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Community Profile: Unincorporated Marin

Within the study area, unincorporated communities are sprinkled up the shoreline. Most vulnerable areas are residential, with a few commercial areas impacted in Marin City, Strawberry, Almonte, and Waldo Point Harbor, and in Black Point in the north. Marin County unincorporated communities are regulated by the County of Marin. In the near-term, 3,450 acres could be exposed to sea level rise. By the long-term, 8,644 acres could be exposed to sea level rise and 9,196 acres could be exposed with an additional 100-year storm surge. Key issues in Marin County’s unincorporated communities include:

- Development in the tidal zone in Waldo Point Harbor, Paradise Cay, Greenbrae, and Strawberry could be vulnerable in the near-term.
- Communities along tidal estuaries and creeks such as Kentfield, Santa Venetia, and Tamalpais Valley are first vulnerable to storms in the near- and medium-terms, and vulnerable to sea level rise in the long-term.
- In the low lying exposed areas in nearly every community, except Kentfield, subsidence is an ongoing issue that sea level rise could only exacerbate. This impacts buildings, roads, and utility infrastructure.
- Bel Marin Keys, if left to tidal influences, could be flooded out by the end of the century.
- Several key roads, including, Shoreline Highway from the Manzanita Park and Ride to Tam Junction, US Highway 101 in Marin City, Waldo Point Harbor, and Greenbrae, State Route 37 in North Novato, Tiburon Boulevard at the Cove Shopping Center, Redwood Highway and Sir Francis Drake Boulevard in Greenbrae and Larkspur, and Bel Marin Keys Boulevard already weather seasonal storm flooding. These roads could anticipate more frequent tidal impacts and more severe storm impacts sooner than later.
- Some North Marin Water District infrastructure in North Novato and Bel Marin Keys may be vulnerable in the long-term.
- Marin County Health Innovation Campus in San Rafael is vulnerable in the near-term to storm surge and the medium-term to sea level rise.
- The Marin City shopping center would experience more severe flooding seasonally through the near-term, and flooding from ocean storm surge and sea level rise in the medium and long-terms.

IMPACTS AT-A-GLANCE: SCENARIO 6

9,200 acres exposed	51,000+ people
3,800+ living units	77 commercial parcels
30+ miles flooded	Property Owners Caltrans SMART Marin County DPW North Marin Water District Marin Couth Fire and Sherriff Sanitary Districts PG&E
Existing seasonal flooding and subsidence	
\$945 million in assessed property value; more than \$650 million in single-family housing market value ²¹¹	



Greenbrae Boardwalk. Credit: BVB Consulting LLC



Santa Venetia. Nov. 25, 2015. Credit: Light Hawk Aerial

²¹¹ 2016 dollars

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Vulnerable Assets

The most vulnerable assets in Marin County's unincorporated communities in the near-term are Shoreline Highway through Almonte, Waldo Point Harbor houseboats and facilities, Greenbrae homes and facilities, and Paradise Cay homes and marina. The elevated homes on Greenbrae Boardwalk and floating homes in Waldo Point Harbor may be more adaptable in the near term than homes with solid foundations. In the medium-term, portions of Bel Marin Keys could face impacts, as would Santa Venetia homes, Tamalpais Valley homes, and the Greenwood Cove, Strawberry Circle, Strawberry Village Shopping Center, homes along Seminary Drive in Strawberry, and Kentfield creek side homes. In the long-term, Black Point and North Novato could anticipate damaging impacts.

Many of the unincorporated communities are in, near, or depend on low lying flood prone areas and require stormwater engineering to stave off the

impacts of seasonal flooding. Sea level rise could exacerbate this seasonal storm flooding, and in some cases, could flood out an entire community. Note that recent construction at the Waldo Point Harbor entrance and parking area would reduce the amount and timing of on land flooding estimated by the CoSMoS model. In addition, numbers may be low for this community because not all houseboats are digitized. In addition, the model treats tide gates in Bel Marin Keys as open, where as in practice, community managers could close the gates to prevent lagoon flooding, likely through the near- to medium-terms.

The following sections detail the land, building, transportation, utility, working land, natural resource, recreation, emergency, and cultural assets that are sensitive to saltwater flooding and subsidence, with little to no ability to adapt to higher high tide conditions and therefore, vulnerable to sea level rise and a 100-year storm surge.

Table 119. Unincorporated Marin Communities' Acreage Exposed by BayWAVE Scenario

Location	Scenarios					
	Near-term		Medium-term		Long-term	
	1	2	3	4	5	6
Bel Marin Keys	1,759	1,794	1,802	2,155	2,332	2,350
Waldo Point Harbor	598	610	604	611	611	613
St. Vincent's	256	346	339	353	1,240	1,413
Strawberry	255	282	270	301	328	375
North Novato	118	575	226	2,457	2,827	2,930
San Quentin	116	115	115	115	122	135
Tiburon	102	108	103	108	107	113
Almonte	99	137	115	146	146	157
Paradise Cay	67	69	69	74	91	111
Santa Venetia	29	211	56	221	232	269
Pt. San Pedro	14	62	58	65	78	83
Greenbrae	13	21	14	22	24	24
Kentfield	10	28	12	33	53	118
Bayside Acres	9	9	10	10	12	24
Country Club	4	4	4	4	9	10
Black Point	1	58	62	346	388	408
Tamalpais		28	1	29	28	30
Marin City				3	7	36
California Park					9	10
Total	3,450	4,457	3,860	7,053	8,644	9,196

Source: MarinMap, CoSMoS

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Land

Land is a scarce resource in Marin County. Sea level rise would only reduce the available dry land even further, displacing tens of thousands of people.

Acres

Near-term: Scenarios 1 & 2

As shown in [Table 119](#), in near-term scenario 1, 3,450 acres could be flooded at the average high higher tide (MHHW) across 19 unincorporated communities. Of the near twenty areas that could be vulnerable, the top three with the largest area exposed to tidal flooding are:

1. Bel Marin Keys, 1,750 acres,
2. Waldo Point Harbor area, 598 acres, and
3. St. Vincent's, 256 acres.

Strawberry is a close fourth with 255 acres. Black Point, Tamalpais Valley, Marin City, and California Park are not exposed under scenario 1.

Add an additional storm surge, scenario 2, and 1,000 more acres could be vulnerable to storm surge impacts within the unincorporated area. The top three under storm surge conditions are similar, though North Novato replaces St. Vincent's with 575 acres flooded. Strawberry and Santa Venetia could expect several hundred acres flooded with surge waters. Note that much of the flooded area is marsh and open lands, especially north of the Tiburon peninsula.

While not high in acreage numbers, communities such as Almonte, Greenbrae, Waldo Point Harbor, and Paradise Cay, that are relatively small, could experience tidal and storm flooding on a large portion of their developed area.

Medium-term: Scenarios 3 & 4

In the medium-term, trends and values for tidal flooding are similar to the near storm surge scenario 2. With a 100-year storm surge; however, significantly more acreage could temporarily flood. North Novato and Bel Marin Keys could expect more than 2,000 flooded acres during a storm surge if the bay rises by 20 inches. Overall, roughly 7,000 acres could flood under scenario 4 conditions. Most protective shoreline levees in unincorporated Marin, if not already overtopped in the near-term, would be overtopped at this water level.

Long-term: Scenarios 5 & 6

In long-term scenario 5, more than 8,500 acres could be subject to tidal flooding and storm surge flooding, and an additional 600 acres could expect storm surge flooding. In long-term scenario 5, the most acres are flooded in:

1. North Novato, 9,800 acres,
2. Bel Marin Keys, 2,300 acres, and
3. St. Vincent's, 1,400 acres.

Adding the additional storm surge only exacerbates flooding potential in these three communities and several others. Waldo Point Harbor could anticipate roughly 600 acres exposed across all of the scenarios, which is the entire community. Black Point, Strawberry, and Santa Venetia could anticipate 200 to 400 acres exposed in the low lying areas of their community.

Parcels

Near-term: Scenarios 1 & 2

As shown in [Table 120](#), in near-term scenario 1, eighty-two parcels could be flooded at MHHW. Many of these parcels are marshy or in the water with houseboats. Of the communities that could be vulnerable, the top three with the highest number of parcels exposed to tidal flooding are:

1. Waldo Point Harbor, 59 parcels,
2. Greenbrae, 54 parcels, and
3. Bel Marin Keys, 45 parcels.

Elevated and floating homes on these parcels may prove to be adaptable to rising tides.



*Dipsea Café along Coyote Creek. King Tide, Nov. 25, 2015.
Credit: Marin County CDA*

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Table 120. Unincorporated Marin Vulnerable Parcels in the Near-term

Location	Near-term			
	Scenario 1		Scenario 2	
	#	%	#	%
Waldo Point	59	12	68	14
Greenbrae	54	62	68	78
Bel Marin Keys	45	6	121	16
Paradise Cay	28	8	34	9
Strawberry	26	2	29	2
Almonte	22	32	46	68
Bayside Acres	19	9	19	9
Tiburon	13	4	22	7
St. Vincent's	7	10	12	18
Santa Venetia	4		604	36
Kentfield	2	0	4	0
Black Point	1	0	9	1
Country Club	1	0	2	0
San Quentin	1	1	1	1
Tamalpais			97	4
Total	282	2	1,088	8

Source: MarinMap, CoSMoS

Paradise Cay and Strawberry are a close fourth with more than 25 flooded parcels. Tamalpais Valley, Marin City, and California Park are not exposed under scenario 1.

Add an additional storm surge, scenario 2, and just less than 1,000 more acres could be vulnerable to storm surge impacts. The top three under storm surge conditions are:

1. Santa Venetia, 604 parcels,
2. Bel Marin Keys, 121 parcels, and
3. Tamalpais Valley, 97 parcels.

While not high in number of parcels, the small communities of Greenbrae, Almonte, Waldo Point Harbor, and Paradise Cay, could experience tidal and storm flooding on a large portion of their developed area. By the end of this term, 60 percent of Greenbrae parcels could suffer regular tidal flooding, and another twenty percent would flood during a storm-surge. Floating homes in Waldo Point Harbor and elevated homes on piers along Greenbrae Boardwalk may adapt well to higher water levels due to storm surge.

Table 121. Unincorporated Marin Vulnerable Parcels in the Medium-term

Location	Medium-term			
	Scenario 3		Scenario 4	
	#	%	#	%
Bel Marin Keys	97	13	172	23
Waldo Point	64	13	73	14
Greenbrae	57	66	70	80
Paradise Cay	38	10	54	15
Almonte	32	47	52	76
Strawberry	25	2	76	5
Bayside Acres	19	9	20	9
Tiburon	16	5	22	7
Black Point	15	2%	46	5
St. Vincent's	12	18	13	19
Santa Venetia	4	0	652	39
Kentfield	3	0	9	0
Tamalpais	3	0	98	4
Country Club	2	0	2	0
San Quentin	1	1	1	1
North Novato			24	3
Total	388	3	1,384	10

Source: MarinMap, CoSMoS

Medium-term: Scenarios 3 & 4

Overall, roughly 400 acres could experience tidal flooding in medium-term scenario 3, mostly in water based communities. For example, if protective levees and tide gates fail, Bel Marin Keys could experience flooding on the highest number of parcels, followed by Waldo Point and Greenbrae.

By number, under storm surge conditions, Santa Venetia levee failures could lead to more than 650 being flooded. These parcels amount to nearly 40 percent of the community's parcels. Santa Venetia is followed by Bel Marin Keys and Strawberry. By proportion, Almonte is the second most compromised with 64 percent of existing g parcels flooded. In unincorporated Marin, in medium-term scenario 4, 20 inches of sea level rise with a 100-year storm surge, these levee breaches could facilitate flooding about 1,400 parcels.

Long-term: Scenarios 5 & 6

As shown [Table 122](#), in long-term scenario 5, 82 parcels could be flooded at the average higher high

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tide (MHHW). Houseboat and unauthorized water oriented communities are almost entirely compromise, with flood water reaching further inland into the narrow valleys of the south, and open low lands of the north. Of the communities that could be vulnerable, the top three with the highest number of parcels exposed to tidal flooding are:

1. Bel Marin Keys, 711 parcels,
2. Santa Venetia, 653 parcels, and
3. Strawberry, 155 parcels.

Paradise Cay, Tamalpais Valley, Waldo Point, and Greenbrae follow. Bel Marin Keys also tops the list of most compromised, with 94 percent of parcels vulnerable to tidal flooding at MHHW. Both Greenbrae and Almonte parcels are around 80 percent compromised, with Santa Venetia, the next most compromised at 40 percent of parcels flooded.

Add a 100-year storm surge, scenario 6, and about 1,000 more parcels could be vulnerable to storm surge impacts. The top three vulnerable communities under storm surge conditions are:

1. Santa Venetia, 821 parcels,
2. Bel Marin Keys, 750 parcels, and
3. Strawberry, 287 parcels.

Kentfield follows with more than 250 flooded parcels as Corte Madera Creek overflows its banks. The top three compromised communities by percent of community are:

1. Almonte, 100 percent,
2. Bel Marin Keys, 99 percent, and
3. Greenbrae, 82 percent of parcels flooded.

Almonte is an essential regional asset and through way to West Marin, Mill Valley, and the Marin Headlands. Bel Marin Keys and Greenbrae are highly sought after residential locations that sustain significant storm exposure.

Table 122. Unincorporated Marin Vulnerable Parcels in the Long-term

Location	Long-term			
	Scenario 5		Scenario 6	
	#	%	#	%
Bel Marin Keys	711	94	750	99
Santa Venetia	653	39	821	49
Strawberry	155	9	287	17
Paradise Cay	103	28	193	52
Tamalpais	94	4	109	4
Waldo Point	75	15	78	15
Greenbrae	70	80	71	82
Black Point	66	8	172	20
Almonte	53	78	69	100
Kentfield	52	2	236	9
California Park	41	15	54	20
North Novato	30	4	53	7
Bayside Acres	23	11	36	17
St. Vincent's	22	32	32	47
Tiburon	18	5	81	24
Country Club	6	1	21	5
San Quentin	1	1	9	11
Marin City			20	4
Point San Pedro			5	50
China Camp			5	45
Total	2,173	15	3,102	22

Source: MarinMap, CoSMoS



Greenbrae Boardwalk. Credit: BYB Consulting LLC

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Buildings

Many parcels contain buildings, especially in Southern Marin. Buildings typically provide the most function and direct benefit to human activities, are costly to repair or replace, and contain valuable personal or business property. The most vulnerable buildings in Unincorporated Marin are those that already exist beyond mean sea level in Waldo Point, Greenbrae, and Black Point. The floating homes in Waldo Point Harbor and elevated homes on piers along Greenbrae Boardwalk may be more adaptable than homes with solid foundations. While not counted as buildings, unauthorized residential boats moored in Richardson's Bay are also vulnerable to dramatic changes in tide and storm surges. The next most vulnerable are development on fill, typically found in Bel Marin Keys, Paradise Cay, Tamalpais, and Santa Venetia.

Near-term: Scenarios 1 & 2

In the near-term, about 200 buildings could be exposed to tidal flooding, primarily in Greenbrae and Waldo Point, where homes are elevated on piers or float over the tide lands, which could also allow them to adapt to flooding. According to CoSMoS and MarinMap, nearly 60 percent of Greenbrae buildings, mostly homes, could be compromised. In addition, several buildings close to the water in Almonte, Paradise Cay, Bel Marin Keys, and Strawberry could also experience tidal flooding.

Under 100-year storm surge conditions, these communities would experience worsening conditions. More than 1,000 additional buildings would now experience storm-surge flooding, if they have not already. These buildings are concentrated in Santa Venetia, with more than 900 flooded buildings, where storm surges would overtop protective levees along Las Gallinas Creek. Santa Venetia is also susceptible to subsidence that is likely to worsen as sea levels rise and infiltrate the soggy soils beneath the development.

By portion of buildings compromised by tidal and storm surge flooding, the top three communities are:

1. Greenbrae, 90 percent,
2. Santa Venetia, 40 percent, and
3. Waldo Point, 25 percent of parcels flooded.

In the near-term, storm surge flooding could have significant impacts in these communities, especially Greenbrae. The communities have weathered these dramatic conditions in the past; however, these

events are likely to increase in severity and frequency.

Table 123. Unincorporated Marin Vulnerable Buildings in the Near-term

Location	Near-term			
	Scenario 1		Scenario 2	
	#	%	#	%
Greenbrae	72	59	112	91
Waldo Point	61	16	89	23
Bel Marin Keys	20	3	118	17
Almonte	7	1	63	7
Strawberry	7	0	58	3
Paradise Cay	4	1	48	16
Uninc. Tiburon	1	0	18	6
Santa Venetia			911	41
Tamalpais			100	3
Black Point			15	1
Country Club			5	1
Bayside Acres			3	1
Point San Pedro			2	2
China Camp			1	9
Total	172	0	1,552	2

Source: MarinMap, CoSMoS

Medium-term: Scenarios 3 & 4

In the medium-term, more than 400 buildings could experience tidal flooding at MHHW. These buildings are concentrated in Bel Marin Keys, Greenbrae, and Waldo Point Harbor, with around 90 buildings each. Fifty buildings in Paradise Cay could also experience tidal flooding. The top three exposed communities in the medium-term are Greenbrae, at 66 percent, Waldo Point, at 23 percent, and Paradise Cay at 17 percent of buildings compromised by tidal flooding. Under storm-surge conditions, the communities with the highest number of flooded building are:

1. Santa Venetia, 945 buildings,
2. Bel Marin Keys, 176 buildings, and
3. Strawberry, 117 buildings.

By portion of flooded buildings within the community, the top three exposed communities are:

1. Greenbrae, 93 percent,
2. Santa Venetia, 42 percent

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3. Paradise Cay, 25 percent.

The elevated homes along Greenbrae Boardwalk have superstructures that sit on piers over the tide lands. They may be more adaptable to than homes on solid foundations.

Table 124. Unincorporated Marin Vulnerable Buildings in the Medium-term

Location	Medium-term			
	Scenario 3		Scenario 4	
	#	%	#	%
Greenbrae	81	66	115	93
Waldo Point	87	23	90	23
Bel Marin Keys	92	13	176	25
Almonte	30	3	84	9
Strawberry	33	2	117	7
Paradise Cay	52	17	80	26
Uninc. Tiburon	13	4	18	6
Santa Venetia	2	0	945	42
Tamalpais Valley	2	0	103	4
Black Point	18	2	30	3
Country Club	6	1	6	1
Bayside Acres	2	1	5	2
Point San Pedro	2	2	4	5
China Camp	1	9	1	9
Kentfield			11	0
Study Area	424	1	1,969	3

Source: MarinMap, CoSMoS

Long-term: Scenarios 5 & 6

In the long-term, nearly 3,000 buildings could be exposed to tidal flooding on the shores of Unincorporated Marin, amounting to 4 percent of the parcels in Unincorporated Marin. The top three tidally flooded communities by number of buildings are:

1. Santa Venetia, 982 buildings,
2. Bel Marin Key, 683 buildings, and
3. Strawberry, 185 buildings.

By proportion, the top three vulnerable water oriented communities are:

1. Greenbrae, 97 percent,
2. Bel Marin Key, 96 percent, and
3. Paradise Cay, 51 percent of buildings.

With the additional 110-year storm surge, 1,000 more buildings, for about 5 percent of buildings in the unincorporated portion of the study area, could be damaged by flooding.

Table 125. Unincorporated Marin Vulnerable Buildings in the Long-term

Location	Long-term			
	Scenario 5		Scenario 6	
	#	%	#	%
Greenbrae	119	97	120	98
Waldo Point	90	23	386	100
Bel Marin Keys	683	96	707	99
Almonte	86	9	106	11
Strawberry	185	11	264	15
Paradise Cay	157	51	219	71
Tiburon	17	6	23	7
Santa Venetia	982	44	1,142	51
Tamalpais Valley	98	3	103	4
Black Point	65	6	89	8
Country Club	18	4	21	4
Bayside Acres	5	2	6	3
Point San Pedro	21	24	25	2
China Camp	1	9	1	9
Kentfield	79	3	247	8
St. Vincent's	10	11	16	18
San Quentin	10	3	32	9
California Park	10	5	13	6
Marin City	1	0	38	9
Study Area	2,856	4	3,826	5

Source: MarinMap, CoSMoS

The top three storm surge flooded communities by number of buildings are:

1. Santa Venetia, 1,142 buildings,
2. Bel Marin Key, 683 buildings, and
3. Waldo Point, 306 buildings.

By proportion, the top three vulnerable communities with the greatest portion of vulnerable buildings are:

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1. Waldo Point, 100 percent
2. Bel Marin Key, 99 percent, and
3. Greenbrae, 98 percent of buildings.

By scenario 6, 60 inches of sea level rise and a 100-year storm surge, entire communities could be left in recovery, or at worst retreat.

The following sections provide area specific details related to buildings in each incorporated community starting in Southern Marin and traveling north. Southern Marin, with the exception of Santa Venetia, is more vulnerable in the near- and medium-term.

Marin City

The Marin City shopping center could face storm impacts in the long-term and some minor flooding could impact the current Ross building. Buildings beyond the shopping center, including apartments and Martin Luther King Academy, could also experience impacts during a 100-year storm.

Waldo Point Harbor

Every building and houseboat in Waldo Point Harbor could anticipate impacts from sea level rise and a 100-year storm surge. The houseboats and marina facilities could flood over seven feet in the medium-term and nearly eleven feet at MHHW. The businesses at the US Highway 101 on ramp could anticipate over two feet of flooding.

Floating homes made of wood are the primary housing type and building type in the community. The few land based commercial buildings are wooden structures. Development is divided into two areas, Waldo Point Harbor and Richardson Bay Marina. In total, about 450 houseboats and 800 to 900 people live here. Many of the houseboats are held to pylons with u-locks that could float off the top of the pier if the tide is high enough. Others are tied with ropes that have their limits or could hold the home under water as the tides rise. Roughly twenty buildings, known as arcs, are the most vulnerable because they are attached to the ground and do not fluctuate with the tides. In addition, many front entrances to the homes are on the lower level with finger docks that go down or up to the water, depending on the tide. If the tide is too high, the finger docks may become unsafely slanted, or even flooded at one end or the other. These ramps are already relatively steep at king tides according to the Richardson Bay Floating Homes Association. Finally, the parking and access areas could be flooded and are already prone to continuous subsidence.

At the marina, ten percent of the slips can be used for residential purposes. Additionally, live aboards, or unauthorized boats anchored in the waters of Richardson Bay one or more persons may live on, are highly vulnerable to storms and higher tides. According to the Richardson Bay Floating Homes Association, about 240 unauthorized boats are in the Bay as residences, though some may be junk boats without residents. The marina office is highly vulnerable on Gate 6 Road, which is vulnerable to subsidence. The businesses off the entrance to US Highway 101 northbound could be vulnerable to over two feet of tidewaters. By the long-term scenario, if the docking systems, land base, and homes are not able to adjust, the entire building stock could be lost.

Almonte, Tamalpais Valley

Housing at risk is in the low-lying area off Coyote Creek where it meets Bothin Marsh. These homes are protected by earthen berms or levees and pump stations for stormwater that stave off current high tides. However, with a combination of stormwater, storm surge, and high tide the area can flood. Sea level rise could exacerbate this in the near-term. Storm surges in the medium-term could impact 100 properties. By the medium-term, a couple of properties could anticipate tidal MHHW flooding. In the long-term, nearly 100 properties could anticipate tidal impacts at MHHW. These properties are a relatively small portion of the housing stock in the community.

Strawberry

Vulnerable properties in Strawberry are concentrated in low lying pockets along the steep shoreline. In the near-term, these include the commercial properties along Seminary Marsh, residential properties along Greenwood Cove.

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Richardson Bay Marina, East Pier 6 looking to the west pier. Waldo Point Harbor. April 2016. Credit: BVB Consulting LLC



View of pathway and tidal zone of Coyote Creek. Tamalpais Valley. Feb. 2016. Credit: Marin County DPW



Vulnerable homes bordering Greenwood Cove. Feb. 18, 2016. Credit: Marin County DPW.



Paradise Cay Aerial View. Credit: Unknown

The Westminster Presbyterian Church, preschool, and emergency shelter is located here and could be impacted near the end of the century. Strawberry Circle could anticipate storm impacts in the near-term and tidal flooding in the long-term. A few homes along Seminary Drive could be vulnerable to sea level rise in the long-term. The Strawberry Village Shopping Center could be vulnerable by scenario 6, along with homes along Harbor Point.

All of the commercial properties in Strawberry could anticipate impacts including retail, restaurants, a gas station, and others along Seminary Marsh and the Strawberry Village Shopping Center. The vulnerable residential parcels make up a small portion of all the residential parcels in the community. Properties on the bluff edge may also be subject to increases in erosion and could face bluff collapse.

Unincorporated Tiburon and Paradise Cay

While properties are impacted in unincorporated Tiburon, most are not directly impacted. A few homes could be impacted nearing Paradise Cay. Beaches, docks, and bluff stability could be of concern however for several properties.

Paradise Cay is quite the contrary. This community rests mostly on the shore and into San Pablo Bay. Paradise Cay, much like Waldo Point Harbor, could be completely lost to sea level rise with more than 70 percent of the parcels compromised by MHHW tidal flooding in the long-term. Storm surges could do significant damage before sea level rise takes full effect, especially considering the storm impacts on erosion and subsidence. These parcels and buildings are all south east of Paradise Drive. The buildings across the road are safe under the BayWAVE scenarios.

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Greenbrae

Greenbrae low lands could be vulnerable. The Greenbrae Boardwalk is in the tidal zone east of US Highway 101 and along Corte Madera Creek west of 101. The eastern portion is slightly more vulnerable than the western portion, with every building exposed in the near-term. In the near-term on the northern side, nearly every home is exposed to a 100-year storm surge. Pylons that extend deep into the bay mud typically support these homes and elevate them above the marsh, which can make them more adaptable. This portion of the community may be lost in the long-term. The land flanking US Highway 101 is also vulnerable. Marin RV Park is located here along with a few businesses and a gas station.

Kentfield

Kentfield is located north east of Larkspur up Corte Madera Creek. The majority of the buildings including, Kent Middle School, Bacich Elementary School and College of Marin, could be vulnerable in scenario 6. A few buildings along McAllister's Slough could be vulnerable to a 100-year storm surge by scenario 4. Many of the homes here and lining Beren's Slough could be vulnerable to sea level rise alone in the long-term. Nevertheless, this community is vulnerable to stormwater flooding, and when combined with the BayWAVE scenarios, the combined flooding could be damaging sooner.

California Park

Ten parcels in California Park could be vulnerable to sea level rise by scenario 5, and 13 with the additional 100-year storm surge. Very little of this hillside community is impacted directly.

Bayside Acres and County Club

Bayside Acres and Country Club are two small communities along Pt. San Pedro Road, each bordered by San Rafael on three sides and bay water on the remaining side. These communities are primarily residential. In addition to residential, Country Club features Lowrie Yacht Harbor, a commercial enterprise. In the near-term, Country Club properties along the bay could experience sea level rise impacts. Ten or so more properties could be vulnerable to long-term sea levels between Pt. San Pedro Road and the Marin Yacht Club. Bayside Acres could anticipate a few buildings closest to the water vulnerable in the medium- and long-terms.

Point San Pedro

Point San Pedro features McNear's Beach Park. In the long-term, scenario 6, a 100-year storm surge could reach the clubhouse, pool, and fronting lawn. The larger bay front lawn that leads to the McNear's Beach Pier will be slowly compromised by the tide between the medium and long-terms. By scenario 5, this area would shrink by about half. To learn more about this facility see the recreation section of this profile or the Recreation Profile.

Santa Venetia

The vulnerable area of Santa Venetia is primarily residential. A few small commercial parcels are impacted along Pt. San Pedro Road, as is Gallinas Landing. Every building and property east of N. San



Santa Venetia during a major flood. Credit: Marin County DPW

Pedro Road is vulnerable to storm surge waters by scenario 2, and sea level rise alone between the medium-term and the long-term. This may be possible around three feet of sea level rise when the levees protecting the existing housing could be overtopped by tidal waters. By scenario 6, more than 900 homes could be impacted. The homes and business just west of North San Pedro Road could be vulnerable in scenario 6.

St. Vincent's

St. Vincent's is home to St. Vincent's private school, Silveira Ranch grazing lands, and sanitary district lands that are also leased for grazing. These open lands are often wet during storms and high tides seasonally. The school and farm buildings are not vulnerable to salt water under the BayWAVE scenarios. To learn more about this area, see the utilities and agricultural sections of this Profile.

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Bel Marin Keys

Bel Marin Keys is a managed community that interfaces with tidewater held at bay by a large levee system on the affronting state public lands, and local protections including tide gates that manage the flow water into and out of the manmade lagoons. The model treats the lagoons as a continuous tidal system and does not account for lagoon engineering and management. Because of this, the model may overestimate flooding depths and extents in the near- and medium-terms. In the long term, especially with a storm surge, it is possible the tide gates and levees buffering the community from tidal influx could be overwhelmed.



Low lying properties in Black Point. Credit: Marin County CDA

Black Point and Green Point

Black Point's vulnerable parcels are concentrated along the inland marshes near State Route 37 and in the small commercial area on Atherton Drive. The low-lying homes in the marshes off Hunter's Club Road could be vulnerable to sea level rise in the medium-term. While several hillside parcels could be vulnerable to erosion, much of the buildings are perched on the bluffs out of the potential tidal flow. Some of the shoreline buildings have docks and piers that could be damaged in storms and may need to be adjusted to not flood during average high tides in the near-term.

Green Point does not have many vulnerable parcels. Those that are situated around the marshes could be vulnerable in the long-term to sea level rise and a 100-year storm surge. Only a few could be impacted by sea level rise alone in the same time period.

North Novato

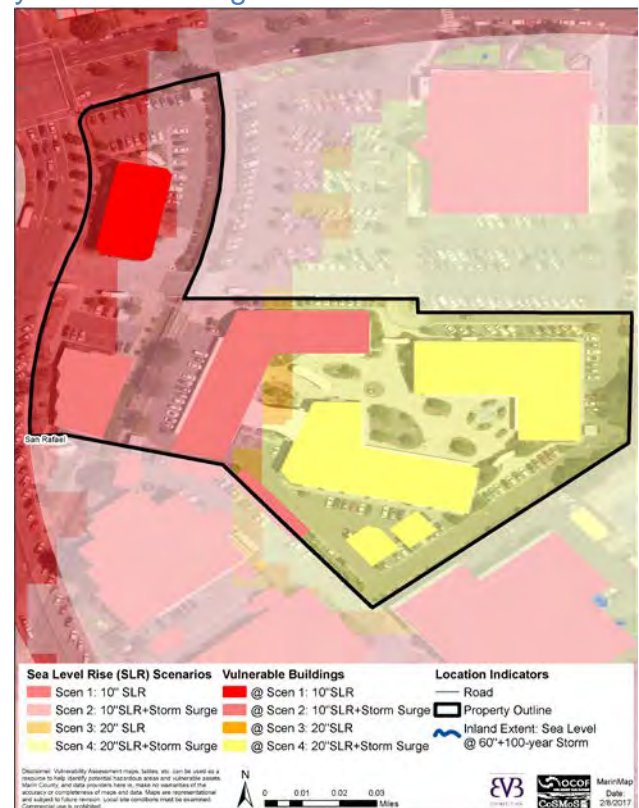
Several undeveloped shoreline parcels could be vulnerable to sea level rise in the near-term. In the

long-term, water can reach to the Marin County Airport at Gross Field, and beyond US Highway 101 impacting a few business at the airport and along Binford Road.

County Owned Facilities

While technically in San Rafael, the Marin County Exhibition Hall and parking lot area vulnerable to a 100-year storm surge. In addition, McInnis Park could anticipate tidal and storm surge waters engulf the creek side athletic fields and park entrance. The Marin County Health Innovation Campus is also in San Rafael in the highly vulnerable Canal District.

Map 1. Health Innovation Campus is Vulnerable to Sea Level Rise and a 100-year Storm Surge



In the near-term, access to the site could be an issue, and the buildings facing Kerner Boulevard could impact with a storm surge in the near-term and sea level rise in the long-term. The rear two buildings could be vulnerable to a storm surge in scenario 4 and sea level rise in scenario 5.

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In addition, the county owns or holds several easements for utility equipment, such as stormwater pump stations that could also anticipate tidal flooding. Finally, several other county parks could be vulnerable, though they do not have vulnerable buildings and are discussed in the recreation section of this profile.

The maps on the following pages illustrate vulnerable buildings. The areas in the call out circles enable the reader to see areas that are difficult to see on the large scale map. The circles do not indicate that these areas are more vulnerable than others along the shoreline.

Map 114. Southern Unincorporated Marin Vulnerable Buildings

Vulnerable Assets

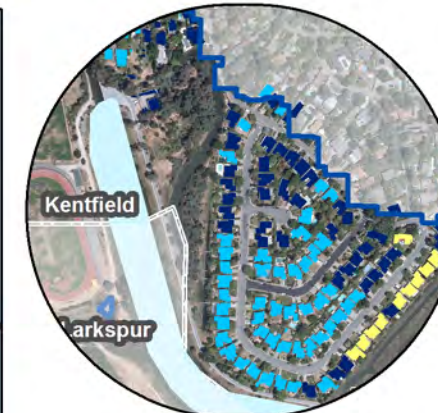
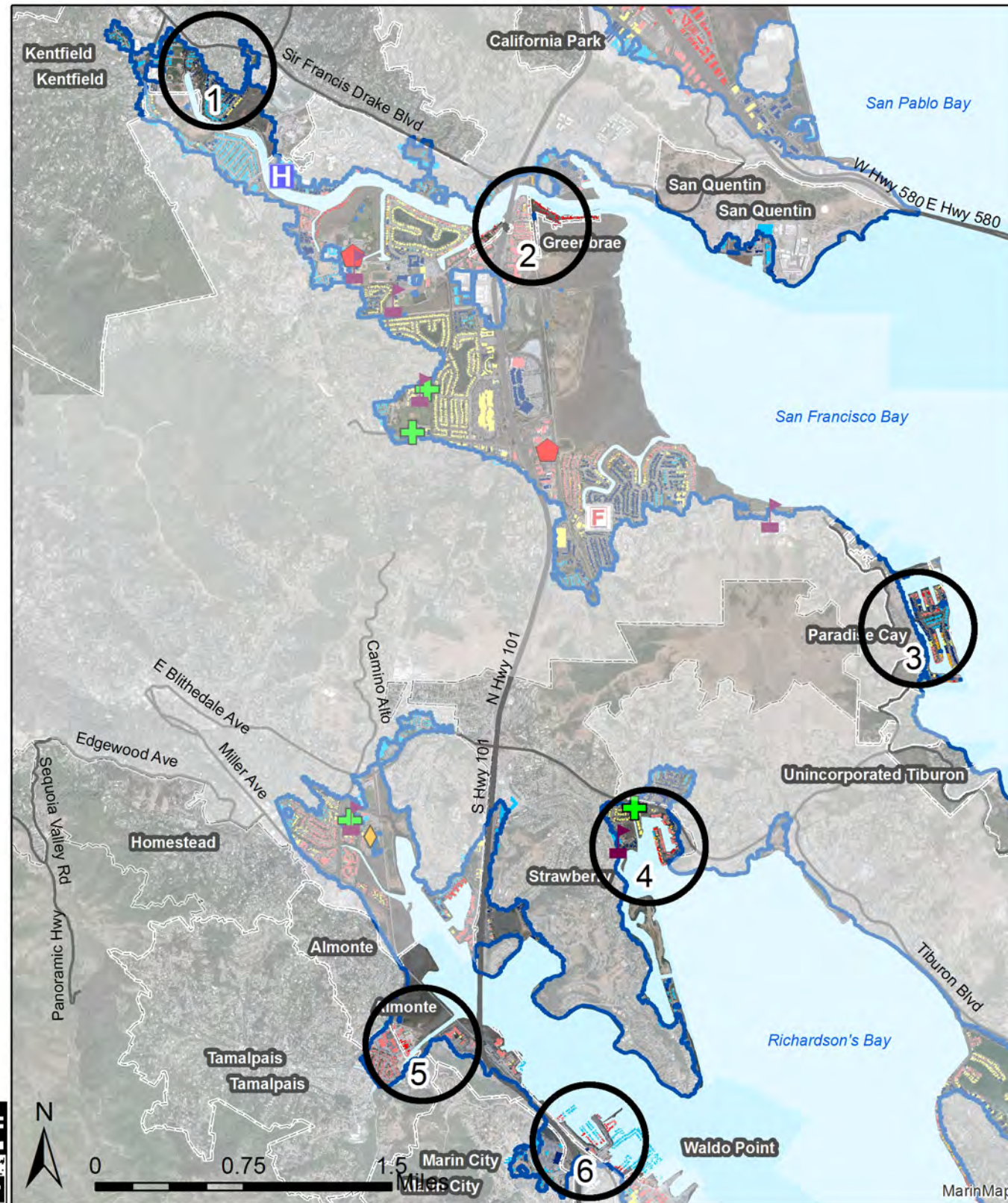
- School
- Fire Station
- Emergency Shelter
- Law Enforcement
- Medical Facility
- District Office

Vulnerable Buildings

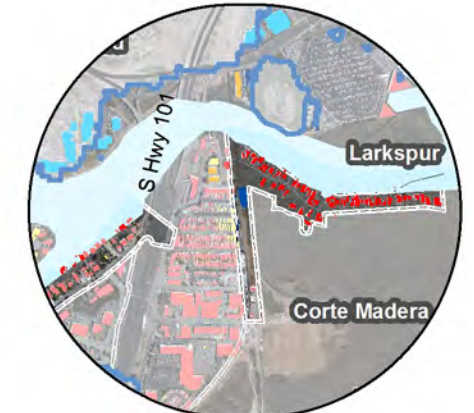
- Scen. 1: 10" Sea Level Rise (SLR)
- Scen. 2: 10" SLR+Storm Surge
- Scen. 3: 20" Sea Level Rise
- Scen. 4: 20"SLR+Storm Surge
- Scen 5: 60" Sea Level Rise
- Scen. 6: 60"SLR+Storm Surge

Location Indicators

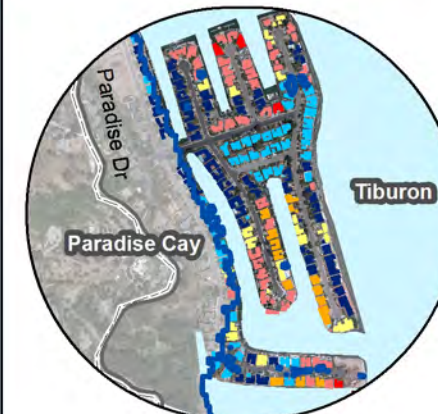
- Unincorporated
- Municipality
- Road
- Bay
- Inland Extent: Sea Level @ 60"+100-year Storm



1: Kentfield



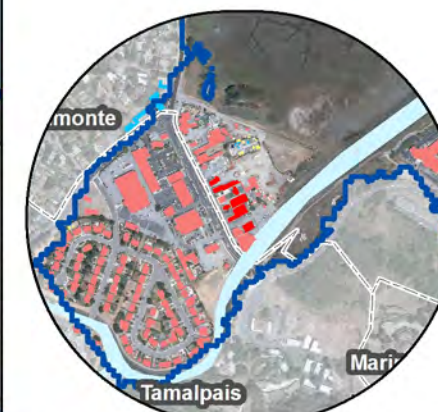
2: Greenbrae



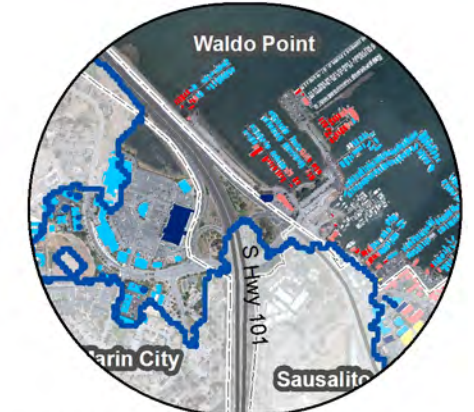
3: Paradise Cay



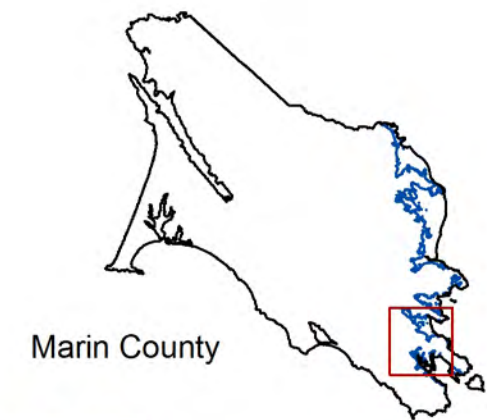
4: Strawberry



5: Tamalpais Valley/Almonte



6: Marin City/Waldo Pt. Harbor



Date: 6/15/2017



Disclaimer: Vulnerability Assessment maps, tables, etc. can be used as a resource to help identify potential hazardous areas and vulnerable assets. Marin County, and data providers here in, make no warranties of the accuracy or completeness of maps and data. Maps are representational and subject to future revision. Local site conditions must be examined. Commercial use is prohibited.

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Map 115. Northern Unincorporated Marin Vulnerable Buildings

Vulnerable Assets

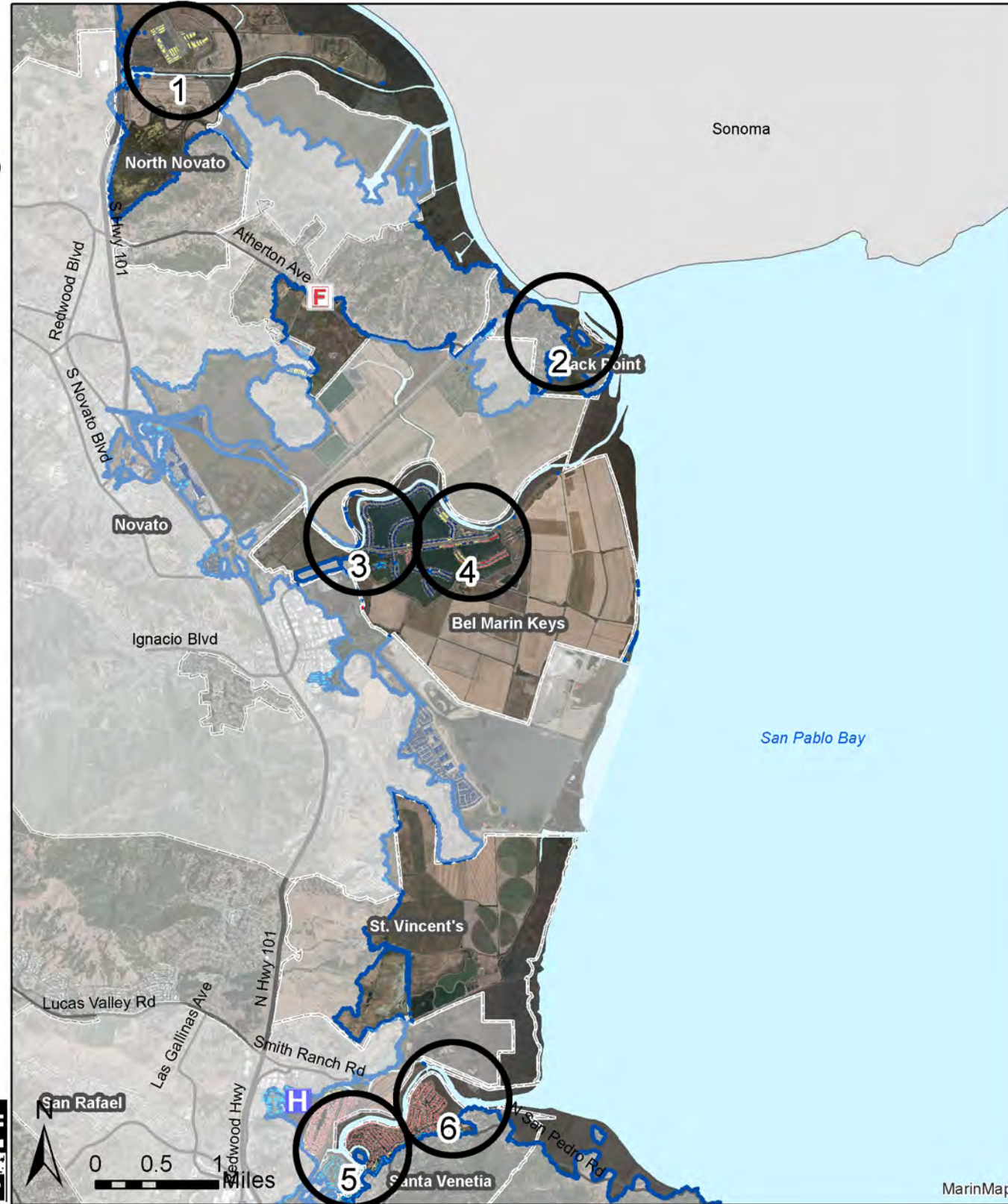
- F** Fire Station
- H** Medical Facility

Vulnerable Buildings

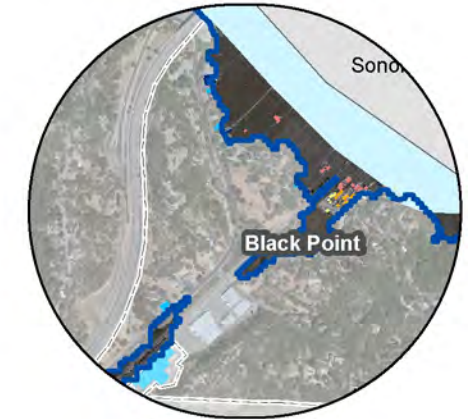
- Scen. 1: 10" Sea Level Rise (SLR)
- Scen. 2: 10" SLR+Storm Surge
- Scen. 3: 20" Sea Level Rise
- Scen. 4: 20"SLR+Storm Surge
- Scen 5: 60" Sea Level Rise
- Scen. 6: 60"SLR+Storm Surge

Location Indicators

- Unincorporated
- Municipality
- Road
- Bay
- Inland Extent: Sea Level @ 60"+100-year Storm



1: Gross Field Airport



2: Black Point



3: Western Bel Marin Keys



4: Eastern Bel Marin Keys

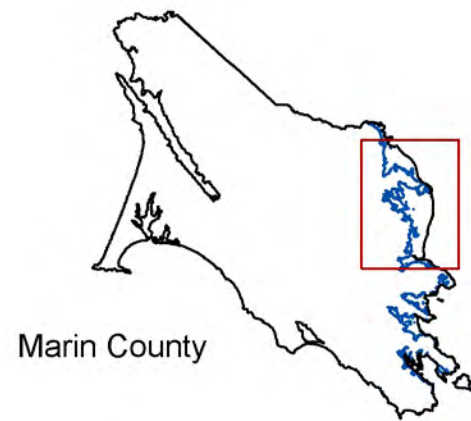


5: Western Santa Venetia



6: Eastern Santa Venetia

Disclaimer: Vulnerability Assessment maps, tables, etc. can be used as a resource to help identify potential hazardous areas and vulnerable assets. Marin County, and data providers here in, make no warranties of the accuracy or completeness of maps and data. Maps are representational and subject to future revision. Local site conditions must be examined. Commercial use is prohibited.



Marin County



Date: 4/1/2017



MarinMap

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Collectively, all of the communities could anticipate 3,000 parcels with nearly 4,000 buildings vulnerable to sea level rise. This is about one quarter of the parcels and one third of the buildings impacted in the study area. In the long-term, fifteen percent of the parcels and five percent of the buildings in unincorporated Marin could be compromised. [Table 125](#) summarizes the number of buildings impacted in each community across the BayWAVE scenarios.

While a very small portion of the vulnerable properties are commercial, a majority of the commercial properties in the study area in the County of Marin could be vulnerable to sea level rise and nearly all could be vulnerable under scenario 6 parameters. Within the study area, the Santa Venetia and Kentfield may hold the last available commercial parcels in the study area.

Taking a closer look at the buildings across the unincorporated Marin communities, the majority of buildings could experience up to three feet of tidal flooding across scenarios 1, 2, and 3 with roughly 100, 250, and 1,200 buildings respectively. In scenario 1, almost 20 buildings could anticipate more than three feet to six feet of flooding. In scenario 3, nearly 75 buildings could anticipate tidal impacts between three feet to six feet of flooding, and nearly 100 could anticipate depths more than six feet up to 10 feet. By scenario 5, nearly 1,300 buildings could anticipate tidal impacts between three feet to six feet of flooding, nearly 250 could anticipate depths more than six feet up to 10 feet, and 80 could experience depths beyond 10 feet. These figures are available in [Table 126](#). Appendix B provides this table for each unincorporated community.

[Table 127](#) estimates damage costs using FEMA tagging designations for buildings and their contents. If every vulnerable building is destroyed under scenario 6 conditions \$945 million in assessed structural value could be lost. At minor levels of damage, up to \$65 million in damages could occur across the unincorporated area in the study area.²¹²

Amongst the communities, Strawberry could expect the greatest loss in assessed structural value, followed by Bel Marin Keys and Santa Venetia. At yellow tag levels of damage, minor damage, because of the number of buildings impacted, Santa Venetia could expect the most substantial losses of

\$5 to 19 million.²¹³ Bel Marin Keys follows with \$3.5 million to \$12 million in damages. Waldo Point Harbor is third, with nearly \$2 million to \$6.5 million in potential damages at the minor level.²¹⁴

Table 126. Unincorporated Marin Vulnerable Buildings by Flood Depth at MHHW

Flood Depth (feet)	Scenarios		
	Near-term	Medium-term	Long-term
	1	3	5
0.1-1	34	111	266
1.1-2	23	102	492
2.1-3	56	44	422
3.1-4	13	50	615
4.1-5	3	9	576
5.1-6	4	14	175
6.1-7	1	36	58
7.1-8	1	48	37
8.1-9	1	16	118
9.1-10		1	41
10.1+			81

Source: MarinMap, CoSMoS



Manzanita Area during king tide. Nov. 25, 2015. 10:40 a.m.

²¹² 2016 dollars

²¹³ 2016 dollars

²¹⁴ 2016 dollars

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Table 127. Unincorporated Vulnerable Buildings FEMA HAZUS Storm Damage Cost* Estimates in Long-term Scenario 6

Location	Yellow Tag: Minor Damage \$5,000/building minimum	Orange Tag: Moderate Damage \$17,001/building minimum	Red Tag: Destroyed Assessed structural value
Almonte	\$530,000	\$1,802,106	\$37,738,121
Bayside Acres	\$30,000	\$102,006	\$5,340,362
Bel Marin Keys	\$3,535,000	\$12,019,707	\$188,722,172
Black Point	\$445,000	\$1,513,089	\$15,807,484
California Park	\$65,000	\$221,013	\$1,508,352
Country Club	\$105,000	\$357,021	\$6,311,404
Greenbrae	\$600,000	\$2,040,120	\$8,836,871
Kentfield	\$1,235,000	\$4,199,247	\$99,778,853
Marin City	\$190,000	\$646,038	\$24,685,548
North Novato	\$1,340,000	\$4,556,268	\$7,911,796
Paradise Cay	\$1,095,000	\$3,723,219	\$123,268,429
Point San Pedro	\$125,000	\$425,025	\$33,137
San Quentin	\$160,000	\$544,032	\$689,013
Santa Venetia	\$5,710,000	\$19,415,142	\$124,787,181
St. Vincent's	\$80,000	\$272,016	\$4,477,392
Strawberry	\$1,320,000	\$4,488,264	\$214,941,911
Tamalpais	\$515,000	\$1,751,103	\$22,654,207
Tiburon	\$115,000	\$391,023	\$36,868,808
Waldo Point	\$1,930,000	\$6,562,386	\$21,056,654
Total	\$19,125,000	\$65,028,825	\$945,417,695

Source: MarinMap, CoSMoS

* 2016 dollars

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Transportation

Transportation impacts could be the main issue in several communities, where shut downs and detours, if possible, would impact many more people than properties. In addition to over land flooding that could damage the road surface, roads could be vulnerable to erosion and subsidence. Several locations already experience seasonal flooding, such as Manzanita, that prompt several-hour traffic delays. These events could increase in frequency and intensity, potentially to unmanageable and unbearable chronic flooding. The most vulnerable high capacity roads in the unincorporated communities are:

- Shoreline Highway from the Manzanita Park and Ride to Tam Junction in Almonte and Tamalpais Valley,
- US Highway 101 in Strawberry, Greenbrae, and US-101 and State Route 37 in Black Point and North Novato,
- Tiburon Boulevard at the Cove Shopping Center bordering Strawberry,
- Redwood Highway in Greenbrae,
- Bel Marin Keys Boulevard,
- Atherton Avenue in Black Point, and
- N. San Pedro Road in Santa Venetia.

Table 128 shows the cumulative lengths of all the roads and trails vulnerable in each community. The table also annotates who is responsible for the roadway. In several cases, responsibility for a road may be divided amongst several governments that will need to work together when making improvements and adjustments for higher floodwaters. Examples include Point San Pedro Road, Paradise Drive, and Sir Francis Drake Boulevard. In addition, several streets are privately maintained and could necessitate action by homeowner's associations or individual property owners. The property owners would likely need to work in cooperation with the public street improvement the private street connects to. The annotations are as follows:

M = Marin County
C = State of California
L = Local Municipality
P = Private

Overall, up to three miles, mostly under the purview of Caltrans, could be vulnerable in the near-term. In scenario 2, the 100-year storm surge could impact twelve more local roads, especially in Santa Venetia,

Strawberry, Tamalpais Valley, and Almonte. By scenario 3, all of the roads in the previous scenario could expect tidal impacts though at a lesser extent of 7.4 miles. Scenario 4 adds a few more roads to the list and floods more of the already vulnerable roads to reach 24 miles of road impacted by 20 inches of sea level rise and a seasonal 100-year storm surge. By scenario 5, 5 feet of sea level rise, nearly 18 miles could expect tidal flooding, including those in scenarios 1-4, additional streets in Strawberry, and the first roads that could be impacted in Marin City. By scenario 6, an additional 12.5 miles could be compromised by nuisance, or temporary, flooding.

Marin City

Marin City could experience impacts to overland flooding from sea level rise on Highway 101, Donohue Street, and Drake Avenue at the off ramp from 101 south extending into the community. When these roads flood from stormwater and high tides seasonally, it can create extensive traffic backups along 101, and eliminates all vehicular access to and from Marin City. In addition, US Highway 101 already suffers from subsidence. This is evident by two large bumps from the sanitary sewerage pipes crossing underneath. According to Sanitary District engineers, the highway is sinking around the pipes. Disruptions in this system could also greatly impact essential transit service.



Stormwater Pond in Marin City. US Highway 101 is behind.
Credit: Marin County DPW

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Table 128. Unincorporated Marin Roads Vulnerable to Sea Level Rise and a 100-year Storm Surge

	Near-term		Medium-term		Long-term	
	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
	3 miles	15 miles	7 miles	24 miles	18 miles	30 miles
Almonte		Hwy 101 ^C Bolin St ^M Pohono St ^M Shoreline Hwy ^C		Roads in scenario 2	Roads in scenarios 2 & 4 Almonte Blvd ^M	Roads in scenarios 2, 4 & 5 Helen Ave ^M
Bayside Acres				Beach Dr ^M	Beach Dr ^M	Beach Dr ^M
Bel Marin Keys	Bel Marin Keys Blvd ^M	Roads in scenario 1 Bahama Reef ^M Del Oro Lagoon ^M	Roads in scenario 1	Roads in scenarios 1-3	Roads in scenarios 1-4 Bermuda Harbour ^M Calypso Shores ^M Caribe Isle ^M Cavalla Cay ^M Dolphin Isle ^M Montego Key ^M	Roads in scenarios 1-5
Black Point				Atherton Ave ^M Bachelors Rd ^P Bayview St ^P Beattie Ave ^P Bucks Landing Rd ^C Cavallero Ct ^P Channel Dr ^P Days Island Rd ^P Holly Ave ^P Norton Ave ^P Olive Ave ^M School Rd ^M	Roads in scenario 4 Glen Rd ^P Harbor Dr ^P Hunters Club Rd ^P Tamarin Ln ^P	Roads in scenarios 4 & 5
California Park					Auburn St ^M Woodland Ave ^M	Roads in scenario 5
China Camp		N San Pedro Rd ^M		Roads in scenario 2	Roads in scenarios 2 & 4	Roads in scenarios 2, 4, & 5
Country Club		Harbor View Ct ^M		Roads in scenario 2	Roads in scenarios 2 & 4	Roads in scenarios 2, 4, & 5 Pt. San Pedro Rd ^M Summit Ave ^M
Greenbrae	Greenbrae Boardwalk ^P	Hwy 101 ^C Lucky Dr ^M		Roads in scenario 2	Roads in scenarios 2 & 4	Roads in scenarios 2, 4, & 5

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	Near-term		Medium-term		Long-term	
	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Kentfield				Berens Dr ^M Lilac Ave ^M McAllister Ave ^M	Roads in scenario 4 Lancaster Ave ^M Sherwood Ct ^M Stadium Wy ^P	Roads in scenarios 4 & 5 Acacia Ave ^M Bon Air Rd ^M College Ave ^M Hillside Ave ^M Kent Ave ^M Laurel Grove Ave ^M Sir Francis Drake Blvd ^M
Country Club						Pt. San Pedro Rd ^{M,L}
Marin City					Hwy 101 ^C Donahue St ^M Drake Ave ^M	Roads in scenario 5 Terners Dr ^M
North Novato	Hwy 37 ^C	Roads in scenario 1	Roads in scenarios 1 & 2	Roads in scenarios 1-3 Airport Rd ^M Binford Rd ^M	Roads in scenarios 1-4 Hwy 101 ^C	Roads in scenarios 1-5
Paradise Cay		St. Lucia Place ^M		Roads in scenario 2 Jamaica St ^M Paradise Cay Marina ^P St Thomas Wy ^M	Roads in scenarios 2 & 4 Martinique Ave ^M	Roads in scenarios 2, 4, & 5 Saba Ln ^M Trinidad Dr ^M
Pt. San Pedro		McNear Brickyard Rd ^P McNears Rd ^P		Roads in scenario 2 Pt. San Pedro Rd ^M		
San Quentin	Hwy 580 ^C	Roads in scenario 1	Roads in scenarios 1 & 2	Roads in scenarios 1-3	Roads in scenarios 1-4 Levee Rd ^P	Roads in scenarios 1-5 Waterfront Rd ^P

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	Near-term		Medium-term		Long-term	
	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Santa Venetia		N San Pedro Rd ^M Adrian Wy ^M Ash Wy ^M Birch Wy ^M Descanso Wy ^M Estancia Wy ^M Galerita Wy ^M Geneva Wy ^M Hacienda Wy ^M Hawthorn Wy ^M La Pasada ^M La Playa Wy ^M LaBrea Wy ^M Mabry Wy ^M Meadow Dr ^M Palmera Wy ^M Rafael Wy ^M Rosal Wy ^M Vendola Dr ^M		Roads in scenario 2 Rincon Wy ^M	Roads in scenarios 2 & 4	Roads in scenarios 2, 4, & 5 Edward Ave ^M Lowell Ave ^M Mark Twain Ave ^M Steven Wy ^M Whittier Ave ^M
Strawberry	Hwy 101 ^C	Roads in scenario 1 Barbaree Way ^M Channel Lndg ^P Greenwood Bay Dr ^P Greenwood Cove Dr ^M Redwood Hwy Frontage Rd ^M Salt Lndg ^M Seminary Dr ^M	Roads in scenarios 1 & 2	Roads in scenarios 1 & 2 De Silva Island Dr ^P E Strawberry Dr ^M Strawberry Cir ^M	Roads in scenarios 2 & 4 Belvedere Dr ^M Captains Lndg ^M Harbor Cove Way ^M Ricardo Rd ^M Seadrift Lndg ^M Tiburon Blvd (CA 131) ^C Villa Laguna ^P	Roads in scenarios 1-5 Heron Dr ^M Strawberry Lndg ^P Strawberry Village ^P Weatherly Dr ^M
Tamalpais		Shoreline Hwy ^C Tennessee Valley Rd ^M Almonte Blvd ^M Cardinal Ct ^M Cardinal Rd ^M Flamingo Rd ^M		Roads in scenario 2	Roads in scenario 2	Roads in scenarios 2 & 5 Gibson Ave ^M
Waldo Point	Gate 6 Dock ^P Gate 6 Rd ^M	Gate 6 1/2 Rd ^P Liberty Dock ^P	Roads in scenarios 1 & 2	Roads in scenarios 1-3 Shoreline Hwy ^C Bolinas St ^M	Roads in scenarios 1-4	Roads in scenarios 1-5 Main Dock ^P

Source: MarinMap, CoSMoS

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Shoreline Highway, Tam Junction, Almonte. King tide, Nov. 24, 2015. Credit: Marin County CDA

Waldo Point Harbor

Waldo Point Harbor is one of the first communities to experience local road impacts. Gate 6 Road, maintained by Marin County, and Gate 6 Dock, maintained privately, are vulnerable in near-term scenario 1. In addition, parking areas for residents and marina users could also be compromised here. Waldo Point Harbor recently completed a project elevating the parking area four feet to account for subsidence and erosion. Gate 6½ Road could expect storm surge flooding by scenario 2, and tidal flooding by scenario 3, preventing residents from reach their house boats. In addition, the entrance to Waldo Point Harbor at US Highway 101 and Bridgeway, could flood tidally in the long-term, and be compromised by sea level rise and a 100-year storm surge seasonally in the medium-term. Finally, the marina and harbor facilities, including Liberty Dock and Main Dock, could be vulnerable to storm surge damage and high tides that reach beyond the pylons of the facility in the near-term.

Almonte & Tamalpais Valley

Nuisance flooding already burdens Almonte and Tamalpais Valley multiple times a year. Two major interchanges, commonly known as Tam Junction and Manzanita, are the gateway to Muir Woods, the Marin Headlands, and Mill Valley, where US Highway 101, Shoreline Highway, and Miller Avenue come together. Shoreline Highway at the US Highway 101 off ramp already suffers seasonal flooding and could expect tidal flooding of up to two feet in the medium-term. The Manzanita interchange is undergoing engineering studies to better manage the storm and tidewaters that prevent traffic flow for commuters, transit riders, visitors, and locals. Tam Junction could expect tidal flooding in the long-term. Nearer Coyote Creek, Shoreline Highway could expect flooding in the medium-term. Neighborhood roads vulnerable border Coyote Creek, and could expect tidal flooding impacts if the creek tops its banks. Of note, school aged children not be able to get to school via Miller Avenue, which floods now seasonally, and could expect tidal impacts in the medium-term.

Transit also travels through area. In fact, the Manzanita park and ride lot serves as a transit hub for commuters that park their cars under the freeway overpass. Golden Gate Transit, Marin Transit, the Marin Airporter, Sonoma Airport Shuttle, private company employee buses, such as Genentech, and others pick-up commuters from the Manzanita site. The lot already experiences flooding during seasonal high tides and storm event combinations. By long-term scenario 5, the lot could be vulnerable to high levels of flooding multiple times a month several months of the year. Transit also travels through Tam Junction. The shuttle and parking area for taking visitors to West Marin is based in the vulnerable area as well.

Hundreds of bicyclists take on Shoreline Highway and use the Mill Valley/Sausalito Pathway, and each could be tidally flooded by the medium-term. Additionally, the walking path along Coyote Creek that is part of the Bay Trail on top of the levees protecting lower Tamalpais Valley is vulnerable.

Strawberry

In the near-term, US Highway 101 off ramps here could expect tidal impacts. This area already floods seasonally. With respect to local roads, Strawberry may avoid tidal impacts until the long-term, and could expect storm surge flooding along Seminary Drive, the Frontage Road, and smaller streets in

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Greenwood Cove in the near-term, and De Silva Island Dr., Strawberry Drive, and Strawberry Circle. By the long-term, Seminary Drive could expect more than 3½ feet of water at MHHW, and Redwood Highway Frontage Road could expect nearly five feet of tidal flooding at MHHW. In addition, private docks and piers could expect storm damage and flooding in the near-term.

Transit routes are also vulnerable along these roads. The MT and GGT stops that could be flooded out at high tide and/or with a 100-year storm surge are:

- Redwood Highway Frontage Rd. & Belvedere,
- Strawberry Frontage Rd. & US 101 North on-Ramp,
- 598 Redwood Highway Frontage Rd.,
- Redwood Frontage Rd. at Seminary Dr., and
- Seminary Dr. Bus Pad South Bound.

Unincorporated Tiburon & Paradise Cay

The roads in lower Paradise Cay are vulnerable to seasonal flooding and continuous subsidence. These influences are anticipated to get worse in the near-term. However, the roads are with the housing tracks and the buildings protect the roads from flooding until the long-term, except St. Lucia Place, which could expect medium-term tidal impacts at the end of the cul-de-sac. Residents in these communities could also be burdened by breakdowns in the Tiburon and Corte Madera road networks because they must travel through them to reach their community.

Kentfield

Much like with buildings, roads are primarily impacted in scenario 6. Roads in the Berens and McAllister Slough areas may be subject to flooding by scenario 2, and could likely suffer tidal impacts in the medium- to long-terms. This could also impact transit services and the stop at College Avenue and Kent Avenue.

Greenbrae

Greenbrae is vulnerable in the near-term, as is the US Highway 101 off Ramp to Sir Frances Drake Blvd. If the boardwalk is vulnerable people may not be able to safely access or leave their homes. The boardwalk is the only accessible by foot. The parking area could also experience tidal flooding in the medium-term. The remaining neighborhood

could expect storm surge impacts, including Lucky Drive west of the freeway. Shoreline trails here and a bus stop at the freeway off ramp are also vulnerable. Bus stops include:

- Sir Francis Drake Blvd. & McAllister Ave.,
- 2052 Redwood Highway, and
- South Eliseo Dr., & Via Holon.

Finally, privately owned and maintained docks and piers could be damaged in storms and high tides.

California Park

California Park properties dependent on access from Woodland Avenue could be prevented at MHHW in the long-term. Traveling beyond Woodland Avenue in to San Rafael could be compromised sooner.

Bayside Acres & County Club

Lowrie Yacht Harbor in Country Club is vulnerable to storms and extreme high tides. Point San Pedro Road is vulnerable along its route in these communities and San Rafael in the long-term that could impact residents and travelers from passing through the area.



Waldo Point Harbor King Tide. Nov. 24, 2015. Credit: Marin County CDA

Santa Venetia

Several local roads could be vulnerable to storm surges in the near-term, and could experience tidal flooding by the long-term. Pt. San Pedro Road could

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expect long-term flooding near the primary residential area and medium-term impacts with up to nine inches of tidal flooding in China Camp State Park. Santa Venetia, in general, is vulnerable to subsidence that will likely worsen as MHHW moves inland. Finally, privately owned and maintained docks and piers could be damaged in storms and high tides.

Transit through the exposed area travels and stops on Adrian Way. Adrian Way could be flooded by more than five feet of tidal waters near the stop locations and much of its path. In addition, SMART rail tracks from mile post 15.9 to 16.9 could be vulnerable to the BayWAVE scenarios. The SMART track would likely only be vulnerable under scenario 6, sea level rise combined with a 100-year storm surge.

St. Vincent's

The Bay Trail and a local trail could be vulnerable in this area, as is a portion of the SMART track at miles posts 21.4 to 23.0.

Bel Marin Keys

Bel Marin Keys Blvd., leading to Bel Marin Keys is not impacted until scenario 6. Long-term tidal flooding could compromise access at the entrance. Within the community, Bel Marin Keys Blvd. could expect tidal flooding at the far end, its intersection with Del Oro Lagoon, and at the end of Bahama Reef. Every street, according to the CoSMoS model, could expect tidal and 100-year storm surge impacts across the BayWAVE scenarios, with the majority flooded at MHHW by the long-term. Privately and HOA owned and maintained docks and piers could be damaged in storms and high tides, though many of these facilities are within the internal lagoons that could temper the effects of sea level rise. In addition, one public dock in the community could be vulnerable in the near-term.

Black Point and Green Point

Black Point and Green Point could expect long-term sea level rise impacts to State Route 37 leading all the way up to Atherton Avenue from U.S. Highway 101, with depths reaching more than eight feet. Storm surge impacts could occur by the medium-term. This road is already vulnerable to stormwater, high tide storm surge combinations seasonally and is being studied by Caltrans for improvements.

Atherton Avenue could expect impacts off and on along its course, with primarily long-term storm surge exposure. At School Road and Olive Road, storm surges could reach Atherton Avenue in the medium-term and tidal MHHW exposure in the long-term. Atherton Avenue is vulnerable to sea level rise in the medium-term by Hunter's Club Road. Hunter's Club Road could expect impacts in the near-term with a storm surge. Under scenario 6, storm surge exposure could be felt near the golf course. Day Island, Norton Avenue, and Channel Road could all experience long-term sea level rise impacts. In addition to roads, the Black Point Boat Launch could expect a 75 percent reduction in capacity in the long-term with predicted average high tides according to asset managers. Privately owned and maintained docks and piers could be damaged in storms and high tides.

North Novato


Primary transportation issues in North Novato are at the Marin County Airport at Gness Field, and US Highway 101 flooding just north of the airport and Binford Road. These assets could expect long-term average high tide impacts. Gness Field could expect more than ten feet of tidal floodwater by scenario 5.

In addition, SMART track mile posts 32.9 to 33.4, could be vulnerable through this stretch of the county.

The maps on the following pages illustrate vulnerable transportation features. The areas in the call out circles enable the reader to see areas that are difficult to see on the large scale map. The circles do not indicate that these areas are more vulnerable than others along the shoreline.

Map 116. Northern Unincorporated Marin Vulnerable Transportation Assets

Vulnerable Assets

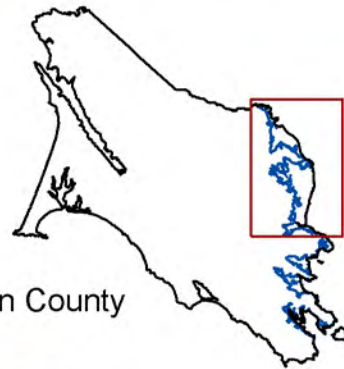
-  Airport
-  Public Boat Launch
-  GGT Bus Stop
-  MT Bus Stop
-  Bike path
-  Bay Trail
-  Trail
-  SMART Track

Vulnerable Roads

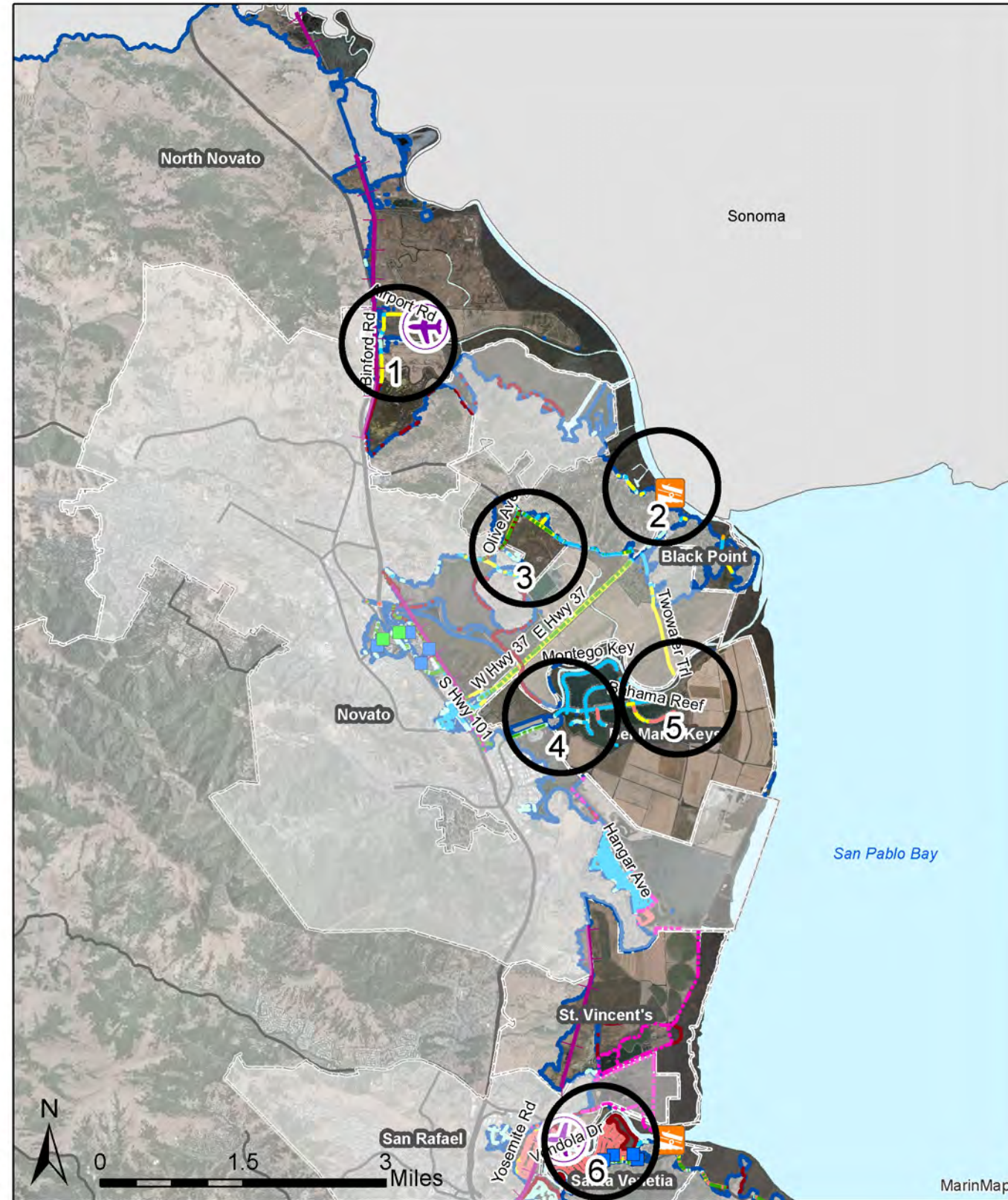
-  @10" Sea Level Rise (SLR)
-  @10"SLR+ 100-year Storm Surge
-  @20" Sea Level Rise
-  @20"SLR+ 100-year Storm Surge
-  @60" Sea Level Rise
-  @60"SLR+ 100-year Storm Surge

Location Indicators

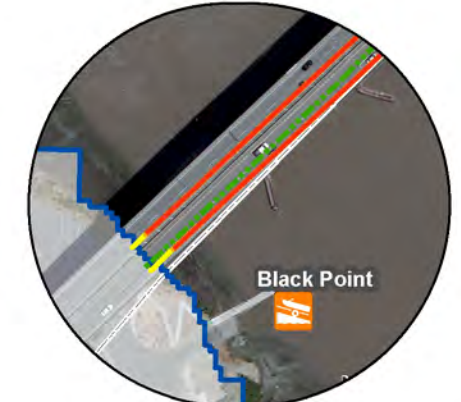
-  Unincorporated
-  Municipality
-  Road
-  Bay
-  Inland Extent: Sea Level @ 60"+100-year Storm



Marin County



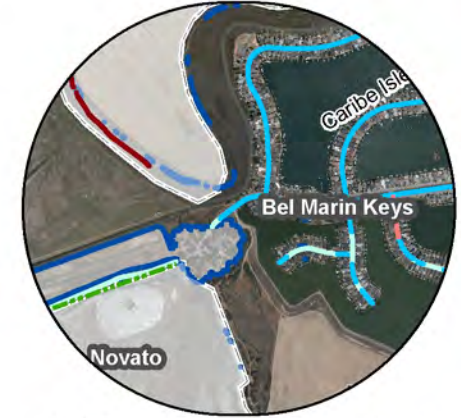
1: U.S. Hwy. 101



2: State Route 37



3: Atherton Ave.



4: Western Bel Marin Keys



5: Eastern Bel Marin Keys



6: Santa Venetia

Disclaimer: Vulnerability Assessment maps, tables, etc. can be used as a resource to help identify potential hazardous areas and vulnerable assets. Marin County, and data providers here in, make no warranties of the accuracy or completeness of maps and data. Maps are representational and subject to future revision. Local site conditions must be examined. Commercial use is prohibited.



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Map 117. Southern Unincorporated Marin Vulnerable Transportation Assets

Vulnerable Assets

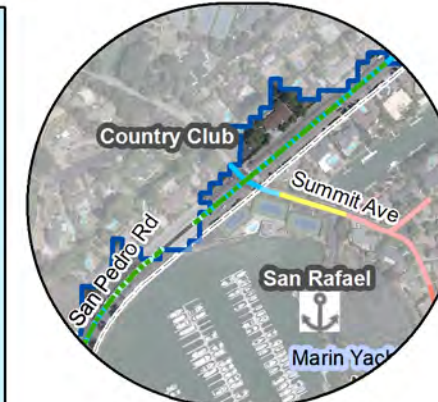
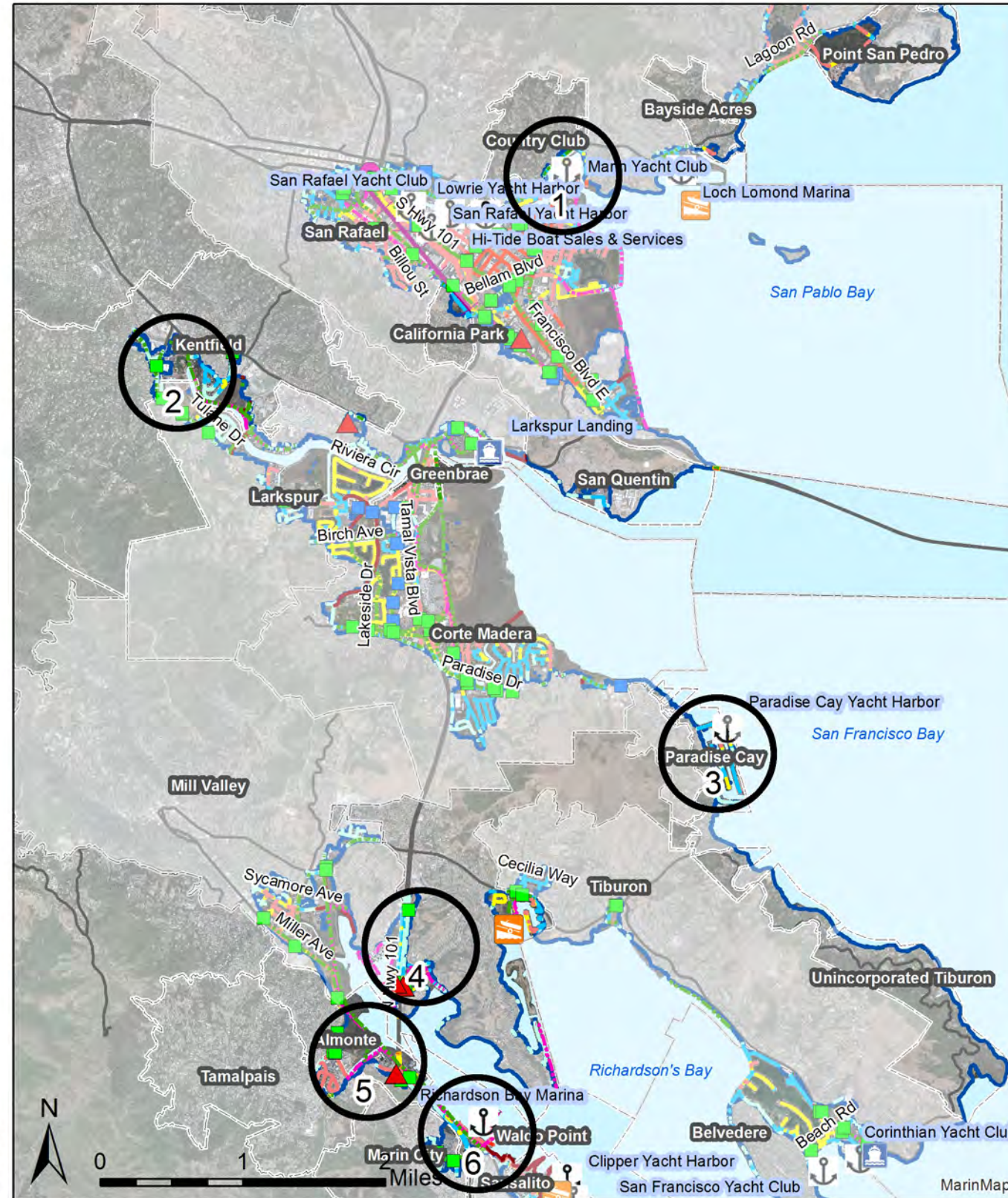
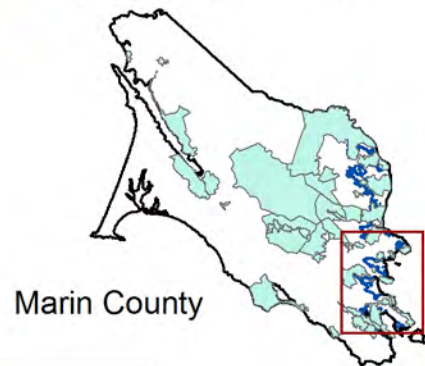
- Marina
- Ferry
- Public Boat Launch
- Park & Ride
- GGT Bus Stop
- MT Bus Stop
- SMART Track
- Bike path
- Bay Trail
- Trail

Vulnerable Roads

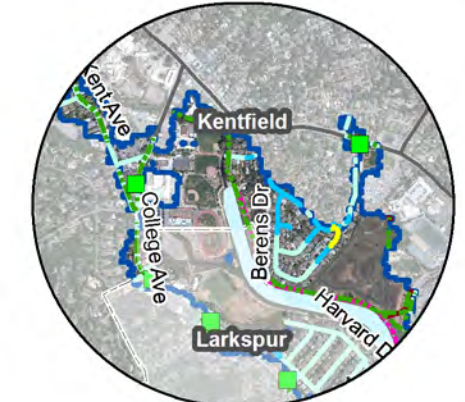
- @10" Sea Level Rise (SLR)
- @10"SLR+ 100-year Storm Surge
- @20" Sea Level Rise
- @20"SLR+ 100-year Storm Surge
- @60" Sea Level Rise
- @60"SLR+ 100-year Storm Surge

Location Indicators

- Unincorporated
- Municipality
- Road
- Bay
- Inland Extent: Sea Level @ 60"+100-year Storm



1: Pt. San Pedro Rd.



2: Kentfield



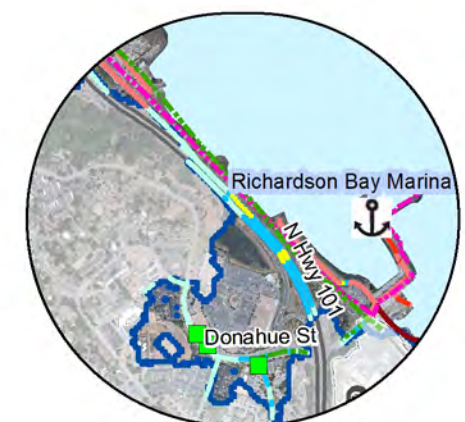
3: Paradise Cay



4: U.S. Hwy. 101 @ Strawberry



5: Almonte/Manzanita Park & Ride



6: Marin City/Waldo Point Harbor

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Date: 6/15/2017



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Utilities

Every unincorporated community is dependent on regional and local utilities. To get a full picture of utility concerns for the whole county read the Utilities Profile. Every community in the study area could expect the following utility vulnerabilities:

- Underground pipes facing compounding pressure forces from water and the road,
- Road erosion and collapse with underlain pipes,
- Saltwater inflow and infiltration can cause inefficiencies in wastewater treatment,
- Continuously subsiding soils or fill, and
- Pump stations in storm water and wastewater systems could expect escalating activity and capacity demands, more energy consumption, and wear and tear.

Most of Marin's unincorporated communities depend on service providers with headquarters and facilities in incorporated areas. For example, the six sanitary districts serving in Almonte, Tamalpais Valley, and Strawberry send their effluent to the SASM wastewater treatment plant in Mill Valley, Santa Venetia that pipes its effluent to Las Gallinas wastewater treatment plan on the edges of San Rafael, and Bel Marin Keys sends its effluent to Novato for treatment.

Water issues may be a concern in the North Marin Water District where assets in Bel Marin Keys could be compromised. By the medium-term, the Bel Marin Keys distribution system could expect impacts from saltwater intrusion. In addition, a cathodic protection anode bed that protects this communities water pipelines from corrosion may also be vulnerable.

In addition, most of the sanitary district and water district lands in St. Vincent's and Bel Marin Keys used in their processes could be vulnerable to sea level rise flooding. This could impact infiltration rates for the sanitary district process.

Waldo Point Harbor is unique because each home is outfitted with utilities that travel through flexible hoses that are attached below the dock with enough slack to adjust for today's high and low tides. If the tides are too high, these hoses may no longer reach and could become disconnected. Moreover, these systems depend on pumps for water and wastewater. If the electrical components of the pumps become flooded, the utilities would also turn off. Greenbrae Boardwalk, like Waldo Point Harbor, has utilities along the dock, or boardwalk; however, the water and sewer pipelines are freestanding. The

gas, electric and water lines are elevated and the sewer is buried with three elevated pumps.

The maps on the following pages illustrate vulnerable utility features. The areas in the call out circles enable the reader the see areas that are difficult to see on the large scale map. The circles do not indicate that these areas are more vulnerable than others along the shoreline.



Greenbrae Boardwalk utility lines line the pathway. Credit: BVB Consulting LLC

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Stormwater pump station. Santa Venetia. Credit: BVB Consulting LLC

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Map 118. Northern Unincorporated Marin Vulnerable Potable Water Assets

Vulnerable Assets

● NMWD Facility

Pipeline

— Other

— Intermediate

— Recycled Water

— Potable Water

□ Water District Parcels

Location Indicators

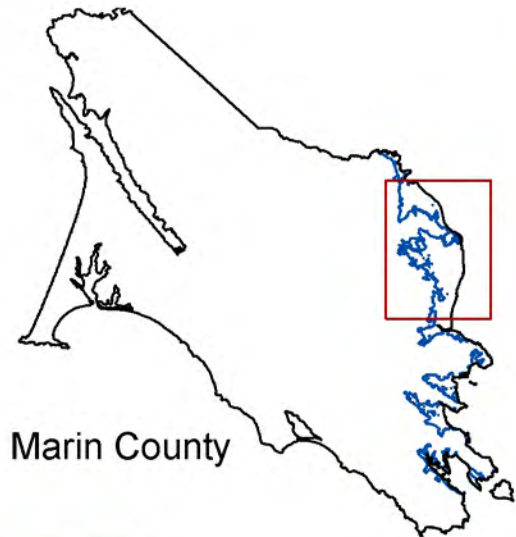
□ Unincorporated

□ Municipality

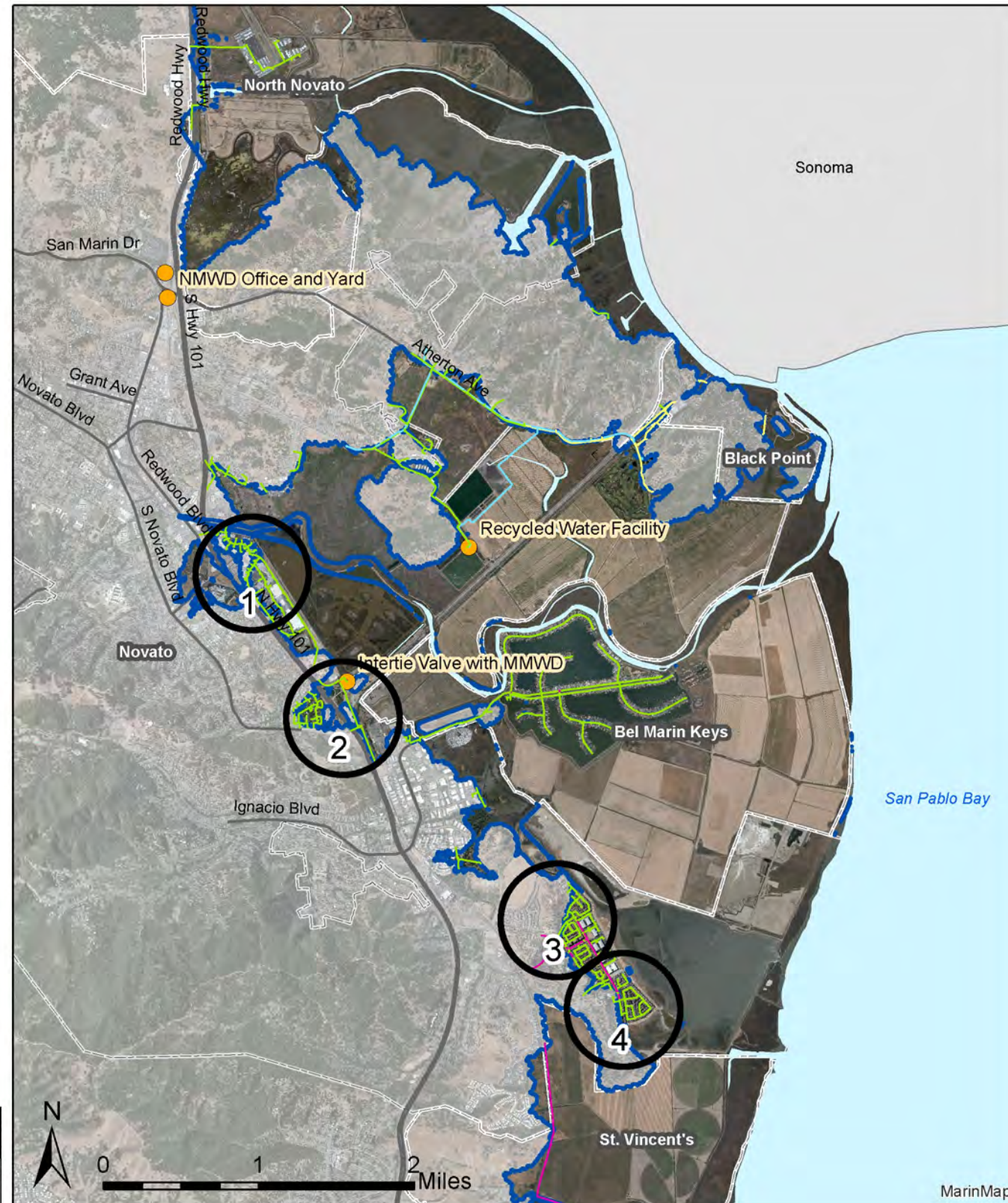
— Road

□ Bay

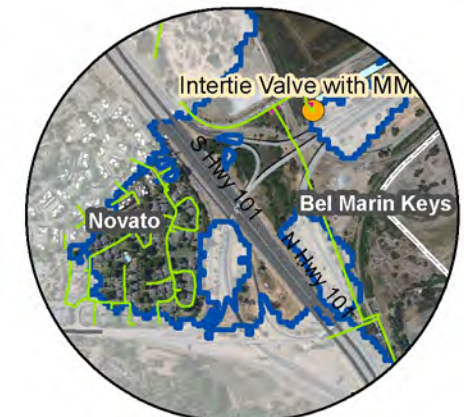
~ Inland Extent: Sea Level @ 60"+100-year Storm



Marin County



1: U.S. Hwy. 101 @ Rowland Blvd.



2: U.S. Hwy. 101 @ State Route 37



3: Upper Hamilton



4: Lower Hamilton



Date: 4/1/2017



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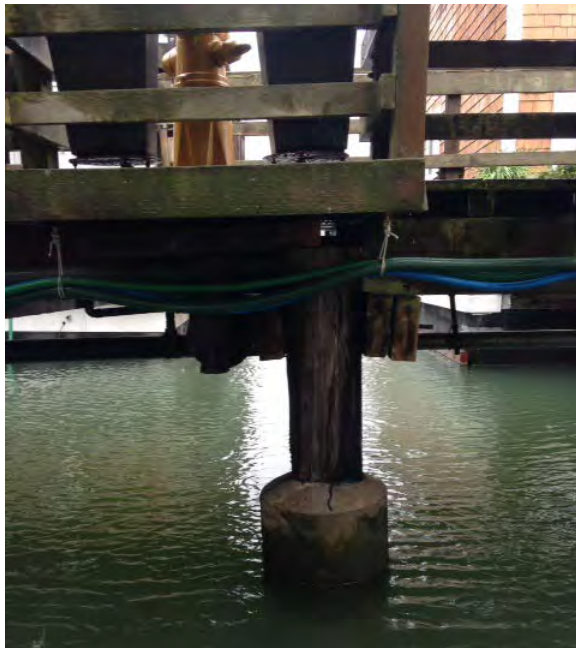
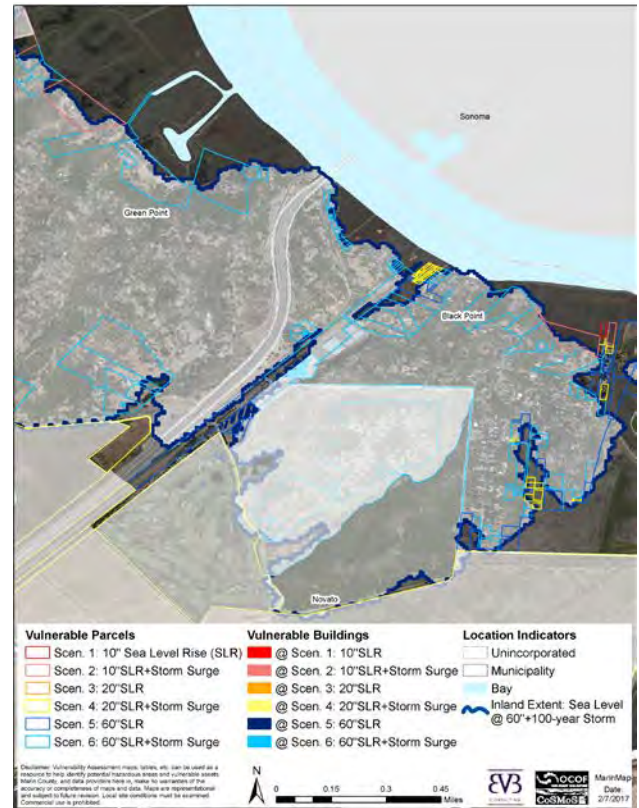
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Unincorporated Tiburon does host a small treatment plant for Sanitary District Number 5 that could experience long-term flooding during a 100-year storm surge, though asset managers did not assess the site as being sensitive to temporary flooding.

Communities in the study area using Onsite Wastewater Treatment Systems are Unincorporated Tiburon and Black Point. However, many of the built areas of these properties are at higher elevations than the exposed area, and could be free from impacts from sea level rise. In the worst case, sea level rise could alter soil permeability and chemistry in the disposal field. If water levels are high and sustaining enough, effluent from the disposal field could contaminate the estuary. Even new shallow or above ground systems, with high water level kill switches, could be impacted by flood waters and affected by power outages. Erosion could also reduce land area available for percolation. Finally, if groundwater rises under septic tanks with enough pressure, the tanks could pop out of the ground.

These systems are privately managed by the landowner and regulated by Marin County and the Regional Water Quality Control Board. The Marin Countywide Plan (CWP), the Marin County Development Code, and the State Water Control Board's Onsite Wastewater Treatment Systems Policy regulate septic systems.

Map 119. Black Point & Green Point Properties with Potentially Vulnerable OWTs



Utility lines at East Road 6 Houseboats at Waldo Point Harbor. Credit: BVB Consulting LLC

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Map 120. Unincorporated Tiburon Properties with Potentially Vulnerable OWTSS



Santa Venetia floods during 1983 storm that caused major damage in the Bay Area. Credit: Marin Watersheds

Stormwater management is large function of the County of Marin Department of Public Works and a significant amount of land is dedicated to stormwater management for containment and infiltration. In addition, critical infrastructure relays stormwater from pipes, accessible by manholes, tide gates, or pump stations. Some of this infrastructure could weather sea level because it is newer and/or has more advanced technology than older options. Nevertheless, these assets, such as pump stations, could sink in the face of liquefying underlain soils, be overtopped entirely, compromised during an extended power outage, and corrode and wear from increased use and saltwater exposure if not adequately elevated. In total, roughly 15 pump stations, more than 81,000 feet of pipes, and several channels, and a few ponds that could expect new or worsening tidal water flooding.

Map 121. Northern Unincorporated Marin Vulnerable Stormwater Assets

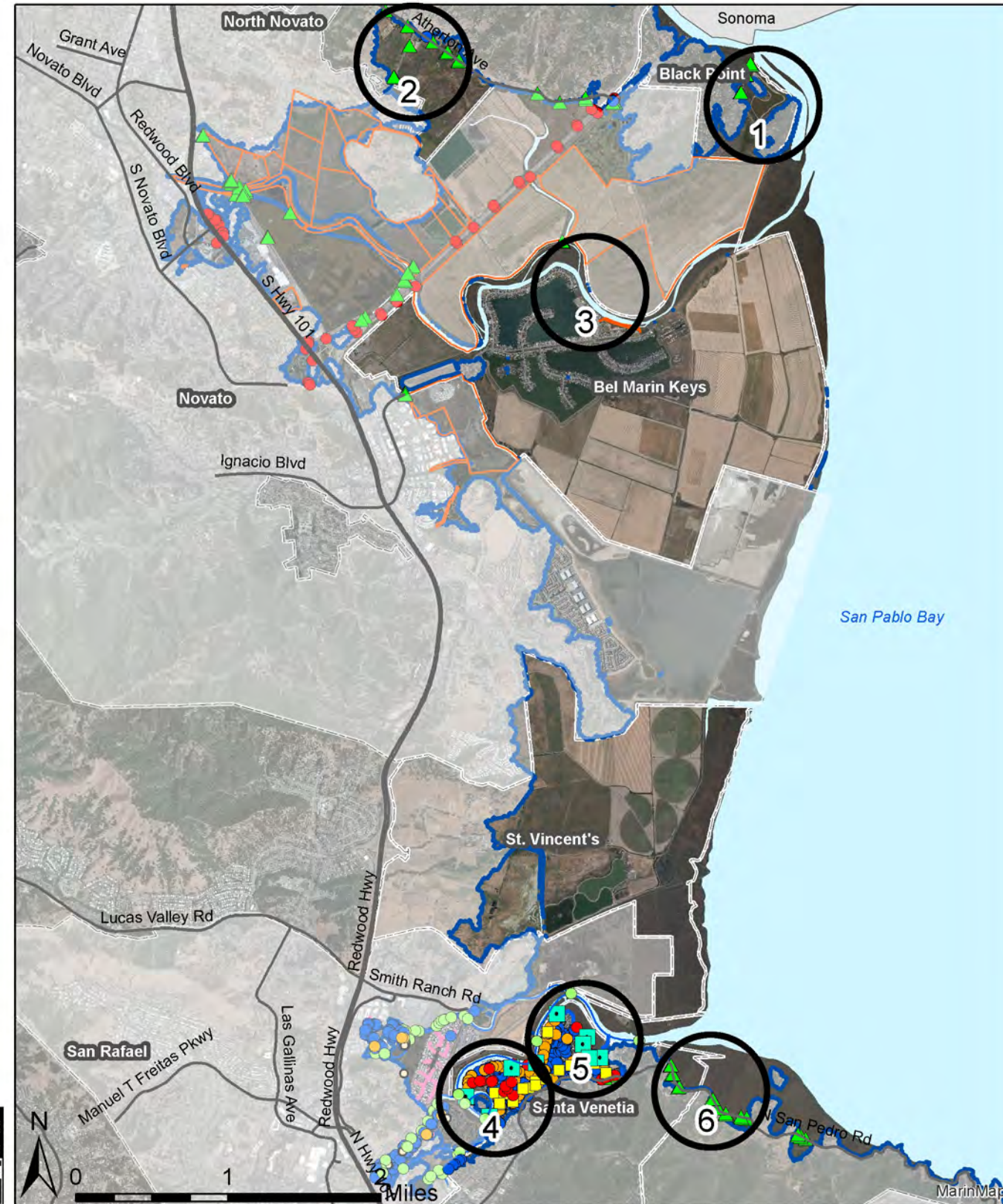
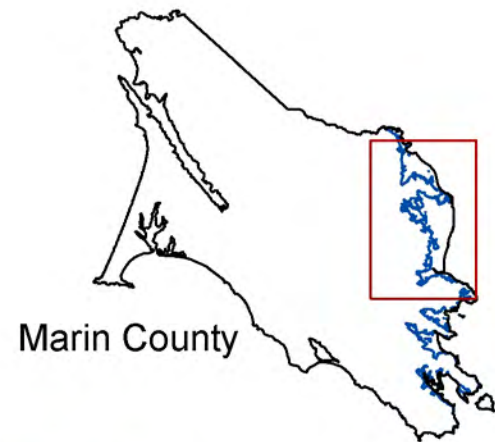
Vulnerable Assets

- ▲ Culvert
- Catch Basin
- Manhole
- Structures
- Pipe Inlet/Outlet
- Pump Station

- Channel
- Pipe
- Flood Control Parcels

Location Indicators

- Unincorporated
- Municipality
- Road
- Bay
- ~ Inland Extent: Sea Level @ 60"+100-year Storm



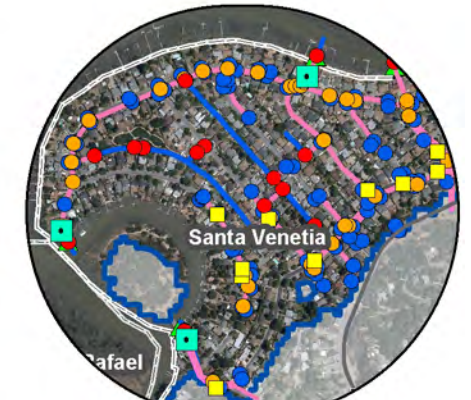
1: Black Point



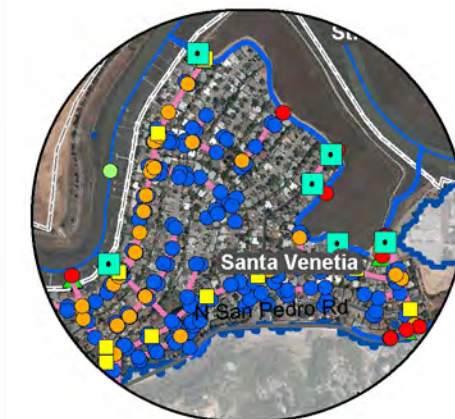
2: Atherton Ave.
@ Olive Ave.



3: Bel Marin Keys



4: Santa Venetia



5: Santa Venetia



6: N. San Pedro Rd.

Disclaimer: Vulnerability Assessment maps, tables, etc. can be used as a resource to help identify potential hazardous areas and vulnerable assets. Marin County, and data providers here in, make no warranties of the accuracy or completeness of maps and data. Maps are representational and subject to future revision. Local site conditions must be examined. Commercial use is prohibited.

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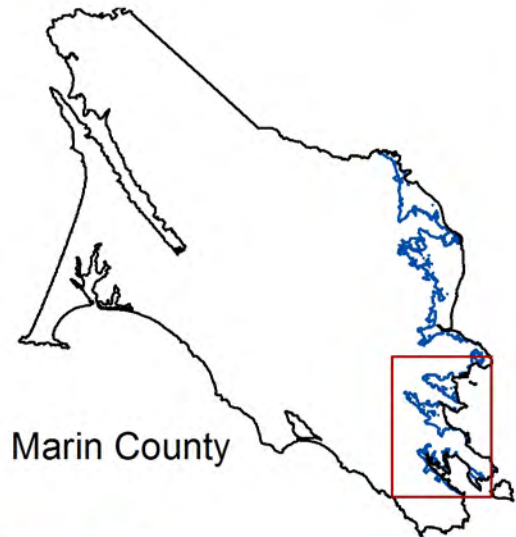
Map 122. Southern Unincorporated Marin Vulnerable Stormwater Assets

Vulnerable Assets

- Pump Station
- Manhole
- Structures
- Pipe End
- Catch Basin
- Channel
- Pipe
- ▲ Culvert
- Pond

Location Indicators

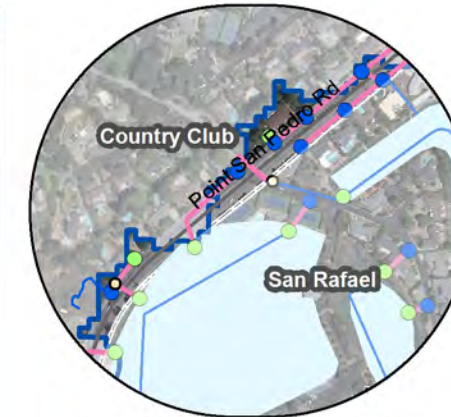
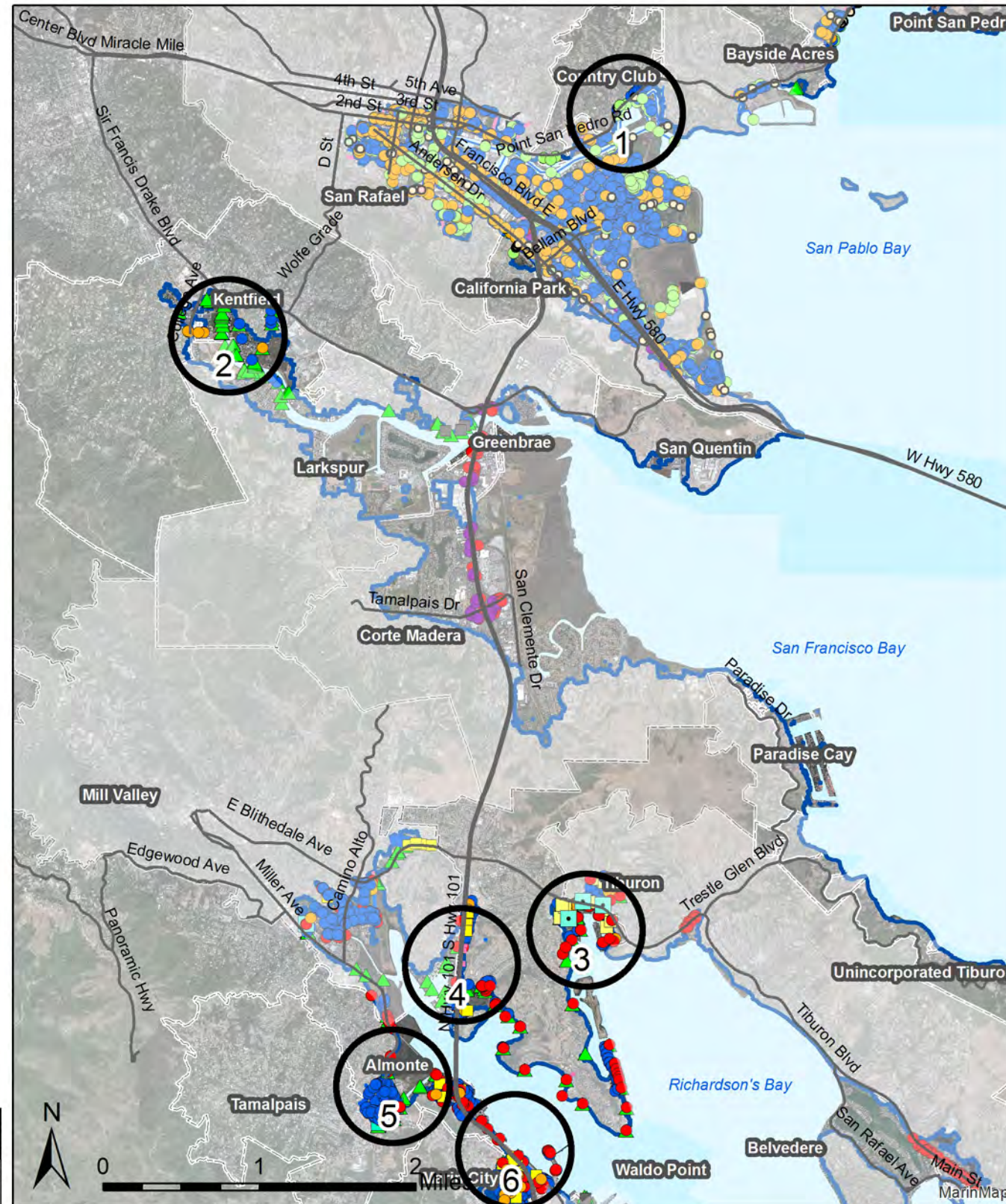
- Unincorporated
- Municipality
- Road
- Bay
- ~ Inland Extent: Sea Level @ 60"+100-year Storm



Marin County



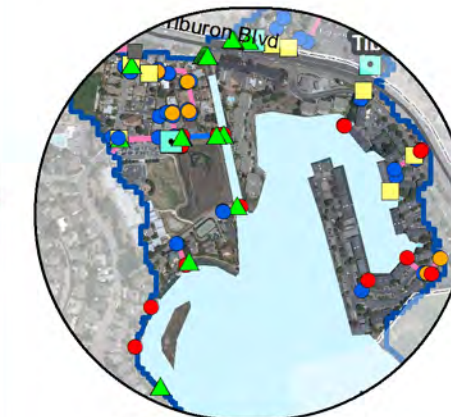
Date: 6/15/2017



1: Pt. San Pedro Rd.



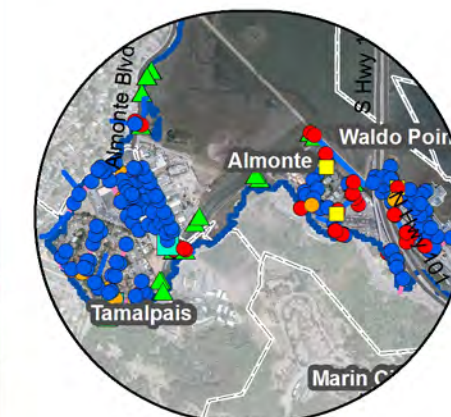
2: Corte Madera Creek



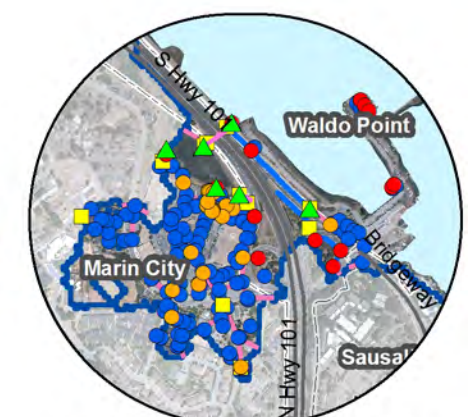
3: Saltworks Canal



4: Strawberry @ Da Silva Island



5: Tamalpais Valley & Almonte



6: Marin City & Waldo Point

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Electric transmission tower on Nyhan Creek levee in Tam Valley. Credit: Marin County DPW

With respect to PG&E natural gas and electrical assets, several can be found in the unincorporated areas. With the exception of Black Point, the communities in the study receive natural gas the PG&E. Both natural gas and electrical transmission lines could be vulnerable in St. Vincent's. Bel Marin Keys has a vulnerable electrical substation, which if flooded, could impact Bel Marin Key residents. Finally, nearly forty transmission towers along Highway 37 and a more northerly trajectory could expect higher water levels and increased levels of subsidence.

The utilities represented on the maps show the available geographic digitized data. Absence of a utility feature on the maps may be because the data is not available in a digitized format; not because the features are not considered vulnerable.

The maps on the previous and following pages illustrate vulnerable utility features. The areas in the call out circles enable the reader the see areas that are difficult to see on the large scale map. The circles do not indicate that these areas are more vulnerable than others along the shoreline.



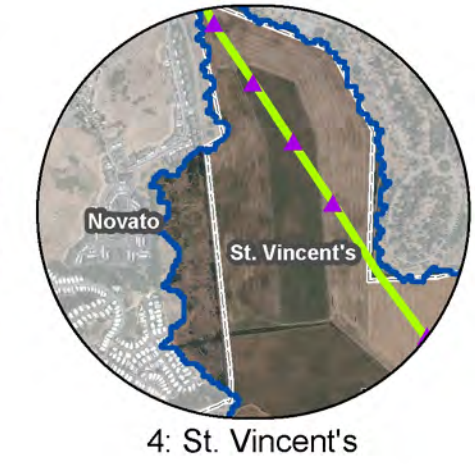
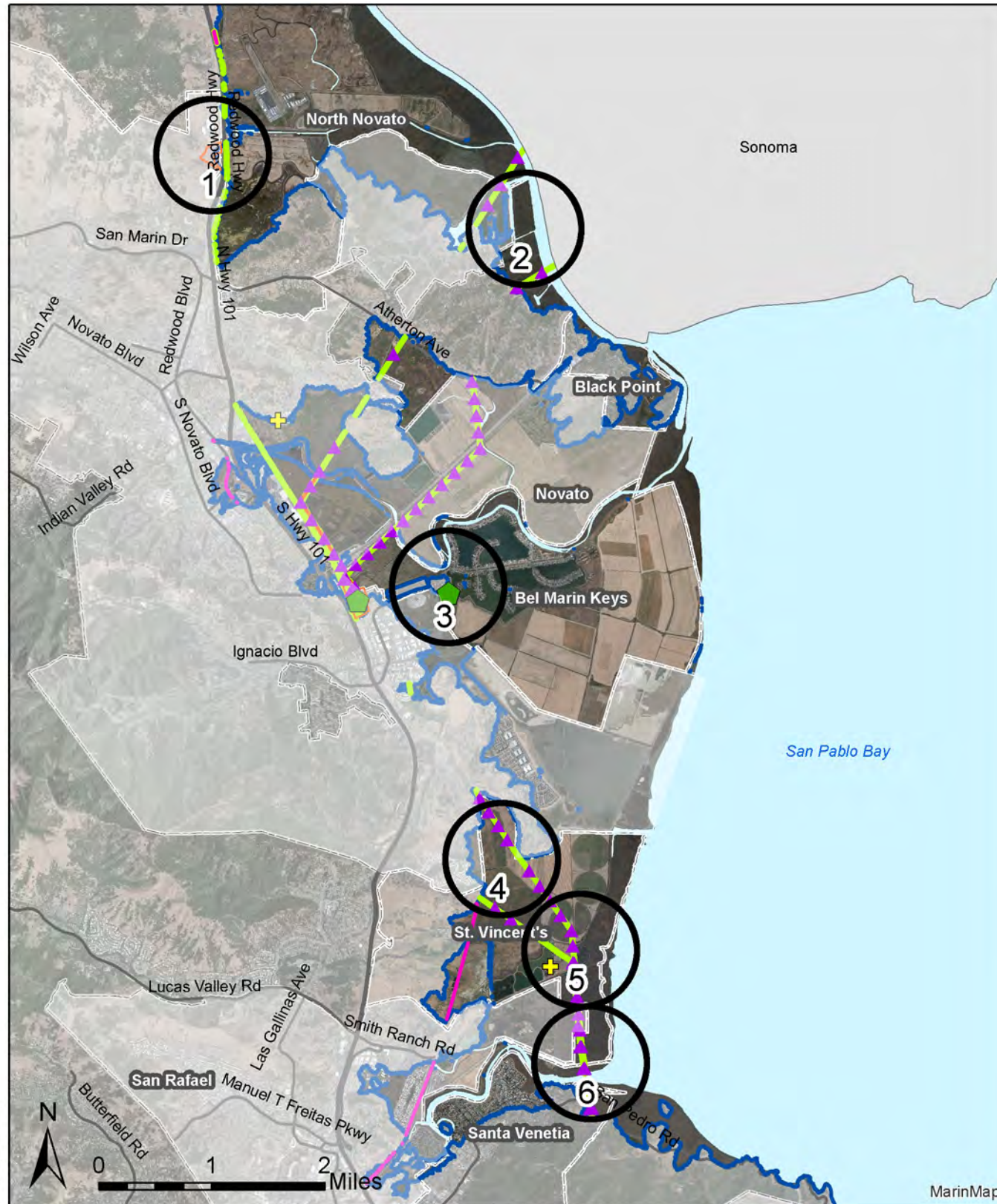
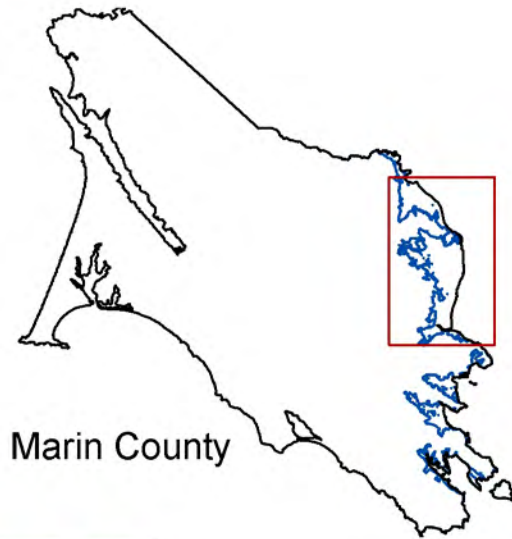
PG&E repair from storm damage in Tamalpais Valley. Credit Marin County DPW

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Map 123. Northern Unincorporated Marin Vulnerable Gas and Electric Assets

Vulnerable Assets

- + Solar Array
- PG&E Assets**
- Electric Transmission Line
- Natural Gas Pipeline
- ◆ Substation
- ▲ Transmission Tower
- PG&E Property
- PG&E Buildings
- Location Indicators**
- Unincorporated
- Municipality
- Road
- Bay
- ~ Inland Extent: Sea Level @ 60"+100-year Storm



Disclaimer: Vulnerability Assessment maps, tables, etc. can be used as a resource to help identify potential hazardous areas and vulnerable assets. Marin County, and data providers here in, make no warranties of the accuracy or completeness of maps and data. Maps are representational and subject to future revision. Local site conditions must be examined. Commercial use is prohibited.



Date: 3/30/2017



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Map 124. Southern Unincorporated Marin Vulnerable Gas and Electric Assets

Vulnerable Assets

+ Solar Installation

PG&E Assets

— Electric Transmission Lines

— Natural Gas Pipeline

◆ Substation

▲ Transmission Tower

□ PG&E Property

■ PG&E Buildings

Location Indicators

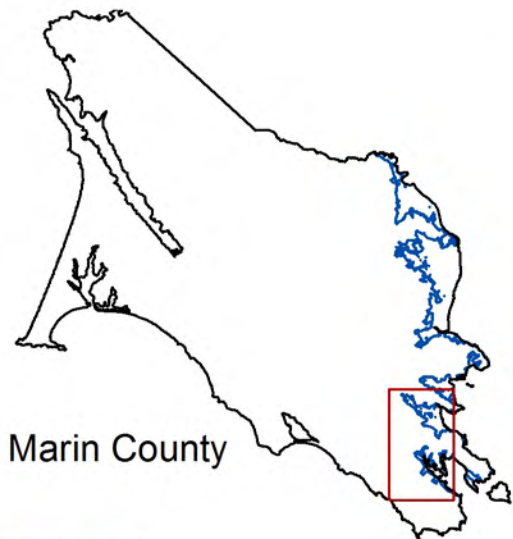
□ Unincorporated

□ Municipality

— Road

— Bay

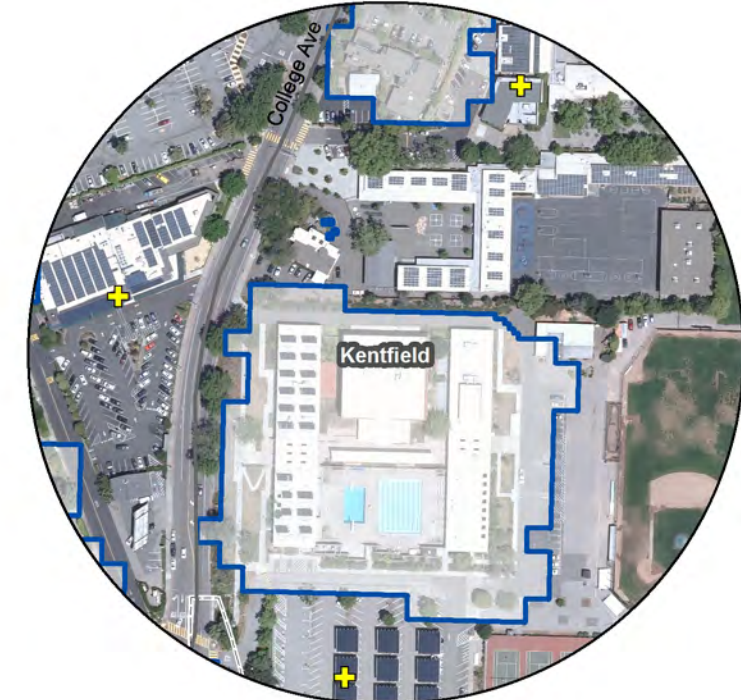
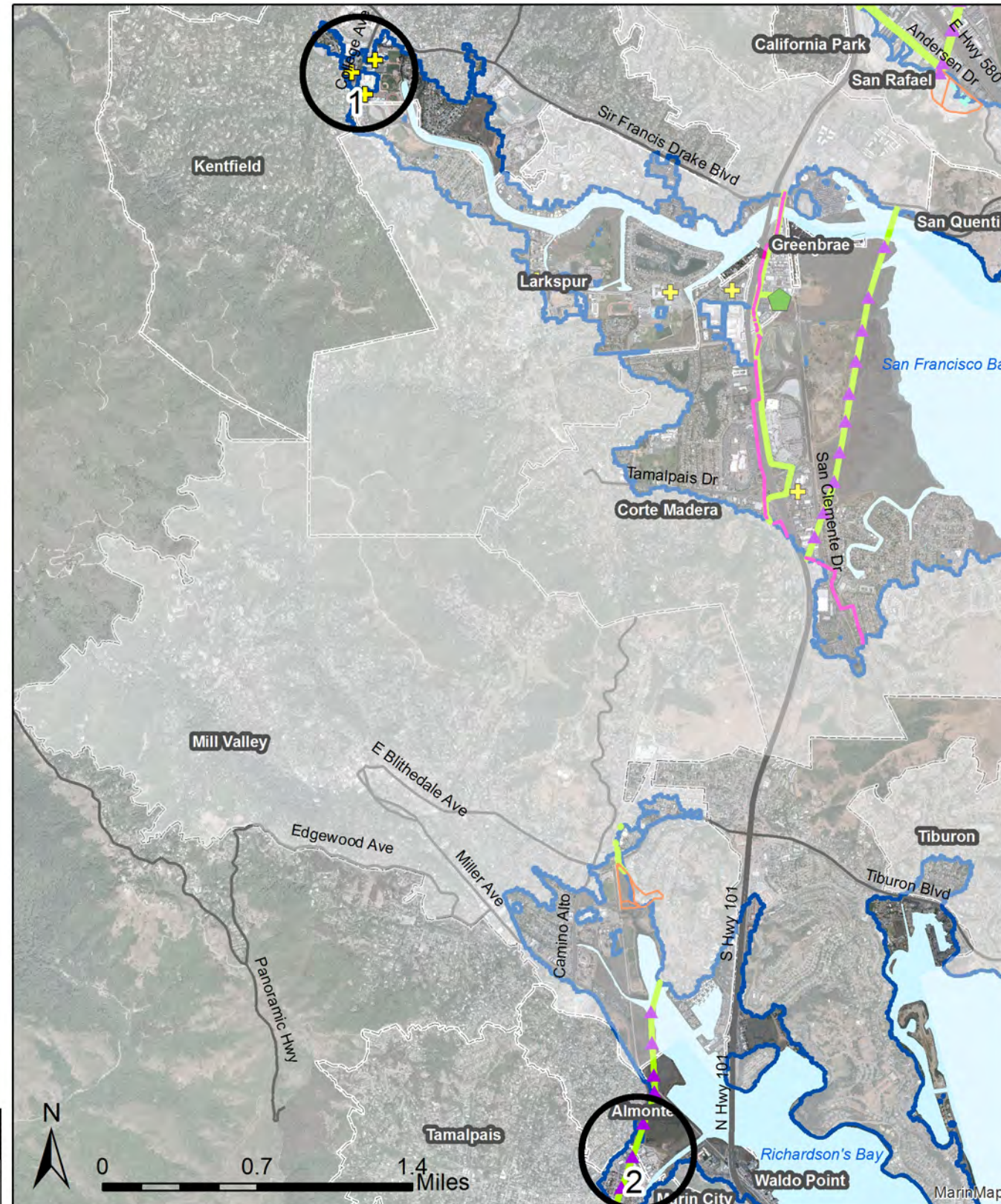
— Inland Extent: Sea Level @ 60"+100-year Storm



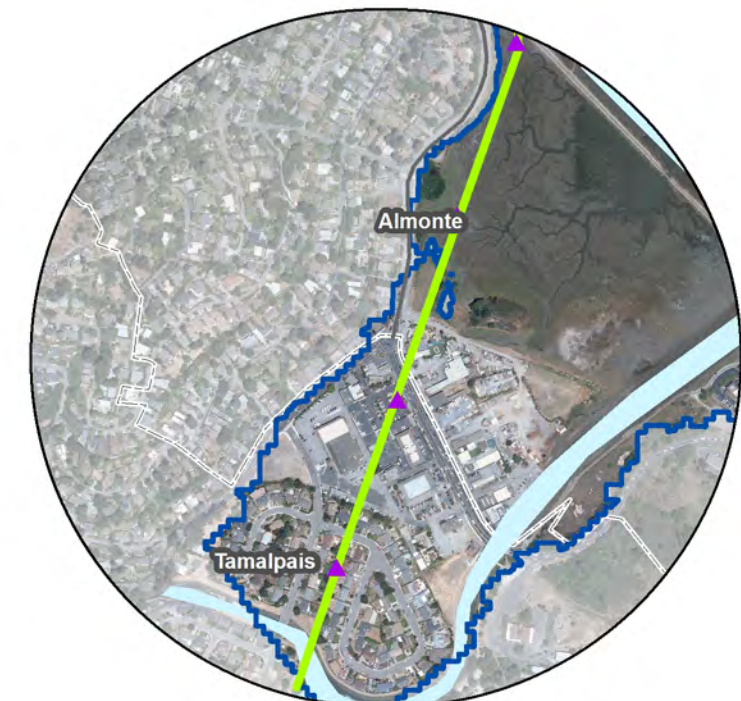
Marin County



Date: 6/15/2017



1: College Ave.



2: Tamalpais/Almonte

Disclaimer: Vulnerability Assessment maps, tables, etc. can be used as a resource to help identify potential hazardous areas and vulnerable assets. Marin County, and data providers here in, make no warranties of the accuracy or completeness of maps and data. Maps are representational and subject to future revision. Local site conditions must be examined. Commercial use is prohibited.

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Working Lands

The few operations vulnerable to sea level rise on the Marin shoreline are ranches, dairies, and small produce farms. The parcels are concentrated in St. Vincent's, surrounding Bel Marin Keys, and in North Novato. In addition to losing valuable grazing land to salt water, loss of vehicular access to and from sites and processing facilities during storms, and eventually, on a regular basis could be a significant factor.

As shown in Table 129, the main area impacted is public land that is leased to ranchers for grazing. Under scenario 5, with 60 inches of sea level rise, just more than 4,100 acres across 27 parcels could be vulnerable. With storm conditions, an additional 200 acres across twelve parcels could be vulnerable.

Table 129. Vulnerable Agricultural Parcels and Acreage by Community

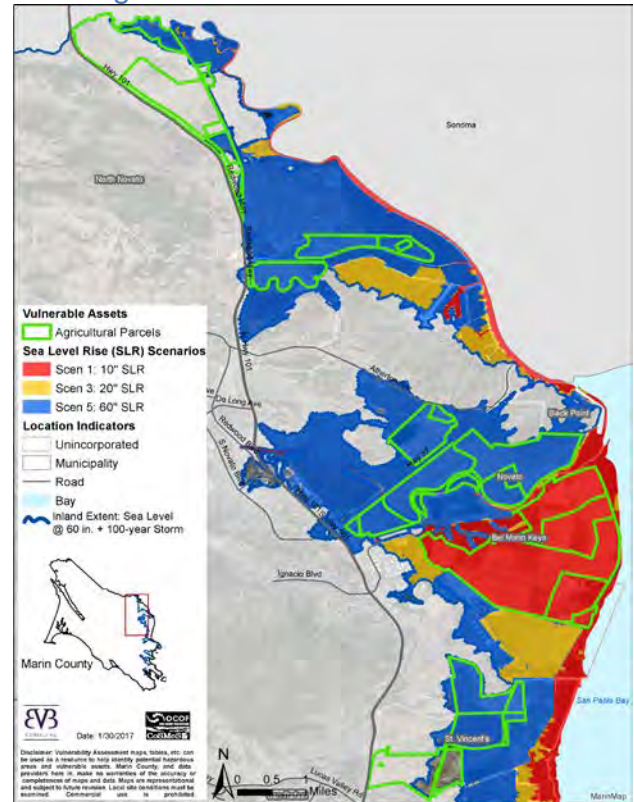
	Scenario			
	Near- to Medium-terms		Long-term	
	1 & 3		5	
	#	Acres	#	Acres
Bel Marin Keys	1	28	4	178
North Novato			7	510
St. Vincent's			5	460
Public Land	8	1,924	11	3,000
Total	9	1,952	27	4,148

Source: MarinMap, CoSMoS



Pacheco Pond, Bel Marin Keys. Credit: Marin County DPW

Map 125. Unincorporated Marin Vulnerable Working Lands



Vulnerable land based operations account for \$17,745,567 in assessed land and improvement value²¹⁵ that could expect losses as lands newly under water become waters of the State. Moreover, agriculture is a highly regulated industry at nearly all levels of government. For example, at the federal level is the Clean Water Act (Sections 401 and 404)²¹⁶ and total maximum daily sediment loads that farmers must comply with to reduce erosion and sediment loads to creeks. In several cases, to comply and improve water quality, farmers have fenced off creeks from livestock wading, installed new stream crossings and restored riparian areas that could be compromised under these sea level rise scenarios. Habitat changes prompted by sea level rise could require new conservation management plans and improvements in the coming decades to ensure water quality standards are upheld.

²¹⁵ 2016 dollars

²¹⁶ US Environmental Protection Agency. Water: Clean Water Act. *Water Quality and 401 Certification*. http://water.epa.gov/lawsregs/guidance/cwa/waterquality_index.cfm



Santa Venetia Marsh. Credit: BVB Consulting LLC



Marshes along Richardson Bay. Credit: C. Solin

Natural Resources

Paradise Beach and McNears Beach in unincorporated Marin are rocky and narrow and are highly vulnerable to sea level rise.

Marshes and mudflats are far more extensive and offer rich wildlife habitat. Bothin Marsh and Coyote Creek front Almonte and Tamalpais Valley, the Strawberry tidal area and the Seminary Marsh in Strawberry, Corte Madera Ecological Reserve extending to Greenbrae, China Camp State Park marsh, Santa Venetia Boardwalk Marsh, and extensive marshes up the shores of Saint Vincent's, Bel Marin Keys, Black Point, Green Point, and North Novato. These marshes and mud flats provide feeding and breeding grounds for the endangered Ridgway's Rail, salt marsh harvest mouse, and the tidewater goby. Federally listed endangered plants found in the vulnerable areas are white-rayed pentachaeta, Tiburon paint brush, and Tiburon jewel flower.

Marshes, if flooded more frequently can become flooded out and convert to mudflat habitat. If the marshes are supplied with adequate sediment from upstream or have room to retreat landward they may be able to maintain the higher elevation marsh habitats. This is possible in the northern portion of the study area, where large swaths of open land exist. In the southern portion of the study area, this is less feasible due to development barriers. Marshes here could expect significant habitat shifts as sea level rise.

Several wildlife reserves are along the shoreline and in the open waters on islands, such as Aramburu Island, used by birds, Marin Islands, Castro Rocks, used by seals and sea lions, and San Pablo Wildlife Reserve. Additionally, several patches eel grass, totaling roughly 20 acres, likely an underestimation based on comparing aerial photography, ecological studies, and state data sources, were observed around the Tiburon Peninsula.

Recreation

Recreational opportunities in unincorporated Marin are bountiful. The main recreation assets that could be compromised are beaches, on-street bike pathways and sidewalks, dedicated bike and walkways, and boating facilities in the vulnerable area. The Charles McGlashan pathway is vulnerable where it meets Shoreline Highway in Tamalpais Valley, pathways around Black Point, Bel Marin Keys, Greenbrae and Strawberry could expect

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impacts in the medium-term. Many of these pathways are lengths of the Bay Trail. The portion of the Mill Valley/Sausalito Pathway fronting Almonte and Tamalpais Valley is vulnerable in the near-term. The County of Marin also operates a boat launch in Black Point that could expect reductions in capacity of up to 75 percent in the long-term, when flooding could reach seven feet at MHHW.

In addition, the low lying portions of several county parks could be inundated at average high tides. At Paradise and McNears Beach Parks, the beach component could disappear in the medium- to long-terms. The highly utilized fishing piers here are also vulnerable to weakening and overtopping in the long-term, especially during storms. At McNears Beach Park, the club house and pool are also vulnerable in the long-term scenario 6.

McInnis Park could also anticipate some impacts along the creek channel into the soccer fields and eventually reaching the entrance. The McInnis Trail could also be compromised at high tides. The marshlands bordering the park could expect habitat transitions. Other parks, such as Ring Mountain, Deer Island are mostly uplands and would only experience flooding on the lower fringes. This is also the case for China Camp State Park and Angel Island State Park; however, in both parks the main attractions and gathering places are on the shore.

District-run parks and pathways in Strawberry could be vulnerable in the near-term, as could Cavila Cay Park in Bel Marin Keys. Additional parks in Strawberry and the remaining parks in Bel Marin Keys could be vulnerable by long-term scenario 5, as are parks in North Novato and Santa Venetia.

Boating activities in Richardson Bay Marina, Waldo Pint Harbor, Lowrie Yacht Club, Bel Marin Keys boat launches and public dock, private docks and piers could be vulnerable to storm surges and may need to adjust to accommodate rising high tides. In addition, visitor serving hotels and restaurants in Almonte and Tamalpais Valley could also be vulnerable to sea level rise in the near-term.

The maps on the following pages illustrate vulnerable natural resource, recreation, emergency and historic features. The areas in the call out circles enable the reader the see areas that are difficult to see on the large scale map. The circles do not indicate that these areas are more vulnerable than others along the shoreline.



Bothin Marsh and the Mill Valley/ Sausalito Pathway Flooded at king tide. Credit: J. Poskazner



Black Point Boat Launch at State Route 37 and the Petaluma River. Credit: BYB Consulting LLC

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Table 130. Unincorporated Marin Vulnerable Parks and Facilities






	Near-term		Medium-term		Long-term	
	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Almonte	Charles F. McGlashan Pathway ^M	See scenario 1				
Bel Main Keys	Cavalía Cay Park Bahama Reef Boat Launch Dolphin Isle Boat Launch	See scenario 1			See scenario 1 Public Dock Bel Marin Keys Yacht Club Caribe Isle Park Montego Park Calypso Bay Public Dock Bahama Reef Boat Launch Del Oro Park	See scenarios 1 & 5
Black Point	Black Point Boat Launch ^M	See scenario 1				
North Novato					Rush Creek ^M Deer Island ^M	See scenario 4
Santa Venetia	Santa Margarita Island ^M Santa Venetia Marsh ^M	See scenario 1			Pueblo Park ^M Adrian Rosal Park ^M Castro Park ^M	See scenarios 1 & 5
Strawberry	Brickyard Cove Community Park Community Park Boat Launch Strawberry Point Tidal Area ^M Strawberry Point Park Aramburu Island ^M	See scenario 1				
San Rafael	John F. McInnis Park ^M Buck's Landing	See scenario 1				
Tiburon	Paradise Beach Park ^M	See scenario 1				

Source: *MarinMap*, *CoSMoS*

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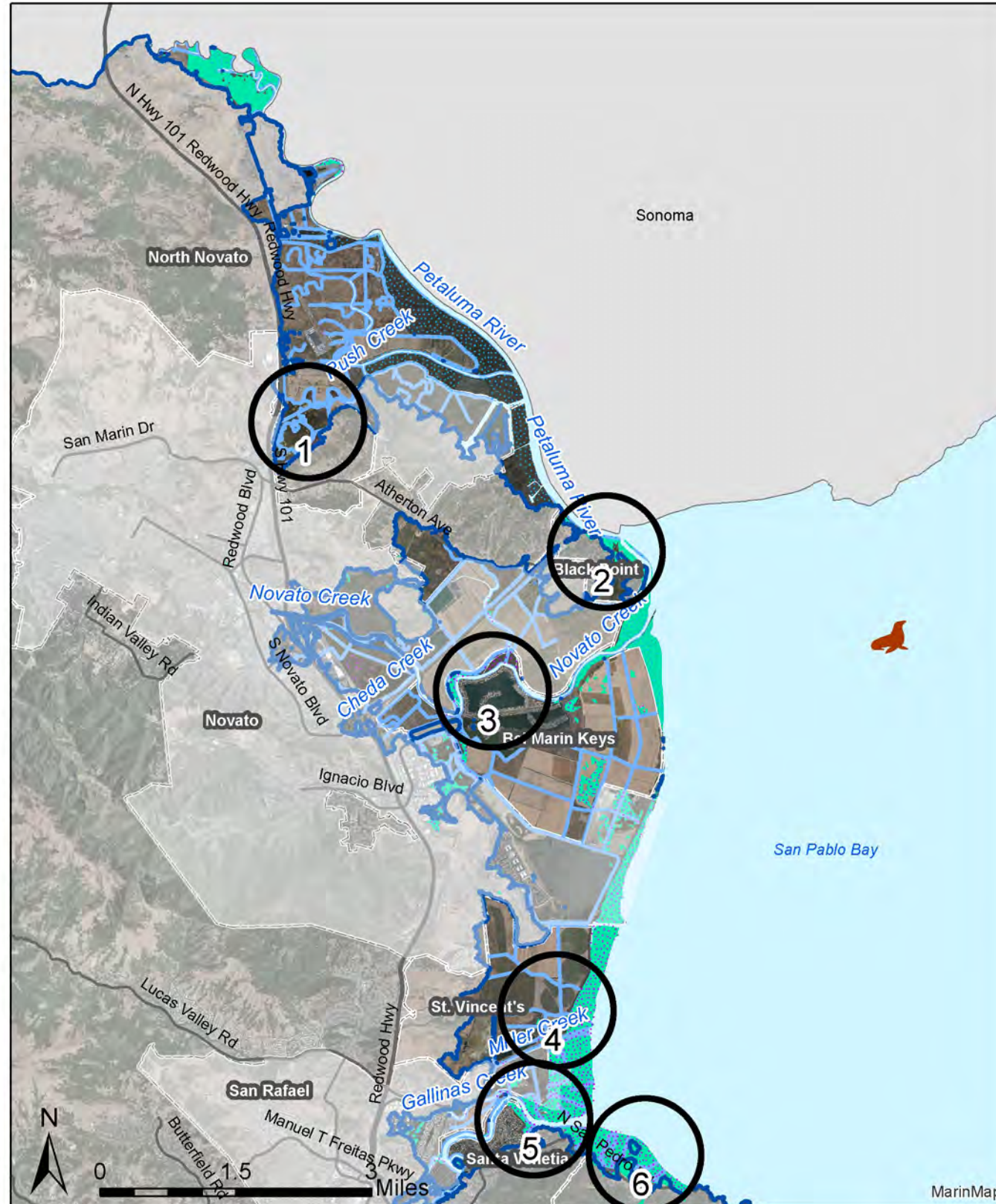
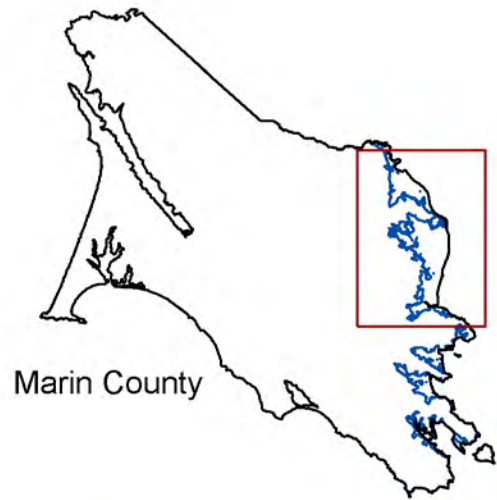
Map 126. Northern Unincorporated Marin Vulnerable Natural Resource Assets

Vulnerable Assets

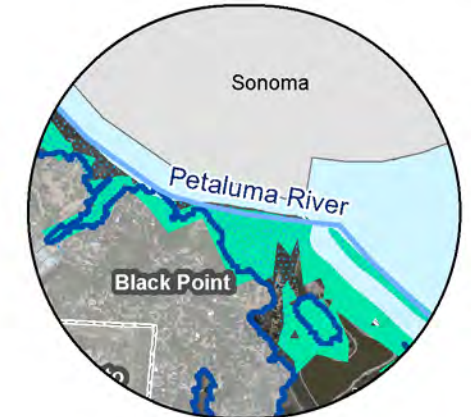
-  Mammal Haulouts
-  Streams
-  Marsh
-  Estuary
-  Wetland

Location Indicators

-  Unincorporated
-  Municipality
-  Road
-  Bay
-  Inland Extent: Sea Level @ 60"+100-year Storm



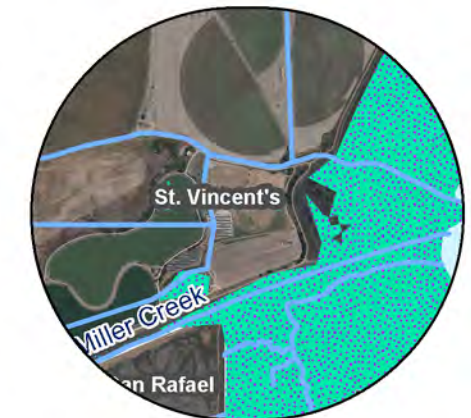
1: Rush Creek



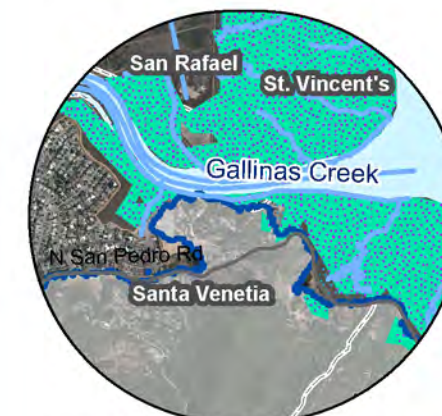
2: Black Point



3: Novato Creek



4: Miller Creek



5: Santa Venetia Marsh



6: Gallinas Creek Estuary

Disclaimer: Vulnerability Assessment maps, tables, etc. can be used as a resource to help identify potential hazardous areas and vulnerable assets. Marin County, and data providers here in, make no warranties of the accuracy or completeness of maps and data. Maps are representational and subject to future revision. Local site conditions must be examined. Commercial use is prohibited.














Date: 4/1/2017

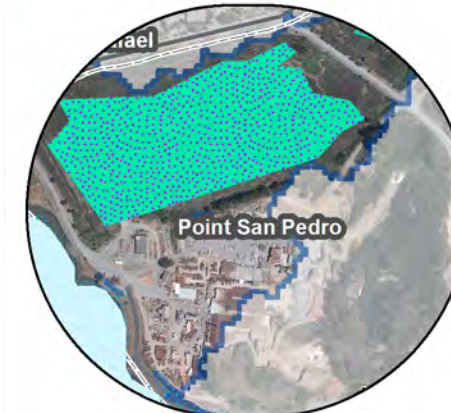
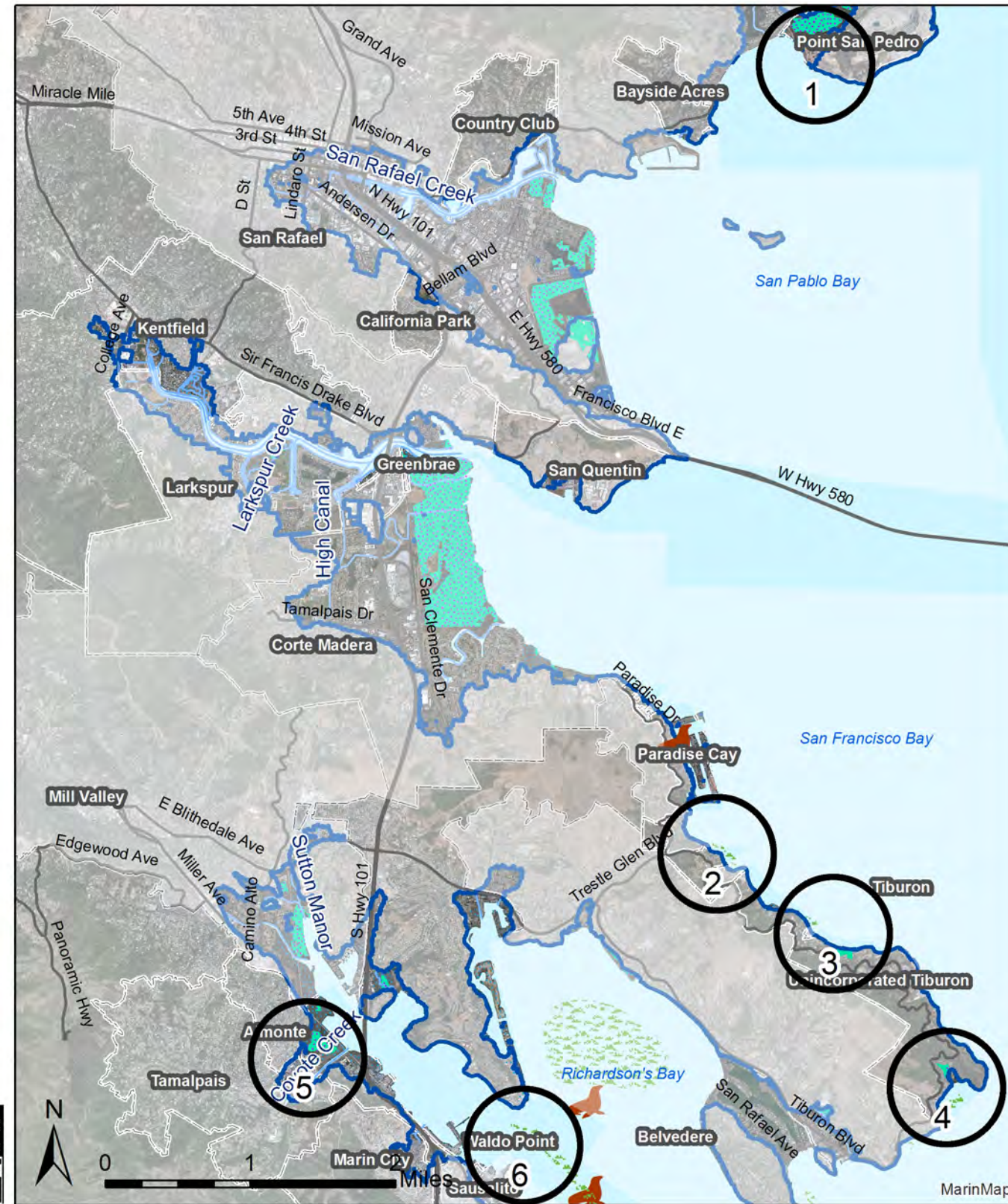


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Map 127. Southern Unincorporated Marin Vulnerable Natural Resource Assets

Vulnerable Assets

-  Mammal Haulouts
 -  Streams
 -  Eelgrass
 -  Marsh
 -  Estuary
 -  Wetland
- ## Location Indicators
-  Unincorporated
 -  Municipality
 -  Road
 -  Bay
 -  Inland Extent: Sea Level @ 60"+100-year Storm



1: Pt. San Pedro



2: Paradise Dr.



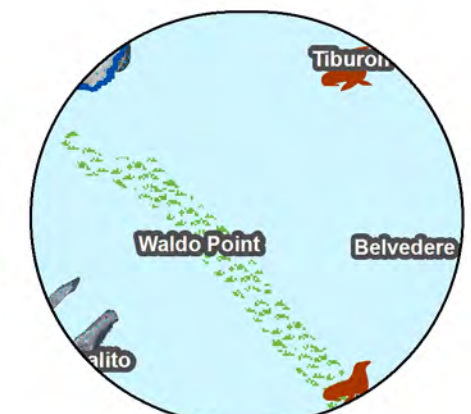
3: Paradise Dr.



4: Paradise Dr.

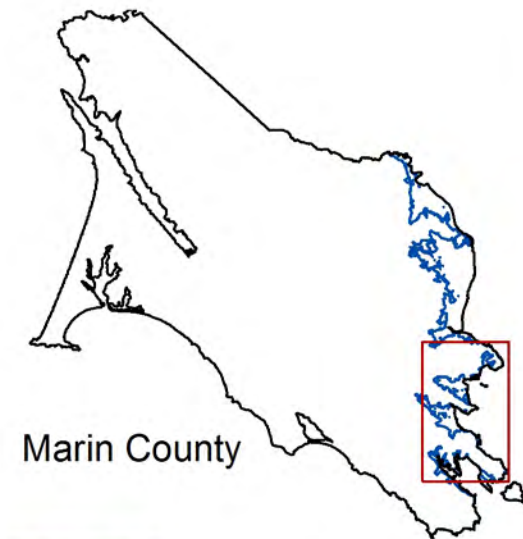


5: Bothin Marsh



6: Richardson's Bay

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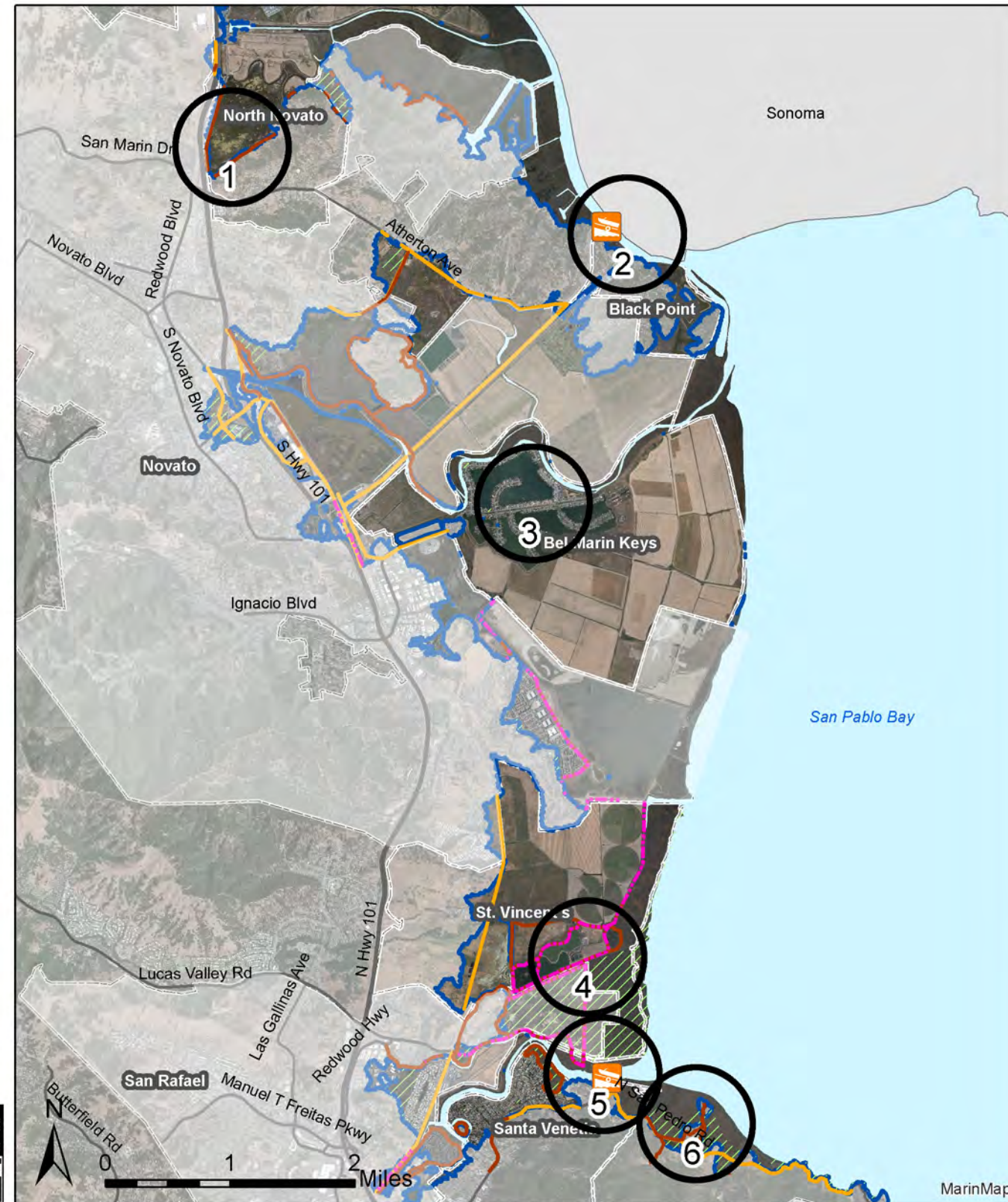
CA Dept. of Fish & Wildlife
Date: 6/15/2017



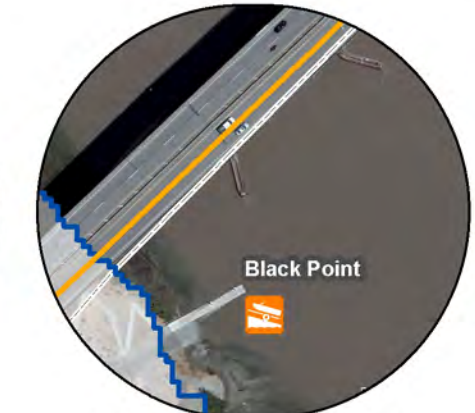
Map 128. Northern Unincorporated Marin Vulnerable Recreation Assets

Vulnerable Assets

-  Public Boat Launch
 -  Bay Trail
 -  Trail
 -  Bikeway
 -  Park
- Location Indicators**
-  Unincorporated
 -  Municipality
 -  Road
 -  Bay
 -  Inland Extent: Sea Level @ 60"+100-year Storm



1: Rush Creek



2: Petaluma River Boat Launch & Fishing Access



3: Bel Marin Keys



4: St. Vincent's

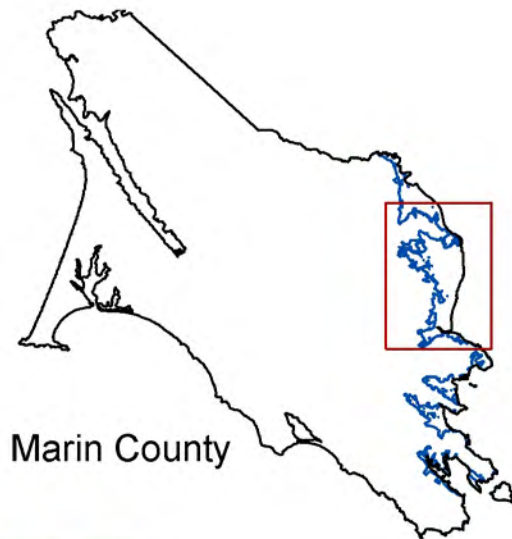


5: Buck's Landing



6: China Camp State Park

Disclaimer: Vulnerability Assessment maps, tables, etc. can be used as a resource to help identify potential hazardous areas and vulnerable assets. Marin County, and data providers here in, make no warranties of the accuracy or completeness of maps and data. Maps are representational and subject to future revision. Local site conditions must be examined. Commercial use is prohibited.



Date: 2/9/2017

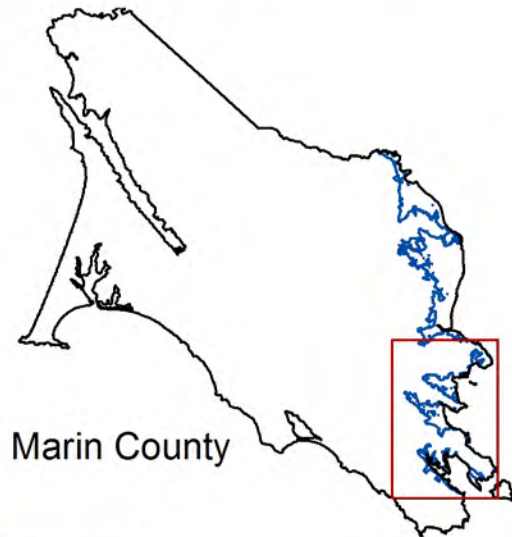


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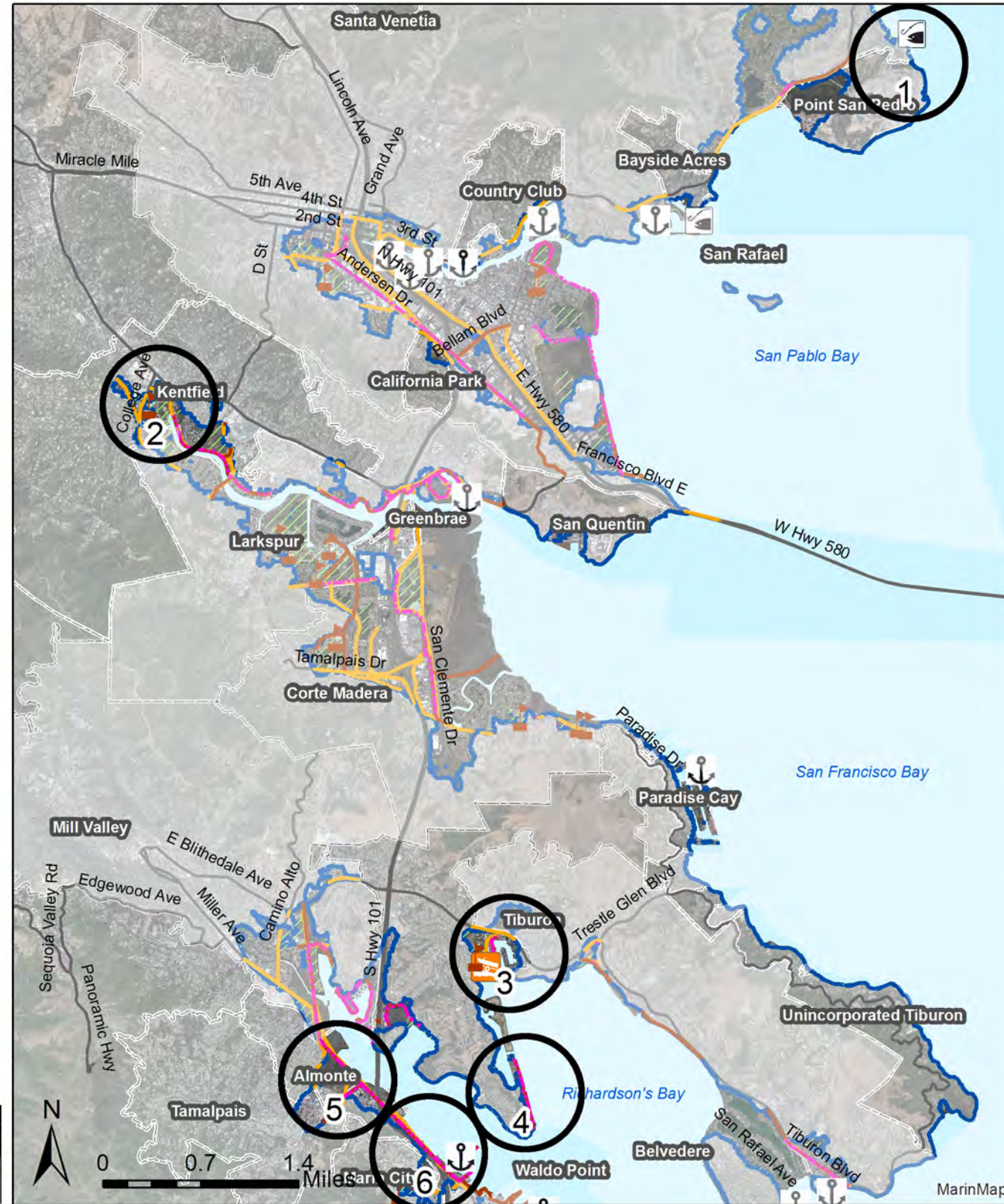
Map 129. Southern Unincorporated Marin Vulnerable Recreation Assets

Vulnerable Assets

- School
 - Public Boat Launch
 - Public Fishing Pier
 - Marina
 - Bay Trail
 - Trail
 - Bikeway
 - Park
- Location Indicators**
- Unincorporated
 - Municipality
 - Road
 - Bay
 - Inland Extent: Sea Level @ 60"+100-year Storm



Date: 6/15/2017



1: McNears Beach Park



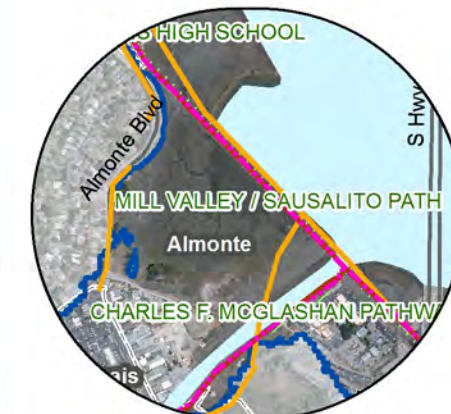
2: Kentfield



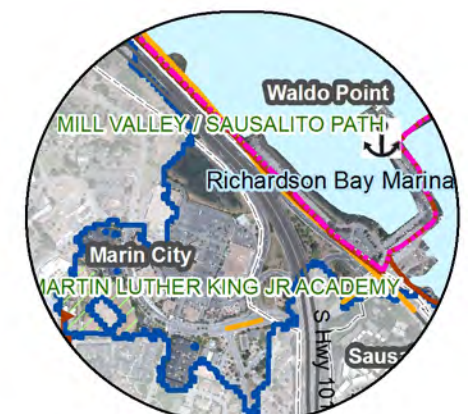
3: Strawberry



4: Strawberry Point



5: Tamalpais Valley



6: Waldo Point Harbor

Disclaimer: Vulnerability Assessment maps, tables, etc. can be used as a resource to help identify potential hazardous areas and vulnerable assets. Marin County, and data providers here in, make no warranties of the accuracy or completeness of maps and data. Maps are representational and subject to future revision. Local site conditions must be examined. Commercial use is prohibited.

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Emergency Services

All but two of the unincorporated communities do not have vulnerable emergency service assets. First, the fire service water tanks and reserves in the greater Novato area could be a concern for the northern shoreline communities. These features are mapped in the Utilities Profile. Finally, Marin County Sheriff maintains a rescue boat at Richardson Bay, or Kappas Marina. This marina is vulnerable in the near-term to damage. This feature is mapped in the Emergency Services Profile.

The main cause for concern with respect to emergency services is interrupted or blocked vehicular access. This could lengthen response times and require alternative routes be used or developed. Much like with utilities, the communities rely on emergency service assets headquartered in other communities. Unincorporated Tiburon and Paradise Cay could be burdened by impacts to the Tiburon Fire Department and the Corte Madera Fire Department, and the Central Marin Police Department. Santa Venetia, California Park, Bayside Acres, and Country Club could be impacted by interruptions in San Rafael emergency services and access. And finally, Bel Marin Keys, Black Point, Green Point, and North Novato could be vulnerable to interruptions to the Novato Fire Department and access for all other emergency services. To read more and reference maps about access issues, see the Transportation and Emergency Service Profiles.

Cultural Resources

Key resources in unincorporated Marin are federal or state lands. Historic sites may contribute to local sense of place and can help define community character and identity. Specific locations of archaeological sites are confidential.

Fort Baker

National Register of Historic Places

Vulnerable Resources: Seawall, Marine Hoist and Dock, Refueling Dock and Marine Railway

Scenarios: All

Flood Depths: 0-7'10"+100-year storm surge

Primary Building Materials: Concrete, Wood, Steel

At the southeastern foot of Marin County, Fort Baker was acquired by the Federal Government in 1866 and served as an Army Post until the mid-1990s. Now part of the Golden Gate National Recreation Area; its historic structures have remained intact including the numerous military buildings. Three structures in the low lying area looking out to

Horseshoe Bay could be vulnerable to flood depths of more than 4 feet in the near-term and nearly 8 feet plus storm surges in the long-term:

1. Seawall
2. Marine Hoist
3. Refueling Dock and Marine Railway
4. Replacement Value = \$2,142,003^{217,218}



Horseshoe Cove and Fort Baker (circa 1950s) Credit: Golden Gate National Recreation Area Park and Archives Record center



1889 photo of China Camp with drying grounds. Source: Wikipedia.

²¹⁷ National Park Service. 2015. Adapting to Climate Change in National Parks

²¹⁸ 2015 dollars

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Angel Island

California State Landmark

National Register of Historic Places (Immigration Station)

Vulnerable Resources: Ferry terminal (access, non-historic)

Scenarios: All

Flood Depths: 0- 6'9"+100-year storm surge

Historically, Angel Island is known for its immigration station, sometimes referred to as the “Ellis Island of the West.” From 1910-1940, hundreds of thousands of immigrants, typically from China and Japan, were detained on the island, sometimes for months as part of immigration control. The island is a popular destination for visitors with a variety of recreational activities and historic buildings.

The Angel Island ferry terminal is vulnerable in the near-term, with flood depths increasing in medium- and long-term scenarios. If the ferry terminal floods it could cause a reduction or loss in tourism activity and revenue needed to sustain the historic buildings on higher grounds. Aside from the ferry terminal, Angel Island’s historic structures are not directly vulnerable to sea level rise.

China Camp State Park

National Register of Historic Places

Vulnerable Resources: Shrimp Shed and 305’ Pier

Scenarios: All

Flood Depths: 0-10'0"+100-year storm surge

Primary Building Materials: Wood

Historic American Landscape Survey: Underway

China Camp was once home to Miwok Native Americans and a historic shell mound marks their presence here. This site is also one of the only remaining historic Chinese-American shrimp villages in the Bay Area. In the late 1800s, China Camp housed around 500 residents, many from Canton, who made a living in shrimp harvesting. The shrimp was typically dried on the banks and shipped back to China for medicinal purposes. Both racially motivated legislation and environmental changes led to the decline of shrimping practices. Several of the historic structures are intact and protected by a seventy-five acre 1979 National Register of Historic Places designation. Lastly, a Historic American Landscape Survey is underway.²¹⁹

Vulnerable structures at China Camp include the wood-framed shrimp shed and 305 foot pier along its waterfront. Flood depths could reach up to ten feet, potentially drowning the pier and structurally damaging to both resources. The Shrimp Shed serves a visitor center with educational panels and artifacts and is open to the public. These historic artifacts could also be damaged, if tide water enters the building. Erosion could further exacerbate impacts to the site, damaging the cultural landscape and the beach itself. Furthermore, North San Pedro Road through China Camp already floods at king tides. This would worsen with higher sea levels.

Table 131 ranks example vulnerable assets by onset and flood depth. Note that a 100-year storm surge could add one to three feet of saltwater. Moreover, the highest high tides could impact a larger area and result in greater depths as well. Several assets that could anticipate 100-year storm surge flooding only in long-term scenario 6 are

- Shopping center, housing, and Martin Luther King Jr. Academy, Marin City,
- Anthony G. Marin College, and Bacich Elementary and Adaline E. Kent Middle Schools,
- Strawberry Point Elem. School and Strawberry Village Shopping Center, Strawberry,
- Paradise Cove Treatment Plant, Unincorporated Tiburon,
- Marin County Expo Center and Amphitheater, Santa Venetia, and
- An additional five archeological sites.



December 12, 2016 king tide floods China Camp historic pier. Credit: R. Rothbart

²¹⁹ Patillo, C. *China Camp HALS*. Last updated July 1, 2012. <http://halsca.blogspot.com/2012/07/china-camp-hals.html>

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Table 131. Example Unincorporated Marin Vulnerable Assets by Sea Level Rise Onset & Flooding at MHHW

Location	Asset	Scenarios		
		1	3	5
		Near-term	Medium-term	Long-term
Confidential locations	Archaeological Sites	3 sites no data	5 sites no data	14 sites 1'11" to 10'8"
Pt. San Pedro	China Camp State Park	7'6"	8'1"	18'4"
San Rafael	John F. McInnis Park	7'6"	8'6"	10'6"
Pt. San Pedro	China Camp Historic District* 2 historic structures	0-7'3"	0-7'8"	0-10'0"
Santa Venetia	Santa Venetia Marsh	7'	7'10"	9'11"
San Pablo Bay	San Pablo Bay Wildlife Area	6'9"	7'2"	19'
Santa Venetia	Santa Margarita Island	5'8"	6'8"	8'8"
Bel Marin Keys	Del Oro Park	5'2"	5'8"	8'9"
Bel Marin Keys	Cavalía Cay Park	5'1"	5'8"	8'9"
Bel Marin Keys	Dolphin Isle Boat Launch	5'1"	5'8"	8'9"
Lucky Drive	Homes on water west of 101	0-5'	0-5'8"	3'-8'6"
Greenbrae Bdwk	Homes east of 101	0-4'9"	0-5'5"	5'-8'5"
Bel Marin Keys	Bahama Reef Boat Launch	4'6"	5'2"	8'1"
Waldo Point	Richardson Bay Marina	4'5"	7'4"	18'7"
Fort Baker	National Recreation Area 3 Classified Structures*	0-4'5"	0'-5'2"	0-7'10"
Pt. San Pedro	Mc Nears Beach Park	4'4"	5'9"	8'
Bel Marin Keys	Bel Marin Keys Blvd	0-3'10"	0-4'6"	0-8'6"
Angel Island	Angel Island Ferry Terminal	0-3"	0-11"	0-6'9"
Black Point	Black Point Boat Launch	2'8"	3'10"	7'
Bel Marin Keys	Homes west of Bel Marin Keys Blvd.	0-2'7"	0-3'	3"-4'9"
Paradise Cay	Homes	0-2'4"	0-2'8"	5'3"
Greenbrae Bdwk	Greenbrae Boardwalk raised walkway	5"-1'7"	1'-2'4"	3'3"-5'
Almonte	Seaplane Adventures	9"	2'	5'
Tamalpais	Tam Junction businesses	0-8"	7"-2'	1'5"-5'3"
Paradise Cay	Paradise Cay Yacht Harbor	2"	1'6"	3'10"
Waldo Point	Businesses		0"-7'7"	1'5"-10'10"
Almonte	Charles F. McGlashan Pathway		7'6"	10'8"
Tamalpais	Shoreline Highway		5"-7'5"	2"-12'5"
Strawberry	Brickyard Cove		6'11"	9'11"
Strawberry	Greenwood Cove homes		2"-6'6"	6"-8'
Strawberry	Strawberry Recreation District		5'11"	8'11"
Strawberry	Strawberry Recreation District		5'4"	10'
Strawberry	Strawberry Point Tidal Area		5'1"	8'1"
Strawberry	Strawberry Point Park		4'10"	9'2"
Strawberry	Strawberry Recreation District		4'4"	8'1"

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Location	Asset	Scenarios		
		1	3	5
		Near-term	Medium-term	Long-term
Almonte	Shoreline Highway		0-3'10"	1'6"-7'
Santa Venetia	Santa Venetia homes		1"-3'6"	2"-6'7"
Greenbrae	Marin RV Park		1'4"-2'5"	3'5"-6'
Bel Marin Keys	Montego Park		2'	5'4"
Almonte	Shoreline Hwy at U.S. Highway 101 (Manzanita)		1'3"-2'	4'3"-5'
Almonte	Shoreline development		0-2'	1'8"-5'
Tamalpais Valley	Birdland neighborhood		0-1'10"	2"-5'9"
Strawberry	Strawberry Circle		7"-1'10"	1'5"-4'9"
Waldo Point	Gate 6 Road		0-1'9"	1'10"-4'9"
China Camp SP	N. San Pedro Road		0-1'8"	1'7"-3'8"
Strawberry	Homes along Seminary Dr.		3"-1'3"	8"-3'6"
Almonte	Caltrans corporate yard		1'	4'
Bayside Acres	Beach Drive		1"-1'	2'4"-3'10"
Santa Venetia	N. San Pedro Road		0-9"	1'8"-3'5"
San Quentin	Buildings		3"-7"	8"-1'5"
Bel Marin Keys	Bel Marin Keys CSD office		6"	1'3"
Strawberry	Westminster Presbyterian Church & preschool		6"	1'2"
San Rafael	Marin County Health Innovation Campus		4"	3'4"
St. Vincent's	SMART Rail			0-10'9"
Novato	Deer Island			10'10"
North Novato	Marin County Airport @ Gness Field			10'4"
Bel Marin Keys	Caribe Isle Park			7'4"
Bel Marin Keys	Calypso Bay Public Dock			7'4"
Bel Marin Keys	Bel Marin Keys Public Dock			7'4"
Bel Marin Keys	Bel Marin Keys Yacht Club			7'4"
North Novato	SMART Rail			0-7'
Santa Venetia	Castro Park			6'11"
Santa Venetia	Neighborhood streets			6"-6'8"
Santa Venetia	Candy's Park			6'3"
Black Point	Atherton Avenue			0-6'
Santa Venetia	Adrian Rosal Park			5'10"
Santa Venetia	Pueblo Park			4'11"
Strawberry	Redwood Highway Frontage Road			1'2"-4'10"
Strawberry	Strawberry Circle homes			1'4"-4'8"
Country Club	Pt. San Pedro Road			5"-4'
Marin City	S. Hwy 101 Off Ramp			5"-4'
Strawberry	Commercial along Seminary Marsh			5"-4'
Kentfield	Apartments & offices off Sir Francis Drake Blvd.			3'10"
Strawberry	Baseball diamonds			3'10"
Strawberry	Seminary Drive			7"-3'7"

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Location	Asset	Scenarios		
		1	3	5
		Near-term	Medium-term	Long-term
Corte Madera	Ring Mountain			3'6"
Strawberry	Tiburon Blvd.			5"-3'4"
Bel Marin Keys	Homes east of Bel Marin Keys Blvd.			3"-3'3"
North Novato	Hwy 101 South bound off ramp			1'9"-2'7"
Almonte	Tam Junction			1'6"-2'5"
Almonte	Almonte Blvd.			1'10"-2'5"
Kentfield	Homes along McAllister Slough			6"-2'5"
North Novato	Redwood Highway			1'9"-2'4"
North Novato	Hwy 101 North bound			4"-2'4"
Marin City	Hwy 101 North bound			0-2'
Strawberry	De Silva Island Drive			10"-1'10"
Kentfield	Stadium Way			1'5"-1'9"
Paradise Cay	Paradise Cay Marina			1'-1'10"
Strawberry	Hwy 101 North bound			1'7"-1'8"
Kentfield	Homes along Beren's Slough			10"-1'8"
Strawberry	Hwy 101 South bound off ramp			2"-1'
Bel Marin Keys	NMWD Cathodic Protection Well			No data
Unincorporated Tiburon	Paradise Beach Park	Beach floods at existing high tide		
Bel Marin Keys	NMWD Water distribution system	Underground asset		
Marin City	Sewage Pipes under Hwy 101	Subsidence, underground asset		
Strawberry	Salt Works Canal	Water Resource		
Strawberry	Aramburu Wildlife Preserve	No data		

Source: MarinMap, CoSMoS