



Looking upstream to Lower West Creek from near STA 3+30' (August 3, 2022).

Executive Summary: Flood Risk Reduction Alternatives

Marin County Flood Control & Water Conservation District Zone 4

East Creek & West Creek

Tiburon, California

October 11, 2023



Prepared by:

Matt Smeltzer, P.E.
Engineer/Geomorphologist
CA Civil Engineer #71671

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East Creek and West Creek drain Tiburon’s Bel Aire neighborhood to Richardson Bay south of Tiburon Blvd (State Route 131). Portions of both creeks are prone to overbank flooding onto creekside residential properties during severe storms. Marin County Flood Control District Zone 4 maintains flood mitigation infrastructure and manages routine maintenance of both creeks to minimize flood risk. In November 2022, the Zone 4 Advisory Board directed District staff to develop three flood risk reduction “alternatives” for each creek – a low-cost, a medium-cost, and a high-cost alternative – and deliver for the Board’s consideration a presentation summarizing the effectiveness and estimated implementation cost of each alternative.

As a consultant to the District, Geomorph Design Group (GDG) updated hydraulic models of each creek and used the models to develop a range of flood risk reduction alternatives for both creeks:

	Low-Cost	Medium-Cost	High-Cost
East Creek	Minimum Plan	Medium Plan	Medium Plan + 1+2+3
West Creek	Minimum Plan 2	Medium Plan 3-2	Maximum Plan Med-3

GDG produced a July 18, 2023 report documenting the how much each alternative would reduce flood water surface elevations (WSEs) adjacent to floodprone properties. District staff and GDG presented report findings at the July 25, 2023 Advisory Board meeting, including planning-level implementation cost estimates.

East Creek Flood Risk Reduction Alternatives

East Creek Minimum Plan. *Status Quo*. District continues current program of periodic ongoing as-needed vegetation and sediment removal from accessible reaches of East Creek downstream and upstream from Cecilia Way culvert according to the current permitted extents.

Cost	~\$45k annual maintenance cost
Effectiveness	Reduces 50-year flood WSEs about 0.4 feet in the floodprone reach of East Creek, but the reduced WSEs are still about 0.5 feet higher than the top of creek bank.

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East Creek Medium Plan. District implements a more comprehensive “creek restoration” project to extend vegetation and sediment removal over a broader reach of East Creek than currently permitted. District would need to design the project and obtain new environmental permits for implementation. District would monitor vegetation establishment and sediment deposition following restoration of the “completely dredged” condition to determine if and what ongoing channel maintenance sediment and vegetation removal activities would be required to maintain plan effectiveness over time.

Cost	~\$744k plus to-be-determined annual maintenance cost
Effectiveness	Reduces 50-year flood WSEs about 0.9 feet in the floodprone reach of East Creek, but the reduced WSEs are still very near the top of creek bank, and 100-year flood WSEs may be 0.5 feet higher.

Optional Add-On: Replacing an existing deteriorated 24”-high wood wall “flood barrier” extending along the top of bank of East Creek along the rear of 100, 106, 112, 118, 124, and 130 Leland Way was presented as an add-on option for the Medium Plan. The wood wall would mitigate both for the higher 100-year flood WSEs and for the potential effect of ongoing, although lesser, cyclical vegetation establishment in the channel. Design and construction of the optional flood barrier is not included in the estimated cost.

East Creek Medium Plan +1+2+3. District implements the East Creek Medium Plan. And three more expensive capital improvement projects are also implemented:

1. Marin County replaces the approximately 275-ft-long 52”-diameter culverts in the County Right-of-Way and easement between State Route 131 (Tiburon Boulevard) and the Richardson Bay outfall with 66”-diameter culverts (matching the diameter of Caltrans’ culverts under Tiburon Blvd).
2. Richardson Bay Sanitary District modifies the grouted rock-lined channel inlet at the sanitary sewer crossing and some length of the rock-lined channel to widen and lower the channel bed, as may include new concrete abutments for the overhead sewer pipe crossing.
3. Town of Tiburon or others replace Cecilia Way culvert and concrete transition channel with a wider natural bottom channel formed by new pier-supported vertical concrete retaining walls clear-spanned by a new roadway bridge deck.

Zone 4 does not have the right-of-way to implement infrastructure modification projects #2 and #3.

Cost	~\$10M plus to-be-determined annual maintenance cost
Effectiveness	Reduces 50-year flood WSEs about 1.6 feet in the floodprone reach of East Creek, to about 0.7 feet below

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	the top of creek bank. 100-year flood WSEs may be near the top of creek bank.
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West Creek Flood Risk Reduction Alternatives

West Creek Minimum Plan 2. District would obtain new permits and implement one-time hand-work to remove about 100 CY of foreign rock and concrete materials accumulated in places along the length of the channel bed in an approximately 300-ft long reach of Lower West Creek and an approximately 400-ft-long reach of Upper West Creek, including minor bank shaping and biotechnical erosion protection in Upper West Creek. Creek naturalization. No tree removals.

Cost	~\$365k plus to-be-determined annual maintenance cost
Effectiveness	Reduces 50-year flood WSEs about 0.2-0.4 feet in the downstream part of the floodprone reach of Upper West Creek, but the reduced WSEs are still about 0.3 feet higher than the top of creek bank. Unchanged flood WSEs in the upstream part of the reach remain 0.3-0.6 feet higher than the top of creek bank.

West Creek Medium Plan 3-2. District would obtain new permits to implement the hand-work naturalization work under the West Creek Minimum Plan as well as additional measures extending upstream through the floodprone length of Upper West Creek:

- Replace the existing grade-controlling channel-spanning concrete stormwater outfall apron near Station 11+50' with an adequate width-and-depth rock-lined channel at the new outfall and biotechnical bank erosion protected grade-transitioned bed and banks upstream and downstream.
- Remove four large non-native in-channel trees that detailed hydraulic modeling shows block flows and increase flood WSEs. Also remove the stumps of removed in-channel trees and repair the disturbed and adjacent channel banks with more steeply sloped, possibly physically stabilized bank materials such as rock rip-rap placed by an excavator in certain places where hydraulic modeling shows enlarging the channel would reduce 50-year WSEs at remaining floodprone locations. Extents of rock rip-rap bank stabilization determine amounts of environmental mitigation required by permitting agencies.

Medium Plan 3-2 is a thorough creek naturalization project that restores adequate width, depth, and slope channel for reasonably optimizing creek flow conveyance in West Creek. Medium Plan 3-2 pre-empts future work requirements for removing the concrete outfall as it continues to degrade, and emergency maintenance work to clear debris blockages and repair bank erosion when large in-channel trees are wind-thrown.

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Cost	~\$1M plus to-be-determined annual maintenance cost
Effectiveness	Reduces 50-year flood WSEs about 0.4-1.2 feet along the floodprone length of Upper West Creek, but the reduced WSEs may still be about 0.1 feet higher than the top of creek bank in a short segment of the creek near Station 10+40'. 100-year flood WSEs may be about 0.3 feet higher than the creek bank in the same segment.

Optional Add-On: Similar to the existing wood wall "flood barrier" along East Creek, a relatively inexpensive low-technology "flood barrier" could be installed along the top of bank within the segment of creek near Station 10+40' to provide more uniformly-distributed flood risk reduction along the reach. Design and construction of the optional flood barrier is not included in the estimated cost.

West Creek Maximum Plan Med-3. District implements West Creek Medium Plan 3-2. And two more expensive capital improvement projects are also implemented:

1. Caltrans upgrades the culverts running under Tiburon Blvd from 60" CMP to 66" RCP culverts.
2. Town of Tiburon or others replace Cecilia Way culvert and concrete transition channel with a wider or same-width natural bottom culvert with a natural, self-setting bed elevation and possibly a higher ceiling.

Zone 4 does not have the right-of-way to implement these infrastructure modification projects.

Cost	~\$7M plus to-be-determined annual maintenance cost
Effectiveness	Compared to Medium Plan 3-2, the Maximum Plan reduces WSEs immediately upstream from both culvert inlets, but does not reduce WSEs in the floodprone reach of West Creek.