

Pulling Data into a Pile: An Innovative Approach to Data Management and Sharing



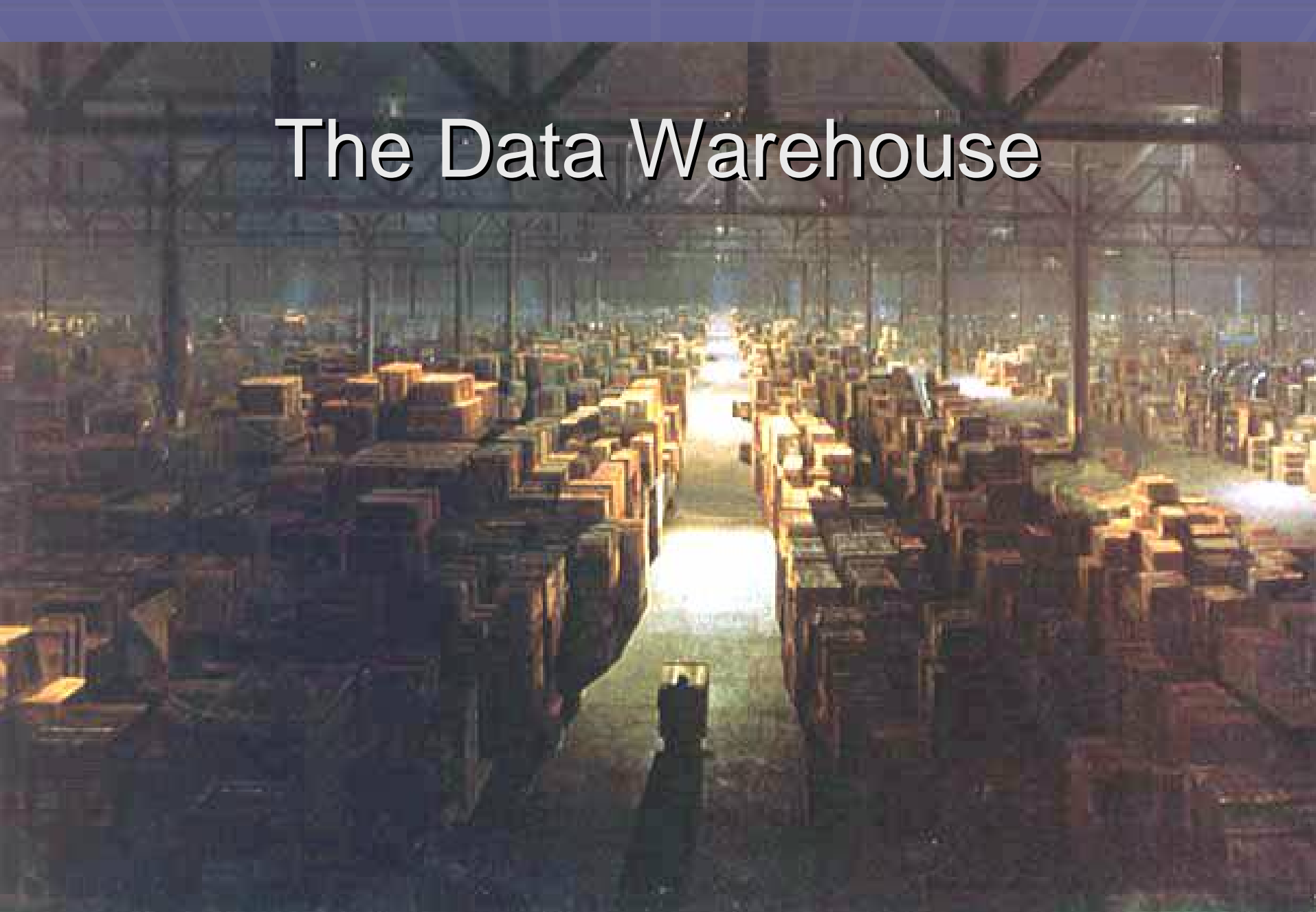
Karen Worcester
David Paradies
Mary Adams

**Central Coast Ambient
Monitoring Program**

California Central Coast Water Board
Bay Foundation of Morro Bay



The Data Warehouse



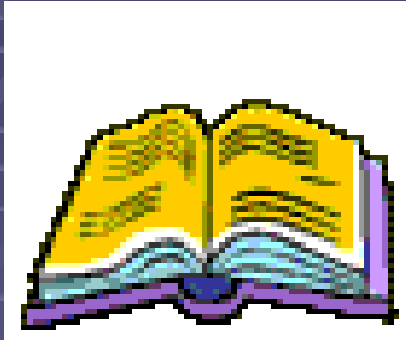
Retrieving Data



Data Management as Martial Art Form

- New monitoring program for Central Coast agriculture started in 2005
- No existing infrastructure for organizing permit data
- State's ambient database was not yet set up to receive data from outside users

Central Coast Program for Agriculture



Education



Implementation of
Management Practices



Monitoring



With 2000 enrollees, we needed to leverage staffing with technology!



We Structured Ag Monitoring for Compatibility

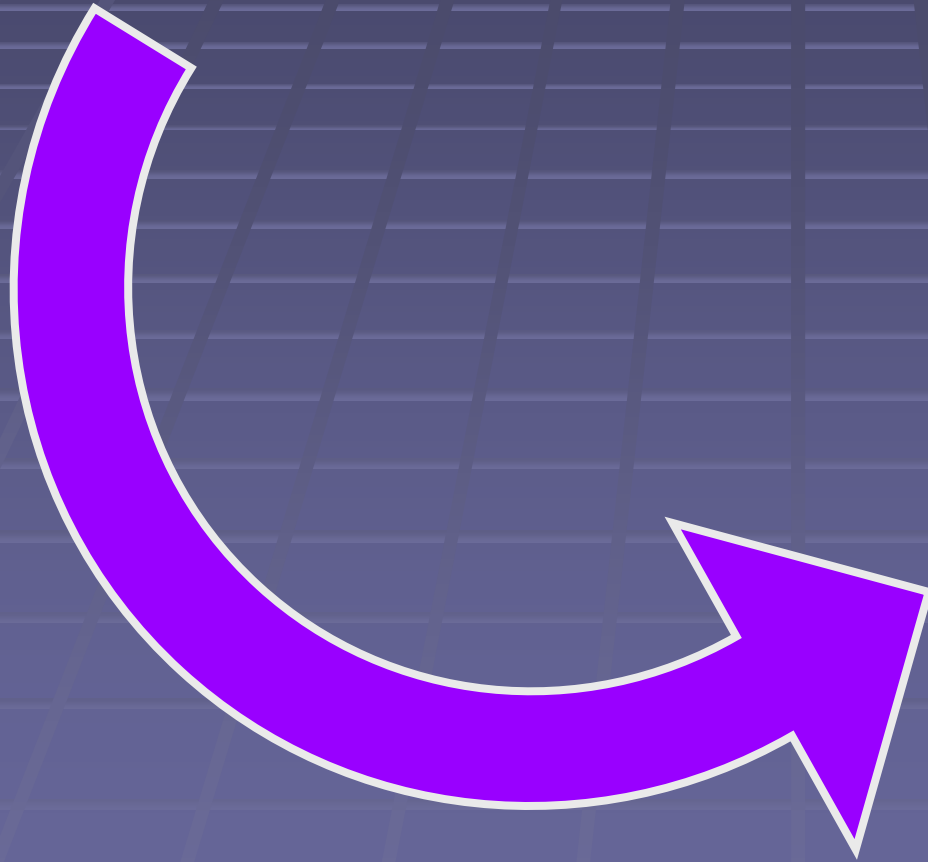
- With Central Coast Ambient Monitoring Program (CCAMP)
- With City of Salinas storm water permit
- With State's Quality Assurance and data delivery approaches

SWAMP



- SWAMP is California's Surface Water Ambient Monitoring Program
- SWAMP data delivery is required for several regulatory and grant programs
- SWAMP will serve as a water quality data warehouse

CCAMP Web-based Data Delivery and Checking



www.ccamp.org



[CCWQP Data Main Page](#)

Central Coast Irrigated Agriculture Waiver Program

LWA File upload system

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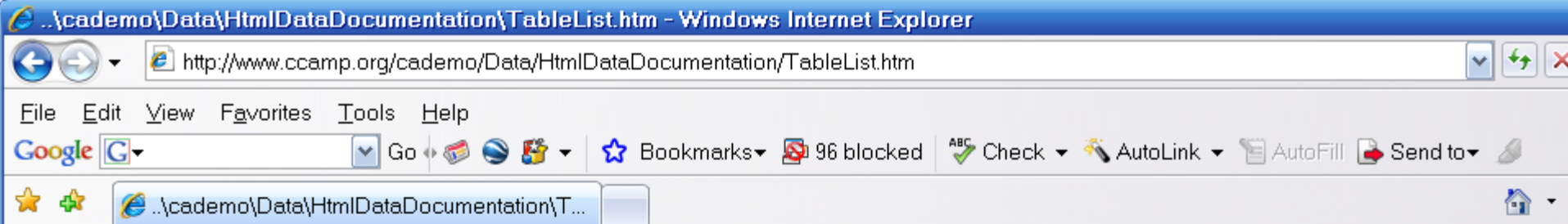
Table Description	Table Name	Example 1	Table Type
Tables intended for Electronic Delivery	and Details		
A list monitoring programs conducted by an organization	ParentProjects	MS-Excel	*Exchange
Contains a list of Monitoring Projects	Projects	MS-Excel	*Exchange
Contains calibration data for field equipment	Equip Cal Data	MS-Excel	Exchange
Contains a site list	Sites	MS-Excel	Exchange
Contains Water Quality Field and Lab data	WQ Data	MS-Excel	Exchange
Supporting Tables intended to provide consistent nomenclature			
Contains a list of labs and agencies	AgencyLookUp	MS-Excel	Lookup
Contains a list of characteristics or parameters being measured	Analytes	MS-Excel	Lookup
Contains a list of field Equipment Names and Ids	FieldResEquipLookUp	MS-Excel	Lookup
Contains a list of valid entries for matrices	Matrix	MS-Excel	Lookup
Contains a list of valid entries for test methods	Method	MS-Excel	Lookup
Contains a list of valid entries for Result Qualifiers(e.g. <, DNQ, ND, etc.)	ResultQualifier	MS-Excel	Lookup
Contains a list of valid entries for Swamp Sample Types	SampleType	MS-Excel	Lookup
Contains a list of units of measure	Units	MS-Excel	Lookup

[Return to list of tables](#)

Table Name: Sites

Contains a site list

Column Name	Column Description	Column Data Type
ProjectID	The project for which this sampling event took place from the 'ProjectsLookup' table	from table
H2OBody	The local name of a basin plan designated waterbody	text
SiteTag	A short identifier for a monitoring site in a defined format	from table
SiteName	The name of a monitoring site	text
SiteDesc	A description of a monitoring site	text
Latitude	The latitude of a monitoring site	decimal degrees
Longitude	The longitude of a monitoring site	decimal degrees
Datum	The identifier for a geographic datum from a table of acceptable types	text
DateEst	The date that a monitoring site was established	mm/dd/yy
Notes	Gernal comments	text
HUC	Hydrologic Unit	from table
HBASA	Hydrologic SubArea	from table
NHD_reach	NHD Reach Code	from table
NHD_comid	NHD plus Comid	from table



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Address http://www.ccamp.org/ca3/Data/Formats/Sites.xls									
Go Bookmarks 0 blocked Check AutoLink AutoFill Send to									
B8	fx San Juan Creek								
	A	B	C	D	E	F	G	H	
1	ProjectID	H2OBody	SiteTag	SiteName	SiteDesc	Latitude	Longitude	Datum	Date
2	R3_CMPnorth	Carnadero Creek	305CAN	Carnadero Creek u/s Pajaro River		36.959910	-121.534790	NAD83	1/1
3	R3_CMPnorth	Pajaro River	305CHI	Pajaro River at Chittenton		36.900300	-121.597700	NAD83	1/1
4	R3_CMPnorth	Salsipuedes Creek	305COR	Salsipuedes Creek d/s of Corralitos Creek u/s from Hwy 129		36.921850	-121.732500	NAD83	1/1
5	R3_CMPnorth	Pajaro River	305FRA	Millers Canal at Frazier Lake Rd		36.963730	-121.492260	NAD83	1/1
6	R3_CMPnorth	Llagas Creek	305LCS	Llagas Creek at Southside		36.989310	-121.532860	NAD83	1/1
7	R3_CMPnorth	Pajaro River	305PJP	Pajaro River at Main Street		36.905180	-121.751140	NAD83	1/1
8	R3_CMPnorth	San Juan Creek	305SJA	San Juan Creek at Anzar Rd		36.875360	-121.561410	NAD83	1/1
9	R3_CMPnorth	Struve Slough	305STL	Struve Slough at Lee Rd.		36.903890	-121.783770	NAD83	1/1
10	R3_CMPnorth	Tequisquita Slough	305TSR	Tequisquita Slough u/s Pajaro River @ Shore Rd		36.942500	-121.444830	NAD83	1/1
11	R3_CMPnorth	Watsonville Slough	305WSA	Watsonville Slough at San Andreas Rd	Sample site	36.888010	-121.804780	NAD83	1/1
12	R3_CMPnorth	Moro Cojo Slough	306MOR	Moro Cojo Slough at Highway 1	Sample site	36.795790	-121.783100	NAD83	3/3
13	R3_CMPnorth	Salinas Reclamation Canal	309ALG	Salinas Reclamation Canal at La Guardia		36.656830	-121.613500	NAD83	1/1
14	R3_CMPnorth	Alisal Slough	309ASB	Alisal Slough at White Barn		36.725450	-121.730170	NAD83	1/1
15	R3_CMPnorth	Blanco Drain	309BLA	Blanco Drain below Pump		36.708520	-121.748900	NAD83	1/1
16	R3_CMPnorth	Chualar Creek	309CRR	Chualar Creek at Chualar River Road		36.563760	-121.513930	NAD83	1/1
17	R3_CMPnorth	Espinosa Slough	309ESP	Espinosa Slough upstream from Alisal Slough		36.736840	-121.733860	NAD83	1/1
18	R3_CMPnorth	Gabilan Creek	309GAB	Gabilan Creek at Boronda Road		36.715260	-121.616900	NAD83	1/1
19	R3_CMPnorth	Salinas River (Mid)	309GRN	Salinas River at Elm Rd in Greenfield		36.337690	-121.205180	NAD83	1/1
20	R3_CMPnorth	Salinas Reclamation Canal	309JON	Salinas Reclamation Canal at San Jon Road		36.702470	-121.708680	NAD83	1/1
21	R3_CMPnorth	Merrit Ditch	309MER	Merrit Ditch upstream from Highway 183		36.751840	-121.742080	NAD83	1/1
22	R3_CMPnorth	Natividad Creek	309NAD	Natividad Creek upstream from Salinas Reclamation Canal		36.708080	-121.599580	NAD83	1/1
23	R3_CMPnorth	Old Salinas River	309OLD	Old Salinas River at Monterey Dunes Way		36.772291	-121.787855	NAD83	3/3
24	R3_CMPnorth	Quail Creek	309QUI	Quail Creek at Highway 101		36.609560	-121.561370	NAD83	1/1
25	R3_CMPnorth	Salinas River (Lower)	309SAC	Salinas River at Chualar bridge on River Road		36.553757	-121.547737	NAD83	1/1
26	R3_CMPnorth	Salinas River	309SAG	Salinas River at Gonzales River Rd Bridge		36.486340	-121.469750	NAD83	1/1
27	R3_CMPnorth	Salinas River	309SSP	Salinas River at Spreckels Gage		36.629050	-121.688150	NAD83	1/1
28	R3_CMPnorth	Tembladero Slough	309TEH	Tembladero Slough at Haro		36.759320	-121.754870	NAD83	1/1
29	R3_CMPsouth	Chorro Creek	310CCC	Chorro Creek u/s from Chorro Flats		35.357460	-120.812100	NAD83	1/1
30	R3_CMPsouth	Los Berros Creek	310LBC	Los Berros Creek at Century		35.103060	-120.578890	NAD83	1/1
31	R3_CMPsouth	Prefumo Creek	310PRE	Prefumo Creek at Calle Joaquin		35.247200	-120.681890	NAD83	1/1
32	R3_CMPsouth	Davenport Creek	310SLD	Davenport Creek at Broad Street		35.218740	-120.618240	NAD83	1/1
33	R3_CMPsouth	Arroyo Grande Creek	310USG	Arroyo Grande Creek at old USGS gage		35.124450	-120.569130	NAD83	1/1



[CCWQP Data Main Page](#)

Central Coast Irrigated Agriculture Waiver Program

LWA File upload system

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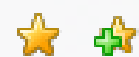
File 3:

File 4:

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SWAMP Electronic Data Delivery Clearinghouse: File Integrity Report (3/12/2007 10:52:02 AM)

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Table Description	Table Name	Table File	Error	Table Type
Tables intended for Electronic Delivery	and Error Types	& Errors	Count	
Contains a list of Parent Monitoring Projects	ParentProjects	ParentProjects.xls	0	*Exchange
Contains a list of Projects	Projects	Projects.xls	54	*Exchange
Contains calibration data for field equipment	Equip Cal Data	Equip Cal Data.xls	22	Exchange
Contains a Project site list	Sites	Sites.xls	29	Exchange
Contains Water Quality Field and Lab data	WQ Data	WQ Data.xls	49	Exchange



 http://www.ccamp.org/cademo/Data/Reports/Sites.htm

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   Sites

[Return to list of tables](#)

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Datum	The identifier for a geographic datum from a table of acceptable types	text	
DateEst	The date that a monitoring site was established	mm/dd/yy	1
Notes	Gernal comments	text	
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Contains Water Quality Field and Lab data	WQ Data	WQ Data.xls	49	Exchange



Address http://www.ccamp.org/cademo/Data/temp_Data/WQ_Data.xls

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R1C5	Sampler_Name																		
	1	2	3	4	10	11	18	20	21	22	23	24	25	26	27	28	29	30	
	ProjectID	SiteTag	SampleDate	SampleTime	SampleTypeCode	Lab	AnalysisDate	MatrixName	MethodName	AnalyteName	Unit	Basis	Result	ResultQualCode	SigFig	MDL	PQL	QACo	
2	R3_CMPNorth	306MOR	01/26/05	9:38	Grab	Field Measured	1/26/2005	Air	Therm01826	Air Temperature	Celsius		12.9 =			-88	0.1		
3	R3_CMPNorth	306MOR	02/16/05	8:20	Grab	Field Measured	2/16/2005	Air	Therm01826	Air Temperature	Celsius		15.4 =			-88	0.1		
4	R3_CMPNorth	306MOR	03/21/05	9:01	Grab	Field Measured	3/21/2005	Air	Therm01826	Air Temperature	Celsius		14.7 =			-88	0.1		
5	R3_CMPSouth	312SMA	01/27/05	7:40	FieldBlank	FGL	2/2/2005	Blankwater	SM 2540 C,E	Dissolved Solids, Total	mg/L		-3.8 ND			3.8	40		
6	R3_CMPNorth	309ALG	02/17/05	10:10	Grab	Field Measured	2/17/2005	Air	Therm01826	Air Temperature	Celsius		12.5 =			-88	0.1		
7	R3_CMPNorth	309ALG	03/22/05	13:00	Grab	Field Measured	3/22/2005	Air	Therm01826	Air Temperature	Celsius		11.9 =			-88	0.1		
8	R3_CMPNorth	309ASB	01/26/05	13:41	Grab	Field Measured	1/26/2005	Air	Therm01826	Air Temperature	Celsius		18.4 =			-88	0.1		
9	R3_CMPNorth	309ASB	02/16/05	14:20	Grab	Field Measured	2/16/2005	Air	Therm01826	Air Temperature	Celsius		19.2 =			-88	0.1		
10	R3_CMPNorth	309ASB	03/21/05	14:45	Grab	Field Measured	3/21/2005	Air	Therm01826	Air Temperature	Celsius		17.3 =			-88	0.1		
11	R3_CMPNorth	309BLA	01/26/05	14:29	Grab	Field Measured	1/26/2005	Air	Therm01826	Air Temperature	Celsius					-88	0.1		
12	R3_CMPNorth	309BLA	02/16/05	15:24	Grab	Field Measured	2/16/2005	Air	Therm01826	Air Temperature	Celsius					-88	0.1		
13	R3_CMPNorth	309BLA	03/21/05	15:50	Grab	Field Measured	3/21/2005	Air	Therm01826	Air Temperature	Celsius					-88	0.1		
14	R3_CMPSouth	312SMA	01/27/05	7:40	FieldBlank	FGL	2/8/2005	Blankwater	SM 4500 NH3 H	Ammonia as N, Total	mg/L					0.042	0.2		
15	R3_CMPNorth	309CRR	02/17/05	13:35	Grab	Field Measured	2/17/2005	Air	Therm01826	Air Temperature	Celsius					-88	0.1		
16	R3_CMPNorth	309CRR	03/22/05	11:19	Grab	Field Measured	3/22/2005	Air	Therm01826	Air Temperature	Celsius		20.2 =			-88	0.1		
17	R3_CMPNorth	309ESP	01/26/05	12:35	Grab	Field Measured	1/26/2005	Air	Therm01826	Air Temperature	Celsius		17.6 =			-88	0.1		
18	R3_CMPNorth	309ESP	02/16/05	12:33	Grab	Field Measured	2/16/2005	Air	Therm01826	Air Temperature	Celsius		19.8 =			-88	0.1		
19	R3_CMPNorth	309ESP	03/21/05	14:02	Grab	Field Measured	3/21/2005	Air	Therm01826	Air Temperature	Celsius		16.4 =			-88	0.1		
20	R3_CMPSouth	312SMA	01/27/05	7:40	FieldBlank	FGL	2/1/2005	Blankwater	SM 4500 NO3 F	Nitrate/Nitrite as N	mg/L		-0.014 ND			0.014	0.1		
21	R3_CMPNorth	309GAB	02/17/05	8:30	Grab	Field Measured	2/17/2005	Air	Therm01826	Air Temperature	Celsius		14.3 =			-88	0.1		
22	R3_CMPNorth	309GAB	03/22/05	14:16	Grab	Field Measured	3/22/2005	Air	Therm01826	Air Temperature	Celsius		11.4 =			-88	0.1		
23	R3_CMPNorth	309JON	01/26/05	15:31	Grab	Field Measured	1/26/2005	Air	Therm01826	Air Temperature	Celsius		14.5 =			-88	0.1		
24	R3_CMPNorth	309JON	02/16/05	17:16	Grab	Field Measured	2/16/2005	Air	Therm01826	Air Temperature	Celsius		15.9 =			-88	0.1		
25	R3_CMPNorth	309JON	03/21/05	16:36	Grab	Field Measured	3/21/2005	Air	Therm01826	Air Temperature	Celsius		13 =			-88	0.1		
26	R3_CMPNorth	309MER	01/26/05	11:20	Grab	Field Measured	1/26/2005	Air	Therm01826	Air Temperature	Celsius		16.6 =			-88	0.1		
27	R3_CMPNorth	309MER	02/16/05	11:31	Grab	Field Measured	2/16/2005	Air	Therm01826	Air Temperature	Celsius		18.7 =			-88	0.1		
28	R3_CMPNorth	309MER	03/21/05	11:50	Grab	Field Measured	3/21/2005	Air	Therm01826	Air Temperature	Celsius		19.4 =			-88	0.1		
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46																			

Could not find Unit
'Celsius' in lookup table
Units.xls

Data delivered using this format

- CCAMP data
- Ag program data
- Volunteer data (\$40 K grant)
- Grants projects (\$500 K grant)
- Data organized through outside grant through the Monterey Bay National Marine Sanctuary

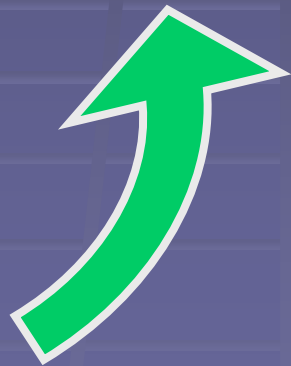
We have over 200,000 lines of data in this format!

Getting Data out of the Pile



Data format is compatible

- With SWAMP
- With CCAMP QA checker
- With CCAMP web site generator
- With CCAMP 303(d) listing tools



CCAMP QA Checker

- Direct upload from LIMS
- Electronic checking of
 - Matrix spike recoveries and duplicates
 - Laboratory duplicates
 - Field duplicates
 - Lab flag vocabulary
- Decision support for fitness of use
 - “acceptable”, “estimated”, or “rejected”

CCAMP Website Generator

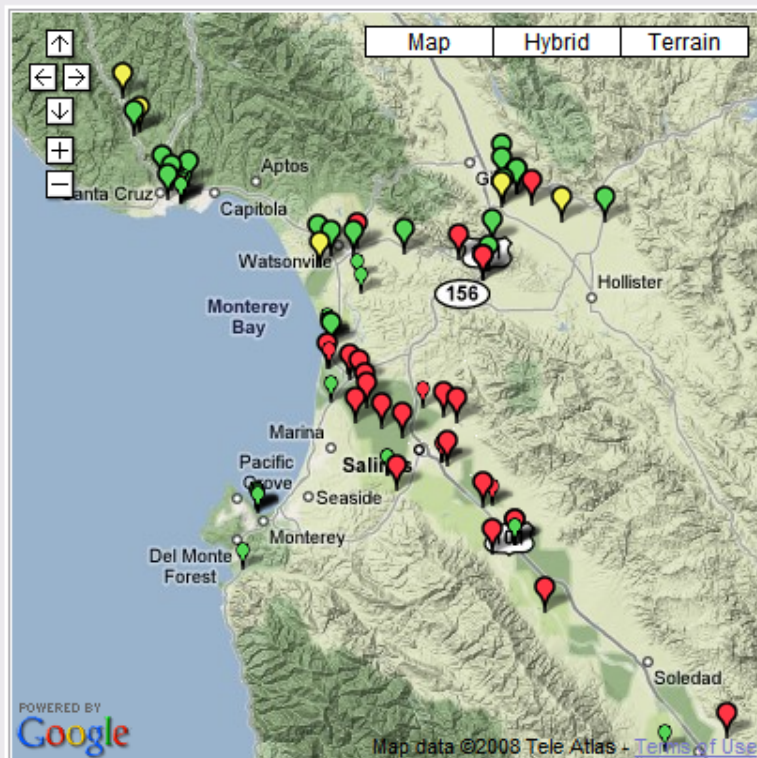
- Uses open source code
- Compatible with Google Earth, Google Maps, Yahoo maps
- Displays data from multiple projects
- Integrates land use information
- Can spawn websites for participating programs



Central Coast Ambient Monitoring Program

[California Environmental Protection Agency: Central Coast Water Board](#)

CCAMP Aquatic Toxicity Testing Data Survey



Watershed views: [Central Coast](#) [Monterey Bay area](#) [Santa Maria area](#) [Santa Lucia](#)

- No Toxic effects were found
- Only Sub-Lethal Toxic effects were found
- One or more Lethal Toxic effects were found

Data view selection criteria:

Year round view

Hide Land Cover

Only one sample was taken

Multiple samples were taken

Data used in this survey includes toxicity samples taken by multiple monitoring projects. Data from at least one sampling event from 191 monitoring sites in 106 central coast water bodies. Each monitoring project has its own monitoring design and therefore sample counts and test species vary among projects. The current CCAMP approach involves the collection of four types of toxicity tests at each site. In water samples; 1) An invertebrate species, 2) A fish species, 3) An algal species. In sediment samples 4) An invertebrate species.

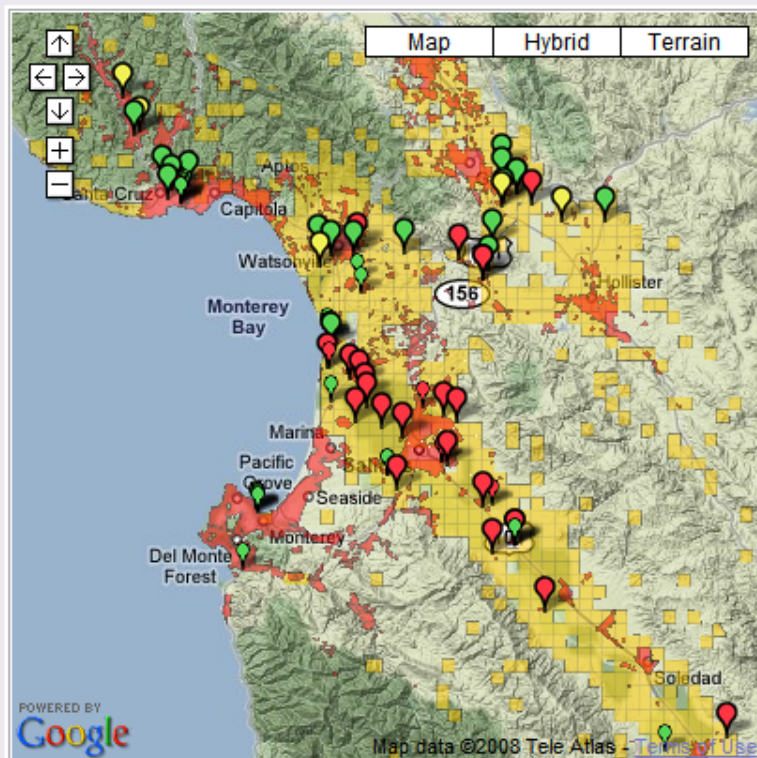
Monitoring site locations shown here have not undergone quality assurance review to establish their exact positions.



Central Coast Ambient Monitoring Program

[California Environmental Protection Agency: Central Coast Water Board](#)

CCAMP Aquatic Toxicity Testing Data Survey



Watershed views: [Central Coast](#) [Monterey Bay area](#) [Santa Maria area](#) [Santa](#)

- No Toxic effects were found
- Only Sub-Lethal Toxic effects were found
- One or more Lethal Toxic effects were found

Data view selection criteria:

Invertebrates in water

Year round view

Show Land Cover

Urban Areas

Pesticide Use Reports

Only one sample was taken

Multiple samples were taken

Data used in this survey includes toxicity samples taken by multiple monitoring projects. Data from at least one sampling event from 191 monitoring sites in 106 central coast water bodies. Each monitoring project has its own monitoring design and therefore sample counts and test species vary among projects. The current CCAMP approach involves the collection of four types of toxicity tests at each site. In water samples; 1) An invertebrate species, 2) A fish species, 3) An algal species. In sediment samples 4) An invertebrate species.

Monitoring site locations shown here have not undergone quality assurance review to establish their exact positions.

CCAMP 303(d) Listing Tools

- Scans data for exceedances
 - Applies site, water body, regional, state and national criteria
- Produces “Lines of Evidence”
 - Specific to analyte, beneficial use, water body and project
 - QA documentation
 - References on criteria, data used
 - Spatial and temporal representation

How does it do this?

- Sites and water bodies are cross-walked to beneficial uses and any specific criteria
- Analytes are cross-walked to criteria for specific beneficial uses
- Each criterion has attached source documentation
- All Projects have documentation on level of quality assurance

Lines of Evidence

Region	3
Waterbody Segment	Salinas Reclamation Canal
Pollutant	Ammonia as N, Unionized
Matrix	Water
Beneficial use(s)	Region 3 Aquatic Life
Water Quality Objective/Criteria	Central Coast Waterboard Basin Plan General Objective, Chapter III, Section II.A.2 General Objectives for Inland Surface Waters, Enclosed Bays, Estuaries.
Evaluation Guideline	Basin Plan General Objective (page III-4) states that the discharge of wastes shall not cause concentrations of unionized ammonia (NH₃) to exceed 0.025 mg/l (as N) in receiving waters.
Sample Count	25
Exceedance Count	7
Data References	Data for this assessment unit was collected by one monitoring project: CCAMP (Salinas)
Spatial Representation	Data for this line of evidence for Salinas Reclamation Canal was collected at 2 monitoring sites [309ALD-Salinas Reclamation Canal at Boranda Road, 309ALU-Salinas Reclamation Canal at Airport Road]
Temporal Representation	Data was collected over the time period 11/30/1999-12/12/2006
Water Body Specific Information	Staff is not aware of any special conditions that might effect interpretation of the data.
Data Quality Assessment	Excellent
QAPP Information	All data was collected following the Standard Operating Procedures and Data Quality Objectives outlined in the SWAMP QAMP, (Puckett, 2002).

Our data has generated over
6,000 Lines of Evidence for
303(d) and 305(b) uses

Incentives for Use

- Compatible with SWAMP data structures
- Simple tabular delivery format
- Reduces data management staffing because of web checker and other tools
- Web site provides incentive to play
- Puts project data in larger context
- Meets grant delivery requirements

Questions?

Karen Worcester

kworcester@waterboards.ca.gov

(805) 549-3333

