



Managing Dredging Information in San Francisco Bay: an Interagency Solution

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OCTOBER 25-27, 2017

WEDA PACIFIC CHAPTER MEETING



The DMMO

- ▶ **Dredged Material Management Office**

- ▶ Based in San Francisco Bay
- ▶ Members include the San Francisco Bay Conservation and Development Commission, Regional Water Quality Control Board, State Lands Commission, U.S. Army Corps of Engineers, and the U.S. Environmental Protection Agency, with participation from Fish and Game, National Marine Fisheries Service, and the Fish and Wildlife Service

- ▶ **Purpose**

- ▶ To cooperatively review sediment quality information and make suitability determinations for material proposed for disposal in San Francisco Bay



Managing Dredging Information

- ▶ **Data Management (done well) is Hard**
 - ▶ Ideal options involve trained data scientists with knowledge of dredging and passion for data quality
 - ▶ Software and hardware components are only part of the solution, somewhat limited due to specialties of dredging data
- ▶ **Success Requires Ownership and Buy-In**
 - ▶ Planning should focus on long-term ownership of the data
 - ▶ Users should understand the value of well-managed data, and receive sufficient training to capitalize on information availability
- ▶ **Data Organization is Key**
 - ▶ Know your data, how it is interrelated, and what questions it needs to answer



Early Project Stages

- ▶ **DMMO Data Problems Defined**
 - ▶ Lack of access to testing data
- ▶ **Mission Needs Statement**
 - ▶ Interviews with the DMMO and selected applicants
 - ▶ MNS defined existing workflow and data sources
 - ▶ Recommendations for systematic approach
- ▶ **Historic Data Migration**
- ▶ **Modular Development**
- ▶ **Testing Data Template and QA/QC Requirements**
- ▶ **Lead to Design and Implementation of DMMO Website**

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SAN FRANCISCO BAY dredging and disposal DATABASE

PROJECTS LIST | MEETING AREA | DATA SEARCH

PROJECTS LIST
MEETING AREA
DATA SEARCH

Welcome to the San Francisco Bay Dredging and Disposal Database

This web site provides information for permitting agencies, dredging project proponents, and the public regarding navigational dredging projects processed through the Dredged Material Management Office (DMMO) in the San Francisco Bay area.

Members of the public do not need to log in to view and download information from this site. Similarly, permittees and applicants do not need to log in to submit (upload) documents to the Meeting Area for DMMO to review.


Use the links here or on the left to:

- Go to the "[Projects List](#)" to access reports and other information regarding individual dredging projects;
- Go to the "[Meeting Area](#)" to submit (upload) dredging project documents or data for DMMO agencies to review; and
- Go to the "[Data Search](#)" page to search a database of available past sediment chemistry and bioassay test results for dredging projects throughout the Bay area.

Additional technical and policy guidance about dredging in the San Francisco Bay area is available at the main DMMO web site:
[www.spn.usace.army.mil/Missions/DredgingWorkPermits/DredgedMaterialManagementOffice\(DMMO\).aspx](http://www.spn.usace.army.mil/Missions/DredgingWorkPermits/DredgedMaterialManagementOffice(DMMO).aspx)

About the DMMO:

The DMMO is a joint program of the San Francisco Bay Conservation and Development Commission (BCDC), San Francisco Bay Regional Water Quality Control Board (RWQCB), California State Lands Commission (CSLC), the San Francisco District U.S. Army Corps of Engineers (USACE), and Region 9 of the U.S. Environmental Protection Agency (EPA). Also participating are the California Department of Fish and Wildlife (formally Fish and Game), the National Marine Fisheries Service, and the U.S. Fish and Wildlife Service who provide advice and expertise to the process. The purpose of the DMMO is to cooperatively review sediment quality sampling plans, analyze the results of sediment quality testing, and make suitability determinations for material proposed for disposal or beneficial reuse in and around the San Francisco Bay area. The goal of this interagency group is to increase efficiency and coordination between the member agencies and to foster a comprehensive and consolidated approach to handling dredged material management issues.

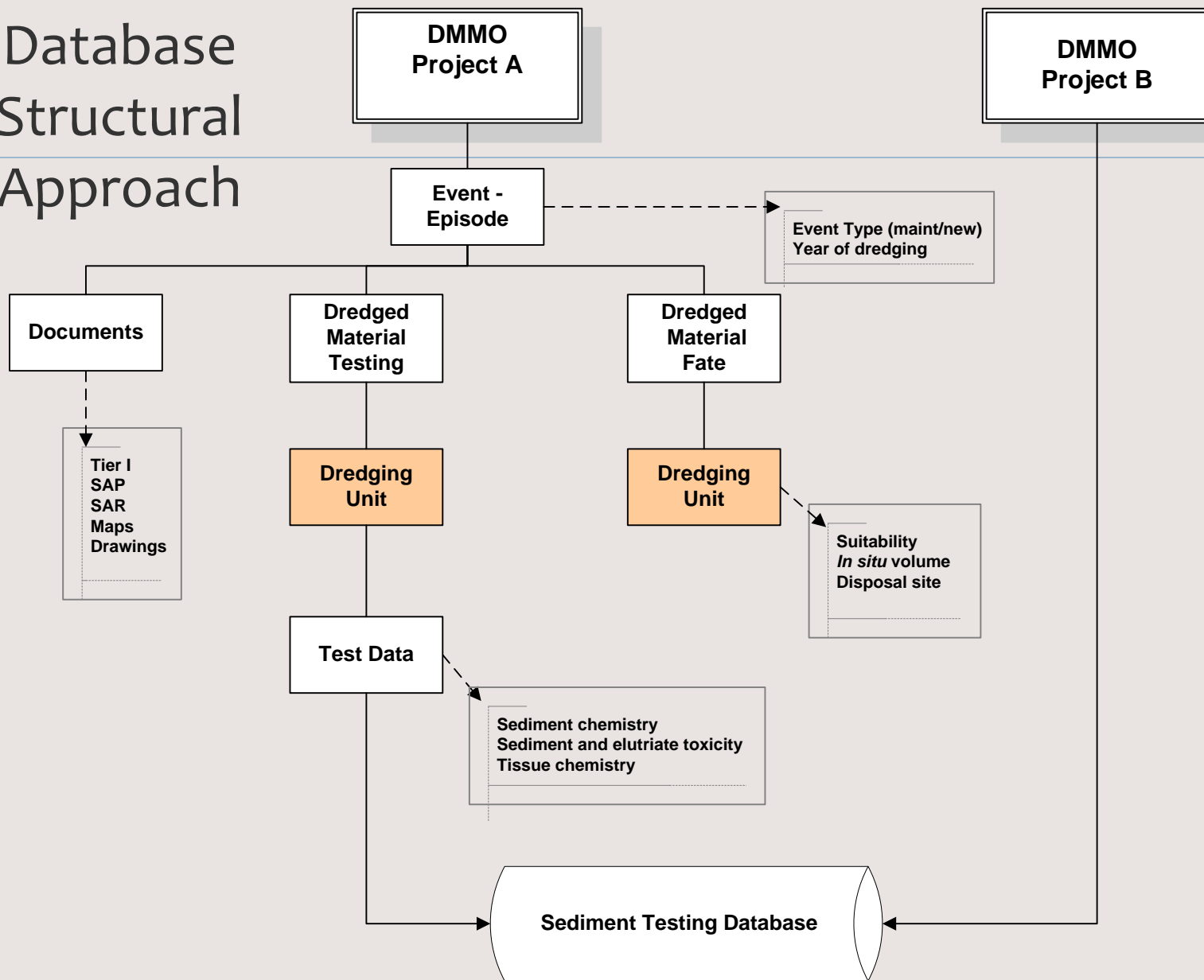




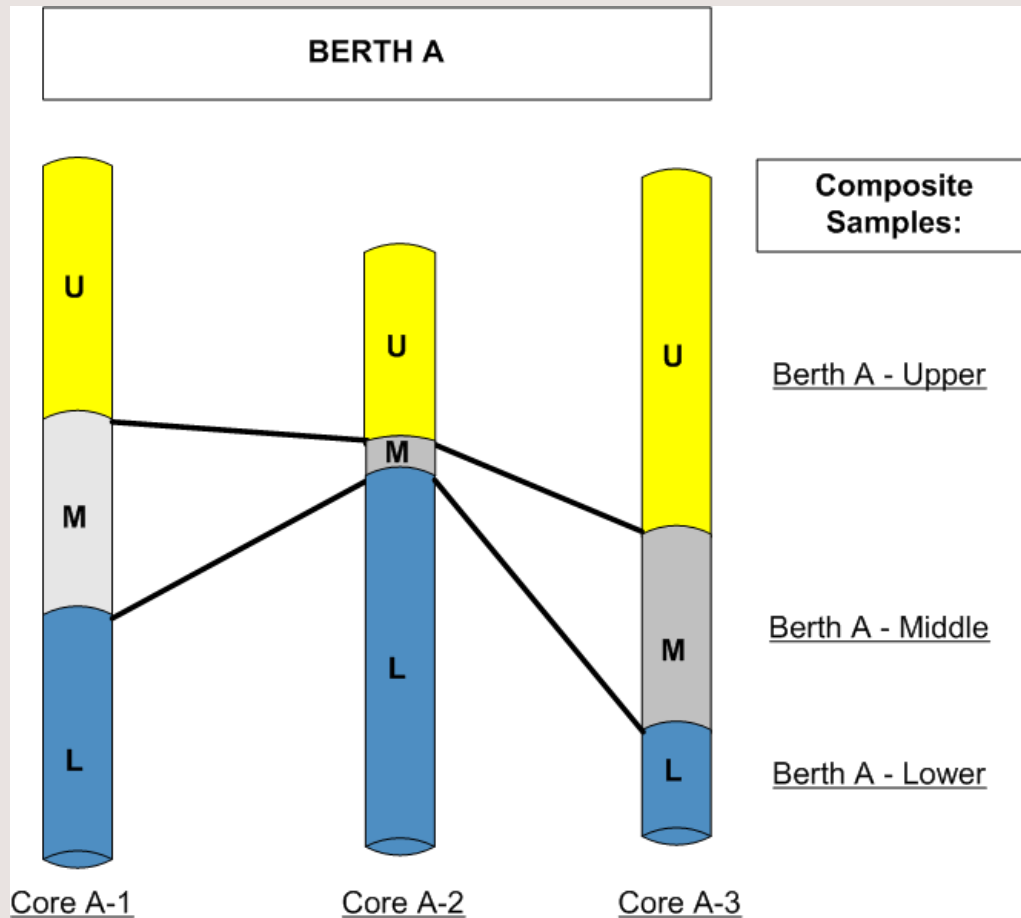
Features of the DMMO Solution

- ▶ Provides Access to Active/Historic Project Information
 - ▶ **Organization is centered on Projects/Applicants**
- ▶ Supports Internally-Checked Standardized Templates
 - ▶ Templates for sediment, elutriate, and tissue chemistry and bioassay data, as well as dredging planning and field data
 - ▶ Website includes automated upload and checking of templates
- ▶ Facilitates DMMO Meetings
 - ▶ Meeting Room features recent documents and approval status
- ▶ Supported by Comprehensive Historic Data
 - ▶ Website includes standard and custom query functionality

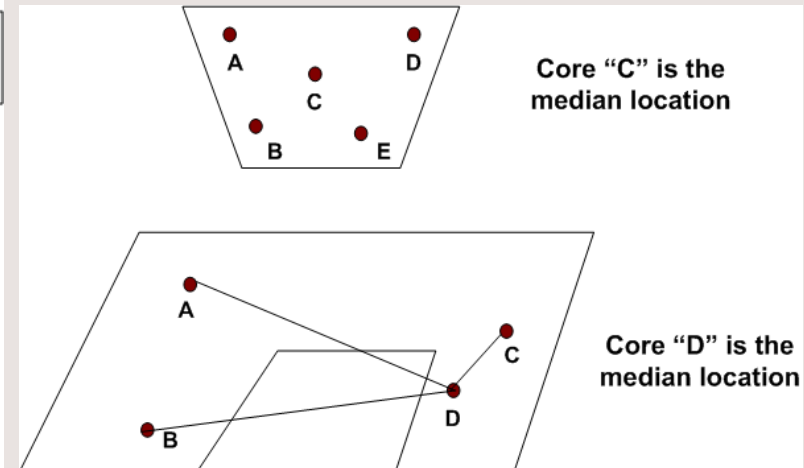
Database Structural Approach



Dredging Data Complexity: the Composite



- ▶ Composite Location
 - ▶ Median coordinates



- ▶ Composite Depth
 - ▶ Average of upper and lower depths



DMMO Testing Data Template

▶ Purpose and Goals

- ▶ Incorporate standard, high quality testing data for use by the DMMO, dredging applicants, and the general public
- ▶ Reduce the time required to manage the information by DMMO staff

▶ Includes Laboratory and Field Collection Information

- ▶ Laboratory templates include internal checks for formatting and QA/QC sample types
- ▶ A final Master template checks between templates so that Composite field and laboratory samples are linked

▶ Other Features

- ▶ Compatible with California valid value standards (e.g., CEDEN)
- ▶ Includes full documentation

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Dredging Project List
Excel Template

DMMO Sediment Characterization Template

The template is provided for submission of sediment testing data for a dredging project. The template has macros that check the data for format and data consistency. Instructions are imbedded in the files as the first worksheet. An example filled-out template is also provided below.

Excel Template and User Manual

Title	Last Updated
 DMMO Sediment Testing Data Templates April 2016	2016-05-12 16:50:33
 DMMO Sediment Testing Data User Documentation	2016-05-06 11:20:08
 DMMO Sediment Testing Template Quick Start Guide	2016-05-06 11:20:42

Master_Template_KMU1_10-26-2015.xls [Compatibility Mode] - Microsoft Excel

Home Insert Page Layout Formulas Data Review View Developer Acrobat

Paste Clipboard Font Alignment Number Styles Cells Editing

A2 4/1/2016

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	DMMO Sediment Characterization Template - Master Template V3 Documentation													
2	Apr-2016													
3														
4	This set of templates was based on the California Surface Water Ambient Monitoring Program (SWAMP), with modifications necessary for Dredged Material Management Office (DMMO) database.													
5														
6	Please refer to the User's Manual for general instructions on how to populate the template and operate the 'Check Data' command.													
7														
8	Startup Notes													
9	1. Make a copy of all of the templates you will need for your project in a project-specific folder.													
10	2. The following four templates must always be included in a project folder: Master, Station, Core/Grab, and Sediment Chemistry.													
11	3. If you have elutriate chemistry, tissue chemistry (bioaccumulation results), or bioassay data, then make a copy of those templates also.													
12	4. We recommend that you rename the templates based on your specific project, but keep the root word in the file name for each type of data.													
13	5. The root words "Stat," "Core," "SedC," "BioA," "Elut," and "Tiss" are discussed in the User's Manual.													
14														
15	Master Template													
16	The Master Template will be used last. The purpose of the Master template is to:													
17	1. Ensure that checks have been run in the analytical results templates (sediment, elutriate, and tissue chemistry, and bioassay data).													
18	2. Check that station and sample names are consistently used between templates.													
19	3. Prepare the templates for submission over the DMMO website.													
20	4. Create a QA/QC report that will be used by the DMMO to review the submitted data (note that before the QA/QC Report is generated, the User will be prompted to enter information that will associate the data submission to a DMMO Project and Event).													
21														
22														
23	Overview Notes (applicable to all templates)													
24	- Information that is not entered in the specified columns will not be incorporated into the DMMO Sediment Characterization Database.													
25	- Do not rename or move the columns in any of the worksheets in the DMMO Master Template file.													
26	- Do not rename or move the worksheets in the template.													
27														
28														

Instructions Checker Errors SummaryErrors Readiness Summary QAQCReport QAQC_LookUp

Select destination and press ENTER or choose Paste

100%

Quality Assurance/Quality Control Report

Report Date 3-Mar-2017

Project Name: Benicia Marina 2016
 Submitter: Robert Gee
 Project ID: 230

SAR Report: 2016_Benicia Marina_SAR_25889
 Company: Pacific Ecorisk
 Event ID: 2278
 Applicant: Cullen-Sherry Associates & City of Benicia

Part Number: 1 - Overall Summary

CONTACTS

Chemistry labs: ALS Laboratory Group
 Bioassay labs: Pacific Ecorisk

SUMMARY OF SAMPLES AND DATA TYPES COLLECTED FOR EACH DREDGING UNIT

Station Code (Dredging Unit)	# of Core Samples Collected	# of Grab Sample Collected	Location Information Available?	Sample Date Range (mm/dd/yyyy)	Sediment Chem	Bioassay	Tissue Chem	Elutriate Chem
BM-DU1	4	0	Yes	3/1/2016 to 6/6/2016	Yes	Yes	No	No
BM-DU2	8	0	Yes	3/1/2016 to 6/6/2016	Yes	Yes	No	No
SF-9	0	0	No	No Data	No	Yes	No	No
LC	0	0	No	No Data	No	Yes	No	No
SW	0	0	No	No Data	No	Yes	No	No
SC	0	0	No	No Data	No	Yes	No	No

SUMMARY OF ANALYTICAL TESTING

Summary of Analytical Methods and Reporting Units

Matrix Name	Chemical Group	Method	Reporting Units	Basis	Range of Reporting Limits
Sediment	CONVENTIONAL	EPA 160.3M	%	WW	NR
Sediment	CONVENTIONAL	PSEP	%	DW	0.05
Sediment	GRAIN SIZE	PSEP	%	DW	NR
Sediment	METALS	EPA 6020	MG/KG DW	DW	.02 to 1.9
Sediment	METALS	EPA 7471B	MG/KG DW	DW	.018 to .398
Sediment	METALS	EPA 7742	MG/KG DW	DW	.1 to 20
Sediment	ORGANOTINS	KRONE	UG/KG	DW	1 to 2.7
Sediment	PAHS	EPA 8270SIM	UG/KG	DW	2.5 to 6.5
Sediment	PCB CONGENERES	EPA 8082	UG/KG	DW	.13 to .46
Sediment	PESTICIDES	EPA 8081	UG/KG	DW	.5 to 66

QAQC Sample Summary

MatrixName	Sample Type	Reported?	Count
Sediment	Target sample	Yes	2
Sediment	Duplicate	Yes	2
Sediment	Lab Control Sample (LCS)	Yes	1
Sediment	LCS Duplicate	Yes	1
Sediment	Matrix Spike	Yes	1



DMMO Website Features

▶ **Projects**

- ▶ A project can be an applicant (e.g., Port of Oakland) or a federal navigation project (e.g., Pinole Shoal)
- ▶ One cycle of application, testing, dredging and disposal is called an “Event”

▶ **Upload Data and Documents**

- ▶ Includes both document and template upload procedures

▶ **Meeting Area**

- ▶ Provides area for DMMO to review data and documents prior to a DMMO meeting

▶ **Sediment Testing Database Query and Download**

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PROJECTS LIST | MEETING AREA | DATA SEARCH

PROJECTS LIST
 MEETING AREA
 DATA SEARCH
 Dredging Project List
 Excel Template

DREDGING PROJECTS

From this page, you can view or download information about permitted San Francisco Bay area dredging projects. **You do NOT need to log in** to view or download existing project information.

If you are a dredging project applicant or permittee and wish to submit new documents (such as sampling plans, project drawings, or letters) to the DMMO for review, please do so on the "[Meeting Area](#)" page. Laboratories may also submit new testing data directly to the DMMO database by going to the "[Meeting Area](#)" page.

TO VIEW EXISTING DOCUMENTS and other information (including past sediment testing data) for any project, click on the project name in the list below. (Further instructions for accessing existing project information are provided on each Project Page.)

TO SUBMIT NEW DOCUMENTS OR LABORATORY DATA related to a dredging project, please go to the "[Meeting Area](#)" page.

Dredging Project Pages

Select a project from the list below by clicking on the hyperlink project name or filter the projects by using the search utility.

Select Project by:

Filter by Keyword:

Project	Applicant
US Coast Guard Integrated Support Command (259)	US Coast Guard, Civil Engineering Unit Oakland
US Coast Guard Station Golden Gate (258)	US Coast Guard, Civil Engineering Unit Oakland
US Coast Guard Station Vallejo (260)	US Coast Guard, Civil Engineering Unit Oakland
US Coast Guard Station Yerba Buena Island (261)	US Coast Guard, Civil Engineering Unit Oakland

DMMO - USACE Napa River

www.dmmosfbay.org/site/alias_9052/0/Default.aspx

USACE Napa River Federal Channel Maintenance Dredging (379)

Project Home | Testing Data | Disposal Logs | Administration | DMMO Home

Submittals

Return to Projects List

To choose a different project, [click here](#).

Disposal Log Data

Access Project Documents and Data

Use the Project Quick Links below to see or download this project's **Permit History**, a summary of DMMO **Suitability Determinations**, and any **Documents** submitted to DMMO such as Sampling and Analysis Plans (SAPs) and Sampling and Analysis Results (SARs).

You may also view and download past **Testing Results** for this project in two ways: (1) view testing data from different testing episodes using the "Dredging Events/Status" list below Project Quick Links; or (2) refine your search and query for specific data types using the [Project Test Data](#) link at the left of the page.

Site Map

Project Test Data

Project Quick Links

- [Permit History](#)
- [Suitability Summary](#)
- [Documents \(jump to page\)](#)
- [Historical Sediment Chemistry Testing Data \(jump to page\)](#)
- [Historical Bioassay Testing Data \(jump to page\)](#)

Events Status

Search Filter:

Event Name	Event Type	Prop. Depth (ft, MLLW)	Over Depth (ft)	Prop. Vol. (cy)	Prop. Year	Actual Vol. (bin, cy)	Comments
2016 Lower Napa River Federal Navigation Channel	Maint	9.0	1.0	12,236	2016	62,709	-15 ft. + 2 ft. over...
2015 Napa River Federal Navigation Maint. Dredging	Maint	10.0	2.0	102,042	2015	0	c/o Napa Co. Flood C...

[Add Event](#) Query Checked Events: [Go](#)



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mmsosfbay.org/site/alias_dmno/71024/DesktopDefault.aspx?alias_dmno&Page...

and disposal DATABASE

MEETING AREA | DATA SEARCH | Disposal Logs | DMMO Databases | Administration

Upload Documents or Data for DMMO Review HERE:

Document Name:

Document Type:

Project:

Event:

Document Date:

Include document for consideration at the next DMMO Meeting

Document URL/Path

Lower Napa Rive...I 2015 SAR.pdf

Maximum upload file size is 1024 MB

** Required*

EXA

osfbay.org/site/alias_dmno/71024/DesktopDefault.aspx?alias_dmno&PageID=71024

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and disposal DATABASE

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Upload Documents or Data for DMMO Review HERE:

DMMO Sediment Data Template

Please provide a title to associate with your DMMO Template and upload your DMMO Sediment Data Template (DMMO Template) starting with the master excel file. The master excel file will be checked to verify that the 'Check Data' macro has been run and that the results are valid. You will also be required to upload the additional 1-6 supporting files that make up the entire DMMO Template.

Submission Title:

Master excel file:	Master_LNRFNC_2015(1).xls	<input type="button" value="Choose File"/>
Bioassay excel file:	Bioassay_LNRFNC_2015(1).xls	<input type="button" value="Choose File"/>
Stations excel file:	Station_LNRFNC_2015(1).xls	<input type="button" value="Choose File"/>
Core/Grab excel file:	CoreGrab_LNRFNC_2015(1).xls	<input type="button" value="Choose File"/>
Sediment chemistry excel file:	SedChemistry_LNRFNC_2015(1).xls	<input type="button" value="Choose File"/>
Elutriate chemistry excel file:	ElutriateChemistry_LNRFNC_2015(1).xls	<input type="button" value="Choose File"/>



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Upload Documents or Data for DMMO Review HERE:

Search Filter: Include Approved

Document Template

	Document	Project	Status	QA Report	Uploaded	Uploader
	Characterization of Sediment from Napa River Fed Nav Channel	Napa River Federal Channel Maintenance Dredging (379)	Not Approved		2017-10-09	peggy.myre@exadata.net
	USACE Napa Fed Channel Data 2015	Napa River Federal Channel Maintenance Dredging (379)	Not Approved	Report	2017-10-09	peggy.myre@exadata.net

Upcoming DMMO Meeting Dates

The agenda for the next DMMO meeting is typically available 1 week prior to the meeting date, and can be downloaded from <http://www.spn.usace.army.mil/Missions/DredgingWorkPermits/Meetings.aspx>

(Agendas for current and past DMMO meetings as of 6/01/2016 are available at the "Agenda" link located at the top left corner of this page. Older agendas can be found [here](#).)

Oct 4, 2017	11:00 am	BCDC	**Meeting CANCELLED**
Oct 18, 2017	11:00 am	BCDC	455 Golden Gate Ave., Suite 10600, San Francisco 94102
Nov 1, 2017	11:00 am	BCDC	455 Golden Gate Ave., Suite 10600, San Francisco 94102
Nov 15, 2017	11:00 am	BCDC	455 Golden Gate Ave., Suite 10600, San Francisco 94102
Nov 29, 2017	11:00 am	BCDC	455 Golden Gate Ave., Suite 10600, San Francisco 94102
Dec 13, 2017	11:00 am	BCDC	455 Golden Gate Ave., Suite 10600, San Francisco 94102

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www.dmmosfbay.org/site/alias_dmmo/71024/DesktopDefault.aspx?alias_dmmo&PageID=71024

Upload Documents or Data for DMMO Review HERE:

Search Filter: Include Approved

Document Template

	Document	Project	Status	QA Report	Uploaded	Uploader
	REVISED SF Marina West Basin Tier I request for I-dock	San Francisco Marina-West Basin (300)			2017-05-02	shelahs
	US Coast Guard Island Station Alameda Tier I 2017	US Coast Guard Integrated Support Command (259)			2017-03-02	shelahs
	USCG Golden Gate 2016 Testing Data	US Coast Guard Station Golden Gate (258)		Report	2017-03-31	peggy.myre@exadata.net
	Sampling and Analysis Report for Station Golden Gate	US Coast Guard Station Golden Gate (258)			2016-03-11	unknown
	Oakland Harbor SAP for 2017 Dredging	USACE Oakland Inner/Outer Harbor (275)			2017-03-28	unknown
	Oakland Inner and Outer Harbor Channels 2017 Operations and Maintenance Dredging Sampling and Analysis Report - Final	USACE Oakland Inner/Outer Harbor (275)			2017-08-25	unknown
	Oakland Inner and Outer Harbor Channels 2017 Operations and Maintenance Dredging Sampling and Analysis Report Appendices	USACE Oakland Inner/Outer Harbor (275)			2017-08-25	unknown
	Oakland Harbor 2017 Tier I	USACE Oakland Inner/Outer Harbor (275)			2017-08-30	unknown
	2016 Richmond Harbor Eelgrass Survey	USACE Richmond Inner/Outer Harbor (276)			2017-03-02	siu.jennifer@epa.gov
	USACE Richmond Outer Harbor Tier I	USACE Richmond Inner/Outer Harbor (276)			2016-05-12	unknown
	USACE Richmond Outer Harbor SAR (Revised)	USACE Richmond Inner/Outer Harbor (276)			2016-03-21	unknown
	USACE San Bruno Shoal 2016 Testing Data	USACE San Bruno Shoal (337)		Report	2017-03-08	peggy.myre@exadata.net



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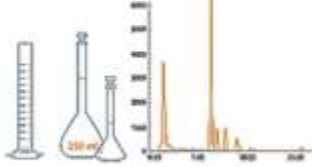
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TESTING DATA

Dredging projects include sediment sampling information that allows the DMMO to determine the suitability of that material for disposal or reuse at one of the managed dredged material placement sites in and around San Francisco Bay. The information collected for any project may include physical, chemical, and/or biological testing data. Available testing data for all Bay Area dredging projects has been compiled in a database that is available to search here. (The database currently includes testing data from approximately 2000 - 2010.)



NOTE The DMMO database accepts data submitted by testing labs without change or filtering. Macros built into the DMMO Excel Templates check to ensure that the data are in an acceptable format for submission to the DMMO database, but they do not evaluate data quality or accuracy. **This means that users are responsible for screening whether any data they view are appropriate for their intended uses.**

You may **view or download existing data** either by building your own [Custom Queries here](#) or by using the Automated Data Queries provided below. (The ability to select data spatially from a map will be coming in a future update.)

Testing laboratories with approved passwords may **submit new testing data** via the [Meeting Area](#). (Lab data are uploaded via standardized Excel Templates. The DMMO Excel Templates, an example data file, and a Template User Manual are available [here](#).)

Automated Data Queries

Clicking on the links below will generate the described information from the database.

[Study List](#): Results are organized by study type and name, showing total number of samples (not including controls), and the date range of the study.

[Geographic Distribution](#): Geographic distribution of samples.

[Statistical Range of Sediment Chemistry](#): Values excluding data below detection, organized by chemical group.

[Statistical Range of Tissue Laboratory Bioaccumulation Chemistry](#): Values excluding data below detection, organized by species and chemical group.

[Statistical Range of Bioassay Data](#): Values excluding negative control samples, organized by taxonomic group, species, and test end point.

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- Testing Data
- Custom Queries

Build Custom Queries

You can build your own custom queries for sediment chemistry, tissue chemistry, or bioassay data in the database. Each query allows you to select by project, location, or attribute.

Sediment Chemistry

To improve performance and maximize the usefulness of your results, select sediment chemistry data by narrowing your choices below. You may select data by chemical, project location, project proponent, or project name, or all of the above. The project location choices are Place Name (large area or water body), Location or Feature (dredging area, reference area, smaller location name), or Port. The Project Proponent or Applicant name will be the name of the applicant for dredging projects. The Project Name is the name and year of the study conducted at that location. You also have a choice to exclude data below detection, or exclude reference and control data.

Chemical Group: Metal Chemical: Mercury
Project Location: Place Name Richardson Bay
Project Proponent or Permit Applicant Name: All
Project Name: All

Data Handling Preferences:
 Exclude Data Below Detection
 Exclude Reference Data

Submit Query

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Sediment Chemistry

Query Results

Chemical Group: **Metal**
 Chemical: **Mercury**
 Project Location: **Place Name:Richardson Bay**
 Project Proponent or Permit Applicant Name: **All**
 Project Name: **All**
 Exclude Data Below Detection: **No**
 Exclude Reference Data: **No**

[Download CSV File](#)

Total Rows: 15

StudyID	Study Name	Agency	StationID	Latitude	Longitude	Water Body	Watershed	County	SampleID	Sample Method	Sample Type	Date Sampled	Date Analyzed	Upper Sed Depth (ft)	Lower Sed Depth (ft)
256_2456_4_17	Strawberry Channel 2014	Recreation District and The Cove Apartments	A	37.87833	-122.4947	Strawberry Point	San Francisco Bay	Marin	A-Comp	Core	RESULT	4/2/2014	4/14/2014	0	2.5
256_2456_4_17	Strawberry Channel 2014	Recreation District and The Cove Apartments	B	37.88334	-122.4825	Strawberry Point	San Francisco Bay	Marin	B-Comp	Core	RESULT	4/2/2014	4/14/2014	0	3.47
256_2456_4_17	Strawberry Channel	Recreation District and	C	37.89556	-122.5008	Strawberry	San Francisco	Marin	C-Comp	Core	RESULT	4/2/2014	4/14/2014	0	3.68

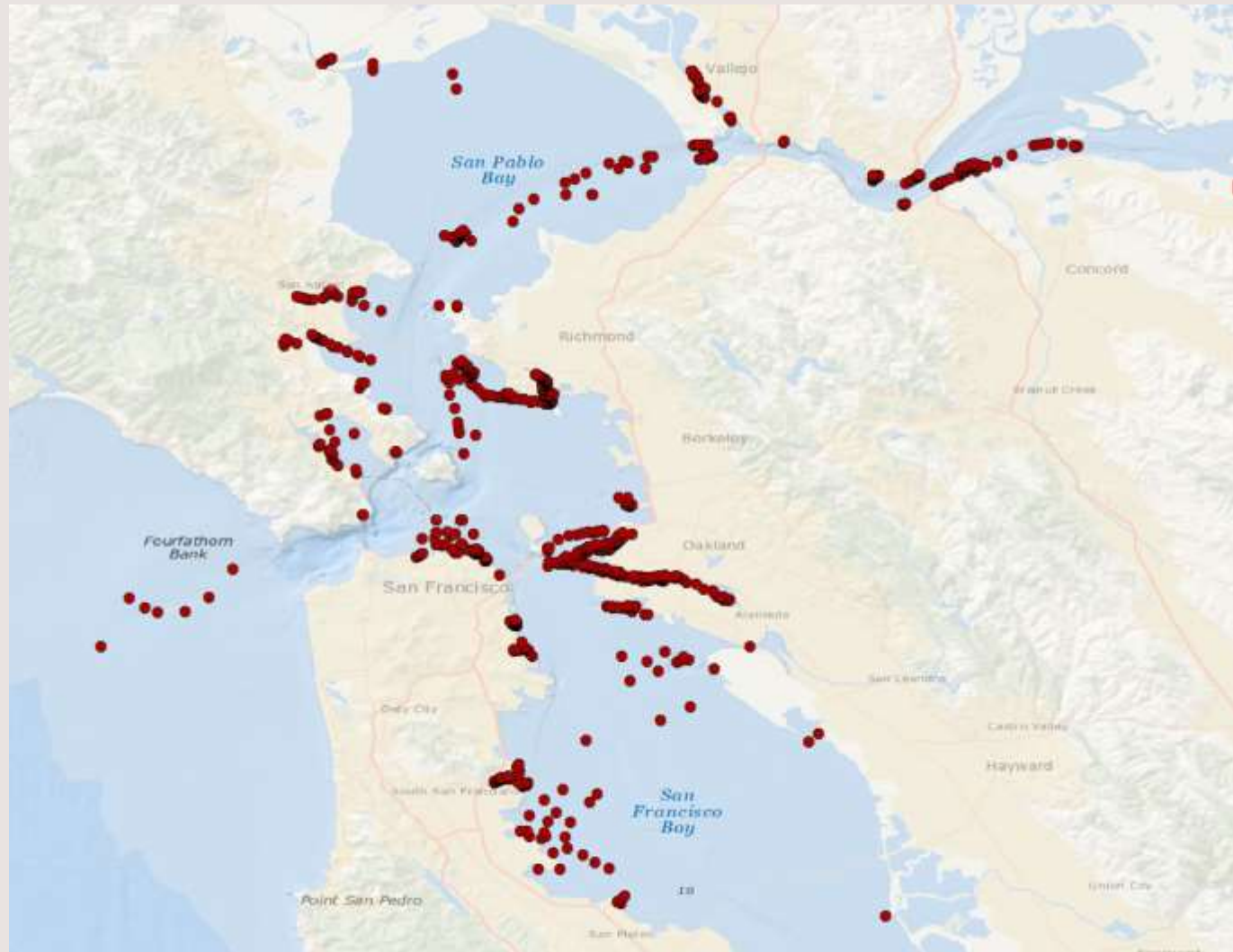


Content of the Testing Database

Database Element	Number of Records
Studies (Project/Event)	240
Cores	4,423
Composite Samples (including reference)	2,159
Chemistry Records	
Sediment chemistry	146,080
Elutriate chemistry	5,867
Tissue chemistry	127,455
Bioassay Record	
Replicate results	36,182
Summary results	14,797



Station Distribution in Testing Data



OCTOBER 25-27, 2017

WEDA PACIFIC CHAPTER MEETING



What Has Worked

- ▶ **Improved Information Sharing**
 - ▶ Document management prior to, during, and after dredging projects has facilitated DMMO discussion and decisions
- ▶ **Project Tracking**
 - ▶ Easy viewing of dredging events and episodes within a project, with suitability, summary volume and disposal information
- ▶ **Readily-Available Historic Information**
 - ▶ Streamlines historic review of a proposed dredging site
 - ▶ Bay-wide regional use of testing data
- ▶ **Long-term Planning**
 - ▶ Discussions with SFEI for assistance in data management



Lessons Learned

- ▶ **Ownership is the Key to Longevity**
 - ▶ Discussions continue on long-term plan for managing data
 - ▶ Important to have participants that understand data science
 - ▶ Build in training for data providers and users
- ▶ **Enforcement**
 - ▶ The system does not work without incoming information
- ▶ **A Living Project**
 - ▶ The database must reflect updates to dredging regulations, testing methods, and other regulatory changes
 - ▶ Hardware, software, and internet security issues are never static and must be considered in long-term planning



Take-Home Points

- ▶ **A Successful Data Management Approach**
 - ▶ Needs Assessment – Know your data
 - ▶ Planning – Data management plan, short- and long-term
 - ▶ Ownership and Buy-in – Data providers and users
- ▶ **Data Management Plan: Phases or Modules**
 - ▶ Data migration
 - ▶ System design and development
 - ▶ Testing, documentation, long-term maintenance
- ▶ **Data Organization and Personnel are Key**
 - ▶ What information do you have, how is it interrelated, and what questions does it needs to answer?
 - ▶ Involve data scientists who understand dredging and are passionate about data



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