North Coast Sea Level (NCSL) Project
Draft
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Goals of Project

- Develop and support infrastructure to establish a vertical reference system for accurate and timely land and sea level elevations to determine sea level rise along California's North Coast, Shelter Cove – Crescent City, CA.

- Evaluate vulnerability of local coastal habitats, communities, and infrastructure to long term and abrupt tectonic land level changes, and, resulting sea level changes.

- Provide essential support to restore and manage estuarine communities including eelgrass beds and salt marshes in regards to rising sea level and climate change in Humboldt Bay.

Project Benefits and Management Applications

- Provide foundational information for all Sea Level Rise (SLR) predictions and facilitate management and planning for rising sea level scenarios through:

    - Constructing additional tide gages
    - Updating and densifying vertical control.
    - Downscaling of global models to local and regional areas
    - Removal of significant tectonic impacts to SLR predictions

    - Assist pre-disaster mitigation planning for coastal hazards such as earthquakes, tsunamis, coastal flooding and sea level rise by increasing mapping accuracy of:

        - Tsunami inundation
        - FEMA flood zones – Flood Insurance Rate Maps (FIRM)
        - Regional relative and absolute sea level changes
        - Local and regional surface elevation changes
        - Transportation & evacuation routes

- Provide State agencies basis for planning and permitting in compliance with CA Gov. Executive Order S-13-08

- Complete a tectonic model of coastal uplift for the Cascadia subduction zone for California, Oregon and Washington.

- Provide regional West Coast benefits to Pacific Flyway migratory bird species.

- Contribute updated elevations for vertical and tidal bench marks.

- Contributes to National Geodetic Survey Height Modernization Program (NOAA program).

- North Coast Sea Level is a model project that starts local and builds regionally; can be applied elsewhere on the West Coast.

North Coast Sea Level Project Scope **Grand Total $300k**

- Tide gages Total $145k

    - Fill regional gaps in sea level observations.
    - Provide redundant yet independent measures of sea level near North Spit.
    - Establish realistic local sea level trends within Humboldt Bay.

- Install permanent tide gage at Trinidad Harbor. $30k
    - Establish ties to nearby CGPS station TRND for monitoring land/gage
    - Utilize historic observations to provide immediate independent estimates of SLR to compare to North Spit.
        - Northern Hydrology and Cascadia Geosciences

- (Permanent tide gage at King Salmon. $0k)
    - (Potential PG&E funded installation at power generation facility for seismic haz.).
        - (PG&E Univ. of Oregon)
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- Install CGPS station on/near North Spit tide gage. $20k
    - Help rectify regionally anomalous sea level measurements by monitoring land/gage continuously
    - Determine relative movement of land/gage from 2 other CGPS within 10 km
        - Humboldt State University – Dept. of Geology

- Deploy temporary tide gages at available historic tide gage locations Subtotal $95k

    - Establish sea level observation points to occupy once/year
    - Tie temporary gage site to tidal bench mark and updated vertical control.
    - Analyze 30 yr record of sea level rise; build on available historic records (1970s) to determine independent historic sea level trends near anomalous North Spit gage.
        - Humboldt Bay (11)
        - Eel River Delta
        - Shelter Cove
        - Klamath Estuary
        - Crescent City
            - 4 sets of equipment $20k
            - Establish site infrastructure at 15 locations $30k
            - Deploy & rotate regionally every 3-6 months $20k
                - Cascadia GeoSciences & Northern Hydrology
        - Pursue research funds through BLM to establish infrastructure at Shelter Cove and one other location along Lost Coast Management Region.
            - Cascadia Geosciences, Northern Hydrology, and University of Oregon

- Upgrade water depth sensors in the Central and Northern California Ocean Observing System (CeNCOOS) to provide fixed measure of SLR.
    - Deploy stationary vented water depth sensors with external data loggers.
    - Humboldt Bay (4) $25k
        - Humboldt State University - CeNCOOS Program

- Level line and GPS surveys Total $120k

    - Establish new control along South Spit and South Humboldt Bay
    - Evaluate and analyze shifts between available historic level lines
    - Evaluate historic relative sea level measurements for inference of land movement
    - Perform GPS surveys and compare historic and contemporary elevation shifts
    - Prioritize leveling efforts based on historic analysis and documented movement
    - Update elevations to form backbone for all critical infrastructure and research
    - Update essential links between tidal measurements and geodetic datums
        - Sea level (tide gages)
        - Tidal bench marks link sea level to point on land
        - NAVD88 is geodetic datum all elevations referenced to

    - Re-level selected NAVD88 level lines (~ 20 years out of date)

        - Level perimeter of Humboldt Bay including US 101 corridor $35k
        - Level from US 101 through Eel River Delta $25k
            - CalTrans District 1
            - County of Humboldt
            - Contractor

    - Tie historic surveys (1931, 1944, 1967, 1988, 1992) where possible $5k
        - Univ. of Oregon & Humboldt State University

    - Establish level lines across Quaternary thrust faults near Eureka and ACV $10k
        - Little Salmon fault (pilot)
        - Mad River fault zone (second phase)
        - Humboldt State University & Cascadia GeoSciences

- GPS Height Modernization and Maintenance of Vertical and Horizontal Control network
  Subtotal $45k

    - Collect regional GPS observations in accordance to NGS Height Standards $10k
        - Equipment: CalTrans, NGS, & HSU

    - Maintain coordinates through repeated GPS surveys to update changes due to secular tectonic movement at both vertical and horizontal control. $20k
        - Cascadia GeoSciences, HSU, contracted processing facility

    - Resurvey network for significant tectonic events (M6.5+) $10k
        - All Hands (CalTrans, County of Humboldt, NGS, HSU, U of Ore)

    - Incorporate gravity observations to improve local geoid and regional geophysical database $5k
        - USGS Menlo Park (pending future discussions)

- Data processing/archiving/dissemination Total $35k

    - Submit data to National Geodetic Survey for 'blue booking' to provide updated (publicly accessible) survey control. $10k
        - Consult with California Spatial Reference Center (CSRC) to identify expert contractor needed for satisfy procedures.

    - Analyze vertical rates of land level changes (1931, 1944, 1967, 1988, present) $5k

    - Process all available regional GPS observations 1993-present. $5k

    - Bring new tide gage and CGPS data online for daily downloads and real time data $15k

◊ Technical Advisory, Project Supporters, and Potential Collaborators

o Federal

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