City of San Diego Analyzes Ocean Data with Dynamic GIS Tools

Leveraging Web 2.0 Technology

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What we will cover today

- Who we are
- What we do
- BioMap Overview
  - Purpose
  - Architecture
  - User Interface
    - Tools
    - Data Inspectors
      - CTD
      - Bacteriology
      - Benthic communities
- Summary & Future Directions...

All in 30 minutes...

The City of San Diego
Wastewater System and Facilities

- Wastewater collection
    - 1.3 million people

- Advanced primary treatment and disposal for 15 municipalities
    - 2.2 million people

- Treatment Plants = 4

- Volume of wastewater treated
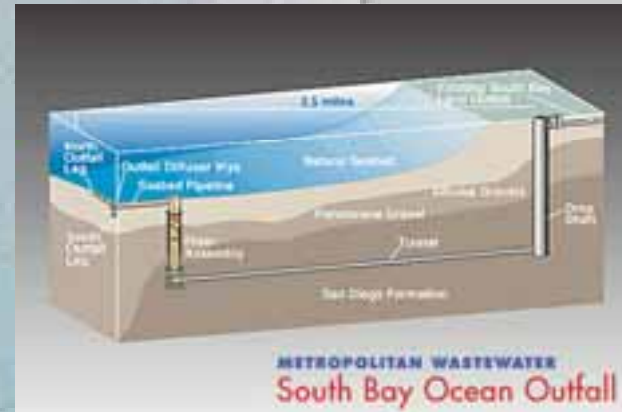   - 62,000,000,000 gallons / year

City of San Diego
Public Utilities Department
Environmental Monitoring &
Technical Services Division (EMTS)
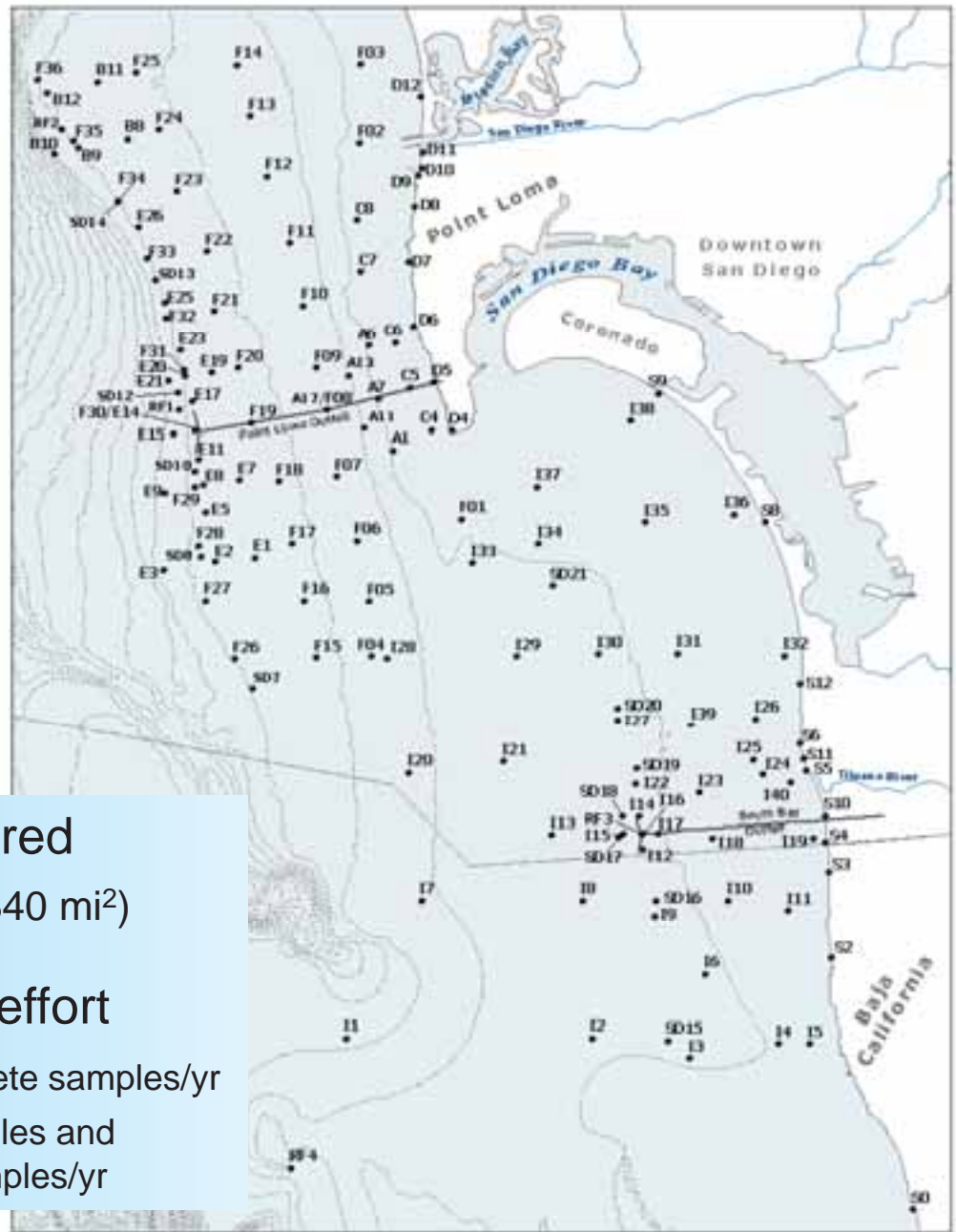

Point Loma WTP

Point Loma (PL) Ocean Outfall

- Since 1963
- extended in 2003
- now ~7.2 km long   (4.5 mi)
- discharges ~175 MGD
- @ depth of 100m   (320 ft)

South Bay (SB) Ocean Outfall

- Since 1999
- ~5.6 km long   (3.5 mi)
- discharges ~20 MGD
- @ depth of 27m (90 ft)

Total area covered

~880 km² (~340 mi²)

Total sampling effort

7,838 – total discrete samples/yr

26,178 – total samples and subsamples/yr

Ocean Monitoring Program Research Data

NPDES Permit Reqs

- Bacteriology / Beach Closures

- Water quality (CTD)

- Sediment contaminants

- Benthic communities

- Fish size & abundance

- Bioaccumulation

- Toxicology

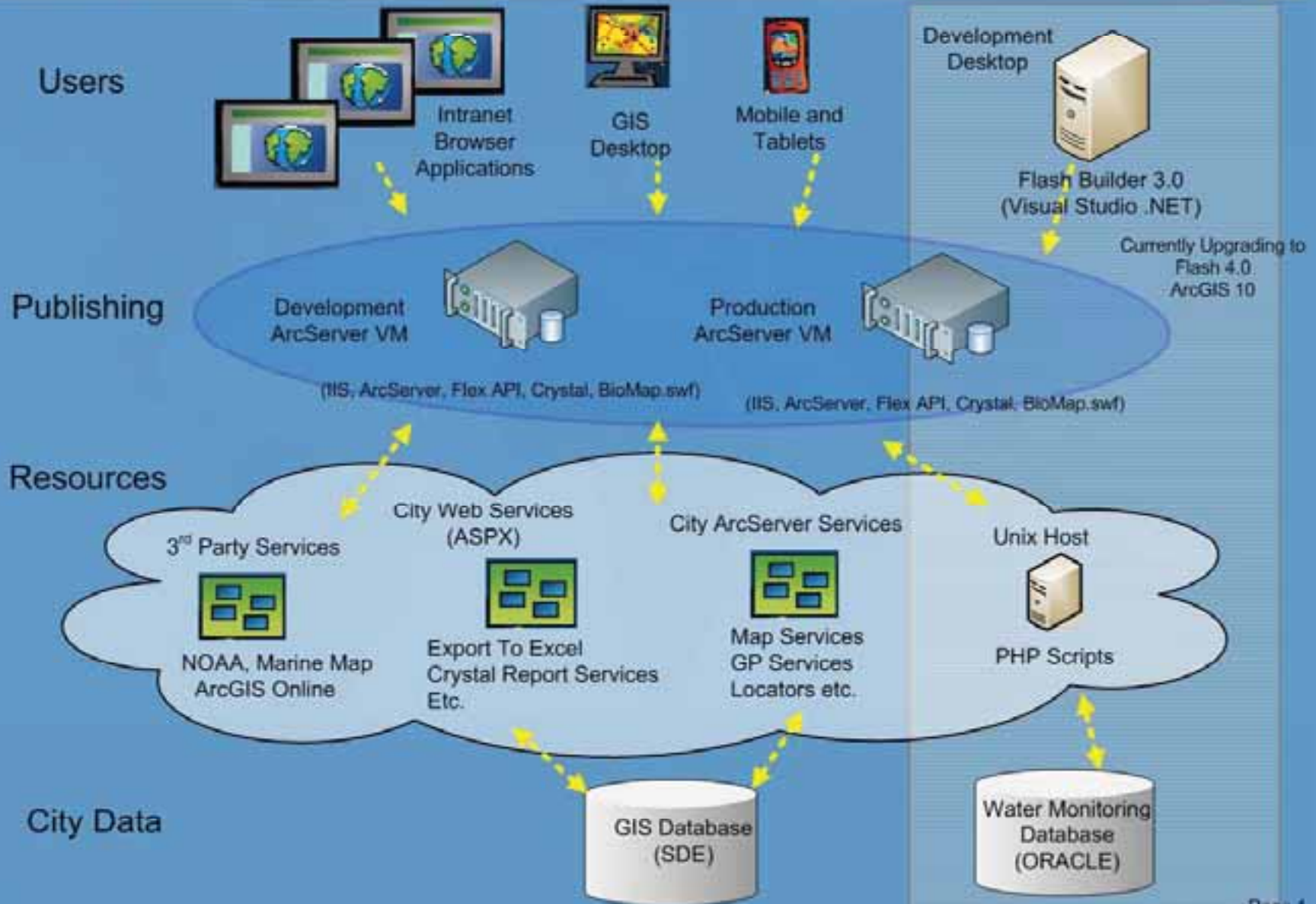- Moored Observation System (2006)

- Remote Sensing (2002)

BioMap

- All staff can dynamically analyze data
  – Instant feedback loop

- Huge dataset with many parameters and conditions

- Results for on-the-fly queries

- Trends, History and Outliers

Exploration

- Rapid data overlay

- Flexible Queries

- Direct Link to Oracle database

- Printing, Exporting to Excel, and Reporting

- Spatial Distribution Statistics

BioMap Infrastructure

Users

Intranet Browser Applications

GIS Desktop

Mobile and Tablets

Development Desktop

Flash Builder 3.0 (Visual Studio .NET)

Currently Upgrading to Flash 4.0. ArcGIS 10

Publishing

Development ArcServer VM

Production ArcServer VM

(IIS, ArcServer, Flex API, Crystal, BioMap.swf)

(IIS, ArcServer, Flex API, Crystal, BioMap.swf)

Resources

3rd Party Services

City Web Services (ASPX)

City ArcServer Services

Unix Host

NOAA, Marine Map ArcGIS Online

Export To Excel Crystal Report Services Etc.

Map Services GP Services Locators etc.

PHP Scripts

City Data

GIS Database (SDE)

Water Monitoring Database (ORACLE)

Page 1

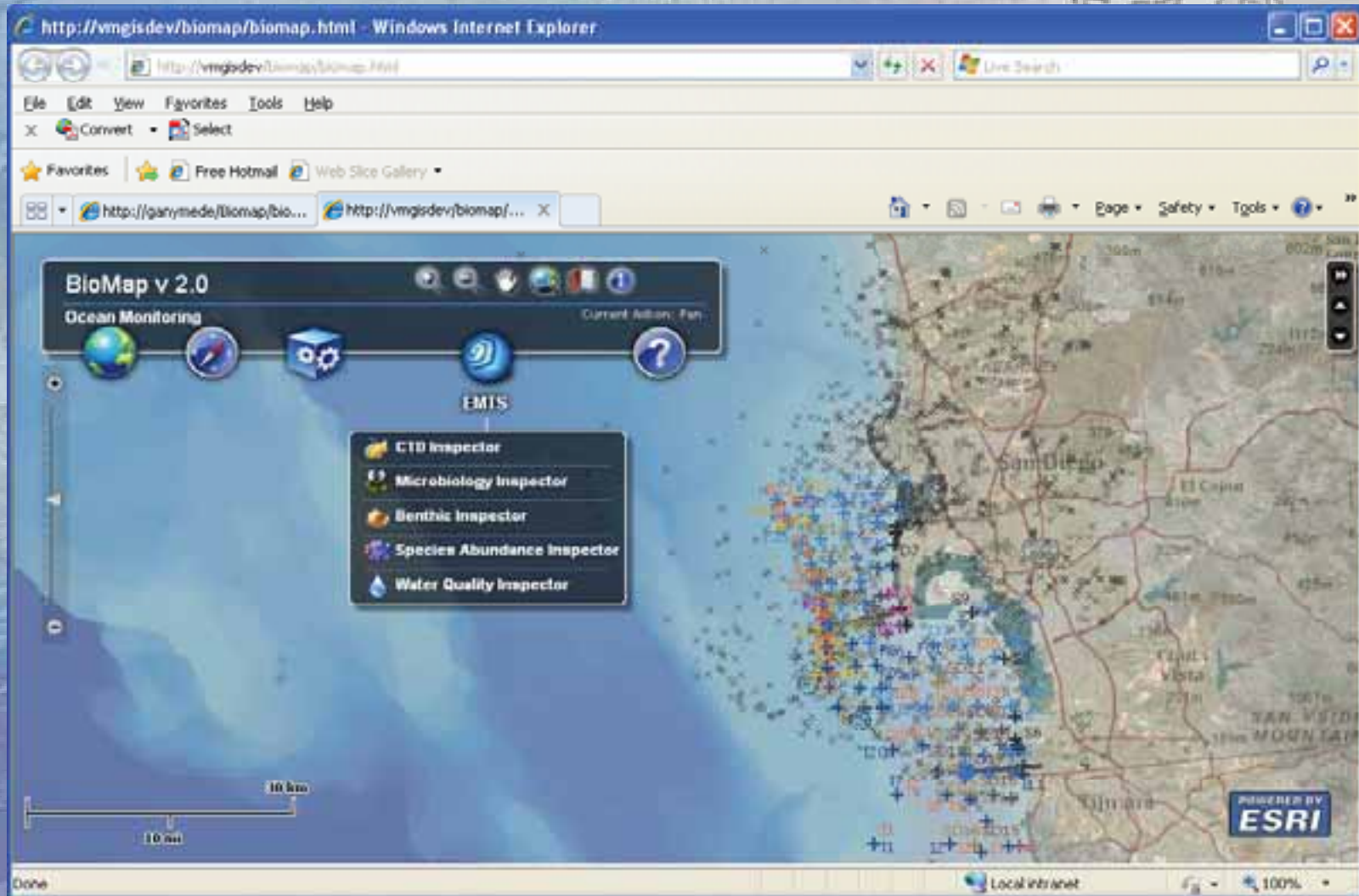# Standard GIS Tools

Cached templates

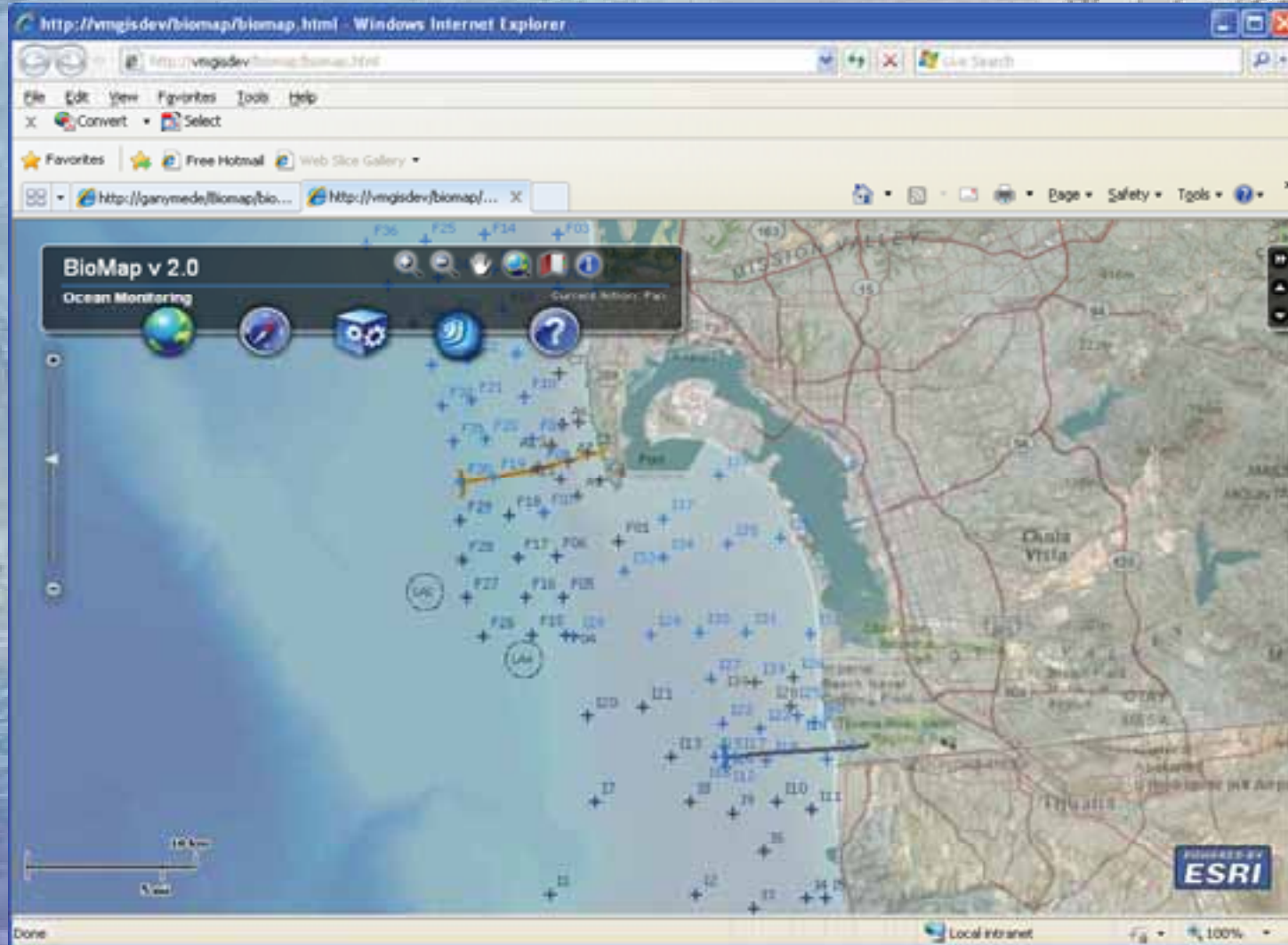# Mash-Up of Local and National, Current and Historical Map Data
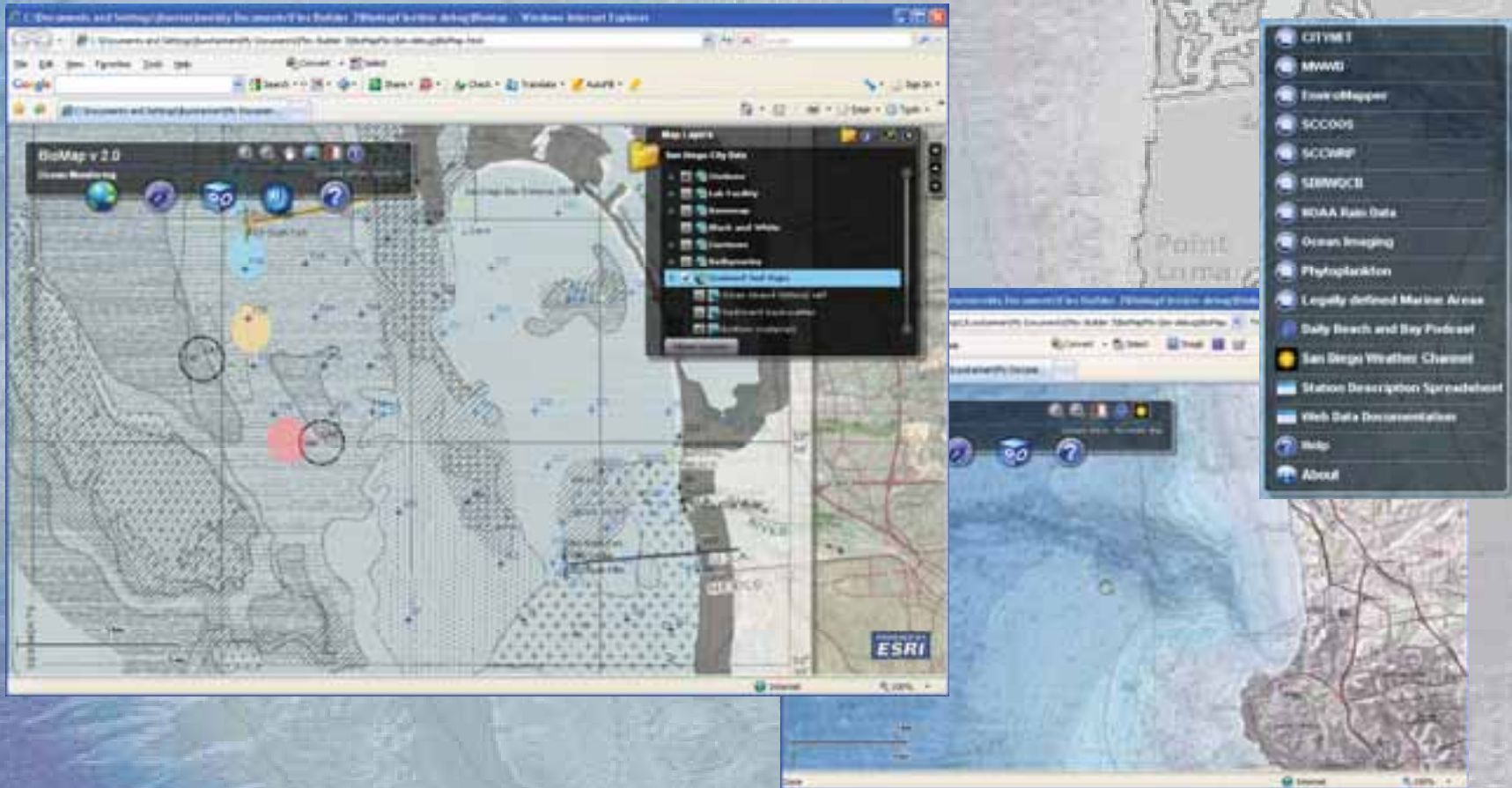
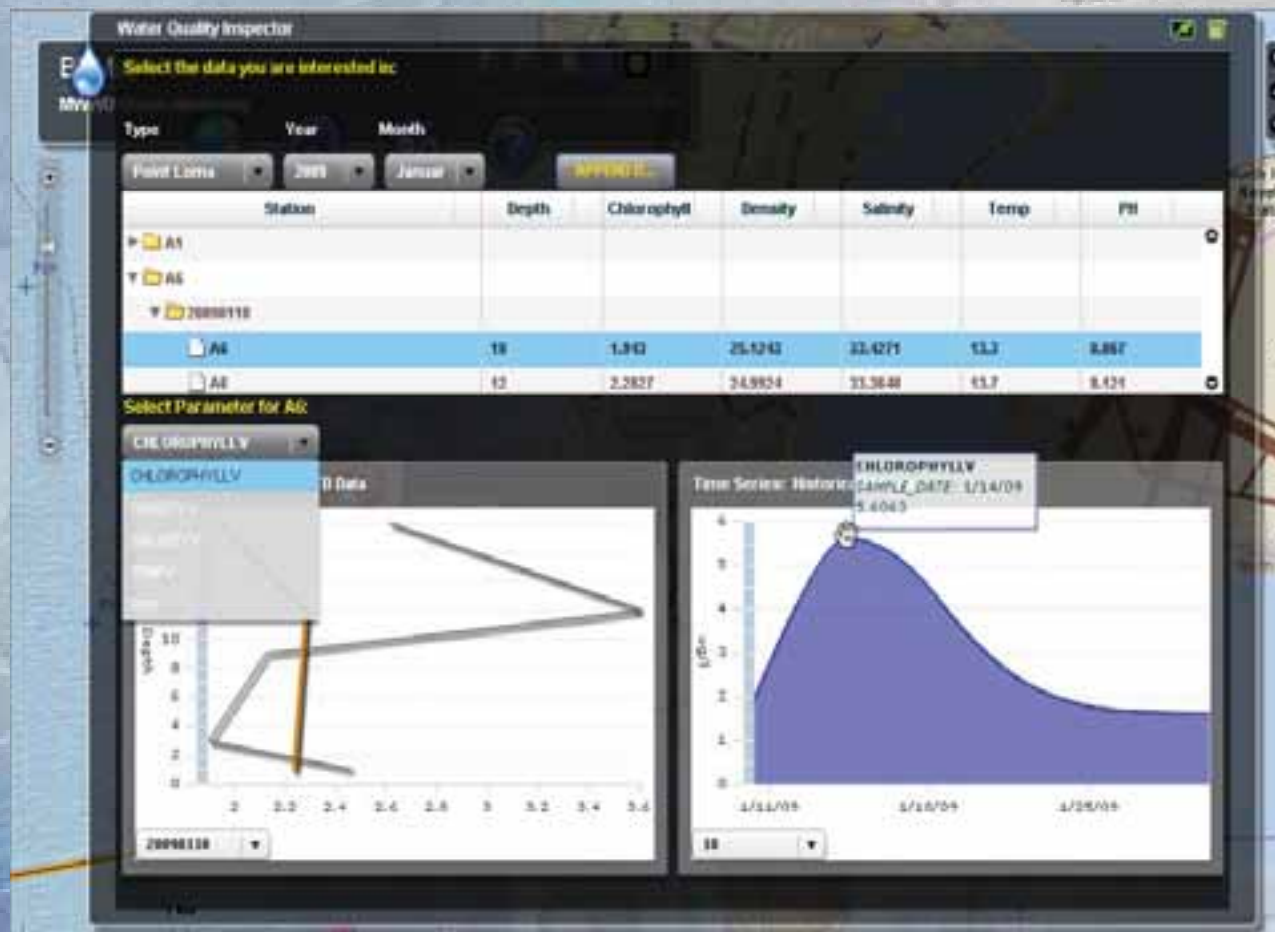*La Jolla Canyon bathymetry with hillshade and USGS Topo from ArcGIS online:*

Not-so-standard GIS tools:
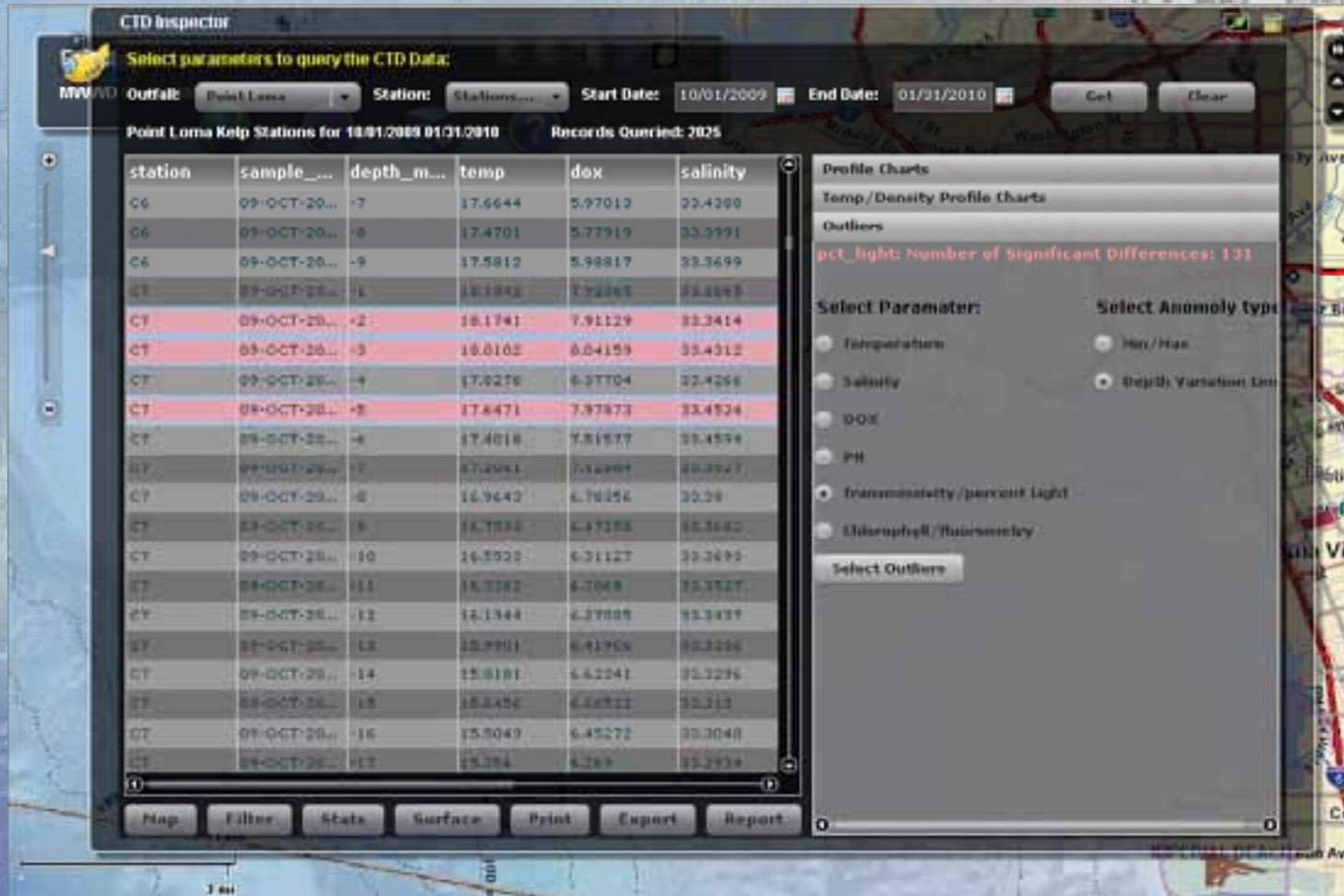## the Marine Data Inspectors

CTD Inspector for Water Quality Data

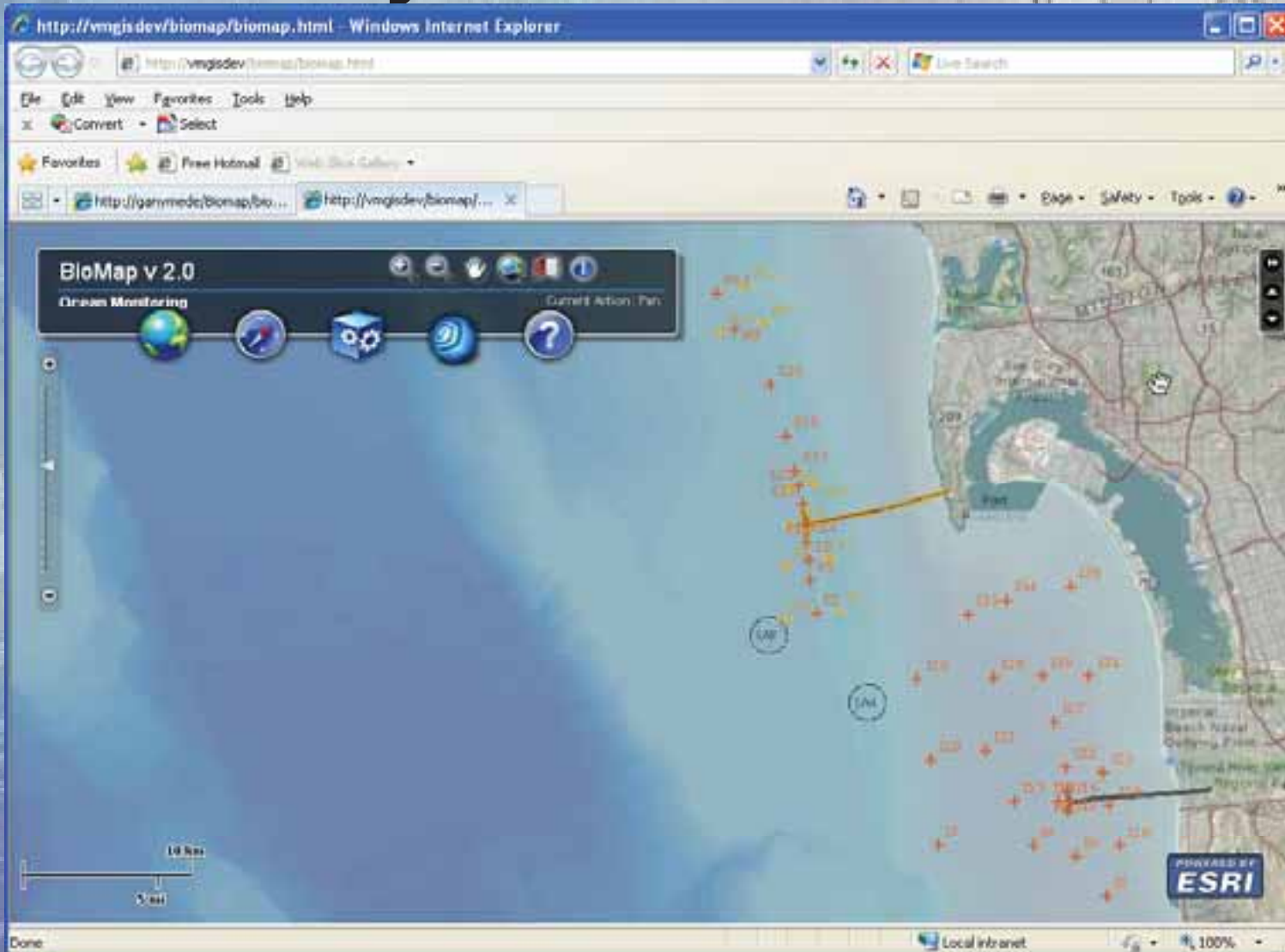# Investigate Water Column Profiles and Historical Variances

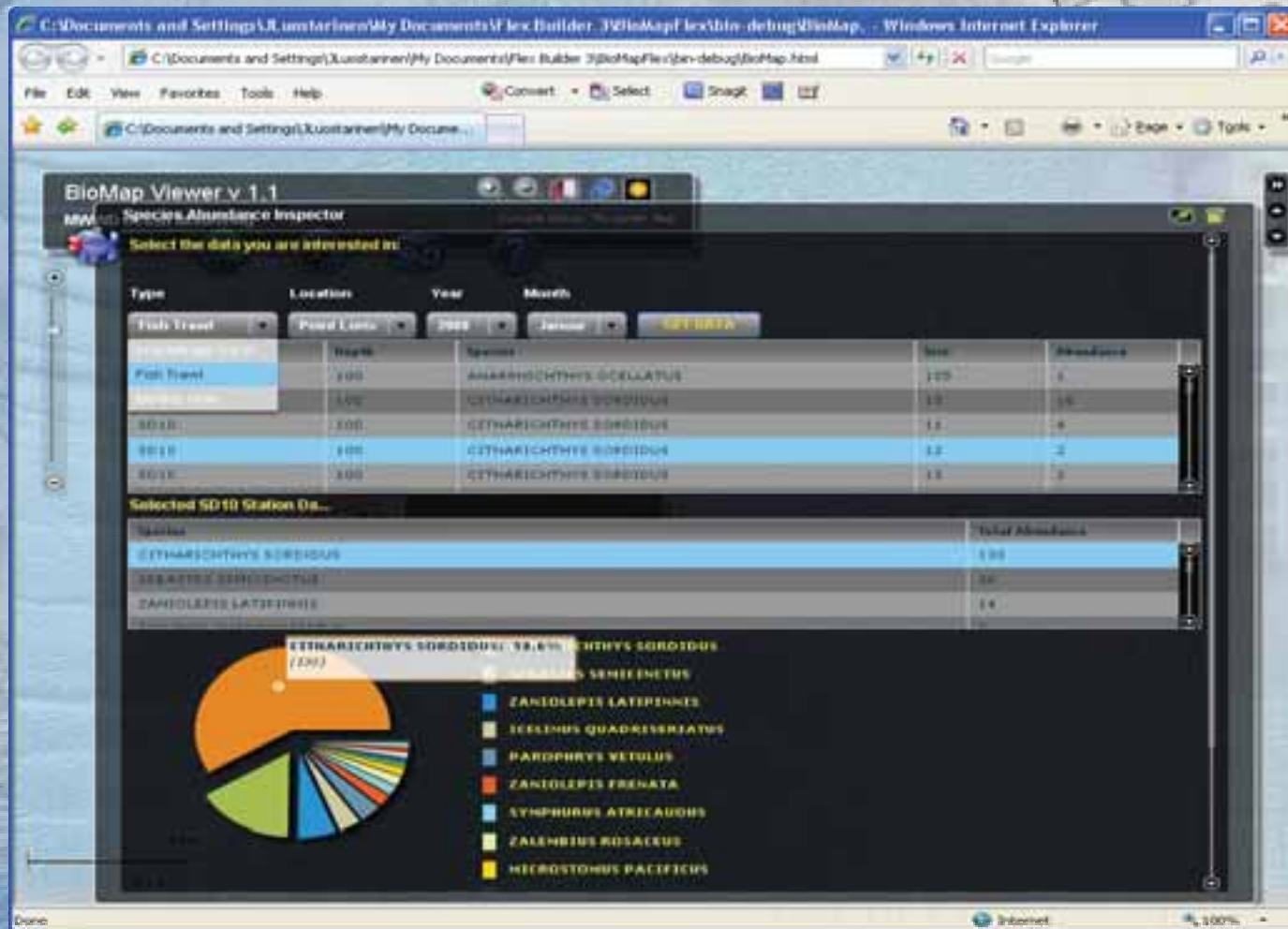# Review Trends and Find Data Anomalies in CTD Data

*Data anomalies highlighted in **pink** in data grid and on Map*

Benthic Inspector for Macrofauna Community Data

Species Abundance and Diversity

Pie chart of invertebrate species collected at a particular station on a given sample date

TJ Spill- Jan 2011

BioMap Demo (.wmv)

Flexible User Interface:

- Build SQL Query without SQL
  - (1 year CTD data = 40k rows → 9 sec – no indexing)
- Multiple Levels of Filtering
  - Select by Project, List, Map
  - Grid allows dynamic sorting, filtering and manual selection
- User-controlled thematic mapping
  - Change Symbol Colors, Size
  - Change Class Ranges and Outlier limits

- 2011-02-07 12.33 5Min.wmv

Tips and Thoughts for Developers

- Allowed User Investigation by using static SQL on the back end, change parameters from client. Put Code in the most efficient place (DB, mid-tier, client)
- Map is Data Driven
  - only settings for graphics are adjustable
- Use what is already available in your existing environment (even if it isn't the programmers first choice)
- The question on What Technology?
  - Balance of standards, what is in the existing resources, and staff familiarity. Then just go for it!

Future Directions…

- Tools for increasingly synoptic views by juxtaposing data layers, graphs, timelines, and spatial statistics
    - Investigate the benefits of NetCDF format

- Systematic use of spatial statistics

- Real-time integration of automated data sources

- Spatially-linked video and animations
    - Tool to help compile screen-capture animations

- Plume tracking with 3D ocean circulation models

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View This Presentation at:

www.quarticsolutions.com

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