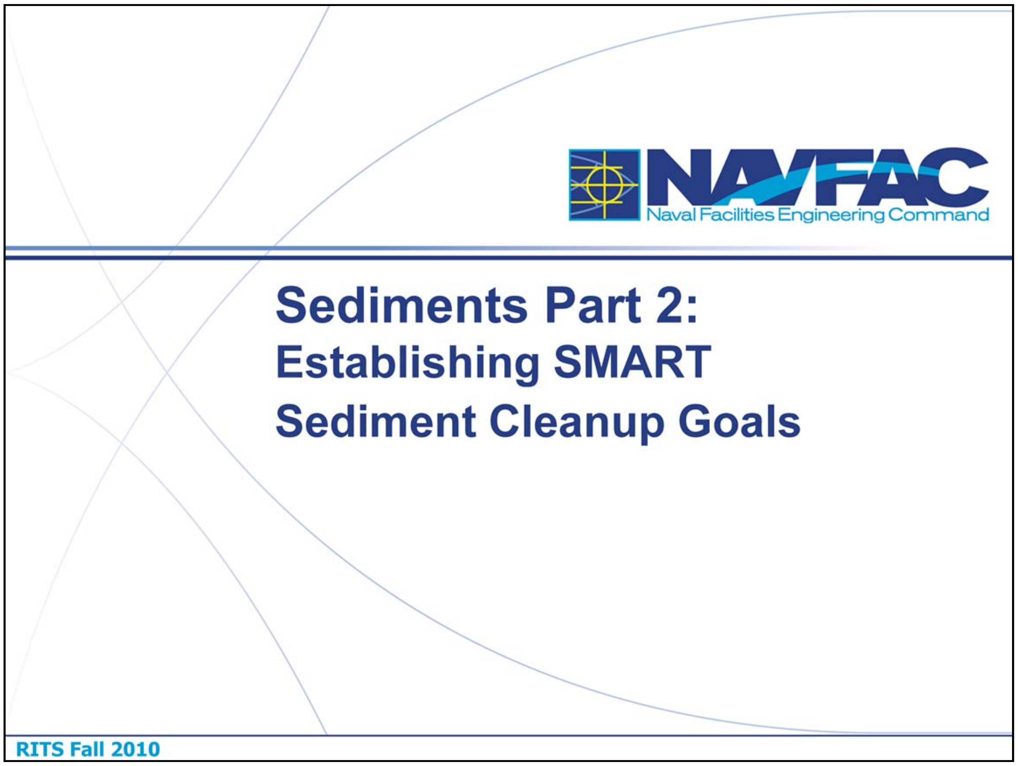
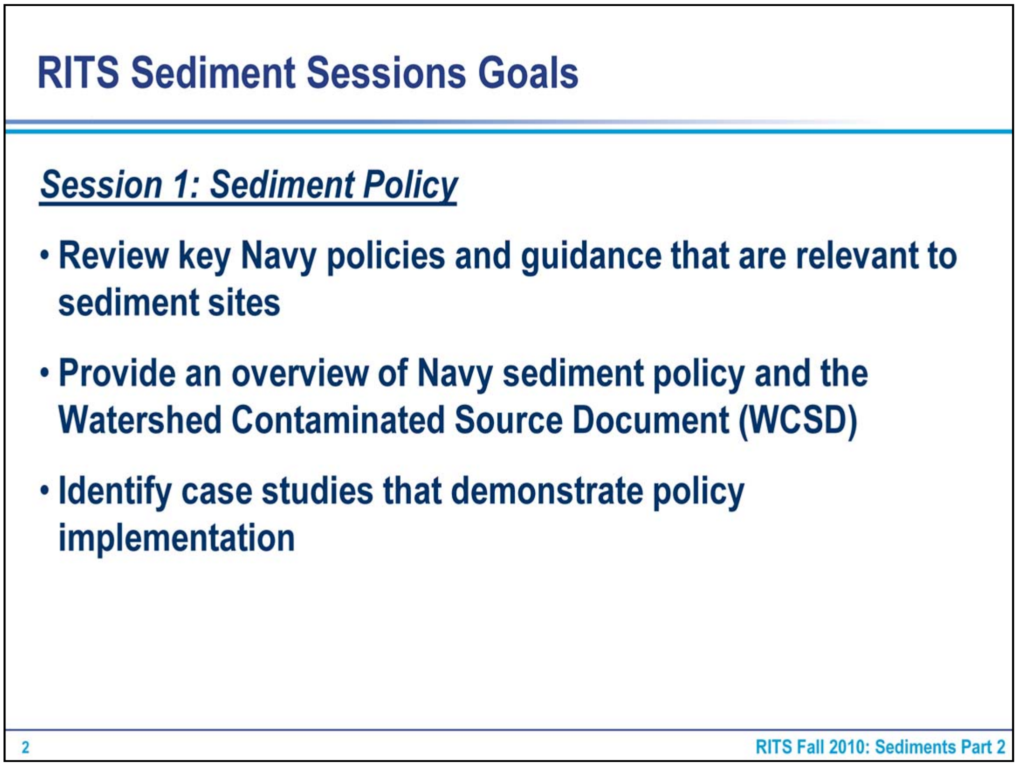
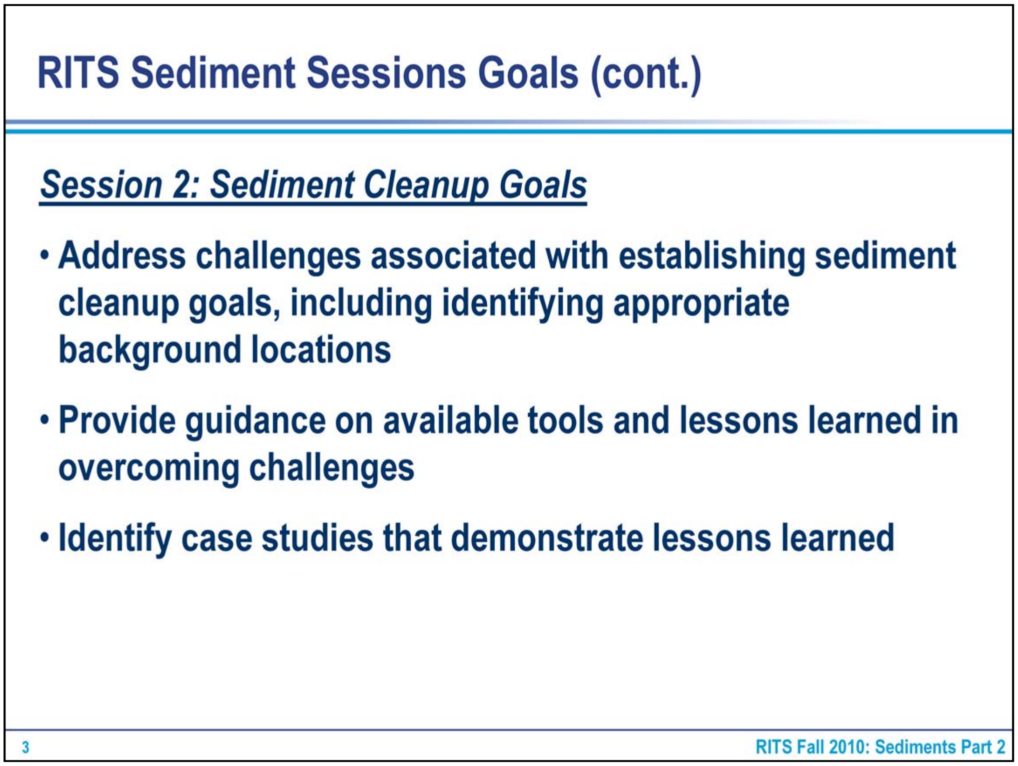


Welcome to Part 2 of the Sediment RITS, Establishing SMART Sediment Cleanup Goals.



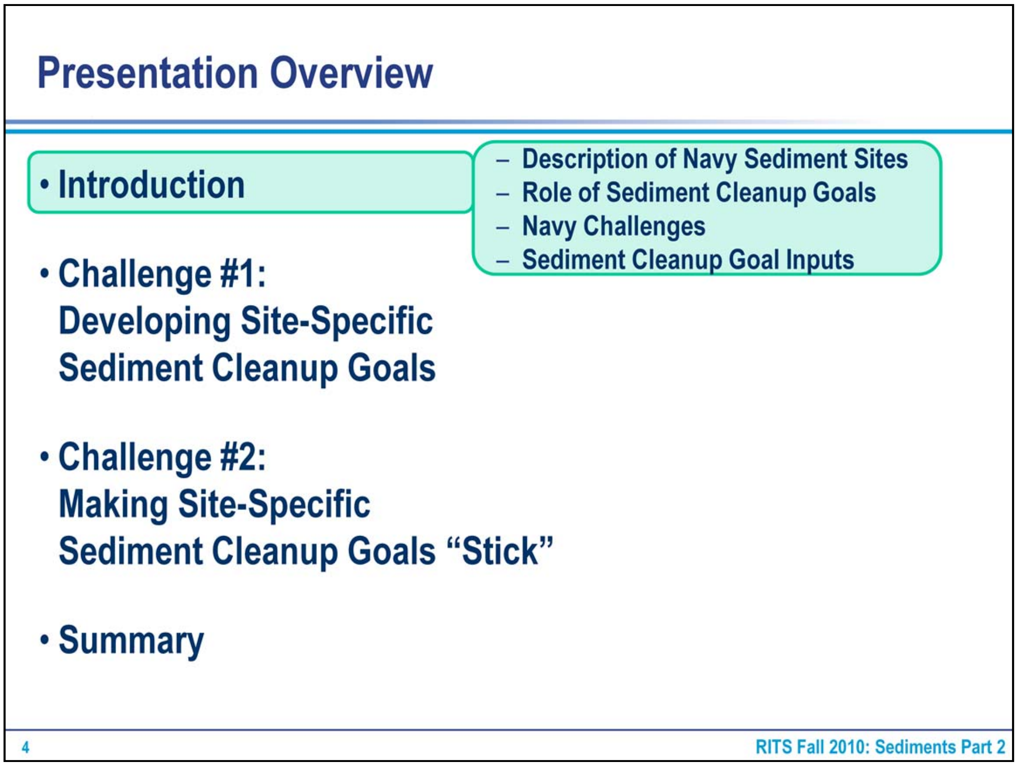
The main objective of the Sediment RITS Part 1 presentation, Managing Sediment Sites using Navy Policy and Guidance, was provided earlier. To reiterate, the objective of that presentation was to provide a refresher on the available policies, guidance, and resources that are available to Navy project managers to help support the investigation and remediation of sediment sites.



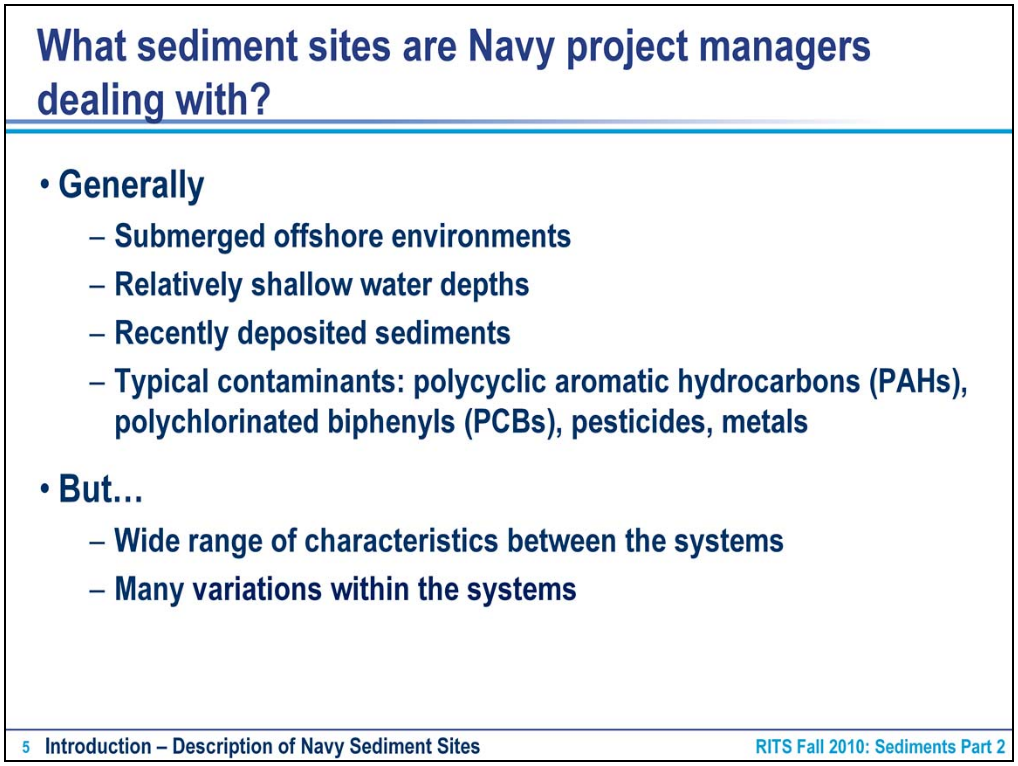
The main objective of the Sediment RITS Part 2 presentation, Establishing SMART Sediment Cleanup Goals, is to define specific challenges identified by the Navy in establishing sediment cleanup goals, including identifying appropriate background locations to properly characterize and assess sediment sites.

The presentation will focus on the specific challenges identified by the Navy, and will provide lessons learned and guidance to Navy project managers in utilizing available tools and “tricks of the trade” to overcome the identified challenges.

The presentation will provide case studies to demonstrate the challenges as experienced for actual Navy sediment sites and to demonstrate the lessons learned for these actual sites.



The presentation overview serves as a guide for the presentation and is used a number of times to keep the presentation on track and to keep the audience aware of its place in the presentation.



While there are a set of general characteristics that typically define the nature of Navy sediment sites, there are a wide range of environments and a wide range of varying conditions within specific systems. For instance, water depths at Navy sediment sites may not always be shallow, and the contaminants may be highly mixed and varied.

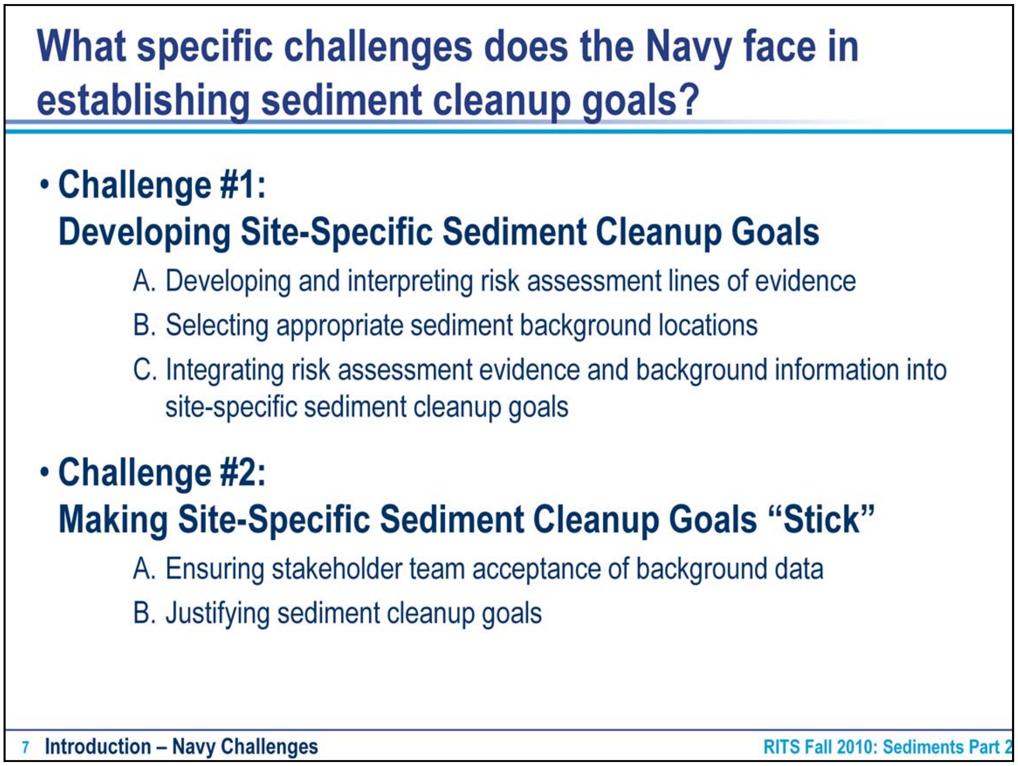
These general complexities present challenges, as they in turn complicate site conditions that inform risk-management, including fate and transport mechanisms, exposure pathways, and receptor categories of interest.

What role do sediment cleanup goals play?

- Similar to onshore sites
  - Define "acceptable" contaminant concentration levels
  - Yield basis for risk management decision-making
  - Support derivation of remediation footprints/prisms
  - Support development of remediation strategy

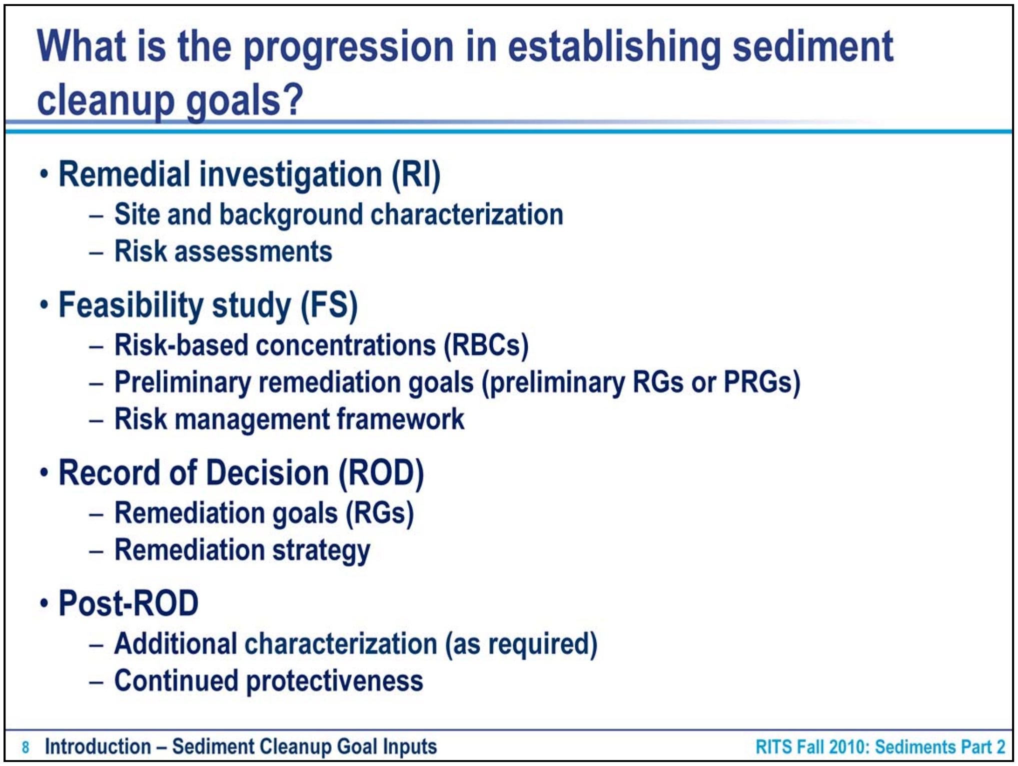
6 Introduction – Role of Sediment Cleanup Goals   RITS Fall 2010: Sediments Part 2

Sediment cleanup goals are the functional equivalent of cleanup goals developed for any other onshore site.



As summarized in the Sediment RITS Part 1 presentation, the Navy's Sediment Issue Focus Team developed and conducted a survey in Fall 2009 to query Navy project managers about their experiences with sediment sites. The Fall 2009 Sediment Issue Focus Team survey revealed eight challenges faced by Navy project managers, three of which were most commonly expressed.

Sediment RITS Part 1 tackled one of the three "top" challenges (i.e., "Identifying and Controlling Non-Navy Inputs/Sources"), while this presentation takes on the remaining two, namely "Developing Site-Specific Sediment Cleanup Goals" and "Determining Background/Reference Locations". For thoroughness and a more direct connection to the Fall 2009 Sediment Issue Focus Team survey, this presentation takes on these "top" challenges in the context of several more discrete challenges by grouping the challenges into "Developing Site-Specific Sediment Cleanup Goals" and "Making Site-Specific Sediment Cleanup Goals "Stick"".

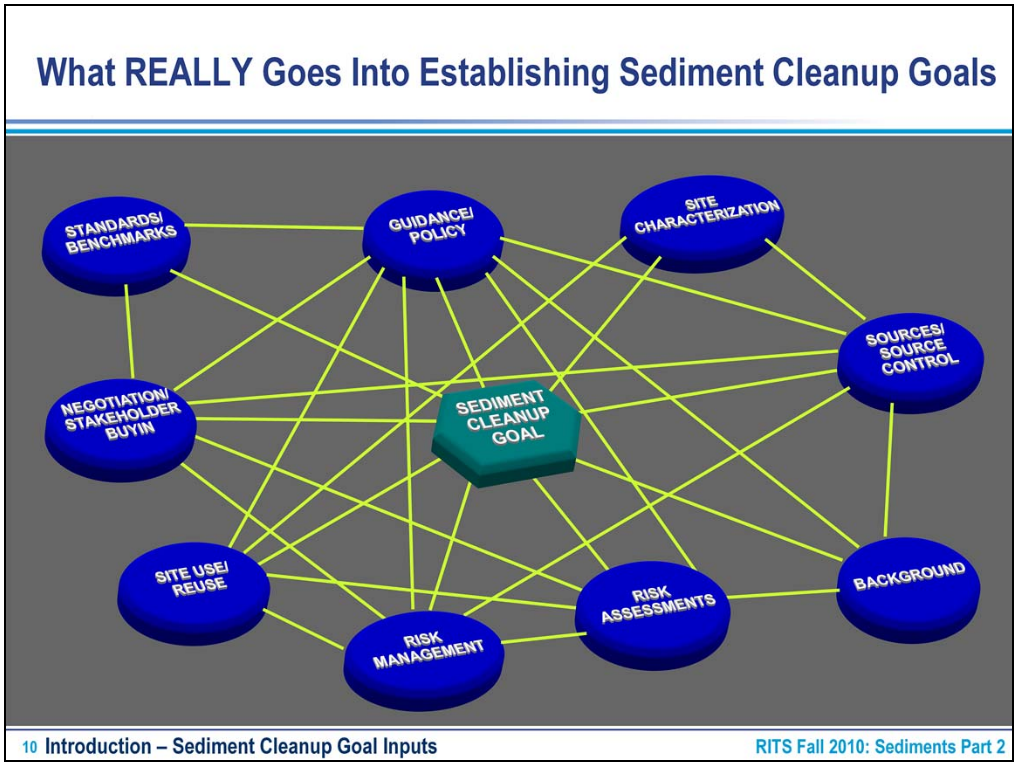


Arriving at a sediment cleanup goal typically follows a progression similar to arriving at a cleanup goal for an onshore site (i.e., a soil or groundwater cleanup goal).

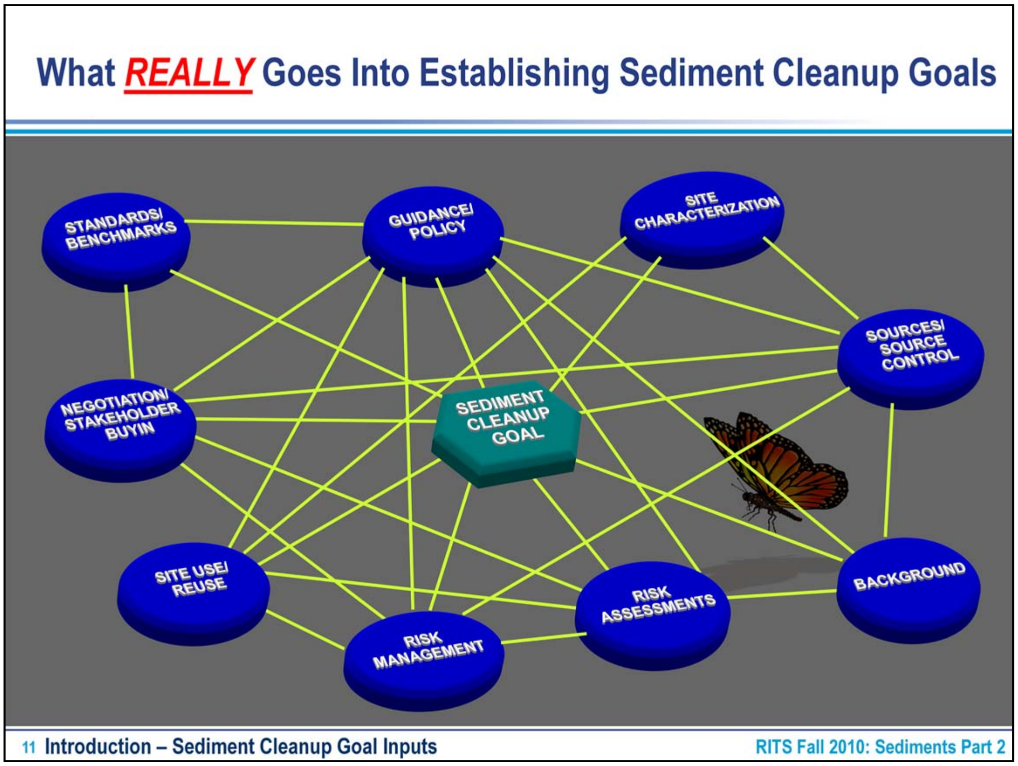
Following the Comprehensive Environmental Response, Compensation, and Liability Act framework, this progression typically involves characterizing and assessing the site and placing the site characterization into the context of risk through an RI, developing a framework for risk-management, including preliminary, risk-protective goals, through an FS, and then formally documenting the relevant cleanup goals and remediation strategy in a ROD. Following the ROD, additional site characterization may be required and the protectiveness of a remedy (and it's components, including cleanup goals) would be evaluated periodically.

For a sediment site, this progression is often more complicated given the relative complexity of sediment sites in general, the long time that the process may take relative to an onshore site, and the increased likelihood of information needs evolving over time.

Sediment cleanup goals are derived from a number of inputs. While other inputs may exist, the nine categorical inputs demonstrated on this figure capture the information that is commonly integrated into a sediment cleanup goal. This figure essentially demonstrates a basic “Conceptual Site Model” for deriving a sediment cleanup goal.



Within the basic "Conceptual Site Model" for deriving a sediment cleanup goal, the individual inputs are not unidirectional and are not actually discrete inputs. In fact, each input interrelates with others, and in many cases, interrelates with several others in a layered fashion.



Due to the interrelatedness of the inputs within the basic “Conceptual Site Model” for deriving a sediment cleanup goal, a change in one input often affects several other inputs. To borrow from “chaos theory”, this “butterfly effect” adds tremendous complexity to the decision-making for a sediment site, as the inputs are truly both interrelated and dynamic.

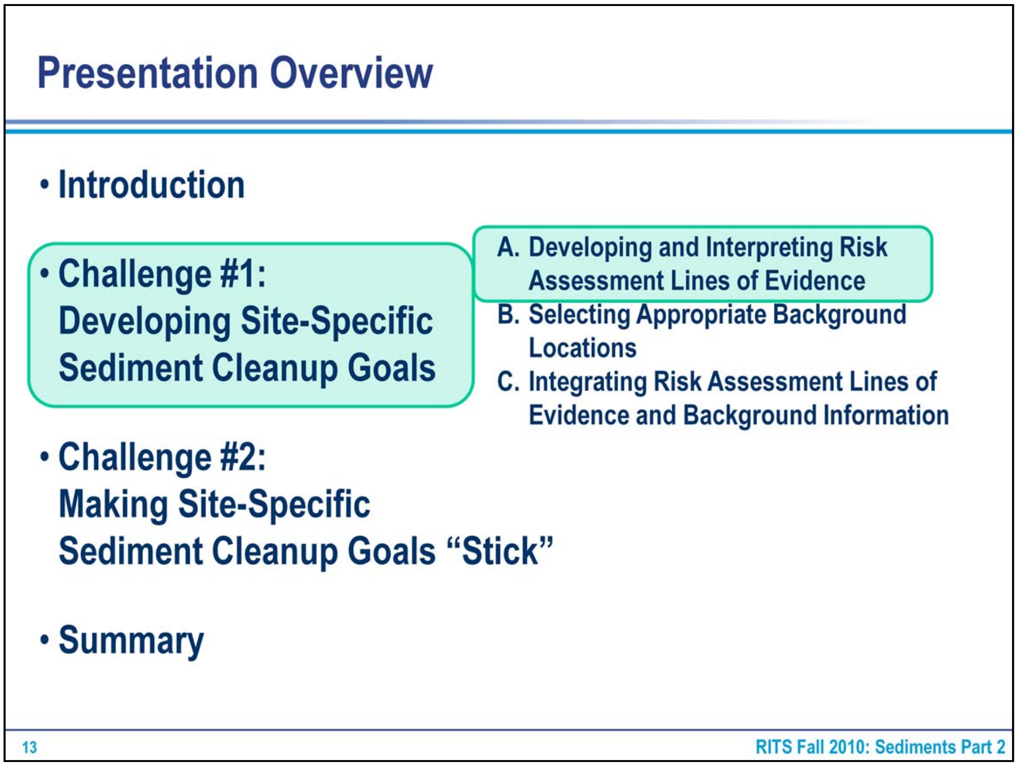
For the purposes of this presentation, the discussion is based on the sediment cleanup goal inputs being relatively static.

General Context

- Strategies for investigating and remediating sediment sites consistent with onshore sites
  - But sediment sites are typically more complex and last longer
- Resources (time and money) are finite
  - Sediment sites complicated by greater uncertainty
- Overall objective is integrating multiple, interrelated inputs into "final" (approved and accepted) sediment cleanup goals
  - Typically iterative and interactive process of science and negotiation

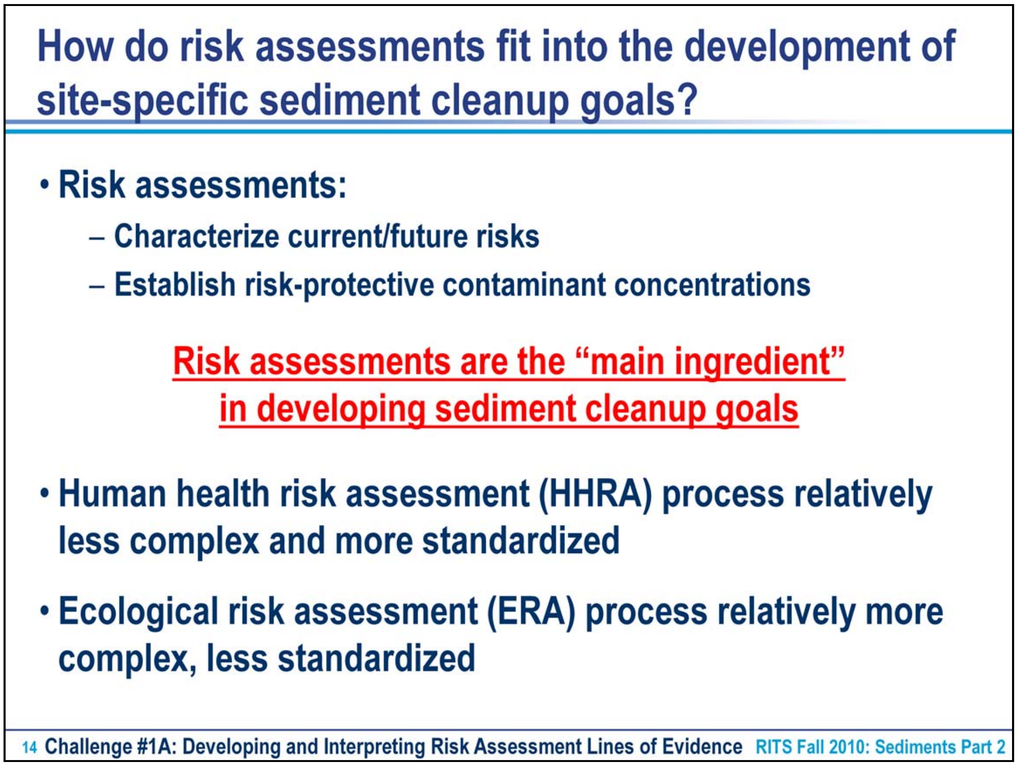
12 Introduction – Sediment Cleanup Goal Inputs RITS Fall 2010: Sediments Part 2

The strategies applied for investigating, assessing, and remediating sediment sites are similar to onshore sites (i.e., soil and groundwater sites). However, the specific tactics are more complex and can be limited by resource constraints. In addition, the field of sediment science is not a "definitive" one and is rather evolving as the collective experience unfolds.



The presentation is now moving on to Specific Challenge #1, Developing Site-Specific Sediment Cleanup Goals. In this portion of the presentation, three discrete challenges are addressed, namely "Developing and Interpreting Risk Assessment Lines of Evidence", "Selecting Appropriate Background Locations", and "Integrating Risk Assessment Lines of Evidence and Background Information". Tools and "tricks of the trade" are provided to overcome these discrete challenges, and a case-study exploring a real Navy site and lessons learned is highlighted for each of the discrete challenges.

The following slides address the specific challenge "Developing and Interpreting Risk Assessment Lines of Evidence".

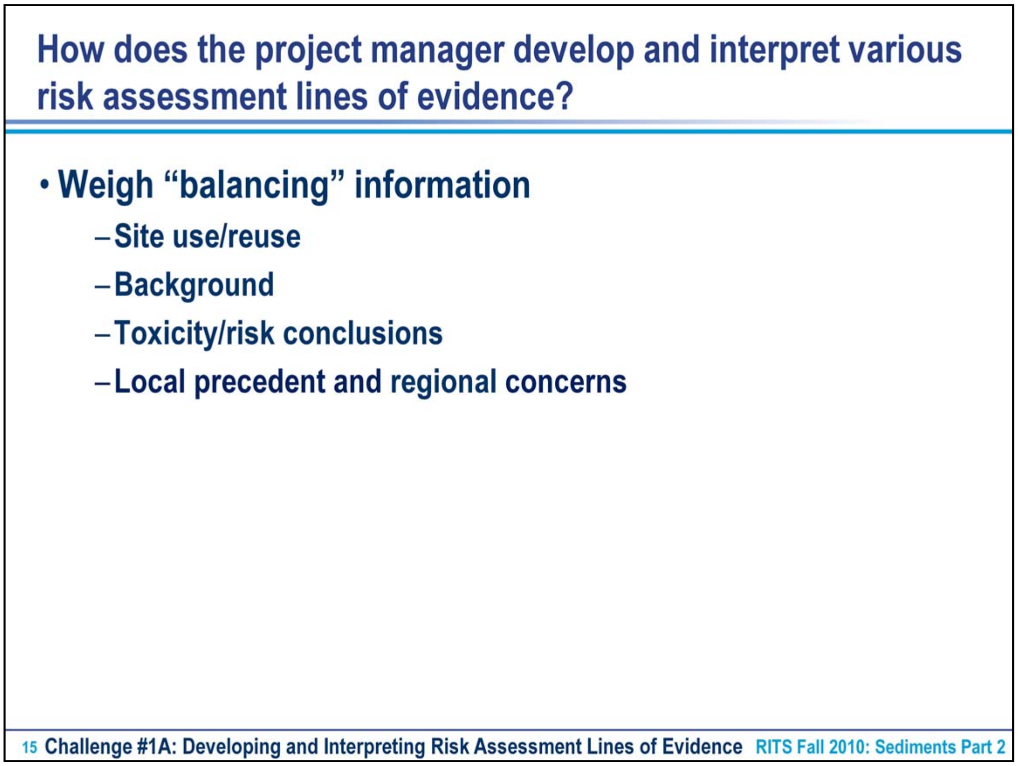


Sediment site remediation is a risk-focused process, and the risk assessments are intended to provide the fundamental basis for risk-management.

Typically, consistent with onshore sites, the HHRA is more standardized and less complex, while the ERA is less standardized and more complex. This is generally due to the relatively small number of relevant pathways and limited receptor categories in the HHRA and the greater number of potential receptors and pathways of potential significance for the ERA.

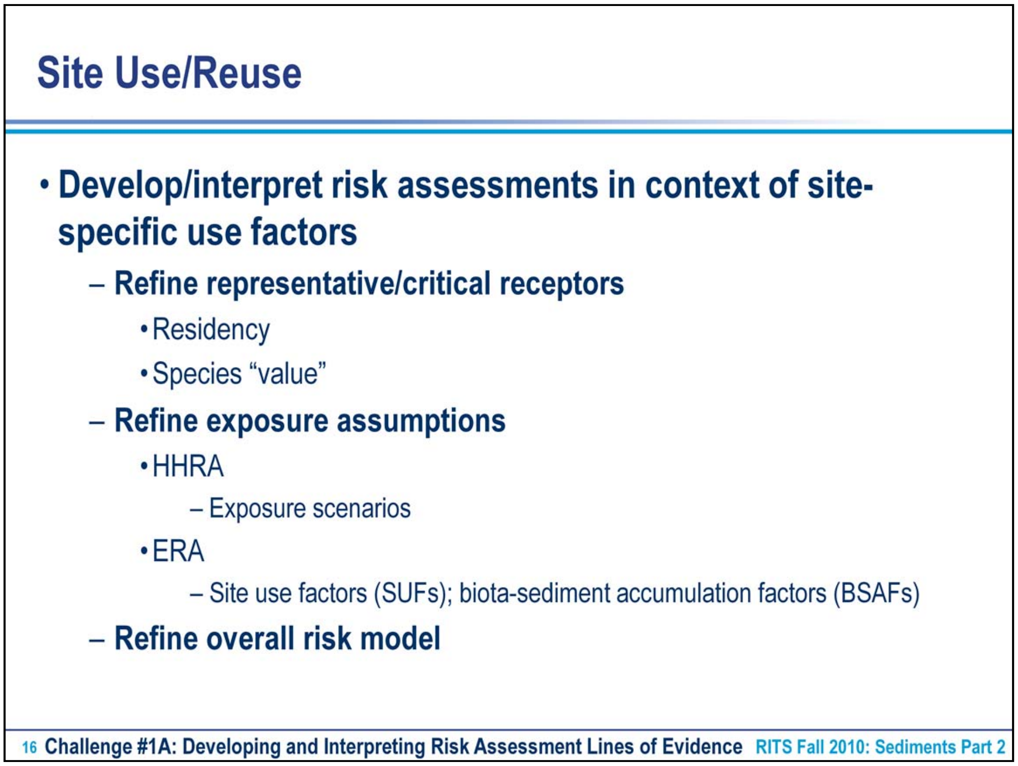
However, for sediment sites, the HHRA can have unique pathways and the ERA often has even more complicated pathways given the complex relationship between sediments and sediment-dwelling organisms and higher trophic levels. For this reason, both the HHRA and ERA can be complicated for a sediment site.

This presentation assumes that the fundamentals of actually performing risk assessments are well known.



The key to developing and/or interpreting risk assessment lines of evidence for a sediment site is to weigh relevant balancing information.

Given the complexity of sediment sites and the uniqueness of risk assessments for these sites, great interpretive power is available through balancing factors that place risk assessments in a clearer context. While other sources of balancing information may exist, lessons learned at sediment sites suggest that those listed (i.e., site use/reuse, background, toxicity/risk conclusions, and local precedent and regional concerns) have a significant impact on framing risk assessment lines of evidence.



Given the critical nature of risk assessments in developing sediment cleanup goals, in that risk assessments are the most basic building block of risk-management decision-making, all risk assessment factors should be considered in the context of site use/reuse.

Project managers should ensure that risk models are clearly based on relevant site use/reuse evidence, and should ensure that model inputs (and/or the interpretation of model results) are refined to reflect actual site conditions. For instance, ERAs often rely on “common” fish species, when in fact those species may have limited value to an ecosystem or may not be resident at the site, or otherwise on “default” SUFs/BSAFs when those “defaults” may not truly characterize the site. Similarly, HHRAs often integrate residential exposure scenarios when such scenarios may be truly irrelevant to a sediment site or may confound more than clarify risk assessment lines of evidence.

Background

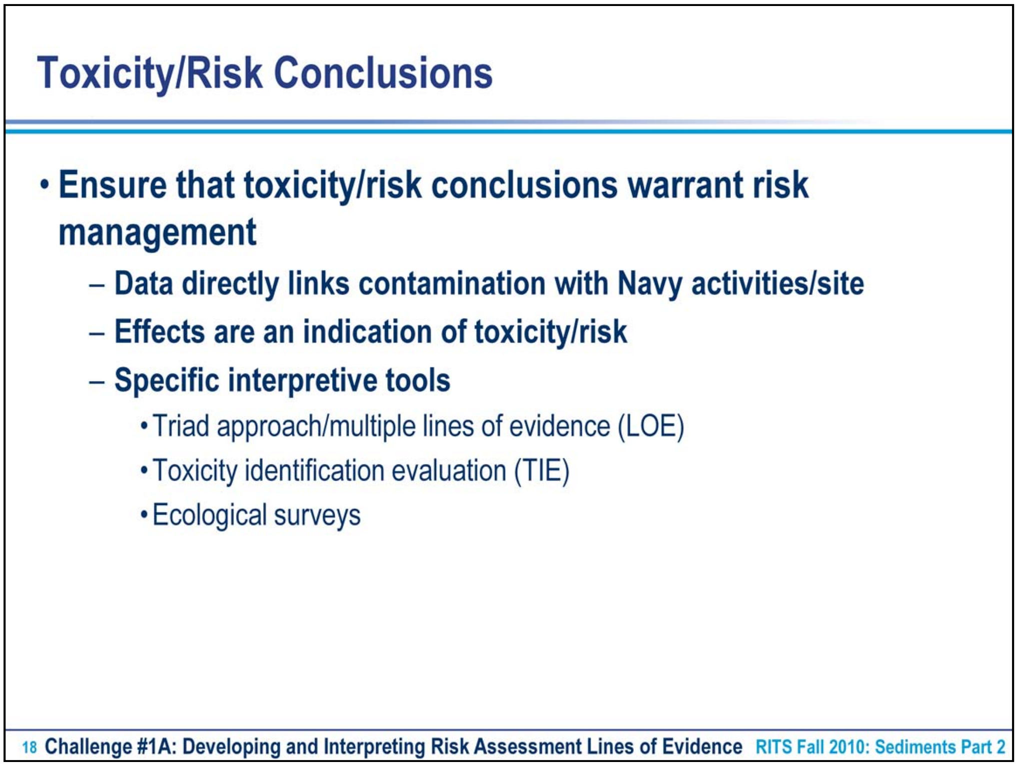
- **Ensure that background data needed to fully develop and interpret risk assessments are available**
  - **Background data end use**
  - **Fundamental questions that frame risk management**
    - Direct measurements at background stations
  - **Appropriate data assessment**
  - **Adherence to Data Quality Objectives (DQOs)**

17 **Challenge #1A: Developing and Interpreting Risk Assessment Lines of Evidence** RITS Fall 2010: Sediments Part 2

Background data are critically important to frame the characterization and assessment of a sediment site, as risk-management is focused on incremental risk. Later portions of this presentation focus on the relationship of background to incremental risk, as well as actual background site selection. For the particular issue covered by this slide, the concept of background relates to the nature of the actual background dataset.

When developing and interpreting risk assessment lines of evidence, the project manager should ensure that the background dataset was developed properly to include information that actually answers critical questions and that the data themselves have been assessed appropriately in the context of these questions.

For instance, if the risk assessments are intended to include an interpretation of toxicity testing results, then the background dataset should (or may need to) include comparable testing results to allow for a meaningful interpretation of this line of evidence.



Toxicity and risk are not algebraic formulas, and do not necessarily express simple, directional, and/or linear relationships. The project manager should ensure that findings of toxicity/risk are actually related to a Navy impact and are not confounded by potentially “extraneous” relationships that do not warrant risk-management.

Tools such as the Triad Approach/multiple LOE, TIE, and/or ecological surveys can be used to put findings in perspective.

The Triad Approach/multiple LOE is an approach to systematically assessing various component inputs to a risk/toxicity finding to determine the “true” level of affect. The TIE process is a tool to sequentially evaluate potential causation for a toxicity/risk finding that can resolve confounding, non-contamination factors from contamination factors and may ultimately determine that a finding of toxicity/risk is related to a non-contaminant effect. Similarly, ecological surveys can be used to statistically evaluate ecological assemblages and directly frame toxicity/risk in the context of actual observable effects.

Triad Approach/Multiple Lines of Evidence

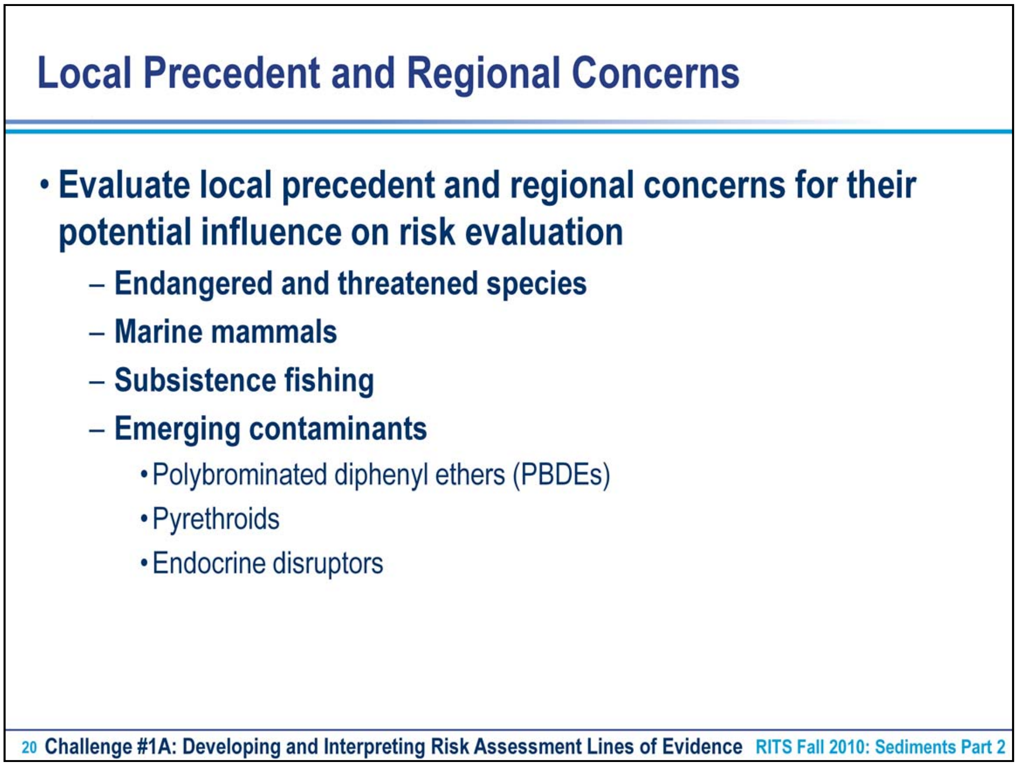
Toxicity	Chemistry Exposure	Potential for Chemically Mediated Effects	Station Assessment	Severity of Biological Effects	Benthic Disturbance	Toxicity
High	High	High Potential	Clearly Impacted	High Effect	High	High
Moderate	High	High Potential	Clearly Impacted	High Effect	High	Moderate
High	High	High Potential	Clearly Impacted	Moderate Effect	Moderate	High
Moderate	High	High Potential	Clearly Impacted	Moderate Effect	Moderate	Moderate
High	Moderate	Moderate Potential	Likely Impacted	High Effect	High	High
Moderate	Moderate	Moderate Potential	Likely Impacted	High Effect	High	Moderate
Low	High	Moderate Potential	Likely Impacted	High Effect	High	Low
High	Low	Moderate Potential	Likely Impacted	High Effect	High	High
High	High	High Potential	Likely Impacted	Low Effect	Low	High
Moderate	High	High Potential	Likely Impacted	Low Effect	Low	Moderate
High	High	High Potential	Likely Impacted	Low Effect	Reference	High
High	Minimal	Moderate Potential	Likely Impacted	High Effect	High	High
Moderate	Low	Moderate Potential	Likely Impacted	High Effect	High	Moderate
Low	Moderate	Moderate Potential	Likely Impacted	High Effect	High	Low
Low	Low	Low Potential	Not Likely Impacted	Moderate Effect	Moderate	Low
High	Minimal	Low Potential	Not Likely Impacted	Low Effect	Low	High
Low	Low	Low Potential	Not Likely Impacted	Low Effect	Low	Low
Moderate	Low	Moderate Potential	Not Likely Impacted	Low Effect	Low	Moderate

Southern California Coastal Water Research Project

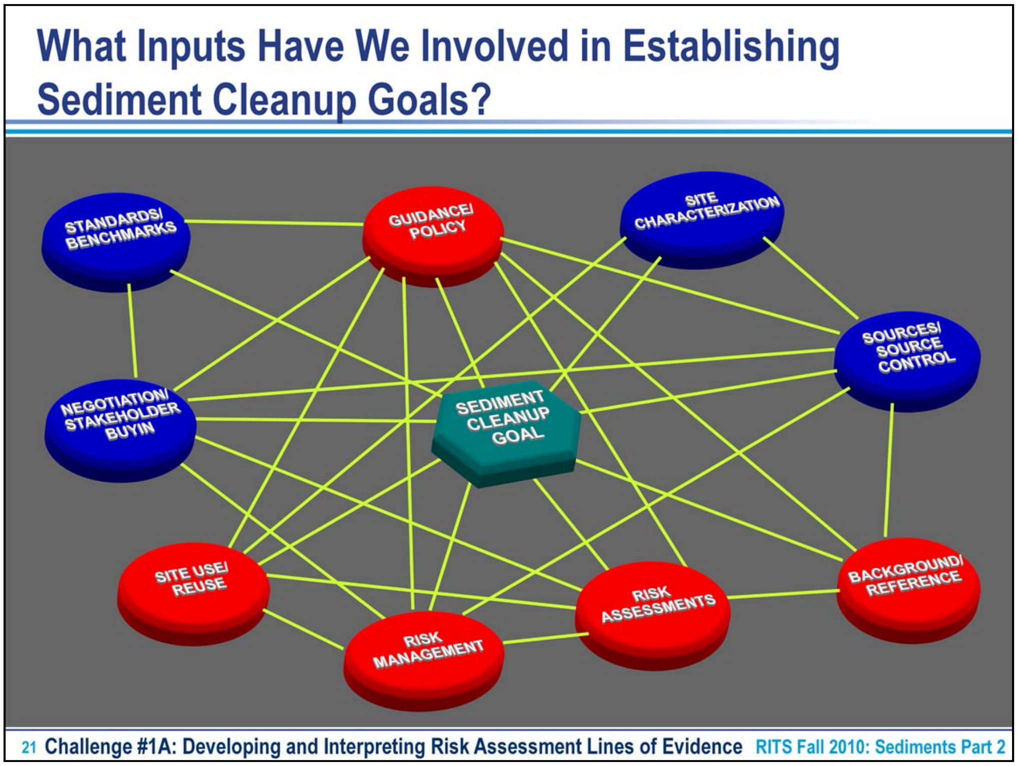
This example table shows the relationship between individual LOE categories (toxicity, chemistry exposure, and benthic disturbance) rolled up to an effects assessment (potential for chemically mediated effects and severity of biological effects) and ultimately to a station assessment result (clearly or likely impacted). Arrows indicate the progression of classification.

From: Southern California Coastal Water Research Project

http://www.sccwrp.org/ResearchAreas/Contaminants/SedimentQualityAssessment/DirectEffectsInBays/IntegratingMultipleLinesOfEvidence.aspx



Certain local and regional concerns can tilt the scales in weighing risk assessment lines of evidence. For instance, a particular species may carry such weight due to local or regional concerns, that it may be necessary to include as the relevant species of concern despite other evidence. Or, a particular human exposure pathway may be the driving pathway in considering human health risk due to stakeholder concerns. Emerging contaminants may not be sourced from the Navy, but may confound analyses or may be a local/regional concern of significant proportion and may require specific assessment.

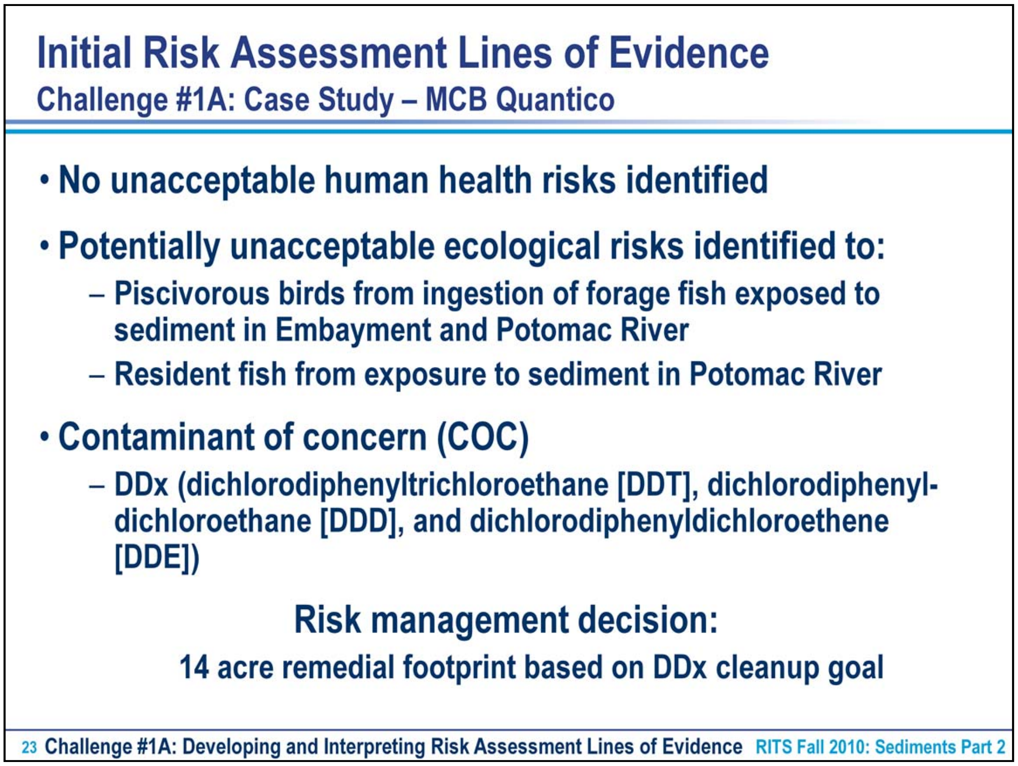


The single challenge of "Evaluating and Interpreting Risk Assessment Lines of Evidence" has already "triggered" five of the nine categorical inputs to developing a sediment cleanup goal.

Challenge #1A: Case Study – MCB Quantico

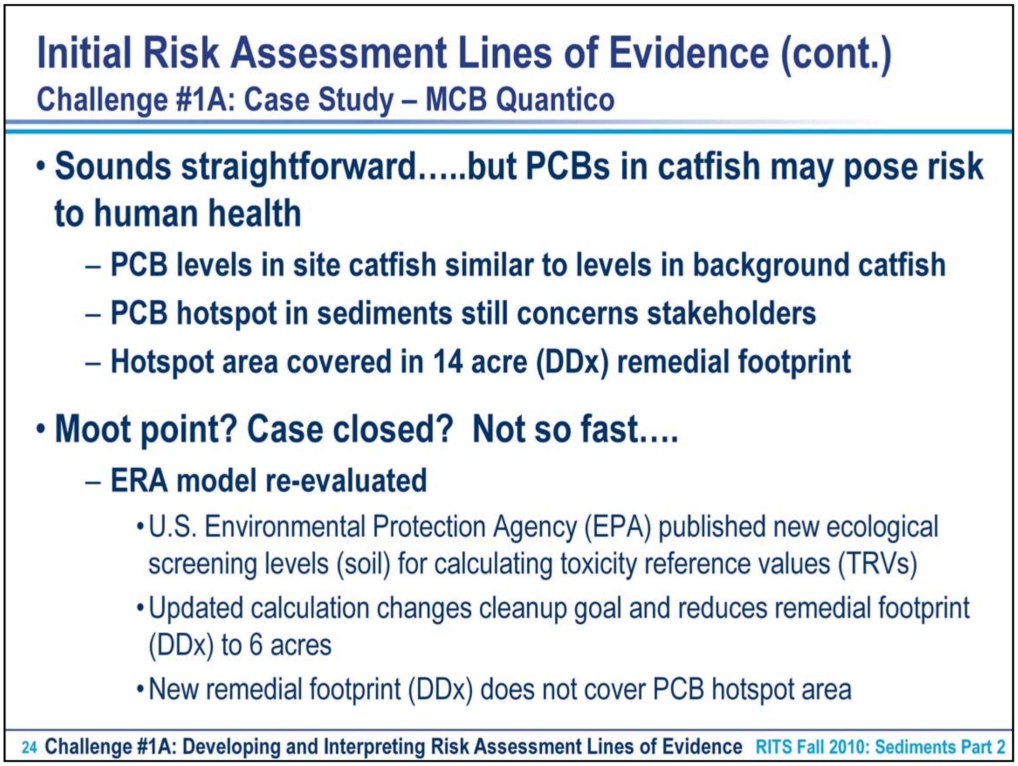
- **MCB Quantico contains a variety of aquatic habitats**
  - Potomac River (large active water body)
  - Chopawamsic Creek (significant surface area and continual flow)
  - Abrahams Creek (limited area with minimal flow)
  - Sites composed of open water, shallow marsh, wetlands
- **Potomac River Embayment, IR Site 99**
  - Onshore contaminant sources identified and remediated
  - Interim Remedial Action (IRA) completed
  - Post-IRA study, FS, and Long Term Monitoring (LTM) Plan developed
  - Additional remediation (capping) planned

Marine Corps Base Quantico has a long history (93 years) with the first military operations established in 1917. MCB Quantico encompasses a large footprint (~60,000 acres) with a wide variety of aquatic and terrestrial habitats.



The initial FS determined there were no unacceptable human health risks, while two potentially unacceptable ecological risks were identified.

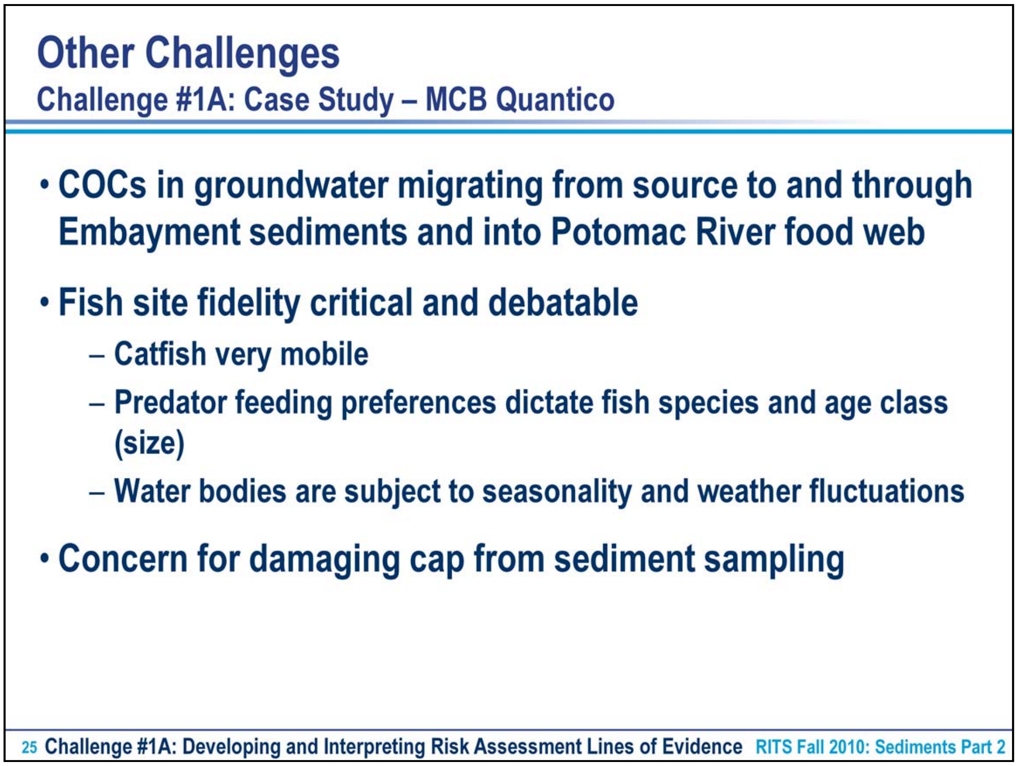
The primary COCs were DDx (DDT and its degradation products DDD and DDE), and based on the DDx cleanup goal, a 14 acre remedial footprint was identified.



Acceptable human health risk comes with caveat; it is acceptable due to similar tissue concentrations of a second COC group (PCBs) measured in fish collected at background locations.

This caveat generated concern for an area of sediments containing elevated PCBs, but the PCB area of concern was covered by the DDx remedial footprint.

However, during the multi-year process, U.S. EPA published new regulatory guidance for factors used to calculate ecological risk.

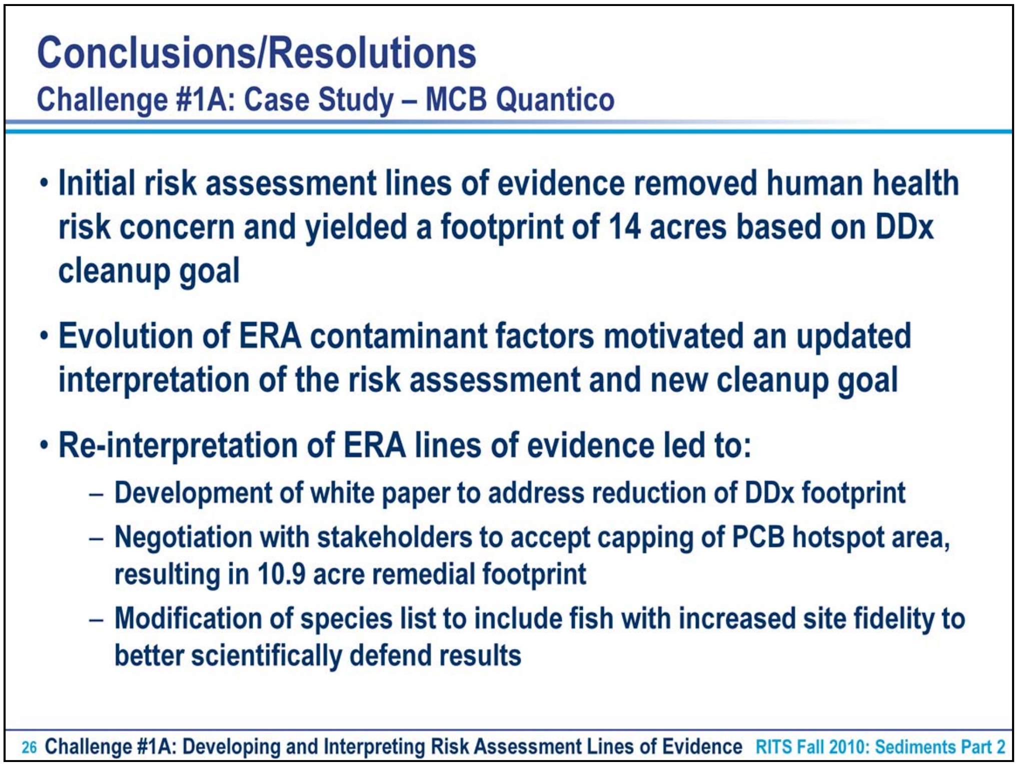


Challenges were site specific and complicated the remediation design.

Understanding the site ecosystems, including physical, biological, and chemical factors was essential to understanding processes such as contaminant transport.

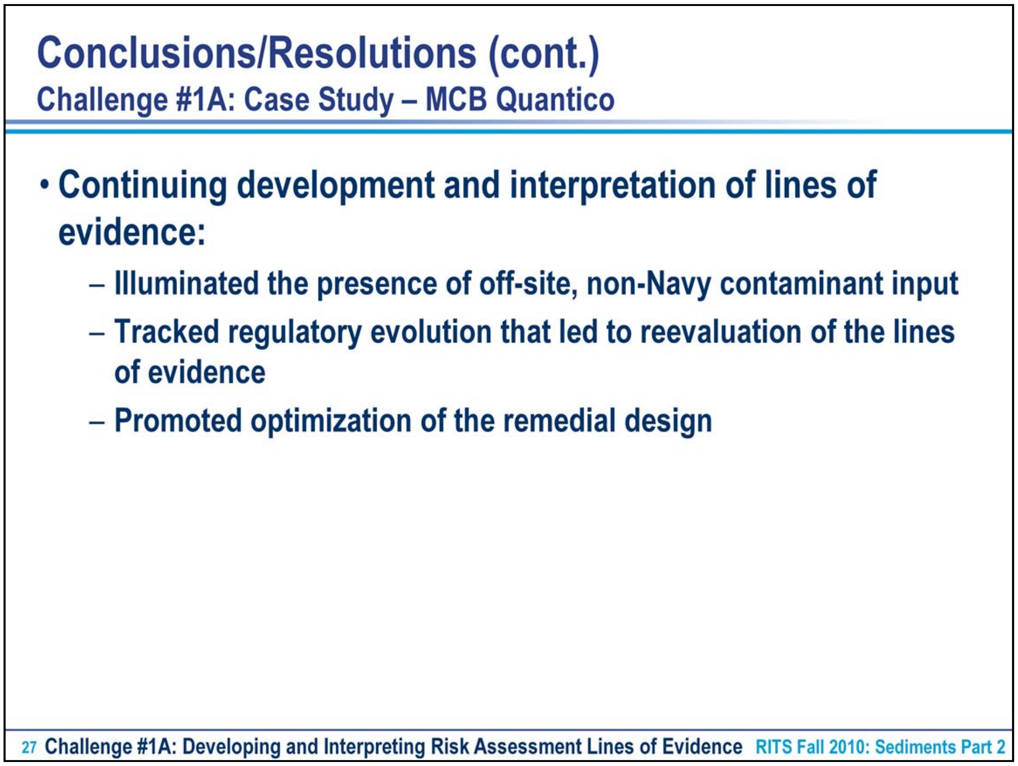
In this case, due to the concern for contaminants dissolved in water, and the difficult to quantify flow rate of groundwater, it was reasonable to include biota as a measurement endpoint that integrates contaminant input over time.

Physical limitations of the thin cap design contributed to the concern for using ongoing sediment sampling as an assessment tool. This was likely a “red herring”, but a difficult one to disprove.



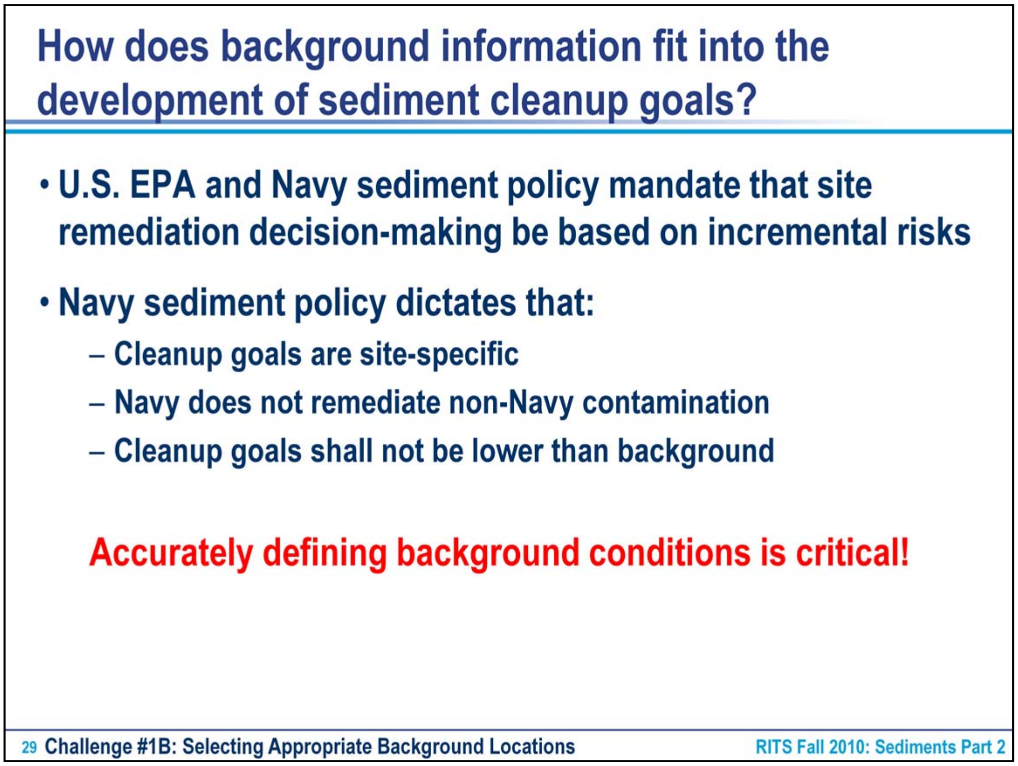
The initial LOEs integrated COC, receptor, and DQO information. However, inputs were not static, and maintaining up-to-date regulatory framework was critical to the success of the remedial design.

As the regulatory framework and the remedial design evolved, it was beneficial to maintain engagement with the stakeholders and keep them up to speed on the changes, which included preparing white papers to support negotiations.



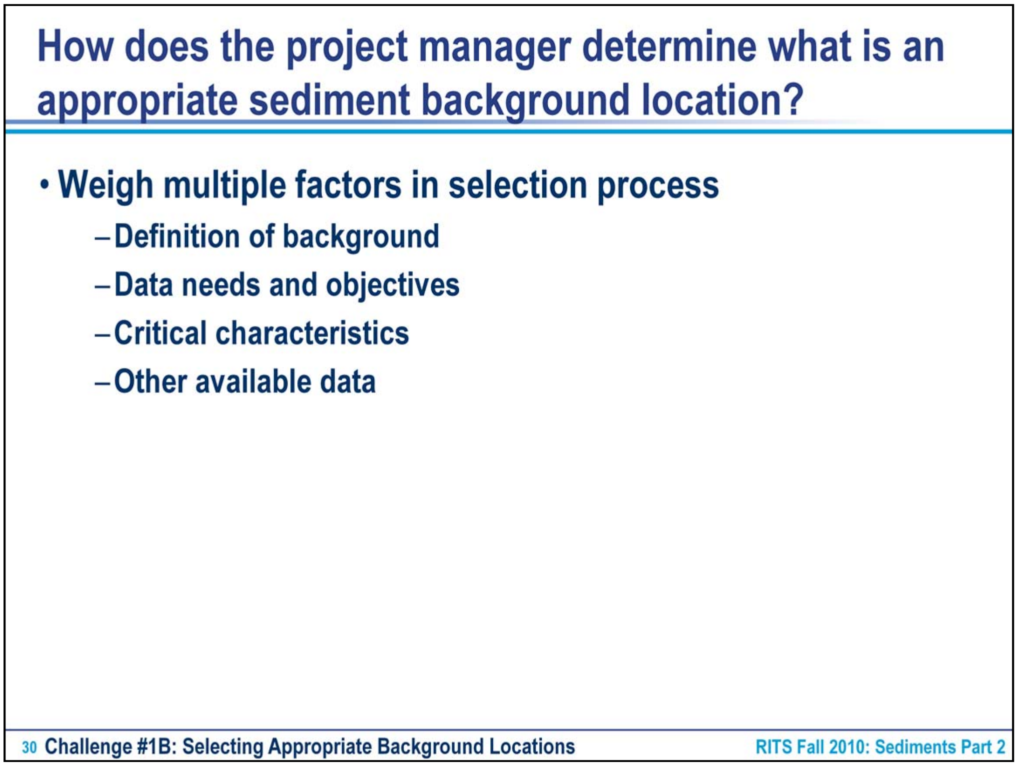
In this case, keeping current with the evolution of the regulatory framework combined with engaging the stakeholders resulted in optimizing the remedial design and reducing the remedial footprint.

The following slides address the specific challenge "Selecting Appropriate Background Locations".



As previously summarized in the Sediment RITS Part 1 presentation, there are specific elements of Navy policy that compel the use of site-specific and background information in developing sediment cleanup goals.

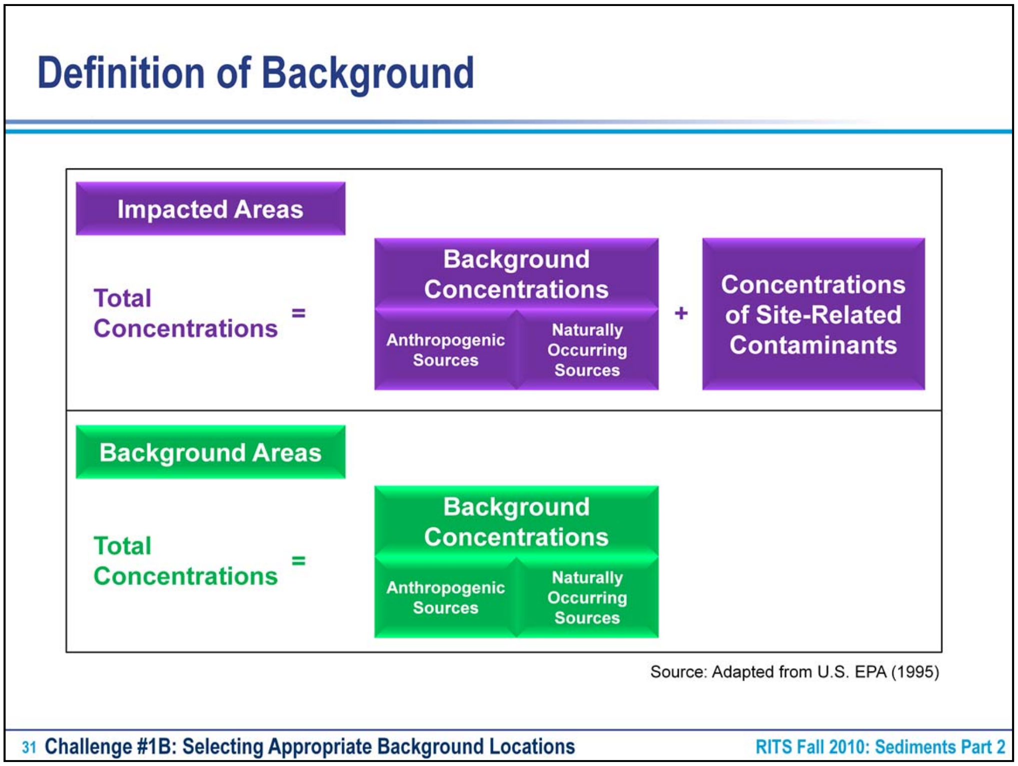
In addition, Navy and U.S. EPA policy specify that risk-management be based on incremental risk, which necessarily includes background.



Selecting an appropriate background location for a sediment site is a critical step in characterizing the site, performing risk assessments, and developing a risk-management framework. Unfortunately, while it seems a simple and straightforward task, it often is not.

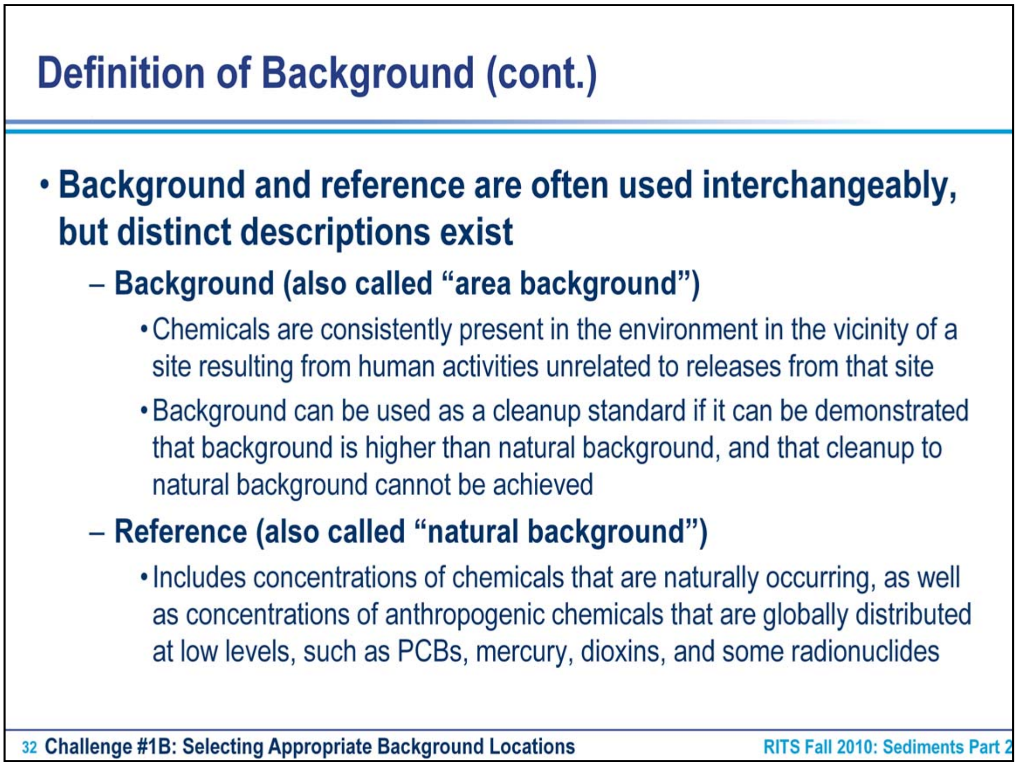
Given the complexities of sediment sites, the related complexities in risk assessments for sediment sites, and the need to properly evaluate risk assessment lines of evidence, the selection of a proper background site should be approached carefully.

The most effective approach to selecting a background location integrates multiple factors, balancing these factors on the basis of site-specific needs and decisions. While other factors may need to be balanced in selecting a background site, lessons learned at sediment sites suggest that those listed (i.e., definition of background, data needs and objectives, critical characteristics, and other available data) have a significant impact on the selection process and outcome.



As indicated earlier in the presentation, the focus of risk-management at a Navy sediment site is on incremental risk, or that risk that exceeds the risk of "background" conditions.

This graphic demonstrates simply that impacted areas contain concentrations of contaminants that are site (i.e., source) related and concentrations that are related to background. In turn, background concentrations are made up of what is naturally-occurring (e.g., from natural geologic sources) and what is anthropogenic but not "source" related (i.e., is ubiquitous in the environment).

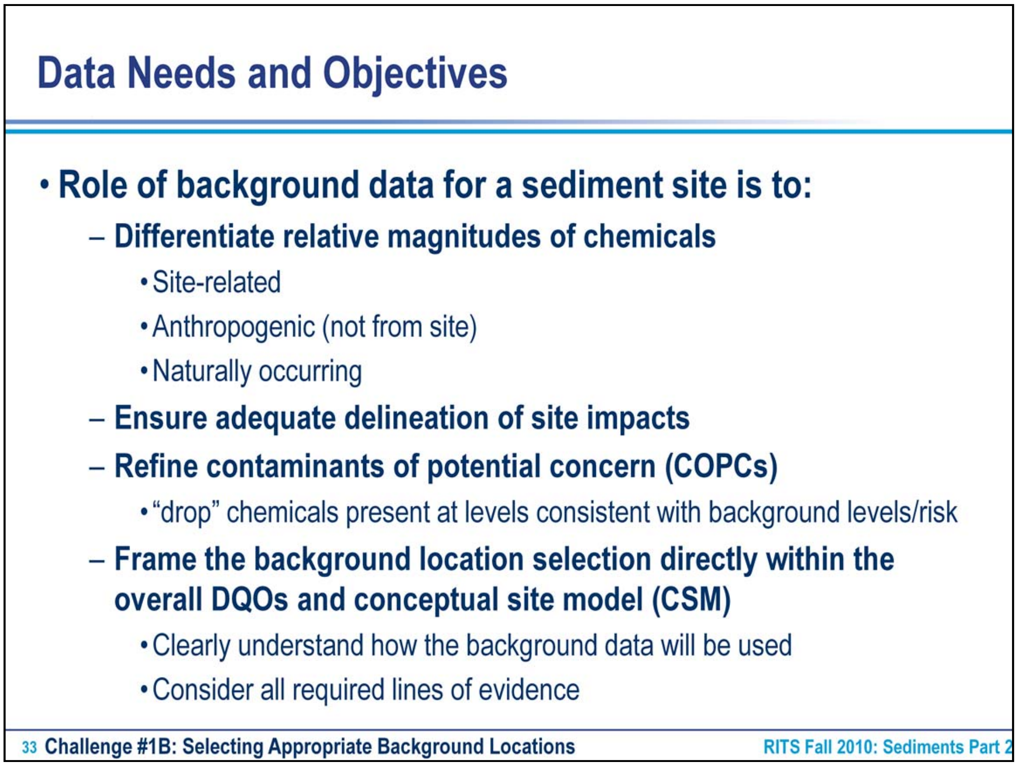


For a sediment site, the background site, which may be called "area background", is used to characterize the levels of naturally-occurring contaminants and ubiquitous anthropogenic contamination in the regional environment. For instance, metals are associated with natural background and may also be associated with regional anthropogenic impact (e.g., nickel).

Alternatively, a "natural background" site may be required that is used to characterize the levels of naturally-occurring contaminants and ubiquitous anthropogenic contamination in the global environment. For instance, PAHs are globally distributed at some concentration from natural fires.

In most cases for sediment site characterization, "background" is used to refer to naturally-occurring and regional/global anthropogenic impact that must be understood to frame site impacts and risk.

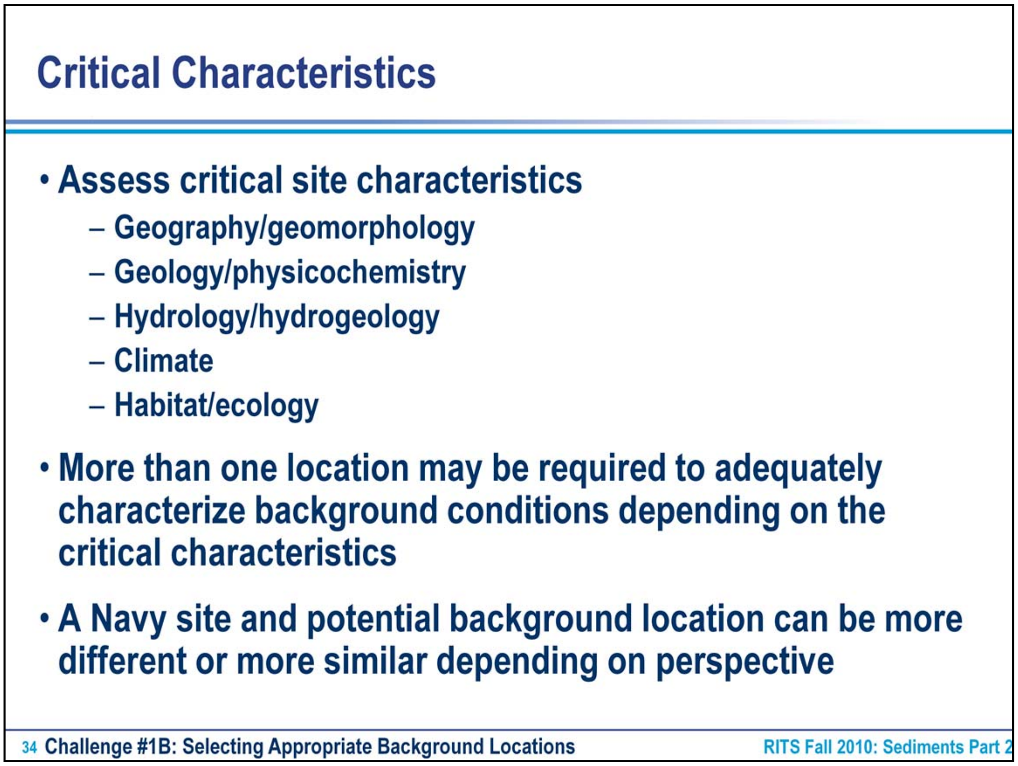
Occasionally, a "control" site may be needed, for instance when performing toxicity testing.



In selecting an appropriate background site, the project manager should clearly understand how the background data will be used and what fundamental questions will be answered using the data.

Background data are used to assess the magnitude of background contaminant impacts and to frame the characterization of the actual site relative to background conditions. Background data are also used to frame incremental risk and to refine the COC list to those contaminants that are truly related to a site impact and a "significant" risk warranting risk-management. In addition, other background "measures" may be required to answer fundamental questions, perhaps including background toxicity testing.

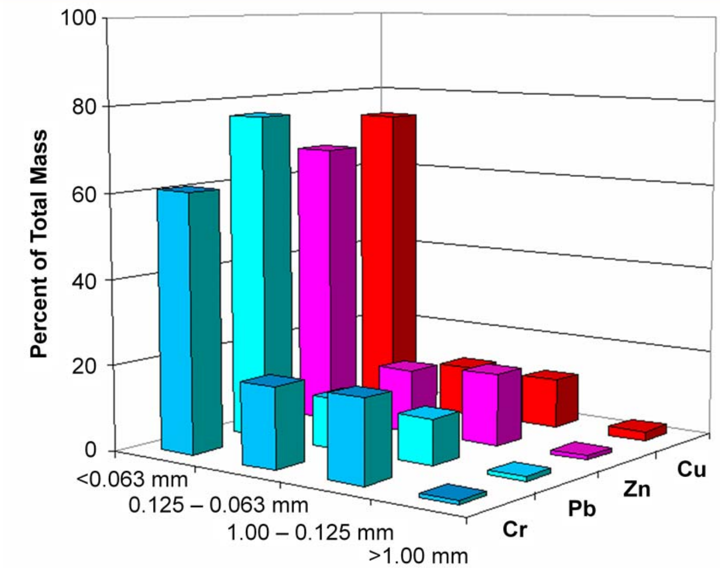
The project manager should ensure that the purpose and use of the background data is fully understood, and that the background site is suitable to generate the needed data in that context.



Depending on the ultimate use of a background dataset, certain critical characteristics will determine the appropriateness of a background location, and the project manager should assess the relationship between data use and critical characteristics.

For instance, if the background dataset will be used only to understand the magnitude of contaminant concentrations, then geologic and physicochemical compatibility is probably most critical. Alternatively, if ecological toxicity is the ultimate question, then climatologic and habitat factors are probably most critical. However, since more than one study question is usually of importance in evaluating background, then the project manager must weight the varying needs with their related critical characteristics.

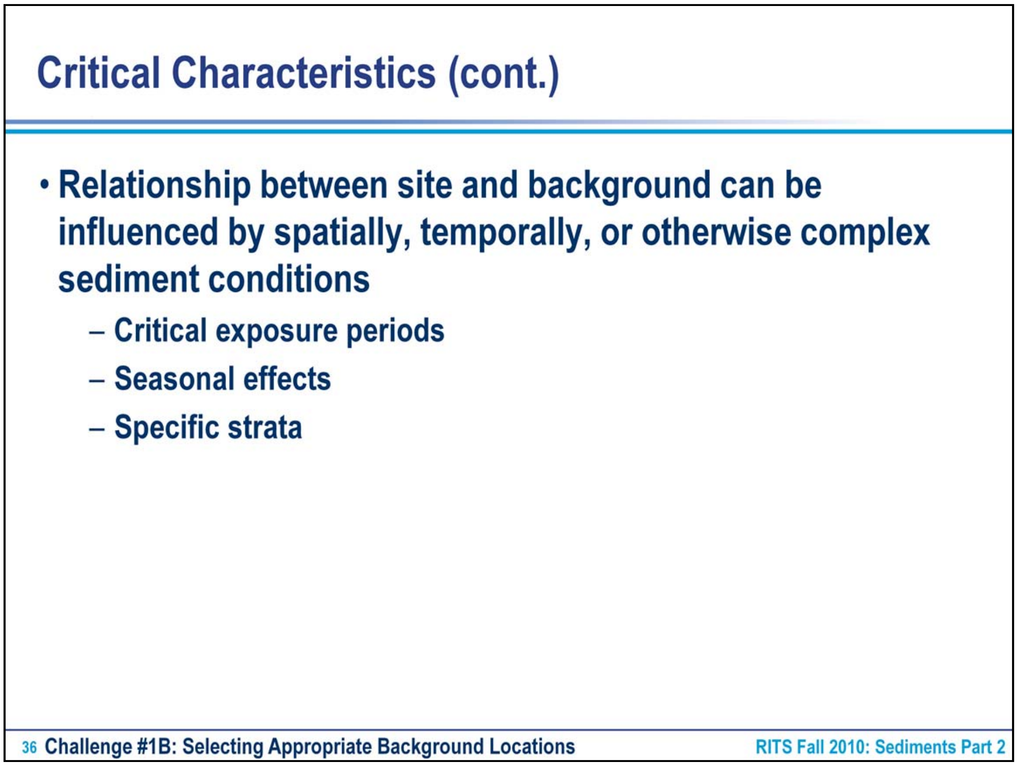
Critical Characteristics (cont.)



35 **Challenge #1B: Selecting Appropriate Background Locations** RITS Fall 2010: Sediments Part 2

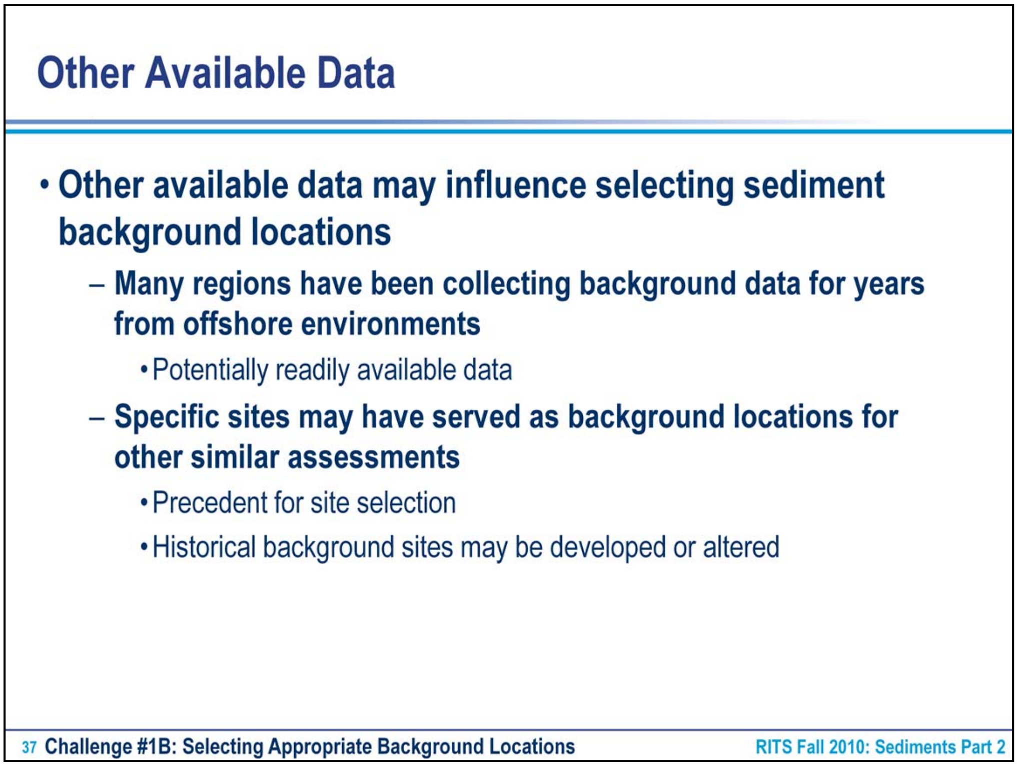
In this example, site data were evaluated for contaminant concentration and relationship to particle size. Contamination was seen in multiple particle size classes, and the overall weight of evidence suggested sand blast grit to be the primary source. In fact, by evaluating background samples, the site contamination was determined to likely be naturally occurring (through scanning electron microscopy) and not from sandblasting grit. This highlights the importance of assessing the critical characteristics that relate background conditions to a site.

From SPAWAR, 2001. Technical Report 1918, “Use of Data on Contaminant/ Sediment Interactions to Streamline Sediment Assessment and Management”



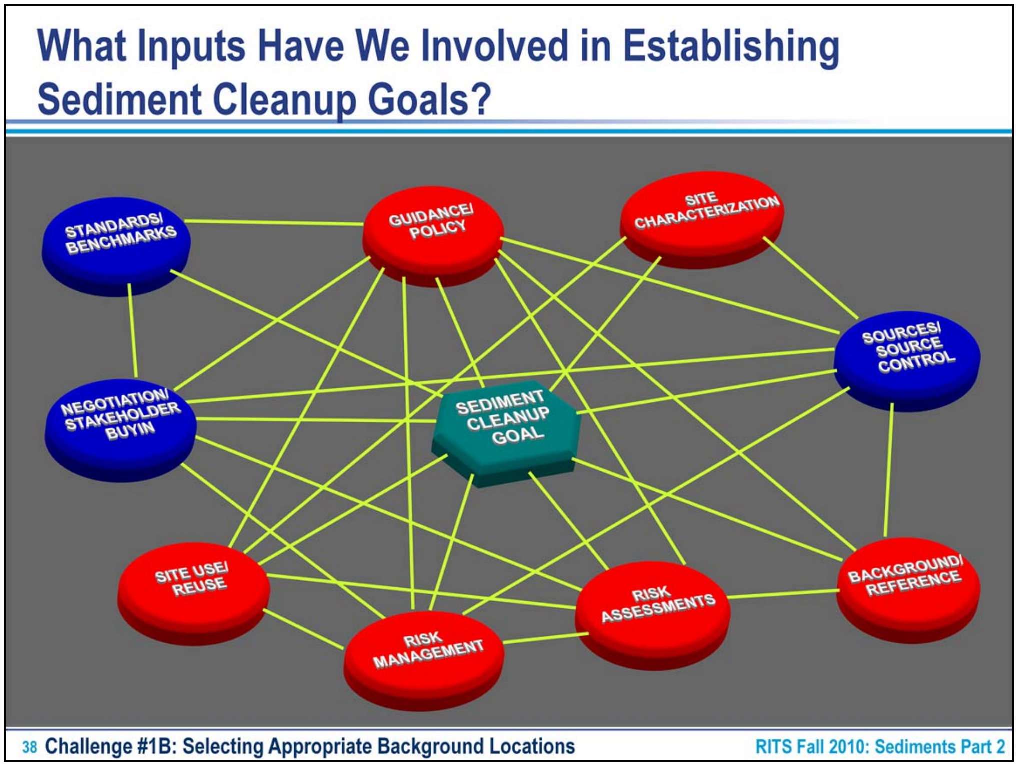
The project manager should also note that, within the various critical characteristics that define the relevant relationship between a site and a background location, there may be additional complexities.

For instance, if background site selection is most important to compare observed levels of ecological toxicity, then the sites would potentially be most critically related through climatologic and habitat factors. However, those relationships should take into account all other related information (and the associated DQO process), including organism life cycle history and seasonal lipid effects that may be influenced by sampling season.



While mining the “gray” literature can be challenging, the project manager would be well served to understand the availability of background data from other sources and/or the selection of background sites for similar purposes through other projects/programs.

Many regions, for instance the San Francisco Bay region, have been developing and augmenting background data for years, and these datasets could potentially provide useful data or provide a valuable framework for background site selection.



The challenges of “Evaluating and Interpreting Risk Assessment Lines of Evidence” and “Selecting Appropriate Background Locations” have already “triggered” six of the nine categorical inputs to developing a sediment cleanup goal.

Challenge #1B: Case Study – Alameda Point IR Site 2

- Site contains former landfill and wetland area, wetland area contains ponds, ponds contain sediments
- Wetland area, including sediments, investigated through extensive RI
- Background data were needed to frame site characterization and risk assessments for the wetland area pond sediments

39 Challenge #1B: Selecting Appropriate Background Locations RITS Fall 2010: Sediments Part 2

Alameda IR Site 2 is characterized by a very unique physical and habitat setting, including two wetland area ponds, one with direct communication with San Francisco Bay and the other disconnected from the Bay.

The Navy needed a background site to properly characterize IR Site 2 and to frame the risk assessments for the site, including the wetland area ponds. In addition to needing contaminant concentration data from a background site, the DQOs established conducting toxicity and bioaccumulation testing as a need for the background location.

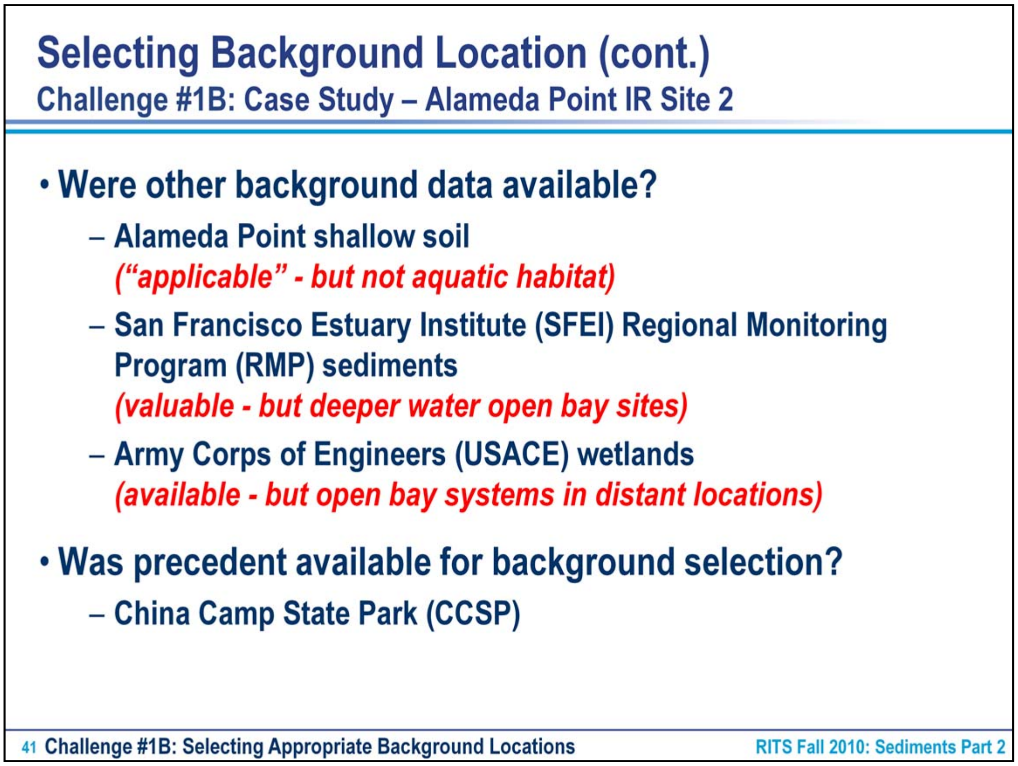
Selecting Background Location

Challenge #1B: Case Study – Alameda Point IR Site 2

- How were background data to be used?
  - Chemical characterization
  - Toxicity/bioaccumulation testing
- What were the critical characteristics?
  - Geography – near Navy site
  - Geology – similar lithologic makeup
  - Geomorphology/hydrology – similar local environment (e.g., ponded surface water)
  - Habitat – similar habitat and ecological assemblage
  - Season – wet season

40 Challenge #1B: Selecting Appropriate Background Locations RITS Fall 2010: Sediments Part 2

In the process of identifying an appropriate background location, the Navy developed DQOs for how the background data would be used and assessed the various critical characteristics that would inform the selection. The Navy determined that several characteristics were critical, with the weight of evidence suggesting that factors related to ecological toxicity and bioaccumulation testing were the most critical.

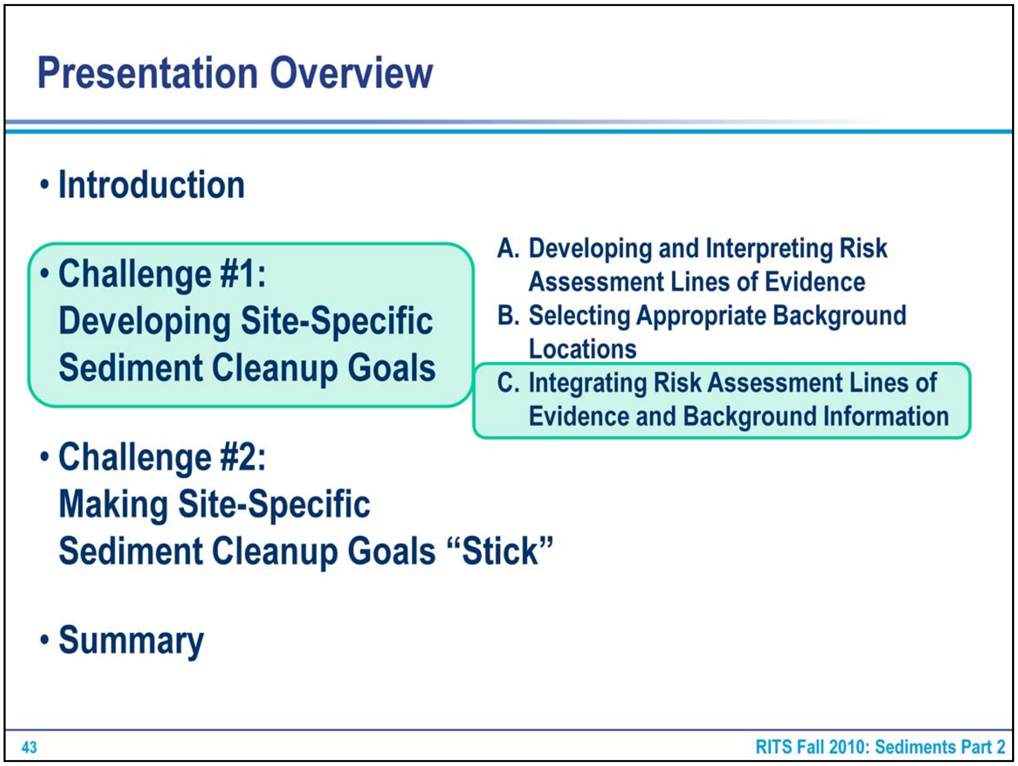


The Navy also evaluated available sources of potentially usable background data to determine if these data could be utilized and/or if the datasets suggested a framework for background site selection. The Navy identified several sources of potentially usable background data, some of which were actually integrated into the RI data assessment. The Navy also identified a background site utilized during other DoD environmental investigation work (i.e., CCSP, which was sampled as a background location during the investigation of Hamilton Army Airfield).

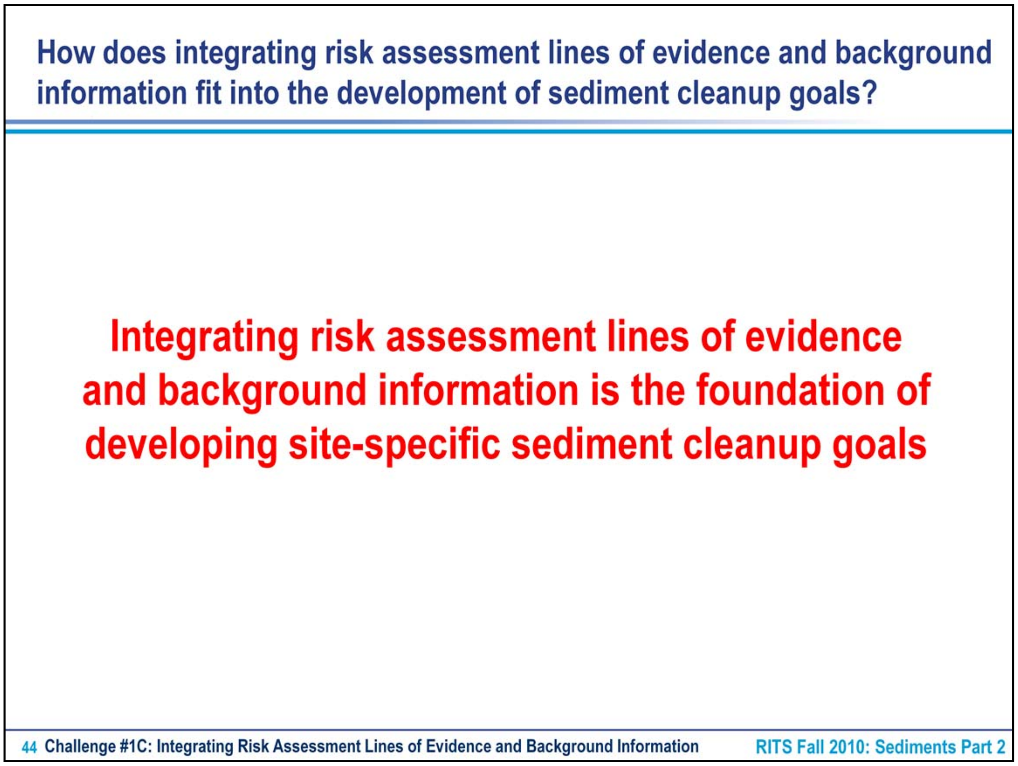
Selected Site: CCSP

Challenge #1B: Case Study – Alameda IR Site 2

Based on its optimally satisfying the critical characteristics needed for a background site, CCSP was selected as the appropriate background location for Alameda Point IR Site 2, and was successfully sampled to provide the necessary background data assessment for the RI.



The following slides address the specific challenge "Integrating Risk Assessment Lines of Evidence and Background Information".



In reality, the integration of risk assessment lines of evidence, including background information, is the foundation of developing cleanup goals.

How does the project manager integrate risk assessment lines of evidence and background information?

- When developing cleanup goals, be **SMART**

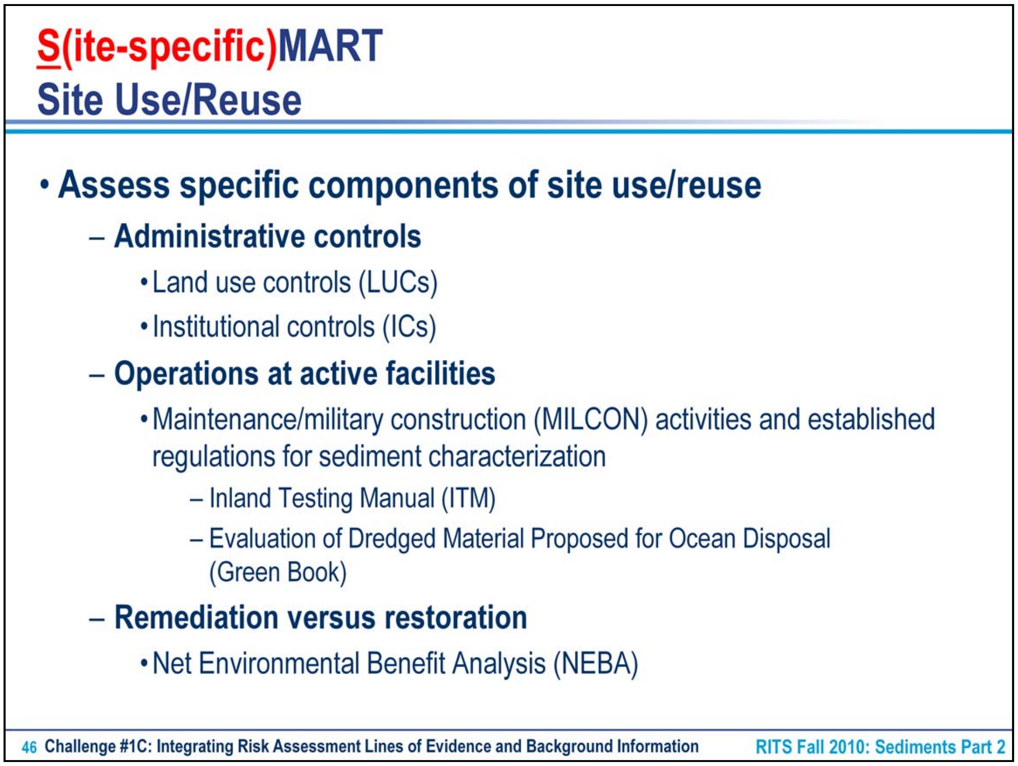
Site-specific	• Site use/reuse
Measurable	• Monitoring approach
Attainable	• Compliance endpoints • Sources/source control
Relevant	• Policy • Standards • Precedent
Time-bound	• Exit strategy

45 Challenge #1C: Integrating Risk Assessment Lines of Evidence and Background Information RITS Fall 2010: Sediments Part 2

The SMART framework provides a building plan for integrating relevant risk assessment and background information into cleanup goals. Each of the elements within the categories are the building materials.

SMART is originally from the business management industry, November 1981 publication in Management Review ("There's a SMART Way to Write Management's Goals and Objectives").

The SMART concept can be "translated" into many fields and disciplines, with the general structural elements having flexibility to capture specific criticalities. Specifically for developing sediment cleanup goals, the SMART categories can be reasonably expressed as "site-specific", "measurable", "attainable", "relevant", and "time-bound".

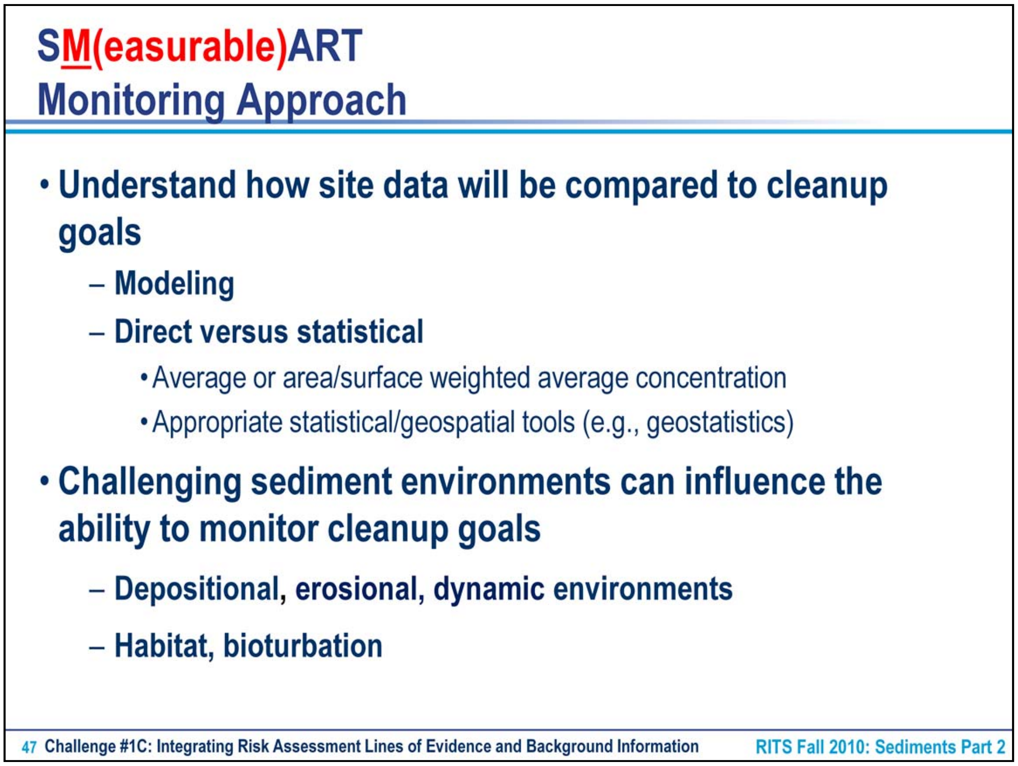


In integrating risk assessment and background information, site-specificity should be considered by the project manager, now in terms of broader, structural issues. Notably, some of these issues may already have been considered in developing the risk assessment itself, but they are generally more applicable to frame ultimate decision-making once the risk assessment LOEs are available.

Administrative controls can influence the development of cleanup goals by providing a site use framework that would necessitate goals based on specific exposures or, alternatively, prevent the use of specific goals based on precluded activities (and pathways).

Operational considerations can influence the development of cleanup goals by framing risk-management decisions in terms of operational needs. For instance, if a sediment cleanup project would be most efficient if supported by a particular disposal option, then goals associated with that option may be selected.

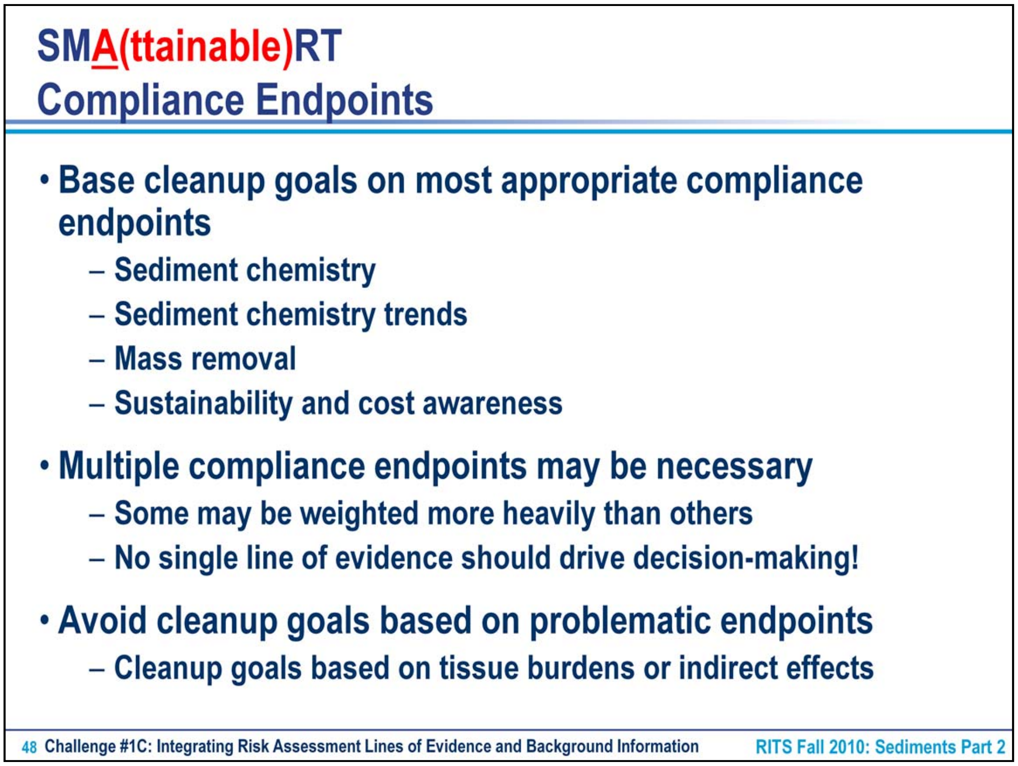
“Restoration” initiatives are gaining popularity in the sediments industry as a potentially effective solution for impacted sites where remediation is impractical, risk/toxicity are not definitive, or other reasons. A “restoration” plan may include a different approach for developing cleanup goals (or no cleanup goals).



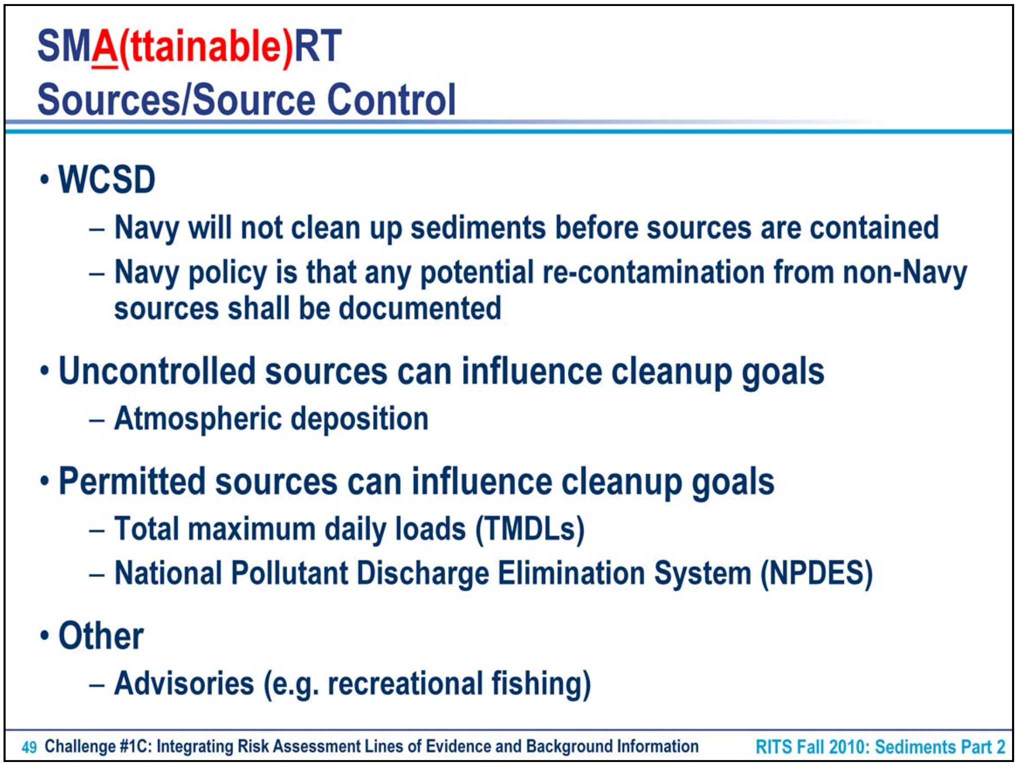
A sediment cleanup goal must be based on something that can actually be quantified or otherwise verified.

The project manager should understand how the cleanup goal will be assessed in comparison to site data, and if that assessment is actually a reasonable and possible approach. This includes understanding the basic assessment framework and more detailed information in the context of DQOs.

The project manager should also understand that what appear to be measurable goals can be confounded by transient, dynamic, and/or complicated sediment environments. For instance, if a risk-management framework and sediment cleanup goals are based on a specific sediment horizon (e.g., the “bioturbation zone”) and organisms exist at the site that could actually bioturbate a zone deeper than assumed, the goal may not be truly measurable as intended by the DQOs.



The project manager should ensure that the cleanup goal is distilled to some metric that is directly and demonstrably attainable, recognizing that more than one compliance endpoint may be required to assess the remedy. To every extent possible, the project manager should avoid "putting all eggs in one basket" by relying on a single line of evidence to evaluate attainment, while recognizing that professional judgment is required to establish a framework for evaluating multiple endpoints.

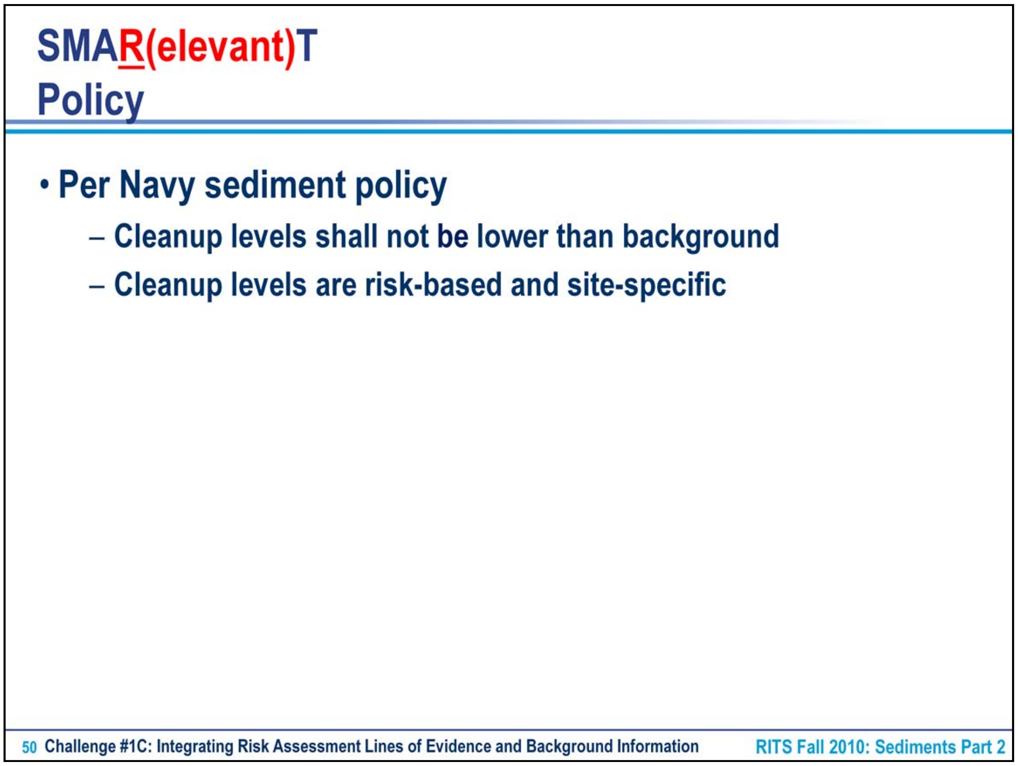


The project manager should recognize that a cleanup goal is not attainable if other conditions dictate it cannot persist.

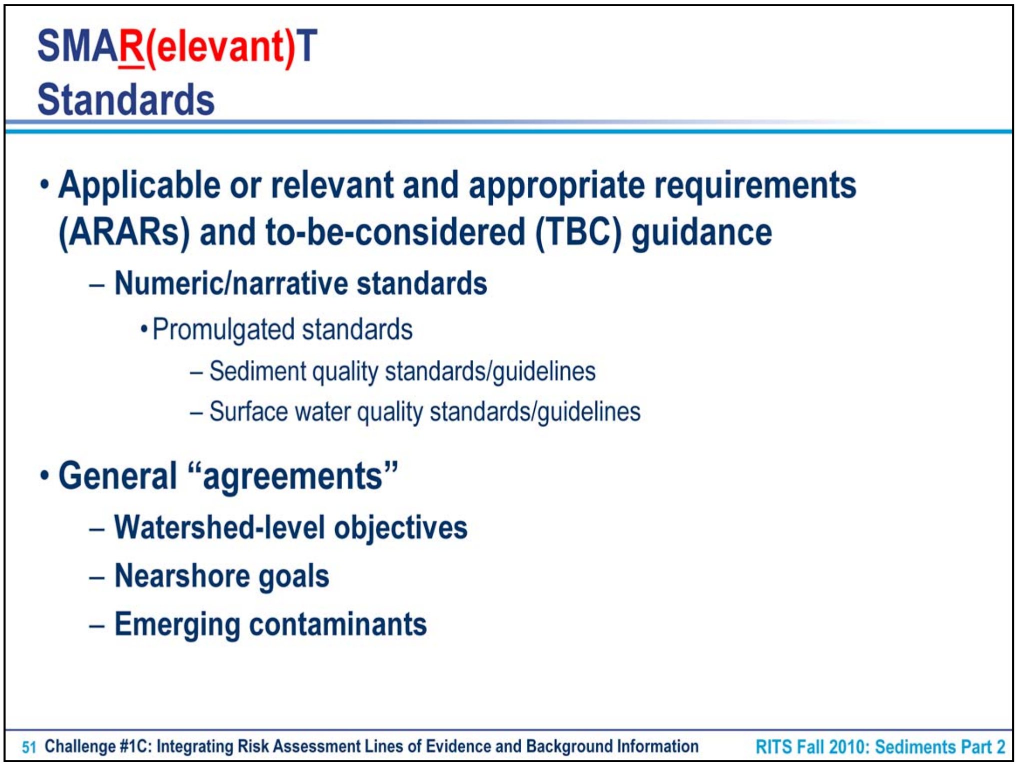
The WCSD was summarized in the Sediment RITS Part 1 presentation.

If other sources are present, be they uncontrolled or “controlled” (i.e., permitted), such sources could re-impact a site at levels exceeding cleanup goals. In such cases, a cleanup goal lower than the expected level of recontamination would not be attainable.

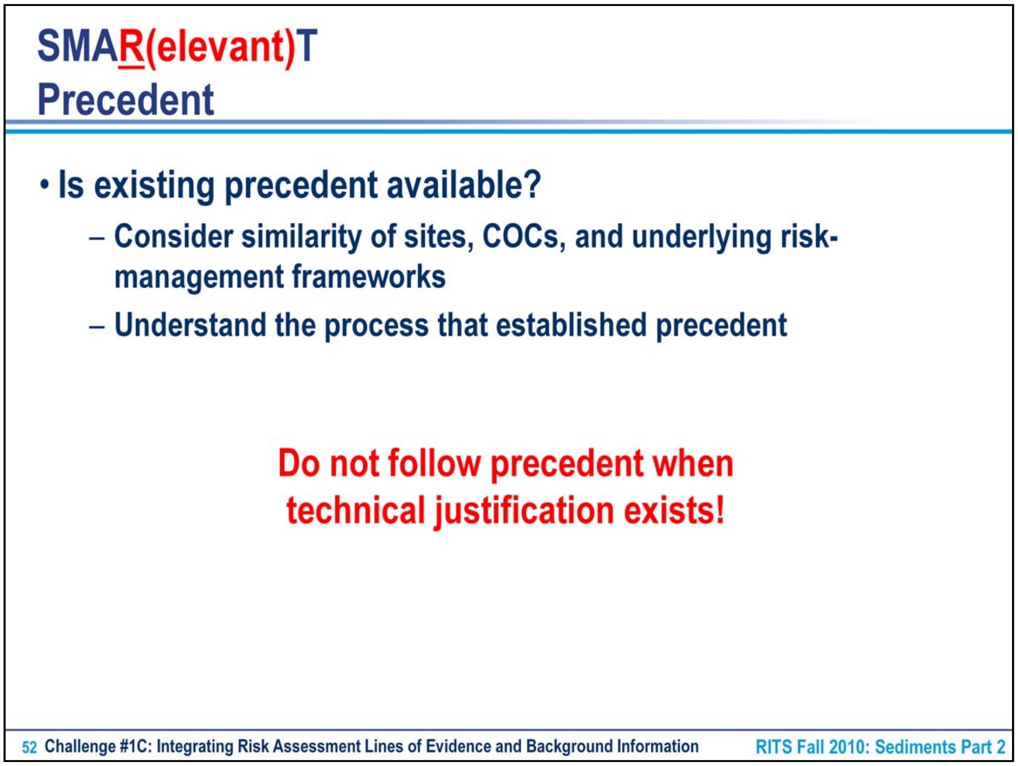
The project manager should also be aware of other potential limits (or influences) on goal attainability. For instance, advisories of some sort (e.g., recreational fishing advisories) may exist that link to levels of contamination that are “permissible”.



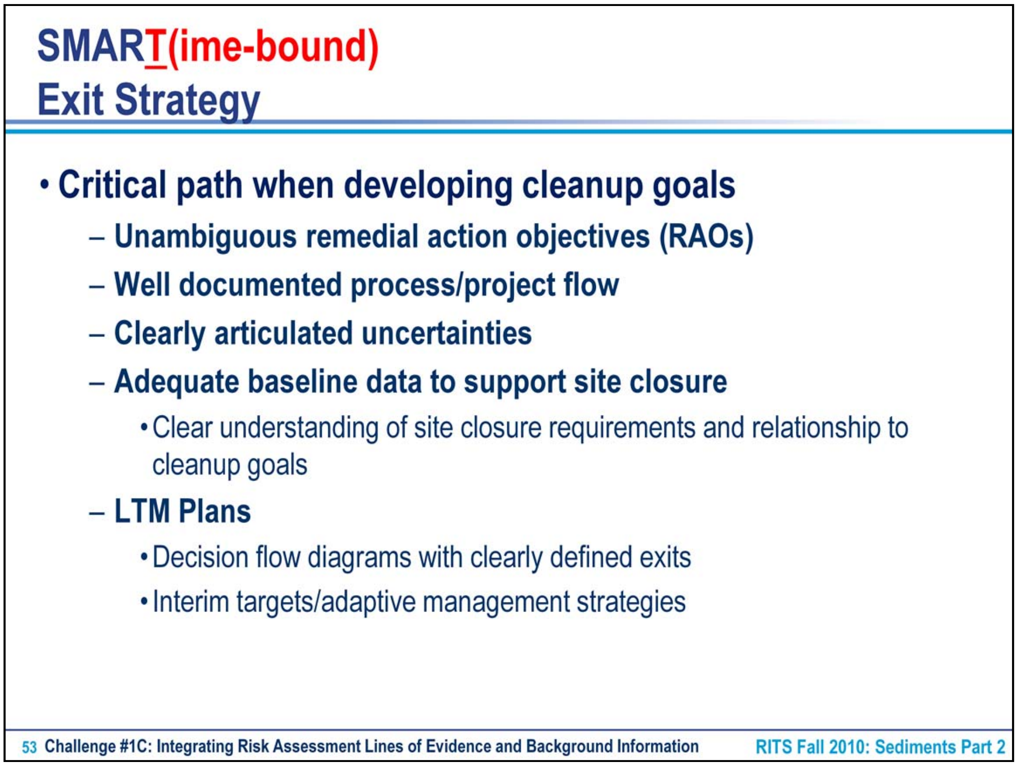
While sediment cleanup goals must be risk-based and site-specific, a sediment cleanup goal would obviously not be relevant if it were below background.



The project manager must be aware of the regulatory framework associated with contaminant levels. In addition to numeric/narrative standards that make up ARARs and TBCs, the project manager should be aware of other, non-promulgated levels that could influence goal setting. For instance, certain locations may have non-promulgated objectives for specific watersheds or nearshore environments (e.g., San Francisco Bay "agreements" for PAHs and PCBs).

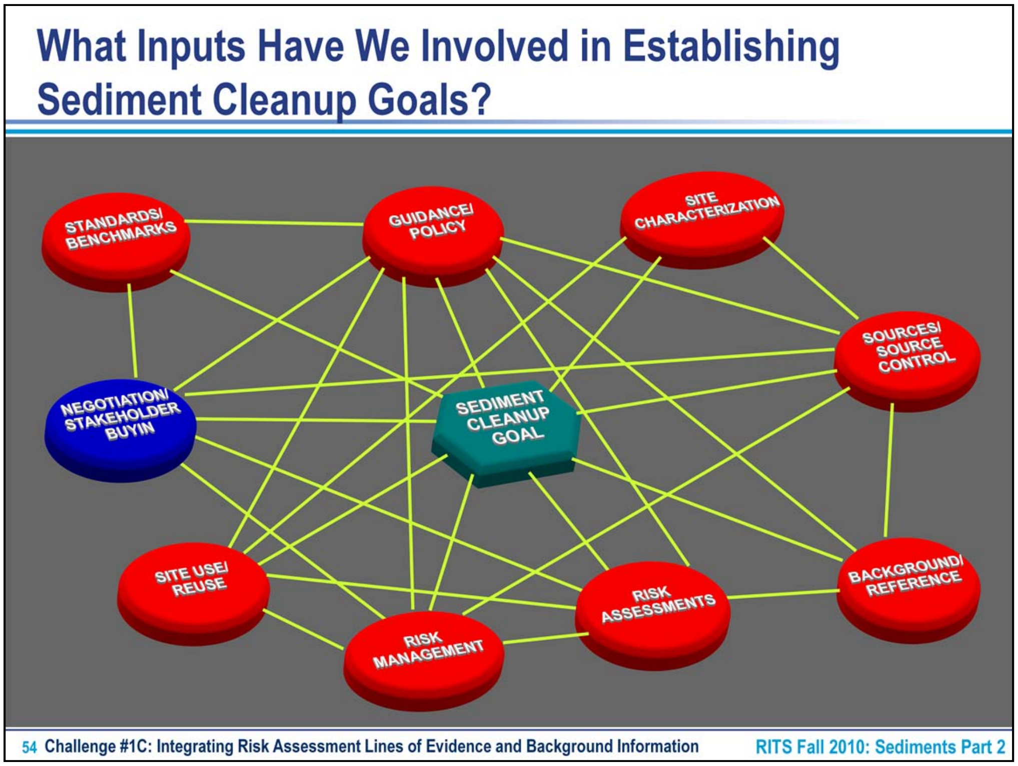


The project manager should be aware of existing precedent for sites that are similar in terms of both site type and COCs. For precedent to be truly relevant, the project manager should understand as best possible the risk-management framework and decision-making process that led to a goal for another site. Equally importantly, where precedent does not form a relevant framework for a Navy site, the project manager should not follow that precedent.



Sediment sites are typically long-lasting. However, the project manager should develop cleanup goals within an overall framework that provides temporal boundaries. Otherwise, sites may end up in an “endless do loop”.

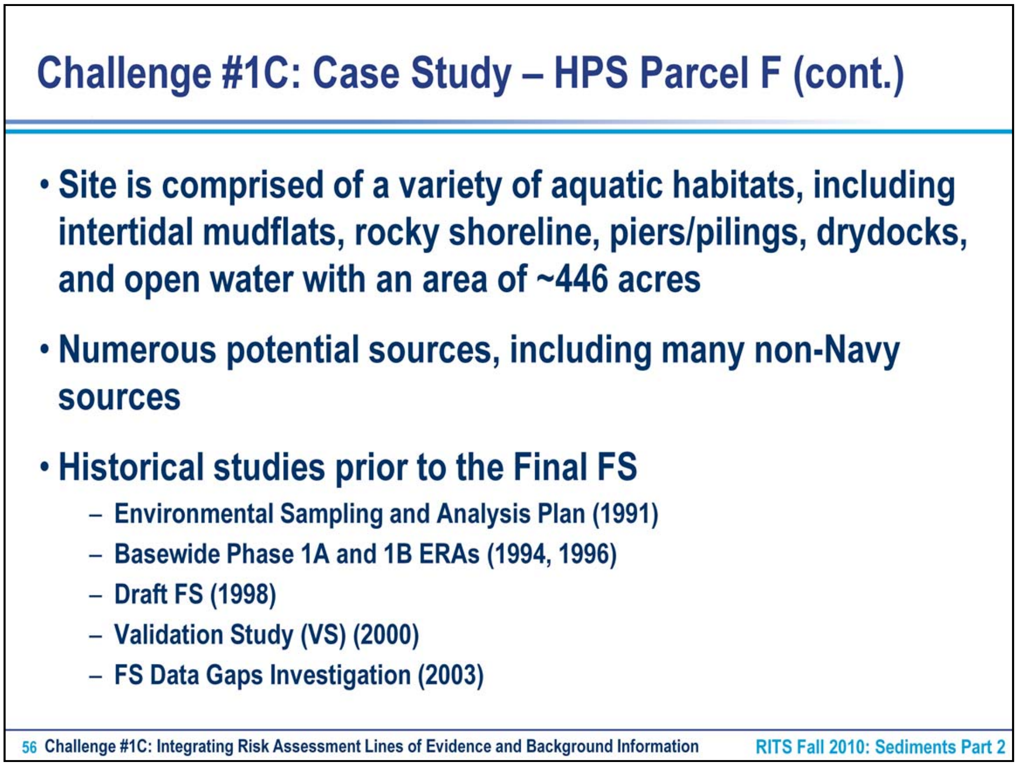
Sediment cleanup goals should be developed in a manner that ultimately provides for an appropriate exit.



The challenges of “Evaluating and Interpreting Risk Assessment Lines of Evidence” and “Selecting Appropriate Background Locations” “triggered” six of the nine categorical inputs to developing a sediment cleanup goal. Now, by integrating these challenges into a sediment cleanup goal selection framework, eight of the nine inputs have been “triggered”.

Challenge #1C: Case Study – Hunters Point Shipyard (HPS) Parcel F

- Parcel F is all of the aquatic area of HPS.
- Yosemite Creek to the southwest of HPS. This is one potential source of non-Navy contamination in the area.
- HPS commercially opened in 1870; supported Navy operations in WWI. Acquired by the Navy in 1940.
- Navy operations closed in 1974, space leased to contractors.
- HPS included in the BRAC process in 1994.

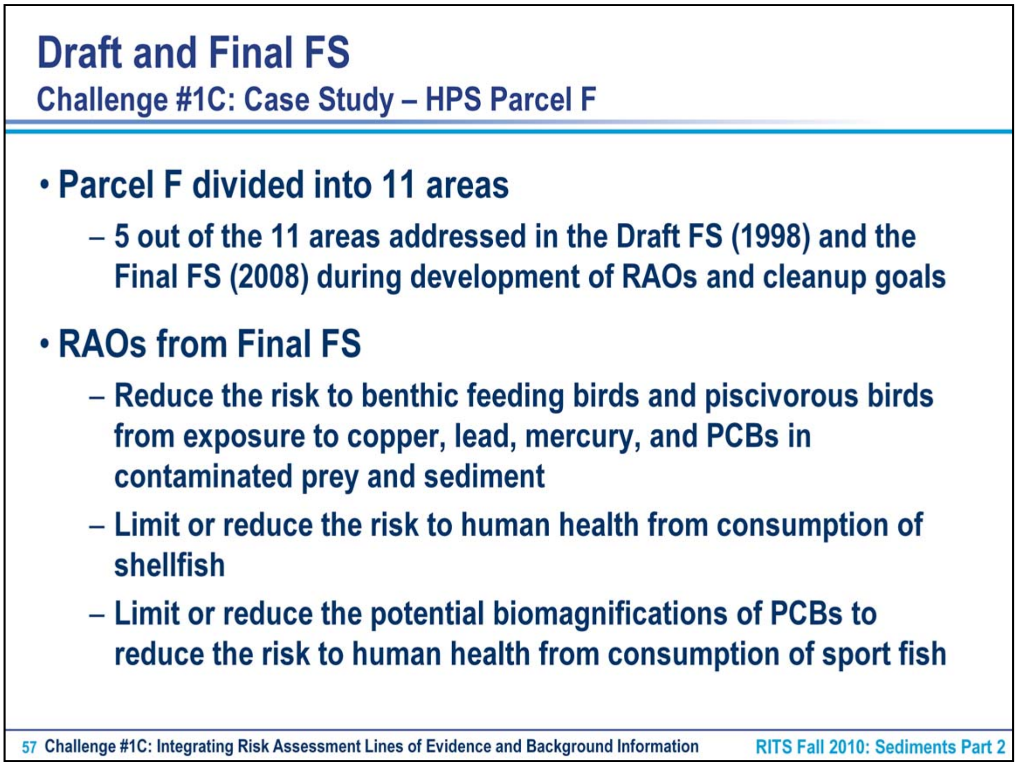


The variety of habitats creates a challenge in developing CSMs.

The location of HPS is subject to significant tidal and wind driven currents that transport sediments throughout South San Francisco Bay.

The South and Central San Francisco Bay region is comprised of dense industrial and urban developed watersheds.

The timeline for the studies to date is over 17 years, a very long time in the environmental field.



Parcel split into 11 sections

The ecological RAO in the Final FS is based on risk to birds.

The human health RAO is based on the risk from consumption of shellfish.

The RAO for fish was a long lasting deliberation. Sport fish are important species, but extremely mobile with expected very low SUFs for any individual site.

Challenges

Challenge #1C: Case Study – HPS Parcel F

- **Challenges during development of SMART cleanup goals**
  - **Initial cleanup goals for protection of ecological receptors based on conservative assumptions**
    - Application of a SUF of 1.0 for Surf scoters (benthic feeding birds) at risk through ingestion of prey and incidental ingestion of sediment
  - **Regulatory request for 200 µg/kg sediment concentration for PCBs for protection of human health**
  - **Ancillary data recommended for inclusion in development of cleanup goals**

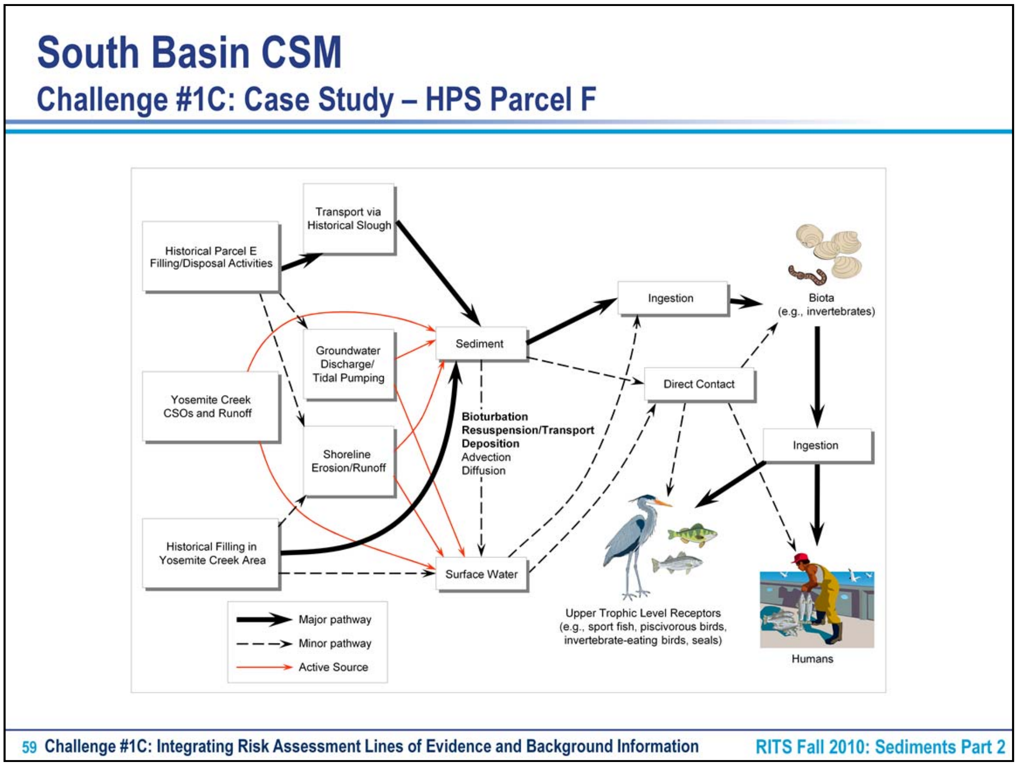
58 Challenge #1C: Integrating Risk Assessment Lines of Evidence and Background Information RITS Fall 2010: Sediments Part 2

Initial goals described from 1994 - 1998 evolved a great deal, resulting in efforts to develop a SMARTER approach

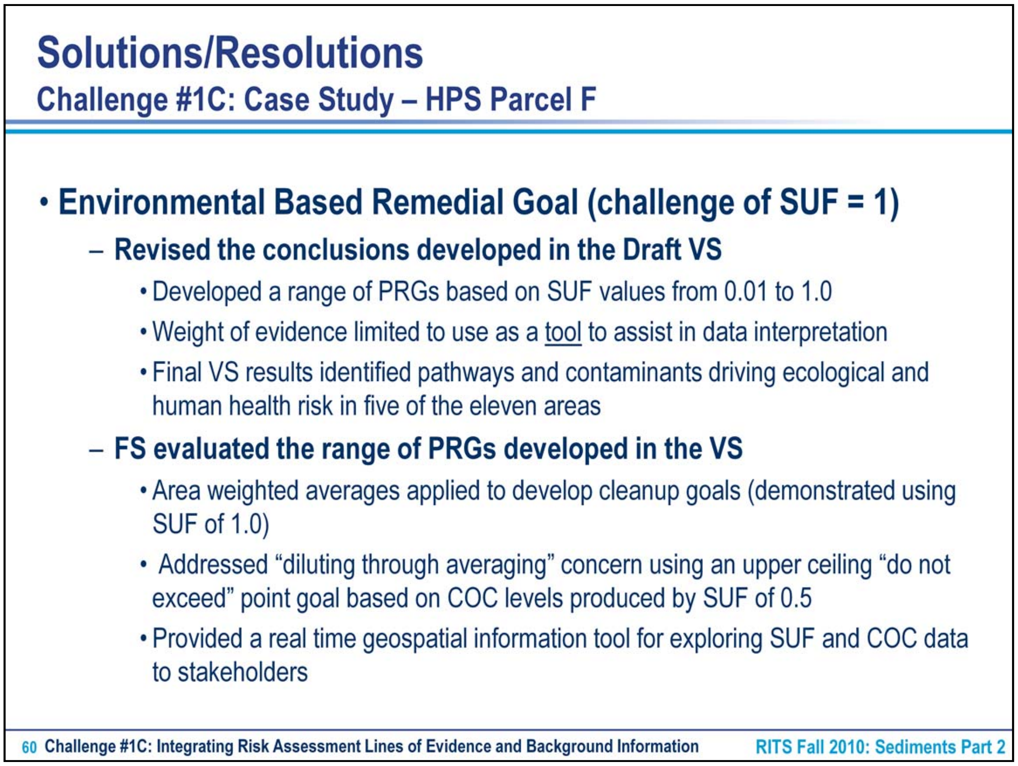
SUF of 1.0 for a large bird is commendable for being conservative, but is not realistic.

Strict numerical precedents for sediment are also not an environmentally sensible approach.

Ancillary data can cause distractions when they become an attractive nuisance.



This is an example of an HPS CSM, and the multiple levels of understanding required to assess risk.



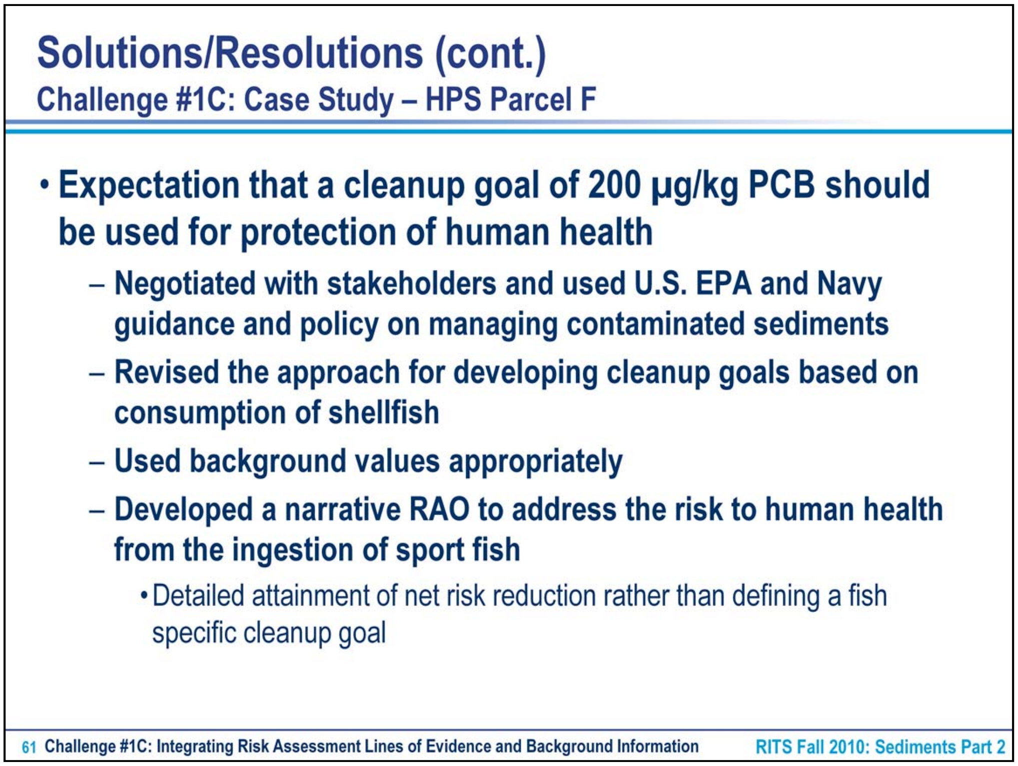
To provide a decision framework for discussion and negotiation, a range of PRGs were provided in the VS.

Instead of being locked into a weight of evidence matrix, weight of evidence was used to assist in data interpretation.

To maintain progress at the site while agreement on final cleanup goals was being negotiated, the VS did not provide cleanup goals, but it rather focused on identifying pathways and contaminants driving risk for use in the FS.

A major precedent was reached by use of area weighted averages.

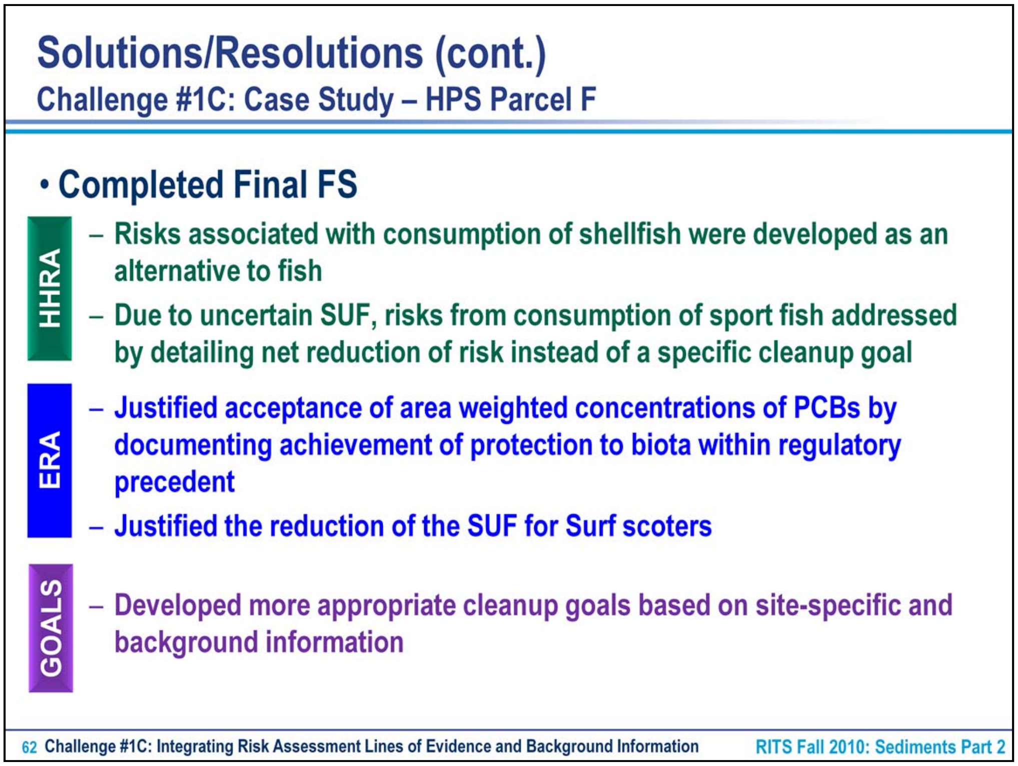
Buy-in on reducing the SUF below 1 was assisted by providing stakeholders a geospatial information program that provided the capability of running scenarios of SUF and COC concentrations. When run, it became obvious to stakeholders that an SUF of 1 was not reasonable.



Initial background sought by stakeholders were PCB concentrations in the 'spine' of San Francisco Bay where values are low due to the high sediment and water transport rates and resulting dilution. Spine of the bay values were used for metals.

Five background locations were used for bioaccumulation comparisons. Five locations created a better average of San Francisco Bay conditions by having a broader habitat/geographical coverage and a spectrum of sediment properties.

A critical solution was achieved by developing and presenting a narrative approach to addressing the risk to humans from consumption of sport fish. Sport fish have low, but difficult to quantify SUFs. By detailing how the risk reduction resulting from the remedial action of returning sediment to background conditions, a specific cleanup goal for sport fish was not necessary.



Due to the difficulties with fish tissue concentrations as a cleanup goal, an acceptable and measurable alternative (*Macoma nasuta*) tissue consumption was used for a human health cleanup goal.

A narrative describing the resulting net reduction of risk from remedial actions was used as a solution to the sport fish challenge.

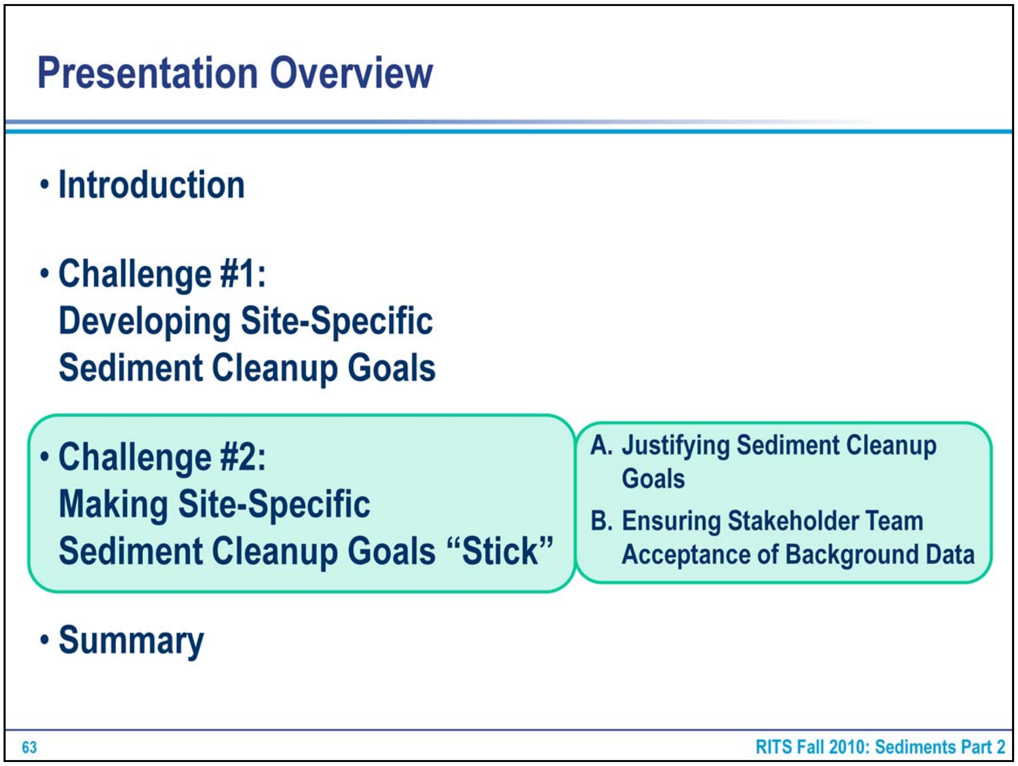
A significant solution was reached by using area weighted average concentrations which initiated a reasonable precedent in San Francisco Bay.

Using interactive software, a solution on the Surf scoter SUF was reached.

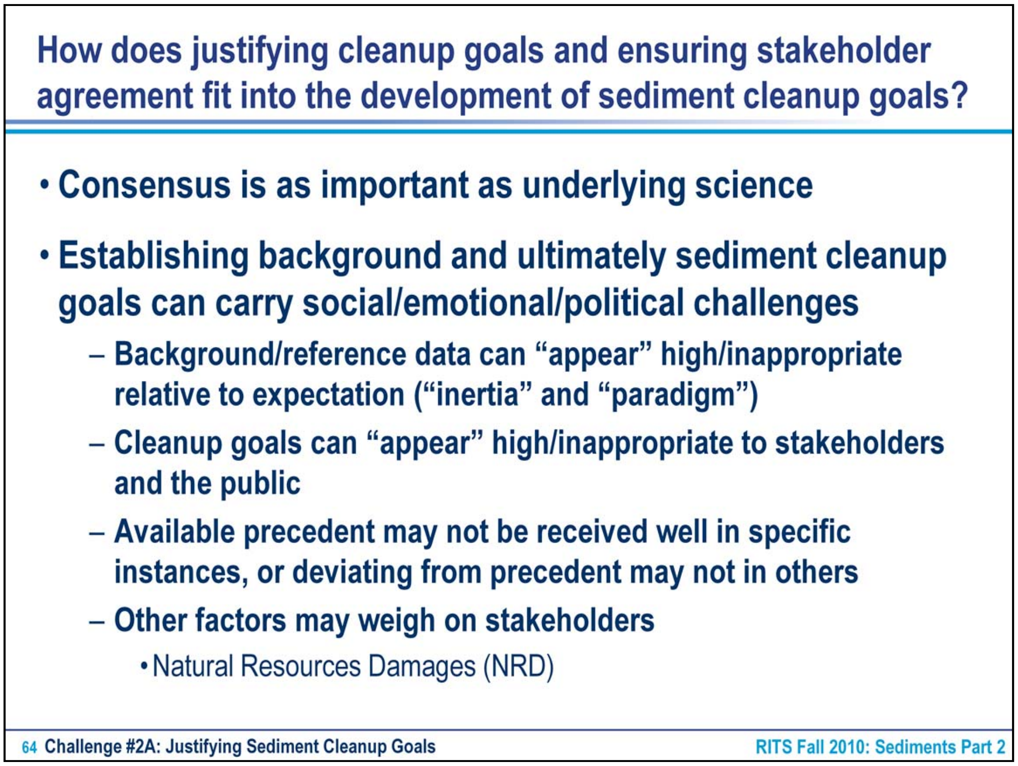
Utilizing not only the five background locations, but included other SF Bay sediment data and sediment trap data to achieve agreement and acceptance of the cleanup goals.

Utilizing several (5) background locations was necessary to achieve agreement and acceptance of the cleanup goals.

As time progressed, stakeholder concerns grew, and previous conservative draft cleanup goals became questionable. As data were collected and regulations evolved, it was a challenge to limit a large expansion of the cleanup goals.



The following slides address the challenge “Making Site-Specific Sediment Cleanup Goals “Stick””. While there are two specific challenges associated, the slides cover both specific challenges as one given the identical nature of the path to overcoming the challenges.



The decision-making and agreements surrounding the science of establishing sediment cleanup goals is as important as the science itself. Without consensus, the project does not move forward.

The project manager should be aware that establishing sediment cleanup goals is the result of stakeholder interaction, and varying perspectives among the stakeholder team. There are social, emotional, and political concerns at play beyond the science.

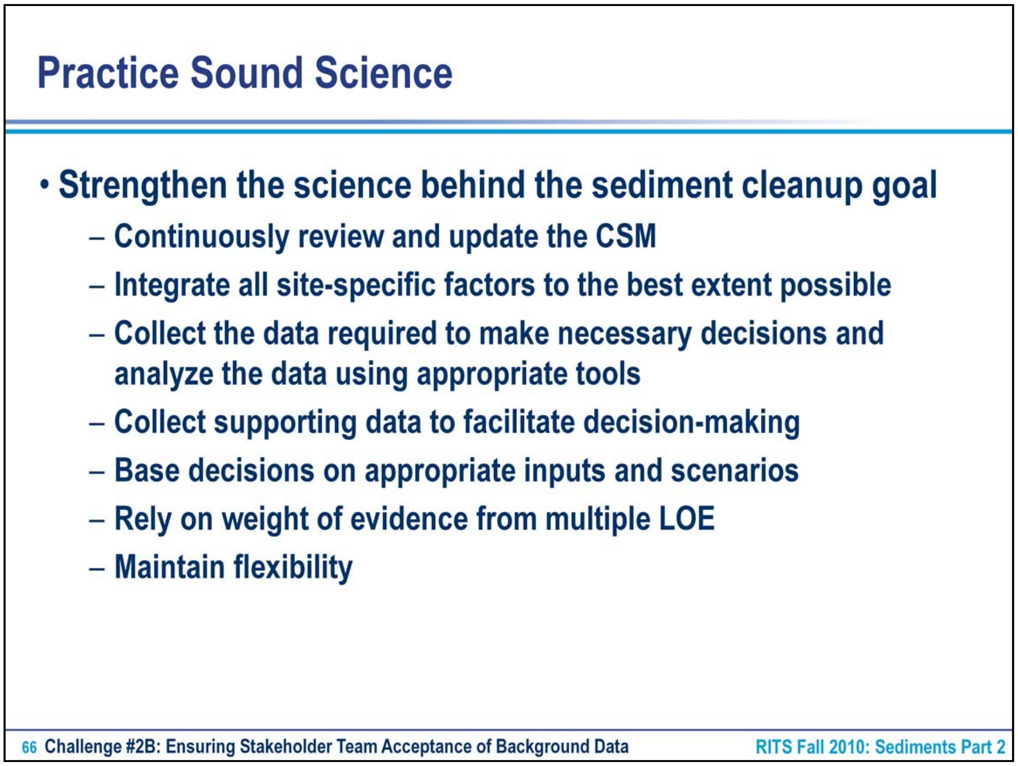
How does the project manager obtain consensus?

- **Practice sound science**
  - **Document and reference scientific approach**
- **Practice SMARTER management**
  - **Engage**
    - Proactive negotiation
  - **Record**
    - Documentation

65 Challenge #2B: Ensuring Stakeholder Team Acceptance of Background Data RITS Fall 2010: Sediments Part 2

Consensus is obtained by practicing sound science and practicing effective project and stakeholder management.

Advancing the concept of SMART to SMARTER, and adding the building blocks of “engage” and “record”, the project manager can effectively negotiate and document decisions.



Strong science is always the objective of the project manager.

The project manager can facilitate “agreement” and “buy-in” by practicing proactive negotiation. Proactive negotiation integrates all decision-makers and decision-shapers to foster project “ownership” (i.e., a practical involvement).

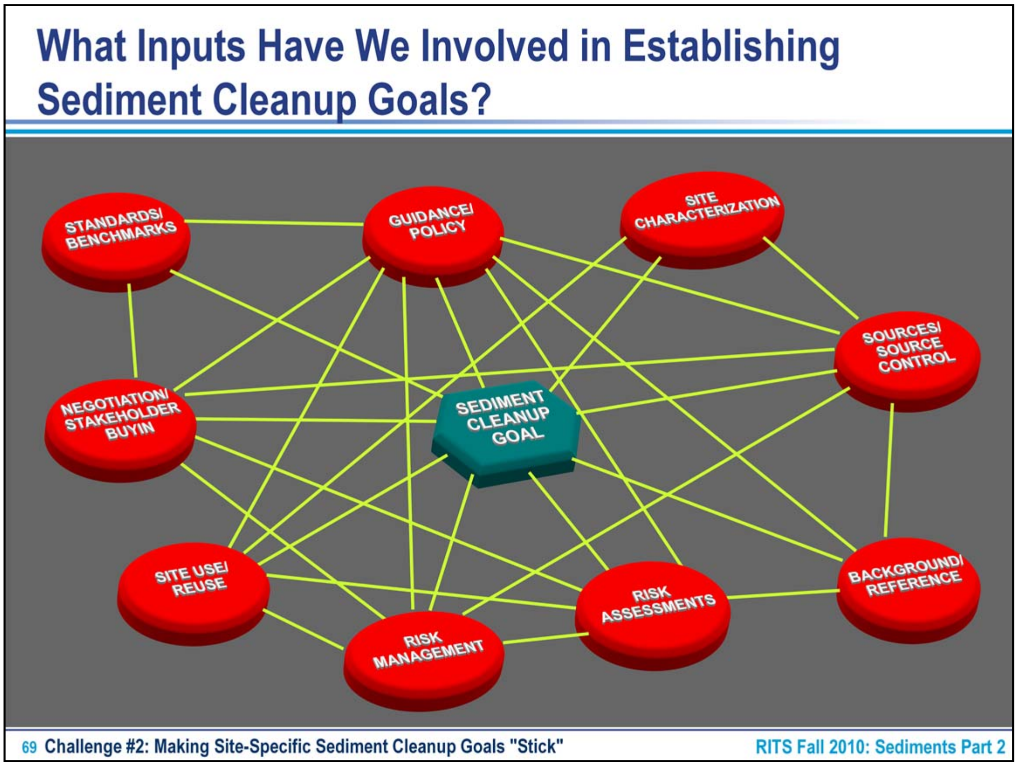
Such negotiation can overcome the common obstacles of stakeholder turnover and the “moving target”.

SMARTER(ecord) Management Documentation

- **Formally document decisions and consensus**
  - What needs to be done and why
  - What has been done and why
  - What does not need to be done and why not
  - What has not been done and why not
- **Establish framework for documenting decisions and consensus**
  - Define what are “decision” documents
  - Role of supporting information
    - Meetings, e-mails, notes
  - Mechanism for sharing and storing “decision” documents

68 Challenge #2B: Ensuring Stakeholder Team Acceptance of Background Data | RITS Fall 2010: Sediments Part 2

To “protect” the process of negotiation and decision-making, the project manager should develop an effective framework for documenting and communicating the decision-making process.



After working through the challenge of “Making Site-Specific Sediment Cleanup Goals “Stick””, all of the nine categorical inputs to developing a sediment cleanup goal have been “triggered”.

Challenge #2: Case Study – BNC OU B Marine

- BNC OU B Marine located within Sinclair Inlet in the Puget Sound system
- RAOs
  - Reduce the concentration of PCBs in sediments to reduce PCB concentrations in fish tissue
  - Selectively remove sediment with high concentrations of mercury collocated with PCBs
- Sediment remedial action
  - Dredging and capping
  - Maintenance dredging program assimilated

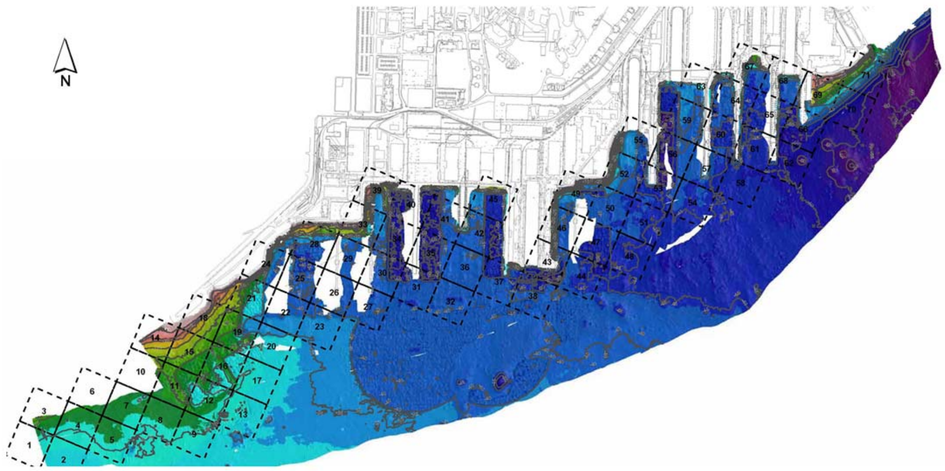
70 Challenge #2: Making Site-Specific Sediment Cleanup Goals "Stick" RITS Fall 2010: Sediments Part 2

Remedial action completed in phases between 2000 and 2004 (i.e., majority of dredging and capping completed in 2000/2001, with additional capping in 2004).

Maintenance dredging program was conducted to deepen the turning basin, and sediments from the maintenance dredging program were incorporated into the sediment remedy as needed (and at great cost savings to the Navy).

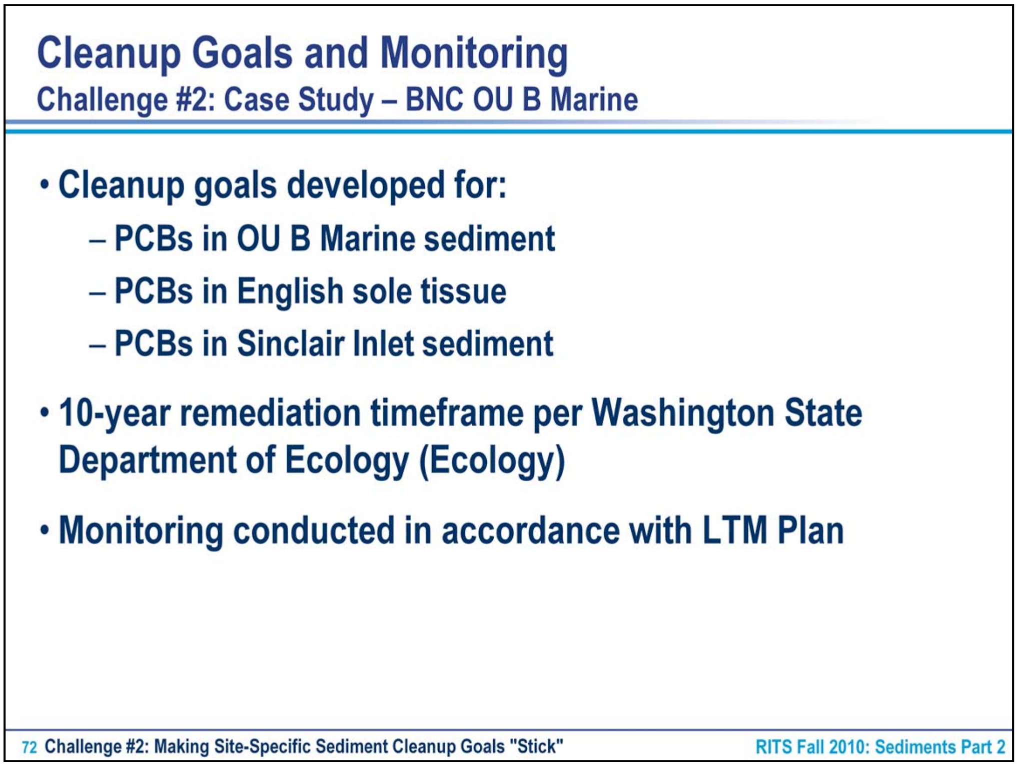
BNC OU B Marine Bathymetry

Challenge #2: Case Study – BNC OU B Marine



71 Challenge #2: Making Site-Specific Sediment Cleanup Goals "Stick" RITS Fall 2010: Sediments Part 2

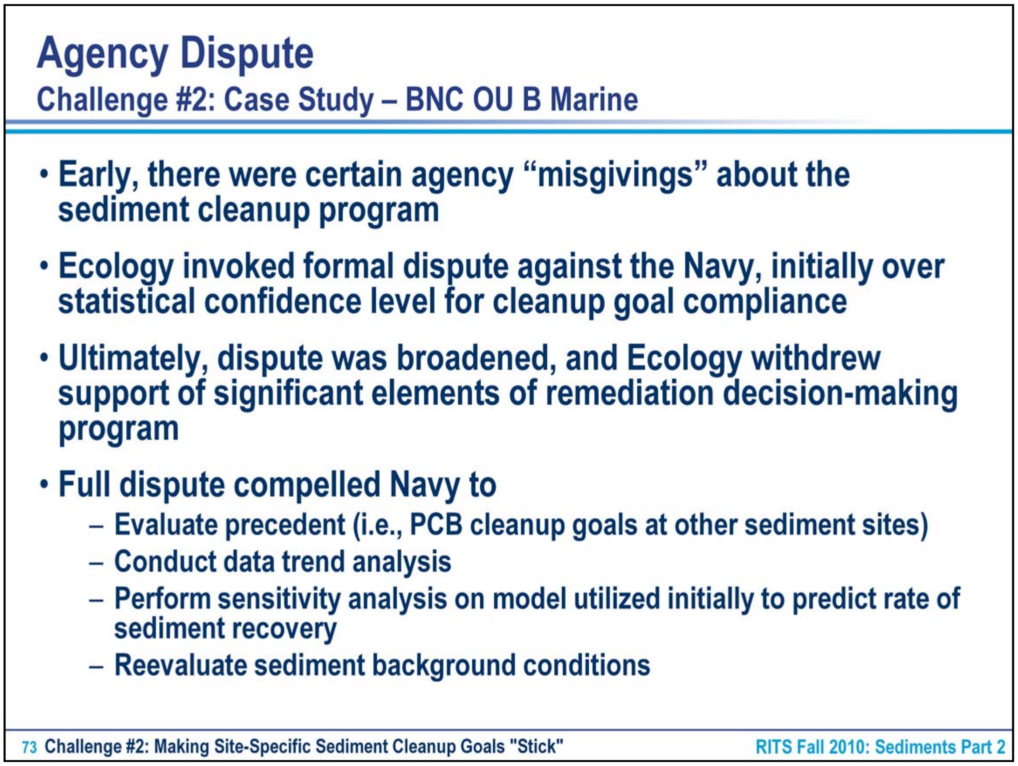
This image is a bathymetric survey map of the Sinclair Inlet at BNC, demonstrating the remedial action areas.



Sediment cleanup goals were derived for PCBs in OU B Marine sediment (to protect fish based on recovery modeling), Sinclair Inlet sediment (essentially background), and English sole tissue (again, essentially background).

Remedy timeframe began in 2004 with final capping, requirement to complete by 2014.

Monitoring has been biennial; sediment and/or fish tissue sampled in 2003, 2005, and 2007.



There were certain stakeholder concerns initially during the risk-management decision-making and remedial action; however, those phases were accomplished successfully.

Navy conducted monitoring and reporting following the remedial action, at which time the agencies became uncomfortable with certain project elements. Ultimately, this led to a agency dispute that compelled the Navy to react to agency concerns before "proceeding".

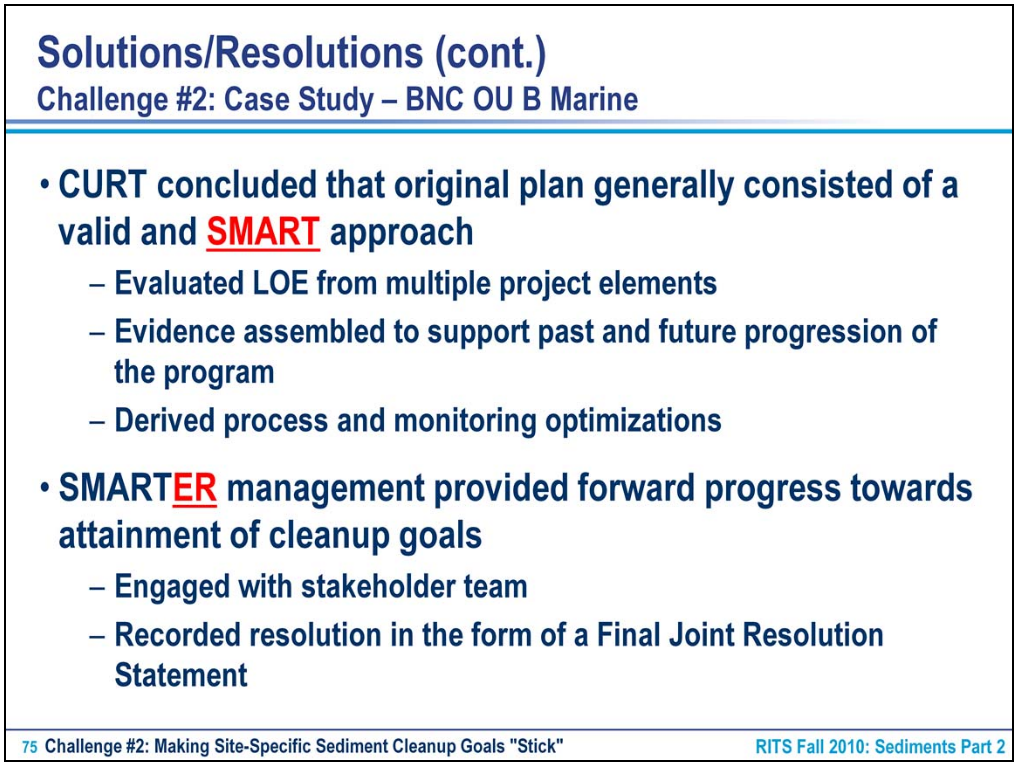
Solutions/Resolutions

Challenge #2: Case Study – BNC OU B Marine

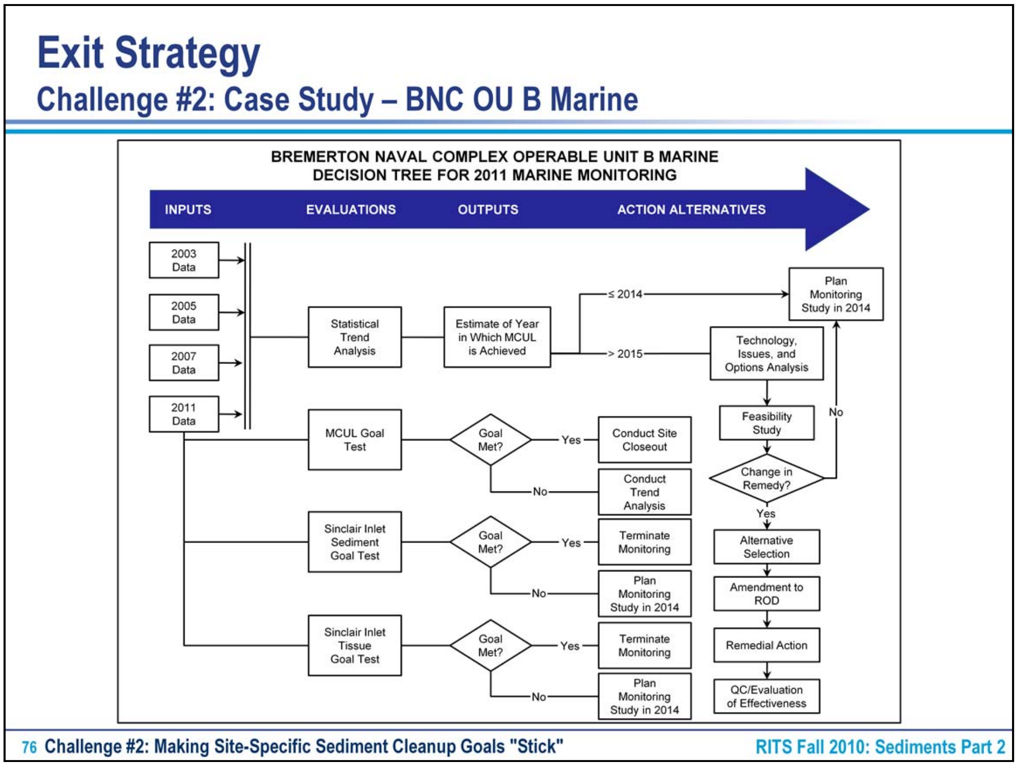
- Navy actively participated in Dispute Resolution Committee (DRC), made up of Navy, U.S. EPA, and Ecology
- Navy actively communicated and shared information with other stakeholders (e.g., Suquamish Tribe)
- Navy formally responded to dispute requirements
- Navy convened Cleanup Review Team (CURT) to evaluate numerous lines of scientific evidence
  - Reassessed monitoring data, updated the CSM, and optimized a clear and relevant closure strategy
  - Statistically evaluated relationship between site data and background conditions
  - Evaluated other sources and their relationship to OU B Marine program

74 Challenge #2: Making Site-Specific Sediment Cleanup Goals "Stick" RITS Fall 2010: Sediments Part 2

To resolve the agency dispute, the Navy engaged in a SMARTER management framework by proactively engaging the stakeholder team, including local Tribal concerns, and by formally documenting the science and consensus. The Navy bolstered the science by convening a CURT to evaluate the project and make recommendations for optimization.



The implementation of the SMARTER management framework indicated that, while certain improvements and optimizations were possible, the project had generally been conducted in a SMART fashion to date. The SMARTER framework also ultimately led to a favorable resolution of the agency dispute.



This chart provides an example of an exit strategy to temporally bound the OU B Marine sediment remedy. Contaminant trend analysis predicts compliance with the OU B Marine sediment cleanup goal by 2014, and statistical analysis of the OU B Marine monitoring data suggest that the Sinclair Inlet beyond OU B Marine is at “background”. Ultimately, the next round of monitoring (2011) will demonstrate this continued trend towards cleanup goal compliance. Other measures are possible depending on the outcome, but those measures also have a definitive timeframe.

The following slides provide a summary of the Sediment RITS Part 2 presentation, including take home points, relevant guidance, and relevant contact information.

Take-Home Messages

- Know how background data will be used in relation to site data and how background data will be evaluated and interpreted within the DQO process
- Select background locations that are directly meaningful and from which data can be collected that are optimally representative in the context of understanding site impacts and supporting risk management decisions
- Generate primary and supporting data necessary to answer critical questions, recognizing that information complexity/cost should be proportional to the weight of the decision being made
- Continuously update the CSM, paying close attention to elements that might be overlooked or underweighted relative to their potential influence on the process

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Take-Home Messages (cont.)

- Recognize that there may be a range for sediment cleanup goals (background or lower to risk-based level), and that a comprehensive strategy for developing sediment cleanup goals is critical in establishing the most appropriate goals possible
- Incorporate all site-specific inputs possible (risk, background, site use/reuse, sources/source control, compliance endpoints, data evaluation strategies, and exit strategies) into developing sediment cleanup goals
- Be SMART in developing cleanup goals that are meaningful, can be measured and achieved, and fit the risk management framework and exit strategy
- Be SMARTER by proactively engaging stakeholders to foster "ownership" and obtain formal agreements at critical project milestones and document the DOs/DIDs as well as the DON'T's/DIDN'T's
- Maintain flexibility and adaptability

Relevant Guidance – Navy

- Example Approach for the Development of Site-Specific Preliminary Remediation Goals for Protection of Ecological and Human Health at Navy Aquatic Sites (SP-2102-ENV, 2001)
- Department of the Navy. 2002. "Policy on Sediment Site Investigation and Response Action." February 8.
- Guidance for Environmental Background Analysis – Volume II: Sediment (UG-2054-ENV, 2003)
- Using Sediment Identification Evaluations to Improve the Development of Remedial Goals for Aquatic Habitats (SP-2132-ENV, 2003)
- Guide for Planning and Conducting Sediment Pore Water Toxicity Identification Evaluations (TIE) to Determine Causes of Acute Toxicity at Navy Aquatic Sites (UG-2052-ENV, 2003)
- Implementation Guide for Assessing and Managing Contaminated Sediment and Navy Facilities (UG-2053-ENV, 2003)

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Relevant Guidance – U.S. EPA

- Determination of Background Concentrations of Inorganics in Soils and Sediments at Hazardous Waste Site (540/5-96/500, 1995)
- Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites (540-R-01-003, 2002)
- Risk Assessment Guidance for Superfund (RAGS) Part B - Development of Risk-Based Preliminary Remediation Goals (540/R-92/003, 1991)
- Role of Background in the CERCLA Cleanup Program (OSWER 9285.6-07P, 2002)
- USEPA. 2005. "Contaminated Sediment Remediation Guidance for Hazardous Waste Sites." EPA 540-R05-012 OSWER 9355.0-85. December.

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Relevant Guidance – Other

- U.S. EPA/U.S Army Corps of Engineers (USACE)
  - Evaluation of Dredged Material Proposed for Ocean Disposal – Testing Manual (503/8-91/001, 1991)
    - a.k.a. – “Green Book”
  - Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Testing Manual (823-B-98-004, 1998)
    - a.k.a. – “Inland Testing Manual (ITM)”
- "There's a S.M.A.R.T. Way to Write Management's Goals and Objectives." (Management Review, Vol 70/Issue 11, Nov 1981)

Navy Technical Support

- Risk Assessment Workgroup (RAW)
  - Sediments characterization
  - Risk assessments
  - Background
- Alternative Restoration Technology Team (ARTT)
  - Sediment remediation
- Optimization Workgroup
  - Long-term monitoring and exit strategies
- Sediment Issues Focus Team (SIFT)
  - General sediment issues