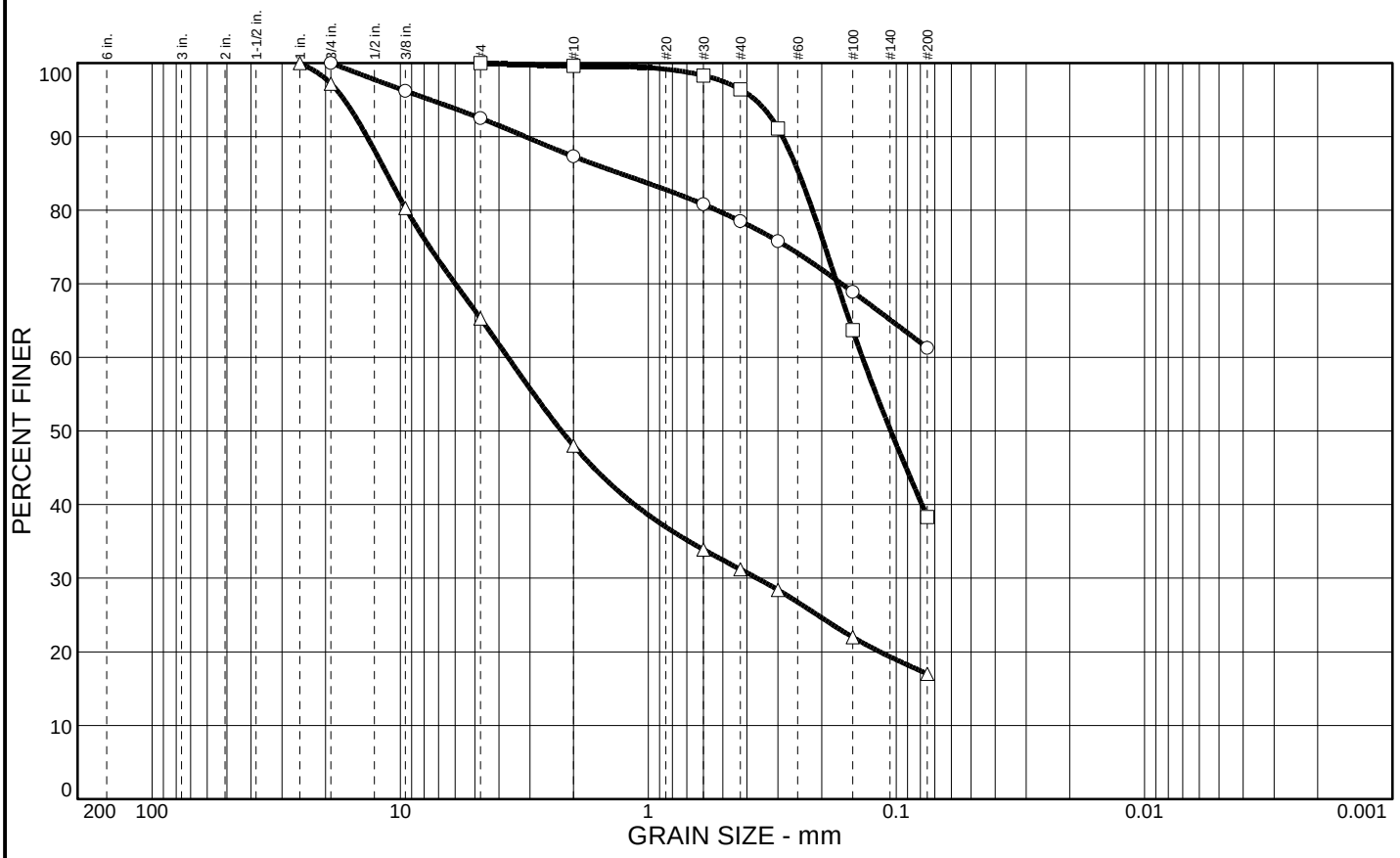
Appendix C

Laboratory Test Results

Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		7.5	31.2	61.3		CL		19	30
□			61.7	38.3		SM		26	24
△		34.7	48.3	17.0					

SIEVE inches size	PERCENT FINER ○	□	△
1"			100.0
3/4"	100.0		97.2
3/8"	96.2		80.3
GRAIN SIZE			
D_{60}		0.137	3.68
D_{30}			0.364
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	92.5	100.0	65.3
#10	87.3	99.6	48.0
#30	80.8	98.3	33.9
#40	78.5	96.4	31.2
#50	75.8	91.1	28.4
#100	68.9	63.7	22.0
#200	61.3	38.3	17.0

SOIL DESCRIPTION

○ Brown Sandy Lean CLAY

□ Brown Silty SAND

△ Brown Clayey SAND w/ Gravel

REMARKS:

○

□

△ Due to the small sample size, relative to the largest particle size, this data should be considered to be approximate.

○ Source: MW# 1 Elev./Depth: 7.5'

□ Source: MW# 2 Elev./Depth: 5.0'

△ Source: MW# 2 Elev./Depth: 20'

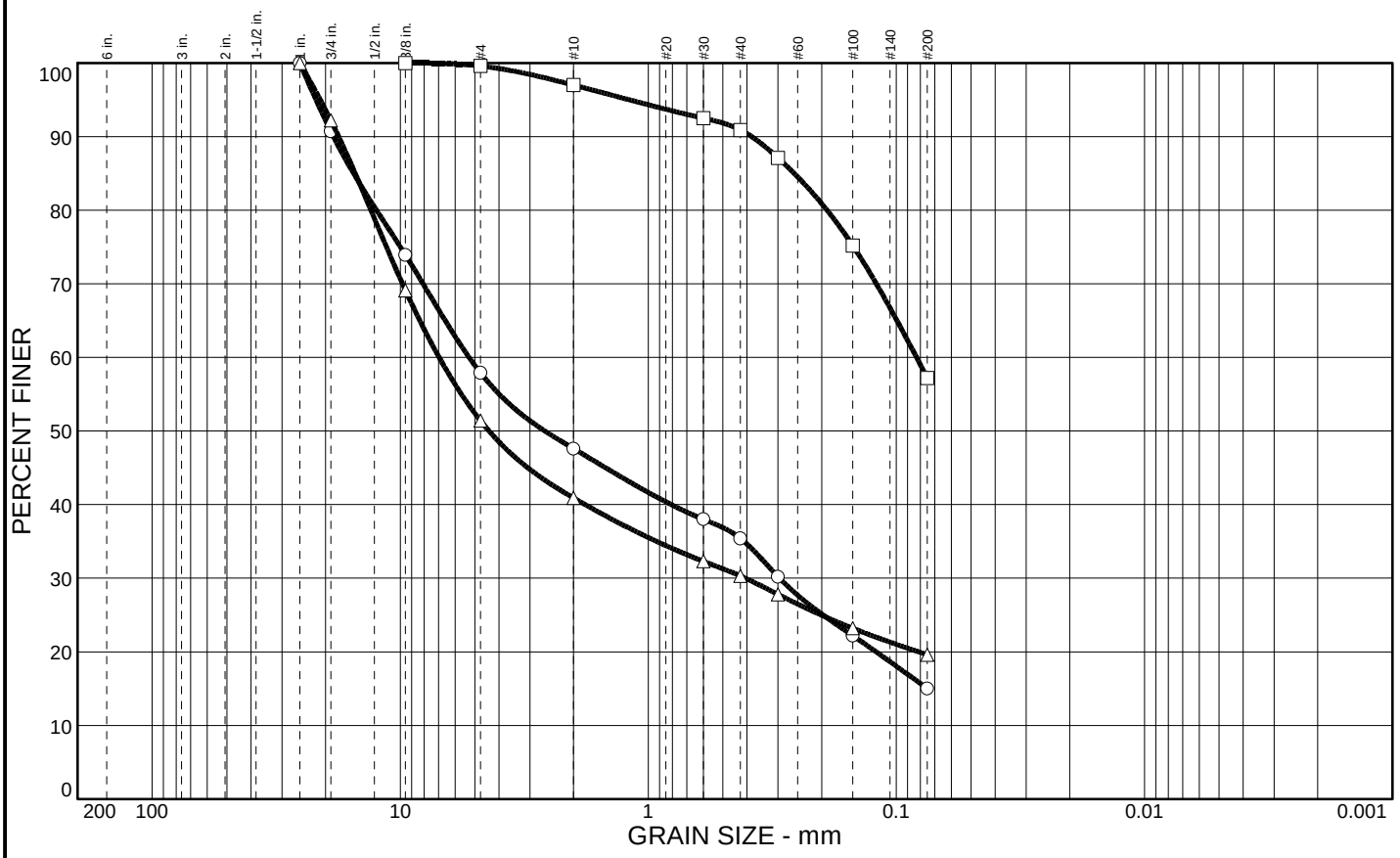
COOPER TESTING LABORATORY

Client: GEI Consultants, Inc.

Project: Former Nursery Detention Basin - 1610277

Project No.: 250-066 Figure

Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		42.1	42.9	15.0		SC-SM		16	23
□		0.4	42.4	57.2		CL		19	32
△		48.6	31.8	19.6		GC		18	31

SIEVE inches size	PERCENT FINER ○	□	△
1"	100.0		100.0
3/4"	90.7		92.2
3/8"	73.9	100.0	69.1
GRAIN SIZE			
D_{60}	5.28	0.0829	6.97
D_{30}	0.296		0.406
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	57.9	99.6	51.4
#10	47.6	97.0	40.9
#30	38.0	92.5	32.3
#40	35.4	90.9	30.3
#50	30.2	87.1	27.8
#100	22.2	75.2	23.2
#200	15.0	57.2	19.6

SOIL DESCRIPTION

○ Brown Silty, Clayey SAND w/ Gravel

□ Brown Sandy Lean CLAY

△ Brown Lean Clayey GRAVEL w/ Sand

REMARKS:

○ Due to the small sample size, relative to the largest particle size, this data should be considered to be approximate.

□

△ Due to the small sample size, relative to the largest particle size, this data should be considered to be approximate.

○ Source: MW# 3 Elev./Depth: 5.0'

□ Source: MW# 3 Elev./Depth: 12.5'

△ Source: MW# 3 Elev./Depth: 15.0'

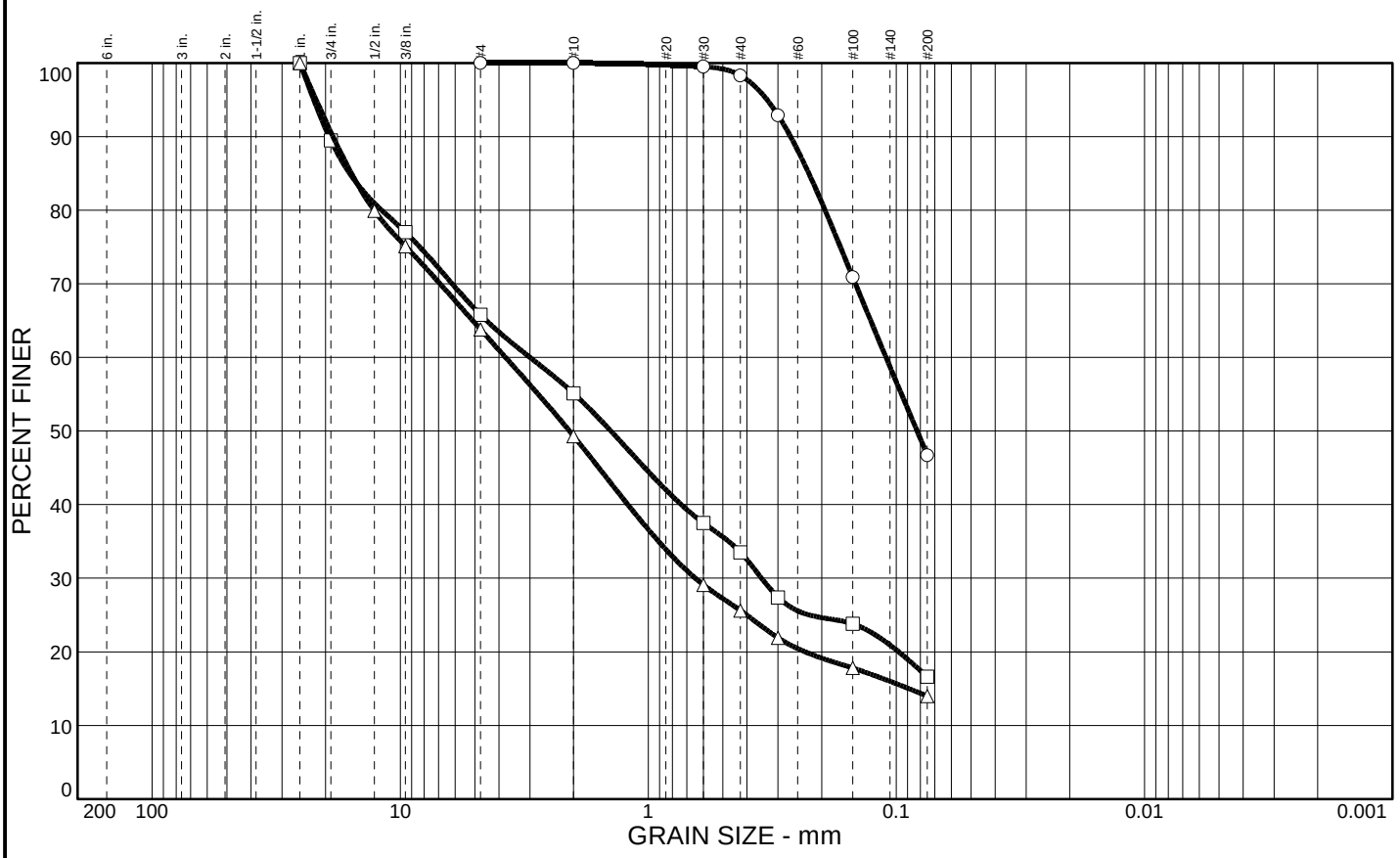
COOPER TESTING LABORATORY

Client: GEI Consultants, Inc.

Project: Former Nursery Detention Basin - 1610277

Project No.: 250-066 Figure

Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			53.3	46.7		SC-SM		18	25
□		34.2	49.2	16.6		SC		18	27
△		36.2	49.8	14.0					

SIEVE inches size	PERCENT FINER ○	□	△
1"		100.0	100.0
3/4"		89.5	
1/2"			79.9
3/8"		77.0	75.1
	GRAIN SIZE		
D_{60}	0.110	3.00	3.77
D_{30}		0.350	0.647
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	100.0	65.8	63.8
#10	100.0	55.1	49.3
#30	99.5	37.5	29.1
#40	98.3	33.5	25.6
#50	92.9	27.4	21.9
#100	70.9	23.8	17.8
#200	46.7	16.6	14.0

SOIL DESCRIPTION

○ Brown Silty, Clayey SAND

□ Brown Lean Clayey SAND w/ Gravel

△ Brown Clayey SAND w/ Gravel

REMARKS:

○

□ Due to the small sample size, relative to the largest particle size, this data should be considered to be approximate.

△ Due to the small sample size, relative to the largest particle size, this data should be considered to be approximate.

○ Source: SB# 1 Elev./Depth: 12.5'

□ Source: SB# 1 Elev./Depth: 22.5'

△ Source: SB# 1 Elev./Depth: 27.5'

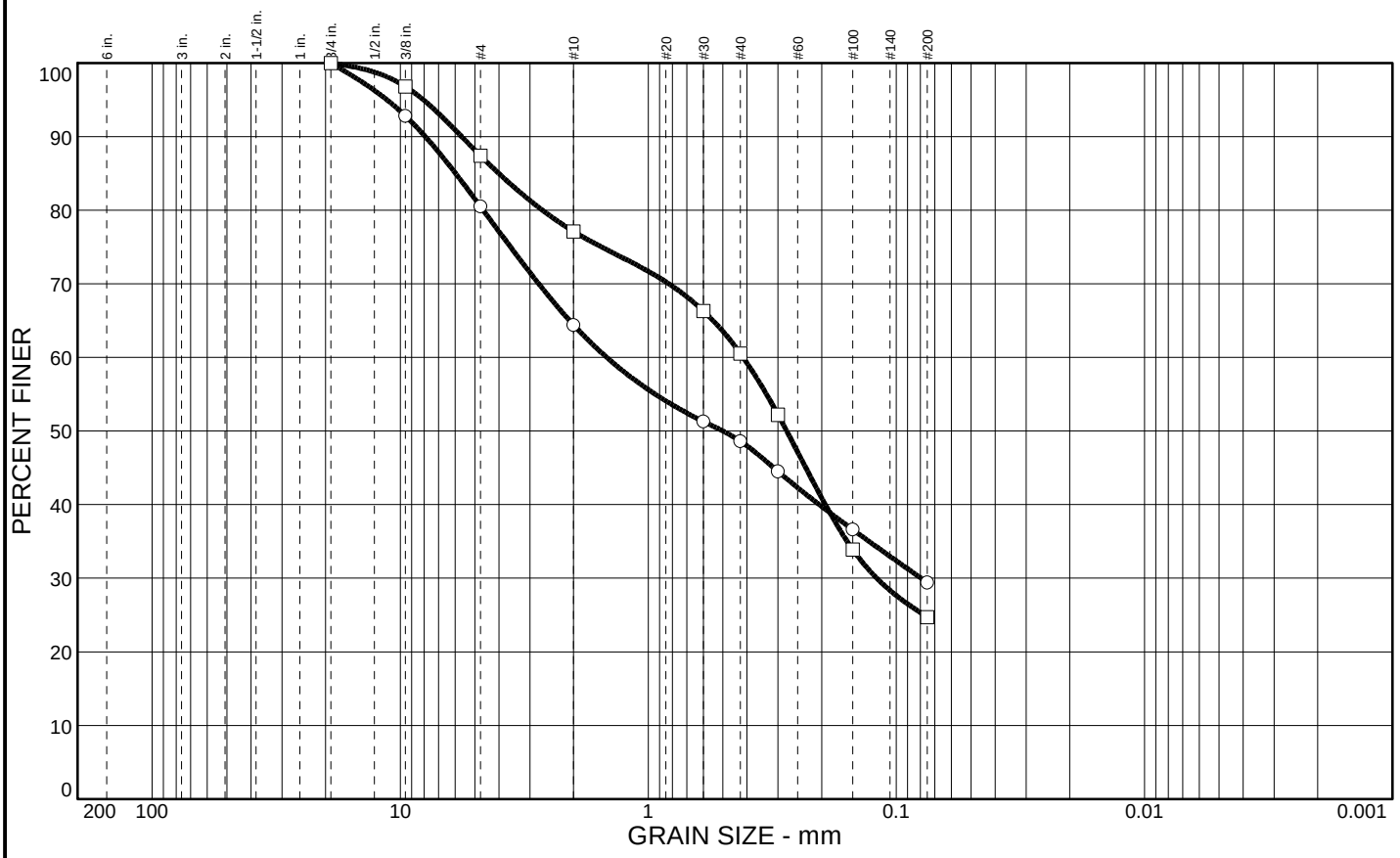
COOPER TESTING LABORATORY

Client: GEI Consultants, Inc.

Project: Former Nursery Detention Basin - 1610277

Project No.: 250-066 Figure

Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		19.5	51.1	29.4		SC		18	26
□		12.6	62.7	24.7					

SIEVE inches size	PERCENT FINER ○	□	
3/4"	100.0	100.0	
3/8"	92.8	96.8	
GRAIN SIZE			
D_{60}	1.47	0.415	
D_{30}	0.0795	0.120	
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	
#4	80.5	87.4	
#10	64.4	77.1	
#30	51.3	66.3	
#40	48.6	60.5	
#50	44.5	52.2	
#100	36.6	33.9	
#200	29.4	24.7	

SOIL DESCRIPTION

○ Olive Brown Lean Clayey SAND w/ Gravel

□ Olive Brown Silty SAND

REMARKS:

○

□

○ Source: SB# 2 Elev./Depth: 0'

□ Source: SB# 2 Elev./Depth: 7.5'

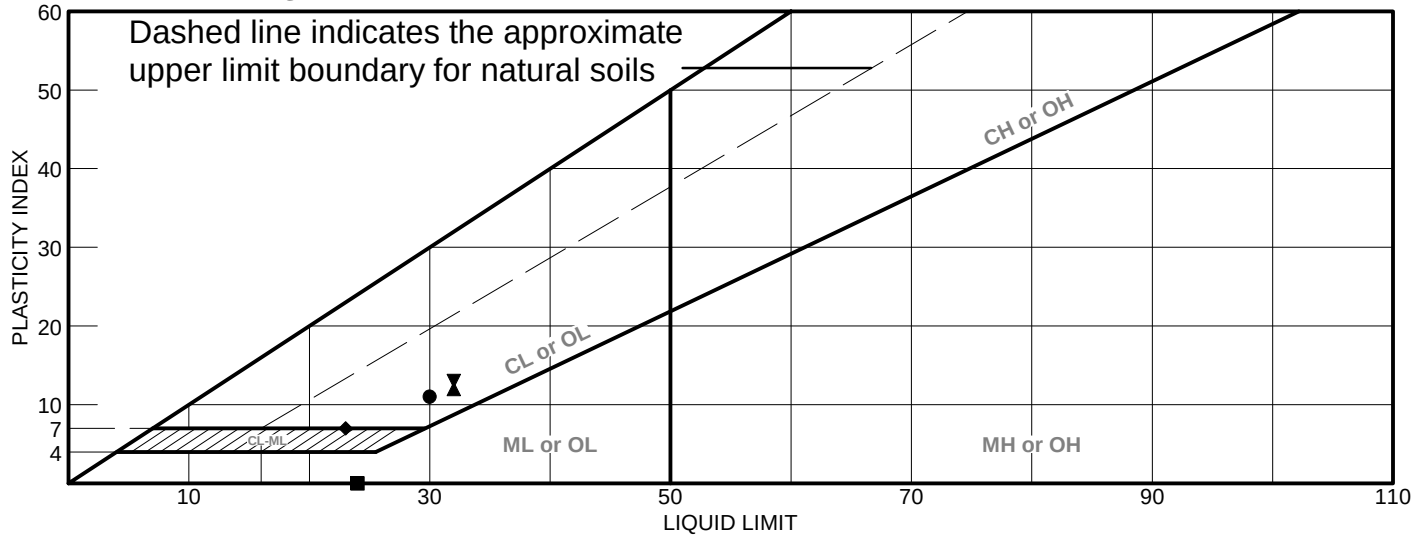
COOPER TESTING LABORATORY

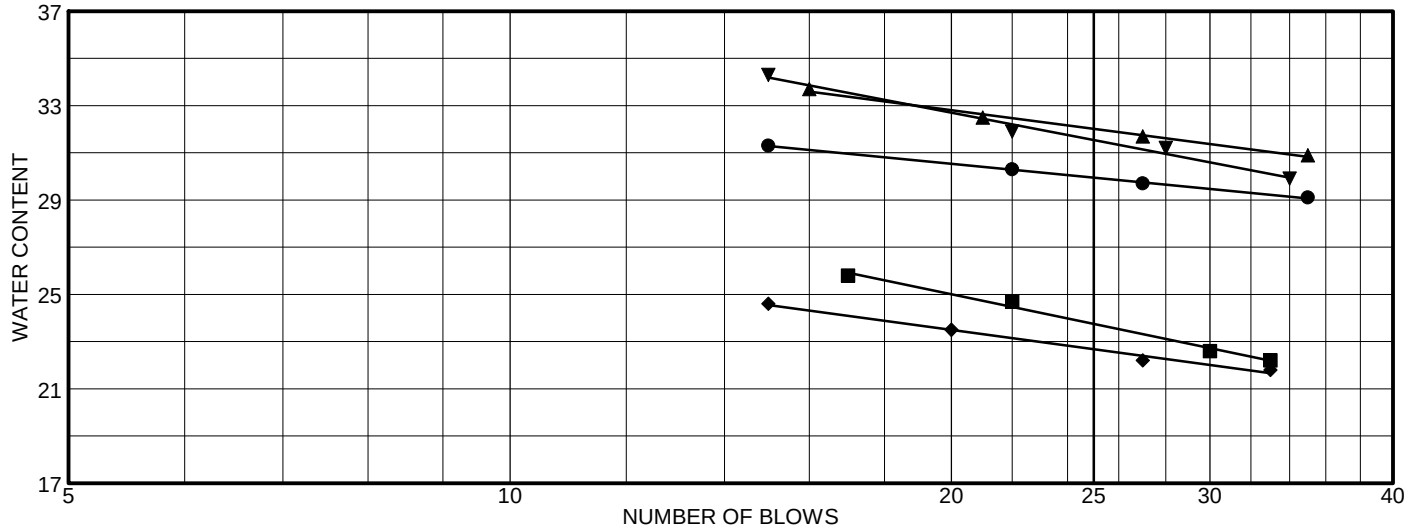
Client: GEI Consultants, Inc.

Project: Former Nursery Detention Basin - 1610277

Project No.: 250-066 Figure

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown Sandy Lean CLAY	30	19	11	78.5	61.3	CL
■	Brown Silty SAND	24	26	NP	96.4	38.3	SM
▲	Brown Sandy Lean CLAY	32	20	12			
◆	Brown Silty, Clayey SAND w/ Gravel	23	16	7	35.4	15.0	SC-SM
▼	Brown Sandy Lean CLAY	32	19	13	90.9	57.2	CL

Project No. 250-066 **Client:** GEI Consultants, Inc.

Project: Former Nursery Detention Basin - 1610277

●	**Source:** MW# 1	**Elev./Depth:** 7.5'
■	**Source:** MW# 2	**Elev./Depth:** 5.0'
▲	**Source:** MW# 2	**Elev./Depth:** 12.5'
◆	**Source:** MW# 3	**Elev./Depth:** 5.0'
▼	**Source:** MW# 3	**Elev./Depth:** 12.5'

Remarks:

●

■ Could not roll out. Sample slides in bowl. Non-plastic.

▲

◆

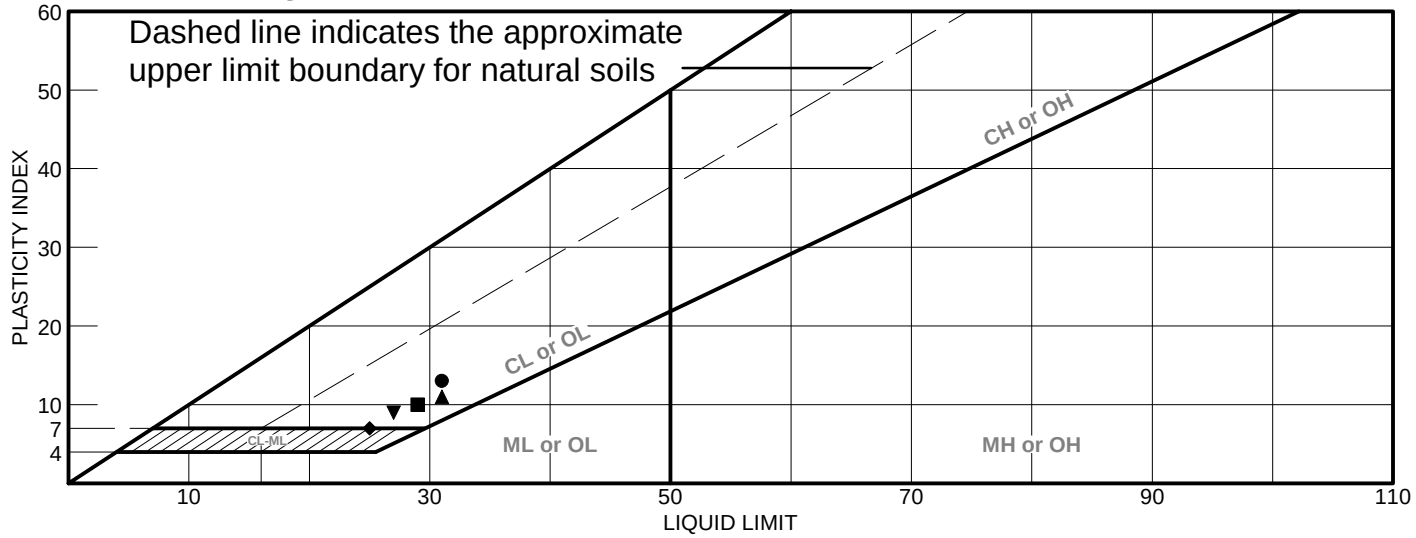
▼

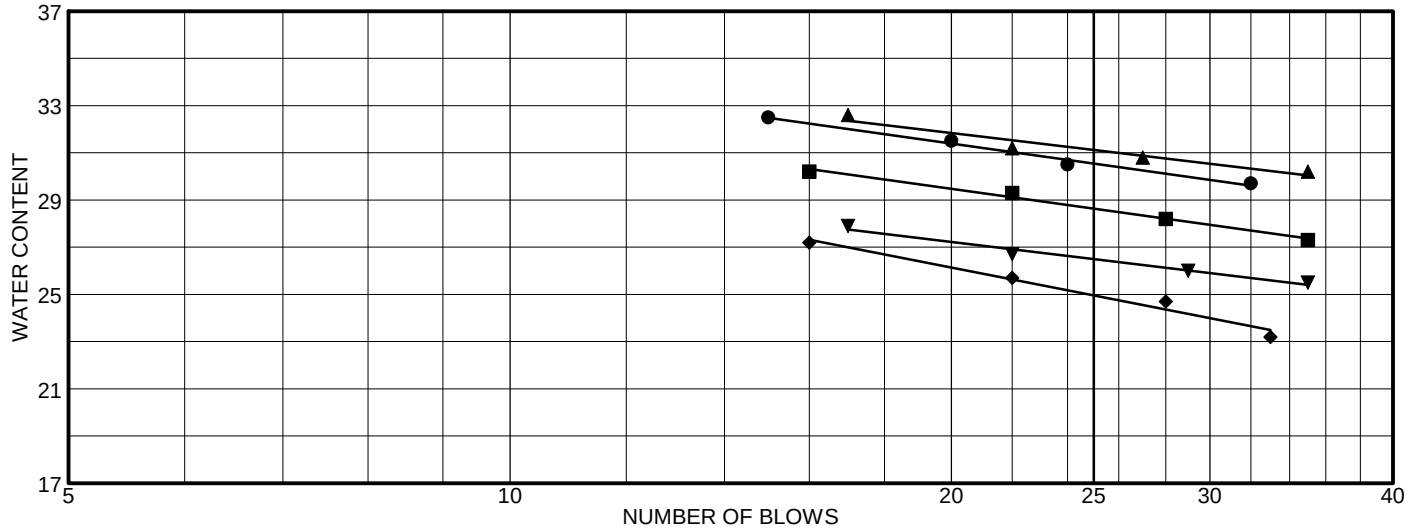
LIQUID AND PLASTIC LIMITS TEST REPORT

COOPER TESTING LABORATORY

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown Lean Clayey GRAVEL w/ Sand	31	18	13	30.3	19.6	GC
■	Brown Lean Clayey SAND	29	19	10			
▲	Brown Sandy Lean CLAY	31	20	11			
◆	Brown Silty, Clayey SAND	25	18	7	98.3	46.7	SC-SM
▼	Brown Lean Clayey SAND w/ Gravel	27	18	9	33.5	16.6	SC

Project No. 250-066 **Client:** GEI Consultants, Inc.

Project: Former Nursery Detention Basin - 1610277

● **Source:** MW# 3	**Elev./Depth:** 15.0'
■ **Source:** SB# 1	**Elev./Depth:** 5.0'
▲ **Source:** SB# 1	**Elev./Depth:** 10'
◆ **Source:** SB# 1	**Elev./Depth:** 12.5'
▼ **Source:** SB# 1	**Elev./Depth:** 22.5'

Remarks:

●

■

▲

◆

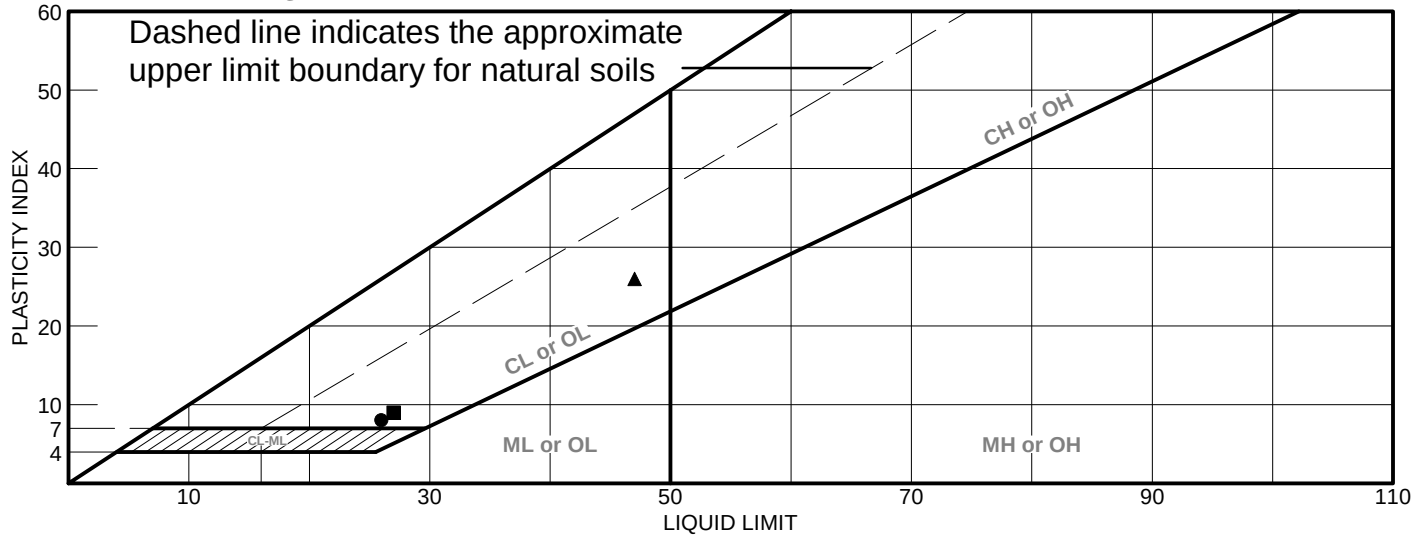
▼

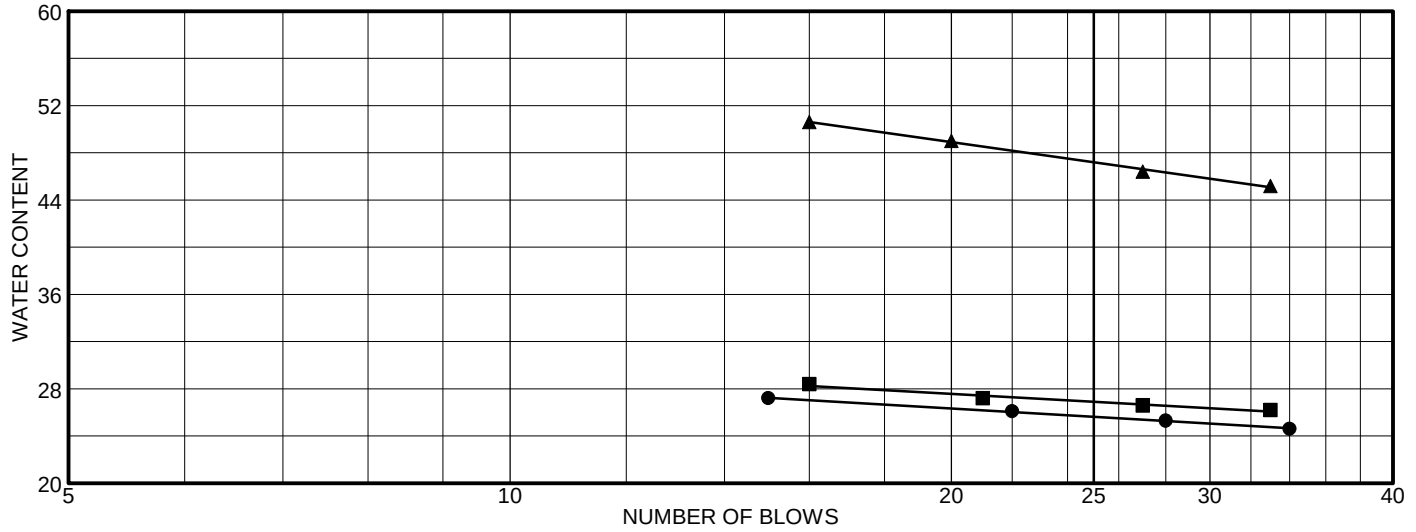
LIQUID AND PLASTIC LIMITS TEST REPORT

COOPER TESTING LABORATORY

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Olive Brown Lean Clayey SAND w/ Gravel	26	18	8	48.6	29.4	SC
■	Dark Brown Sandy Lean CLAY	27	18	9			
▲	Dark Brown Sandy Lean CLAY	47	21	26			

Project No. 250-066 **Client:** GEI Consultants, Inc.

Project: Former Nursery Detention Basin - 1610277

● **Source:** SB# 2 **Elev./Depth:** 0'

■ **Source:** SB# 2 **Elev./Depth:** 12.5'

▲ **Source:** SB# 2 **Elev./Depth:** 27.5'

Remarks:

●

■

▲

LIQUID AND PLASTIC LIMITS TEST REPORT

COOPER TESTING LABORATORY

Figure


Curtis & Tompkins, Ltd.
Analytical Laboratories, Since 1878

Curtis & Tompkins, Ltd., Analytical Laboratories, Since 1878
2323 Fifth Street, Berkeley, CA 94710, Phone (510) 486-0900

Laboratory Job Number 279328
ANALYTICAL REPORT

GEI Consultants, Inc.
180 Grand Avenue
Oakland, CA 94612

Project : 1610277
Location : Former Nursery Detention Basin
Level : II

Sample ID	Lab ID
MW #1	279328-001
MW #3	279328-002

This data package has been reviewed for technical correctness and completeness. Release of this data has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature. The results contained in this report meet all requirements of NELAC and pertain only to those samples which were submitted for analysis. This report may be reproduced only in its entirety.

Signature: Mikelle Chong Date: 08/19/2016

Mikelle Chong
Project Manager
mikelle.chong@ctberk.com

CA ELAP# 2896, NELAP# 4044-001

Curtis & Tompkins, Ltd.

CASE NARRATIVE

Laboratory number:	**279328**
Client:	**GEI Consultants, Inc.**
Project:	**1610277**
Location:	**Former Nursery Detention Basin**
Request Date:	**08/03/16**
Samples Received:	**08/03/16**

This data package contains sample and QC results for two six-point soil composites, requested for the above referenced project on 08/03/16. The samples were received cold and intact.

Volatile Organics by GC/MS (EPA 8260B):
No analytical problems were encountered.

Semivolatile Organics by GC/MS (EPA 8270C):
Bis(2-ethylhexyl)phthalate was detected between the MDL and the RL in the method blank for batch 237734; this analyte was not detected in samples at or above the RL. No other analytical problems were encountered.

Pesticides (EPA 8081A):
All samples underwent sulfur cleanup using the copper option in EPA Method 3660B. All samples underwent florisil cleanup using EPA Method 3620C. Matrix spikes QC846055,QC846056 (batch 237742) were not reported because the parent sample required a dilution that would have diluted out the spikes. No other analytical problems were encountered.

PCBs (EPA 8082):
All samples underwent sulfuric acid cleanup using EPA Method 3665A. All samples underwent sulfur cleanup using the copper option in EPA Method 3660B. No analytical problems were encountered.

Metals (EPA 6020 and EPA 7471A):
Chromium was detected above the RL in the method blank for batch 237809; this analyte was detected in samples at a level at least 10 times that of the blank. Arsenic, vanadium, and zinc were detected between the MDL and the RL in the method blank for batch 237809; these analytes were detected in samples at a level at least 10 times that of the blank. Mercury was detected between the MDL and the RL in the method blank for batch 238064; this analyte was either not detected in samples at or above the RL, or detected at a level at least 10 times that of the blank. No other analytical problems were encountered.

Moisture (ASTM D2216/CLP):
No analytical problems were encountered.

Total Organic Carbon (TOC) (WALKLEY-BLACK):
No analytical problems were encountered.

Curtis & Tompkins, Ltd.

CASE NARRATIVE

Laboratory number:	**279328**
Client:	**GEI Consultants, Inc.**
Project:	**1610277**
Location:	**Former Nursery Detention Basin**
Request Date:	**08/03/16**
Samples Received:	**08/03/16**

Particle Size (ASTM):

Cooper Testing Labs in Palo Alto, CA performed the analysis (not NELAP certified). Please see the Cooper Testing Labs case narrative.

CHAIN OF CUSTODY

Curtis & Tompkins Laboratories
ENVIRONMENTAL ANALYTICAL TESTING LABORATORY
In Business Since 1878

2323 Fifth Street
Berkeley, CA 94710

Phone (510) 486-0900
Fax (510) 486-0532

Page ____ of ____

Chain of Custody # _____

C&T LOGIN # 279328

Project No: 1610277
Project Name: Former Nursery Detention Basin
Project P. O. No:
EDD Format: Report Level ☐ II ☐ III ☐ IV
Turnaround Time: ☐ RUSH _____ ☒ Standard

Sampler:
Report To: Graham Bradner
Company: GEI
Telephone: ~~☒~~ (916) 631-4577
Email: gbradner@geiconsultants.com

Lab No.	Sample ID.	SAMPLING		MATRIX				# of Containers	CHEMICAL PRESERVATIVE				
		Date Collected	Time Collected	Water	Solid				HCl	H2SO4	HNO3	NaOH	None
	MW#1	8/3/16	1100		X			6					X
	MW#3	↓	1400		X			6					X

ANALYTICAL REQUEST

– TOC	– Metals 6010B or 6020	– VOCs 8260	– SVOCs 8270	– PCBs Aroclors 8082	– 8081A	– Sieve w/ 200 wash	– TPH + Gas 8015	– TEHM 8015 + Silica Gel	Sulfur	– COMP	– Moisture								
–	–	–	–	–	–	–	–	–		–	–								

Notes:
removed TPH analysis per Tim 08/04

SAMPLE RECEIPT
☐ Intact
☐ Cold
☐ On Ice
☐ Ambient

RELINQUISHED BY:
Tim Haynes DATE: 8/3/16 TIME: 1835
DATE: TIME:
DATE: TIME:

RECEIVED BY:
dnguyen DATE: 8/3/16 TIME: 18:35
DATE: TIME:
DATE: TIME:

COOLER RECEIPT CHECKLIST

Curtis & Tompkins, Ltd.

Login # 279328 Date Received 8/3/16 Number of coolers 1
Client GEI Project 161027

Date Opened 8/3 By (print) CB (sign) [signature]
Date Logged in 8/4 By (print) SC (sign) [signature]
Date Labelled ↓ By (print) ↓ (sign) ↓

1. Did cooler come with a shipping slip (airbill, etc) _____ YES (NO)
Shipping info _____

2A. Were custody seals present? .... ☐ YES (circle) on cooler on samples ☒ NO
How many _____ Name _____ Date _____
2B. Were custody seals intact upon arrival? _____ YES NO (N/A)
3. Were custody papers dry and intact when received? _____ (YES) NO
4. Were custody papers filled out properly (ink, signed, etc)? _____ (YES) NO
5. Is the project identifiable from custody papers? (If so fill out top of form) ___ (YES) NO
6. Indicate the packing in cooler: (if other, describe) _____

☐ Bubble Wrap ☐ Foam blocks ☒ Bags ☐ None
☐ Cloth material ☐ Cardboard ☐ Styrofoam ☐ Paper towels

7. Temperature documentation: * Notify PM if temperature exceeds 6°C

Type of ice used: ☒ Wet ☐ Blue/Gel ☐ None Temp(°C) 3.3

☐ Temperature blank(s) included? ☐ Thermometer# _____ ☒ IR Gun# B

☐ Samples received on ice directly from the field. Cooling process had begun

8. Were Method 5035 sampling containers present? _____ YES (NO)
If YES, what time were they transferred to freezer? _____
9. Did all bottles arrive unbroken/unopened? _____ (YES) NO
10. Are there any missing / extra samples? _____ YES (NO)
11. Are samples in the appropriate containers for indicated tests? _____ (YES) NO
12. Are sample labels present, in good condition and complete? _____ (YES) NO
13. Do the sample labels agree with custody papers? _____ (YES) NO
14. Was sufficient amount of sample sent for tests requested? _____ (YES) NO
15. Are the samples appropriately preserved? _____ YES NO (N/A)
16. Did you check preservatives for all bottles for each sample? _____ YES NO (N/A)
17. Did you document your preservative check? (pH strip lot# _____) YES NO (N/A)
18. Did you change the hold time in LIMS for unpreserved VOAs? _____ YES NO (N/A)
19. Did you change the hold time in LIMS for preserved terracores? _____ YES NO (N/A)
20. Are bubbles > 6mm absent in VOA samples? _____ YES NO (N/A)
21. Was the client contacted concerning this sample delivery? _____ YES (NO)
If YES, Who was called? _____ By _____ Date: _____

COMMENTS _____

Curtis & Tompkins, Ltd.

Detections Summary for 279328

Results for any subcontracted analyses are not included in this summary.

Client : GEI Consultants, Inc.
Project : 1610277
Location : Former Nursery Detention Basin

Client Sample ID : MW #1 Laboratory Sample ID : 279328-001

Analyte	Result	Flags	RL	MDL	Units	Basis	IDF	Method	Prep Method
Toluene	0.9	J	5.4	0.8	ug/Kg	Dry	0.9921	EPA 8260B	EPA 5030B
Phenanthrene	13	J	73	10	ug/Kg	Dry	1.000	EPA 8270C	EPA 3550B
bis(2-Ethylhexyl)phthalate	67	J	360	9.5	ug/Kg	Dry	1.000	EPA 8270C	EPA 3550B
Heptachlor epoxide	7.3		1.9	0.27	ug/Kg	Dry	1.000	EPA 8081A	EPA 3550B
4,4'-DDE	58		3.6	0.48	ug/Kg	Dry	1.000	EPA 8081A	EPA 3550B
4,4'-DDD	6.0	C	3.6	0.52	ug/Kg	Dry	1.000	EPA 8081A	EPA 3550B
4,4'-DDT	110		3.6	0.48	ug/Kg	Dry	1.000	EPA 8081A	EPA 3550B
alpha-Chlordane	33		1.9	0.28	ug/Kg	Dry	1.000	EPA 8081A	EPA 3550B
gamma-Chlordane	33		1.9	0.40	ug/Kg	Dry	1.000	EPA 8081A	EPA 3550B
Antimony	0.21	J	2.2	0.086	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Arsenic	8.1		0.27	0.080	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Barium	210		0.27	0.059	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Beryllium	0.55		0.27	0.055	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Cadmium	0.13	J	0.27	0.032	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Chromium	100		0.27	0.084	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Cobalt	20		0.27	0.053	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Copper	39		0.35	0.12	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Lead	15		0.27	0.077	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Molybdenum	0.35		0.27	0.087	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Nickel	140		0.27	0.082	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Selenium	0.20	J	2.2	0.081	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Silver	0.050	J	0.27	0.032	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Thallium	0.066	J	0.27	0.058	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Vanadium	54		0.35	0.12	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Zinc	85		1.1	0.28	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Total Organic Carbon	1.0		0.05		%	Dry	1.000	WALKLEY-BLACK	METHOD

Curtis & Tompkins, Ltd.

Client Sample ID : MW #3 Laboratory Sample ID : 279328-002

Analyte	Result	Flags	RL	MDL	Units	Basis	IDF	Method	Prep Method
Phenanthrene	14	J	70	10	ug/Kg	Dry	1.000	EPA 8270C	EPA 3550B
bis(2-Ethylhexyl)phthalate	39	J	350	9.2	ug/Kg	Dry	1.000	EPA 8270C	EPA 3550B
Antimony	0.20	J	2.1	0.085	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Arsenic	7.6		0.26	0.079	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Barium	440		29	7.6	mg/Kg	Dry	2500	EPA 6020	EPA 3050B
Beryllium	0.59		0.26	0.054	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Cadmium	0.057	J	0.26	0.032	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Chromium	95		0.26	0.083	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Cobalt	22		0.26	0.052	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Copper	39		0.34	0.11	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Lead	11		0.26	0.076	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Mercury	0.25		0.017	0.0030	mg/Kg	Dry	1.000	EPA 7471A	METHOD
Molybdenum	0.79		0.26	0.086	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Nickel	130		0.26	0.081	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Selenium	0.19	J	2.1	0.080	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Silver	0.040	J	0.26	0.032	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Thallium	0.070	J	0.26	0.057	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Vanadium	59		0.34	0.11	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Zinc	80		1.1	0.28	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Total Organic Carbon	0.42		0.05		%	Dry	1.000	WALKLEY-BLACK	METHOD

C = Presence confirmed, but RPD between columns exceeds 40%

J = Estimated value

Curtis & Tompkins, Ltd.

Purgeable Organics by GC/MS

Lab #:	279328	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 5030B
Project#:	1610277	Analysis:	EPA 8260B
Field ID:	MW #1	Diln Fac:	0.9921
Lab ID:	279328-001	Batch#:	237945
Matrix:	Soil	Sampled:	08/03/16
Units:	ug/Kg	Received:	08/03/16
Basis:	dry	Analyzed:	08/11/16

Moisture: 8%

Analyte	Result	RL	MDL
Freon 12	ND	11	0.4
Chloromethane	ND	11	1.1
Vinyl Chloride	ND	11	1.0
Bromomethane	ND	11	1.3
Chloroethane	ND	11	0.5
Trichlorofluoromethane	ND	5.4	0.8
Acetone	ND	22	3.6
Freon 113	ND	5.4	0.5
1,1-Dichloroethene	ND	5.4	1.0
Methylene Chloride	ND	22	1.2
Carbon Disulfide	ND	5.4	0.9
MTBE	ND	5.4	1.1
trans-1,2-Dichloroethene	ND	5.4	0.9
Vinyl Acetate	ND	54	0.8
1,1-Dichloroethane	ND	5.4	1.2
2-Butanone	ND	11	1.4
cis-1,2-Dichloroethene	ND	5.4	0.9
2,2-Dichloropropane	ND	5.4	1.2
Chloroform	ND	5.4	1.4
Bromochloromethane	ND	5.4	1.0
1,1,1-Trichloroethane	ND	5.4	0.9
1,1-Dichloropropene	ND	5.4	0.7
Carbon Tetrachloride	ND	5.4	0.5
1,2-Dichloroethane	ND	5.4	1.0
Benzene	ND	5.4	1.0
Trichloroethene	ND	5.4	0.9
1,2-Dichloropropane	ND	5.4	0.8
Bromodichloromethane	ND	5.4	0.9
Dibromomethane	ND	5.4	0.8
4-Methyl-2-Pentanone	ND	11	1.1
cis-1,3-Dichloropropene	ND	5.4	0.7
Toluene	0.9 J	5.4	0.8
trans-1,3-Dichloropropene	ND	5.4	0.7
1,1,2-Trichloroethane	ND	5.4	0.7
2-Hexanone	ND	11	0.9
1,3-Dichloropropane	ND	5.4	0.9
Tetrachloroethene	ND	5.4	0.6
Dibromochloromethane	ND	5.4	0.6
1,2-Dibromoethane	ND	5.4	0.7
Chlorobenzene	ND	5.4	0.7
1,1,1,2-Tetrachloroethane	ND	5.4	0.7
Ethylbenzene	ND	5.4	0.7
m,p-Xylenes	ND	5.4	1.3
o-Xylene	ND	5.4	0.7
Styrene	ND	5.4	0.6
Bromoform	ND	5.4	0.4
Isopropylbenzene	ND	5.4	0.5
1,1,2,2-Tetrachloroethane	ND	5.4	0.4
1,2,3-Trichloropropane	ND	5.4	0.6
Propylbenzene	ND	5.4	0.5

J= Estimated value
ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Purgeable Organics by GC/MS

Lab #:	279328	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 5030B
Project#:	1610277	Analysis:	EPA 8260B
Field ID:	MW #1	Dil'n Fac:	0.9921
Lab ID:	279328-001	Batch#:	237945
Matrix:	Soil	Sampled:	08/03/16
Units:	ug/Kg	Received:	08/03/16
Basis:	dry	Analyzed:	08/11/16

Analyte	Result	RL	MDL
Bromobenzene	ND	5.4	0.6
1,3,5-Trimethylbenzene	ND	5.4	0.6
2-Chlorotoluene	ND	5.4	0.7
4-Chlorotoluene	ND	5.4	0.7
tert-Butylbenzene	ND	5.4	0.4
1,2,4-Trimethylbenzene	ND	5.4	0.6
sec-Butylbenzene	ND	5.4	0.5
para-Isopropyl Toluene	ND	5.4	0.5
1,3-Dichlorobenzene	ND	5.4	0.5
1,4-Dichlorobenzene	ND	5.4	0.6
n-Butylbenzene	ND	5.4	0.4
1,2-Dichlorobenzene	ND	5.4	0.6
1,2-Dibromo-3-Chloropropane	ND	5.4	1.0
1,2,4-Trichlorobenzene	ND	5.4	0.5
Hexachlorobutadiene	ND	5.4	0.3
Naphthalene	ND	5.4	1.1
1,2,3-Trichlorobenzene	ND	5.4	0.5

Surrogate	%REC	Limits
Dibromofluoromethane	97	78-134
1,2-Dichloroethane-d4	89	80-138
Toluene-d8	94	80-120
Bromofluorobenzene	109	78-123

J= Estimated value
ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Purgeable Organics by GC/MS

Lab #:	279328	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 5030B
Project#:	1610277	Analysis:	EPA 8260B
Field ID:	MW #3	Diln Fac:	0.9671
Lab ID:	279328-002	Batch#:	237987
Matrix:	Soil	Sampled:	08/03/16
Units:	ug/Kg	Received:	08/03/16
Basis:	dry	Analyzed:	08/12/16

Moisture: 5%

Analyte	Result	RL	MDL
Freon 12	ND	10	0.4
Chloromethane	ND	10	1.1
Vinyl Chloride	ND	10	0.9
Bromomethane	ND	10	1.2
Chloroethane	ND	10	0.5
Trichlorofluoromethane	ND	5.1	0.7
Acetone	ND	20	3.4
Freon 113	ND	5.1	0.4
1,1-Dichloroethene	ND	5.1	1.0
Methylene Chloride	ND	20	1.1
Carbon Disulfide	ND	5.1	0.9
MTBE	ND	5.1	1.0
trans-1,2-Dichloroethene	ND	5.1	0.9
Vinyl Acetate	ND	51	0.7
1,1-Dichloroethane	ND	5.1	1.2
2-Butanone	ND	10	1.4
cis-1,2-Dichloroethene	ND	5.1	0.9
2,2-Dichloropropane	ND	5.1	1.1
Chloroform	ND	5.1	1.3
Bromochloromethane	ND	5.1	1.0
1,1,1-Trichloroethane	ND	5.1	0.8
1,1-Dichloropropene	ND	5.1	0.6
Carbon Tetrachloride	ND	5.1	0.5
1,2-Dichloroethane	ND	5.1	0.9
Benzene	ND	5.1	0.9
Trichloroethene	ND	5.1	0.9
1,2-Dichloropropane	ND	5.1	0.8
Bromodichloromethane	ND	5.1	0.9
Dibromomethane	ND	5.1	0.8
4-Methyl-2-Pentanone	ND	10	1.0
cis-1,3-Dichloropropene	ND	5.1	0.6
Toluene	ND	5.1	0.7
trans-1,3-Dichloropropene	ND	5.1	0.7
1,1,2-Trichloroethane	ND	5.1	0.6
2-Hexanone	ND	10	0.9
1,3-Dichloropropane	ND	5.1	0.9
Tetrachloroethene	ND	5.1	0.5
Dibromochloromethane	ND	5.1	0.5
1,2-Dibromoethane	ND	5.1	0.7
Chlorobenzene	ND	5.1	0.7
1,1,1,2-Tetrachloroethane	ND	5.1	0.6
Ethylbenzene	ND	5.1	0.7
m,p-Xylenes	ND	5.1	1.3
o-Xylene	ND	5.1	0.6
Styrene	ND	5.1	0.6
Bromoform	ND	5.1	0.4
Isopropylbenzene	ND	5.1	0.5
1,1,2,2-Tetrachloroethane	ND	5.1	0.4
1,2,3-Trichloropropane	ND	5.1	0.6
Propylbenzene	ND	5.1	0.5
Bromobenzene	ND	5.1	0.5

ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Purgeable Organics by GC/MS

Lab #:	279328	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 5030B
Project#:	1610277	Analysis:	EPA 8260B
Field ID:	MW #3	Dil'n Fac:	0.9671
Lab ID:	279328-002	Batch#:	237987
Matrix:	Soil	Sampled:	08/03/16
Units:	ug/Kg	Received:	08/03/16
Basis:	dry	Analyzed:	08/12/16

Analyte	Result	RL	MDL
1,3,5-Trimethylbenzene	ND	5.1	0.6
2-Chlorotoluene	ND	5.1	0.7
4-Chlorotoluene	ND	5.1	0.7
tert-Butylbenzene	ND	5.1	0.4
1,2,4-Trimethylbenzene	ND	5.1	0.6
sec-Butylbenzene	ND	5.1	0.4
para-Isopropyl Toluene	ND	5.1	0.4
1,3-Dichlorobenzene	ND	5.1	0.4
1,4-Dichlorobenzene	ND	5.1	0.5
n-Butylbenzene	ND	5.1	0.4
1,2-Dichlorobenzene	ND	5.1	0.5
1,2-Dibromo-3-Chloropropane	ND	5.1	1.0
1,2,4-Trichlorobenzene	ND	5.1	0.4
Hexachlorobutadiene	ND	5.1	0.3
Naphthalene	ND	5.1	1.0
1,2,3-Trichlorobenzene	ND	5.1	0.4

Surrogate	%REC	Limits
Dibromofluoromethane	95	78-134
1,2-Dichloroethane-d4	93	80-138
Toluene-d8	96	80-120
Bromofluorobenzene	105	78-123

ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Batch QC Report

Purgeable Organics by GC/MS

Lab #:	279328	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 5030B
Project#:	1610277	Analysis:	EPA 8260B
Matrix:	Soil	Batch#:	237945
Units:	ug/Kg	Analyzed:	08/11/16
Diln Fac:	1.000		

Type: BS Lab ID: QC846870

Analyte	Spiked	Result	%REC	Limits
1,1-Dichloroethene	25.00	27.21	109	70-134
Benzene	25.00	24.33	97	80-123
Trichloroethene	25.00	25.74	103	80-128
Toluene	25.00	23.96	96	80-120
Chlorobenzene	25.00	24.26	97	80-123

Surrogate	%REC	Limits
Dibromofluoromethane	107	78-134
1,2-Dichloroethane-d4	112	80-138
Toluene-d8	98	80-120
Bromofluorobenzene	102	78-123

Type: BSD Lab ID: QC846871

Analyte	Spiked	Result	%REC	Limits	RPD	Lim
1,1-Dichloroethene	25.00	22.86	91	70-134	17	22
Benzene	25.00	22.09	88	80-123	10	21
Trichloroethene	25.00	22.71	91	80-128	13	23
Toluene	25.00	20.88	84	80-120	14	20
Chlorobenzene	25.00	21.82	87	80-123	11	20

Surrogate	%REC	Limits
Dibromofluoromethane	105	78-134
1,2-Dichloroethane-d4	112	80-138
Toluene-d8	96	80-120
Bromofluorobenzene	100	78-123

RPD= Relative Percent Difference

Curtis & Tompkins, Ltd.

Batch QC Report

Purgeable Organics by GC/MS

Lab #:	279328	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 5030B
Project#:	1610277	Analysis:	EPA 8260B
Type:	BLANK	Dil'n Fac:	1.000
Lab ID:	QC846872	Batch#:	237945
Matrix:	Soil	Analyzed:	08/11/16
Units:	ug/Kg		

Analyte	Result	RL	MDL
Freon 12	ND	10	0.4
Chloromethane	ND	10	1.0
Vinyl Chloride	ND	10	0.9
Bromomethane	ND	10	1.2
Chloroethane	ND	10	0.5
Trichlorofluoromethane	ND	5.0	0.7
Acetone	ND	20	3.3
Freon 113	ND	5.0	0.4
1,1-Dichloroethene	ND	5.0	0.9
Methylene Chloride	ND	20	1.1
Carbon Disulfide	ND	5.0	0.9
MTBE	ND	5.0	1.0
trans-1,2-Dichloroethene	ND	5.0	0.8
Vinyl Acetate	ND	50	0.7
1,1-Dichloroethane	ND	5.0	1.2
2-Butanone	ND	10	1.3
cis-1,2-Dichloroethene	ND	5.0	0.9
2,2-Dichloropropane	ND	5.0	1.1
Chloroform	ND	5.0	1.3
Bromochloromethane	ND	5.0	0.9
1,1,1-Trichloroethane	ND	5.0	0.8
1,1-Dichloropropene	ND	5.0	0.6
Carbon Tetrachloride	ND	5.0	0.5
1,2-Dichloroethane	ND	5.0	0.9
Benzene	ND	5.0	0.9
Trichloroethene	ND	5.0	0.8
1,2-Dichloropropane	ND	5.0	0.8
Bromodichloromethane	ND	5.0	0.8
Dibromomethane	ND	5.0	0.8
4-Methyl-2-Pentanone	ND	10	1.0
cis-1,3-Dichloropropene	ND	5.0	0.6
Toluene	ND	5.0	0.7
trans-1,3-Dichloropropene	ND	5.0	0.6
1,1,2-Trichloroethane	ND	5.0	0.6
2-Hexanone	ND	10	0.9
1,3-Dichloropropane	ND	5.0	0.8
Tetrachloroethene	ND	5.0	0.5
Dibromochloromethane	ND	5.0	0.5
1,2-Dibromoethane	ND	5.0	0.7
Chlorobenzene	ND	5.0	0.7
1,1,1,2-Tetrachloroethane	ND	5.0	0.6
Ethylbenzene	ND	5.0	0.7
m,p-Xylenes	ND	5.0	1.3
o-Xylene	ND	5.0	0.6
Styrene	ND	5.0	0.6
Bromoform	ND	5.0	0.4
Isopropylbenzene	ND	5.0	0.5
1,1,2,2-Tetrachloroethane	ND	5.0	0.4
1,2,3-Trichloropropane	ND	5.0	0.6
Propylbenzene	ND	5.0	0.4
Bromobenzene	ND	5.0	0.5
1,3,5-Trimethylbenzene	ND	5.0	0.6
2-Chlorotoluene	ND	5.0	0.7

ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Batch QC Report

Purgeable Organics by GC/MS

Lab #:	279328	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 5030B
Project#:	1610277	Analysis:	EPA 8260B
Type:	BLANK	Diln Fac:	1.000
Lab ID:	QC846872	Batch#:	237945
Matrix:	Soil	Analyzed:	08/11/16
Units:	ug/Kg		

Analyte	Result	RL	MDL
4-Chlorotoluene	ND	5.0	0.6
tert-Butylbenzene	ND	5.0	0.4
1,2,4-Trimethylbenzene	ND	5.0	0.6
sec-Butylbenzene	ND	5.0	0.4
para-Isopropyl Toluene	ND	5.0	0.4
1,3-Dichlorobenzene	ND	5.0	0.4
1,4-Dichlorobenzene	ND	5.0	0.5
n-Butylbenzene	ND	5.0	0.4
1,2-Dichlorobenzene	ND	5.0	0.5
1,2-Dibromo-3-Chloropropane	ND	5.0	0.9
1,2,4-Trichlorobenzene	ND	5.0	0.4
Hexachlorobutadiene	ND	5.0	0.3
Naphthalene	ND	5.0	1.0
1,2,3-Trichlorobenzene	ND	5.0	0.4

Surrogate	%REC	Limits
Dibromofluoromethane	108	78-134
1,2-Dichloroethane-d4	114	80-138
Toluene-d8	96	80-120
Bromofluorobenzene	107	78-123

ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Batch QC Report

Purgeable Organics by GC/MS

Lab #:	279328	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 5030B
Project#:	1610277	Analysis:	EPA 8260B
Field ID:	MW #2	Batch#:	237945
MSS Lab ID:	279335-001	Sampled:	08/04/16
Matrix:	Soil	Received:	08/04/16
Units:	ug/Kg	Analyzed:	08/11/16
Basis:	dry		

Type:	MS	Moisture:	8%
Lab ID:	QC846987	Diln Fac:	0.9843

Analyte	MSS Result	Spiked	Result	%REC	Limits
1,1-Dichloroethene	<1.015	53.49	58.61	110	56-133
Benzene	<0.9749	53.49	51.33	96	57-120
Trichloroethene	<0.9024	53.49	51.54	96	49-145
Toluene	<0.7686	53.49	55.51	104	51-120
Chlorobenzene	<0.7413	53.49	51.41	96	47-120

Surrogate	%REC	Limits
Dibromofluoromethane	95	78-134
1,2-Dichloroethane-d4	90	80-138
Toluene-d8	107	80-120
Bromofluorobenzene	101	78-123

Type:	MSD	Moisture:	8%
Lab ID:	QC846988	Diln Fac:	0.9960

Analyte	Spiked	Result	%REC	Limits	RPD	Lim
1,1-Dichloroethene	54.13	55.40	102	56-133	7	46
Benzene	54.13	48.64	90	57-120	7	44
Trichloroethene	54.13	47.74	88	49-145	9	46
Toluene	54.13	46.50	86	51-120	19	47
Chlorobenzene	54.13	44.70	83	47-120	15	50

Surrogate	%REC	Limits
Dibromofluoromethane	95	78-134
1,2-Dichloroethane-d4	89	80-138
Toluene-d8	95	80-120
Bromofluorobenzene	103	78-123

RPD= Relative Percent Difference

Curtis & Tompkins, Ltd.

Batch QC Report

Purgeable Organics by GC/MS

Lab #:	279328	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 5030B
Project#:	1610277	Analysis:	EPA 8260B
Type:	LCS	Diln Fac:	1.000
Lab ID:	QC847044	Batch#:	237987
Matrix:	Soil	Analyzed:	08/12/16
Units:	ug/Kg		

Analyte	Spiked	Result	%REC	Limits
1,1-Dichloroethene	25.00	26.55	106	70-134
Benzene	25.00	23.97	96	80-123
Trichloroethene	25.00	25.63	103	80-128
Toluene	25.00	23.99	96	80-120
Chlorobenzene	25.00	25.21	101	80-123

Surrogate	%REC	Limits
Dibromofluoromethane	103	78-134
1,2-Dichloroethane-d4	102	80-138
Toluene-d8	97	80-120
Bromofluorobenzene	100	78-123

Curtis & Tompkins, Ltd.

Batch QC Report

Purgeable Organics by GC/MS

Lab #:	279328	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 5030B
Project#:	1610277	Analysis:	EPA 8260B
Type:	BLANK	Dil'n Fac:	1.000
Lab ID:	QC847046	Batch#:	237987
Matrix:	Soil	Analyzed:	08/12/16
Units:	ug/Kg		

Analyte	Result	RL	MDL
Freon 12	ND	10	0.4
Chloromethane	ND	10	1.0
Vinyl Chloride	ND	10	0.9
Bromomethane	ND	10	1.2
Chloroethane	ND	10	0.5
Trichlorofluoromethane	ND	5.0	0.7
Acetone	ND	20	3.3
Freon 113	ND	5.0	0.4
1,1-Dichloroethene	ND	5.0	0.9
Methylene Chloride	ND	20	1.1
Carbon Disulfide	ND	5.0	0.9
MTBE	ND	5.0	1.0
trans-1,2-Dichloroethene	ND	5.0	0.8
Vinyl Acetate	ND	50	0.7
1,1-Dichloroethane	ND	5.0	1.2
2-Butanone	ND	10	1.3
cis-1,2-Dichloroethene	ND	5.0	0.9
2,2-Dichloropropane	ND	5.0	1.1
Chloroform	ND	5.0	1.3
Bromochloromethane	ND	5.0	0.9
1,1,1-Trichloroethane	ND	5.0	0.8
1,1-Dichloropropene	ND	5.0	0.6
Carbon Tetrachloride	ND	5.0	0.5
1,2-Dichloroethane	ND	5.0	0.9
Benzene	ND	5.0	0.9
Trichloroethene	ND	5.0	0.8
1,2-Dichloropropane	ND	5.0	0.8
Bromodichloromethane	ND	5.0	0.8
Dibromomethane	ND	5.0	0.8
4-Methyl-2-Pentanone	ND	10	1.0
cis-1,3-Dichloropropene	ND	5.0	0.6
Toluene	ND	5.0	0.7
trans-1,3-Dichloropropene	ND	5.0	0.6
1,1,2-Trichloroethane	ND	5.0	0.6
2-Hexanone	ND	10	0.9
1,3-Dichloropropane	ND	5.0	0.8
Tetrachloroethene	ND	5.0	0.5
Dibromochloromethane	ND	5.0	0.5
1,2-Dibromoethane	ND	5.0	0.7
Chlorobenzene	ND	5.0	0.7
1,1,1,2-Tetrachloroethane	ND	5.0	0.6
Ethylbenzene	ND	5.0	0.7
m,p-Xylenes	ND	5.0	1.3
o-Xylene	ND	5.0	0.6
Styrene	ND	5.0	0.6
Bromoform	ND	5.0	0.4
Isopropylbenzene	ND	5.0	0.5
1,1,2,2-Tetrachloroethane	ND	5.0	0.4
1,2,3-Trichloropropane	ND	5.0	0.6
Propylbenzene	ND	5.0	0.4
Bromobenzene	ND	5.0	0.5
1,3,5-Trimethylbenzene	ND	5.0	0.6
2-Chlorotoluene	ND	5.0	0.7

ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Batch QC Report

Purgeable Organics by GC/MS

Lab #:	279328	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 5030B
Project#:	1610277	Analysis:	EPA 8260B
Type:	BLANK	Diln Fac:	1.000
Lab ID:	QC847046	Batch#:	237987
Matrix:	Soil	Analyzed:	08/12/16
Units:	ug/Kg		

Analyte	Result	RL	MDL
4-Chlorotoluene	ND	5.0	0.6
tert-Butylbenzene	ND	5.0	0.4
1,2,4-Trimethylbenzene	ND	5.0	0.6
sec-Butylbenzene	ND	5.0	0.4
para-Isopropyl Toluene	ND	5.0	0.4
1,3-Dichlorobenzene	ND	5.0	0.4
1,4-Dichlorobenzene	ND	5.0	0.5
n-Butylbenzene	ND	5.0	0.4
1,2-Dichlorobenzene	ND	5.0	0.5
1,2-Dibromo-3-Chloropropane	ND	5.0	0.9
1,2,4-Trichlorobenzene	ND	5.0	0.4
Hexachlorobutadiene	ND	5.0	0.3
Naphthalene	ND	5.0	1.0
1,2,3-Trichlorobenzene	ND	5.0	0.4

Surrogate	%REC	Limits
Dibromofluoromethane	105	78-134
1,2-Dichloroethane-d4	106	80-138
Toluene-d8	110	80-120
Bromofluorobenzene	104	78-123

ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Batch QC Report

Purgeable Organics by GC/MS

Lab #:	279328	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 5030B
Project#:	1610277	Analysis:	EPA 8260B
Field ID:	ZZZZZZZZZZ	Batch#:	237987
MSS Lab ID:	279653-014	Sampled:	08/11/16
Matrix:	Soil	Received:	08/11/16
Units:	ug/Kg	Analyzed:	08/12/16
Basis:	as received		

Type: MS Diln Fac: 0.9653
Lab ID: QC847171

Analyte	MSS Result	Spiked	Result	%REC	Limits
1,1-Dichloroethene	<0.8465	48.26	51.56	107	56-133
Benzene	<0.8129	48.26	47.55	99	57-120
Trichloroethene	<0.7524	48.26	51.60	107	49-145
Toluene	<0.6408	48.26	45.51	94	51-120
Chlorobenzene	<0.6181	48.26	45.46	94	47-120

Surrogate	%REC	Limits
Dibromofluoromethane	109	78-134
1,2-Dichloroethane-d4	121	80-138
Toluene-d8	94	80-120
Bromofluorobenzene	98	78-123

Type: MSD Diln Fac: 0.9242
Lab ID: QC847172

Analyte	Spiked	Result	%REC	Limits	RPD	Lim
1,1-Dichloroethene	46.21	54.97	119	56-133	11	46
Benzene	46.21	48.39	105	57-120	6	44
Trichloroethene	46.21	50.82	110	49-145	3	46
Toluene	46.21	45.10	98	51-120	3	47
Chlorobenzene	46.21	45.80	99	47-120	5	50

Surrogate	%REC	Limits
Dibromofluoromethane	108	78-134
1,2-Dichloroethane-d4	115	80-138
Toluene-d8	93	80-120
Bromofluorobenzene	103	78-123

RPD= Relative Percent Difference

Curtis & Tompkins, Ltd.

Semivolatile Organics by GC/MS

Lab #:	279328	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 3550B
Project#:	1610277	Analysis:	EPA 8270C
Field ID:	MW #1	Batch#:	237734
Lab ID:	279328-001	Sampled:	08/03/16
Matrix:	Soil	Received:	08/03/16
Units:	ug/Kg	Prepared:	08/05/16
Basis:	dry	Analyzed:	08/15/16
Diln Fac:	1.000		

Moisture: 8%

Analyte	Result	RL	MDL
N-Nitrosodimethylamine	ND	360	36
Phenol	ND	360	19
bis(2-Chloroethyl)ether	ND	360	14
2-Chlorophenol	ND	360	18
1,3-Dichlorobenzene	ND	360	13
1,4-Dichlorobenzene	ND	360	11
Benzyl alcohol	ND	360	17
1,2-Dichlorobenzene	ND	360	10
2-Methylphenol	ND	360	17
bis(2-Chloroisopropyl) ether	ND	360	20
4-Methylphenol	ND	360	19
N-Nitroso-di-n-propylamine	ND	360	36
Hexachloroethane	ND	360	13
Nitrobenzene	ND	360	13
Isophorone	ND	360	12
2-Nitrophenol	ND	730	11
2,4-Dimethylphenol	ND	360	15
Benzoic acid	ND	1,800	550
bis(2-Chloroethoxy)methane	ND	360	13
2,4-Dichlorophenol	ND	360	14
1,2,4-Trichlorobenzene	ND	360	11
Naphthalene	ND	73	9.6
4-Chloroaniline	ND	360	18
Hexachlorobutadiene	ND	360	66
4-Chloro-3-methylphenol	ND	360	16
2-Methylnaphthalene	ND	73	11
Hexachlorocyclopentadiene	ND	730	66
2,4,6-Trichlorophenol	ND	360	15
2,4,5-Trichlorophenol	ND	360	9.6
2-Chloronaphthalene	ND	360	60
2-Nitroaniline	ND	730	36
Dimethylphthalate	ND	360	10
Acenaphthylene	ND	73	9.3
2,6-Dinitrotoluene	ND	360	9.6
3-Nitroaniline	ND	730	36
Acenaphthene	ND	73	13
2,4-Dinitrophenol	ND	730	170
4-Nitrophenol	ND	730	75
Dibenzofuran	ND	360	9.6
2,4-Dinitrotoluene	ND	360	11
Diethylphthalate	ND	360	9.3
Fluorene	ND	73	9.7
4-Chlorophenyl-phenylether	ND	360	11
4-Nitroaniline	ND	730	36
4,6-Dinitro-2-methylphenol	ND	730	46
N-Nitrosodiphenylamine	ND	360	61
Azobenzene	ND	360	13
4-Bromophenyl-phenylether	ND	360	64
Hexachlorobenzene	ND	360	13

J= Estimated value
ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Semivolatile Organics by GC/MS

Lab #:	279328	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 3550B
Project#:	1610277	Analysis:	EPA 8270C
Field ID:	MW #1	Batch#:	237734
Lab ID:	279328-001	Sampled:	08/03/16
Matrix:	Soil	Received:	08/03/16
Units:	ug/Kg	Prepared:	08/05/16
Basis:	dry	Analyzed:	08/15/16
Diln Fac:	1.000		

Analyte	Result	RL	MDL
Pentachlorophenol	ND	730	160
Phenanthrene	13 J	73	10
Anthracene	ND	73	13
Di-n-butylphthalate	ND	360	13
Fluoranthene	ND	73	9.4
Pyrene	ND	73	10
Butylbenzylphthalate	ND	360	13
3,3'-Dichlorobenzidine	ND	730	47
Benzo(a)anthracene	ND	73	9.4
Chrysene	ND	73	13
bis(2-Ethylhexyl)phthalate	67 J	360	9.5
Di-n-octylphthalate	ND	360	9.2
Benzo(b)fluoranthene	ND	73	13
Benzo(k)fluoranthene	ND	73	9.5
Benzo(a)pyrene	ND	73	9.5
Indeno(1,2,3-cd)pyrene	ND	73	13
Dibenz(a,h)anthracene	ND	73	13
Benzo(g,h,i)perylene	ND	73	9.4

Surrogate	%REC	Limits
2-Fluorophenol	99	25-120
Phenol-d5	99	36-120
2,4,6-Tribromophenol	66	27-120
Nitrobenzene-d5	62	44-120
2-Fluorobiphenyl	70	47-120
Terphenyl-d14	81	49-120

J= Estimated value
ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Semivolatile Organics by GC/MS

Lab #:	279328	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 3550B
Project#:	1610277	Analysis:	EPA 8270C
Field ID:	MW #3	Batch#:	237734
Lab ID:	279328-002	Sampled:	08/03/16
Matrix:	Soil	Received:	08/03/16
Units:	ug/Kg	Prepared:	08/05/16
Basis:	dry	Analyzed:	08/15/16
Diln Fac:	1.000		

Moisture: 5%

Analyte	Result	RL	MDL
N-Nitrosodimethylamine	ND	350	35
Phenol	ND	350	18
bis(2-Chloroethyl)ether	ND	350	13
2-Chlorophenol	ND	350	17
1,3-Dichlorobenzene	ND	350	13
1,4-Dichlorobenzene	ND	350	11
Benzyl alcohol	ND	350	16
1,2-Dichlorobenzene	ND	350	10
2-Methylphenol	ND	350	16
bis(2-Chloroisopropyl) ether	ND	350	19
4-Methylphenol	ND	350	18
N-Nitroso-di-n-propylamine	ND	350	35
Hexachloroethane	ND	350	13
Nitrobenzene	ND	350	13
Isophorone	ND	350	11
2-Nitrophenol	ND	700	11
2,4-Dimethylphenol	ND	350	15
Benzoic acid	ND	1,800	530
bis(2-Chloroethoxy)methane	ND	350	12
2,4-Dichlorophenol	ND	350	13
1,2,4-Trichlorobenzene	ND	350	10
Naphthalene	ND	70	9.3
4-Chloroaniline	ND	350	17
Hexachlorobutadiene	ND	350	64
4-Chloro-3-methylphenol	ND	350	16
2-Methylnaphthalene	ND	70	10
Hexachlorocyclopentadiene	ND	700	64
2,4,6-Trichlorophenol	ND	350	15
2,4,5-Trichlorophenol	ND	350	9.3
2-Chloronaphthalene	ND	350	58
2-Nitroaniline	ND	700	35
Dimethylphthalate	ND	350	9.9
Acenaphthylene	ND	70	9.0
2,6-Dinitrotoluene	ND	350	9.3
3-Nitroaniline	ND	700	35
Acenaphthene	ND	70	13
2,4-Dinitrophenol	ND	700	170
4-Nitrophenol	ND	700	72
Dibenzofuran	ND	350	9.2
2,4-Dinitrotoluene	ND	350	10
Diethylphthalate	ND	350	9.0
Fluorene	ND	70	9.4
4-Chlorophenyl-phenylether	ND	350	10
4-Nitroaniline	ND	700	35
4,6-Dinitro-2-methylphenol	ND	700	44
N-Nitrosodiphenylamine	ND	350	59
Azobenzene	ND	350	13
4-Bromophenyl-phenylether	ND	350	62
Hexachlorobenzene	ND	350	13

J= Estimated value
ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Semivolatile Organics by GC/MS

Lab #:	279328	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 3550B
Project#:	1610277	Analysis:	EPA 8270C
Field ID:	MW #3	Batch#:	237734
Lab ID:	279328-002	Sampled:	08/03/16
Matrix:	Soil	Received:	08/03/16
Units:	ug/Kg	Prepared:	08/05/16
Basis:	dry	Analyzed:	08/15/16
Diln Fac:	1.000		

Analyte	Result	RL	MDL
Pentachlorophenol	ND	700	160
Phenanthrene	14 J	70	10
Anthracene	ND	70	13
Di-n-butylphthalate	ND	350	13
Fluoranthene	ND	70	9.1
Pyrene	ND	70	9.9
Butylbenzylphthalate	ND	350	13
3,3'-Dichlorobenzidine	ND	700	45
Benzo(a)anthracene	ND	70	9.1
Chrysene	ND	70	13
bis(2-Ethylhexyl)phthalate	39 J	350	9.2
Di-n-octylphthalate	ND	350	8.9
Benzo(b)fluoranthene	ND	70	13
Benzo(k)fluoranthene	ND	70	9.1
Benzo(a)pyrene	ND	70	9.1
Indeno(1,2,3-cd)pyrene	ND	70	13
Dibenz(a,h)anthracene	ND	70	13
Benzo(g,h,i)perylene	ND	70	9.1

Surrogate	%REC	Limits
2-Fluorophenol	100	25-120
Phenol-d5	101	36-120
2,4,6-Tribromophenol	70	27-120
Nitrobenzene-d5	62	44-120
2-Fluorobiphenyl	69	47-120
Terphenyl-d14	83	49-120

J= Estimated value
ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Batch QC Report

Semivolatile Organics by GC/MS

Lab #:	279328	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 3550B
Project#:	1610277	Analysis:	EPA 8270C
Type:	BLANK	Diln Fac:	1.000
Lab ID:	QC846023	Batch#:	237734
Matrix:	Soil	Prepared:	08/05/16
Units:	ug/Kg	Analyzed:	08/15/16

Analyte	Result	RL	MDL
N-Nitrosodimethylamine	ND	330	33
Phenol	ND	330	17
bis(2-Chloroethyl)ether	ND	330	12
2-Chlorophenol	ND	330	16
1,3-Dichlorobenzene	ND	330	12
1,4-Dichlorobenzene	ND	330	10
Benzyl alcohol	ND	330	15
1,2-Dichlorobenzene	ND	330	9.4
2-Methylphenol	ND	330	15
bis(2-Chloroisopropyl) ether	ND	330	18
4-Methylphenol	ND	330	17
N-Nitroso-di-n-propylamine	ND	330	33
Hexachloroethane	ND	330	12
Nitrobenzene	ND	330	12
Isophorone	ND	330	11
2-Nitrophenol	ND	660	10
2,4-Dimethylphenol	ND	330	14
Benzoic acid	ND	1,700	500
bis(2-Chloroethoxy)methane	ND	330	11
2,4-Dichlorophenol	ND	330	13
1,2,4-Trichlorobenzene	ND	330	9.6
Naphthalene	ND	66	8.7
4-Chloroaniline	ND	330	16
Hexachlorobutadiene	ND	330	60
4-Chloro-3-methylphenol	ND	330	15
2-Methylnaphthalene	ND	66	9.8
Hexachlorocyclopentadiene	ND	660	60
2,4,6-Trichlorophenol	ND	330	14
2,4,5-Trichlorophenol	ND	330	8.7
2-Chloronaphthalene	ND	330	55
2-Nitroaniline	ND	660	33
Dimethylphthalate	ND	330	9.3
Acenaphthylene	ND	66	8.5
2,6-Dinitrotoluene	ND	330	8.8
3-Nitroaniline	ND	660	33
Acenaphthene	ND	66	12
2,4-Dinitrophenol	ND	660	160
4-Nitrophenol	ND	660	68
Dibenzofuran	ND	330	8.7
2,4-Dinitrotoluene	ND	330	9.6
Diethylphthalate	ND	330	8.5
Fluorene	ND	66	8.9
4-Chlorophenyl-phenylether	ND	330	9.7
4-Nitroaniline	ND	660	33
4,6-Dinitro-2-methylphenol	ND	660	42
N-Nitrosodiphenylamine	ND	330	56
Azobenzene	ND	330	12
4-Bromophenyl-phenylether	ND	330	58
Hexachlorobenzene	ND	330	12
Pentachlorophenol	ND	660	150
Phenanthrene	ND	66	9.6
Anthracene	ND	66	12

J= Estimated value
ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Batch QC Report

Semivolatile Organics by GC/MS

Lab #:	279328	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 3550B
Project#:	1610277	Analysis:	EPA 8270C
Type:	BLANK	Diln Fac:	1.000
Lab ID:	QC846023	Batch#:	237734
Matrix:	Soil	Prepared:	08/05/16
Units:	ug/Kg	Analyzed:	08/15/16

Analyte	Result	RL	MDL
Di-n-butylphthalate	ND	330	12
Fluoranthene	ND	66	8.6
Pyrene	ND	66	9.3
Butylbenzylphthalate	ND	330	12
3,3'-Dichlorobenzidine	ND	660	43
Benzo(a)anthracene	ND	66	8.6
Chrysene	ND	66	12
bis(2-Ethylhexyl)phthalate	13 J	330	8.7
Di-n-octylphthalate	ND	330	8.4
Benzo(b)fluoranthene	ND	66	12
Benzo(k)fluoranthene	ND	66	8.6
Benzo(a)pyrene	ND	66	8.6
Indeno(1,2,3-cd)pyrene	ND	66	12
Dibenz(a,h)anthracene	ND	66	12
Benzo(g,h,i)perylene	ND	66	8.6

Surrogate	%REC	Limits
2-Fluorophenol	111	25-120
Phenol-d5	106	36-120
2,4,6-Tribromophenol	71	27-120
Nitrobenzene-d5	72	44-120
2-Fluorobiphenyl	81	47-120
Terphenyl-d14	85	49-120

J= Estimated value
ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Batch QC Report

Semivolatile Organics by GC/MS

Lab #:	279328	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 3550B
Project#:	1610277	Analysis:	EPA 8270C
Type:	LCS	Diln Fac:	1.000
Lab ID:	QC846024	Batch#:	237734
Matrix:	Soil	Prepared:	08/05/16
Units:	ug/Kg	Analyzed:	08/15/16

Analyte	Spiked	Result	%REC	Limits
Phenol	2,694	1,490	55	42-120
2-Chlorophenol	2,694	1,801	67	45-120
1,4-Dichlorobenzene	2,694	1,754	65	48-120
N-Nitroso-di-n-propylamine	2,694	1,607	60	27-123
1,2,4-Trichlorobenzene	2,694	2,149	80	50-120
4-Chloro-3-methylphenol	2,694	2,563	95	59-120
Acenaphthene	1,010	740.4	73	53-120
4-Nitrophenol	2,694	2,119	79	47-120
2,4-Dinitrotoluene	2,694	2,276	85	55-120
Pentachlorophenol	2,694	1,388	52	32-120
Pyrene	1,010	826.8	82	52-120

Surrogate	%REC	Limits
2-Fluorophenol	74	25-120
Phenol-d5	59	36-120
2,4,6-Tribromophenol	86	27-120
Nitrobenzene-d5	75	44-120
2-Fluorobiphenyl	75	47-120
Terphenyl-d14	88	49-120

Curtis & Tompkins, Ltd.

Organochlorine Pesticides

Lab #:	279328	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 3550B
Project#:	1610277	Analysis:	EPA 8081A
Field ID:	MW #1	Batch#:	237742
Lab ID:	279328-001	Sampled:	08/03/16
Matrix:	Soil	Received:	08/03/16
Units:	ug/Kg	Prepared:	08/05/16
Basis:	dry	Analyzed:	08/08/16
Diln Fac:	1.000		

Moisture: 8%

Analyte	Result	RL	MDL
alpha-BHC	ND	1.9	0.27
beta-BHC	ND	1.9	0.44
gamma-BHC	ND	1.9	0.43
delta-BHC	ND	1.9	0.22
Heptachlor	ND	1.9	0.41
Aldrin	ND	1.9	0.46
Heptachlor epoxide	7.3	1.9	0.27
Endosulfan I	ND	1.9	0.35
Dieldrin	ND	1.9	0.51
4,4'-DDE	58	3.6	0.48
Endrin	ND	3.6	0.64
Endosulfan II	ND	3.6	0.53
Endosulfan sulfate	ND	3.6	0.53
4,4'-DDD	6.0 C	3.6	0.52
Endrin aldehyde	ND	3.6	0.43
4,4'-DDT	110	3.6	0.48
alpha-Chlordane	33	1.9	0.28
gamma-Chlordane	33	1.9	0.40
Methoxychlor	ND	19	2.9
Toxaphene	ND	66	16

Surrogate	%REC	Limits
TCMX	84	44-125
Decachlorobiphenyl	77	39-121

C= Presence confirmed, but RPD between columns exceeds 40%
ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Organochlorine Pesticides

Lab #:	279328	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 3550B
Project#:	1610277	Analysis:	EPA 8081A
Field ID:	MW #3	Batch#:	237742
Lab ID:	279328-002	Sampled:	08/03/16
Matrix:	Soil	Received:	08/03/16
Units:	ug/Kg	Prepared:	08/05/16
Basis:	dry	Analyzed:	08/08/16
Diln Fac:	1.000		

Moisture: 5%

Analyte	Result	RL	MDL
alpha-BHC	ND	1.8	0.26
beta-BHC	ND	1.8	0.42
gamma-BHC	ND	1.8	0.42
delta-BHC	ND	1.8	0.22
Heptachlor	ND	1.8	0.39
Aldrin	ND	1.8	0.45
Heptachlor epoxide	ND	1.8	0.26
Endosulfan I	ND	1.8	0.34
Dieldrin	ND	1.8	0.50
4,4'-DDE	ND	3.5	0.47
Endrin	ND	3.5	0.62
Endosulfan II	ND	3.5	0.52
Endosulfan sulfate	ND	3.5	0.51
4,4'-DDD	ND	3.5	0.50
Endrin aldehyde	ND	3.5	0.42
4,4'-DDT	ND	3.5	0.46
alpha-Chlordane	ND	1.8	0.27
gamma-Chlordane	ND	1.8	0.38
Methoxychlor	ND	18	2.8
Toxaphene	ND	64	15

Surrogate	%REC	Limits
TCMX	96	44-125
Decachlorobiphenyl	97	39-121

ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Batch QC Report

Organochlorine Pesticides

Lab #:	279328	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 3550B
Project#:	1610277	Analysis:	EPA 8081A
Type:	BLANK	Diln Fac:	1.000
Lab ID:	QC846053	Batch#:	237742
Matrix:	Soil	Prepared:	08/05/16
Units:	ug/Kg	Analyzed:	08/08/16

Analyte	Result	RL	MDL
alpha-BHC	ND	0.86	0.12
beta-BHC	ND	0.86	0.20
gamma-BHC	ND	0.86	0.20
delta-BHC	ND	0.86	0.10
Heptachlor	ND	0.86	0.19
Aldrin	ND	0.86	0.21
Heptachlor epoxide	ND	0.86	0.12
Endosulfan I	ND	0.86	0.16
Dieldrin	ND	0.86	0.23
4,4'-DDE	ND	1.7	0.22
Endrin	ND	1.7	0.29
Endosulfan II	ND	1.7	0.24
Endosulfan sulfate	ND	1.7	0.24
4,4'-DDD	ND	1.7	0.24
Endrin aldehyde	ND	1.7	0.20
4,4'-DDT	ND	1.7	0.22
alpha-Chlordane	ND	0.86	0.13
gamma-Chlordane	ND	0.86	0.18
Methoxychlor	ND	8.6	1.3
Toxaphene	ND	30	7.3

Surrogate	%REC	Limits
TCMX	86	44-125
Decachlorobiphenyl	76	39-121

ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Batch QC Report

Organochlorine Pesticides

Lab #:	279328	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 3550B
Project#:	1610277	Analysis:	EPA 8081A
Type:	LCS	Diln Fac:	1.000
Lab ID:	QC846054	Batch#:	237742
Matrix:	Soil	Prepared:	08/05/16
Units:	ug/Kg	Analyzed:	08/08/16

Analyte	Spiked	Result	%REC	Limits
gamma-BHC	13.18	14.17	107	44-121
Heptachlor	13.18	14.18	108	45-129
Aldrin	13.18	14.15	107	45-120
Dieldrin	13.18	13.40 #	102	49-131
Endrin	13.18	12.12	92	43-135
4,4'-DDT	13.18	10.06	76	37-141

Surrogate	%REC	Limits
TCMX	108	44-125
Decachlorobiphenyl	87	39-121

#= CCV drift outside limits; average CCV drift within limits per method requirements

Curtis & Tompkins, Ltd.

Polychlorinated Biphenyls (PCBs)

Lab #:	279328	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 3550B
Project#:	1610277	Analysis:	EPA 8082
Matrix:	Soil	Sampled:	08/03/16
Units:	ug/Kg	Received:	08/03/16
Basis:	dry	Prepared:	08/08/16
Diln Fac:	1.000	Analyzed:	08/09/16
Batch#:	237812		

Field ID: MW #1 Lab ID: 279328-001
Type: SAMPLE Moisture: 8%

Analyte	Result	RL	MDL
Aroclor-1016	ND	13	3.2
Aroclor-1221	ND	26	8.6
Aroclor-1232	ND	13	4.2
Aroclor-1242	ND	13	3.9
Aroclor-1248	ND	13	4.1
Aroclor-1254	ND	13	3.3
Aroclor-1260	ND	13	2.1

Surrogate	%REC	Limits
Decachlorobiphenyl	81	25-135

Field ID: MW #3 Lab ID: 279328-002
Type: SAMPLE Moisture: 5%

Analyte	Result	RL	MDL
Aroclor-1016	ND	13	3.1
Aroclor-1221	ND	25	8.4
Aroclor-1232	ND	13	4.1
Aroclor-1242	ND	13	3.8
Aroclor-1248	ND	13	4.0
Aroclor-1254	ND	13	3.2
Aroclor-1260	ND	13	2.0

Surrogate	%REC	Limits
Decachlorobiphenyl	82	25-135

Type: BLANK Lab ID: QC846342

Analyte	Result	RL	MDL
Aroclor-1016	ND	4.8	1.2
Aroclor-1221	ND	9.6	3.2
Aroclor-1232	ND	4.8	1.5
Aroclor-1242	ND	4.8	1.4
Aroclor-1248	ND	4.8	1.5
Aroclor-1254	ND	4.8	1.2
Aroclor-1260	ND	4.8	0.77

Surrogate	%REC	Limits
Decachlorobiphenyl	107	25-135

ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Batch QC Report

Polychlorinated Biphenyls (PCBs)

Lab #:	279328	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 3550B
Project#:	1610277	Analysis:	EPA 8082
Type:	LCS	Diln Fac:	1.000
Lab ID:	QC846343	Batch#:	237812
Matrix:	Soil	Prepared:	08/08/16
Units:	ug/Kg	Analyzed:	08/09/16

Analyte	Spiked	Result	%REC	Limits
Aroclor-1016	165.6	174.4	105	64-140
Aroclor-1260	165.6	155.8	94	65-146

Surrogate	%REC	Limits
Decachlorobiphenyl	92	25-135

Curtis & Tompkins, Ltd.

Batch QC Report

Polychlorinated Biphenyls (PCBs)

Lab #:	279328	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 3550B
Project#:	1610277	Analysis:	EPA 8082
Field ID:	ZZZZZZZZZZ	Batch#:	237812
MSS Lab ID:	279347-002	Sampled:	08/04/16
Matrix:	Soil	Received:	08/04/16
Units:	ug/Kg	Prepared:	08/08/16
Basis:	as received	Analyzed:	08/09/16
Diln Fac:	1.000		

Type: MS Lab ID: QC846344

Analyte	MSS Result	Spiked	Result	%REC	Limits
Aroclor-1016	<2.952	166.2	214.0	129	60-161
Aroclor-1260	38.23	166.2	248.9	127	42-166

Surrogate	%REC	Limits
Decachlorobiphenyl	91	25-135

Type: MSD Lab ID: QC846345

Analyte	Spiked	Result	%REC	Limits	RPD	Lim
Aroclor-1016	166.6	219.9	132	60-161	2	43
Aroclor-1260	166.6	269.4	139	42-166	8	51

Surrogate	%REC	Limits
Decachlorobiphenyl	90	25-135

RPD= Relative Percent Difference

Curtis & Tompkins, Ltd.

California Title 22 Metals

Lab #:	279328	Project#:	1610277
Client:	GEI Consultants, Inc.	Location:	Former Nursery Detention Basin
Field ID:	MW #1	Basis:	dry
Lab ID:	279328-001	Sampled:	08/03/16
Matrix:	Soil	Received:	08/03/16
Units:	mg/Kg		

Moisture: 8%

Analyte	Result	RL	MDL	Diln Fac	Batch#	Prepared	Analyzed	Prep	Analysis
Antimony	0.21 J	2.2	0.086	25.00	237809	08/08/16	08/09/16	EPA 3050B	EPA 6020
Arsenic	8.1	0.27	0.080	25.00	237809	08/08/16	08/09/16	EPA 3050B	EPA 6020
Barium	210	0.27	0.059	25.00	237809	08/08/16	08/09/16	EPA 3050B	EPA 6020
Beryllium	0.55	0.27	0.055	25.00	237809	08/08/16	08/09/16	EPA 3050B	EPA 6020
Cadmium	0.13 J	0.27	0.032	25.00	237809	08/08/16	08/09/16	EPA 3050B	EPA 6020
Chromium	100	0.27	0.084	25.00	237809	08/08/16	08/09/16	EPA 3050B	EPA 6020
Cobalt	20	0.27	0.053	25.00	237809	08/08/16	08/09/16	EPA 3050B	EPA 6020
Copper	39	0.35	0.12	25.00	237809	08/08/16	08/09/16	EPA 3050B	EPA 6020
Lead	15	0.27	0.077	25.00	237809	08/08/16	08/09/16	EPA 3050B	EPA 6020
Mercury	ND	0.018	0.0033	1.000	238064	08/15/16	08/16/16	METHOD	EPA 7471A
Molybdenum	0.35	0.27	0.087	25.00	237809	08/08/16	08/11/16	EPA 3050B	EPA 6020
Nickel	140	0.27	0.082	25.00	237809	08/08/16	08/09/16	EPA 3050B	EPA 6020
Selenium	0.20 J	2.2	0.081	25.00	237809	08/08/16	08/09/16	EPA 3050B	EPA 6020
Silver	0.050 J	0.27	0.032	25.00	237809	08/08/16	08/09/16	EPA 3050B	EPA 6020
Thallium	0.066 J	0.27	0.058	25.00	237809	08/08/16	08/09/16	EPA 3050B	EPA 6020
Vanadium	54	0.35	0.12	25.00	237809	08/08/16	08/09/16	EPA 3050B	EPA 6020
Zinc	85	1.1	0.28	25.00	237809	08/08/16	08/09/16	EPA 3050B	EPA 6020

J= Estimated value
ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

California Title 22 Metals

Lab #:	279328	Project#:	1610277
Client:	GEI Consultants, Inc.	Location:	Former Nursery Detention Basin
Field ID:	MW #3	Basis:	dry
Lab ID:	279328-002	Sampled:	08/03/16
Matrix:	Soil	Received:	08/03/16
Units:	mg/Kg		

Moisture: 5%

Analyte	Result	RL	MDL	Diln Fac	Batch#	Prepared	Analyzed	Prep	Analysis
Antimony	0.20 J	2.1	0.085	25.00	237809	08/08/16	08/09/16	EPA 3050B	EPA 6020
Arsenic	7.6	0.26	0.079	25.00	237809	08/08/16	08/09/16	EPA 3050B	EPA 6020
Barium	440	29	7.6	2,500	237809	08/08/16	08/12/16	EPA 3050B	EPA 6020
Beryllium	0.59	0.26	0.054	25.00	237809	08/08/16	08/09/16	EPA 3050B	EPA 6020
Cadmium	0.057 J	0.26	0.032	25.00	237809	08/08/16	08/09/16	EPA 3050B	EPA 6020
Chromium	95	0.26	0.083	25.00	237809	08/08/16	08/09/16	EPA 3050B	EPA 6020
Cobalt	22	0.26	0.052	25.00	237809	08/08/16	08/09/16	EPA 3050B	EPA 6020
Copper	39	0.34	0.11	25.00	237809	08/08/16	08/09/16	EPA 3050B	EPA 6020
Lead	11	0.26	0.076	25.00	237809	08/08/16	08/09/16	EPA 3050B	EPA 6020
Mercury	0.25	0.017	0.0030	1.000	238064	08/15/16	08/16/16	METHOD	EPA 7471A
Molybdenum	0.79	0.26	0.086	25.00	237809	08/08/16	08/11/16	EPA 3050B	EPA 6020
Nickel	130	0.26	0.081	25.00	237809	08/08/16	08/09/16	EPA 3050B	EPA 6020
Selenium	0.19 J	2.1	0.080	25.00	237809	08/08/16	08/09/16	EPA 3050B	EPA 6020
Silver	0.040 J	0.26	0.032	25.00	237809	08/08/16	08/09/16	EPA 3050B	EPA 6020
Thallium	0.070 J	0.26	0.057	25.00	237809	08/08/16	08/09/16	EPA 3050B	EPA 6020
Vanadium	59	0.34	0.11	25.00	237809	08/08/16	08/09/16	EPA 3050B	EPA 6020
Zinc	80	1.1	0.28	25.00	237809	08/08/16	08/09/16	EPA 3050B	EPA 6020

J= Estimated value
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Batch QC Report

California Title 22 Metals

Lab #:	279328	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 3050B
Project#:	1610277	Analysis:	EPA 6020
Type:	BLANK	Diln Fac:	25.00
Lab ID:	QC846328	Batch#:	237809
Matrix:	Soil	Prepared:	08/08/16
Units:	mg/Kg	Analyzed:	08/08/16

Analyte	Result	RL	MDL
Antimony	ND	2.0	0.077
Arsenic	0.21 J	0.25	0.071
Barium	ND	0.25	0.052
Beryllium	ND	0.25	0.049
Cadmium	ND	0.25	0.029
Chromium	0.47 b	0.25	0.075
Cobalt	ND	0.25	0.047
Copper	ND	0.31	0.10
Lead	ND	0.25	0.069
Molybdenum	ND	0.25	0.077
Nickel	ND	0.25	0.073
Selenium	ND	2.0	0.072
Silver	ND	0.25	0.029
Thallium	ND	0.25	0.052
Vanadium	0.22 J	0.31	0.10
Zinc	0.47 J	1.0	0.25

J= Estimated value
b= See narrative
ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Batch QC Report

California Title 22 Metals

Lab #:	279328	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 3050B
Project#:	1610277	Analysis:	EPA 6020
Matrix:	Soil	Batch#:	237809
Units:	mg/Kg	Prepared:	08/08/16
Diln Fac:	25.00	Analyzed:	08/08/16

Type: BS Lab ID: QC846329

Analyte	Spiked	Result	%REC	Limits
Antimony	24.51	22.13	90	80-120
Arsenic	24.51	25.21	103	80-121
Barium	24.51	24.91	102	80-121
Beryllium	12.25	11.66	95	80-120
Cadmium	24.51	23.70	97	80-120
Chromium	24.51	25.38	104	80-131
Cobalt	24.51	25.45	104	80-132
Copper	24.51	23.11	94	80-137
Lead	24.51	24.62	100	80-125
Molybdenum	24.51	23.39	95	80-120
Nickel	24.51	25.00	102	77-141
Selenium	24.51	24.14	99	80-129
Silver	2.451	2.348	96	80-122
Thallium	24.51	24.19	99	80-120
Vanadium	24.51	24.40	100	80-128
Zinc	24.51	25.11	102	80-133

Type: BSD Lab ID: QC846330

Analyte	Spiked	Result	%REC	Limits	RPD	Lim
Antimony	24.27	22.79	94	80-120	4	20
Arsenic	24.27	26.12	108	80-121	5	21
Barium	24.27	25.73	106	80-121	4	20
Beryllium	12.14	11.93	98	80-120	3	20
Cadmium	24.27	24.82	102	80-120	6	20
Chromium	24.27	26.84	111	80-131	7	25
Cobalt	24.27	26.71	110	80-132	6	24
Copper	24.27	24.66	102	80-137	7	27
Lead	24.27	25.17	104	80-125	3	20
Molybdenum	24.27	22.62	93	80-120	2	20
Nickel	24.27	25.72	106	77-141	4	29
Selenium	24.27	25.69	106	80-129	7	22
Silver	2.427	2.499	103	80-122	7	20
Thallium	24.27	24.62	101	80-120	3	20
Vanadium	24.27	25.74	106	80-128	6	24
Zinc	24.27	25.78	106	80-133	4	23

RPD= Relative Percent Difference

Curtis & Tompkins, Ltd.

Batch QC Report

California Title 22 Metals

Lab #:	279328	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 3050B
Project#:	1610277	Analysis:	EPA 6020
Field ID:	ZZZZZZZZZZ	Batch#:	237809
MSS Lab ID:	279117-003	Sampled:	07/26/16
Matrix:	Soil	Received:	07/28/16
Units:	mg/Kg	Prepared:	08/08/16
Basis:	as received	Analyzed:	08/08/16
Diln Fac:	25.00		

Type: MS Lab ID: QC846331

Analyte	MSS Result	Spiked	Result	%REC	Limits
Antimony	0.1860	26.32	13.88	52	21-120
Arsenic	10.05	26.32	38.51	108	75-122
Barium	27.36	26.32	50.12	86	54-148
Beryllium	0.06667	13.16	12.77	97	80-120
Cadmium	<0.02565	26.32	26.46	101	80-120
Chromium	20.47	26.32	48.57	107	60-158
Cobalt	5.534	26.32	32.25	102	73-142
Copper	1.791	26.32	28.74	102	59-150
Lead	1.692	26.32	27.68	99	68-137
Molybdenum	0.4329	26.32	23.96	89	71-120
Nickel	23.53	26.32	49.80	100	57-161
Selenium	<0.06483	26.32	26.32	100	75-128
Silver	<0.02583	2.632	2.749	104	77-120
Thallium	<0.04630	26.32	25.93	99	76-120
Vanadium	18.18	26.32	44.03	98	65-150
Zinc	18.17	26.32	45.38	103	44-158

Type: MSD Lab ID: QC846332

Analyte	Spiked	Result	%REC	Limits	RPD	Lim
Antimony	24.04	12.66	52	21-120	0	29
Arsenic	24.04	34.99	104	75-122	3	24
Barium	24.04	43.11	66	54-148	11	28
Beryllium	12.02	12.09	100	80-120	4	20
Cadmium	24.04	24.45	102	80-120	1	20
Chromium	24.04	45.97	106	60-158	0	36
Cobalt	24.04	30.18	103	73-142	1	34
Copper	24.04	30.44	119	59-150	14	52
Lead	24.04	25.97	101	68-137	2	32
Molybdenum	24.04	21.68	88	71-120	1	20
Nickel	24.04	48.65	105	57-161	2	47
Selenium	24.04	24.07	100	75-128	0	20
Silver	2.404	2.526	105	77-120	1	20
Thallium	24.04	23.74	99	76-120	0	20
Vanadium	24.04	42.55	101	65-150	2	28
Zinc	24.04	45.67	114	44-158	6	33

RPD= Relative Percent Difference

Curtis & Tompkins, Ltd.

Batch QC Report

California Title 22 Metals

Lab #:	279328	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	METHOD
Project#:	1610277	Analysis:	EPA 7471A
Analyte:	Mercury	Diln Fac:	1.000
Type:	BLANK	Batch#:	238064
Lab ID:	QC847358	Prepared:	08/15/16
Matrix:	Soil	Analyzed:	08/15/16
Units:	mg/Kg		

Result	RL	MDL
0.0058 J	0.016	0.0029

J= Estimated value
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Batch QC Report

California Title 22 Metals

Lab #:	279328	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	METHOD
Project#:	1610277	Analysis:	EPA 7471A
Analyte:	Mercury	Batch#:	238064
Matrix:	Soil	Prepared:	08/15/16
Units:	mg/Kg	Analyzed:	08/16/16
Diln Fac:	1.000		

Type	Lab ID	Spiked	Result	%REC	Limits	RPD	Lim
BS	QC847359	0.2083	0.1913	92	80-120		
BSD	QC847360	0.2049	0.1943	95	80-120	3	20

RPD= Relative Percent Difference

Curtis & Tompkins, Ltd.

Batch QC Report

California Title 22 Metals

Lab #:	279328	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	METHOD
Project#:	1610277	Analysis:	EPA 7471A
Analyte:	Mercury	Diln Fac:	1.000
Field ID:	ZZZZZZZZZZ	Batch#:	238064
MSS Lab ID:	279344-001	Sampled:	08/03/16
Matrix:	Soil	Received:	08/03/16
Units:	mg/Kg	Prepared:	08/15/16
Basis:	as received	Analyzed:	08/15/16

Type	Lab ID	MSS Result	Spiked	Result	%REC	Limits	RPD	Lim
MS	QC847361	0.2728	0.2016	0.4747	100	69-142		
MSD	QC847362		0.1953	0.4610	96	69-142	2	36

RPD= Relative Percent Difference

Curtis & Tompkins, Ltd.

Total Organic Carbon (TOC)

Lab #:	279328	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	METHOD
Project#:	1610277	Analysis:	WALKLEY-BLACK
Analyte:	Total Organic Carbon	Batch#:	237846
Matrix:	Soil	Sampled:	08/03/16
Units:	%	Received:	08/03/16
Basis:	dry	Analyzed:	08/08/16
Diln Fac:	1.000		

Field ID	Type	Lab ID	Result	RL	Moisture
MW #1	SAMPLE	279328-001	1.0	0.05	8%
MW #3	SAMPLE	279328-002	0.42	0.05	5%
	BLANK	QC846469	ND	0.01	

ND= Not Detected
RL= Reporting Limit

Curtis & Tompkins, Ltd.

Batch QC Report

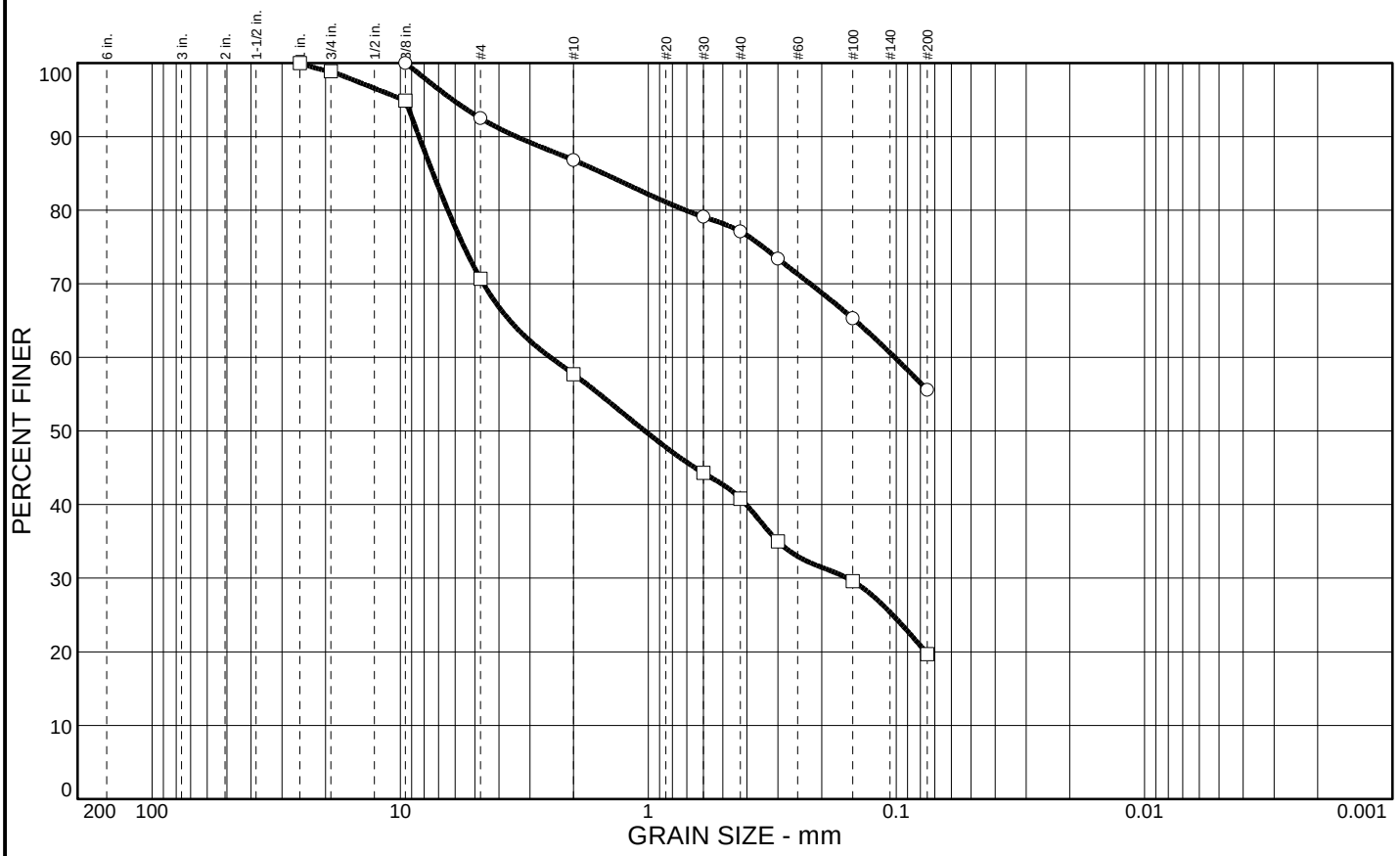
Total Organic Carbon (TOC)

Lab #:	279328	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	METHOD
Project#:	1610277	Analysis:	WALKLEY-BLACK
Analyte:	Total Organic Carbon	Diln Fac:	1.000
Field ID:	MW #1	Batch#:	237846
MSS Lab ID:	279328-001	Sampled:	08/03/16
Matrix:	Soil	Received:	08/03/16
Units:	%	Analyzed:	08/08/16
Basis:	dry		

Type	Lab ID	MSS Result	Spiked	Result	%REC	Limits	Moisture	RPD	Lim
LCS	QC846470		0.1300	0.1240	95	80-120			
MS	QC846471	1.020	0.7030	1.655	90	66-120	8%		
MSD	QC846472		0.6996	1.579	80	66-120	8%	5	20

RPD= Relative Percent Difference

Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		7.5	36.9	55.6					
□		29.3	51.0	19.7					

SIEVE inches size	PERCENT FINER ○	□	
1"		100.0	
3/4"		98.9	
3/8	100.0	94.9	
	GRAIN SIZE		
D_{60}	0.102	2.48	
D_{30}		0.158	
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	
#4	92.5	70.7	
#10	86.8	57.7	
#30	79.1	44.3	
#40	77.1	40.8	
#50	73.4	35.0	
#100	65.3	29.6	
#200	55.6	19.7	

SOIL DESCRIPTION

○ Olive Brown Sandy CLAY

□ Olive Brown Clayey SAND w/ Gravel

REMARKS:

○

□

○ Source: MW #1

□ Source: MW #3

COOPER TESTING LABORATORY

Client: Curtis & Tompkins, Ltd.

Project: Nursery Detention Basin - 279328

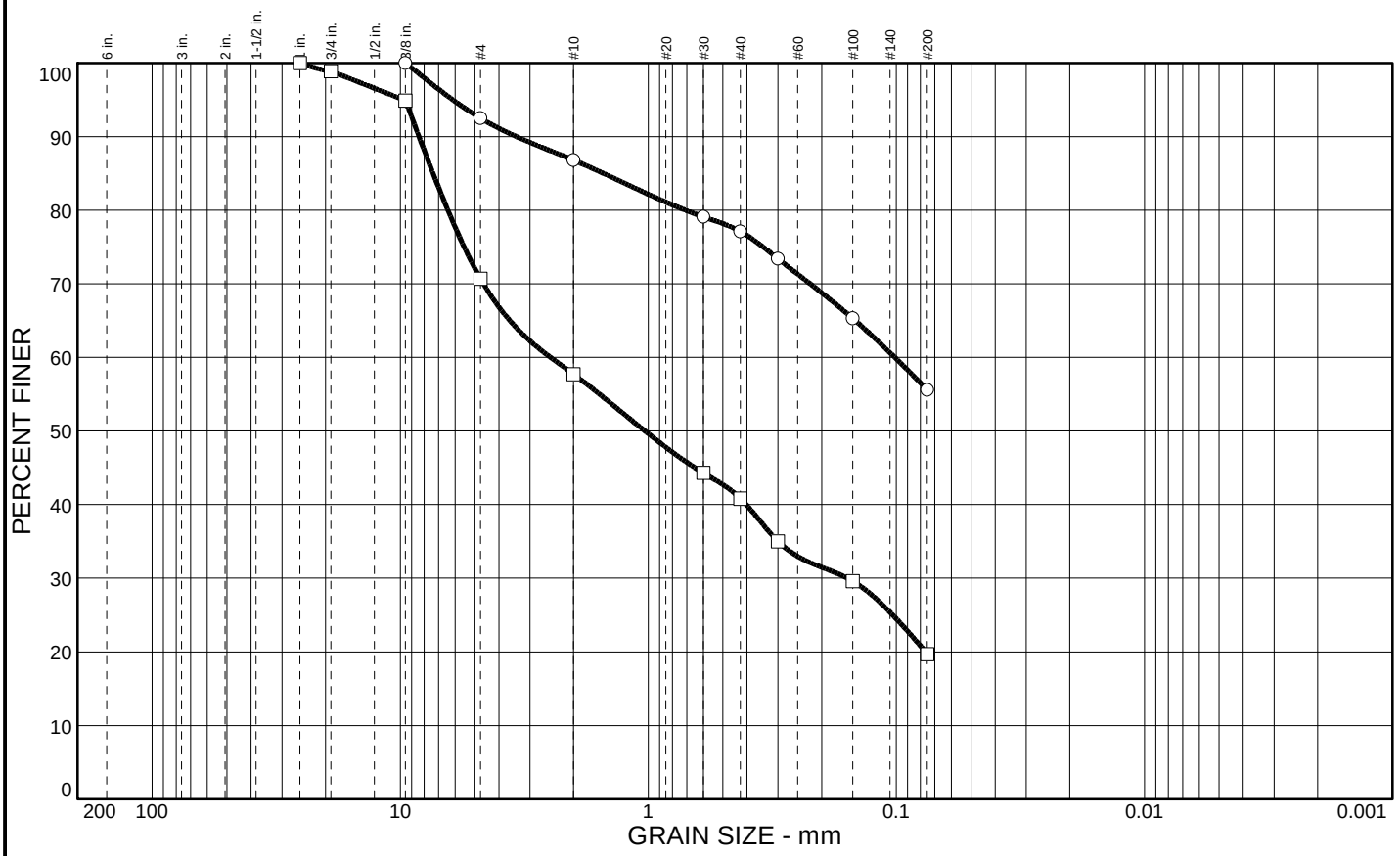
Project No.: 202-066 Figure

Laboratory Job Number 279328

Subcontracted Products

Cooper Testing Labs

Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		7.5	36.9	55.6					
□		29.3	51.0	19.7					

SIEVE inches size	PERCENT FINER ○	□	
1"		100.0	
3/4"		98.9	
3/8	100.0	94.9	
	GRAIN SIZE		
D_{60}	0.102	2.48	
D_{30}		0.158	
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	
#4	92.5	70.7	
#10	86.8	57.7	
#30	79.1	44.3	
#40	77.1	40.8	
#50	73.4	35.0	
#100	65.3	29.6	
#200	55.6	19.7	

SOIL DESCRIPTION

○ Olive Brown Sandy CLAY

□ Olive Brown Clayey SAND w/ Gravel

REMARKS:

○

□

○ Source: MW #1

□ Source: MW #3

COOPER TESTING LABORATORY

Client: Curtis & Tompkins, Ltd.

Project: Nursery Detention Basin - 279328

Project No.: 202-066 Figure


Curtis & Tompkins, Ltd.
Analytical Laboratories, Since 1878

Curtis & Tompkins, Ltd., Analytical Laboratories, Since 1878
2323 Fifth Street, Berkeley, CA 94710, Phone (510) 486-0900

Laboratory Job Number 279335
ANALYTICAL REPORT

GEI Consultants, Inc.
180 Grand Avenue
Oakland, CA 94612

Project : 1610277
Location : Former Nursery Detention Basin
Level : II

Sample ID	Lab ID
MW #2	279335-001
SB #3	279335-002

This data package has been reviewed for technical correctness and completeness. Release of this data has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature. The results contained in this report meet all requirements of NELAC and pertain only to those samples which were submitted for analysis. This report may be reproduced only in its entirety.

Signature: _____ Date: 08/30/2016

Dina Ali
Project Manager
dina.ali@ctberk.com

CA ELAP# 2896, NELAP# 4044-001

Curtis & Tompkins, Ltd.

CASE NARRATIVE

Laboratory number:	**279335**
Client:	**GEI Consultants, Inc.**
Project:	**1610277**
Location:	**Former Nursery Detention Basin**
Request Date:	**08/04/16**
Samples Received:	**08/04/16**

This data package contains sample and QC results for two six-point soil composites, requested for the above referenced project on 08/04/16. The samples were received on ice and intact.

Volatile Organics by GC/MS (EPA 8260B):
No analytical problems were encountered.

Semivolatile Organics by GC/MS (EPA 8270C):
Matrix spikes QC846264,QC846265 (batch 237795) were not reported because the parent sample required a dilution that would have diluted out the spikes. 1,2,4-trichlorobenzene was detected between the MDL and the RL in the method blank for batch 237795; this analyte was not detected in samples at or above the RL. No other analytical problems were encountered.

Pesticides (EPA 8081A):
All samples underwent sulfur cleanup using the copper option in EPA Method 3660B. All samples underwent florisil cleanup using EPA Method 3620C. Matrix spikes QC846055,QC846056 (batch 237742) were not reported because the parent sample required a dilution that would have diluted out the spikes. No other analytical problems were encountered.

PCBs (EPA 8082):
All samples underwent sulfuric acid cleanup using EPA Method 3665A. All samples underwent sulfur cleanup using the copper option in EPA Method 3660B. No analytical problems were encountered.

Metals (EPA 6020 and EPA 7471A):
Mercury was detected between the MDL and the RL in the method blank for batch 238064; this analyte was detected in samples at a level at least 10 times that of the blank. Chromium was detected above the RL in the method blank for batch 237809; this analyte was detected in samples at a level at least 10 times that of the blank. Arsenic, vanadium, and zinc were detected between the MDL and the RL in the method blank for batch 237809; these analytes were detected in samples at a level at least 10 times that of the blank. No other analytical problems were encountered.

Moisture (ASTM D2216/CLP):
No analytical problems were encountered.

Total Organic Carbon (TOC) (WALKLEY-BLACK):
No analytical problems were encountered.

Curtis & Tompkins, Ltd.

CASE NARRATIVE

Laboratory number:	**279335**
Client:	**GEI Consultants, Inc.**
Project:	**1610277**
Location:	**Former Nursery Detention Basin**
Request Date:	**08/04/16**
Samples Received:	**08/04/16**

Particle Size (ASTM):

Cooper Testing Labs in Palo Alto, CA performed the analysis (not NELAP certified). Please see the Cooper Testing Labs case narrative.

CHAIN OF CUSTODY

Curtis & Tompkins Laboratories
ENVIRONMENTAL ANALYTICAL TESTING LABORATORY
In Business Since 1878

2323 Fifth Street
Berkeley, CA 94710

Phone (510) 486-0900
Fax (510) 486-0532

Chain of Custody # _____

C&T LOGIN #279335

Project No: 160277
Project Name: Former Nursery Detention Basin
Project P. O. No:
EDD Format: Report Level ☐ II ☐ III ☐ IV
Turnaround Time: ☐ RUSH _____ ☒ Standard

Sampler:
Report To: Graham Bradner
Company: GEI Consultants, Inc.
Telephone: (916) 631-4577
Email: gbradner@geiconsultants.com

Lab No.	Sample ID.	SAMPLING		MATRIX				# of Containers	CHEMICAL PRESERVATIVE				
		Date Collected	Time Collected	Water	Solid				HCl	H2SO4	HNO3	NaOH	None
	MW#2	8/4/16	8:00am										
	SB#3												

ANALYTICAL REQUEST

TOC	Metals 6010B or 6020	VOCs 8260	SVOCs 8270	PCB Aroclors 8082	Organochlorine Pesticides 8081A	Sieve w/ 200 wash
1	1	1	1	1	1	1
1	1	1	1	1	1	1

Notes:

SAMPLE RECEIPT
☐ Intact
☐ Cold
☒ On Ice
☐ Ambient

RELINQUISHED BY:
Maydel Uzcategui DATE: 8/4/16 TIME: 13:29
DATE: TIME:
DATE: TIME:

RECEIVED BY:
Pat Hanafy DATE: 8/4/16 TIME: 13:29
DATE: TIME:
DATE: TIME:

COOLER RECEIPT CHECKLIST

Curtis & Tompkins, Ltd.

Login # 279335 Date Received 8/4/16 Number of coolers 1
Client GEI Project 1610277

Date Opened 8/4 By (print) CB (sign) [signature]
Date Logged in ↓ By (print) DTN (sign) [signature]
Date Labelled ↓ By (print) CB (sign) [signature]

1. Did cooler come with a shipping slip (airbill, etc) ____ YES (NO)
   Shipping info ____
2A. Were custody seals present? .... ☐ YES (circle) on cooler on samples ☒ NO
   How many ____ Name ____ Date ____
2B. Were custody seals intact upon arrival? ____ YES NO (N/A)
3. Were custody papers dry and intact when received? ____ (YES) NO
4. Were custody papers filled out properly (ink, signed, etc)? ____ (YES) NO
5. Is the project identifiable from custody papers? (If so fill out top of form) ____ (YES) NO
6. Indicate the packing in cooler: (if other, describe) ____

☐ Bubble Wrap ☐ Foam blocks ☒ Bags ☐ None
☐ Cloth material ☐ Cardboard ☐ Styrofoam ☐ Paper towels

7. Temperature documentation: * Notify PM if temperature exceeds 6°C

Type of ice used: ☒ Wet ☐ Blue/Gel ☐ None Temp(°C) 4.1

☒ Temperature blank(s) included? ☒ Thermometer# 4 ☐ IR Gun# ____

☐ Samples received on ice directly from the field. Cooling process had begun

8. Were Method 5035 sampling containers present? ____ YES (NO)
   If YES, what time were they transferred to freezer? ____
9. Did all bottles arrive unbroken/unopened? ____ (YES) NO
10. Are there any missing / extra samples? ____ YES (NO)
11. Are samples in the appropriate containers for indicated tests? ____ (YES) NO
12. Are sample labels present, in good condition and complete? ____ (YES) NO
13. Do the sample labels agree with custody papers? ____ (YES) NO
14. Was sufficient amount of sample sent for tests requested? ____ (YES) NO
15. Are the samples appropriately preserved? ____ YES NO (N/A)
16. Did you check preservatives for all bottles for each sample? ____ YES NO (N/A)
17. Did you document your preservative check? (pH strip lot# ____) YES NO (N/A)
18. Did you change the hold time in LIMS for unpreserved VOAs? ____ YES NO (N/A)
19. Did you change the hold time in LIMS for preserved terracores? ____ YES NO (N/A)
20. Are bubbles > 6mm absent in VOA samples? ____ YES NO (N/A)
21. Was the client contacted concerning this sample delivery? ____ YES (NO)
   If YES, Who was called? ____ By ____ Date: ____

COMMENTS ____

Curtis & Tompkins, Ltd.

Detections Summary for 279335

Results for any subcontracted analyses are not included in this summary.

Client : GEI Consultants, Inc.
Project : 1610277
Location : Former Nursery Detention Basin

Client Sample ID : MW #2 Laboratory Sample ID : 279335-001

Analyte	Result	Flags	RL	MDL	Units	Basis	IDF	Method	Prep Method
Phenanthrene	11	J	73	10	ug/Kg	Dry	1.000	EPA 8270C	EPA 3550B
bis(2-Ethylhexyl)phthalate	11	J	360	9.5	ug/Kg	Dry	1.000	EPA 8270C	EPA 3550B
Antimony	0.23	J	2.2	0.081	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Arsenic	7.8		0.27	0.075	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Barium	200		0.27	0.055	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Beryllium	0.55		0.27	0.052	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Cadmium	0.090	J	0.27	0.030	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Chromium	110		0.27	0.079	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Cobalt	19		0.27	0.050	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Copper	28		0.68	0.11	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Lead	9.5		0.27	0.073	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Mercury	0.17		0.019	0.0034	mg/Kg	Dry	1.000	EPA 7471A	METHOD
Molybdenum	0.21	J	0.27	0.082	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Nickel	120		0.27	0.077	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Selenium	0.19	J	2.2	0.076	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Silver	0.050	J	0.27	0.030	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Thallium	0.055	J	0.27	0.054	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Vanadium	54		0.33	0.11	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Zinc	72		1.1	0.27	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Total Organic Carbon	0.86		0.05		%	Dry	1.000	WALKLEY-BLACK	METHOD

Curtis & Tompkins, Ltd.

Client Sample ID : SB #3 Laboratory Sample ID : 279335-002

Analyte	Result	Flags	RL	MDL	Units	Basis	IDF	Method	Prep Method
2-Methylnaphthalene	12	J	72	11	ug/Kg	Dry	1.000	EPA 8270C	EPA 3550B
Phenanthrene	28	J	72	10	ug/Kg	Dry	1.000	EPA 8270C	EPA 3550B
bis(2-Ethylhexyl)phthalate	68	J	360	9.4	ug/Kg	Dry	1.000	EPA 8270C	EPA 3550B
Antimony	0.13	J	2.2	0.082	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Arsenic	5.8		0.27	0.075	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Barium	170		0.27	0.056	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Beryllium	0.55		0.27	0.052	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Cadmium	0.080	J	0.27	0.030	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Chromium	68		0.27	0.080	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Cobalt	17		0.27	0.050	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Copper	29		0.33	0.11	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Lead	10		0.27	0.073	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Mercury	0.66		0.018	0.0033	mg/Kg	Dry	1.000	EPA 7471A	METHOD
Molybdenum	0.44		0.27	0.082	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Nickel	89		0.27	0.078	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Selenium	0.14	J	2.2	0.077	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Silver	0.063	J	0.27	0.031	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Thallium	0.057	J	0.27	0.055	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Vanadium	44		0.69	0.11	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Zinc	62		1.1	0.27	mg/Kg	Dry	25.00	EPA 6020	EPA 3050B
Total Organic Carbon	0.43		0.05		%	Dry	1.000	WALKLEY-BLACK	METHOD

J = Estimated value

Curtis & Tompkins, Ltd.

Purgeable Organics by GC/MS

Lab #:	279335	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 5030B
Project#:	1610277	Analysis:	EPA 8260B
Field ID:	MW #2	Diln Fac:	0.9940
Lab ID:	279335-001	Batch#:	237945
Matrix:	Soil	Sampled:	08/04/16
Units:	ug/Kg	Received:	08/04/16
Basis:	dry	Analyzed:	08/11/16

Moisture: 8%

Analyte	Result	RL	MDL
Freon 12	ND	11	0.4
Chloromethane	ND	11	1.1
Vinyl Chloride	ND	11	1.0
Bromomethane	ND	11	1.3
Chloroethane	ND	11	0.5
Trichlorofluoromethane	ND	5.4	0.8
Acetone	ND	22	3.6
Freon 113	ND	5.4	0.5
1,1-Dichloroethene	ND	5.4	1.0
Methylene Chloride	ND	22	1.2
Carbon Disulfide	ND	5.4	0.9
MTBE	ND	5.4	1.1
trans-1,2-Dichloroethene	ND	5.4	0.9
Vinyl Acetate	ND	54	0.8
1,1-Dichloroethane	ND	5.4	1.2
2-Butanone	ND	11	1.5
cis-1,2-Dichloroethene	ND	5.4	0.9
2,2-Dichloropropane	ND	5.4	1.2
Chloroform	ND	5.4	1.4
Bromochloromethane	ND	5.4	1.0
1,1,1-Trichloroethane	ND	5.4	0.9
1,1-Dichloropropene	ND	5.4	0.7
Carbon Tetrachloride	ND	5.4	0.5
1,2-Dichloroethane	ND	5.4	1.0
Benzene	ND	5.4	1.0
Trichloroethene	ND	5.4	0.9
1,2-Dichloropropane	ND	5.4	0.8
Bromodichloromethane	ND	5.4	0.9
Dibromomethane	ND	5.4	0.8
4-Methyl-2-Pentanone	ND	11	1.1
cis-1,3-Dichloropropene	ND	5.4	0.7
Toluene	ND	5.4	0.8
trans-1,3-Dichloropropene	ND	5.4	0.7
1,1,2-Trichloroethane	ND	5.4	0.7
2-Hexanone	ND	11	0.9
1,3-Dichloropropane	ND	5.4	0.9
Tetrachloroethene	ND	5.4	0.6
Dibromochloromethane	ND	5.4	0.6
1,2-Dibromoethane	ND	5.4	0.7
Chlorobenzene	ND	5.4	0.7
1,1,1,2-Tetrachloroethane	ND	5.4	0.7
Ethylbenzene	ND	5.4	0.7
m,p-Xylenes	ND	5.4	1.4
o-Xylene	ND	5.4	0.7
Styrene	ND	5.4	0.6
Bromoform	ND	5.4	0.4
Isopropylbenzene	ND	5.4	0.5
1,1,2,2-Tetrachloroethane	ND	5.4	0.4
1,2,3-Trichloropropane	ND	5.4	0.6
Propylbenzene	ND	5.4	0.5
Bromobenzene	ND	5.4	0.6

ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Purgeable Organics by GC/MS

Lab #:	279335	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 5030B
Project#:	1610277	Analysis:	EPA 8260B
Field ID:	MW #2	Dil'n Fac:	0.9940
Lab ID:	279335-001	Batch#:	237945
Matrix:	Soil	Sampled:	08/04/16
Units:	ug/Kg	Received:	08/04/16
Basis:	dry	Analyzed:	08/11/16

Analyte	Result	RL	MDL
1,3,5-Trimethylbenzene	ND	5.4	0.6
2-Chlorotoluene	ND	5.4	0.7
4-Chlorotoluene	ND	5.4	0.7
tert-Butylbenzene	ND	5.4	0.4
1,2,4-Trimethylbenzene	ND	5.4	0.6
sec-Butylbenzene	ND	5.4	0.5
para-Isopropyl Toluene	ND	5.4	0.5
1,3-Dichlorobenzene	ND	5.4	0.5
1,4-Dichlorobenzene	ND	5.4	0.6
n-Butylbenzene	ND	5.4	0.4
1,2-Dichlorobenzene	ND	5.4	0.6
1,2-Dibromo-3-Chloropropane	ND	5.4	1.0
1,2,4-Trichlorobenzene	ND	5.4	0.5
Hexachlorobutadiene	ND	5.4	0.3
Naphthalene	ND	5.4	1.1
1,2,3-Trichlorobenzene	ND	5.4	0.5

Surrogate	%REC	Limits
Dibromofluoromethane	95	78-134
1,2-Dichloroethane-d4	88	80-138
Toluene-d8	94	80-120
Bromofluorobenzene	104	78-123

ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Purgeable Organics by GC/MS

Lab #:	279335	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 5030B
Project#:	1610277	Analysis:	EPA 8260B
Field ID:	SB #3	Diln Fac:	0.9560
Lab ID:	279335-002	Batch#:	237945
Matrix:	Soil	Sampled:	08/04/16
Units:	ug/Kg	Received:	08/04/16
Basis:	dry	Analyzed:	08/11/16

Moisture: 7%

Analyte	Result	RL	MDL
Freon 12	ND	10	0.4
Chloromethane	ND	10	1.1
Vinyl Chloride	ND	10	1.0
Bromomethane	ND	10	1.2
Chloroethane	ND	10	0.5
Trichlorofluoromethane	ND	5.1	0.7
Acetone	ND	21	3.4
Freon 113	ND	5.1	0.5
1,1-Dichloroethene	ND	5.1	1.0
Methylene Chloride	ND	21	1.1
Carbon Disulfide	ND	5.1	0.9
MTBE	ND	5.1	1.0
trans-1,2-Dichloroethene	ND	5.1	0.9
Vinyl Acetate	ND	51	0.7
1,1-Dichloroethane	ND	5.1	1.2
2-Butanone	ND	10	1.4
cis-1,2-Dichloroethene	ND	5.1	0.9
2,2-Dichloropropane	ND	5.1	1.1
Chloroform	ND	5.1	1.3
Bromochloromethane	ND	5.1	1.0
1,1,1-Trichloroethane	ND	5.1	0.8
1,1-Dichloropropene	ND	5.1	0.6
Carbon Tetrachloride	ND	5.1	0.5
1,2-Dichloroethane	ND	5.1	1.0
Benzene	ND	5.1	0.9
Trichloroethene	ND	5.1	0.9
1,2-Dichloropropane	ND	5.1	0.8
Bromodichloromethane	ND	5.1	0.9
Dibromomethane	ND	5.1	0.8
4-Methyl-2-Pentanone	ND	10	1.0
cis-1,3-Dichloropropene	ND	5.1	0.6
Toluene	ND	5.1	0.7
trans-1,3-Dichloropropene	ND	5.1	0.7
1,1,2-Trichloroethane	ND	5.1	0.6
2-Hexanone	ND	10	0.9
1,3-Dichloropropane	ND	5.1	0.9
Tetrachloroethene	ND	5.1	0.5
Dibromochloromethane	ND	5.1	0.5
1,2-Dibromoethane	ND	5.1	0.7
Chlorobenzene	ND	5.1	0.7
1,1,1,2-Tetrachloroethane	ND	5.1	0.6
Ethylbenzene	ND	5.1	0.7
m,p-Xylenes	ND	5.1	1.3
o-Xylene	ND	5.1	0.6
Styrene	ND	5.1	0.6
Bromoform	ND	5.1	0.4
Isopropylbenzene	ND	5.1	0.5
1,1,2,2-Tetrachloroethane	ND	5.1	0.4
1,2,3-Trichloropropane	ND	5.1	0.6
Propylbenzene	ND	5.1	0.5
Bromobenzene	ND	5.1	0.5

ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Purgeable Organics by GC/MS

Lab #:	279335	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 5030B
Project#:	1610277	Analysis:	EPA 8260B
Field ID:	SB #3	Dil'n Fac:	0.9560
Lab ID:	279335-002	Batch#:	237945
Matrix:	Soil	Sampled:	08/04/16
Units:	ug/Kg	Received:	08/04/16
Basis:	dry	Analyzed:	08/11/16

Analyte	Result	RL	MDL
1,3,5-Trimethylbenzene	ND	5.1	0.6
2-Chlorotoluene	ND	5.1	0.7
4-Chlorotoluene	ND	5.1	0.7
tert-Butylbenzene	ND	5.1	0.4
1,2,4-Trimethylbenzene	ND	5.1	0.6
sec-Butylbenzene	ND	5.1	0.4
para-Isopropyl Toluene	ND	5.1	0.4
1,3-Dichlorobenzene	ND	5.1	0.5
1,4-Dichlorobenzene	ND	5.1	0.6
n-Butylbenzene	ND	5.1	0.4
1,2-Dichlorobenzene	ND	5.1	0.5
1,2-Dibromo-3-Chloropropane	ND	5.1	1.0
1,2,4-Trichlorobenzene	ND	5.1	0.4
Hexachlorobutadiene	ND	5.1	0.3
Naphthalene	ND	5.1	1.0
1,2,3-Trichlorobenzene	ND	5.1	0.4

Surrogate	%REC	Limits
Dibromofluoromethane	97	78-134
1,2-Dichloroethane-d4	92	80-138
Toluene-d8	95	80-120
Bromofluorobenzene	104	78-123

ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Batch QC Report

Purgeable Organics by GC/MS

Lab #:	279335	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 5030B
Project#:	1610277	Analysis:	EPA 8260B
Matrix:	Soil	Batch#:	237945
Units:	ug/Kg	Analyzed:	08/11/16
Diln Fac:	1.000		

Type: BS Lab ID: QC846870

Analyte	Spiked	Result	%REC	Limits
1,1-Dichloroethene	25.00	27.21	109	70-134
Benzene	25.00	24.33	97	80-123
Trichloroethene	25.00	25.74	103	80-128
Toluene	25.00	23.96	96	80-120
Chlorobenzene	25.00	24.26	97	80-123

Surrogate	%REC	Limits
Dibromofluoromethane	107	78-134
1,2-Dichloroethane-d4	112	80-138
Toluene-d8	98	80-120
Bromofluorobenzene	102	78-123

Type: BSD Lab ID: QC846871

Analyte	Spiked	Result	%REC	Limits	RPD	Lim
1,1-Dichloroethene	25.00	22.86	91	70-134	17	22
Benzene	25.00	22.09	88	80-123	10	21
Trichloroethene	25.00	22.71	91	80-128	13	23
Toluene	25.00	20.88	84	80-120	14	20
Chlorobenzene	25.00	21.82	87	80-123	11	20

Surrogate	%REC	Limits
Dibromofluoromethane	105	78-134
1,2-Dichloroethane-d4	112	80-138
Toluene-d8	96	80-120
Bromofluorobenzene	100	78-123

RPD= Relative Percent Difference

Curtis & Tompkins, Ltd.

Batch QC Report

Purgeable Organics by GC/MS

Lab #:	279335	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 5030B
Project#:	1610277	Analysis:	EPA 8260B
Type:	BLANK	Dil'n Fac:	1.000
Lab ID:	QC846872	Batch#:	237945
Matrix:	Soil	Analyzed:	08/11/16
Units:	ug/Kg		

Analyte	Result	RL	MDL
Freon 12	ND	10	0.4
Chloromethane	ND	10	1.0
Vinyl Chloride	ND	10	0.9
Bromomethane	ND	10	1.2
Chloroethane	ND	10	0.5
Trichlorofluoromethane	ND	5.0	0.7
Acetone	ND	20	3.3
Freon 113	ND	5.0	0.4
1,1-Dichloroethene	ND	5.0	0.9
Methylene Chloride	ND	20	1.1
Carbon Disulfide	ND	5.0	0.9
MTBE	ND	5.0	1.0
trans-1,2-Dichloroethene	ND	5.0	0.8
Vinyl Acetate	ND	50	0.7
1,1-Dichloroethane	ND	5.0	1.2
2-Butanone	ND	10	1.3
cis-1,2-Dichloroethene	ND	5.0	0.9
2,2-Dichloropropane	ND	5.0	1.1
Chloroform	ND	5.0	1.3
Bromochloromethane	ND	5.0	0.9
1,1,1-Trichloroethane	ND	5.0	0.8
1,1-Dichloropropene	ND	5.0	0.6
Carbon Tetrachloride	ND	5.0	0.5
1,2-Dichloroethane	ND	5.0	0.9
Benzene	ND	5.0	0.9
Trichloroethene	ND	5.0	0.8
1,2-Dichloropropane	ND	5.0	0.8
Bromodichloromethane	ND	5.0	0.8
Dibromomethane	ND	5.0	0.8
4-Methyl-2-Pentanone	ND	10	1.0
cis-1,3-Dichloropropene	ND	5.0	0.6
Toluene	ND	5.0	0.7
trans-1,3-Dichloropropene	ND	5.0	0.6
1,1,2-Trichloroethane	ND	5.0	0.6
2-Hexanone	ND	10	0.9
1,3-Dichloropropane	ND	5.0	0.8
Tetrachloroethene	ND	5.0	0.5
Dibromochloromethane	ND	5.0	0.5
1,2-Dibromoethane	ND	5.0	0.7
Chlorobenzene	ND	5.0	0.7
1,1,1,2-Tetrachloroethane	ND	5.0	0.6
Ethylbenzene	ND	5.0	0.7
m,p-Xylenes	ND	5.0	1.3
o-Xylene	ND	5.0	0.6
Styrene	ND	5.0	0.6
Bromoform	ND	5.0	0.4
Isopropylbenzene	ND	5.0	0.5
1,1,2,2-Tetrachloroethane	ND	5.0	0.4
1,2,3-Trichloropropane	ND	5.0	0.6
Propylbenzene	ND	5.0	0.4
Bromobenzene	ND	5.0	0.5
1,3,5-Trimethylbenzene	ND	5.0	0.6
2-Chlorotoluene	ND	5.0	0.7

ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Batch QC Report

Purgeable Organics by GC/MS

Lab #:	279335	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 5030B
Project#:	1610277	Analysis:	EPA 8260B
Type:	BLANK	Diln Fac:	1.000
Lab ID:	QC846872	Batch#:	237945
Matrix:	Soil	Analyzed:	08/11/16
Units:	ug/Kg		

Analyte	Result	RL	MDL
4-Chlorotoluene	ND	5.0	0.6
tert-Butylbenzene	ND	5.0	0.4
1,2,4-Trimethylbenzene	ND	5.0	0.6
sec-Butylbenzene	ND	5.0	0.4
para-Isopropyl Toluene	ND	5.0	0.4
1,3-Dichlorobenzene	ND	5.0	0.4
1,4-Dichlorobenzene	ND	5.0	0.5
n-Butylbenzene	ND	5.0	0.4
1,2-Dichlorobenzene	ND	5.0	0.5
1,2-Dibromo-3-Chloropropane	ND	5.0	0.9
1,2,4-Trichlorobenzene	ND	5.0	0.4
Hexachlorobutadiene	ND	5.0	0.3
Naphthalene	ND	5.0	1.0
1,2,3-Trichlorobenzene	ND	5.0	0.4

Surrogate	%REC	Limits
Dibromofluoromethane	108	78-134
1,2-Dichloroethane-d4	114	80-138
Toluene-d8	96	80-120
Bromofluorobenzene	107	78-123

ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Batch QC Report

Purgeable Organics by GC/MS

Lab #:	279335	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 5030B
Project#:	1610277	Analysis:	EPA 8260B
Field ID:	MW #2	Batch#:	237945
MSS Lab ID:	279335-001	Sampled:	08/04/16
Matrix:	Soil	Received:	08/04/16
Units:	ug/Kg	Analyzed:	08/11/16
Basis:	dry		

Type:	MS	Moisture:	8%
Lab ID:	QC846987	Diln Fac:	0.9843

Analyte	MSS Result	Spiked	Result	%REC	Limits
1,1-Dichloroethene	<1.015	53.49	58.61	110	56-133
Benzene	<0.9749	53.49	51.33	96	57-120
Trichloroethene	<0.9024	53.49	51.54	96	49-145
Toluene	<0.7686	53.49	55.51	104	51-120
Chlorobenzene	<0.7413	53.49	51.41	96	47-120

Surrogate	%REC	Limits
Dibromofluoromethane	95	78-134
1,2-Dichloroethane-d4	90	80-138
Toluene-d8	107	80-120
Bromofluorobenzene	101	78-123

Type:	MSD	Moisture:	8%
Lab ID:	QC846988	Diln Fac:	0.9960

Analyte	Spiked	Result	%REC	Limits	RPD	Lim
1,1-Dichloroethene	54.13	55.40	102	56-133	7	46
Benzene	54.13	48.64	90	57-120	7	44
Trichloroethene	54.13	47.74	88	49-145	9	46
Toluene	54.13	46.50	86	51-120	19	47
Chlorobenzene	54.13	44.70	83	47-120	15	50

Surrogate	%REC	Limits
Dibromofluoromethane	95	78-134
1,2-Dichloroethane-d4	89	80-138
Toluene-d8	95	80-120
Bromofluorobenzene	103	78-123

RPD= Relative Percent Difference

Curtis & Tompkins, Ltd.

Semivolatile Organics by GC/MS

Lab #:	279335	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 3550B
Project#:	1610277	Analysis:	EPA 8270C
Field ID:	MW #2	Batch#:	237795
Lab ID:	279335-001	Sampled:	08/04/16
Matrix:	Soil	Received:	08/04/16
Units:	ug/Kg	Prepared:	08/08/16
Basis:	dry	Analyzed:	08/19/16
Diln Fac:	1.000		

Moisture: 8%

Analyte	Result	RL	MDL
N-Nitrosodimethylamine	ND	360	36
Phenol	ND	360	19
bis(2-Chloroethyl)ether	ND	360	14
2-Chlorophenol	ND	360	18
1,3-Dichlorobenzene	ND	360	13
1,4-Dichlorobenzene	ND	360	11
Benzyl alcohol	ND	360	17
1,2-Dichlorobenzene	ND	360	10
2-Methylphenol	ND	360	17
bis(2-Chloroisopropyl) ether	ND	360	20
4-Methylphenol	ND	360	19
N-Nitroso-di-n-propylamine	ND	360	36
Hexachloroethane	ND	360	13
Nitrobenzene	ND	360	13
Isophorone	ND	360	12
2-Nitrophenol	ND	730	11
2,4-Dimethylphenol	ND	360	15
Benzoic acid	ND	1,800	540
bis(2-Chloroethoxy)methane	ND	360	12
2,4-Dichlorophenol	ND	360	14
1,2,4-Trichlorobenzene	ND	360	11
Naphthalene	ND	73	9.5
4-Chloroaniline	ND	360	18
Hexachlorobutadiene	ND	360	66
4-Chloro-3-methylphenol	ND	360	16
2-Methylnaphthalene	ND	73	11
Hexachlorocyclopentadiene	ND	730	66
2,4,6-Trichlorophenol	ND	360	15
2,4,5-Trichlorophenol	ND	360	9.5
2-Chloronaphthalene	ND	360	60
2-Nitroaniline	ND	730	36
Dimethylphthalate	ND	360	10
Acenaphthylene	ND	73	9.3
2,6-Dinitrotoluene	ND	360	9.6
3-Nitroaniline	ND	730	36
Acenaphthene	ND	73	13
2,4-Dinitrophenol	ND	730	170
4-Nitrophenol	ND	730	75
Dibenzofuran	ND	360	9.5
2,4-Dinitrotoluene	ND	360	11
Diethylphthalate	ND	360	9.2
Fluorene	ND	73	9.7
4-Chlorophenyl-phenylether	ND	360	11
4-Nitroaniline	ND	730	36
4,6-Dinitro-2-methylphenol	ND	730	46
N-Nitrosodiphenylamine	ND	360	61
Azobenzene	ND	360	13
4-Bromophenyl-phenylether	ND	360	64
Hexachlorobenzene	ND	360	13

J= Estimated value
ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Semivolatile Organics by GC/MS

Lab #:	279335	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 3550B
Project#:	1610277	Analysis:	EPA 8270C
Field ID:	MW #2	Batch#:	237795
Lab ID:	279335-001	Sampled:	08/04/16
Matrix:	Soil	Received:	08/04/16
Units:	ug/Kg	Prepared:	08/08/16
Basis:	dry	Analyzed:	08/19/16
Diln Fac:	1.000		

Analyte	Result	RL	MDL
Pentachlorophenol	ND	730	160
Phenanthrene	11 J	73	10
Anthracene	ND	73	13
Di-n-butylphthalate	ND	360	13
Fluoranthene	ND	73	9.4
Pyrene	ND	73	10
Butylbenzylphthalate	ND	360	13
3,3'-Dichlorobenzidine	ND	730	47
Benzo(a)anthracene	ND	73	9.4
Chrysene	ND	73	13
bis(2-Ethylhexyl)phthalate	11 J	360	9.5
Di-n-octylphthalate	ND	360	9.2
Benzo(b)fluoranthene	ND	73	13
Benzo(k)fluoranthene	ND	73	9.4
Benzo(a)pyrene	ND	73	9.4
Indeno(1,2,3-cd)pyrene	ND	73	13
Dibenz(a,h)anthracene	ND	73	13
Benzo(g,h,i)perylene	ND	73	9.4

Surrogate	%REC	Limits
2-Fluorophenol	114	25-120
Phenol-d5	108	36-120
2,4,6-Tribromophenol	77	27-120
Nitrobenzene-d5	83	44-120
2-Fluorobiphenyl	89	47-120
Terphenyl-d14	93	49-120

J= Estimated value
ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Semivolatile Organics by GC/MS

Lab #:	279335	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 3550B
Project#:	1610277	Analysis:	EPA 8270C
Field ID:	SB #3	Batch#:	237795
Lab ID:	279335-002	Sampled:	08/04/16
Matrix:	Soil	Received:	08/04/16
Units:	ug/Kg	Prepared:	08/08/16
Basis:	dry	Analyzed:	08/19/16
Diln Fac:	1.000		

Moisture: 7%

Analyte	Result	RL	MDL
N-Nitrosodimethylamine	ND	360	36
Phenol	ND	360	19
bis(2-Chloroethyl)ether	ND	360	13
2-Chlorophenol	ND	360	18
1,3-Dichlorobenzene	ND	360	13
1,4-Dichlorobenzene	ND	360	11
Benzyl alcohol	ND	360	17
1,2-Dichlorobenzene	ND	360	10
2-Methylphenol	ND	360	17
bis(2-Chloroisopropyl) ether	ND	360	20
4-Methylphenol	ND	360	19
N-Nitroso-di-n-propylamine	ND	360	36
Hexachloroethane	ND	360	13
Nitrobenzene	ND	360	13
Isophorone	ND	360	12
2-Nitrophenol	ND	720	11
2,4-Dimethylphenol	ND	360	15
Benzoic acid	ND	1,800	540
bis(2-Chloroethoxy)methane	ND	360	12
2,4-Dichlorophenol	ND	360	14
1,2,4-Trichlorobenzene	ND	360	10
Naphthalene	ND	72	9.4
4-Chloroaniline	ND	360	18
Hexachlorobutadiene	ND	360	65
4-Chloro-3-methylphenol	ND	360	16
2-Methylnaphthalene	12 J	72	11
Hexachlorocyclopentadiene	ND	720	65
2,4,6-Trichlorophenol	ND	360	15
2,4,5-Trichlorophenol	ND	360	9.4
2-Chloronaphthalene	ND	360	59
2-Nitroaniline	ND	720	36
Dimethylphthalate	ND	360	10
Acenaphthylene	ND	72	9.2
2,6-Dinitrotoluene	ND	360	9.4
3-Nitroaniline	ND	720	36
Acenaphthene	ND	72	13
2,4-Dinitrophenol	ND	720	170
4-Nitrophenol	ND	720	74
Dibenzofuran	ND	360	9.4
2,4-Dinitrotoluene	ND	360	10
Diethylphthalate	ND	360	9.1
Fluorene	ND	72	9.6
4-Chlorophenyl-phenylether	ND	360	10
4-Nitroaniline	ND	720	36
4,6-Dinitro-2-methylphenol	ND	720	45
N-Nitrosodiphenylamine	ND	360	60
Azobenzene	ND	360	13
4-Bromophenyl-phenylether	ND	360	63
Hexachlorobenzene	ND	360	13

J= Estimated value
ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Semivolatile Organics by GC/MS

Lab #:	279335	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 3550B
Project#:	1610277	Analysis:	EPA 8270C
Field ID:	SB #3	Batch#:	237795
Lab ID:	279335-002	Sampled:	08/04/16
Matrix:	Soil	Received:	08/04/16
Units:	ug/Kg	Prepared:	08/08/16
Basis:	dry	Analyzed:	08/19/16
Diln Fac:	1.000		

Analyte	Result	RL	MDL
Pentachlorophenol	ND	720	160
Phenanthrene	28 J	72	10
Anthracene	ND	72	13
Di-n-butylphthalate	ND	360	13
Fluoranthene	ND	72	9.3
Pyrene	ND	72	10
Butylbenzylphthalate	ND	360	13
3,3'-Dichlorobenzidine	ND	720	46
Benzo(a)anthracene	ND	72	9.3
Chrysene	ND	72	13
bis(2-Ethylhexyl)phthalate	68 J	360	9.4
Di-n-octylphthalate	ND	360	9.1
Benzo(b)fluoranthene	ND	72	13
Benzo(k)fluoranthene	ND	72	9.3
Benzo(a)pyrene	ND	72	9.3
Indeno(1,2,3-cd)pyrene	ND	72	13
Dibenz(a,h)anthracene	ND	72	13
Benzo(g,h,i)perylene	ND	72	9.3

Surrogate	%REC	Limits
2-Fluorophenol	115	25-120
Phenol-d5	106	36-120
2,4,6-Tribromophenol	74	27-120
Nitrobenzene-d5	87	44-120
2-Fluorobiphenyl	92	47-120
Terphenyl-d14	94	49-120

J= Estimated value
ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Batch QC Report

Semivolatile Organics by GC/MS

Lab #:	279335	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 3550B
Project#:	1610277	Analysis:	EPA 8270C
Type:	BLANK	Diln Fac:	1.000
Lab ID:	QC846262	Batch#:	237795
Matrix:	Soil	Prepared:	08/08/16
Units:	ug/Kg	Analyzed:	08/09/16

Analyte	Result	RL	MDL
N-Nitrosodimethylamine	ND	330	42
Phenol	ND	330	15
bis(2-Chloroethyl)ether	ND	330	22
2-Chlorophenol	ND	330	14
1,3-Dichlorobenzene	ND	330	42
1,4-Dichlorobenzene	ND	330	42
Benzyl alcohol	ND	330	16
1,2-Dichlorobenzene	ND	330	22
2-Methylphenol	ND	330	14
bis(2-Chloroisopropyl) ether	ND	330	16
4-Methylphenol	ND	330	16
N-Nitroso-di-n-propylamine	ND	330	15
Hexachloroethane	ND	330	42
Nitrobenzene	ND	330	22
Isophorone	ND	330	10
2-Nitrophenol	ND	670	39
2,4-Dimethylphenol	ND	330	19
Benzoic acid	ND	1,700	380
bis(2-Chloroethoxy)methane	ND	330	10
2,4-Dichlorophenol	ND	330	9.3
1,2,4-Trichlorobenzene	31 J	330	22
Naphthalene	ND	67	13
4-Chloroaniline	ND	330	13
Hexachlorobutadiene	ND	330	22
4-Chloro-3-methylphenol	ND	330	8.7
2-Methylnaphthalene	ND	67	9.9
Hexachlorocyclopentadiene	ND	670	76
2,4,6-Trichlorophenol	ND	330	11
2,4,5-Trichlorophenol	ND	330	9.2
2-Chloronaphthalene	ND	330	8.4
2-Nitroaniline	ND	670	34
Dimethylphthalate	ND	330	8.4
Acenaphthylene	ND	67	8.4
2,6-Dinitrotoluene	ND	330	34
3-Nitroaniline	ND	670	42
Acenaphthene	ND	67	8.4
2,4-Dinitrophenol	ND	670	150
4-Nitrophenol	ND	670	75
Dibenzofuran	ND	330	8.4
2,4-Dinitrotoluene	ND	330	8.3
Diethylphthalate	ND	330	8.4
Fluorene	ND	67	8.4
4-Chlorophenyl-phenylether	ND	330	8.4
4-Nitroaniline	ND	670	42
4,6-Dinitro-2-methylphenol	ND	670	42
N-Nitrosodiphenylamine	ND	330	8.4
Azobenzene	ND	330	8.4
4-Bromophenyl-phenylether	ND	330	8.4
Hexachlorobenzene	ND	330	8.4
Pentachlorophenol	ND	670	100
Phenanthrene	ND	67	8.4
Anthracene	ND	67	9.0

J= Estimated value
ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Batch QC Report

Semivolatile Organics by GC/MS

Lab #:	279335	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 3550B
Project#:	1610277	Analysis:	EPA 8270C
Type:	BLANK	Diln Fac:	1.000
Lab ID:	QC846262	Batch#:	237795
Matrix:	Soil	Prepared:	08/08/16
Units:	ug/Kg	Analyzed:	08/09/16

Analyte	Result	RL	MDL
Di-n-butylphthalate	ND	330	9.5
Fluoranthene	ND	67	9.4
Pyrene	ND	67	8.4
Butylbenzylphthalate	ND	330	9.6
3,3'-Dichlorobenzidine	ND	670	79
Benzo(a)anthracene	ND	67	8.4
Chrysene	ND	67	8.4
bis(2-Ethylhexyl)phthalate	ND	330	8.5
Di-n-octylphthalate	ND	330	34
Benzo(b)fluoranthene	ND	67	8.4
Benzo(k)fluoranthene	ND	67	8.4
Benzo(a)pyrene	ND	67	8.4
Indeno(1,2,3-cd)pyrene	ND	67	8.4
Dibenz(a,h)anthracene	ND	67	8.4
Benzo(g,h,i)perylene	ND	67	8.4

Surrogate	%REC	Limits
2-Fluorophenol	70	25-120
Phenol-d5	72	36-120
2,4,6-Tribromophenol	32	27-120
Nitrobenzene-d5	54	44-120
2-Fluorobiphenyl	58	47-120
Terphenyl-d14	52	49-120

J= Estimated value
ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Batch QC Report

Semivolatile Organics by GC/MS

Lab #:	279335	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 3550B
Project#:	1610277	Analysis:	EPA 8270C
Type:	LCS	Diln Fac:	2.000
Lab ID:	QC846263	Batch#:	237795
Matrix:	Soil	Prepared:	08/08/16
Units:	ug/Kg	Analyzed:	08/09/16

Analyte	Spiked	Result	%REC	Limits
Phenol	2,661	2,043	77	42-120
2-Chlorophenol	2,661	2,089	78	45-120
1,4-Dichlorobenzene	2,661	2,281	86	48-120
N-Nitroso-di-n-propylamine	2,661	2,340	88	27-123
1,2,4-Trichlorobenzene	2,661	2,400	90	50-120
4-Chloro-3-methylphenol	2,661	2,126	80	59-120
Acenaphthene	998.0	739.2	74	53-120
4-Nitrophenol	2,661	1,965	74	47-120
2,4-Dinitrotoluene	2,661	2,245	84	55-120
Pentachlorophenol	2,661	1,291	48	32-120
Pyrene	998.0	764.1	77	52-120

Surrogate	%REC	Limits
2-Fluorophenol	63	25-120
Phenol-d5	66	36-120
2,4,6-Tribromophenol	70	27-120
Nitrobenzene-d5	53	44-120
2-Fluorobiphenyl	60	47-120
Terphenyl-d14	51	49-120

Curtis & Tompkins, Ltd.

Organochlorine Pesticides

Lab #:	279335	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 3550B
Project#:	1610277	Analysis:	EPA 8081A
Field ID:	MW #2	Batch#:	237742
Lab ID:	279335-001	Sampled:	08/04/16
Matrix:	Soil	Received:	08/04/16
Units:	ug/Kg	Prepared:	08/05/16
Basis:	dry	Analyzed:	08/08/16
Diln Fac:	1.000		

Moisture: 8%

Analyte	Result	RL	MDL
alpha-BHC	ND	1.9	0.27
beta-BHC	ND	1.9	0.44
gamma-BHC	ND	1.9	0.43
delta-BHC	ND	1.9	0.22
Heptachlor	ND	1.9	0.41
Aldrin	ND	1.9	0.46
Heptachlor epoxide	ND	1.9	0.27
Endosulfan I	ND	1.9	0.35
Dieldrin	ND	1.9	0.51
4,4'-DDE	ND	3.6	0.48
Endrin	ND	3.6	0.64
Endosulfan II	ND	3.6	0.53
Endosulfan sulfate	ND	3.6	0.53
4,4'-DDD	ND	3.6	0.51
Endrin aldehyde	ND	3.6	0.43
4,4'-DDT	ND	3.6	0.48
alpha-Chlordane	ND	1.9	0.28
gamma-Chlordane	ND	1.9	0.40
Methoxychlor	ND	19	2.9
Toxaphene	ND	66	16

Surrogate	%REC	Limits
TCMX	110	44-125
Decachlorobiphenyl	95	39-121

ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Organochlorine Pesticides

Lab #:	279335	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 3550B
Project#:	1610277	Analysis:	EPA 8081A
Field ID:	SB #3	Batch#:	237742
Lab ID:	279335-002	Sampled:	08/04/16
Matrix:	Soil	Received:	08/04/16
Units:	ug/Kg	Prepared:	08/05/16
Basis:	dry	Analyzed:	08/08/16
Diln Fac:	1.000		

Moisture: 7%

Analyte	Result	RL	MDL
alpha-BHC	ND	1.8	0.26
beta-BHC	ND	1.8	0.42
gamma-BHC	ND	1.8	0.42
delta-BHC	ND	1.8	0.22
Heptachlor	ND	1.8	0.39
Aldrin	ND	1.8	0.44
Heptachlor epoxide	ND	1.8	0.26
Endosulfan I	ND	1.8	0.34
Dieldrin	ND	1.8	0.50
4,4'-DDE	ND	3.5	0.47
Endrin	ND	3.5	0.62
Endosulfan II	ND	3.5	0.52
Endosulfan sulfate	ND	3.5	0.51
4,4'-DDD	ND	3.5	0.50
Endrin aldehyde	ND	3.5	0.42
4,4'-DDT	ND	3.5	0.46
alpha-Chlordane	ND	1.8	0.27
gamma-Chlordane	ND	1.8	0.38
Methoxychlor	ND	18	2.8
Toxaphene	ND	64	15

Surrogate	%REC	Limits
TCMX	101	44-125
Decachlorobiphenyl	94	39-121

ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Batch QC Report

Organochlorine Pesticides

Lab #:	279335	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 3550B
Project#:	1610277	Analysis:	EPA 8081A
Type:	BLANK	Diln Fac:	1.000
Lab ID:	QC846053	Batch#:	237742
Matrix:	Soil	Prepared:	08/05/16
Units:	ug/Kg	Analyzed:	08/08/16

Analyte	Result	RL	MDL
alpha-BHC	ND	0.86	0.12
beta-BHC	ND	0.86	0.20
gamma-BHC	ND	0.86	0.20
delta-BHC	ND	0.86	0.10
Heptachlor	ND	0.86	0.19
Aldrin	ND	0.86	0.21
Heptachlor epoxide	ND	0.86	0.12
Endosulfan I	ND	0.86	0.16
Dieldrin	ND	0.86	0.23
4,4'-DDE	ND	1.7	0.22
Endrin	ND	1.7	0.29
Endosulfan II	ND	1.7	0.24
Endosulfan sulfate	ND	1.7	0.24
4,4'-DDD	ND	1.7	0.24
Endrin aldehyde	ND	1.7	0.20
4,4'-DDT	ND	1.7	0.22
alpha-Chlordane	ND	0.86	0.13
gamma-Chlordane	ND	0.86	0.18
Methoxychlor	ND	8.6	1.3
Toxaphene	ND	30	7.3

Surrogate	%REC	Limits
TCMX	86	44-125
Decachlorobiphenyl	76	39-121

ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Batch QC Report

Organochlorine Pesticides

Lab #:	279335	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 3550B
Project#:	1610277	Analysis:	EPA 8081A
Type:	LCS	Diln Fac:	1.000
Lab ID:	QC846054	Batch#:	237742
Matrix:	Soil	Prepared:	08/05/16
Units:	ug/Kg	Analyzed:	08/08/16

Analyte	Spiked	Result	%REC	Limits
gamma-BHC	13.18	14.17	107	44-121
Heptachlor	13.18	14.18	108	45-129
Aldrin	13.18	14.15	107	45-120
Dieldrin	13.18	13.40 #	102	49-131
Endrin	13.18	12.12	92	43-135
4,4'-DDT	13.18	10.06	76	37-141

Surrogate	%REC	Limits
TCMX	108	44-125
Decachlorobiphenyl	87	39-121

#= CCV drift outside limits; average CCV drift within limits per method requirements

Curtis & Tompkins, Ltd.

Polychlorinated Biphenyls (PCBs)

Lab #:	279335	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 3550B
Project#:	1610277	Analysis:	EPA 8082
Matrix:	Soil	Sampled:	08/04/16
Units:	ug/Kg	Received:	08/04/16
Basis:	dry	Prepared:	08/08/16
Diln Fac:	1.000	Analyzed:	08/09/16
Batch#:	237812		

Field ID: MW #2 Lab ID: 279335-001
Type: SAMPLE Moisture: 8%

Analyte	Result	RL	MDL
Aroclor-1016	ND	13	3.2
Aroclor-1221	ND	26	8.6
Aroclor-1232	ND	13	4.2
Aroclor-1242	ND	13	3.9
Aroclor-1248	ND	13	4.1
Aroclor-1254	ND	13	3.3
Aroclor-1260	ND	13	2.1

Surrogate	%REC	Limits
Decachlorobiphenyl	94	25-135

Field ID: SB #3 Lab ID: 279335-002
Type: SAMPLE Moisture: 7%

Analyte	Result	RL	MDL
Aroclor-1016	ND	13	3.2
Aroclor-1221	ND	26	8.5
Aroclor-1232	ND	13	4.2
Aroclor-1242	ND	13	3.8
Aroclor-1248	ND	13	4.1
Aroclor-1254	ND	13	3.3
Aroclor-1260	ND	13	2.1

Surrogate	%REC	Limits
Decachlorobiphenyl	89	25-135

Type: BLANK Lab ID: QC846342

Analyte	Result	RL	MDL
Aroclor-1016	ND	4.8	1.2
Aroclor-1221	ND	9.6	3.2
Aroclor-1232	ND	4.8	1.5
Aroclor-1242	ND	4.8	1.4
Aroclor-1248	ND	4.8	1.5
Aroclor-1254	ND	4.8	1.2
Aroclor-1260	ND	4.8	0.77

Surrogate	%REC	Limits
Decachlorobiphenyl	107	25-135

ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Batch QC Report

Polychlorinated Biphenyls (PCBs)

Lab #:	279335	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 3550B
Project#:	1610277	Analysis:	EPA 8082
Type:	LCS	Diln Fac:	1.000
Lab ID:	QC846343	Batch#:	237812
Matrix:	Soil	Prepared:	08/08/16
Units:	ug/Kg	Analyzed:	08/09/16

Analyte	Spiked	Result	%REC	Limits
Aroclor-1016	165.6	174.4	105	64-140
Aroclor-1260	165.6	155.8	94	65-146

Surrogate	%REC	Limits
Decachlorobiphenyl	92	25-135

Curtis & Tompkins, Ltd.

Batch QC Report

Polychlorinated Biphenyls (PCBs)

Lab #:	279335	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 3550B
Project#:	1610277	Analysis:	EPA 8082
Field ID:	ZZZZZZZZZZ	Batch#:	237812
MSS Lab ID:	279347-002	Sampled:	08/04/16
Matrix:	Soil	Received:	08/04/16
Units:	ug/Kg	Prepared:	08/08/16
Basis:	as received	Analyzed:	08/09/16
Diln Fac:	1.000		

Type: MS Lab ID: QC846344

Analyte	MSS Result	Spiked	Result	%REC	Limits
Aroclor-1016	<2.952	166.2	159.0	96	60-161
Aroclor-1260	38.23	166.2	248.9	127	42-166

Surrogate	%REC	Limits
Decachlorobiphenyl	91	25-135

Type: MSD Lab ID: QC846345

Analyte	Spiked	Result	%REC	Limits	RPD	Lim
Aroclor-1016	166.6	158.4	95	60-161	1	43
Aroclor-1260	166.6	269.4	139	42-166	8	51

Surrogate	%REC	Limits
Decachlorobiphenyl	90	25-135

RPD= Relative Percent Difference

Curtis & Tompkins, Ltd.

California Title 22 Metals

Lab #:	279335	Project#:	1610277
Client:	GEI Consultants, Inc.	Location:	Former Nursery Detention Basin
Field ID:	MW #2	Basis:	dry
Lab ID:	279335-001	Sampled:	08/04/16
Matrix:	Soil	Received:	08/04/16
Units:	mg/Kg		

Moisture: 8%

Analyte	Result	RL	MDL	Diln Fac	Batch#	Prepared	Analyzed	Prep	Analysis
Antimony	0.23 J	2.2	0.081	25.00	237809	08/08/16	08/13/16	EPA 3050B	EPA 6020
Arsenic	7.8	0.27	0.075	25.00	237809	08/08/16	08/13/16	EPA 3050B	EPA 6020
Barium	200	0.27	0.055	25.00	237809	08/08/16	08/13/16	EPA 3050B	EPA 6020
Beryllium	0.55	0.27	0.052	25.00	237809	08/08/16	08/13/16	EPA 3050B	EPA 6020
Cadmium	0.090 J	0.27	0.030	25.00	237809	08/08/16	08/13/16	EPA 3050B	EPA 6020
Chromium	110	0.27	0.079	25.00	237809	08/08/16	08/13/16	EPA 3050B	EPA 6020
Cobalt	19	0.27	0.050	25.00	237809	08/08/16	08/13/16	EPA 3050B	EPA 6020
Copper	28	0.68	0.11	25.00	237809	08/08/16	08/29/16	EPA 3050B	EPA 6020
Lead	9.5	0.27	0.073	25.00	237809	08/08/16	08/13/16	EPA 3050B	EPA 6020
Mercury	0.17	0.019	0.0034	1.000	238064	08/15/16	08/16/16	METHOD	EPA 7471A
Molybdenum	0.21 J	0.27	0.082	25.00	237809	08/08/16	08/13/16	EPA 3050B	EPA 6020
Nickel	120	0.27	0.077	25.00	237809	08/08/16	08/13/16	EPA 3050B	EPA 6020
Selenium	0.19 J	2.2	0.076	25.00	237809	08/08/16	08/13/16	EPA 3050B	EPA 6020
Silver	0.050 J	0.27	0.030	25.00	237809	08/08/16	08/13/16	EPA 3050B	EPA 6020
Thallium	0.055 J	0.27	0.054	25.00	237809	08/08/16	08/13/16	EPA 3050B	EPA 6020
Vanadium	54	0.33	0.11	25.00	237809	08/08/16	08/13/16	EPA 3050B	EPA 6020
Zinc	72	1.1	0.27	25.00	237809	08/08/16	08/13/16	EPA 3050B	EPA 6020

J= Estimated value
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

California Title 22 Metals

Lab #:	279335	Project#:	1610277
Client:	GEI Consultants, Inc.	Location:	Former Nursery Detention Basin
Field ID:	SB #3	Basis:	dry
Lab ID:	279335-002	Sampled:	08/04/16
Matrix:	Soil	Received:	08/04/16
Units:	mg/Kg		

Moisture: 7%

Analyte	Result	RL	MDL	Diln Fac	Batch#	Prepared	Analyzed	Prep	Analysis
Antimony	0.13 J	2.2	0.082	25.00	237809	08/08/16	08/29/16	EPA 3050B	EPA 6020
Arsenic	5.8	0.27	0.075	25.00	237809	08/08/16	08/29/16	EPA 3050B	EPA 6020
Barium	170	0.27	0.056	25.00	237809	08/08/16	08/29/16	EPA 3050B	EPA 6020
Beryllium	0.55	0.27	0.052	25.00	237809	08/08/16	08/29/16	EPA 3050B	EPA 6020
Cadmium	0.080 J	0.27	0.030	25.00	237809	08/08/16	08/29/16	EPA 3050B	EPA 6020
Chromium	68	0.27	0.080	25.00	237809	08/08/16	08/29/16	EPA 3050B	EPA 6020
Cobalt	17	0.27	0.050	25.00	237809	08/08/16	08/29/16	EPA 3050B	EPA 6020
Copper	29	0.33	0.11	25.00	237809	08/08/16	08/30/16	EPA 3050B	EPA 6020
Lead	10	0.27	0.073	25.00	237809	08/08/16	08/29/16	EPA 3050B	EPA 6020
Mercury	0.66	0.018	0.0033	1.000	238064	08/15/16	08/16/16	METHOD	EPA 7471A
Molybdenum	0.44	0.27	0.082	25.00	237809	08/08/16	08/29/16	EPA 3050B	EPA 6020
Nickel	89	0.27	0.078	25.00	237809	08/08/16	08/29/16	EPA 3050B	EPA 6020
Selenium	0.14 J	2.2	0.077	25.00	237809	08/08/16	08/29/16	EPA 3050B	EPA 6020
Silver	0.063 J	0.27	0.031	25.00	237809	08/08/16	08/29/16	EPA 3050B	EPA 6020
Thallium	0.057 J	0.27	0.055	25.00	237809	08/08/16	08/29/16	EPA 3050B	EPA 6020
Vanadium	44	0.69	0.11	25.00	237809	08/08/16	08/29/16	EPA 3050B	EPA 6020
Zinc	62	1.1	0.27	25.00	237809	08/08/16	08/29/16	EPA 3050B	EPA 6020

J= Estimated value
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Batch QC Report

California Title 22 Metals

Lab #:	279335	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 3050B
Project#:	1610277	Analysis:	EPA 6020
Type:	BLANK	Diln Fac:	25.00
Lab ID:	QC846328	Batch#:	237809
Matrix:	Soil	Prepared:	08/08/16
Units:	mg/Kg	Analyzed:	08/08/16

Analyte	Result	RL	MDL
Antimony	ND	2.0	0.077
Arsenic	0.21 J	0.25	0.071
Barium	ND	0.25	0.052
Beryllium	ND	0.25	0.049
Cadmium	ND	0.25	0.029
Chromium	0.47 b	0.25	0.075
Cobalt	ND	0.25	0.047
Copper	ND	0.31	0.10
Lead	ND	0.25	0.069
Molybdenum	ND	0.25	0.077
Nickel	ND	0.25	0.073
Selenium	ND	2.0	0.072
Silver	ND	0.25	0.029
Thallium	ND	0.25	0.052
Vanadium	0.17 J	0.31	0.10
Zinc	0.43 J	1.0	0.25

J= Estimated value
b= See narrative
ND= Not Detected at or above MDL
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Batch QC Report

California Title 22 Metals

Lab #:	279335	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 3050B
Project#:	1610277	Analysis:	EPA 6020
Matrix:	Soil	Batch#:	237809
Units:	mg/Kg	Prepared:	08/08/16
Diln Fac:	25.00	Analyzed:	08/08/16

Type: BS Lab ID: QC846329

Analyte	Spiked	Result	%REC	Limits
Antimony	24.51	22.22	91	80-120
Arsenic	24.51	24.33	99	80-121
Barium	24.51	25.17	103	80-121
Beryllium	12.25	11.87	97	80-120
Cadmium	24.51	23.24	95	80-120
Chromium	24.51	25.05	102	80-131
Cobalt	24.51	24.79	101	80-132
Copper	24.51	22.06	90	80-137
Lead	24.51	24.50	100	80-125
Molybdenum	24.51	23.39	95	80-120
Nickel	24.51	24.78	101	77-141
Selenium	24.51	23.84	97	80-129
Silver	2.451	2.456	100	80-122
Thallium	24.51	23.82	97	80-120
Vanadium	24.51	23.80	97	80-128
Zinc	24.51	24.60	100	80-133

Type: BSD Lab ID: QC846330

Analyte	Spiked	Result	%REC	Limits	RPD	Lim
Antimony	24.27	21.29	88	80-120	3	20
Arsenic	24.27	23.51	97	80-121	2	21
Barium	24.27	23.99	99	80-121	4	20
Beryllium	12.14	11.12	92	80-120	6	20
Cadmium	24.27	22.66	93	80-120	2	20
Chromium	24.27	24.32	100	80-131	2	25
Cobalt	24.27	24.32	100	80-132	1	24
Copper	24.27	21.41	88	80-137	2	27
Lead	24.27	23.39	96	80-125	4	20
Molybdenum	24.27	22.62	93	80-120	2	20
Nickel	24.27	23.62	97	77-141	4	29
Selenium	24.27	23.26	96	80-129	1	22
Silver	2.427	2.250	93	80-122	8	20
Thallium	24.27	22.92	94	80-120	3	20
Vanadium	24.27	22.85	94	80-128	3	24
Zinc	24.27	23.52	97	80-133	3	23

RPD= Relative Percent Difference

Curtis & Tompkins, Ltd.

Batch QC Report

California Title 22 Metals

Lab #:	279335	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	EPA 3050B
Project#:	1610277	Analysis:	EPA 6020
Field ID:	ZZZZZZZZZZ	Batch#:	237809
MSS Lab ID:	279117-003	Sampled:	07/26/16
Matrix:	Soil	Received:	07/28/16
Units:	mg/Kg	Prepared:	08/08/16
Basis:	as received	Analyzed:	08/08/16
Diln Fac:	25.00		

Type: MS Lab ID: QC846331

Analyte	MSS Result	Spiked	Result	%REC	Limits
Antimony	0.1860	26.32	13.79	52	21-120
Arsenic	10.05	26.32	36.50	101	75-122
Barium	27.36	26.32	49.12	83	54-148
Beryllium	0.06667	13.16	12.69	96	80-120
Cadmium	<0.02565	26.32	24.92	95	80-120
Chromium	20.47	26.32	47.05	101	60-158
Cobalt	5.534	26.32	31.29	98	73-142
Copper	1.791	26.32	27.46	98	59-150
Lead	1.692	26.32	26.70	95	68-137
Molybdenum	0.4329	26.32	23.96	89	71-120
Nickel	23.53	26.32	48.61	95	57-161
Selenium	<0.06483	26.32	24.70	94	75-128
Silver	<0.02583	2.632	2.547	97	77-120
Thallium	<0.04630	26.32	24.87	95	76-120
Vanadium	18.18	26.32	42.68	93	65-150
Zinc	18.17	26.32	44.64	101	44-158

Type: MSD Lab ID: QC846332

Analyte	Spiked	Result	%REC	Limits	RPD	Lim
Antimony	24.04	11.72	48	21-120	7	29
Arsenic	24.04	32.30	93	75-122	6	24
Barium	24.04	41.79	60	54-148	12	28
Beryllium	12.02	11.34	94	80-120	2	20
Cadmium	24.04	22.70	94	80-120	0	20
Chromium	24.04	43.55	96	60-158	3	36
Cobalt	24.04	29.05	98	73-142	0	34
Copper	24.04	37.09	147	59-150	38	52
Lead	24.04	26.13	102	68-137	6	32
Molybdenum	24.04	21.68	88	71-120	1	20
Nickel	24.04	46.41	95	57-161	0	47
Selenium	24.04	22.85	95	75-128	1	20
Silver	2.404	2.351	98	77-120	1	20
Thallium	24.04	22.57	94	76-120	1	20
Vanadium	24.04	40.52	93	65-150	0	28
Zinc	24.04	46.81	119	44-158	10	33

RPD= Relative Percent Difference

Curtis & Tompkins, Ltd.

Batch QC Report

California Title 22 Metals

Lab #:	279335	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	METHOD
Project#:	1610277	Analysis:	EPA 7471A
Analyte:	Mercury	Diln Fac:	1.000
Type:	BLANK	Batch#:	238064
Lab ID:	QC847358	Prepared:	08/15/16
Matrix:	Soil	Analyzed:	08/15/16
Units:	mg/Kg		

Result	RL	MDL
0.0058 J	0.016	0.0029

J= Estimated value
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Batch QC Report

California Title 22 Metals

Lab #:	279335	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	METHOD
Project#:	1610277	Analysis:	EPA 7471A
Analyte:	Mercury	Batch#:	238064
Matrix:	Soil	Prepared:	08/15/16
Units:	mg/Kg	Analyzed:	08/16/16
Diln Fac:	1.000		

Type	Lab ID	Spiked	Result	%REC	Limits	RPD	Lim
BS	QC847359	0.2083	0.1913	92	80-120		
BSD	QC847360	0.2049	0.1943	95	80-120	3	20

RPD= Relative Percent Difference

Curtis & Tompkins, Ltd.

Batch QC Report

California Title 22 Metals

Lab #:	279335	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	METHOD
Project#:	1610277	Analysis:	EPA 7471A
Analyte:	Mercury	Diln Fac:	1.000
Field ID:	ZZZZZZZZZZ	Batch#:	238064
MSS Lab ID:	279344-001	Sampled:	08/03/16
Matrix:	Soil	Received:	08/03/16
Units:	mg/Kg	Prepared:	08/15/16
Basis:	as received	Analyzed:	08/15/16

Type	Lab ID	MSS Result	Spiked	Result	%REC	Limits	RPD	Lim
MS	QC847361	0.2728	0.2016	0.4747	100	69-142		
MSD	QC847362		0.1953	0.4610	96	69-142	2	36

RPD= Relative Percent Difference

Curtis & Tompkins, Ltd.

Total Organic Carbon (TOC)

Lab #:	279335	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	METHOD
Project#:	1610277	Analysis:	WALKLEY-BLACK
Analyte:	Total Organic Carbon	Batch#:	237846
Matrix:	Soil	Sampled:	08/04/16
Units:	%	Received:	08/04/16
Basis:	dry	Analyzed:	08/08/16
Diln Fac:	1.000		

Field ID	Type	Lab ID	Result	RL	Moisture
MW #2	SAMPLE	279335-001	0.86	0.05	8%
SB #3	SAMPLE	279335-002	0.43	0.05	7%
	BLANK	QC846469	ND	0.01	

ND= Not Detected
RL= Reporting Limit

Curtis & Tompkins, Ltd.

Batch QC Report

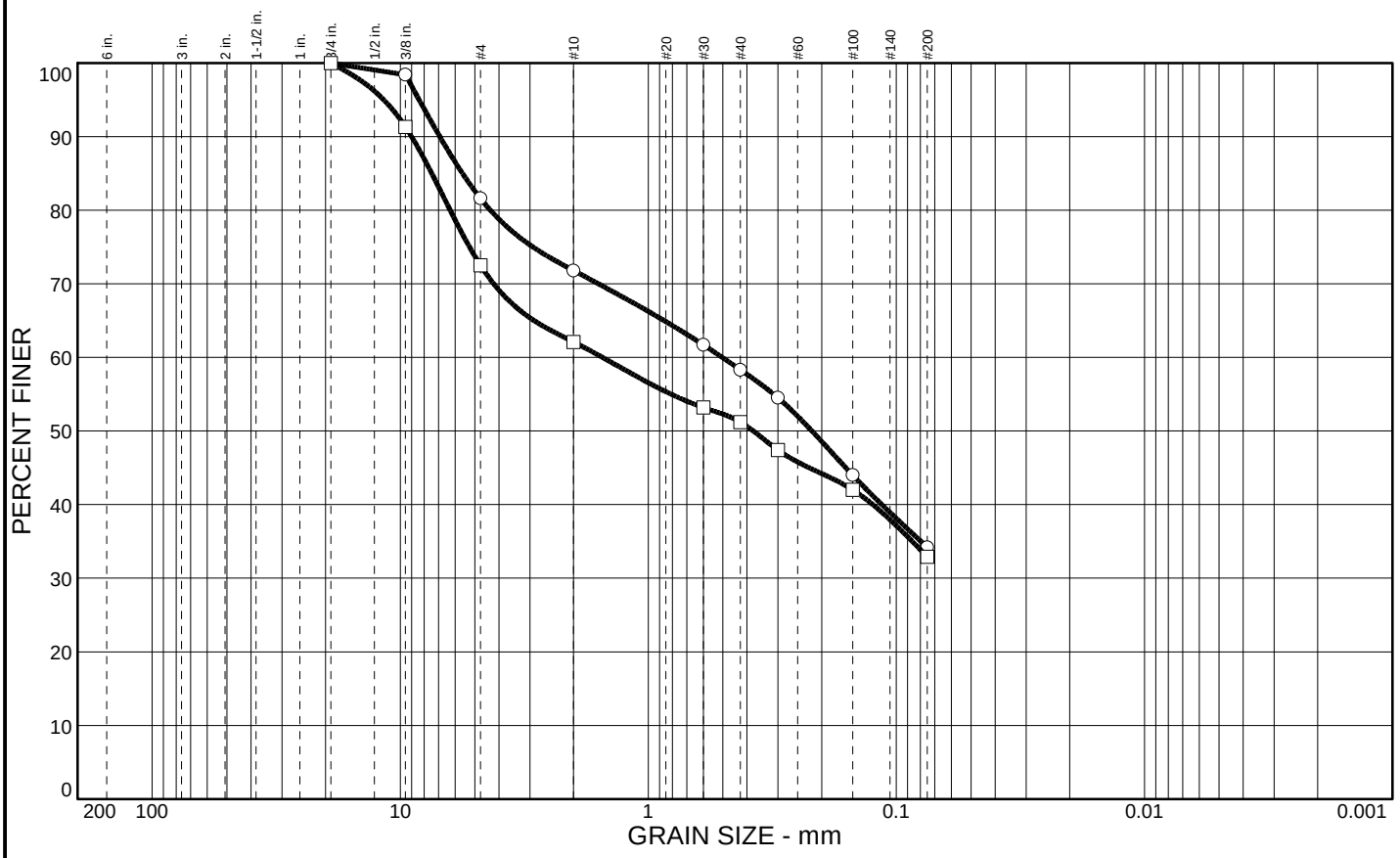
Total Organic Carbon (TOC)

Lab #:	279335	Location:	Former Nursery Detention Basin
Client:	GEI Consultants, Inc.	Prep:	METHOD
Project#:	1610277	Analysis:	WALKLEY-BLACK
Analyte:	Total Organic Carbon	Diln Fac:	1.000
Field ID:	MW #1	Batch#:	237846
MSS Lab ID:	279328-001	Sampled:	08/03/16
Matrix:	Soil	Received:	08/03/16
Units:	%	Analyzed:	08/08/16
Basis:	dry		

Type	Lab ID	MSS Result	Spiked	Result	%REC	Limits	Moisture	RPD	Lim
LCS	QC846470		0.1300	0.1240	95	80-120			
MS	QC846471	1.020	0.7030	1.655	90	66-120	8%		
MSD	QC846472		0.6996	1.579	80	66-120	8%	5	20

RPD= Relative Percent Difference

Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		18.4	47.4	34.2					
□		27.5	39.6	32.9					

SIEVE inches size	PERCENT FINER ○	□	
3/4"	100.0	100.0	
3/8"	98.4	91.3	
	GRAIN SIZE		
D_{60}	0.504	1.53	
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	
#4	81.6	72.5	
#10	71.8	62.1	
#30	61.7	53.2	
#40	58.3	51.2	
#50	54.5	47.4	
#100	44.0	42.0	
#200	34.2	32.9	

SOIL DESCRIPTION

○ Yellowish Brown Clayey SAND w/ Gravel

□ Olive Brown Clayey SAND w/ Gravel

REMARKS:

○

□

○ Source: MW #2

□ Source: SB #3

COOPER TESTING LABORATORY

Client: Curtis & Tompkins

Project: Nursery Detention Basin - 279335

Project No.: 202-067

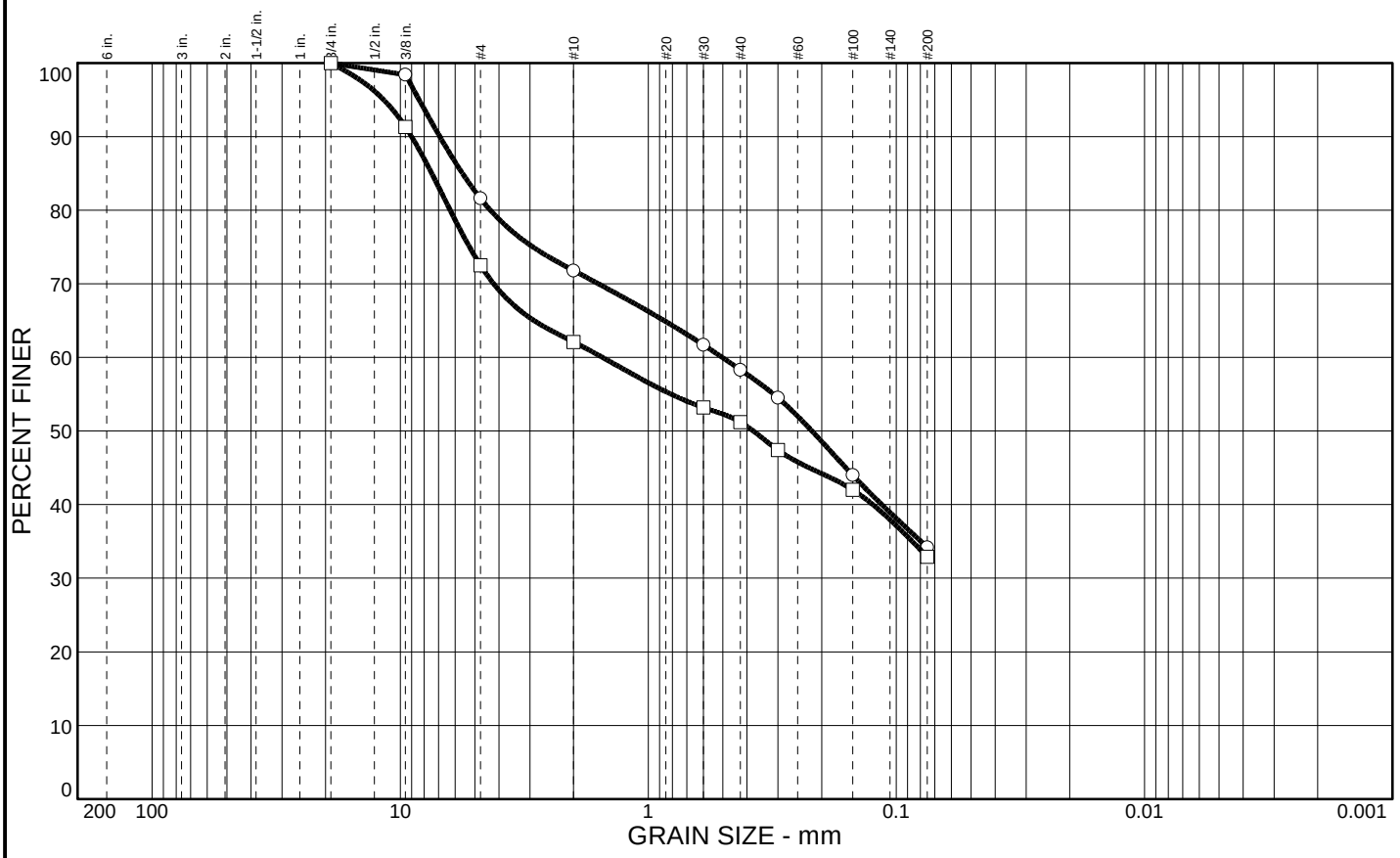
Figure

Laboratory Job Number 279335

Subcontracted Products

Cooper Testing Labs

Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		18.4	47.4	34.2					
□		27.5	39.6	32.9					

SIEVE inches size	PERCENT FINER ○	□	
3/4"	100.0	100.0	
3/8"	98.4	91.3	
	GRAIN SIZE		
D_{60}	0.504	1.53	
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	
#4	81.6	72.5	
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#30	61.7	53.2	
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#50	54.5	47.4	
#100	44.0	42.0	
#200	34.2	32.9	

SOIL DESCRIPTION

○ Yellowish Brown Clayey SAND w/ Gravel

□ Olive Brown Clayey SAND w/ Gravel

REMARKS:

○

□

○ Source: MW #2

□ Source: SB #3

COOPER TESTING LABORATORY

Client: Curtis & Tompkins

Project: Nursery Detention Basin - 279335

Project No.: 202-067

Figure

Appendix D

Transducer Installation Records, Calibration Reports, and CD of Operation Manual

Table D-1 - Transducer Installation Records

Former Nursery Detention Basin Project, Marin County Flood Control and Water Conservation District

Piezometer	Ground Surface Elevation (feet)[1]	Height of Vault Above Ground Surface (feet)	Date	Time	Manual Depth to Water From Top of Vault (feet)	Transducer Pressure Reading (psi)[2]	Absolute Pressure Reading (psi)	Height of Water Above Transducer (feet)	Calculated Transducer Elevation (feet)	Transducer Elevation for Pressure Conversion (feet)
MW#1	233.9	0.17	12/5/2016	2:05 PM	8.71	19.11	4.48	10.33	215.03	**215.02**
			11/23/2016	11:05 AM	8.84	19.18	4.43	10.22	215.01	
MW#2	234.6	0.08	12/5/2016	2:40 PM	8.78	19.49	4.86	11.22	214.68	**214.70**
			11/23/2016	10:00 AM	9.00	19.51	4.75	10.97	214.71	
MW#3	232.9	0.08	12/5/2016	3:00 PM	8.31	19.37	4.74	10.95	213.72	**213.73**
			11/23/2016	10:35 AM	8.52	19.40	4.64	10.72	213.74	
Baro	N/A	N/A	12/5/2016	2:00 PM	N/A	14.64	0.00	0.00	N/A	N/A
			12/5/2016	3:00 PM	N/A	14.63	0.00	0.00	N/A	N/A
			11/23/2016	12:00 PM	N/A	14.76	0.00	0.00	N/A	N/A

Notes:

[1]Existing Ground Elevations (ft) obtained from MCFCWD LiDAR assembled in 2011 and revised in 2013 (6th edition, dated 12/18/2013)

[2]Readings from transducer collected on 11/23/16 at 11:00 AM & 12:00 PM; 12/5/16 at 2:00 PM

MW-1

In-Situ Inc.

Calibration Report

Report Number: 20160928155447-478804

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Rugged TROLL 200**
Full Scale Depth Range:	**0- 30 Ft (0- 9 m)**
Serial Number:	**478804**
Hardware Version:	0
Firmware Version:	1.02

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2016-09-28 15:54:47 (UTC)
Nominal Range of Applied Temperature:	0 C to +50 C
Temperature Accuracy Specification:	+/- 0.3 C From 0 C to +50 C
Nominal Range of Applied Pressure:	7 PSI - 30 PSI Absolute
Pressure Accuracy Specification:	Typical +/-0.1% FS, Maximum +/-0.3% FS

Post-Calibration Check:

Parameter	Applied	Reported	Deviation	Unit
Depth	35.7452	35.7479	0.0027	FT
Depth	18.0596	18.0641	0.0045	FT
Depth	0.3756	0.3750	-0.0005	FT
Temperature	19.9755	19.9323	-0.0432	C

Calibration Procedures and Equipment Used:

Manu MENSOR Model 600 SerialNo 621434
Manu Agilent Model 53131A-010 SerialNo MY47000169
Manu Instrulab Model 406X-0031-01 SerialNo 2-31140
Manu Instrulab Model 3312A-14-15-24 SerialNo 31139
Manu Agilent Model 34970A SerialNo MY44038788

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. Pressure calibration is conducted in units of PSI Absolute.
4. The total range of applied pressure includes pressure due to both the water column and 1 bar of atmosphere.
5. The pressure accuracy specification is in terms of the full-scale capability of the pressure sensor (i.e. maximum water depth + 1 bar atmosphere).
6. The Post-Calibration data is expressed, for convenience, in terms of water depth. An ambient barometric pressure of 1 bar is assumed.
7. Conversion factors: 2.30666 FT/PSI, 14.50377 PSI/bar.

Performed By: TG

MW-2

In-Situ Inc.

Calibration Report

Report Number: 20160928155333-478802

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Rugged TROLL 200**
Full Scale Depth Range:	**0- 30 Ft (0- 9 m)**
Serial Number:	**478802**
Hardware Version:	0
Firmware Version:	1.02

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2016-09-28 15:53:03 (UTC)
Nominal Range of Applied Temperature:	0 C to +50 C
Temperature Accuracy Specification:	+/- 0.3 C From 0 C to +50 C
Nominal Range of Applied Pressure:	7 PSI - 30 PSI Absolute
Pressure Accuracy Specification:	Typical +/-0.1% FS, Maximum +/-0.3% FS

Post-Calibration Check:

Parameter	Applied	Reported	Deviation	Unit
Depth	35.7450	35.7414	-0.0036	FT
Depth	18.0594	18.0516	-0.0078	FT
Depth	0.3754	0.3797	0.0044	FT
Temperature	19.8705	19.8818	0.0113	C

Calibration Procedures and Equipment Used:

Manu MENSOR Model 600 SerialNo 621384
Manu Agilent Model 53131A-010 SerialNo MY40012869
Manu Instrulab Model 406X-0031-01 SerialNo 3-31103
Manu Instrulab Model 3312A-14-15-24 SerialNo 31140

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. Pressure calibration is conducted in units of PSI Absolute.
4. The total range of applied pressure includes pressure due to both the water column and 1 bar of atmosphere.
5. The pressure accuracy specification is in terms of the full-scale capability of the pressure sensor (i.e. maximum water depth + 1 bar atmosphere).
6. The Post-Calibration data is expressed, for convenience, in terms of water depth. An ambient barometric pressure of 1 bar is assumed.
7. Conversion factors: 2.30666 FT/PSI, 14.50377 PSI/bar.

Performed By: TG

MW-3

In-Situ Inc.

Calibration Report

Report Number: 20160419154829-454884

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Rugged TROLL 200**
Full Scale Depth Range:	**0- 30 Ft (0- 9 m)**
Serial Number:	**454884**
Hardware Version:	0
Firmware Version:	1.02

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2016-04-19 15:48:29 (UTC)
Nominal Range of Applied Temperature:	0 C to +50 C
Temperature Accuracy Specification:	+/- 0.3 C From 0 C to +50 C
Nominal Range of Applied Pressure:	7 PSI - 30 PSI Absolute
Pressure Accuracy Specification:	Typical +/-0.1% FS, Maximum +/-0.3% FS

Post-Calibration Check:

Parameter	Applied	Reported	Deviation	Unit
Depth	35.7454	35.7428	-0.0027	FT
Depth	18.0598	18.0584	-0.0015	FT
Depth	0.3747	0.3767	0.0021	FT
Temperature	19.9885	19.9421	-0.0464	C

Calibration Procedures and Equipment Used:

Manu MENSOR Model 600 SerialNo 621384
Manu Agilent Model 53131A-010 SerialNo MY47000169
Manu Instrulab Model 406X-0031-01 SerialNo 31098-2
Manu Instrulab Model 3312A-14-15-24 SerialNo 31139

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. Pressure calibration is conducted in units of PSI Absolute.
4. The total range of applied pressure includes pressure due to both the water column and 1 bar of atmosphere.
5. The pressure accuracy specification is in terms of the full-scale capability of the pressure sensor (i.e. maximum water depth + 1 bar atmosphere).
6. The Post-Calibration data is expressed, for convenience, in terms of water depth. An ambient barometric pressure of 1 bar is assumed.
7. Conversion factors: 2.30666 FT/PSI, 14.50377 PSI/bar.

Performed By: KK

In-Situ Inc.

Calibration Report

Report Number: 20160921203032-477615

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Rugged BaroTROLL**
Full Scale Depth Range:	**0- 15 Ft (0- 1 m)**
Serial Number:	**477615**
Hardware Version:	0
Firmware Version:	1.01

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2016-09-21 20:30:32 (UTC)
Nominal Range of Applied Temperature:	0 C to +50 C
Temperature Accuracy Specification:	+/- 0.3 C From 0 C to +50 C
Nominal Range of Applied Pressure:	7 PSI - 30 PSI Absolute
Pressure Accuracy Specification:	Typical +/-0.1% FS, Maximum +/-0.3% FS

Post-Calibration Check:

Parameter	Applied	Reported	Deviation	Unit
Depth	35.7450	35.7488	0.0038	FT
Depth	9.2175	9.2204	0.0029	FT
Depth	-17.3088	-17.3105	-0.0016	FT
Temperature	19.9940	20.0006	0.0066	C

Calibration Procedures and Equipment Used:

Manu Mensor Model APC600 SerialNo 622739
Manu Agilent Model 53131A-010 SerialNo MY47001576
Manu Instrulab Model 406X-0031-01 SerialNo 1-31139
Manu Instrulab Model 3312A-14-15-24 SerialNo 31134
Manu Mensor Model APC600 SerialNo 610914

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. Pressure calibration is conducted in units of PSI Absolute.
4. The total range of applied pressure includes pressure due to both the water column and 1 bar of atmosphere.
5. The pressure accuracy specification is in terms of the full-scale capability of the pressure sensor (i.e. maximum water depth + 1 bar atmosphere).
6. The Post-Calibration data is expressed, for convenience, in terms of water depth. An ambient barometric pressure of 1 bar is assumed.
7. Conversion factors: 2.30666 FT/PSI, 14.50377 PSI/bar.

Performed By: RG

APPENDIX D
Hydrology Supporting Documentation

Table of Contents

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Guide to Appendix D

This appendix is a compilation of a number of technical memoranda and other reports that provide detailed information about the flood modeling with and without the Project, alone and in combination with foreseeable projects, and the alternatives to it that were discussed in the Draft EIR's Chapter 6, *Alternatives*. The appendix also includes information about potential geomorphic change within the watershed. Some of the most relevant contents of this appendix are as follows.

Basin Design Drawings

For Nursery Basin design drawings, including the different basins considered in Chapter 6's alternatives to the proposed Project, see figures on **pages 10 through 13** in D-1: *San Anselmo Flood Risk Reduction Project CEQA Support Conceptual Designs and Supplemental Modeling of Option 2A for Different Layouts of Sunnyside Detention Basin* (Stetson Engineers, January 2018). The Nursery Basin Element design for the proposed Project is on **Figure 1** on **page 10**. This is the same design as in Alternative – Raised Building Alternative. The Nursery Basin Element design for Alternative 4 – Increased Capacity Basin Alternative is on **Figure 2** on **page 11**. The Nursery Basin Element design for the Alternative 2 – Morningside/Passive Basin Alternative is on **Figure 4** on **page 13**. This is the same design as in the "Modified Alternative".

Flood Model Results – Proposed Project vs. Existing Conditions

For flood modeling comparing existing conditions and proposed Project completion for the 10-year, 25-year, and 100-year events, see figures on **pages 14 through 22** in D-1: *San Anselmo Flood Risk Reduction Project CEQA Support Conceptual Designs and Supplemental Modeling of Option 2A for Different Layouts of Sunnyside Detention Basin.* The 10-year event results are shown on **Figures 5a**, **5b**, and **5c** of that document. The 25-year event results are shown on **Figures 6a**, **6b**, and **6c** of that document. The 100-year event results are shown on **Figures 7a**, **7b**, and **7c** of that document. In that same document, **Figures 8a**, **8b**, and **8c** show the only changes (the differences) between the existing conditions and the post-Project implementation conditions for the 10-year event. **Figures 9a**, **9b**, and **9c** show the changes in the 25-year event; **Figures 10a**, **10b**, and **10c** show the changes in the 100-year event. These figures are on **pages 23 through 31**.

Flood Model Results – Proposed Project PLUS Expected Future Projects vs. Existing Conditions

For flood modeling of the Project with expected future projects, including those being planned as part of the Ross Valley Flood Protection and Watershed Program (e.g., the Winship Bridge Replacement Project and others, as discussed in Chapter 5, *Growth-Inducing and Cumulative Impacts*), see **Figures 5c, 5d, 6c, 6d, 7c,** and **7d** in D-3: *Supplemental Report on Hydraulic Analysis of San Anselmo Flood Risk Reduction Project, Option 2A: Hydraulic Analysis of Complete Removal of Bridge Building #2.* These figures are on **pages 10 through 15**.

Flood Model Results – Alternatives to the Project

For flood modeling of alternatives to the proposed Project (as presented in *Chapter 6, Alternatives*), see the following:

- **Alternative 2 – Morningside/Passive Basin Alternative** – The 10-year event results are shown on **Figures 1a, 1b, 1c,** and **1d** of the D-2: *Report on Hydraulic Analysis of the Morningside Alternative.* The 25-year event results are shown on **Figures 2a, 2b, 2c,** and **2d** of that document. The 100-year event results are shown on **Figures 3a, 3b, 3c,** and **3d** of that document. The Morningside/Passive Basin Alternative combined with the foreseeable projects (i.e., the same expected future removals of the Winship Bridge and others) for the 10-year event results are shown on **Figures 4a, 4b, 4c,** and **4d.** The Morningside/Passive Basin Alternative combined with foreseeable projects for the 25-year event results are shown on **Figures 5a, 5b, 5c,** and **5d.** The Morningside/Passive Basin Alternative combined with foreseeable projects for the 100-year event results are shown on **Figures 6a, 6b, 6c,** and **6d.**
- **Alternative 3 – Raised Building Alternative** – This alternative was not separately modeled for changes in flood risk because – with the building's foundation out of the creek channel – the effects on hydraulics and flooding would be almost identical to the proposed Project.
- **Alternative 4 – Increased Capacity Basin Alternative** – The 10-year event results are shown on **Figures 8a, 8b,** and **8c** of the D-1: *San Anselmo Flood Risk Reduction Project CEQA Support Conceptual Designs and Supplemental Modeling of Option 2A for Different Layouts of Sunnyside Detention Basin.* The 25-year event results are shown on **Figures 9a, 9b,** and **9c** of that document. The 100-year event results are shown on **Figures 10a, 10b,** and **10c** of that document. These figures are on **pages 23 through 31**.

Modified Alternative (Passive Basin from Alternative 2 plus Downtown San Anselmo element from proposed Project) - The 10-year event results are shown on **Figures 11a, 11b,** and **11c** of the D-1: *San Anselmo Flood Risk Reduction Project CEQA Support Conceptual Designs and Supplemental Modeling of Option 2A for Different Layouts of Sunnyside Detention Basin.* The 25-year event results are shown on **Figures 12a, 12b,** and **12c** of that document. The 100-year event results are shown on **Figures 13a, 13b,** and **13c** of that document. These figures are on **pages 32 through 40**.

D-1 San Anselmo Flood Risk Reduction Project CEQA Support Conceptual Designs and Supplemental Modeling of Option 2A for Different Layouts of Sunnyside Detention Basin

San Anselmo Flood Risk Reduction Project CEQA Support
Conceptual Designs and Supplemental Modeling of Option 2A
for Different Layouts of Sunnyside Detention Basin

Stetson Engineers Inc.
January 31, 2018

Background

Stetson previously prepared a conceptual design of the Sunnyside Nursery DB (about 39 acre-ft in storage capacity at the spillway crest; Layout 1 in Table 1) and prepared HEC-RAS hydraulic modeling of the San Anselmo Flood Risk Reduction Project, Option 2A[1] (Stetson, 2017). The previous modeling analysis found that the Sunnyside DB would provide flood reduction benefit during the 10-year flood in the Fairfax and Downtown San Anselmo areas, but, due to its limited storage capacity, would have less benefit during the 25-year flood and very little benefit during the 100-year flood.

Stetson recently revised the conceptual design of the Sunnyside Nursery DB (about 34 acre-ft in storage capacity at the spillway crest; Layout 3 in Table 1) based on CH2M's gravity design and the District's direction to narrow the width of the perimeter road from 15 ft to 10 ft. Hydraulic modeling analysis of this layout was also performed and documented (Stetson, 2018). As expected, the revised DB design would further reduce the flood damage reduction benefit due to the reduction in storage capacity.

As an alternative, the District also considered a deepened/enlarged Sunnyside DB with a pump for complete draining. The deepening was to the depth needed to achieve the storage capacity of 39 acre-ft at the spillway crest to match Stetson's previous design. The purpose of the pump would be to prevent the DB from partially filling (in the day/hours prior to initiation of detention operations) due to inflowing groundwater seepage, and thereby maintain open space in the DB for a later time when detention of floodwater is needed. The pump would also be used after detention operations to remove water down to the floor of the basin in order to ready the basin for detention again, if/when needed. The concept design of this layout (Layout 4 in Table 1) was documented in the Stetson 12/20/2017 technical memorandum entitled "San Anselmo Flood Risk Reduction Project CEQA Support/ Conceptual Designs for Deepened/Enlarged Sunnyside Detention Basin and Pump Station."

The District is now also considering other layouts. Table 1 shows a list of layouts. This technical memorandum summarizes the conceptual designs and hydraulic modeling for Layouts 2, 6, and 7.

---

[1]The San Anselmo Flood Risk Reduction Project, Option 2A aims to reduce the risk and the extent and severity of flooding in Ross Valley by providing temporary storage of floodwaters and increasing the capacity of the creek to convey floodwaters. Floodwater storage would be provided in an improved former Nursery near White Hill, just west of Fairfax, commonly referred to as the "Former Nursery Detention Basin" or "Sunnyside Nursery Detention Basin." Increased conveyance capacity would be achieved by removing the commercial building that spans over the creek in downtown San Anselmo located at 634-636 San Anselmo Avenue, commonly referred to as Building Bridge #2.

Table 1 Design Layouts for Sunnyside Detention Basin

Layout	Description	E&W setback (feet)	E berm top. elev. (ft NAVD 88)	WSE at Spillway Crest (ft NAVD88)	Storage Capacity at Spillway Crest (acre-feet)	Modeled by Stetson ?	How was DB modeled?	EIR analysis?	Notes
1	Naturalistic design dated 6/14/17 with 2:1 side slopes, no perimeter road incoporated	50	238	235	39	Yes	Storage Area	No	Relied on LIDAR and side slopes steeper than current design, this design didn't incorporate permiter road
2 (Proposed Project)	CH2M gravity design, 15' wide perimeter road, same berm top elevation as Option 1	50	238	235	33	No, but assume results would be similar to Option 3		**Yes, Proposed Project**	Consistent with NOP; Detailed field survey topo data provided by CH2M
3	Stetson's gravity design dated 12/7/17 where the perimeter road width is reduced from 15' to 10'	50	238	235	34	Yes	2D Flow Area	No	Consistent with NOP; Detailed field survey topo data provided by CH2M
4	Stetson's pump design dated 12-7-17 with basin deepened by 2.5', 10' wide perimeter road	50	238	235	39	No, but assume results would be similar to Option 1		No	Detailed field survey topo data provided by CH2M
5	Narrower setback, same berm top, gravity design, 15' wide perimeter road	25	238	235	36	No		No	
6 (Deeper Basin)	Narrower setback, same berm top and deepened basin by 2.5', basin drains by pump, 15' wide perimeter road	25	238	235	41	To be modeled by Stetson	2D Flow Area	**Yes, Alternative**	Detailed field survey topo data provided by CH2M
7 (Passive Basin)	Narrower setbacks, basin fills and drains passively with no creek diversion structure; berms on the east and west end of the basin, 15' wide perimeter road	25	232	N/A (No spillway)	20 acre-ft at the max WSE	To be modeled by Stetson	2D Flow Area	**Yes, Alternative**	Detailed field survey topo data provided by CH2M

Conceptual Designs for Layouts 2, 6, and 7 of the Sunnyside DB

Conceptual Design for Layout 2 (Proposed Project)

Figure 1 shows the conceptual design for Layout 2 of the Sunnyside DB based on the CH2M gravity design with a 15 ft wide perimeter road. Layout 2 has a setback of 50 ft from the property lines on the east and west sides. The design was based on the field topographic survey data provided by CH2M. The top of the perimeter road has an elevation of 238 ft NAVD88 and the DB has a lowest bottom floor elevation of 223.8 ft NAVD88 at the southeast corner. The resulting storage at the spillway crest elevation of 235 ft NAVD88 is about 33 acre-ft, which is about 6 acre-ft less than the previous design by Stetson for Layout 1. The conceptual design was intended to address concerns expressed by nearby property owners regarding the configuration and positioning of the basin.

Because of the limited storage capacity of the detention basin and the need to use available storage space to its fullest to reduce flooding downstream, the detention basin was designed to have two outlets penetrating the spillway structure across the creek: one is a smaller (6 ft by 4 ft) ungated box culvert that is always open to allow limited, continuous discharge during detention operations and to allow passage of sediment, woody debris, and wildlife; and the other is a larger (10 ft by 5 ft) box culvert with a gate control which would normally be kept open to allow unimpeded passage of a range of flows. The larger gated culvert would be closed during a flood event. The timing of closure of the gated culvert would be just before the time of incipient flooding downstream. When the gated culvert is closed, the creek water level behind the spillway will rise until it reaches the top of the left bank (looking downstream). When the rising creek water level rises above the top of the left bank, flood water will then start to flow over the left bank into the detention basin area. This overflow would be similar to flow over a side weir.

A 36-inch diameter low-level drain outlet pipe with an invert elevation at about 223.8 ft NAVD88 was designed to drain the detention basin. After a flood event, the basin will first be passively drained by the ungated culvert (6 ft by 4 ft box culvert) to about 228 ft NAVD88 (the lowest top elevation of the left bank). The remainder of the basin will be actively drained by opening of the low-level outlet pipe (by a flood operator). It would take about 8 hours for the outlet pipe to fully drain the water remaining in the basin. The low-level drain outlet pipe would normally be kept open[2] and then closed for flood detention at the same time the gated culvert on the spillway structure is closed.

The spillway structure includes a 95-ft long broad-crested spillway which, in conjunction with the ungated culvert, conveys surcharge flows downstream. There are 3 ft of *freeboard*, which is the difference between the elevation of the spillway crest (235 ft NAVD88) and the elevation of the top of the berm (238 ft NAVD88). The spillway structure conveys discharges up to the 1,000-year discharge with 1.5 ft of *residual freeboard*, which is the difference between the maximum water surface elevation (during

[2] The need for a backflow gate on the low-level drain outlet pipe will be evaluated during final design.

the 1,000-year flood) and the top of the berm. This complies with DSOD's requirement for a minimum of 1.5 ft of *residual freeboard*.

Conceptual Design for Layout 6 (Deeper Basin)

Figure 2 shows the conceptual design for Layout 6, the deepened/enlarged Sunnyside DB. This design is similar to Layout 4 except that the width of the perimeter road is widened from 10 ft to 15 ft and the setback on the east and west sides is narrowed from 50 ft to 25 ft. Layout 6 has a storage capacity of about 41 acre-ft at the spillway crest.

The conceptual design for Layout 6 of the deepened/enlarged Sunnyside DB (Figure 2) also shows the configuration of the inlet/outlet features of a pump station. Figure 3 shows the pump station profile. A vertical turbine pump would be suitable for this application. The pump house should be located well above the 100-year water level of about 236.5 ft NAVD. The pump station was designed with the following main elements:

- catch basin with trash rack/sediment screen at the southeast corner of the DB;
- pipe for directing flow from the catch basin to the pump sump;
- vertical turbine pump with concrete supporting structures; and
- pump discharge pipe.

The sizing of the pump station and general rules of the DB operations provided for Layout 4 would also apply for Layout 6. Refer to the Stetson 12/20/2017 technical memorandum entitled "San Anselmo Flood Risk Reduction Project CEQA Support/ Conceptual Designs for Deepened/Enlarged Sunnyside Detention Basin and Pump Station", for sizing of the pump station and general rules of the DB operations.

The pump station was sized to have a minimum hydraulic power of about 10 horsepower for delivery of water at a discharge rate of 1,170 gpm.

The following is a summary of general rules of the DB operations:

More than 24 hours prior to a forecasted flood event (i.e., normal operations):

1. Keep the 36-inch diameter low-level drain outlet pipe open for draining the groundwater seepage and minimizing accumulation of water in the DB[3].

24-hour prior to a forecasted flood event:

1) Turn the pump on to evacuate any accumulated water in the deepened part of the DB and prevent further accumulation of water prior to the time when the DB gate is closed.

Immediately prior to a flood event:

1) Close the 36-inch diameter low-level drain outlet pipe for flood detention at the same time the gated culvert is closed.
2) Turn off the pump.

[3] The need for a backflow gate on the low-level drain outlet pipe will be evaluated during final design.

3) Close the gated culvert to initiate floodwater diversion (Note: The timing of closure of the gated culvert would be just before the time of incipient flooding downstream).

Immediately after a flood event:

1) Open the gated culvert for draining floodwater.
2) Open the 36-inch diameter low-level drain outlet pipe for additional draining of floodwater and keep it open.

Conceptual Design for Layout 7 (Passive Basin)

Figure 4 shows the conceptual design for Layout 7 of the Sunnyside DB with no creek diversion structure for passive operations. The side weir along the left bank of the creek was designed to have a crest elevation of 228 ft NAVD88. This elevation is the water surface elevation in the creek at the DB site at the time of incipient flooding downstream. In other words, at the time when downstream incipient flooding occurs, a portion of flood water would begin to passively enter into the DB over the side weir. The side weir of Layout 7 has the same crest elevation and length as Layouts 2 and 6. This allows for an even comparison of flood reduction benefit among the three layouts. Layout 7 has an east berm top elevation of 232 ft NAVD88 and a storage capacity of about 20 acre-ft at the simulated 100-year maximum water surface elevation (229.9 ft NAVD88).

Under this concept, the 36-inch diameter low-level outlet pipe would be kept open all the time for passive operations[4].

Hydraulic Modeling for Layouts 2, 6, and 7 of the Sunnyside DB with Complete Removal of Building Bridge #2

Stetson performed hydraulic modeling to assess the project effects and cumulative effects of Option 2A with regard to flooding. For the modeling, Stetson used US Army Corp of Engineers software, HEC-RAS version 5.0, which has combined 1D and 2D hydraulic modeling capabilities. Stetson recently developed a combined 1D/2D unsteady-flow model application for the Corte Madera Creek watershed. The model starts at the bay and extends upstream along the mainstream and tributaries to the proposed upper watershed detention basins in Fairfax that are currently under environmental review. The model was calibrated to the 12/15/2016 bankfull event and the 12/31/2005 flood event (an approximate 100-year flood), and verified to the 1/4/1982 flood event (an approximate 150-year flood; Stetson, 2017). The model was peer reviewed by the US Army Corp of Engineers in 2017.

[4] The need for a backflow gate on the low-level drain outlet pipe will be evaluated during final design.

The following scenarios were analyzed:

- Existing Conditions (EC), to serve as the "Baseline" basis for comparison
- Option 2A (Sunnyside DB Layout 2 and complete removal of BB#2) added to EC, to assess "Project" effects
- Option 2A (Sunnyside DB Layout 6 and complete removal of BB#2) added to EC, to assess "Project" effects
- Option 2A (Sunnyside DB Layout 7 and complete removal of BB#2) added to EC, to assess "Project" effects

For each scenario, the following three flood events were analyzed:

- Q100, major, rare flood, similar to 12/31/05 flood
- Q25, moderate, infrequent flood
- Q10, minor flood, less frequent than 2017 flood event (7-year flood event)

Results of Hydraulic Analysis in Terms of Floodplain Inundation

Figures 5a to 5c show the changes in the HEC-RAS model-simulated floodplain inundation extent and depth between Option 2A (Sunnyside DB Layout 2 and complete removal of BB#2) and existing conditions for the 10-year flood. Figures are provided covering Fairfax, Upper San Anselmo, and Lower San Anselmo areas. Similarly, Figures 6a to 6c show the model-simulated results for the 25-year flood and Figures 7a to 7c for the 100-year flood.

Figures 8a to 8c show the changes in the HEC-RAS model-simulated floodplain inundation extent and depth between Option 2A (Sunnyside DB Layout 6 and complete removal of BB#2) and existing conditions for the 10-year flood. Similarly, Figures 9a to 9c show the model-simulated results for the 25-year flood and Figures 10a to 10c for the 100-year flood.

Figures 11a to 11c show the changes in the HEC-RAS model-simulated floodplain inundation extent and depth between Option 2A (Sunnyside DB Layout 7 and complete removal of BB#2) and existing conditions for the 10-year flood. Similarly, Figures 12a to 12c show the model-simulated results for the 25-year flood and Figures 13a to 13c for the 100-year flood.

Tables 2, 3, and 4 are a summary of results for Option 2A for the three layouts of Sunnyside DB (Layout 2, Layout 6, and Layout 7, respectively).

Table 2 Summary of Benefits of Option 2A (Sunnyside DB Layout 2 and Complete Removal of BB#2) Compared to Existing Condition

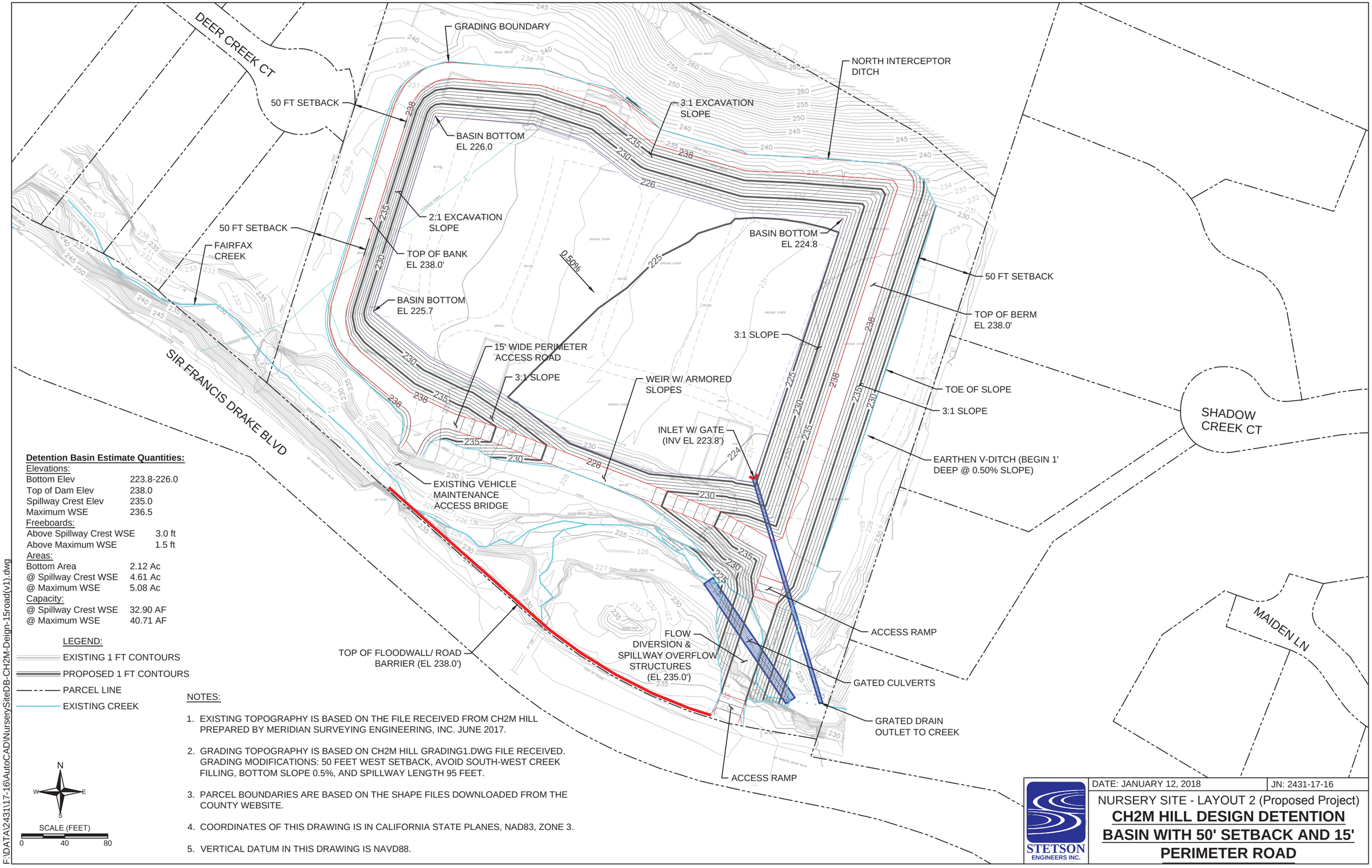
Figure No.	Flow Condition	Location	Summary of Benefits	Any Flooding Increase?
Figure 5a	Q10	Fairfax	• Reduces inundation extent due to Sunnyside detention basin • Reduces inundation depth by up to 10 inches	None
Figure 5b		Downtown SA (Upper)	• Reduces inundation extent due to Sunnyside detention basin and Building Bridge #2 removal • Reduces inundation depth by up to 17 inches	None
Figure 5c		Downtown SA (Lower)	• Reduces inundation extent due to Sunnyside detention basin and Building Bridge #2 removal • Reduces inundation depth by up to 18 inches	None
Figure 6a	Q25	Fairfax	• Nearly zero reduction in inundation extent • Reduces inundation depth by up to 1 inch	None
Figure 6b		Downtown SA (Upper)	• Nearly zero reduction in inundation extent • Reduces inundation depth by up to 6 inches	None
Figure 6c		Downtown SA (Lower)	• Nearly zero reduction in inundation extent • Reduces inundation depth by up to 6 inches	Minor increase in flooding in the area between Winship and Barber Bridges
Figure 7a	Q100	Fairfax	• Nearly zero reduction	None
Figure 7b		Downtown SA (Upper)	• Nearly zero reduction in inundation extent • Reduces inundation depth by up to 5 inches	None
Figure 7c		Downtown SA (Lower)	• Nearly zero reduction in inundation extent • Reduces inundation depth by up to 5 inches	Minor increase in flooding in the area between Winship and Barber Bridges

Table 3 Summary of Benefits of Option 2A (Sunnyside DB Layout 6 and Complete Removal of BB#2) Compared to Existing Condition

Figure No.	Flow Condition	Location	Summary of Benefits	Any Flooding Increase?
Figure 8a	Q10	Fairfax	• Reduces inundation extent due to Sunnyside detention basin • Reduces inundation depth by up to 14 inches	None
Figure 8b		Downtown SA (Upper)	• Reduces inundation extent due to Sunnyside detention basin and Building Bridge #2 removal • Reduces inundation depth by up to 23 inches	None
Figure 8c		Downtown SA (Lower)	• Reduces inundation extent due to Sunnyside detention basin and Building Bridge #2 removal • Reduces inundation depth by up to 24 inches	None
Figure 9a	Q25	Fairfax	• Nearly zero reduction in inundation extent • Reduces inundation depth by up to 2 inches	None
Figure 9b		Downtown SA (Upper)	• Nearly zero reduction in inundation extent • Reduces inundation depth by up to 6 inches	None
Figure 9c		Downtown SA (Lower)	• Nearly zero reduction in inundation extent • Reduces inundation depth by up to 6 inches	Minor increase in flooding in the area between Winship and Barber Bridges
Figure 10a	Q100	Fairfax	• Nearly zero reduction in inundation extent • Reduces inundation depth by up to 2 inches	None
Figure 10b		Downtown SA (Upper)	• Nearly zero reduction in inundation extent • Reduces inundation depth by up to 7 inches	None
Figure 10c		Downtown SA (Lower)	• Nearly zero reduction in inundation extent • Reduces inundation depth by up to 6 inches	Minor increase in flooding in the area between Winship and Barber Bridges

Table 4 Summary of Benefits of Option 2A (Sunnyside DB Layout 7 and Complete Removal of BB#2) Compared to Existing Condition

Figure No.	Flow Condition	Location	Summary of Benefits	Any Flooding Increase?
Figure 11a	Q10	Fairfax	• Reduces inundation extent due to Sunnyside detention basin • Reduces inundation depth by up to 4 inches	None
Figure 11b		Downtown SA (Upper)	• Reduces inundation extent due to Sunnyside detention basin and Building Bridge #2 removal • Reduces inundation depth by up to 12 inches	None
Figure 11c		Downtown SA (Lower)	• Reduces inundation extent due to Sunnyside detention basin and Building Bridge #2 removal • Reduces inundation depth by up to 13 inches	None
Figure 12a	Q25	Fairfax	• Nearly zero reduction in inundation extent • Reduces inundation depth by up to 1 inch	None
Figure 12b		Downtown SA (Upper)	• Nearly zero reduction in inundation extent • Reduces inundation depth by up to 4 inches	None
Figure 12c		Downtown SA (Lower)	• Nearly zero reduction in inundation extent • Reduces inundation depth by up to 4 inches	Minor increase in flooding in the area between Winship and Barber Bridges
Figure 13a	Q100	Fairfax	• Nearly zero reduction	None
Figure 13b		Downtown SA (Upper)	• Nearly zero reduction in inundation extent • Reduces inundation depth by up to 5 inches	None
Figure 13c		Downtown SA (Lower)	• Nearly zero reduction in inundation extent • Reduces inundation depth by up to 4 inches	Minor increase in flooding in the area between Winship and Barber Bridges



Detention Basin Estimate Quantities:

Elevations:	
Bottom Elev	223.8-226.0
Top of Dam Elev	238.0
Spillway Crest Elev	235.0
Maximum WSE	236.5
Freeboards:	
Above Spillway Crest WSE	3.0 ft
Above Maximum WSE	1.5 ft
Areas:	
Bottom Area	2.12 Ac
@ Spillway Crest WSE	4.61 Ac
@ Maximum WSE	5.08 Ac
Capacity:	
@ Spillway Crest WSE	32.90 AF
@ Maximum WSE	40.71 AF

LEGEND:

- EXISTING 1 FT CONTOURS
- PROPOSED 1 FT CONTOURS
- PARCEL LINE
- EXISTING CREEK

N / W / E / S

SCALE (FEET)
0 40 80

NOTES:

1. EXISTING TOPOGRAPHY IS BASED ON THE FILE RECEIVED FROM CH2M HILL PREPARED BY MERIDIAN SURVEYING ENGINEERING, INC. JUNE 2017.
2. GRADING TOPOGRAPHY IS BASED ON CH2M HILL GRADING1.DWG FILE RECEIVED. GRADING MODIFICATIONS: 50 FEET WEST SETBACK, AVOID SOUTH-WEST CREEK FILLING, BOTTOM SLOPE 0.5%, AND SPILLWAY LENGTH 95 FEET.
3. PARCEL BOUNDARIES ARE BASED ON THE SHAPE FILES DOWNLOADED FROM THE COUNTY WEBSITE.
4. COORDINATES OF THIS DRAWING IS IN CALIFORNIA STATE PLANES, NAD83, ZONE 3.
5. VERTICAL DATUM IN THIS DRAWING IS NAVD88.

STETSON ENGINEERS INC.

DATE: JANUARY 12, 2018 | JN: 2431-17-16

NURSERY SITE - LAYOUT 2 (Proposed Project)

CH2M HILL DESIGN DETENTION BASIN WITH 50' SETBACK AND 15' PERIMETER ROAD

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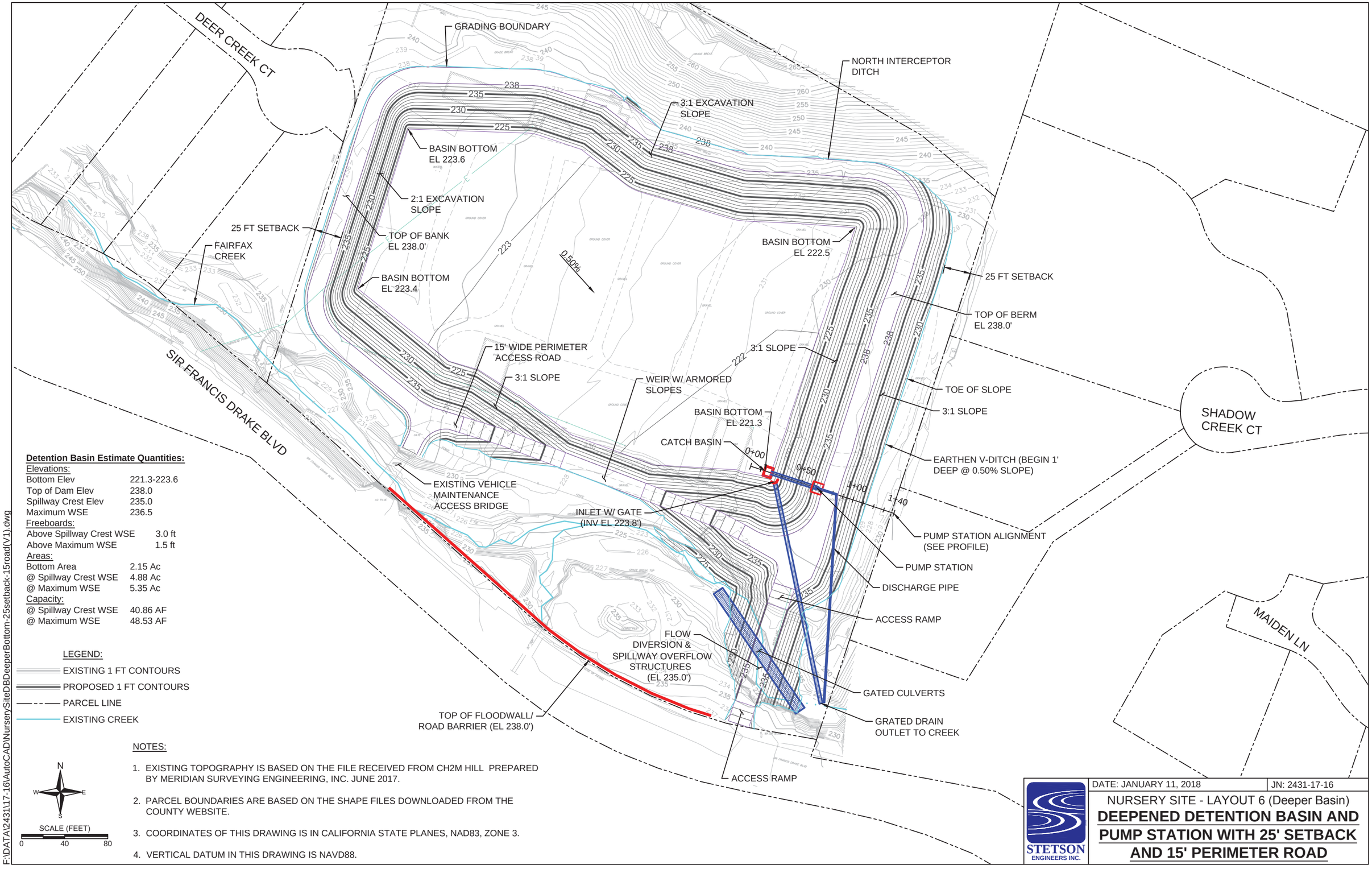
Figure 2



Detention Basin Estimate Quantities:

Elevations:	
Bottom Elev	221.3-223.6
Top of Dam Elev	238.0
Spillway Crest Elev	235.0
Maximum WSE	236.5
Freeboards:	
Above Spillway Crest WSE	3.0 ft
Above Maximum WSE	1.5 ft
Areas:	
Bottom Area	2.15 Ac
@ Spillway Crest WSE	4.88 Ac
@ Maximum WSE	5.35 Ac
Capacity:	
@ Spillway Crest WSE	40.86 AF
@ Maximum WSE	48.53 AF

LEGEND:

- EXISTING 1 FT CONTOURS
- PROPOSED 1 FT CONTOURS
- PARCEL LINE
- EXISTING CREEK

N
W E
S

SCALE (FEET)
0 40 80

NOTES:

1. EXISTING TOPOGRAPHY IS BASED ON THE FILE RECEIVED FROM CH2M HILL PREPARED BY MERIDIAN SURVEYING ENGINEERING, INC. JUNE 2017.
2. PARCEL BOUNDARIES ARE BASED ON THE SHAPE FILES DOWNLOADED FROM THE COUNTY WEBSITE.
3. COORDINATES OF THIS DRAWING IS IN CALIFORNIA STATE PLANES, NAD83, ZONE 3.
4. VERTICAL DATUM IN THIS DRAWING IS NAVD88.

STETSON ENGINEERS INC.

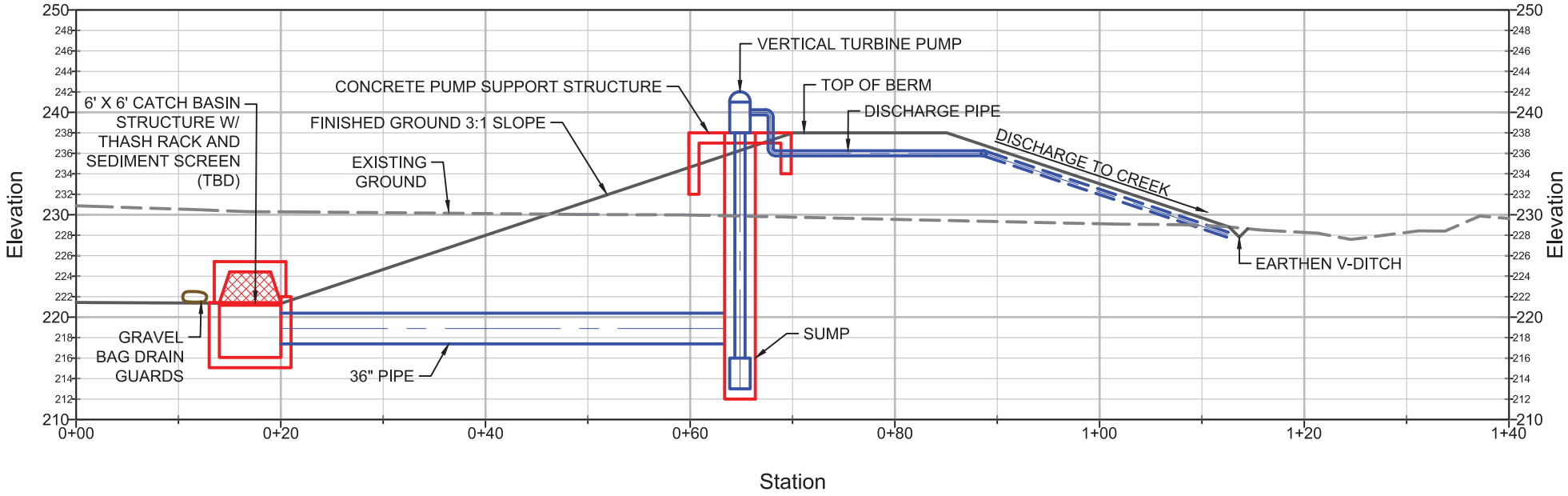
DATE: JANUARY 11, 2018 | JN: 2431-17-16

NURSERY SITE - LAYOUT 6 (Deeper Basin)

DEEPENED DETENTION BASIN AND PUMP STATION WITH 25' SETBACK AND 15' PERIMETER ROAD

F:\DATA\2431\17-16\AutoCAD\NurserySiteDBDeeperBottom-25setback-15road(V1).dwg

PUMP STATION PROFILE



SCALE (FEET)
0 7.5 15

F:\DATA\2431\17-16\AutoCAD\NurserySiteDBDeeperBottom-25setback-15road(V1).dwg

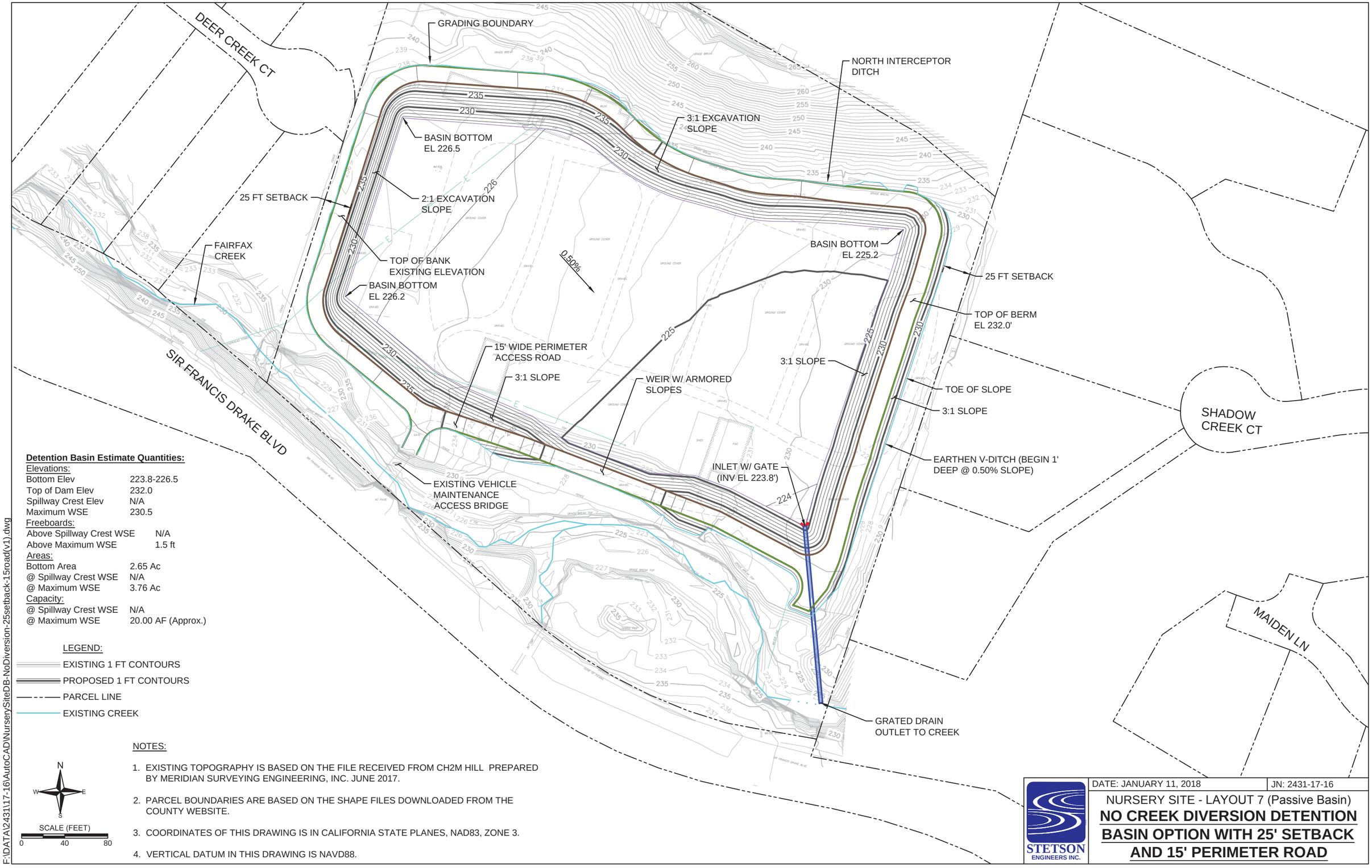
STETSON ENGINEERS INC.

DATE: JANUARY 11, 2018 | JN: 2431-17-16

NURSERY SITE - LAYOUT 6

DEEPENED DETENTION BASIN AND PUMP STATION WITH 25' SETBACK AND 15' PERIMETER ROAD

PUMP STATION PROFILE



Detention Basin Estimate Quantities:

Elevations:	
Bottom Elev	223.8-226.5
Top of Dam Elev	232.0
Spillway Crest Elev	N/A
Maximum WSE	230.5
Freeboards:	
Above Spillway Crest WSE	N/A
Above Maximum WSE	1.5 ft
Areas:	
Bottom Area	2.65 Ac
@ Spillway Crest WSE	N/A
@ Maximum WSE	3.76 Ac
Capacity:	
@ Spillway Crest WSE	N/A
@ Maximum WSE	20.00 AF (Approx.)

LEGEND:

- EXISTING 1 FT CONTOURS
- PROPOSED 1 FT CONTOURS
- PARCEL LINE
- EXISTING CREEK

N
W E
S

SCALE (FEET)
0 40 80

NOTES:

1. EXISTING TOPOGRAPHY IS BASED ON THE FILE RECEIVED FROM CH2M HILL PREPARED BY MERIDIAN SURVEYING ENGINEERING, INC. JUNE 2017.
2. PARCEL BOUNDARIES ARE BASED ON THE SHAPE FILES DOWNLOADED FROM THE COUNTY WEBSITE.
3. COORDINATES OF THIS DRAWING IS IN CALIFORNIA STATE PLANES, NAD83, ZONE 3.
4. VERTICAL DATUM IN THIS DRAWING IS NAVD88.

STETSON ENGINEERS INC.

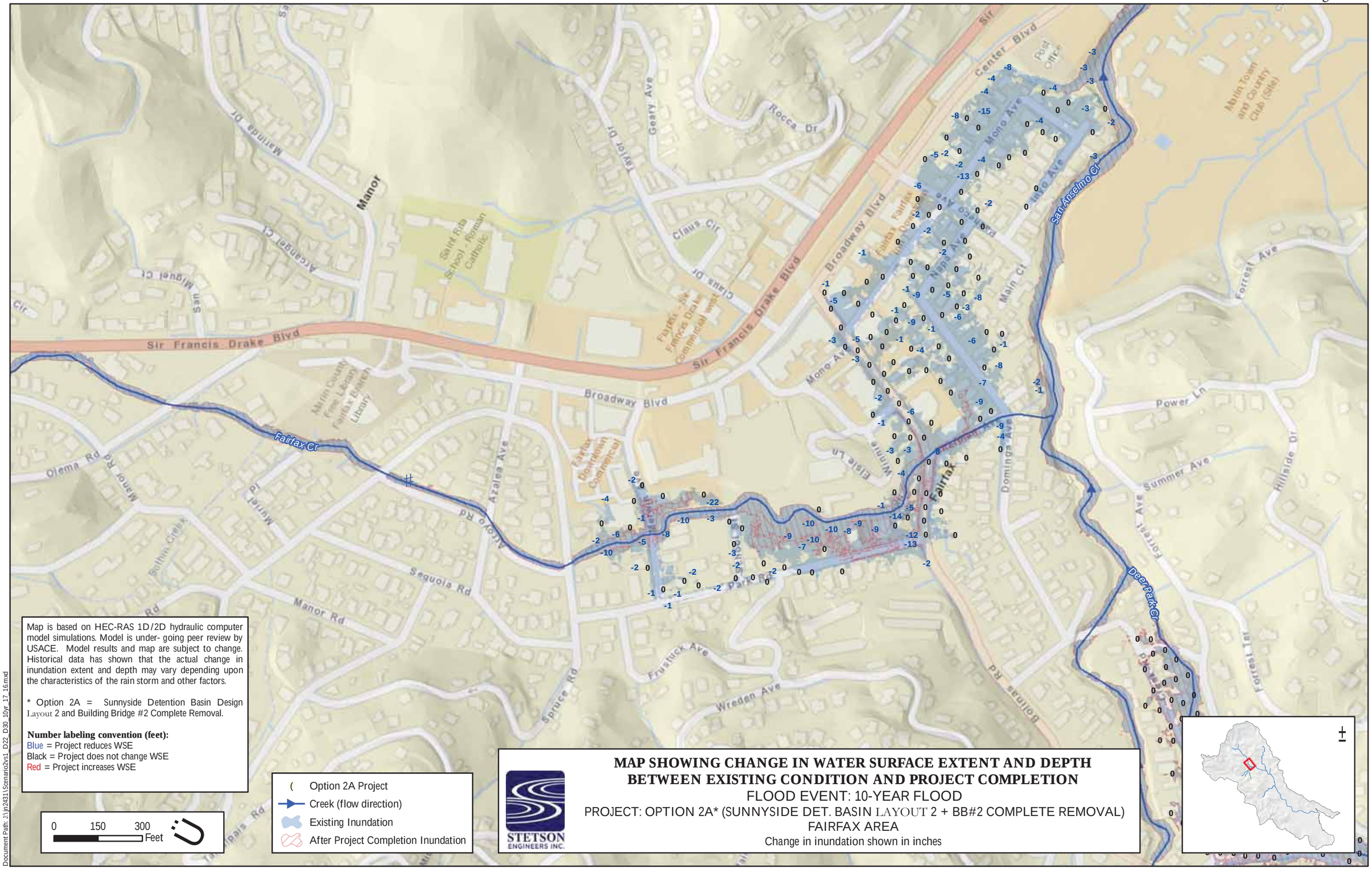
DATE: JANUARY 11, 2018 | JN: 2431-17-16

NURSERY SITE - LAYOUT 7 (Passive Basin)

NO CREEK DIVERSION DETENTION BASIN OPTION WITH 25' SETBACK AND 15' PERIMETER ROAD

F:\DATA\2431\17-16\AutoCAD\NurserySiteDB-NoDiversion-25setback-15road(v1).dwg

Figure 5a



Map is based on HEC-RAS 1D/2D hydraulic computer model simulations. Model is under- going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

* Option 2A = Sunnyside Detention Basin Design Layout 2 and Building Bridge #2 Complete Removal.

Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 150 300 Feet

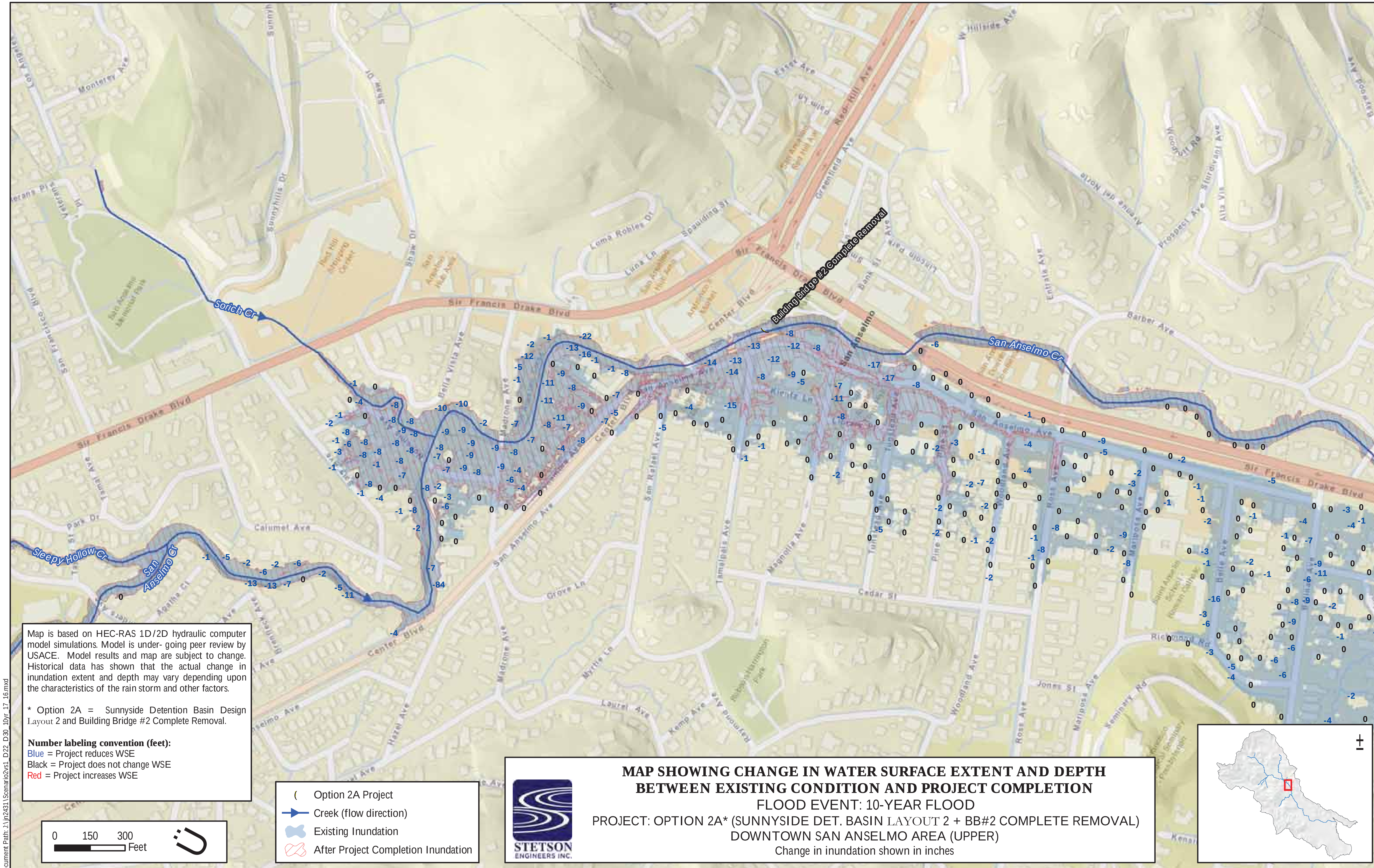
(Option 2A Project
Creek (flow direction)
Existing Inundation
After Project Completion Inundation

STETSON ENGINEERS INC.

MAP SHOWING CHANGE IN WATER SURFACE EXTENT AND DEPTH BETWEEN EXISTING CONDITION AND PROJECT COMPLETION
FLOOD EVENT: 10-YEAR FLOOD
PROJECT: OPTION 2A* (SUNNYSIDE DET. BASIN LAYOUT 2 + BB#2 COMPLETE REMOVAL)
FAIRFAX AREA
Change in inundation shown in inches

Document Path: J:\jn2431\Scenario2vs1_D22_D30_10yr_17_16.mxd

Figure 5b



Map is based on HEC-RAS 1D/2D hydraulic computer model simulations. Model is under- going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

* Option 2A = Sunnyside Detention Basin Design Layout 2 and Building Bridge #2 Complete Removal.

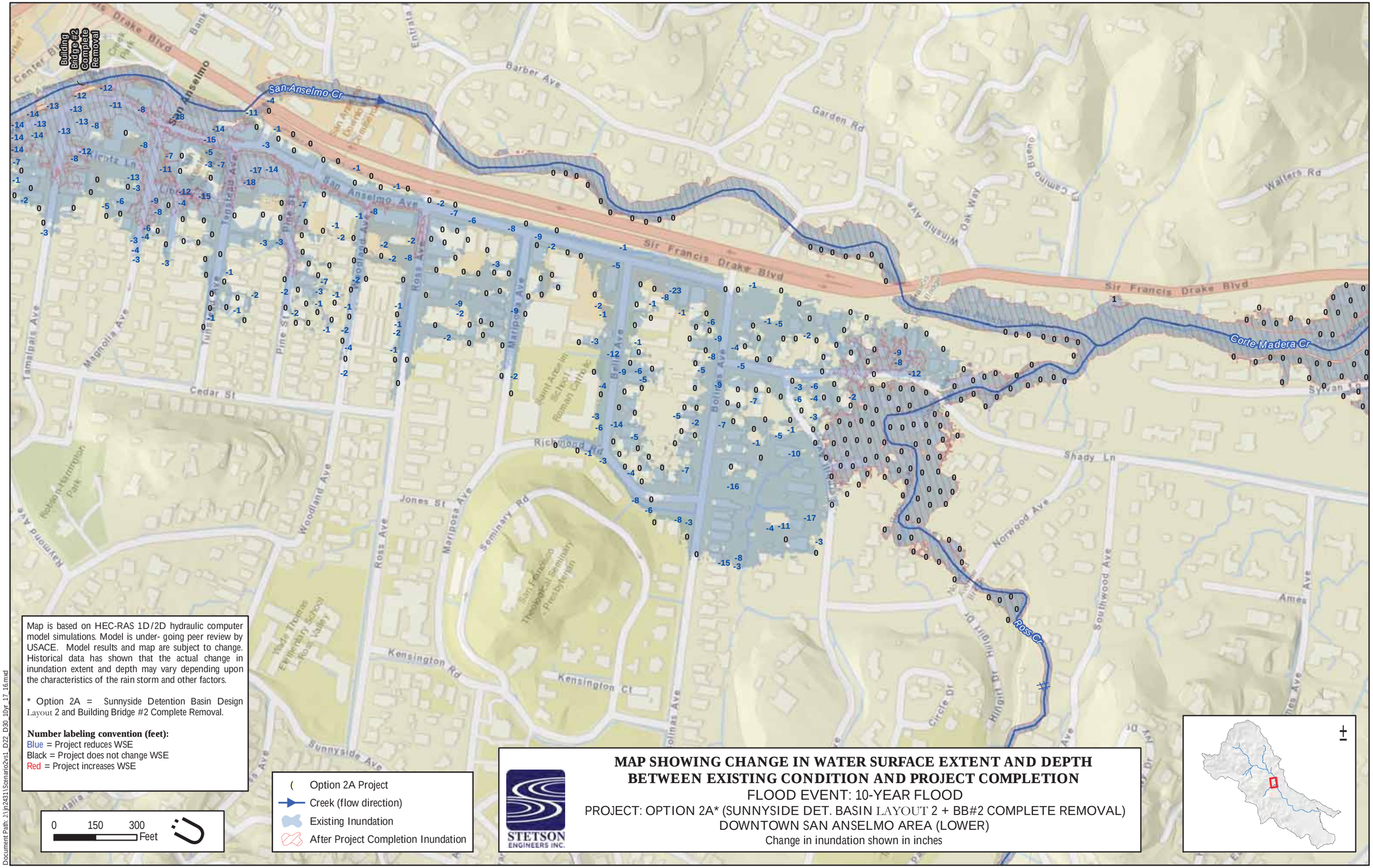
Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

Option 2A Project
Creek (flow direction)
Existing Inundation
After Project Completion Inundation

STETSON ENGINEERS INC.

MAP SHOWING CHANGE IN WATER SURFACE EXTENT AND DEPTH BETWEEN EXISTING CONDITION AND PROJECT COMPLETION
FLOOD EVENT: 10-YEAR FLOOD
PROJECT: OPTION 2A* (SUNNYSIDE DET. BASIN LAYOUT 2 + BB#2 COMPLETE REMOVAL)
DOWNTOWN SAN ANSELMO AREA (UPPER)
Change in inundation shown in inches

Document Path: J:\jn2431\Scenario2vs1_D22_D30_10yr_17_16.mxd



Map is based on HEC-RAS 1D/2D hydraulic computer model simulations. Model is under- going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

* Option 2A = Sunnyside Detention Basin Design Layout 2 and Building Bridge #2 Complete Removal.

Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 150 300 Feet

Option 2A Project
Creek (flow direction)
Existing Inundation
After Project Completion Inundation

STETSON ENGINEERS INC.

MAP SHOWING CHANGE IN WATER SURFACE EXTENT AND DEPTH BETWEEN EXISTING CONDITION AND PROJECT COMPLETION
FLOOD EVENT: 10-YEAR FLOOD
PROJECT: OPTION 2A* (SUNNYSIDE DET. BASIN LAYOUT 2 + BB#2 COMPLETE REMOVAL)
DOWNTOWN SAN ANSELMO AREA (LOWER)
Change in inundation shown in inches

Document Path: J:\jn\2431\Scenario2\s1_D22_D30_10yr_17_16.mxd

Figure 6a

Map is based on HEC-RAS 1D/2D hydraulic computer model simulations. Model is under- going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

* Option 2A = Sunnyside Detention Basin Design Layout 2 and Building Bridge #2 Complete Removal.

Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

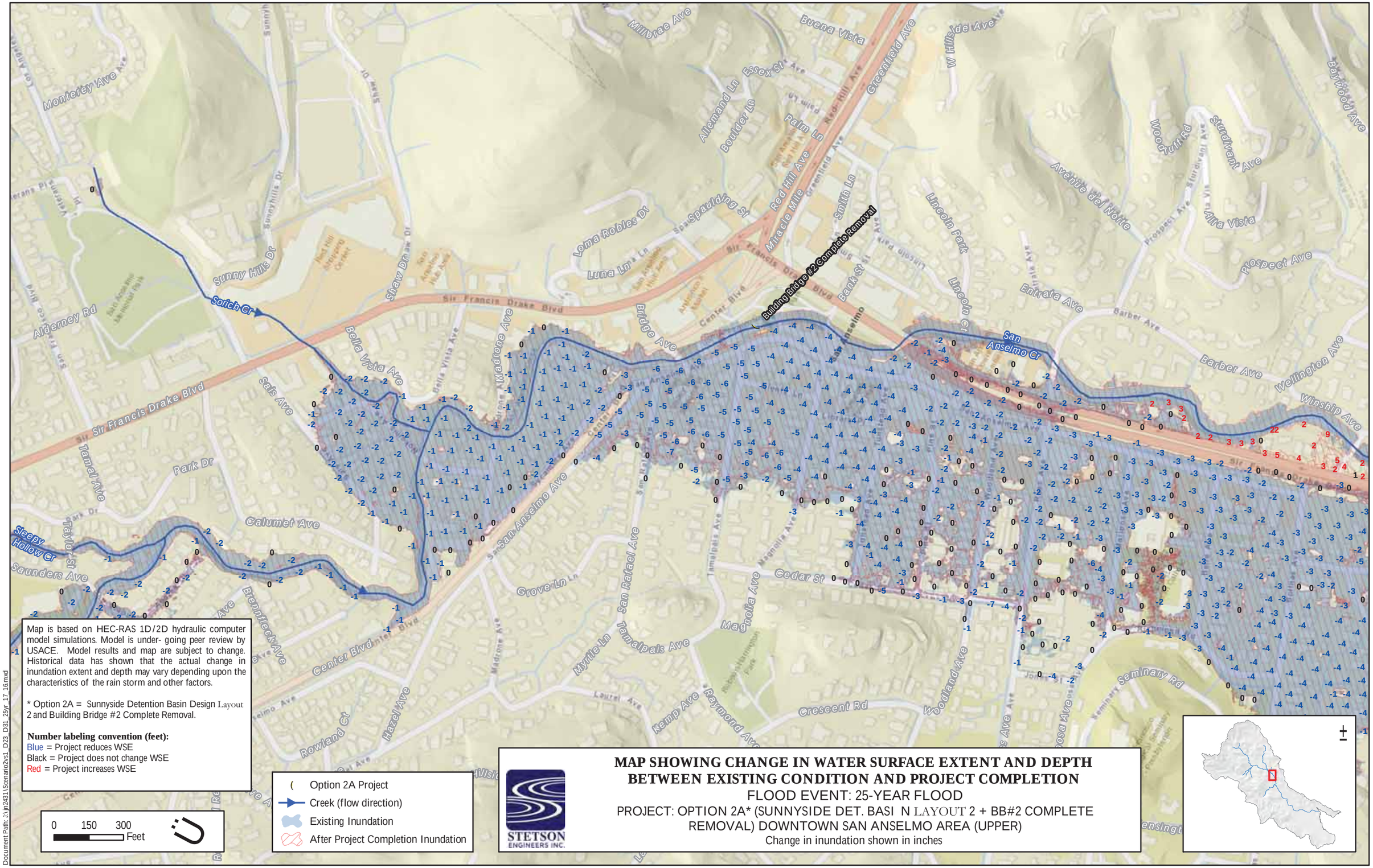
0 150 300 Feet

(Option 2A Project
Creek (flow direction)
Existing Inundation
After Project Completion Inundation

STETSON ENGINEERS INC.

MAP SHOWING CHANGE IN WATER SURFACE EXTENT AND DEPTH BETWEEN EXISTING CONDITION AND PROJECT COMPLETION
FLOOD EVENT: 25-YEAR FLOOD
PROJECT: OPTION 2A* (SUNNY SIDE DET. BASIN LAYOUT 2 + BB#2 COMPLETE REMOVAL)
FAIRFAX AREA
Change in inundation shown in inches

Document Path: J:\jn2431\Scenario2\vs1_D23_D31_25yr_17_16.mxd



Map is based on HEC-RAS 1D/2D hydraulic computer model simulations. Model is under- going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

* Option 2A = Sunnyside Detention Basin Design Layout 2 and Building Bridge #2 Complete Removal.

Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

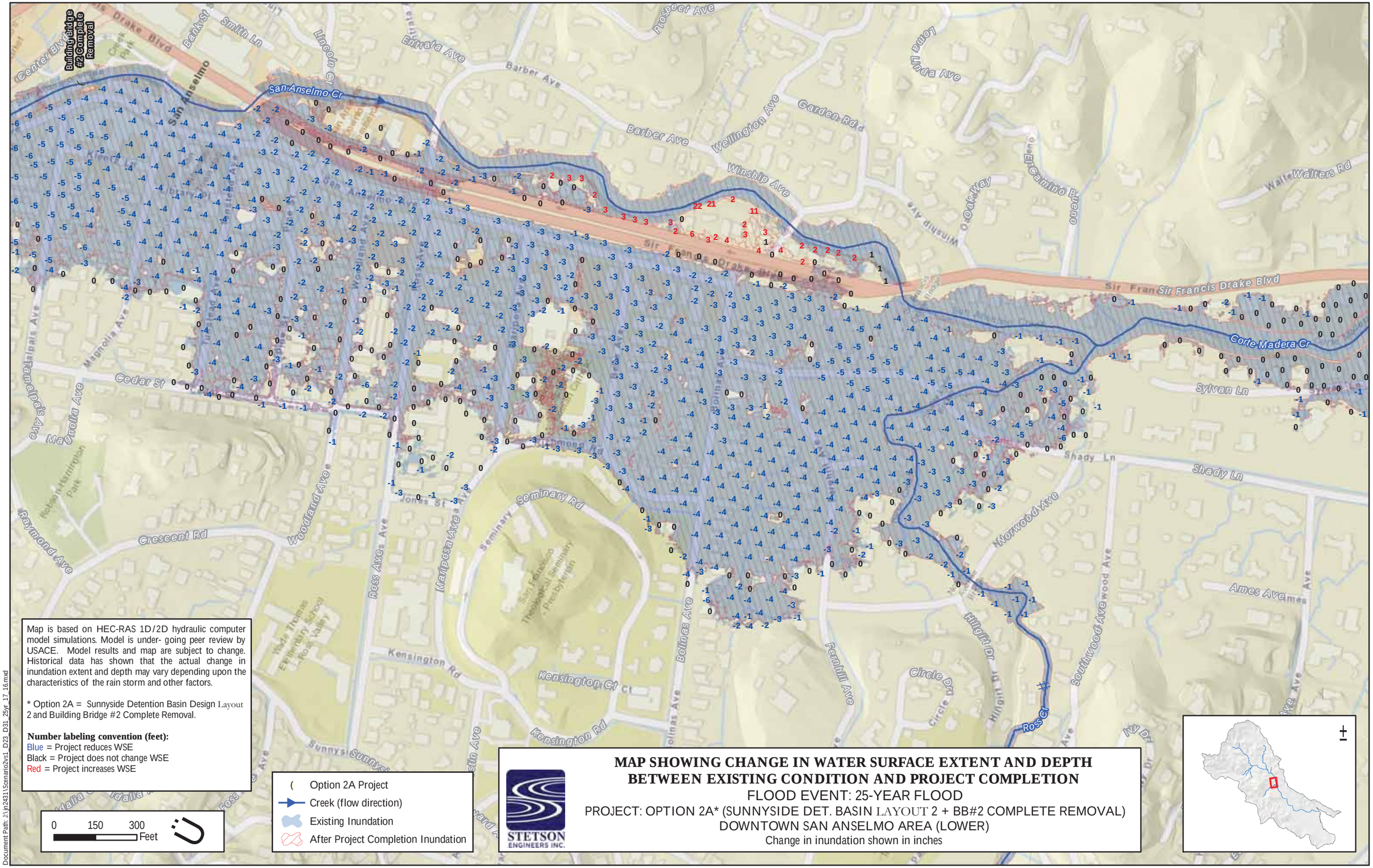
0 150 300 Feet

Option 2A Project
Creek (flow direction)
Existing Inundation
After Project Completion Inundation

STETSON ENGINEERS INC.

MAP SHOWING CHANGE IN WATER SURFACE EXTENT AND DEPTH BETWEEN EXISTING CONDITION AND PROJECT COMPLETION
FLOOD EVENT: 25-YEAR FLOOD
PROJECT: OPTION 2A* (SUNNYSIDE DET. BASI N LAYOUT 2 + BB#2 COMPLETE REMOVAL) DOWNTOWN SAN ANSELMO AREA (UPPER)
Change in inundation shown in inches

Document Path: J:\jn\2431\Scenario2\vs1_D23_D31_25yr_17_16.mxd



Map is based on HEC-RAS 1D/2D hydraulic computer model simulations. Model is under- going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

* Option 2A = Sunnyside Detention Basin Design Layout 2 and Building Bridge #2 Complete Removal.

Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

Document Path: J:\jn2431\Scenario2vs1_D23_D31_25yr_17_16.mxd

Map is based on HEC-RAS 1D/2D hydraulic computer model simulations. Model is under- going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

* Option 2A = Sunnyside Detention Basin Design Layout 2 and Building Bridge #2 Complete Removal.

Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 150 300 Feet

(Option 2A Project
Creek (flow direction)
Existing Inundation
After Project Completion Inundation

STETSON ENGINEERS INC.

MAP SHOWING CHANGE IN WATER SURFACE EXTENT AND DEPTH BETWEEN EXISTING CONDITION AND PROJECT COMPLETION

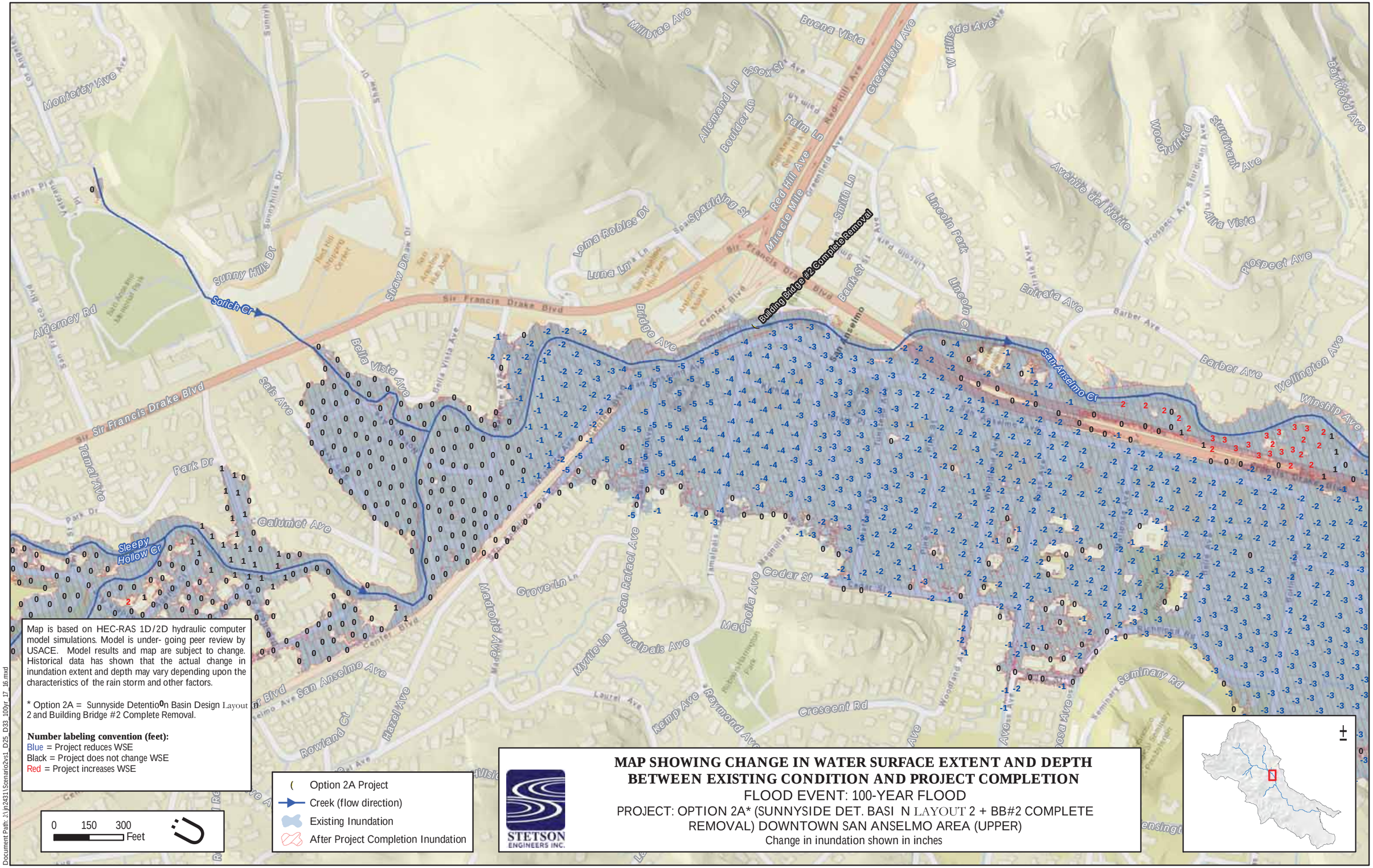
FLOOD EVENT: 100-YEAR FLOOD

PROJECT: OPTION 2A* (SUNNY SIDE DET. BASIN LAYOUT 2 + BB#2 COMPLETE REMOVAL)

FAIRFAX AREA

Change in inundation shown in inches

Document Path: J:\jn2431\Scenario2\vs1_D25_D33_100yr_17_16.mxd



Map is based on HEC-RAS 1D/2D hydraulic computer model simulations. Model is under- going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

* Option 2A = Sunnyside Detention Basin Design Layout 2 and Building Bridge #2 Complete Removal.

Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

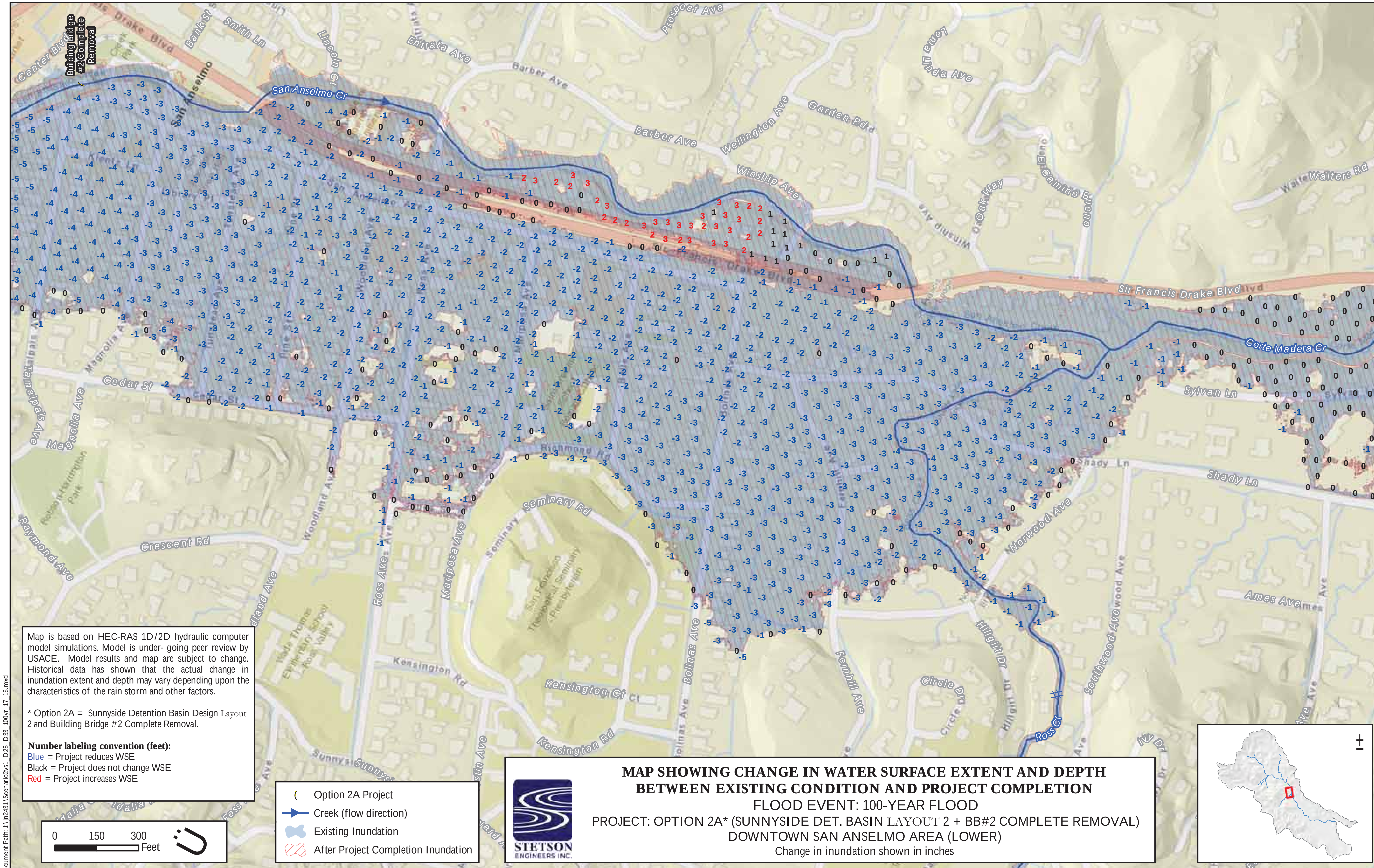
0 150 300 Feet

(Option 2A Project
Creek (flow direction)
Existing Inundation
After Project Completion Inundation

STETSON ENGINEERS INC.

MAP SHOWING CHANGE IN WATER SURFACE EXTENT AND DEPTH BETWEEN EXISTING CONDITION AND PROJECT COMPLETION
FLOOD EVENT: 100-YEAR FLOOD
PROJECT: OPTION 2A* (SUNNYSIDE DET. BASIN LAYOUT 2 + BB#2 COMPLETE REMOVAL) DOWNTOWN SAN ANSELMO AREA (UPPER)
Change in inundation shown in inches

Document Path: J:\jn2431\Scenario2vs1_D25_D33_100yr_17_16.mxd



Map is based on HEC-RAS 1D/2D hydraulic computer model simulations. Model is under- going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

* Option 2A = Sunnyside Detention Basin Design Layout 2 and Building Bridge #2 Complete Removal.

Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 150 300 Feet

Option 2A Project
Creek (flow direction)
Existing Inundation
After Project Completion Inundation

MAP SHOWING CHANGE IN WATER SURFACE EXTENT AND DEPTH BETWEEN EXISTING CONDITION AND PROJECT COMPLETION

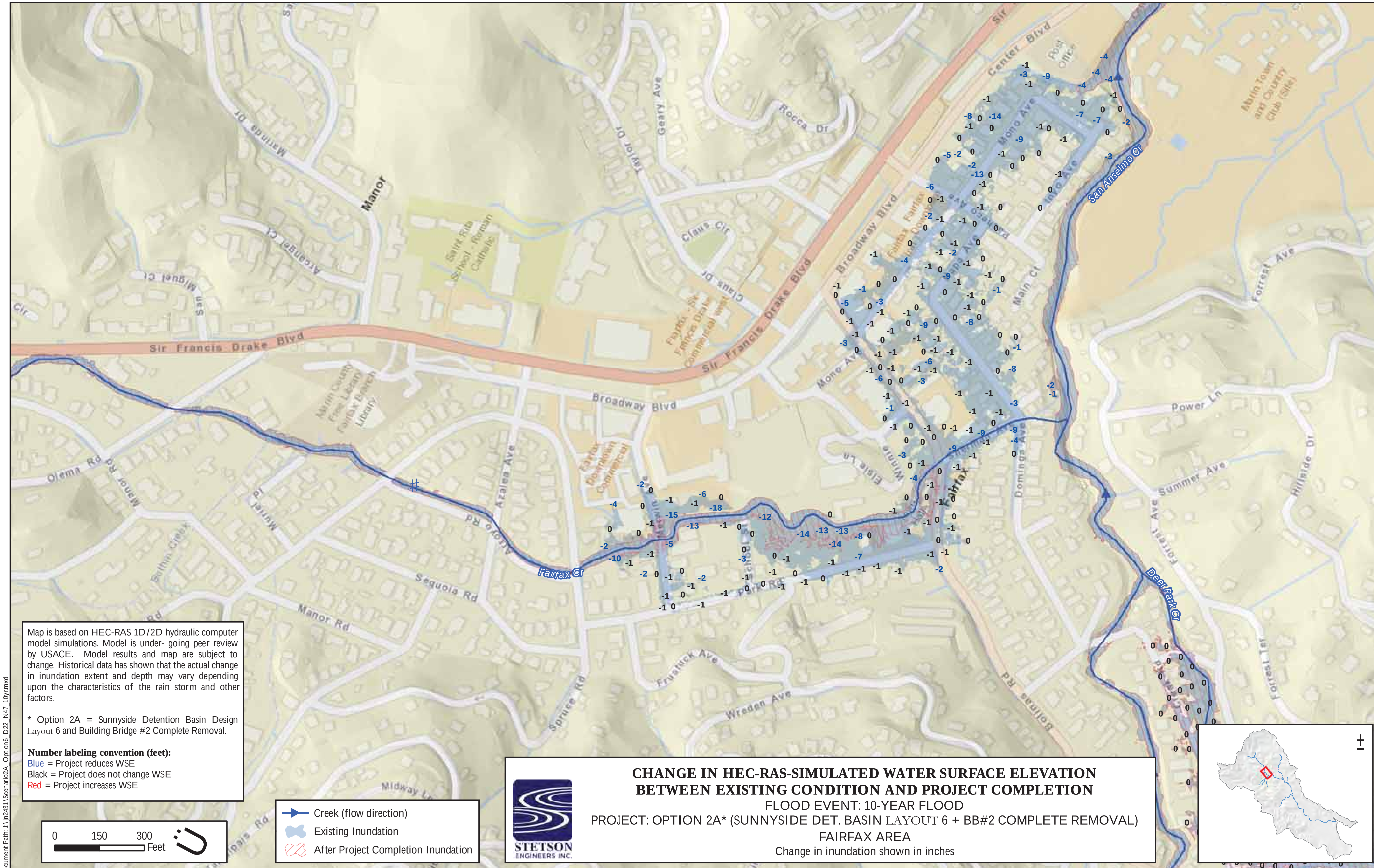
FLOOD EVENT: 100-YEAR FLOOD

PROJECT: OPTION 2A* (SUNNYSIDE DET. BASIN LAYOUT 2 + BB#2 COMPLETE REMOVAL)

DOWNTOWN SAN ANSELMO AREA (LOWER)

Change in inundation shown in inches

STETSON ENGINEERS INC.



Map is based on HEC-RAS 1D/2D hydraulic computer model simulations. Model is under- going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

* Option 2A = Sunnyside Detention Basin Design Layout 6 and Building Bridge #2 Complete Removal.

Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 150 300 Feet

Creek (flow direction)
Existing Inundation
After Project Completion Inundation

STETSON ENGINEERS INC.

CHANGE IN HEC-RAS-SIMULATED WATER SURFACE ELEVATION BETWEEN EXISTING CONDITION AND PROJECT COMPLETION

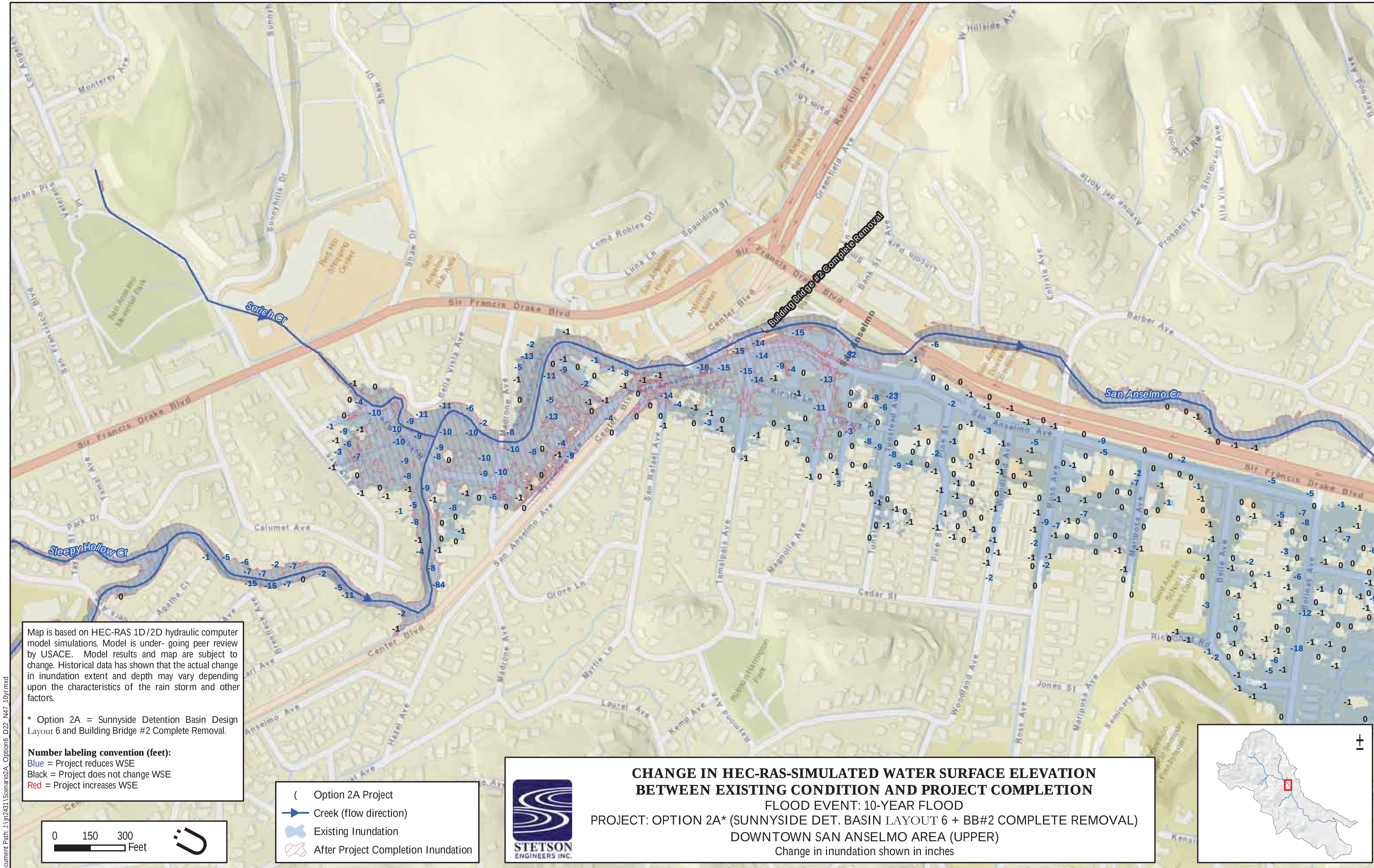
FLOOD EVENT: 10-YEAR FLOOD

PROJECT: OPTION 2A* (SUNNYSIDE DET. BASIN LAYOUT 6 + BB#2 COMPLETE REMOVAL)

FAIRFAX AREA

Change in inundation shown in inches

Document Path: J:\jn2431\Scenario2A_Option6_D22_N47_10yr.mxd



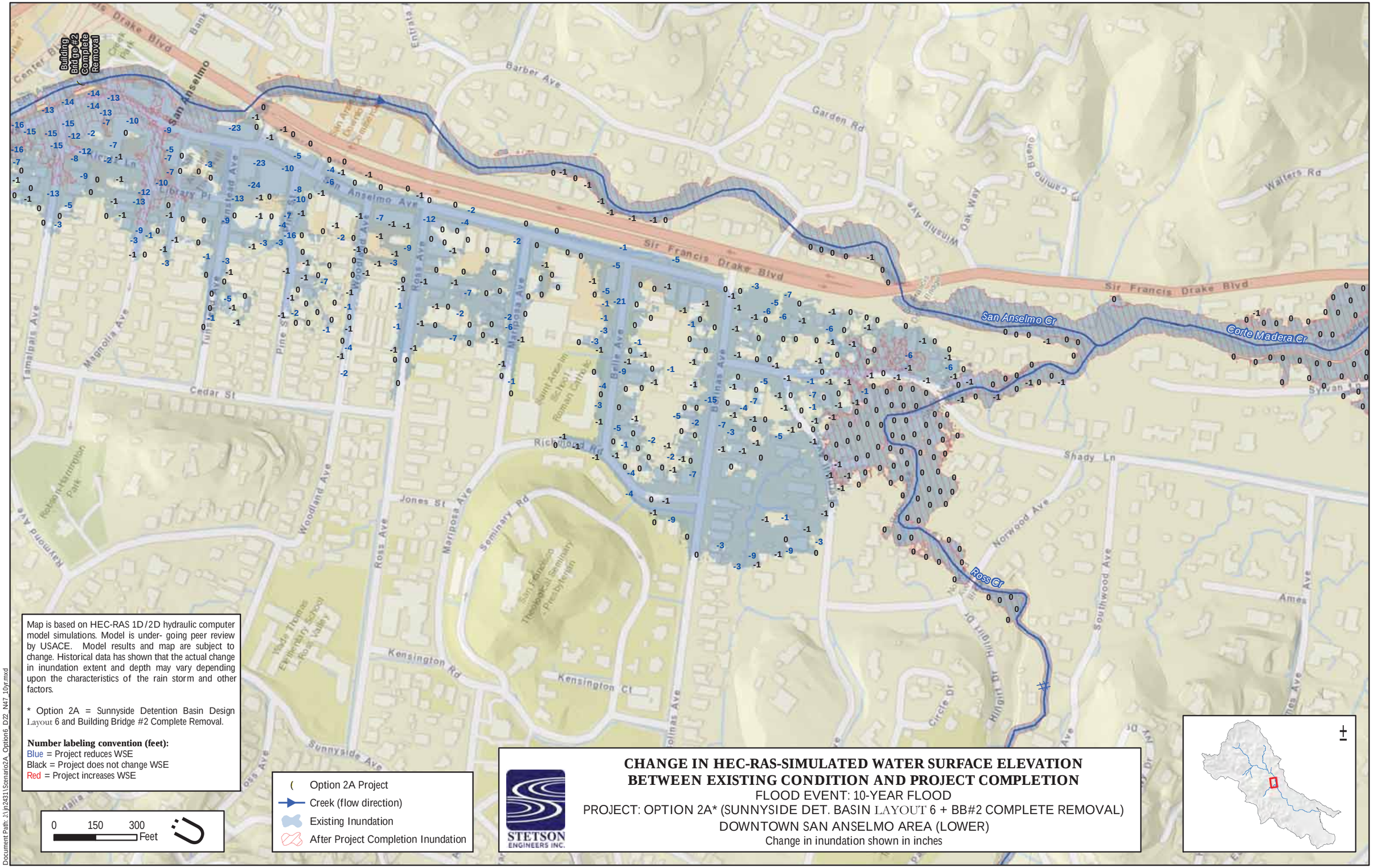
Map is based on HEC-RAS 1D/2D hydraulic computer model simulations. Model is under- going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

* Option 2A = Sunnyside Detention Basin Design Layout 6 and Building Bridge #2 Complete Removal.

Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

CHANGE IN HEC-RAS-SIMULATED WATER SURFACE ELEVATION BETWEEN EXISTING CONDITION AND PROJECT COMPLETION
FLOOD EVENT: 10-YEAR FLOOD
PROJECT: OPTION 2A* (SUNNYSIDE DET. BASIN LAYOUT 6 + BB#2 COMPLETE REMOVAL)
DOWNTOWN SAN ANSELMO AREA (UPPER)
Change in inundation shown in inches

Document Path: J:\jn2431\Scenario2A_Option6_D22_N47_10yr.mxd



Map is based on HEC-RAS 1D/2D hydraulic computer model simulations. Model is under- going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

* Option 2A = Sunnyside Detention Basin Design Layout 6 and Building Bridge #2 Complete Removal.

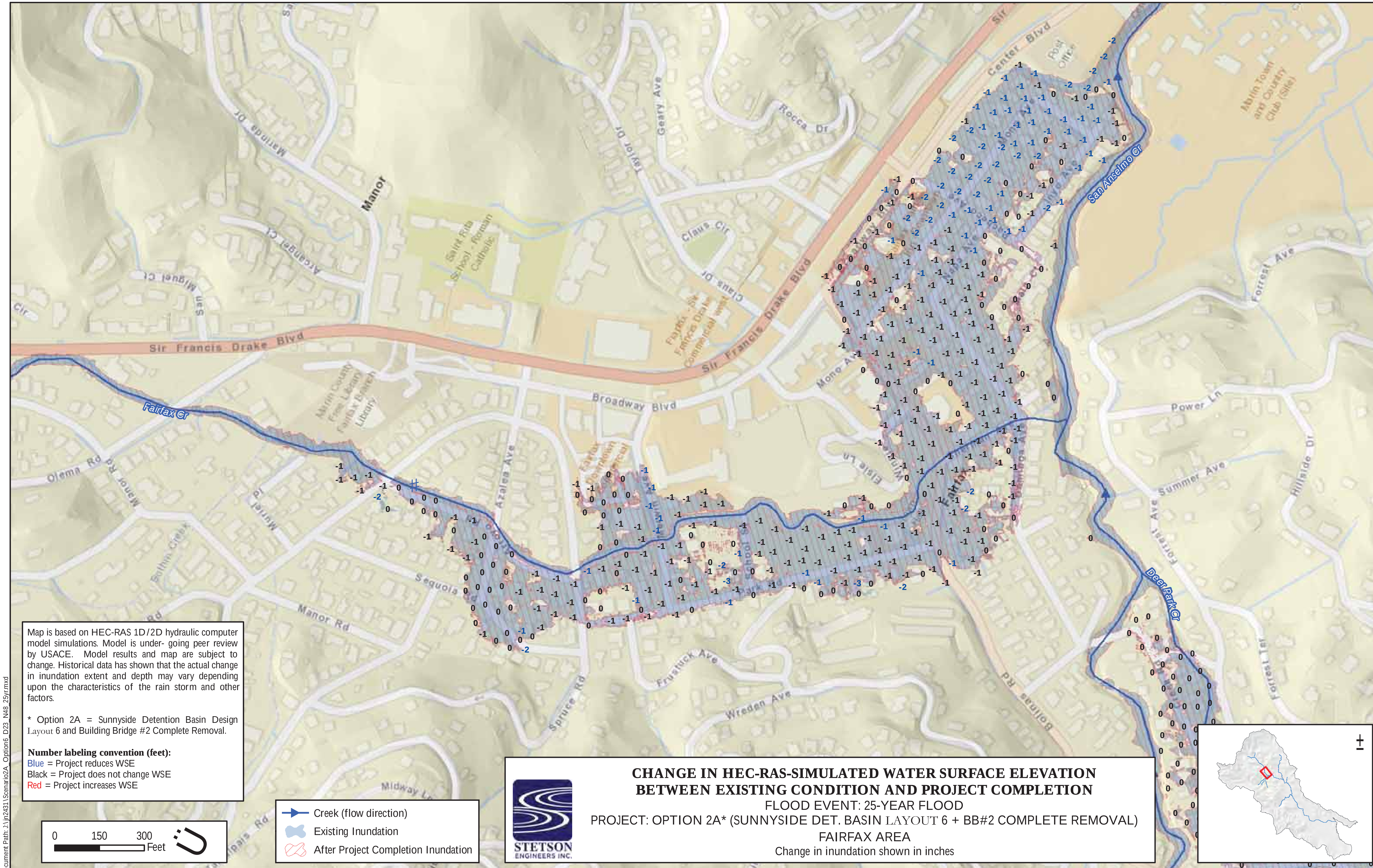
Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 150 300 Feet

(Option 2A Project
Creek (flow direction)
Existing Inundation
After Project Completion Inundation

STETSON ENGINEERS INC.

CHANGE IN HEC-RAS-SIMULATED WATER SURFACE ELEVATION BETWEEN EXISTING CONDITION AND PROJECT COMPLETION
FLOOD EVENT: 10-YEAR FLOOD
PROJECT: OPTION 2A* (SUNNYSIDE DET. BASIN LAYOUT 6 + BB#2 COMPLETE REMOVAL)
DOWNTOWN SAN ANSELMO AREA (LOWER)
Change in inundation shown in inches



Map is based on HEC-RAS 1D/2D hydraulic computer model simulations. Model is under- going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

* Option 2A = Sunnyside Detention Basin Design Layout 6 and Building Bridge #2 Complete Removal.

Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 150 300 Feet

Creek (flow direction)
Existing Inundation
After Project Completion Inundation

STETSON ENGINEERS INC.

CHANGE IN HEC-RAS-SIMULATED WATER SURFACE ELEVATION BETWEEN EXISTING CONDITION AND PROJECT COMPLETION

FLOOD EVENT: 25-YEAR FLOOD

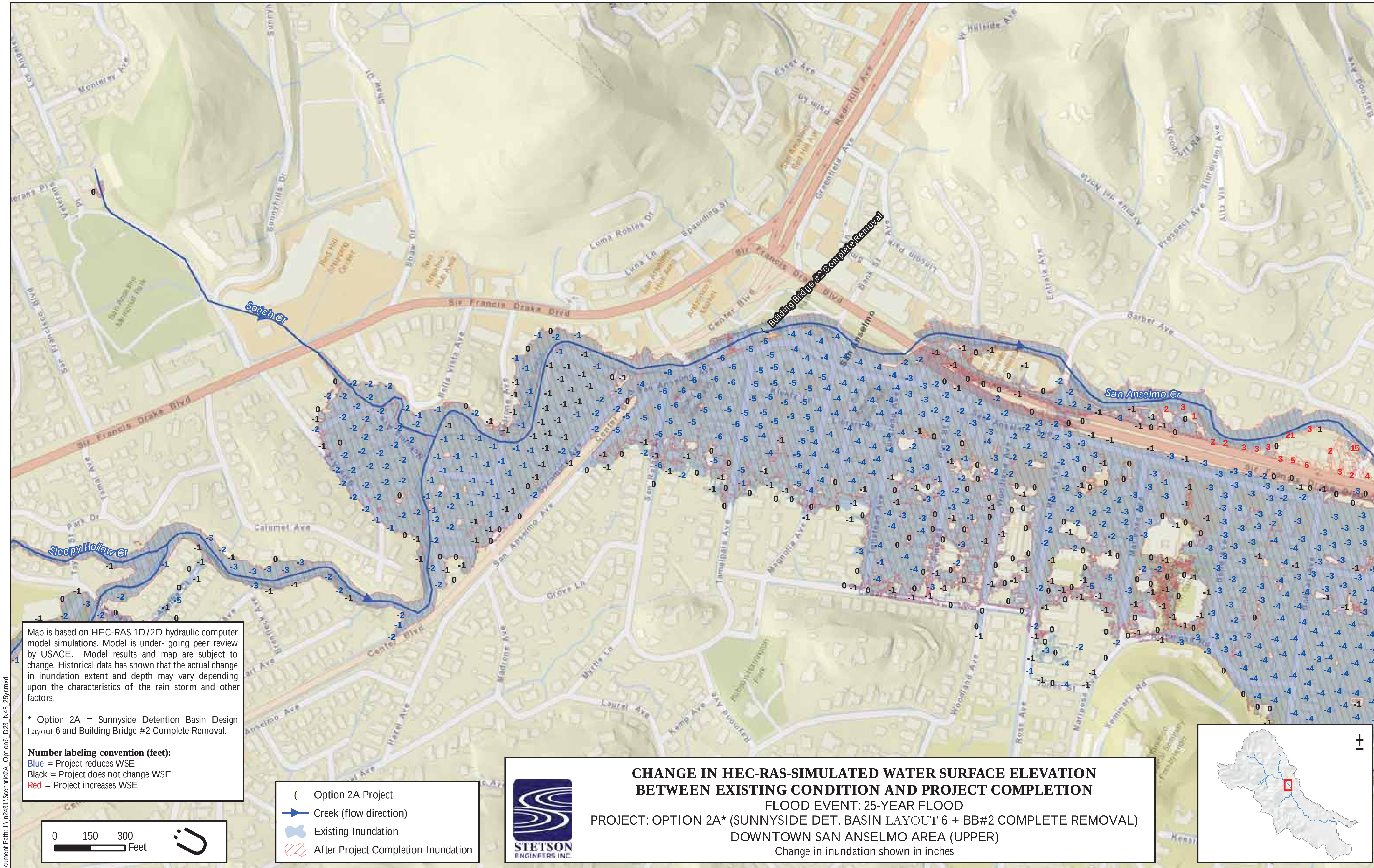
PROJECT: OPTION 2A* (SUNNYSIDE DET. BASIN LAYOUT 6 + BB#2 COMPLETE REMOVAL)

FAIRFAX AREA

Change in inundation shown in inches

Document Path: J:\jn2431\Scenario2A_Option6_D23_N48_25yr.mxd

Figure 9b



Map is based on HEC-RAS 1D/2D hydraulic computer model simulations. Model is under- going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

* Option 2A = Sunnyside Detention Basin Design Layout 6 and Building Bridge #2 Complete Removal.

Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

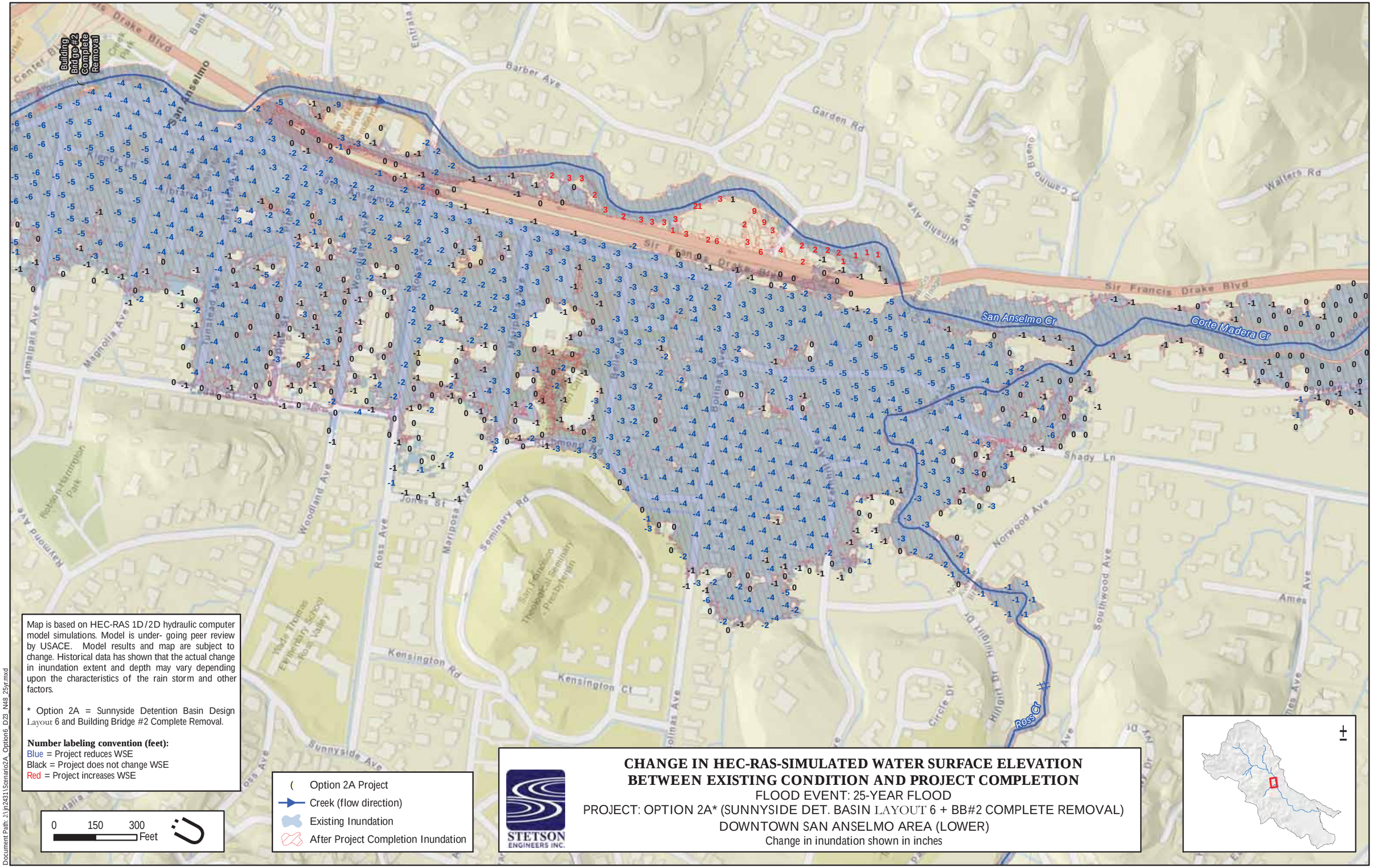
0 150 300 Feet

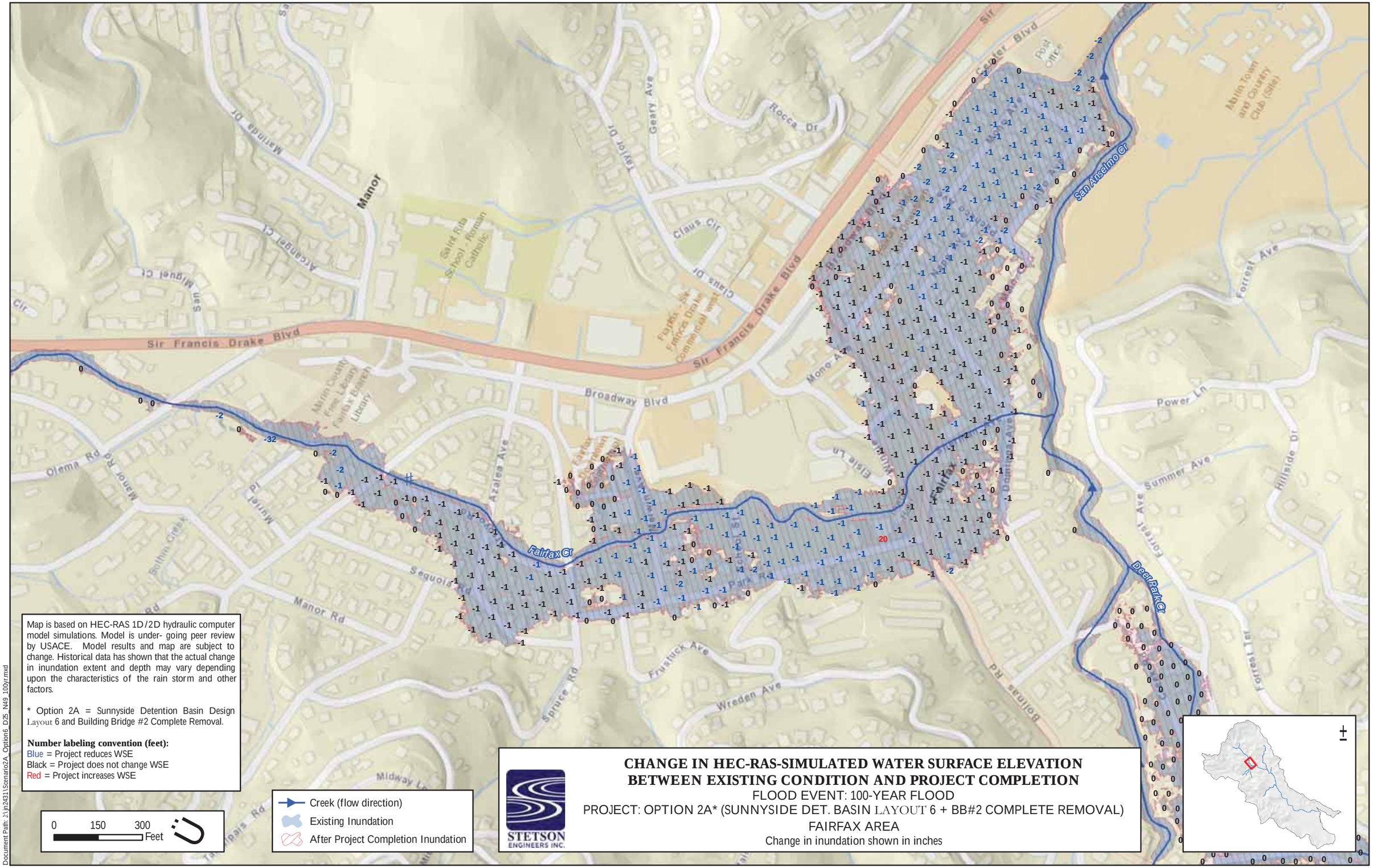
Option 2A Project
Creek (flow direction)
Existing Inundation
After Project Completion Inundation

CHANGE IN HEC-RAS-SIMULATED WATER SURFACE ELEVATION BETWEEN EXISTING CONDITION AND PROJECT COMPLETION
FLOOD EVENT: 25-YEAR FLOOD
PROJECT: OPTION 2A* (SUNNYSIDE DET. BASIN LAYOUT 6 + BB#2 COMPLETE REMOVAL)
DOWNTOWN SAN ANSELMO AREA (UPPER)
Change in inundation shown in inches

STETSON ENGINEERS INC.

Document Path: J:\jn2431\Scenario2A_Option6_D23_N48_25yr.mxd


Building Bridge #2 Complete Removal
San Anselmo
Sir Francis Drake Blvd
Barber Ave
Garden Rd
Winship Ave
Oak Way
Camino Bueno
Walters Rd
San Anselmo Cr
Corte Madera Cr
Tamalpais Ave
Magnolia Ave
Woodland Ave
Ross Ave
Mariposa
Sorsinary Rd
Kensington Rd
Kensington Ct
Sunnyside Ave
Norwood Ave
Southwood Ave
Shady Ln
Ames Ave
Hillgirt Dr
Circle Dr
Ross Cr
Robert Harrington Park
Yeda Thomas Elementary School - Ross Valley
San Francisco Theological Seminary - Presbyterian
Map is based on HEC-RAS 1D/2D hydraulic computer model simulations. Model is under- going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.
* Option 2A = Sunnyside Detention Basin Design Layout 6 and Building Bridge #2 Complete Removal.
Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE
0 150 300 Feet
Option 2A Project
Creek (flow direction)
Existing Inundation
After Project Completion Inundation
STETSON ENGINEERS INC.
CHANGE IN HEC-RAS-SIMULATED WATER SURFACE ELEVATION
BETWEEN EXISTING CONDITION AND PROJECT COMPLETION
FLOOD EVENT: 25-YEAR FLOOD
PROJECT: OPTION 2A* (SUNNYSIDE DET. BASIN LAYOUT 6 + BB#2 COMPLETE REMOVAL)
DOWNTOWN SAN ANSELMO AREA (LOWER)
Change in inundation shown in inches
Document Path: J:\jn2431\Scenario2A_Option6_D23_N48_25yr.mxd



Map is based on HEC-RAS 1D/2D hydraulic computer model simulations. Model is under- going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

* Option 2A = Sunnyside Detention Basin Design Layout 6 and Building Bridge #2 Complete Removal.

Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

STETSON ENGINEERS INC.

CHANGE IN HEC-RAS-SIMULATED WATER SURFACE ELEVATION BETWEEN EXISTING CONDITION AND PROJECT COMPLETION

FLOOD EVENT: 100-YEAR FLOOD

PROJECT: OPTION 2A* (SUNNYSIDE DET. BASIN LAYOUT 6 + BB#2 COMPLETE REMOVAL)

FAIRFAX AREA

Change in inundation shown in inches

Document Path: J:\jn\24311\Scenario2A_Option6_D25_N49_100yr.mxd

Map is based on HEC-RAS 1D/2D hydraulic computer model simulations. Model is under- going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

* Option 2A = Sunnyside Detention Basin Design Layout 6 and Building Bridge #2 Complete Removal.

Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 150 300 Feet

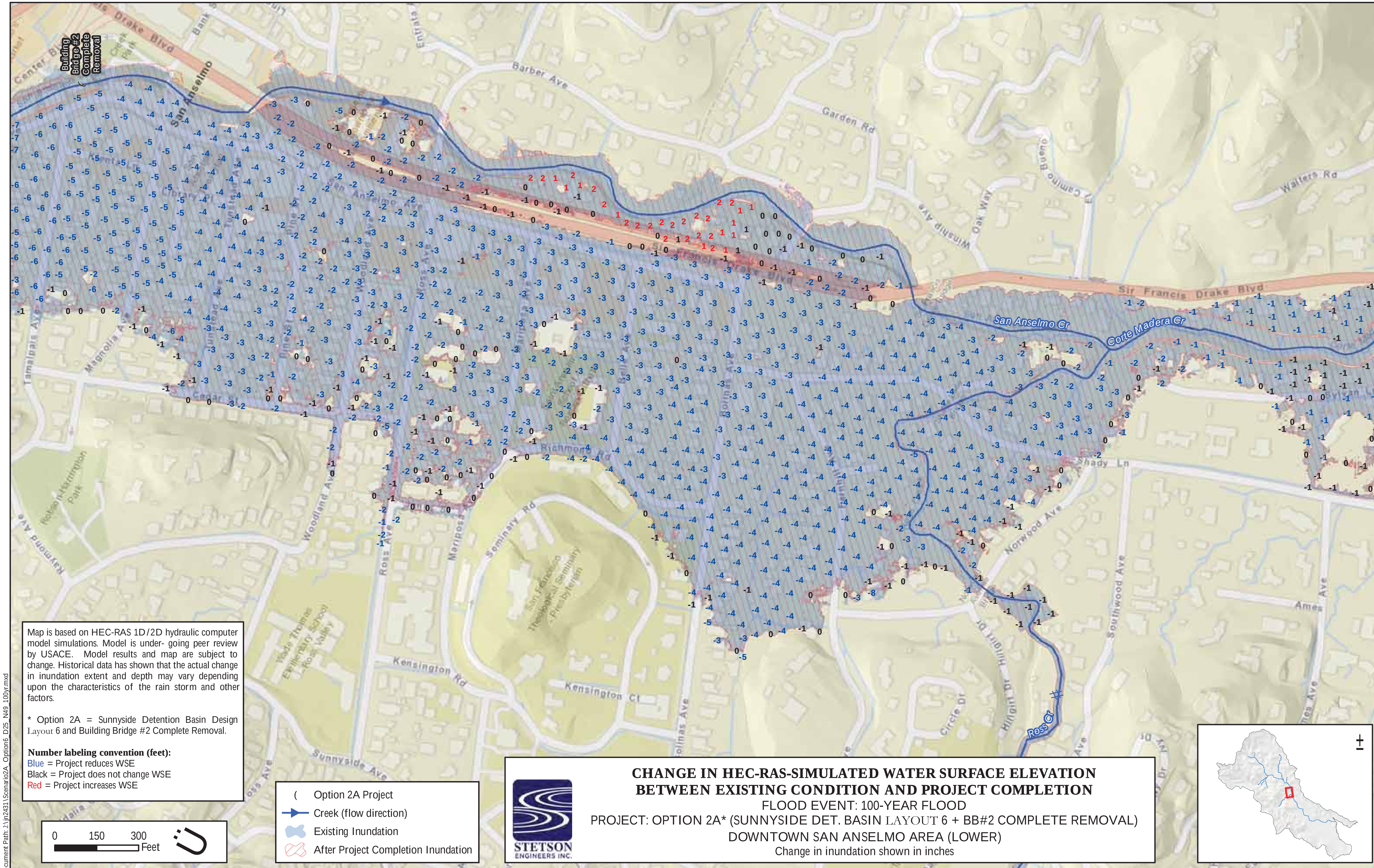
(Option 2A Project
Creek (flow direction)
Existing Inundation
After Project Completion Inundation

STETSON ENGINEERS INC.

CHANGE IN HEC-RAS-SIMULATED WATER SURFACE ELEVATION BETWEEN EXISTING CONDITION AND PROJECT COMPLETION

FLOOD EVENT: 100-YEAR FLOOD
PROJECT: OPTION 2A* (SUNNYSIDE DET. BASIN LAYOUT 6 + BB#2 COMPLETE REMOVAL)
DOWNTOWN SAN ANSELMO AREA (UPPER)
Change in inundation shown in inches

Document Path: J:\jn2431\Scenario2A_Option6_D25_N49_100yr.mxd



Map is based on HEC-RAS 1D/2D hydraulic computer model simulations. Model is under- going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

* Option 2A = Sunnyside Detention Basin Design Layout 6 and Building Bridge #2 Complete Removal.

Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

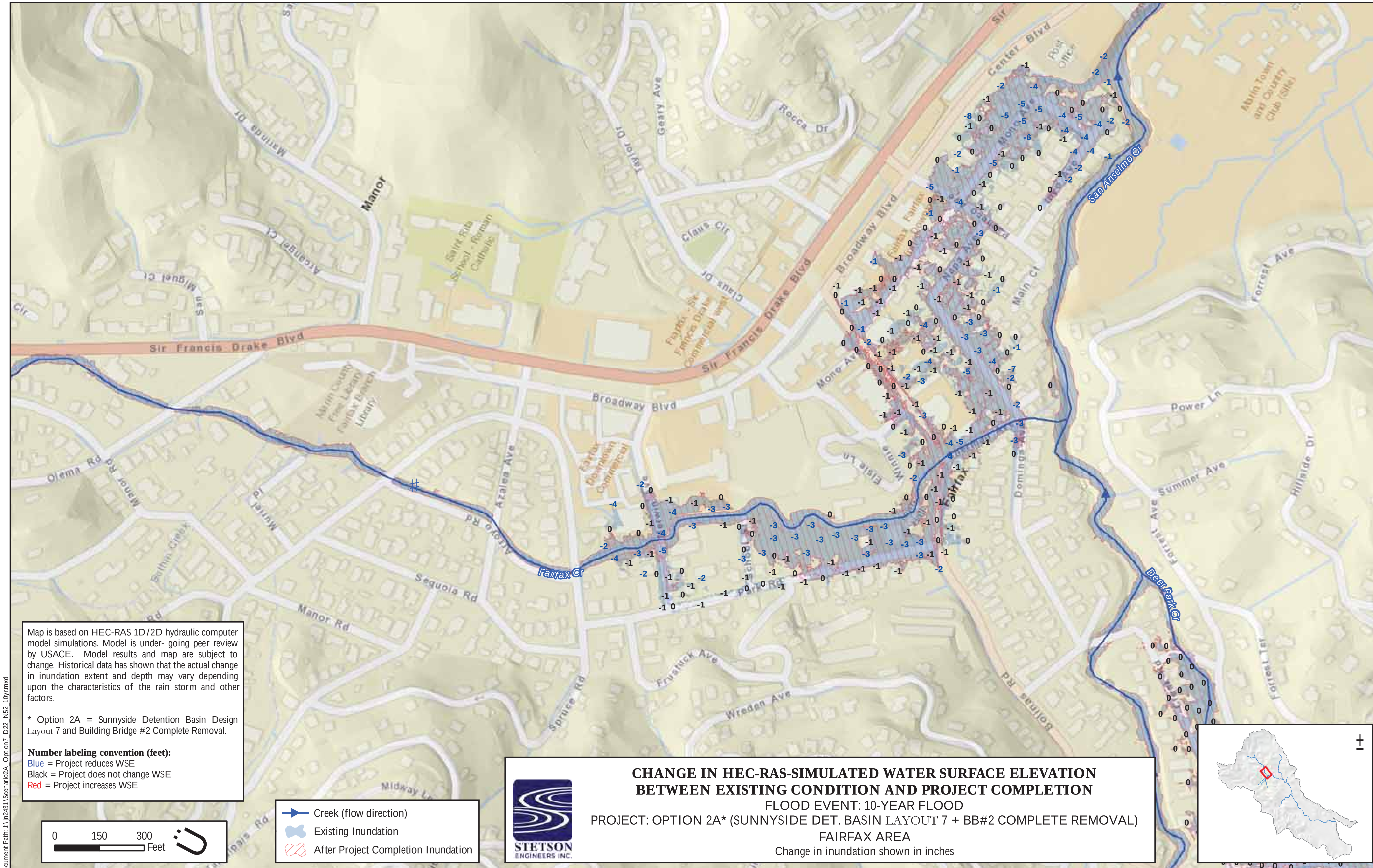
0 150 300 Feet

Option 2A Project
Creek (flow direction)
Existing Inundation
After Project Completion Inundation

STETSON ENGINEERS INC.

CHANGE IN HEC-RAS-SIMULATED WATER SURFACE ELEVATION BETWEEN EXISTING CONDITION AND PROJECT COMPLETION
FLOOD EVENT: 100-YEAR FLOOD
PROJECT: OPTION 2A* (SUNNYSIDE DET. BASIN LAYOUT 6 + BB#2 COMPLETE REMOVAL)
DOWNTOWN SAN ANSELMO AREA (LOWER)
Change in inundation shown in inches

Document Path: J:\jn2431\Scenario2A_Option6_D25_N49_100yr.mxd



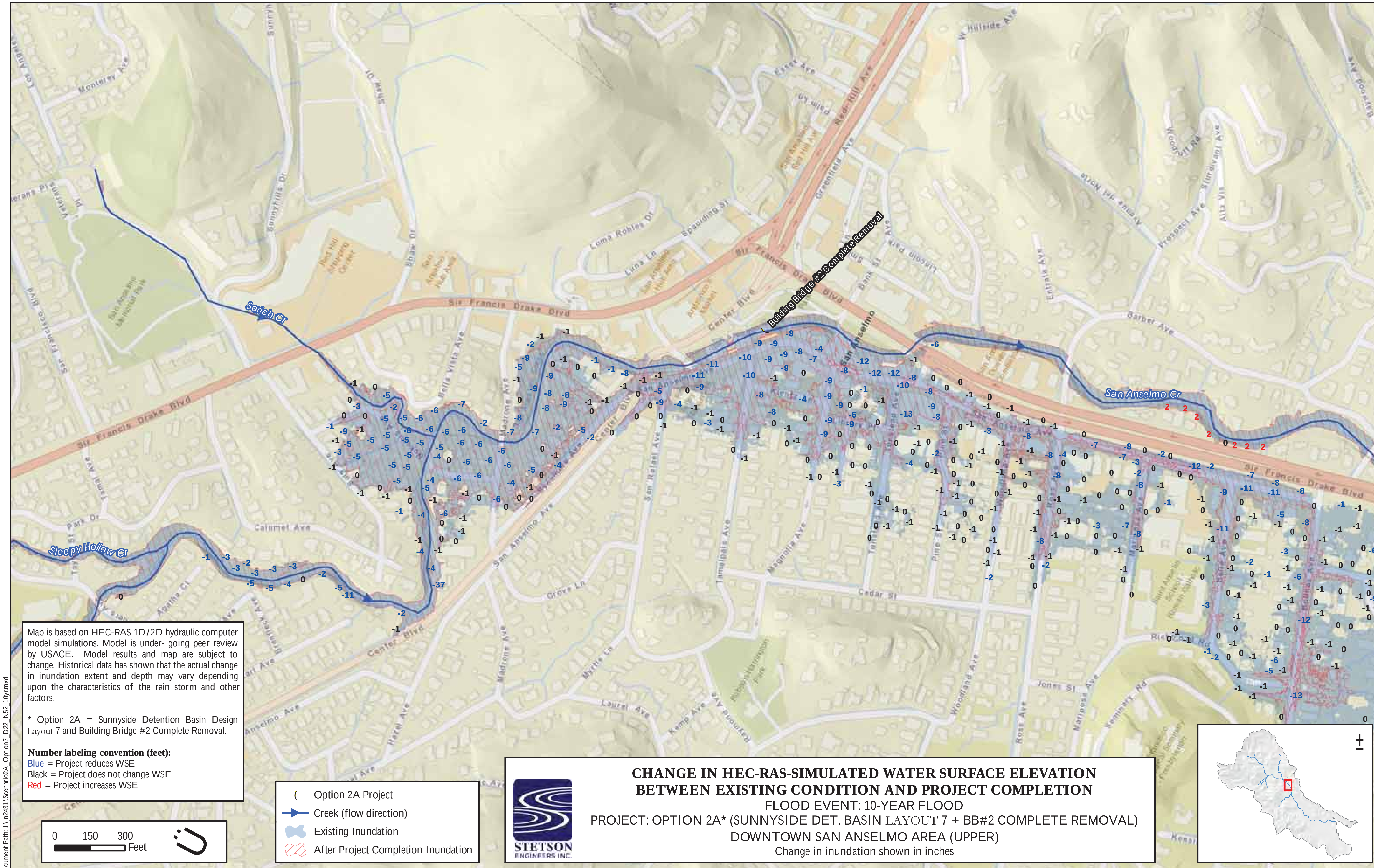
Map is based on HEC-RAS 1D/2D hydraulic computer model simulations. Model is under- going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

* Option 2A = Sunnyside Detention Basin Design Layout 7 and Building Bridge #2 Complete Removal.

Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

CHANGE IN HEC-RAS-SIMULATED WATER SURFACE ELEVATION BETWEEN EXISTING CONDITION AND PROJECT COMPLETION
FLOOD EVENT: 10-YEAR FLOOD
PROJECT: OPTION 2A* (SUNNYSIDE DET. BASIN LAYOUT 7 + BB#2 COMPLETE REMOVAL)
FAIRFAX AREA
Change in inundation shown in inches

Document Path: J:\jn2431\Scenario2A_Option7_D22_N52_10yr.mxd


Building Bridge #2 Complete Removal
Sorich Cr
San Anselmo Cr
Sleepy Hollow Cr
Sir Francis Drake Blvd
Center Blvd
San Anselmo Ave
Red Hill Ave
Map is based on HEC-RAS 1D/2D hydraulic computer model simulations. Model is under- going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.
* Option 2A = Sunnyside Detention Basin Design Layout 7 and Building Bridge #2 Complete Removal.
Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE
0 150 300 Feet
Option 2A Project
Creek (flow direction)
Existing Inundation
After Project Completion Inundation
STETSON ENGINEERS INC.

CHANGE IN HEC-RAS-SIMULATED WATER SURFACE ELEVATION BETWEEN EXISTING CONDITION AND PROJECT COMPLETION

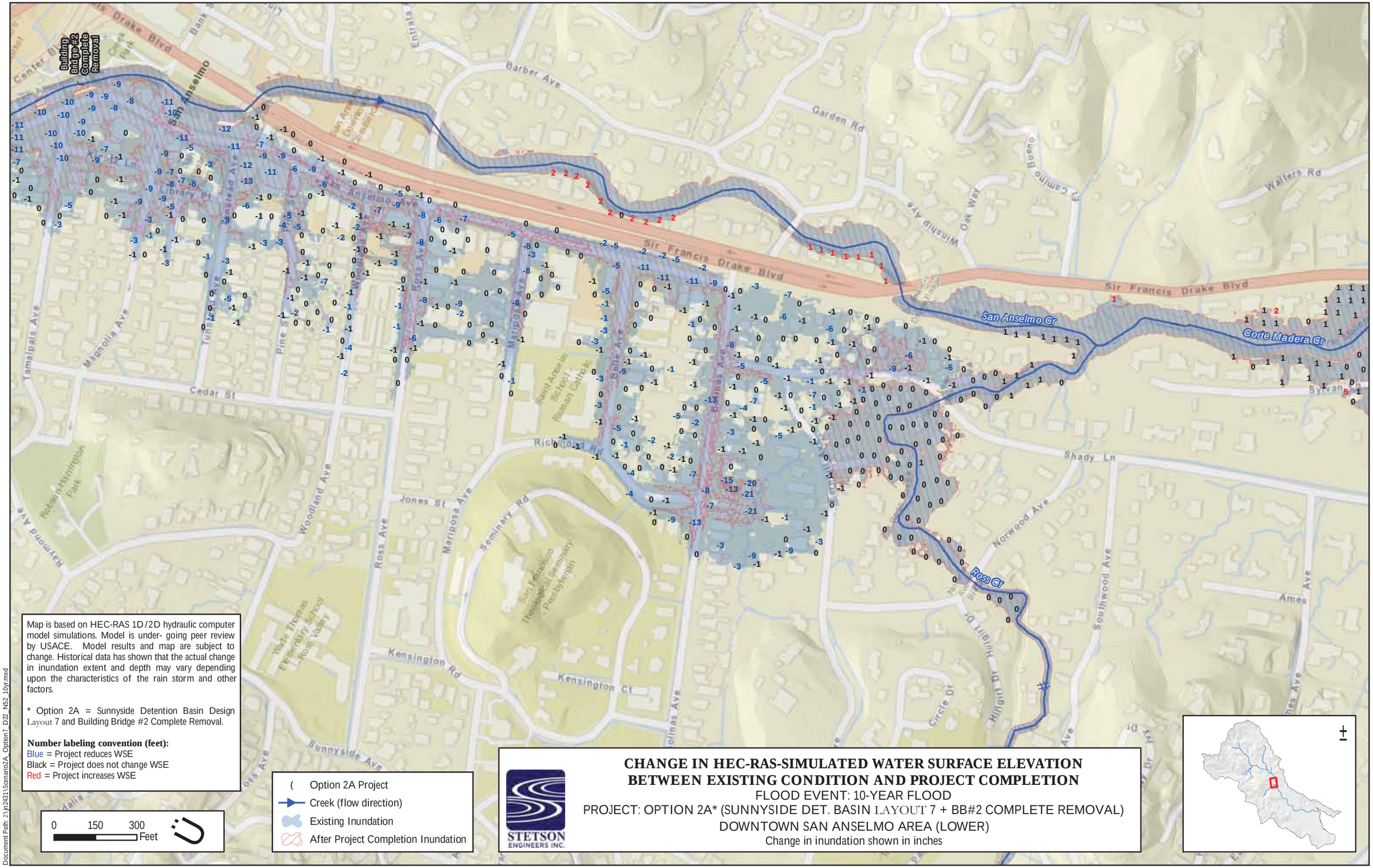
FLOOD EVENT: 10-YEAR FLOOD

PROJECT: OPTION 2A* (SUNNYSIDE DET. BASIN LAYOUT 7 + BB#2 COMPLETE REMOVAL)

DOWNTOWN SAN ANSELMO AREA (UPPER)

Change in inundation shown in inches

Document Path: J:\jn2431\Scenario2A_Option7_D22_N52_10yr.mxd



Map is based on HEC-RAS 1D/2D hydraulic computer model simulations. Model is under- going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

* Option 2A = Sunnyside Detention Basin Design Layout 7 and Building Bridge #2 Complete Removal.

Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 150 300 Feet

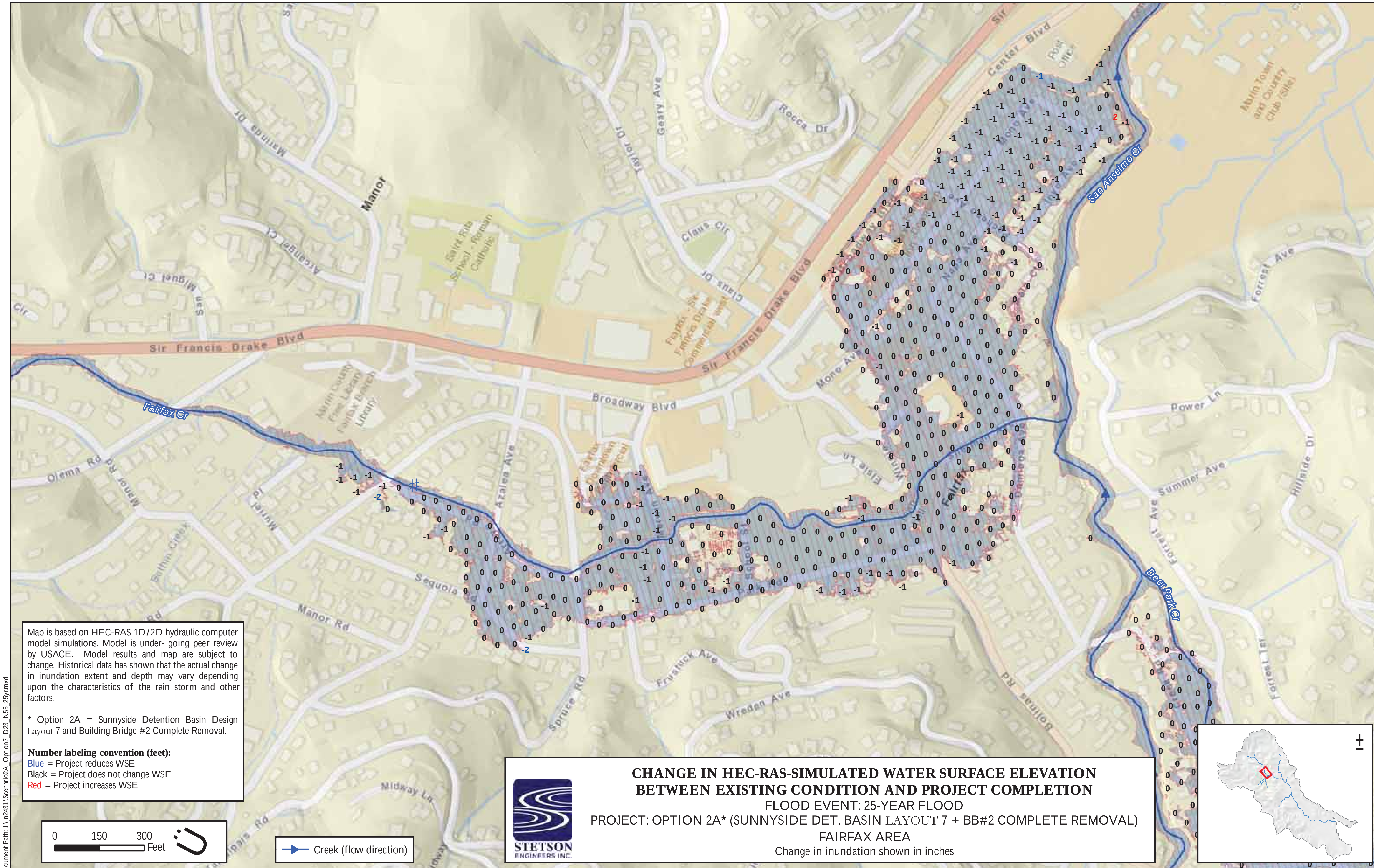
Option 2A Project
Creek (flow direction)
Existing Inundation
After Project Completion Inundation

STETSON ENGINEERS INC.

CHANGE IN HEC-RAS-SIMULATED WATER SURFACE ELEVATION BETWEEN EXISTING CONDITION AND PROJECT COMPLETION
FLOOD EVENT: 10-YEAR FLOOD
PROJECT: OPTION 2A* (SUNNYSIDE DET. BASIN LAYOUT 7 + BB#2 COMPLETE REMOVAL)
DOWNTOWN SAN ANSELMO AREA (LOWER)
Change in inundation shown in inches

Document Path: J:\jn\2431\Scenario2A_Option7_D2_N52_10yr.mxd

Figure 12a



Map is based on HEC-RAS 1D/2D hydraulic computer model simulations. Model is under- going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

* Option 2A = Sunnyside Detention Basin Design Layout 7 and Building Bridge #2 Complete Removal.

Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

STETSON ENGINEERS INC.

CHANGE IN HEC-RAS-SIMULATED WATER SURFACE ELEVATION BETWEEN EXISTING CONDITION AND PROJECT COMPLETION

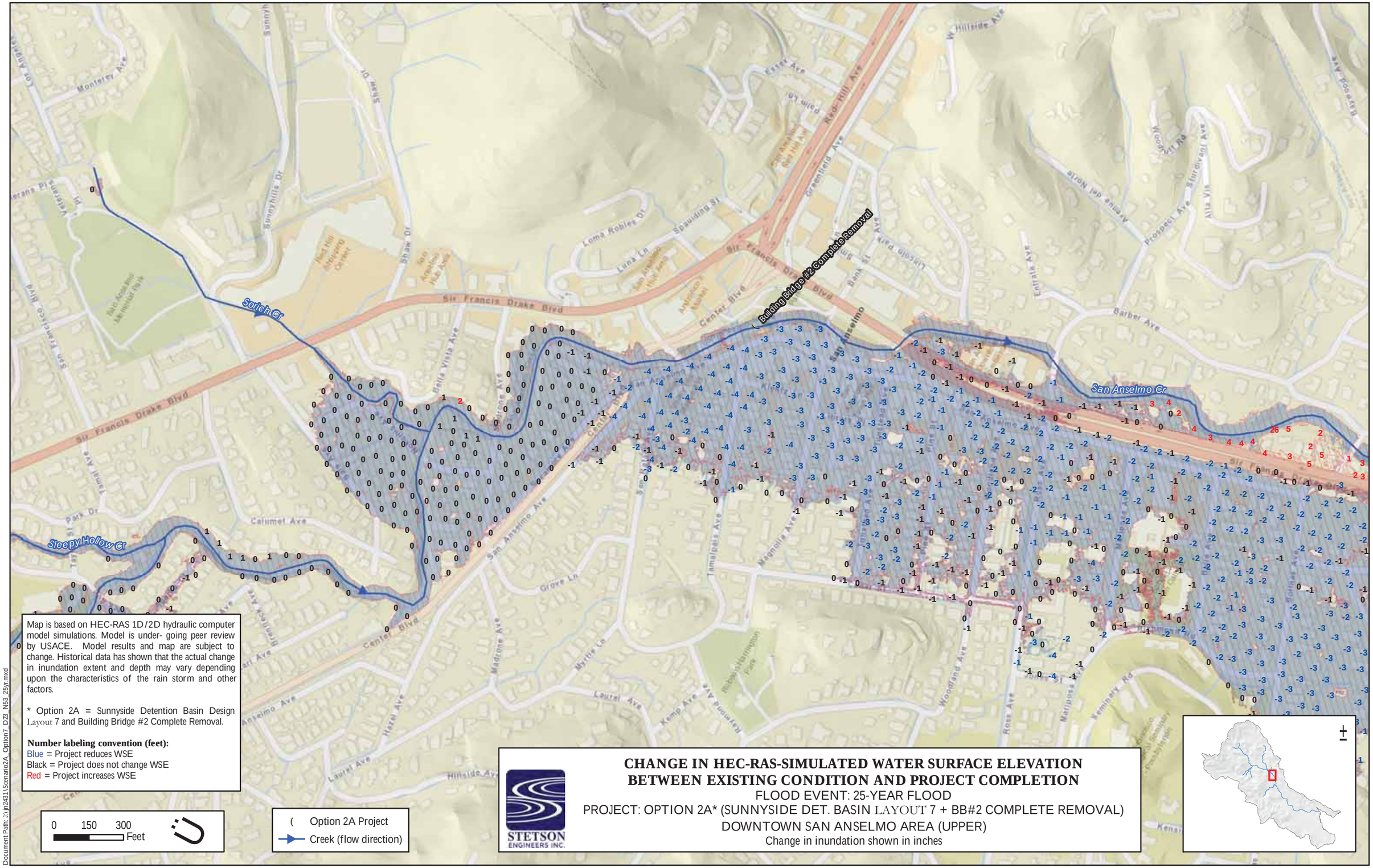
FLOOD EVENT: 25-YEAR FLOOD

PROJECT: OPTION 2A* (SUNNYSIDE DET. BASIN LAYOUT 7 + BB#2 COMPLETE REMOVAL)

FAIRFAX AREA

Change in inundation shown in inches

Document Path: J:\jn2431\Scenario2A_Option7_D23_N53_25yr.mxd



Map is based on HEC-RAS 1D/2D hydraulic computer model simulations. Model is under- going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

* Option 2A = Sunnyside Detention Basin Design Layout 7 and Building Bridge #2 Complete Removal.

Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 150 300 Feet

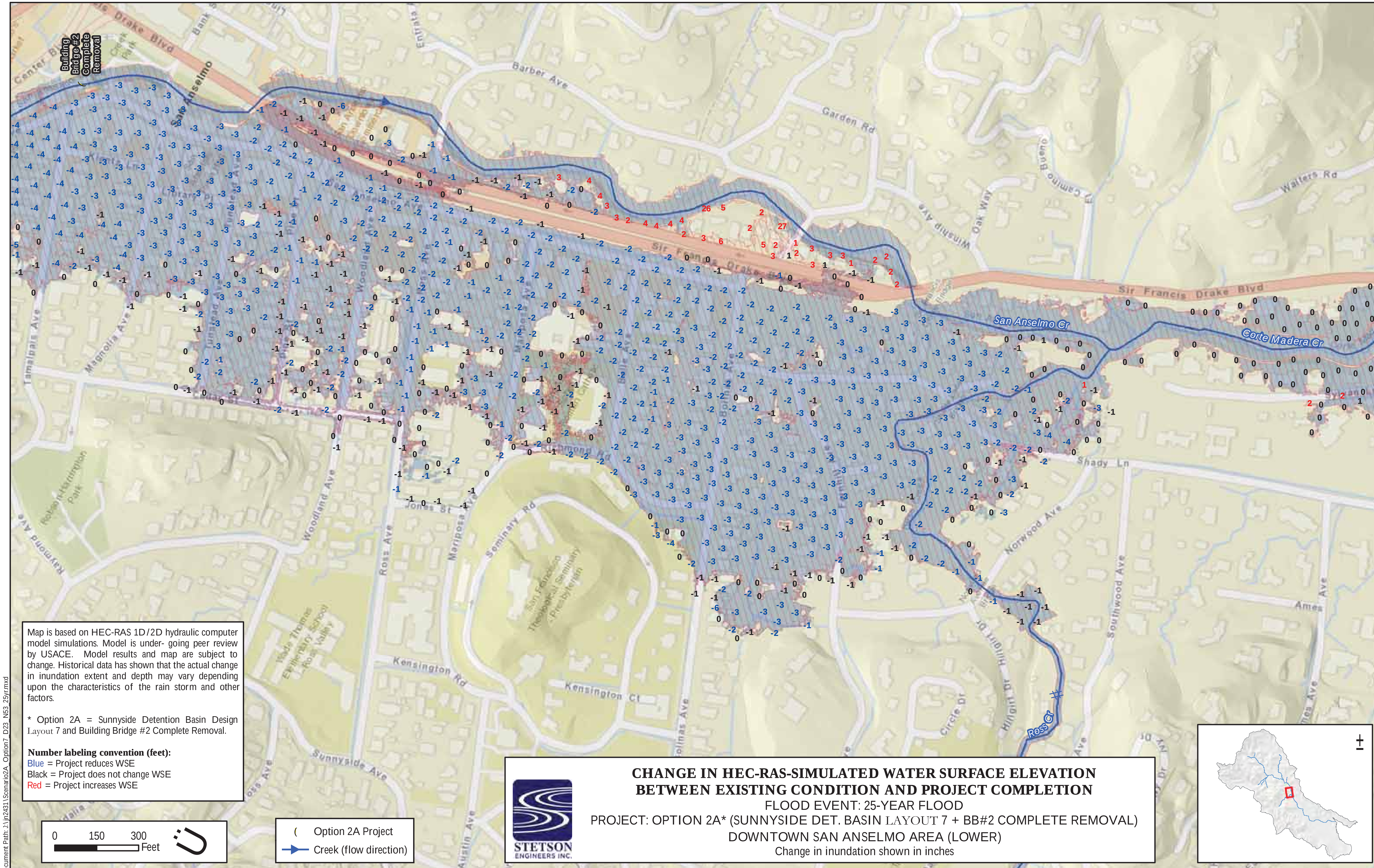
(Option 2A Project
Creek (flow direction)

STETSON ENGINEERS INC.

CHANGE IN HEC-RAS-SIMULATED WATER SURFACE ELEVATION BETWEEN EXISTING CONDITION AND PROJECT COMPLETION
FLOOD EVENT: 25-YEAR FLOOD
PROJECT: OPTION 2A* (SUNNYSIDE DET. BASIN LAYOUT 7 + BB#2 COMPLETE REMOVAL)
DOWNTOWN SAN ANSELMO AREA (UPPER)
Change in inundation shown in inches

Document Path: J:\jn\24311\Scenario2A_Option7_D23_N53_25yr.mxd

Figure 12c



Map is based on HEC-RAS 1D/2D hydraulic computer model simulations. Model is under- going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

* Option 2A = Sunnyside Detention Basin Design Layout 7 and Building Bridge #2 Complete Removal.

Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

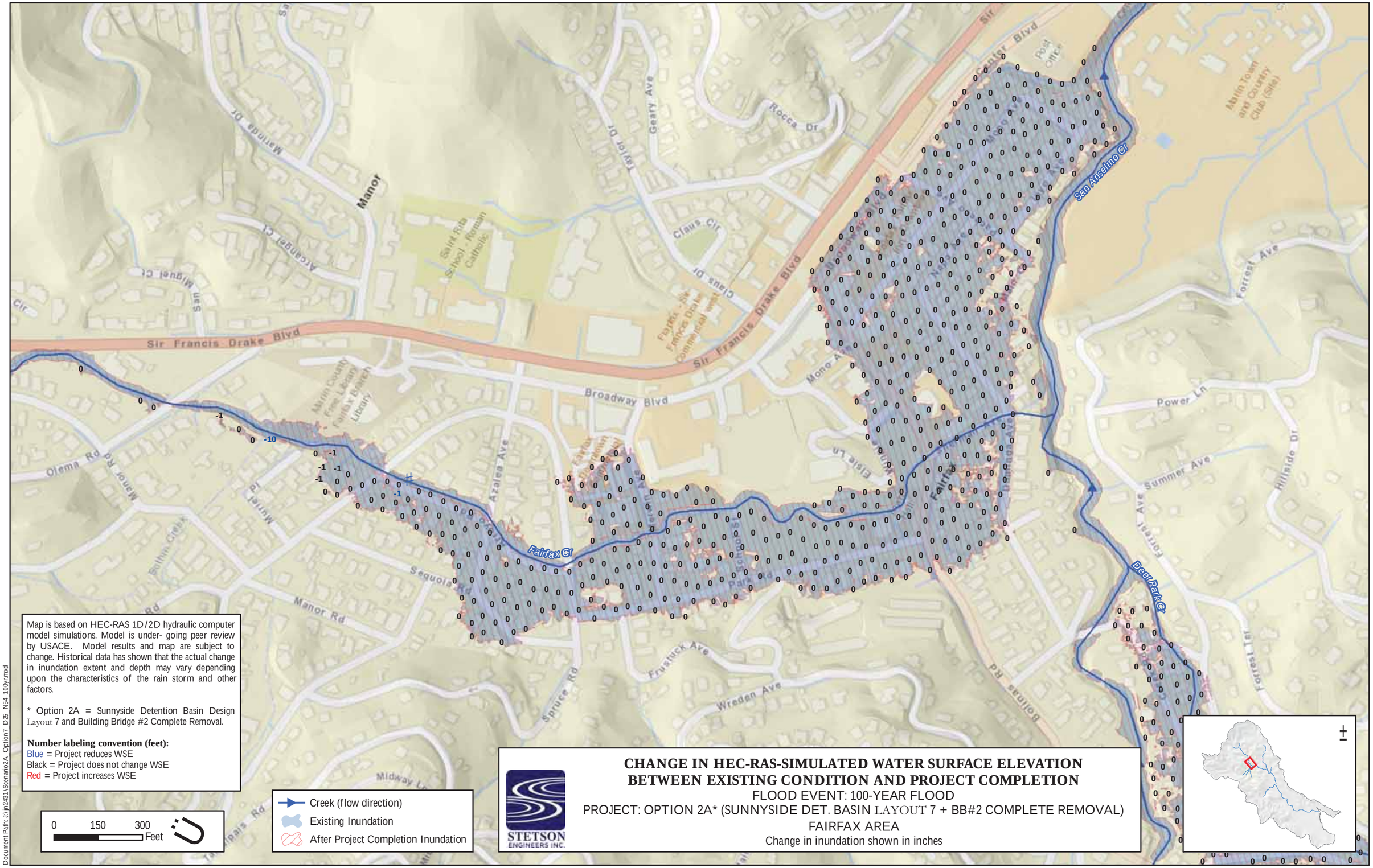
0 150 300 Feet

(Option 2A Project
Creek (flow direction)

CHANGE IN HEC-RAS-SIMULATED WATER SURFACE ELEVATION BETWEEN EXISTING CONDITION AND PROJECT COMPLETION
FLOOD EVENT: 25-YEAR FLOOD
PROJECT: OPTION 2A* (SUNNYSIDE DET. BASIN LAYOUT 7 + BB#2 COMPLETE REMOVAL)
DOWNTOWN SAN ANSELMO AREA (LOWER)
Change in inundation shown in inches

STETSON ENGINEERS INC.

Document Path: J:\jn2431\Scenario2A_Option7_D23_N53_25yr.mxd



Map is based on HEC-RAS 1D/2D hydraulic computer model simulations. Model is under- going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

* Option 2A = Sunnyside Detention Basin Design Layout 7 and Building Bridge #2 Complete Removal.

Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

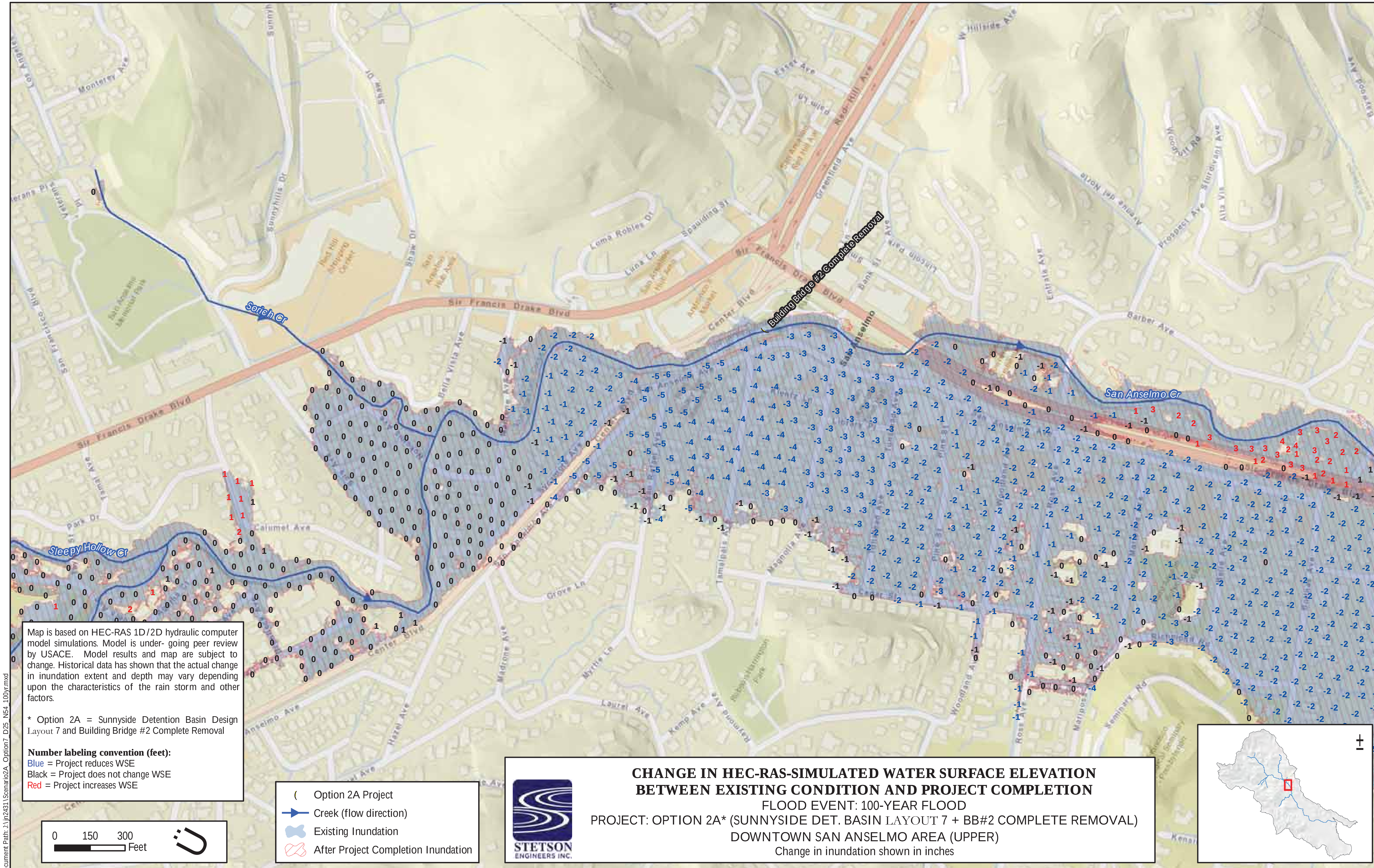
0 150 300 Feet

Creek (flow direction)
Existing Inundation
After Project Completion Inundation

STETSON ENGINEERS INC.

CHANGE IN HEC-RAS-SIMULATED WATER SURFACE ELEVATION BETWEEN EXISTING CONDITION AND PROJECT COMPLETION
FLOOD EVENT: 100-YEAR FLOOD
PROJECT: OPTION 2A* (SUNNYSIDE DET. BASIN LAYOUT 7 + BB#2 COMPLETE REMOVAL)
FAIRFAX AREA
Change in inundation shown in inches

Document Path: J:\jn2431\Scenario2A_Option7_D25_N54_100yr.mxd



Map is based on HEC-RAS 1D/2D hydraulic computer model simulations. Model is under- going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

* Option 2A = Sunnyside Detention Basin Design Layout 7 and Building Bridge #2 Complete Removal

Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 150 300 Feet

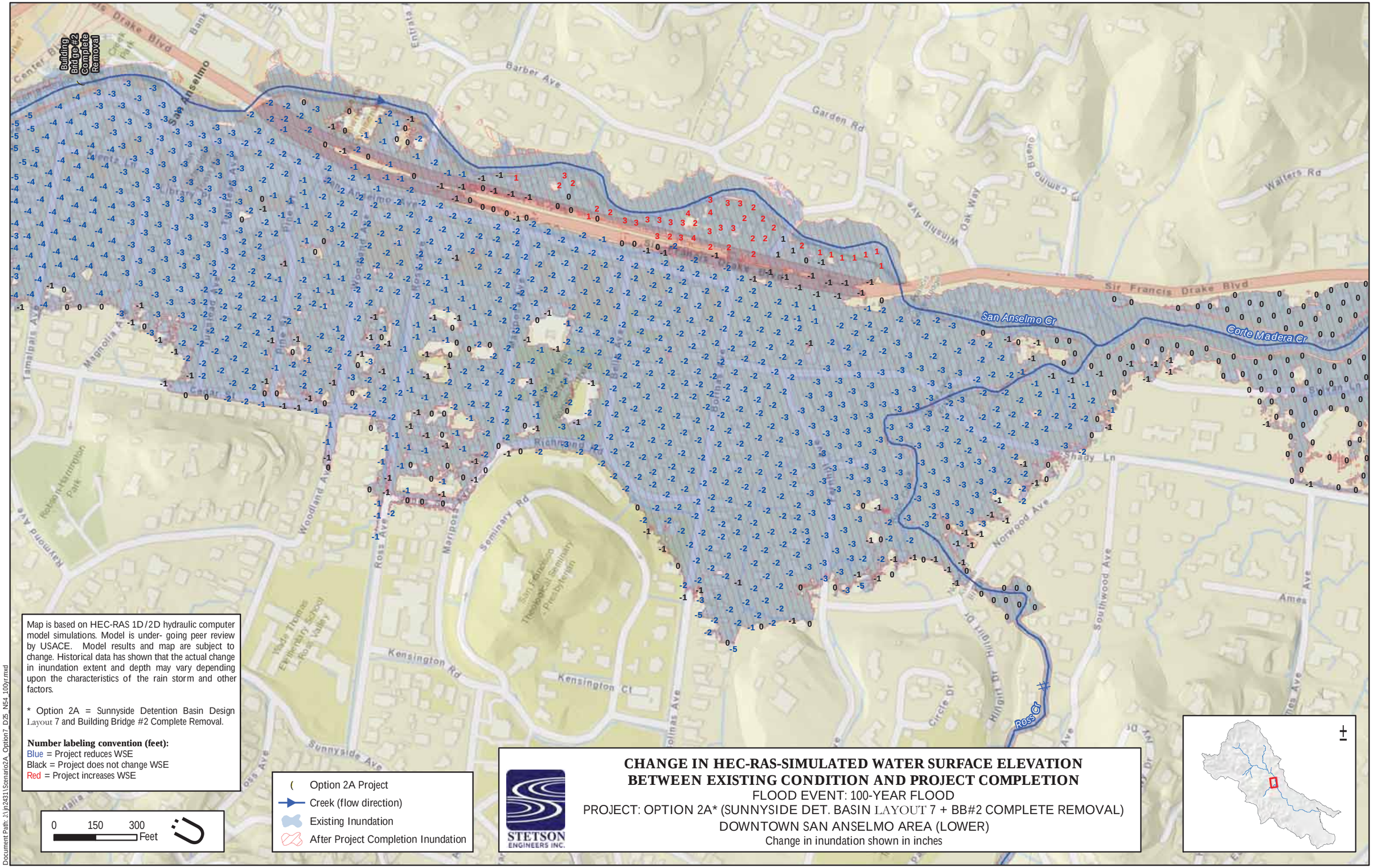
Option 2A Project
Creek (flow direction)
Existing Inundation
After Project Completion Inundation

STETSON ENGINEERS INC.

CHANGE IN HEC-RAS-SIMULATED WATER SURFACE ELEVATION BETWEEN EXISTING CONDITION AND PROJECT COMPLETION

FLOOD EVENT: 100-YEAR FLOOD
PROJECT: OPTION 2A* (SUNNYSIDE DET. BASIN LAYOUT 7 + BB#2 COMPLETE REMOVAL)
DOWNTOWN SAN ANSELMO AREA (UPPER)
Change in inundation shown in inches

Document Path: J:\jn2431\Scenario2A_Option7_D25_N54_100yr.mxd



Map is based on HEC-RAS 1D/2D hydraulic computer model simulations. Model is under- going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

* Option 2A = Sunnyside Detention Basin Design Layout 7 and Building Bridge #2 Complete Removal.

Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 150 300 Feet

(Option 2A Project
Creek (flow direction)
Existing Inundation
After Project Completion Inundation

STETSON ENGINEERS INC.

CHANGE IN HEC-RAS-SIMULATED WATER SURFACE ELEVATION BETWEEN EXISTING CONDITION AND PROJECT COMPLETION
FLOOD EVENT: 100-YEAR FLOOD
PROJECT: OPTION 2A* (SUNNYSIDE DET. BASIN LAYOUT 7 + BB#2 COMPLETE REMOVAL)
DOWNTOWN SAN ANSELMO AREA (LOWER)
Change in inundation shown in inches

Document Path: J:\jn2431\Scenario2A_Option7_D25_N54_100yr.mxd

D-2 Report on Hydraulic Analysis of the Morningside Alternative

Report on Hydraulic Analysis of the Morningside Alternative

Stetson Engineers Inc.
May 2, 2018

Introduction

This report documents the hydraulic analysis and assessment of the Morningside Alternative for flood risk management of Sleepy Hollow Creek. The assessment considered both project effects and cumulative effects in conjunction with other foreseeable projects[1] with regard to flooding.

The Morningside Alternative consists of the following measures:

- Removal of Morningside Bridge;
- Replacement of Mountain View Bridge; and
- Construction of Sunnyside passive detention basin (DB).

Stetson prepared a conceptual design for the Mountain View replacement bridge in November 2016 and for the Sunnyside passive DB[2] in January 2018. The design for the Mountain View replacement bridge would create a bigger opening and raise the bridge soffit from the existing elevation 76.9 ft to 78.3 ft NAVD88. Refer to Attachment A for the conceptual design. The approximate flood magnitude when the water surface elevation reaches the new soffit in terms of recurrence interval is about the 9-year flood.

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[1] The foreseeable projects here are the same foreseeable projects as in other reports related to the San Anselmo Flood Risk Management Project except no Building Bridge #2 removal. Specifically, the foreseeable projects here include the following projects:

- Azalea Avenue Bridge Replacement;
- Madrone Avenue Bridge Replacement;
- Nokomis Avenue Bridge Replacement;
- Sycamore Avenue/Center Boulevard Bridge Replacement;
- Bridge Avenue Bridge Replacement;
- Winship Avenue Bridge Replacement; and
- Unit 4 Measures 1, 2, and 3 in Stetson's 2008 Letter Report to the Corps.

[2] The Sunnyside passive DB was designed with no creek diversion structure. The side weir along the left bank of the creek was designed to have a crest elevation of 228 ft NAVD88. This elevation is the water surface elevation in the creek at the DB site at the time of incipient flooding downstream in Fairfax. In other words, at the time when downstream incipient flooding occurs, a portion of flood water would begin to passively enter into the DB over the side weir. The Sunnyside passive DB would have an east berm top elevation of 232 ft NAVD88 and a storage capacity of about 20 acre-ft at the simulated 100-year maximum water surface elevation (229.9 ft NAVD88).

A 36-inch diameter low-level drain outlet pipe with an invert elevation at about 223.8 ft NAVD88 was designed to drain the detention basin. Under this concept, the designed 36-inch diameter low-level outlet pipe would be kept open at all times.

Hydraulic Modeling for the Morningside Alternative

Stetson performed hydraulic modeling to assess the project effects and cumulative effects of the Morningside Alternative with regard to flooding. For the modeling, Stetson used US Army Corps of Engineers software, HEC-RAS version 5.0, which has combined 1D and 2D hydraulic modeling capabilities. Stetson recently developed a combined 1D/2D unsteady-flow model application for the Corte Madera Creek watershed. The model starts from the bay and extends upstream along the mainstream and tributaries (including the Sleepy Hollow Creek) to the proposed upper watershed detention basins in Fairfax that are currently under environmental review. The model was calibrated to the 12/15/2016 bankfull event and the 12/31/2005 flood event (an approximate 100-year flood), and verified to the 1/4/1982 flood event (an approximate 150-year flood; Stetson, 2017). The model is undergoing peer review by the US Army Corps of Engineers.

The following three scenarios were analyzed:

- Existing Conditions (EC), to serve as the "Baseline" basis for comparison
- Morningside Alternative added to EC, to assess "Project" effects
- Morningside Alternative + Foreseeable Projects added to EC, to assess "cumulative" effects

For each scenario, the following three flood events were analyzed:

- Q100, major, rare flood, similar to 12/31/05 flood
- Q25, moderate, infrequent flood
- Q10, minor flood, less frequent than 2017 flood event (7-year flood event)

Results of Hydraulic Analysis in Terms of Floodplain Inundation

Figures 1a to 1d show the changes in the HEC-RAS model-simulated floodplain inundation extent and depth between Morningside Alternative and existing conditions for the 10-year flood. Figures are provided covering Fairfax, Sleepy Hollow, Upper San Anselmo, and Lower San Anselmo areas. Similarly, Figures 2a to 2d show the model-simulated results for the 25-year flood and Figure 3a to 3d for the 100-year flood.

Figures 4a to 4d show the changes in the HEC-RAS model-simulated floodplain inundation extent and depth between Morningside Alternative + Foreseeable Projects and existing conditions for the 10-year flood. Similarly, Figures 5a to 5d show the model-simulated results for the 25-year flood and Figures 6a to 6d for the 100-year flood.

Table 1 is a summary of results for Morningside Alternative and Table 2 is a summary of results for Morningside Alternative + Foreseeable Projects.

The Morningside Alternative alone would slightly increase flooding in the Downtown SA area during the 25-year (see Figures 1c and 1d). But the Morningside Alternative + the Foreseeable Projects would mitigate for the slight increase in flooding caused by Morningside Alternative alone.

Table 2 Summary of Benefits of Morningside Alternative verses Existing Condition

Figure No.	Flow Condition	Location	Summary of Benefits	Any Flooding Increase?
Figure 1a	Q10	Fairfax	• Reduces inundation extent due to Sunnyside passive DB • Reduces inundation depth by up to 13 inches	None
Figure 1b		Sleepy Hollow	• Reduces inundation extent due to Morningside measures • Reduces inundation depth by up to 28 inches	Slightly increases flooding in the area near Sorich Creek confluence
Figure 1c		Downtown SA (Upper)	• No effect	Slightly increases flooding in the area near Sorich Creek confluence
Figure 1d		Downtown SA (Lower)	• No effect	None
Figure 2a	Q25	Fairfax	• Nearly zero reduction in inundation extent • Reduces inundation depth by up to 2 inch	None
Figure 2b		Sleepy Hollow	• Reduces inundation extent due to Morningside measures • Reduces inundation depth by up to 24 inches	Slightly increases flooding in the area below Mountain View replacement bridge and in the area between Sleepy Hollow Creek and Sorich Creek
Figure 2c		Downtown SA (Upper)	• Nearly zero effect in inundation extent	Slightly increases flooding in the upper Down SA area
Figure 2d		Downtown SA (Lower)	• Nearly zero effect in inundation extent	Slightly increases flooding in the lower Down SA area
Figure 3a	Q100	Fairfax	• No effect	None
Figure 3b		Sleepy Hollow	• Nearly zero reduction in inundation extent • Reduces inundation depth by up to 7 inch	Slightly increases flooding in the area below Mountain View replacement bridge
Figure 3c		Downtown SA (Upper)	• No effect	None
Figure 3d		Downtown SA (Lower)	• No effect	None

Table 3 Summary Benefits of Morningside Alternative + Foreseeable Projects verses Existing Condition

Figure No.	Flow Condition	Location	Summary of Results	Any Increased Flooding?
Figure 4a	Q10	Fairfax	• Reduces inundation extent due to Sunnyside passive DB • Reduces inundation depth by up to 13 inches	None
Figure 4b		Sleepy Hollow	• Reduces inundation extent due to Morningside measures • Reduces inundation depth by up to 28 inches	None
Figure 4c		Downtown SA (Upper)	• Reduces inundation extent due to replacements of Nokomis, Madrone, Center and Bridge Ave Bridges. • Reduces inundation depth by up to 26 inches	None
Figure 4d		Downtown SA (Lower)	• Reduces inundation extent due to replacements of Center and Bridge Ave Bridges. • Reduces inundation depth by up to 16 inches	None
Figure 5a	Q25	Fairfax	• Reduces inundation extent due to replacement of Azalea Bridge • Reduces inundation depth by up to 27 inches	None
Figure 5b		Sleepy Hollow	• Reduces inundation extent due to Morningside measures • Reduces inundation depth by up to 24 inches	Slightly increases flooding in the area below Mountain View replacement bridge
Figure 5c		Downtown SA (Upper)	• Reduces inundation extent • Reduces inundation depth by up to 20 inches	None
Figure 5d		Downtown SA (Lower)	• Nearly no effect	Slightly increases flooding in the area below Winship replacement bridge
Figure 6a	Q100	Fairfax	• Reduces inundation extent due to replacement of Azalea Bridge • Reduces inundation depth by up to 14 inches	None
Figure 6b		Sleepy Hollow	• Nearly no effect on inundation extent • Reduces inundation depth by up to 7 inches	Slightly increases flooding in the area below Mountain View replacement bridge
Figure 6c		Downtown SA (Upper)	• Reduces inundation extent • Reduces inundation depth by up to 18 inches	None
Figure 6d		Downtown SA (Lower)	• Reduces inundation extent • Reduces inundation depth by up to 18 inches	None

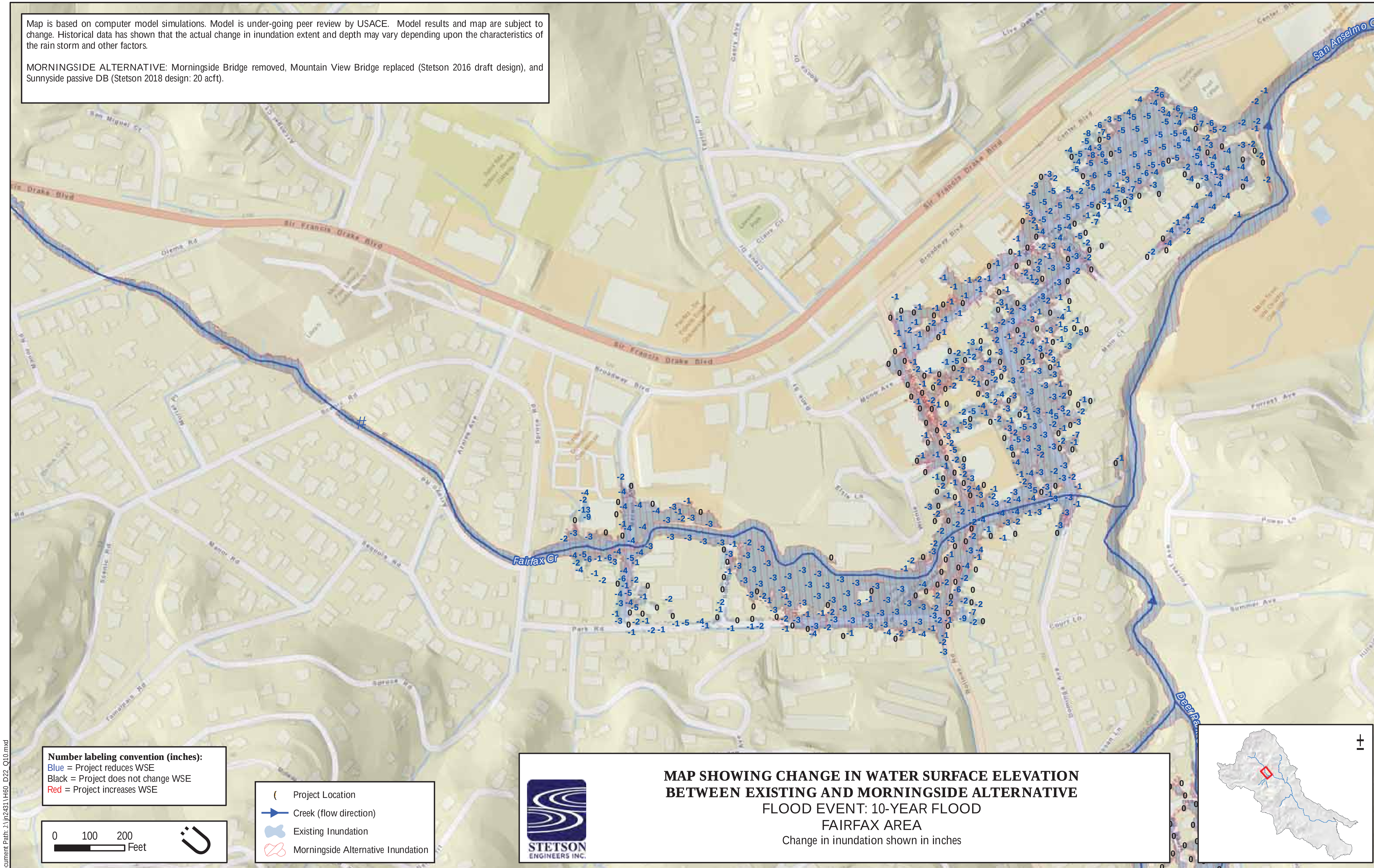
Results of Hydraulic Analysis in Terms of Channel Water Surface Level

Figures 7a to 7c compare the HEC-RAS model-simulated channel water surface profiles along Fairfax Creek for the 10-year flood, 25-year flood, and 100-year flood, respectively[3]. Similarly, Figures 8a to 8c compare the simulated channel water surface profiles along Sleepy Hollow Creek and Figures 9a to 9c compare the simulated channel water surface profiles along San Anselmo Creek. Each figure includes three water surface profiles: (1) existing condition, (2) after project construction, and (3) after project + Foreseeable Projects construction.

[3] The Fairfax water surface profile in the 1D in-channel model does not show the creek water surface onto and across Bolinas Ave and down to Sherman Ave. The water surface downstream of the entrance to the Sherman Ave culvert is shown in the 2D floodplain model results (see Figures 1a, 2a, 3a, 4a, 5a, and 6a). This is related to the 1D/2D model configuration. In this HEC-RAS 1D/2D model configuration, a single 2D Flow Area is used for the Fairfax Creek floodplain. This single 2D Flow Area covers the both the right and left floodplains of the creek as well as the ground above the Fairfax (Sherman Ave) culvert. Floodwaters in the right floodplain and left floodplain can have a direct connection/exchange as floodwaters flow over and above the culvert.

Map is based on computer model simulations. Model is under-going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

MORNINGSIDE ALTERNATIVE: Morningside Bridge removed, Mountain View Bridge replaced (Stetson 2016 draft design), and Sunnyside passive DB (Stetson 2018 design: 20 acft).



Number labeling convention (inches):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 100 200 Feet

(Project Location
Creek (flow direction)
Existing Inundation
Morningside Alternative Inundation

MAP SHOWING CHANGE IN WATER SURFACE ELEVATION BETWEEN EXISTING AND MORNINGSIDE ALTERNATIVE

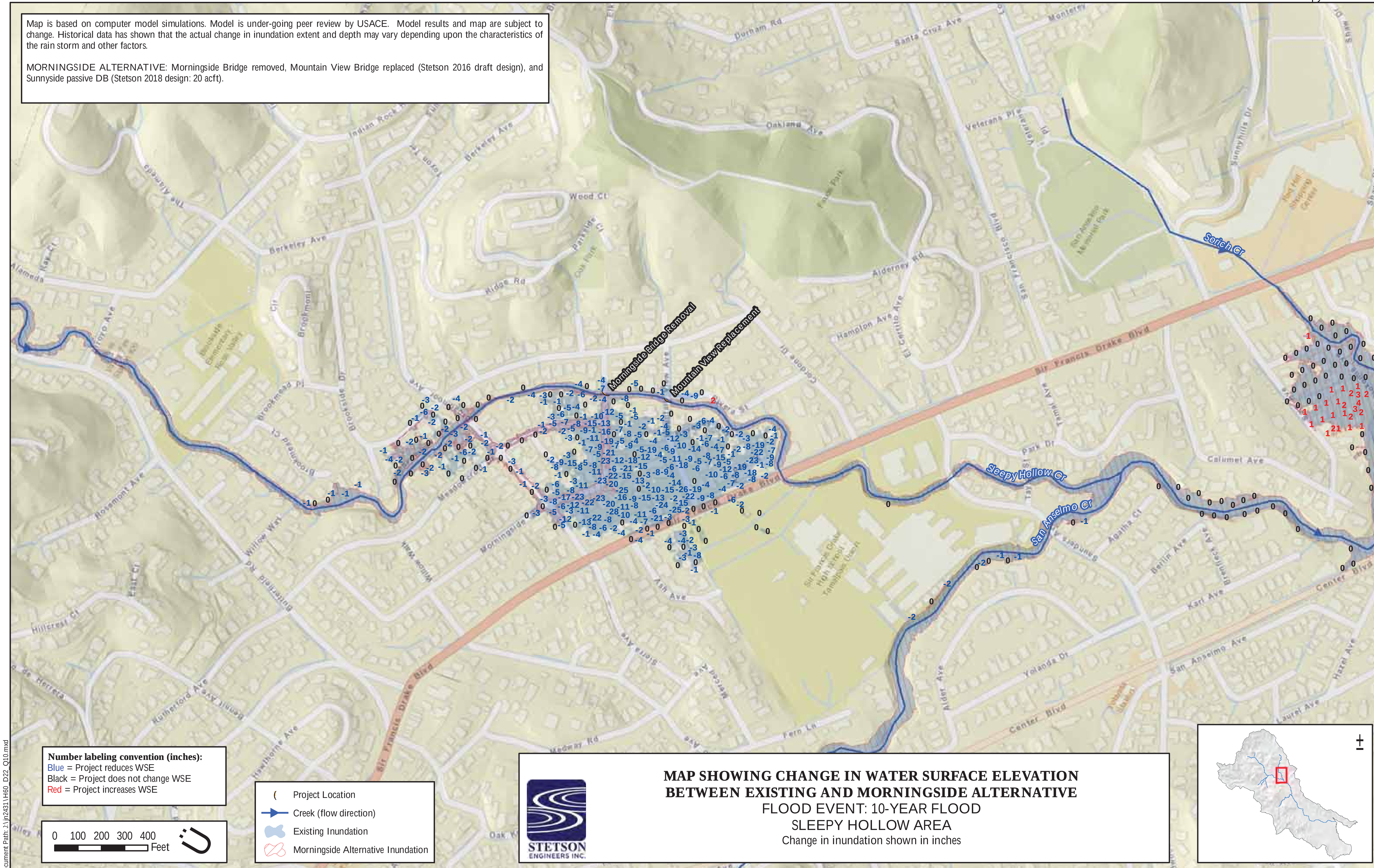
FLOOD EVENT: 10-YEAR FLOOD
FAIRFAX AREA
Change in inundation shown in inches

STETSON ENGINEERS INC.

Document Path: J:\jn2431\H60_D22_Q10.mxd

Map is based on computer model simulations. Model is under-going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

MORNINGSIDE ALTERNATIVE: Morningside Bridge removed, Mountain View Bridge replaced (Stetson 2016 draft design), and Sunnyside passive DB (Stetson 2018 design: 20 acft).



Number labeling convention (inches):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 100 200 300 400 Feet

(Project Location
Creek (flow direction)
Existing Inundation
Morningside Alternative Inundation

STETSON ENGINEERS INC.

MAP SHOWING CHANGE IN WATER SURFACE ELEVATION BETWEEN EXISTING AND MORNINGSIDE ALTERNATIVE
FLOOD EVENT: 10-YEAR FLOOD
SLEEPY HOLLOW AREA
Change in inundation shown in inches

Document Path: J:\jn2431\H60_D22_Q10.mxd

FIGURE 1c - Downtown San Anselmo Area (Upper)

Map is based on computer model simulations. Model is under-going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

MORNINGSIDE ALTERNATIVE: Morningside Bridge removed, Mountain View Bridge replaced (Stetson 2016 draft design), and Sunnyside passive DB (Stetson 2018 design: 20 acft).

San Anselmo Cr

Sorich Cr

Sir Francis Drake Blvd

Center Blvd

Cedar St

Jones St

Grove Ln

Document Path: J:\jn\24311H60_D22_Q10.mxd

Number labeling convention (inches):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 100 200 Feet

(Project Location
Creek (flow direction)
Existing Inundation
Morningside Alternative Inundation

STETSON ENGINEERS INC.

MAP SHOWING CHANGE IN WATER SURFACE ELEVATION BETWEEN EXISTING AND MORNINGSIDE ALTERNATIVE
FLOOD EVENT: 10-YEAR FLOOD
DOWNTOWN SAN ANSELMO AREA (UPPER)
Change in inundation shown in inches

FIGURE 1d - Downtown San Anselmo Area (Lower)

Map is based on computer model simulations. Model is under-going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

MORNINGSIDE ALTERNATIVE: Morningside Bridge removed, Mountain View Bridge replaced (Stetson 2016 draft design), and Sunnyside passive DB (Stetson 2018 design: 20 acft).

San Anselmo Cr

Corte Madera Cr

Ross Cr

Sir Francis Drake Blvd

Document Path: J:\jn2431\H60_D22_Q10.mxd

Number labeling convention (inches):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 100 200 Feet

(Project Location
Creek (flow direction)
Existing Inundation
Morningside Alternative Inundation

STETSON ENGINEERS INC.

MAP SHOWING CHANGE IN WATER SURFACE ELEVATION BETWEEN EXISTING AND MORNINGSIDE ALTERNATIVE
FLOOD EVENT: 10-YEAR FLOOD
DOWNTOWN SAN ANSELMO AREA (LOWER)
Change in inundation shown in inches

FIGURE 2a - Fairfax Area

Map is based on computer model simulations. Model is under-going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

MORNINGSIDE ALTERNATIVE: Morningside Bridge removed, Mountain View Bridge replaced (Stetson 2016 draft design), and Sunnyside passive DB (Stetson 2018 design: 20 acft).

Fairfax Cr

San Anselmo Cr

Sir Francis Drake Blvd

Broadway Blvd

Deer Park

Number labeling convention (inches):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 100 200 Feet

Creek (flow direction)
Existing Inundation
Morningside Alternative Inundation

STETSON ENGINEERS INC.

MAP SHOWING CHANGE IN WATER SURFACE ELEVATION BETWEEN EXISTING AND MORNINGSIDE ALTERNATIVE
FLOOD EVENT: 25-YEAR FLOOD
FAIRFAX AREA
Change in inundation shown in inches

4/30/2018

Document Path: J:\jn2431\H61_D23_Q25.mxd

Map is based on computer model simulations. Model is under-going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

MORNINGSIDE ALTERNATIVE: Morningside Bridge removed, Mountain View Bridge replaced (Stetson 2016 draft design), and Sunnyside passive DB (Stetson 2018 design: 20 acft).

Morningside Bridge Removal

Mountain View Replacement

Sorich Cr

Sleepy Hollow Cr

Elmo Cr

Sir Francis Drake Blvd

Number labeling convention (inches):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 100 200 300 400 Feet

(Project Location
Creek (flow direction)
Existing Inundation
Morningside Alternative Inundation

STETSON ENGINEERS INC.

MAP SHOWING CHANGE IN WATER SURFACE ELEVATION BETWEEN EXISTING AND MORNINGSIDE ALTERNATIVE
FLOOD EVENT: 25-YEAR FLOOD
SLEEPY HOLLOW AREA
Change in inundation shown in inches

4/30/2018

Document Path: J:\jn2431\H61_D23_Q25.mxd

FIGURE 2c - Downtown San Anselmo Area (Upper)

Map is based on computer model simulations. Model is under-going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

MORNINGSIDE ALTERNATIVE: Morningside Bridge removed, Mountain View Bridge replaced (Stetson 2016 draft design), and Sunnyside passive DB (Stetson 2018 design: 20 acft).

San Anselmo Cr

Sorich Cr

Sir Francis Drake Blvd

Center Blvd

Cedar St

Creek (flow direction)
Existing Inundation
Morningside Alternative Inundation

Number labeling convention (inches):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 100 200 Feet

STETSON ENGINEERS INC.

MAP SHOWING CHANGE IN WATER SURFACE ELEVATION BETWEEN EXISTING AND MORNINGSIDE ALTERNATIVE
FLOOD EVENT: 25-YEAR FLOOD
DOWNTOWN SAN ANSELMO AREA (UPPER)
Change in inundation shown in inches

4/30/2018

Document Path: J:\jn2431\H61_D23_Q25.mxd

FIGURE 2d - Downtown San Anselmo Area (Lower)

Map is based on computer model simulations. Model is under-going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

MORNINGSIDE ALTERNATIVE: Morningside Bridge removed, Mountain View Bridge replaced (Stetson 2016 draft design), and Sunnyside passive DB (Stetson 2018 design: 20 acft).

San Anselmo Cr

Corte Madera Cr

Ross Cr

Sir Francis Drake Blvd

Number labeling convention (inches):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 100 200 Feet

Creek (flow direction)
Existing Inundation
Morningside Alternative Inundation

STETSON ENGINEERS INC.

MAP SHOWING CHANGE IN WATER SURFACE ELEVATION BETWEEN EXISTING AND MORNINGSIDE ALTERNATIVE
FLOOD EVENT: 25-YEAR FLOOD
DOWNTOWN SAN ANSELMO AREA (LOWER)
Change in inundation shown in inches

4/30/2018

Document Path: J:\jn2431\H61_D23_Q25.mxd

FIGURE 3a - Fairfax Area

Map is based on computer model simulations. Model is under-going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

MORNINGSIDE ALTERNATIVE: Morningside Bridge removed, Mountain View Bridge replaced (Stetson 2016 draft design), and Sunnyside passive DB (Stetson 2018 design: 20 acft).

Fairfax Cr

San Anselmo Cr

Sir Francis Drake Blvd

Broadway Blvd

Deer Park

Number labeling convention (inches):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 100 200 Feet

Creek (flow direction)
Existing Inundation
Morningside Alternative Inundation

STETSON ENGINEERS INC.

MAP SHOWING CHANGE IN WATER SURFACE ELEVATION BETWEEN EXISTING AND MORNINGSIDE ALTERNATIVE
FLOOD EVENT: 100-YEAR FLOOD
FAIRFAX AREA
Change in inundation shown in inches

4/30/2018

Document Path: J:\jn2431\H62_D25_Q100.mxd

FIGURE 3b - Sleepy Hollow Area

Map is based on computer model simulations. Model is under-going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

MORNINGSIDE ALTERNATIVE: Morningside Bridge removed, Mountain View Bridge replaced (Stetson 2016 draft design), and Sunnyside passive DB (Stetson 2018 design: 20 acft).

Morningside Bridge Removal

Mountain View Replacement

Sorich Cr

Sleepy Hollow Cr

Arroyo Sleepy Hollow

Fern Cr

Number labeling convention (inches):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 100 200 300 400 Feet

(Project Location
Creek (flow direction)
Existing Inundation
Morningside Alternative Inundation

STETSON ENGINEERS INC.

MAP SHOWING CHANGE IN WATER SURFACE ELEVATION BETWEEN EXISTING AND MORNINGSIDE ALTERNATIVE
FLOOD EVENT: 100-YEAR FLOOD
SLEEPY HOLLOW AREA
Change in inundation shown in inches

4/30/2018

Document Path: J:\jn\24311\H62_D25_Q100.mxd

FIGURE 3c - Downtown San Anselmo Area (Upper)

Map is based on computer model simulations. Model is under-going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

MORNINGSIDE ALTERNATIVE: Morningside Bridge removed, Mountain View Bridge replaced (Stetson 2016 draft design), and Sunnyside passive DB (Stetson 2018 design: 20 acft).

San Anselmo Cr

Sorich Cr

Sir Francis Drake Blvd

Document Path: J:\jn2431\H62_D25_Q100.mxd

Number labeling convention (inches):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 100 200 Feet

Creek (flow direction)
Existing Inundation
Morningside Alternative Inundation

STETSON ENGINEERS INC.

MAP SHOWING CHANGE IN WATER SURFACE ELEVATION BETWEEN EXISTING AND MORNINGSIDE ALTERNATIVE
FLOOD EVENT: 100-YEAR FLOOD
DOWNTOWN SAN ANSELMO AREA (UPPER)
Change in inundation shown in inches

4/30/2018

FIGURE 3d - Downtown San Anselmo Area (Lower)

Map is based on computer model simulations. Model is under-going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

MORNINGSIDE ALTERNATIVE: Morningside Bridge removed, Mountain View Bridge replaced (Stetson 2016 draft design), and Sunnyside passive DB (Stetson 2018 design: 20 acft).

San Anselmo Cr

Corte Madera Cr

Ross Cr

Sir Francis Drake Blvd

Number labeling convention (inches):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 100 200 Feet

Creek (flow direction)
Existing Inundation
Morningside Alternative Inundation

STETSON ENGINEERS INC.

MAP SHOWING CHANGE IN WATER SURFACE ELEVATION BETWEEN EXISTING AND MORNINGSIDE ALTERNATIVE
FLOOD EVENT: 100-YEAR FLOOD
DOWNTOWN SAN ANSELMO AREA (LOWER)
Change in inundation shown in inches

4/30/2018

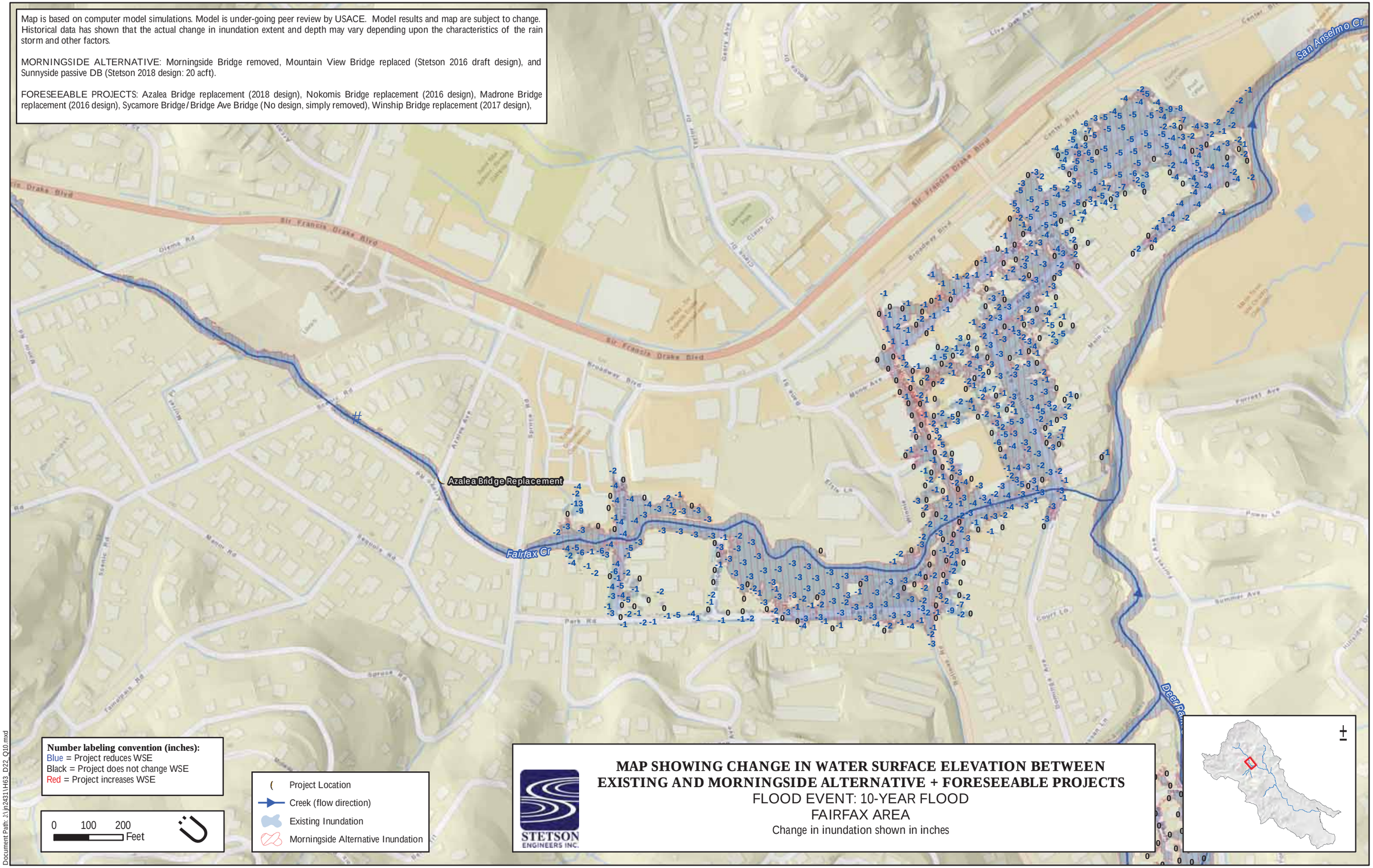
Document Path: J:\jn2431\H62_D25_Q100.mxd

FIGURE 4a - Fairfax Area

Map is based on computer model simulations. Model is under-going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

MORNINGSIDE ALTERNATIVE: Morningside Bridge removed, Mountain View Bridge replaced (Stetson 2016 draft design), and Sunnyside passive DB (Stetson 2018 design: 20 acft).

FORESEEABLE PROJECTS: Azalea Bridge replacement (2018 design), Nokomis Bridge replacement (2016 design), Madrone Bridge replacement (2016 design), Sycamore Bridge/ Bridge Ave Bridge (No design, simply removed), Winship Bridge replacement (2017 design),



Number labeling convention (inches):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 100 200 Feet

(Project Location
Creek (flow direction)
Existing Inundation
Morningside Alternative Inundation

STETSON ENGINEERS INC.

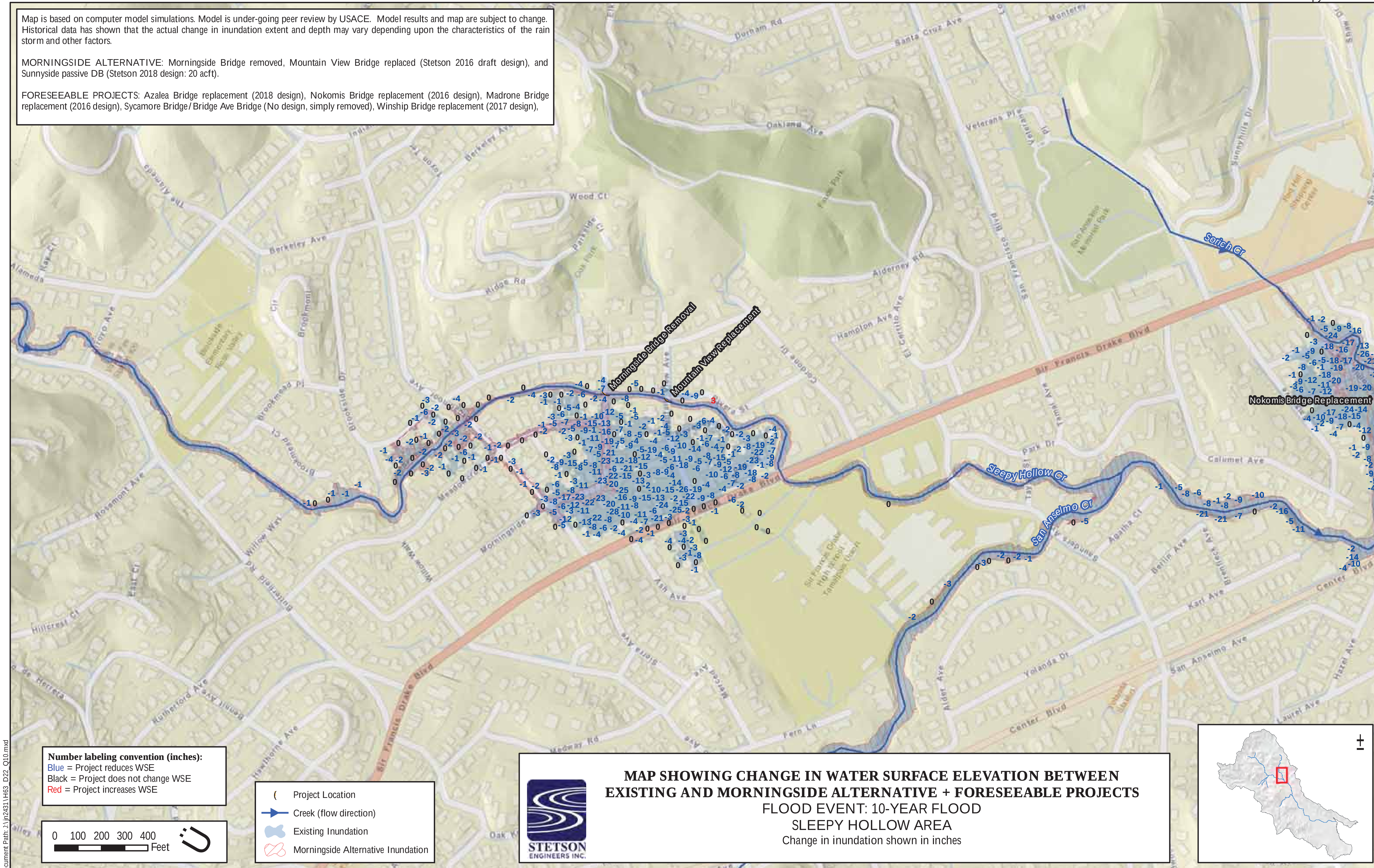
MAP SHOWING CHANGE IN WATER SURFACE ELEVATION BETWEEN EXISTING AND MORNINGSIDE ALTERNATIVE + FORESEEABLE PROJECTS
FLOOD EVENT: 10-YEAR FLOOD
FAIRFAX AREA
Change in inundation shown in inches

Document Path: J:\jn\24311\H63_D22_Q10.mxd

Map is based on computer model simulations. Model is under-going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

MORNINGSIDE ALTERNATIVE: Morningside Bridge removed, Mountain View Bridge replaced (Stetson 2016 draft design), and Sunnyside passive DB (Stetson 2018 design: 20 acft).

FORESEEABLE PROJECTS: Azalea Bridge replacement (2018 design), Nokomis Bridge replacement (2016 design), Madrone Bridge replacement (2016 design), Sycamore Bridge/Bridge Ave Bridge (No design, simply removed), Winship Bridge replacement (2017 design),



Number labeling convention (inches):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 100 200 300 400 Feet

(Project Location
Creek (flow direction)
Existing Inundation
Morningside Alternative Inundation

STETSON ENGINEERS INC.

MAP SHOWING CHANGE IN WATER SURFACE ELEVATION BETWEEN EXISTING AND MORNINGSIDE ALTERNATIVE + FORESEEABLE PROJECTS
FLOOD EVENT: 10-YEAR FLOOD
SLEEPY HOLLOW AREA
Change in inundation shown in inches

Document Path: J:\jn2431\H63_D22_Q10.mxd

FIGURE 4c - Downtown San Anselmo Area (Upper)

Map is based on computer model simulations. Model is under-going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

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San Anselmo Cr

Bridge Ave Bridge Replacement

Center Blvd Bridge Replacement

Madrone Bridge Replacement

Nokomis Bridge Replacement

Sorich Cr

Sir Francis Drake Blvd

Cedar St

Number labeling convention (inches):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 100 200 Feet

(Project Location
Creek (flow direction)
Existing Inundation
Morningside Alternative Inundation

STETSON ENGINEERS INC.

MAP SHOWING CHANGE IN WATER SURFACE ELEVATION BETWEEN EXISTING AND MORNINGSIDE ALTERNATIVE + FORESEEABLE PROJECTS
FLOOD EVENT: 10-YEAR FLOOD
DOWNTOWN SAN ANSELMO AREA (UPPER)
Change in inundation shown in inches

Document Path: J:\jn2431\H63_D22_Q10.mxd

FIGURE 4d - Downtown San Anselmo Area (Lower)

Map is based on computer model simulations. Model is under-going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

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FORESEEABLE PROJECTS: Azalea Bridge replacement (2018 design), Nokomis Bridge replacement (2016 design), Madrone Bridge replacement (2016 design), Sycamore Bridge/ Bridge Ave Bridge (No design, simply removed), Winship Bridge replacement (2017 design),

San Anselmo Cr

Winship Bridge Replacement

Corte Madera Cr

Ross Cr

Sir Francis Drake Blvd

Cedar St

Jones St

Kensington Rd

Oak Way

El Camino

Sylvan Ln

Shady Ln

Norwood Ave

Circle Dr

Ivy Dr

Bolinas Ave

Marinda Ave

Document Path: J:\jn2431\H63_D22_Q10.mxd

Number labeling convention (inches):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 100 200 Feet

(Project Location
Creek (flow direction)
Existing Inundation
Morningside Alternative Inundation

STETSON ENGINEERS INC.

MAP SHOWING CHANGE IN WATER SURFACE ELEVATION BETWEEN EXISTING AND MORNINGSIDE ALTERNATIVE + FORESEEABLE PROJECTS
FLOOD EVENT: 10-YEAR FLOOD
DOWNTOWN SAN ANSELMO AREA (LOWER)
Change in inundation shown in inches

Map is based on computer model simulations. Model is under-going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

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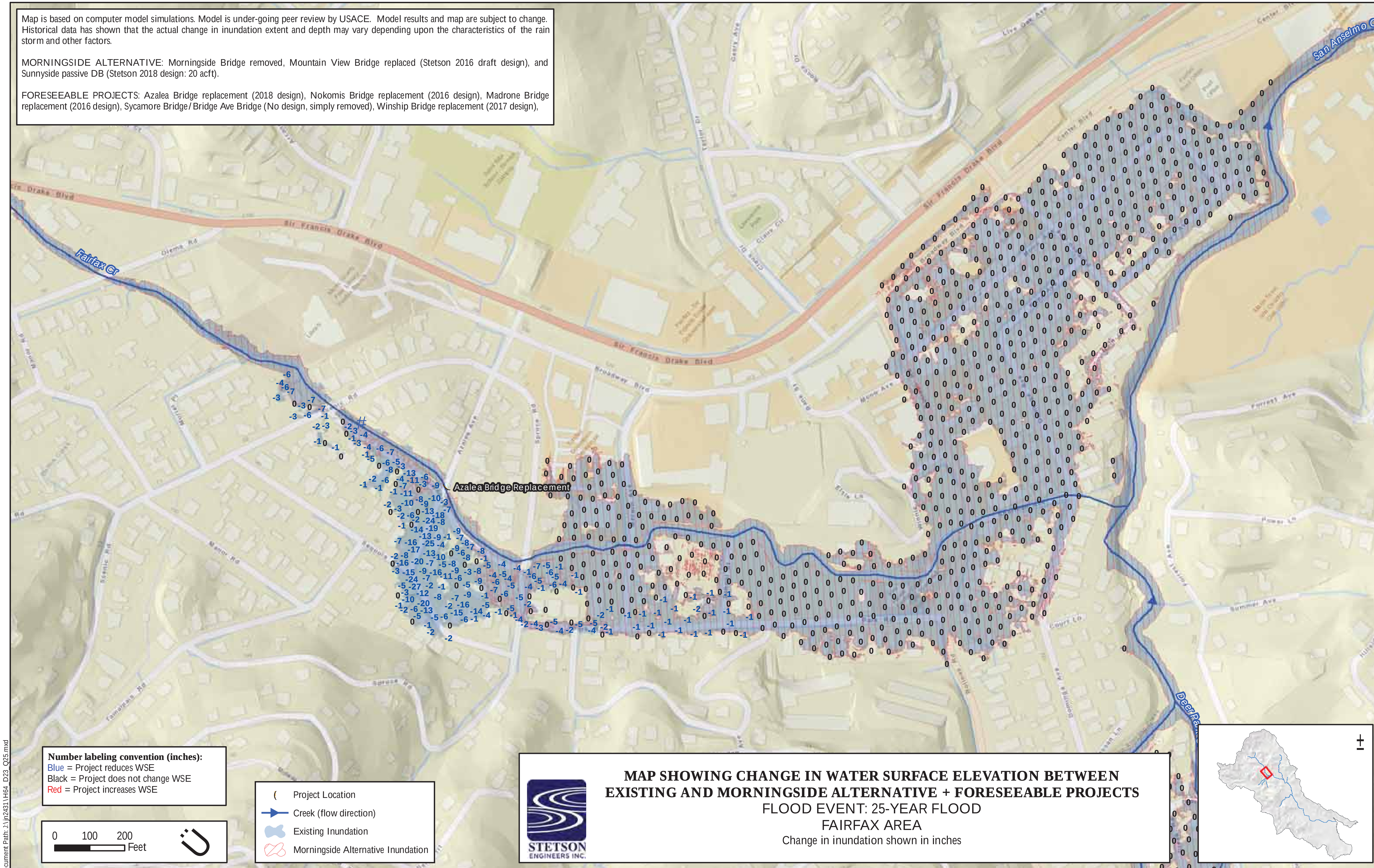

Number labeling convention (inches):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 100 200 Feet

(Project Location
Creek (flow direction)
Existing Inundation
Morningside Alternative Inundation

MAP SHOWING CHANGE IN WATER SURFACE ELEVATION BETWEEN EXISTING AND MORNINGSIDE ALTERNATIVE + FORESEEABLE PROJECTS

FLOOD EVENT: 25-YEAR FLOOD

FAIRFAX AREA

Change in inundation shown in inches

STETSON ENGINEERS INC.

Document Path: J:\jn2431\H64_D23_Q25.mxd

Map is based on computer model simulations. Model is under-going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

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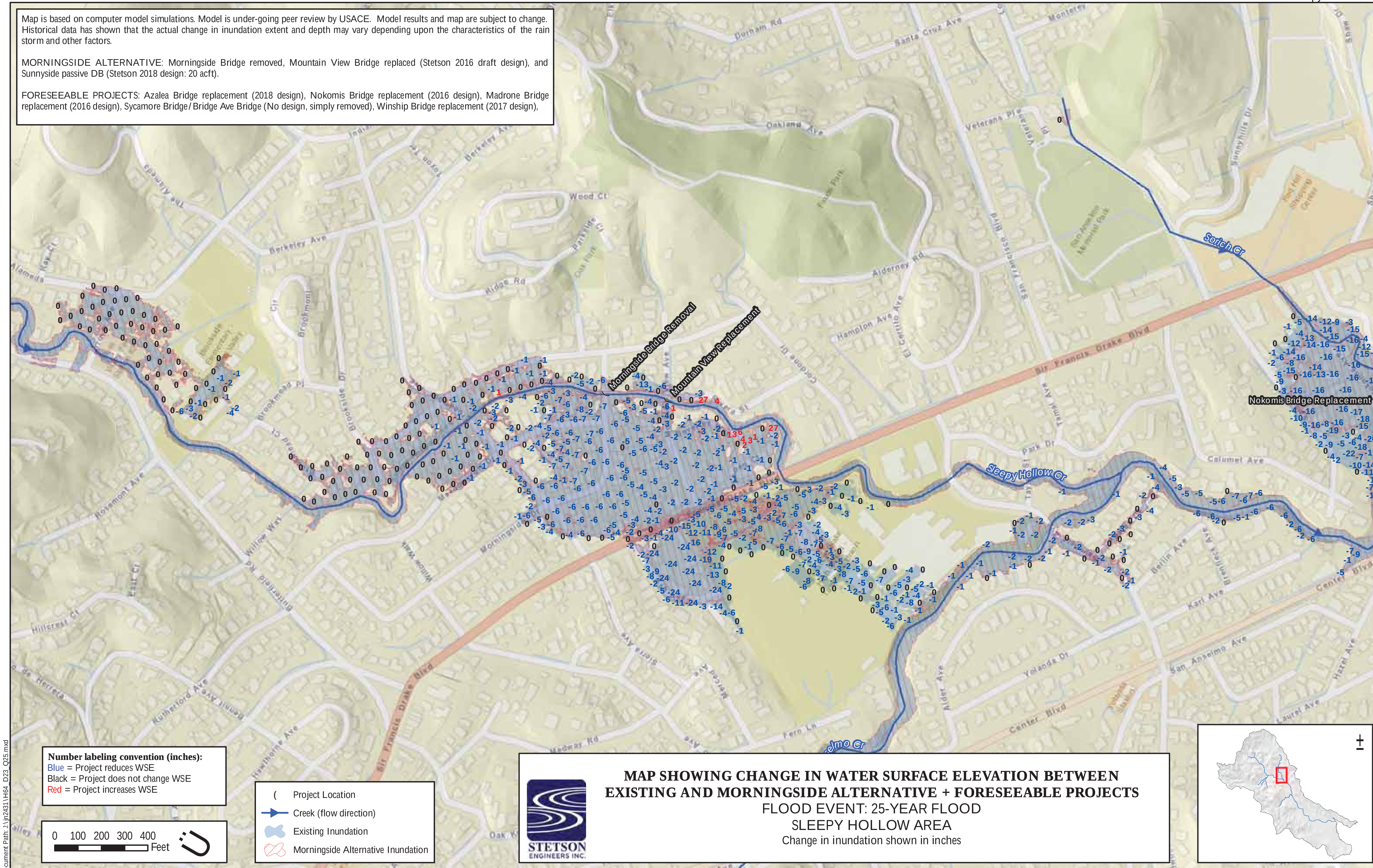

Number labeling convention (inches):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 100 200 300 400 Feet

(Project Location
Creek (flow direction)
Existing Inundation
Morningside Alternative Inundation

MAP SHOWING CHANGE IN WATER SURFACE ELEVATION BETWEEN EXISTING AND MORNINGSIDE ALTERNATIVE + FORESEEABLE PROJECTS
FLOOD EVENT: 25-YEAR FLOOD
SLEEPY HOLLOW AREA
Change in inundation shown in inches

STETSON ENGINEERS INC.

FIGURE 5c - Downtown San Anselmo Area (Upper)

Map is based on computer model simulations. Model is under-going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

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San Anselmo Cr

Bridge Ave Bridge Replacement

Center Blvd Bridge Replacement

Madrone Bridge Replacement

Nokomis Bridge Replacement

Sorich Cr

Sir Francis Drake Blvd

Number labeling convention (inches):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 100 200 Feet

(Project Location
Creek (flow direction)
Existing Inundation
Morningside Alternative Inundation

STETSON ENGINEERS INC.

MAP SHOWING CHANGE IN WATER SURFACE ELEVATION BETWEEN EXISTING AND MORNINGSIDE ALTERNATIVE + FORESEEABLE PROJECTS
FLOOD EVENT: 25-YEAR FLOOD
DOWNTOWN SAN ANSELMO AREA (UPPER)
Change in inundation shown in inches

Document Path: J:\jn2431\H64_D23_Q25.mxd

FIGURE 5d - Downtown San Anselmo Area (Lower)

Map is based on computer model simulations. Model is under-going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

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San Anselmo Cr

Winship Bridge Replacement

Sir Francis Drake Blvd

Corte Madera Cr

Ross Cr

Number labeling convention (inches):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 100 200 Feet

(Project Location
Creek (flow direction)
Existing Inundation
Morningside Alternative Inundation

STETSON ENGINEERS INC.

MAP SHOWING CHANGE IN WATER SURFACE ELEVATION BETWEEN EXISTING AND MORNINGSIDE ALTERNATIVE + FORESEEABLE PROJECTS
FLOOD EVENT: 25-YEAR FLOOD
DOWNTOWN SAN ANSELMO AREA (LOWER)
Change in inundation shown in inches

Document Path: J:\jn2431\H64_D23_Q25.mxd

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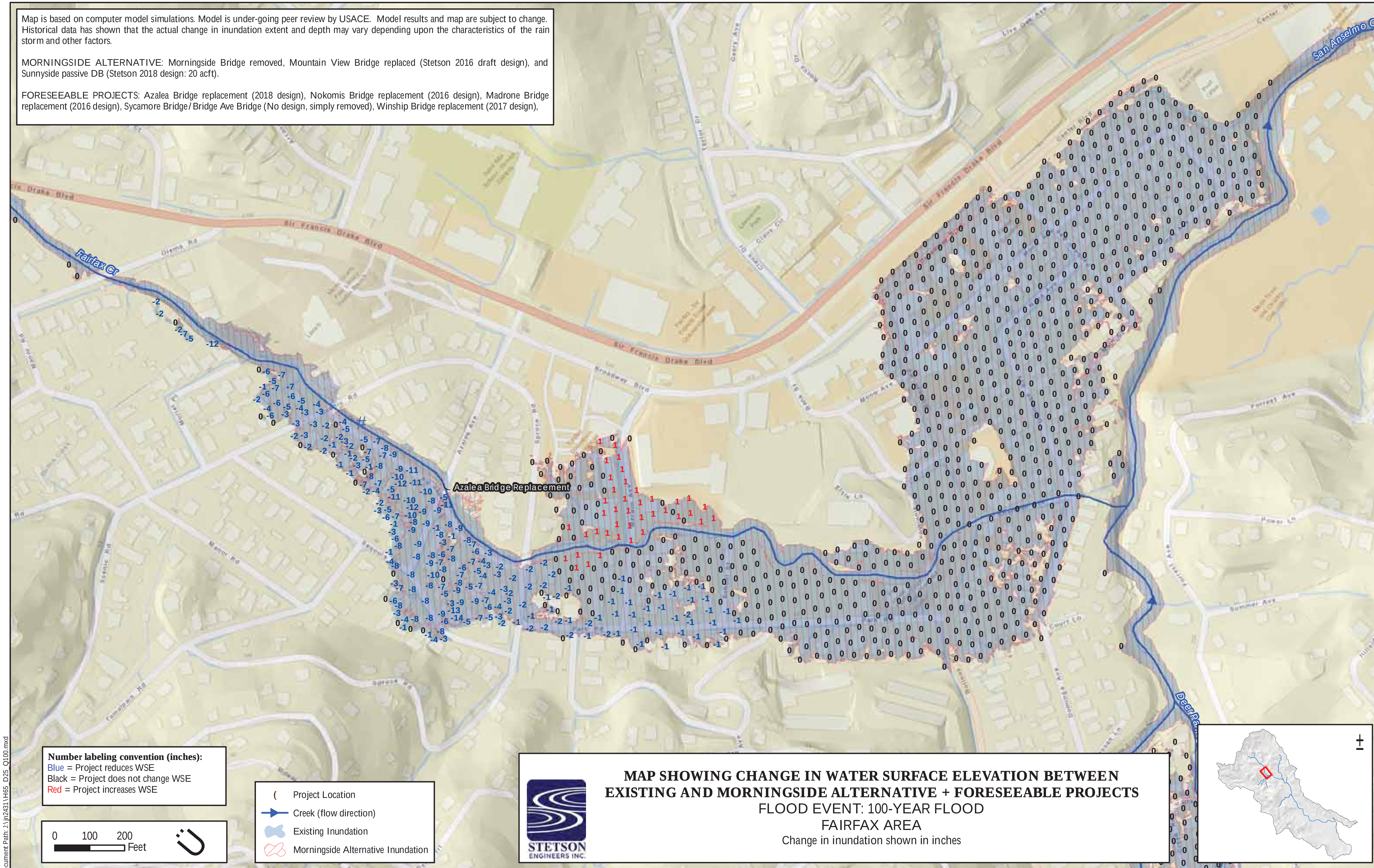

Number labeling convention (inches):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 100 200 Feet

(Project Location
Creek (flow direction)
Existing Inundation
Morningside Alternative Inundation

MAP SHOWING CHANGE IN WATER SURFACE ELEVATION BETWEEN EXISTING AND MORNINGSIDE ALTERNATIVE + FORESEEABLE PROJECTS

FLOOD EVENT: 100-YEAR FLOOD

FAIRFAX AREA

Change in inundation shown in inches

STETSON ENGINEERS INC.

Document Path: J:\jn2431\H65_D25_Q100.mxd

Map is based on computer model simulations. Model is under-going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

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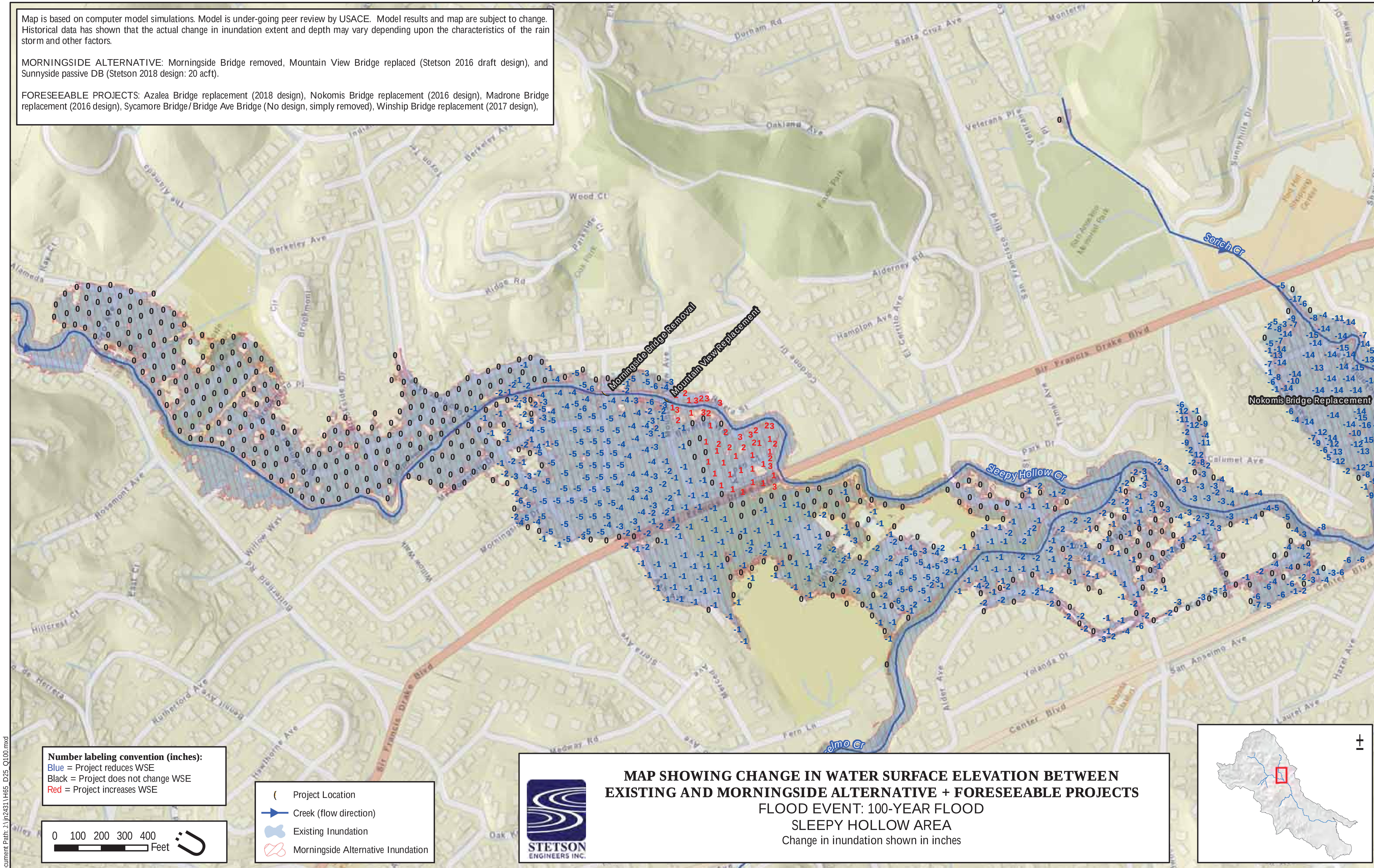

Number labeling convention (inches):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 100 200 300 400
Feet

(Project Location
Creek (flow direction)
Existing Inundation
Morningside Alternative Inundation

MAP SHOWING CHANGE IN WATER SURFACE ELEVATION BETWEEN EXISTING AND MORNINGSIDE ALTERNATIVE + FORESEEABLE PROJECTS
FLOOD EVENT: 100-YEAR FLOOD
SLEEPY HOLLOW AREA
Change in inundation shown in inches

STETSON ENGINEERS INC.

Document Path: J:\jn2431\H65_D25_Q100.mxd

FIGURE 6c - Downtown San Anselmo Area (Upper)

Map is based on computer model simulations. Model is under-going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

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San Anselmo Cr

Bridge Ave Bridge Replacement

Center Blvd Bridge Replacement

Madrone Bridge Replacement

Nokomis Bridge Replacement

Sorich Cr

Sir Francis Drake Blvd

Number labeling convention (inches):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 100 200 Feet

(Project Location
Creek (flow direction)
Existing Inundation
Morningside Alternative Inundation

STETSON ENGINEERS INC.

MAP SHOWING CHANGE IN WATER SURFACE ELEVATION BETWEEN EXISTING AND MORNINGSIDE ALTERNATIVE + FORESEEABLE PROJECTS
FLOOD EVENT: 100-YEAR FLOOD
DOWNTOWN SAN ANSELMO AREA (UPPER)
Change in inundation shown in inches

Document Path: J:\jn2431\H65_D25_Q100.mxd

FIGURE 6d - Downtown San Anselmo Area (Lower)

Map is based on computer model simulations. Model is under-going peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

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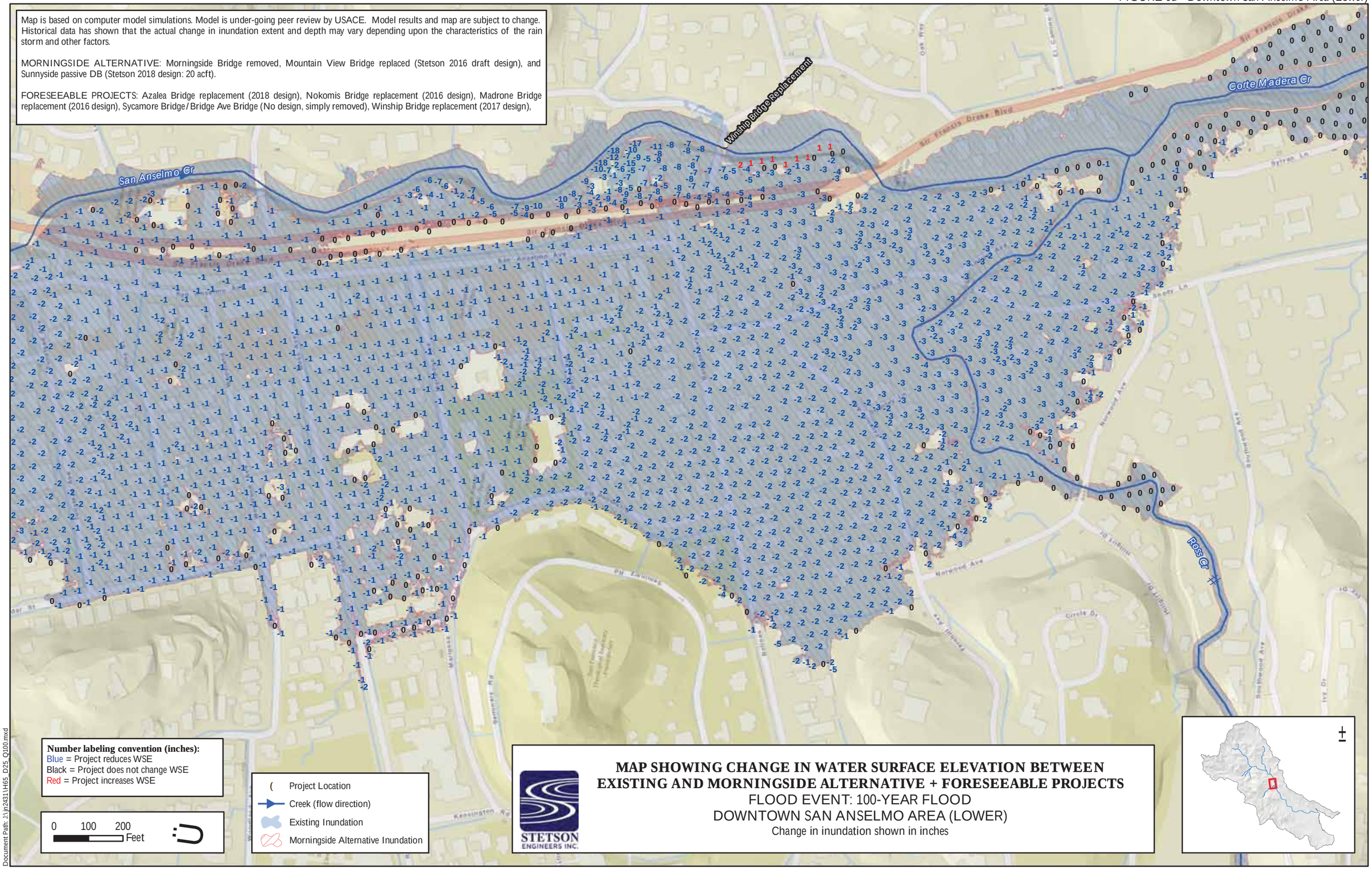


Number labeling convention (inches):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

0 100 200 Feet

(Project Location
Creek (flow direction)
Existing Inundation
Morningside Alternative Inundation

STETSON ENGINEERS INC.

MAP SHOWING CHANGE IN WATER SURFACE ELEVATION BETWEEN EXISTING AND MORNINGSIDE ALTERNATIVE + FORESEEABLE PROJECTS
FLOOD EVENT: 100-YEAR FLOOD
DOWNTOWN SAN ANSELMO AREA (LOWER)
Change in inundation shown in inches

Document Path: J:\jn\24311\H65_D25_Q100.mxd

Figure 7a 10-Year Water Surface Profiles along Fairfax Creek

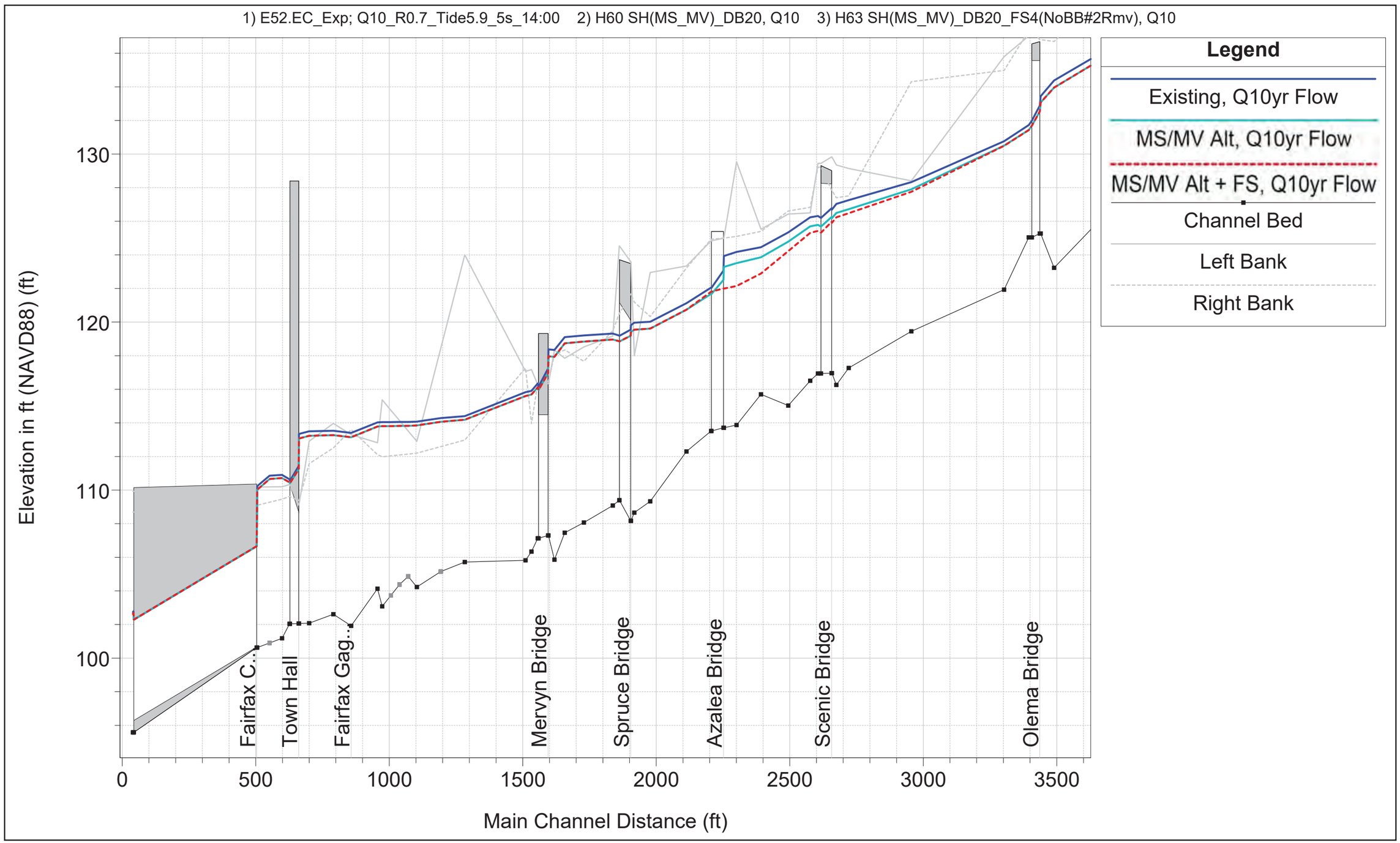


Figure 7b 25-Year Water Surface Profiles along Fairfax Creek

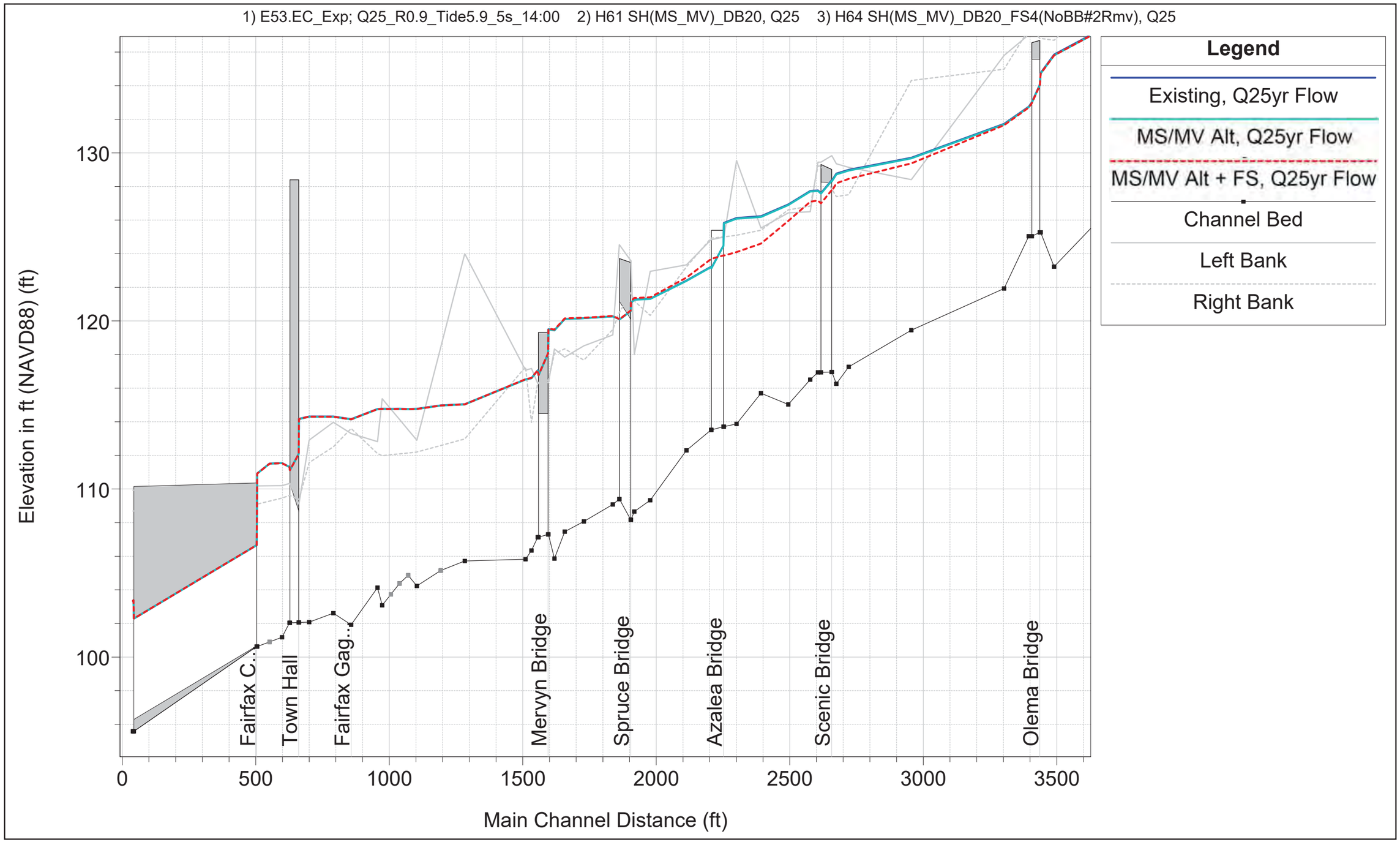


Figure 7c 100-Year Water Surface Profiles along Fairfax Creek

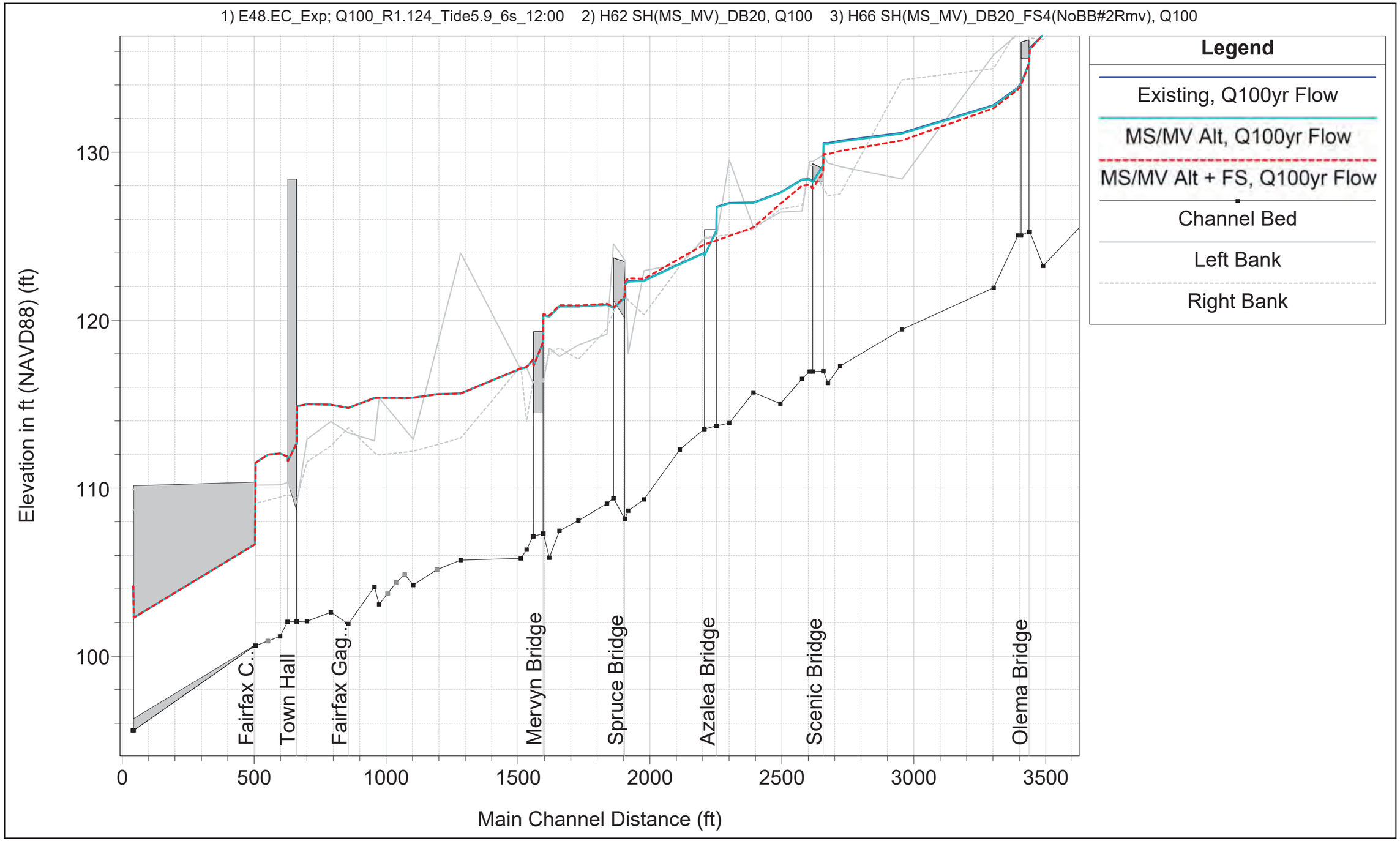


Figure 8a 10-Year Water Surface Profiles along Sleepy Hollow Creek

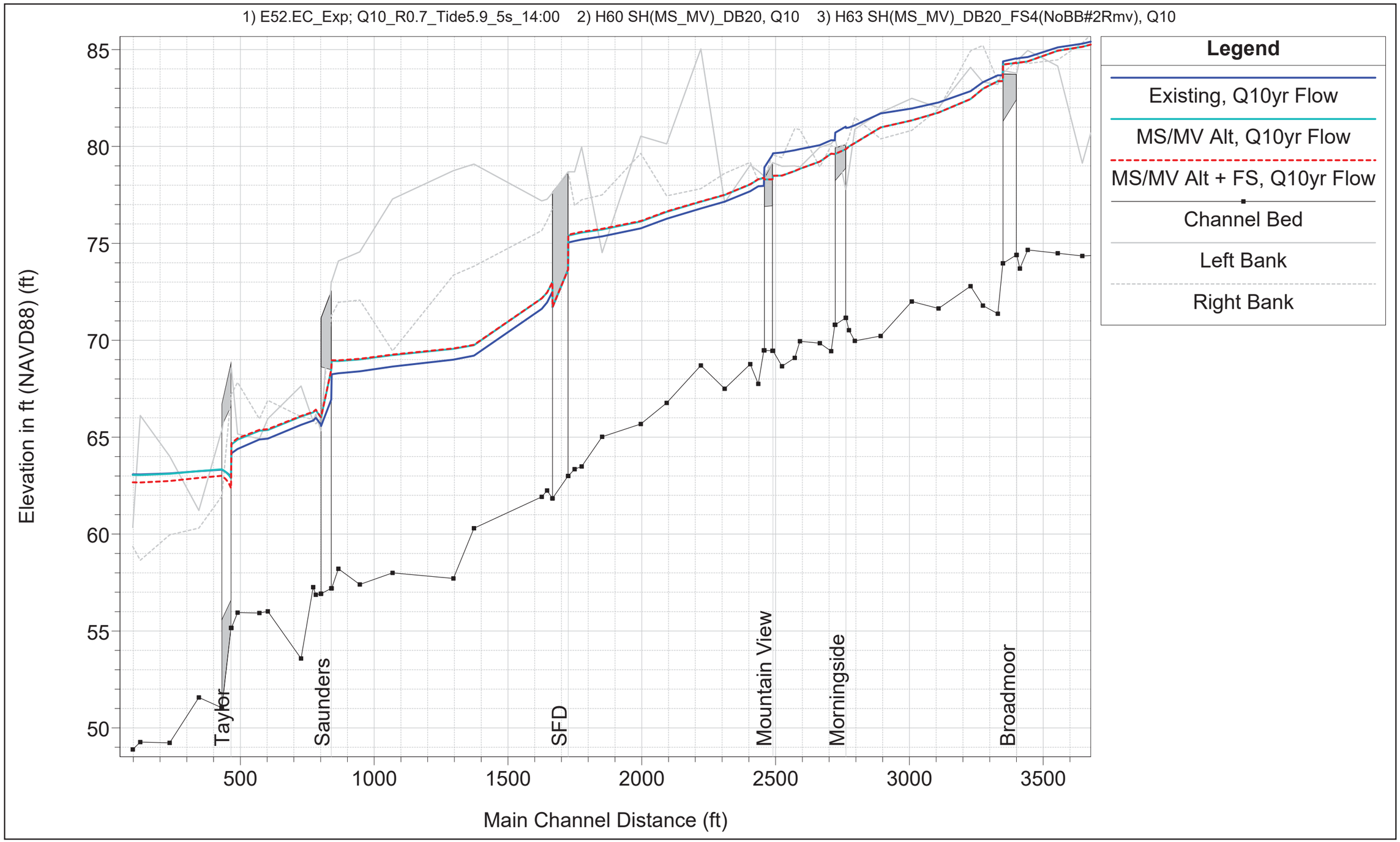


Figure 8b 25-Year Water Surface Profiles along Sleepy Hollow Creek

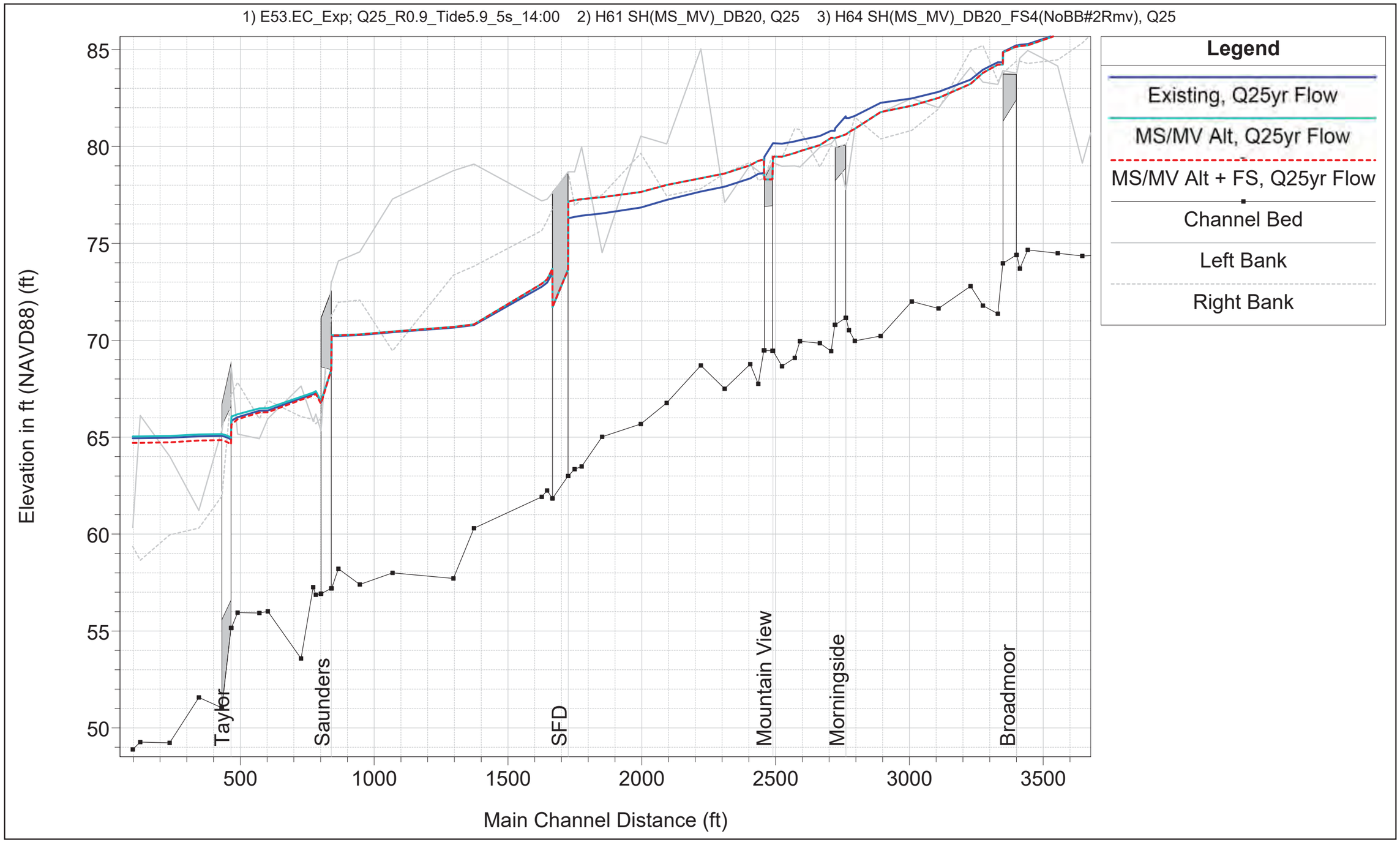


Figure 8c 100-Year Water Surface Profiles along Sleepy Hollow Creek

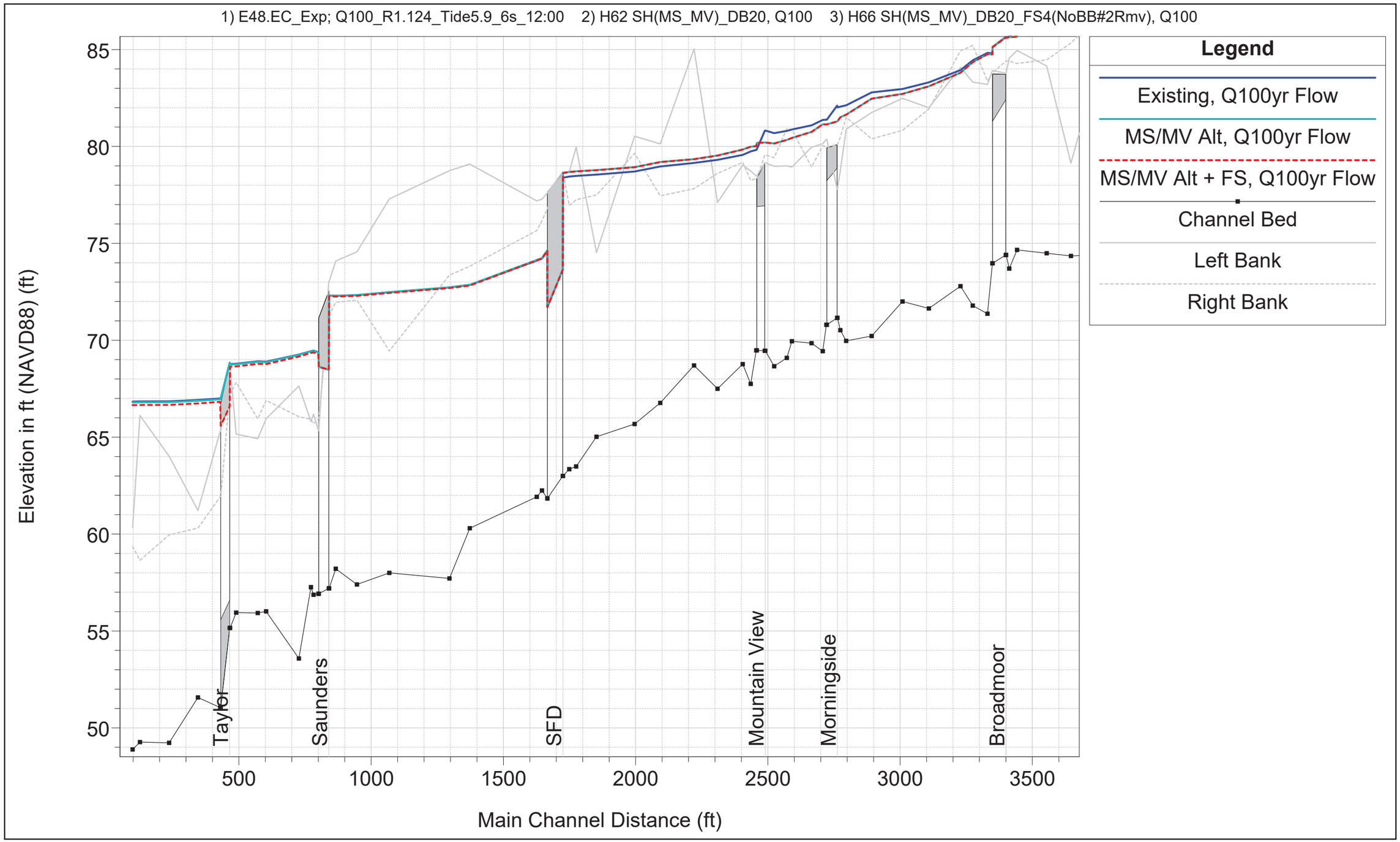
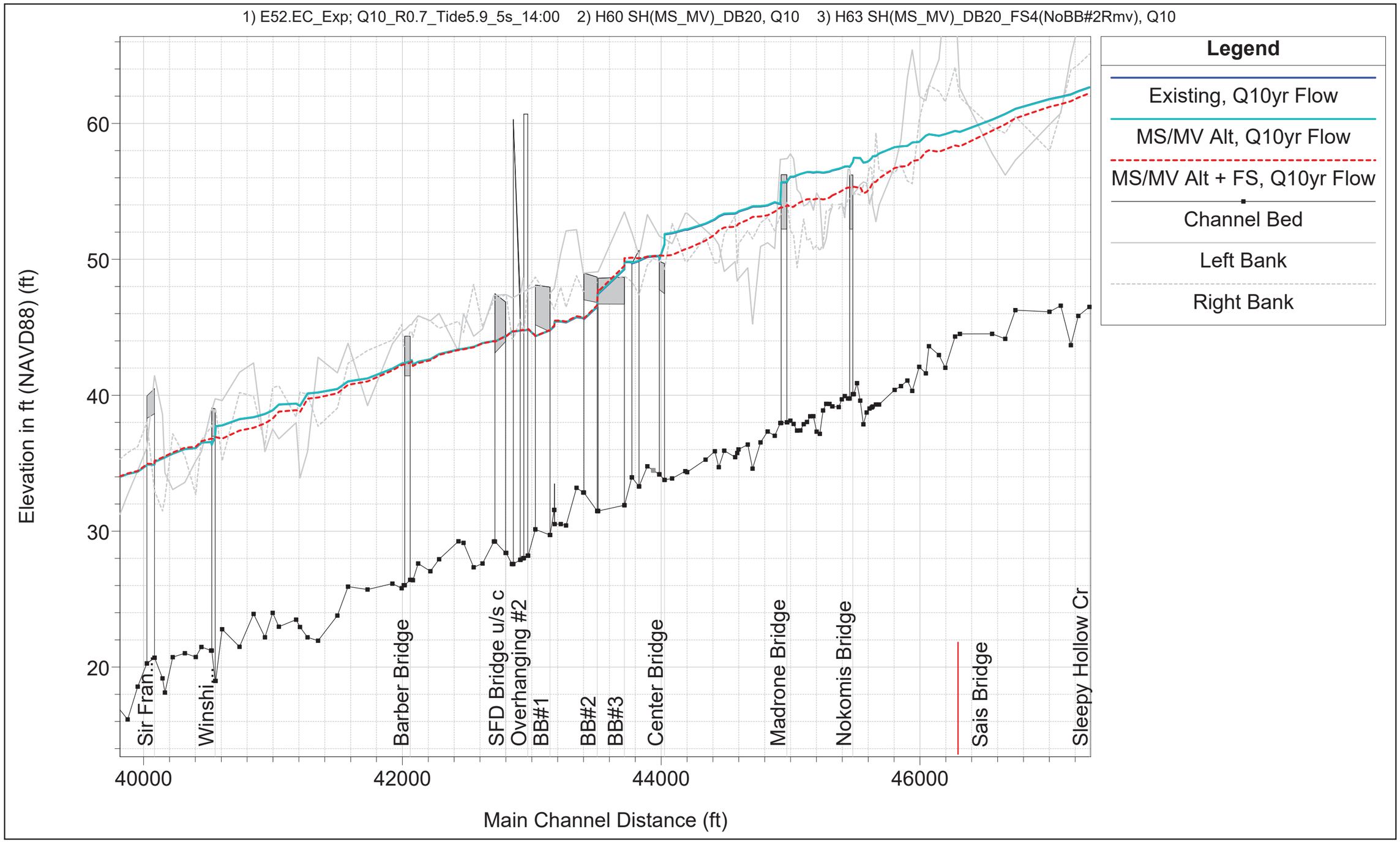


Figure 9a 10-Year Water Surface Profiles along San Anselmo Creek



Note: The Sais Ave footbridge is not included in the model and not shown in the graph This bridge is high and above the creek water surface elevation and, thus, has no backwater effect. The relatively high top of bank elevations at the Sais Ave footbridge shown in the graph is an indication of the high elevation of the bridge.

Figure 9b 25-Year Water Surface Profiles along San Anselmo Creek

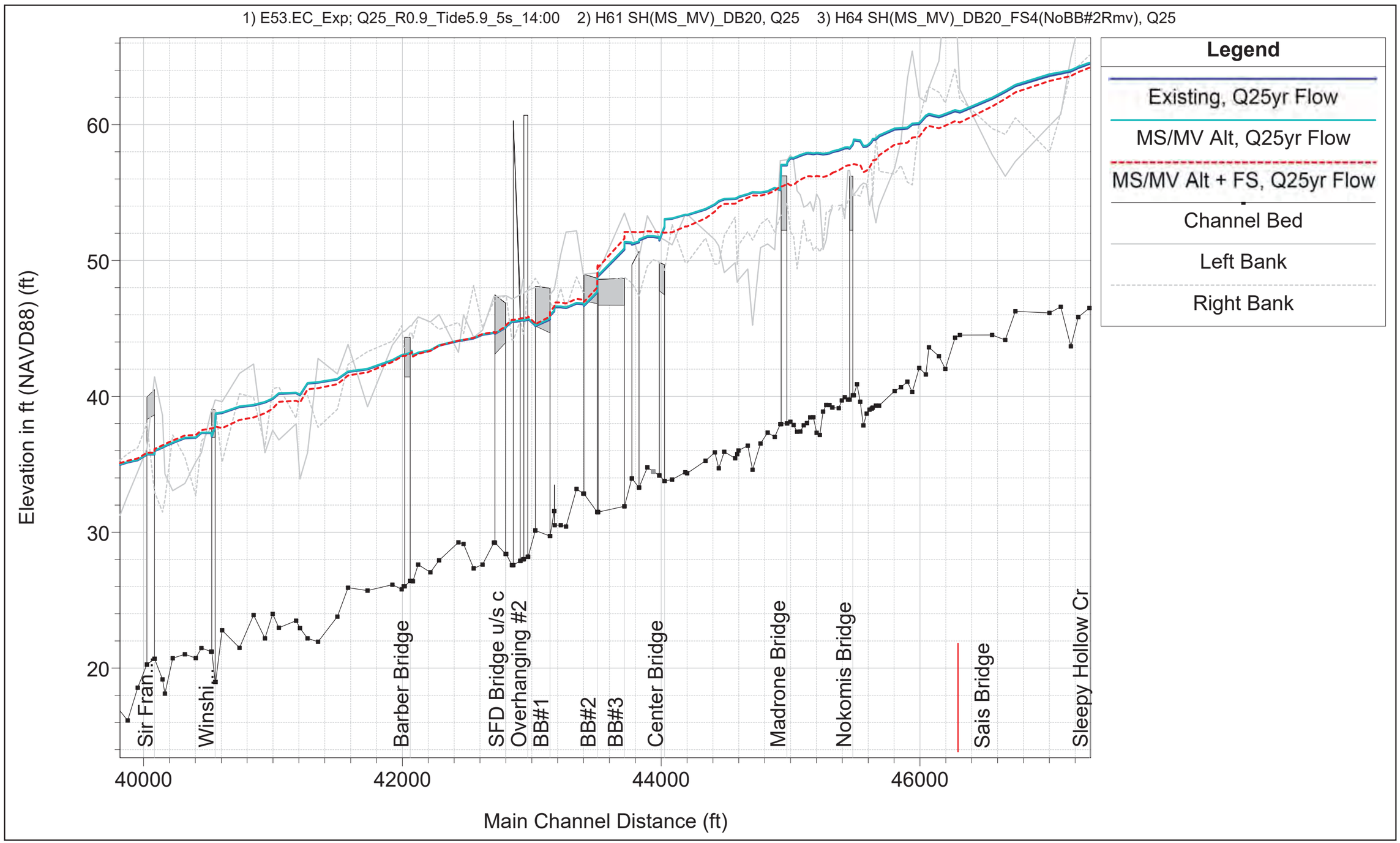


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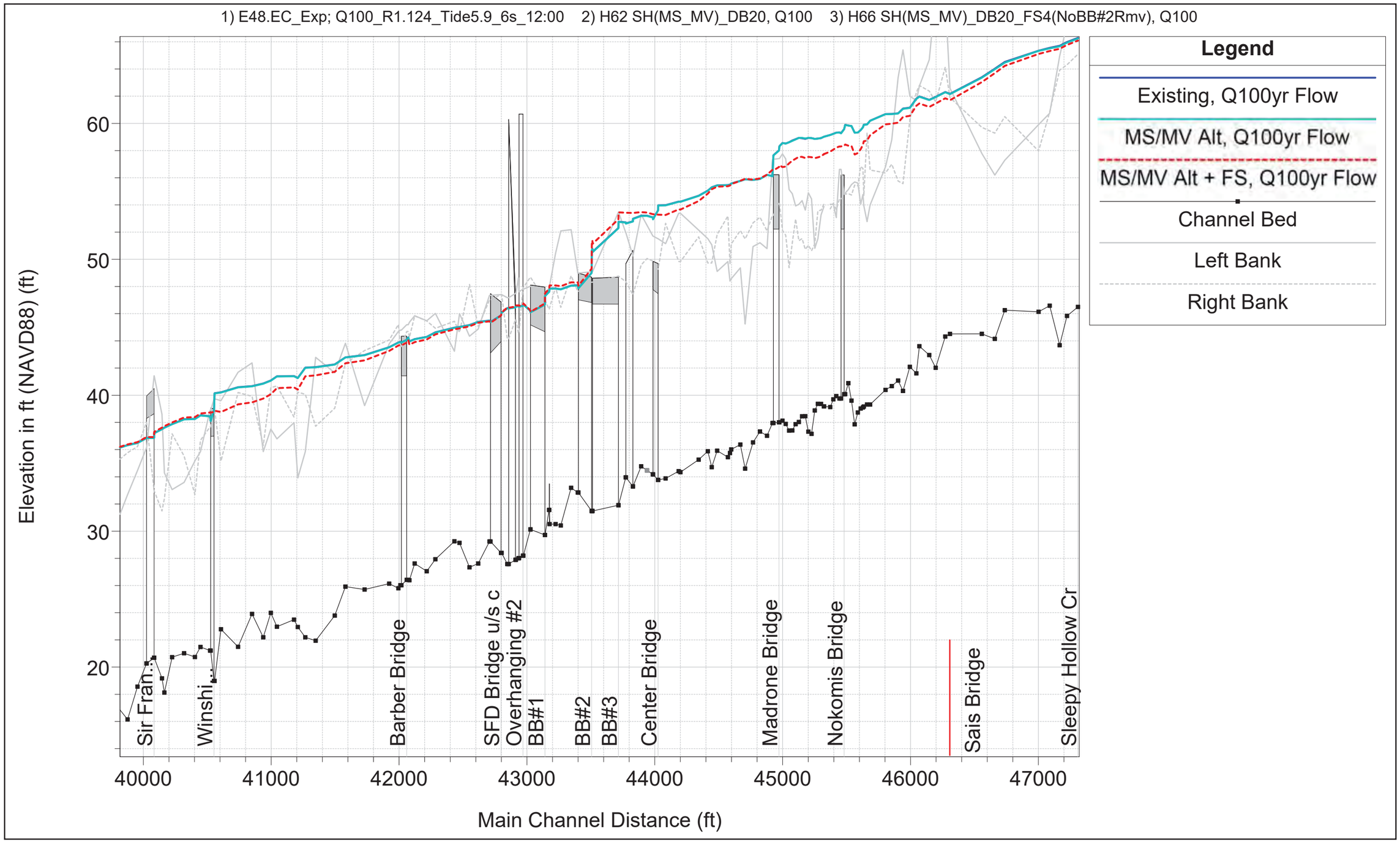
Figure 9c 100-Year Water Surface Profiles along San Anselmo Creek



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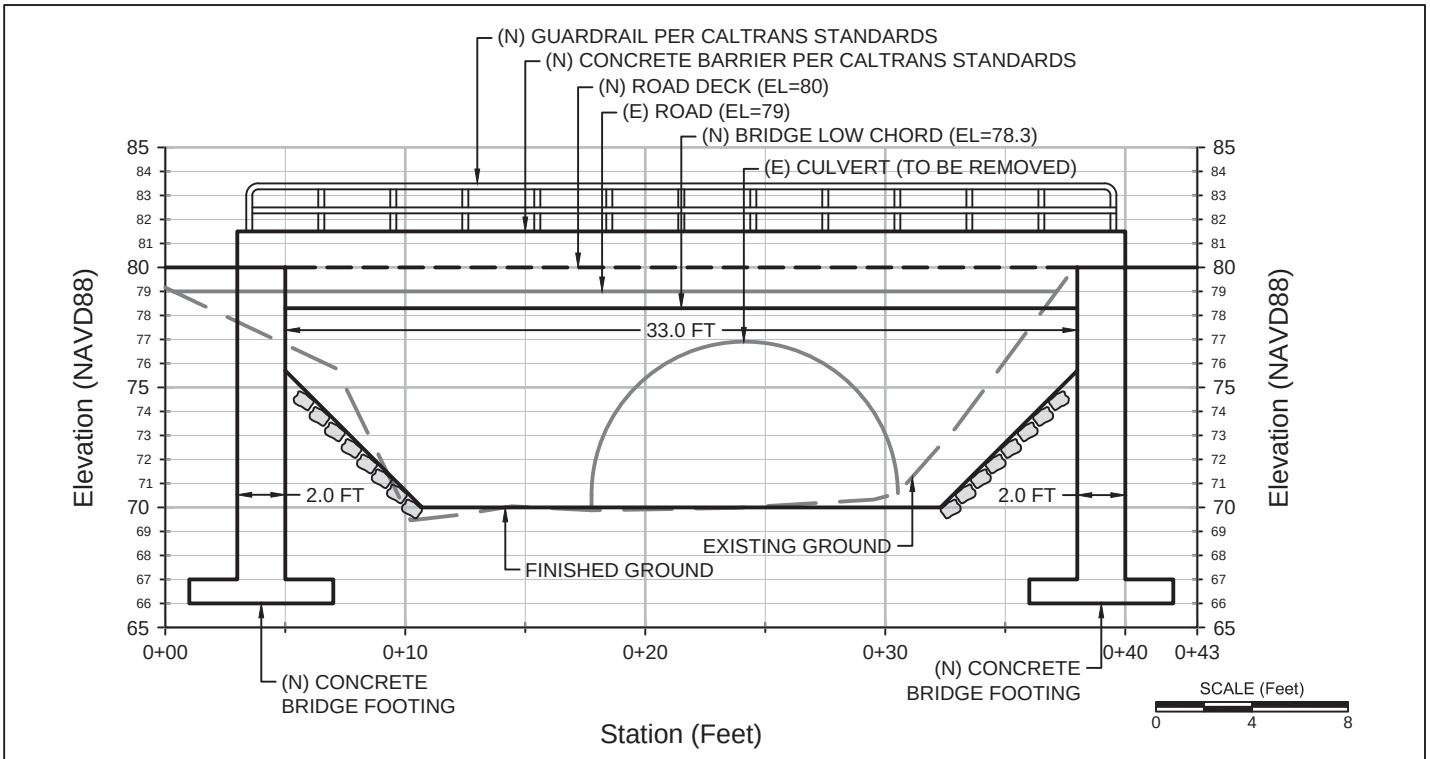
Attachment A

Conceptual Designs and Mountain View Replacement Bridge and Sunnyside Passive Detention Basin



LEGEND

REMOVE EXISTING SEWER

INSTALL NEW SEWER

N

W E

S

SCALE (Feet)

0 8 16

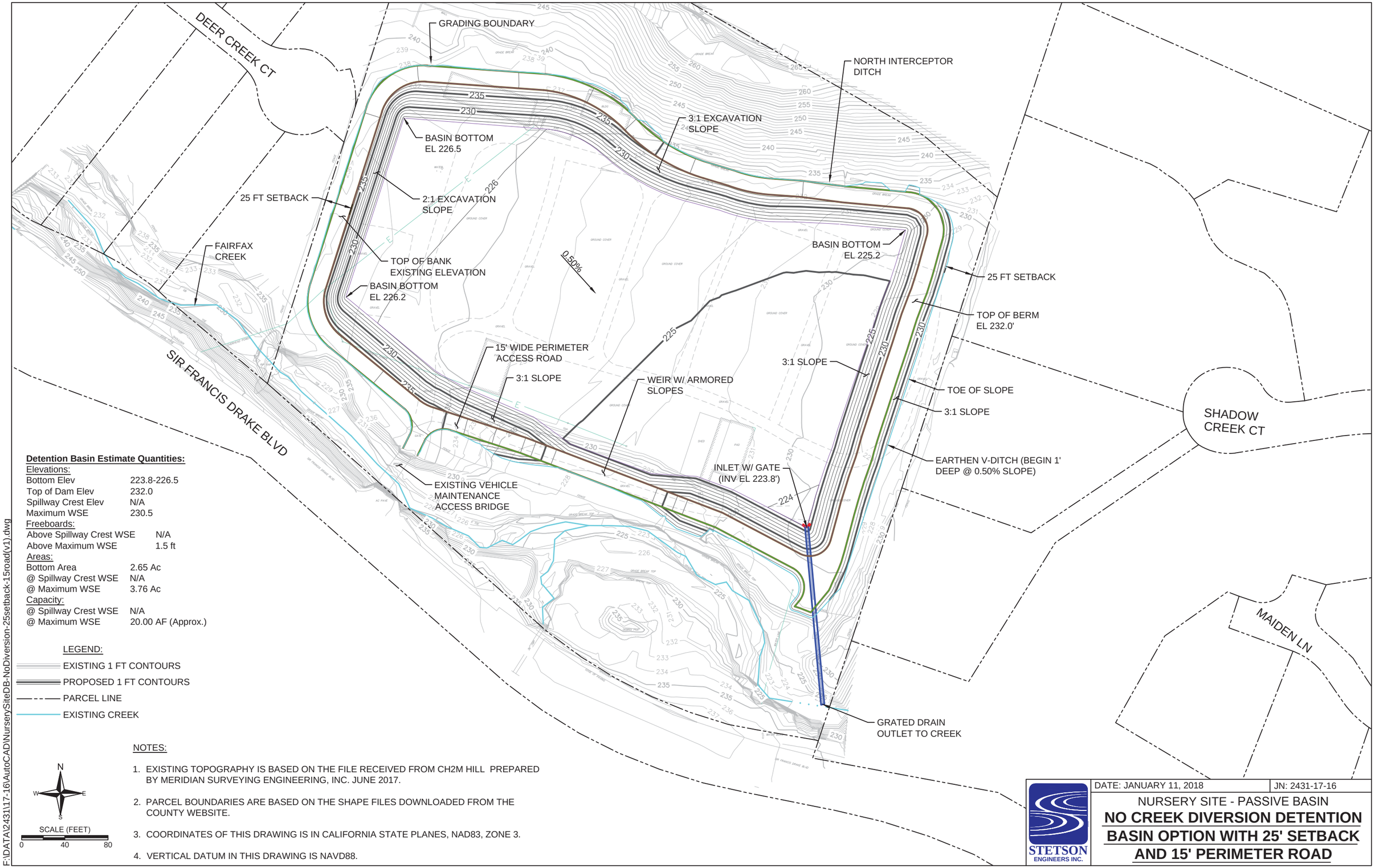
STETSON ENGINEERS INC.

DATE: NOVEMBER 30, 2016

JN: 2431-16-1

MOUNTAIN VIEW AVE BRIDGE REPLACEMENT

F:\DATA\2431\AutoCAD\Sleepy Hollow\ConceptDesign.dwg



Detention Basin Estimate Quantities:

Elevations:	
Bottom Elev	223.8-226.5
Top of Dam Elev	232.0
Spillway Crest Elev	N/A
Maximum WSE	230.5
Freeboards:	
Above Spillway Crest WSE	N/A
Above Maximum WSE	1.5 ft
Areas:	
Bottom Area	2.65 Ac
@ Spillway Crest WSE	N/A
@ Maximum WSE	3.76 Ac
Capacity:	
@ Spillway Crest WSE	N/A
@ Maximum WSE	20.00 AF (Approx.)

LEGEND:

- EXISTING 1 FT CONTOURS
- PROPOSED 1 FT CONTOURS
- PARCEL LINE
- EXISTING CREEK

N
W E
S

SCALE (FEET)
0 40 80

NOTES:

1. EXISTING TOPOGRAPHY IS BASED ON THE FILE RECEIVED FROM CH2M HILL PREPARED BY MERIDIAN SURVEYING ENGINEERING, INC. JUNE 2017.
2. PARCEL BOUNDARIES ARE BASED ON THE SHAPE FILES DOWNLOADED FROM THE COUNTY WEBSITE.
3. COORDINATES OF THIS DRAWING IS IN CALIFORNIA STATE PLANES, NAD83, ZONE 3.
4. VERTICAL DATUM IN THIS DRAWING IS NAVD88.

STETSON ENGINEERS INC.

DATE: JANUARY 11, 2018 | JN: 2431-17-16

NURSERY SITE - PASSIVE BASIN

NO CREEK DIVERSION DETENTION BASIN OPTION WITH 25' SETBACK AND 15' PERIMETER ROAD

F:\DATA\2431\17-16\AutoCAD\NurserySiteDB-NoDiversion-25setback-15road(v1).dwg

D-3 Supplemental Report on Hydraulic Analysis of San Anselmo Flood Risk Reduction Project, Option 2A: Hydraulic Analysis of Complete Removal of Building Bridge #2

Supplemental Report
on Hydraulic Analysis of San Anselmo Flood Risk Reduction Project, Option 2A:
Hydraulic Analysis of Complete Removal of Building Bridge #2

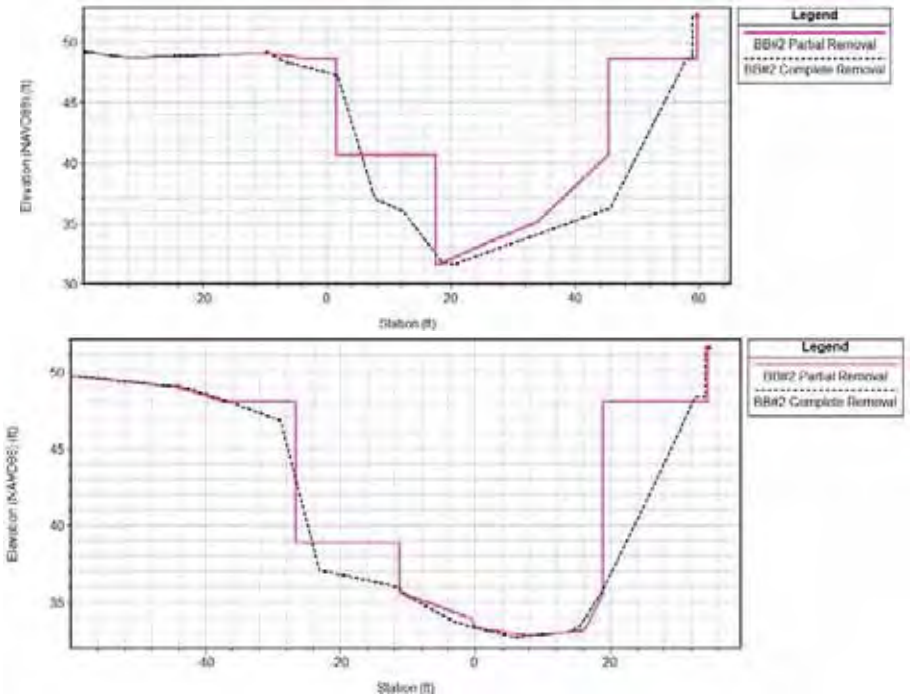
Stetson Engineers Inc.
September 15, 2017

Introduction

The "Report on Hydraulic Analysis of San Anselmo Flood Risk Reduction Project, Option 2A" dated August 23, 2017 documented the hydraulic analysis of Option 2A which consists of partial removal of Building Bridge #2 (BB#2) and the Sunnyside Nursery detention basin. The report also included an assessment of both project effects and cumulative effects in conjunction with other foreseeable projects with regard to flooding.

This supplemental report documents the same hydraulic analysis and assessment, except that the partial removal of BB#2 in Option 2A is changed to complete removal of BB#2.

Stetson prepared a conceptual design for the complete removal of BB #2 in June 2014. In the conceptual design (attached), the building structure crossing the creek and all concrete foundation and retailing walls would be removed. Creek restoration measures would be implemented. For comparison, the concrete foundation and retailing walls would remain in the conceptual design for the partial removal of BB#2. The graph below compares cross sections for partial and complete removal of BB#2.



Comparison of Cross Sections between Partial Removal and Complete Removal of BB#2
(Top: upstream cross section at station 43507; Bottom: downstream cross section at station 43397)

Supplemental Hydraulic Modeling for Option 2A (Complete Removal of BB#2)

Stetson performed supplemental hydraulic modeling to assess the project effects and cumulative effects of Option 2A (complete removal of BB#2) with regard to flooding. The supplemental analysis used the same combined HEC-RAS1D/2D unsteady-flow model that was used in the hydraulic analysis of the partial removal of BB#2.

Similar to the hydraulic analysis of the partial removal of BB#2, the following three scenarios were analyzed:

- Existing Conditions (EC), to serve as the "Baseline" basis for comparison
- EC + Option 2A (complete removal of BB#2), to assess "Project" effects
- EC + Option 2A (complete removal of BB#2) + Foreseeable Projects, to assess "cumulative" effects

For each scenario, the following three flood events were analyzed:

- Q100, major, rare flood, similar to 12/31/05 and 1/4/82 floods
- Q25, moderate, infrequent flood
- Q10, minor, less infrequent flood

Results of Hydraulic Analysis in Terms of Floodplain Inundation

In terms of comparison to partial removal of BB#2, results of modeling complete removal of BB#2 only show differences in floodplain inundation in the Downtown San Anselmo area. Therefore, only the results for the Downtown San Anselmo area are shown in this supplemental report. The results for other areas (i.e., Fairfax, Sleepy Hollow, and Ross/Kentfield) are the same as those under partial removal and, therefore, are not shown in this supplemental report. For easier comparison of the results for partial removal and complete removal, the same figure numbering used in the 8/23/2017 report for partial removal was applied in this supplemental report. For example, in both the 8/23/2017 report and this supplemental report, Figure 2c shows the 10-year floodplain inundation results for the Downtown San Anselmo Area (Upper).

Figures 2c and 2d show the changes in the HEC-RAS model-simulated floodplain inundation extent and depth between Option 2A (complete removal of BB#2) and existing conditions for the 10-year flood for the Downtown San Anselmo area. Similarly, Figures 3c and 3d show the model-simulated results for the 25-year flood, and Figures 4c and 4d for the 100-year flood.

Figures 5c and 5d show the changes in the HEC-RAS model-simulated floodplain inundation extent and depth between Option 2A (complete removal of BB#2) + Foreseeable Projects and existing conditions for the 10-year flood in the Downtown San Anselmo area. Similarly, Figures 6c and 6d show the model-simulated results for the 25-year flood, and Figures 7c and 7d for the 100-year flood.

In general, complete removal of BB#2 has the similar floodplain inundation extent as partial removal of BB#2 under the three different flood conditions (10-year, 25-year, and 100-year). Complete removal of BB#2 would reduce floodplain inundation depth just slightly more than partial removal of BB#2 by up to 0.1 ft.

Option 2A (complete removal of Building Bridge #2) would slightly increase flooding in the area between Winship and Barber Bridges during the 25-year and 100-year floods (see Figures 3d and 4d). This increase is similar to the increase resulting from partial removal of BB#2. Option 2A (complete removal of Building Bridge #2) + the Foreseeable Projects would mitigate for the slight increase in flooding caused by Option 2A alone.

Results of Hydraulic Analysis in Terms of Channel Water Surface Level

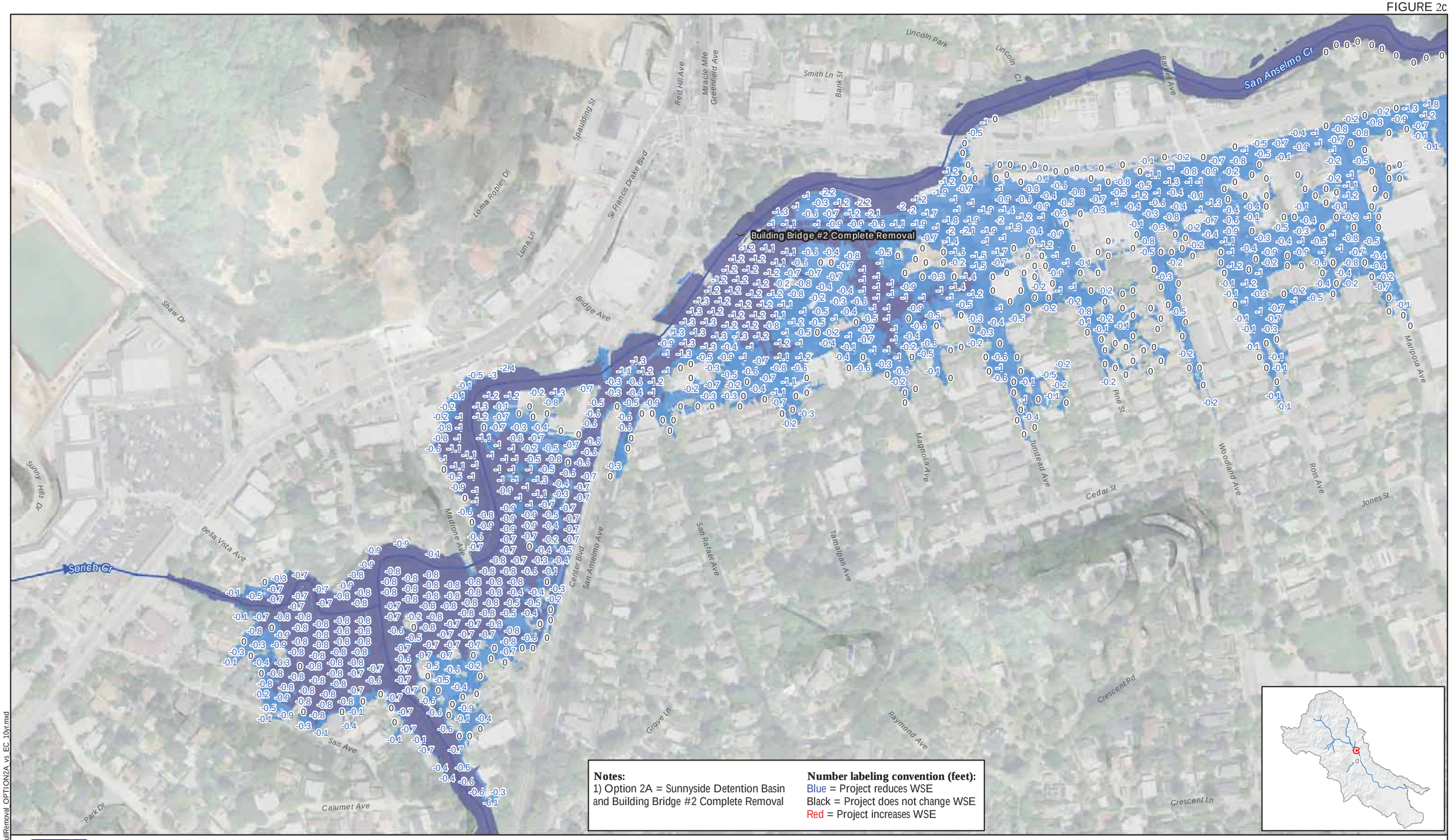
Figures 8 to 10 compare the HEC-RAS model-simulated in-channel water surface profiles along the San Anselmo Creek for partial removal with complete removal of BB#2 for the 10-year flood, 25-year flood, and 100-year flood, respectively, under the Option 2A condition.

Similarly, Figures 11 to 13 compare the simulated in-channel water surface profiles along the San Anselmo Creek for partial removal with complete removal of BB#2 under the Option 2A + Foreseeable Projects condition.

Complete removal of BB#2 would lower the in-channel water surface elevation at the upstream face of BB#2 slightly more than partial removal of BB#2 by up to 0.1 ft.

Results of Hydraulic Analysis in Terms of Channel Hydraulic Capacity

Compared to partial removal of BB#2, complete removal of BB#2 provides negligible increase in channel hydraulic capacity because its lowering of the in-channel water surface elevation is minimal.



Notes:
1) Option 2A = Sunnyside Detention Basin and Building Bridge #2 Complete Removal

Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

Existing Inundation
Option 2A Inundation
Existing Inundation & Option 2A Inundation
Creek (flow direction)
(Option 2A Project

STETSON ENGINEERS INC.

CHANGE IN HEC-RAS-SIMULATED INUNDATION EXTENT AND DEPTH BETWEEN OPTION 2A (COMPLETE REMOVAL) AND EXISTING CONDITIONS FOR 10-YEAR FLOOD DOWNTOWN SAN ANSELMO AREA (UPPER)

0 110 220 Feet

Document Path: J:\jn2646\FullRemoval_OPTION2A_vs_EC_10yr.mxd

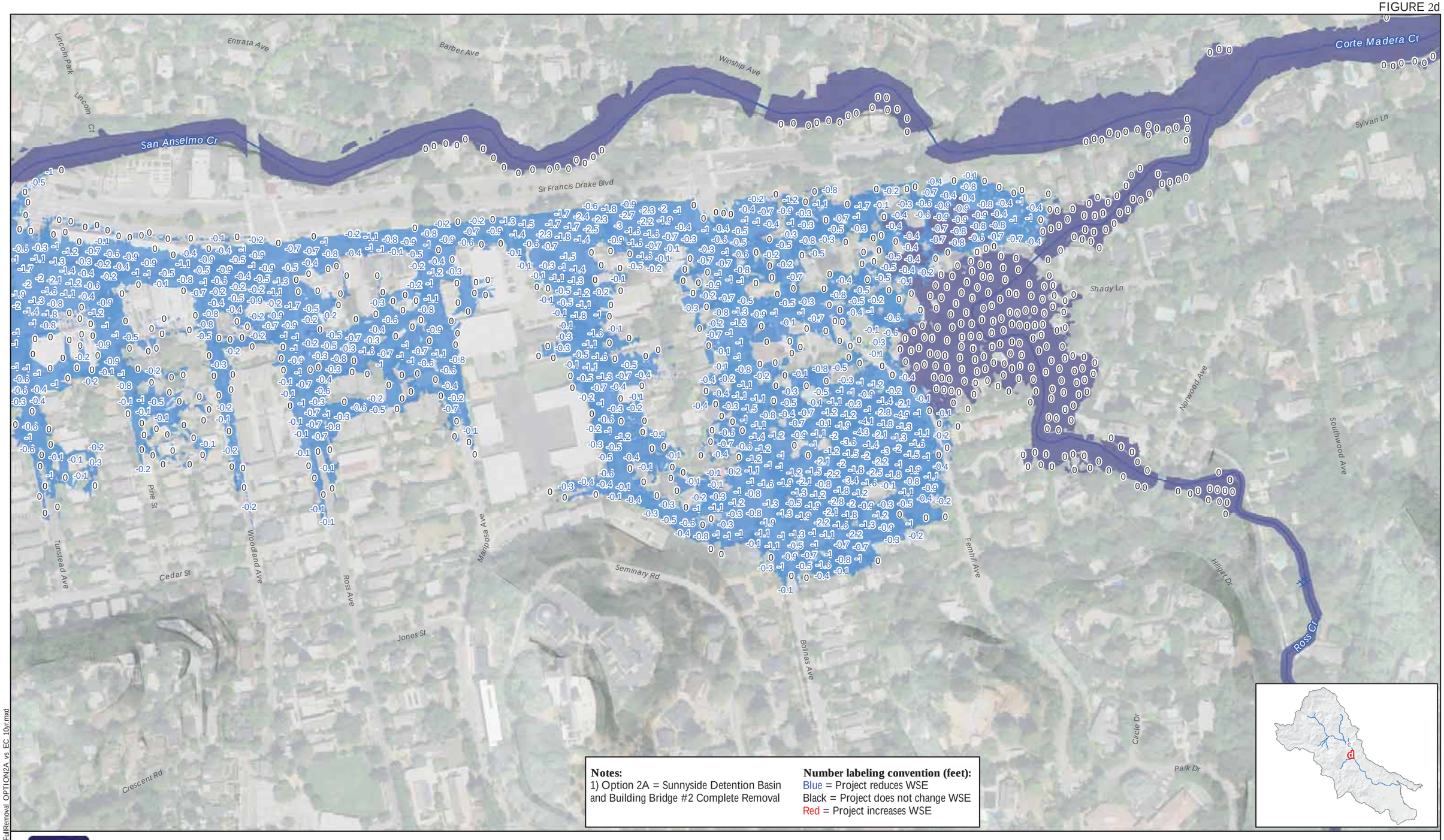

Lincoln Park
Lincoln Ct
Entrata Ave
Barber Ave
Winship Ave
San Anselmo Cr
Corte Madera Cr
Sylvan Ln
Sir Francis Drake Blvd
Shady Ln
Norwood Ave
Southwood Ave
Pine St
Tunstead Ave
Woodland Ave
Ross Ave
Cedar St
Jones St
Crescent Rd
Mariposa Ave
Seminary Rd
Bolinas Ave
Fernhill Ave
Hillgirt Dr
Ross Cr
Circle Dr
Park Dr
Notes:
1) Option 2A = Sunnyside Detention Basin and Building Bridge #2 Complete Removal
Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE
Existing Inundation
Option 2A Inundation
Existing Inundation & Option 2A Inundation
Creek (flow direction)
STETSON ENGINEERS INC.
CHANGE IN HEC-RAS-SIMULATED INUNDATION EXTENT AND DEPTH
BETWEEN OPTION 2A (COMPLETE REMOVAL) AND
EXISTING CONDITIONS FOR 10-YEAR FLOOD
DOWNTOWN SAN ANSELMO AREA (LOWER)
0 100 200
Feet
Document Path: J:\jn2646\FullRemoval_OPTION2A_vs_EC_10yr.mxd

FIGURE 3c

Building Bridge #2 Complete Removal

Notes:
1) Option 2A = Sunnyside Detention Basin and Building Bridge #2 Complete Removal

Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

Existing Inundation
Option 2A Inundation
Existing Inundation & Option 2A Inundation
Creek (flow direction)
(Option 2A Project

STETSON ENGINEERS INC.

CHANGE IN HEC-RAS-SIMULATED INUNDATION EXTENT AND DEPTH BETWEEN OPTION 2A (COMPLETE REMOVAL) AND EXISTING CONDITIONS FOR 25-YEAR FLOOD DOWNTOWN SAN ANSELMO AREA (UPPER)

0 110 220 Feet

Document Path: J:\jn\2646\FullRemoval_OPTION2A_vs_EC_25yr.mxd

FIGURE 3d

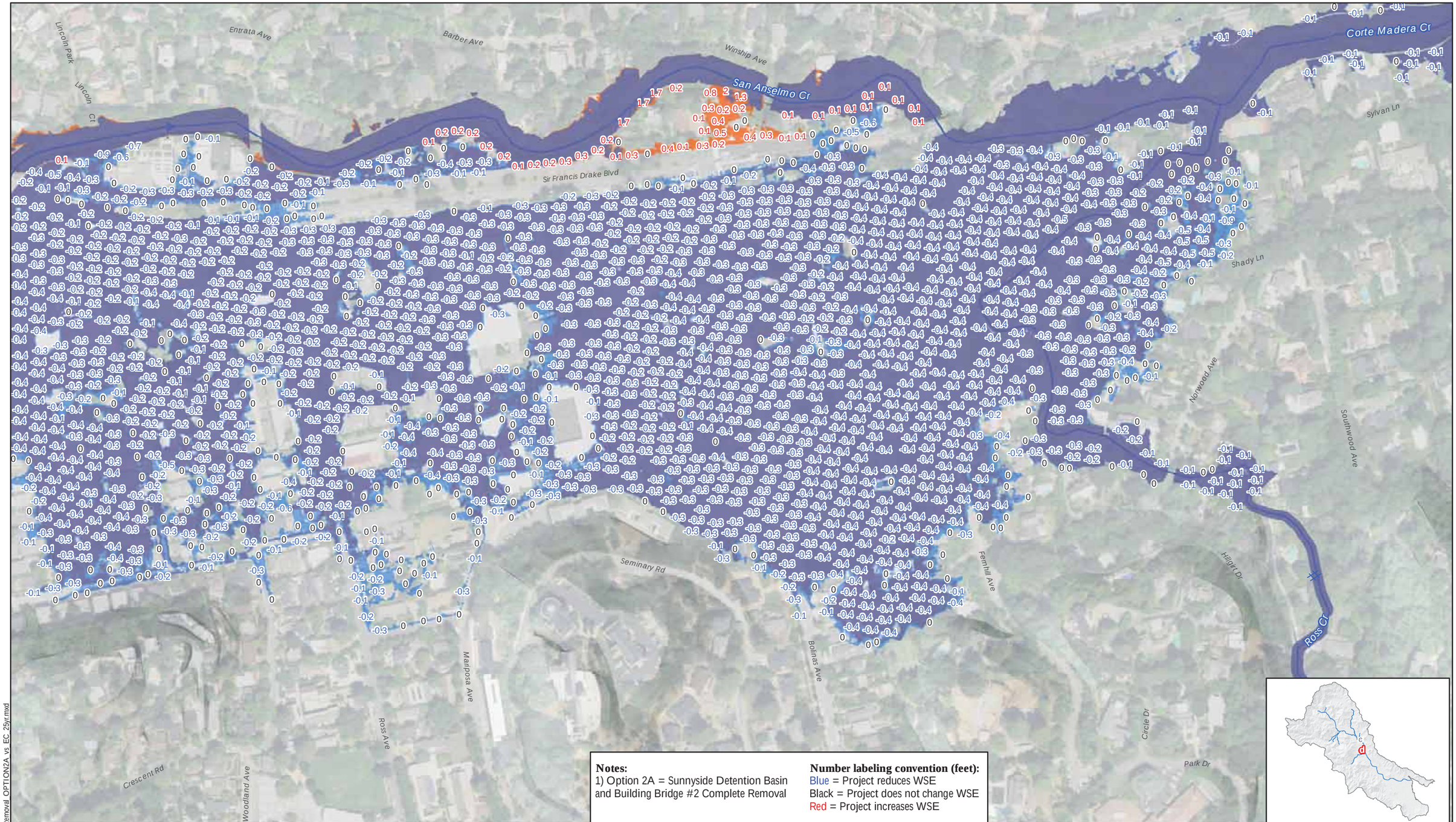
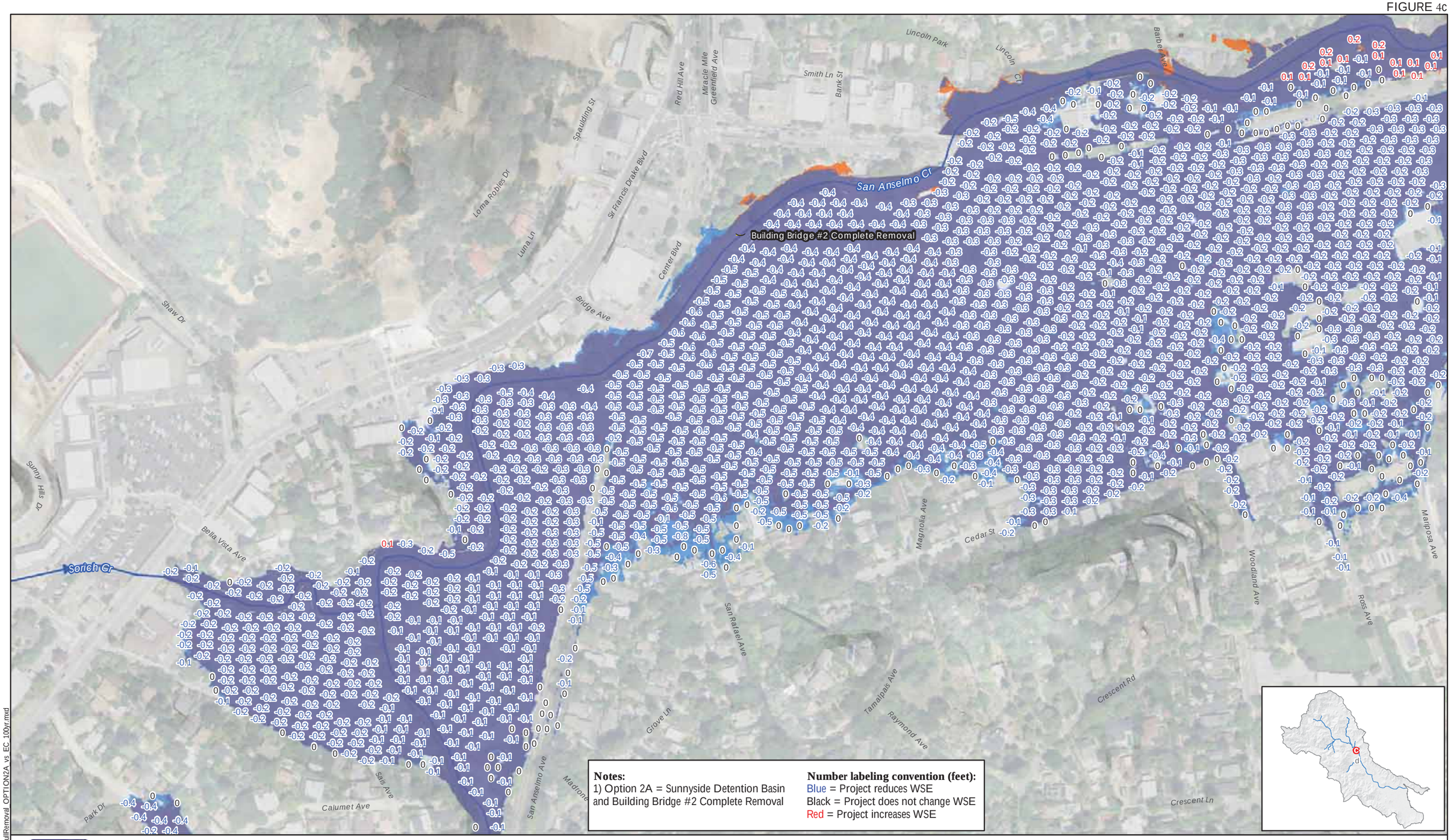

Lincoln Park
Lincoln Ct
Entrata Ave
Barber Ave
Winship Ave
San Anselmo Cr
Corte Madera Cr
Sylvan Ln
Sir Francis Drake Blvd
Shady Ln
Norwood Ave
Southwood Ave
Seminary Rd
Fernhill Ave
Hillgirt Dr
Ross Cr
Mariposa Ave
Bolinas Ave
Ross Ave
Crescent Rd
Woodland Ave
Circle Dr
Park Dr
Notes:
1) Option 2A = Sunnyside Detention Basin and Building Bridge #2 Complete Removal
Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE
Existing Inundation
Option 2A Inundation
Existing Inundation & Option 2A Inundation
Creek (flow direction)
STETSON ENGINEERS INC.
CHANGE IN HEC-RAS-SIMULATED INUNDATION EXTENT AND DEPTH BETWEEN OPTION 2A (COMPLETE REMOVAL) AND EXISTING CONDITIONS FOR 25-YEAR FLOOD DOWNTOWN SAN ANSELMO AREA (LOWER)
0 100 200 Feet
Document Path: J:\jn2646\FullRemoval_OPTION2A_vs_EC_25yr.mxd

FIGURE 4c



Notes:
1) Option 2A = Sunnyside Detention Basin and Building Bridge #2 Complete Removal

Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

STETSON ENGINEERS INC.

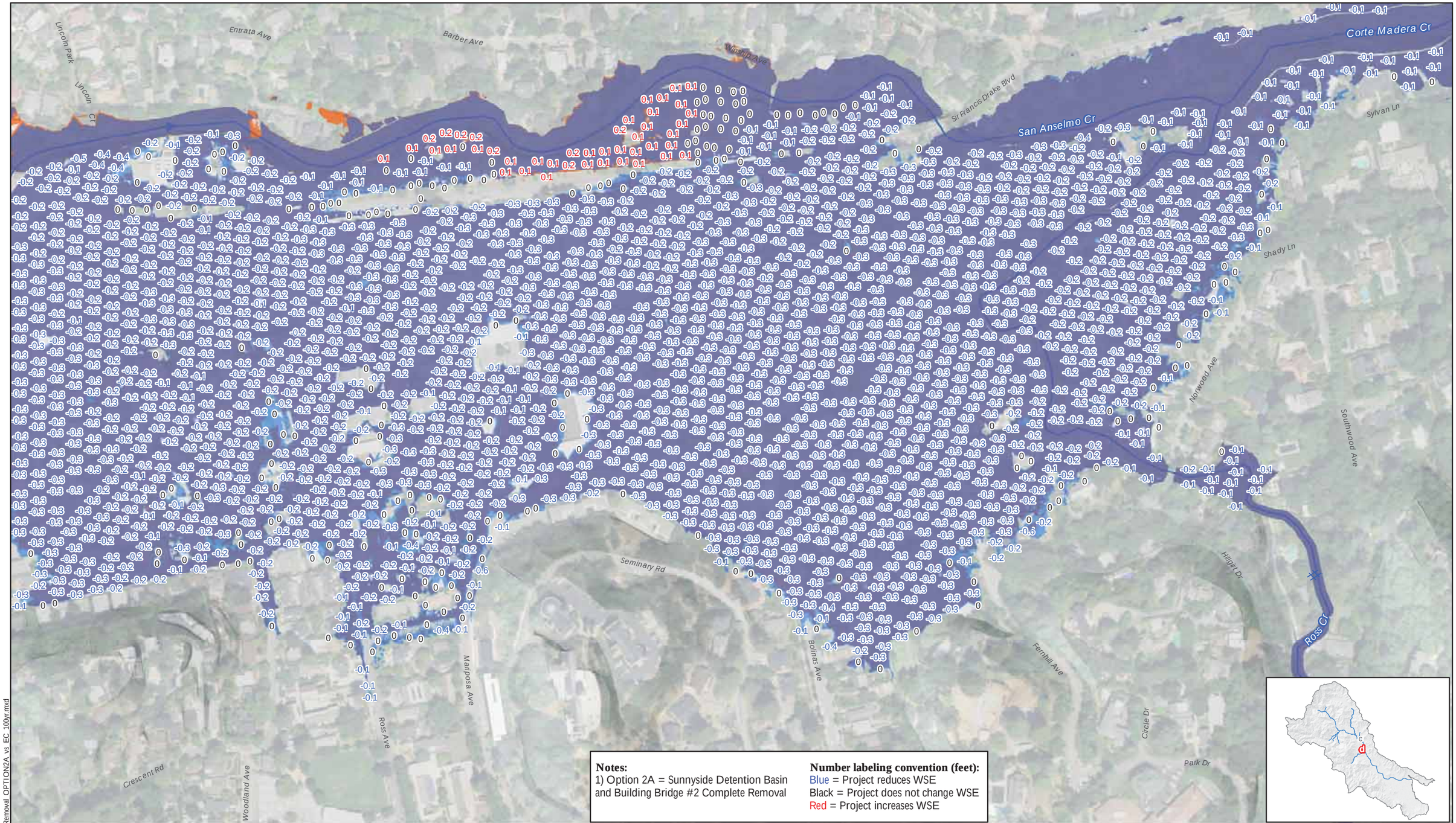
Existing Inundation
Option 2A Inundation
Existing Inundation & Option 2A Inundation
Creek (flow direction)
(Option 2A Project

CHANGE IN HEC-RAS-SIMULATED INUNDATION EXTENT AND DEPTH BETWEEN OPTION 2A (COMPLETE REMOVAL) AND EXISTING CONDITIONS FOR 100-YEAR FLOOD DOWNTOWN SAN ANSELMO AREA (UPPER)

0 110 220 Feet

Document Path: J:\jn\2646\FullRemoval_OPTION2A_vs_EC_100yr.mxd

FIGURE 4d



Notes:
1) Option 2A = Sunnyside Detention Basin and Building Bridge #2 Complete Removal

Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

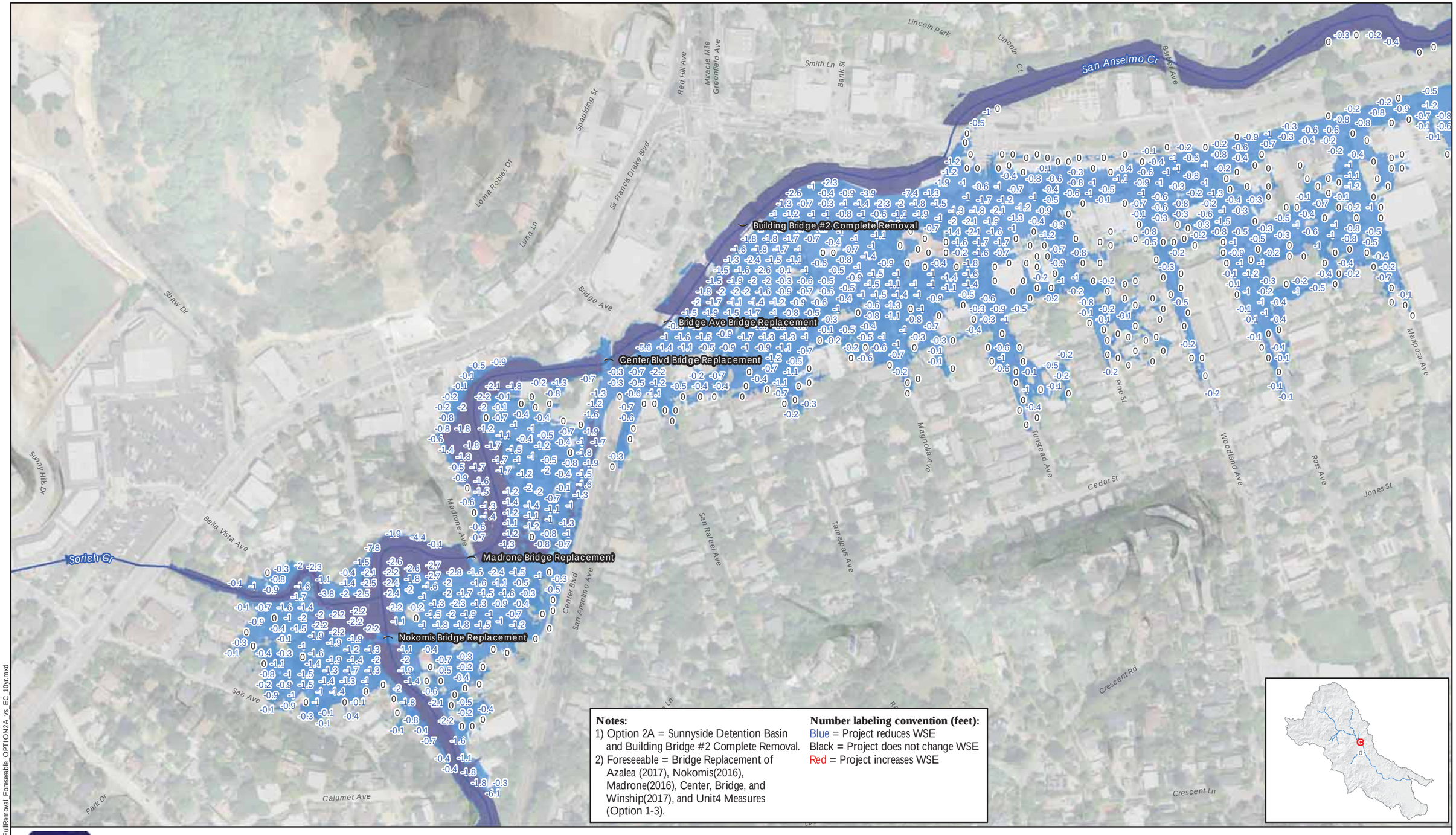
Existing Inundation
Option 2A Inundation
Existing Inundation & Option 2A Inundation
Creek (flow direction)

STETSON ENGINEERS INC.

CHANGE IN HEC-RAS-SIMULATED INUNDATION EXTENT AND DEPTH BETWEEN OPTION 2A (COMPLETE REMOVAL) AND EXISTING CONDITIONS FOR 100-YEAR FLOOD DOWNTOWN SAN ANSELMO AREA (LOWER)

0 100 200 Feet

Document Path: J:\jn2646\FullRemoval_OPTION2A_vs_EC_100yr.mxd



Notes:
1) Option 2A = Sunnyside Detention Basin and Building Bridge #2 Complete Removal.
2) Foreseeable = Bridge Replacement of Azalea (2017), Nokomis(2016), Madrone(2016), Center, Bridge, and Winship(2017), and Unit4 Measures (Option 1-3).

Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

STETSON ENGINEERS INC.

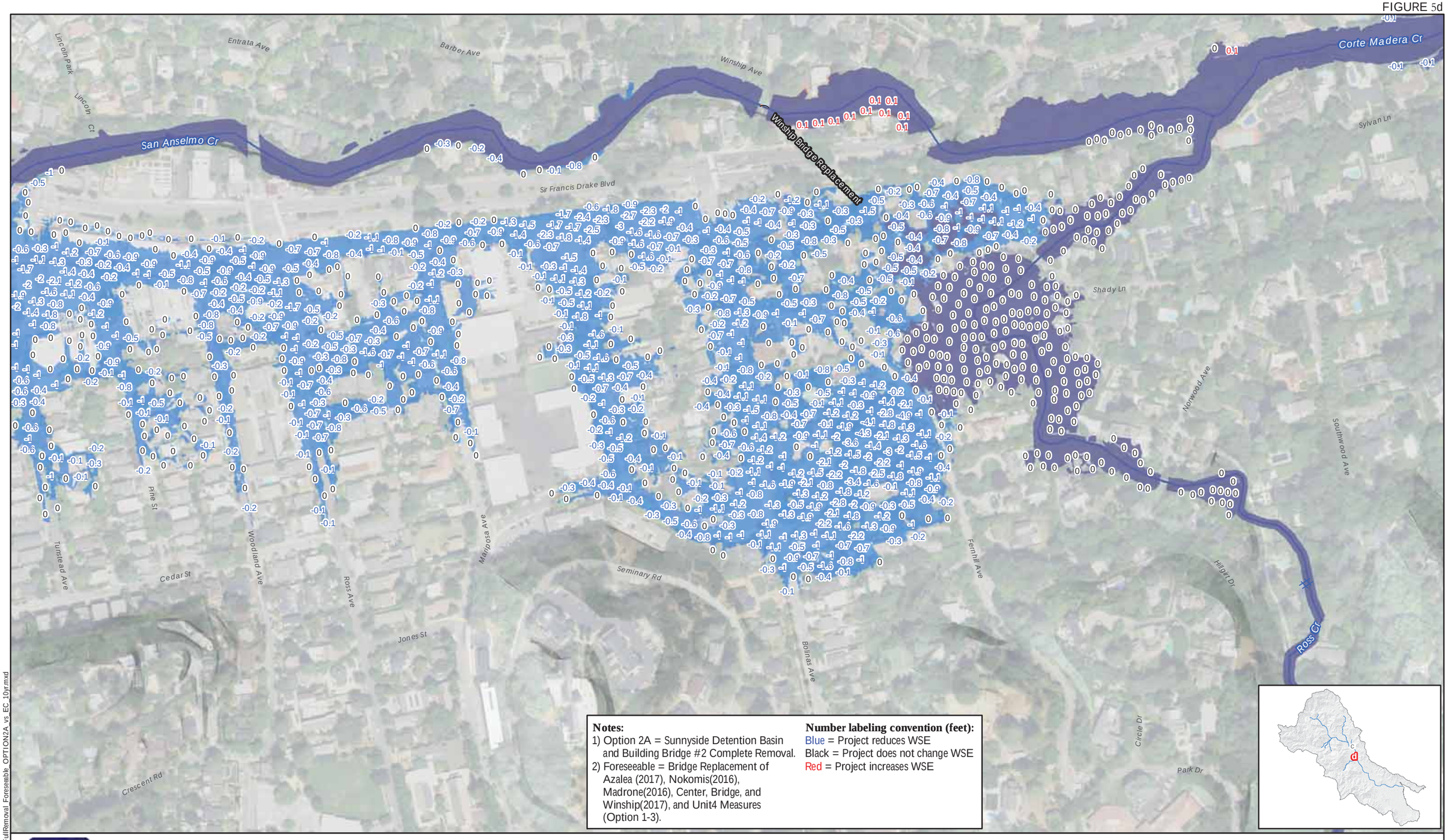
Existing Inundation
Option 2A + Foreseeable Inundation
Existing Inundation & Option 2A + Foreseeable Inundation
Creek (flow direction)
(Option 2A Project
) Foreseeable Project

CHANGE IN HEC-RAS-SIMULATED INUNDATION EXTENT AND DEPTH BETWEEN OPTION 2A (COMPLETE REMOVAL) + FORESEEABLE PROJECTS AND EXISTING CONDITIONS FOR 10-YEAR FLOOD DOWNTOWN SAN ANSELMO AREA (UPPER)

0 110 220 Feet

Document Path: J:\jn2646\FullRemoval_Foreseeable_OPTION2A_vs_EC_10yr.mxd

FIGURE 5d



Notes:
1) Option 2A = Sunnyside Detention Basin and Building Bridge #2 Complete Removal.
2) Foreseeable = Bridge Replacement of Azalea (2017), Nokomis(2016), Madrone(2016), Center, Bridge, and Winship(2017), and Unit4 Measures (Option 1-3).

Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

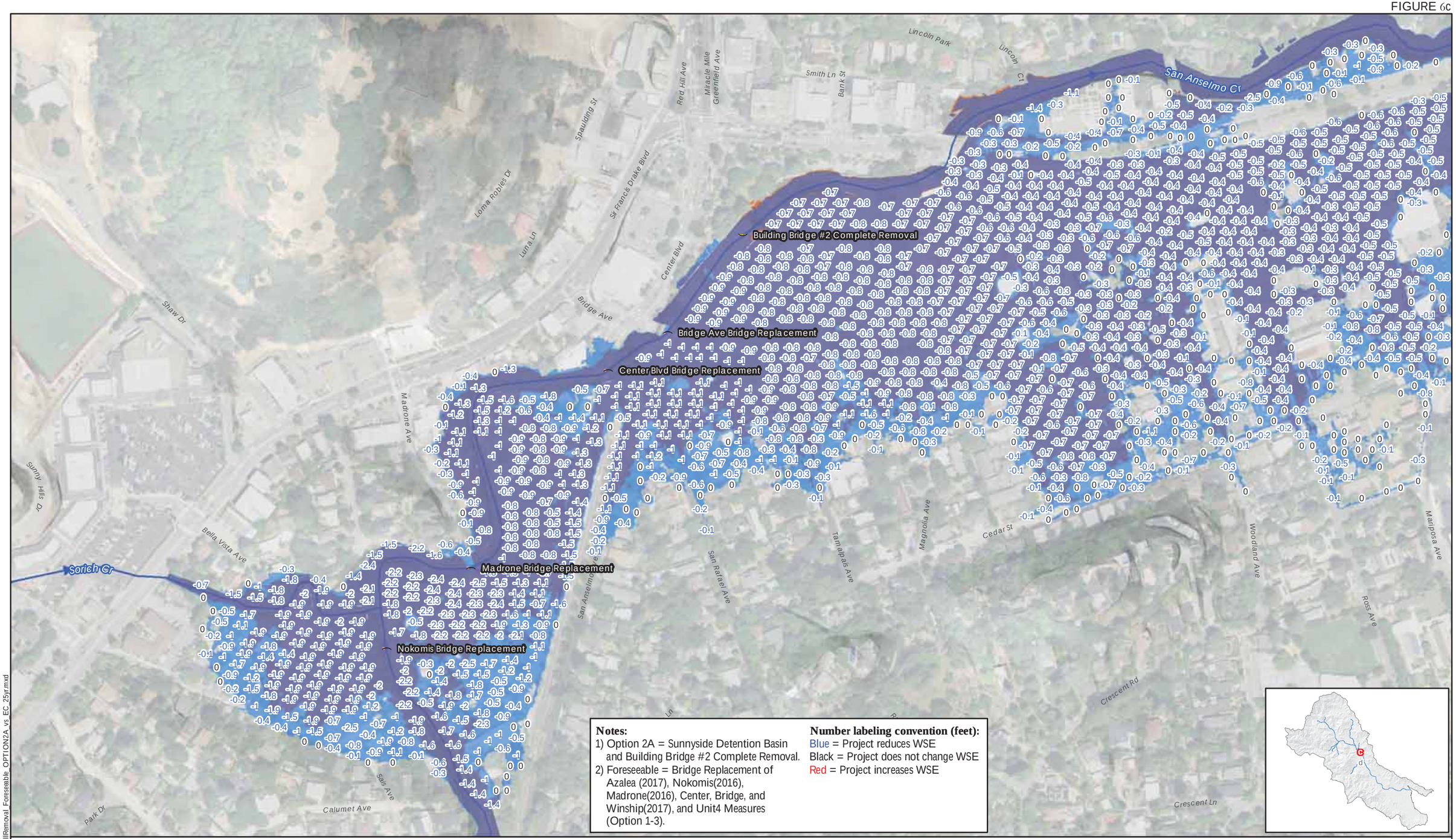
STETSON ENGINEERS INC.

Existing Inundation
Option 2A + Foreseeable Inundation
Existing Inundation & Option 2A + Foreseeable Inundation
Creek (flow direction)
(Option 2A Project
) Foreseeable Project

CHANGE IN HEC-RAS-SIMULATED INUNDATION EXTENT AND DEPTH BETWEEN OPTION 2A (COMPLETE REMOVAL) + FORESEEABLE PROJECTS AND EXISTING CONDITIONS FOR 10-YEAR FLOOD DOWNTOWN SAN ANSELMO AREA (LOWER)

0 100 200 Feet

Document Path: J:\jn2646\FullRemoval_Foreseeable_OPTION2A_vs_EC_10yr.mxd



Notes:
1) Option 2A = Sunnyside Detention Basin and Building Bridge #2 Complete Removal.
2) Foreseeable = Bridge Replacement of Azalea (2017), Nokomis(2016), Madrone(2016), Center, Bridge, and Winship(2017), and Unit4 Measures (Option 1-3).

Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

STETSON ENGINEERS INC.

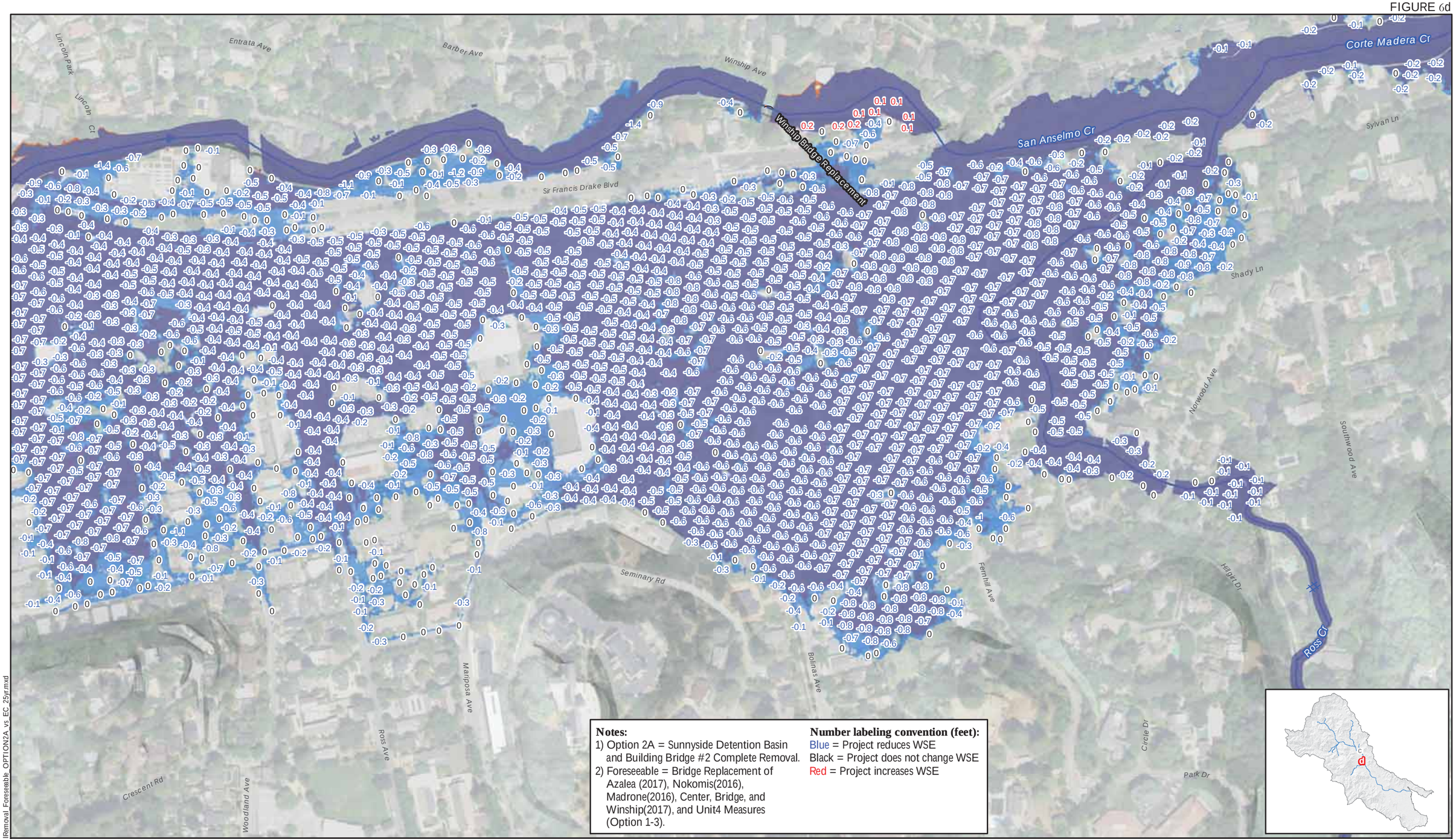
Existing Inundation
Option 2A + Foreseeable Inundation
Existing Inundation & Option 2A + Foreseeable Inundation
Creek (flow direction)
(Option 2A Project
) Foreseeable Project

CHANGE IN HEC-RAS-SIMULATED INUNDATION EXTENT AND DEPTH BETWEEN OPTION 2A (COMPLETE REMOVAL) + FORESEEABLE PROJECTS AND EXISTING CONDITIONS FOR 25-YEAR FLOOD DOWNTOWN SAN ANSELMO AREA (UPPER)

0 110 220 Feet

Document Path: J:\jn2646\FullRemoval_Foreseeable_OPTION2A_vs_EC_25yr.mxd

FIGURE 6d



Notes:
1) Option 2A = Sunnyside Detention Basin and Building Bridge #2 Complete Removal.
2) Foreseeable = Bridge Replacement of Azalea (2017), Nokomis(2016), Madrone(2016), Center, Bridge, and Winship(2017), and Unit4 Measures (Option 1-3).

Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

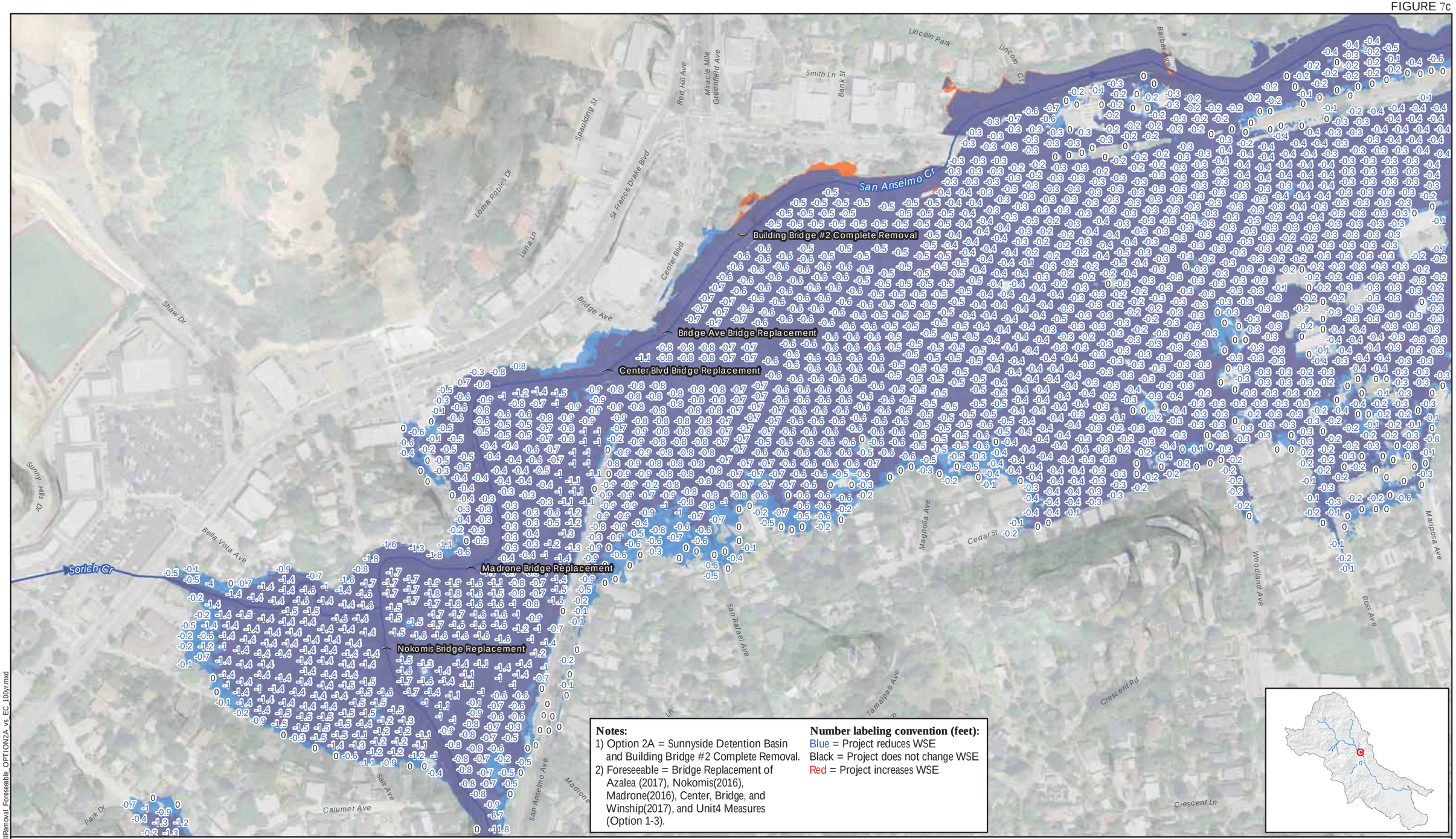
Existing Inundation
Option 2A + Foreseeable Inundation
Existing Inundation & Option 2A + Foreseeable Inundation
Creek (flow direction)
Foreseeable Project

STETSON ENGINEERS INC.

CHANGE IN HEC-RAS-SIMULATED INUNDATION EXTENT AND DEPTH BETWEEN OPTION 2A (COMPLETE REMOVAL) + FORESEEABLE PROJECTS AND EXISTING CONDITIONS FOR 25-YEAR FLOOD DOWNTOWN SAN ANSELMO AREA (LOWER)

0 100 200 Feet

Document Path: J:\jn2646\FullRemoval_Foreseeable_OPTION2A_vs_EC_25yr.mxd



Notes:
1) Option 2A = Sunnyside Detention Basin and Building Bridge #2 Complete Removal.
2) Foreseeable = Bridge Replacement of Azalea (2017), Nokomis(2016), Madrone(2016), Center, Bridge, and Winship(2017), and Unit4 Measures (Option 1-3).

Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

STETSON ENGINEERS INC.

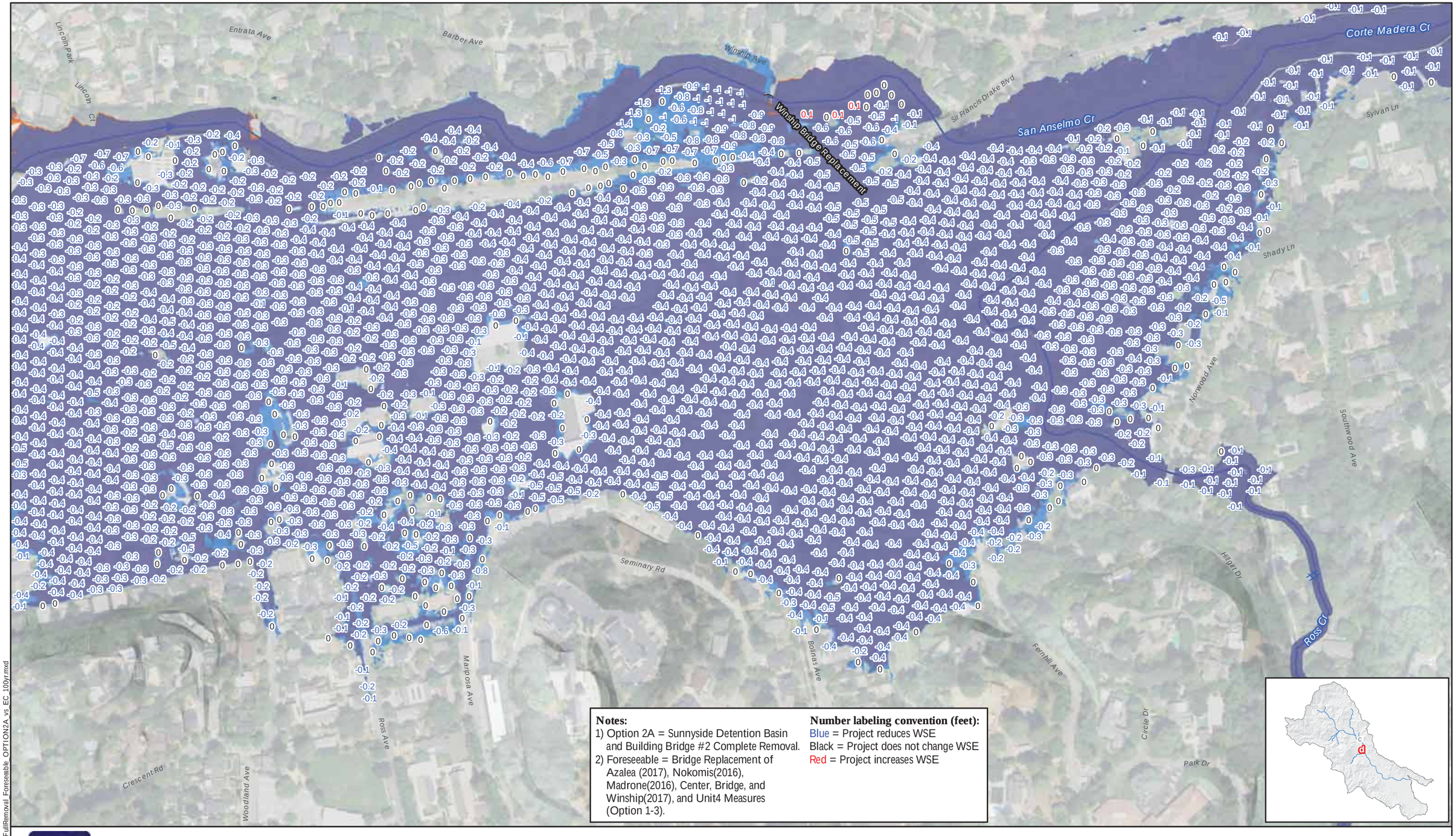
Existing Inundation
Option 2A + Foreseeable Inundation
Existing Inundation & Option 2A + Foreseeable Inundation
Creek (flow direction)
(Option 2A Project
) Foreseeable Project

CHANGE IN HEC-RAS-SIMULATED INUNDATION EXTENT AND DEPTH BETWEEN OPTION 2A (COMPLETE REMOVAL) + FORESEEABLE PROJECTS AND EXISTING CONDITIONS FOR 100-YEAR FLOOD DOWNTOWN SAN ANSELMO AREA (UPPER)

0 110 220 Feet

Document Path: J:\jn\2646\FullRemoval_Foreseeable_OPTION2A_vs_EC_100yr.mxd

FIGURE 7d



Notes:
1) Option 2A = Sunnyside Detention Basin and Building Bridge #2 Complete Removal.
2) Foreseeable = Bridge Replacement of Azalea (2017), Nokomis(2016), Madrone(2016), Center, Bridge, and Winship(2017), and Unit4 Measures (Option 1-3).

Number labeling convention (feet):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

STETSON ENGINEERS INC.

Existing Inundation
Option 2A + Foreseeable Inundation
Existing Inundation & Option 2A + Foreseeable Inundation
Creek (flow direction)
Foreseeable Project

CHANGE IN HEC-RAS-SIMULATED INUNDATION EXTENT AND DEPTH BETWEEN OPTION 2A (COMPLETE REMOVAL) + FORESEEABLE PROJECTS AND EXISTING CONDITIONS FOR 100-YEAR FLOOD DOWNTOWN SAN ANSELMO AREA (LOWER)

0 100 200 Feet

Document Path: J:\jn2646\FullRemoval_Foreseeable_OPTION2A_vs_EC_100yr.mxd

Figure 8 Comparison of Water Surface Profiles along the San Anselmo Creek between Complete and Partial Removal of BB#2 , 10-Year Flow (Upper/Lower San Anselmo Area), **Option 2A**

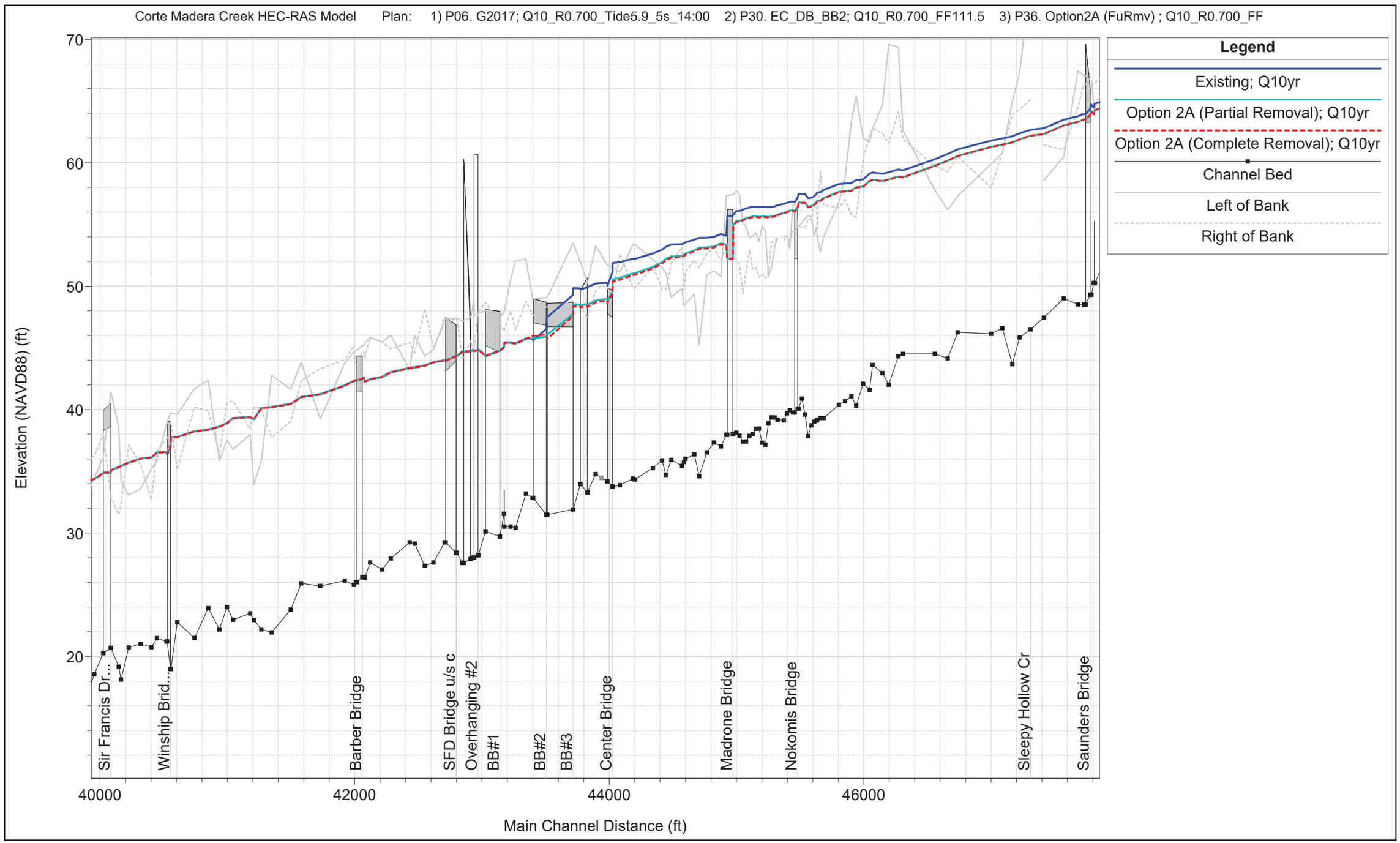


Figure 9 Comparison of Water Surface Profiles along the San Anselmo Creek between Complete and Partial Removal of BB#2 , 25-Year Flow (Upper/Lower San Anselmo Area), **Option 2A**

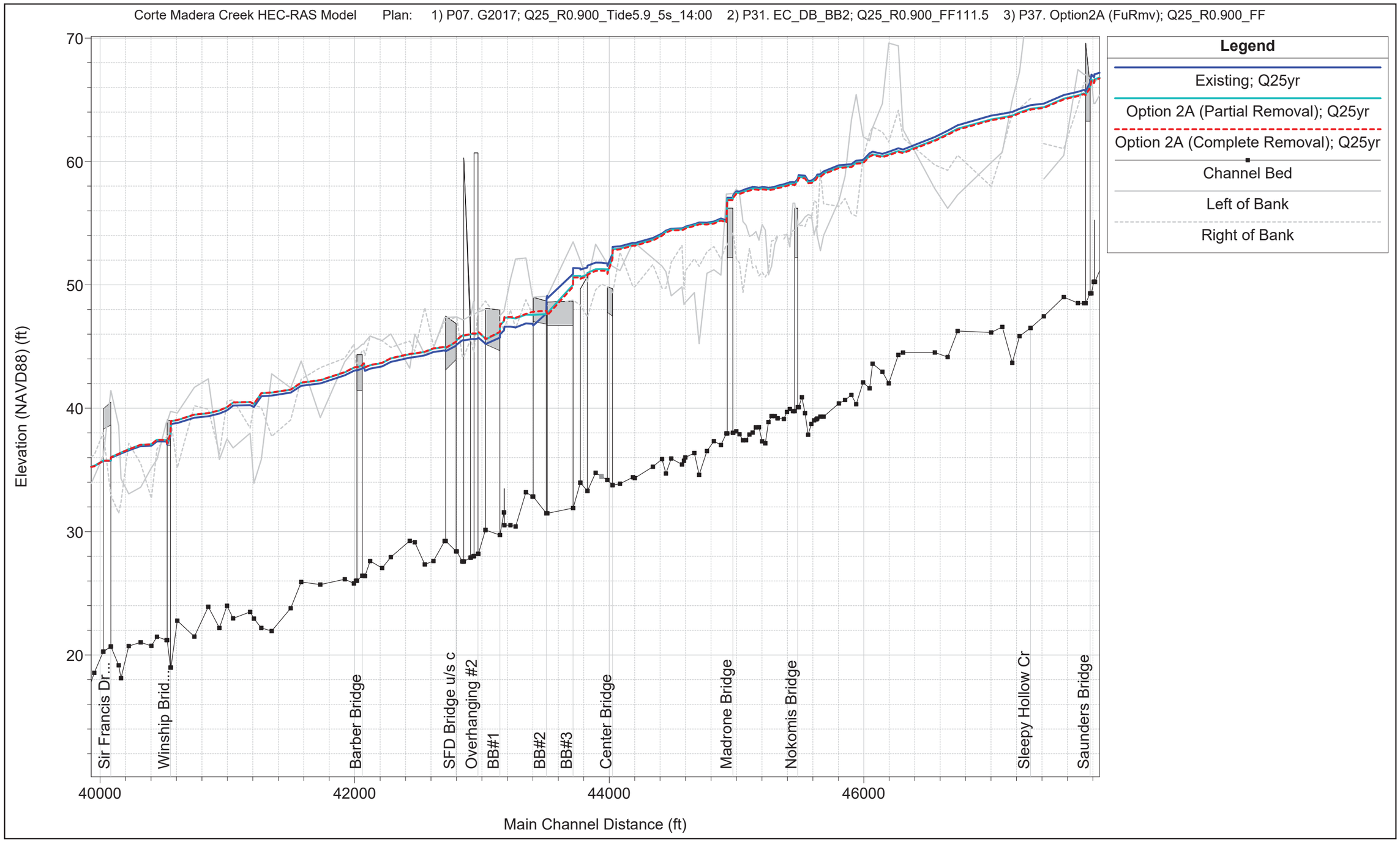


Figure 10 Comparison of Water Surface Profiles along the San Anselmo Creek between Complete and Partial Removal of BB#2 , 100-Year Flow (Upper/Lower San Anselmo Area), **Option 2A**

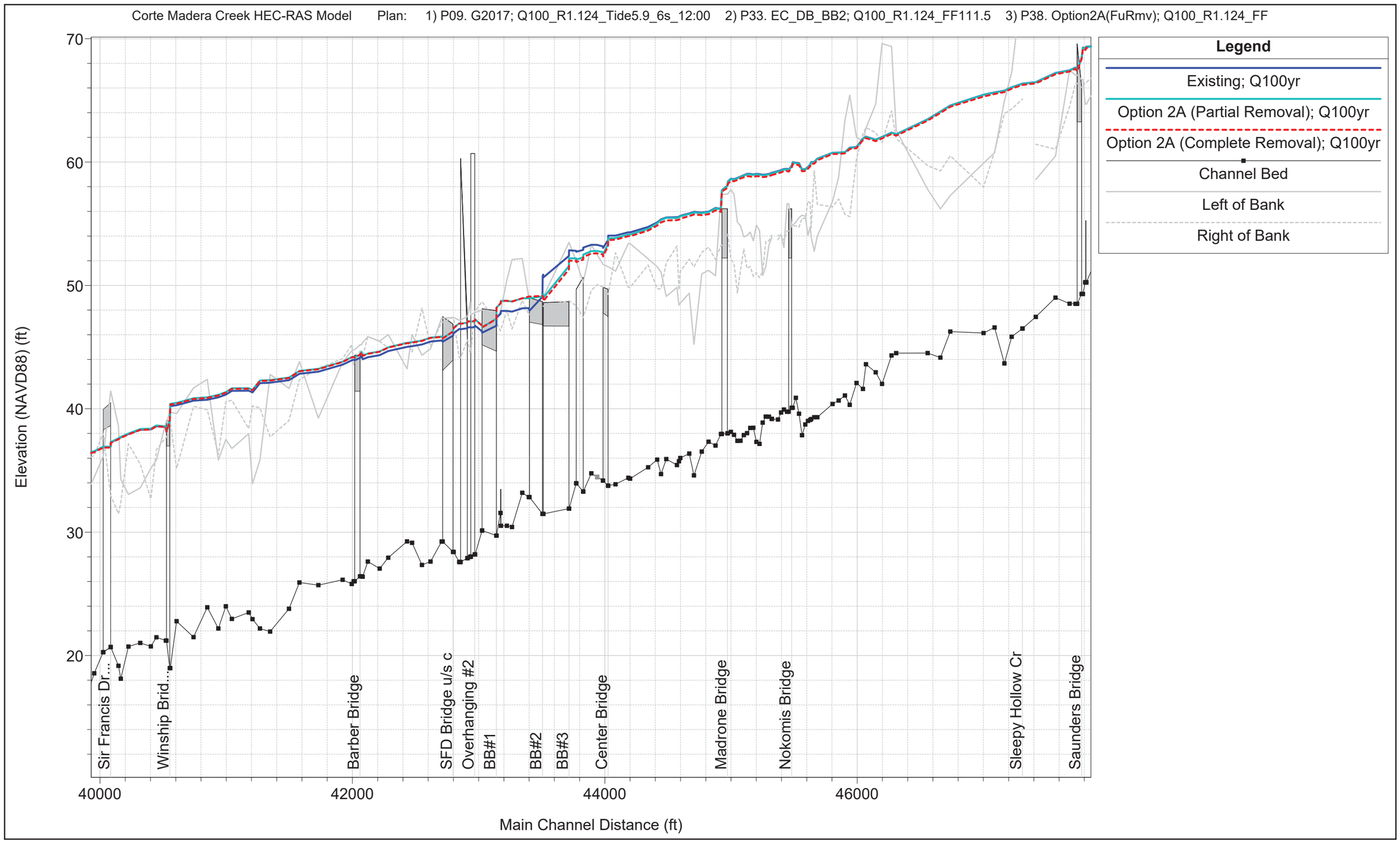


Figure 11 Comparison of Water Surface Profiles along the San Anselmo Creek between Complete and Partial Removal of BB#2 , 10-Year Flow (Upper/Lower San Anselmo Area), **Option 2A + Foreseeable Projects**

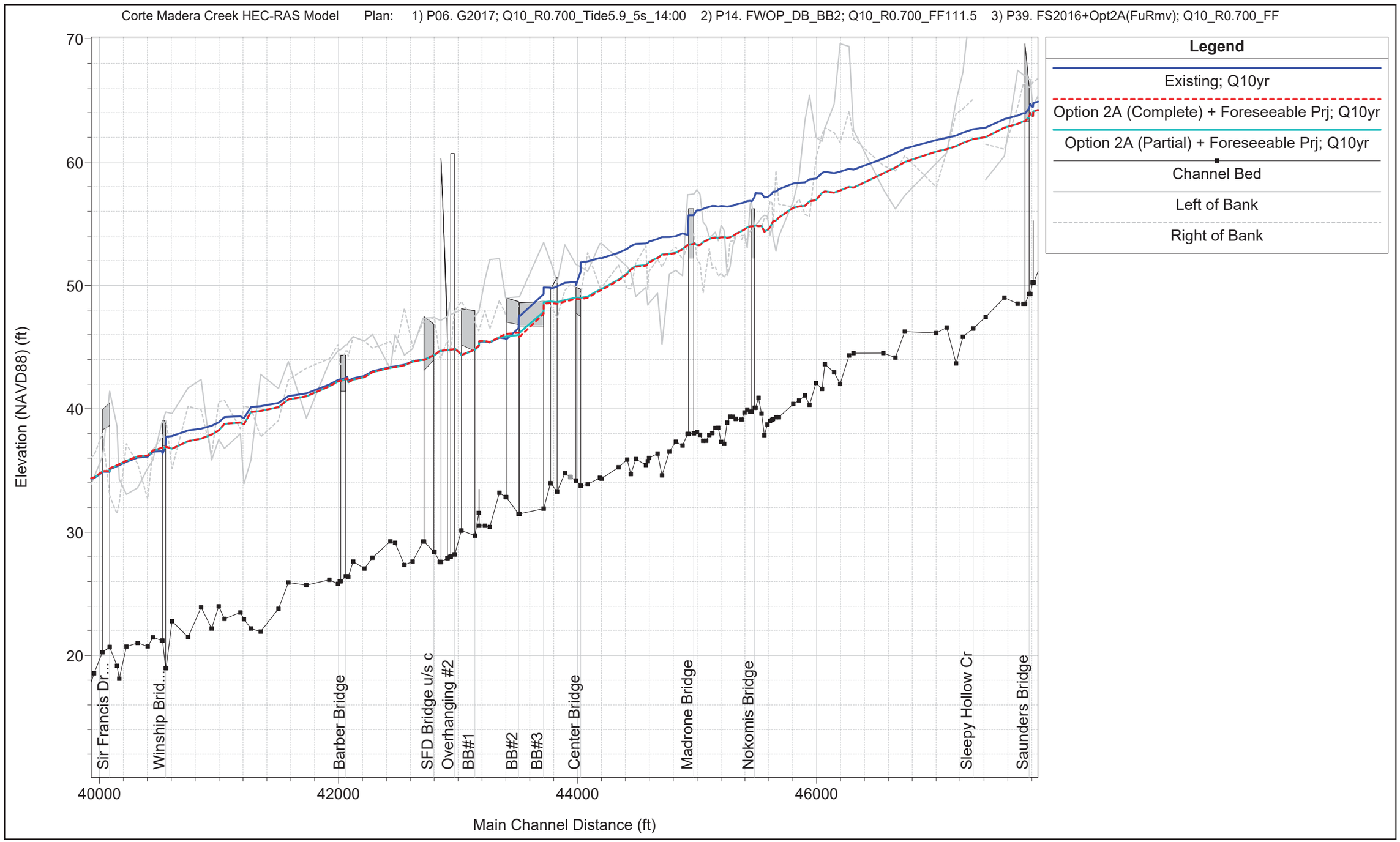


Figure 12 Comparison of Water Surface Profiles along the San Anselmo Creek between Complete and Partial Removal of BB#2 , 25-Year Flow (Upper/Lower San Anselmo Area), **Option 2A + Foreseeable Projects**

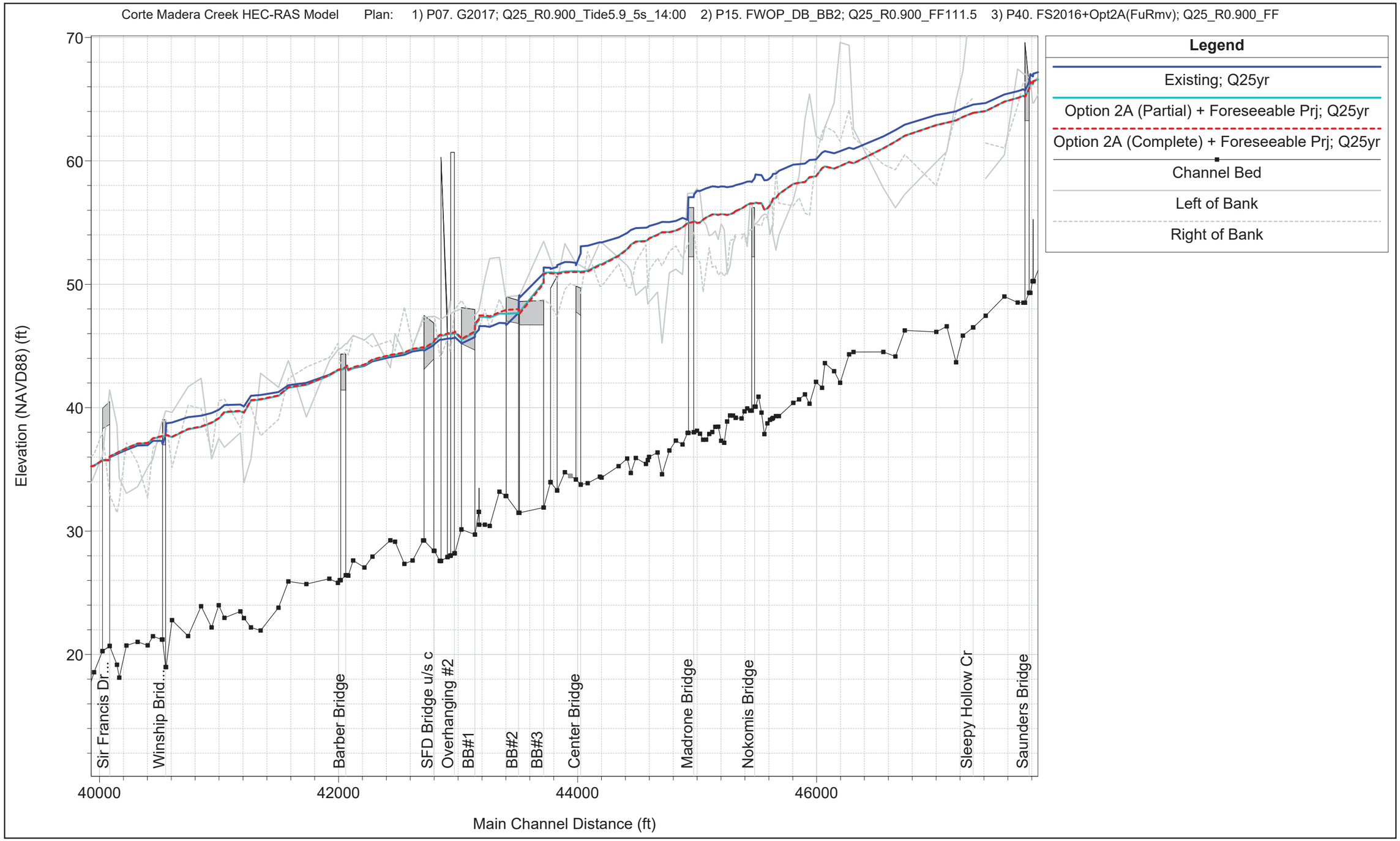
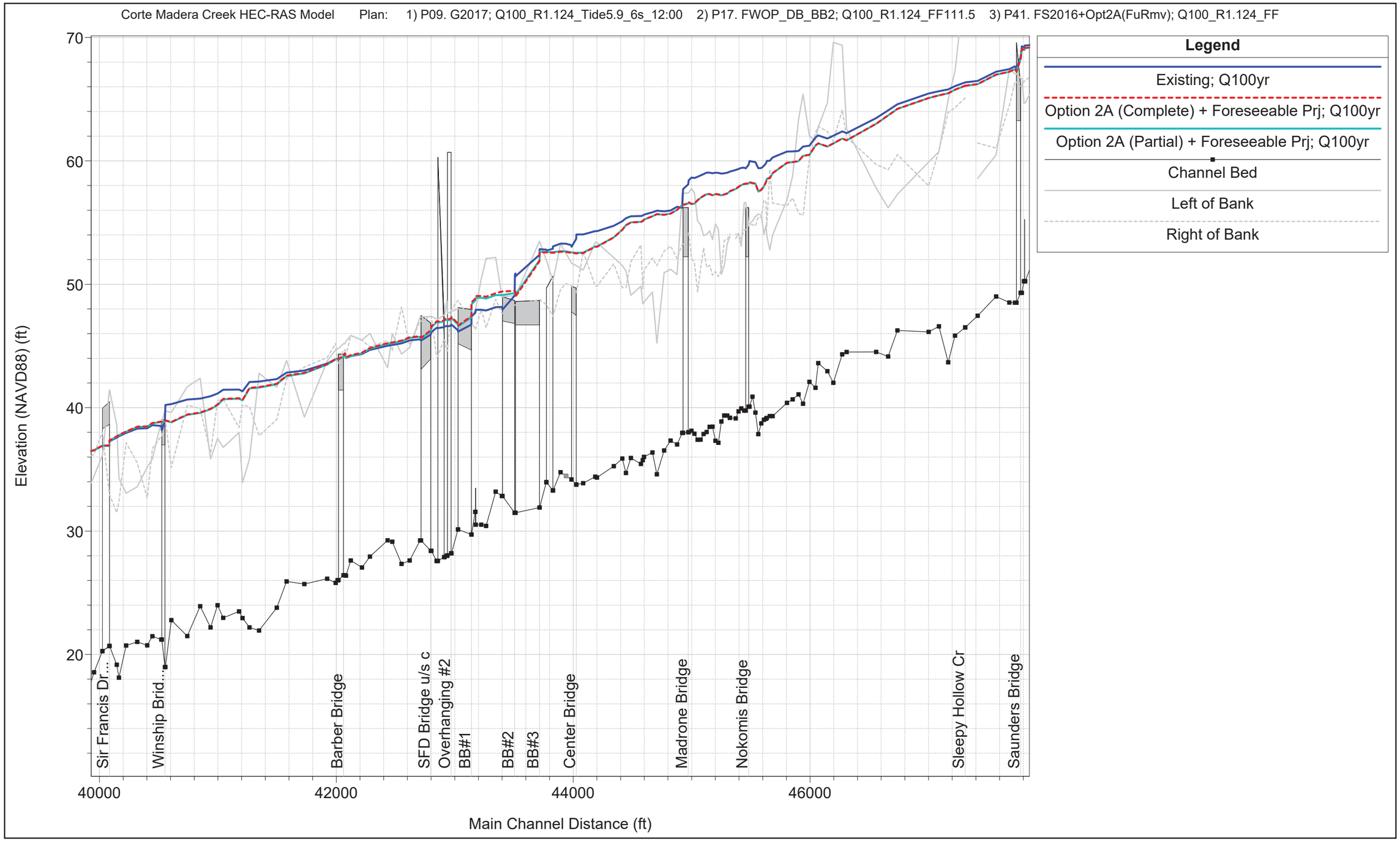
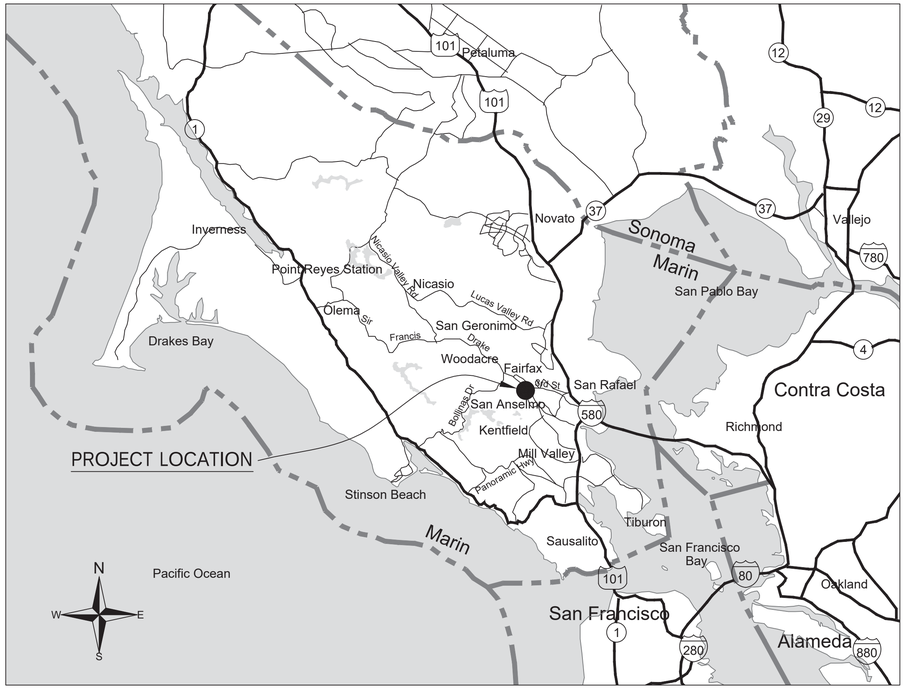


Figure 13 Comparison of Water Surface Profiles along the San Anselmo Creek between Complete and Partial Removal of BB#2 , 100-Year Flow (Upper/Lower San Anselmo Area), **Option 2A + Foreseeable Projects**



TOWN OF SAN ANSELMO PROPERTY ACQUISITION AND DEMOLITION OF BRIDGE BUILDING # 2 AND RIPARIAN RESTORATION PROJECT, MARIN COUNTY, CALIFORNIA



VICINITY MAP

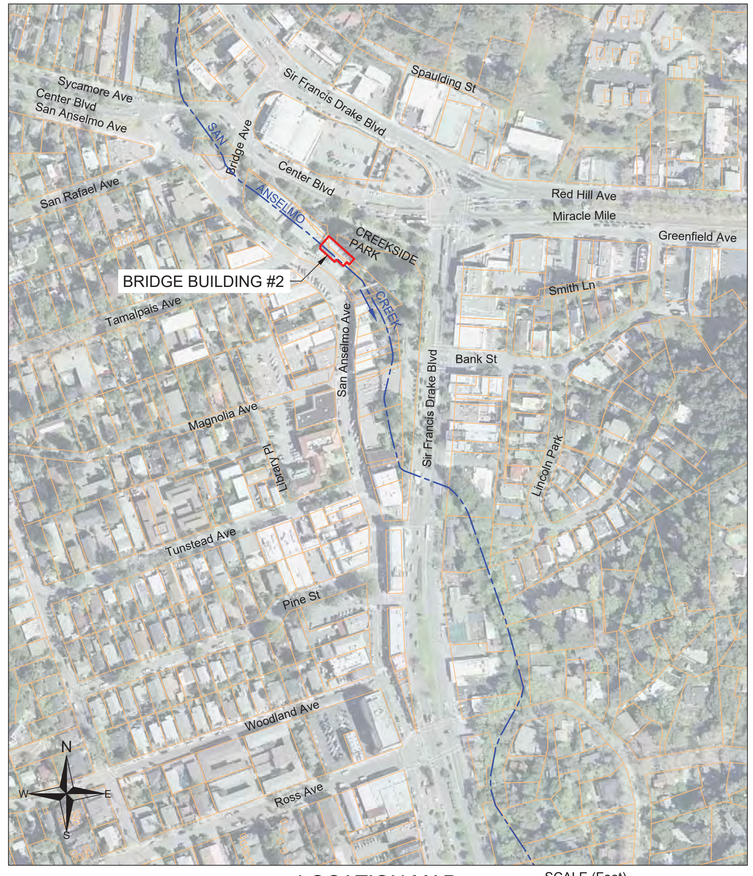
AGENCY NAME:	TOWN OF SAN ANSELMO
LAND OWNER:	MR. GEOFFREY KOBLICK
SITE ADDRESS:	634 - 636 SAN ANSELMO AVE.
	SAN ANSELMO, CA. 94960
CIVIL ENGINEER:	JAMES REILLY PE.
	STETSON ENGINEERS INC.
	2171 E. FRANCISCO BLVD., SUITE K
	SAN RAFAEL, CA. 94901
MAP PREPARER:	GUSTAVO TRINIDAD PE.
DATE:	JUNE 10, 2014

SHEET INDEX

SHEET No.	DESCRIPTION
1	TITLE SHEET AND LOCATION MAP
2	SITE PLAN VIEW
3	SITE CROSS-SECTIONS AND DETAIL

ABBREVIATIONS

APPROX	APPROXIMATE
AVE	AVENUE
CY	CUBIC YARD
DIA	DIAMETER
(E)	EXISTING
ELEV	ELEVATION
FL	FLOW LINE
FT	FEET
IN	INCHES
H	HORIZONTAL
HWY	HIGHWAY
LN	LINE
LT	LIGHT
MAX	MAXIMUM
MIN	MINIMUM
(N)	NEW
No	NUMBER
O.C	ON CENTER
PSI	POUNDS PER SQUARE INCH
RD	ROAD
SF	SQUARE FEET
ST	STREET
STA	STATION
TYP	TYPICAL
V	VERTICAL
#	NUMBER
'	FEET
"	INCHES



LOCATION MAP

SCALE (Feet)
0 200 400

LEGEND
- CREEK
- PARCEL LINE
- PROJECT SITE

DESIGNED: G. Trinidad	No.	DATE	REVISION	BY	APPROVED
DRAFTED: G. Trinidad					
CHECKED: J. Reilly					

STETSON ENGINEERS INC.

Stetson Engineers Inc.
2171 E. Francisco Blvd., Suite K
San Rafael, CA. 94901
(415) 457-0701

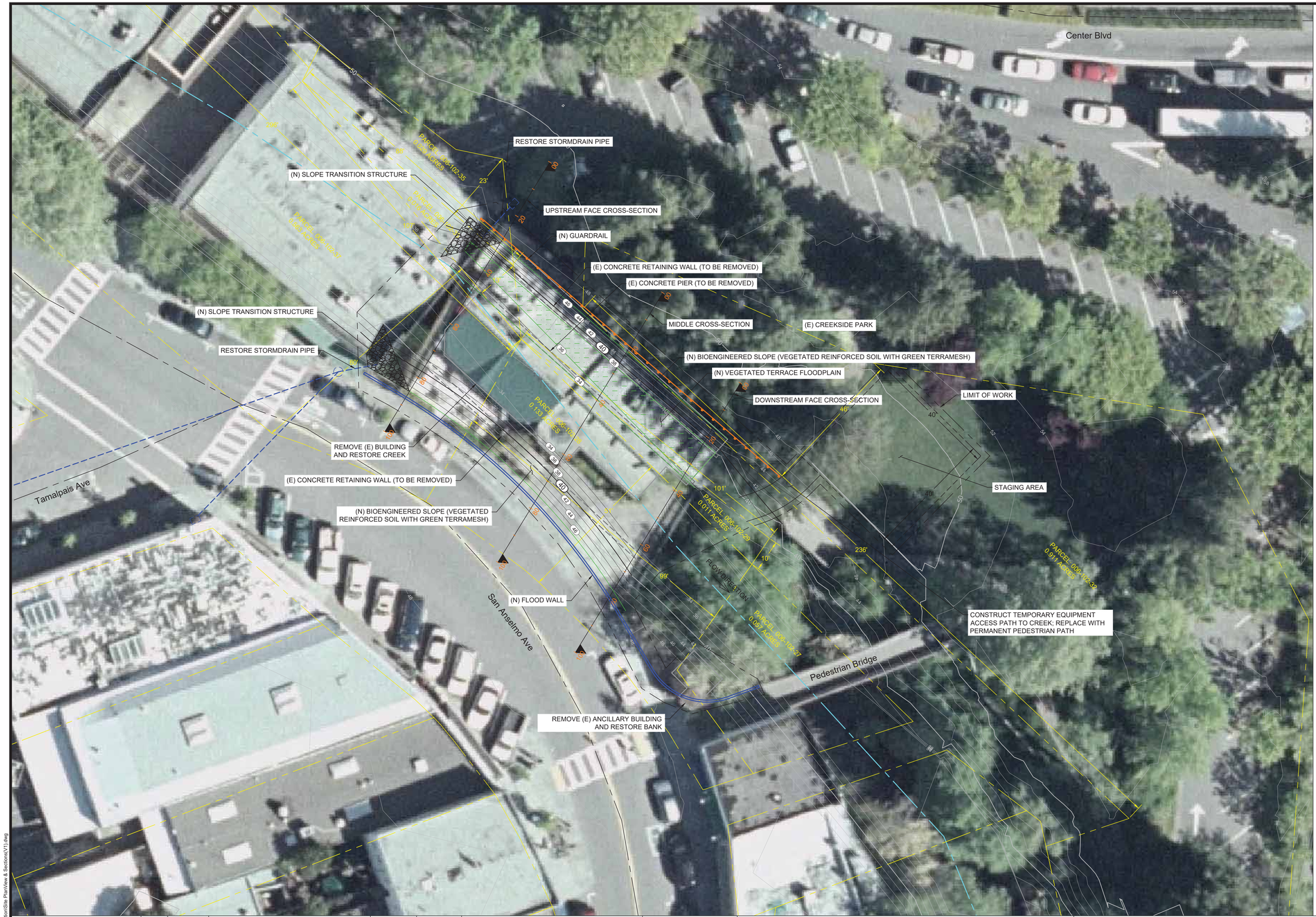
TOWN OF SAN ANSELMO PROPERTY ACQUISITION AND DEMOLITION OF BRIDGE BUILDING # 2 AND RIPARIAN RESTORATION PROJECT, MARIN COUNTY, CALIFORNIA

TITLE SHEET AND LOCATION MAP

DATE: JUNE 10, 2014
SCALE: AS INDICATED
PROJECT No.: 2482-02

SHEET 1 OF 3

I:\DATA\2482\AutoCAD\Grant Application\Title&Location.dwg



N

W E

S

SCALE (Feet)

0 15 30

LEGEND

- EXISTING CONTOUR LINES (2009 LIDAR DATA)
- PROPOSED CONTOUR LINES
- EXISTING BUILDING TO BE REMOVED
- CREEK FLOW LINE
- STORM DRAIN PIPE (APPROX LOCATION)
- EXISTING CONCRETE WALL TO BE REMOVED
- ROAD CENTERLINE
- PARCEL LINE
- NEW GUARDRAIL
- NEW FLOOD WALL
- NEW VEGETATED TERRACE
- STAGING AREA LINE
- LIMIT OF WORK LINE

ESTIMATED QUANTITIES:

BUILDINGS TO BE REMOVED AREA = 3,200 SF
CONCRETE TO BE REMOVED VOLUME = 1,000 CY
NEW FLOOD WALL LENGTH = 175 FT
NEW GUARDRAIL LENGTH = 125 FT
NEW BIO ENGINEERING SLOPE AREA = 2,500 SF
NEW VEGETATED TERRACE AREA = 800 SF

NOTES:

1. VERTICAL DATUM NAVD88.
2. TOPOGRAPHY AND EXISTING FEATURES SHOWN ARE APPROXIMATE, MAY NOT REFLECT ACTUAL LOCATIONS.
3. PARCEL LAYOUT IS APPROXIMATE BASED ON COUNTY OF MARIN WEBSITE DATA.
4. NO MAJOR UTILITIES IN LIMIT OF WORK. UTILITIES LOCATIONS SHALL BE VERIFIED, LOCATED AND IDENTIFIED BEFORE STARTING ANY WORK.
5. USE EXISTING PARK ACCESS FROM PARKING LOT DURING CONSTRUCTION. PARK ACCESS AND STAGING AREA SHALL BE RESTORED TO PRE-CONSTRUCTION CONDITION.

DESIGNED: G. Trinidad	No.	DATE	REVISION	BY	APPROVED
DRAFTED: G. Trinidad					
CHECKED: J. Reilly					

STETSON ENGINEERS INC.

Stetson Engineers Inc.
2171 E. Francisco Blvd., Suite K
San Rafael, CA. 94901
(415) 457-0701

TOWN OF SAN ANSELMO PROPERTY ACQUISITION AND DEMOLITION OF BRIDGE BUILDING # 2 AND RIPARIAN RESTORATION PROJECT, MARIN COUNTY, CALIFORNIA

SITE PLAN VIEW

DATE: JUNE 10, 2014

SCALE: 1" = 15'

PROJECT No.: 2482-02

SHEET 2 OF 3

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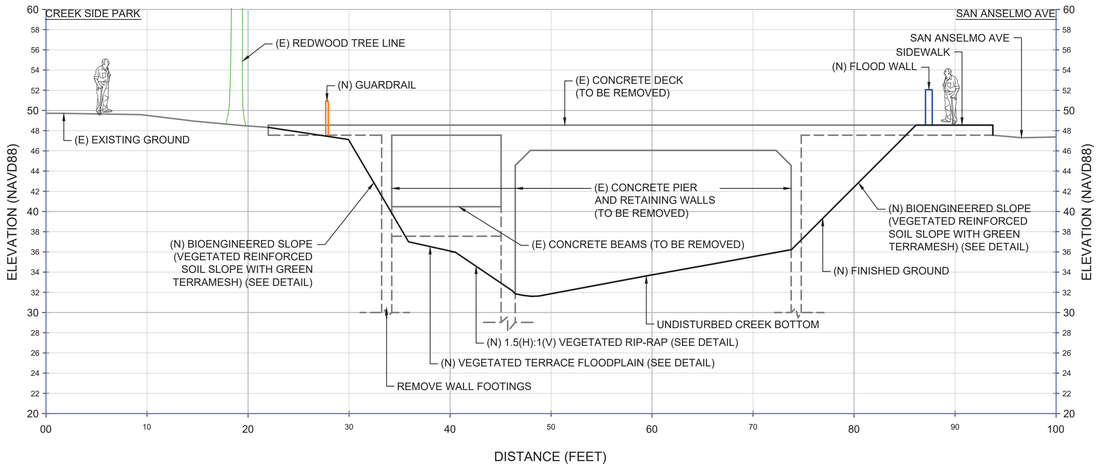
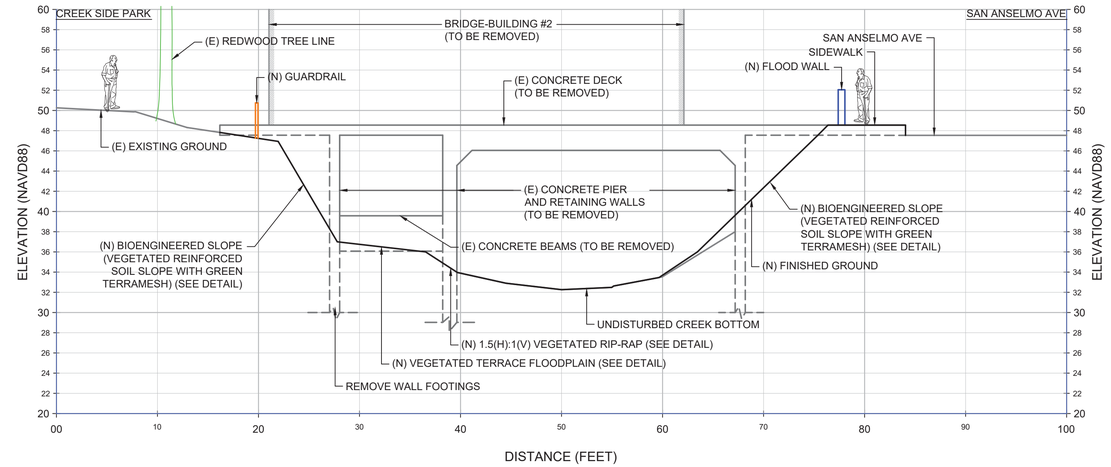
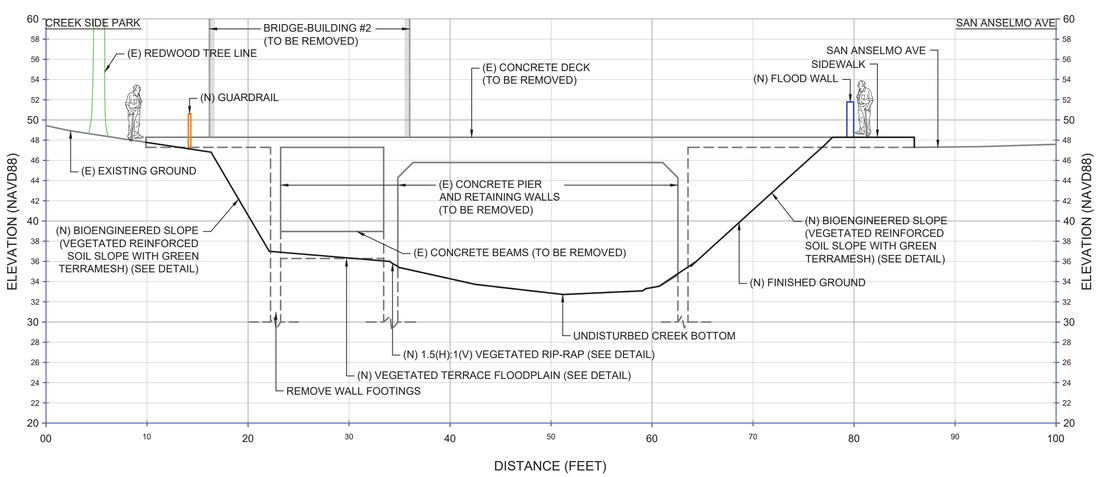
UPSTREAM FACE CROSS-SECTION



MIDDLE CROSS-SECTION

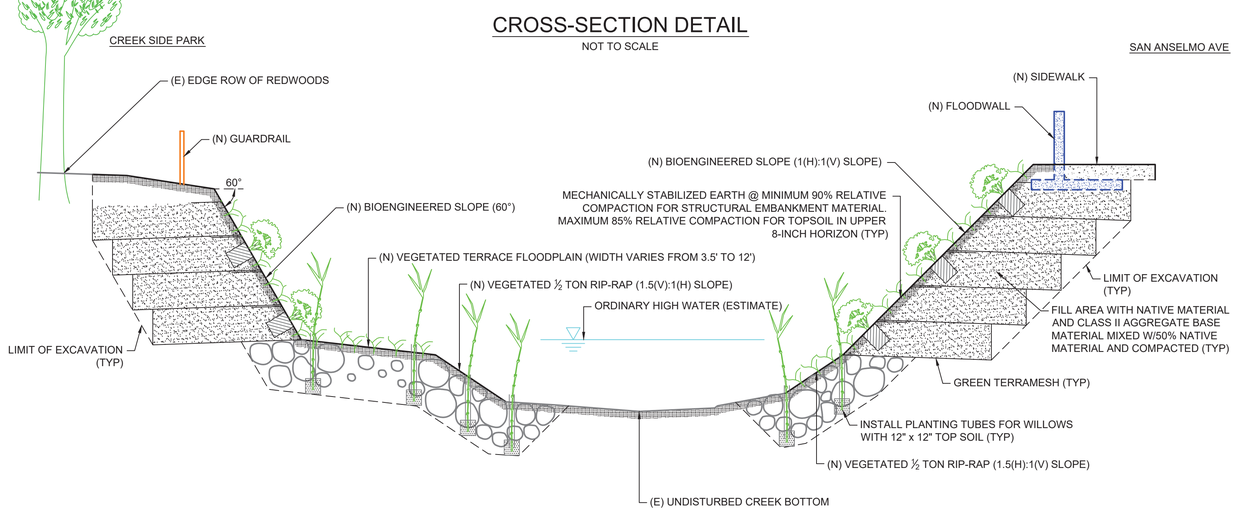


DOWNSTREAM FACE CROSS-SECTION



CROSS-SECTION DETAIL

NOT TO SCALE



NOTES:

1. VERTICAL DATUM NAVD88.
2. ALL CROSS-SECTIONS ARE LOOKING DOWNSTREAM.

SCALE (Feet)
0 7.5 15

DESIGNED: G. Trinidad	No.	DATE	REVISION	BY	APPROVED
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TOWN OF SAN ANSELMO PROPERTY ACQUISITION AND DEMOLITION OF BRIDGE BUILDING # 2 AND RIPARIAN RESTORATION PROJECT, MARIN COUNTY, CALIFORNIA

SITE CROSS-SECTIONS AND DETAIL

DATE: JUNE 10, 2014
SCALE: AS INDICATED
PROJECT No.: 2482-02

SHEET 3 OF 3

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D-4 Geomorphic and Scour Assessment Corte Madera Creek Flood Protection Project, Option 2A and 2A Plus

TECHNICAL MEMORANDUM

Geomorphic and Scour Assessment Corte Madera Creek Flood Protection Project, Option 2A and 2A Plus

PREPARED FOR:	Russ Eberwein, P.E. Senior Civil Engineer County of Marin Department of Public Works, Flood Control and Water Resources Division
PREPARED BY:	Mitchell Swanson, Geomorphologist, CH2M mitch.swanson@ch2m.com Jeremy Thomas, Geomorphologist, CH2M jeremy.thomas@ch2m.com
DATE:	December 4, 2017; revised January 15 and February 23, 2018

Introduction

The proposed Corte Madera Creek Flood Protection Project (proposed project) is located in Marin County, California, within Corte Madera Creek (CMC) and along the tributary streams of Fairfax Creek and San Anselmo Creek (Figure 1). This technical memorandum (TM) presents the results of a reconnaissance-level geomorphic assessment of two flood protection options proposed by the Marin County Flood Control and Water Conservation District (District) in the CMC watershed.

The two flood protection options are as follows:

Option 2A

1. Construct a flood detention facility along Fairfax Creek at the former Sunnyside Nursery site.
2. Remove Building Bridge #2 (BB#2) from San Anselmo Creek channel in downtown San Anselmo.

Option 2A Plus Foreseeable Future Conditions (Option 2A Plus)

1. Features of Option 2A.
2. Remove and replace bridges at Azalea Avenue, Nokomis Avenue, Madrone Avenue, Center Boulevard, Bridge Boulevard, and Winship Avenue.
3. Remove the fish ladder in CMC at the head of the concrete channel in Ross.

CMC and several of its tributaries flow in densely urbanized commercial and residential areas that have been flooded numerous times in the recent past. The purpose of Options 2A and 2A Plus is to increase the hydraulic capacity of the CMC and detain floodwaters to lower the flood peak and reduce urban flood risk. The hydraulic changes associated with these improvements could potentially impact the movement of sediment, change erosional and depositional patterns in channels, and disrupt the geomorphic processes that govern channel stability.

The purpose of this TM is to characterize potential geomorphic changes and how the flood improvements might impact infrastructure. This characterization is necessary for a California Environmental Quality Act (CEQA) environmental review. The scope of this investigation is limited to sediment transport and scour effects of the proposed project; the changes in hydraulics associated with flood dynamics are addressed by Stetson Engineers, Inc. (Stetson) (Stetson, 2017a; 2017b).

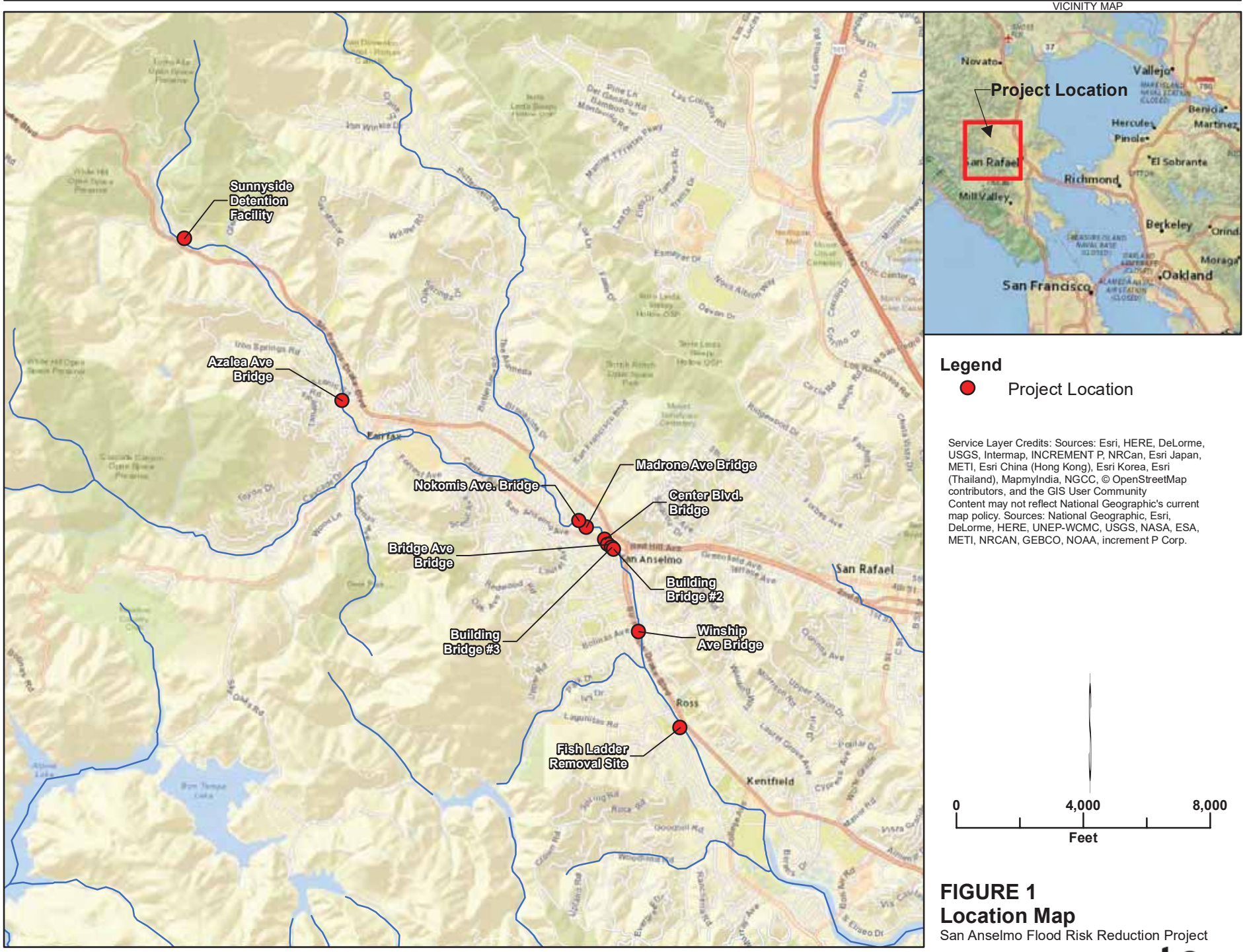

FIGURE 1
Location Map
San Anselmo Flood Risk Reduction Project

ch2m

Study Objectives

The objectives of this study are as follows:

1. Characterize the environmental setting of the CMC watershed as it affects geomorphic processes in Fairfax, San Anselmo, and Corte Madera creeks, including effects of historical and present land uses.
2. Gain an understanding of and document geomorphic and sediment transport conditions and processes at each of the eight sites identified above for Option 2A or Option 2A Plus where improvements are proposed.
3. Review hydraulic modeling output provided by the District and completed by others for on existing conditions, Option 2A, and Option 2A Plus to estimate the potential impacts at the eight improvement locations resulting from erosion, bed scour, bank erosion, and sedimentation that could damage infrastructure, impair flood operations and/or cause channel instability.
4. Identify feasible countermeasures, if practical, to offset potentially significant geomorphic impacts.

Methods

This study was conducted at a reconnaissance level; the analysis and results primarily rely on existing information and data with limited new data collection.

Existing data and information were collected and reviewed, including information about the CMC watershed geomorphology, flooding, sediment transport, and historical geomorphic and channel stability studies, most notably Stetson (Stetson, 2000), Marin County Watersheds[1], and the San Anselmo Historical Museum.[2]

Available project design documents and drawings were reviewed as listed below, and the features of each improvement were confirmed:

- A preliminary set of 10% complete design drawings (CH2M, 2017a)
- The U.S. Army Corps of Engineers (USACE) Hydrologic Engineering Center's River Analysis System (HEC-RAS) hydraulic modeling data (Stetson, 2017a; 2017b) for the Sunnyside Detention Basin
- BB#2 removal and channel bank reconstruction plans CH2M, 2017b)

The District provided CH2M HILL Engineers Inc. (CH2M) with HEC-RAS hydraulic modeling prepared by Stetson (Stetson, 2017a; 2017b) for existing conditions and Options 2A and 2A Plus for a projected 25-year flood event. CH2M used this modeling information and prepared appropriate graphs, plots, and tables for field work and an impact analysis. The HEC-RAS modeling information includes output of important hydraulic variables that are proxies for sediment transport, including flow velocity, mean shear stress, and stream power.

The impact analyses focused on changes in peak mean shear stress, comparing existing conditions with Option 2A and Option 2A Plus. Shear stress governs the sizes of sediment moved on a channel bed and is an indication of the potential for channel bed erosion. Scour is the short-term erosion and lowering of the channel bed during peak flow conditions and is a key factor for designing protection for infrastructure such as bridges (e.g. abutments, support piers), retaining walls and rock slope revetments.

For this assessment, CH2M compared the bed material sediment sizes at each site with HEC-RAS output and critical shear stress particle size mobility relations developed by the U.S. Geological Survey (USGS) (USGS, 2008). This comparison was used to determine whether a significant change in scour depth could occur at each site and, thus, produce a potentially significant impact.

[1] http://www.marinwatersheds.org/rossvalleywatershed-org/index.html

[2] http://sananselmohistory.org/articles/flooding/

CH2M conducted field reconnaissance on November 1 and 2, 2017, to visit each site where improvements are proposed. Each site was documented via photographs and video with field notes, including evidence of current and past erosion, sediment deposition, and channel morphology changes. A general characterization of bed and bank materials and sizes was made at each site. To assess the potential mobility of a gravel/cobble bar under Building Bridge #3 (BB#3), pebble counts were taken and the raw data were reduced to grain-size cumulative frequency using standard techniques (Wolman, 1954). Key information was compiled into fact sheets for each site (Attachment A).

The CH2M geomorphology team coordinated through conference calls and emails with District staff and the project's CEQA consultant, Environmental Science Associates (ESA). Key information was exchanged and confirmed through these conversations, including the scope of this investigation, final proposed project features, the contents of this TM, and schedule.

Setting

The downtown commercial and residential properties affected by flooding are within the valley floor or floodplain communities of Fairfax, San Anselmo, and Ross. The CMC flows generally southeast, draining 28 square miles from the crest of the Coast Range (maximum elevation 2,571 feet) into Richardson Bay at sea level. The upper watershed and terrain surrounding the valley floors is steep with a mix of forest and grassland covers, and includes both open space and rural residential development. The valley floors are densely developed with residential and commercial cover, much of it impervious. Creek channels are highly modified and encroached by roads, narrow bridges, retaining walls, fill, pipelines, and buildings that span the creek as bridges or overhang the creek like balconies. Sir Francis Drake Boulevard is the main access road from Highway 101 to the upper watershed.

The CMC watershed experiences a Mediterranean climate that produces seasonal winter rains from October to April (averaging 40 inches per year), which periodically include intense storms that trigger hillslope erosion and landslides and cause widespread flooding and erosion. Recent damaging flood events include those occurring in 1986, 1995, 1997, 2005, and 2017. Geologically, the CMC watershed is underlain by highly sheared and deformed rock of the Mesozoic Franciscan Formation, including mélange units that have been identified with high sediment production. Combined with tectonic uplift and intense winter storms, the hillslopes of the CMC watershed produce rapidly peaking floods and an abundant volume of coarse and fine sediments through landslides and natural- and human-caused gully and sheet erosion.

Fairfax Creek, San Anselmo Creek, and the CMC flow within incised, single thread channels featuring gravel beds bounded by steep and erosive banks generally over 6 feet high. Human-caused hydro-modification of watershed land cover by roads, urban and agricultural development, logging and grazing, and channelization led to systemwide channel incision thought to be on the order of 4 or more feet by the early 1900s (Stetson, 2000). Creekside development was particularly aggressive in the early to mid-1900s, when channel banks were often filled and replaced with vertical walls or rock-slope revetments, or both, and the construction of several buildings that partially span or fully cover the stream channel within downtown San Anselmo. Numerous undersized public and private bridges form significant hydraulic constrictions. Many of these were constructed in the early 1900s with center support piers and narrow abutments that constrict channel flow area, in some cases, to 50 percent less than the adjoining reaches. Backwatering upstream of constricted bridges increases overbank flooding onto the developed floodplains and disrupts sediment transport. Many of the bridges have experienced damage by Historic channel bed erosion (degradation). It is generally believed that most of the channel bed incision ceased in the early 1900s as vertical erosion reached the depth of erosionally resistant bedrock (Stetson, 2000).

Hydraulic/Geomorphic Effects, Potential Impacts, and Potential Mitigations of Proposed Project Options 2A and 2A Plus

Options 2A and 2A Plus include strategic removal of constrictions to remove backwater effects, to increase channel flood capacity, and to reduce the frequency and extent of overbank flooding. Removal of constrictions can change the hydraulic forces governing erosion and sediment transport ridge removal, and replacements can increase flooding downstream due to an increase in-channel flows (i.e., rather than overbank flows). The proposed Sunnyside flood detention facility is designed to offset this impact. It includes a diversion dam across Fairfax Creek that would pond floodwaters in order to divert peak flow over an armored weir and into the detention basin. However, ponding and flow diversion out of the creek can affect sediment transport and geomorphic processes governing channel stability.

Generally speaking, where hydraulic forces increase, the channel bed and banks could erode. Of particular concern is the depth of scour or short-term lowering of the channel bed during peak flow, which could undermine channel banks, bridge abutments and support piers, pipelines, building structures, and retaining walls.

Conversely, a decrease in hydraulic force such as that resulting from the detention facility operation, could induce sediment deposition, fill the channel, reduce channel flood capacity, and increase overbank flooding. Channel filling can also cause abrupt lateral erosion and movement (i.e., avulsion) through adjacent floodplain properties.

Option 2A

Sunnyside Detention Facility

Figure 2 and the attached fact sheet (Attachment A) show the proposed layout and design of the Sunnyside detention facility and key features. A levee embankment will separate a proposed detention basin to the north from the Fairfax Creek channel to the south. A 13-foot high diversion dam would be constructed across Fairfax Creek to pond floodwater upstream and allow excess rising flows to spill over an armored lateral weir on the levee crest at the northern side of the channel into the adjacent detention basin. The detention basin would be constructed by excavating the floodplain bench north of Fairfax Creek and using fill to create berms up to 6 feet high on the eastern and southern sides of the detention basin, forming a detention-basin dam to the east and the aforementioned levee embankment between the detention basin and the creek to the south. A gravity flow culvert would drain the basin after storms and discharge back into Fairfax Creek, discharging just downstream of the Fairfax Creek diversion dam. The diversion dam would have a 6-foot wide by 4-foot high ungated opening to allow normal streamflows to pass through the structure without entering the detention basin (Figure 3). There would also be a second 10-foot wide by 5-foot high gated culvert in the diversion dam to control the diversion of the flow into the detention facility, and an armored emergency spillway across the diversion dam crest to pass excess flow without overtopping either the diversion dam embankment crest or the detention-basin eastern embankment crest when the detention facility is full.

Fairfax Creek at the former Sunnyside Nursery site (Attachment A) has a coarse gravel bed with vertical, sandy loam banks that are eroding along several sections just upstream of the diversion dam site. Bay laurel and other trees line the channel banks with soil-binding roots that increase erosional resistance; where trees are lost to erosion, the banks have retreated rapidly.

LEGEND

- Project Area
- 17421005 Parcel Boundary
- Creek Flowline
- Drainage
- MBGR
- Floodwall
- North Interceptor Ditch and Underdrain
- Access Ramp
- Access Road
- Armored Slopes
- Dam
- Gated Culvert
- Inlet
- Native Grassland
- Seasonal Tributary / Drainage Channel
- Spillway
- Oak Bay Woodlands Plantings

N

0 100 200

Feet

FIGURE 2
Sunnyside Nursery Flood Diversion and Storage Basin Site Plan
San Anselmo Flood Risk Reduction Project
Marin County, California

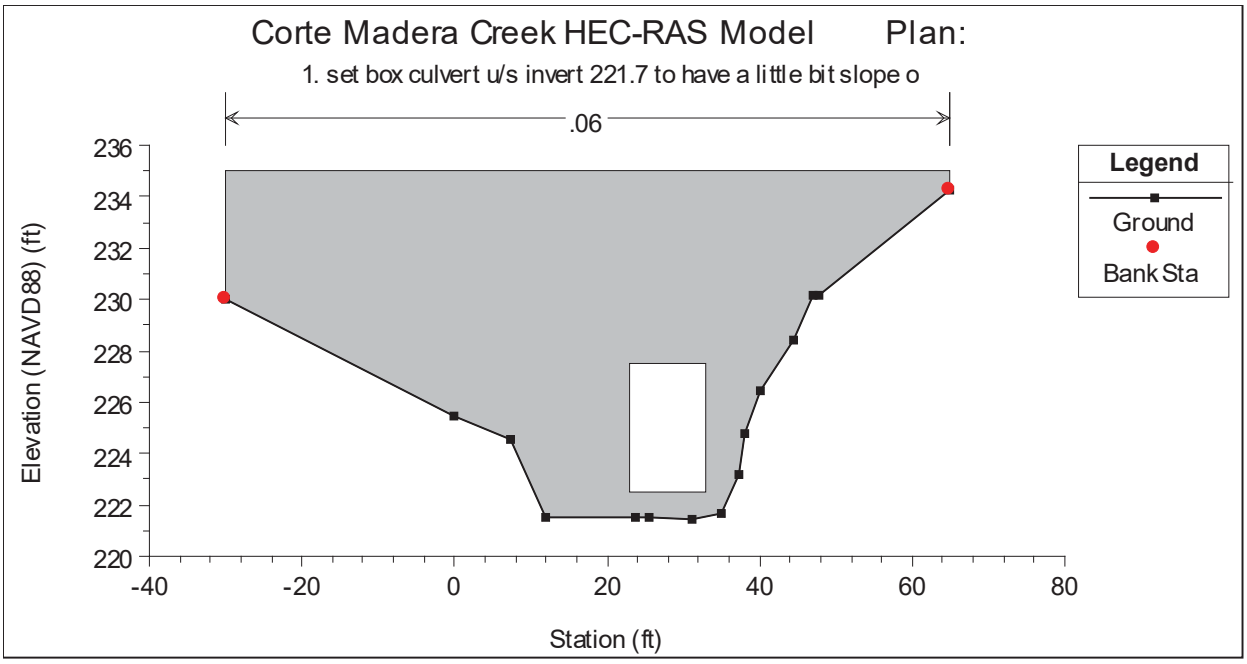

Figure 3. HEC-RAS Cross Section 10500 Showing Proposed Diversion Dam

As of November 2017, the left bank (northern bank), where the proposed lateral weir is to be located, was actively eroding and undermining trees. This erosion appeared to be in response to a recently deposited gravel bar on the right side of the channel where an ephemeral tributary discharges into Fairfax Creek (Figure 4). The drainage area for this small tributary exhibits active landsliding and erosion, indicating a high rate of sediment production and delivery. This local source adds to the coarse sediment load flowing into the project site from upper Fairfax Creek.

HEC-RAS modeling shows that operation of the detention facility creates a significant reduction in sediment transport capacity upstream of the diversion dam across Fairfax Creek during the peak 6-hour period of the 25-year design flood (Figure 5). Under existing conditions, flood flows are adequate to maintain the low flow and bankfull channel by moving the coarse gravel to small cobble-sized channel bed materials downstream (USGS, 2008). With the proposed facility operations and the gated outlet on diversion dam closed, the available shear stress in the Fairfax Creek above the diversion dam is reduced; Fairfax Creek will be able to transport only sand-sized particles, meaning that nearly all sediment flowing into the local reach under peak conditions would cease moving and deposit. These sediments could partially or substantially fill the channel over the long term or during a single large flood event. Channel filling by sedimentation could reduce hydraulic performance of the detention system by raising the water surface elevation and disrupting the timing of overbank spill over the weir. Flood reduction benefits could be reduced if the detention basin fills on the rising limb of the hydrograph because of sediment deposits in the channel. This could also cause more frequent spills over the diversion dam spillway (elevation 235 feet), upstream flooding, bank erosion, and possible channel avulsion northward into the detention basin or southward toward Sir Francis Drake Boulevard. Design of the downstream apron of the diversion dam spillway would need to account for the potential for increased spillway flows. If the bed elevation is raised to the lateral weir height (i.e., 228 feet), coarse sediments might be deposited in the detention basin, which would add to an unknown volume of fine suspended sediments already entrained in weir overflow.

Preliminary estimates of sediment deposition during operation indicate that the loss of channel flood capacity is potentially significant. Estimates using local bed load transport data are widely variable, but when the same estimates are made using sediment transport formulas, a mid-range estimate matches a bedload data set taken between 1980 and 1981. These mid-range results indicate the channel upstream

of the diversion dam could be partially or fully filled with sediment during the 10- and 25- year design flood events.

Field inspection of older flood deposits in Fairfax Creek between the diversion dam and bridge indicate past episode(s) of channel filling up to elevation ±232 feet; however, these could be related to the extreme January 3-5 1982 flood event, which triggered numerous landslides and delivered large volumes of sediment from hillslopes to stream channels, particularly in Marin and Santa Cruz counties. In 1989, the USGS estimated that the 1982 event was a greater than 100-year peak flow on CMC near Ross, with over 14 inches of rain falling in 36 hours. The extreme rainfall rates (which induced hillslope erosion) in January 1982 were preceded by an unusually wet winter season, leaving saturated watersheds as the antecedent (i.e., pre-January 3) condition. Additional study is needed to calculate the frequency of events involving heightened sediment delivery from hillslopes to stream channels.

The hydraulic effects of detention facility operations and the potential for increased sediment deposition in Fairfax Creek could extend upstream of the District-owned property. Loss of coarse sediment transport and supply downstream of the diversion dam could cause enhanced erosion via sediment hungry water effects, a condition where hydraulic force increases as sediment load is lost to upstream deposition.

LEGEND

- Sunnyside Detention Facility
- Creek Flowline
- Approximate Watershed Area (54 acres) of tributary flowing into Fairfax Creek at Sunnyside Detention Facility Site

N

0 350 700

Feet

FIGURE 4
Sunnyside Detention Facility
Fairfax Creek
San Anselmo Flood Risk Reduction Project
Marin County, California

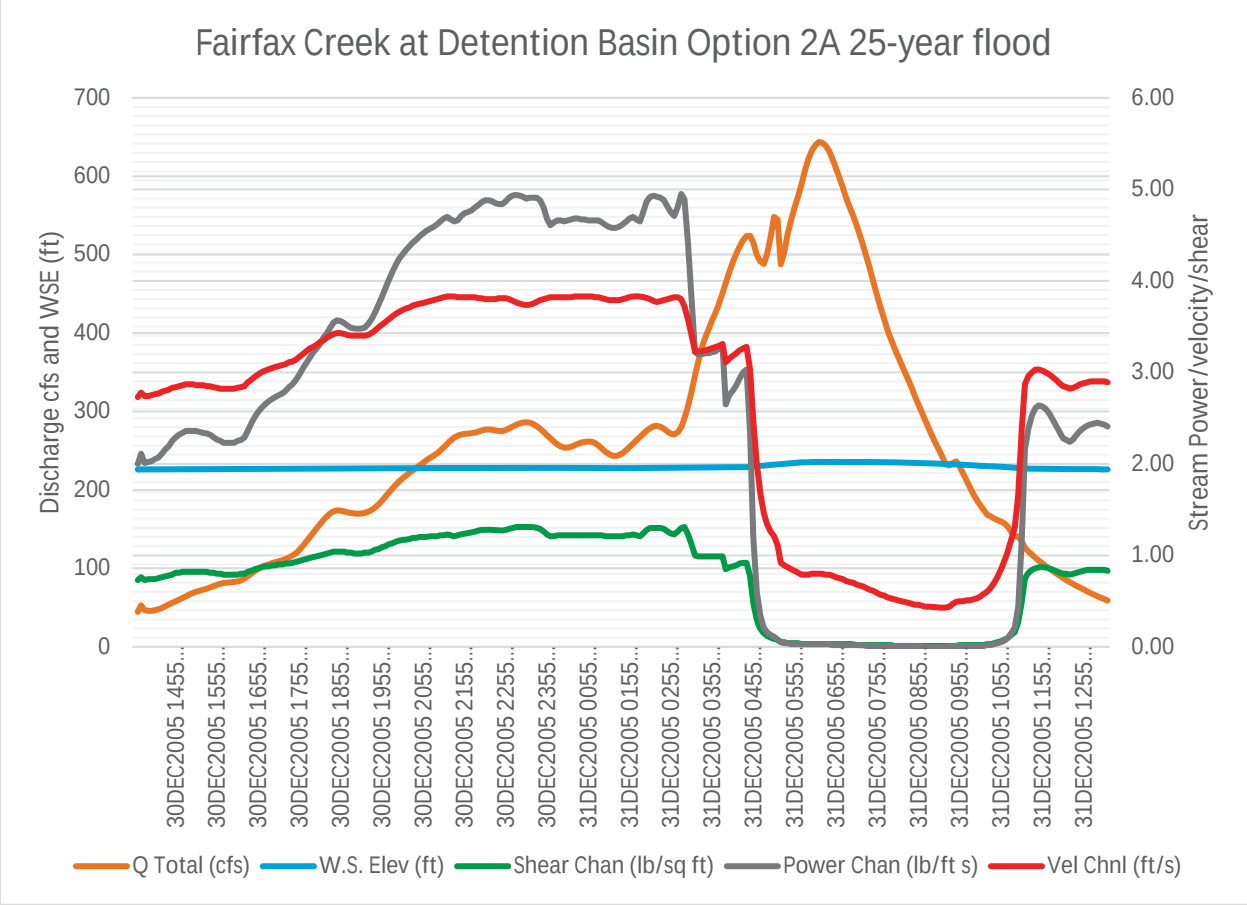

Figure 5. Hydraulic Output for HEC-RAS Cross Section 10745 for 25-Year Flood Event

With the gated opening on the diversion dam closed, storage of floodwater in Fairfax Creek upstream of the proposed diversion dam causes dramatic reductions in velocity, shear stress and stream power for the 6-hour peak flow period (0455 hours to 1055 hours).

There are countermeasures that could offset the sediment deposition effects; however, these require further investigation and HEC-RAS hydraulic modeling beyond the scope of this investigation. Candidate countermeasures would require estimating the locations, volumes, and rates of sediment deposition in Fairfax Creek during a single 25-year design event, and multiple flood events over long-term future conditions. Periodic maintenance dredging within the project property boundaries (and possibly upstream) could be effective if sediment deposition rates do not affect single flood operations. Estimating the volume and frequency of dredging requires further study. If it is found through further study that sediment deposition and channel filling during a single flood event would have a significant impact, modifying the design of the diversion dam outlet, emergency spillway or operations, or modifying a combination of the three, could flush sediment downstream. In addition, it might be possible to discharge the detention basin after the flood into Fairfax Creek upstream of the diversion dam and flush the stored sediments downstream. Other possible countermeasures could be revealed upon further study and analysis.

Periodic maintenance dredging and other countermeasures could involve additional costs and may have additional environmental impacts such as the following:

- Limited fish passage due to channel blockage
- Loss of riparian vegetation via sedimentation-induced erosion and avulsion
- Impact to long-term water quality due to discharge of fine sediments from erosion of channel banks

Removal of BB#2

Figure 6 shows the demolition and channel reconstruction plans for the BB#2 in San Anselmo Creek and the location of BB#3 immediately upstream. Option 2A includes removal of the BB#2 building as well as all of the underlying concrete walls and support piers that lay within the channel bed and banks. The proposed channel reconstruction plans shown on Figure 6 include bioengineered bank protection with a rock revetment and native riparian vegetation plantings.

San Anselmo Creek flows beneath BB#3, which is just upstream of the BB#2 removal site. Under BB#3, a 2- to 3-foot high (above low water) gravel/cobble bar has formed by sediment deposition in the hydraulic backwater area created by the BB#2 constriction during storm runoff events. The gravel bar and low-flow channel are bounded by the BB#3 foundation structure that includes support piers and retaining walls. This bar has a surface pavement of coarse gravels (i.e., greater than 16 millimeters [mm] mean diameter) and cobbles (great than 64 mm mean diameter) with underlying finer gravels and sands. The sediments are generally loosely consolidated except for the upstream head of the bar, where interlocking large cobbles and small boulders armor the bed.

Removal of the BB#2 structure would eliminate a hydraulic constriction and associated upstream backwatering under BB#3. This would increase local hydraulic forces and sediment transport capacity through BB#3 and for approximately 70 feet further upstream to the Bridge Avenue bridge, where a concrete-covered pipe forms a sill across the channel bed and functions as grade control.

To assess changes in sediment mobility upstream of BB#2 constriction, new bed material grain-size data were collected by pebble counts taken along three transects under BB#3 (Attachment B). Under existing conditions, and using the pebble count data (Attachment B) and the critical shear thresholds from USGS (USGS, 2008), over 80 percent of the grain sizes sampled are already mobile under the 25-year design event. Under Option 2A, the sizes and fraction of bed materials mobilized increases to nearly 90 percent. This indicates that scour could increase in the channel reach from BB#2 though BB#3 upstream to Bridge Avenue and the sill; this reach includes support piers and a retaining wall under BB#3, channel banks, and the concrete sill and pipeline at Bridge Avenue.

Based upon the information presented above, there is the potential for erosion and scour damage to the foundation of BB#3, the channel banks between BB#2 and BB#3 and the banks upstream of BB#3 to the concrete sill at Bridge Avenue. It is feasible to install scour protection countermeasures for these locations, including adding new rock revetment or extending the depth of existing rock revetments, and extending the foundations of vertical retaining walls using sheet pile or concrete. New bioengineered bank protection may be needed where protection is presently absent (i.e., between BB#2 and BB#3 and upstream of BB#3 to Bridge Avenue). The depth and design of the scour protection would be determined during engineering design and, if necessary, added to construction plans and specifications then implemented. The potential for environmental impacts of any countermeasures employed would need to be addressed (e.g., removal of natural channel bank or bed and vegetation and habitats).

LEGEND

- 006-102-25 Parcel
- Creek
- 2 Foot Elevation Contours

Building Bridge #3

- Building Bridge #3
- Concrete Sill Across Channel Bed
- Gravael Bar

Building Bridge #2

- Concrete Pier (to be removed)
- Concrete Retaining Wall (to be removed)
- Flood Wall
- Permeable Pavers Patio / Viewing and Siting Area
- Remove Ancillary Building and Restore Bank
- Remove Building and Restore Creek
- Vegetated Terrace Floodplain
- Floodgate
- Guardrail
- Temporary Construction Access
- Profile
- Restore Stormdrain Pipe

0 50 100 Feet N

FIGURE 6
Building Bridge #2 Demolition Plan and Building Bridge #3 and Underlying Gravel Bar
San Anselmo Flood Risk Reduction Project
Marin County, California

Option 2A Plus Foreseeable Future Conditions

The following analysis of Option 2A Plus was prepared to the level of detail necessary for CEQA cumulative impact analysis per discussion with the District's CEQA consultant.

Option 2A Plus includes Option 2A (and the impacts and mitigations described above), as well as the following bridge removals and replacements:

- Azalea Avenue
- Madrone Avenue
- Nokomis Avenue
- Center Boulevard
- Bridge Avenue
- Winship Avenue
- Fish ladder structure located at the head of the concrete channel in CMC in Ross

The conditions at each of these sites are shown in the fact sheets in Attachment A. Each of the bridges to be removed and replaced is hydraulically constricted and HEC-RAS hydraulic modeling of the anticipated 25-year flood indicates potential changes in erosion, scour and sediment transport. Figure 7 shows the changes in grain sizes mobilized by changes in peak shear stress during a 25-year event. In general, the bed materials observed at each site are already mobile under existing conditions, and the changes are relatively minor. The notable exception is Madrone Street Bridge, where shear stress is lowered; however, based on field observations, it appears that most of the channel bed sediments will still be mobile, and no major changes in channel stability are anticipated.

HEC-RAS modeling indicates that the removal of the fish ladder in CMC Ross significantly increases peak shear stress upstream of the ladder from that moving cobble-sized (64-mm) sediment to that moving boulder-sized (256-mm and greater) sediment (Figure 7). Inspection of the reach from the fish ladder upstream to Lagunitas Road indicates a high degree of stability, with bank armoring by rock revetments and dense bank vegetation. Moreover, the potentially affected channel bed is protected against significant incision by the 5,000-foot long CMC concrete channel that begins just below the fish ladder structure.

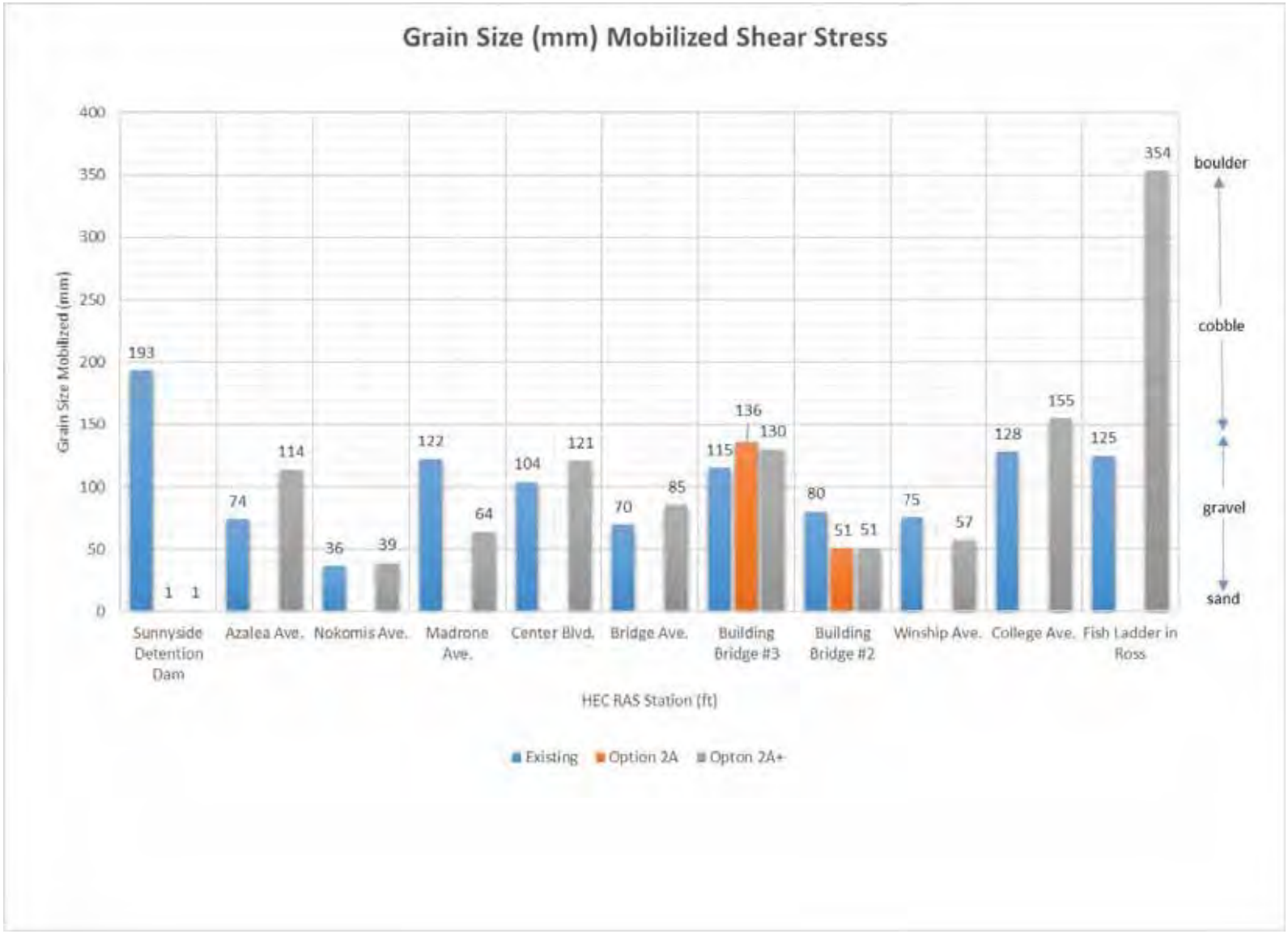

Figure 7. Changes in Maximum Grain Sizes Moved Under Existing Conditions

For Options 2A and 2A Plus at removal/replacement locations using HEC RAS critical shear stress output to particle size moved using USGS (2008)

All of the measures proposed for Option 2A Plus will undergo full engineering design, which will include geotechnical investigations and detailed hydraulic and structural engineering typical for bridge replacements. This would include accounting for potential hydraulic changes in the local reaches and protection of the existing channel, structures, and properties from scour. The scour protection countermeasures available include extending the depth of rock revetments, retaining walls, and bridge abutments and/or installing new erosion protection, as needed. The potential for environmental impacts of any countermeasures employed would need to be addressed (e.g., removal of natural channel bank or bed.

References

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CH2M HILL Engineers, Inc. (CH2M). 2017b. *Building Bridge #2 Demolition and Riparian Restoration Site Plan*. Prepared for the San Anselmo Flood Risk Reduction Project, Marin County Department of Public Works, Flood Control and Water Resources Division

Marin County Watersheds Ross Valley Watershed land cover and vegetation maps viewed October 31, 2017 (http://www.marinwatersheds.org/rossvalleywatershed-org/index.html)

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Attachment A
Corte Madera Creek Improvement Sites Fact Sheets

Fairfax Creek at Sunnyside Nursery Detention Basin Site (HEC-RAS Station 10400 to 11000)

Features Option 2A and 2A Plus: Detention basin, 300-foot-long armored lateral weir, and diversion dam across Fairfax Creek

Channel Dimensions: Flood Channel: 100 feet wide x 13 feet deep; Bankfull: 15 feet wide by 2 feet deep

Bed Slope: 0.005

Bed Materials: Maximum: Large cobble; Average: Medium gravel; Small: Sand

Bank Conditions: Left Bank (LB): eroding; Right bank (RB): aggraded with gravel bar at tributary confluence

Potential Impacts/Countermeasures:

Channel Sedimentation upstream of diversion dam would require periodic dredging; possible compromise in performance during flood

Bank Erosion along LB for entire length of weir requiring installation of rock revetment to depth below potential scour

Figure A-1. Fairfax Creek Looking Upstream
Looking along weir location showing active bank erosion and trees to be removed.

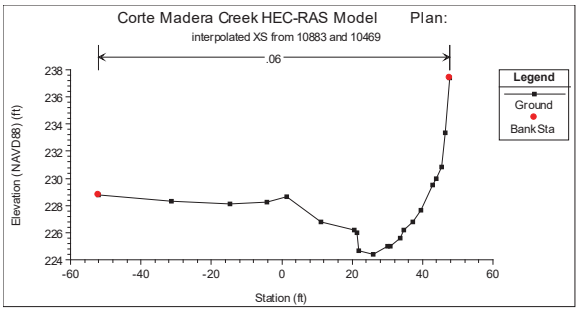

Figure A-2: Fairfax Creek HEC-RAS Cross Section
Looking downstream at proposed weir location.

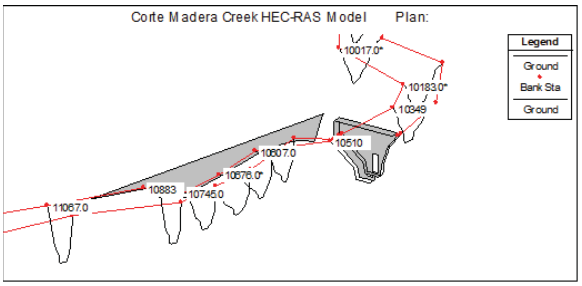

Figure A-3. HEC-RAS 3D Plot of Fairfax Creek
Plot is at Sunnyside Nursery with proposed weir and diversion dam (in grey).

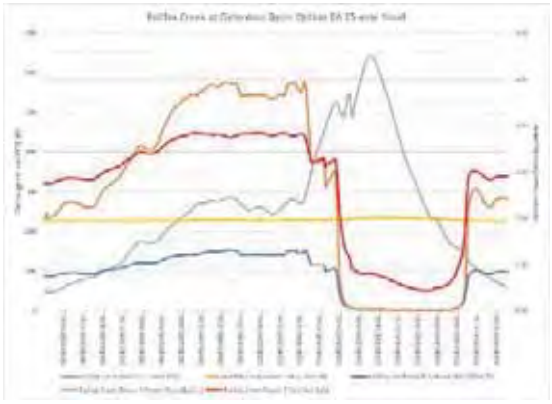

Figure A-4. HEC-RAS Output for 25-year Flood
Plot is for cross section at weir showing loss of sediment transport capacity during 6-hour peak flow period.

Fairfax Creek at Azalea Street Bridge (HEC-RAS Station 2230)

Features Option 2A Plus: Remove and replace

Channel Dimensions: Flood Channel: 25 feet wide by 13 feet deep; Bankfull: 25 feet wide by 2 feet deep

Bed Slope: 0.005

Bed Materials: Maximum: Large cobble; Average: Medium gravel; Small: Muds

Bank Conditions: LB: armored; RB: armored

Potential Impacts/Countermeasures:

Channel Incision: Channel bed well armored less than significant

Bank Erosion: Potential bank toe erosion requiring scour protection to be determined during design

Figure A-5: Azalea Avenue Bridge Upstream View

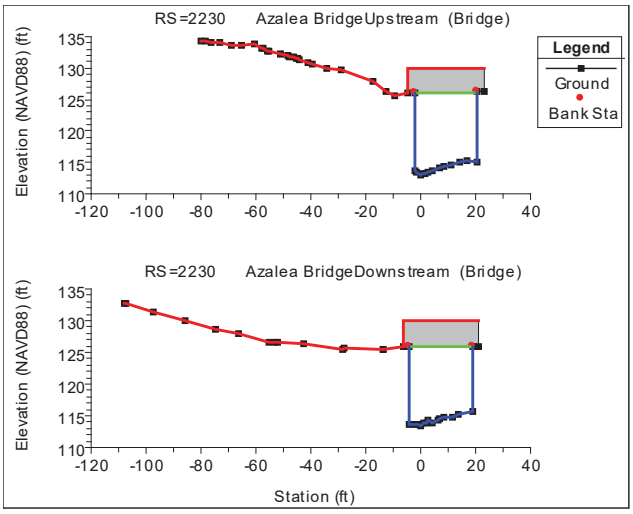

Figure A-6: HEC-RAS plot of Azalea Avenue Bridge

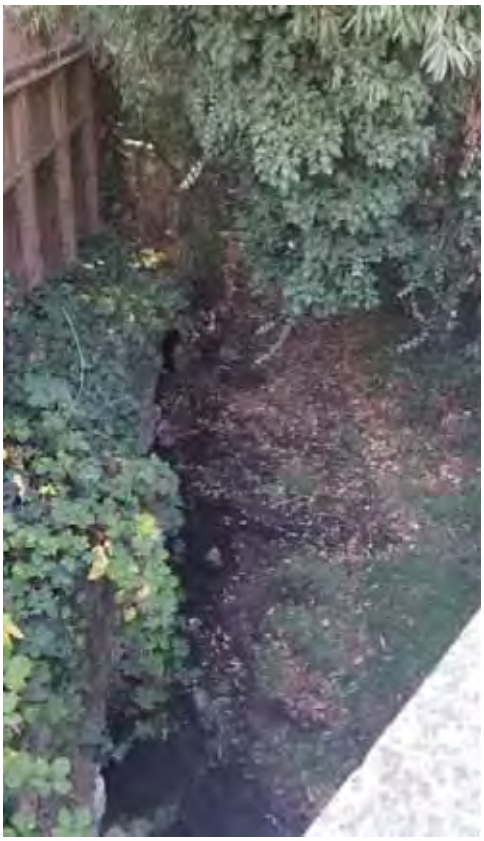

Figure A-7: Azalea Avenue Bridge Downstream Channel

San Anselmo Creek at Nokomis Avenue Bridge (HEC-RAS 455513)

Features Option 2A Plus: Remove and replace

Channel Dimensions: Flood Channel: 75 feet wide by 6 feet deep; Bankfull: 20 feet wide by 4 feet deep

Bed Slope: 0.006

Bed Materials: Maximum: Medium cobble; Average: Large to medium gravel; Small: Sands

Bank Conditions: LB: natural and riprap; RB: concrete wall and riprap

Potential Impacts/Countermeasures:

Mobilization of sediments around the bridge piers. A large bar deposit extending 70 feet upstream of the bridge down to the Sorich Creek confluence (90 feet downstream of the bridge) could be remobilized with bridge replacement.

Figure A-8: View of Upstream Face of Nokomis Bridge
Notice large gravel bar deposits underneath and in left bay of bridge.

Figure A-9: Composition of Gravel Bar at Nokomis Bridge

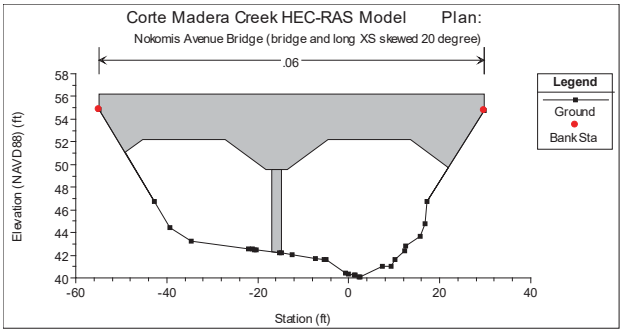

Figure A-10: HEC-RAS cross section at Nokomis Bridge

San Anselmo Creek at Madrone Avenue Bridge (HEC-RAS Station 44949)

Features Option 2A Plus: Remove and replace

Channel Dimensions: Flood Channel: 70 feet wide by 16 feet deep; Bankfull: 20 feet wide by 3 feet deep

Bed Slope: 0.0045

Bed Materials: Maximum: Bedrock / large gravel; Average: Medium gravel; Small: Sands and silts

Bank Conditions: LB: riprap; RB: rip rap and natural

Potential Impacts/Countermeasures:

Channel Incision: Localized mobilization of gravel bar under bridge, but channel bed generally well armored with no evidence of any recent channel adjustment - less than significant

Bank Erosion: Although the channel banks are well armored and seem stable, there is the potential for bank toe erosion requiring scour protection to be determined during design

Figure A-11: View of Channel Upstream of Madrone Avenue

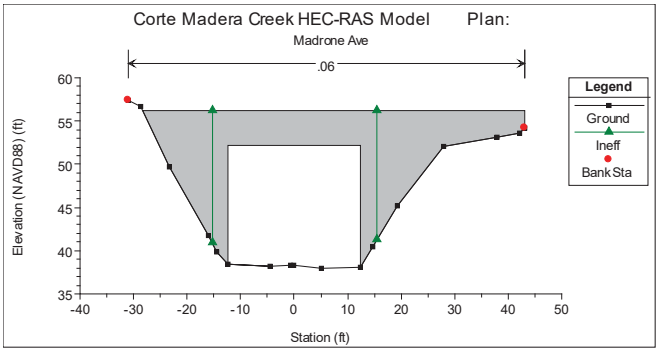

Figure A-12: HEC-RAS Cross Section at Madrone Avenue Bridge

San Anselmo Creek at Center Avenue Bridge (RM 44026)

Features Option 2A Plus: Remove and replace

Channel Dimensions: Flood Channel: 65 feet wide by 18 feet deep; Bankfull: 25 feet wide by 3 feet deep

Bed Slope: 0.004

Bed Materials: Maximum: Embedded large gravel; Average: Medium gravel; Small: Sands and silts

Bank Conditions: LB: riprap, concrete wall, bedrock, and natural; RB: riprap, concrete wall, bedrock, and natural

Potential Impacts/Countermeasures:

Channel Incision: Concrete sill under Bridge Street Bridge (just downstream) creates a backwater effect and controls potential incision - less than significant

Bank Erosion: Although the channel banks have structural control and seem stable, there is the potential for bank toe erosion requiring scour protection to be determined during design

Figure A-13: View of Channel Downstream of Center Avenue Bridge

Figure A-14: View of Channel Upstream of Center Avenue Bridge

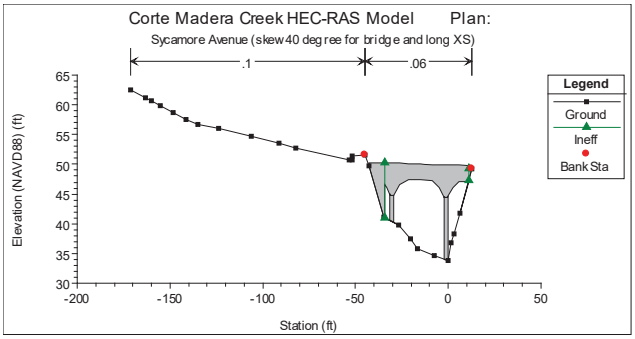

Figure A-15: HEC-RAS Plot at Center Avenue Bridge

San Anselmo Creek at Bridge Boulevard Bridge (HEC-RAS Station 44026)

Features Option 2A Plus: Remove and replace

Channel Dimensions: Flood Channel: 70 feet wide by 14 feet deep; Bankfull: 25 feet wide by 3 feet deep

Bed Slope: 0.004

Bed Materials: Maximum: Concrete sill across channel; Average: Medium to small gravel; Small: Sands and silts

Bank Conditions: LB: Concrete wall, bedrock, and natural; RB: concrete wall, bedrock, and natural

Potential Impacts/Countermeasures:

Channel Incision: Concrete sill under Bridge Street Bridge creates a backwater effect and controls potential incision - less than significant

Bank Erosion: Although the channel banks have structural control and seem stable, there is the potential for bank toe erosion requiring scour protection to be determined during design

Figure A-16: Concrete Sill Extending across Channel on Downstream Face of Bridge Street Bridge

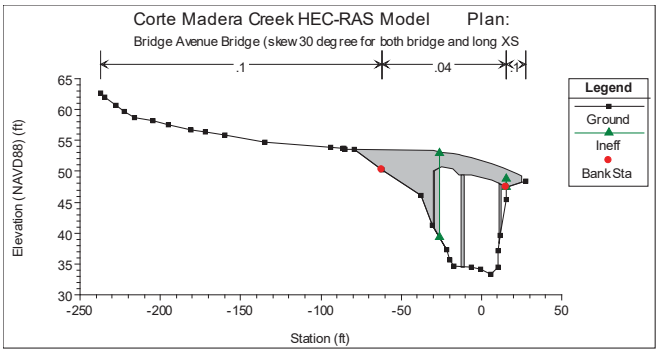

Figure A-17: HEC-RAS Cross Section Bridge Boulevard Bridge

San Anselmo Creek at Winship Avenue Bridge (HEC-RAS Station 40556)

Features Option 2A Plus: Remove and replace

Channel Dimensions: Flood Channel: 80 feet wide by 20 feet deep; Bankfull: 35 feet wide by 4 feet deep

Bed Slope: 0.004

Bed Materials: Maximum: Large cobble; Average: Large to medium gravel; Small: Sands and silts

Bank Conditions: LB: Concrete wall, natural; RB: Concrete wall, natural

Potential Impacts/Countermeasures:

Channel Incision: Potential for mobilization of small gravel bar under bridge and minor channel incision, but channel appears very stable in this reach - less than significant

Bank Erosion: Although the channel banks seem stable, there is the potential for bank toe erosion requiring scour protection to be determined during design

Figure A-18: Looking Upstream at Downstream Face of Winship Avenue Bridge

Figure A-19: Looking Upstream at Channel Upstream of Winship Avenue Bridge

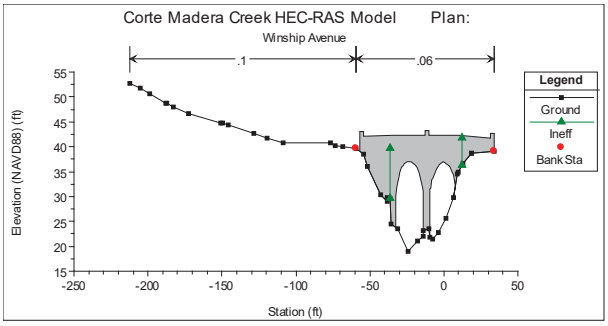

Figure A-20: HEC-RAS Cross Section at Winship Avenue Bridge

Attachment B
Grain Size Data Plot for Gravel Bar under Building Bridge #3 in San Anselmo Creek

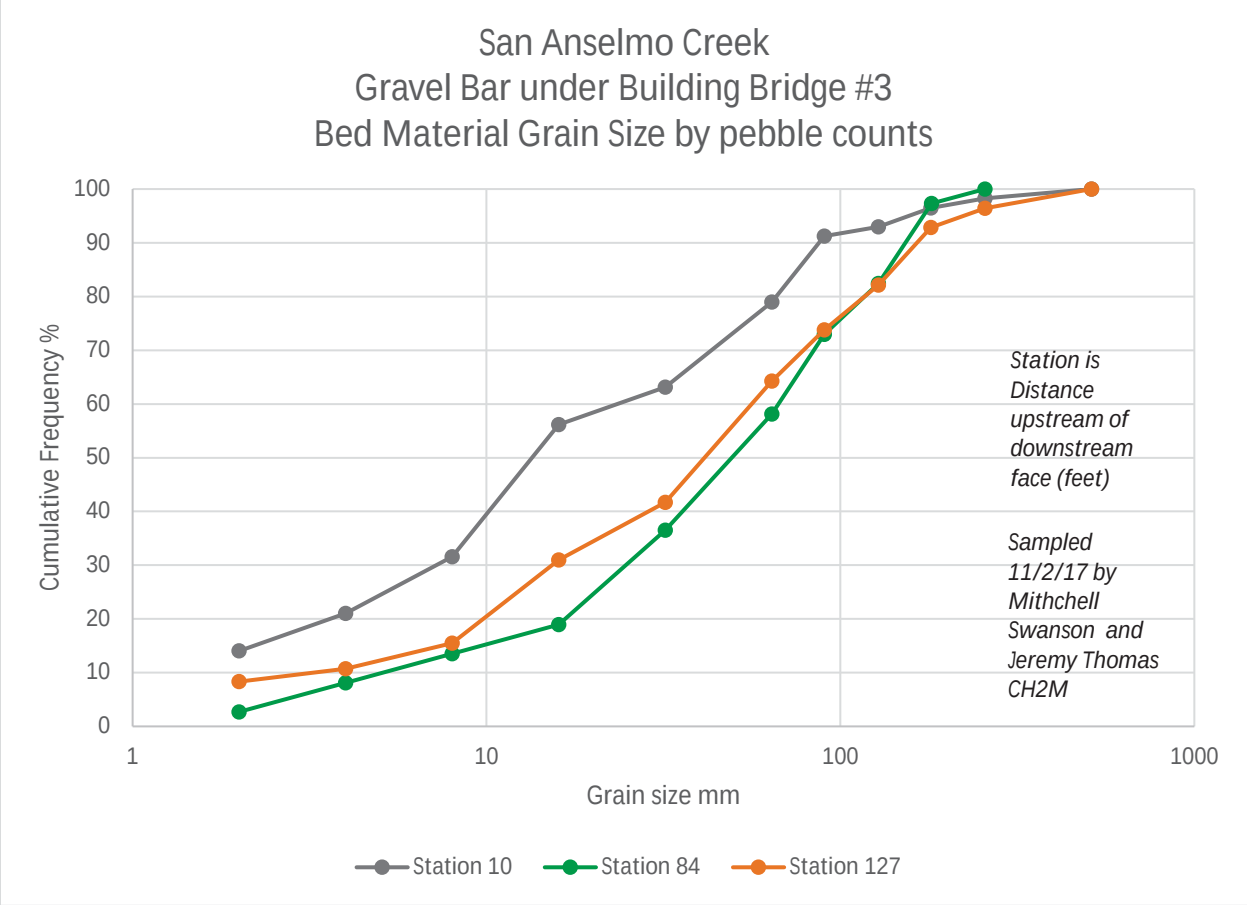

Figure B-1. Channel Bed Grain Size Distribution Sampled by Pebble Counts from Bar under BB#3.

D-5 Supplemental Information Regarding Project Impacts at the Nursery Basin Site

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STETSON ENGINEERS INC.

DRAFT

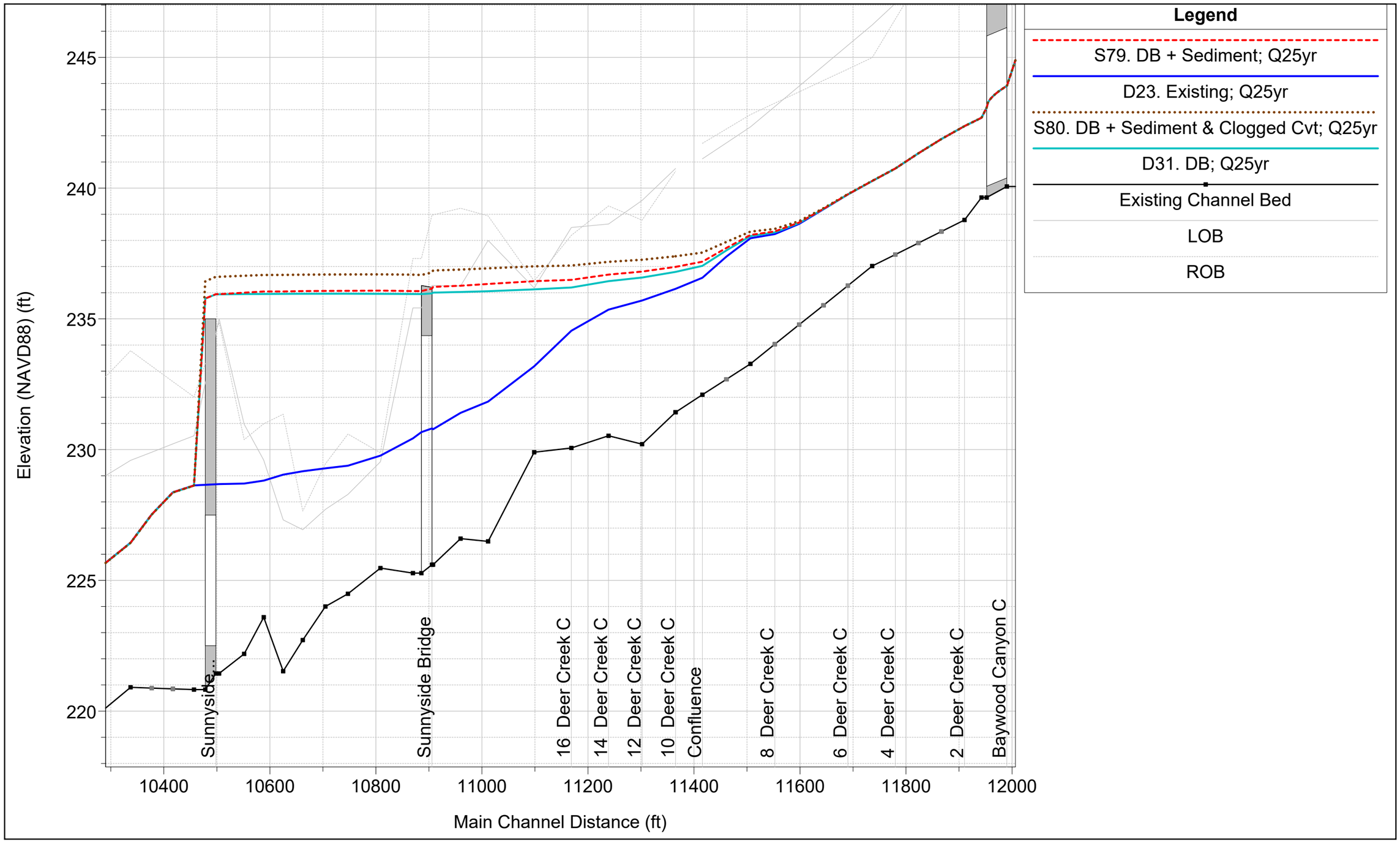
Aerial Image: 2014 (MarinMap)

COMPARISON OF THE EXTENT OF INUNDATION BETWEEN EXISTING CONDITION AND OPTION 2A WITH SEDIMENT AND CLOGGING CONDITION – Q25YR EVENT

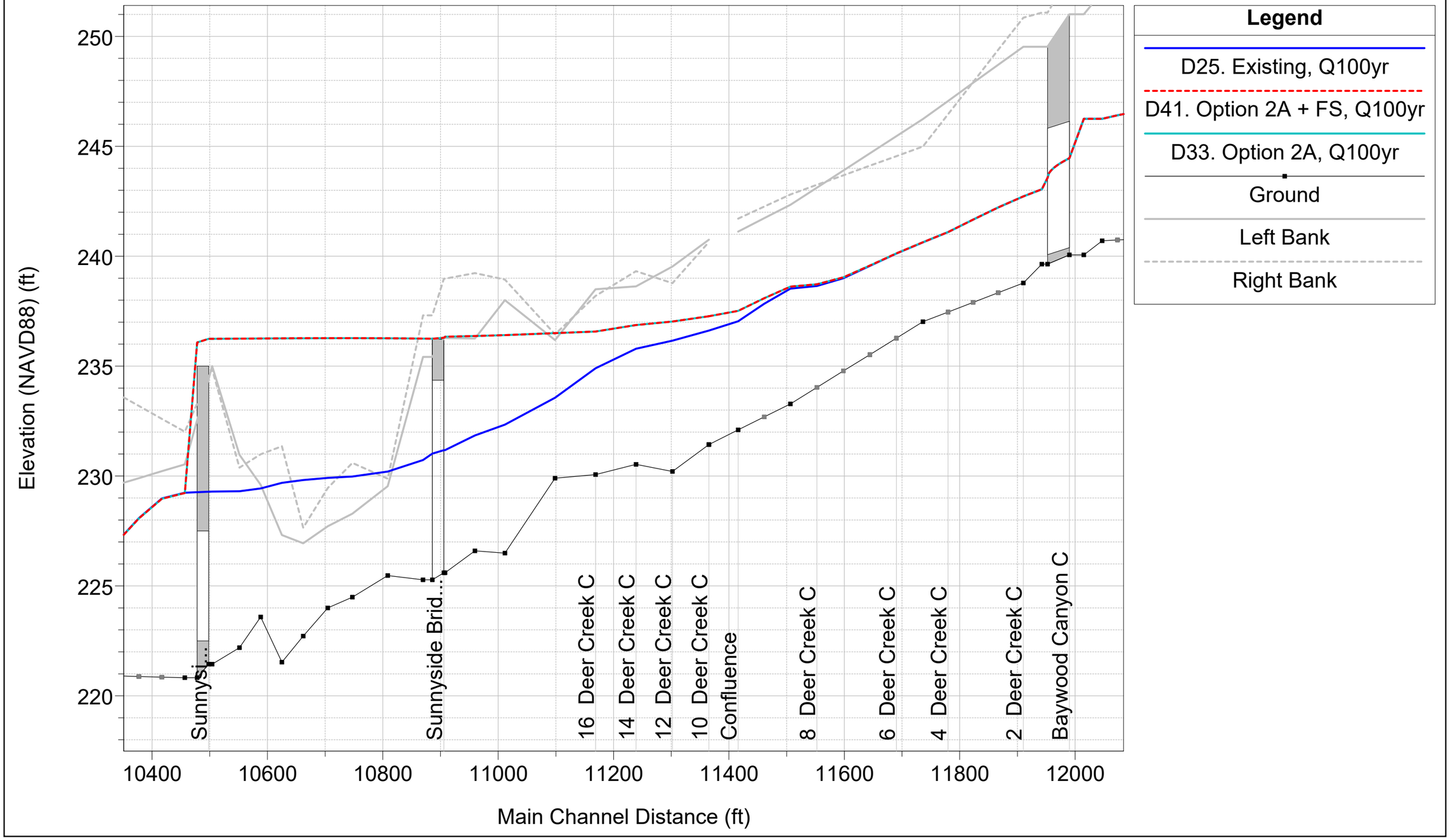
0 25 50 Feet

N

Figure 3 Comparison of Simulated 25-Year Water Surface Elevation Profiles between Sunnyside DB Project, Project with Channel Bed Sedimentation, and Project with Channel Bed Sedimentation /Culvert Clogging Conditions



1) D25.EC_Exp; Q100_R1.124_Tide5.9_6s_12:00 2) D33.DB_Exp; Q100_R1.124_Tide5.9_6s_12:00 3) D41.DB_FS; Q100_R1.124_Tide5.9_6s_12:00



APPENDIX E

Mitigation Monitoring and Reporting Program

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Introduction

The Marin County Flood Control and Water Conservation District (Flood Control District) is the lead agency implementing the California Environmental Quality Act (CEQA) environmental document for the San Anselmo Flood Risk Reduction Project (Project). The primary goal of the Project is to substantially reduce the frequency and severity of flooding within portions of the San Anselmo Creek and Fairfax Creek subwatersheds in Ross Valley. The Flood Control District would meet this goal by implementing a project that would increase creek capacity by enlarging the San Anselmo Creek channel by removing existing obstructions to flow and reducing peak discharge by attenuating flows through use of a flood diversion and storage (FDS) basin. The Flood Control District prepared an environmental impact report (EIR) to evaluate the potential for the Project to result in significant adverse effects on the physical environment.

This Mitigation, Monitoring, and Reporting Program (MMRP) has been formulated based upon the findings of the EIR and lists the Project-level mitigation and minimization measures recommended in the Draft EIR.

This MMRP is designed to fulfill Section 21081.6(a) of the CEQA, which requires public agencies to adopt a reporting or monitoring program whenever a project or program is approved that includes mitigation measures identified in an environmental document for which the agency makes a finding pursuant to CEQA Section 21081(a)(1). Therefore, this MMRP must be adopted when the Flood Control District makes a final decision on the Project.

Table E-1 lists each of the EIR mitigation measures, and includes the following categories for monitoring and reporting.

1. **Implemented By**. The name of the entity responsible for implementing the mitigation measure.

2. **When Implemented**. Most measures are to be implemented prior to, during, or immediately after project construction.

3. **Monitored By**. The name of the person who is responsible for monitoring implementation of the mitigation measure. At this time, the field is blank – it will be completed during implementation.

4. **Verified By**. The signature of the responsible person and the date compliance is verified. At this time, the field is blank – it will be completed during implementation.

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TABLE E-1
MITIGATION, MONITORING, AND REPORTING PROGRAM

Significant Environmental Impact	Mitigation Measure	Implemented By	When Implemented	Monitored By	Verified By (Date and Signature)
4.3 Air Quality and Greenhouse Gas Emissions					
Impact 4.3-1: Construction of the Project would generate criteria pollutant emissions that could exceed air quality standards or contribute substantially to an existing or projected air quality violation.	**Mitigation Measure 4.3-1: BAAQMD Basic Construction Measures** To limit dust, criteria pollutants, and precursor emissions associated with construction, the following BAAQMD-recommended Basic Construction Measures shall be implemented and included in all contract specifications for components constructed under the Project: 1. All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day. 2. All haul trucks transporting soil, sand, or other loose material off-site shall be covered. 3. All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited. 4. All vehicle speeds on unpaved roads shall be limited to 15 mph. 5. All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used. 6. Idling times shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes (as required by the California airborne toxics control measure Title 13, Section 2485 of California Code of Regulations [CCR]). Clear signage shall be provided for construction workers at all access points. 7. All construction equipment shall be maintained and properly tuned in accordance with manufacturer's specifications. All equipment shall be checked by a certified mechanic and determined to be running in proper condition prior to operation. 8. Post a publicly visible sign with the telephone number and person to contact at the Flood Control District regarding dust complaints. This person shall respond and take corrective action within 48 hours. The BAAQMD's phone number shall also be visible to ensure compliance with applicable regulations.	Marin County Flood Control and Water Conservation District (Flood Control District)/Contractor	During construction		
Impact 4.3-2: Construction of the Project would result in emissions that could conflict with the 2017 Clean Air Plan.	**See Mitigation Measure 4.3-1, above.**	Flood Control District/Contractor	During construction		
Impact 4.3-4: Construction of the Project could expose sensitive receptors to toxic air contaminants, including diesel particulate matter emissions.	**Mitigation Measure 4.3-4: Tier 4 Engines for Construction Equipment** All off-road equipment greater than 25 horsepower that operates for more than 20 total hours over the entire duration of construction activities shall have engines that meet the USEPA or CARB Tier 4 interim or Tier 4 Final off-road emission standards.	Flood Control District/ Contractor	During construction		
4.4 Energy, Mineral, Forest and Agricultural Resources					
Impact 4.4-1: Implementation of the Project could use energy, oil, or natural gas in an inefficient manner; encourage activities that would result in the use of large amounts of energy, oil, or natural gas; result in the energy supplier not having the capacity to supply the Project's energy needs with existing or planned supplies; or require the development of new energy resources.	**See Mitigation Measure 4.3-1, above.**	Flood Control District/ Contractor	During construction		
4.5 Biological Resources					
Impact 4.5-1: Project implementation could have substantial adverse effects on special-status aquatic species or habitats.	**Mitigation Measure 4.5-1a: Seasonal Avoidance of Sensitive Aquatic Species** In-water construction work, including activities on the banks that are expected to create turbidity or disturb the streambed, shall be conducted within resource agency-approved work windows intended to reduce potential impacts on salmonids (generally limiting work to the period between June 15 and October 15) with resource agency concurrence for the following exceptions: 1. Removal of debris, foundations or other manmade materials from the creek bed may continue year-round, in areas of the stream which are dry and where such activity shall not create turbidity. 2. Tree removal and invasive species removal may take place year-round, providing the area is free of nesting birds and roosting bats as provided under **Mitigation Measure 4.5-4.** 3. Revegetation activities may occur year-round.	Flood Control District/ Contractor	During construction		

TABLE E-1 (CONTINUED)
MITIGATION, MONITORING, AND REPORTING PROGRAM

Significant Environmental Impact	Mitigation Measure	Implemented By	When Implemented	Monitored By	Verified By (Date and Signature)
4.5 Biological Resources (cont.)					
Impact 4.5-1 (cont.)	**Mitigation Measure 4.5-1b: Relocation of Special-Status Fish** If in-channel work requires dewatering, including for sediment removal maintenance activities, fish shall be captured and relocated downstream of the Project areas to avoid injury and mortality and minimize disturbance. The Flood Control District shall implement the measures below, or whatever more stringent species preservation and avoidance measures are imposed by resource agencies, including NMFS and CDFW, with jurisdiction over aquatic special-status species. 1. The name(s) and credentials of qualified biologist(s) to act as construction monitors shall be submitted to CDFW and NMFS for approval at least 15 days before construction work begins. 2. Prior to and during the initiation of construction activities, qualified fisheries biologist (i.e., approved by CDFW and/or NMFS) shall be present during installation and removal of creek diversion structures. 3. For sites that require flow diversion and exclusion, the work area shall be blocked by placing fine-meshed nets or screens above and below the work area to prevent salmonids from re-entering the work area. To minimize the potential for re-entry, mesh diameter shall not exceed 1/8 inch. The bottom edge of the net or screen shall be secured to the channel bed to prevent fish from passing under the screen. Exclusion screening shall be placed in low velocity areas to minimize fish impingement against the mesh. Screens shall be checked periodically and cleaned of debris to permit free flow of water. 4. Before removal and relocation on individual fish begins, a qualified fisheries biologist shall identify the most appropriate release location(s). In general, release locations should have water temperatures similar to (<3.6°F difference) the capture location and offer ample habitat (e.g., depth, velocity, cover, connectivity) for released fish, and should be selected to minimize the likelihood of reentering the work area or becoming impinged on exclusion nets or screens. 5. The means of capture shall depend on the nature of the work site, and shall be selected by a qualified fisheries biologist as authorized by CDFW and NMFS. Complex stream habitat may require the use of electrofishing equipment, whereas in outlet pools, fish and other aquatic species may be captured by pumping down the pool and then seining or dip netting. Electrofishing, if necessary, shall be conducted only by properly trained personnel holding current permits from CDFW and NMFS and following the most recent NMFS electrofishing guidelines (NMFS, 2000). 6. Initial fish relocation efforts shall be performed several days prior to the scheduled start of construction. Flow diversions and species relocation shall be performed during morning periods. The fisheries biologist shall survey the exclusion screening throughout the diversion effort to verify that no special-status fish, amphibians, or aquatic invertebrates are present. Afternoon pumping activities shall be limited and pumping shall be suspended when water temperatures exceed 18 degrees Celsius (64.5° F). Water temperatures shall be measured periodically, and flow diversion and species relocation shall be suspended if temperatures exceed the 18-degree limit under NMFS guidelines. Handling of fish shall be minimized. When handling is necessary, personnel shall wet hands or nets before touching them. 7. Prior to translocation, fish that are collected during surveys shall be temporarily held in cool, aerated, shaded water using a five-gallon container with a lid. Overcrowding in containers shall be avoided; at least two containers shall be used and no more than 25 fish shall be kept in each bucket. Aeration shall be provided with a battery-powered external bubbler. Fish shall be protected from jostling and noise, and shall not be removed from the container until the time of release. A thermometer shall be placed in each holding container and partial water changes shall be conducted as necessary to maintain a stable water temperature. Special-status fish shall not be held more than 30 minutes. If water temperature reaches or exceeds 18 degrees Celsius (USFWS 2012), the fish shall be released and relocation operations shall cease. 8. If fish are abundant, capture shall cease periodically to allow release and minimize the time fish spend in holding containers. 9. Fish shall not be anesthetized or measured. However, they shall be visually identified to species level, and year classes shall be estimated and recorded. 10. Reports on fish relocation activities shall be submitted to CDFW and NMFS in within one week.	Qualified Fisheries Biologist (construction monitoring; fish relocation); Qualified Fisheries Biologist (reporting)	Prior to and during construction; during construction		
	Mitigation Measure 4.5-1c: Contractor Environmental Awareness Training and Site Protection All construction personnel that are working in areas of potential endangered species habitat shall attend an environmental education program delivered by a qualified biologist prior to working on either Project site. The training shall include an explanation as how to best avoid the accidental take of special-status species, including salmonids and other fish species, western pond turtle, California red-legged frog, and listed birds. The training session shall be mandatory for contractors and all construction personnel. The field meeting shall include topics on species identification, life history, descriptions, and habitat requirements during various life stages. Emphasis shall be placed on the importance of the habitat and life stage requirements within the context of maps showing areas where minimization and avoidance measures are being implemented. The program shall include an explanation of appropriate federal and state laws protecting endangered species. The contractor shall provide closed garbage containers for the disposal of all trash items (e.g., wrappers, cans, bottles, food scraps). Work sites shall be cleaned of litter before closure each day, and placed in wildlife-proof garbage receptacles. Construction personnel shall not feed or otherwise attract any wildlife. No pets, excluding service animals, shall be allowed in construction areas.	Qualified Biologist/ Construction Monitor (training); Contractor (garbage containers, litter removal)	Prior to construction		

TABLE E-1 (CONTINUED)
MITIGATION, MONITORING, AND REPORTING PROGRAM

Significant Environmental Impact	Mitigation Measure	Implemented By	When Implemented	Monitored By	Verified By (Date and Signature)
4.5 Biological Resources (cont.)					
Impact 4.5-2: Project implementation could have substantial adverse effects on special-status plants.	**Mitigation Measure 4.5-2: Avoid Impacts to Rare Plants** A qualified biologist shall conduct a pre-construction survey of each Project site for special-status plant species with the potential to occur within the area of disturbance. The survey shall be floristic in nature and shall follow the procedures outlined in the CDFW Publication *Protocols for Surveying and Evaluating Impacts to Special-status Native Plant Populations and Natural Commu*nities (CDFW, 2009). The survey shall be conducted between April and July in conjunction with the blooming seasons of those rare plants with moderate potential to occur in the Project area. If no special-status plants are observed during appropriately timed surveys by a qualified botanist, it is assumed the construction activity will have no impact on special-status plants and no further action is required. If special-status plants are identified within the Project area, the individuals or populations shall be mapped and quantified and reported to the CNDDB, and the project manager shall be notified so that potential impacts to these known occurrences shall be avoided, when feasible. Coordination with CDFW and/or USFWS staff shall be conducted to establish appropriate avoidance and minimization measures if the species is federally or State listed. Avoidance and minimization measures may include: 1. No-disturbance buffers. 2. Work windows for low impact activities that are compatible with the dormant phase of a special-status plant life cycle but that may kill living plants or severely alter their ability to reproduce. 3. Silt fencing or construction fencing to prevent vehicles, equipment, and personnel from accessing the occupied habitat. 4. Erosion control BMPs such as straw wattles made of rice straw, erosion control blankets, or hydroseeding with a native plant seed mix to prevent sedimentation from upslope construction activities. 5. Before the construction activity commences, special-status plant occurrences shall be marked with pin flags in the field, and all maintenance personnel shall be instructed as to the location and extent of the special-status plants or populations and the importance of avoiding impacts to the species and its habitat. 6. If needed a qualified biologist shall be present or on-call during construction activities to provide guidance on avoiding special-status plants, ensure that other avoidance measures (buffers, fencing, etc.) are observed, and to document the total impact of the maintenance activity, particularly if it is greater or less than anticipated. 7. In consultation with, and as authorized by, CDFW or USFWS, a qualified botanist may collect and spread seeds or relocate plants to appropriate locations.	Qualified Biologist	Prior to construction; during construction		
Impact 4.5-3: Project implementation could have substantial adverse effects on special-status amphibians.	**Mitigation Measure 4.5-3a: Install Wildlife Exclusion Fencing** The Flood Control District shall implement the measures below, or whatever more stringent California red-legged frogs (CRLF) and western pond turtle (WPT) preservation and avoidance measures are imposed by resource agencies with primary jurisdiction over special-status wildlife species, including USFWS and CDFW. 1. Before ground-disturbing activity occurs, the contractor shall install temporary exclusion/silt barrier fencing around the perimeter of the construction site. Fencing shall be installed to the extent necessary to exclude CRLF from the construction area (in areas with habitat), and minimize impacts to natural habitat. Fencing material shall provide for wildlife exclusion as well as maintenance of water quality. Construction personnel and construction activity shall avoid areas outside the fencing. The need for and exact location of the fencing shall be determined by a qualified biologist, with the goal of protecting sensitive biological habitat and water quality. The fencing shall be checked at regular intervals (e.g., weekly) and maintained until construction is complete at individual work sites. The fence shall contain exit funnels to allow any wildlife within the construction area to leave without human intervention while preventing entry into the construction zone. Exit funnels shall be placed at ground level no more than 100 feet apart along the fence, or as modified by a qualified biologist or as directed by resource agencies with primary jurisdiction over special-status wildlife species. 2. The fencing shall be monitored as prescribed in **Mitigation Measure 4.5-6.**	Flood Control District/ Contractor (installation); Qualified Biologist (fence inspection/monitoring)	Prior to construction; during construction		
	Mitigation Measure 4.5-3b: Avoid Impacts to California Red-legged Frog and Western Pond Turtle The name(s) and credentials of the qualified biologist(s) to act as construction monitors shall be submitted to the USFWS for approval at least 15 days before construction work begins. Prior to commencing work, an approved biologist shall survey the entire construction footprint for California red-legged frog and other special-status species with potential to be present, such as western pond turtle. At the beginning of each workday that includes initial ground disturbance, including grading, excavation, and vegetation-removal activities, an approved biologist shall conduct on-site monitoring for the presence of these species in the area where ground disturbance or vegetation removal is planned. If required by the USFWS or CDFW, perimeter fences shall be inspected to ensure they do not have any tears or holes, that the bottoms of the fences are still buried, and that no individuals have been trapped in the fence.	Qualified biologist (site surveying); Contractor (trench covering, temporary fencing)	Prior to construction; during construction		

TABLE E-1 (CONTINUED)
MITIGATION, MONITORING, AND REPORTING PROGRAM

Significant Environmental Impact	Mitigation Measure	Implemented By	When Implemented	Monitored By	Verified By (Date and Signature)
4.5 Biological Resources (cont.)					
Impact 4.5-3 (cont.)	All excavated or deep-walled holes or trenches greater than 2 feet deep shall be covered at the end of each workday using plywood, steel plates, or similar materials, or escape ramps shall be constructed of earth fill or wooden planks to allow animals to exit. Before such holes are filled, they shall be thoroughly inspected for trapped animals. If a special-status species is present within the exclusion fence area during construction, work shall cease in the vicinity of the animal, and the animal shall be allowed to relocate of its own volition unless relocation is permitted by state and/or federal regulatory agencies. The contractor shall maintain the temporary fencing—both exclusion fencing and protective fencing (if installed)—until all construction activities are completed. No construction activities, parking, or staging shall occur beyond the fenced exclusion areas.				
Impact 4.5-4: Project implementation could have substantial adverse effects on nesting birds.	**Mitigation Measure 4.5-4: Avoid Impacts to Special-status and Nesting Birds, including Raptors and Northern Spotted Owls** Tree removal activities shall be avoided during the nesting season (February 1 to August 31). Prior to any tree removal or construction in nesting season, a qualified biologist shall conduct a spotted owl and general nesting bird survey in each Project site and areas within 1/2-mile. Any identified spotted owl nesting areas or activity centers shall be flagged and avoided with a buffer of 1/4-mile throughout the active nesting season. Other nesting birds with active nests in the vicinity of the construction area shall be avoided by a buffer of 50 feet, or as determined in coordination with USFWS and CDFW. Construction work may continue outside of the no-work buffer. Northern spotted owl nesting surveys shall be conducted in coordination with Marin County Parks and Point Blue Conservation Science (Point Blue, 2017).	Flood Control District/ Contractor (scheduling tree removal); Qualified biologist (surveys, monitoring)	Prior to construction; during construction		
Impact 4.5-5: Project implementation could have substantial adverse effects on Northern spotted owls.	**See Mitigation Measure 4.5-4, above.**	Flood Control District/ Contractor (scheduling tree removal); Qualified biologist (surveys, monitoring)	Prior to construction; during construction		
Impact 4.5-6: Project implementation could have substantial adverse effects on special-status bats.	**Mitigation Measure 4.5-6: Avoid Impacts to Special-status Bats** Prior to any construction, a qualified bat biologist shall conduct a pre-construction survey for roosting bats in trees to be removed or pruned and structures to be demolished. If no roosting bats are found, no further action is required. If a bat roost is found, the following measures shall be implemented to avoid impacts on roosting bats. If active maternity roosts are found in trees or structures that shall be removed or demolished as part of construction, tree removal or demolition of that structure shall commence before maternity colonies form (generally before March 1) or after young are flying (generally by July 31). Active maternal roosts shall not be disturbed. If a non-maternal roost of bats is found in a tree or structure to be removed or demolished as part of construction, the individuals shall be safely evicted, under the direction of a qualified bat biologist and with approval from CDFW. Removal of the tree or demolition of the structure should occur no sooner than two nights after the initial minor site modification (to alter airflow), under guidance of the qualified bat biologist. The modifications shall alter the bat habitat, causing bats to seek shelter elsewhere after they emerge for the night. On the following day, the tree or structure may be removed, in presence of the bat biologist. If any bat habitat is not removed, departure of bats from the construction area shall be confirmed with a follow-up survey prior to start of construction.	Qualified bat biologist	Prior to construction		
Impact 4.5-7: Project implementation could adversely affect sensitive natural communities.	**Mitigation Measure 4.5-7a: Vegetation Protection for Sensitive Natural Communities** Prior to start of construction of any Project element, the extent of sensitive natural communities within the work area shall be identified by a qualified botanist or ecologist experienced in the definition and recognition of these communities. The area of impact in sensitive natural communities shall be minimized by siting construction staging and access areas outside the limits of riparian vegetation (as determined during pre-construction surveys) and by utilizing previously-disturbed areas. Before construction begins, the Project engineer and a qualified biologist shall identify locations for equipment and personnel access and materials staging that will minimize riparian vegetation disturbance. When heavy equipment is required, unintentional soil compaction shall be minimized by using equipment with a greater reach, or using low-pressure equipment. Temporary impacts on sensitive natural communities shall be mitigated by revegetation with native species, as required by **Mitigation Measure 4.5-7b.**	Qualified botanist; Contractor/Engineer	Prior to construction; during construction		
	Mitigation Measure 4.5-7b: Habitat Restoration and Monitoring Plan The Flood Control District shall prepare a Habitat Restoration and Monitoring Plan for restoration following construction activities at both Project sites. The plan shall describe required salvage and replanting protocols prior to and after construction is complete and shall thereby reduce the long-term amount of losses of these natural communities. This plan shall include, but not be limited to, protocols for replanting of vegetation removed prior to or during construction, and management and monitoring of the plants to ensure replanting success pursuant to Marin County's Countywide Plan, Marin County Code, or Code requirements of the Town of San Anselmo, or by any more stringent requirements included in other permits issued for the Project. The plan shall specify monitoring and performance criteria for the species planted, invasive species control criteria, as well as the best time of year for seeding to occur, pursuant to requirements of permits from the various resource agencies with regulatory purview over the Project. Revegetated areas shall be monitored for a five-year period to track progress toward performance criteria.	Flood Control District (Habitat Restoration and Monitoring Plan); Contractor, Qualified Biologist (vegetation salvage)	Prior to construction; After construction		

TABLE E-1 (CONTINUED)
MITIGATION, MONITORING, AND REPORTING PROGRAM

Significant Environmental Impact	Mitigation Measure	Implemented By	When Implemented	Monitored By	Verified By (Date and Signature)
4.5 Biological Resources (cont.)					
Impact 4.5-7 (cont.)	Native riparian vegetation that can be propagated by cuttings or easily transplanted such as rushes and sedges within the Project sites shall be salvaged prior to construction and replanted after construction is completed. Areas impacted by construction-related activity shall be replanted or reseeded with native trees, shrubs, and herbaceous perennials and annuals from the watershed under guidance from a qualified biologist. Local plant materials shall be used for revegetation of the disturbed area. The plant materials shall include local cuttings from the local watershed or from adjacent watersheds. This shall ensure that the seeds can be collected during the appropriate season and the container plants shall be of an appropriate size for out-planting. Using local cuttings can reduce the length of this phase. The Habitat Restoration and Monitoring Plan would also address restoration of jurisdictional wetlands and waters. Temporary impacts to wetlands shall be restored onsite with native wetland species under guidance from a qualified biologist. Permanent impacts to jurisdictional wetlands shall be mitigated for by replacement on- or off-site at an equal ratio or whatever more stringent requirements are included in the permits to be issued for the Project. The monitoring plan shall include annual monitoring of restored areas for at least 5 years. The plan shall contain vegetation management protocols, protocols for monitoring replanting success, and an adaptive management plan if success criteria are not being met. The adaptive management plan would include interim thresholds for replanting success and alternative management approaches, such as weed control or additional replanting, to undertake if thresholds are not met.				
	Mitigation Measure 4.5-7c: Avoid Spread of Invasive Species and Pathogens All vehicles and equipment entering each Project site shall be clean of noxious weeds. Noxious weeds could spread between sites as well as from outside the Project sites. All construction equipment shall be washed thoroughly to remove all dirt, plant, and other foreign material prior to entering the Project sites. Particular attention shall be shown to the under-carriage and any surface where soil containing exotic seeds may exist. Arrangements shall be made for inspections of each piece of equipment before entering each Project site to ensure all equipment has been properly washed. Equipment found operating on the Project that has not been i.e., properly washed shall be shut down and may be subject to citation. 1. Certified weed-free permanent and temporary erosion control measures shall be implemented to minimize erosion and sedimentation during and after construction. 2. The contractor shall conform to applicable federal, state, and local seed and noxious weed laws. 3. Nursery operations where plants are stored, propagated, or purchased must certify implementation of best management practices to reduce pest and pathogen contamination within their nursery. 4. Disturbed and decompacted areas outside the restoration area shall be revegetated with locally native vegetation. Revegetated areas shall be protected and tended, including watering when needed, until restoration criteria specified by regulatory agency-issued permits is complete. 5. All tree removal and pruning activities shall include measures to avoid the spread of the Sudden Oak Death (SOD) pathogen. Such measures may include, but are not limited to the following: i. As a precaution against spreading the pathogen, clean and disinfect pruning tools after use on confirmed or suspected infested trees or in known infested areas. Sanitize tools before pruning healthy trees or working in pathogen-free areas. Clean chippers and other vehicles of mud, dirt, leaves, organic material, and woody debris before leaving a site known to have SOD and before entering a site with susceptible hosts. ii. Inform crews about the arboricultural implications of SOD and sanitation practices when they are working in infested areas. iii. Provide crews with sanitation kits containing chlorine bleach, scrub brush, metal scraper, boot brush, and plastic gloves. iv. Sanitize shoes, pruning gear, and other equipment before working in an area with susceptible species. v. When possible, work on SOD-infected and susceptible species during the dry season (June-October). When working in wet conditions, keep equipment on paved, graveled, or dry surfaces and avoid mud. Work in disease-free areas before proceeding to infested areas. vi. If possible, do not collect soil or plant material (wood, brush, leaves, and litter) from host trees in the quarantine area. Within the quarantine area, host material (e.g., wood, bark, brush, chips, leaves, or firewood) from tree removals or pruning of symptomatic or non-symptomatic host plants should remain onsite to minimize pathogen spread. vii. Use all reasonable methods to sanitize personal gear and crew equipment before leaving a SOD infested site. Scrape, brush, and/or hose off accumulated soil and mud from clothing, gloves, boots, and shoes. Remove mud and plant debris by blowing out or power washing chipper trucks, chippers, bucket trucks, fertilization and soil aeration equipment, cranes, and other vehicles. Restrict the movement of soil and leaf litter under and around infected trees as spores may be found there. viii. Tools used in tree removal/pruning may become contaminated and should be disinfected with alcohol or chlorine bleach.	Contractor/ Flood Control District	During construction		

TABLE E-1 (CONTINUED)
MITIGATION, MONITORING, AND REPORTING PROGRAM

Significant Environmental Impact	Mitigation Measure	Implemented By	When Implemented	Monitored By	Verified By (Date and Signature)
4.5 Biological Resources (cont.)					
Impact 4.5-8: Project activities could adversely affect wetlands and other waters.	**See Mitigation Measures 4.5-7a and 4.57b, above.**	4.5-7a. Qualified Botanist; Contractor/Engineer 4.57b. Flood Control District (Habitat Restoration and Monitoring Plan); Contractor, Qualified Biologist (vegetation salvage)	4.5-7a. Prior to construction; during construction 4.57b. Prior to construction; after construction		
Impact 4.5-9: Project construction could adversely affect riparian wildlife movement corridors.	**See Mitigation Measures 4.5-1a, 4.5-3b, 4.5-4, and 4.5-6, above.**	4.5-1a. Flood Control District/Contractor 4.5-3b. Qualified biologist (site surveying); Contractor (trench covering, temporary fencing) 4.5-4. Flood Control District/ Contractor (scheduling tree removal); Qualified biologist (surveys, monitoring) 4.5-6. Qualified bat biologist	4.5-1a. During construction 4.5-3b. Prior to and during construction; During construction 4.5-4. Prior to construction; during construction 4.5-6. Prior to construction		
Impact 4.5-10: Project construction would require tree removal.	**Mitigation Measure 4.5-10: Mitigation for Removal of Heritage or Protected Trees** During construction, as much understory brush and as many native trees as possible shall be retained, to maintain shade-producing and bank-stabilizing vegetation for the creeks. All trees to remain during construction within the grading area shall be protected and trimmed if necessary to ensure their trunks and/or limbs are not disturbed during construction. To mitigate for tree removal: For each tree to be removed, the Flood Control District shall plant a replacement tree of the same species or a suitable native species substitute, at a rate of one planting per tree removed or such other mitigation ratio requirements included in the LSAA to be obtained from CDFW (for riparian trees) or any applicable County and/or town recommendations (for heritage trees), and ensure that replacement trees are planted within or in the vicinity of the Project sites to the maximum extent practicable, as follows: 1. Trees shall be replaced within the first year after the completion of construction or as soon as possible after construction is completed. 2. Selection of replacement sites and installation of replacement plantings shall be supervised by an arborist or biologist with experience in restoration. Irrigation of tree plantings during the initial establishment period shall be provided as deemed necessary by an arborist or biologist, consistent with the site **Habitat Restoration and Monitoring Plan** (**Mitigation Measure 4.5-7b**).	Contractor/ Flood Control District	During construction; After construction		
4.8 Hazards and Hazardous Materials					
Impact 4.8-2: The Project could create a significant hazard to the public or the environment from the Project's location on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5.	**Mitigation Measure 4.8-2a: Check 700/750 Sir Francis Drake Boulevard Investigation Status** Prior to beginning construction activities, the contractor shall check the status of the 700/750 Sir Francis Drake Boulevard investigation available at the SWRCB GeoTracker website at: http://geotracker.waterboards.ca.gov/. Relevant information from the GeoTracker shall be used to inform the Health and Safety Plan and Soil Management Plan, described in subsequent mitigation measures.	Contractor	Prior to construction		
	Mitigation Measure 4.8-2b: Health and Safety Plan The construction contractor(s) shall prepare and implement a site-specific Health and Safety Plan in accordance with 29 CFR 1910.120 to protect construction workers and the public during all excavation and grading activities. The Health and Safety Plan shall include, but is not limited to, the following elements: 1. Designation of a trained, experienced site safety and health supervisor who has the responsibility and authority to develop and implement the site health and safety plan; 2. A summary of all potential risks to construction workers and maximum exposure limits for all known and reasonably foreseeable site chemicals based on the most recent reporting of the investigation at 700/750 Sir Francis Drake Boulevard site overseen by the Regional Water Quality Control Board; 3. Specified personal protective equipment and decontamination procedures, if needed; 4. Emergency procedures, including route to the nearest hospital; and 5. Procedures to be followed in the event that evidence of potential soil or groundwater contamination (such as soil staining, noxious odors, debris or buried storage containers) is encountered.	Contractor	Prior to construction		

TABLE E-1 (CONTINUED)
MITIGATION, MONITORING, AND REPORTING PROGRAM

Significant Environmental Impact	Mitigation Measure	Implemented By	When Implemented	Monitored By	Verified By (Date and Signature)
4.8 Hazards and Hazardous Materials (cont.)					
Impact 4.8-2 (cont.)	These procedures shall be in accordance with hazardous waste operations regulations and specifically include, but are not limited to, the following: immediately stopping work in the vicinity of unknown discovered or suspected hazardous materials release and notifying the Marin County CUPA (415-473-7085). Mitigation Measure 4.8-2b applies to both the Nursery Basin and the Downtown San Anselmo sites.				
	Mitigation Measure 4.8-2c: Soil Management Plan For the Downtown San Anselmo site, the Flood Control District or its contractor shall develop and implement a Soil Management Plan that includes a materials disposal plan specifying how the construction contractor shall remove, handle, transport, and dispose of all excavated material in a safe, appropriate, and lawful manner. The plan shall identify protocols for training workers to recognize potential soil contamination (such as soil staining, noxious odors, debris or buried storage containers), soil testing and disposal by a qualified contractor in the event that contamination is identified, and identification of approved disposal sites (e.g., Redwood Landfill in Novato). Contract specifications shall mandate approval of the Soil Management Plan by the Flood Control District as well as full compliance with all applicable local, state, and federal regulations related to the identification, transportation, and disposal of hazardous materials.	Flood Control District/ Contractor	Prior to construction; during construction		
4.9 Hydrology and Water Quality					
Impact 4.9-1: Project construction could violate water quality standards and/or waste discharge requirements, provide substantial additional sources of polluted runoff, or otherwise substantially degrade water quality.	**Mitigation Measure 4.9-1: Implement Dewatering BMPs for In-Water Work** For in-water dewatering during sediment removal activities, the Flood Control District or its contractor(s) shall prepare a Dewatering Plan. The Dewatering Plan shall identify best management practices (BMPs) that ensure sediment removal activities meet water quality objectives. In-stream sediment removal shall follow approved and permitted dewatering practices for wet weather sediment removal during more infrequent flood events in Fairfax Creek. This work shall be timed to take place as flows are receding and only after instream measures to reduce downstream turbidity are in place. In addition, the Flood Control District shall implement the measures below, or whatever more stringent water quality protection measures are imposed by the RWQCB. 1. All work performed in-water shall be completed in a manner that meets the water quality objectives to ensure the protection of beneficial uses as specified in the Basin Plan 2. All dewatering and diversion methods shall be installed such that natural flow is maintained upstream and downstream of the project area. 3. Any temporary dams or diversion shall be installed such that the diversion does not cause sedimentation, siltation, or erosion upstream or downstream of the project area. 4. Screened pumps shall be used in accordance with CDFW's fish screening criteria and in accordance with the NMFS Fish Screening Criteria for Anadromous Salmonids and the Addendum for Juvenile Fish Screen Criteria for Pump Intakes 5. Cofferdams shall remain in place and functional throughout the in-stream construction or maintenance periods. 6. Disturbance of protected riparian vegetation shall be limited or avoided entirely.	Flood Control District/ Contractor	Prior to construction (Dewatering Plan); During construction (in-water work)		
Impact 4.9-3. The Project would alter existing drainage patterns, potentially causing new erosion or siltation.	**Mitigation Measure 4.9-3a. Prioritize Nursery Basin Reach for Stream Maintenance** The Stream Maintenance Program waste discharge requirements impose limits on the total volume of material allowed to be removed from all of the streams covered by that permit. In order to retain the design capacity of the Nursery Basin and the associated storage within the Fairfax Creek channel behind the diversion structure, the Flood Control District shall prioritize sediment removal at this site over other sites covered by the Stream Maintenance Program and shall remove all deposited sediment up to the maximum volume allowed under the existing permit (2,100 cubic yards). If deposited sediment still remains after removing the maximum volume, then this site shall be prioritized in subsequent years to remove the remaining sediment and any newly accumulated material, again up to the maximum allowed.	Flood Control District	After construction		
	Mitigation Measure 4.9-3b. Scour Analysis and Protection Measures Upstream of the Downtown San Anselmo Site Due to the dependence of erosion and sedimentation patterns on the bed-scale morphology of the new structures, measures to counter scour and sedimentation issues must be based on more advanced project design. To reduce Project impacts on erosion and sedimentation, the Flood Control District shall conduct a scour analysis for the San Anselmo Creek channel upstream of the Downtown San Anselmo site and then develop and implement appropriate scour countermeasures from the analysis into project design and operations. The analysis shall be based on at least 30 percent design and must evaluate the potential for scour and channel bank erosion including specifying the expected depth and lateral extent both immediately upstream and downstream of the Project site from 634-636 San Anselmo Avenue to Bridge Avenue bridge. The analysis shall recommend foundation designs and scour protection measures that protect structures to depths below potential scour, estimated using standard engineering methods. The Flood Control District shall implement the foundation designs and scour protection measures in final project design. Foundation design and scour protection measures commonly used to protect existing in-channel structures and banks and that could be implemented in this Project include but are not limited to: 1. Adding new rock revetment or extending the depth of existing rock revetments 2. Extending the foundations of vertical retaining walls using sheet pile or concrete	Flood Control District	Prior to construction		

TABLE E-1 (CONTINUED)
MITIGATION, MONITORING, AND REPORTING PROGRAM

Significant Environmental Impact	Mitigation Measure	Implemented By	When Implemented	Monitored By	Verified By (Date and Signature)
4.9 Hydrology and Water Quality (cont.)					
Impact 4.9-4: The Project would substantially alter the existing drainage pattern of the watershed, altering patterns of flooding onsite and offsite.	**Mitigation Measure 4.9-4: Provide Flood Protection to Substantially Affected Areas** For areas upstream and downstream of the Winship Bridge (between Barber Avenue and the Sir Francis Drake Bridge): ~~If the Winship Bridge Replacement Project is not completed prior to construction of the Project,~~ tThe Flood Control District shall develop~~, fund,~~ and implement flood barriers on properties where existing habitable structures would experience new inundation in a 25-year event. The flood barriers shall be designed based on hydraulic modeling demonstrating that the flood barriers would protect existing habitable structures on any properties upstream of the Sir Francis Drake Bridge from new inundation during the 25-year event. or to any higher degree of protection required for that particular type of measure by applicable building codes. Flood barriers include but are not limited to the following measures: • Elevation of structures above the 100-year flood elevations • Basement removal and construction of an addition to contain utilities removed from the basement • Wet flood proofing of structures, in which, with use of water resistant materials, floodwaters are allowed to enter a structure during a flood event • Dry flood proofing of structures • Berms or flood walls For areas immediately upstream of the Nursery Basin site: The Flood Control District shall develop~~, fund,~~ and implement flood barriers on properties where existing habitable structures would experience new inundation in a 25-year event. For both of those locations: The flood barriers would ensure that existing habitable structures would not be inundated by the 25-year event. Upon confirmation of permission by the property owners, the Flood Control District shall implement this measure, including implementing any measures identified in permits required from the California Department of Fish and Wildlife, Regional Water Quality Control Board, or other regulatory agencies. However, the potentially adversely affected parcels are privately owned, and the Flood Control District ~~cannot necessarily~~ is not proposing to require the installation or implementation of flood barriers ~~because~~ without the consent of the property owner(s), who may ~~specifically~~ request that such measures not be implemented. In that case, this Mitigation Measure ~~shall~~ would not be implemented, and the affected parcels may experience an increased level of flood inundation in a 25-year event or larger. The degree of flood protection provided to an individual property will vary depending on the specifics of the flood barrier selected. For most of the flood barriers, the Flood Control District shall provide protection from the 25-year event. However, pursuant to Marin County building code and associated permitting requirements, any increase in structure elevation must be to an elevation sufficient to raise the finished first floor above the elevation of the 100-year flood event. Therefore, property owners who accept that form of flood barrier would receive assistance to implement 100-year protection. ***Funding and Implementation Responsibility (Both Locations):*** For flood walls or berms at the top-of-bank of San Anselmo Creek or Fairfax Creek on privately owned parcels and with the property owners' permission, the Flood Control District shall fund, design, build, and maintain all aspects of those measures, including their possible future removal if implementation of other flood risk reduction projects renders these flood walls or berms unnecessary as determined by the Flood Control District. For a flood barrier that involves improvements or modifications to privately owned habitable structures covered by Mitigation Measure 4.9-4 (structure elevation, wet proofing, dry proofing, basement removal and construction of an addition to house water heaters, furnaces, and similar home appliances, etc.), the Flood Control District shall fully fund the design and provide funding to the property owner for implementation –that is proportional to the increased flood depth with the project. The funding would be provided to the property owner to implement these modifications or improvements. The property owner would be responsible for construction, implementation, and future maintenance of the structure and any associated flood mitigation measures or improvements.	Flood Control District	Prior to construction		
4.14 Parks and Recreation					
Impact 4.14-2: Construction and operation of the Project could include public access and recreational facilities or could require the construction or expansion of recreational facilities which could have an adverse physical effect on the environment.	**See Mitigation Measures 4.3-1 and 4.9-1, above.**	4.3-1. Flood Control District/ Contractor 4.9-1. Flood Control District/ Contractor	4.3-1. During construction 4.9-1. Prior to construction (Dewatering Plan); During construction (in-water work)		

TABLE E-1 (CONTINUED)
MITIGATION, MONITORING, AND REPORTING PROGRAM

Significant Environmental Impact	Mitigation Measure	Implemented By	When Implemented	Monitored By	Verified By (Date and Signature)
4.15 Transportation and Circulation					
Impact 4.15-1: Construction activity associated with the Project would temporarily generate increased traffic volumes in relation to the existing traffic load and capacity of the road system (potentially resulting in a substantial increase in traffic congestion affecting vehicle or transit circulation), and could conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system.	**Mitigation Measure 4.15-1: Traffic Management Plan** Prior to initiation of construction, the Project contractor(s) shall use a qualified traffic engineer to prepare a TMP. The TMP shall be developed during the design phase on the basis of detailed design plans for the approved Project. The TMP shall be reviewed and approved by the Flood Control District and agencies with jurisdiction over roadways affected by Project construction activities, prior to construction. Once approved, the TMP shall be incorporated into the contract documents specifications. The TMP shall include, but not necessarily be limited to, the elements listed below: 1. Develop truck access routes to minimize impacts on local street circulation. The route selection for movement of heavy equipment and truck traffic shall be coordinated with the Marin County Department of Public Works, Marin County Sheriff's Department, and Police Departments for applicable towns, cities, and unincorporated communities. Truck drivers shall be notified of, and required to use, the most direct route between the Project work sites and U.S. 101. 2. As needed to avoid unacceptably adverse impacts on traffic flow, schedule truck trips outside of peak morning and afternoon/evening traffic hours. 3. Control and monitor construction vehicle movements by enforcing standard construction specifications through periodic on-site inspections. 4. Install traffic control devices where traffic conditions warrant, as specified in the applicable jurisdiction's standards (e.g., the California Manual on Uniform Traffic Control Devices; Part 6: Temporary Traffic Control); flaggers would be used, when warranted, to control vehicle movements. 5. Implement a public information program to notify interested parties of the impending construction activities using means such as print media, radio, and/or web-based messages and information. 6. Comply with roadside safety protocols to reduce the risk of accidents. 7. Maintain access for emergency vehicles at all times. Provide advance notification to local police, fire, and emergency service providers of the timing, location, and duration of construction activities that could affect the movement of emergency vehicles on area roadways. 8. Store all equipment and materials in designated contractor staging areas on or adjacent to the worksite, in such a manner to minimize obstruction to traffic. 9. Identify locations for parking by construction workers (within the construction work site or at the designated construction staging areas, or, if needed, at a nearby location with transport provided between the parking location and the worksite). 10. Prior to Project construction, document road conditions for all routes that shall be used by Project-related vehicles. Roads damaged by construction shall be repaired to a structural condition equal to that which existed prior to construction activity. 11. Maintaining pedestrian and bicycle access and circulation during Project construction where safe to do so. If construction activities encroach on bicycle routes or multi-use paths, advance warning signs (e.g., "Bicyclists Allowed Use of Full Lane" and/or "Share the Road") shall be posted that indicate the presence of such users. During construction, an environmental compliance manager shall monitor and complete a construction monitor environmental inspection report checklist to ensure that the contractor implements the TMP measures included in the contract documents. Any noncompliance shall be documented and reported to the Flood Control District to ensure corrective action. A final compliance report shall be prepared post-construction.	Qualified Traffic Engineer/ Contractor/ Flood Control District; Construction Monitor (environmental inspection)	Prior to construction (TMP); During and after construction (construction monitor environmental inspection)		
Impact 4.15-2: Implementation of the Project could impede access to local streets or adjacent uses, including access for emergency vehicles.	**See Mitigation Measure 4.15-1, above.**	Qualified Traffic Engineer/ Contractor/ Flood Control District; Environmental compliance manager (construction monitor environmental inspection)	Prior to construction (TMP); During and after construction (construction monitor environmental inspection)		
Impact 4.15-3: Implementation of the Project could have an adverse effect on pedestrian and bicycle accessibility and safety.	**See Mitigation Measure 4.15-1, above.**	Qualified Traffic Engineer/ Contractor/ Flood Control District; Environmental compliance manager (construction monitor environmental inspection)	Prior to construction (TMP); During and after construction (construction monitor environmental inspection)		
Impact 4.15-4: Construction activity associated with the Project could temporarily increase traffic safety hazards due to incompatible uses (e.g., heavy truck traffic, and roadway wear-and-tear).	**See Mitigation Measure 4.15-1, above.**	Qualified Traffic Engineer/ Contractor/ Flood Control District; Environmental compliance manager (construction monitor environmental inspection)	Prior to construction (TMP); During and after construction (construction monitor environmental inspection)		