Preliminary Bolinas Lagoon Intervention Alternatives

Reference Number	Alternatives	Pros	Cons	Objective 1 Monitor condition of the lagoon	Objective 2 Extend longevity of existing tidal and subtidal habitats	Objective 3 Reestablish lost tidal and subtidal habitats	Potential for adverse impacts	Lifespan (years)
NA	No-action	Allows the lagoon to evolve toward a shallow intertidal condition; no adverse impacts attributable to intervention activities.	Does not met any of the project goals and objectives. Does not ameliorate the loss of tidal prism and shifts in habitats attributable to human disturbance.	o	o	o	o	o
Monitoring and Adaptive Management Measures								
M-1	Install Tide Gauge	Would add to long term data set & provide critical information on lagoon's tidal prism. Would add to long term data set & provide critical information on lagoon's tidal prism.	None.	++	o	o	o	10 to 50++
M-2	Develop Monitoring and Reporting Program	Would inform managers of lagoon status, with or without a project.	Uncertainties/difficulties include funding, organizing data, reporting out, etc.	+++	o	o	o	50++
M-3	Develop Contingency Plan to Reopen Inlet	Would prevent prolonged inlet closure.	Would only occur after closure, when conditions had already deteriorated.	o	o	o	o	50++
Non Dredging Alternatives								
ND-1	Watershed Management including reestablish Pine Gulch Creek Floodplain	Would reduce sediment delivery, decrease rate of infill, slow the rate of progradation of PGCD, and improve floodplain function & habitat for fish and wildlife species. Because growth of the delta reduces wind wave action that maintains equilibrium mudflat elevations, reducing future progradation will reduce future loss of tidal prism and expansion of tidal marsh.	Land owners choice to implement recommendations. Would need to negotiate with land owner; Lands, Easements, Rights-of-Way, Relocations & Disposal sites (LERRD's) a local cost. Possible issues with flooding.	o	++	o	o	50++
ND-2	Open Seadrift Lagoon	Ameliorates some impacts of human actions in that area; increase of subtidal & intertidal habitats; improves circulation; increases tidal prism.	Potential to introduce invasive sp. to rest of lagoon (crab sp.); may fill with sediment; unknown impacts to water quality; low tides could bring unpleasant smell to residents; may have safety issues for children using the lagoon.	o	o	+	+	10 to 15
ND-3	Create additional groins towards to west of Bolinas Groin	Benefit of groin is to provide a wider beach that reduces erosion of bluffs and therefore amount of fine sediments carried into the lagoon.	Groins less effective in winter when most erosion of bluffs occurs; uncertainties include getting permits from GFNMS and CCC & public acceptability.	o	+	o	o	50++

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ND-4	Reestablish Poison Lake/Easkoot Creek storm overflow to ocean	Would restore historical route of the creek; could decrease rate of infill.	Effectiveness not currently known; contribution of sediment from this creek significant? Conflict with State Park land use?	o	+	o	o	50++

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Dredging + Non Dredging Combinations								
DN-1	Watershed Management and Reestablish PGC floodplain; open diked areas to tidal cycles; excavate PGC Delta	When done together, project has potential for long-term benefits. Would reduce sediment delivery, decrease rate of infill, slow or eliminate the rate of progradation of PGCD and improve floodplain function & habitat for fish and wildlife species. Removes some direct and indirect impacts of human actions; direct increases in abundance of intertidal and subtidal habitats and increase in tidal prism; indirect benefit of wind-wave erosion keeping equilibrium mudflat elevations and preventing expansion of tidal marsh.	Tradeoffs with tidal marsh; adverse short-term impacts on water-quality and to benthos/fish/birds; temporary disturbance to wildlife from dredging. Larger dredge volumes will result in greater time and thereby increase period and extent of adverse impacts. Difficulty in obtaining permits from agencies including GFNMS.	o	++	+	++	50++
DN-2	DN-1 plus Dredge Bolinas Channel; couple with eel grass restoration	Same as DN-1 plus: Reconnection of Bolinas Channel with PG Creek and additional drainage area will increase tidal scour and may allow Bolinas Lagoon to remain open. Actions may be self-sustaining when done in concert. May allow for successful restoration of eel grass beds.	Same as DN-1 plus: With larger area and volume of dredged sediments, greater time will be required and thereby increase period of adverse impacts.	o	++	++	++	10 to 50++
DN-3	DN-2 plus Dredge North Basin	Same as DN-2 plus dredging the North Basin reestablishes lost subtidal habitat; connecting with Bolinas Channel may provide sufficient tidal drainage and scour to keep Bolinas Channel open.	Same as DN-2 plus significantly greater area to be dredged.	o	+++	+++	+++	10 to 50++

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The following alternatives are not recommended for further consideration as individual or combination dredging activities. Some of these have been incorporated in to the alternatives listed above.								
D-1	Remove Kent Island	Increases, at least temporarily, intertidal & subtidal habitats & tidal prism.	Flood shoal would reform. Large footprint/impact area with adverse short-term impacts on water-quality and to benthos/fish/birds; temporary disturbance to wildlife from dredging.	o	+	+	++	10 to 25+
D-2	Dredge North Basin	Increases tidal prism considerably; avoids removal of/impacts to salt marsh; provides more diverse habitat to waterfowl; increases flow & circulation.	Relatively short-term benefit if done alone as basin would accumulate sediment; potentially large footprint/impact area with adverse short-term impacts on water-quality and to benthos/fish/birds; temporary disturbance to wildlife from dredging.	o	++	++	+++	10 to 50++
D-3	Dredge Main Channel	Some increases in tidal prism; increases flow & scour; provides some habitat to fish, diving birds and seals.	Short-term benefit if done in isolation (tidal channels change in response to drainage area characteristics). Does not increase habitat to a great extent by itself. See impacts from dredging under D-1, above.	o	+	+?	+++	5 to 25+
D-4	Dredge Bolinas Channel	Small increase in tidal prism; increases flow & scour; may allow for eelgrass restoration; improves habitat for fish, (fish-eating) wading birds & diving birds.	Short-term benefit is done in isolation; see impacts from dredging under D-1, above.	o	+	+?	++	10 to 25++
D-5	Excavate Pine Gulch Creek Delta	Removes some direct and indirect impacts of human actions; interrupts progradation of delta in sheltered area; increases relative abundance of intertidal and subtidal habitats; increases tidal prism; indirect benefit of wind-wave erosion keeping equilibrium mudflat elevations and preventing expansion of tidal marsh.	Without watershed management or reactivating floodplain, delta would reform. Potentially large footprint/impact area; tradeoffs with wetlands, higher intertidal habitats (riparian forest would be conserved). See impacts from dredging under D-2, above.	o	++	+	++	10 to 50++
D-6	Dredge South Lagoon Channel	Increases tidal prism, flow & scour somewhat; increases flow close to former fill areas (Dipsea Rd; causeway).	Short-term benefit; does not increase tidal prism or restore habitat to a great extent by itself; see impacts from dredging under D-2, above.	o	+	+?	++	5 to 25+

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DC-1	Dredge Bolinas Channel, North Basin and Main Channel	Large, but temporary, increase in tidal prism; increase in frequently submerged habitats; improves habitat for waterfowl, fish and seals.	Add impacts of individual components previously listed.	o	+++	+?	+++	10 to 50+

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ND-5	Restore Eelgrass Beds	Direct and indirect habitat benefits for fish and wildlife species in the subtidal area as well as adjacent non-vegetated areas & salt marshes.	No increase in tidal prism or improvement to flow or circulation; uncertainty whether or not the restoration would be sustainable. Must be implemented with a dredging alternative.	o	o	+	o	1 to 50++
ND-6	Excavate Highway 1 and Dipsea Road Fills	Few impacts to intertidal and subtidal habitats; removes direct human impacts; creates some habitat	Small habitat contribution in marginal areas; tidal prism increase is small	o	o	+	o	50++
ND-7	Armor Bolinas Bluffs	Could reduce future sediment load and decrease rate of infill.	Only indirect habitat benefits; uncertainties include getting permits from GFNMS and CCC & public acceptability.	o	+	o	+	50++