

Yurok Tribe Environmental Data Storage System:

Regional Tribal Mentoring Program
and Custom Database Development

Ken Fetcho – Yurok Tribe
Region IX WQX/STORET Tribal Workshop
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Tribal Mentoring Program

- Encourage Tribes to Pursue Exchange Network Funding
- Share YTEP's success story
- Provide input during proposal development
- Share custom database with Tribes

Why Pursue EN Funding?

- The Network provides an opportunity to streamline data handling (reducing staff time required to push data to EPA), share data within ecoregions, and improve the way Tribes evaluate and respond to changing environmental conditions that affect the health of their Nations.

Benefits to Tribes

- Everything the Yurok Tribe has done is available to any interested Tribe to build off of, utilize, or copy; we are interested in encouraging Tribes to improve their internal data handling processes as a primary use of the EN, with satisfaction of EPA's reporting requirements as a seamless component of that data management.

How YTEP Utilized EN Funds

- Developed Real-Time Monitoring Network
- Developed Custom Database (YEDSS) to transmit data to USEPA = node client
 - AQS
 - WQX
 - FRS
- Developed On-Line Data Portal

Data Storage & Analysis

➤ Old System:

- Excel-Based
- Required extensive work each year to analyze data and compose reports
- Resulted in numerous duplicate files and no security on unvalidated or validated data
- Data transfer to STORET or AQS extremely cumbersome

➤ YEDSS:

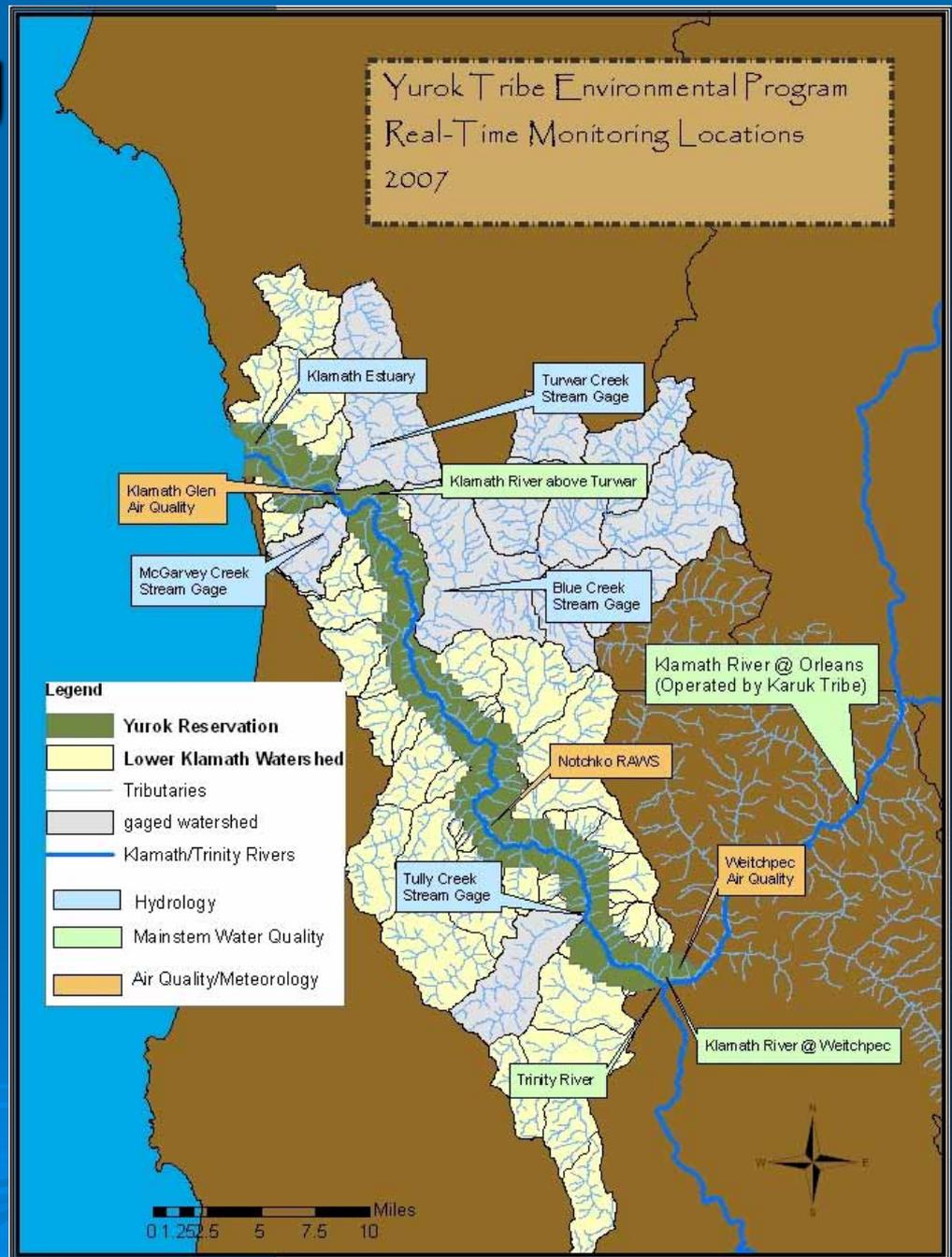
- Automates data validation
- Raw and validated data are segregated and protected
- Automates data summaries and charts for reports
- Pushes data manually to AQS and WQX
- Submits FRS data to CDX
- Stores metadata, QA data, and photos

Data Transmissions

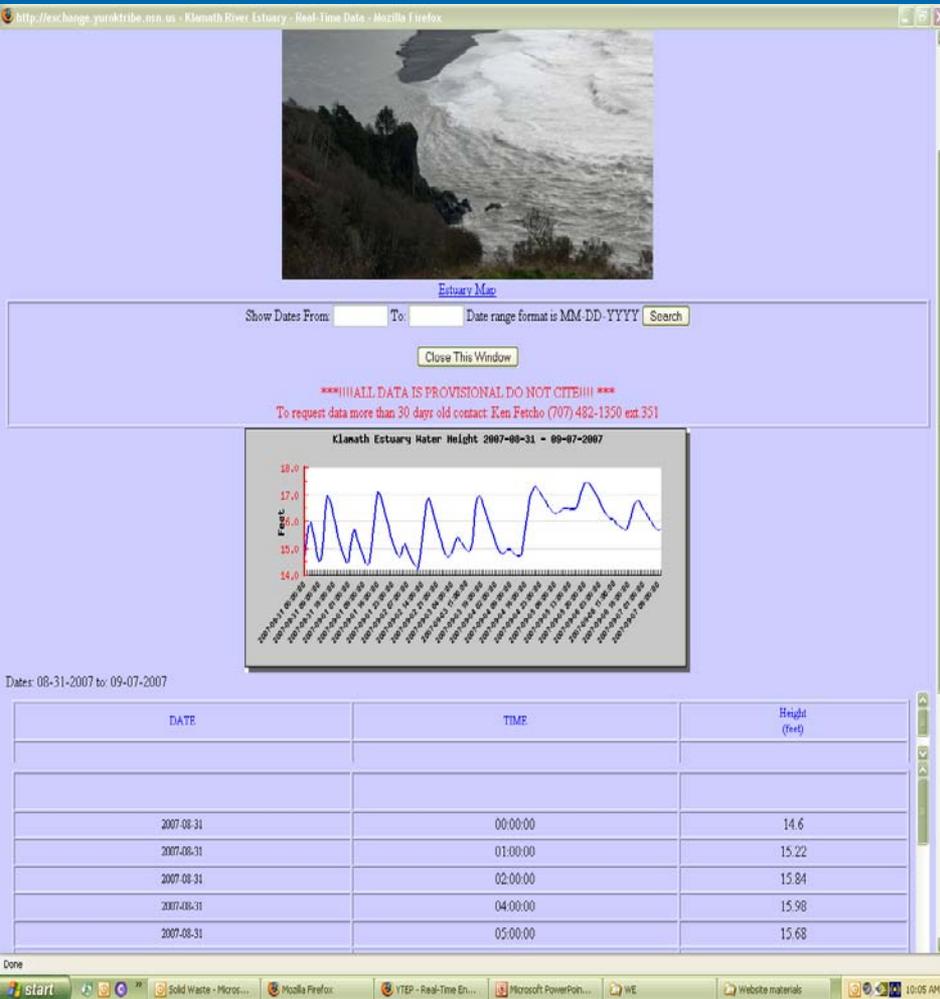
- Uploading air quality data to AQS using YEDSS since March of 2007
- The Yurok Tribe was the first entity in Region 9 to upload water quality data to STORET/WQX in August of 2007
- Transmitted FRS data to CDX October 2008
 - UST and Class V UIC well inventory

NEIEN Funding – Element One

- Enabled equipment purchase and establishment of Real-Time Water Quality Monitoring Network



Real-Time Data Delivery



- Developed Website to display real-time data
- Public can access hourly water and air quality data via internet
- YTEP staff uses network to monitor equipment status
- Scientists and managers use network to monitor current conditions

NEIEN Funding – Element Two

➤ YEDSS Water Quality Modules

- Grab Data (Bacteria, Nutrient, Metals) collection, validation, storage, analysis, and “push” to WQX
- Continuous Data collection, validation, storage, and analysis
- Hydrology Data collection, validation, storage, and analysis

The screenshot displays the YEDSS software interface, version 1.3.3, with the user logged in as 'cwatt'. The main menu includes 'Data View', 'Photos', 'Data Entry', 'Data Review', and 'LogBookViewer'. The 'Water Quality' module is active, showing a form for data entry. The form is divided into sections for 'Tot. Col.', 'Ecoli', and 'Enterococci'. Each section has a 'Result' field, a 'Reporting Limit' field, a 'Units' dropdown menu, and a 'Method' dropdown menu. The 'Tot. Col.' section has 'CFU' and '9223-B' selected. The 'Ecoli' section has 'count' and '9223-B' selected. The 'Enterococci' section has 'count' and an empty method dropdown. To the right of these sections are fields for 'SITE', 'DATE' (1/ 4/2007), 'TIME', 'STAFF', 'Lab', and 'Lab Date' (1/ 4/2007). A 'NOTES' section is a large empty text area. A 'Submit' button is at the bottom right. The status bar at the bottom left shows 'Status: '.

NEIEN Funding – Element Three

➤ YEDSS Air Quality Modules

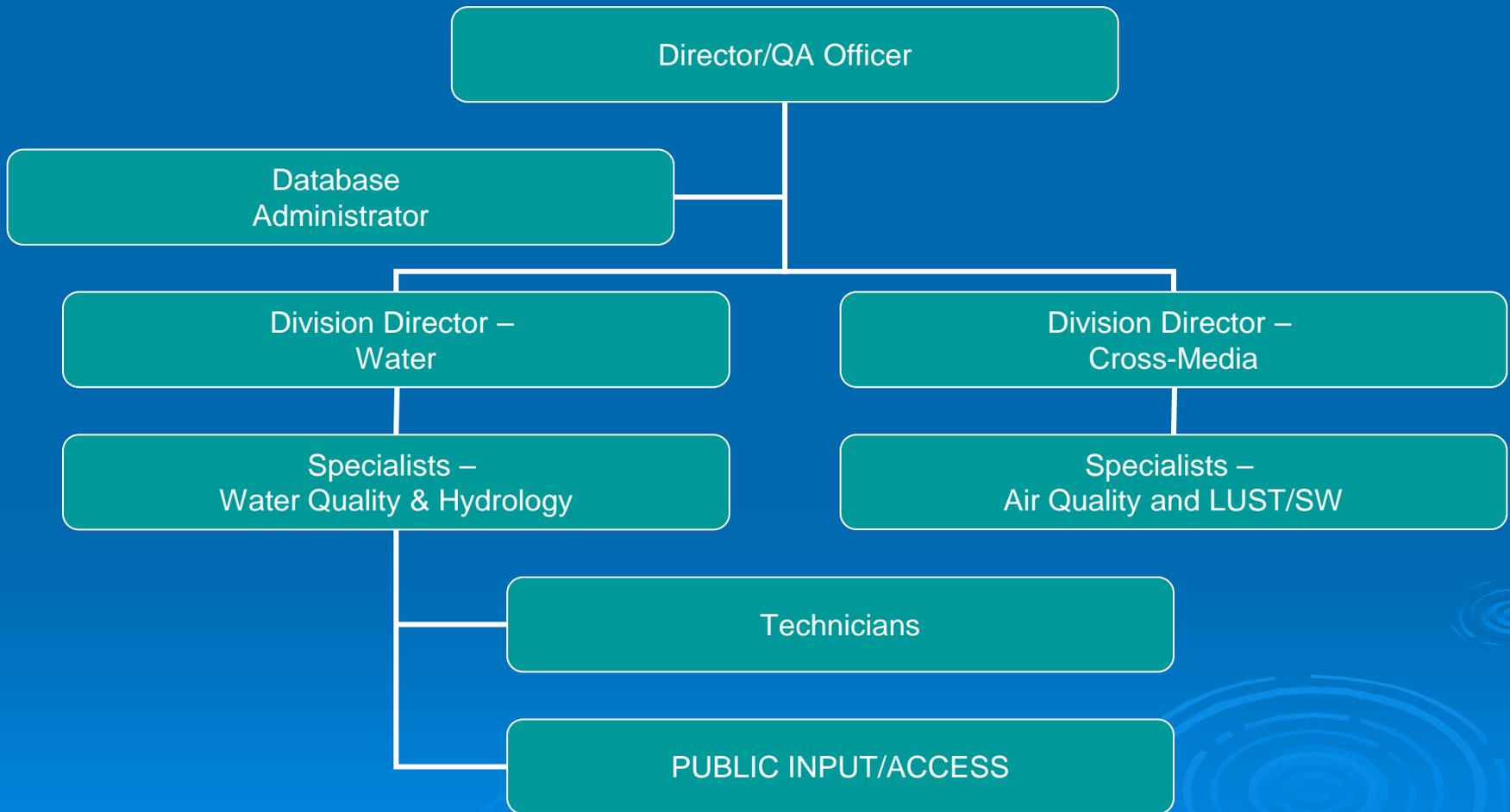
- Meteorological Data collection, validation, storage, analysis, and “push” to AQS
- Particulate Matter Data collection, validation, storage, analysis, and “push” to AQS



QA and Transmission

- All users have a security and access level
- Continuous data uploaded is auto-validated
- Data transferred to a “pending” log
- QA of at least 10% of data is required
- Data can be pushed from the pending log to the database by a higher level user
- Admin-level users can push data to WQX/AQS

YEDSS Security/Access Levels



Recent Accomplishments

- Transmitted Continuous WQ data to WQX
- Developed Geo-referenced Data Portal Leveraging Google Earth Technology
- Mentored multiple Regional 9 Tribes to develop data collection, management and transmission to USEPA

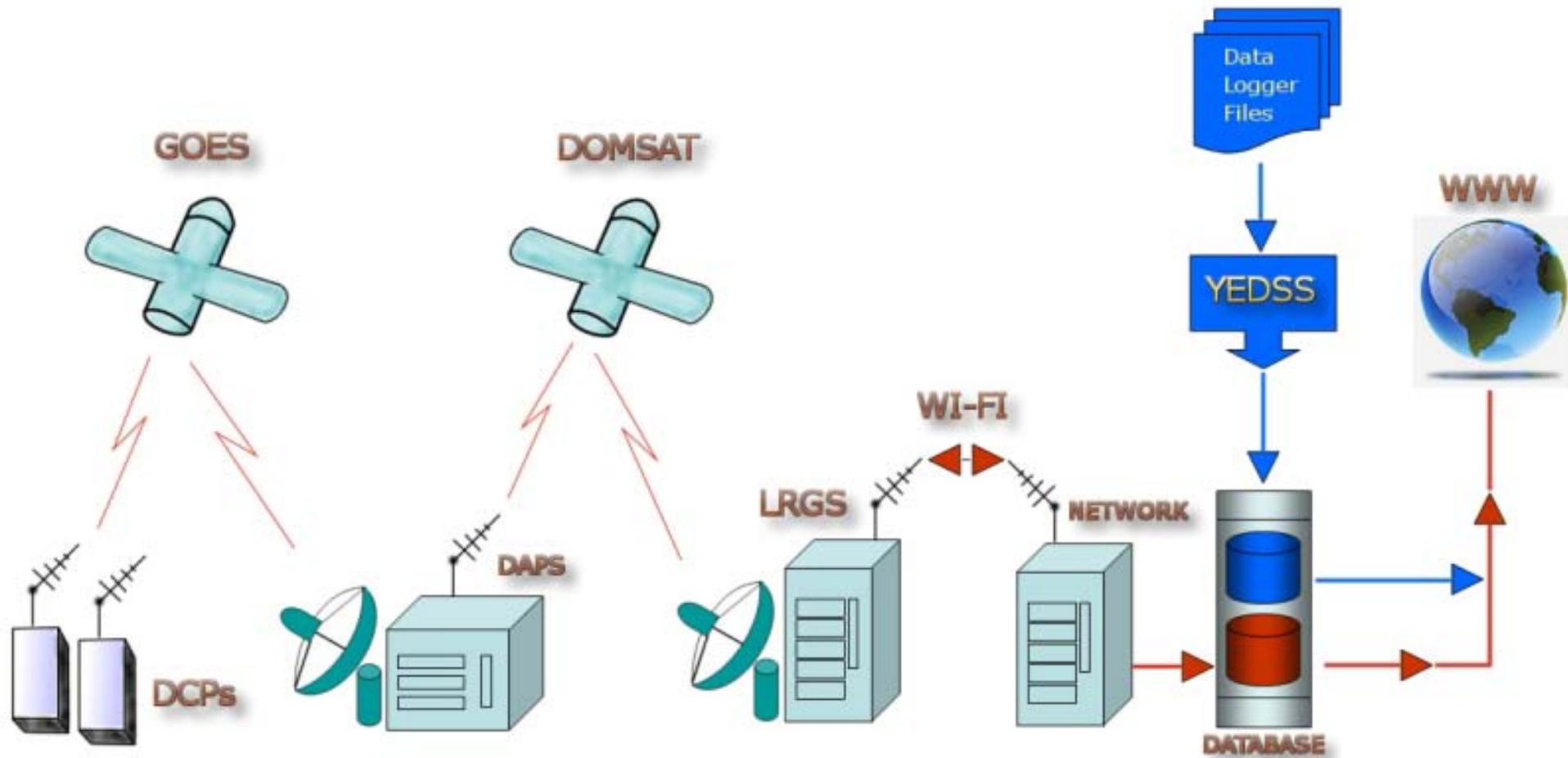
Advantages for Tribes

- YEDSS or similar program is useful for the Tribal program (validation, storage, analysis) as well as fulfilling the data upload requirements of EPA
- YEDSS is built using open-source code and a common programming language (SQL) – can be copied or modified by any programmer
- YEDSS has extensive quality-assurance and validation mechanisms automated – saves staff time; also has cutting-edge security measures to preserve data and protect system



Managing and Reporting Your Environmental Data

YTEP INFORMATION NETWORK



Data is transmitted from monitoring stations and posted on our internet website. Logger files are loaded into YEDSS

Data Types

- **Air Quality**
- **Water Quality**
- **Federal Registered Sites (FRS)**
 - **UST / UIC**

Water Quality

Sensor Parameters Currently Supported:

Water Temp
Specific Conductivity
Percent Dissolved Oxygen
Dissolved Oxygen (MG/L)
Dissolved Oxygen (CHARGE)
PH (Potential Hydrogen)
PH (Milivolts)
Battery Voltage
Salinity
Turbidity
Chlorophyll A
Blue-Green Algae

Water Quality

Over 2,900 Constituents Supported:

Nutrients

Bacteria

Macroinvertebrates

Pesticides

Metals

Algae

Log book entry tracking

The screenshot shows the YEDSS software interface. The title bar reads "YEDSS | admin | Login OK | Version 1.4.5". The menu bar includes "File", "Admin", and "Utils". The main window has several tabs: "Data View", "Photos", "Data Entry", "Data Review", and "LogBookViewer". Below these are sub-tabs for "Hydrology", "Air Quality", "Water Quality", "Bacteria", and "WQX Grab Data". The "Water Quality" section is active, showing fields for "Date" (10/ 5/2007), "Time", "Staff" (admin), "Station" (Select Station), "AT", "BP", "DataSonde Serial #", "DO Probe Removed", "DO Probe Replaced", and "Reference Sonde Serial #". To the right, there are sections for "Max YSI Info" (Deployment and Extraction) and "Data File Dates / Times" (Start and End). Below these is a "Pool Calibration" section with fields for "Initial Reading", "Calibrated to", "Pre-Clean Site", "Pre-Clean Ref.", and "TEMP". A "NOTES" field is also present. At the bottom, there is a "Select File Parsing Method" section with radio buttons for "Design Analysis Logger File With Header", "YSI Data File", "USGS Co-Location Site", "CSV", and "Hydrolab Data File". A "Calibration Date/Time" section includes checkboxes for "DO", "PH", and "SC", a date field (10/ 5/2007), and a time field (HH-MM-SS). Buttons for "- Select Data File -", "Set Header Size", and "Process Data" are visible. The status bar at the bottom left shows "Status: []".

- Data is entered through the log book entry system similar to the in field tech data sheets.
- Logs track data grades, equipment serial numbers, and staff notes about a site visit

Data Quality Objectives (Flags)

View / Edit Water Quality Flag Criteria

If Water temp is less than	5	or greater than	30
If water temp changes by	0.25	Between intervals	
If conductivity changes by	10	Between intervals	
If conductivity is less than	50		
If DO (mg/l) is less than	5	or greater than	12
If DO (mg/l) changes by	0.5	Between intervals	
If DO CHG is less than	25	or greater than	75
If PH changes by	0.25	Between intervals	
<input checked="" type="checkbox"/> Flag DO% if DO (mg/l) is flagged			
<input checked="" type="checkbox"/> Flag DO (mg/l) if DOCHG is flagged			
If SAL is less than	0	or greater than	600
If Turbidity is less than	0	or greater than	600
If Chl A is less than	0	or greater than	600

Settings last updated by: ken on 12/28/2006

Save Changes

- Setting your flagging criteria tells YEDSS how to flag your continuous data.

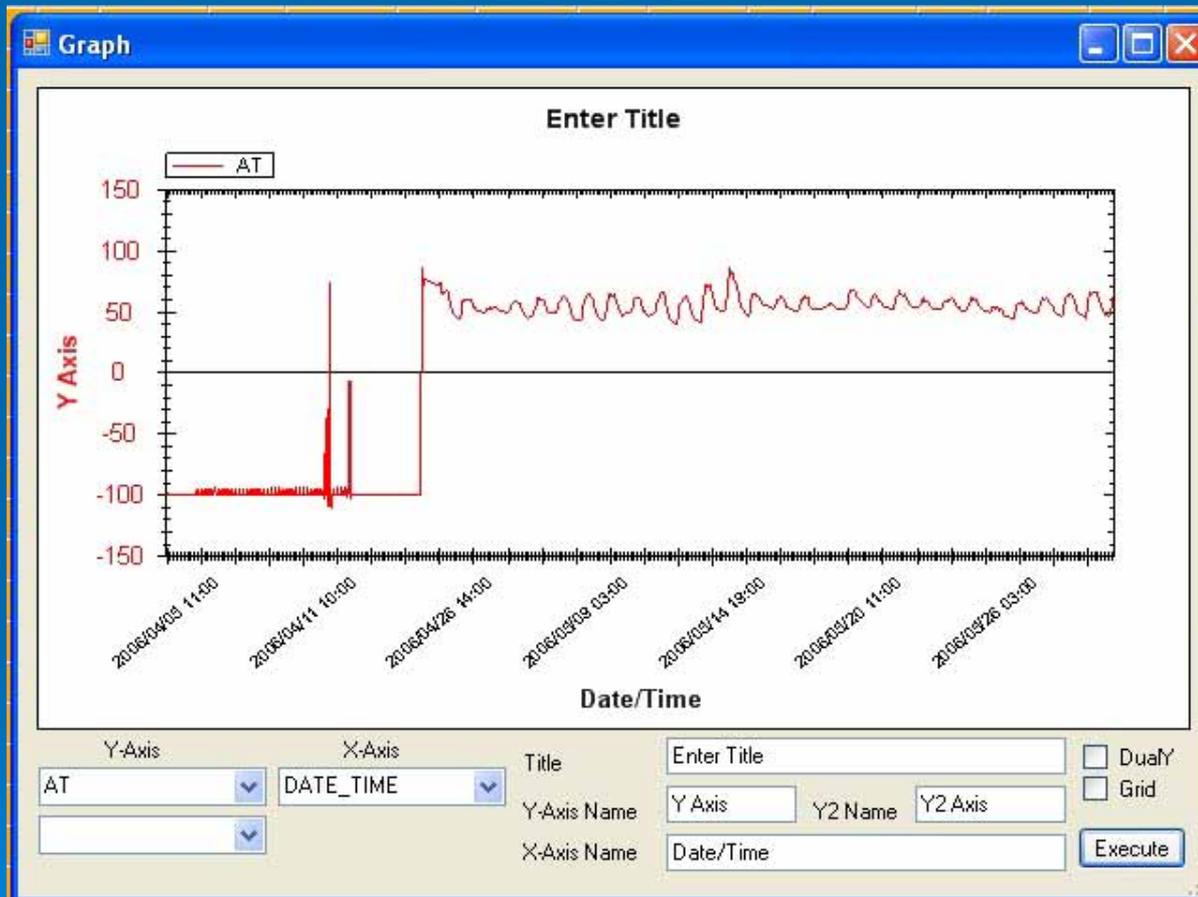
Review your results to find broken or malfunctioning sensors

C	DATE	TIME	tmFlag	HEIGHT	hFlag	AIRTEMP	atFlag	BATTYV	bvFlag
/EY	4/19/2006	12:15:00	<input type="checkbox"/>	2.00	<input type="checkbox"/>	23.58	<input type="checkbox"/>	14.02	<input type="checkbox"/>
/EY	4/19/2006	12:30:00	<input type="checkbox"/>	1.97	<input type="checkbox"/>	24.59	<input type="checkbox"/>	14.10	<input type="checkbox"/>
/EY	4/19/2006	12:45:00	<input type="checkbox"/>	2.00	<input type="checkbox"/>	23.56	<input type="checkbox"/>	14.10	<input type="checkbox"/>
/EY	4/19/2006	13:00:00	<input type="checkbox"/>	2.00	<input type="checkbox"/>	23.24	<input type="checkbox"/>	14.02	<input type="checkbox"/>
/EY	4/19/2006	13:15:00	<input type="checkbox"/>	2.00	<input type="checkbox"/>	23.36	<input type="checkbox"/>	14.10	<input type="checkbox"/>
/EY	4/19/2006	13:30:00	<input type="checkbox"/>	1.98	<input type="checkbox"/>	24.06	<input type="checkbox"/>	14.02	<input type="checkbox"/>
/EY	4/19/2006	13:45:00	<input type="checkbox"/>	1.99	<input type="checkbox"/>	24.93	<input type="checkbox"/>	13.94	<input type="checkbox"/>
/EY	4/19/2006	14:00:00	<input type="checkbox"/>	1.99	<input type="checkbox"/>	25.68	<input type="checkbox"/>	14.02	<input type="checkbox"/>
/EY	4/19/2006	14:15:00	<input type="checkbox"/>	1.99	<input type="checkbox"/>	25.00	<input type="checkbox"/>	14.02	<input type="checkbox"/>
/EY	4/19/2006	14:30:00	<input type="checkbox"/>	2.01	<input type="checkbox"/>	25.06	<input type="checkbox"/>	14.02	<input type="checkbox"/>
/EY	4/19/2006	14:45:00	<input type="checkbox"/>	2.00	<input type="checkbox"/>	25.21	<input type="checkbox"/>	13.94	<input type="checkbox"/>
/EY	4/19/2006	15:00:00	<input type="checkbox"/>	1.99	<input type="checkbox"/>	25.29	<input type="checkbox"/>	13.94	<input type="checkbox"/>
/EY	4/19/2006	15:15:00	<input type="checkbox"/>	2.00	<input type="checkbox"/>	25.19	<input type="checkbox"/>	13.78	<input type="checkbox"/>
/EY	4/19/2006	15:30:00	<input type="checkbox"/>	1.99	<input type="checkbox"/>	25.88	<input type="checkbox"/>	13.78	<input type="checkbox"/>
/EY	4/19/2006	15:45:00	<input type="checkbox"/>	1.99	<input type="checkbox"/>	25.55	<input type="checkbox"/>	14.02	<input type="checkbox"/>
/EY	4/19/2006	16:00:00	<input type="checkbox"/>	2.00	<input type="checkbox"/>	25.24	<input type="checkbox"/>	13.86	<input type="checkbox"/>
/EY	4/19/2006	16:15:00	<input type="checkbox"/>	1.97	<input type="checkbox"/>	24.94	<input type="checkbox"/>	13.70	<input type="checkbox"/>
/EY	4/19/2006	16:30:00	<input type="checkbox"/>	1.99	<input type="checkbox"/>	24.65	<input type="checkbox"/>	13.86	<input type="checkbox"/>
/EY	4/19/2006	16:45:00	<input type="checkbox"/>	2.00	<input type="checkbox"/>	24.35	<input type="checkbox"/>	14.02	<input type="checkbox"/>
/EY	4/19/2006	17:00:00	<input type="checkbox"/>	1.99	<input type="checkbox"/>	24.03	<input type="checkbox"/>	13.63	<input type="checkbox"/>

13533 Rows of data
42 Item Flags
OK

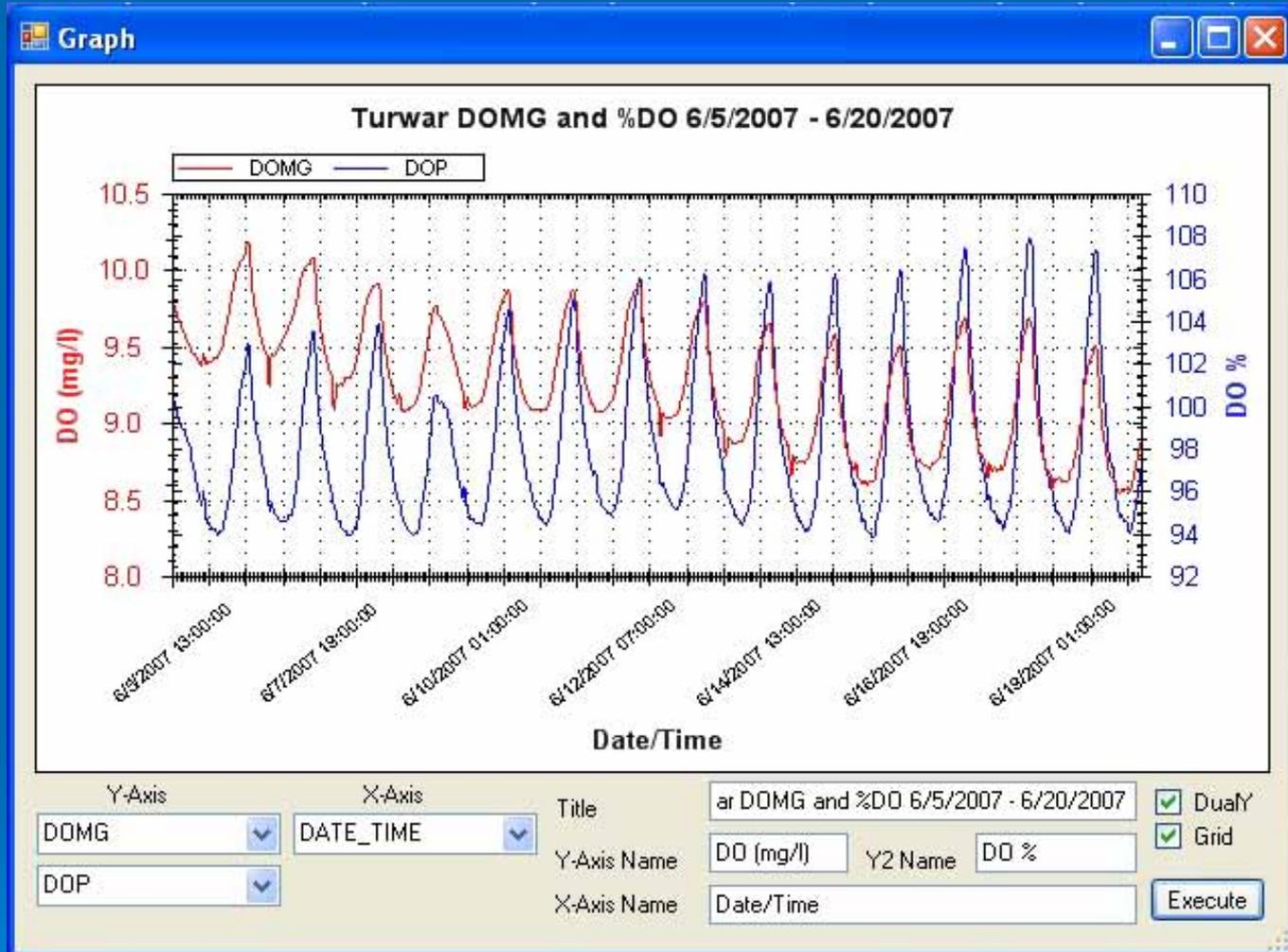
➤ Set or remove flags manually and save them for review.

Spot data errors visually



- Quickly graph data to help you make decisions about data flags.

Quickly graph your data to see trends



- The graph has many functions to aid the visual representation of your data such as dual axis and export functions.

Supervisors required to review data before it goes into the archive

The screenshot shows the YEDSS software interface. The title bar indicates 'YEDSS | cwatt | Login OK | Version 1.3.3'. The menu bar includes 'File', 'Admin', and 'Utils'. The main window has tabs for 'Data View', 'Photos', 'Data Entry', 'Data Review', and 'LogBookViewer'. Under 'Data Review', there are sub-tabs for 'Hydrology', 'Meteorology', and 'Water Quality'. The 'Pending Log Entries' table shows one entry for 1/5/2007 at 12:00 at station MCGARVEY, staff cwatt, with a gage height of 1 and staff height of 1. Below this, a detailed table lists entry elements and their values, including flags like 'DATA_DOWNLOADED' (YES) and 'NEW_ENTRY' (YES). Buttons for 'View Data', 'Finalize', and 'Kill Entry' are visible on the right.

Pending Log Entries								
VISIT_DATE	VISIT_TIME	STATION	STAFF	GAGE_HEIGHT	STAFF_HEIGHT	HEIGHT_CHANG	NEW_GAGE_HE	DATA_I
1/5/2007	12:00	MCGARVEY	cwatt	1	1	NO		YES

ENTRY ELEMENT	ENTRY VALUE
VISIT_DATE	1/5/2007 00:00:00
VISIT_TIME	12:00
STATION	MCGARVEY
STAFF	cwatt
GAGE_HEIGHT	1
STAFF_HEIGHT	1
HEIGHT_CHANGED	NO
NEW_GAGE_HEIGHT	
DATA_DOWNLOADED	YES
FIRST_READING	4/19/2006,12:15:00
LAST_READING	5/4/2006,13:15:00
NOTES	
NEW_ENTRY	YES

- Review data entered by your interns or technicians.
- You can view the flags and even know what has been changed.

Query your archive

The screenshot shows the QueryTool interface with the following components:

- Save / Load Query:** Query Name: [] Save Load Query: [] My Queries Delete Query
- SOURCE INFORMATION:** Database: yedss Table(s): hydro, met, wq, bac_temp, flow Show All Tables
- FIELD SELECTION:** Available Fields: wq.batty, wq.chla, wq.chlaf, wq.date_time, wq.docf, wq.docfg, wq.dof, wq.domf, wq.domg Selected Fields: wq.siteid, wq.domg, wq.dop, wq.ph
- CONDITIONS:** wq.siteid AND OR N/A ADD OPERATOR = WHERE wq.siteid = 'KBW' COMPARE Field CLEAR CONDITIONS CLEAR SORT(S) SORTING wq.siteid wq.siteid
- Data Table:**

siteid	domg	dop	ph
KBW	10.4	103.3	8.18
KBW	10.32	102.5	8.03
KBW	10.23	101.5	8.06
KBW	10.22	101.4	8.09
KBW	10.21	101.3	8.11
KBW	10.21	101.3	8.11
KBW	10.19	101	8.13
KBW	10.17	100.9	8.13
KBW	10.17	100.9	8.13
KBW	10.15	100.6	8.13
KBW	10.15	100.6	8.13
KBW	10.15	100.5	8.13
KBW	10.14	100.4	8.12
KBW	10.11	100	8.13
KBW	10.14	100.2	8.12
KBW	10.13	100	8.12
KBW	10.13	100	8.11
KBW	10.13	99.8	8.11

Submit Query Submit Manual Query SELECT wq.siteid,wq.domg, Graph Export Grid Data Include Header Export Delimiter # Records 7316

- Respond to data requests in minutes instead of searching through data files or Excel sheets.

Query your log entries

The screenshot shows the QueryTool interface. At the top, the 'Save / Load Query' section has a 'Query Name' field and a 'Save' button. The 'Load Query' dropdown is set to 'WE grades'. Below this are three main panels: 'SOURCE INFORMATION', 'FIELD SELECTION', and 'CONDITIONS'. The 'SOURCE INFORMATION' panel shows the database 'yedss' and a list of tables including 't1', 't2', 'transmission_log', 'vaisala_temp', and 'wq'. The 'FIELD SELECTION' panel shows 'Available Fields' and 'Selected Fields'. The 'CONDITIONS' panel shows a condition: 'WHERE wq_log_book.station = 'WE''. Below these panels is a table of log entries with columns: deploy_datetime, extract_datetime, grade_cond, grade_do, grade_ph7, and grade_temp. The table contains 20 rows of data. At the bottom, there are buttons for 'Submit Query', 'Submit Manual Query', 'SELECT wq_log_book.deplo', 'Graph', 'Export Grid Data', 'Include Header', 'Export Delimiter', and '# Records: 176'.

deploy_datetime	extract_datetime	grade_cond	grade_do	grade_ph7	grade_temp
5/17/2006 12:30 PM	6/2/2006 12:02 PM	A	B	A	
6/2/2006 2:30 PM	6/7/2006 1:50 PM	A	I	A	
6/7/2006 3:00 PM	6/13/2006 4:30 PM	A	A	A	
6/27/2006 5:30 PM	7/11/2006 11:00 AM	A	A	A	
7/11/2006 1:30 PM	7/25/2006 9:00 AM	A	A	A	
7/25/2006 11:00 AM	8/8/2006 2:00 PM	A	A	A	
8/8/2006 4:00 PM	8/22/2006 2:00 PM	A	A	A	
8/22/2006 3:00 PM	9/6/2006 1:00 PM	A	A	A	
6/13/2006 7:00 PM	6/27/2006 3:00 PM	A	A	A	
9/6/2006 2:30 PM	9/19/2006 12:00 PM	A	A	A	
9/19/2006 1:30 PM	10/3/2006 12:00 PM	A	A	A	
5/17/2006 12:30 PM	6/2/2006 12:02 PM	A	B	A	
6/2/2006 2:30 PM	6/7/2006 1:50 PM	A	I	A	
6/7/2006 3:00 PM	6/13/2006 4:30 PM	A	A	A	
6/27/2006 5:30 PM	7/11/2006 11:00 AM	A	A	A	
7/11/2006 1:30 PM	7/25/2006 9:00 AM	A	A	A	
7/25/2006 11:00 AM	8/8/2006 2:00 PM	A	A	A	
8/8/2006 4:00 PM	8/22/2006 2:00 PM	A	A	A	

- Information such as data grades and equipment changes can be useful for graphs and reports.

Reports and Tools

- Daily Min / Max / Average for continuous data

Min/Max/Avg

SITEID	DATE	WTEMP_MIN	WTEMP_MAX	WTEMP_AVG	SC_MIN	SC_MAX	SC_AVG	DOP_MIN
KBW	5/17/2006	13.55	14.5	14.16	89	91	89.69	101.1
KBW	5/18/2006	13.57	14.43	14.04	85	88	86.15	100.8
KBW	5/19/2006	12.87	14.21	13.51	85	87	86.09	100.6
KBW	5/20/2006	12.29	12.95	12.65	84	87	85.34	100.9
KBW	5/21/2006	12.78	13.16	13.00	88	91	89.28	99.9
KBW	5/22/2006	12.64	13.35	12.98	91	93	92.09	99.3
KBW	5/23/2006	12.56	13.02	12.78	90	99	94.30	99.8
KBW	5/24/2006	12.02	12.62	12.23	92	98	94.89	100.6
KBW	5/25/2006	12.09	12.47	12.23	91	95	92.91	100.1
KBW	5/26/2006	11.92	12.33	12.22	95	106	99.94	99.3
KBW	5/27/2006	11.46	12.24	11.82	102	103	102.17	98.9
KBW	5/28/2006	11.62	13	12.16	103	107	104.98	99.4
KBW	5/29/2006	12.48	13.98	13.16	107	110	108.11	99.2
KBW	5/30/2006	12.93	14.48	13.64	109	112	109.85	99

Graph Export To CSV

Report your validated data to EPA

Flagged data is not reported to AQS or WQX

WQX XML TOOL

Load Data From Archive

From: Date: 3/12/2004 Time: To: Date: 2/ 8/2007 Time: KR below WT **Get Data**

Data View

SITE	DATE_TIME	TC_RESULT	TC_LIMIT	TC_UNITS	TC_METHOD	ECOLI_RESULT	ECOLI_LIMIT	EA
KR below WTP	3/12/2004 09:05:00	295	10	count	9223-B	ND	10	co
KR below WTP	4/23/2004 08:03:00	226	10	count	9223-B	ND	10	co
KR below WTP	5/18/2004 11:10:00	546	10	count	9223-B	30	10	co
KR below WTP	6/10/2004 06:57:00	161	10	count	9223-B	ND	10	co
KR below WTP	7/20/2004 07:13:00	1374	10	count	9223-B	20	10	co
KR below WTP	8/17/2004 07:25:00	2613	10	count	9223-B	ND	10	co
KR below WTP	9/14/2004 06:52:00	2933	10	count	9223-B	10	10	co
KR below WTP	10/27/2004 10:46:00	2863	10	count	9223-B	20	10	co
KR below WTP	11/30/2004 12:15:00	275	10	count	9223-B	ND	10	co
KR below WTP	1/31/2005 10:23:00	86	10	count	9223-B	ND	10	co
KR below WTP	2/24/2005 14:45:00	41	10	count	9223-B	31	10	co
KR below WTP	4/7/2005 15:38:00	384	10	count	9223-B	10	10	co
KR below WTP	5/13/2005 09:45:00	512	10	count	9223-B	31	10	co
KR below WTP	6/21/2005 09:06:00	309	10	count	9223-B	ND	10	co
KR below WTP	7/27/2005 07:01:00	4100	10	count	9223-B	10	10	co

Fields To Export

TC Ecoli Enterococci >> > TC Ecoli Enterococci << <

Activity: Bacteria Sampling

Monitoring Location: KR below WTP

Export To WQX XML File

Utilities

WQX Sample Prep MetaData

WQX Activity Manager

WQX Monitoring Location Manager

Transmission Log

	tdate	tuser	media	sitenic	start_date_time	end_date_time	destination
	3/27/2007	cwatt	Bacteria	KR above WTP	3/6/2006 12:50 PM	2/28/2007 2:49 PM	WQX
	3/29/2007	cwatt	Bacteria	KR above WTP	3/6/2006 12:50 PM	2/28/2007 2:49 PM	WQX
	3/29/2007	micah	Air	WEITCHPEC	10/1/2006	1/1/2007	AQS
	6/26/2007	cwatt	Bacteria	KE	3/12/2004 9:17 AM	2/28/2007 2:10 PM	WQX
	7/23/2007	micah	Air	WEITCHPEC	1/1/2007	3/31/2007 11:00 PM	AQS
	7/26/2007	cwatt	Bacteria	KR below WTP	3/12/2004 9:05 AM	2/28/2007 2:30 PM	WQX
▶	7/26/2007	cwatt	Bacteria	KR above WTP	3/12/2004 8:50 AM	2/28/2007 2:49 PM	WQX
	8/14/2007	micah	Air	WEITCHPEC	1/1/2007	3/31/2007	AQS
	8/17/2007	cwatt	Bacteria	KE	3/12/2004 9:17 AM	2/28/2007 2:10 PM	WQX
	8/20/2007	cwatt	Bacteria	TR	12/17/2003 12:10 PM	1/25/2006 12:48 PM	WQX
	8/20/2007	cwatt	Bacteria	TG	12/17/2003 8:45 AM	1/25/2006 10:26 AM	WQX
	8/20/2007	cwatt	Bacteria	TC	1/25/2006 11:55 AM	1/25/2006 11:55 AM	WQX
	8/20/2007	cwatt	Bacteria	WE	12/17/2003 11:45 AM	1/25/2006 12:50 PM	WQX

\$\$ Exchange Network \$\$

- Funding assists Tribes in meeting data reporting requirements
- Assists Tribes in updating data management systems and making data available to a wide audience – information is power

Ken Fetcho – YTEP

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