



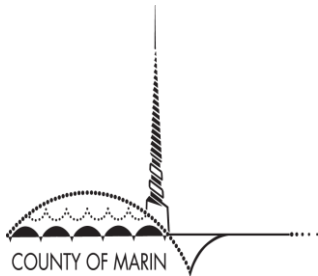
Marin City January 21, 2017 event

Marin City Flood Design Study Update

Zone 3 and Public Meeting

October 24, 2017

Roger Leventhal, PE,
Senior Engineer, Marin
County



Flood Study Team

Roger Leventhal, P.E. Senior Engineer, Overseeing Flood Study (rleventhal@marincounty.org)

Scott McMorrow, Flood Zone 3 Engineer (smcmorrow@marincounty.org)

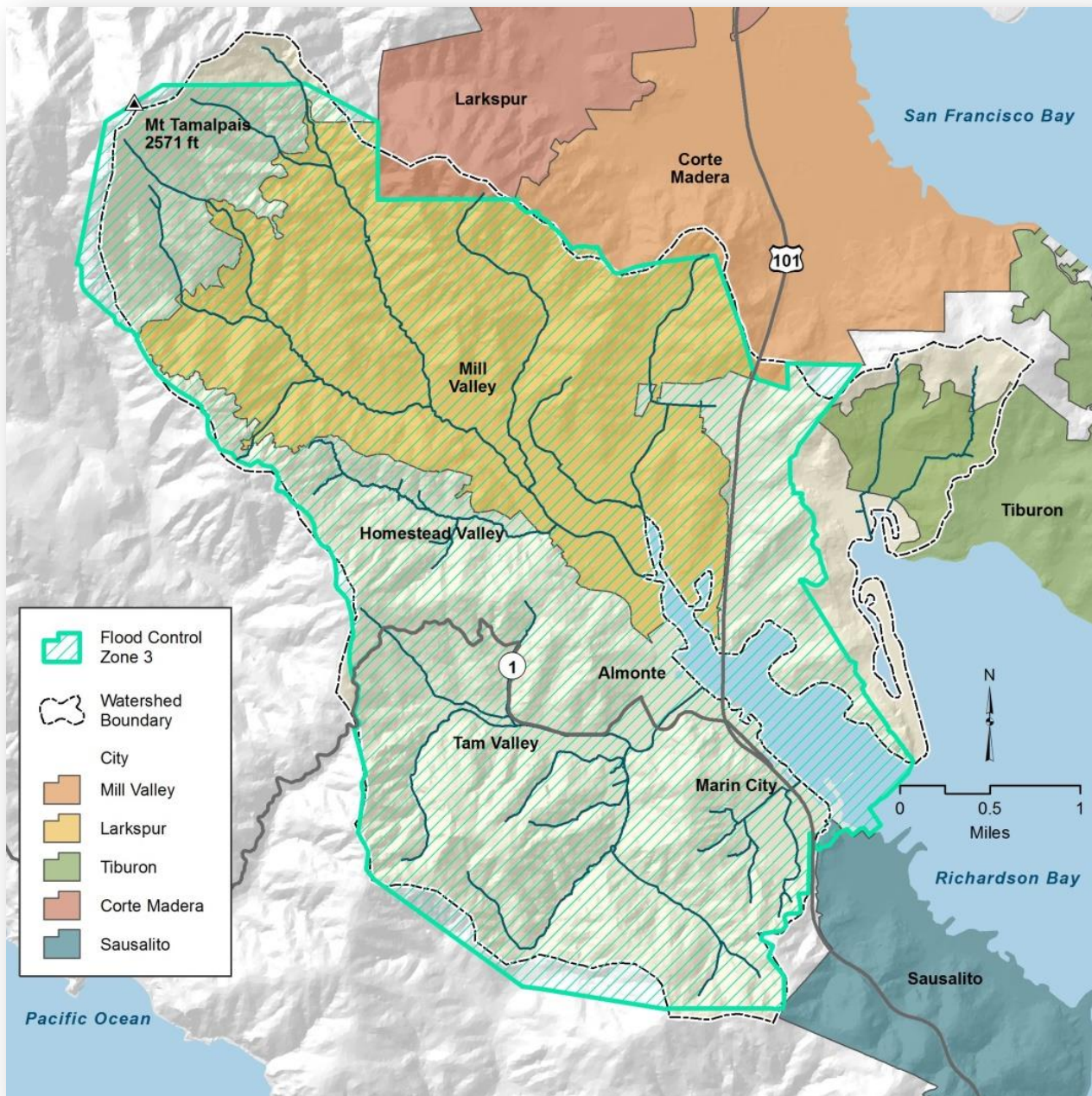
Cheng Soo and Dan Matthies, Wood-Rogers, consultants performing the flood study

Flood Zone 3 Board – Bob Burton, Chair, bob114@comcast.net

Acknowledgements

Thanks to...

- The Transportation Authority of Marin (TAM) for a grant to pay 50 percent of the flood study
- Flood Zone 3 for the other 50% of the study
- ShoreUp Marin – Terri Green and Hannah Durress
- Monique Brown, Marin City CSD
- Supervisor Sears for her work leading the efforts



Flood Zone 3 (hatched)

Marin City Flood Study History

- Dec 2014 Flooding of HWY 101 and Roadway into Marin City
- Mid-2015 County applies for emergency TAM grant for flood study
- Feb 2, 2016 – District issues RFP for Consultants to Prepare Flood Study
- August 16, 2016 - TAM grant approved for \$210,650
- August 16, 2016 – BOS Awards Contract to Wood-Rogers for Flood Study ~ ½ TAM and ½ Zone 3 funds

Marin City Flood Study Background

- Fall 2016 – WR develops model of existing site conditions
- March 7, 2017 – 1st Community Meeting – Review Model and Seek Input
- Tonight – Draft Final Report and 2nd Community Meeting to Review Flood Reduction Alternatives)

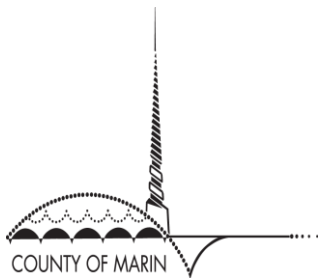


*Highway 101 flooding
December 2014*

Marin City Flood Study Scope

- Scope is to evaluate flooding in Marin City watershed public areas and develop a range of flood reduction alternatives
- Not intended to address private homeowner property drainage issues
- Focused on flooding, not sanitary sewer or geotechnical (landslide) issues

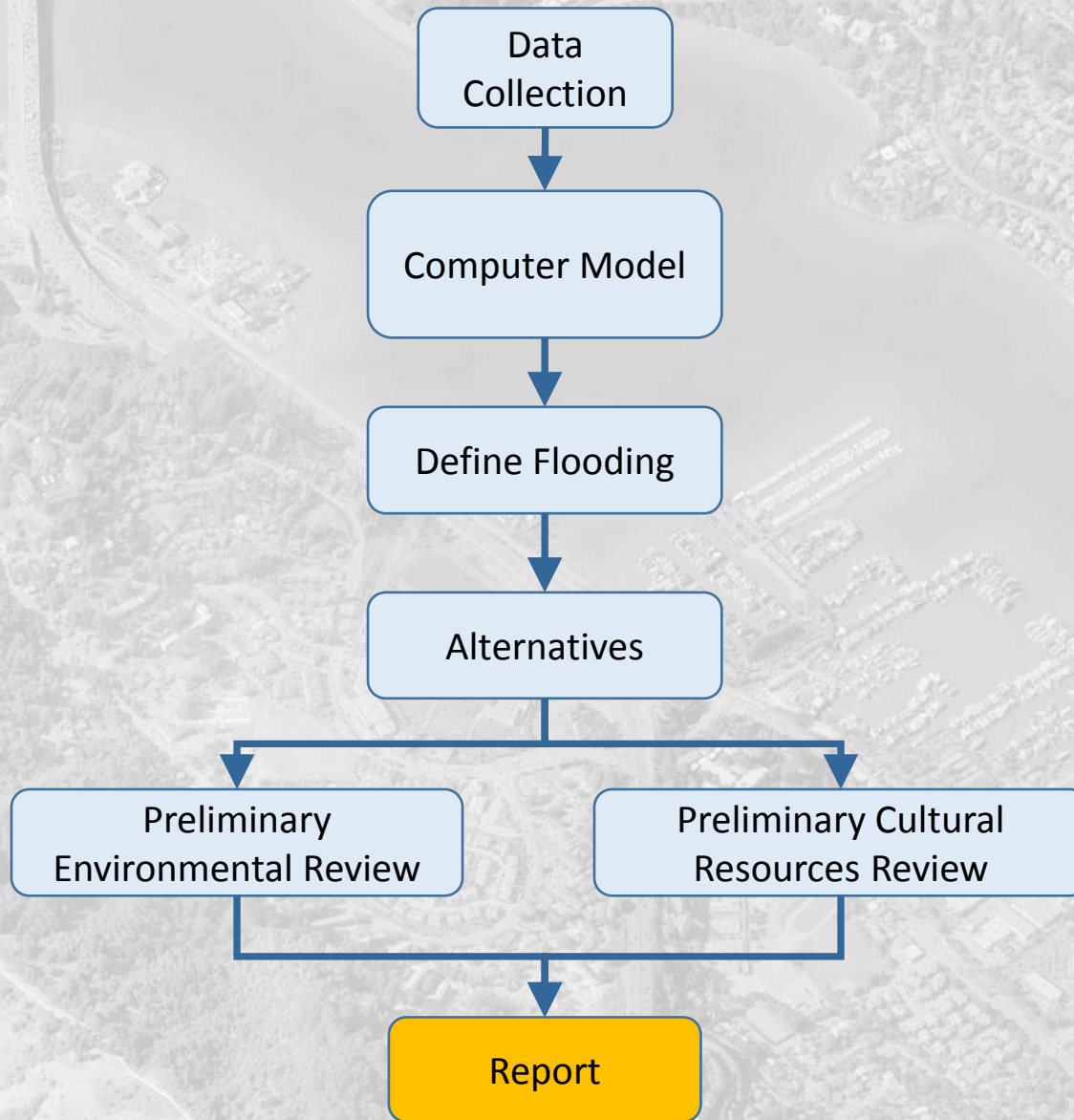
Wood-Rogers Presentation

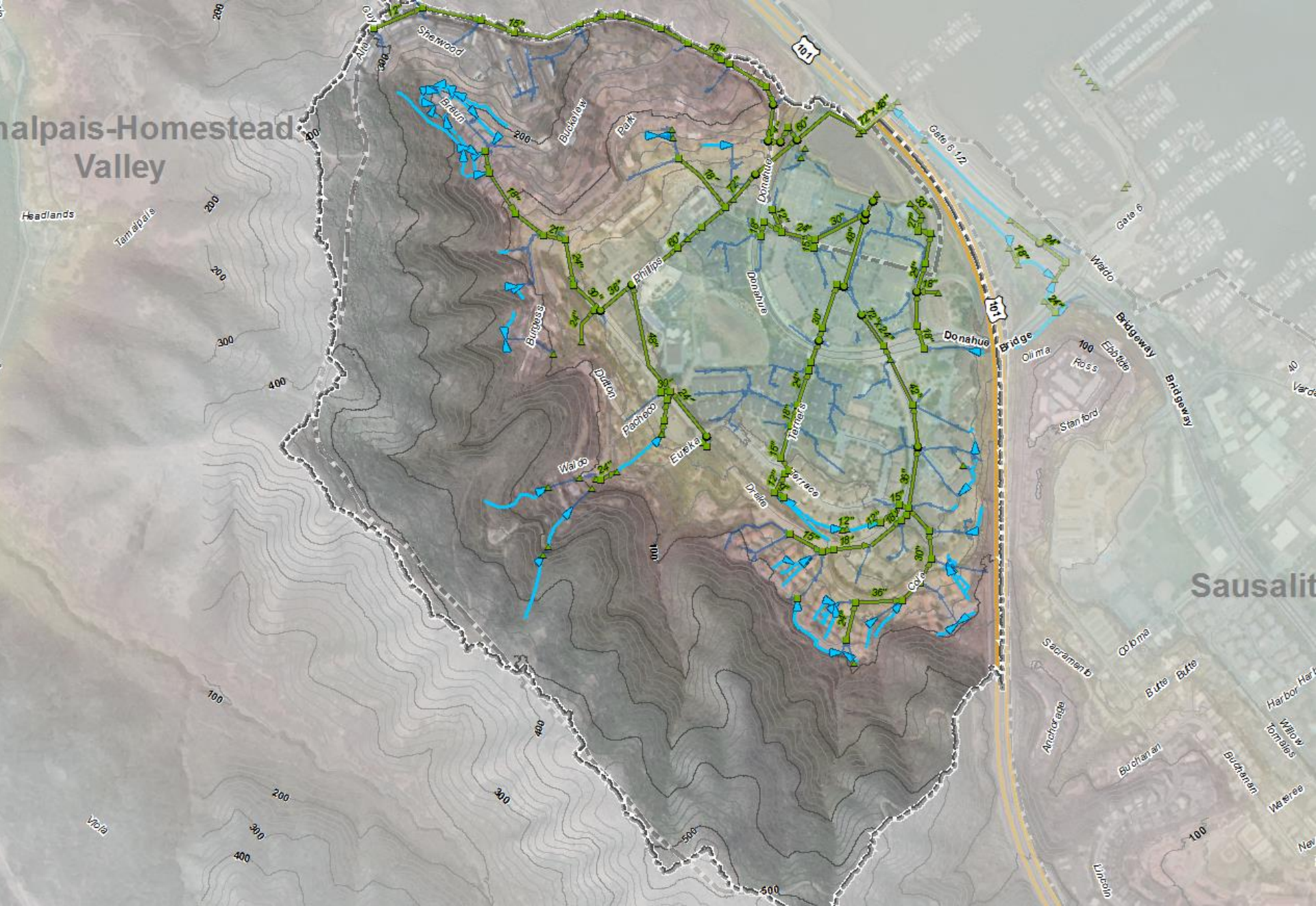




Agenda:

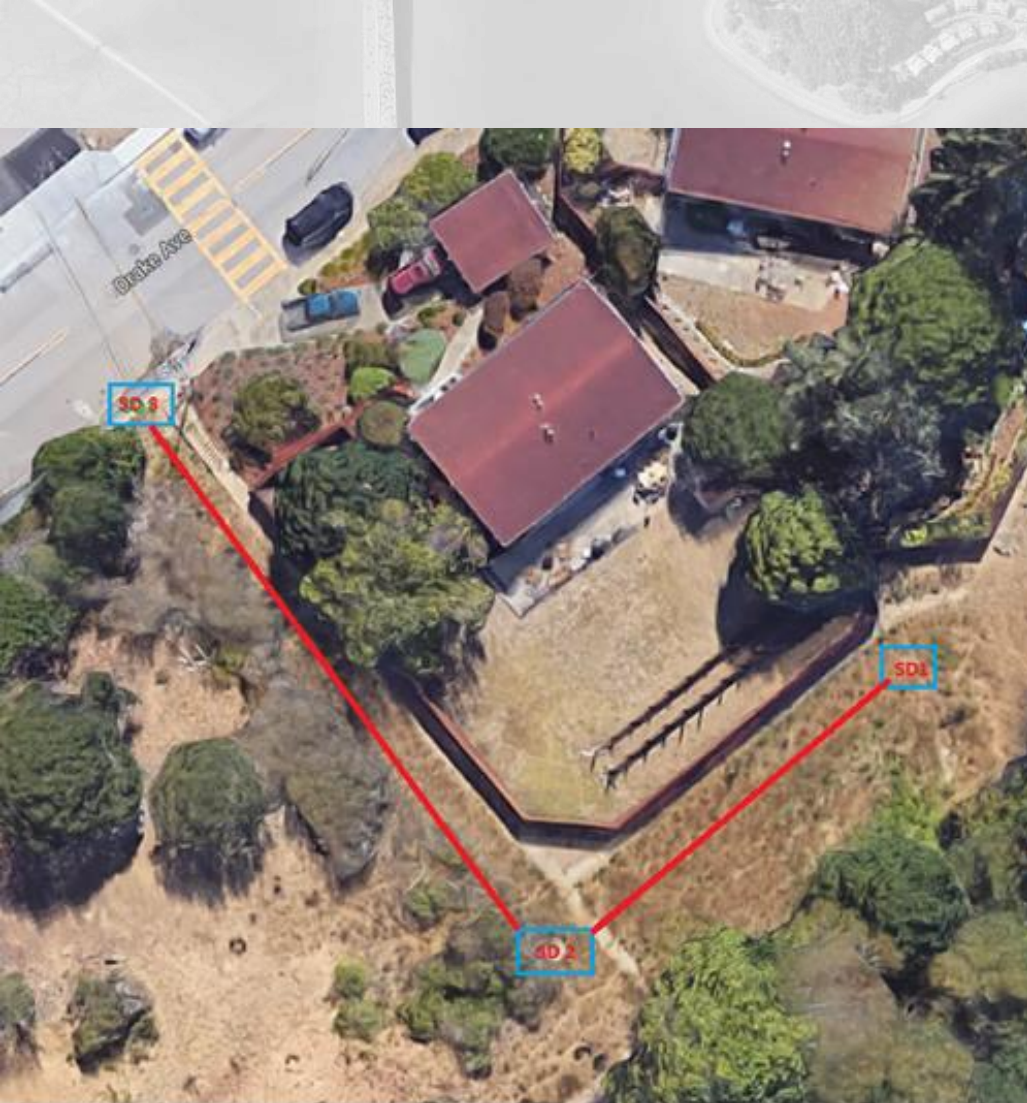
- Study
- Alternatives
- Grant Application





STUDY EXTENT





DIABLO PLUMBING

street di - unknown

8.41 °	1.85 °	93 °F	896 mbar	32.00 °F
4 °	0 °	102 °F	619 mbar	
2017-10-16	20:17:34	0:12:51		

DIABLO PLUMBING

street di - unknown

10.54 °	-0.03 °	91 °F	894 mbar	32.00 °F
1 °	0 °	104 °F	617 mbar	
2017-10-16	20:16:21	0:11:38		
121.76 ft	121.76 ft	0.00 ft	2.56 ft/min	



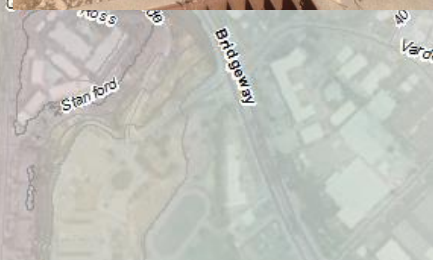
PIPE INSPECTION



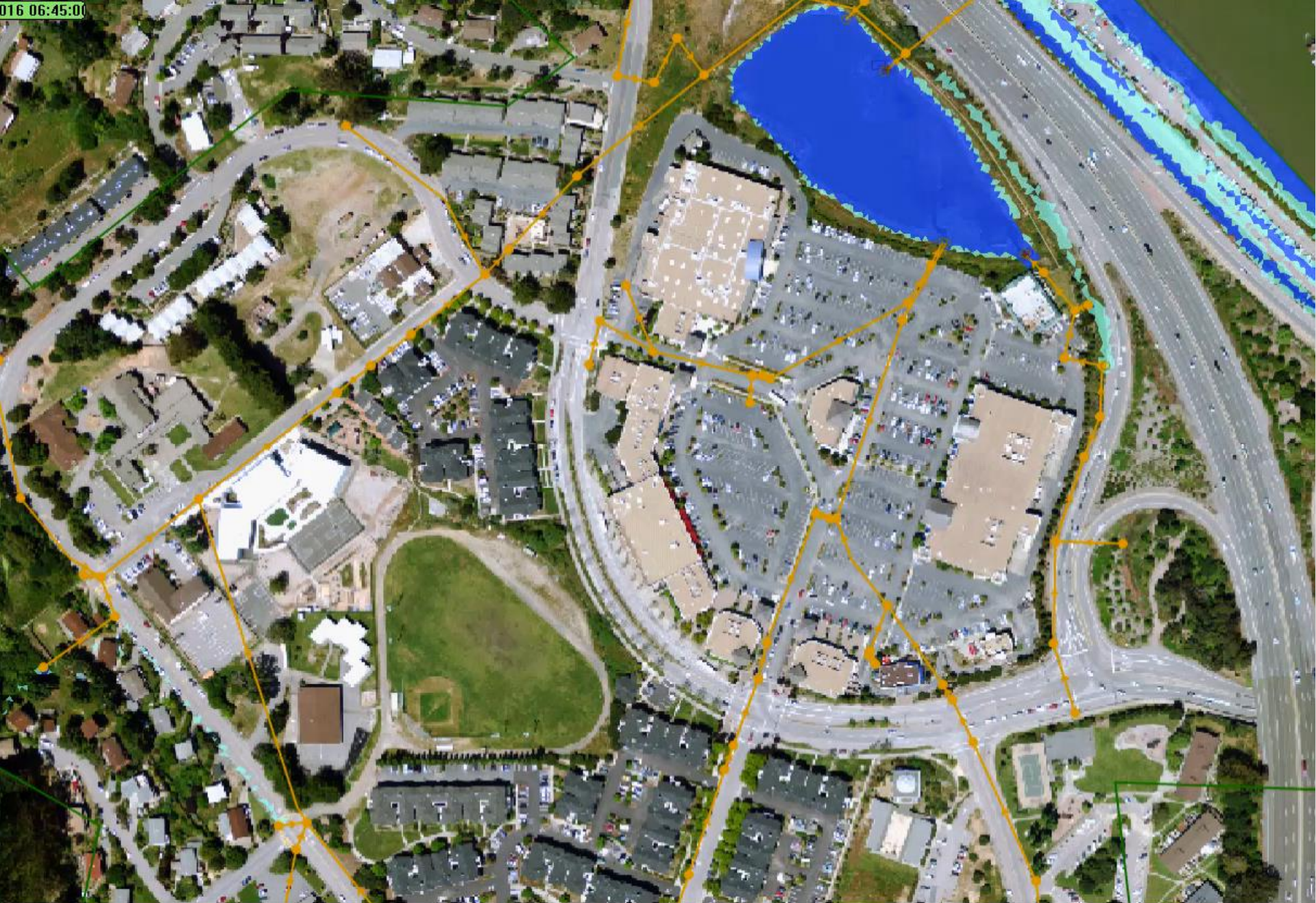
BAPTIST CHURCH TEMPORARY MITIGATION



DETENTION BASIN TEMPORARY WALL

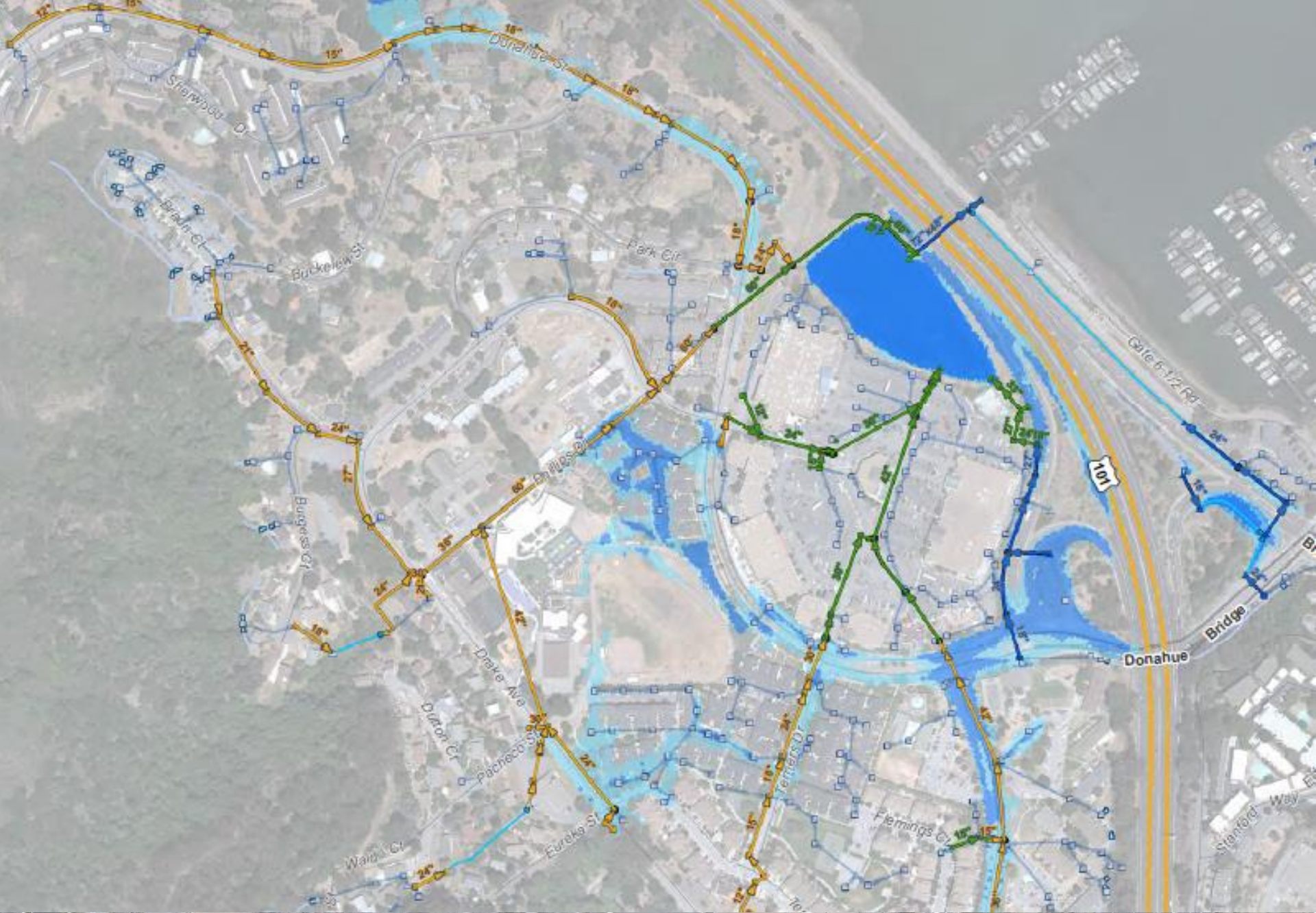



SITE WALK





Result






Marin County Looked at These Types of Improvements:

- Culverts Under Highway
- Tide Gates in Pipes
- Desilting Pond
- New Pipes
- Floodwalls
- Pump Stations
- Detention Basins
- Raising Roads
- Green Infrastructure
- Combinations of These
- Others

POTENTIAL SOLUTION (ALTERNATIVE 1)

COUNTY OF
MARIN

 WOOD RODGERS
www.woodrogers.com



...and carefully measured the benefit of each improvement and combinations of improvements

POTENTIAL SOLUTION (ALTERNATIVE 1)

No.	Improvements	100-year Combined Frequency Flood Elev. (ft, NAVD88)						Improvement Costs
		Detention Basin			US 101 Off Ramp (Flood > 7.0 ft)			
		1-yr Rain + 100-yr Tide	10-yr Rain + 10-yr Tide	100-yr Rain + MHHW Tide	1-yr Rain + 100-yr Tide	10-yr Rain + 10-yr Tide	100-yr Rain + MHHW Tide	
	2014 Existing Conditions	9.33		9.03	9.33		9.03	NA
	2017 Existing Conditions	9.44	9.15	8.59	8.67	8.87	9.85	NA
LL1	Proposed US 101 Culvert Inlet Flap Gate	6.49	8.39	9.05	6.53	8.41	9.10	\$50,000
LL2	Desilt Detention Basin & Lower HWY 101 Culvert Inlet Structure	9.38	9.08	9.07	9.39	9.10	9.12	\$1,831,000
LL3	Proposed Floodwall/ Levee	9.44	9.15	8.59	8.67	8.87	9.85	\$141,000
LL4	Proposed 50 cfs Pump Station	8.95	8.63	8.28	8.95	8.66	8.49	\$3,000,000
LL5	Proposed HWY101 48" RCP Culvert	9.43	8.73	7.89	9.43	8.75	8.32	\$591,000
LL6	Proposed Caltrans' Detention Basin, overflow weir & drain pipe	9.34	9.02	8.91	9.36	9.03	8.97	\$468,000
LL7	Proposed Caltrans' 15 cfs Pump Station	9.34	9.02	8.91	9.35	9.04	8.94	\$2,500,000
LL8	Raised Road	9.44	9.15	8.59	8.67	8.87	9.85	\$6,186,000
H9	Improvements LL1 & LL2	4.92	8.00	8.97	No	8.04	9.04	\$1,881,000
LL1	Improvements LL1 & LL4	6.16	8.14	8.78	6.20	8.17	8.87	\$3,050,000
LL1	Improvements LL1 & LL5	6.49	8.25	8.09	6.53	8.28	8.41	\$641,000
LL1	Improvements LL1, LL2 & LL3	4.92	8.05	8.54	No	8.04	9.81	\$2,022,000
LL1	Improvements LL1, LL2 & LL4	3.64	6.38	7.73	No	6.89	8.17	\$4,881,000
LL1	Improvements LL1, LL3 & LL4	5.30	7.42	7.90	No	7.72	9.30	\$3,191,000
LL1 5	Improvements LL1, LL2, LL3 & LL4	3.66	6.39	7.51	No flood	6.90	8.74	\$5,022,000
LL1	Improvements LL3 & LL6	9.44	9.15	8.51	8.31	8.51	9.59	\$609,000
LL1	Improvements LL3, LL6 & LL7	9.52	9.29	8.67	6.87	7.47	9.31	\$3,109,000

Results

12

POTENTIAL SOLUTION (ALTERNATIVE 1)



Tamalpais-Homestead Valley

Pump Station

New, Bigger, Pipes

Desilt Basin

Tide Gates

BIG PUMP STATION (ALTERNATIVE 1)



Tamalpais-Homestead Valley

New, Bigger, Pipes

Floodwall

Desilt Basin

Pump Station

Tide Gates

Detention Basin

SMALL CALTRANS PUMP STATION (ALTERNATIVE 2)



New, Bigger, Pipes

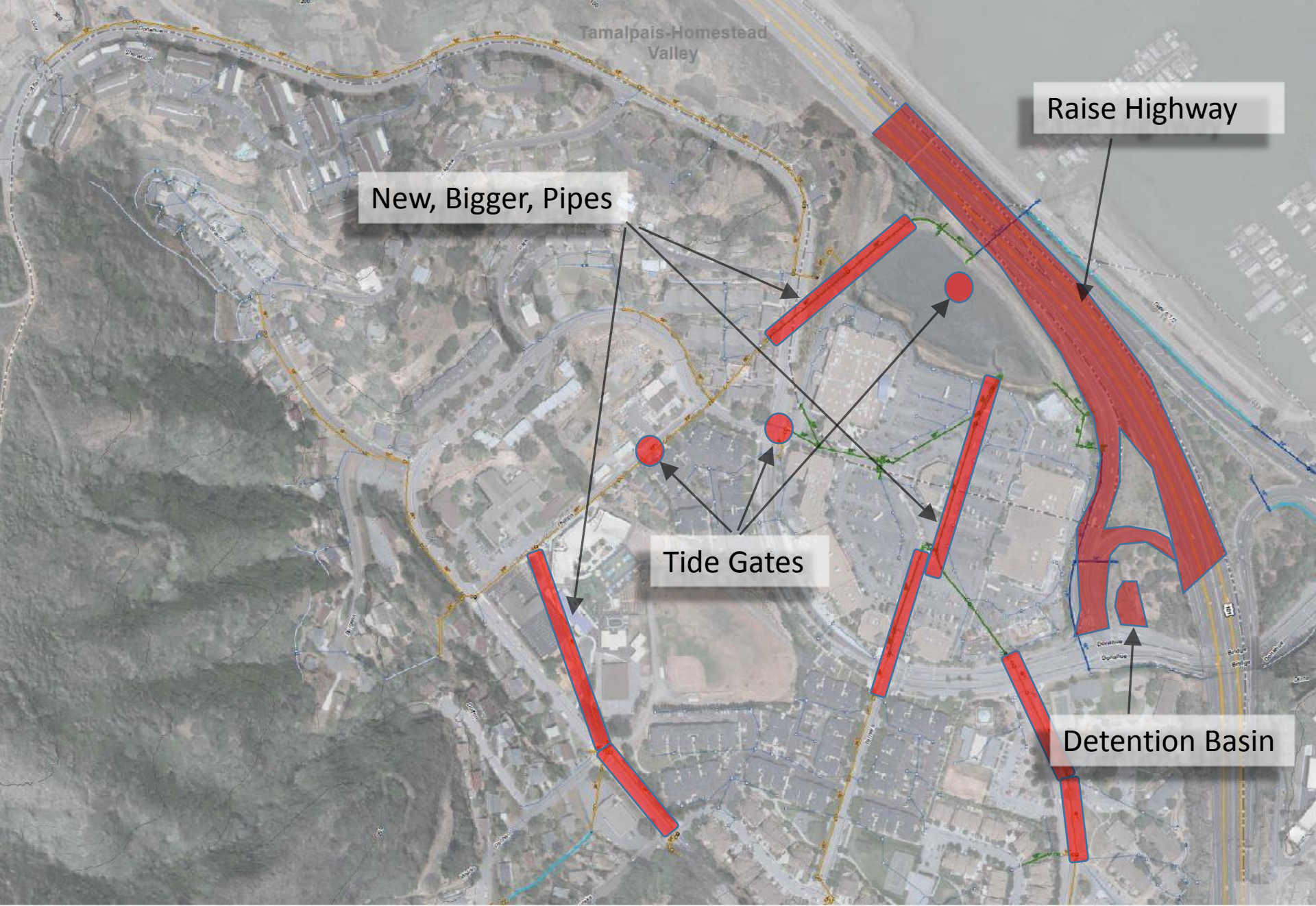
Floodwall

Pump Station

Tide Gates

Detention Basin

MIDSIZE CALTRANS PUMP STATION (ALTERNATIVE 3)



Tamalpais-Homestead Valley

Raise Highway

New, Bigger, Pipes

Tide Gates

Detention Basin

HIGHWAY RAISING (ALTERNATIVE 4)

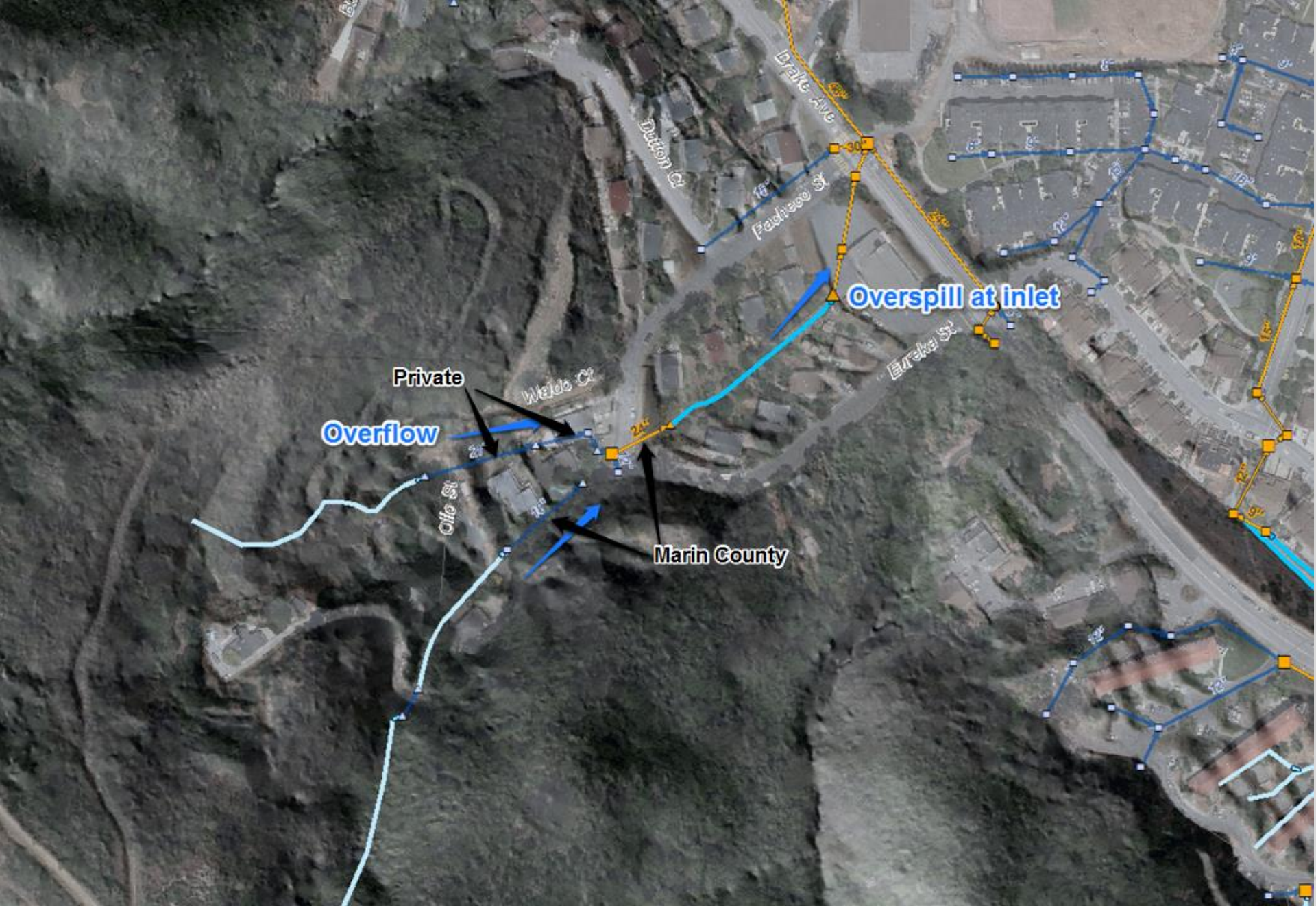
Improvement Condition	Pro		Con					Final Score
	10-year Benefit (ac)	100-year Benefit (ac)	Capital Cost	O&M Cost (20-yr)	Environ.	Caltrans Participation/Coordination (1-5)	Sea Level Rise Sensitivity (1-3)	
Alternative 1	10.0	13.6	\$7,600,000	\$1,900,000	\$350,000	1	3	
Alternative 2	9.6	13.4	\$7,100,000	\$1,900,000	\$350,000	2	3	
Alternative 3	9.6	13.3	\$5,300,000	\$1,700,000	\$250,000	3	3	
Alternative 4	7.2	10.0	\$35,000,000	\$100,000*	\$250,000	5	3	

*Caltrans O&M costs not calculated

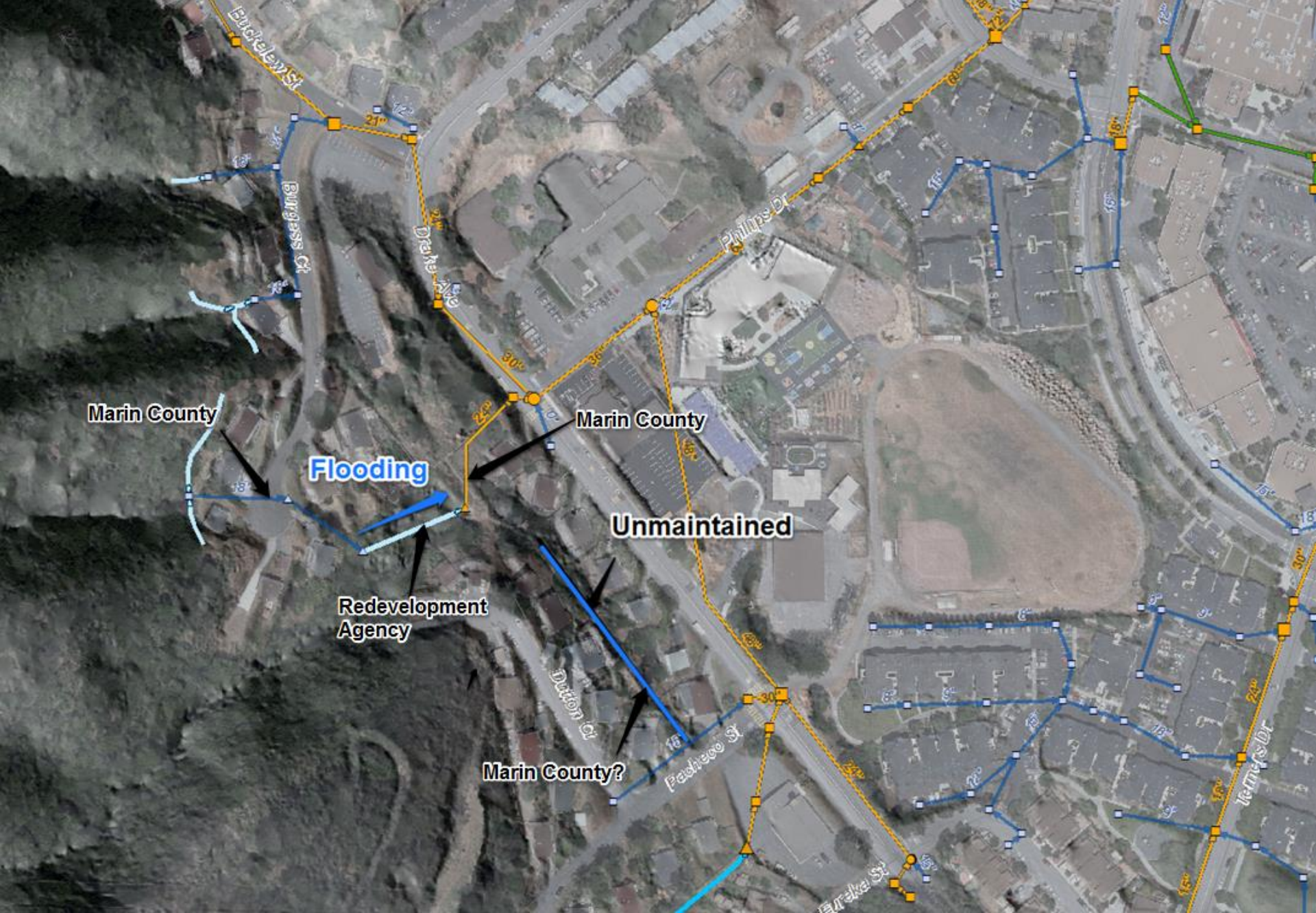
Improvement Condition	Improvements	Facility Ownership	Capital Cost
Alternative 1	Bore & Jack 48" RCP	Caltrans	\$9,850,000
	SRT Tide Gate and Flap Gate	Gateway Shopping Center	
	Desilt Pond	Gateway Shopping Center	
	Pump Station	Gateway Shopping Center	
Alternative 2	Bore & Jack 48" RCP	Caltrans	\$9,350,000
	SRT Tide Gate and Flap Gate	Gateway Shopping Center	
	Desilt Pond	Gateway Shopping Center	
	Pump Station	Caltrans	
	Detention Basin	Caltrans	
	Floodwall	Gateway Shopping Center	
Alternative 3	Bore & Jack 48" RCP	Caltrans	\$7,250,000
	SRT Tide Gate and Flap Gate	Gateway Shopping Center	
	Pump Station	Caltrans	
	Detention Basin	Caltrans	
	Floodwall	Gateway Shopping Center	
Alternative 4	Highway Raising	Caltrans	\$35,350,000
	Bypass Pipe System	Marin County	



LOCAL DRAINAGE ISSUES



LOCAL DRAINAGE ISSUES



Marin County

Flooding

Marin County

Unmaintained

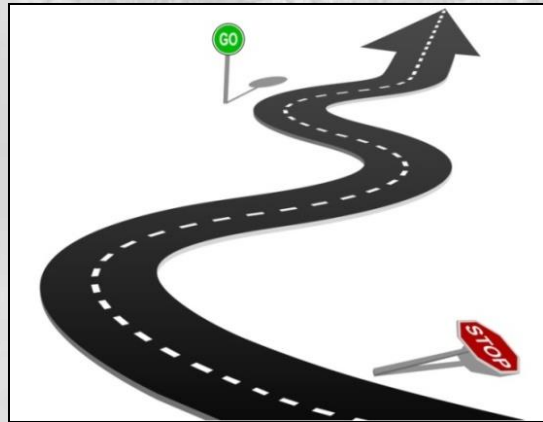
Redevelopment Agency

Marin County?



LOCAL DRAINAGE ISSUES

Next Steps In The Design and Construction Process



Funded



Not Funded

Flood Study
(Now)

Consensus on
Proposed
Solutions and
Costs (Next)

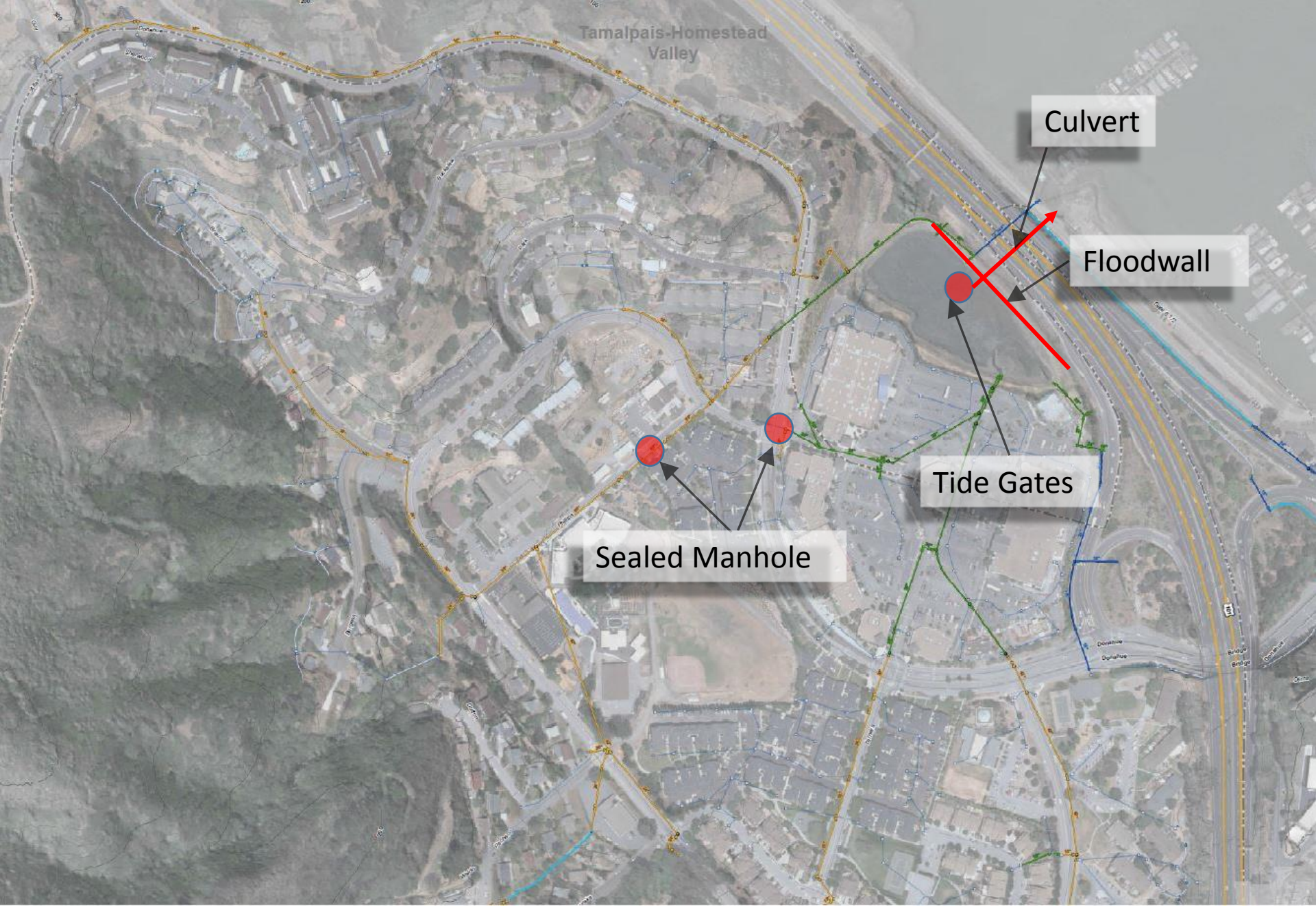
Final Design,
Plans and Specs
and Permits

Find the Money
Get Permits,
CEQA and
Construct (Last)

Possible FEMA Grant

- Possible \$1.5M Total FEMA grant with \$1.25M (75%) FEMA Funds and \$375,000 (25%) in Zone 3 Funds due November 15, 2017
- Grant would cover following items:
 - New culvert under 101 with tide gate
 - Flap gates on culverts entering pond
 - New floodwall around pond
 - Sealing manholes to avoid backwater flooding
- Board action item tonight





Tamalpais-Homestead Valley

Culvert

Floodwall

Tide Gates

Sealed Manhole

GRANT FUNDING



Next Steps

- Comments to draft due in 30 days
- Work with Zone Board, CalTrans, Shopping Center and Community to find consensus on next steps
- Participate through your flood zone meetings, community groups such as ShoreUp Marin and others



An aerial photograph of a coastal town, likely in Marin County, California. The town is built on a hillside overlooking a large body of water. A prominent bridge spans across the water, connecting the town to a larger landmass. The image is overlaid with a semi-transparent blue filter.

Questions?

DISCUSSION

COUNTY OF
MARIN



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POTENTIAL SOLUTION (ALTERNATIVE 1)



POTENTIAL SOLUTION (ALTERNATIVE 2)



POTENTIAL SOLUTION (ALTERNATIVE 3)



POTENTIAL SOLUTION (ALTERNATIVE 4)

**2017 MARIN CITY DMP PROJECT
ALTERNATIVE 1 BASIN IMPROVEMENTS**

Improvements Included

- 1 Bore and Jack Hwy 101 culvert
- 2 Install inlet structure flap gate & SRT gate
- 3 Desilt pond & lower culvert inlet structure
- 4 Construct 50 cfs pump station

Item No.	Item Description	Quantity	Unit	Unit Cost	Cost	Annual O&M Cost	20-Year PV O&M Cost
1	Bore and Jack 290 LF of 48" RCP Class IV	290	LF	1,900	\$ 551,000	\$ 5,000	\$ 74,760
	Inlet Structure for 48" RCP	1	LS	20,000	\$ 20,000		
	Outlet Structure for 48" RCP	1	LS	20,000	\$ 20,000		
					\$ 591,000		
2	Flap gate for existing 6x4' RCB	1	EA	30,000	\$ 30,000	\$ 1,000	\$ 14,952
	SRT Tide Gate for new 48" RCP	1	EA	50,000	\$ 50,000		
3	Desilt Pond and dispose of material	11874	CY	150	\$ 1,781,100	\$ 15,000	\$ 224,279
	Lower existing culvert inlet structure invert	1	LS	50,000	\$ 50,000		
4	Construct 50 cfs Pump Station	1	LS	3,000,000	\$ 3,000,000	\$ 104,000	\$ 1,555,000
	and connect to existing culvert inlet structure				\$ 3,000,000		
General	Mobilization and Demobilization	1	LS	279,105	\$ 279,105		
	Storm Water Pollution Control	1	LS	30,000	\$ 30,000		
	Traffic Control	1	LS	50,000	\$ 50,000		
					\$ 359,105		
					\$ 5,861,205	\$ 125,000	\$ 1,868,990
					with 30% contingency \$ 7,619,567		

**2017 MARIN CITY DMP PROJECT
ALTERNATIVE 2 BASIN IMPROVEMENTS**

Improvements Included

- 1 Bore and Jack Hwy 101 culvert
- 2 Install inlet structure flap gate & SRT gate
- 3 Desilt pond & lower culvert inlet structure
- 4 Caltrans detention basin
- 5 Caltrans 10 cfs pump station
- 6 City detention basin floodwall

Item No.	Item Description	Quantity	Unit	Unit Cost	Cost	Annual O&M Cost	20-Year PV O&M Cost
1	Bore and Jack 290 LF of 48" RCP Class IV	290	LF	1,900 \$	551,000 \$	5,000 \$	74,703
	Inlet Structure for 48" RCP	1	LS	20,000 \$	20,000		
	Outlet Structure for 48" RCP	1	LS	20,000 \$	20,000		
				\$	691,000		
2	Flap gate on existing 6'x4' RCB	1	LS	30,000 \$	30,000 \$	1,000 \$	14,941
	SRT Tide Gate for new 48" RCP	1	EA	50,000 \$	50,000		
				\$	80,000		
3	Desilt Pond and dispose of material	11874	CY	150 \$	1,781,100 \$	15,000 \$	224,109
	Lower existing culvert inlet structure invert	1	LS	50,000 \$	50,000		
				\$	1,831,100		
4	Caltrans detention basin excavation	3745	CY	15 \$	56,175 \$	5,000 \$	74,703
	Off haul and dispose of excavation material	3745	CY	15 \$	56,175		
	Clearing and Grubbing	0.3	AC	10,000 \$	3,000		
	Erosion control seeding	0.3	AC	6,000 \$	1,800		
	Install (trench) 18" rcp connection basin to existing drain pipe	95	LF	125 \$	11,875		
	Install (trench) 48" rcp connection basin to existing drain pipe	110	LF	250 \$	27,500		
	Flap gate on 18" pipe	1	LS	10,000 \$	10,000		
	Flap gate on 48" pipe	1	LS	20,000 \$	20,000		
	Retaining wall	4420	SF	50 \$	221,000		
Construct 2 special boxes with weir structures	2	LS	30,000 \$	60,000			
				\$	487,626		
5	Caltrans 10 cfs Pump Station and connect forcemain (trench) to city detention basin	1	LS	2,000,000 \$	2,000,000 \$	101,000 \$	1,509,000
				\$	2,000,000		
6	City detention basin floodwall	470	LF	300 \$	141,000 \$	3,500 \$	52,292
				\$	141,000		
General	Mobilization and Demobilization	1	LS	262,031 \$	262,031		
	Storm Water Pollution Control	1	LS	30,000 \$	30,000		
	Traffic Control	1	LS	100,000 \$	100,000		
				\$	392,031		
				\$	5,502,656 \$	130,500 \$	1,949,748
				with 30% contingency	\$	7,153,453	

**2017 MARIN CITY DMP PROJECT
ALTERNATIVE 3 BASIN IMPROVEMENTS**

Improvements Included

- 1 Bore and Jack Hwy 101 culvert
- 2 Install inlet structure flap gate & SRT gate
- 3 Caltrans detention basin
- 4 Caltrans 15 cfs pump station
- 5 City detention basin floodwall

Item No.	Item Description	Quantity	Unit	Unit Cost	Cost	Annual O&M Cost	20-Year PV O&M Cost
1	Bore and Jack 290 LF of 48" RCP Class IV	290	LF	1,900 \$	551,000 \$	5,000 \$	74,703
	Inlet Structure for 48" RCP	1	LS	20,000 \$	20,000		
	Outlet Structure for 48" RCP	1	LS	20,000 \$	20,000		
					\$ 691,000		
2	Install flap gate on existing 6'x4' RCB	1	LS	30,000 \$	30,000 \$	1,000 \$	14,941
	SRT Tide Gate for new 48" RCP	1	EA	50,000 \$	50,000		
					\$ 80,000		
3	Caltrans detention basin excavation	3745	CY	15 \$	56,175 \$	5,000 \$	74,703
	Off haul and dispose of excavation material	3745	CY	15 \$	56,175		
	Clearing and Grubbing	0.3	AC	10,000 \$	3,000		
	Erosion control seeding	0.3	AC	6,000 \$	1,800		
	Install (trench) 18" rcp connection basin to existing drain pipe	95	LF	125 \$	11,875		
	Install (trench) 48" rcp connection basin to existing drain pipe	110	LF	250 \$	27,500		
	Flap gate on 18" pipe	1	LS	10,000 \$	10,000		
	Flap gate on 48" pipe	1	LS	20,000 \$	20,000		
	Retaining wall	4420	SF	50 \$	221,000		
Construct 2 special boxes with weir structures	2	LS	30,000 \$	60,000			
					\$ 487,626		
4	Caltrans 15 cfs Pump Station	1	LS	2,500,000 \$	2,500,000 \$	101,000 \$	1,509,000
	and connect force main (trench) to city detention basin				\$ 2,600,000		
5	City detention basin floodwall	470	LF	300 \$	141,000 \$	3,500 \$	52,292
General	Mobilization and Demobilization	1	LS	195,476 \$	195,476		
	Storm Water Pollution Control	1	LS	30,000 \$	30,000		
	Traffic Control	1	LS	100,000 \$	100,000		
					\$ 326,476		
					\$ 4,105,001 \$	115,500 \$	1,725,639
					with 30% contingency \$ 5,336,502		

2017 MARIN CITY DMP PROJECT
ALTERNATIVE 4 BASIN IMPROVEMENTS

Improvements Included

- 1 Install inlet structure flap gate
- 2 Caltrans Hwy 101 and off-ramp raising
- 3 Caltrans on-ramp detention basin
- 4 Bypass pipe

Item No.	Item Description	Quantity	Unit	Unit Cost	Cost	Annual O&M Cost	20-Year PV O&M Cost
1	Flap gate on existing 6'x4' RCB	1	LS	30,000	\$ 30,000	\$ 1,000	\$ 14,941
					\$ 30,000		
2	Raise 5 ac of Hwy 101 Rebuild two Interchanges Right-of-way acquisition Drainage and Signage Traffic Control Construction Phasing	1	LS	25,000,000	\$ 25,000,000		
					\$ 25,000,000		
3	Caltrans detention basin on-ramp excavation	960	CY	15	\$ 14,400	\$ 5,000	\$ 74,703
	Off haul and dispose of excavation material	960	CY	15	\$ 14,400		
	Clearing and Grubbing	0.2	AC	10,000	\$ 2,000		
	Erosion control seeding	0.2	AC	6,000	\$ 1,200		
					\$ 17,600		
4	30" bypass pipe to Caltrans detention basin	350	LF	155	\$ 54,250		
					\$ 54,250		
General	Mobilization and Demobilization	1	LS	1,276,593	\$ 1,276,593		
	Storm Water Pollution Control	1	LS	30,000	\$ 30,000		
	Traffic Control	1	LS	400,000	\$ 400,000		
					\$ 1,706,593		
					\$ 26,808,443	\$ 6,000	\$ 89,644
					with 30% contingency \$ 34,850,975		