

Appendix E. Summary of relevant monitoring metrics and protocols.

Monitoring Metric	Monitoring Protocol	Source / Citation
Nekton abundance, species richness	SMI; collected with ditch nets and throw traps to evaluate the richness and abundance of the fauna that inhabit the waters of a wetland	Neckles <i>et al.</i> 2013; DRAFT SMI Report from R5
Bird abundance, species richness	SMI, SHARP bird surveys	SHARP protocol, http://www.tidalmarshbirds.org/?page_id=1595
Plant Community composition, abundance, richness	SMI, SHARP vegetation protocol (circular plot and point intercept transects); IWMM habitat quality/quantity	<p><i>SHARP</i>: www.tidalmarshbirds.org</p> <p><i>IWMM</i>: http://iwmmprogram.org/, Loges et al. 2014 (Also, see FWS SMI protocols)</p>
Water level, Inundation time	Continuous monitoring via Solinst (or HOBO) Level logger stations deployed in arrays across the marsh, on a seasonal basis; basic hydrology is determined from level loggers in wells that measure water level over time by pressure transduction. This gives an indication of tidal range and amount of time the marsh platform is inundated.	FWS protocol, SMI
Marsh Surface	SETs and Feldspar	2016 NPS SET Protocol, adopted as official FWS protocol: https://fishnet.fws.doi.net/regions/5/nwrs/im/NSE/ProtocolsFinal/Forms/AllItems.aspx

Elevation change and Sediment Accretion Rate	<p>Marker horizons; changes seen in SETs are a combination of sediment deposition rates and rate of changes in the elevation of shallow marsh soils (due to compaction, decay, etc.). Sediment accretion rates can be separated from SET measurements cross referencing data collected from feldspar horizon marker which just gives an indication of sediment deposition rate. This is done by spreading a layer of feldspar (marker horizon) over a section of marsh and measuring the accumulation of natural sediment above it over time.</p>	
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Monitoring Metric	Monitoring Protocol	Source / Citation
Water Quality: temperature, salinity, conductivity: DO, pH, dissolved nitrogen, dissolved phosphorous, Chlorophyll-a, pheophytin, TSS	A water quality (WQ) monitoring network will be established, collecting continuous temperature, conductivity, salinity data, with 4 strategically placed YSI Sondes, 3 of which provide real-time data online. Sondes'	Ganju <i>et al.</i> , 2015

	<p>maintenance and calibration will be accomplished by Refuge hydrologist; data processing will be conducted by University or USGS partners. In addition Refuge hydrology/biological staff will conduct bi-monthly grab samples at 4 sites to test for pH, total dissolved nitrogen, total dissolved phosphorus, Chlorophyll-a content, pheophytin, and total suspended solids (TSS). Will be processed by partners through a combination of in-lab processing (TSS) and independent lab analysis (nutrients).</p>	
Flood/ebb SSC differential, organic-inorganic suspended sediment ratio	<p>Continuous monitoring via ADCP backscatter interpretation (with calibration);</p> <p>Monitoring Protocol: Seal Beach National Wildlife Refuge Sediment Flux – USGS Western Ecological Research Center, San Francisco Bay Estuary Field Station</p>	Ganju <i>et al.</i> , 2015
Total marsh surface area	<p>Remote sensing (DigitalGlobe Imagery/Aerial Photography/LiDAR/Structure from Motion Drone Imagery are all possibilities) interpreted to GIS spatial layer (2 dimensional)</p>	To be determined
Shoreline position/length in linear feet	<p>Remote sensing (DigiGlobe Imagery/Aerial Photography/LiDAR/Structure from Motion Drone Imagery are all possibilities) interpreted to GIS spatial layer (1-D, linear)</p>	To be determined
Landscape analysis	Aerial imagery and interpretation	<p>DigitalGlobe: https://evwhs.digitalglobe.com/myDigitalGlobe/login#16/39.1010/-74.8841</p>

		National Geospatial-Intelligence Agency sponsored Enhanced-View Web hosting of digital aerial images
Bathymetric Profile	RTK measurement of water depth	