

Humboldt Bay Vertical Reference System
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NOTES and recommendations were received from: Mark Hemphill-Haley(HSU) and Dave Ryan (Humboldt County)

Proposal Structure:

- Develop white paper or abstract for each component of science plan, as a stand-alone project for individual funding and combined for overall project plan and budget
- Identify resources to assist with project; organizations/companies for funding a portion of the project: PG&E for monitoring tide gauges, land level changes
- Simple science plan for West Coast Governors Agreement workshop (Nov 12, San Francisco) ; include horizontal and vertical reference system methods.
- Describe level of precision (3 options for plan: 1st order, 2nd, 3rd); installation and monitoring in terms of each level. Horizontal displacement through time, monitor by GPS; constrain model, determine better model for geophysical. Vertical – relative measurements, use GPS stations as reference; behavior of monument through permanent GPS survey
- Funding: 20 million national wide; West Coast Governor’s Agreement (WCGA) submitting \$2 million project which this could be part of; initial funding look at trends, regional basis, pilot project with HSU students along Little Salmon Fault

Benefits to natural resource management and policy decisions DEVELOP NARRATIVE FOR THESE:

- Better manage species and habitats
- Coastal and marine spatial management (CSMP) regarding uses of habitats and the ocean
- Tie in management benefits, end users
- Address how the project will advance or support CSMP; geological information is a fundamental step in planning for SLR; California is the missing piece of research along west coast
- Tie into WCGA Action Coordination Teams: climate change, sea floor mapping, sediment management and ocean awareness and literacy are priority issues; develop infrastructure with letters of support from organizations that will benefit from science plan
- Tectonics bundled into benefits section

Goals:

Re-level perimeter of Humboldt Bay and tie into historic level lines to look at land level changes AND/or relevel benchmarks from Scotia to Crescent City

- Improve estimates of *local and regional sea level trends and land uplift*
- Gauge locations: decide on coverage and cost; PG&E possibly fund relocating historic gauges; review historic trends; for temporary gauges, have gauges active on half of the sites (3-6 months) at one time then switch
- USACE identified two gauge locations: Fields Landing, Samoa
- Need one on east side of bay: north bay difficult; Bracut, Gannon Slough
- Time series comparison of existing gauges: Hookton, Mad River Slough, Bucksport, Eureka Slough bridge (Target store)
- Reoccupy historic tide gauge stations
- Identify 1-2 new tide gauge station locations in Humboldt Bay

Summary of Tide Gauge work

- Campaign gauges – short term, USACE locations of existing gauges
- Identify location gaps and prioritize infill; explore feasibility of reoccupying existing locations; contact Ray for cost estimates for reinstallation and new gauges
- Identify minimum number of tide gauges need to estimate sea level rise and complete Quality Assurance and Quality Control.
- Monitoring, analysis, reporting: decide on relocation from analysis; depends on cost for accuracy (NOAA protocols adds cost – 2 gauges per site, accuracy depends on equipment; desired outcome dictates accuracy level); 3 additional sites (east side) needed for long-term; short level monitoring data not useful, need long term monitoring to compare historical data
- Two-tiered strategy: long term, short term (campaign)
- Trinidad (new pier) Eel River Delta, Shelter Cove, Klamath (Yurok tribe)
- Emphasize maritime habitat management and applications; broader impacts (eelgrass, migratory species; marsh system, road infrastructure, port and harbor, mariculture); prototype (test site) for other areas (broader impacts along west coast)

Tasks:

- Determine local tide gauge needs; prioritize locations, minimum number, campaign (PG&E funded) or permanent (WCGA); Precision and accuracy for desired outcome, results - Jeff and Todd
- Cost – Ray; Jay and Tom work with Ray for cost, depending on desired results and accuracy (precision and accuracy go along with reliability)

Leveling:

- Geographical Scope (Don) – perimeter of bay; density, location of stations, spacing, GPS network between benchmarks
- Reconnaissance to existing locations
- Infill benchmarks for required spacing or where historical benchmarks are missing (Rod Monument requirements); use existing infrastructure, design GPS network
- Market to CalTrans management for their involvement as lead agency; compliance with Governors executive order for SLR adaptation

- PILOT and EDUCATIONAL RELATED PROJECT: Alternative funding: Ray and Mark Hemphill-Haley using Oregon equipment and HSU students for project along Little Salmon Fault and expand to Russ Fault; capacity building for larger project
- WCGA fund tide gauges; different funding for leveling, possibly NPLCC?

Summary of benchmark leveling:

- Compile existing benchmark and rod data (Hwy 211 benchmarks, SCS benchmarks – Table Bluff, '94 earthquake area leveling project – Fortuna area for Eel River Valley), recon, infill gaps (surface monuments vs control marks); involve Harbor District (Towilla Consulting, data on benchmarks used by Harbor District, might not use NGS standards): Todd, Don, Tom
- Leveling: flat area, high production, convenient access; 35 km around bay, 3-4 monuments per day = ~ 3 weeks
- GPS component - determine network design, density of benchmarks, occupation time, receiver quality; need USGS involvement (Robert Cicle, Menlo Park)
- Projects for WCGA integrated proposal: tide gauge installation, monitor, analyze data; NGS standards for GPS leveled sites; emphasize data useful for determining local impacts of SLR, independent analysis of sea level data (involve Rick Wilson, CGS geologist)
- Bathymetry mapping with habitats – currently happening along outer coast through MLPA monitoring – data gap in area from high tide to 20-25' depth; get update on LIDAR to nearshore

Tasks:

- Compile existing tide gauge data; prioritize locations for new stations (campaign or permanent), consider Trinidad, Eel River Valley, Shelter Cove – Jeff, Todd
- Leveling plan line; height modernization – NGS defined protocol; cost estimate to bluebook level – 2 cm± vertical accuracy – Todd, Don, Tom, Whelan, include Dave Hull
- Determine level of precision, accuracy, cost – Jay, Tom, Ray
- Compile list of end users, consider level of accuracy needed for each - Tom, Susan
- Funding for local server or use existing (CENCOOS); local clearing house for data – compiling, analysis, archive
- Contact USGS, CGS – Tom

Timeline:

- Compile list of end-users by Tues, Nov 2 – Tom, Susan
- One pager on project components done by Friday, Nov 5
- 2-3 page bulleted project description for workshop on Nov 12: Keywords - SLR, support and advance coastal and marine spatial planning, port navigation (project can assist Harbor District by providing gauges, less sensors Dist needs to supply), benefits to commerce (protocol for ships and commerce navigation infrastructure)