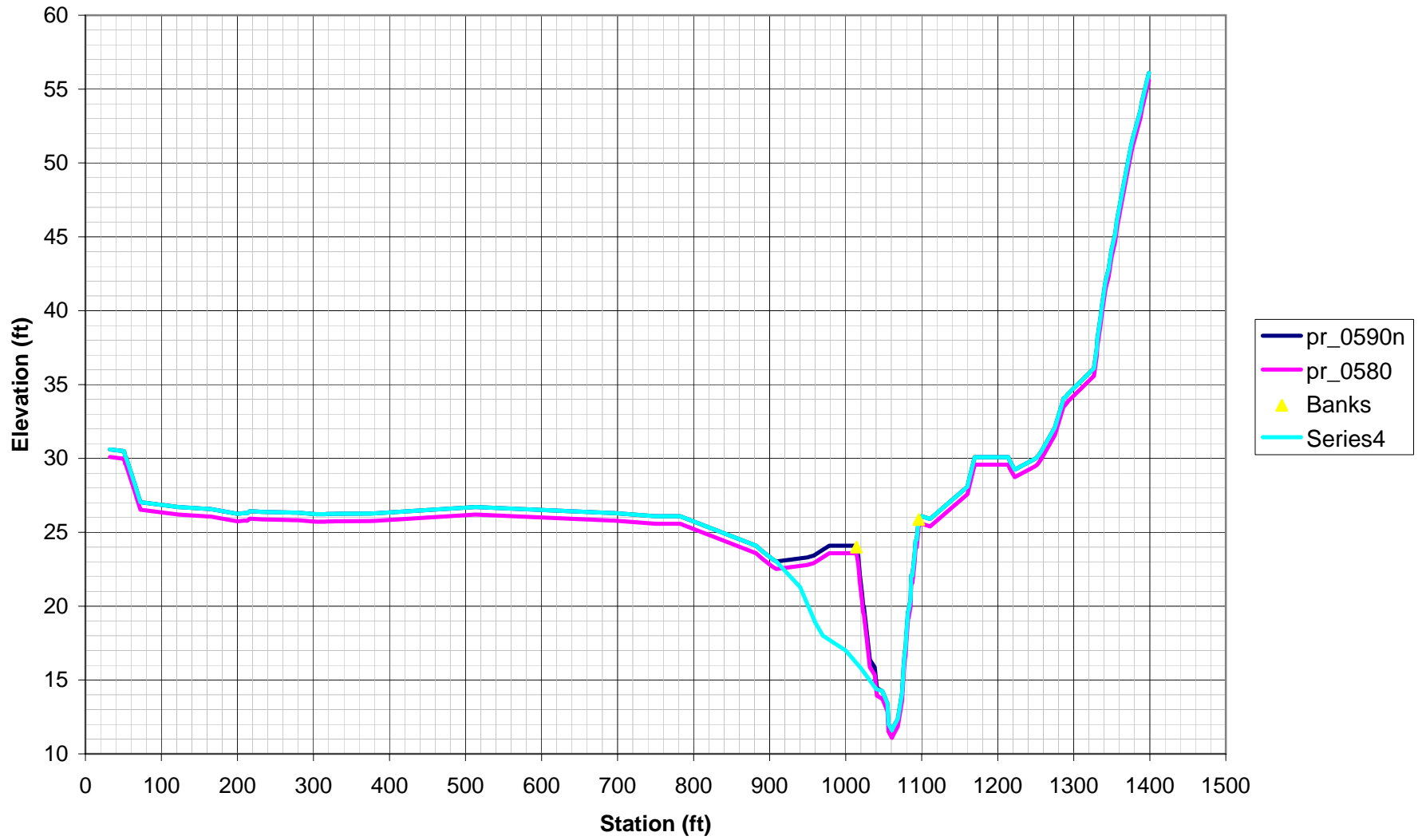
### Node pr\_0570 to pr\_0560



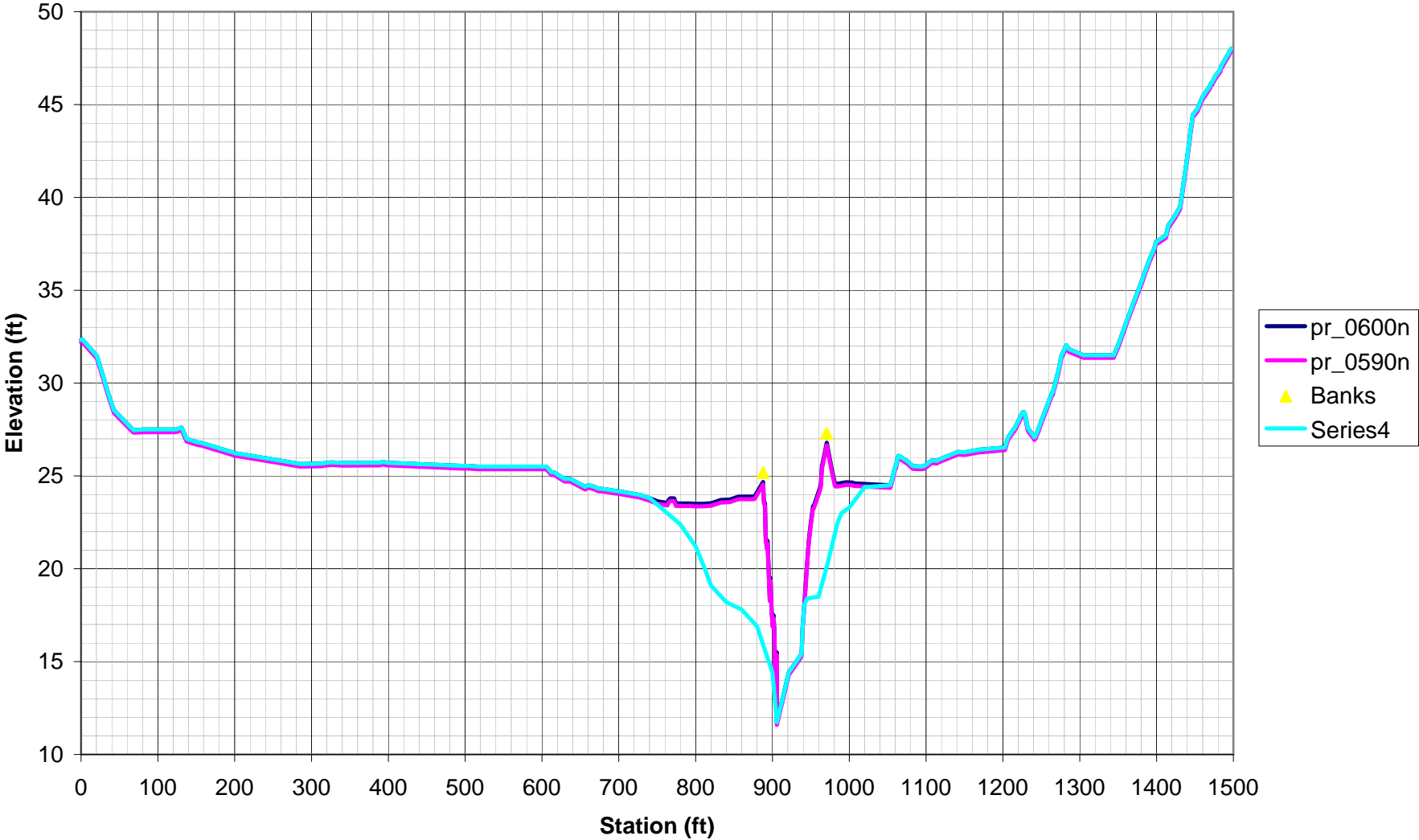
### Node pr\_0580 to pr\_0570



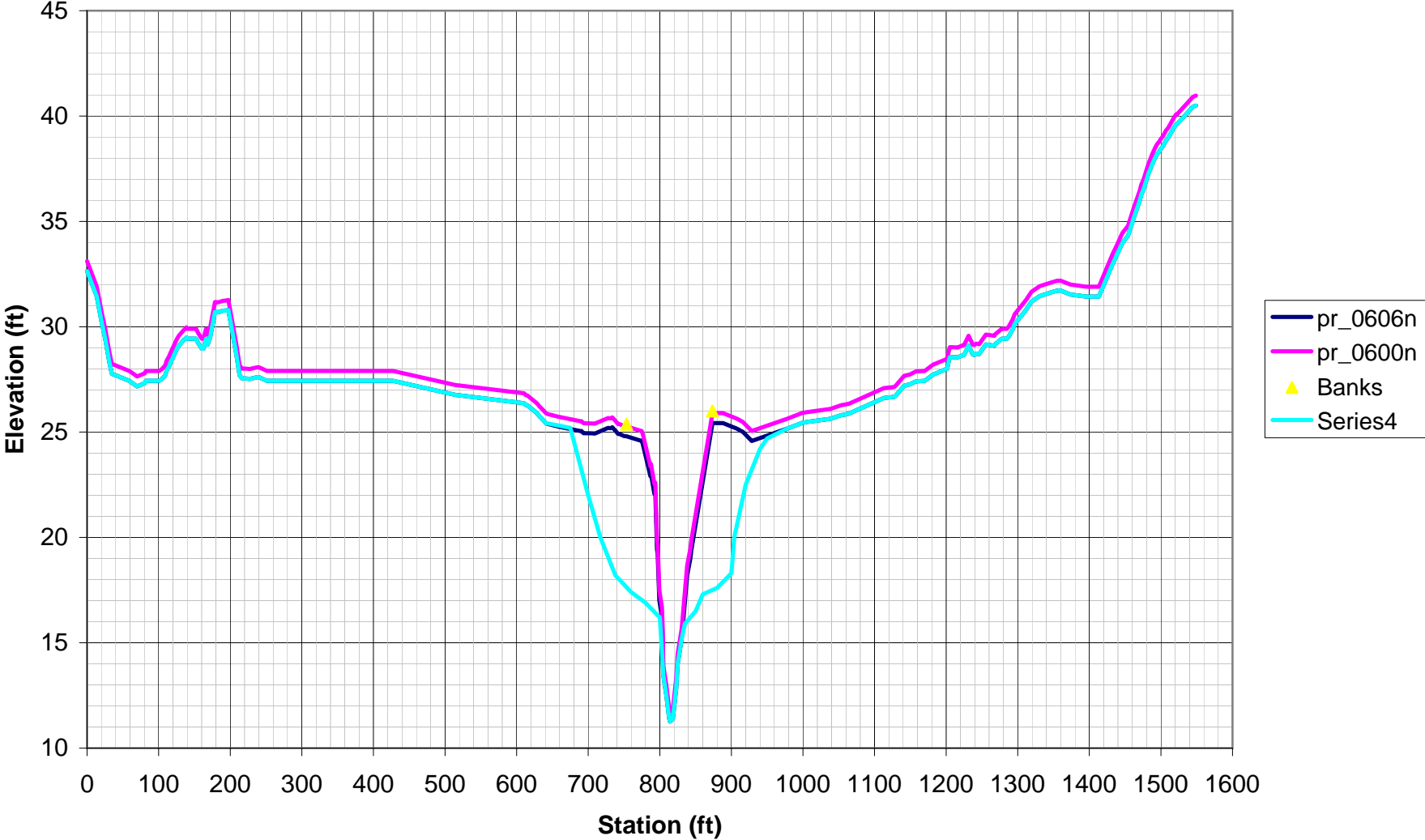
### Node pr\_0590n to pr\_0580



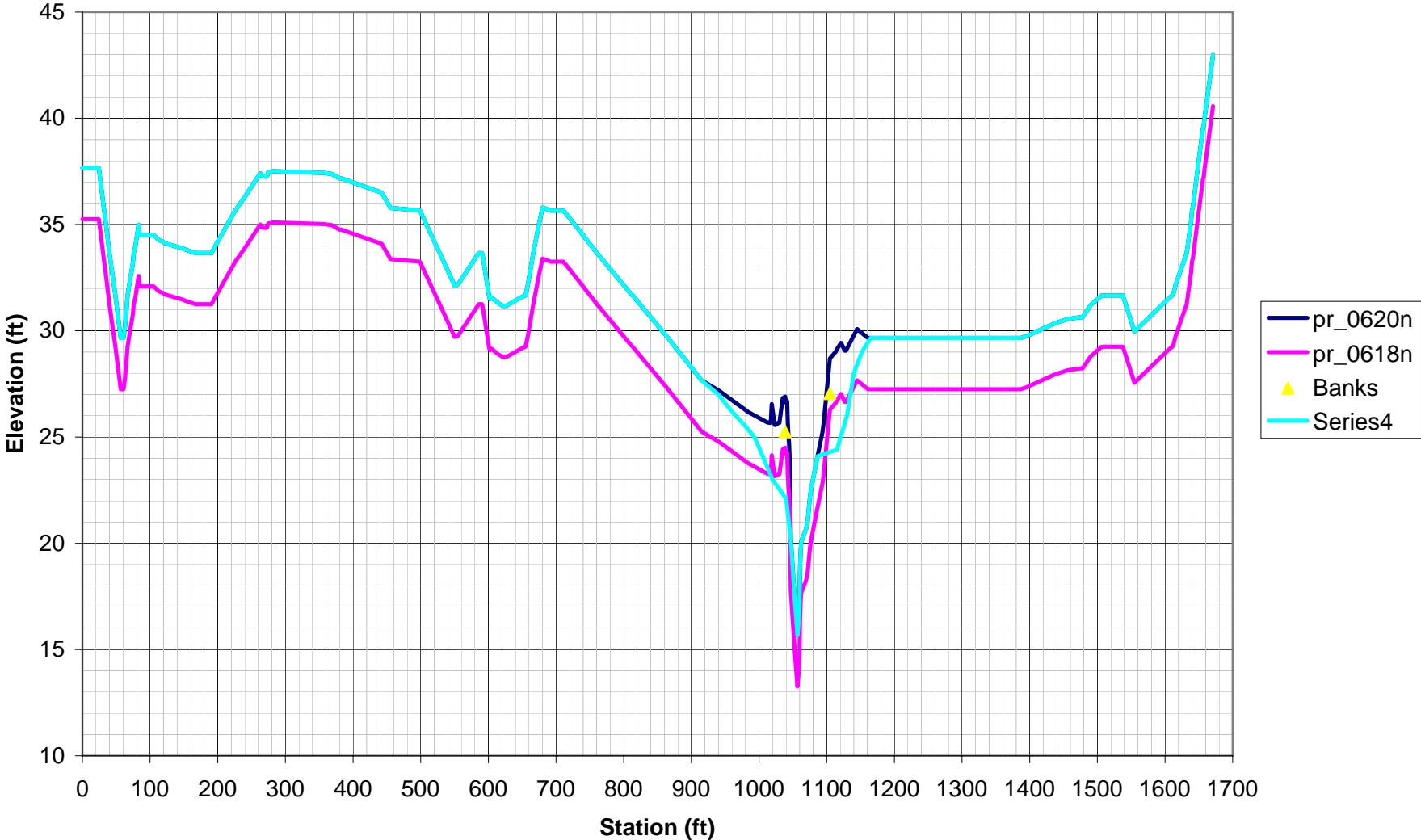
Node pr\_0600n to pr\_0590n



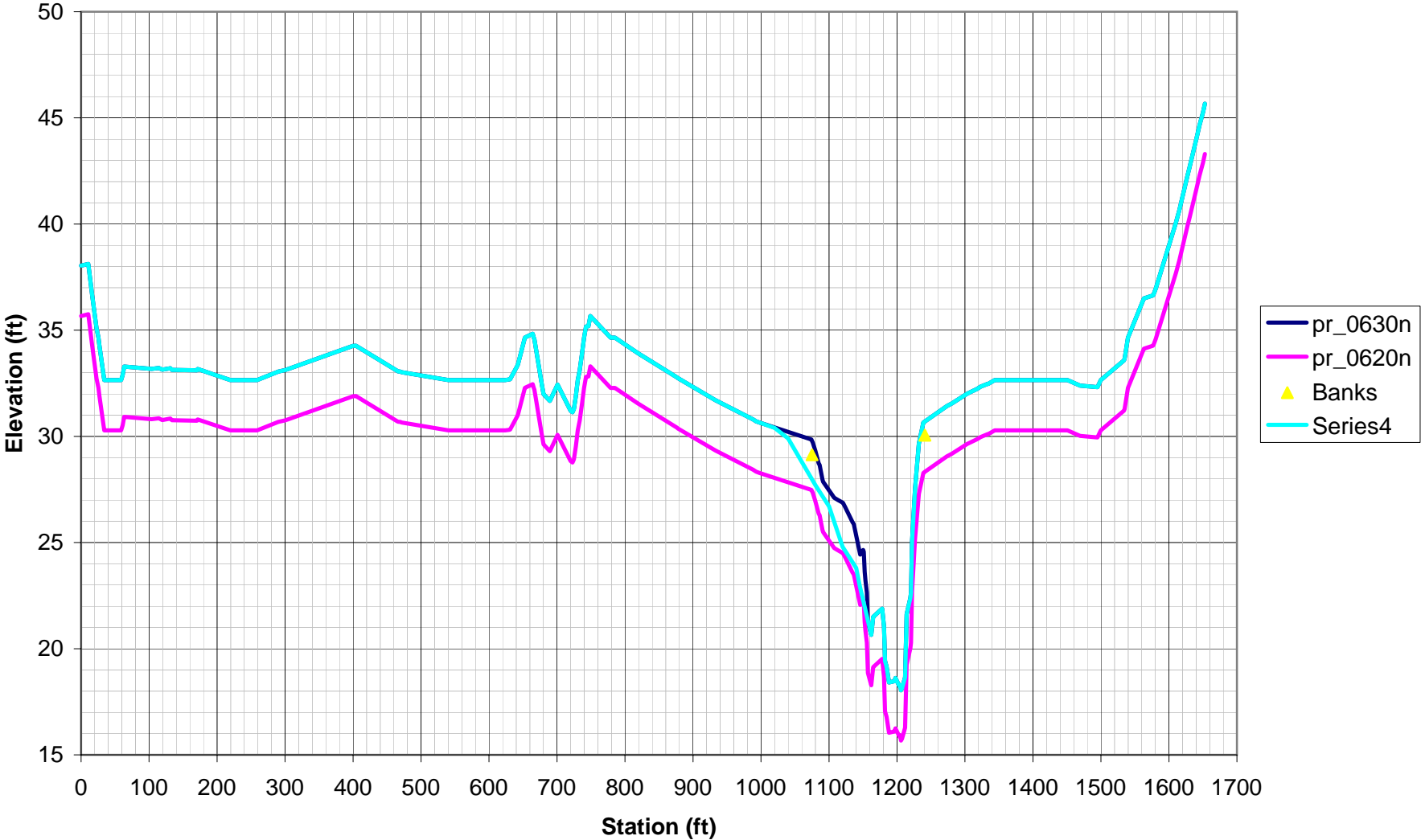
Node pr\_0606n to pr\_0600n



Node pr\_0620n to pr\_0618n

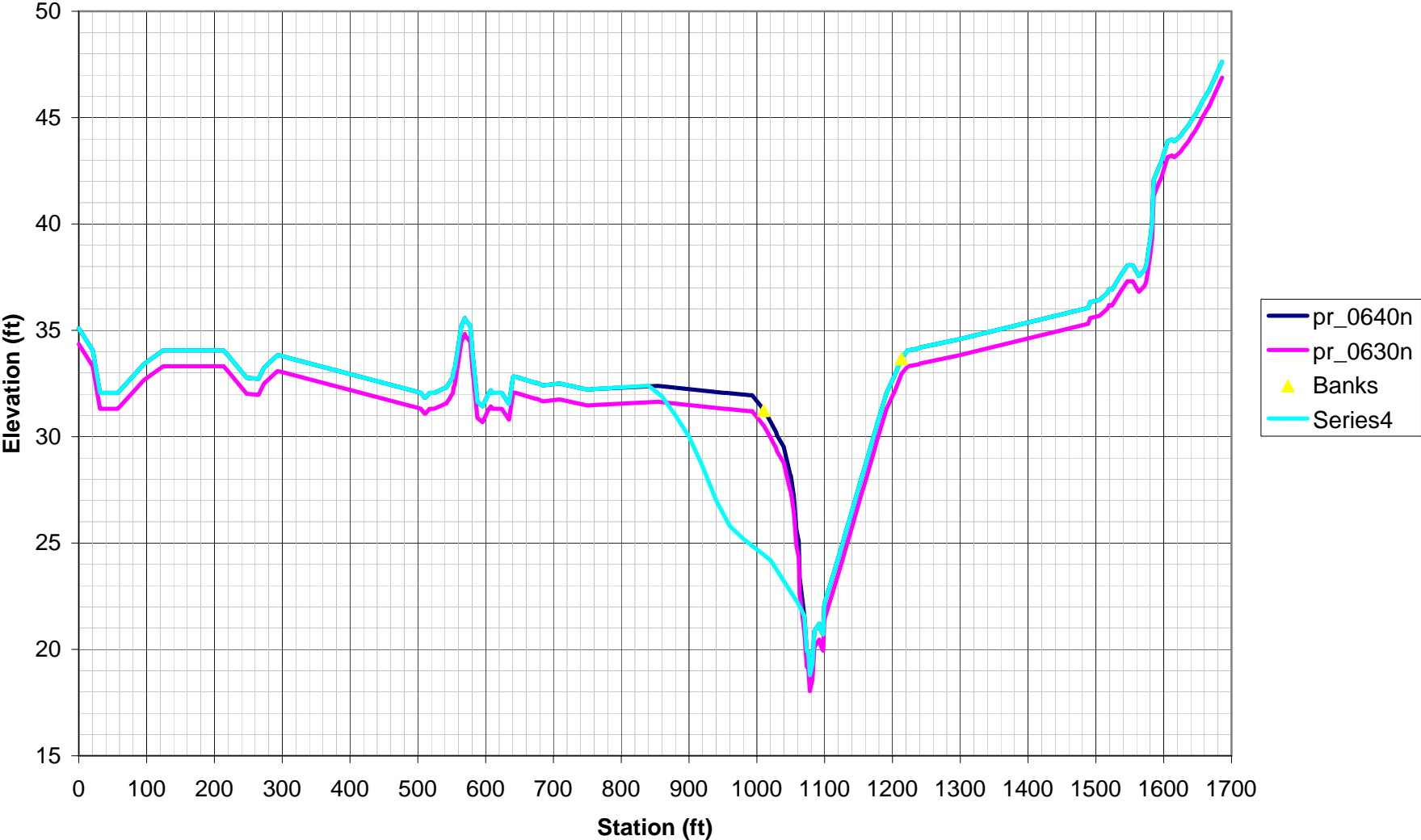


Node pr\_0630n to pr\_0620n

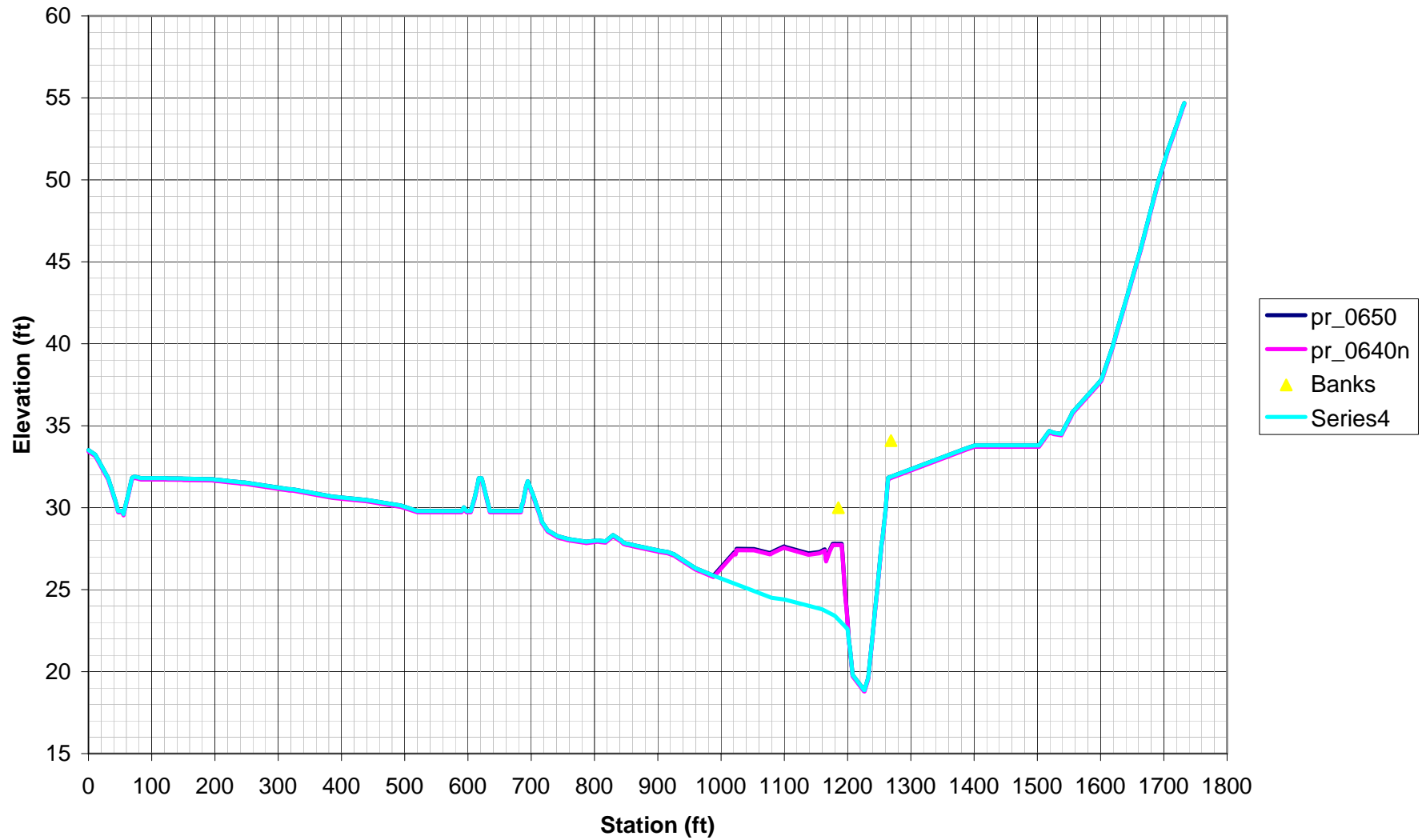




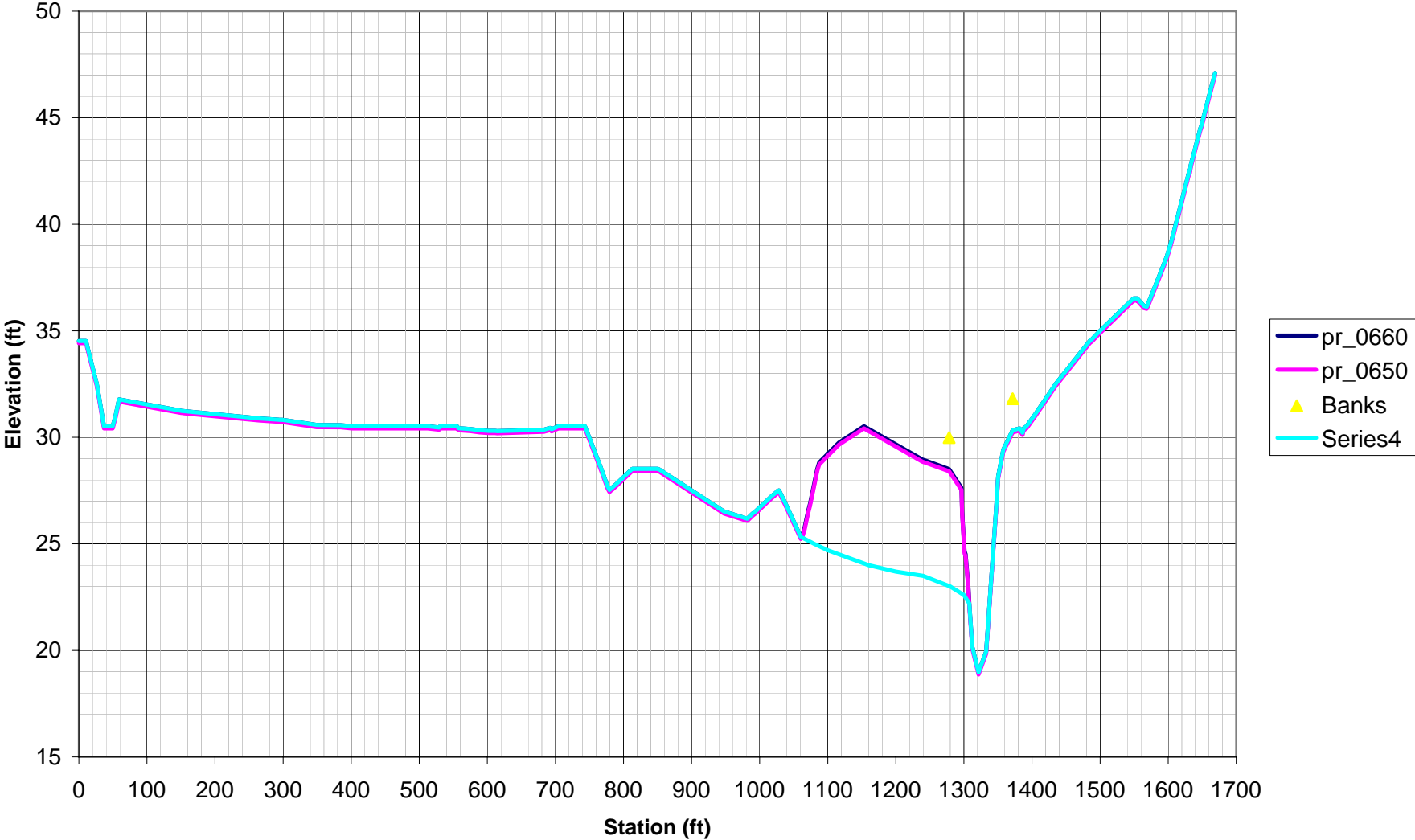
Node pr\_0640n to pr\_0630n



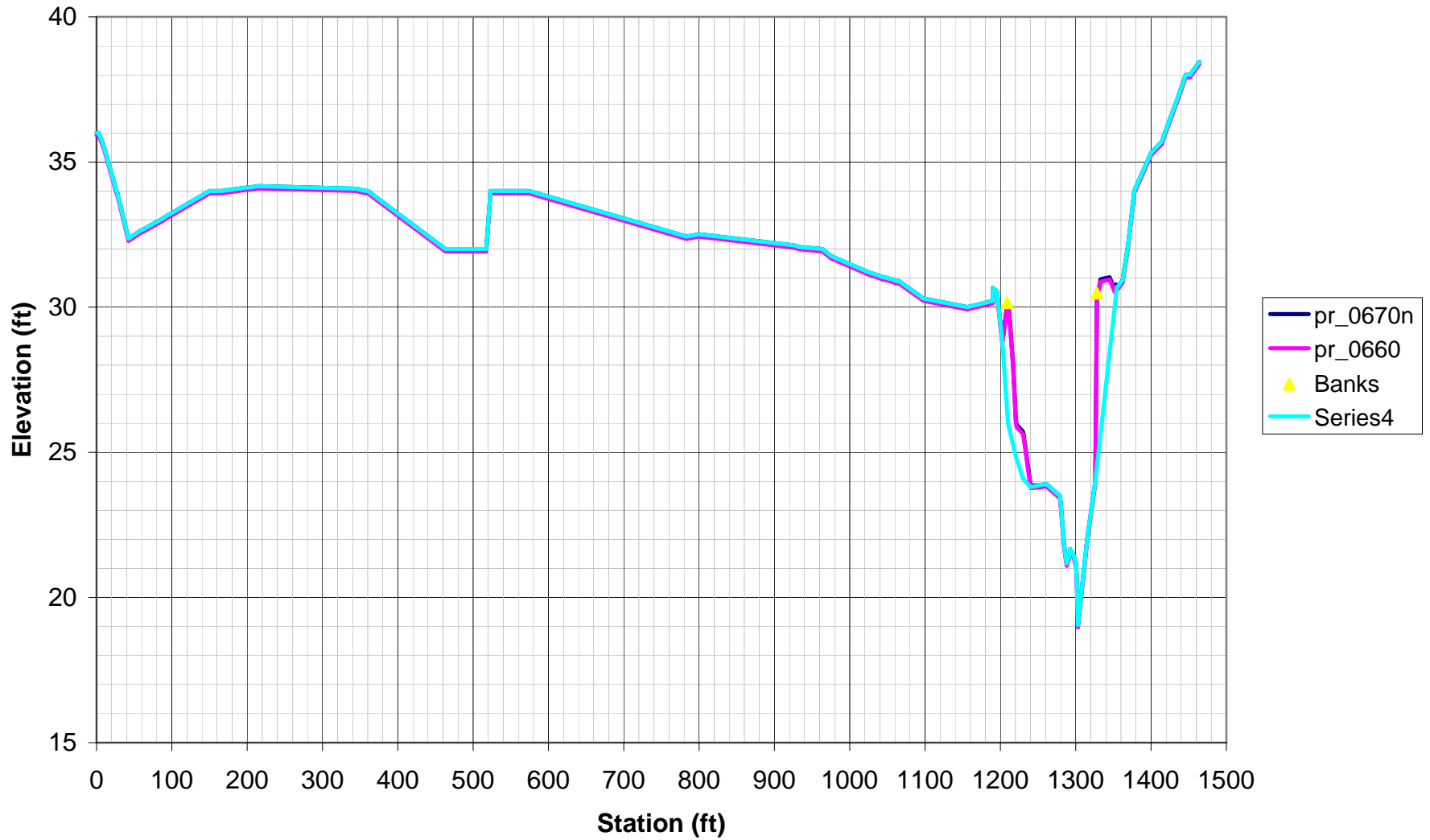
### Node pr\_0650 to pr\_0640n



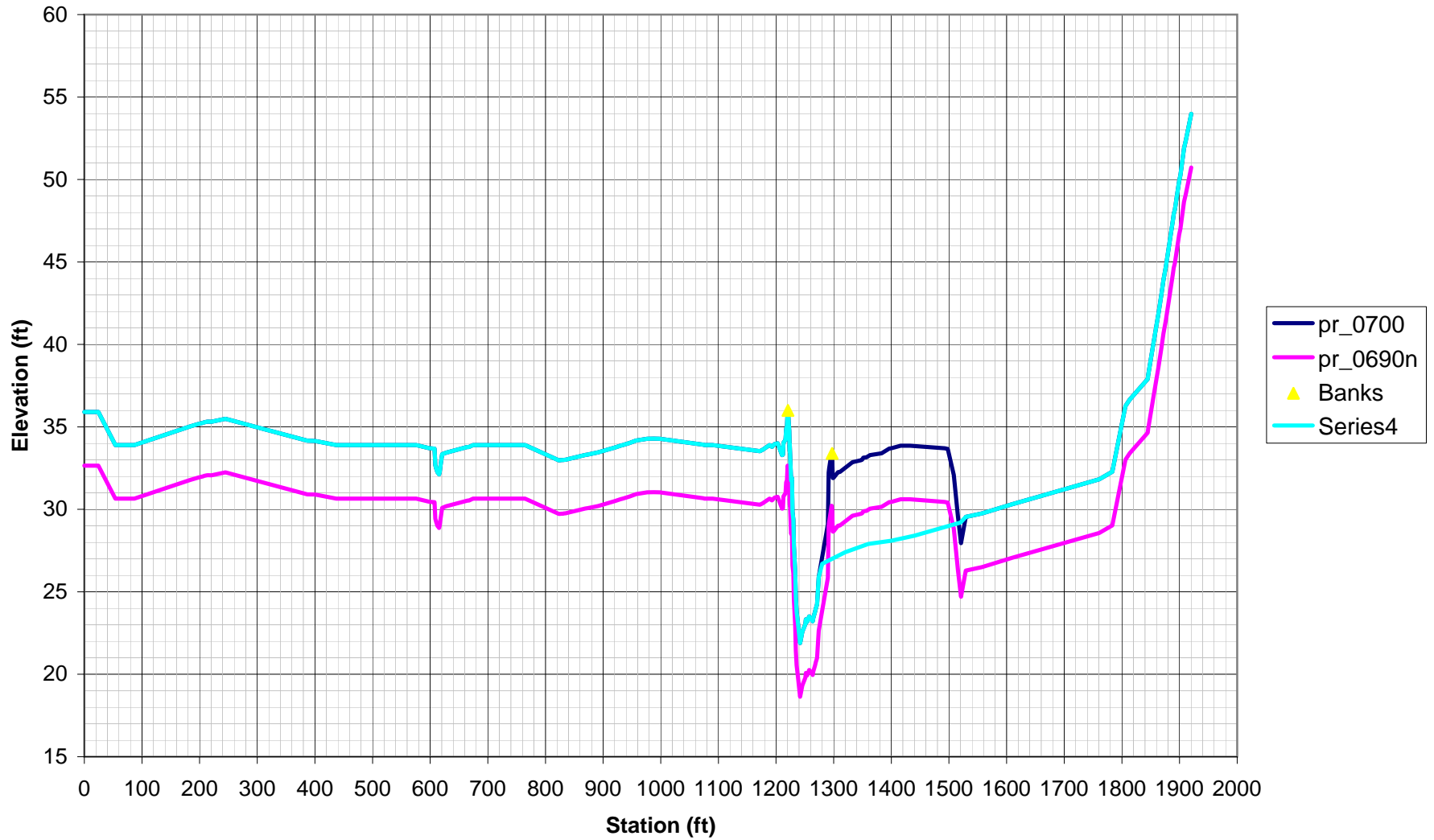
### Node pr\_0660 to pr\_0650



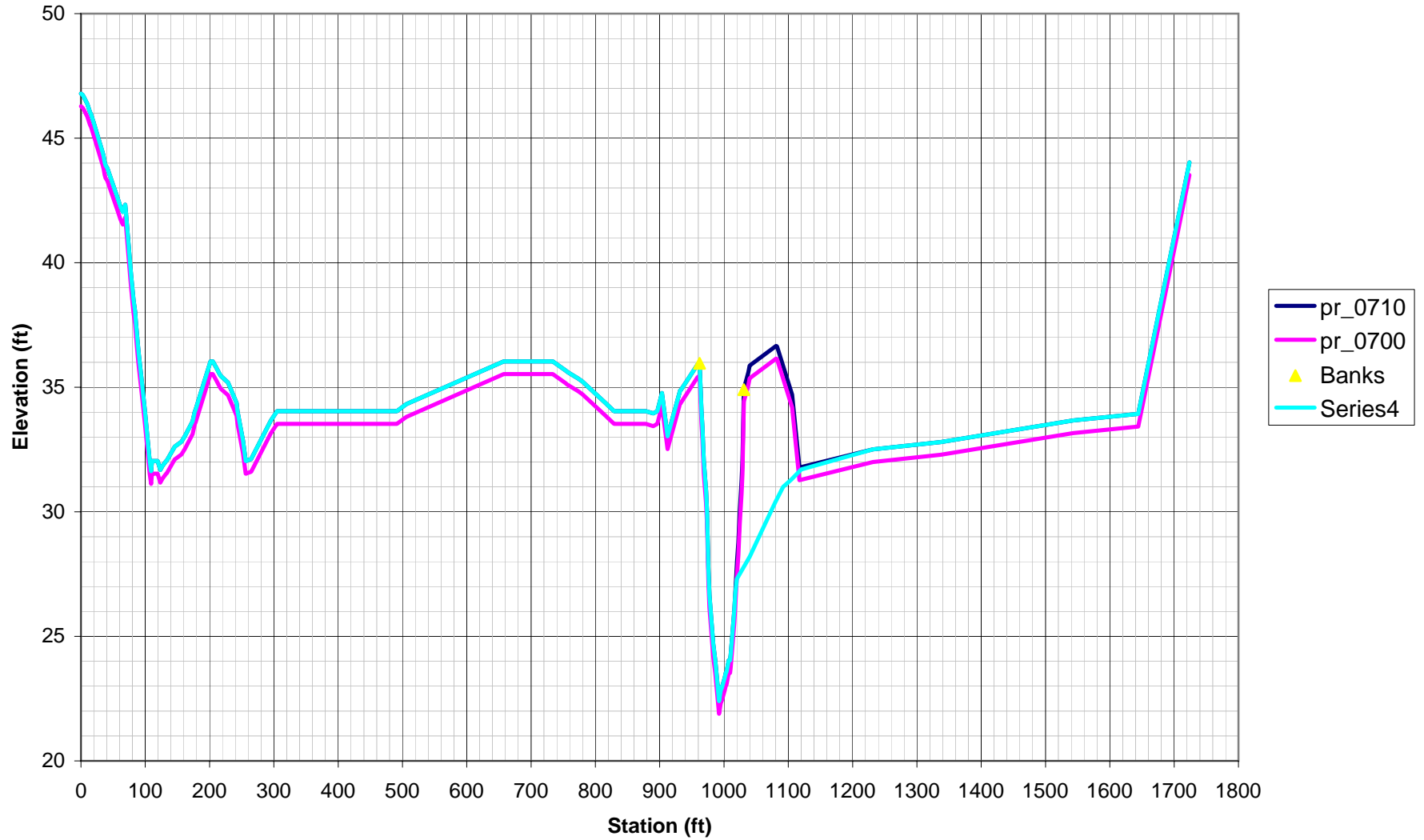
### Node pr\_0670n to pr\_0660



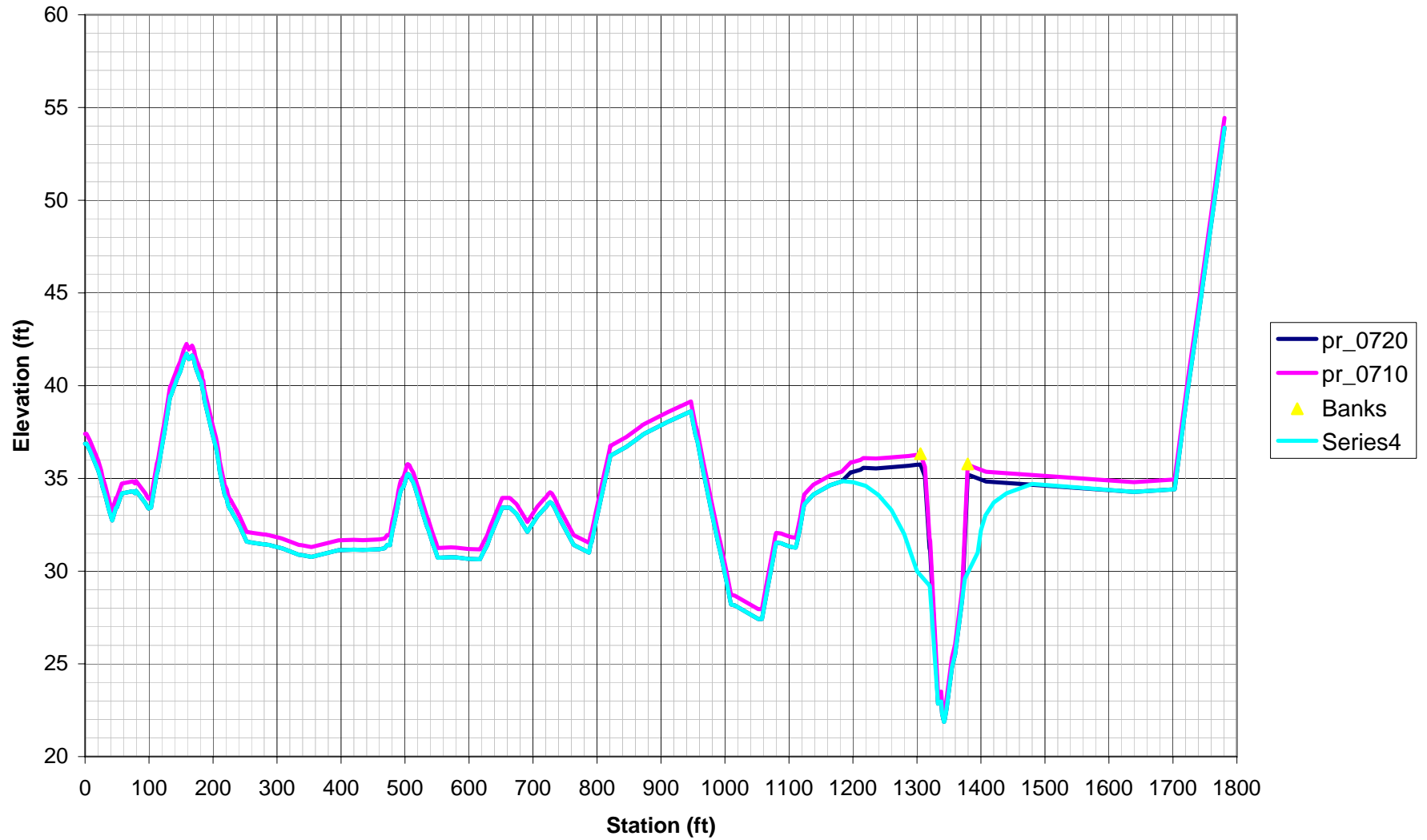
### Node pr\_0700 to pr\_0690n



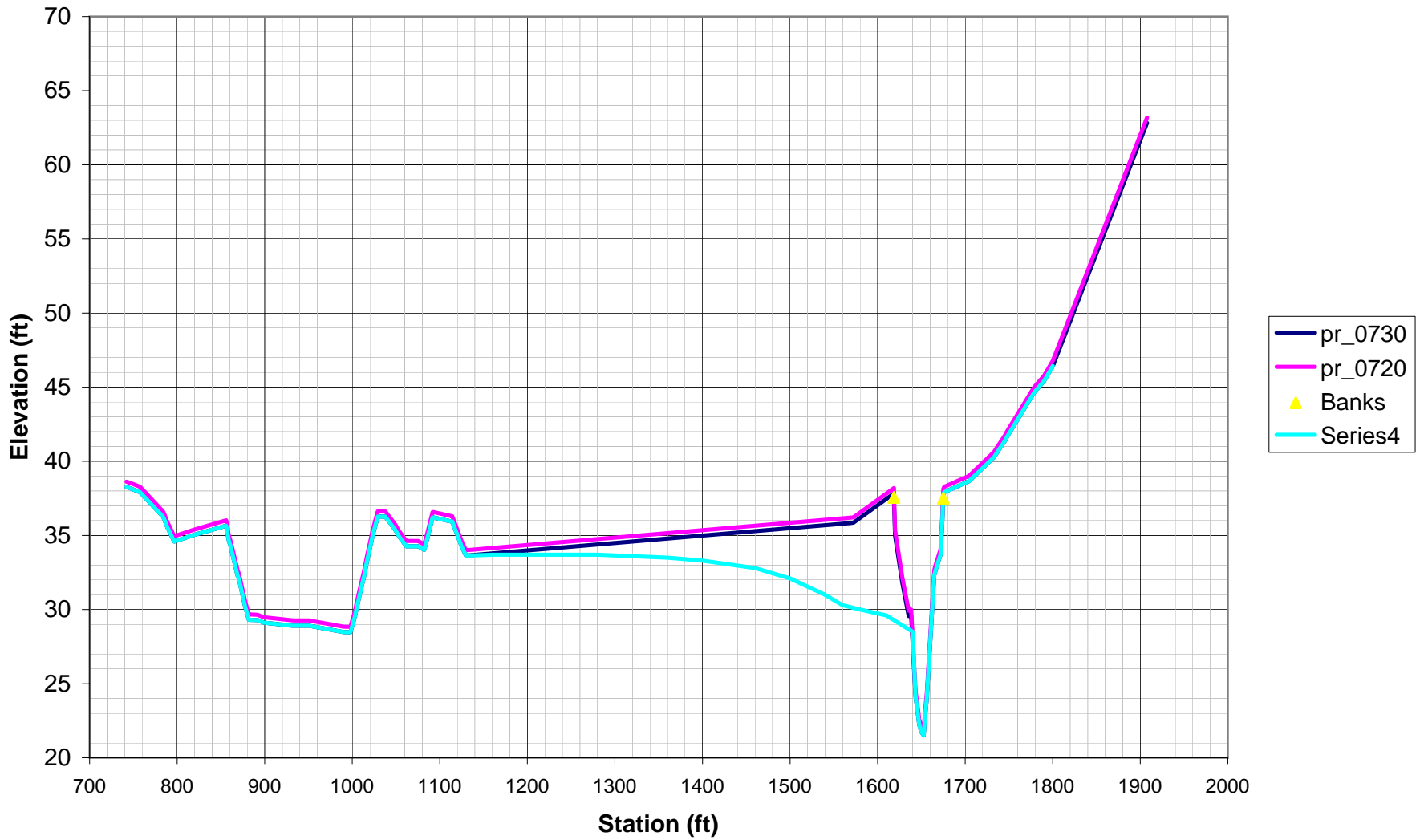
### Node pr\_0710 to pr\_0700



### Node pr\_0720 to pr\_0710

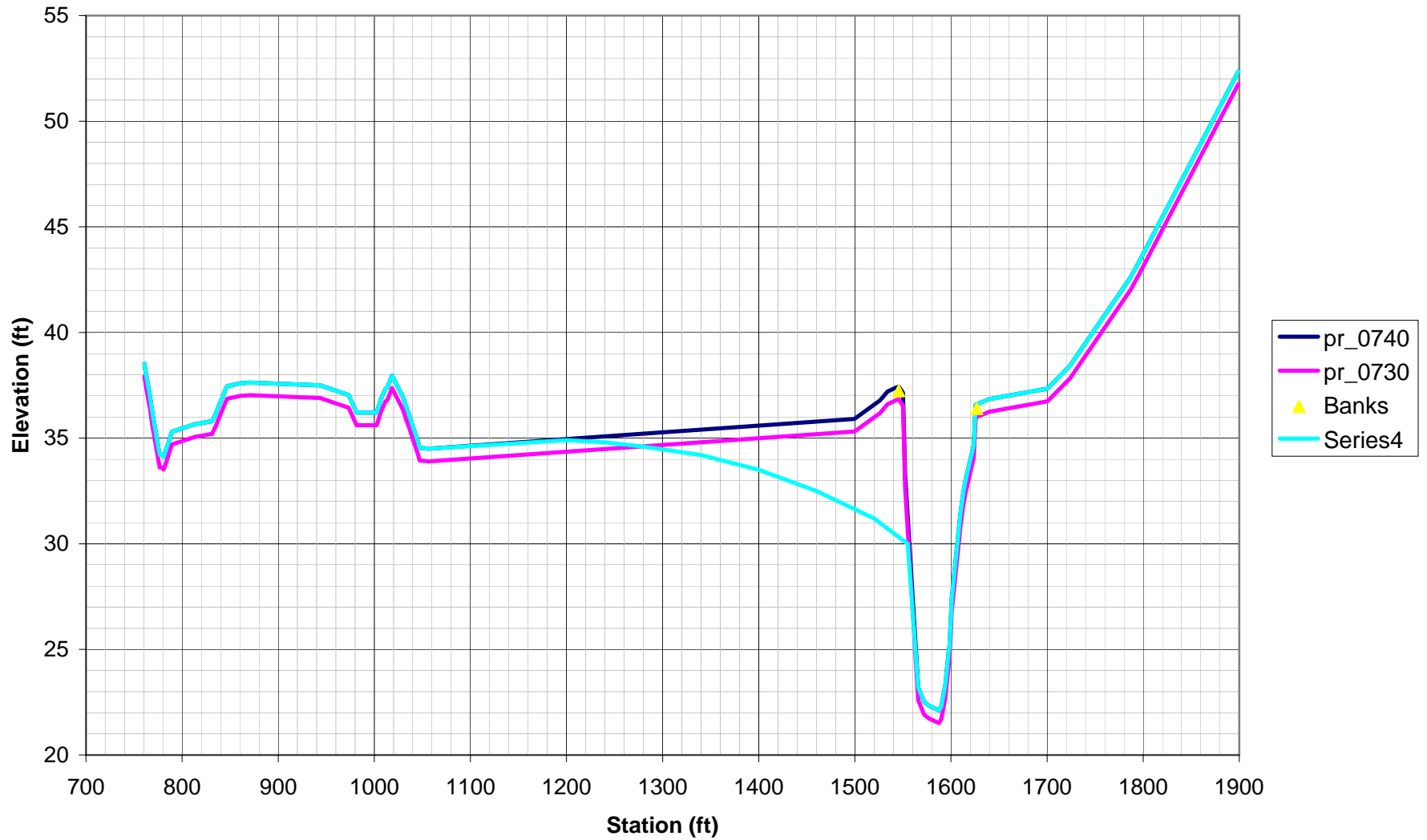


### Node pr\_0730 to pr\_0720

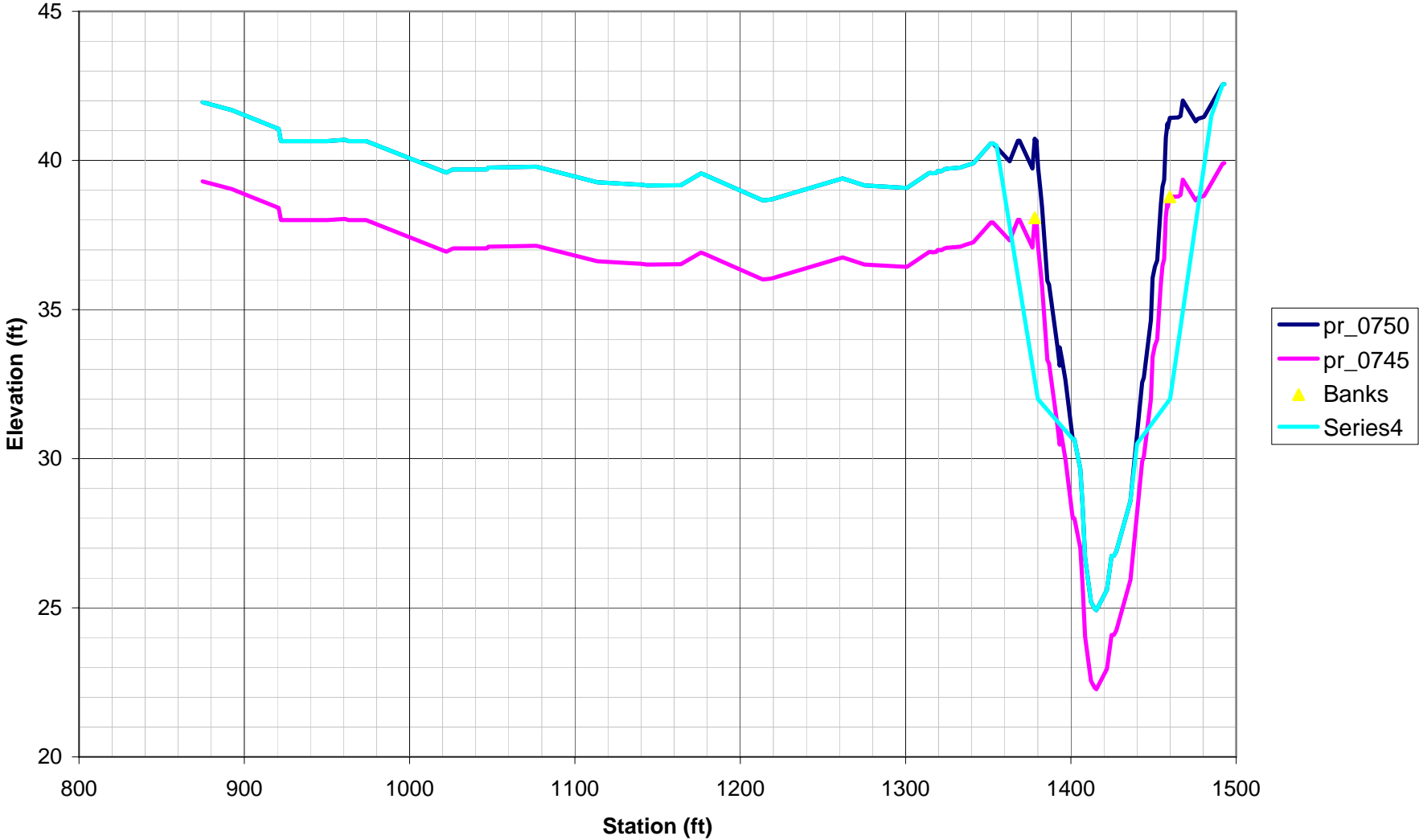




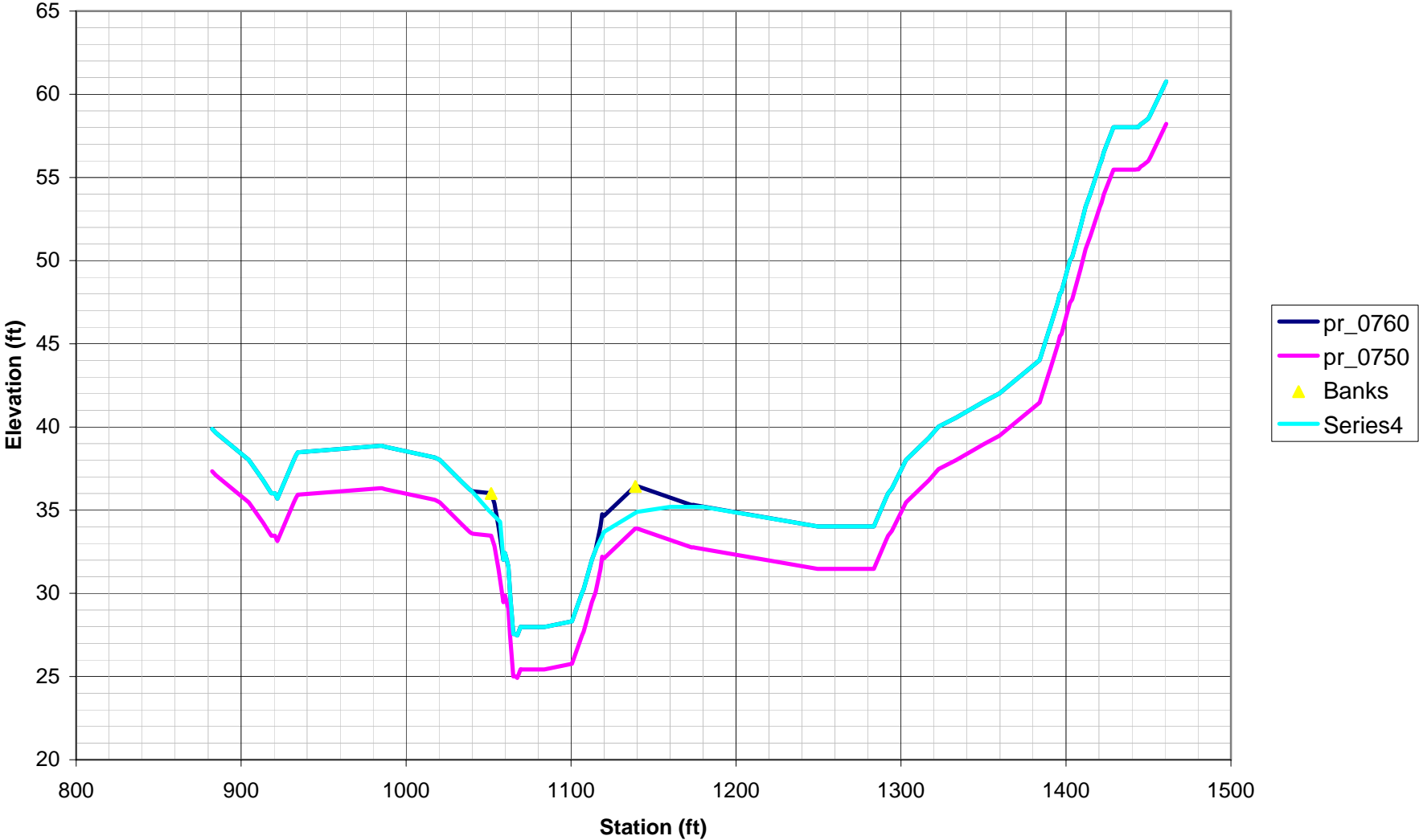
### Node pr\_0740 to pr\_0730



### Node pr\_0750 to pr\_0745



### Node pr\_0760 to pr\_0750



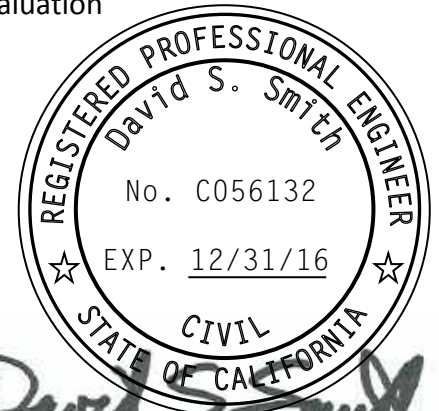
## **Exhibit 2**

### **2015 Denman Terracing Phase 3 Memo**



## MEMORANDUM

Project: Phase 3 Denman Reach Terracing Hydraulic Evaluation  
Subject: Results Summary  
Date: March 18, 2015  
To: Pamela Tuft, City of Petaluma  
Kent Carothers, City of Petaluma  
From: David S. Smith, P.E., WEST Consultants, Inc.



This memo summarizes the analysis completed by WEST Consultants, Inc. (WEST) as a subconsultant to Questa Engineering Corporation (Questa) for the City of Petaluma (the City) to evaluate the effects of floodplain terracing in the Phase 3 Denman Reach of the Petaluma River between Corona Road and Petaluma Boulevard North.

XP-Storm version 2010 (build May 20, 2010) was used in this evaluation. The previous Denman terracing evaluation completed by WEST in February 2012 was updated to incorporate changes to the terracing concept. The methods used to evaluate the hydraulic effects of terracing are described below along with the results of this study.

### Floodplain Terraces

Cross sections were revised to incorporate the terracing concept based on AutoCAD contour data provided by Questa. Affected cross sections are shown in Attachment 1. Each cross section graphic includes two lines:

- Blue – The cross section shape and elevation at the cut line location representing existing conditions.
- Yellow – The cross section shape and elevation at the cut line location representing the terracing concept.

The existing floodplain terraces between nodes pr\_0606n (Corona Road) to pr\_0618n were already included in the model. Terraces were added to the cross section geometry upstream of node pr\_0618 to a point downstream of Petaluma Boulevard North (node pr\_0660). Node locations are illustrated on the Flood Boundary Map Exhibits.

### Approach

The 10- and 100-year rainfall events were used to evaluate the effectiveness of the proposed terracing project. Watershed percent imperviousness was based on buildout

(year 2025) conditions for model runs with and without terraces, consistent with the data utilized for the General Plan 2025 Environmental Impact Report hydraulic evaluation.

### **Results**

Tabular comparisons of model results with and without terracing for the 10- and 100-year events are provided in Tables 1 and 2. Flood boundary comparisons with and without terracing for the 10- and 100-year events are provided in 6 panels—3 for the 10-year event and 3 for the 100-year event.

The model results suggest that terracing will provide a water surface elevation reduction in the terraced reach and the reach immediately upstream. The reduction in water surface elevation for the terraced reach averages 0.60 feet for the 10-year event and 0.45 feet for the 100-year event. Maximum reductions occur at node pr\_0660 and are equal to 0.90 feet for the 10-year event and 0.70 feet for the 100-year event.

Although the terracing reduces water surface elevations adjacent to the project, there is an increase in peak discharge and water surface elevation downstream of the Denman Reach. The location and magnitude of the increase is different for the 10- and 100-year events. For the 10-year event, the increase in discharge occurs immediately downstream of the Denman terracing reach and ends at node pr\_0300 with no increase further downstream. The maximum increase in discharge for the 10-year event is 0.3% (about 17 cfs) and the maximum increase in water surface elevation is about 0.01 feet (roughly 1/10<sup>th</sup> of an inch). For the 100-year event, the increase in discharge does not occur immediately downstream of the terraced reach—in fact, there is a decrease in discharge between the terraced reach and the outlet mall. Downstream of the outlet mall to the constriction weir there is no change, then downstream of the constriction weir there is an increase in discharge that persists to the end of the modeled reach past Adobe Creek. The maximum increase in discharge for the 100-year event is 0.2% (about 21 cfs) and the maximum water surface increase is about 0.03 feet (roughly 1/3<sup>rd</sup> of an inch) in the downtown area. The reason for the increase in discharge for the 10- and 100-year events is the reduction in floodplain storage in the terraced reach. Even though the excavation for the terracing increases storage, the reduced water surface elevations result in less floodplain storage.

### **Conclusions**

According to the model results, the proposed Denman Reach terracing project successfully reduces water surface elevations in the project reach between nodes pr\_0618 and pr\_0660 as well as immediately upstream to node pr\_0700. However, there is a small increase in flow and water surface elevation for a significant distance downstream (see Tables 1 and 2). Review of the flood boundary maps reveals that the increases in water surface elevation are minor in terms of changes to floodplain area.

**List of Attachments/Exhibits**

<i>Attachment 1</i>	<i>Cross section graphics showing terracing concept</i>
<i>Table 1</i>	<i>XP-Storm Results With and Without Denman Reach Terraces for 10-year Storm</i>
<i>Table 2</i>	<i>XP-Storm Results With and Without Denman Reach Terraces for 100-year Storm</i>
	<i>Flood Boundary Comparison Map for 10-year Storm (3 sheets)</i>
	<i>Flood Boundary Comparison Map for 100-year Storm (3 sheets)</i>

**Table 1. XP-Storm Results With and Without Denman Reach Terraces for 10-year Storm**

Flooding Source	Link ID	U/S Node	D/S Node	Peak Discharge (cfs)			U/S Node Water Surface Elevation (ft)		
				Without Terraces	With Terraces	Change <sup>1</sup>	Without Terraces	With Terraces	Change <sup>1</sup>
Corona Creek	LCC1_963.1	cc_0040	pr_0540n	548	548		23.41	23.41	
	lcc_0050	cc_0050	cc_0040	349	349		23.48	23.48	
	lcc_0060	cc_0060	cc_0050	348	348		23.56	23.56	
	L1166	cc_0060	pr_0560	0	0		22.26	22.26	
	lcc_0070	cc_0070	cc_0060	347	347		23.80	23.81	
	lcc_0075	cc_0075	cc_0070	347	347		24.13	24.13	
	lcc_0080	cc_0080	cc_0075	347	347		25.13	25.13	
	L1124	cc_0080	pr_0580	228	228		25.13	25.13	
	lcc_0085	cc_0085	cc_0080	424	424		25.44	25.44	
	lcc_0090	cc_0090	cc_0085	424	424		25.78	25.78	
	L1123	cc_0090	pr_0590n	-147	-147		26.38	26.38	
	lpr_0020	pr_0020	pr_0010	8564	8559	-5	6.53	6.53	
	lpr_0030	pr_0030	pr_0020	8564	8559	-6	6.59	6.59	
	lpr_0040	pr_0040	pr_0030	8564	8558	-6	6.65	6.65	
	lpr_0050	pr_0050	pr_0040	7135	7134		6.73	6.73	
	lpr_0060	pr_0060	pr_0050	7128	7126		6.76	6.76	
	lpr_0070	pr_0070	pr_0060	7124	7121		6.94	6.94	
	lpr_0080	pr_0080	pr_0070	7121	7117		6.99	6.99	
	lpr_0090	pr_0090	pr_0080	7118	7114		7.06	7.06	
	lpr_0100	pr_0094	pr_0090	6571	6569		7.08	7.08	
	Link1230	pr_0096	pr_0094	6570	6568		7.19	7.19	
	Link1229	pr_0098	pr_0096	6569	6567		7.24	7.24	
	Link1228	pr_0100	pr_0098	6568	6566		7.28	7.28	
	lpr_0110	pr_0110	pr_0100	6534	6532		7.34	7.34	
	lpr_0120	pr_0120	pr_0110	6532	6529		7.34	7.34	
	lpr_0130	pr_0130	pr_0120	6530	6528		7.39	7.39	
	lpr_0140	pr_0140	pr_0130	6527	6529		7.44	7.44	
	lpr_0150	pr_0150	pr_0140	6527	6531		7.52	7.52	
	lpr_0160	pr_0160	pr_0150	6313	6312		7.62	7.62	
	lpr_0170	pr_0170	pr_0160	6312	6311		7.68	7.68	
	lpr_0180	pr_0180	pr_0170	6290	6288		7.73	7.73	
	lpr_0190	pr_0190	pr_0180	6290	6289		7.77	7.77	
	lpr_0195	pr_0195	pr_0190	6228	6241	13	7.88	7.88	
	lpr_0200	pr_0200	pr_0195	5706	5721	15	7.96	7.96	
	Link1239	pr_0206	pr_0200	5674	5690	16	7.98	7.98	
	lpr_0208	pr_0208	pr_0206	5673	5689	16	8.05	8.05	
	lpr_0210	pr_0210	pr_0208	5672	5688	16	8.04	8.04	
	lpr_0220	pr_0220	pr_0210	5654	5670	16	8.09	8.09	
	lpr_0230	pr_0230	pr_0220	5651	5668	17	8.09	8.09	
	lpr_0240	pr_0240	pr_0230	5651	5665	14	8.10	8.10	
	lpr_0250	pr_0250	pr_0240	5651	5661	10	8.10	8.10	
	lpr_0260	pr_0260	pr_0250	5651	5660	9	8.10	8.10	
	lpr_0270	pr_0270	pr_0260	5651	5660	9	8.11	8.11	
	lpr_0280	pr_0280	pr_0270	5651	5660	9	8.12	8.13	
	lpr_0290	pr_0290	pr_0280	5651	5660	9	8.01	8.01	
	lpr_0298	pr_0298	pr_0290	5562	5571	9	8.41	8.41	



**Table 1. XP-Storm Results With and Without Denman Reach Terraces for 10-year Storm**

Flooding Source	Link ID	U/S Node	D/S Node	Peak Discharge (cfs)			U/S Node Water Surface Elevation (ft)		
				Without Terraces	With Terraces	Change <sup>1</sup>	Without Terraces	With Terraces	Change <sup>1</sup>
Petaluma River	lpr_0300	pr_0300	pr_0298	5562	5571	9	8.54	8.55	0.01
	lpr_0308	pr_0308	pr_0300	5562	5571	9	8.75	8.76	0.01
	lpr_0310	pr_0310	pr_0308	5562	5571	9	8.87	8.88	0.01
	lpr_0320	pr_0320	pr_0310	5562	5570	9	8.78	8.79	0.01
	lpr_0330	pr_0330	pr_0320	5562	5570	9	8.90	8.91	0.01
	lpr_0338	pr_0338	pr_0330	5540	5548	9	9.19	9.20	0.01
	lpr_0340	pr_0340	pr_0338	5540	5548	9	9.46	9.47	0.01
	lpr_0350	pr_0350	pr_0340	5540	5548	9	9.79	9.80	0.01
	lpr_0360	pr_0360	pr_0350	5540	5548	9	11.02	11.03	0.01
	lpr_0370	pr_0370	pr_0360	5488	5497	9	11.73	11.74	0.01
	lpr_0380	pr_0380	pr_0370	5488	5497	9	12.24	12.25	0.01
	lpr_0390	pr_0390	pr_0380	4991	4997	6	13.10	13.11	0.01
	lpr_0400	pr_0400	pr_0390	4446	4452	6	13.30	13.31	0.01
	lpr_0420	pr_0420	pr_0400	4445	4452	6	13.55	13.56	0.01
	lpr_0430	pr_0430	pr_0420	4445	4451	6	13.74	13.74	0.01
	lpr_0440	pr_0440	pr_0430	4445	4451	6	15.20	15.21	0.01
	lpr_0445	pr_0445	pr_0440	4444	4450	6	16.13	16.14	0.01
	lpr_0448	pr_0448	pr_0445	4443	4449	6	16.37	16.38	0.01
	lpr_0450	pr_0450	pr_0448	4443	4449	6	16.59	16.60	0.01
	lpr_0452	pr_0452	pr_0450	4444	4450	6	16.75	16.76	0.01
	lpr_0458	pr_0458	pr_0452	4444	4450	6	17.03	17.03	0.01
	lpr_0460	pr_0460	pr_0458	4445	4451	6	17.15	17.15	0.01
	lpr_0465	pr_0465	pr_0460	4415	4421	6	17.38	17.39	0.01
	lpr_0470	pr_0470	pr_0465	4416	4422	6	17.51	17.51	0.01
	lpr_0480	pr_0480	pr_0470	4417	4423	5	17.76	17.77	
	lpr_0490	pr_0490	pr_0480	4419	4424	5	18.25	18.26	0.01
	lpr_0496	pr_0496	pr_0490	4421	4426	5	18.47	18.47	
	lpr_0498	pr_0498	pr_0496	4422	4427		19.01	19.02	
	lpr_0500	pr_0500	pr_0498	4423	4428		19.08	19.08	0.01
	lpr_0510	pr_0510	pr_0500	4424	4429		19.38	19.38	
	lpr_0520	pr_0520	pr_0510	4396	4401		19.82	19.83	
	lpr_0530	pr_0530n	pr_0520	4400	4404		20.25	20.25	0.01
	lpr_0540	pr_0540n	pr_0530n	4403	4407		21.05	21.05	
	lpr_0550	pr_0550	pr_0540n	3911	3915		21.59	21.59	0.01
	lpr_0552	pr_0552	pr_0550	3913	3917		21.69	21.70	0.01
	3876.1	pr_0554	pr_0552				21.66	21.67	
3876.2	pr_0554	pr_0552				21.66	21.67		
lpr_0560	pr_0560	pr_0554	3914	3918		22.26	22.26	0.01	
lpr_0570	pr_0570	pr_0560	3926	3929		24.17	24.17		
lpr_0580	pr_0580	pr_0570	3927	3929		25.15	25.15		
lpr_0590	pr_0590n	pr_0580	3961	3964		26.88	26.89		
lpr_0600	pr_0600n	pr_0590n	4115	4117		27.34	27.34		
lpr_0606	pr_0606n	pr_0600n	4067	4069		28.05	28.05		
2150.1	pr_0607n	pr_0606n	4071	4073		28.32	28.32		
lpr_0608	pr_0608n	pr_0607n	4071	4073		28.34	28.34		
lpr_0610	pr_0610n	pr_0608n	3599	3601		28.71	28.71		

**Table 1. XP-Storm Results With and Without Denman Reach Terraces for 10-year Storm**

Flooding Source	Link ID	U/S Node	D/S Node	Peak Discharge (cfs)			U/S Node Water Surface Elevation (ft)		
				Without Terraces	With Terraces	Change <sup>1</sup>	Without Terraces	With Terraces	Change <sup>1</sup>
	lpr_0612	pr_0612n	pr_0610n	3592	3595		28.85	28.86	0.01
	lpr_0614	pr_0614n	pr_0612n	3585	3589		29.00	29.01	0.01
	lpr_0616	pr_0616n	pr_0614n	3562	3566		29.10	29.10	0.01
	lpr_0618	pr_0618n	pr_0616n	3552	3558	5	29.35	29.35	0.01
Petaluma River (Terracing Reach)	lpr_0620	pr_0620n	pr_0618n	3545	3551	7	30.05	29.98	-0.07
	lpr_0630	pr_0630n	pr_0620n	3542	3549	7	30.55	30.34	-0.21
	lpr_0640	pr_0640n	pr_0630n	3541	3549	8	31.40	30.69	-0.71
	lpr_0650	pr_0650	pr_0640n	3542	3550	8	31.77	30.87	-0.90
	lpr_0660	pr_0660	pr_0650	3551	3554		31.88	30.96	-0.91
	lpr_0670	pr_0670n	pr_0660	3563	3562		32.51	31.88	-0.63
Petaluma River	lpr_0680	pr_0680n	pr_0670n	3553	3548	-5	32.56	31.95	-0.61
	682lob	pr_0682	pr_0680n				32.68	32.06	-0.62
	2792.1	pr_0682	pr_0680n						
	684lob	pr_0684	pr_0682				32.79	32.20	-0.59
	2791.1	pr_0684	pr_0682						
	lpr_0690	pr_0690n	pr_0684	3559	3552	-8	32.74	32.14	-0.60
	lpr_0700	pr_0700	pr_0690n	3567	3556	-12	32.85	32.39	-0.46
	lpr_0710	pr_0710	pr_0700	3570	3558	-12	34.59	34.41	-0.18
	lpr_0720	pr_0720	pr_0710	3535	3523	-12	35.65	35.61	-0.05
	lpr_0723	pr_0723	pr_0720	3535	3524	-11	36.91	36.87	-0.04
	3663.1	pr_0725	pr_0723				37.39	37.38	-0.01
	3663.2	pr_0725	pr_0723				37.39	37.38	-0.01
	lpr_0730	pr_0730	pr_0725	3535	3524	-11	37.65	37.65	
	lpr_0740	pr_0740	pr_0730	3608	3749	141	37.74	37.74	
	2526.1	pr_0745	pr_0740				38.06	38.06	
	2526.2	pr_0745	pr_0740				38.06	38.06	
lpr_0750	pr_0750	pr_0745	3589	3578	-11	38.20	38.19		
lpr_0760	pr_0760	pr_0750	3589	3577	-11	38.33	38.33		
lpc_0450	pc_0450	pr_0760	1702	1692	-10	38.54	38.54	-0.01	
lpc_0800	pc_0800	pc_0450	1678	1668	-10	38.57	38.57		
lpc_1525	pc_1525	pc_0800	1554	1539	-15	38.58	38.58	-0.01	
Washington Creek	lwa_0010	wa_0010	pr_0380	1246	1245		12.84	12.83	
	lwa_0020	wa_0020	wa_0010	1249	1248		14.20	14.20	
	lwa_0030	wa_0030	wa_0020	1249	1249		15.19	15.19	
	lwa_0040	wa_0040	wa_0030	1249	1249		15.38	15.38	
	lwa_0050	wa_0050	wa_0040	1246	1246		17.61	17.61	

Notes:

- (1) Change due to terracing--positive values indicate a increase, and negative values an decrease. Differences in discharge less than 5 cfs and water surface elevation less than 0.005 feet are left blank.

**Table 2. XP-Storm Results With and Without Denman Reach Terraces for 100-year Storm**

Flooding Source	Link ID	U/S Node	D/S Node	Peak Discharge (cfs)			U/S Node Water Surface Elevation (ft)		
				Without Terraces	With Terraces	Change <sup>1</sup>	Without Terraces	With Terraces	Change <sup>1</sup>
Corona Creek	LCC1_963.1	cc_0040	pr_0540n	762	760		27.24	27.26	
	lcc_0050	cc_0050	cc_0040	479	476		27.32	27.34	
	lcc_0060	cc_0060	cc_0050	524	520		27.37	27.38	
	L1166	cc_0060	pr_0560	428	433		27.37	27.38	
	lcc_0070	cc_0070	cc_0060	912	910		27.74	27.77	
	lcc_0075	cc_0075	cc_0070	945	944		27.77	27.80	
	lcc_0080	cc_0080	cc_0075	992	1003	11	27.94	27.96	
	L1124	cc_0080	pr_0580	574	569		27.94	27.96	
	lcc_0085	cc_0085	cc_0080	1508	1514	6	28.40	28.41	
	lcc_0090	cc_0090	cc_0085	1468	1474	6	28.81	28.82	
	L1123	cc_0090	pr_0590n	521	508	-13	28.81	28.82	
	lpr_0020	pr_0020	pr_0010	11974	11991	18	6.53	6.53	
	lpr_0030	pr_0030	pr_0020	11973	11991	18	6.66	6.66	
	lpr_0040	pr_0040	pr_0030	11973	11991	18	6.77	6.77	
	lpr_0050	pr_0050	pr_0040	10959	10978	19	6.99	7.00	
	lpr_0060	pr_0060	pr_0050	10953	10972	19	7.08	7.09	
	lpr_0070	pr_0070	pr_0060	10952	10972	19	7.40	7.40	
	lpr_0080	pr_0080	pr_0070	10952	10971	19	7.50	7.50	
	lpr_0090	pr_0090	pr_0080	10951	10971	19	7.88	7.90	0.03
	lpr_0100	pr_0094	pr_0090	10605	10626	20	7.92	7.95	0.03
	Link1230	pr_0096	pr_0094	10607	10628	20	8.17	8.19	0.03
	Link1229	pr_0098	pr_0096	10608	10629	20	8.26	8.29	0.03
	Link1228	pr_0100	pr_0098	10609	10629	20	8.34	8.36	0.03
	lpr_0110	pr_0110	pr_0100	10591	10611	20	8.45	8.47	0.02
	lpr_0120	pr_0120	pr_0110	10593	10613	20	8.45	8.48	0.03
	lpr_0130	pr_0130	pr_0120	10595	10615	20	8.55	8.57	0.02
	lpr_0140	pr_0140	pr_0130	10597	10618	21	8.64	8.66	0.02
	lpr_0150	pr_0150	pr_0140	10599	10620	21	8.79	8.81	0.02
	lpr_0160	pr_0160	pr_0150	10466	10487	21	8.99	9.01	0.02
	lpr_0170	pr_0170	pr_0160	10471	10491	20	9.09	9.12	0.02
	lpr_0180	pr_0180	pr_0170	10458	10478	20	9.18	9.20	0.02
	lpr_0190	pr_0190	pr_0180	10460	10480	20	9.26	9.28	0.02
	lpr_0195	pr_0195	pr_0190	10464	10484	20	9.52	9.54	0.02
	lpr_0200	pr_0200	pr_0195	10133	10153	20	9.68	9.70	0.02
	Link1239	pr_0206	pr_0200	10114	10133	20	9.72	9.74	0.02
	lpr_0208	pr_0208	pr_0206	10115	10134	19	9.95	9.97	0.03
	lpr_0210	pr_0210	pr_0208	10117	10137	19	9.98	10.00	0.03
	lpr_0220	pr_0220	pr_0210	10108	10127	19	10.15	10.18	0.03
	lpr_0230	pr_0230	pr_0220	10112	10130	18	10.18	10.21	0.03
	lpr_0240	pr_0240	pr_0230	10117	10135	18	10.19	10.22	0.03
	lpr_0250	pr_0250	pr_0240	10120	10138	18	10.19	10.22	0.03
	lpr_0260	pr_0260	pr_0250	10123	10140	18	10.20	10.23	0.03
	lpr_0270	pr_0270	pr_0260	10124	10141	17	10.21	10.24	0.03
	lpr_0280	pr_0280	pr_0270	10126	10143	18	10.24	10.27	0.03
	lpr_0290	pr_0290	pr_0280	10127	10144	17	10.03	10.06	0.03
	lpr_0298	pr_0298	pr_0290	9996	10015	19	10.74	10.76	0.03

**Table 2. XP-Storm Results With and Without Denman Reach Terraces for 100-year Storm**

Flooding Source	Link ID	U/S Node	D/S Node	Peak Discharge (cfs)			U/S Node Water Surface Elevation (ft)		
				Without Terraces	With Terraces	Change <sup>1</sup>	Without Terraces	With Terraces	Change <sup>1</sup>
Petaluma River	lpr_0300	pr_0300	pr_0298	9998	10016	18	10.97	10.99	0.03
	lpr_0308	pr_0308	pr_0300	10000	10018	19	11.37	11.39	0.03
	lpr_0310	pr_0310	pr_0308	10002	10019	18	11.55	11.57	0.02
	lpr_0320	pr_0320	pr_0310	10003	10020	18	11.40	11.42	0.02
	lpr_0330	pr_0330	pr_0320	10004	10021	18	11.59	11.61	0.02
	lpr_0338	pr_0338	pr_0330	9973	9990	18	12.14	12.16	0.02
	lpr_0340	pr_0340	pr_0338	9973	9990	18	12.50	12.52	0.02
	lpr_0350	pr_0350	pr_0340	9974	9991	18	12.90	12.92	0.02
	lpr_0360	pr_0360	pr_0350	9975	9993	17	14.30	14.32	0.02
	lpr_0370	pr_0370	pr_0360	9901	9918	17	15.12	15.14	0.02
	lpr_0380	pr_0380	pr_0370	9902	9919	17	15.74	15.76	0.02
	lpr_0390	pr_0390	pr_0380	8835	8842	8	16.63	16.64	0.01
	lpr_0400	pr_0400	pr_0390	7945	7945		16.87	16.88	0.01
	lpr_0420	pr_0420	pr_0400	7943	7943		17.20	17.21	0.01
	lpr_0430	pr_0430	pr_0420	7943	7942		17.45	17.45	0.01
	lpr_0440	pr_0440	pr_0430	7938	7938		19.12	19.13	
	lpr_0445	pr_0445	pr_0440	7935	7935		19.51	19.51	
	lpr_0448	pr_0448	pr_0445	7934	7933		19.64	19.64	
	lpr_0450	pr_0450	pr_0448	7933	7932		19.75	19.75	
	lpr_0452	pr_0452	pr_0450	7933	7933		19.83	19.83	
	lpr_0458	pr_0458	pr_0452	7936	7935		20.05	20.05	
	lpr_0460	pr_0460	pr_0458	7939	7938		20.13	20.14	
	lpr_0465	pr_0465	pr_0460	7897	7896		20.31	20.31	
	lpr_0470	pr_0470	pr_0465	7902	7900		20.39	20.39	
	lpr_0480	pr_0480	pr_0470	7906	7905		20.67	20.67	
	lpr_0490	pr_0490	pr_0480	7913	7911		21.04	21.04	
	lpr_0496	pr_0496	pr_0490	7919	7917		21.15	21.15	
	lpr_0498	pr_0498	pr_0496	7923	7920		22.04	22.04	
	lpr_0500	pr_0500	pr_0498	7924	7921		22.13	22.13	
	lpr_0510	pr_0510	pr_0500	7929	7926		22.38	22.38	
	lpr_0520	pr_0520	pr_0510	7891	7886		22.85	22.85	
	lpr_0530	pr_0530n	pr_0520	7910	7904	-6	23.54	23.54	
	lpr_0540	pr_0540n	pr_0530n	7921	7914	-7	24.13	24.13	
	lpr_0550	pr_0550	pr_0540n	7261	7251	-10	25.25	25.24	
	lpr_0552	pr_0552	pr_0550	7281	7270	-11	25.37	25.37	
	3876.1	pr_0554	pr_0552				25.40	25.40	
3876.2	pr_0554	pr_0552				25.40	25.40		
lpr_0560	pr_0560	pr_0554	7321	7306	-15	25.78	25.77		
lpr_0570	pr_0570	pr_0560	7013	6992	-21	26.07	26.07		
lpr_0580	pr_0580	pr_0570	7075	7045	-30	26.56	26.55		
lpr_0590	pr_0590n	pr_0580	6668	6636	-33	28.09	28.08	-0.01	
lpr_0600	pr_0600n	pr_0590n	6635	6612	-22	28.43	28.42	-0.01	
lpr_0606	pr_0606n	pr_0600n	6539	6518	-21	29.06	29.06	-0.01	
2150.1	pr_0607n	pr_0606n	6536	6515	-21	29.71	29.69	-0.01	
lpr_0608	pr_0608n	pr_0607n	6535	6515	-21	29.75	29.74	-0.01	
lpr_0610	pr_0610n	pr_0608n	5420	5402	-18	30.12	30.11	-0.01	

**Table 2. XP-Storm Results With and Without Denman Reach Terraces for 100-year Storm**

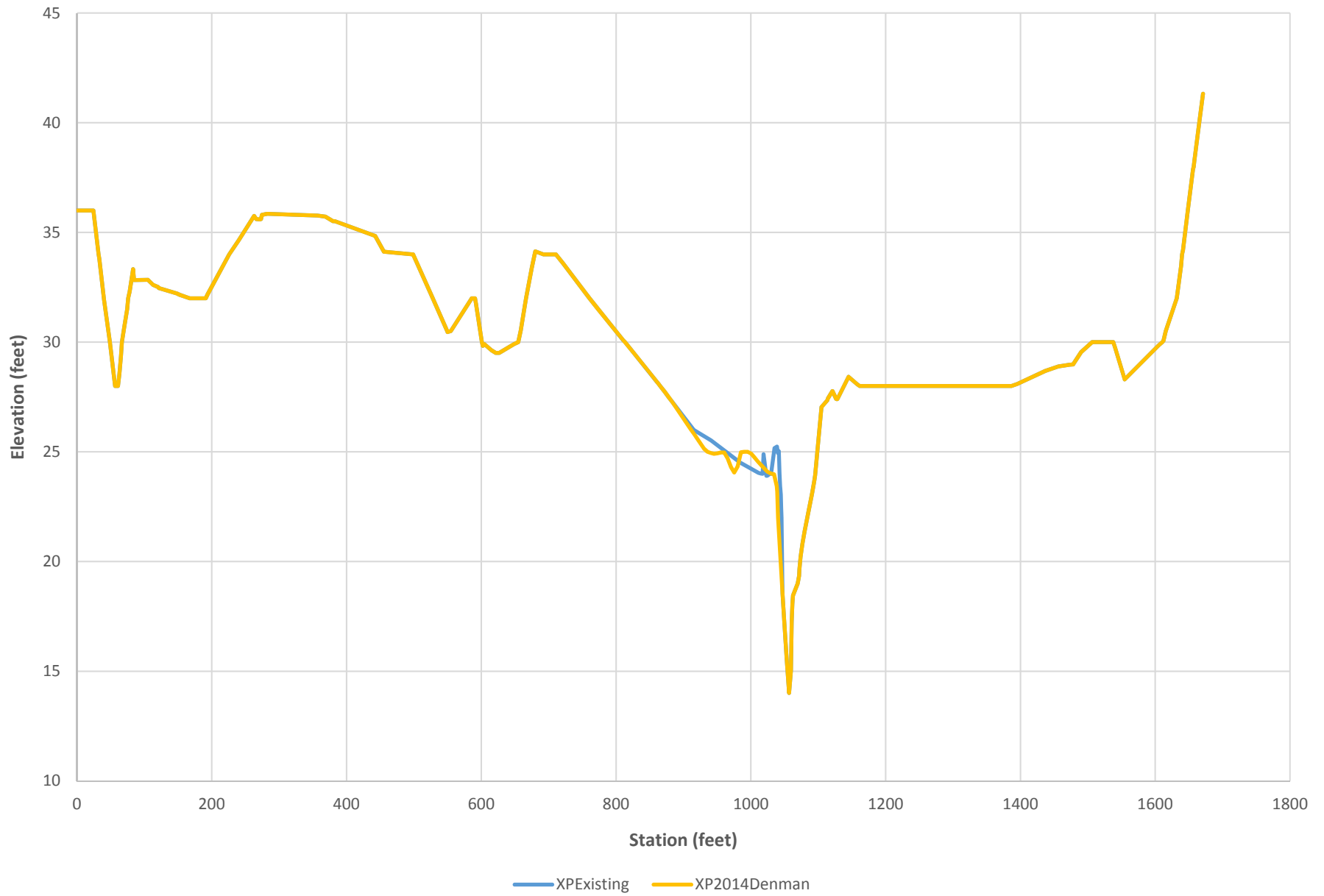
Flooding Source	Link ID	U/S Node	D/S Node	Peak Discharge (cfs)			U/S Node Water Surface Elevation (ft)		
				Without Terraces	With Terraces	Change <sup>1</sup>	Without Terraces	With Terraces	Change <sup>1</sup>
	lpr_0612	pr_0612n	pr_0610n	5416	5398	-18	30.22	30.21	-0.01
	lpr_0614	pr_0614n	pr_0612n	5412	5394	-18	30.45	30.44	-0.01
	lpr_0616	pr_0616n	pr_0614n	5383	5365	-18	30.55	30.54	-0.01
	lpr_0618	pr_0618n	pr_0616n	5382	5363	-18	30.69	30.68	-0.01
Petaluma River (Terracing Reach)	lpr_0620	pr_0620n	pr_0618n	5382	5364	-18	31.16	31.13	-0.03
	lpr_0630	pr_0630n	pr_0620n	5386	5368	-17	31.94	31.75	-0.19
	lpr_0640	pr_0640n	pr_0630n	5377	5360	-17	33.12	32.50	-0.63
	lpr_0650	pr_0650	pr_0640n	5378	5364	-14	33.34	32.65	-0.69
	lpr_0660	pr_0660	pr_0650	5381	5372	-9	33.39	32.69	-0.70
	lpr_0670	pr_0670n	pr_0660	5386	5386		33.89	33.48	-0.41
Petaluma River	lpr_0680	pr_0680n	pr_0670n	5374	5369		33.94	33.54	-0.40
	682lob	pr_0682	pr_0680n				34.20	33.93	-0.27
	2792.1	pr_0682	pr_0680n						
	684lob	pr_0684	pr_0682				34.41	34.21	-0.20
	2791.1	pr_0684	pr_0682						
	lpr_0690	pr_0690n	pr_0684	5398	5394		34.35	34.14	-0.21
	lpr_0700	pr_0700	pr_0690n	5404	5404		34.41	34.22	-0.20
	lpr_0710	pr_0710	pr_0700	5411	5413		35.37	35.38	0.01
	lpr_0720	pr_0720	pr_0710	5375	5369	-6	36.42	36.41	
	lpr_0723	pr_0723	pr_0720	5378	5367	-11	37.42	37.41	-0.01
	3663.1	pr_0725	pr_0723				37.62	37.62	
	3663.2	pr_0725	pr_0723				37.62	37.62	
	lpr_0730	pr_0730	pr_0725	5378	5367	-11	37.78	37.78	
	lpr_0740	pr_0740	pr_0730	5361	5352	-10	38.01	38.01	
	2526.1	pr_0745	pr_0740				38.62	38.61	
	2526.2	pr_0745	pr_0740				38.62	38.61	
	lpr_0750	pr_0750	pr_0745	5361	5351	-10	39.09	39.09	
lpr_0760	pr_0760	pr_0750	5362	5352	-11	39.28	39.28		
lpc_0450	pc_0450	pr_0760	3531	3521	-10	39.62	39.61	-0.01	
lpc_0800	pc_0800	pc_0450	3141	3133	-8	39.67	39.66		
lpc_1525	pc_1525	pc_0800	3236	3230	-6	39.68	39.68	-0.01	
Washington Creek	lwa_0010	wa_0010	pr_0380	1601	1601		15.86	15.88	
	lwa_0020	wa_0020	wa_0010	1609	1609		15.98	16.02	
	lwa_0030	wa_0030	wa_0020	1611	1611		16.40	16.45	
	lwa_0040	wa_0040	wa_0030	1611	1611		16.53	16.57	
	lwa_0050	wa_0050	wa_0040	1608	1608		18.47	18.47	

Notes:

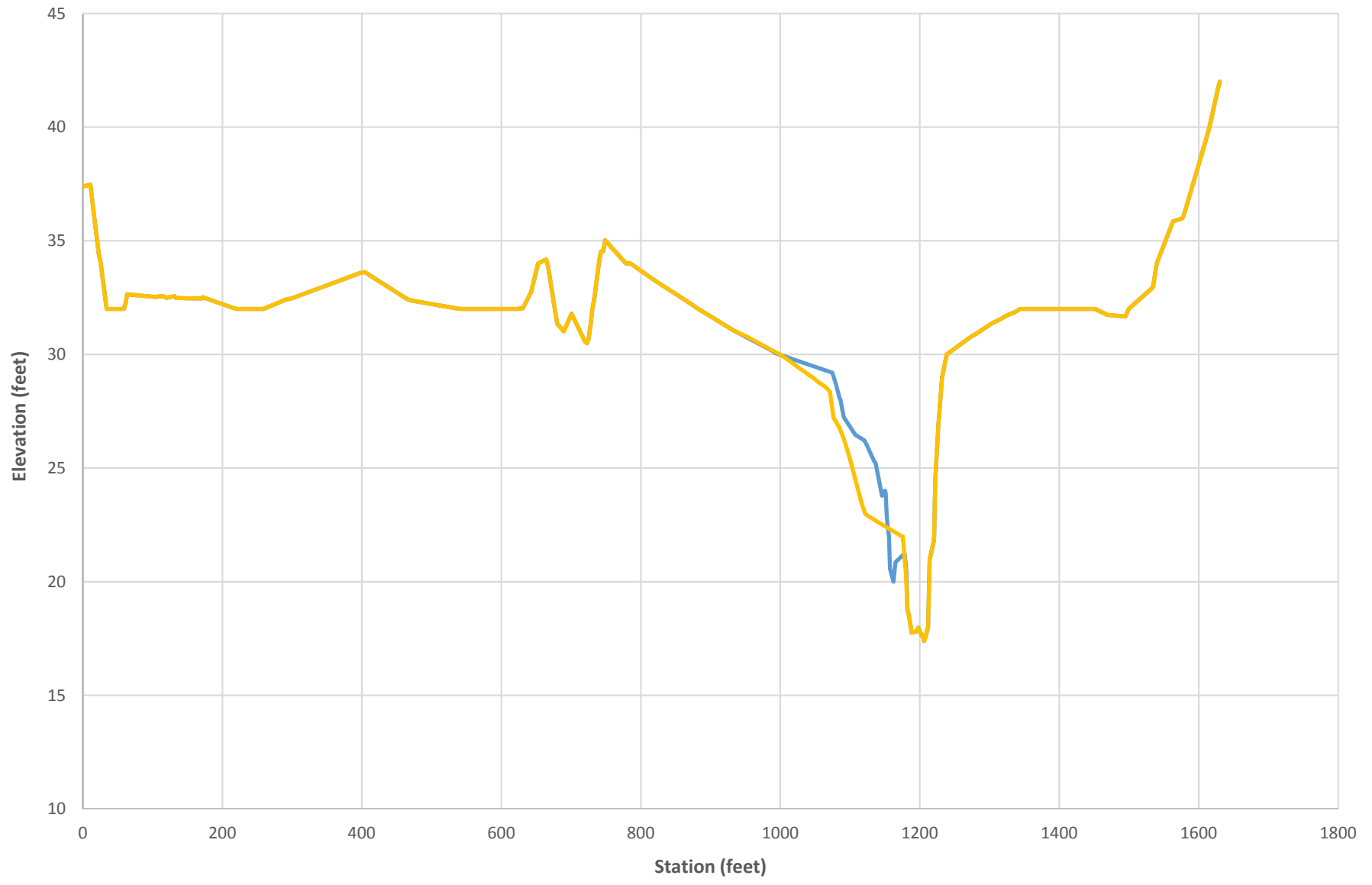
- (1) Change due to terracing--positive values indicate a increase, and negative values an decrease. Differences in discharge less than 5 cfs and water surface elevation less than 0.005 feet are left blank.

**Attachment 1**  
**Cross Section Terracing Edits**

Node pr\_0620 to pr\_0618



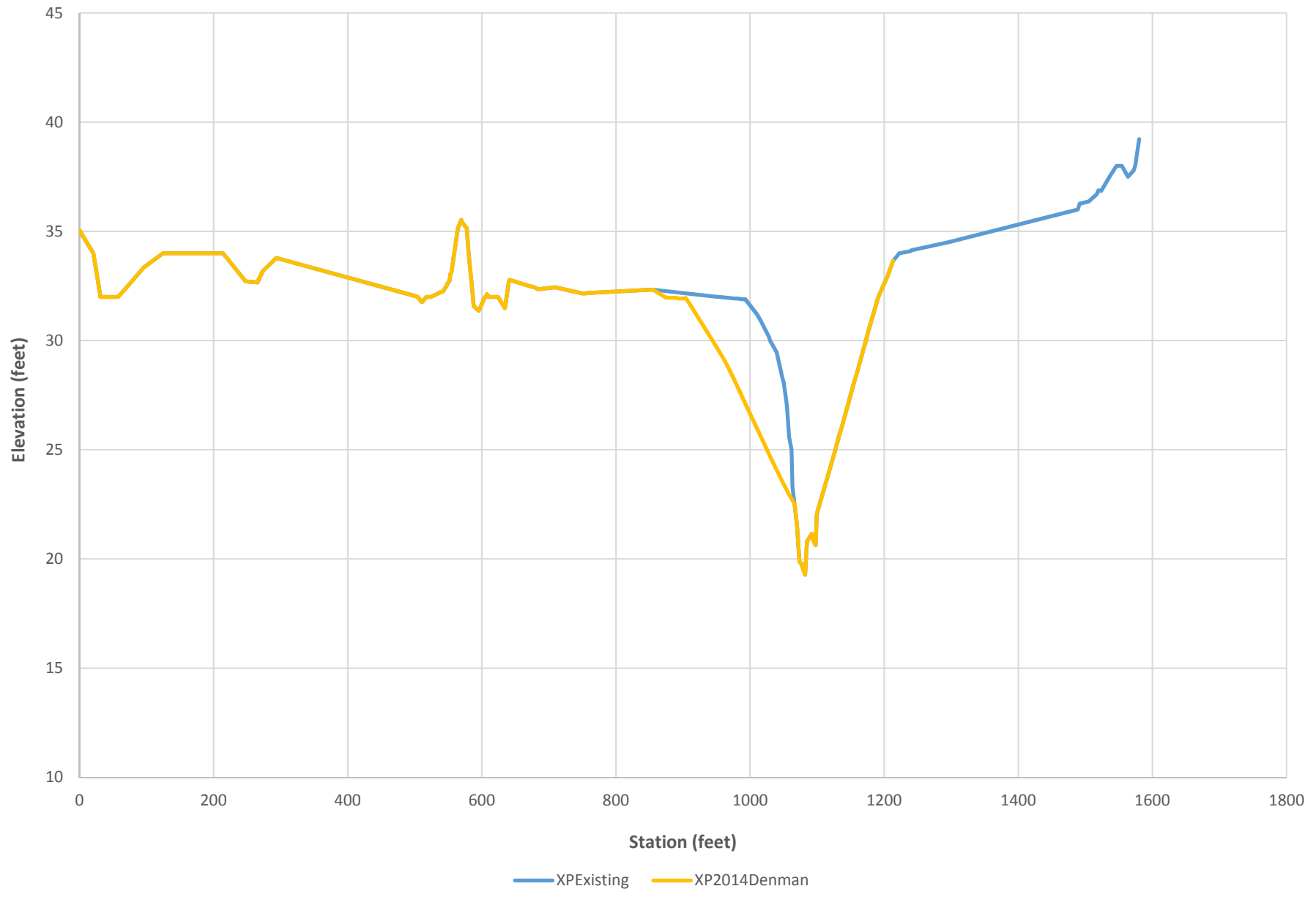
Node pr\_0630 to pr\_0620



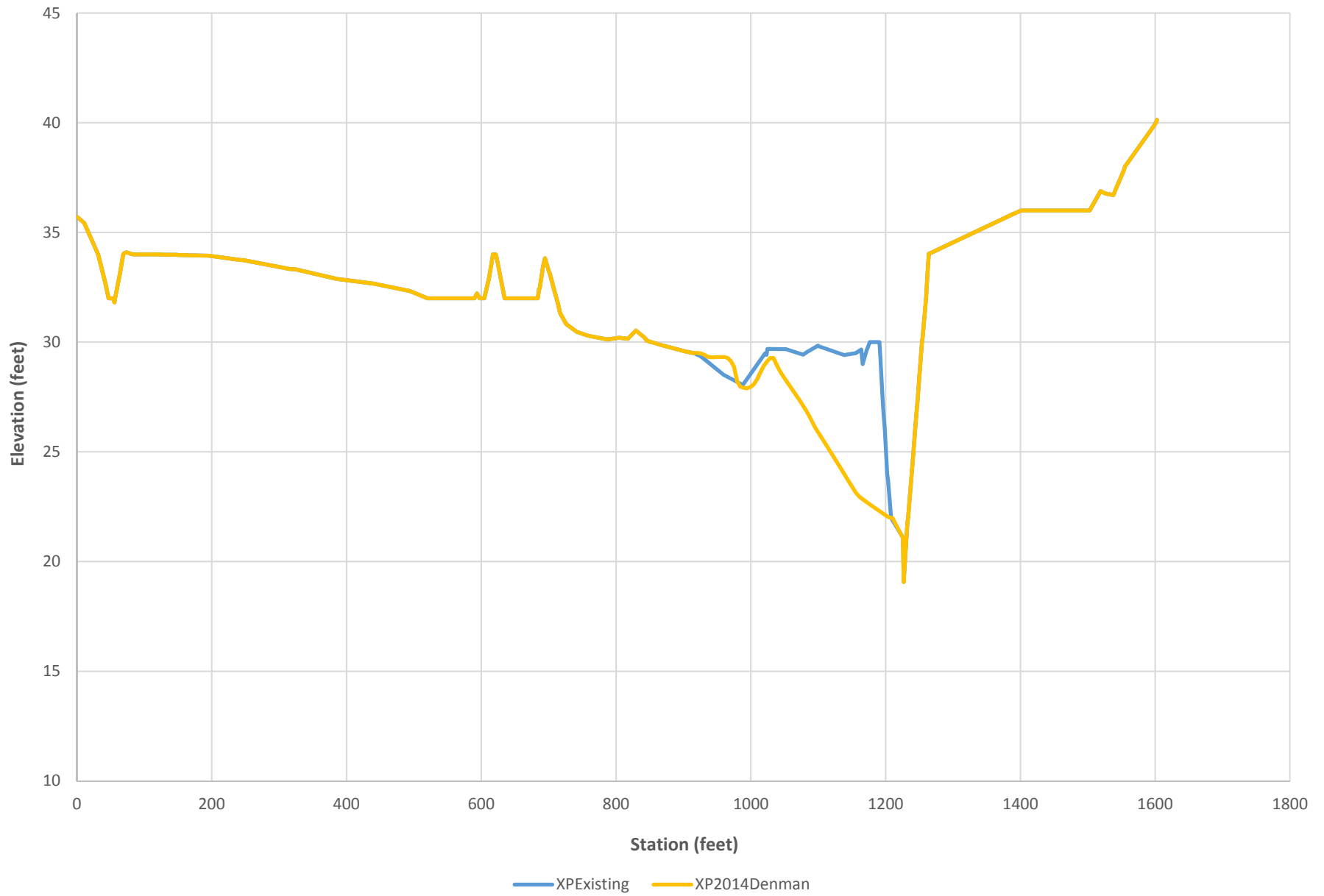
— XPExisting — XP2014Denman



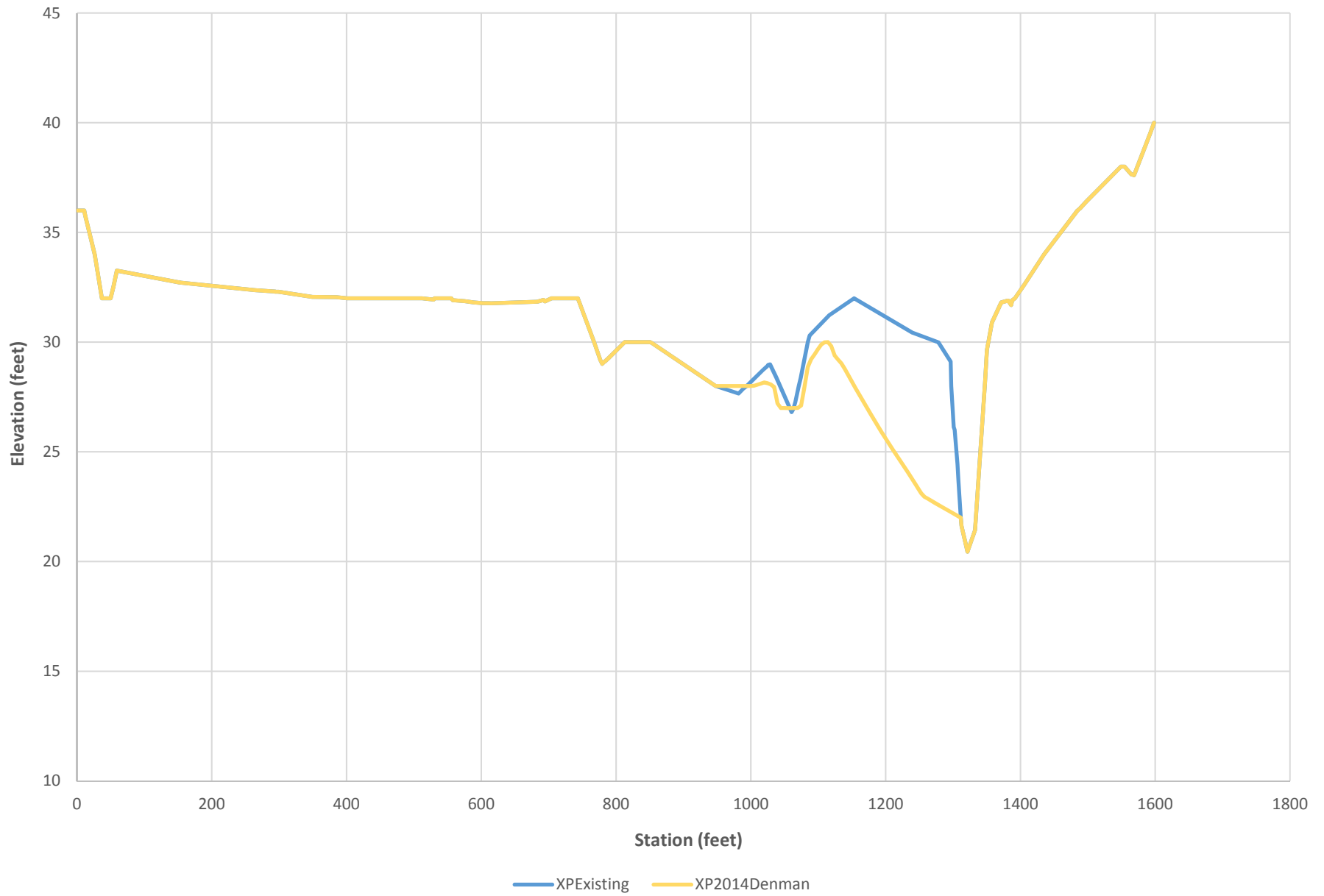
Node pr\_0640 to pr\_0630

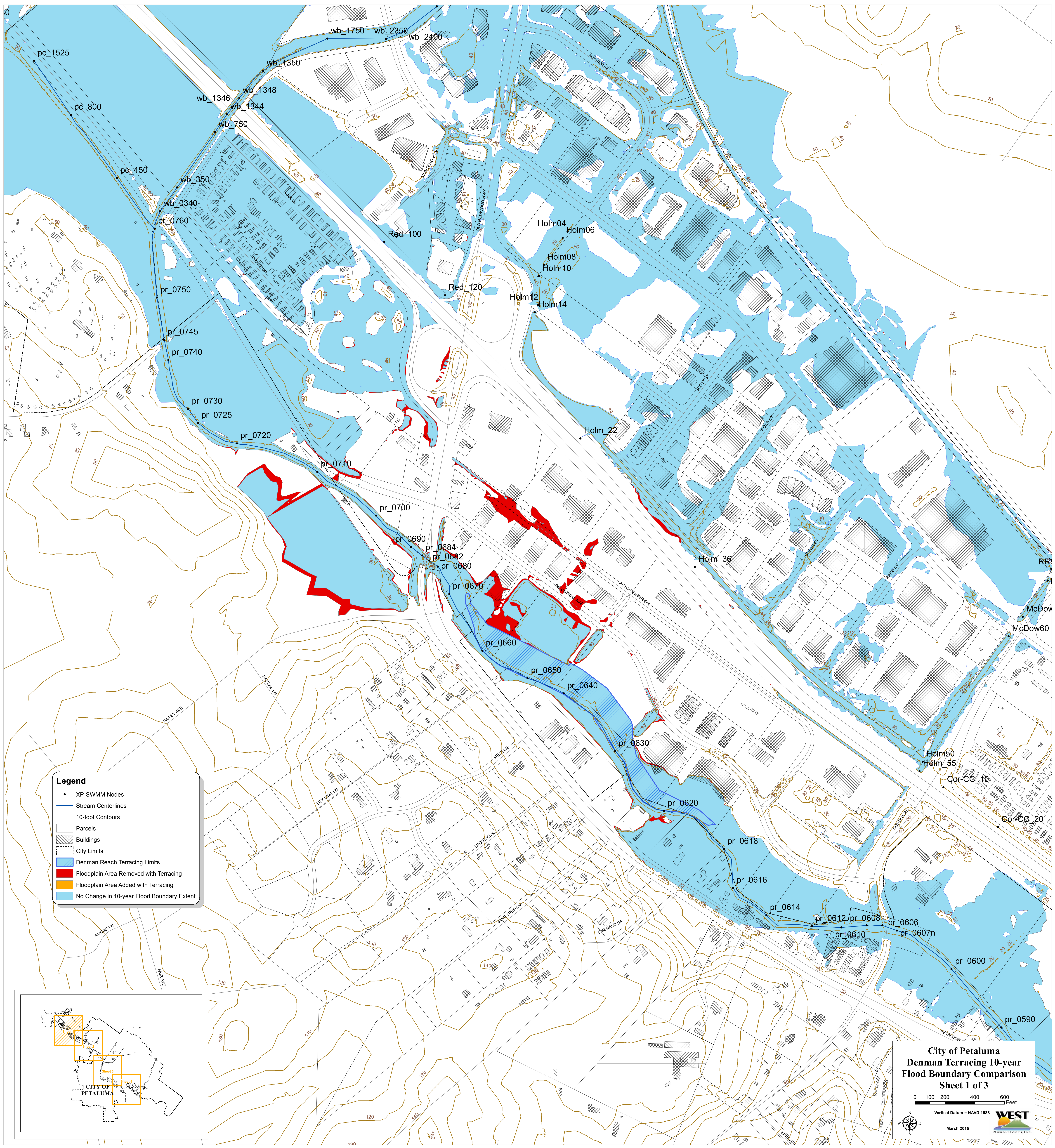


Node pr\_0650 to pr\_0640



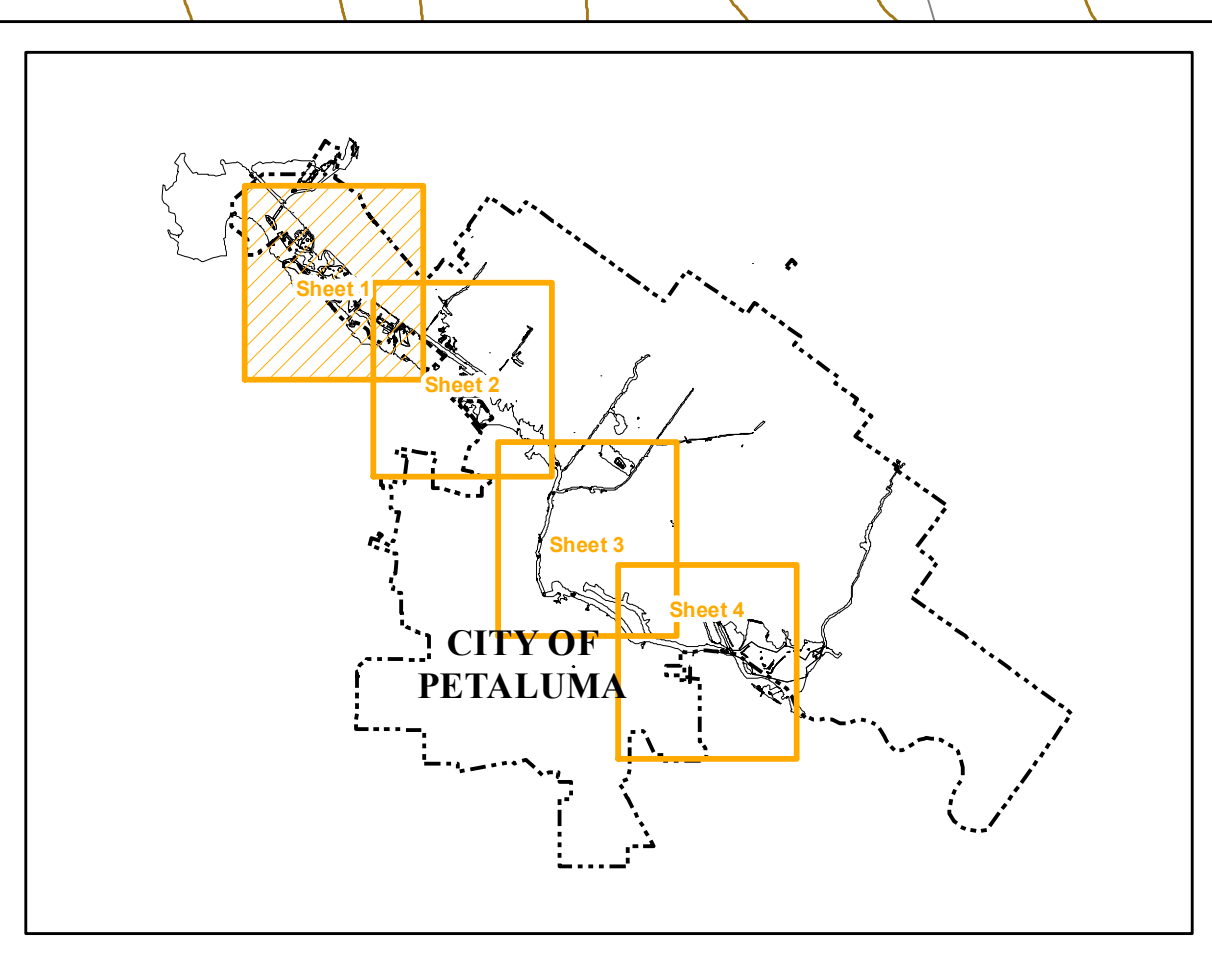
Node pr\_0660 to pr\_0650





**Legend**

- XP-SWMM Nodes
- Stream Centerlines
- 10-foot Contours
- ▭ Parcels
- ▭ Buildings
- ▭ City Limits
- ▭ Denman Reach Terracing Limits
- ▭ Floodplain Area Removed with Terracing
- ▭ Floodplain Area Added with Terracing
- ▭ No Change in 10-year Flood Boundary Extent

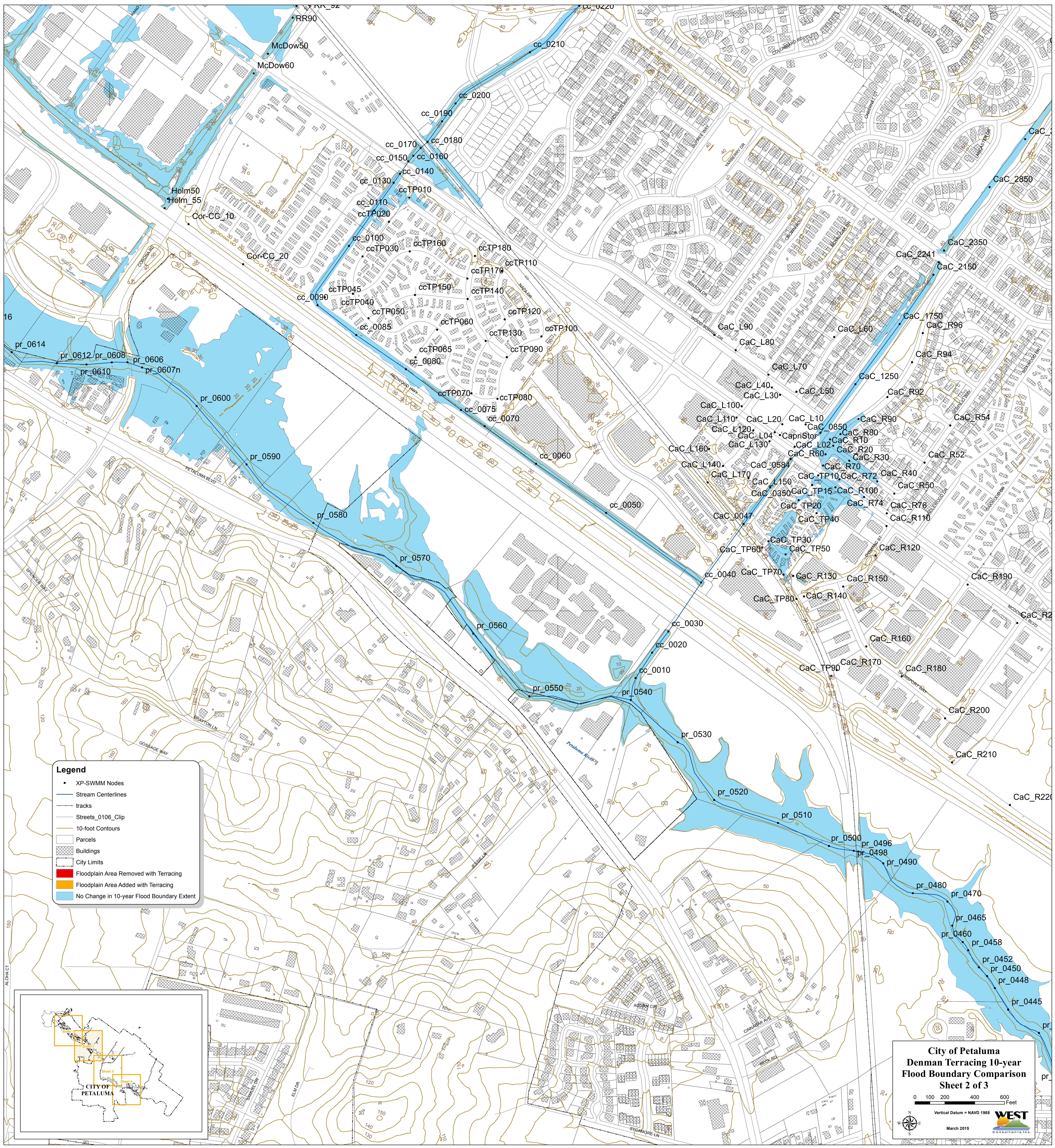


**City of Petaluma  
Denman Terracing 10-year  
Flood Boundary Comparison  
Sheet 1 of 3**

0 100 200 400 600 Feet

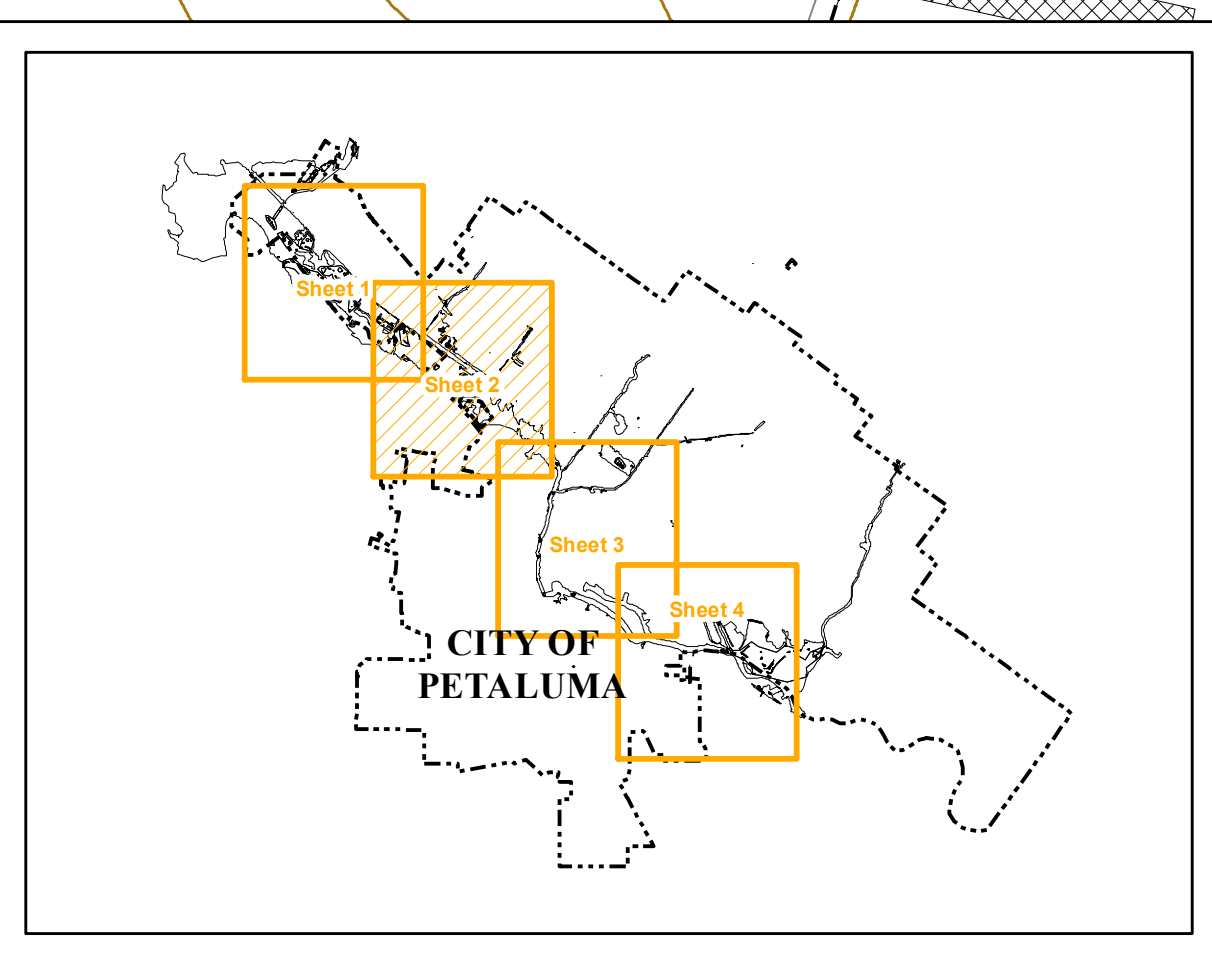
Vertical Datum = NAVD 1988

March 2015



**Legend**

- XP-SWMM Nodes
- Stream Centerlines
- tracks
- Streets\_0106\_Clip
- 10-foot Contours
- ▭ Parcels
- ▭ Buildings
- City Limits
- Floodplain Area Removed with Terracing
- Floodplain Area Added with Terracing
- No Change in 10-year Flood Boundary Extent

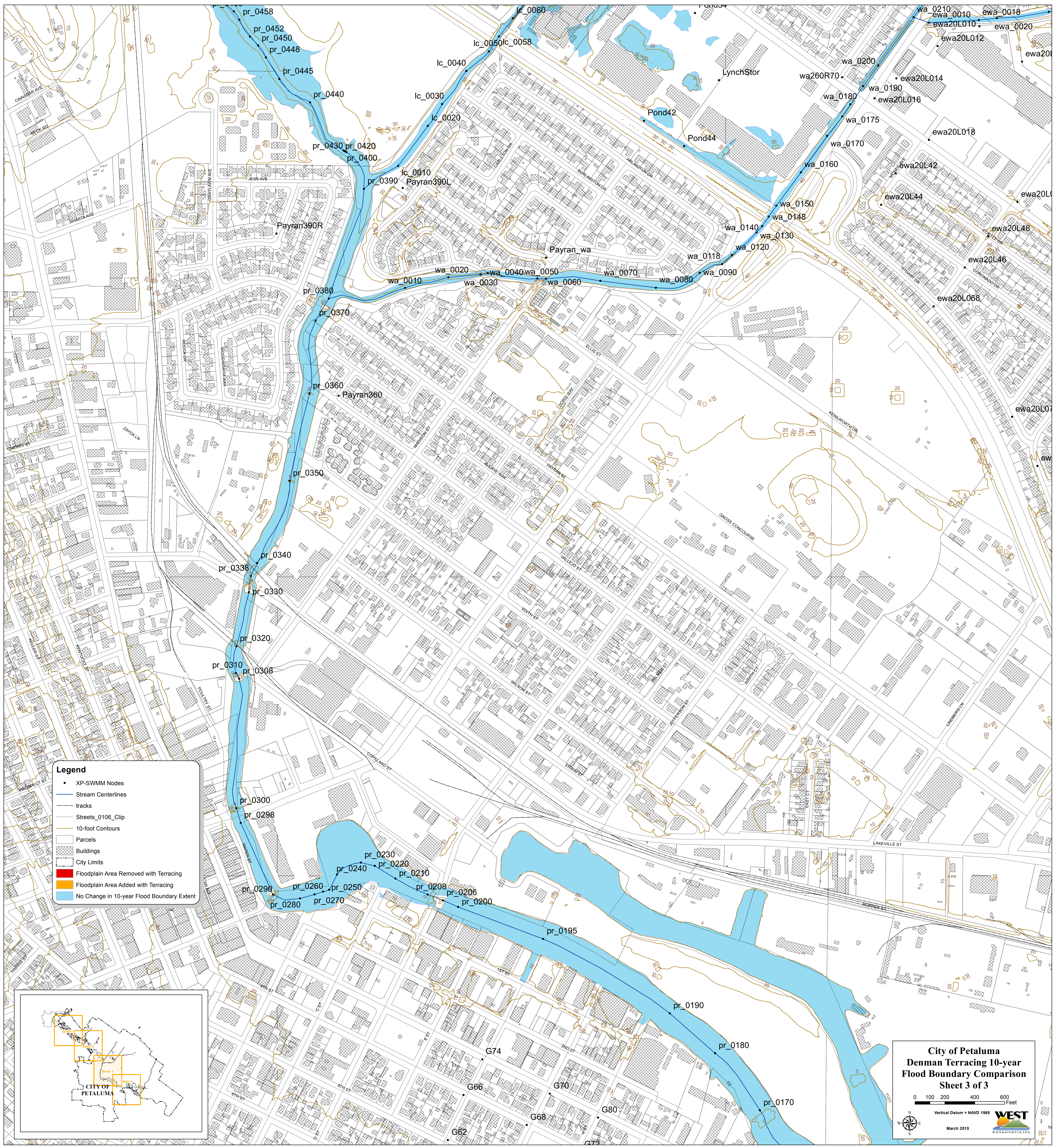


**City of Petaluma  
Denman Terracing 10-year  
Flood Boundary Comparison  
Sheet 2 of 3**

0 100 200 400 600 Feet

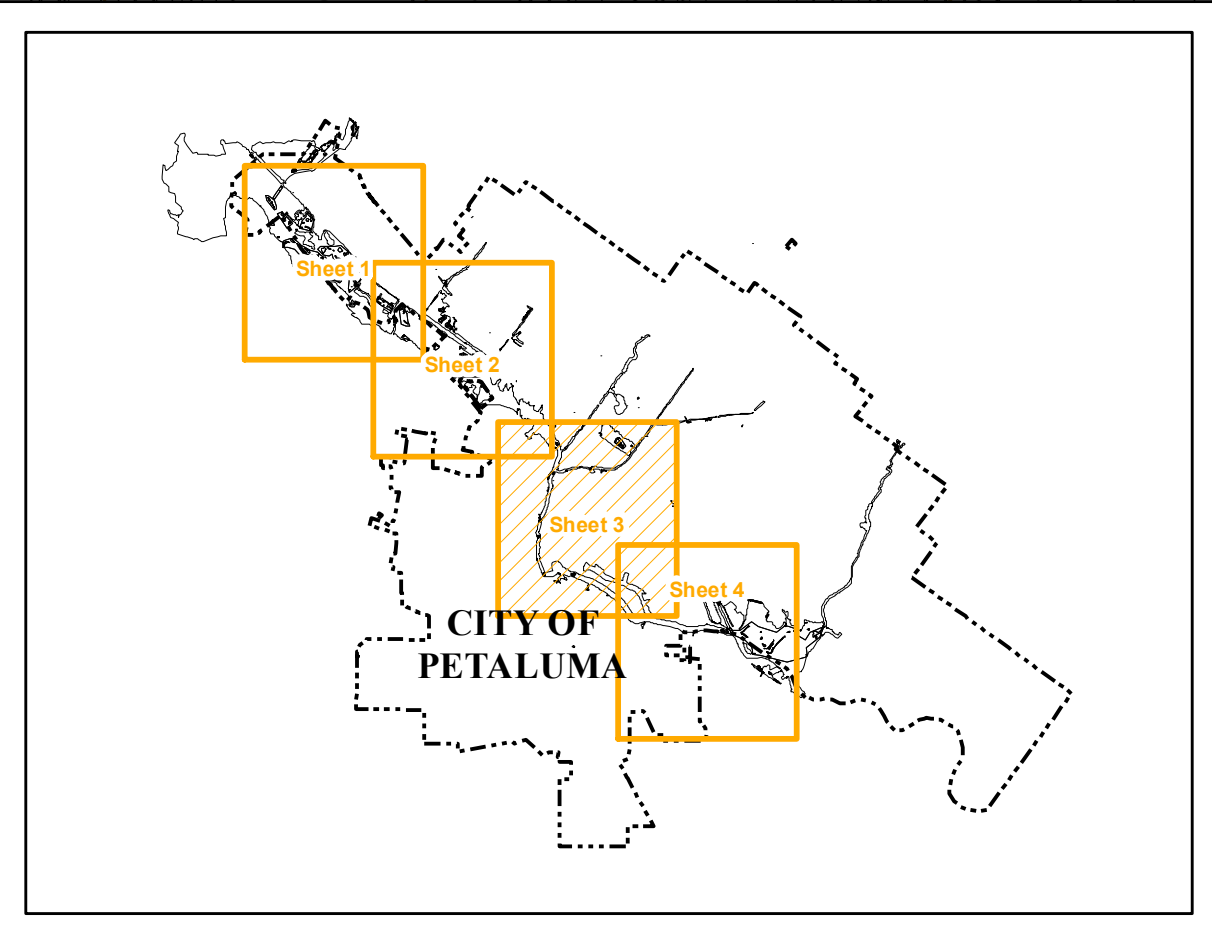
Vertical Datum = NAVD 1988

March 2015



**Legend**

- XP-SWMM Nodes
- Stream Centerlines
- tracks
- Streets\_0106\_Clip
- 10-foot Contours
- ▭ Parcels
- ▭ Buildings
- ▭ City Limits
- ▭ Floodplain Area Removed with Terracing
- ▭ Floodplain Area Added with Terracing
- ▭ No Change in 10-year Flood Boundary Extent

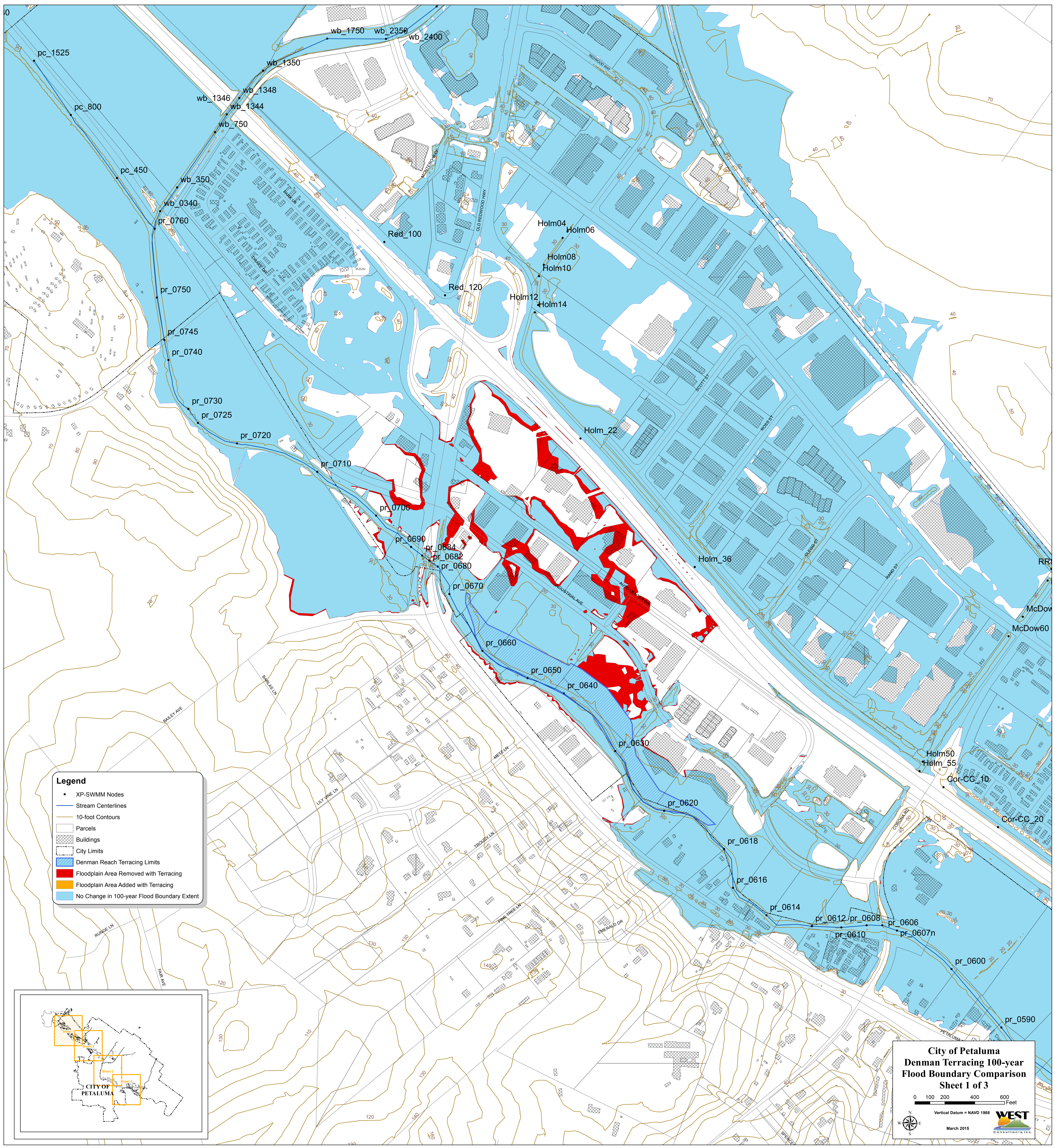


**City of Petaluma  
Denman Terracing 10-year  
Flood Boundary Comparison  
Sheet 3 of 3**

0 100 200 400 600 Feet

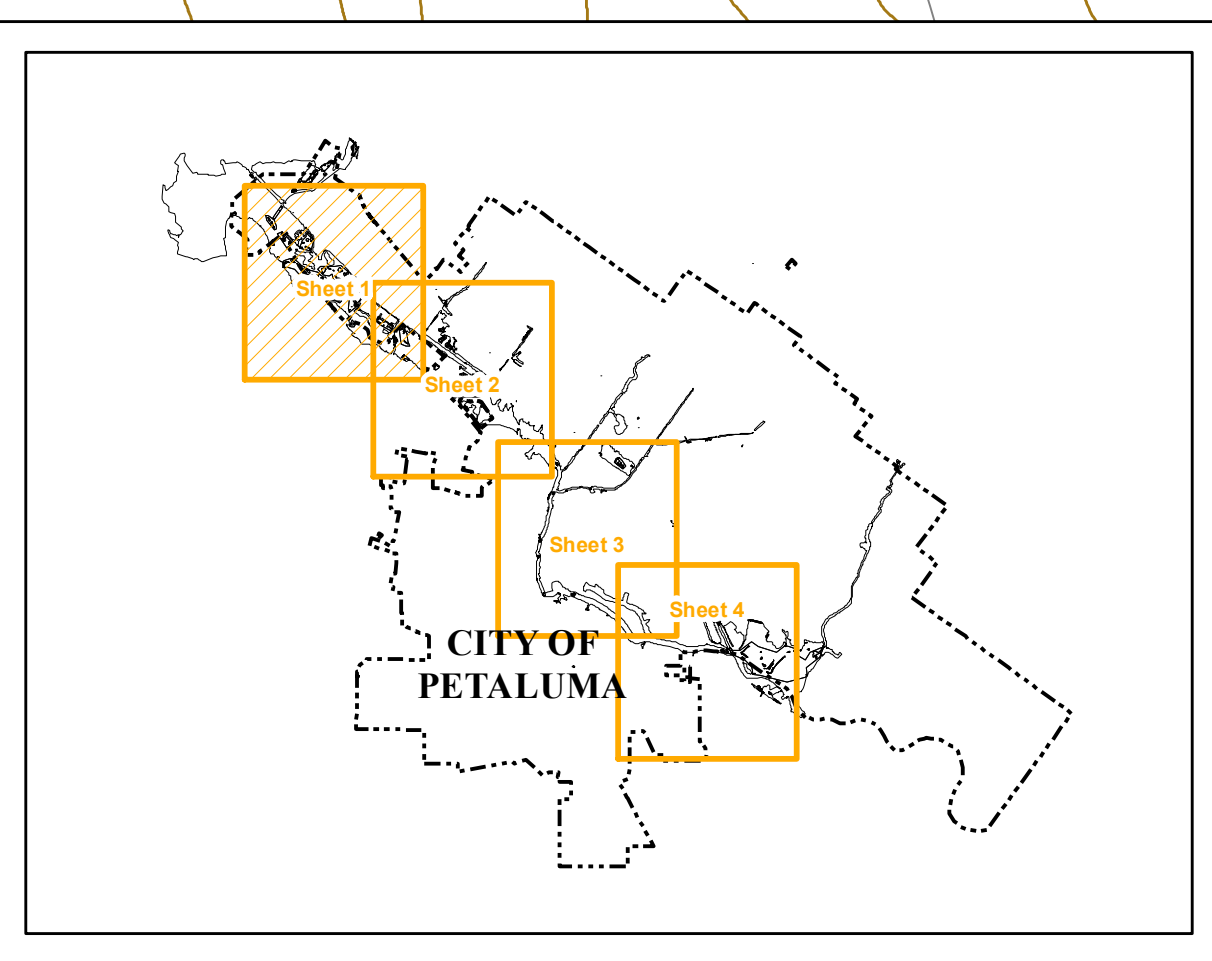
Vertical Datum = NAVD 1988

March 2015



**Legend**

- XP-SWMM Nodes
- Stream Centerlines
- 10-foot Contours
- ▭ Parcels
- ▭ Buildings
- ▭ City Limits
- ▭ Denman Reach Terracing Limits
- ▭ Floodplain Area Removed with Terracing
- ▭ Floodplain Area Added with Terracing
- ▭ No Change in 100-year Flood Boundary Extent

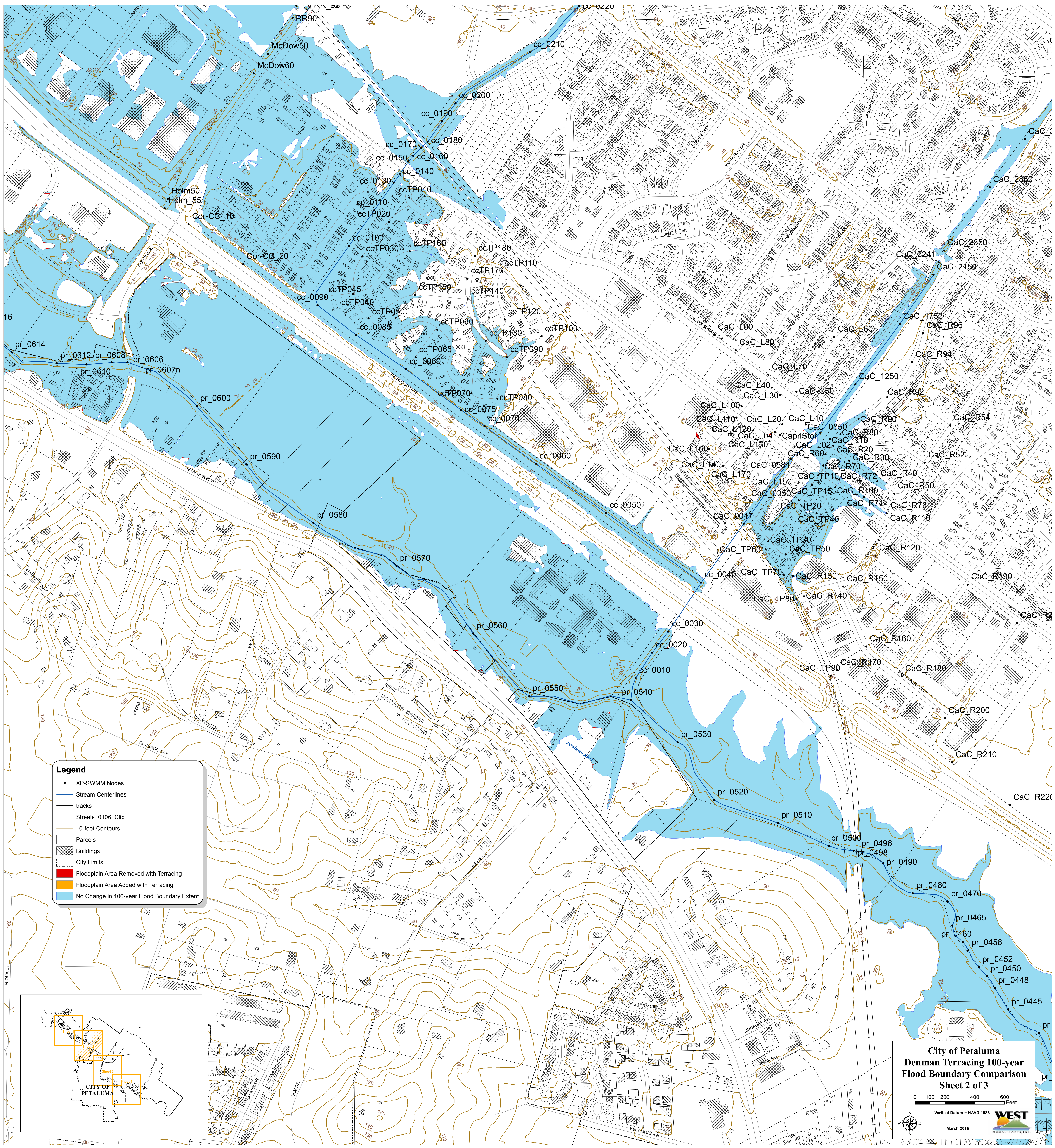


**City of Petaluma  
Denman Terracing 100-year  
Flood Boundary Comparison  
Sheet 1 of 3**

0 100 200 400 600 Feet

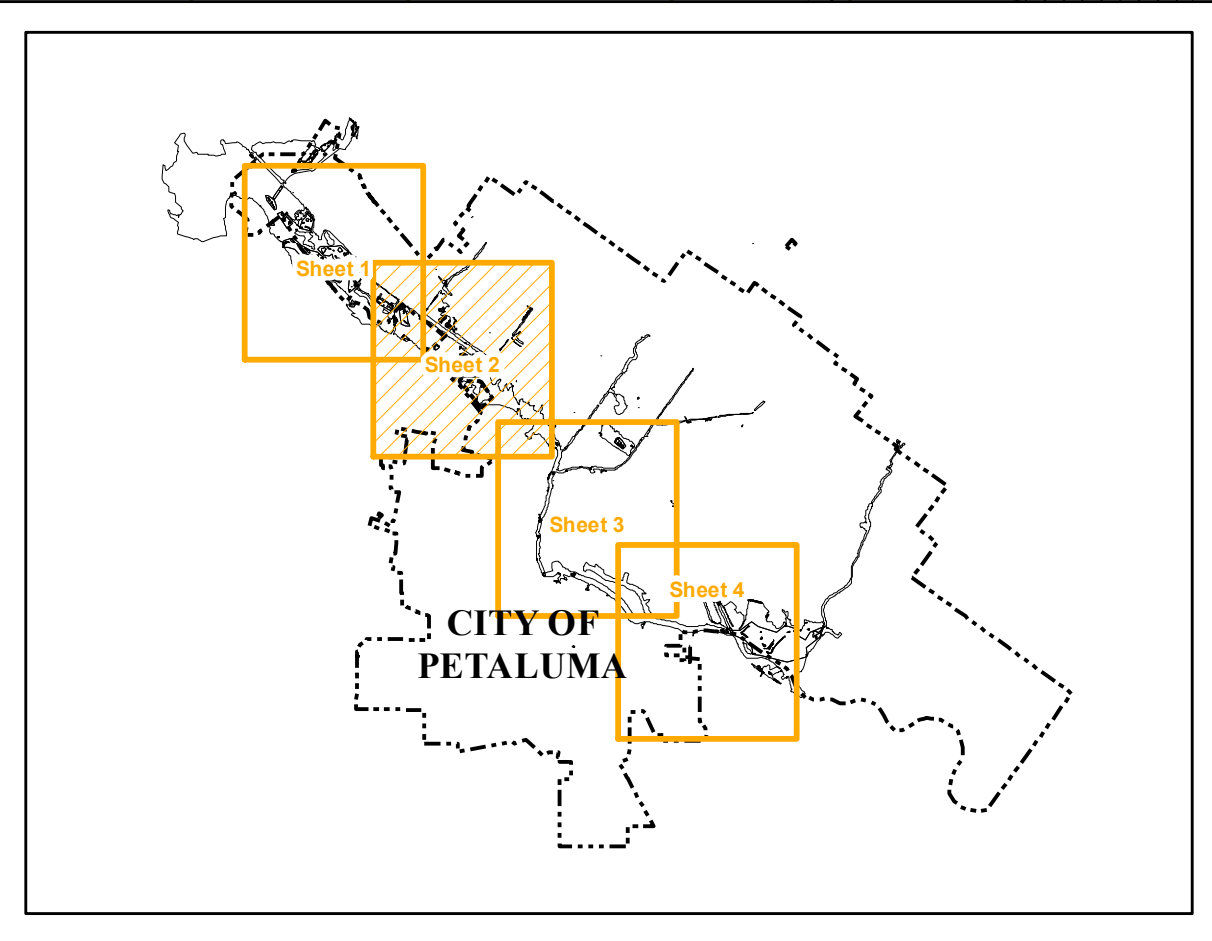
Vertical Datum = NAVD 1988

March 2015



**Legend**

- XP-SWMM Nodes
- Stream Centerlines
- tracks
- Streets\_0106\_Clip
- 10-foot Contours
- ▭ Parcels
- ▭ Buildings
- City Limits
- ▭ Floodplain Area Removed with Terracing
- ▭ Floodplain Area Added with Terracing
- ▭ No Change in 100-year Flood Boundary Extent



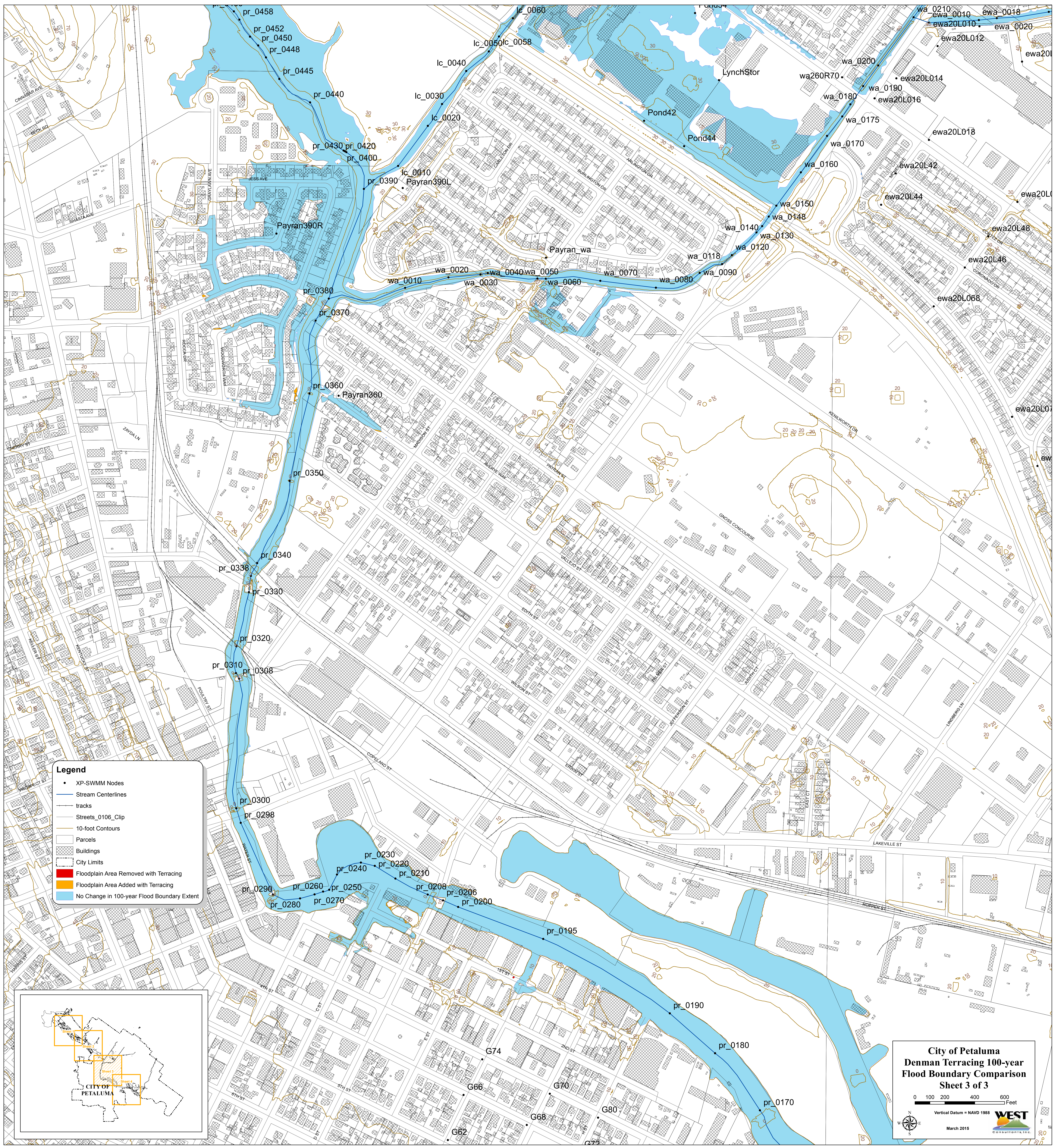
**City of Petaluma  
Denman Terracing 100-year  
Flood Boundary Comparison  
Sheet 2 of 3**

0 100 200 400 600 Feet

Vertical Datum = NAVD 1988

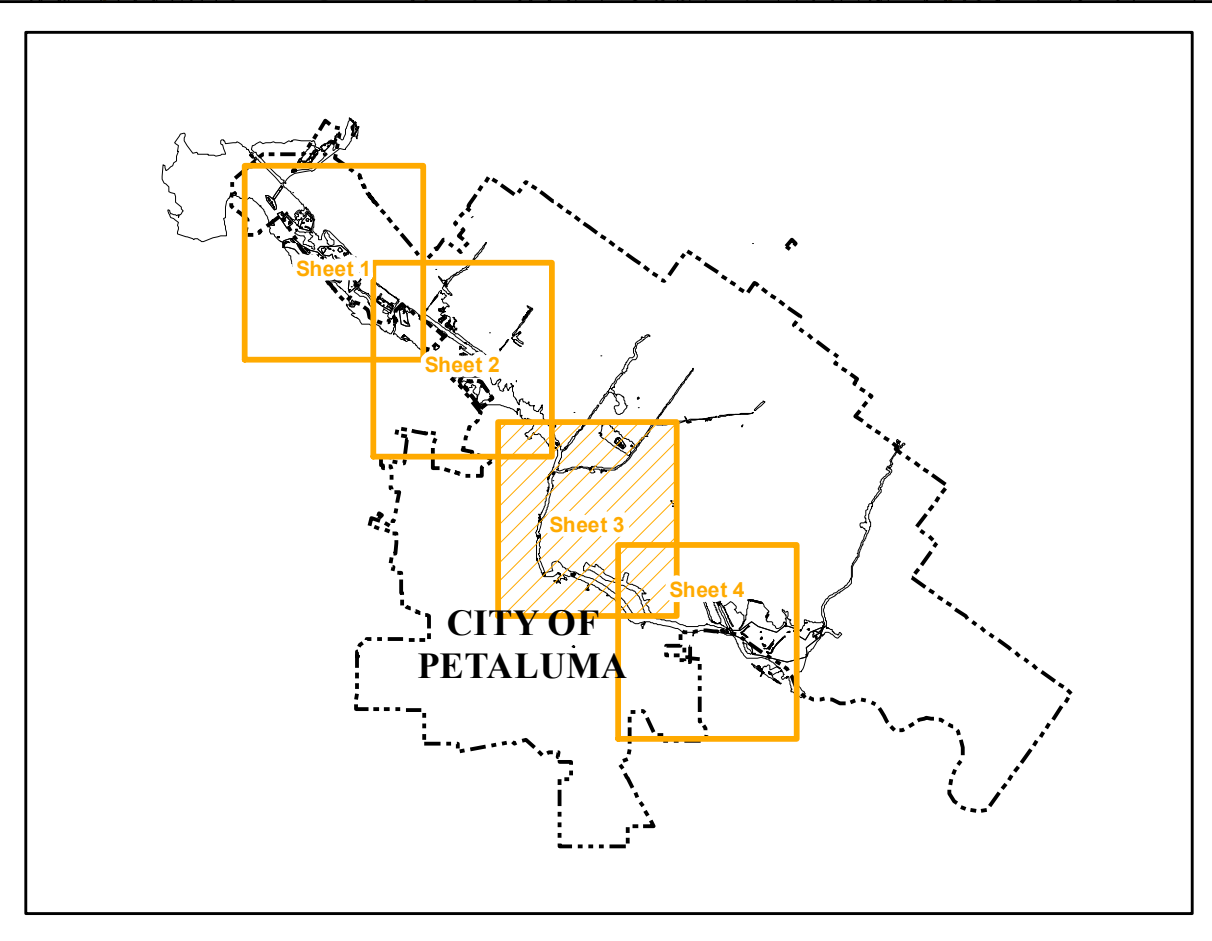
March 2015





**Legend**

- XP-SWMM Nodes
- Stream Centerlines
- tracks
- Streets\_0106\_Clip
- 10-foot Contours
- ▭ Parcels
- ▭ Buildings
- ▭ City Limits
- ▭ Floodplain Area Removed with Terracing
- ▭ Floodplain Area Added with Terracing
- ▭ No Change in 100-year Flood Boundary Extent



**City of Petaluma  
Denman Terracing 100-year  
Flood Boundary Comparison  
Sheet 3 of 3**

0 100 200 400 600 Feet

Vertical Datum = NAVD 1988

March 2015

# Appendix 11-C

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## Storm Water Control Plan for a Regulated Project: Sid Commons

CSW/ Stuber-Stroeh Engineering Group, Inc., July 21, 2015; and

## Preliminary Storm Water Control Plan (Sheet C-7)

CSW/Stuber-Stroeh Engineering Group, Inc., May 1, 2017