

Stream Management Plan Workshop

Step 5 - Existing Data Collection

Data as a Platform

Colorado Water Congress Conference Workshop, August 23-24, 2016



openwater
FOUNDATION

Steve Malers, Open Water Foundation
steve.malers@openwaterfoundation.org
www.openwaterfoundation.org

Open Water Foundation

Social enterprise 501(c)3 nonprofit focusing on developing open source software tools to help make better decisions about water resources. Water is a public resource, and water data and software tools should also be public.



open data | **open software** | **open decisions**

openwaterfoundation.org

Stream Management Plan

“(5) collecting and synthesizing existing data describing flows for river ecosystems, boating, or other needs in the watershed”

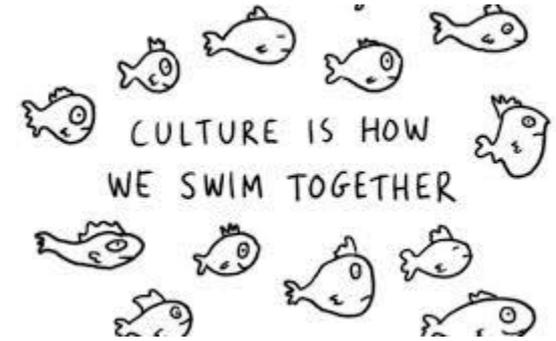
- Colorado Water Plan

Translation: How much wet water do you need, where, and when for environment and recreation?

Also: Water touches everything...and so does data.

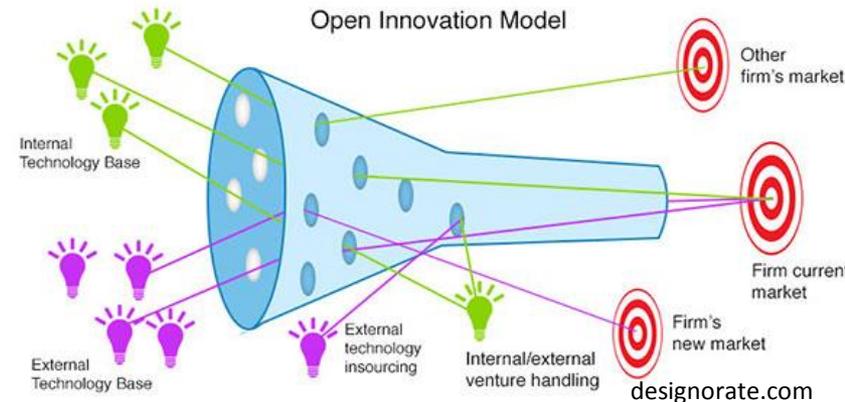
Some Initial Thoughts

- Draw a picture of what you want to do
 - It will guide what you need as input, process, and output
 - Sooner or later you will need to explain what you are doing with a picture
- Good ideas come from anywhere...you just need to find them (or have someone show you)
- Create a culture of true innovation... “the art of the possible”
- Create and leverage building blocks



“-The Connected Company”

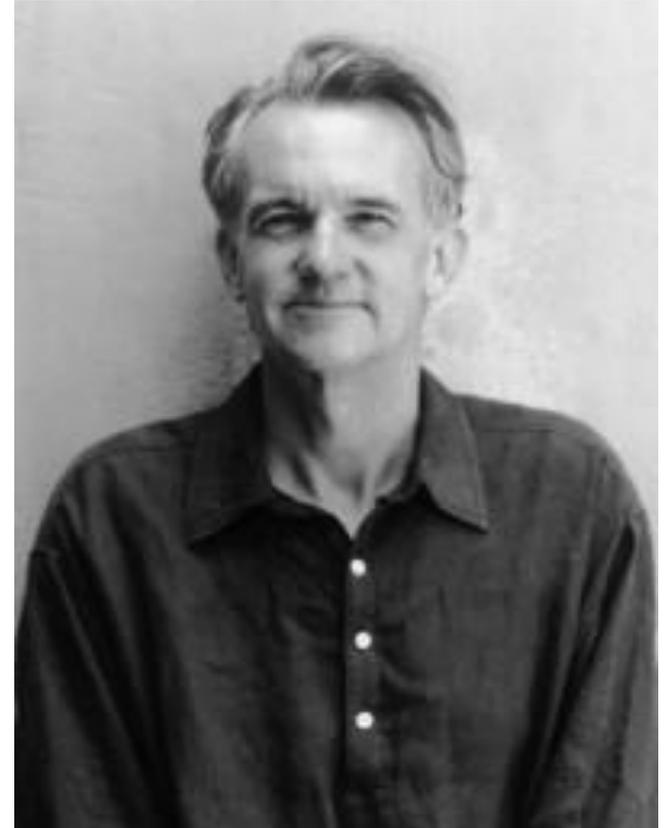
Have you seen this elsewhere...cone of uncertainty?



Telling Your Story with Data

“There are two goals when presenting data: convey your story and establish credibility.”

-Edward Tufte



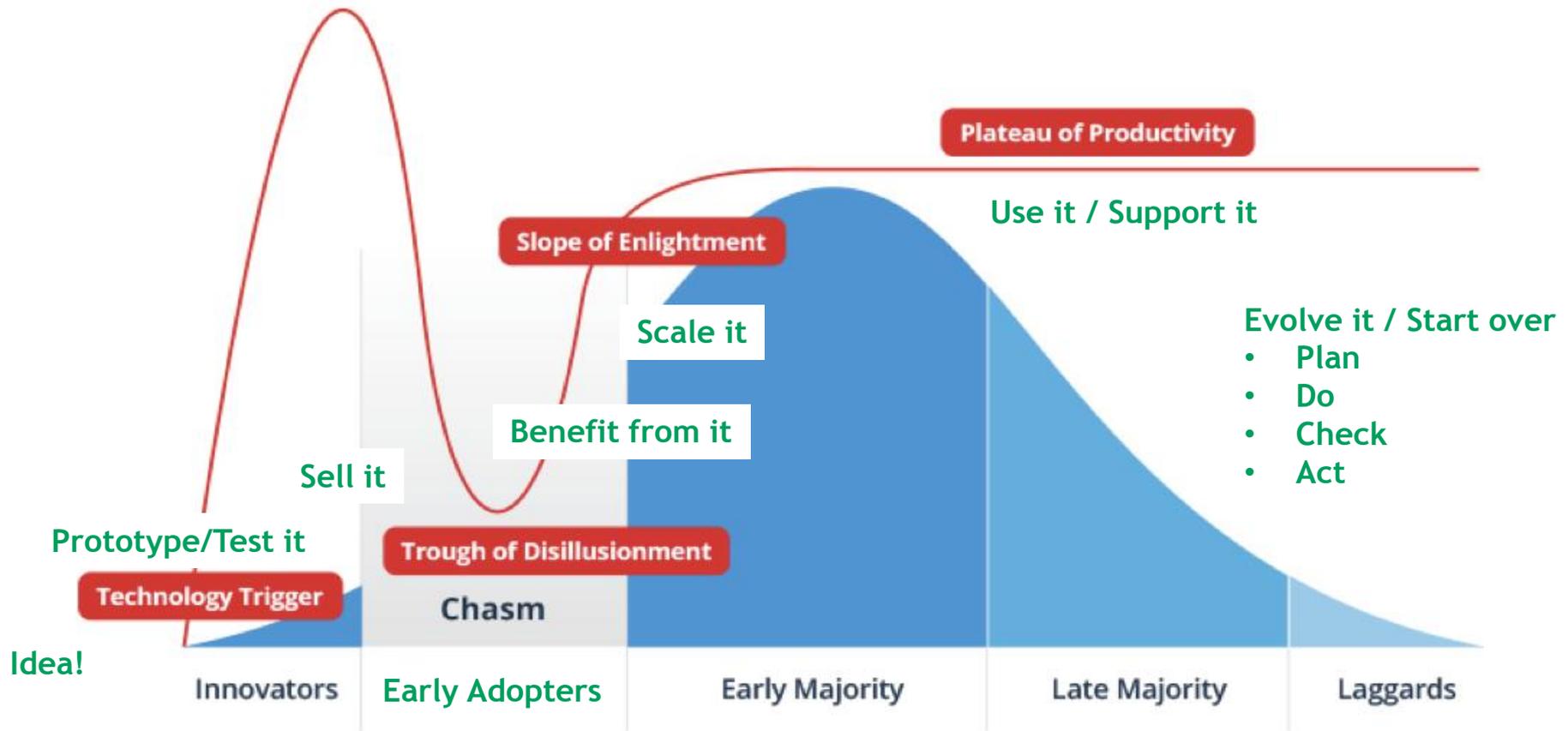
https://en.wikipedia.org/wiki/Edward_Tufte

Your Data Challenge

- Main activities around data:
 - collect
 - manage
 - enhance/modify/quality control
 - use to analyze/model
 - visualize
 - attribute/document/archive/publish
- Do you need a data management plan in your stream management plan?
 - Perhaps, but keep it simple via conventions (who decides on the conventions?)

Diffusion of Innovation

Crossing the Chasm (Geoffrey Moore)



<http://www.datameer.com/blog/big-data-analytics-perspectives/big-data-crossing-the-chasm-in-2013.html>

http://en.wikipedia.org/wiki/Crossing_the_Chasm

Time is REALLY Important

- Time series of data
 - Raw time series data
 - Time series of spatial data layers
 - Animations?
 - What scale/precision? real-time? daily/monthly/annual historical?
- Timestamping/versioning datasets
 - Evolving datasets must be tracked
 - Timestamps need standards: YYYY-MM-DD, YYYYMMDD
- The meaning of time:
 - Observation date/time (when measured)
 - Effective date/time (when something goes into effect)
 - Publish date/time, including software versions

Things change so timestamp is important!

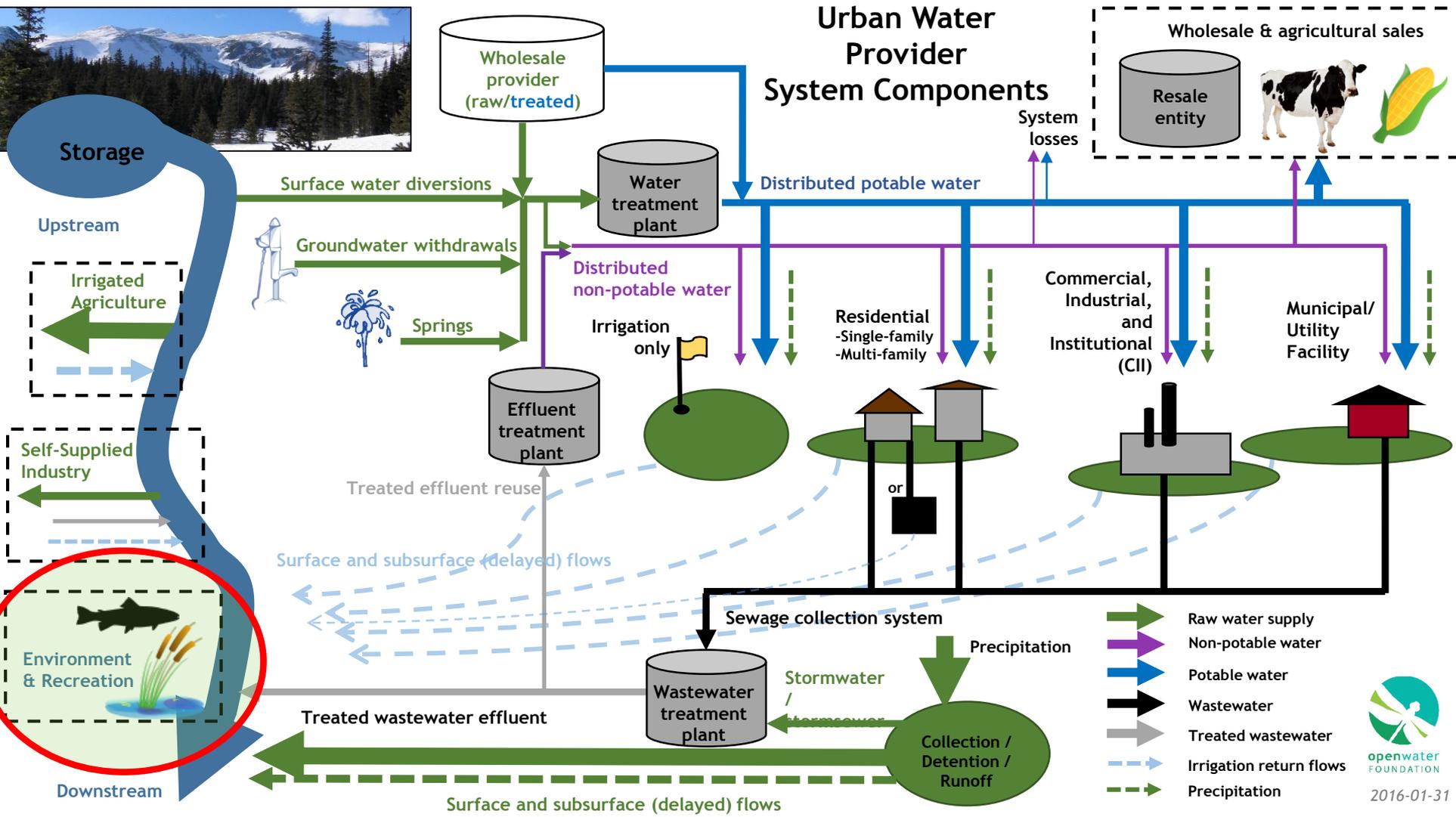
Data schema is REALLY Important

- “schema” = organization or structure
- Consistent definitions
- “conceptual integrity” = things fit together
- Unique data identifiers
 - ideally NOT internal database identifiers
 - best to use original source identifiers used in business processes if possible
- Relationships between datasets
 - direct often better (example=stream ID)
 - inferred or calculated may be more difficult to populate and may not be as good (spatial intersect)
- Transportability (works with different computers, tools)

Does dataset have a time element?

Does dataset have a spatial element?

Be a "Systems Thinker"



How are data uniquely identified in a larger system?
 How might data be used outside of specific analysis/process?

Open Data Definition

- **Accessible to all** - the data becomes accessible outside of the organization that generated or collected it
- **Machine-readable** - data must be usable, which means it must be made available in formats that are easily used by third-party applications
- **Free - zero or low costs** for data access and openness
- **Unrestricted rights to use** - data that is unencumbered by contractual or other restrictions leads to the maximum potential of innovation
 - “Generating Economic Value through Open Data” in “Beyond Transparency”

The Role of Automation

- Automation is fundamental to software/process testing and validating tools.
- Automation requires documentation, simplifies sharing.
- Manual processes are error-prone.
- Manual processes do not scale.
- “Automation frees people to do their best work”.

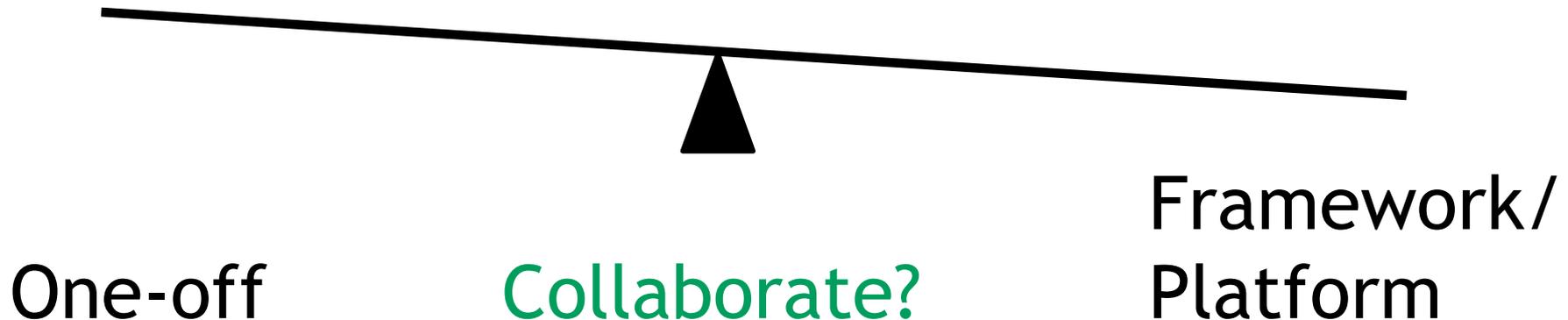
...need to understand the opacity/transparency of automation



One-off vs Framework/Platform

- Just do it!
- I don't have time to figure out a better way!
- Don't expect to do task again.
- Manual effort.
- Effort and cost?
- Who is responsible?

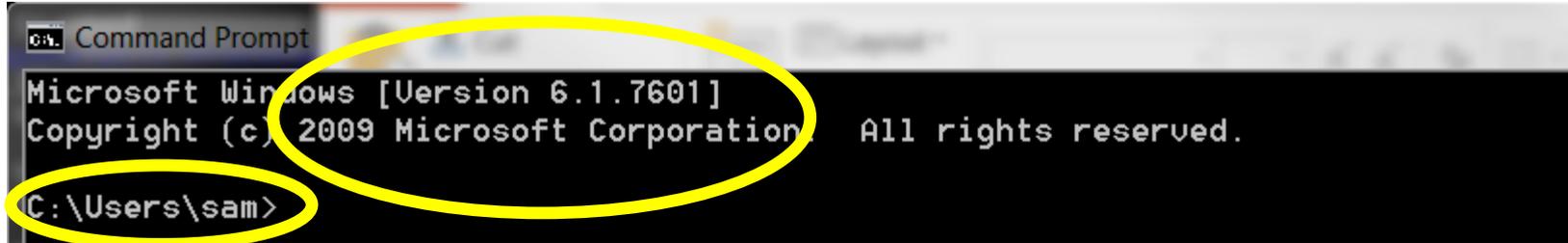
- Invest in tools and processes.
- They can and should be flexible to a degree.
- Assume that a task will need to be repeated later.
- Build a prototype first.
- Effort and cost?
- Who is responsible?



Is there a need for some consistent baseline data, processes, and tools across basins?

(some of you) Embrace the Command Line

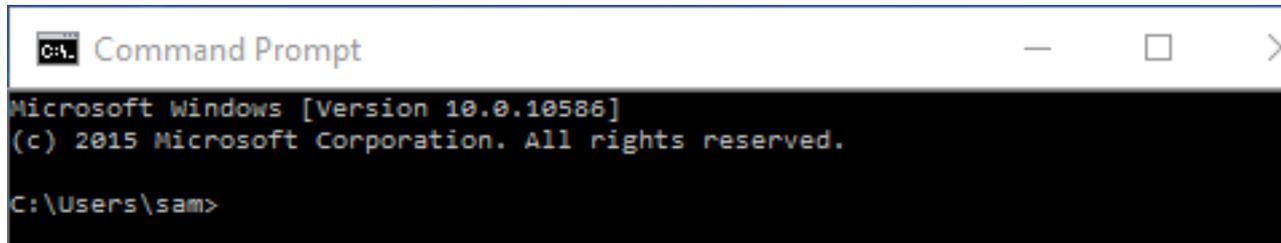
Windows7: Accessories / Command Prompt



```
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.

C:\Users\sam>
```

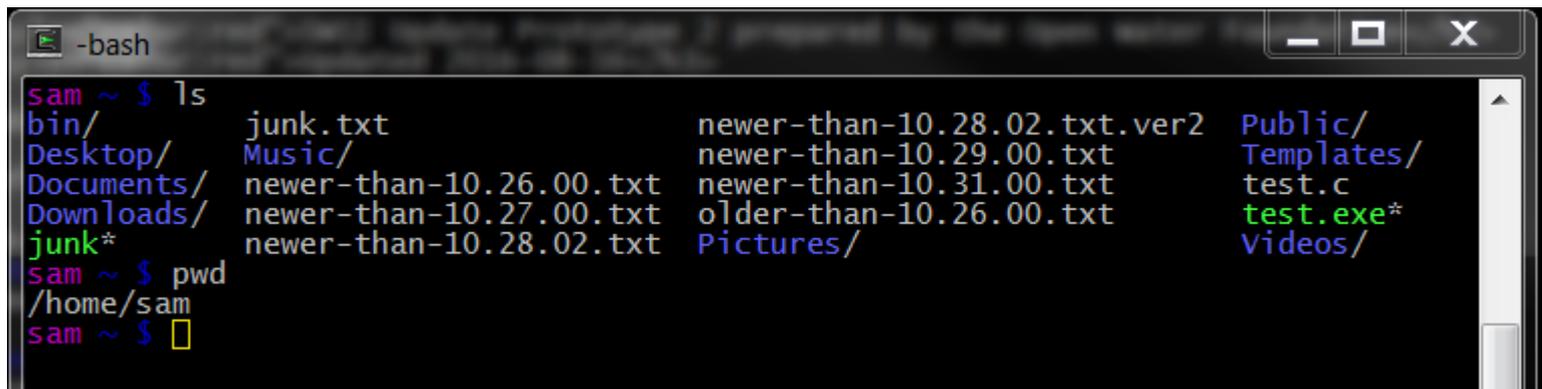
Windows 10: All Apps / Windows System/ Command Prompt



```
Microsoft Windows [Version 10.0.10586]
(c) 2015 Microsoft Corporation. All rights reserved.

C:\Users\sam>
```

Cygwin, Linux, probably a “bash” shell:



```
-bash
sam ~ $ ls
bin/          junk.txt      newer-than-10.28.02.txt.ver2  Public/
Desktop/     Music/       newer-than-10.29.00.txt      Templates/
Documents/   newer-than-10.26.00.txt  newer-than-10.31.00.txt      test.c
Downloads/   newer-than-10.27.00.txt  older-than-10.26.00.txt      test.exe*
junk*        newer-than-10.28.02.txt  Pictures/                     Videos/
sam ~ $ pwd
/home/sam
sam ~ $
```

(some of you) Embrace the API

API = Application Programming Interface

- Documented open standard for requesting and receiving data
- Integrates with software and allows for automation
- Forces publishers and consumers of data to understand the content

You should be asking: “Does it have a REST API?”



Input:

`http://someserver/some/path/to/data?query1=A&query2=B&format=excel`

Output:

Data in a format that you can use: text, csv, JSON, XML, Excel, map layer

Simplest example: a URL that provides a data file

Wouldn't it be nice if....?

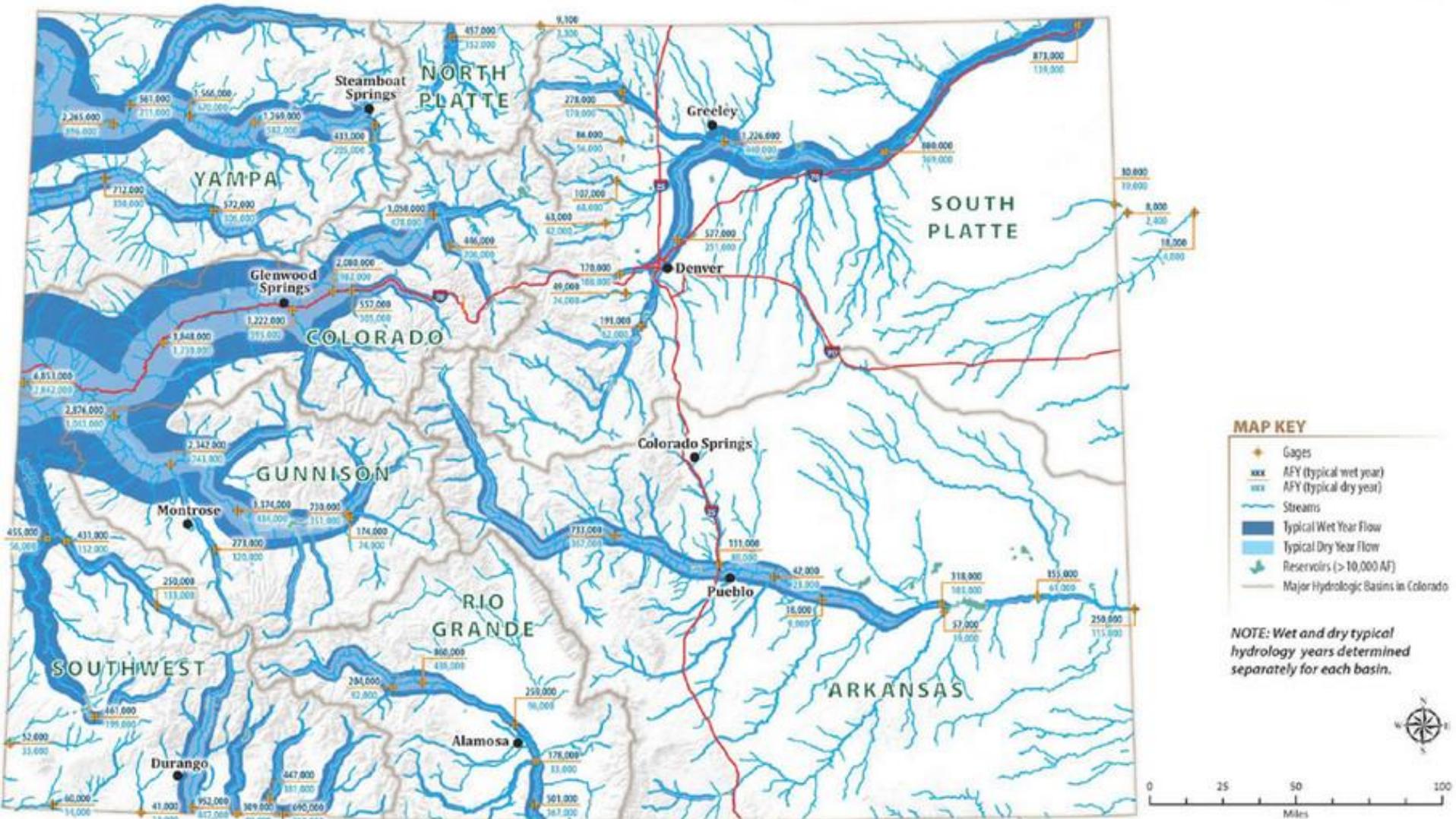
- All R2CROSS datasets are georeferenced and available for download?...even if no instream flow right resulted?
- All useful spatial datasets are linearly referenced to streams with stream mile?
- All useful datasets include attributes that allowed them to be linked spatially and temporally for analysis?
- Datasets are not always distributed as the “latest” but have version dates and a history so that we can understand trends?
- Datasets are publicly available for download?

Useful Concept: The "Snake" Diagram

DRAFT

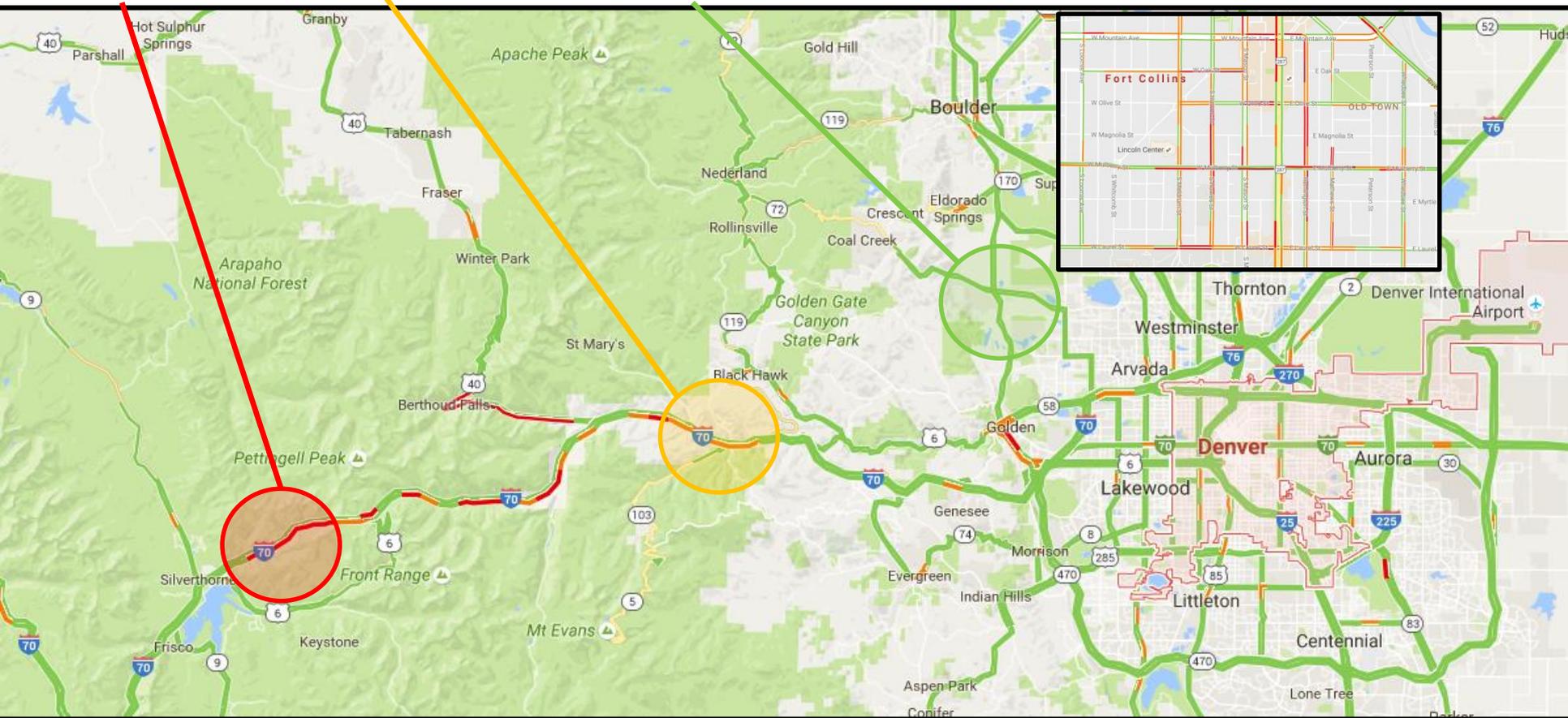
STATEWIDE

Summary of Observed Wet & Dry Surface Water Hydrology



Google Traffic Map

Red=bad, orange=a little bad, green=OK, but need to understand context of “bad”



So how does Google do it? Smart phone crowdsourced data. Resolution to ~300 feet?.

People are now familiar with these types of products.

Can stream conditions be similarly visualized?

National Hydrography Dataset (USGS)

Standard Advanced Annotation Active Tool: Map Navigation

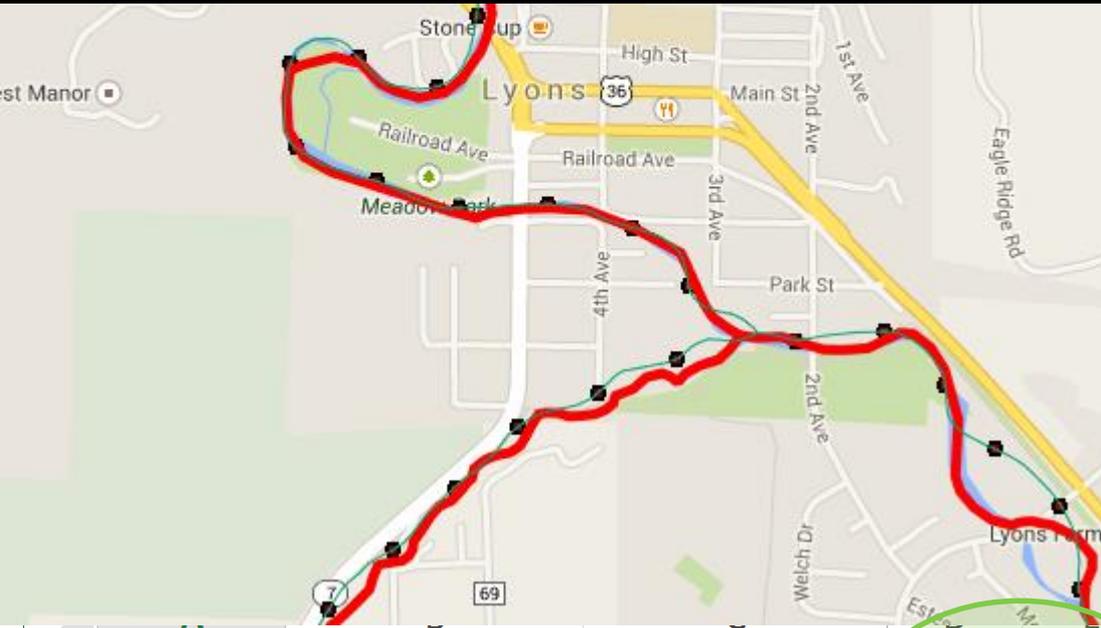
NHD = complicated

<http://viewer.nationalmap.gov/viewer/nhd.html?p=nhd>

**Simpler alternative:
Division of Water Resource's
Source Water Route
Framework (SWRF)**

<http://cdss.state.co.us/GIS/Pages/AllGISData.aspx>

Stream Mile Representation Framework from South Platte/Metro Basin Implementation Plan



*E&R Attributes
 Instream Flow Reaches
 Projects & Methods
 Stream Gages
 Diversion Headgates
 Organization Extent
 Master Plans
 and more...*

1	GNIS_ID	GNIS_Name	GNIS_ID_FMEAS	FMEAS	TMEAS	FocusArea	BaldEagle	BrassyMinnow
614	00205012	Saint Vrain Creek	00205012_000.5	0.5	0.6	Saint Vrain Creek		Yes
615	00205012	Saint Vrain Creek	00205012_000.6	0.6	0.7	Saint Vrain Creek		Yes
616	00205012	Saint Vrain Creek	00205012_000.7	0.7	0.8	Saint Vrain Creek		Yes
617	00205012	Saint Vrain Creek	00205012_000.8	0.8	0.9	Saint Vrain Creek		Yes
618	00205012	Saint Vrain Creek	00205012_000.9	0.9	1.0	Saint Vrain Creek		Yes
619	00205012	Saint Vrain Creek	00205012_001.0	1.0	1.1	Saint Vrain Creek	Yes	Yes
620	00205012	Saint Vrain Creek	00205012_001.1	1.1	1.2	Saint Vrain Creek	Yes	Yes
621	00205012	Saint Vrain Creek	00205012_001.2	1.2	1.3	Saint Vrain Creek	Yes	Yes
622	00205012	Saint Vrain Creek	00205012_001.3	1.3	1.4	Saint Vrain Creek	Yes	Yes

Stream mile + Excel = accessible data

Spatial Scale/Scope: Region/Stream Reach/Focus Area

- **Basin** = Water District/Division, HUC
- **Stream Reach** = Stream mile or landmark range in basin
- **Focus Areas that were used in SWSI & BIPs**
 - Are they needed?
 - Focus area could instead be a basin (HUC)
 - Focus area could instead be a stream reach indicated by stream miles or landmark (many are already doing this).

Some Data Sources

- CDSS: cdss.state.co.us
- CDSS map viewer: see above
- CWCB data viewer:
<https://www.coloradodnr.info/H5V/?Viewer=cwcbmap>
- DWR: water.state.co.us
- Open data portal: data.colorado.gov
- USGS NWIS: <http://waterdata.usgs.gov/nwis>
- RCC ACIS (climate): <http://www.rcc-acis.org/>
- NRCS:
http://www.wcc.nrcs.usda.gov/web_service/awdb_web_service_landing.htm
- EPA: https://www3.epa.gov/storet/web_services.html
- CDSN (water quality): <http://www.coloradowaterdata.org/>
- CNHP: <http://www.cnhp.colostate.edu/>
- DataBasin.org
- Watershed coalitions, Northern Water, river districts, etc.
- data.openwaterfoundation.org

CWCB Data

How would I find data for CWCB environmental and recreational, and stream restoration projects?

“I recommend directing them to CWCB for data related to the Non-Consumptive Needs Assessments and Basin priorities by stream or watershed. Beyond that, I recommend that watershed groups work within their own collaborative to assemble data important to their objectives in Stream Management and/or Watershed planning. This may include water quality data, USFS inventories (roads, culverts), CPW fish data, ecological data generated by local assessments, burn severity data, topography (survey),...”

<http://cwcb.state.co.us/environment/non-consumptive-needs/Paes/main.aspx>

<http://cwcb.state.co.us/ENVIRONMENT/WATERSHED-PROTECTION-RESTORATION/Pages/main.aspx>



Search

Clear All Options

View Types

- Data Lens pages [What's this?](#)
- Datasets
- Charts
- Maps
- Calendars
- Filtered Views
- External Datasets
- Files and Documents
- Forms
- APIs

Categories

- (All)
- Agriculture
- Business
- Demographics
- Economic Growth
- Education
- Water [View All](#)

Topics

- 2013
- bic
- colorado
- gocode
- pueblo

Results matching category of Water

Most Relevant

	Name	Popularity	Type
1.	DWR Water Right Net Amounts Water water right, gocode A Water Right is a property right that is either conditional or	3,164 views	
2.	DWR Well Application Permit Water well, application, permit, gocode All well applications and permits issued.	2,406 views	
3.	DWR Water Right Transactions Water water right, gocode A Water Right is a property right that is either conditional or	1,575 views	
4.	DWR Administrative Structures Water ditch, headgate, reservoir, well, gocode Contains physical, manmade structures used for diverting, storing, releasing, or measuring water; struct	1,520 views	
5.	DWR Current Surface Water Conditions Map (Statewide) Water Current streamflow conditions	1,456 views	
6.	DWR Active Calls Water river administration, river call, gocode Division of Water Resources (DWR) Active Calls. The Call is a term used by the state engineer to effectivel	1,358 views	
7.	DWR Current Surface Water Conditions Water streamflows, current conditions, gocode Division of Water Resources (DWR) Current Surface Water Conditions. This is a list of all remote monitore	1,268 views	
8.	DWR Calls History Water administrative call, gocode Division of Water Resources (DWR) Call History. The Call is a term used by the state engineer to effectivel	1,316 views	
9.	DWR Well Water Level Water well, water level, level, gocode Water Level wells	1,295 views	
10.	DWR Active Calls Map (Statewide) Water river administration, river call, gocode Division of Water Resources (DWR) Active Calls. The Call is a term used by the state engineer to effectivel		

Source for many “flat” datasets and provides an open data platform for distributing datasets

CDSS and CWCB Map Viewers

The screenshot displays the CDSS (Colorado's Decision Support System) Map Viewer interface. The browser address bar shows the URL: <https://www.coloradodnr.info/H5V/Index.html?Viewer=mapviewer>. The interface includes a search bar, a navigation menu with options like Home, Draw, Measure, and Advanced Measurement, and a toolbar with icons for Home, Pan, Zoom In, Zoom Out, Initial View, Full Extent, Previous Extent, Next Extent, Bookmarks, Identify, Print, Export, and Share. A 'Layers' panel on the left lists 'All Available Layers' with checkboxes for various data types, including Climate Station, Climate Isohyet, Surface Water Current Conditions, Active Gage Diversion, Active Gage Reservoir, Active Gage Stream, Surface Water Station (Historic), Structure (Admin/Decreed), Structure (Points of Interest), Well Application, Final Permit, Ground Water, Surface Water Supply Index, Instream Flow, and PLSS. The main map area shows a topographic map of Colorado with numerous colored markers (purple, blue, orange, red) representing data points. A 'Quick Tools' button is visible above the map. The map includes labels for various geographical features such as the Yampa River, Colorado River, and South Platte River, as well as cities like Denver and Fort Collins.

Good for locating data, ad hoc queries

Limitation - limited data download, lack of automation

DNR Weblink Online Documents



COLORADO Water Conservation Board Department of Natural Resources

- Loans & Grants
- Environment
- Water Management
- Legal
- Technical Resources
- Public Information
- About Us

Home > Public Information > Document Search

Public Information

- Board Meetings & Agendas
- Education & Outreach
- Flood & Water Availability Task Forces
- Publications
- Presentations
- Instream Flow Administrative Calls
- Document Search

Document Search

Welcome to the CWCB's Document Search, the online clearinghouse for publicly available documents and materials. Use the searches below to perform common, defined searches or follow the instructions for field and text based searches.

Commonly Searched Documents

Board Meetings

Review past Board Meeting materials, including agendas, minutes, staff memos and audio files

Board Meeting Date -

Document Type



Quick Links

- Search WebLink
- My Weblink - personalize your searches and results
- WebLink Help - additional information and tips

Like many web tools, it can be difficult to find documents if you don't know what to request, some scans are large and slow to download



Search by keyword or location

Get Started

Explore

Create

Community

My Workspace

DATA BASIN | GUIDES & CASE STUDIES | CONSERVATION EASEMENTS IN COLORADO'S FRONT RANGE



Conservation Easements in Colorado's Front Range

By Gregory Stavish

Mar 25, 2014 (Last modified Apr 3, 2014)

A GIS-Based Assessment to Determine the Extent Conservation Easements Protect Biodiversity

Biodiversity in the Colorado Front Range is a critical component for the sustainable development of the region (Chivian and Bernstein, 2010; Pague, et. al, 1996; Pague, et. al, 1993). Modern land conservation efforts, which are often a result of donated gifts or opportunistic purchases, risk ignoring areas of high biodiversity (Whittaker, 1999; Daniels and Daniels, 2003). The nature of establishing conservation easements is, at times, unpredictable (Axel-Lute, 1999). Planning and executing conservation easements requires suitable geographic conditions, local outreach, and long-term negotiations with landowners.

This project used a GIS-based analysis to determine whether conservation easements have protected high biodiversity areas from development. Land trusts, as well as other conservation organizations, can use this information to target outreach campaigns, gain public support, acquire new funding opportunities, and improve public education of the benefits of biodiversity conservation.

Potential Conservation Areas (PCAs) are "land areas that can provide the habitat and ecological processes upon which a particular element (i.e. rare plant and animal species and significant plant communities) occurrence, or suite of element occurrences, depends for its continued existence" (Lyon, et. al, 2001). PCA boundaries are determined by county-wide biological assessments conducted by the Colorado Natural Heritage Program. PCAs are ranked according to their biodiversity significance, ranging from 1 (greatest) to 5 (least). This study only analyzed categories 1 to 3. Each biodiversity category was delineated, analyzed, and



Explore related items...

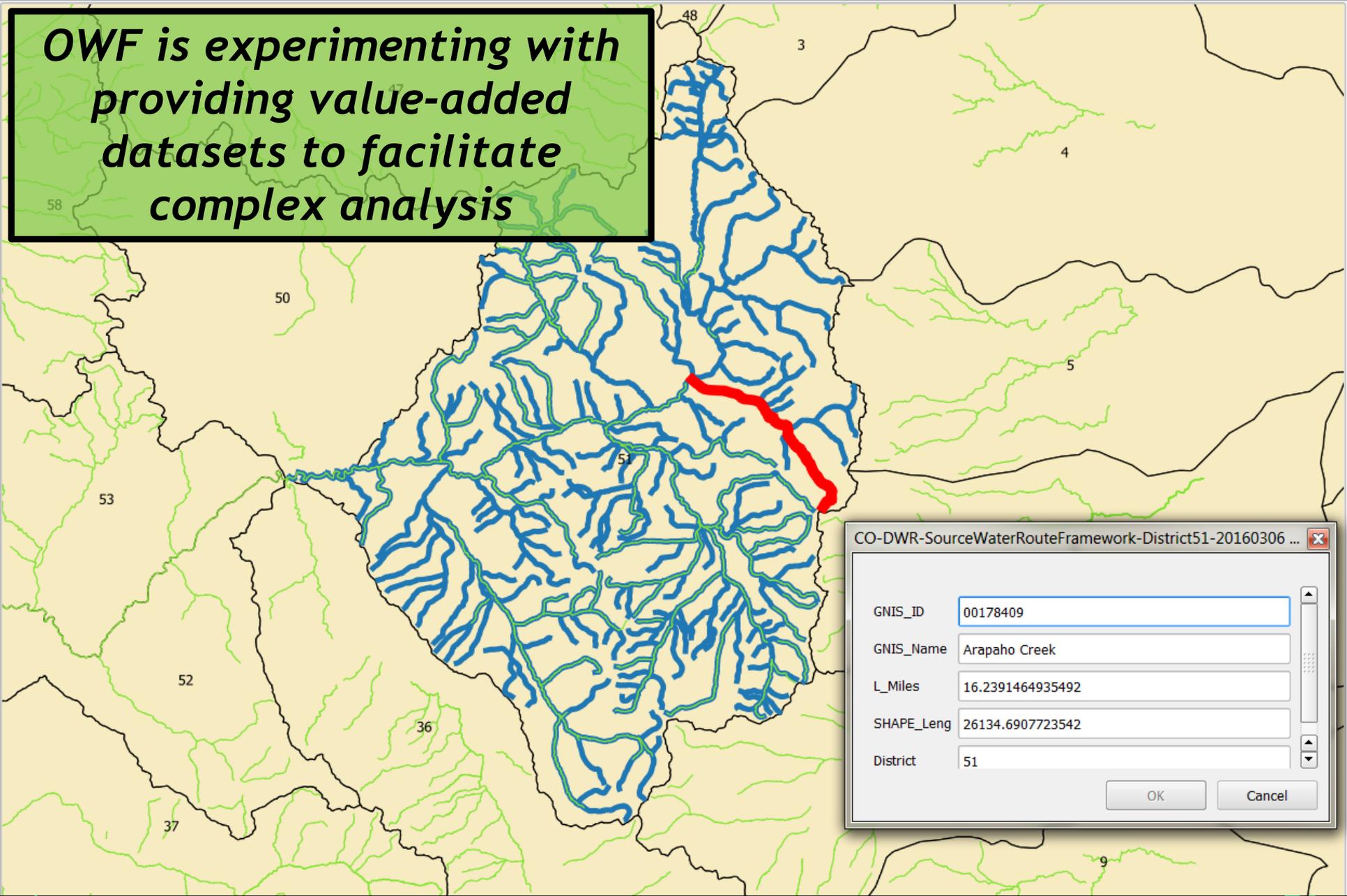


Gallery

A GIS-Based

**National-level
resource**

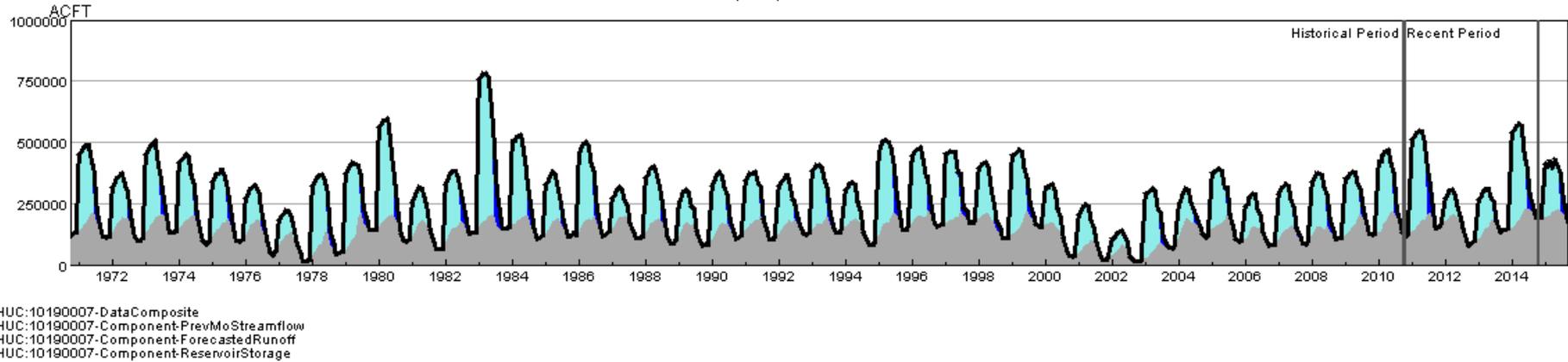
OWF is experimenting with providing value-added datasets to facilitate complex analysis



Time Series Analysis and Automation - TSTool software

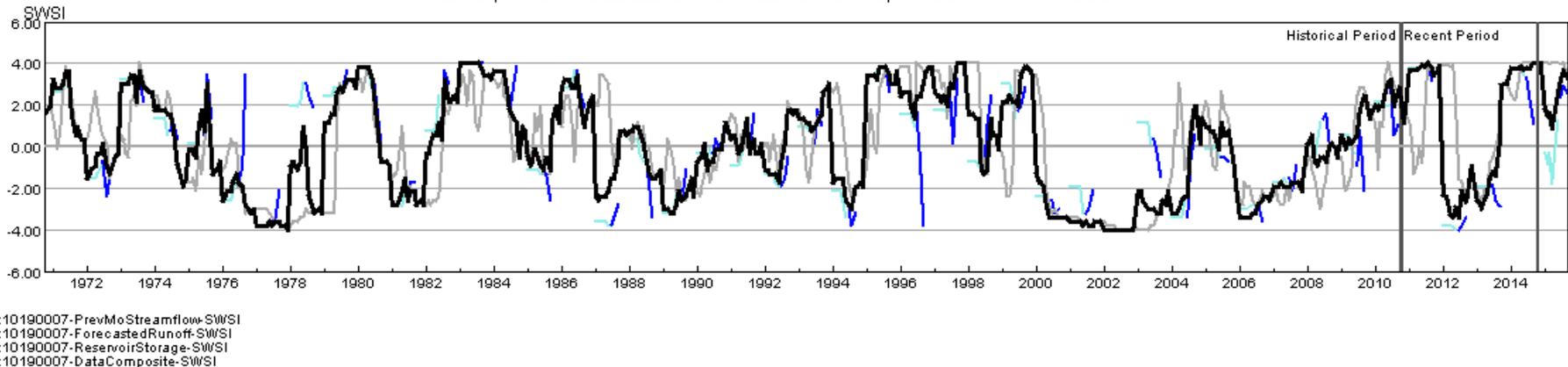
HUC 10190007 (Cache La Poudre) Surface Water Supply

Monthly component volumes



HUC 10190007 (Cache La Poudre) SWSI

Historical period SWSI values establish the SWSI distribution to lookup recent and current SWSI values.



Summary

- Keep it simple
- Don't let technologies abuse you (but they will)
- Understand your data and process limitations
- Prototyping is OK, dead ends happen, but have a roadmap so you know your destination
- Collaboration is easier with open standards and open data
- Learn from others
- Try to be agile

“A river is more than an amenity. It is a treasure. It offers a necessity of life that must be rationed among those who have power over it.” – Supreme Court Justice Oliver Wendell Holmes, Jr. (quote from 1931)

Share It

The content of this presentation is licensed under the Creative Commons Attribution NonCommercial License:
<http://creativecommons.org/licenses/by-nc/4.0>



open data | **open software** | **open decisions**
openwaterfoundation.org