San Diego Bay Sediment Mediation

July 14, 2010

Outline

- Jurisdiction/legal standard – Resolution No. 92-49
- Background levels
- Economic and technological feasibility
- Process for determining alternative cleanup levels
- Identify COCs
- Analyze potential impacts to human health, wildlife, and benthic community
- Confirm alternative cleanup levels protect beneficial uses
- Cleanup footprint
- Remedial design
- Verify remedy success

Jurisdiction

- Water Code Section 13304
  - "Any person who has discharged or discharges waste into the waters of this state in violation of any waste discharge requirement or other order or prohibition issued by a regional board or the state board, or who has caused or permitted, causes or permits, or threatens to cause or permit any waste to be discharged or deposited where it is, or probably will be, discharged into the waters of the state and creates, or threatens to create, a condition of pollution or nuisance, shall upon order of the regional board, clean up the waste or abate the effects of the waste..."

Jurisdiction

- Resolution No. 92-49 Provides Jurisdiction for the Regional Board to Require Remediation of Discharges of Waste
  - Regional Board is authorized “to require complete cleanup of all waste discharged and restoration of affected water to background conditions”
    - Unless not “economically or technologically feasible”
  - “[U]nder no circumstances shall [the Regional Board] require cleanup and abatement which achieves water quality conditions that are better than background conditions”
  - “[D]ischargers are required to clean up and abate the effects of discharges in a manner that promotes attainment of either background water quality, or the best water quality which is reasonable if background levels of water quality cannot be restored, considering all demands being made and to be made on those waters and the total values involved, beneficial and detrimental, economic and social, tangible and intangible”
  - “Any such alternative cleanup level shall:
    - Be consistent with maximum benefit to the people of the state;
    - Not unreasonably affect present and anticipated beneficial use of such water; and
    - Not result in water quality less than that prescribed in the Water Quality Control Plans and Policies adopted by the State and Regional Water Boards”

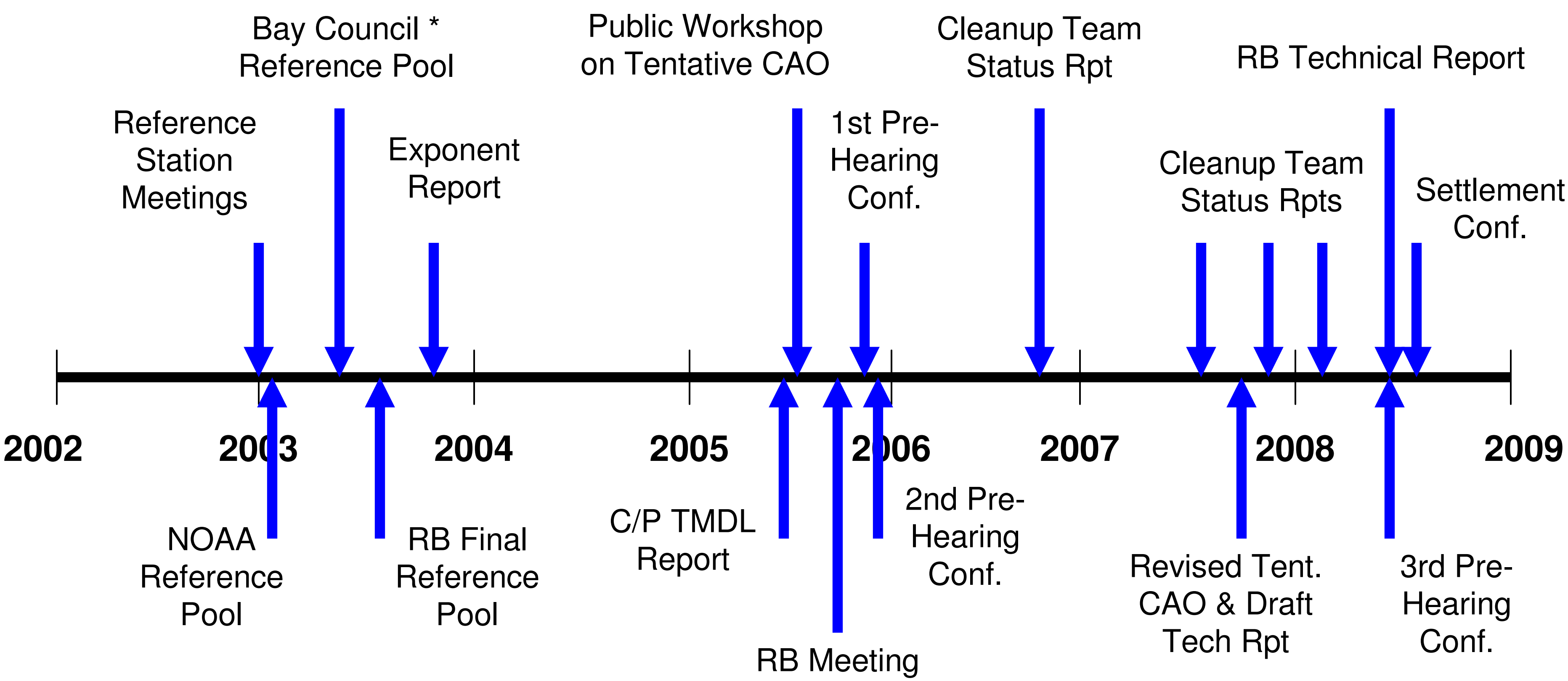
Jurisdiction (92-49)

- Technological Feasibility
  - "Technological feasibility is determined by assessing available technologies, which have been shown to be effective under similar hydrogeologic conditions in reducing the concentration of the constituents of concern."
- Economic Feasibility
  - "Economic feasibility is an objective balancing of the incremental benefit of attaining further reductions in the concentrations of constituents of concern as compared with the incremental cost of achieving those reductions. The evaluation of economic feasibility will include consideration of current, planned, or future land use, social, and economic impacts to the surrounding community including property owners other than the discharger. Economic feasibility, in this Policy, does not refer to the discharger's ability to finance cleanup."

Background

- Definition of Background
  - State: Represents the SD Bay conditions absent Shipyard Sediment Site discharges (consistent with Water Code 13304 and SWRCB Resolution 92-49)
  - Federal
    - U.S. EPA's Sediment Classification Methods Compendium (1992)
      - "A reference sediment, on the other hand, is collected from a location that may contain low to moderate levels of pollutants resulting from both the global inputs and some localized anthropogenic sources, representing the background levels of pollutants in an area..."
    - U.S. EPA's Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites (2002)
      - "background refers to substances or locations that are not influenced by the releases from a site"
  - DTR: Consistent with state and federal definitions of background
    - Utilize Background Levels Based on DTR Reference Conditions
    - The Regional Board selected stations to establish a reference condition reflective of the sediment quality condition that existed within and adjacent to the Shipyard Sediment Site before the discharges occurred.
    - This contemporary ambient background condition is not representative of pristine preindustrial background condition as it considers the global spread of pollutants in the bay from current and historical discharges.

Background Levels



* Bay Council = EHC, Coast Keeper, Audobon, and Sierra Club

Background Levels

- Reference Station Criteria for DTR Background (DTR Section 15.1)
  - Multiple reference sites are preferred
  - Located in relatively clean areas remote from known pollution sources
  - Appreciably free of chemical pollutants
  - Similar physical & chemical characteristics as shipyard site
  - Similar biological characteristics with respect to major taxa and abundance
  - Considers the dispersion of pollutants in the Bay from non-point discharges (current & historical) – global inputs
  - Provides reasonable protection of SD Bay beneficial uses

Background Levels

- Reference Station Selection Process for DTR Background
  - Select stations from 2001 Shipyard/Chollas-Paleta reference data set
  - Select stations from Bight ’98 data set
  - Final screening of combined SY+CP+B’98 reference stations

Background Levels

Selection of Bight '98 Reference Stations

1. SCCWRP Distance From Shore Approach
2. Develop Plots of COCs vs Distance from Shore
3. Calculate Thresholds for each COC
4. Select B'98 Stations < all Thresholds
5. RESULT = Total 22 B'98 Stations
6. Conduct Final Screen
7. RESULT = Total 9 B'98 Stations

Selection of 2001 SY/CP Reference Stations

1. Identify Pool of B'98 Stations
2. Check for Normality
3. Calculate 95% Prediction & Tolerance Limits
4. Compare Limits to 2001 SY/CP Ref Stations
5. Select Suitable Ref Stations
6. RESULT = Total 9 Stations (4 SY, 5 CP)

Final Screen of SY+CP+B'98 Reference Stations

1. Evaluate each Station using 3 Legs of Triad
2. Sediment Chemistry (ERM, Consensus-based SQGs)
3. Amphipod Toxicity
4. Benthic Community (BRI Score)
5. RESULTS = See Table 15-3 in Technical Report

Background Levels

- Comparison of DTR Background Station Sources to Other Background Data Sets

	Total # of Stations	2001 SY Reference Stations	2001 C/P Reference Stations	Bight'98 Reference Stations
Regional Board	18	5	4	9
NOAA	20	3	3	14
Bay Council	7	0	0	7

Background Levels

- DTR reference pool selected based on station criteria for background
  - Most closely represents the pre-discharge condition at the Shipyard Sediment Site
  - Provides an adequate sample size for statistical analysis
  - Provides greater temporal and methodological comparability to the site data
  - Incorporates the natural variability in toxicity and benthic communities in San Diego Bay
  - Captures the range of fines content present at the Shipyard Sediment Site
  - Provides reasonable protection of the benthic community from contaminant-induced degradation

Background Levels

- Final Background Levels From DTR

COC	Units	Background Level
As	mg/kg	7.5
Cd	mg/kg	0.33
Cu	mg/kg	121
Hg	mg/kg	0.57
HPAH	ug/kg	673
Pb	mg/kg	53
PCB	ug/kg	84
TBT	ug/kg	22
Zn	mg/kg	192

Economic Feasibility

- Estimate costs to remediate to background and other alternative remedial levels
- Amount of remediation
  - Volume and costs for dredging and other remediation measures
- Determine economic feasibility
  - Estimate incremental costs for incremental exposure reduction
    - Composite primary COCs
    - Analyze/verify co-location of secondary COCs

Economic Feasibility Requirements of 92-49

- "The Regional Water Board shall…ensure that dischargers shall have the opportunity to select cost-effective methods for… cleaning up or abating the effects [of wastes discharged and] … require the discharger to consider the effectiveness, feasibility, and relative costs of applicable alternative methods for investigation, cleanup and abatement." (92-49)
- Economic feasibility is an objective balancing of the incremental benefit of attaining further reduction in the concentrations of COCs as compared with the incremental cost of achieving those reductions
- "Economic feasibility does not refer to the dischargers' ability to finance cleanup"
- Calculate costs and composite COC exposure reduction from "no action" to background
  - Economically feasible alternative cleanup level is where incremental cost begins to outweigh incremental benefit (exposure reduction)

Economic Feasibility
Site-Specific Analysis

- Comparison of cleanup costs and composite COC exposure reduction shows incremental benefits of cleanup diminish with additional costs
- Exposure reduction benefits are incrementally reduced as costs of cleanup increases
  - Initial exposure reduction is above 14% per $10 million spent up to $30MM
  - Subsequent exposure reduction drops below 3% per $10 million spent beyond approx. $30 million
    - Incremental cost outweighs incremental benefit as costs increase beyond $30 million
  - Proposed cleanup and alternative cleanup levels translate to a cleanup footprint that achieves exposure reduction greater than cleanup levels deemed "economically feasible"

Remediation Cost Elements

- Permitting and Design
  - CEQA. RWQCB lead agency. Discharger prepares EIR. RWQCB revises and certifies EIR.
  - Potential Additional Pre-dredge Characterization
  - Surveying and Engineering Design
  - Agency Authorizations
    - Army Corps of Engineers 404
    - RWQCB 401
    - Port District Coastal Development Permit
    - State Lands Commission Dredging Permit
- Construction Preparation
  - Mobilization/demobilization for 3 seasons.
- Proposed Dredging (143,400 cy)
  - Unconstrained/open areas – 13% of dredge volume
  - Near-shore with obstructions – 87% of dredge volume. Assumption that 10% of area may have debris.
- Protection of Marine Structures
  - Rock/Sand/other
  - Some structures may require replacement
- Sediment Offloading and Management
  - Identification of sediment handling area/facility
  - Dewatering water can go to sanitary sewer
  - Loading
  - Assume 3 seasons to complete the project.

Remediation Cost Elements (cont.)

- Transportation and Disposal
  - 215,100 tons (1cy=1.5t)
  - 10,755 truckloads
  - 25 trucks (500 tons)/day/6 days per week
    - Assumes three 6 month dredge windows and disposal site's ability to receive this quantity per day
    - 25 trucks is 50 truck movements in or out per day. In a 10 hour day this is a truck coming in or out every 12 minutes.
  - Assumes no RCRA hazardous waste. Maximum probable cost assumes California hazardous waste – i.e. out of state disposal.
- Under Pier and offset area Remediation
  - Minimum 1-2 foot clean sand
  - Quarry rock along edges of shoreline/piers
- Clean Sand Cover
  - May be used to manage residuals from dredging
  - Assume ½ the dredge area will receive 2 feet of clean sand
- Eel Grass Habitat Mitigation
  - Assumes off-site location
  - Need to lease off-site location in perpetuity.
  - Assume 5% of dredge area will require 1:1 eelgrass mitigation.
- Short and Long Term Monitoring
  - See monitoring slide

Evaluate Technological Feasibility Requirements

- Technological Feasibility
  - "[D]etermined by assessing available technologies, which have been shown to be effective under similar hydrogeologic conditions in reducing the concentration of the constituents of concern."
  - Practical structural concerns when addressing walls, slopes, above-water structures present technological feasibility issues
  - Some remedial measures are technologically infeasible immediately under piers and immediately adjacent to walls and pilings
    - Remedial measures required for areas under piers are being evaluated
    - Remedial measures required along walls and pilings (i.e., setbacks) will be compensated in remedial footprint
  - Severely limited tidelands area for sediment processing/de-watering
  - Re-suspension of sediment during dredging

Alternative Cleanup Levels Determination Process

- As required by 92-49, alternative cleanup levels shall:
  - Be consistent with maximum benefit to the people of the state
  - Not unreasonably affect present and anticipated beneficial uses of the Site
  - Be consistent with applicable water quality plans

Process for Establishing Alternative Cleanup Levels

- Identify COCs
- Analyze potential impacts to benthic community, human health, and wildlife
  - Benthic community: Analyze potential impacts via Triad, non-Triad and sediment station chemistry
  - Human health and wildlife: Evaluate exposure reduction via Surface Weighted Average Concentrations (SWACs)
- Confirm Alternative Cleanup Levels:
  - do not unreasonably affect:
    - Human health
    - Aquatic dependent wildlife
    - Aquatic life (benthic community)
  - Via Triad and non-Triad marine sediment station chemistry ("Now" testing)
  - consistent with water quality plans
  - consistent with the maximum benefit to the people of the state

Identification of COCs

- Primary COCs associated with greatest exceedance of background and highest magnitude of potential risk at Site:
  - Potential for elevated Human Health, Wildlife, and/or Aquatic Life (Benthos) risks
    - Initial COC list from DTR suggest potential for elevated Human Health, Wildlife, and/or Aquatic Life (Benthos) risks for As, Cd, Cu, Hg, HPAH, Pb, PCB, TBT, and Zn
  - Degree of exceedance of background concentrations at Site
    - Higher exceedance of background suggests stronger association with site and higher potential for exposure reduction
- Secondary COCs (COCs with lower exceedances of background) highly correlated with Primary COCs and would be addressed in a common footprint
  - Secondary COCs correlated with at least one Primary COC

Identification of COCs

- Primary COCs: PCBs, HPAHs, Mercury, Copper, and TBT

- Secondary COCs: Zinc, Cadmium, Lead, and Arsenic

Analysis of Potential Impact to Aquatic Life

- Determine sediment concentrations and conditions at individual stations that do not unreasonably affect aquatic life
  - For areas with triad data
    - Include within the remedial footprint (see slide 34) if DTR weight-of-evidence analysis shows "likely" effects
    - For stations classified as "possibly" impacted under DTR weight-of-evidence analysis, applied proposed SWRCB Sediment Quality Objectives
      - Although SQOs are not applicable to the site
  - For areas without triad data outside the remedial footprint
    - Below Site Specific Median Effects Quotient (SS-MEQ)
    - Determine protective levels for benthic communities based on site specific Lowest Apparent Effects Threshold (LAET)
      - This is the lowest AET for multiple toxicity and benthic community measures at triad stations
    - No station exceeded 60% of LAET (significant margin of safety)
    - Sediment Profile Imaging (SPI) – nearly all locations show Stage 3 (mature) communities

Non-Triad Station Evaluation Method – Site Specific Median Effects Quotient (SS-MEQ)

- Predict “likely” impacted stations in the absence of triad data (chemistry only stations)
- Use median effects concentration from the site specific triad data
- Calculate threshold quotient based on five primary COCs:

$$SS-MEQ=\frac{1}{5}\left[\frac{[Cu]}{ME_{Cu}}+\frac{[Hg]}{ME_{Hg}}+\frac{[HPAH]}{ME_{HPAH}}+\frac{[TPCB]}{ME_{TPCB}}+\frac{[TBT]}{ME_{TBT}}\right]$$

SS-MEQ Threshold and Performance

- Adjust quotient threshold to maximize reliability and balance false positives vs. false negatives
- Optimized threshold: SS-MEQ = 0.9
  - 73% reliability

True Positive 5	True Negative 17
False Positive 7	False Negative 1

*The only false negative was at NA22 which has evidence of physical disturbances.

Confirm that Alternative Cleanup Levels Protect Aquatic Life

- Confirm post-remedial sediment chemistry conditions “do not unreasonably affect” aquatic life
  - Alternative Cleanup Levels are below SS-MEQ Threshold
  - Alternative Cleanup Levels are below Site-specific Lowest Apparent Effects Thresholds (LAETs)
  - Alternative Cleanup Levels approach addresses all areas designated as "likely" impacted or above under the weight of evidence analysis in the DTR
  - Areas outside of the remedial footprint are generally mature benthic communities (SPI data)

Analysis of Potential Impact to Human Health and Wildlife

- SWAC-based alternative cleanup levels applied to human health and aquatic dependent wildlife
- Application of surface concentrations
  - Exposure is related to contaminants in biologically active zone
  - Receptors feed on surface organisms
  - SPI data indicate average maximum feeding void depth of approximately 7 cm
  - Surface data (0-2 cm) is most comprehensive data set representative of surficial exposure and maximum exposure to aquatic life (benthos)
- Averaging area
  - Exposure for these receptors is averaged over the entire site
  - Receptors do not forage or fish over a single station
  - Wildlife receptors range to find adequate food supply
  - Some receptors are migratory and are infrequent visitors
  - Receptor foraging ranges are generally orders of magnitude larger than the entire site

Basis for SWAC

Foraging Areas for Wildlife Receptors

Specie	Published Foraging area (Acres)	Site area without NA22 (Acres)	Foraging area/site area	Notes
Surf scoter	NA	143	NA	Migratory waterfowl - foraging range during feeding dependent on food abundance
Western grebe	NA	143	NA	Migratory waterfowl - foraging range during feeding dependent on food abundance
Least Tern	8,053	143	56	Cal/Ecotox foraging area.
Brown pelican	685,709	143	4,798	Cal/Ecotox foraging area.
California sea lion	725,906	143	5,080	Cal/Ecotox foraging area.
Pacific green sea turtle	NA	143	NA	Migratory specie.

Calculation of SWAC

- Calculate SWAC based on Thiessen polygons
  - The sum of concentrations in each polygon times the area of each polygon divided by the total area of all polygons
- Current SWAC
  - Using surface data (0-2 cm)
- Post-remedial SWAC
  - New exposed surfaces (footprint) following remediation
    - Assumes areas remediated below background would equilibrate to background
    - Assumes variability in footprint is equivalent to variability outside footprint
  - Use existing data for surfaces outside remediation footprint
- Variability of SWACs quantified by 95% confidence limits of the area weighted concentrations

SWAC Approach

- Weigh primary COCs evenly
  - Cu, Hg, HPAH, PCB, TBT
- Rank polygons based on summed ratio of polygon concentration to pre-remedy SWAC

$$Rank = \sum_{CoCs} \frac{C_{polygon}}{SWAC}$$

- Eliminates effect of different concentration ranges
  - e.g., Cu ~100 mg/kg, Hg~1 mg/kg

SWAC Approach

- Highest concentrations relative to pre-remedy SWAC result in highest ranking
- Ranking example:

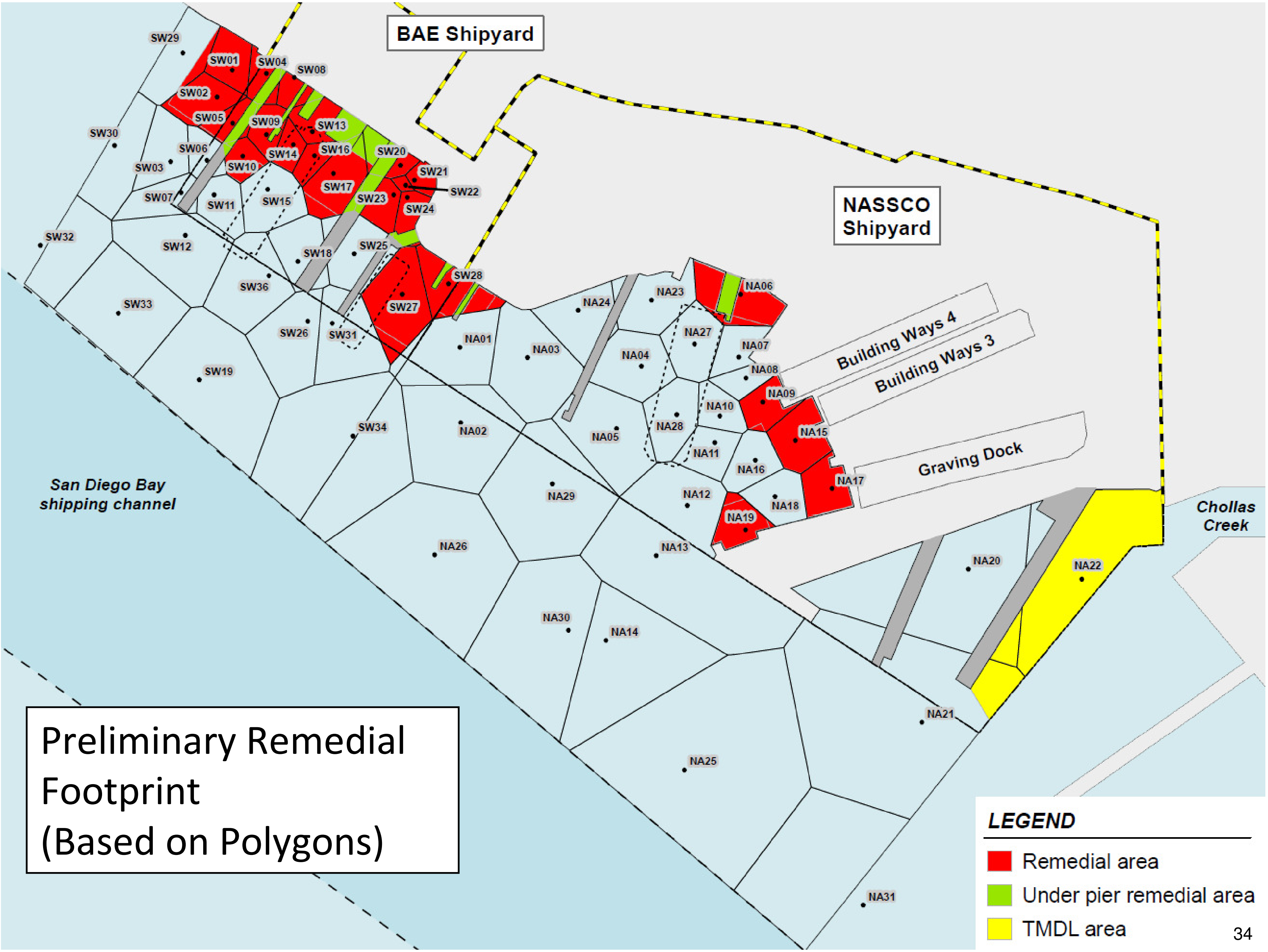
$$\begin{array}{ccccc} Cu & Hg & HPAH & PCB & TBT \end{array}$$

$$Rank_{SW04} = \frac{1500}{185} + \frac{1.75}{0.74} + \frac{14000}{3503} + \frac{4000}{303} + \frac{3250}{163} = 47.6$$

$$Rank_{NA17} = \frac{510}{185} + \frac{0.85}{0.74} + \frac{2950}{3503} + \frac{550}{303} + \frac{1350}{163} = 14.8$$

SWAC Approach

- Rank polygons by highest COC concentrations
- Identify polygons for remedial footprint
- Assume current surface sediment concentrations are replaced by background concentrations in remediated areas
- Calculate post-remedial SWAC
- Repeat until not unreasonably affecting human health and wildlife beneficial uses



BAE Shipyard
NASSCO Shipyard
Building Ways 4
Building Ways 3
Graving Dock
San Diego Bay shipping channel
Chollas Creek
SW29
SW01
SW04
SW08
SW02
SW05
SW09
SW13
SW30
SW06
SW16
SW20
SW03
SW10
SW14
SW21
SW17
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NA29
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NA30
NA14
NA21
NA25
NA31
Preliminary Remedial Footprint
(Based on Polygons)
LEGEND
Remedial area
Under pier remedial area
TMDL area

Quantifying Exposure Reduction of Proposed Remedial Footprint

- Exposure reduction = current SWAC minus post-remedy SWAC
- Normalize to background
  - Current conditions = 0% exposure reduction
  - Remediation to background = 100% exposure reduction relative to background
- Therefore, percent exposure reduction relative to background =
  (current SWAC - final SWAC)/(current SWAC - background) x 100

Quantifying Exposure Reduction Example

- Assume current SWAC of 10 ppm of COC1; final SWAC of 2 ppm; background is 1 ppm
- Exposure reduction = (current SWAC - final SWAC)/(current SWAC - background) x 100:

  (10 – 2)/(10 – 1) x 100 = 89% exposure reduction relative to background

Confirm that Alternative Cleanup Levels Protect Wildlife

- Confirm post-remedial sediment chemistry conditions “do not unreasonably affect” aquatic dependent wildlife
- Use aquatic-dependent wildlife risk-based screening levels that were developed by RWQCB in the DTR (see Appendix 33).
  - DTR screening levels were based on COC levels in prey species tissue that are protective of representative wildlife consumption pathways:
    - Avian – Least Tern, Brown Pelican, Surf Scoter, Western Grebe
    - Reptile – Green Sea Turtle
    - Mammal – California Sea Lion
  - Protective tissue concentrations were calculated by RWQCB using conservative assumptions for:
    - Consumption rates
    - Site use/foraging areas
    - Toxicity Reference Values (TRVs)
  - Protective tissue levels were used by RWQCB to generate sediment screening levels using site-specific bioaccumulation factors (BAFs) for risk-driving chemicals. A BAF is the ratio of fish or lobster tissue concentration (wet wt) to sediment SWAC (dry wt) for a given COC.

Risk-based Sediment Screening Levels for Aquatic-Dependent Wildlife

- Sediment concentration predicted to result in HQ = 1.0
- Derived in DTR using BAF approach for each representative receptor (only lowest value shown)
- Low-TRV screening values represents no effect level
- High-TRV screening value represents lowest known effect level
- Geometric mean screening value selected as protective level

Primary COPC		Low TRV Screening Level from DTR	High TRV Screening Level from DTR	Geometric Mean Screening Level (AUF = 100%)	Geometric Mean Screening Level (AUF = 75%)
Copper	(mg/kg)	184	4,180	877	1,169
Mercury	(mg/kg)	0.15	0.39	0.24	0.32
TBT	(µg/kg)	NA	NA	NA	NA
PCBs	(µg/kg)	58.4	825	219	292
HPAH	(µg/kg)	4,800	48,000	15,000	20,000

NA = Not a wildlife risk driver. No value calculated.

Confirm Alternative Cleanup Levels Protect Human Health

- Confirm post-remedial sediment chemistry conditions “do not unreasonably affect” human health
  - Determine protective levels of sand bass and lobster tissue levels for human consumption
    - Recreational
    - Subsistence
  - Protective tissue levels were based on conservative assumptions for:
    - Consumption rates
    - Site use
  - Protective sediment levels were estimated using site-specific BAFs.

BAF Calculation

- Average BAFs can be calculated as the quotient of the shipyard-wide average tissue concentration divided by the current SWAC for a given chemical.

- PCB BAFs for human angler exposure:
  - Sand bass fillet (recreational): 106.7 ppb ÷ 308 ppb = 0.346
  - Whole sand bass (subsistence): 569.5 ppb ÷ 308 ppb = 1.85
  - Edible lobster (recreational): 7.9 ppb ÷ 308 ppb = 0.0256
  - Whole lobster (subsistence): 43.6 ppb ÷ 308 ppb = 0.142

- BAFs are assumed to be constant over the narrow concentration range from current to projected post remedial SWAC (308 ppb to 194 ppb for PCBs).

Human Health Risk-based Sediment Thresholds

- DTR exposure models and BAFs are used to estimate shipyard-wide SWACs associated with HH risk thresholds
- Cancer thresholds are analyzed at a risk probability of 10^{-5}
- Non-cancer thresholds are analyzed at HI = 1.0

Risk Threshold Estimation

- Calculate chemical-specific threshold exposure points:

  Cancer risk exposure = 10^{-5} ÷ CSF

  Non-cancer risk exposure = RfD

  Where:

  CSF = cancer slope factor

  RfD = reference dose

Risk Threshold Estimation (Cont.)

- Solve DTR exposure model for tissue concentration at threshold exposure points:

$$\mathbf{C = Exposure \times (BW \times AT) \div (CR \times FI \times ED)}$$

Where:

C = Tissue Concentration

CR = Consumption rate

FI = Fractional Intake

ED = Exposure Duration

BW = Body Weight

AT = Averaging Time (30 yr. for non-cancer, 70 yr. for cancer)

Risk Threshold Estimation (Cont.)

- Apply BAF to estimate SWAC associated with threshold exposure points:

$$\mathbf{SWAC = C \div BAF}$$

Where:

SWAC = Threshold sediment concentration

C = Threshold tissue concentration

Example Calculation

Scenario: PCB risks from lobster (subsistence)

Calculate sitewide BAF for whole lobster:

– Average PCB level in whole lobster = 43.6 µg/kg

– Current PCB SWAC = 308 µg/kg

PCB BAF in whole lobster = 43.6 ÷ 308 = 0.142

Calculate threshold exposure points:

– CSF = 2 mg/kg-day $^{-1}$

– RfD = 0.00002 mg/kg-day

Cancer risk threshold exposure = $10^{-5} \div 2 = 5 \times 10^{-6}$ mg/kg-day

Non-cancer risk threshold exposure = 2×10^{-5} mg/kg-day

Example Calculation

Scenario: PCB risks from lobster (subsistence)

Calculate exposure point tissue concentrations:

- CR = 0.161 kg/day
- FI = 1.0
- ED = 30 yrs.
- BW = 70 kg
- AT = 30 yr. for non-cancer, 70 yr. for cancer

C (cancer) = $5 \times 10^{-6} \times (70 \times 70) \div (0.161 \times 1.0 \times 30) = 0.0051$ mg/kg

C (non-cancer) = $2 \times 10^{-5} \times (70 \times 30) \div (0.161 \times 1.0 \times 30)$

$= 0.0087$ mg/kg

Example Calculation (cont.)

Scenario: PCB risks from lobster (subsistence)

Calculate sediment threshold concentrations:

SWAC (cancer) = C (cancer) ÷ BAF = 0.0051 mg/kg ÷ 0.142
= 0.036 mg/kg

SWAC (non-cancer) = C (non-cancer) ÷ BAF = 0.0087 mg/kg ÷ 0.142
= 0.061 mg/kg

Human Health Risk-based Sediment Thresholds - PCBs

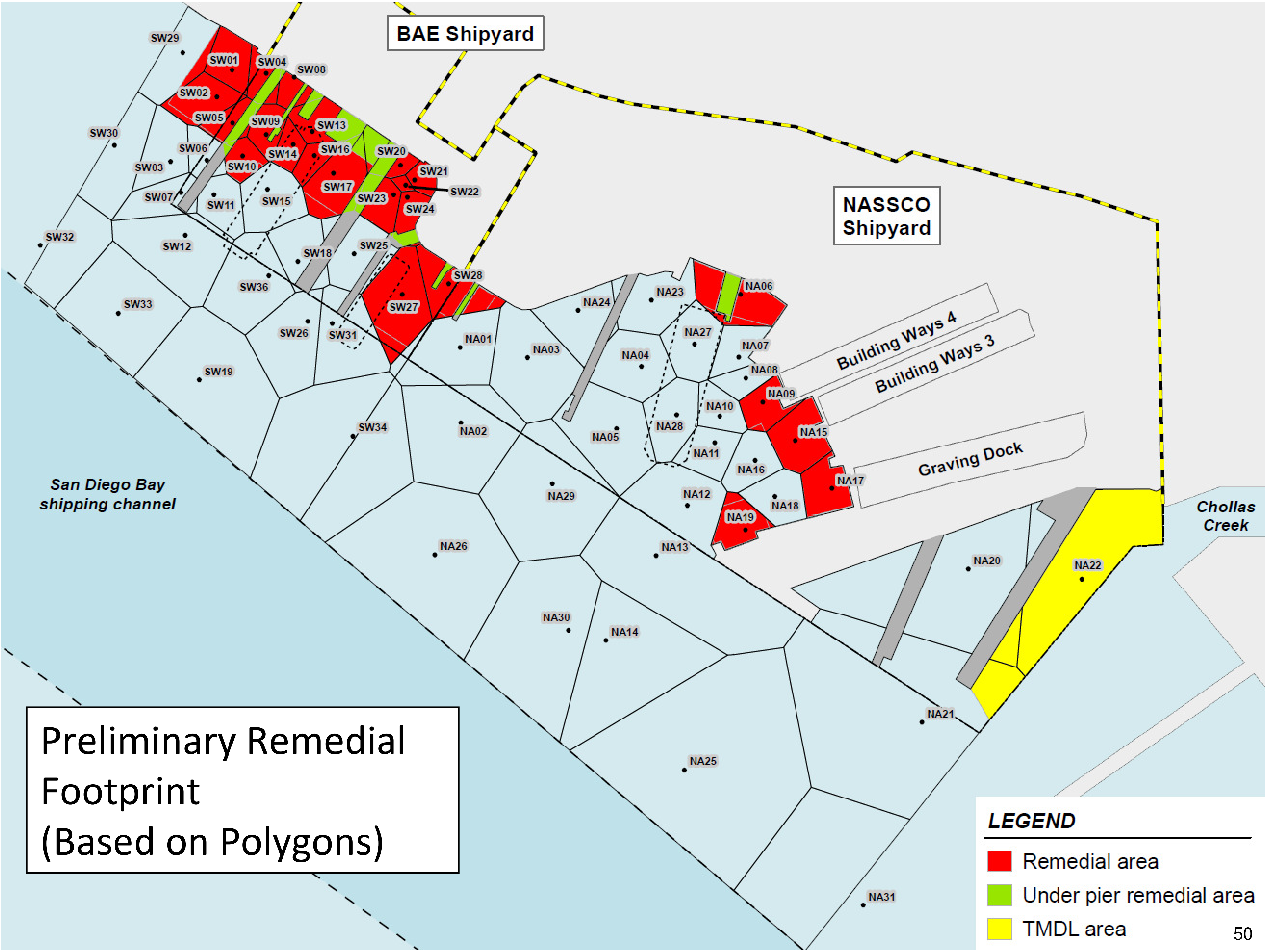
Exposure Scenario	SWAC Risk Threshold (µg/kg)	
	Cancer Risk	Non-Cancer
	10^{-5}	HI = 1.0
Recreational Angler (bass fillet)	112.3	192.4
Subsistence Angler (whole bass)	2.7	4.7
Recreational Angler (edible lobster)	1,516.2	2,599.2
Subsistence Angler (whole lobster)	35.8	61.4

- All calculations shown assume a fractional intake (FI) of 100%.
- HI – Hazard Index

Sediment Concentrations Associated with Cancer Risk to Theoretical Recreational Anglers at Shipyards as a Function of Fractional Intake

Fractional Intake (%)	PCB SWAC (µg/kg)							
	DTR Bkgd.	Projected Post Remedy	Recreational Angler Cancer Risk Probability					
			10^{-6}		10^{-5}		10^{-4}	
			Fish	Lobster	Fish	Lobster	Fish	Lobster
25			44.8	606	448	6,064	4,492	60,648
40			28.0	379	280	3,791	2,808	37,905
75			14.9	202	149	2,022	1,497	20,216
100	84	194	11.2	152	112	1,516	1,123	15,162

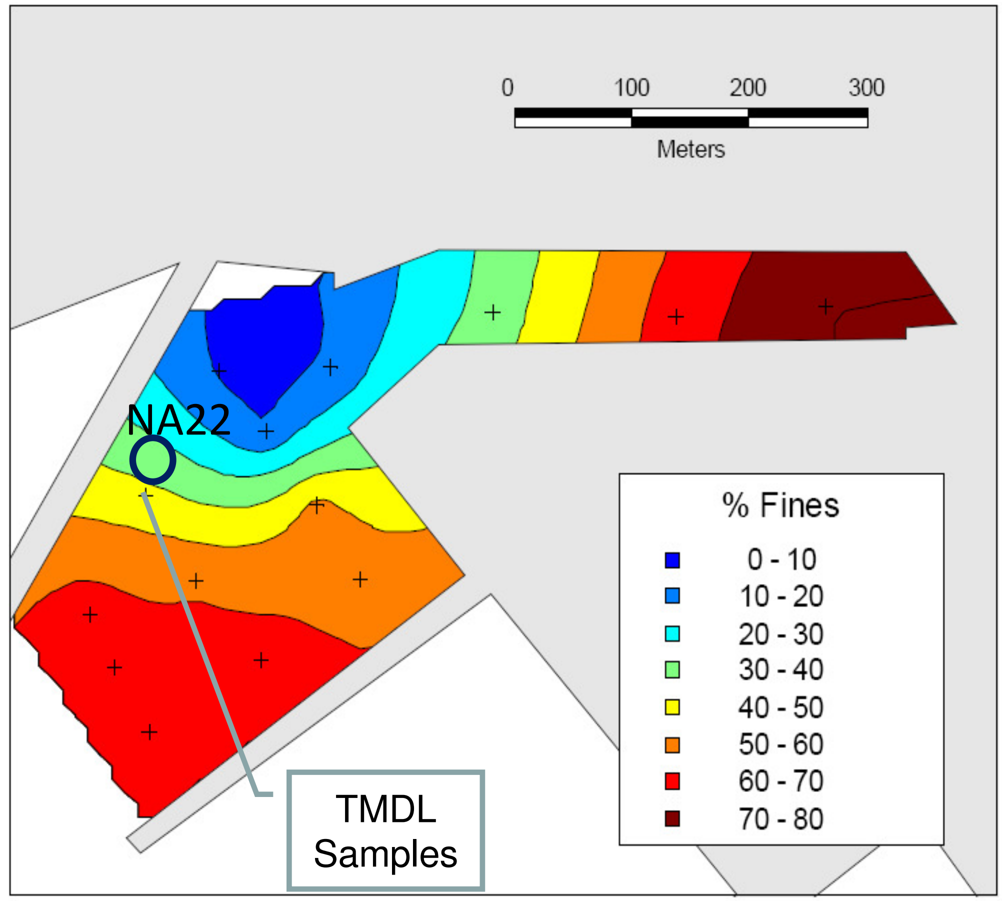
Note: SWAC = Area weighted average concentration across entire shipyard study area estimated to result in specified cancer probability



Preliminary Remedial Footprint (Based on Polygons)

Station NA22 and Chollas Creek Mouth TMDL

- NA22 is "likely" impaired based on benthic assessment, but is not in footprint because evidence that cause is physical disturbance
- Will be addressed in Chollas Creek Mouth TMDL
- NA22 falls directly within the TMDL Study Are
- Much more data available for decision makinç
- One TMDL action can address all of Chollas mouth area
- Unique physical impacts require careful evaluation for decision making – more data assists with this
- CONCLUSION: exclude NA22 polygon from shipyard site area



Spatial distribution of fines for the Chollas site.

Remedial Footprint Stations Ranked by SWAC

Proposed remedial location (yellow)

Station	Composite SWAC Ranking Value	Numerical Ranking
SW04	47.1	1
SW08	33.3	2
SW02	31.5	3
SW24	23.1	4
SW09	17.5	5
SW13	15.2	6
SW28	15.2	7
SW21	14.8	8
SW01	14.8	9
NA17	14.7	10
SW16	13.3	11
SW20	12.0	12
SW05	11.1	13
SW23	10.5	14
SW22	10.4	15
SW17	10.0	16
NA19	10.0	17
NA06	9.8	19
SW10	9.7	20
SW14	9.3	21
NA15	8.8	22
SW27	7.6	23
NA09	5.5	38

Remedial Footprint Stations Ranked by SS-MEQ

Proposed remedial location (yellow)

Station	SSMEQ	Ranking
SW04	4.22	1
SW08	2.99	2
SW02	2.80	3
SW24	1.81	4
SW09	1.60	5
SW13	1.48	6
NA17	1.41	7
SW01	1.40	8
SW16	1.28	9
SW21	1.25	10
SW28	1.20	11
NA06	1.11	12
SW20	1.02	13
SW05	0.94	14
SW23	0.93	15
SW22	0.92	16
SW17	0.92	17
NA19	0.92	18
SW14	0.88	20
NA15	0.86	21
SW10	0.78	22
SW27	0.68	30
NA09	0.62	37

0.9 SS-MEQ Threshold

Remedial Footprint Generally Includes Areas with Highest Concentration of COCs

Station	Total HPAH
SW24	52,000
SW08	25,500
SW09	17,000
SW28	17,000
SW10	16,000
NA07*	15,850
SW02	14,333
SW04	14,000
SW05	13,000
SW22	12,000

Station	PCB Congeners
SW02	5,450
SW04	4,000
SW21	2,400
SW08	2,100
SW28	2,100
SW20	1,600
SW01	1,600
SW05	1,200
SW23	1,000
NA19	990

Station	Tributyltin
SW04	3,250
SW08	1,850
NA17	1,350
SW16	1,100
SW09	910
SW13	790
NA15	670
NA19	570
SW14	450
SW01	450

[Yellow] Within the Proposed Remedial Footprint

*Polygon not Remediated

Remedial Footprint Generally Includes Areas with Highest Concentration of COCs

Station	Copper
SW04	1,500
SW08	920
SW13	800
SW09	660
SW02	570
SW01	560
NA17	510
SW16	430
NA06	395
NA27*	390

Station	Mercury
SW02	4.3
NA06	2.4
SW08	2.3
SW19*	2.1
SW24	1.9
SW04	1.8
SW01	1.5
NA07*	1.5
SW21	1.4
NA09	1.2

Station	Lead
SW04	430
SW08	225
SW09	220
SW02	180
SW01	145
NA06	130
NA23*	120
SW05	120
SW21	120
NA17	115

Within the Proposed Remedial Footprint (yellow-highlighted stations)

*Polygon not Remediated

Remedial Footprint Generally Includes Areas with Highest Concentration of COCs

Station	Arsenic
SW04	73
SW09	27
SW08	24
NA08*	18
SW13	15
SW06*	15
SW23	15
NA17	15
SW28	14
SW20	14

Station	Zinc
SW04	3,450
SW09	1,200
SW08	830
NA17	620
SW02	585
SW13	580
SW01	520
NA27*	500
NA19	450
NA23	430

Station	Cadmium
SW02	3.8
SW04	1.5
SW09	0.9
SW16	0.9
SW03*	0.8
SW06*	0.8
SW10	0.8
SW08	0.8
SW05	0.7
SW13	0.7

[Yellow] Within the Proposed Remedial Footprint

*Polygon not Remediated

Rationale for Excluded Polygons

NA07

- Triad station – not “likely” impaired
- Low toxicity and low benthic impacts
- All COCs below 60% LAET values
- Technical infeasibility
- All COCs less than 3x background, except HPAH

NA08

- All COCs below 60% LAET and SS-MEQ values
- Technical infeasibility
- All COCs less than 3x background

NA23

- All COCs below 60% LAET and SS-MEQ values
- Technical infeasibility
- All COCs less than 3x background

NA27

- All COCs below 60% LAET and SS-MEQ values
- Technical infeasibility
- All COCs less than 4x background

SW03

- Triad station - Low toxicity and low benthic impacts
- All COCs below 60% LAET and SS-MEQ values
- All COCs less than 5x background

SW06

- Nov 09 Triad station – not “likely” impaired
- All COCs below 60% LAET and SS-MEQ values
- All COCs less than 5x background

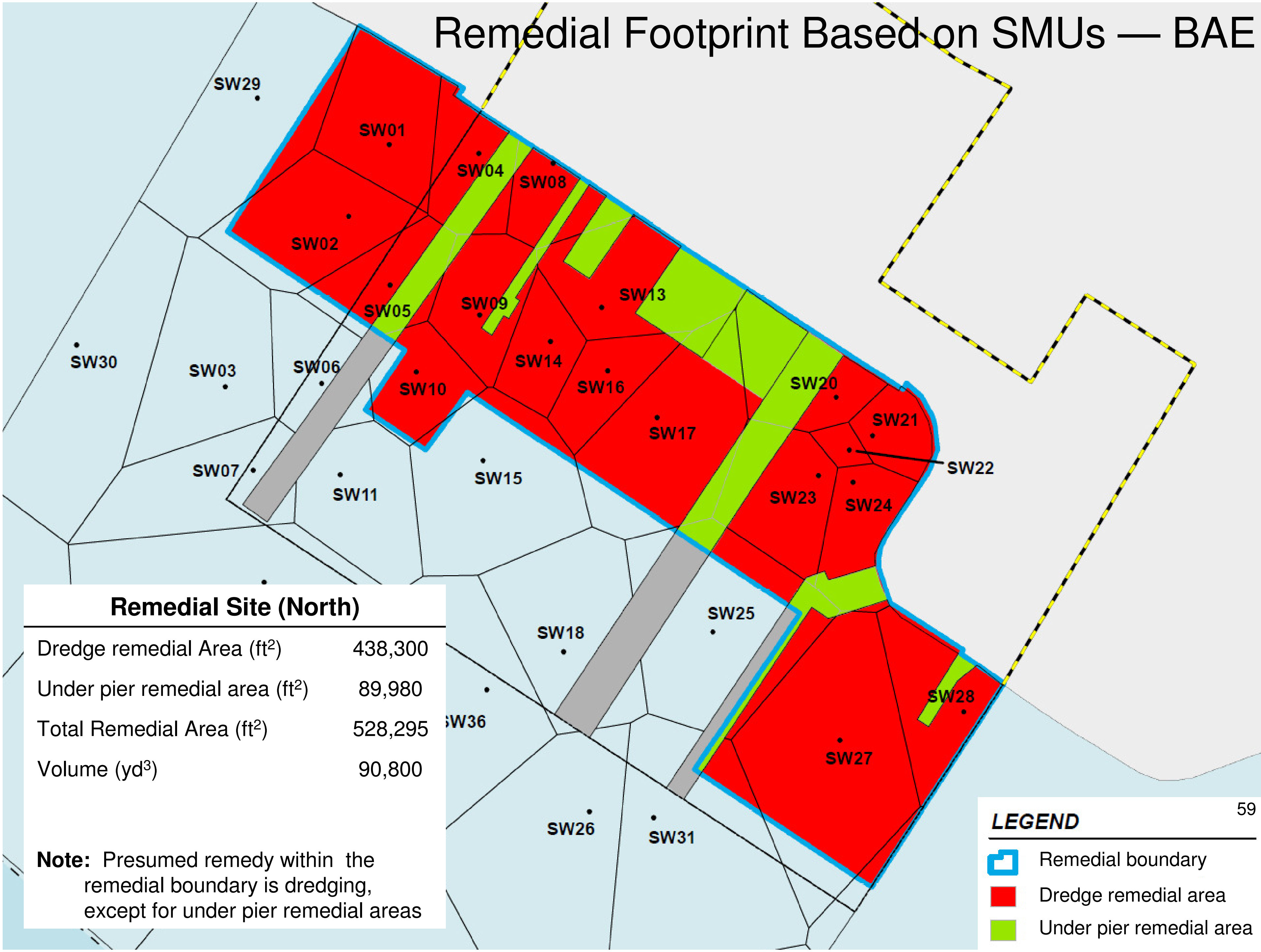
SW19

- Nov 09 Triad station – not “likely” impaired
- All COCs below 60% LAET and SS-MEQ values
- All COCS less than 4x background

Preliminary Remedial Design

- Translates areas of potential impairment into areas requiring remediation
  - Not unreasonably affect beneficial uses
  - Accounts for technological and economic feasibility
- Remedial measures may include dredging (with or without backfill), clean sand covers, thin-layer covers, and/or reactive material amendments
- Reconfigure polygon footprint to technically feasible sediment management units (SMUs)
- Add safety buffer area to footprint to compensate for portions of polygons that will not be remediated:
  - Setbacks from all structures (shores, piers, etc.)
- Inaccessible areas under piers to be remediated using alternative techniques such as thin layer clean sand covers, stabilization, or other methods
- Remove Chollas Creek TMDL area (incl. NA22 SMU) from site area
- Total SMU areas equal total polygon areas

Remedial Footprint Based on SMUs — BAE



Remedial Site (North)

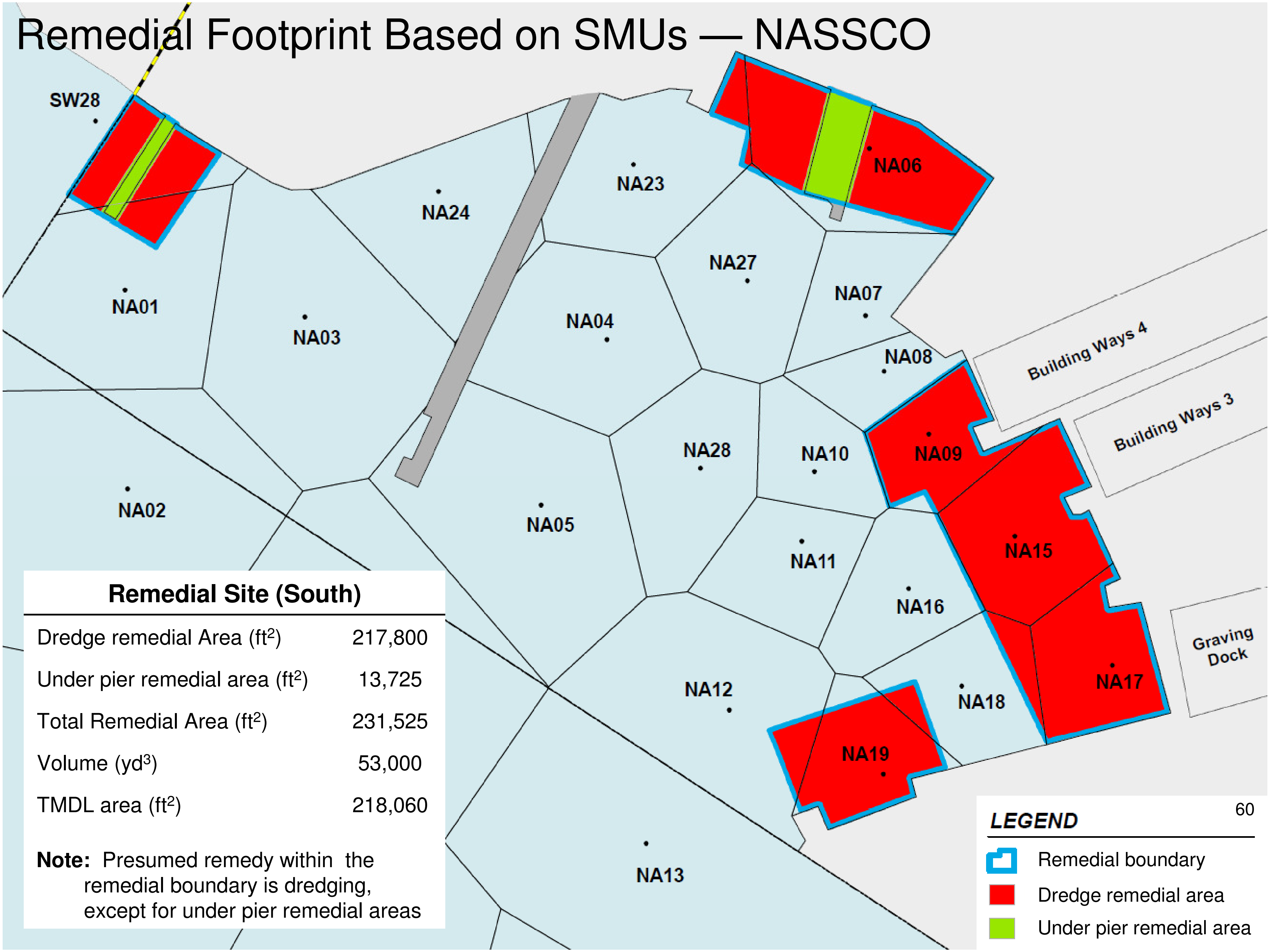
Dredge remedial Area (ft^2)	438,300
Under pier remedial area (ft^2)	89,980
Total Remedial Area (ft^2)	528,295
Volume (yd^3)	90,800

Note: Presumed remedy within the remedial boundary is dredging, except for under pier remedial areas

LEGEND

- Remedial boundary
- Dredge remedial area
- Under pier remedial area

Remedial Footprint Based on SMUs — NASSCO

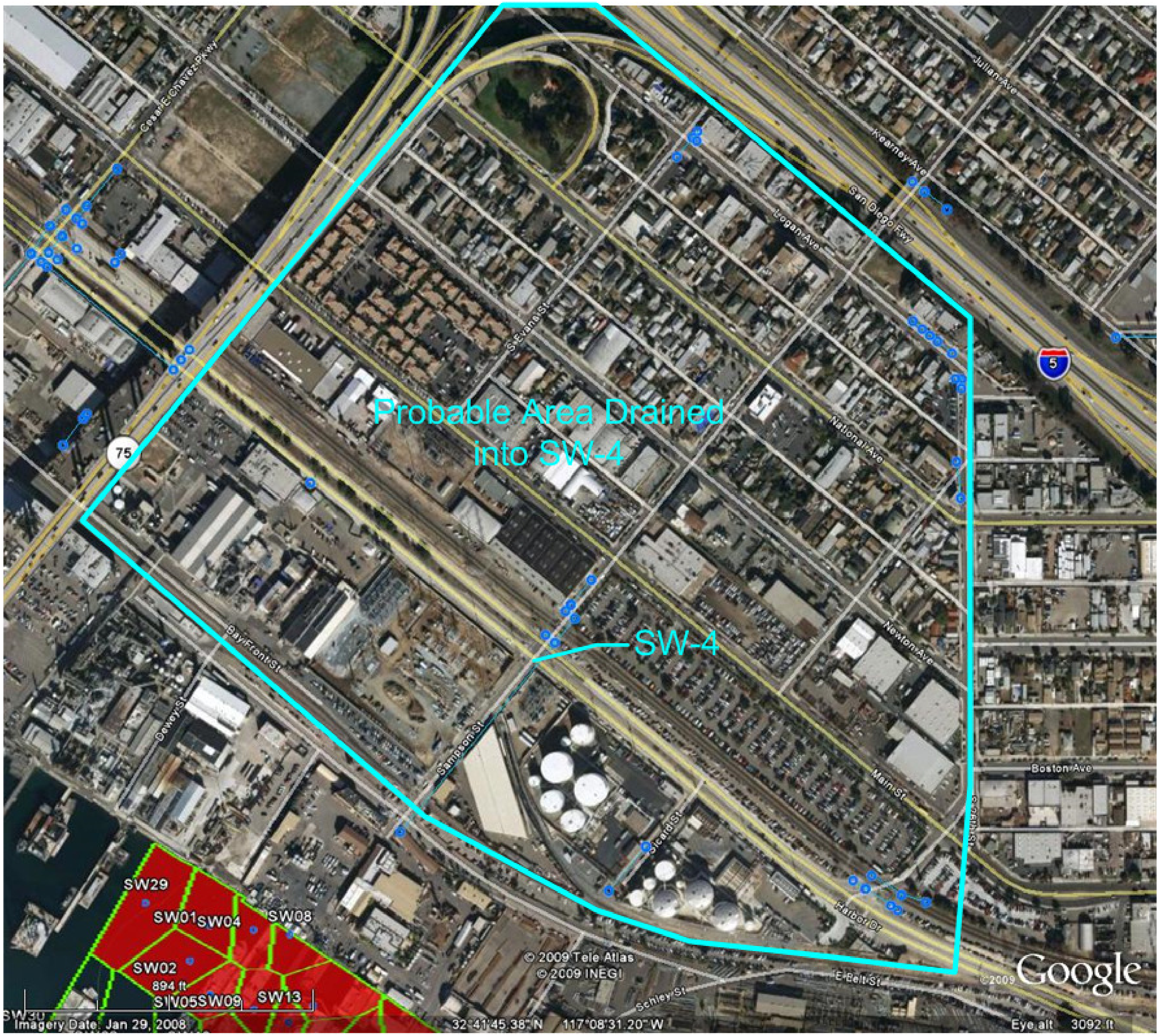


Remedial Site (South)	
Dredge remedial Area (ft^2)	217,800
Under pier remedial area (ft^2)	13,725
Total Remedial Area (ft^2)	231,525
Volume (yd^3)	53,000
TMDL area (ft^2)	218,060

Note: Presumed remedy within the remedial boundary is dredging, except for under pier remedial areas

SW-4 Storm Drain Remedy

- SW-4 drains area upland of BAE
- Take Protective Measures
  - Clean out sediments
  - Repair where damaged
  - Install filter BMPs
  - Verify through CCTV



Footprint Characteristics

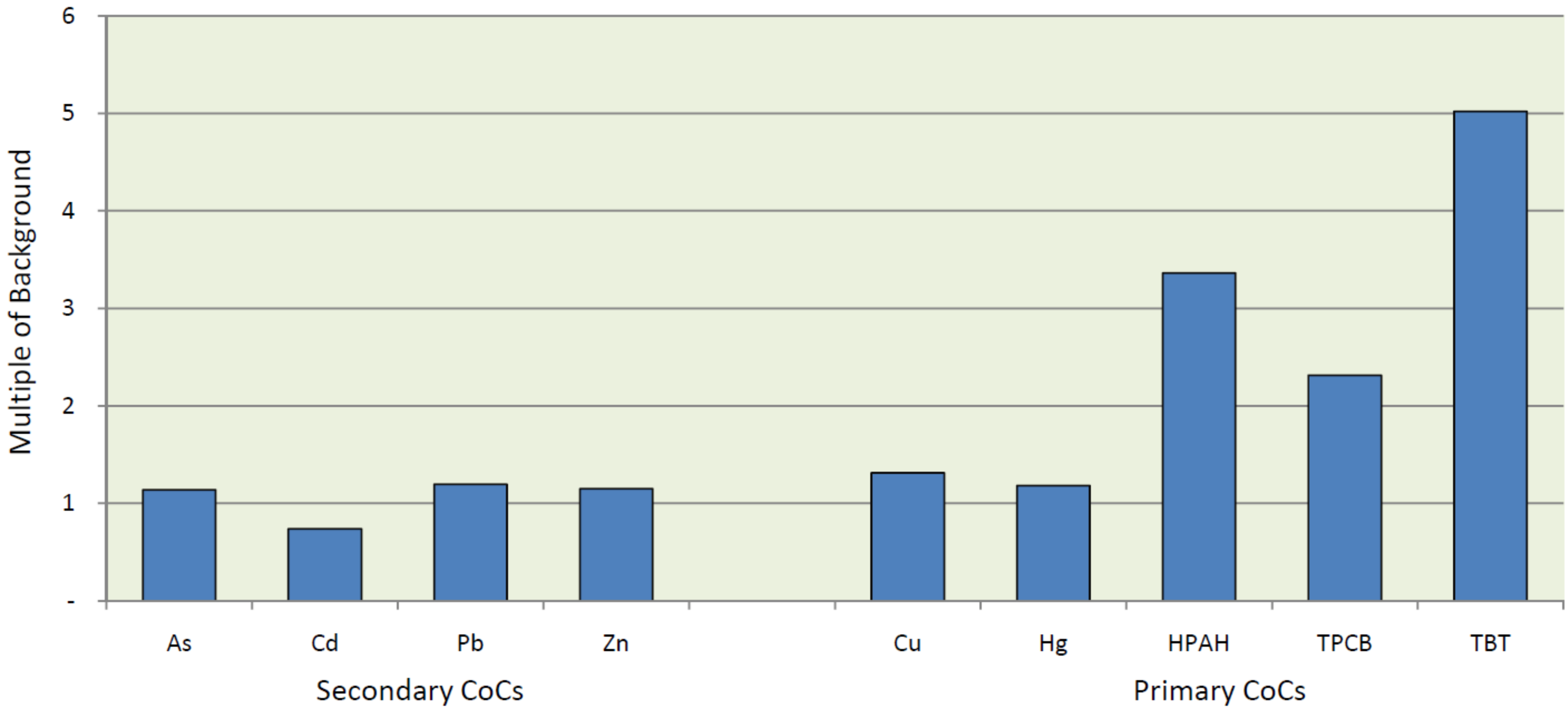
- Total of 23 Polygons
- Captures 100% of triad "likely" and >50% of triad "possible" impacted stations
- Total Remedial Surface Area (incl. under piers) = 794,905 ft^2
- Under-pier Remedial Surface Area = 102,055 ft^2
- Meets SWAC for protection of human health and wildlife
- SWACs are approximately at background for 6 out of 9 COCs
- SWACs always <5X background

COC	Pre-Remedy		Estimated Post-Remedy*	
	SWAC	Station Maximum	SWAC	Station Maximum
Cu (mg/kg)	187	1500	159	390
Hg (mg/kg)	0.75	4.1	0.67	2.1
HPAH (mg/kg)	3.3	52	2.3	16
PCB (ug/kg)	308	5500	194	820
TBT (ug/kg)	163	3300	110	410
SS-MEQ	NA	4.2	NA	0.72

* Based on existing site data.

Evaluate Estimated Post-remedial SWACs Relative to Background

- Compare SWACs to Site-Specific Background Levels
  - SWACs are approximately at background for 6 out of 9 COCs
  - SWACs always <5X background



Confirm Alternate Cleanup Levels Protect Beneficial Uses

Beneficial Use			COC	Condition	Basis
Aquatic Life (Benthos)	Triad Stations		Weight of Evidence Category	No "Likely" Impacted Stations	• Cleanup all areas designated as "likely" impacted or above under the weight of evidence analysis in the DTR
	Non-Triad Stations	SS-MEQ	Quotient of 5 COCs	0.9	• Protective of benthic communities consistent with DTR "likely" stations
		60% of LAET	Cu (mg/kg)	618	• Protective of benthic communities consistent with Site-specific Lowest Apparent Effects Threshold (LAET) • Significant margin of safety
			Hg (mg/kg)	2.4	
			HPAH (mg/kg)	15.6	
			TPCB (ug/kg)	3270	
			TBT (ug/kg)	1140	
		SPI	NA	Presence of Stage 3 Community	• Supporting line of evidence

Confirm Estimated Post-remedial SWACs Protect Beneficial Uses

Beneficial Use	COC	Post Remedial SWAC	Basis
Human Health and Wildlife	Cu (mg/kg)	159	Protective of human health at 100% recreational consumption (FI) of Site species.
			Protective of human health at 100% subsistence consumption of Site whole sand bass.
			Protective of wildlife at 100% consumption of Site species.
	Hg (mg/kg)	0.67	Protective of human health at 100% recreational consumption of Site sand bass fillet and edible lobster.
			Protective of human health at 100% for subsistence consumption of Site whole lobster.
			Protective of wildlife at 100% consumption of Site species, except brown pelican, which is protected at area use factor (AUF) of 50%.
	HPAH (mg/kg)	2.3	Protective of wildlife and human health at 100% of consumption of Site species.
	TPCB (µg/kg)	194	Protective of human health at recreational at 100% consumption of Site edible lobster.
			Protective of human health at 40% recreational consumption of Site sand bass fillet.
			Protective of wildlife at 100% consumption of Site species.
	TBT (µg/kg)	110	Protective of wildlife and human health at 100% of consumption of Site species.

Protection of subsistence consumption of Site species cannot be achieved, even at background levels.
FI (fractional intake) is the percentage of human seafood consumption that comes from the Site.
AUF (area use factor) is the percentage of total wildlife diet that comes from the Site.
Wildlife species assessed include brown pelican, California sea lion, green sea turtle, least tern, surf scoter, and western grebe.
Human health cancer risk for PCBs evaluated at 1×10^{-5} level (1 in 100,000).

Other Considerations From 92-49

- Consistency with Water Quality Control Plans
- Maximum Benefit to People of the State

Water Quality Control Plans

- "Does not result in water quality less than that prescribed in water quality control plans"
  - Basin Plan - Narrative "No toxic pollutants in toxic amounts"
    - "All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life. Compliance with this objective will be determined by use of indicator organisms, analyses of species diversity, population density, growth anomalies, bioassays of appropriate duration, or other appropriate methods as specified by the Regional Board."
    - Addressed by cleanup levels that are protective of human health, wildlife and aquatic life (benthic community) beneficial uses
  - Bays and Estuaries Plan (State SQO) - Narratives for direct and indirect effects
    - Direct Effects
      - "Pollutants in sediments shall not be present in quantities that, alone or in combination, are toxic to benthic communities in bays and estuaries of California" (direct contact with benthic community)
    - Indirect Effects
      - "Pollutants shall not be present in sediments at levels that will bioaccumulate in aquatic life to levels that are harmful to human health" (consumption of fish and shellfish)
    - Addressed by cleanup of "likely" impacted stations and maximum station concentrations estimated to be below cleanup goals

Maximum Benefit to People of the State

- 92-49: when establishing final cleanup levels, consider:
  - "all demands being made and to be made on those waters and the total values involved, beneficial and detrimental, economic and social, tangible and intangible"
  - "current, planned, or future land use, social, and economic impacts to the surrounding community including property owners other than the discharger"

Maximum Benefits to the People

- Shipyards are an important component of Southern California infrastructure
  - BAE and NASSCO yards provide essential repair services for US Navy vessels
    - More than 250 Navy repair availabilities serviced since 2000, with work performed on more than 1,400 ships
  - NASSCO is the last remaining new construction shipyard on the West Coast
    - Largest manufacturer in Southern California
  - The two yards employ ~5,800 skilled tradepersons and 1,100 partners and subcontractors
    - Shipyards are the largest minority employers in San Diego
    - Shipyard employment fills a valuable niche between tourism and high technology industries
- The estimated impact on the local economy of the Working Waterfront is $3.5B per year, with BAE alone having spent ~$500M in the community over the last two years
- Shipyards have made significant investments to reduce or eliminate impacts to the environment
  - Both yards have been “zero discharge” facilities for more than a decade
  - The yards have, between them, eliminated 27 of 32 permitted discharges to SD Bay
  - New NASSCO Blast and Paint facility reduces >95% of VOCs
- Remedial footprint properly accounts for role of industry to provide maximum benefit to the people

Maximum Benefit to People of the State

- Remediated areas will approach reference area sediment concentrations for most COCs
- Remediate areas identified with “likely” impacts to benthic beneficial use
- Reduce risks to human health and aquatic dependent wildlife
- Impacts of remediation on local communities would be temporary; remedial activities would be designed to minimize such impacts
- No adverse effects on sport or commercial angling or other recreational uses because all dredging will occur inside the security boom
- Adverse effects of dredging on benthic communities will be temporary, with stasis expected within 3 years
- Adverse effects on eelgrass beds will be mitigated following remediation

Maximum Benefit to People of the State

- Compared to remediation to background:
  - Significantly less
    - Diesel emissions
    - Greenhouse Gas Emissions
    - Noise
    - Truck traffic
    - Disruption to the community
    - Barge and crane movements in the bay
    - Risk of re-suspension of contaminated sediments
    - Risk of accidents
  - Reduces amount of landfill capacity used
  - Results in no long-term loss of use of the site
  - Allows for continued (albeit interrupted) operation of key shipyard processes enabling critical vessel construction, maintenance and repair to continue, including Navy vessels, and current employment levels
- Significant mass removal
- Source control – zero discharge facilities

Maximum Benefit to People of the State

COC	Estimated Mass Removed (kg)	Estimated Percent Mass Removal
PCBs (as homologs)	370	59
Mercury (Hg)	239	29
Copper (Cu)	50,966	42
High Molecular Weight Polynuclear Aromatic Hydrocarbons (HPAH)	1,344	41
Tri-Butyl Tin (TBT)	95	60

Remedial Monitoring Overview

- Monitoring program is confirmation sampling associated with "existing sediment cleanup activities" at the shipyard sediment site, with the following elements:
  - Pre-Remedy Monitoring ("Now" testing)
  - Remediation Monitoring (Construction Phase)
  - Post-Remediation Monitoring

Pre-Remediation Monitoring

- **Purpose:** Verify site-specific chemical thresholds developed for protection of benthic beneficial uses at non-triad stations
- **Lines of Evidence:** Triad measurements consistent with the Triad study conducted during Phase I of the Shipyard Sediment Investigation
  - Physical/Chemical: PCBs, Copper, Arsenic, Cadmium, Chromium, Lead, Nickel, Silver, Zinc, Selenium, Mercury, PAHs, TBT
  - Toxicity: Amphipod and bivalve larval bioassays
  - Benthic community analysis: full taxonomic analysis
- **Locations:** NA23, NA24, SW06, SW19 and SW30
- **Frequency:** One time event prior to remediation (July 2009)
- **Goals:**
  - Not “likely” affected using DTR approach at levels below the SS-MEQ and LAETs

Pre-Remediation Monitoring

- **Interpretation of Results**

Concentration	DTR Weight of Evidence	Interpretation	Action/Comment
Below SS-MEQ and 60%LAET	Not “Likely”	Site specific thresholds verified	No action required
Above SS-MEQ or 60%LAET	“Likely”	Site specific thresholds verified	Need to assess cause of “likely” result; potential remediation at these stations
Above SS-MEQ or 60%LAET	Not “Likely”	Site specific thresholds verified	False positives are consistent with conservative nature of the site-specific thresholds
Below SS-MEQ and 60%LAET	“Likely” at >1 station driven by chemistry	Site specific thresholds challenged	Need to assess cause of “likely” result and potentially re-evaluate thresholds

Pre-Remediation Monitoring

- **Validating SS-MEQ/LAET Method for Analyzing Stations Without Triad Data**
  - California's Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List (Listing Policy; 2004), employs a binomial distribution test to determine whether a water quality segment is impaired.
  - Under the Listing Policy, a water quality segment is not impaired for toxicants (the null hypothesis is confirmed) if the number of measured exceedances for a sample size of 5 is fewer than 2.
  - Validating the SS-MEQ/60% LAET method as a tool to correctly identify a "Likely" impacted station (testing the null hypothesis) is analogous to measuring for exceedances under the Listing Policy.
  - **Conclusion**: The SS-MEQ/60% LAET method will be confirmed if the number of incorrectly-predicted "Likely" stations is fewer than 2.

CRWQCB. 2004. Water Quality Control Policy For Developing California's Clean Water Act Section 303(d) List. September.

Remediation Monitoring

- Monitoring components
  - Water Quality Monitoring
  - Sediment Monitoring
  - Disposal Monitoring

Remediation Monitoring Water Quality

- **Purpose:**
  - Demonstrate that remediation efforts do not result in exceedances of water quality standards during remediation outside the area of construction activity
- **Lines of Evidence:**
  - Monitor for turbidity as indicator of unacceptable impacts to water quality
    - Perform turbidity and water quality modeling prior to cleanup activities to assess “ambient” conditions.
    - Compare monitoring results to synoptic “ambient” measurements outside the influence of cleanup activities, including Bay conditions and effects of non-remedial shipyard activities
- **Locations/depths:**
  - Approx. 4 samples in a 250 to 500 feet arc from outside of construction activities
    - 250 foot distance serves as ‘early warning’ point
    - 500 foot distance is the actual point of required compliance
  - Approx. 10 feet below surface

Remediation Monitoring Water Quality (cont'd)

- **Frequency:**
  - Perform sampling daily at the start of dredging activities, then if no exceedances occur after three days, decrease frequency to weekly during ongoing activities
  - Return to sampling daily if a significant change in operations occurs, then if no exceedances occur after three days, decrease frequency to weekly during ongoing activities

- **Goals:**
  - Water quality standards (as predicted by turbidity) not significantly impacted beyond construction area (500 feet from dredge/in-water activities)

Remediation Monitoring Sediment Conditions

- **Purpose:** Confirm that remediation has achieved target cleanup levels within footprint
- **Lines of Evidence:**
  - Chemistry: PCBs, Copper, PAHs, TBT, Mercury
- **Locations:** Footprint polygons
  - Re-sample Phase 1 study locations
- **Frequency:** Immediately after confirmation that contractor has achieved dredge depths within an area
- **Goals:**
  - Remediate to DTR reference concentrations inside footprint

Remediation Monitoring Disposal

- **Purpose:** confirm that dredge spoils are acceptable for disposal – at landfill or open-ocean disposal site
- **Lines of Evidence:**
  - Physical/Chemical: dictated by disposal facilities
  - Water content (paint filter test) for land disposal
- **Locations:** Representative locations, dictated by process of disposal facilities
- **Frequency:** Dictated by disposal facility process
- **Goals:**
  - Conditional approval for disposal prior to remediation will be based on existing sampling results
  - Confirmation of material suitability for disposal location(s) will be performed on sediment stockpiles, as needed

Remediation Monitoring Contingencies

- Water Quality Monitoring
  - If exceedance of turbidity or dissolved oxygen at 250 feet (early warning) related to dredging activities
    - Slow remediation activities
    - Sample at 500 feet
      - If exceedance at 500 feet, then
        - » Temporarily suspend remediation activities
        - » Evaluate additional BMPs and equipment changes
        - » If no improvement in turbidity at 500 feet, halt in-water activities until effective modifications to equipment/methods are established
- Sediment Monitoring
  - Remediate to pre-determined depths based on DTR reference
  - After dredging,
    - If sediment concentrations of primary COCs are above 120% of DTR reference in <u>deeper</u> than upper 4 inches of core samples, then additional dredging pass
    - If sediment concentrations are below 120% of reference in <u>deeper</u> than upper 4 inches of core samples, stop dredging and place sand cover, if necessary
    - If refusal, then determination whether sand cover required

Post-Remediation Monitoring Overview

- Overall objective is to verify that pollutant concentrations in the sediments following remediation that are technologically and economically feasible will not unreasonably affect San Diego Bay beneficial uses.

- Specific post-remediation monitoring goals include:
  - Verify that remediation was effective in reducing pollutants in sediments to levels that do not unreasonably affect beneficial uses:
    - human health
    - aquatic dependent wildlife
    - benthic communities
  - Verify that the remedy adequately maintains these levels of protection over the long-term

Post-Remediation Monitoring:

Human Health and Aquatic-Dependent Wildlife

- **Purpose:**
  - Verify that remediation was effective in reducing pollutants in sediments to levels that do not unreasonably impact human health and aquatic-dependent wildlife
  - Verify that the remedy adequately maintains these levels of protection over the long-term
- **Sampling Methodology**
  - Sample at station locations sampled in Phase 1 study
    - Two grab samples will be composited in the field at each station
  - Composite SWAC
    - Technically valid and cost-effective approach for calculating a SWAC
      - Mathematically equivalent to analysis of all individual polygons
    - Three replicate sub-samples of composite samples
  - 28-day Macoma laboratory bioaccumulation test
- **Lines of Evidence:** Chemistry and bioaccumulation measurements
  - Sediment Physical/Chemical: PCBs, Copper, Mercury, PAHs, TBT
  - Bioaccumulation: PCBs, Copper, Mercury, PAHs, TBT

Post-Remediation Monitoring:
Human Health and Aquatic-Dependent Wildlife (cont'd)

- **Locations:**
  - Chemistry: Samples collected at all 65 stations and composited on a surface area weighted basis into 6 sub-regions (see diagram, next slide):
    - NASSCO: Inside footprint; near-shore; near channel
    - BAE: Inside footprint; near-shore; near channel
    - Individual samples to be archived for potential further analysis
  - Bioaccumulation (macoma lab test): Same 9 stations from Phase I of the Shipyard Sediment Investigation (SW04, SW08, SW13, SW21, SW28, and NA06, NA11, NA12 and NA20)
- **Frequency:**
  - Chemistry: Year 2, Year 5; Year 10 (depending on results of year 5 sampling)
  - Bioaccumulation: Year 2, Year 5; Year 10 (depending on results of year 5 sampling)
- **Goals**:
  - Confirm remedial goals met at year 2
    - Site-wide SWAC at or below threshold
    - Bioaccumulation: average of stations sampled decreasing below Phase 1 study
  - Confirm remedial goals are maintained at years 5
    - Site-wide SWAC at or below threshold at years 5
    - Bioaccumulation: average of stations generally constant or decreasing relative to year 2
  - Confirm remedial goals are maintained at year 10 (if necessary based on year 5)
    - Site-wide SWAC at or below threshold at years 10
    - Bioaccumulation: average of stations generally constant or decreasing relative to years 2 and 5

Post-Remedial Monitoring Triggers for Primary COCs

Further evaluation of COC concentrations, including the possible need for further action, will be triggered if the following conditions are not met:

Station-specific sediment concentrations (protection of benthos):
•Below LAETs
•Below SS-MEQ of 0.9

Site-wide SWACs (protection of human health and wildlife):

Copper (185 ppm)
Mercury (0.78 ppm)
TBT (156 ppb)
PCBs (253 ppb total congeners)
HPAH (3.0 ppm)

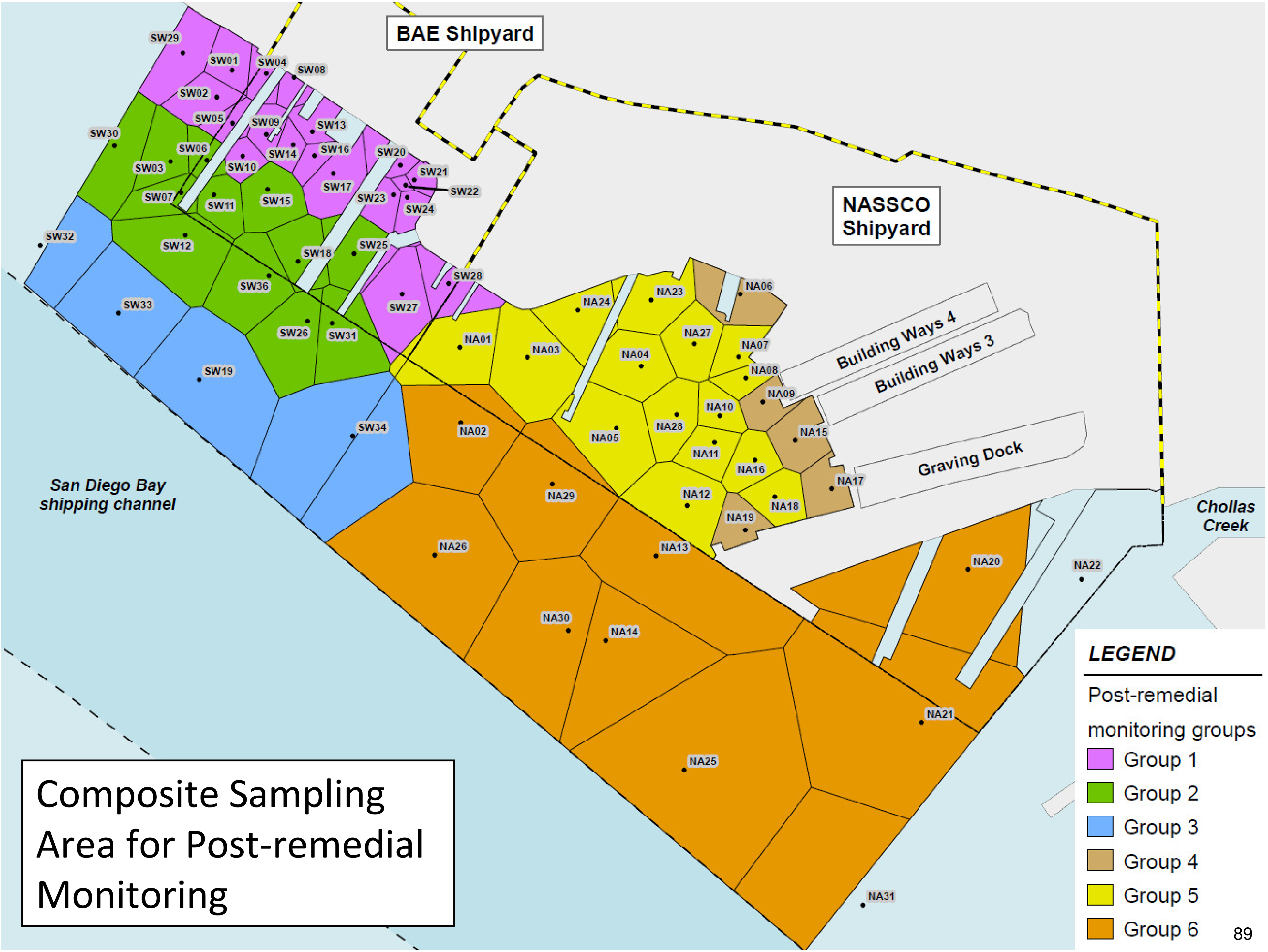
All human and wildlife risk scenarios will be evaluated according to the models and assumptions described in the DTR.

Post-Remedial Monitoring Trigger for Primary COC SWACs

The site-wide SWAC triggers for further evaluation during post-remedial monitoring will be set according to the following criteria:

- The site-wide SWAC triggers are the upper 95% confidence interval (UPL) on the estimated post-remedial SWAC for the primary CoCs.

- Triggers account for natural variability of the predicted post-remedial site-wide SWACs.



Composite Sampling Area for Post-remedial Monitoring

Post-Remediation Monitoring – Benthic Community Conditions

- **Purpose:**
  - Demonstrate that the remediation successfully created conditions that are acceptable for benthic community
- **Lines of Evidence:** Chemistry and toxicity
  - Sediment Physical/Chemical: PCBs, Copper, Mercury, PAHs, TBT, TOC, Grain size
  - Toxicity: Amphipod and bivalve larval bioassays
- **Locations:**
  - Chemistry and Toxicity: Samples collected at 5 DTR “Likely” stations within the footprint (NA19, SW04, SW13, SW22, SW23)
- **Frequency:**
  - Chemistry: Year 2, Year 5; Year 10 (depending on results of year 5 sampling)
  - Toxicity: Year 2, Year 5; Year 10 (depending on results of year 5 sampling)
- **Goals**:
  - Confirm remedial goals met at year 2
    - Chemistry below SS-MEQ and LAET thresholds
    - Toxicity not significantly different from Phase 1 study reference conditions as defined in DTR
  - Confirm remedial goals are maintained at years 5
    - Chemistry below SS-MEQ and LAET thresholds
    - Toxicity not significantly different from Phase 1 study reference conditions as defined in DTR
  - Confirm remedial goals are maintained at year 10 (if necessary based on year 5)
    - Chemistry below SS-MEQ and LAET thresholds
    - Toxicity not significantly different from Phase 1 study reference conditions as defined in DTR

Post-Remediation Monitoring – Benthic Community Development

- **Purpose:**
  - Determine how the benthic community develops within the footprint following remediation
- **Lines of Evidence:**
  - Benthic Community: Full taxonomic analysis
- **Locations:**
  - 5 randomly selected sample locations from within the remedial footprint with 2-3 from each shipyard area other than the 5 stations sampled for chemistry and toxicity
- **Frequency:**
  - Year 3; Year 4
- **Goal**
  - Solely to evaluate the development of the benthic community following remediation
  - Cannot predict the nature or extent of re-colonization

Pre-Remedial Action Implementation Schedule

- CEQA/Environmental Impact Report (EIR)
- Adoption of Order
- Establish Funding Mechanism
- Bid and Selection of RA Project Management Firm
  - PM Firm to provide oversight of remedial action
- Design and Submission of Remedial Action Plan (RAP)
  - Within 90 days of selection of RA PM firm
- Permits/authorizations received from all agencies
  - 401 Water Quality Certification
  - Non-appealable Coastal Development Permit
  - RHA/ACOE/404
  - Shore Sediment Mgt Facility
- Implementation Activities/Schedule Defined by Constraints
  - Vessel/drydock operations
  - Near-shore with obstructions
  - Unconstrained/open areas
  - Under pier areas
  - Clean sand covers
  - Source control (e.g., MS4/SW4)

CEQA EIR Process Timeline

TASK	APPX. TIME NEEDED	EST. COMPLETION DATE
Retain Consultant(s)	1 Week (from date parties agree on payment split)	July 30
Prepare Project Description	4 Weeks	Aug. 27
Develop Alternatives	4 Weeks	Sept. 24
Prepare Technical Reports • Traffic	6 Weeks	Nov. 5
• Air Quality and Climate Change	4 Weeks	Oct. 22
• Noise	3 Weeks	Oct. 15
• Water Quality	6 Weeks	Nov. 5
• Hazardous Materials	4 Weeks	Oct. 22
• Biology	4 Weeks	Oct. 22
Prepare Administrative Draft of EIR	6 Weeks	Dec. 22
Incorporate Edits/Prepare Screencheck Draft EIR	6 Weeks	Feb. 11, 2011
Circulate Draft EIR for Public Review	45 days (minimum required by CEQA)	March 28, 2011
Respond to Comments on Draft EIR	2-4 Weeks (depending on extent of comments)	April 2011
Publish Final EIR	2 Weeks	May 2011
Hold Hearing on Final EIR/Approval of CAO		May 2011

RFP Process for EIR Consultant

- February 2010 – Clean Up Team develops list of potential CEQA environmental consulting firms for the EIR.
- March 9 - Clean Up Team sends Request for Proposal to eight CEQA environmental consulting firms.
- One proposal received (April 9). Seven firms decline to respond for a variety of reasons; two firms say they declined to respond due to potential conflicts of interest.
- April 20 - Clean Up Team interviews firm that submitted proposal. During the interview it is discovered that a key subconsultant (for sediment, hazards, marine biology and water quality impact analysis) has a potential conflict of interest due to work for the Port of San Diego.
- The Clean Up Team explores with the Port whether it will consent to the subconsultant working on the project EIR; the Port refuses.
- The Clean Up Team works to find a replacement for the conflicted subconsultant and re-solicits proposals from certain firms that had originally declined to submit a response.
- May 11 – A second proposal is submitted from one of the firms that had originally declined; the Clean Up Team conducts a telephonic interview with the firm on June 15.
- May 17 - Replacement subconsultant for the original proposal submits a proposal; the Clean Up Team conducts a telephonic interview with the subconsultant on June 22.
- June 24 – Clean Up Team requests a revised and updated proposal from second proposer and replacement subconsultant.
- July 12 – Revised and updated proposal is received.

Remedial Action Implementation Schedule

- Vessel/Drydock Operations
  - These areas to be given first priority for dredging
  - May require quick/short dredging opportunities due to limited open berth space.
- Near-shore Areas
  - Difficult to maneuver
  - Limited room for dredge and barge
  - Potential for use of land-based excavation/dredging
- Under Pier Areas
  - Dredging where possible
  - Utilizing clean sand covers in all other areas
- Unconstrained Open Areas
  - Easiest to dredge, will be scheduled around more difficult areas, such as piers/berths/drydocks/open areas
- Residuals Management/Clean Sand Covers
- Protection of Structures
  - Sheet pile bulkheads, rock reveted slopes, piers, piling
  - Protection/support installed iteratively during remediation
- Dredge Window September 15 through April 1 (California Least Tern)
  - Schedule assumes three (3) dredge episodes

Remedial Action Implementation Schedule (-cont.)