

Colorado's Water Resources Database (HydroBase)

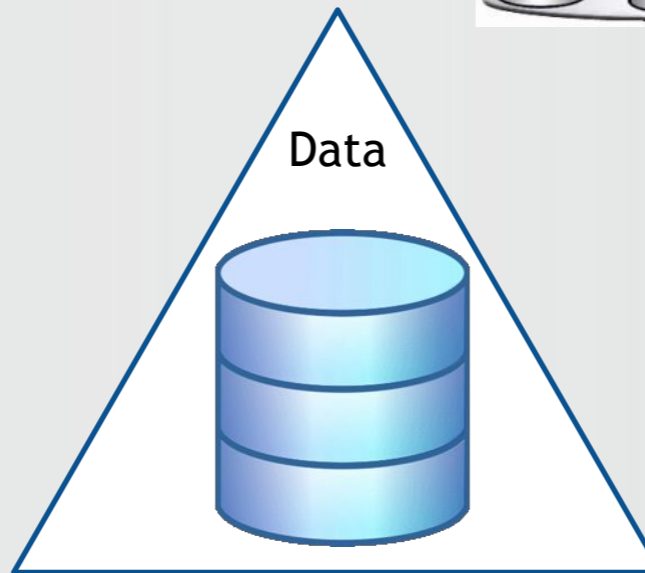
New Mexico water data meeting April 28th, 2020

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Division of Water Resources



What data did we integrate?

Tabular Data
(HydroBase)



Electronic Content



Spatial Data



Tabular data

- Administrative Calls
- Climate Stations *(NOAA, NRCS, other)*
 - Evap
 - Temperature
 - Precipitation
 - Solar
 - Snow (Depth, SWE)
 - Vapor Pressure
 - Wind
- Dam Safety
 - Jurisdictional
 - Non-Jurisdictional
 - Livestock Water Tank / Erosion Control (LSWTECD)
- Final Permits
- Ground Water
 - Geophysical Logs
 - Water Levels *(DWR, USGS)*
- Irrigated Lands
- Stations - Telemetry *(DWR, USGS, Cooperator)*
 - Ditches
 - Reservoirs
 - Streamflow
 - Wells
- Structure
 - Diversion Records
 - Water Rights
 - Well Metering
- Surface Water Stations *(DWR, USGS)*
- Well Applications / Permits

GIS Layers

Polygon / Line

- Admin Boundary
 - City
 - County
 - Designated Basin
 - etc...
- Climate Isohyet
- DWR Admin Data
 - Well encumbrance parcels
- Ground Water
 - Alluvial
 - Bedrock
- Instream Flow Reaches
- Irrigation Canals
- Irrigated Lands
- Soils Information
- Surface Water Supply Index
- Water Source Hydrography

Point

- Climate Stations
- Dam Safety
- Final Permits
- Ground Water
- Structures
- Surface Water
 - Stations - Telemetry
 - Historic Steamflows
- Well Applications / Permits

Raster/Imagery

- Aerial Photos
- NAIP

Electronic Content

- Abandonment Listings
- Board and Commission Meetings
- Consent Maps
- Dam Safety
- Diversion Records
- Division Filings
- Geophysical Logs
- Guidance Documents
- Hearings
- Historical Court Actions
- LSWTECD
- Map and Filing Statements
- Official Tabulations
- Pre-213 Worksheets
- Publications and Reports
- Reference Library
- Referrals
- Rulemaking
- State Archive Inventory Lists
- State Engineer Filing
- Straight Line Diagrams
- Substitute Water Supply Plans
- Water Court
- Water Court Resumes
- Well Permit Information

[Description of all document types](#)

Data Integration

CDSS Vision

- Build singular repository for all data (internal and external)
- DSS tools all data centered

Started by created HydroBase schema/framework. Imported data from:

- dBase
- MS Access
- Spreadsheets (Excel, Quattro Pro, etc.)
- Text files

Data Sources

- DWR business teams
- Federal agencies (USGS, NOAA, NRCS, etc)
- Conservation Districts

Refreshed data annually

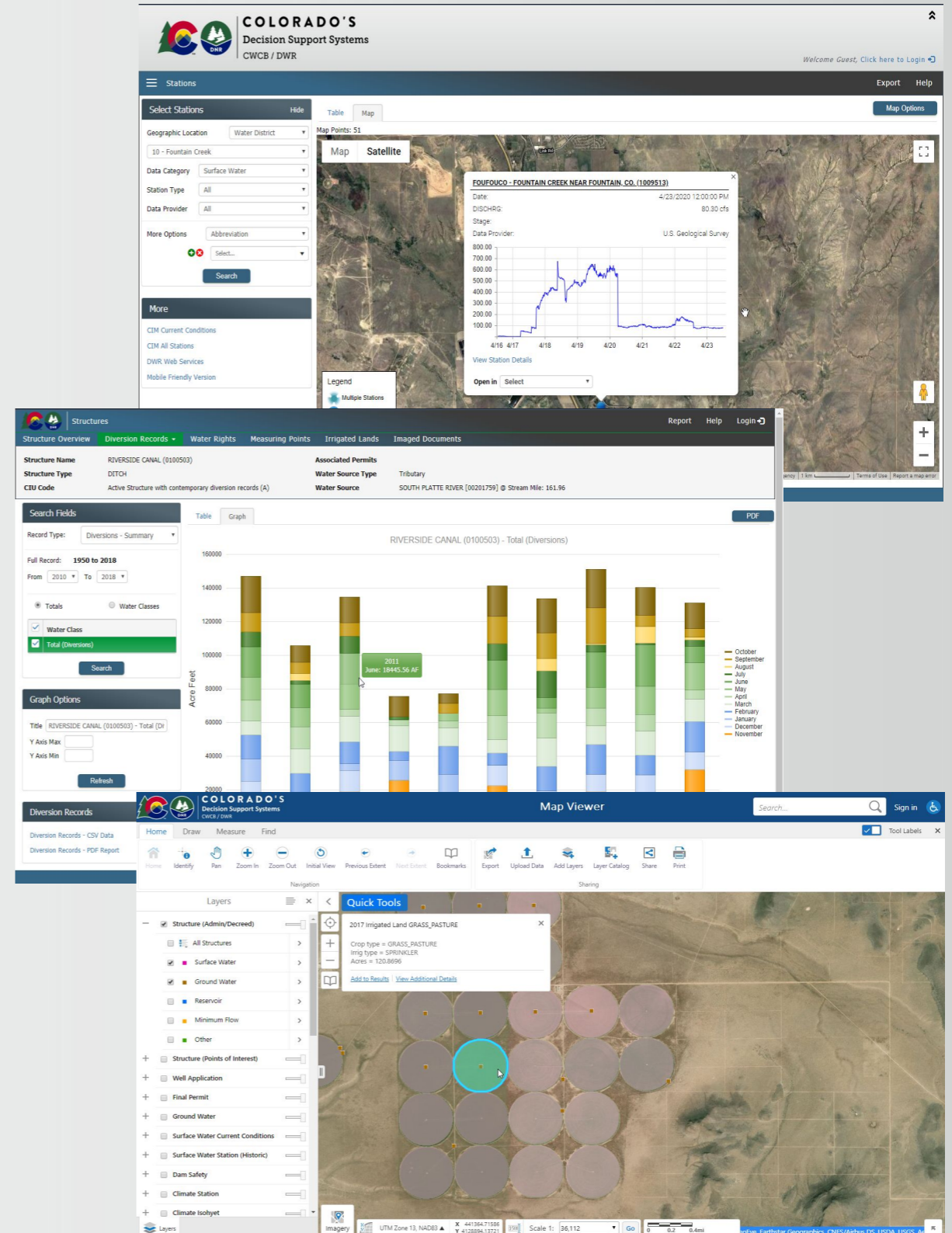
Data Integration today

- **Administrative data**
 - Integrated all DWR data entry directly into HydroBase.
 - Added ability for Water Users to enter/upload Diversion Record, Meter Readings, and Water Levels via Online tools - pending DWR approval
- **Telemetry Data (near real time)**
 - Satellite (DECODES)
 - Cellular
 - REST services pull (USGS, several larger Conservation Districts)
 - REST services push (user provided)
- **Climate Data / Streamflow / Snow Pack (monthly)**
 - Use data provider web services (USGS, NOAA, etc)
- **CDSS Basin projects (special project)**
 - typically one time digitization of historic records, modeling data



Products

- CDSS Modeling Tools
 - *Planning Tools*
- CDSS Online Tools
 - *User Research / Report focus*
- CDSS REST Services
 - *Consumable by other programs*
- Colorado Information Marketplace
 - *Socrata Open Data platform*
 - *API*
 - *User visualization tools*
- Map Viewer
 - *Spatial search/analysis tools*



All accessible via:

<https://www.colorado.gov/cdss>

and/or

<https://dwr.state.co.us/tools/>



COLORADO
Division of Water Resources
Department of Natural Resources

CDSS RESTful Services

Exports formats

- json
- xml
- csv

DSS Site has usage examples for

- Excel
- Google Sheets
- Javascript
- OpenCDSS repository
 - Even more examples

The CDSS REST services provide HydroBase data programmatically for consumption by outside entities. Users can request data from the services in two ways:

- Enter a properly constructed URL in your browser or other application (such as a spreadsheet)
- Send a properly constructed request object with a header

[Datasets](#) [Technical Information & Help](#)

[Getting started](#) [URL Syntax](#) [Response Status and Errors](#) [Custom Response Headers](#) [Response Data Formats](#)

Getting started

Version number: 2.3
Version Number - All
Current user's usage
Release Notes / Ver:
Example usage of R
Example usage of R
Example usage of R

See the [OpenCDSS](#).

The CDSS REST service allows both a
There is also a limit fr
Anonymous Users:

cdss-rest-services-examples

This repository contains examples to access water-related data from the State of Colorado's HydroBase REST web services using various tools and technologies. The project to create this repository was funded by the [Colorado Water Conservation Board \(CWCB\)](#). This repository provides information in addition to that presented on the [Technical Information & Help](#) page. The goal of this repository is to provide examples of technologies that consume the REST web services, implemented in a way that can be understood by a wide audience of users with varying level of technical skills. Hopefully these examples help save time and effort.

- [Introduction](#)
- [Examples](#)
- [Repository Contents](#)
- [Development Environment](#)
- [License](#)
- [Contributing](#)
- [Maintainers](#)
- [Release Notes](#)

Introduction

Colorado's HydroBase REST web services implement [Representational State Transfer \(REST\)](#) web service design. In general terms, this means that each URL provided by web services corresponds to a unique data resource. The web service URLs correspond to major datasets available in HydroBase, typically tables and views in the database. The uniqueness of a URL and corresponding data can be refined by adding query parameters. An example URL is as follows (the `/` forward slash before the `?` is optional):

Technology Stack

Application Development

- SQL Server
- Full Stack .NET
 - MVC Framework
 - .NET Core
 - Entity Framework
- AJAX
- HTML5
- Razor
- jQuery

- Android/Xamarin

GIS Environment

- ArcGIS
- Geocortex

Electronic Content Management

- Laserfiche

Hosting

- State of Colorado OIT
 - Network
 - Virtual Servers

What did it take to get here?

A Team

Water Information Team

- ECM group (8)
- GIS group (2)
- HydroBase Dev. group (2)

IT Team

- 3-5 developers
- 1 Tester + Business UAT
- DBA support
- Network and Server support

Partners

- Colorado Water Conservation Board
- Active Water Community

Ongoing Commitment

- Started in 1990s
- Now on 3rd technology port of some tools
 - Newest port of online tools has taken approximately 6-7 FTE years



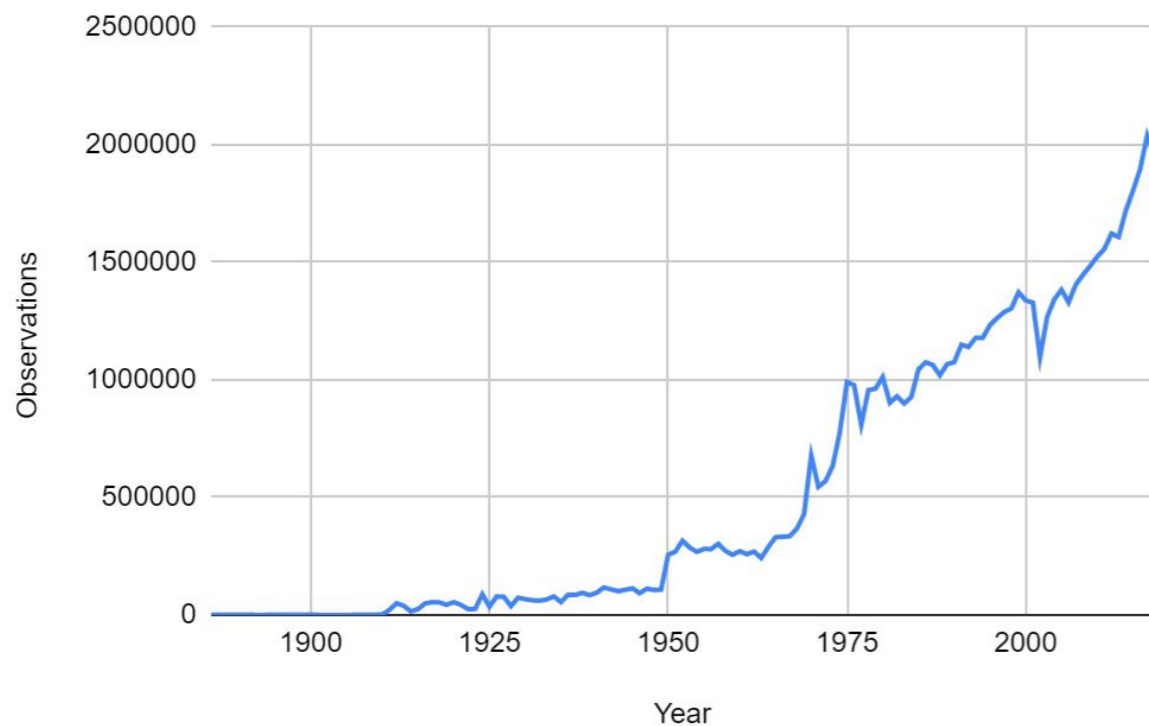
Benefits Recognized

- **Accessibility**
 - 24-hour access to data
 - Essentially all of our data is viewable by public via tools
 - Eliminates conflicting data results
 - Builds trust
- **Better data**
 - Essentially crowdsourced QA QC
- **Decision Making**
 - Quicker, better informed administration of water
- **More administration / data**
 - Less time answering generic data questions, more time for administration for maximum beneficial use

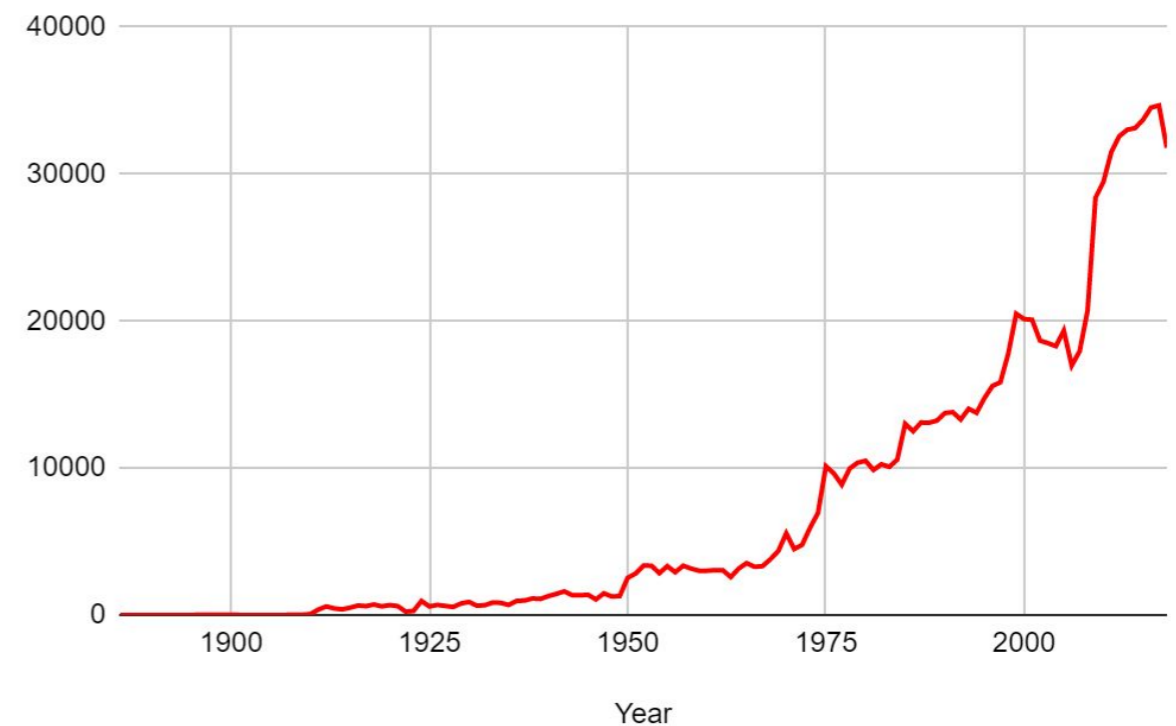
The numbers...

Diversion Records POR: 1886-Current 69,164,297 values (2 GB)

Diversion Records "Observations" By Year



Diversion Record Structures By Year

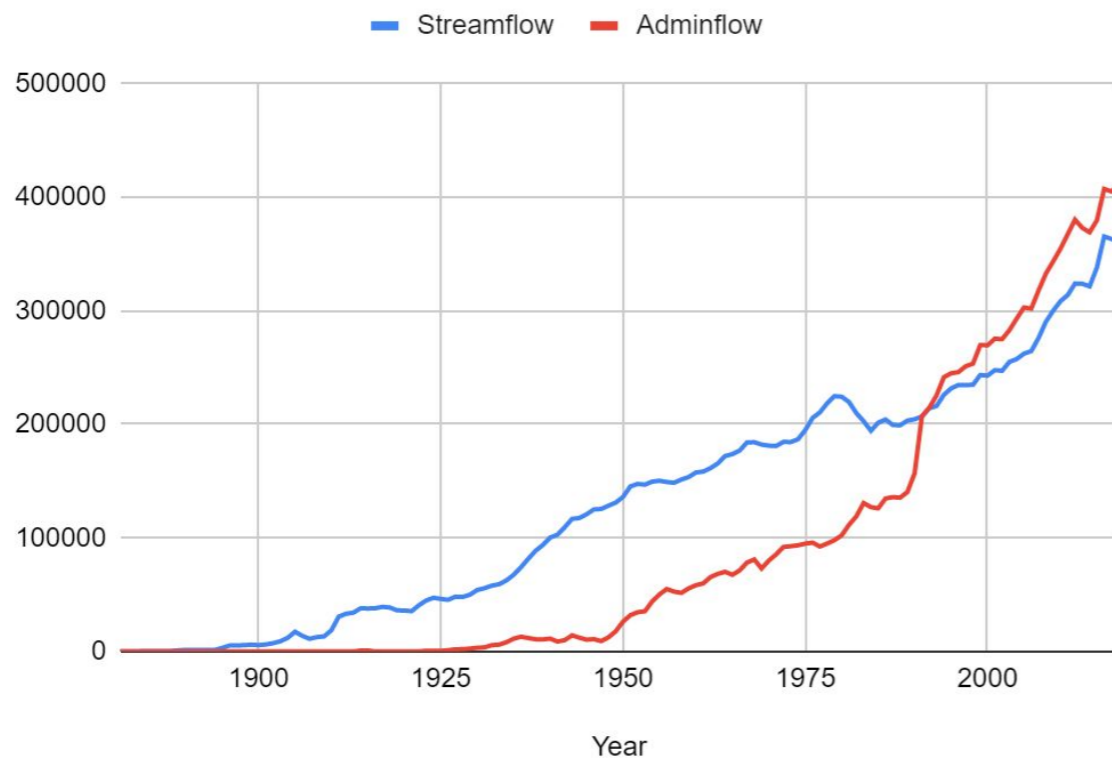


- DWR had complete electronic records from mid-1970's
- CDSS basin projects responsible for most of data digitization back to 1950's
- Pre-1950 typically digitized for water court actions

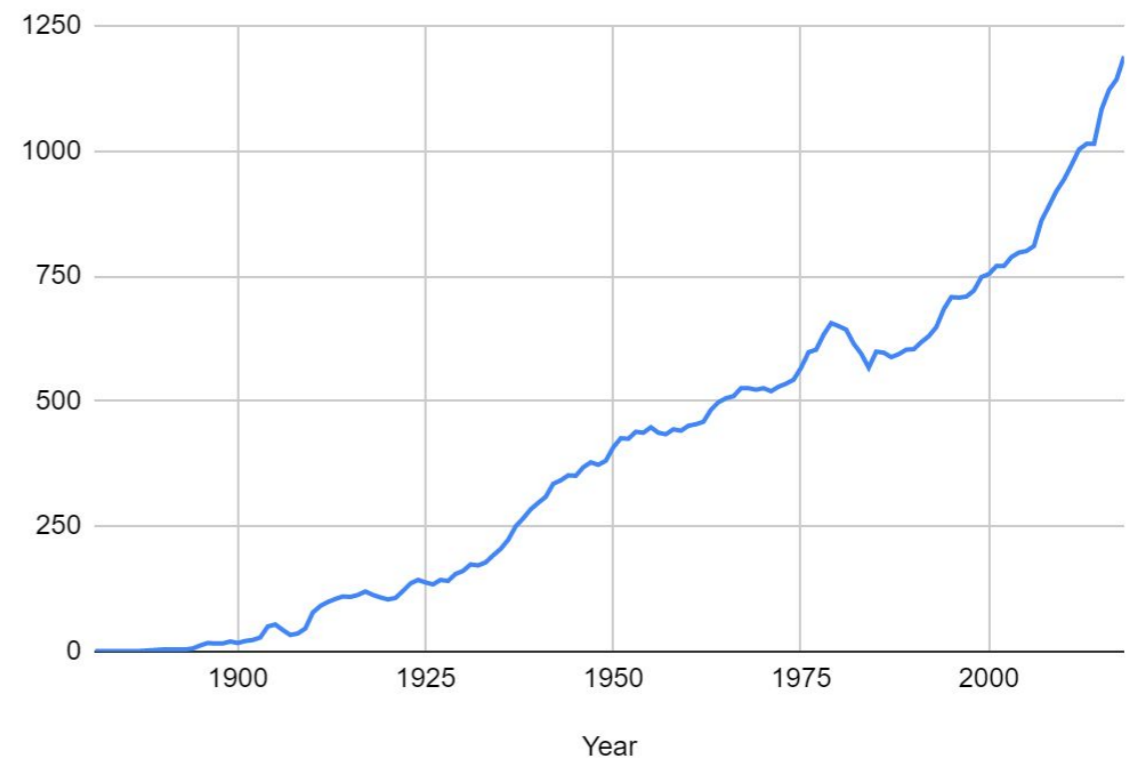
The numbers...

Surface Water Stations POR: 1881-Current 18,418,998 values

Streamflow and Adminflow "Observations" By Year



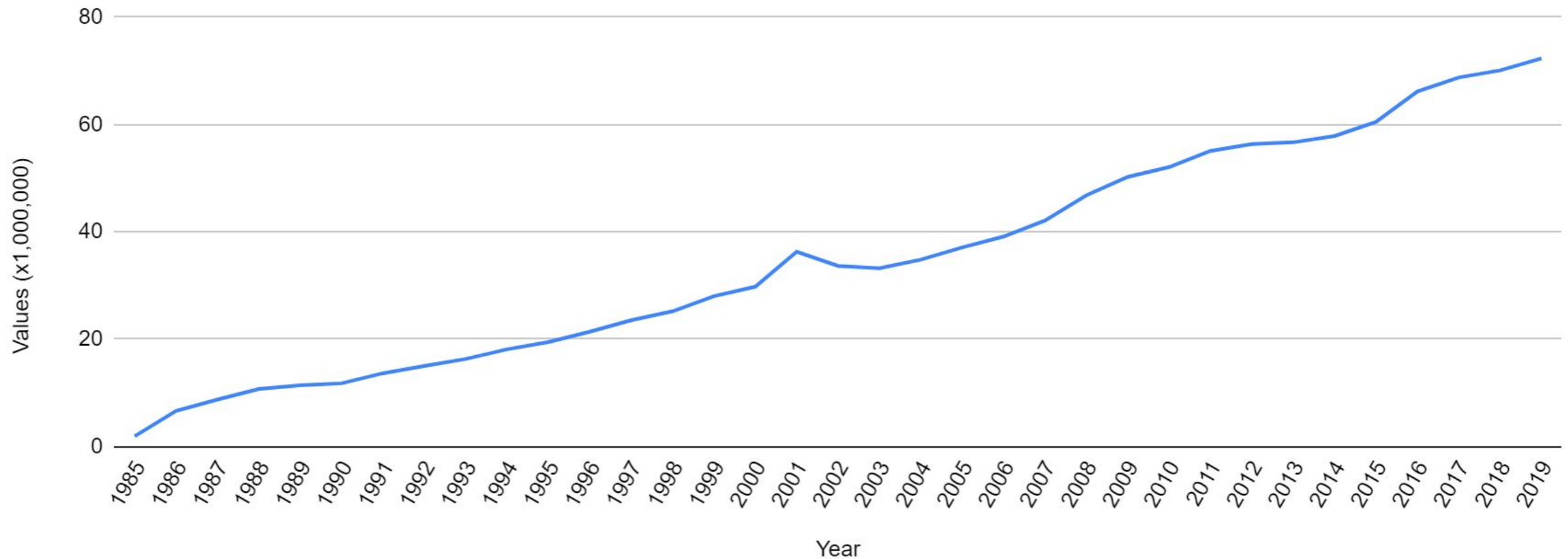
Streamflow and Adminflow Stations By Year



The numbers...

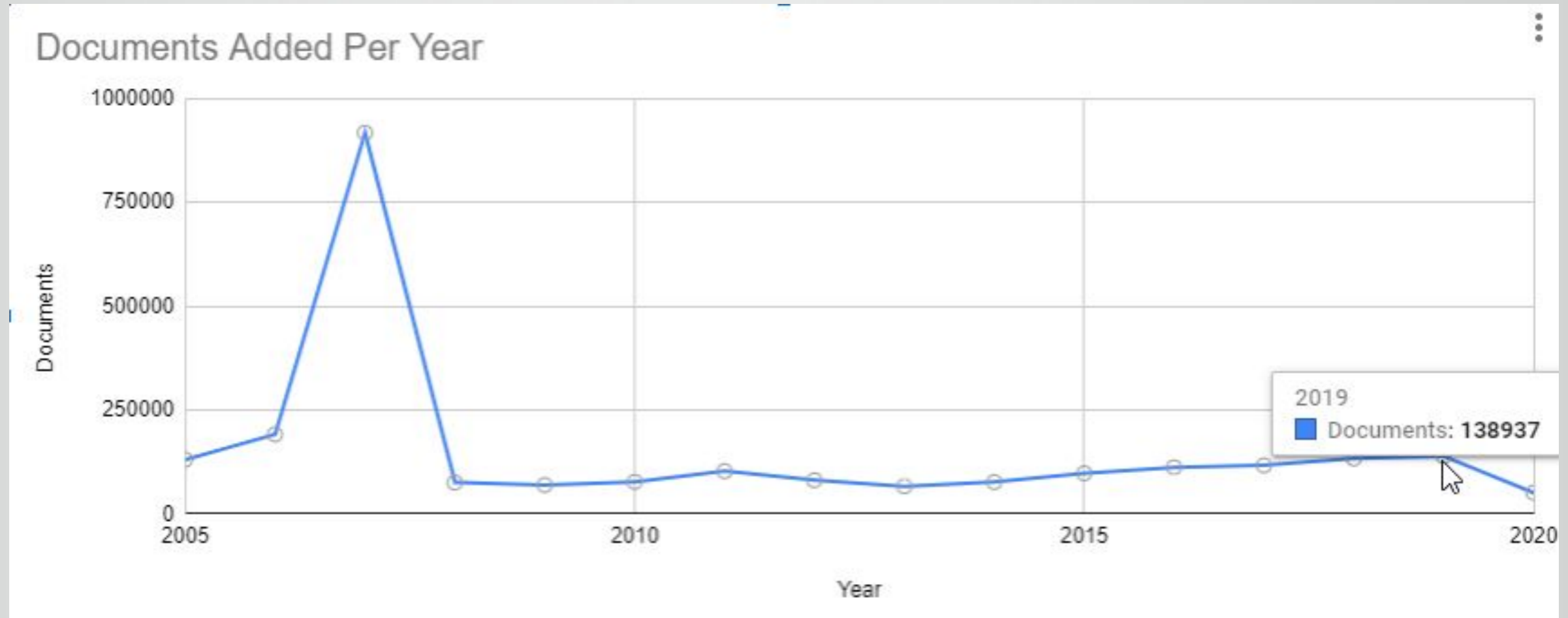
Telemetry Stations POR: 1985-Current 1,273,492,611 values (233 GB)

Telemetry Data received by year



The numbers...

Electronic Documents POR 1850-Current 2,438,979 documents (2.1 TB)



- DWR began digitizing document into a ECM solution in 2000
- Move to Laserfiche ECM solution in 2005
- 2006-2007 Loaded all Water Court actions
- Still a long ways from having everything in backfile imaged

Questions?

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Useful Links:

[Beginner's Guild to DWR's Use of Technology for Water Information](#)

[CDSS Website](#)

[CDSS Online Tools](#)

[Colorado Information MarketPlace](#)

[CDSS REST Web Services](#)