Status and Benefits of Open Water Data

Colorado Water Congress, January 24, 2018

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“Facts are stupid until brought into connection with some general law”

- Louis Agassiz (1807-1873)
Context - Climate Change

NASA Pinpoints Cause of Earth’s Recent Record Carbon Dioxide Spike
3 months ago

NASA, NOAA Data Show 2016 Warmest Year on Record Globally
a year ago

NASA, NOAA to Announce 2016 Global Temperatures, Climate Conditions
a year ago

NASA Plans Another Busy Year for Earth Science Fieldwork
a year ago

NASA Successfully Launches NOAA Advanced Geostationary Weather Satellite
a year ago

From NYC to Rio: NASA Helps Cities Address Climate Risks
a year ago

Long-Term Warming Trend Continued in 2017: NASA, NOAA

2017 Takes Second Place for Hottest Year

2017 was the second hottest year since 1880, when global measurements first became possible.
Federal report says 2017 shattered US damage record for natural disasters

$306.2B (does not consider loss of work?)

2016 State GDP

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
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<tr>
<td>4/6/18</td>
<td>1.25</td>
<td>2.58</td>
<td>2.07</td>
<td>1.88</td>
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<tr>
<td>15</td>
<td>15</td>
<td>Maryland</td>
<td>382,437</td>
<td>2.07</td>
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<tr>
<td>16</td>
<td>16</td>
<td>Indiana</td>
<td>347,249</td>
<td>1.88</td>
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<td>17</td>
<td>17</td>
<td>Minnesota</td>
<td>339,096</td>
<td>1.83</td>
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<tr>
<td>18</td>
<td>18</td>
<td>Tennessee</td>
<td>331,868</td>
<td>1.79</td>
</tr>
<tr>
<td>19</td>
<td>19</td>
<td>Colorado</td>
<td>322,644</td>
<td>1.74</td>
</tr>
<tr>
<td>20</td>
<td>20</td>
<td>Wisconsin</td>
<td>313,088</td>
<td>1.69</td>
</tr>
<tr>
<td>21</td>
<td>21</td>
<td>Arizona</td>
<td>305,849</td>
<td>1.65</td>
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<tr>
<td>22</td>
<td>22</td>
<td>Missouri</td>
<td>299,113</td>
<td>1.62</td>
</tr>
<tr>
<td>23</td>
<td>23</td>
<td>Connecticut</td>
<td>259,918</td>
<td>1.40</td>
</tr>
<tr>
<td>24</td>
<td>24</td>
<td>Louisiana</td>
<td>236,999</td>
<td>1.28</td>
</tr>
</tbody>
</table>

CO 2017 budget: $26.8 B
CO Water Plan Needs: $40B?
Amazon HQ2 = $5B construction
The Big Ditch had so far been a colossal flop, and Teddy Roosevelt desperately needed an engineering genius who could take over the job and “make the dirt fly.”

- David McCullough

“There are three diseases on the Isthmus,” he told them, “yellow fever, malaria, and cold feet. And the worst of these is cold feet.”

- John Frank Stevens, Chief Engineer, Panama Canal

“100 years on Panama Canal still vital to ag economy”

http://mashable.com/2015/11/15/panama-canal-construction
Has the smart phone destroyed a generation?

Beginning Farmers as Percent of All Farmers, by County, 2012
(percent on current operation ten years or less)


Farms with Female Principal Operator, by County, 2012


Open Data as Infrastructure for Innovation

**Visualizations as Insight**

- **DATA**
  - signals, know-nothing
  - given context, becomes
  - useful, organized, structured
  - contextual, synthesized, learning
  - understanding, integrated, actionable
  - change, movement
  - revealed direction
  - revealed principles
  - future
  - why?
  - past
  - what?
  - what is best?
  - what action?
  - visualizations as insight

**Data as Infrastructure**

https://www.pursuant.com/blog/redefining-fundraising-data/
When you don't know where to start, Google can help:

- Google loves Wikipedia:
  - Water is a transparent and nearly colorless chemical substance that is the main constituent of Earth's streams, lakes, and oceans, and the fluids of most living organisms. Its chemical formula is H₂O, meaning that each of its molecules contains one oxygen and two hydrogen atoms that are connected by covalent bonds.

- Local Information:
  - View public notice regarding the recent Treatment Technique Violation issued by the Colorado Department of Public Health and Environment (CDPHE). Vea el aviso público en español aquí. Fort Collins Utilities does not solicit water quality testing at homes or businesses, though some private companies do. Utilities’...
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”
Observations on Status of Open Data

• Demands for access to data and transparency are increasing... for all data.
• Many government entities are making progress on open data
  ...but at the same time data access is being cut back at some levels.
• There are still many barriers and resistance to publishing open data.
A Balance of Transparency and Privacy

Medical science / Your medical data
Laws and legal rulings / Your court case
Science in general / Your intellectual property
Water as a public resource / Your customer and system data
Government budgets / Your tax records
Public process / Private process
Benefits of Open Data

- Open access
- Collaboration (break down silos)
- Transparency
- Reduce costs
- Innovation
Increased Access to Data in Colorado


- Federal Open Water Data Initiative https://acwi.gov/spatial/owdi/

- Bureau of Reclamation Web Services https://water.usbr.gov/

- CO DWR Updated Web Services Coming soon (see other Colorado Water Congress presentation)
The National Water Census Data Platform

A major component of the Water Census is the National Water Census Data Platform, which relies on a series of new data management practices to enable integration and delivery of water budgets information alongside other data of interest to managers, such as water use data or ecological assessment criteria. Eventually, end users of water budget data (i.e. management agencies and decision-makers) will be able to access an integrated online database in a form that will enable them to construct local and regional water budgets. Key components of the National Water Census Data Platform that are currently in development include:

A database of hydrologic indicators, addressing:

- Precipitation
- Evapotranspiration
- Water in storage in snowpack, icefields, and large lakes
- Groundwater level indices
- Rates of groundwater recharge
- Changes in groundwater storage
- Stream and river baseflow characteristics
- Stream and river runoff characteristics
- Total water withdrawals by source
- Interbasin transfers
- Consumptive uses

The National Water Census Data Platform aims to serve as a comprehensive and accessible tool for water resource management.
USGS - NHDPlus High Resolution

NHDPlus HR HydroRegionsMap

NHDPlus High Resolution Beta Availability
By Hydrologic Region
Reclamation Water Information System (RWIS)

The Reclamation Water Information System (RWIS) is a pilot version of a Reclamation-wide system for viewing, accessing, and downloading Reclamation’s data via a centralized data portal. The RWIS pilot serves representative time-series water data from each Reclamation region. With the RWIS pilot, you can:

- Locate Reclamation sites and access current and historical water data by browsing an interactive map.
- Search for water data by location or data type with the query tool.
- Get machine readable water datasets to use as input for your models and analyses via manual downloads or automated data exchange via web service. Use the web service/API URL to feed data to your own applications.

This is a pilot system. Please notify us about any errors, bugs, data requests, feature recommendations, or other feedback so we can improve the site.

Contact Us
Colorado Information Marketplace (data.colorado.gov)

**DWR Water Right Net Amounts**

A Water Right is a property right that is either conditional or absolute and conveys the right to use a particular amount of water, with a specified priority date as confirmed by the water court. The...

**DWR Well Application Permit**

All well applications and permits issued.

**DWR Calls History**

Division of Water Resources (DWR) Call History. The Call is a term used by the state engineer to effectively communicate the administrative status of the natural stream. The Call communicates...

Tags: water right, gocode

Tags: well, application, permit, gocode

Tags: gocode, administrative call
55 datasets found for "water"
# New DWR Web Services

## ASP.NET Web API Help Page

### Introduction

Data provided by the Colorado Division of Water Resources.

For additional help in creating URLs to retrieve values based on resource fields see the following help documents:

- Ground Water Levels
- Ground Water Measurement Time Series
- Administrative Calls

**AdministrativeCalls**

Returns administrative calls. See documentation for optional query parameters and output formats.

<table>
<thead>
<tr>
<th>API</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GET api/v2/admincalls/active</td>
<td>Return list of active administrative calls</td>
</tr>
<tr>
<td>GET api/v2/admincalls/active/(div)</td>
<td>Returns list of active administrative calls by water division</td>
</tr>
<tr>
<td>GET api/v2/admincalls/historic</td>
<td>Returns list of historic administrative calls (see documentation for optional query parameters)</td>
</tr>
<tr>
<td>GET api/v2/admincalls/(call_id)</td>
<td>Return administrative call by call ID</td>
</tr>
</tbody>
</table>

**GroundWater**

Retrieves groundwater level related data. See documentation for optional query parameters and output formats.

<table>
<thead>
<tr>
<th>API</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GET api/v2/groundwater/waterlevels</td>
<td>Returns GroundWaterSearchResult from filters - See documentation for optional querystring parameters</td>
</tr>
<tr>
<td>GET api/v2/groundwater/waterlevels/(wellId)</td>
<td>Return groundwater search by well ID</td>
</tr>
<tr>
<td>GET api/v2/groundwater/wellmeasurements</td>
<td>Return list of GroundWaterMeasurements - See documentation for optional querystring parameters</td>
</tr>
</tbody>
</table>
Open Data Standards

• comma-separated-value
• JSON, GeoJSON
• XML
• Excel is a start!
Observations

• We need more open water-related datasets that are maintained over time and are available for projects ... **need ongoing investment in open datasets.**

• Major water resources studies often spend a lot of time finding and processing data (or reusing outdated data)...*can be more efficient.*

• Datasets from major studies are often not published in an accessible and understandable way... **need to publish machine-readable datasets.**
## Example - Municipal Water Providers

### Open Water Foundation / Data

See also other Open Water Foundation websites:

- data.openwaterfoundation.org (this website) - useful datasets related to water resources
- learn.openwaterfoundation.org - learning resources
- models.openwaterfoundation.org - models and analyses (may include visualizations)
- projects.openwaterfoundation.org - OWF project pages to demonstrate and archive project work
- software.openwaterfoundation.org - software tool projects
- viz.openwaterfoundation.org - interesting and useful data visualizations

<table>
<thead>
<tr>
<th>Dataset ID</th>
<th>Focus</th>
<th>Spatial Extent</th>
<th>Preview Image</th>
<th>Description</th>
<th>Related Visualization</th>
<th>Dataset Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>owf-data-co-municipalities</td>
<td>Municipal</td>
<td>Colorado</td>
<td><img src="data.png" alt="DATA" /></td>
<td>This dataset facilitates relating detailed data from multiple sources. The dataset is maintained under version control in GitHub. Use the link on the right to access data and use the GitHub repository issues to provide feedback.</td>
<td>working on data visualization for municipal data.</td>
<td><a href="https://data.openwaterfoundation.org">Colorado municipalities dataset on GitHub</a></td>
</tr>
<tr>
<td>owf-data-co-municipal-water-providers</td>
<td>Municipal</td>
<td>Colorado</td>
<td><img src="data.png" alt="DATA" /></td>
<td>OWF has created a dataset containing all <strong>Colorado municipal water providers</strong> (utilities, water districts, etc.) cross-referencing identifiers from multiple sources. This dataset facilitates relating detailed data from multiple sources. The dataset is maintained under version control in GitHub. Use the link on the right to access data and use the GitHub repository issues to provide feedback.</td>
<td>OWF is working on data visualization for municipal water provider data.</td>
<td><a href="https://data.openwaterfoundation.org">Colorado municipal water providers dataset on GitHub</a></td>
</tr>
</tbody>
</table>
GitHub provides version control for electronic files.
This repository contains the Open Water Foundation (OWF) dataset for Colorado municipal water providers. This is a foundational dataset that provides unique identifiers and other data for municipal water providers. The identifiers can be used to link other datasets, such as municipalities. OWF has created and is maintaining this dataset to facilitate work on various data analysis and visualization projects in Colorado.

**Repository Contents**

The repository contains the following:

- **analysis/**
  - Process-xlsx-to-csv.TSTool
  - Process-xlsx-to-geojson.TSTool

- **data-orig/**
  - Colorado-FIPS-Places.xlsx
  - Colorado-GNIS-Civil.csv
  - Colorado-LocalGovernment-IDs.csv
  - Colorado-Municipal-Boundaries.geojson
  - Colorado-Municipality-PointLocation.csv
  - Colorado-PWS-IDs.csv
  - Colorado-Special-Districts.geojson
  - Colorado-WaterProvider-PointLocation.csv
  - README.md

- **data/**
  - TSTool software command files to process data into useful forms.
  - TSTool command file that processes the core dataset from .xlsx to .csv.
  - TSTool command file that processes the core dataset from .xlsx to .geojson.

- **Folder containing original data files downloaded from agency websites.**

- **Exported spatial data file from the Colorado Information Marketplace's Mid Saved attribute table of the GIS shapefile downloaded.**

- **Exported spatial data file from the EPA's Safe Drink Exported spatial data file from the Colorado Information Marketplace's Al Saved attribute table of Colorado-Special-Districts.geojson that contains Explanation of folder contents, description of data files, and the method Folder containing data files.**

*Documentation itself is versioned*
Access to Original Dataset File

Original dataset file is versioned and alternate formats and analyses are generated using automation.
Cross-referenced Identifiers

Unique identifiers are key to using the dataset. The dataset contains files such as `Colorado-Municipal-Water-Providers.csv` and other file formats can be viewed online.
Useful Data, Including Spatial Data

Other useful properties, temporal data, and spatial data, from various sources

<table>
<thead>
<tr>
<th>D</th>
<th>OWF_ID_Flag</th>
<th>LocalGovtType</th>
<th>EntityStartYear</th>
<th>EntityStartYear_Flag</th>
<th>EntityEndYear</th>
<th>EntityEndYear_Flag</th>
<th>County_CSV</th>
</tr>
</thead>
<tbody>
<tr>
<td>WC</td>
<td>G</td>
<td>Company</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>Crowley</td>
<td></td>
</tr>
<tr>
<td>MyWSD</td>
<td>G</td>
<td>Water and Sanitation District</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>El Paso</td>
<td></td>
</tr>
<tr>
<td></td>
<td>G</td>
<td>Municipality</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>Las Animas</td>
<td></td>
</tr>
<tr>
<td></td>
<td>G</td>
<td>Municipality</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>Washington</td>
<td></td>
</tr>
<tr>
<td>DataWSD</td>
<td>G</td>
<td>Water and Sanitation District</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>Jefferson</td>
<td></td>
</tr>
<tr>
<td></td>
<td>G</td>
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<td>x</td>
<td>x</td>
<td>x</td>
<td>Alamosa</td>
<td></td>
</tr>
<tr>
<td></td>
<td>G</td>
<td>Company</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>San Miguel</td>
<td></td>
</tr>
</tbody>
</table>
GeoJSON (geojson) files are an open spatial data format, can also provide shapefiles and other spatial data formats.
Simple Spatial Data Visualization

GeoJSON (geojson) files are an open spatial data format, can also provide shapefiles and other spatial data formats.
Using the Datasets

• The dataset files can be downloaded and used directly (Excel) or by other software such as geographic information systems (GIS) or models
• Automate processing
One option: Publish to an Open Data Portal
Use Software for Automation

• Access data on web
• Automate workflows using software
• Implement quality control
Helping you do great science
Create projects, build datasheets, collect data, and view results in real-time.

How It Works

CREATE PROJECTS
Create your own projects. Choose open, member-based, public, or private - it's up to you.

COLLECT DATA
Build custom datasheets. Collect any data you want.

Need to have a steward to manage the dataset.
Focused App: Enhanced Snowpack Products

Colorado's Decision Support Systems (CDSS) SNODAS Tools

- **About**
  - The website is best viewed on a widescreen display. If the layout seems out of order, try maximizing to fill the display. Ctrl and minus can be used to zoom out until the layout seems to be in correct order.
  - Hover over a basin to see the daily mean SWE values and other daily statistics.
  - Use the Select Data button to display historical data for a specified day.
  - Enter animation start and end dates, then press Submit and then press the play button to view the animation of daily SWE data.
  - Click on a basin in the map to select the basin or use the Select Basin to select from the basin list. Then click on buttons in the lower right to display graphs.
  - Once a graph has been opened, click anywhere on the screen to close the graph view and return to the main screen.
  - Reposition the map by holding the mouse button down and dragging.
  - Zoom in and out of the map using the control in the upper left, or use the mouse wheel.
  - Use the Data tab on the left to access data files.

- **Data**
  - Development of the SNODAS Tools was funded by the Colorado Water Conservation Board. The tools were developed by the Open Water Foundation.
  - The website is under development with a scheduled completion date of June 30, 2017. It is likely that changes in its site's functionality and access to data will occur until then.

- **Analysis**
  - Contact: Steve Malers, steve.malers@openwaterfoundation.org
  - Website version: 1.0.2 (2017-04-03)

Created by the Open Water Foundation for the Colorado Water Conservation Board
River Health

Eagle River Health - Sunburst Visualization
Eagle River Watershed-HUCName-SegmentID-StationName-UseClass-Indicator

<table>
<thead>
<tr>
<th>HUCName</th>
<th>Upper Eagle River</th>
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<tbody>
<tr>
<td>SegmentID</td>
<td>COUCEA05c_A</td>
</tr>
<tr>
<td>ReachDescription</td>
<td>Mainstem of the Eagle River from a point immediately above Martin Creek to a point immediately above the confluence with Gore Creek.</td>
</tr>
<tr>
<td>StationID</td>
<td>USGS:209627108264000</td>
</tr>
<tr>
<td>StationName</td>
<td>Eagle River Above Gore Creek Nr Minturn, Co</td>
</tr>
<tr>
<td>OrganizationID</td>
<td>USGS-CA</td>
</tr>
<tr>
<td>UseClass</td>
<td>Aquatic_Life</td>
</tr>
<tr>
<td>Category</td>
<td>Metals</td>
</tr>
<tr>
<td>Indicator</td>
<td>Lead</td>
</tr>
<tr>
<td>Units</td>
<td>ug/l</td>
</tr>
<tr>
<td>valueType</td>
<td>Dissolved</td>
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<tr>
<td>Censored</td>
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<tr>
<td>Minimum</td>
<td>0</td>
</tr>
<tr>
<td>Percentile_15th</td>
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<tr>
<td>Median</td>
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</tr>
<tr>
<td>Percentile_85th</td>
<td>0.29885</td>
</tr>
<tr>
<td>Maximum</td>
<td>0.449</td>
</tr>
<tr>
<td>DateOfMax</td>
<td>4/22/2014</td>
</tr>
<tr>
<td>standard</td>
<td>(1.49203 - (log(hardness)*0.145712))<em>exp(1.273</em>(log(hardness)-4.705))</td>
</tr>
<tr>
<td>StandardsExceeded</td>
<td>NA</td>
</tr>
<tr>
<td>Impaired</td>
<td>NA</td>
</tr>
<tr>
<td>Assessment</td>
<td>Poor Resolution</td>
</tr>
</tbody>
</table>

Legend
- Assessment Colors:
  - Acceptable
  - Concern
  - Data Gap
  - Good
  - Poor
  - Poor Resolution

SegmentID (Category_303d):
- 1
- 2
- 3
- 3a
- 3b
- 4
- 4a
- 4b
- 4c
- 5

UseClass:
- Agriculture
- Aquatic_Life
- Human_Health
- Recreation
A Little Political Data

Current congressional district map

Computer-drawn map to optimize compactness

https://www.reddit.com/r/MapPorn/comments/40tlhb/us_congressional_districts_redrawn_by_a_computer/
Predictions for 2018

- Transparency will be a national political issue.
- There will be significant progress publishing, accessing, and using open water data in Colorado.
- Key projects and organizations will catalyze the use of open data.
- Organizations will increasingly use open data and data-driven stories to present issues through the lens of each organization.
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dondata | opensoftware | opendecisions
openwaterfoundation.org