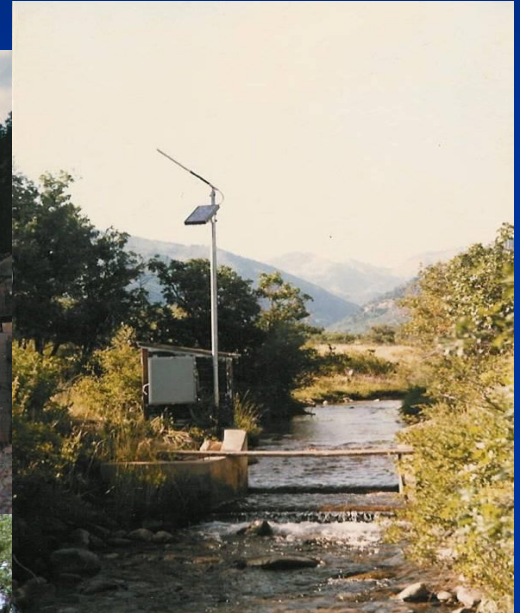
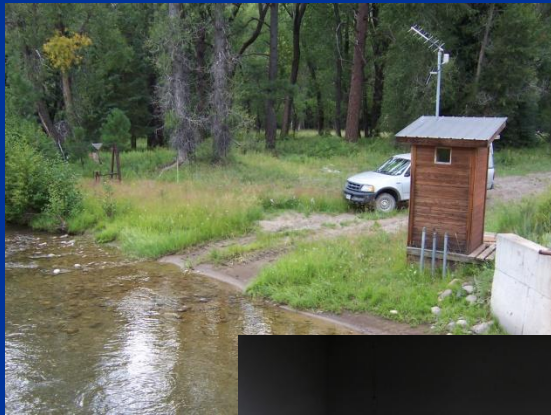


Overview: Colorado's Satellite-Linked Water Resources Monitoring System



Colorado Satellite-Linked Water Resources Monitoring System

- Brief description and update on the current system
- Partnerships and coordination



Partnerships and Coordination

- Federal Agencies
 - **USGS**
 - USBR
 - NOAA-NWS
 - NRCS
 - USFWS
- State Agencies
 - **CWCB**, DOW, Parks, CDPHE
- Local
 - Water Districts
 - Cities
- Water Users

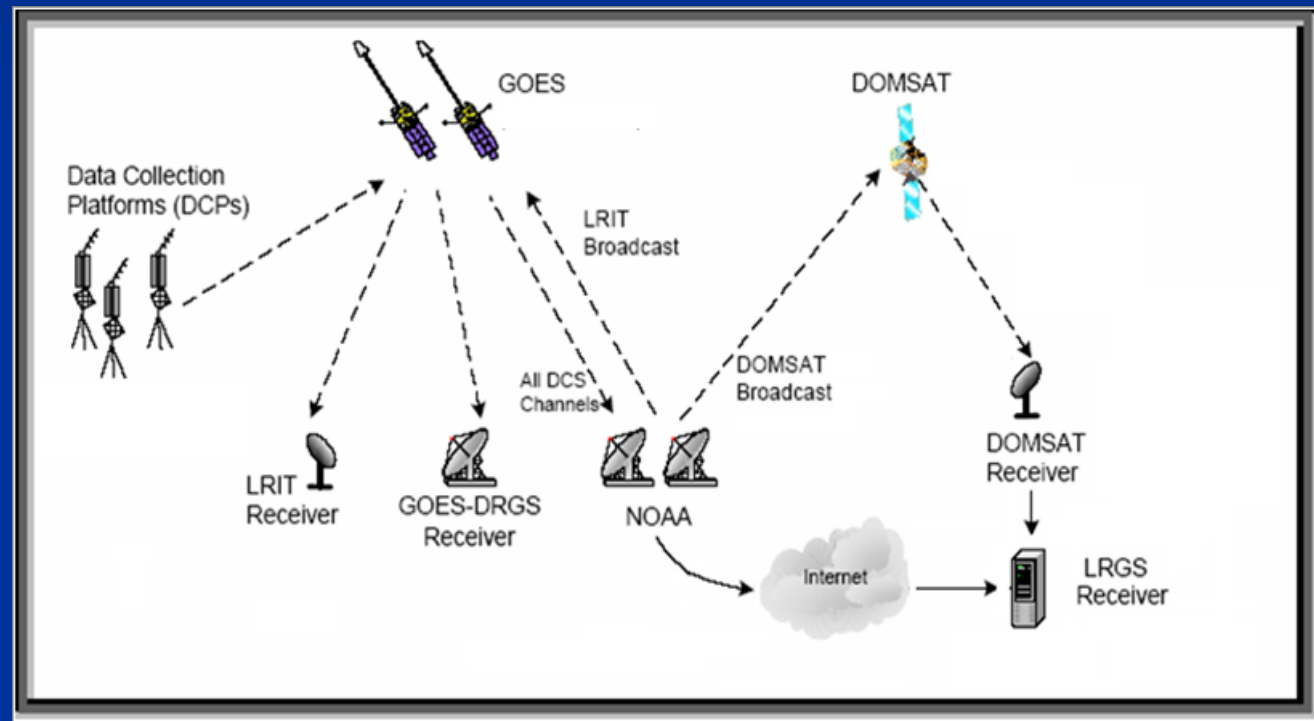
Colorado Satellite-Linked Water Resources Monitoring System

- Water administration /distribution
- Compact administration
- Water storage and release
- Flood warning/monitoring
- Dam safety
- Recreation/safety
- Environmental monitoring
- Minimum stream flow
- Certified final stream flow records
- Hydrologic modeling
- Water rights analyses, exchanges, transfers
- Litigation
- Wildlife and fisheries
- Water quality

Colorado Satellite-Linked Water Resources Monitoring System



a network of automatic surface water gaging stations collecting and reporting observations of stage (water level) and other environmental parameters using satellite telemetry in near real-time



Satellite Monitoring System

Data Collection: Remote Sites

■ Gaging stations

- Rivers, streams, creeks, canals, ditches, reservoirs
- Sense water level or stage by float-activated shaft encoder, bubbler systems, pressure transducers, radar
- Programmable data collection platforms (DCPs) collect and store observations typically every 15 minutes



■ Satellite Telemetry

- Hourly transmissions at 300 baud (older DCPs transmit every 4 hours at 100 baud)
- Use GPS to maintain accurate time synching with GOES satellite
- 91% of active DCPs are converted to High Data Rate (HDR)
- ~ 48 DCPs remain to upgrade to HDR





Satellite Monitoring System Data Collection

■ DWR Data Collection

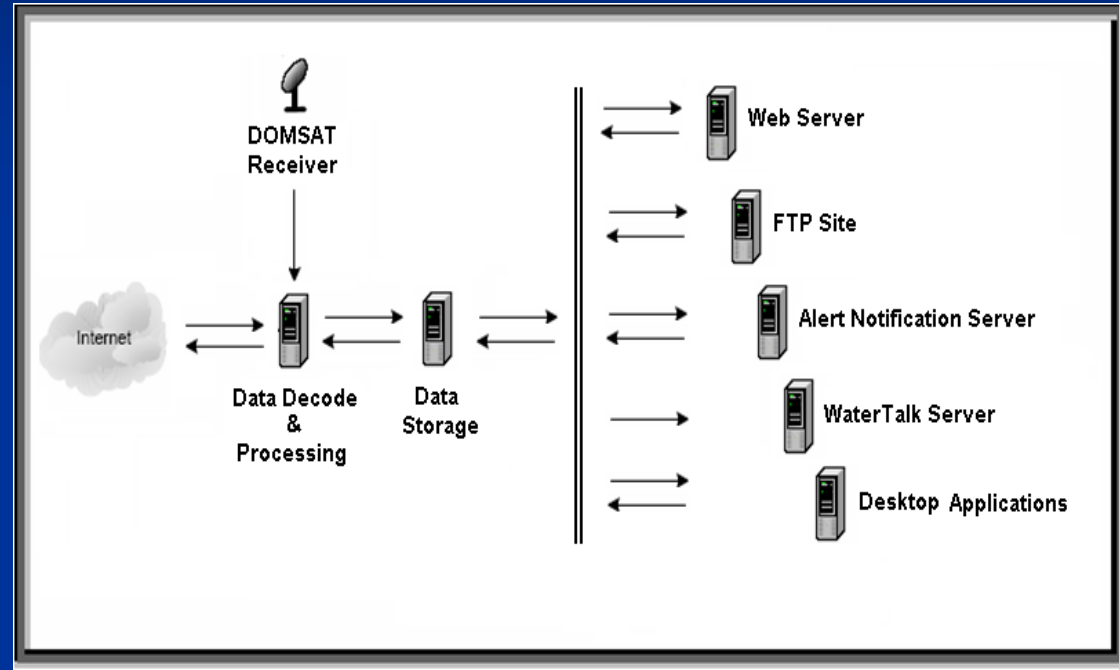
- 463 DWR gaging stations on satellite telemetry
- 65 cooperator gaging stations
- Federal agencies (USBR, USACE, NWS)
- Local entities (Colorado Springs, Aurora, etc.)
- Stream flows and diversions
- Reservoir levels
- Environmental data (precipitation, air and water temperature)
- Water quality parameters (cooperators)

■ Data from external providers

- 375+ external stations
- U.S. Geological Survey
- Water conservancy districts (NCWCD, LSPWCD, SVLHWCD)

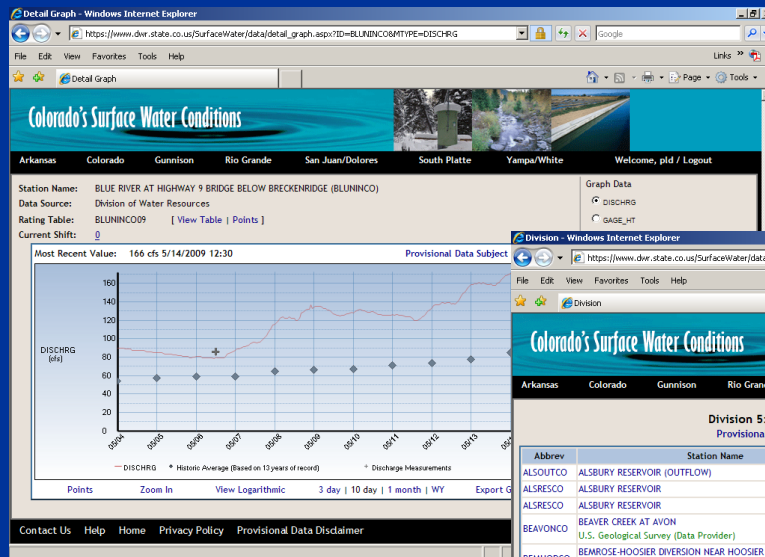
Data Processing Overview

- Decode 463 DWR DCPs
- Decode 65 cooperator DCPs
- 10,700+ transmissions /day
- 105,500+ data values/day
- 32,000+ diagnostics values/day (signal strength, battery voltage, error codes)
- Data provider stations (USGS, NCWCD, others)
 - Via web services
 - Data automation services
 - 45,200+ data values / day



Colorado's Surface Water Conditions Web Site

- Provide near real-time telemetry data to personnel and the public
- Detailed graphs
- Tabular data
- Approximately 3 million page views per year



Division 5: Colorado River Basin
Provisional Data Subject To Revision

Abbrev	Station Name	Parameter	Gage Ht	Value	Date/Time
ALSOUTC	ALSBURY RESERVOIR (OUTFLOW)	DISCHRG	3.28 ft	E	5/14/2009 12:15
ALSRESO	ALSBURY RESERVOIR	ELEV	9049.01 ft	5/14/2009 12:15	
ALSRESO	ALSBURY RESERVOIR	STORAGE	83.2 AF	5/14/2009 12:15	
BEAVONCO	BEAVER CREEK AT AVON	DISCHRG	53 cfs	5/14/2009 12:15	
BEMHODO	BEMHOSE-HOOSIER DIVERSION NEAR HOOSIER PASS	DISCHRG	5.2 cfs	5/14/2009 12:00	
BIGUPPCO	BIG CREEK AT UPPER STATION NEAR COLLBRAN	DISCHRG	2.25 ft	160 cfs	5/14/2009 12:15
BLUABLCO	BLUE RIVER AT BLUE RIVER, CO.	DISCHRG	65 cfs	5/14/2009 09:45	
BLUDILCO	BLUE RIVER BELOW DILLON RESERVOIR	DISCHRG	151 cfs	5/14/2009 11:00	
BLUGRECO	BLUE RIVER BELOW GREEN MOUNTAIN RESERVOIR	DISCHRG	103 cfs	5/14/2009 12:00	
BLUNINCO	BLUE RIVER NEAR DILLON, CO.	DISCHRG	289 cfs	5/14/2009 12:00	
BLUNINCO	BLUE RIVER AT HIGHWAY 9 BRIDGE BELOW BRECKENRIDGE	DISCHRG	1.48 ft	166 cfs	5/14/2009 12:30
BLUPENCO	BLUE RVR ABV PENNSYLVANIA CR NR BLUE RIVER CO.	DISCHRG			
	UPPER BLUE RESERVOIR NEAR BRECKENRIDGE				

Tabular Data - Windows Internet Explorer

Colorado's Surface Water Conditions

Arkansas Colorado Gunnison Rio Grande San Juan/Dolores South Platte Yampa/White Welcome, pld / Logout

Station Name: BLUE RIVER AT HIGHWAY 9 BRIDGE BELOW BRECKENRIDGE (BLUNINCO)
Data Source: Division of Water Resources
Period of Record: 10/1/2008 to Present

Change Data View
Raw Data ☒ DISCHRG
Hourly Ave. ☐ GAGE_HGT
Daily Ave. ☐

Start Date: 5/11/2009
End Date: 5/14/2009

View Data
Export

Change Sort Order

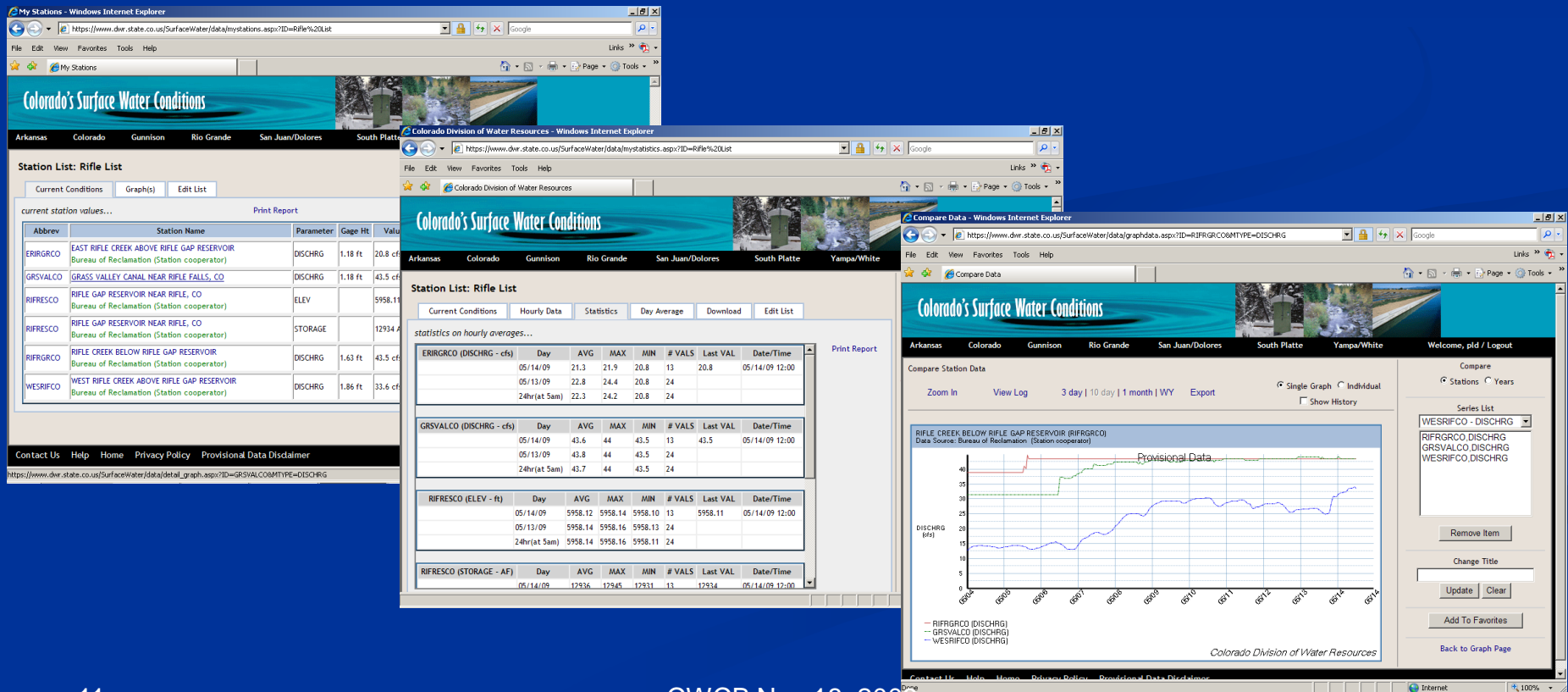
Time	DISCHRG (cfs)	GAGE_HGT (ft)
009 00:00	127	1.29
009 00:15	125	1.28
009 00:30	127	1.29
009 00:45	125	1.28
009 01:00	127	1.29
009 01:15	125	1.28
009 01:30	125	1.28
009 01:45	125	1.28
009 02:00	127	1.29
009 02:15	125	1.28
009 02:30	125	1.28
009 02:45	127	1.29
009 03:00	127	1.29
009 03:15	125	1.28

Division 5
Alphabetical
Water District
All Districts
36 Blue River Basin
37 Eagle River Basin
38 Roaring Fork River Basin
39 Rifle/Elk/Parachute Creeks
45 Divide Creek
50 Muddy/Troublesome Creeks
51 Upper Colorado/Fraser Rivers
52 Pinyon/Cottonwood Creeks
53 Tribes North of Colorado River
70 Roan Creek Basin
72 Lower Colorado River

My Stations
Hydrologic Management System

Colorado's Surface Water Conditions

- Customized user station lists
- Statistics
- Analysis / Comparison Tools



Telephony Solutions

■ Alert Notification System

- Dials out to subscribers
- User subscribed station list
- Informs subscriber of “red flag” conditions (minimum, maximum or rate of change)

■ WaterTalk

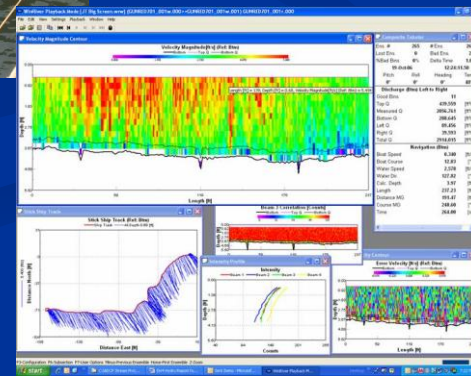
- Inbound stream flow condition requests
- Approximately 90,000 inbound call per year



Colorado Division of Water Resources

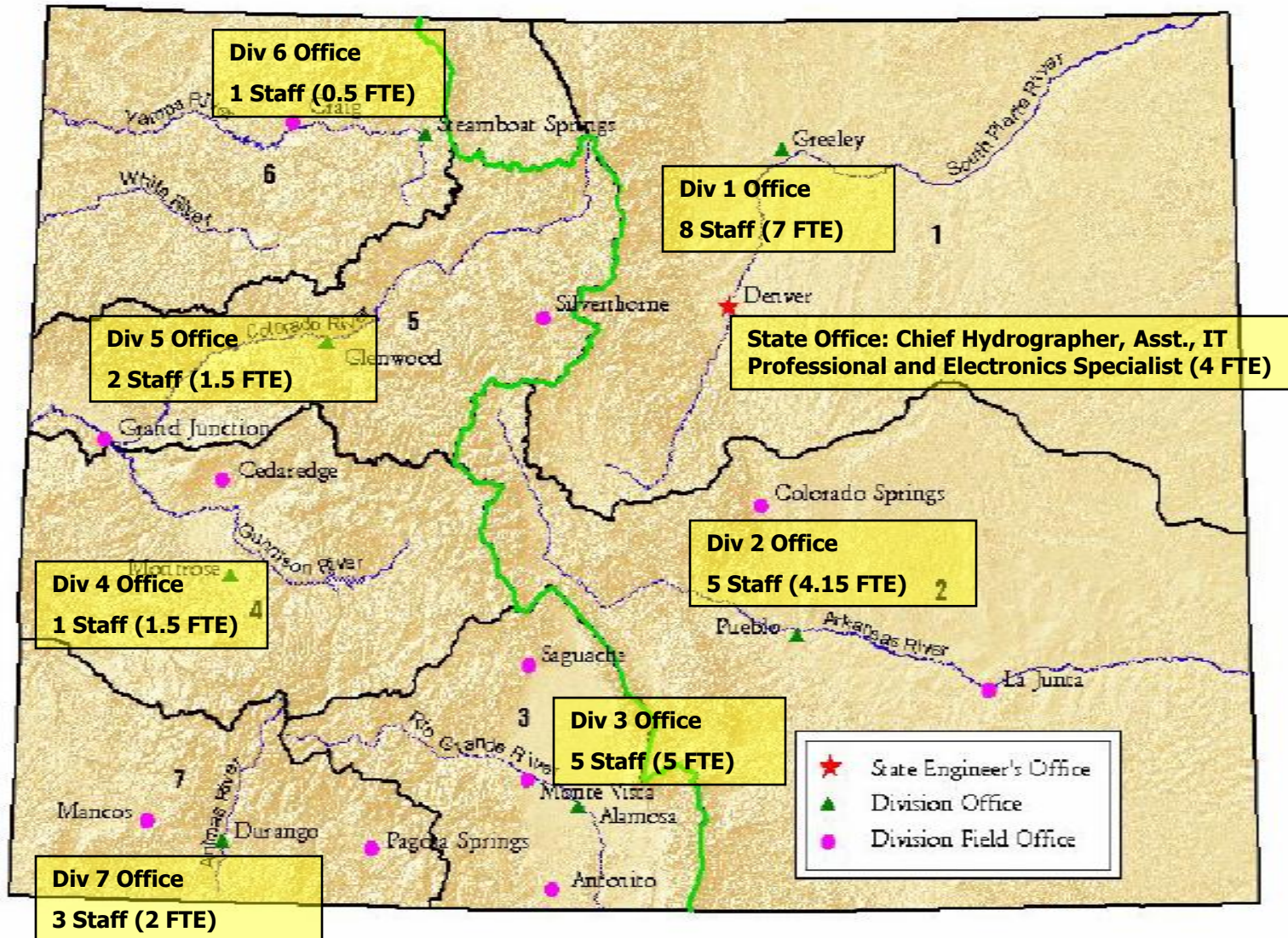
Hydrographic and Satellite Monitoring Branch

- Responsible for over 500 stream, ditch, and reservoir gages with automatic gage height collection and real-time reporting to DWR real-time streamflow web (www.dwr.state.co.us) site via GOES satellite
- 29 staff (24.9 FTE) statewide perform:
 - Gage operation and maintenance,
 - Over 4000 streamflow measurements annually to maintain stage-discharge relationships,
 - Satellite monitoring (electronic) equipment installation and maintenance
 - Streamflow record publication
 - Computer application/website support and maintenance



OFFICE OF THE STATE ENGINEER DIVISION and FIELD OFFICES

26 of 29 Hydro Branch Staff operate and maintain gaging stations



Colorado Satellite-Linked Water Resources Monitoring System

- 2005 streamgaging program cost study with USGS
 - \$2.9 million total annual program cost
 - Personal services (supervisory, field and clerical staff)
 - Field equipment
 - Office space, utilities, and supplies
 - State vehicle lease and O&M (mileage)
 - IT infrastructure (computer hardware) and support for data processing and maintenance
 - 400 active streamgages → \$7250 per gage
- Estimated 2009 program costs
 - \$3.5 million → ~\$7600 per active streamgage

Colorado Satellite-Linked Water Resources Monitoring System

- Annual operating budget for field operations:
 - SM General Fund (2 FTE and \$90,000 operating)
 - SM Cash Fund (\$145,000 annual spending authorization)
 - Current firm revenue is \$172,000 per year
 - CWCB Construction Fund Non-Reimbursable Request (\$350,000)
 - \$245,000 -- High Data Rate DCP upgrade/maintenance program
 - \$50,000 -- Streamgage Flood Hardening
 - \$55,000 -- Streamgage Refurbishment
 - \$40,000 (FY09-10) and \$60,000 (FY10-11) in GF operating to be re-financed with increased SM cash fund revenue

Questions?



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Monitoring Branch
Colorado Division of Water Resources
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