

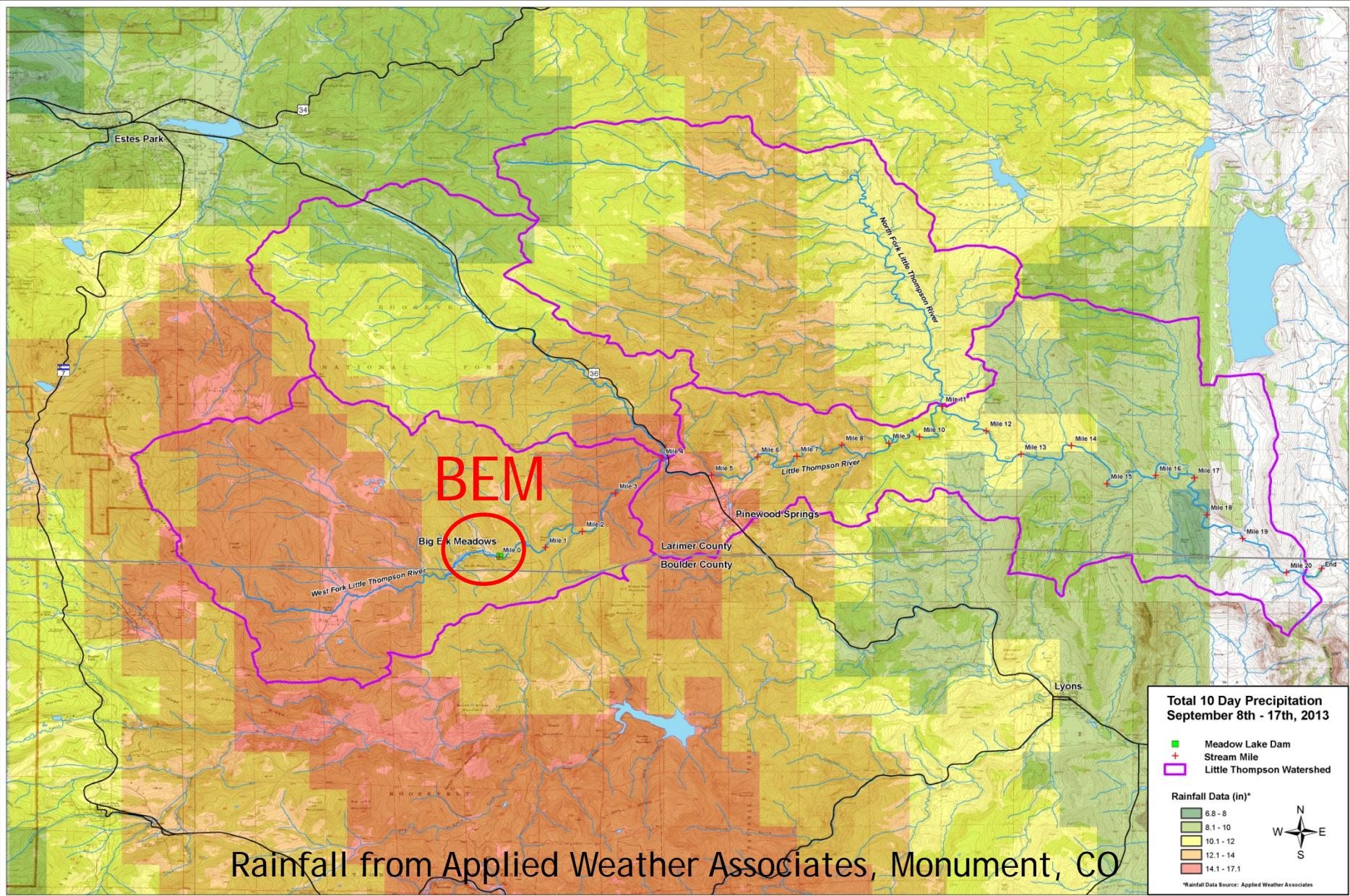
The 2013 Front Range Floods



COLORADO
Division of Water Resources
Department of Natural Resources

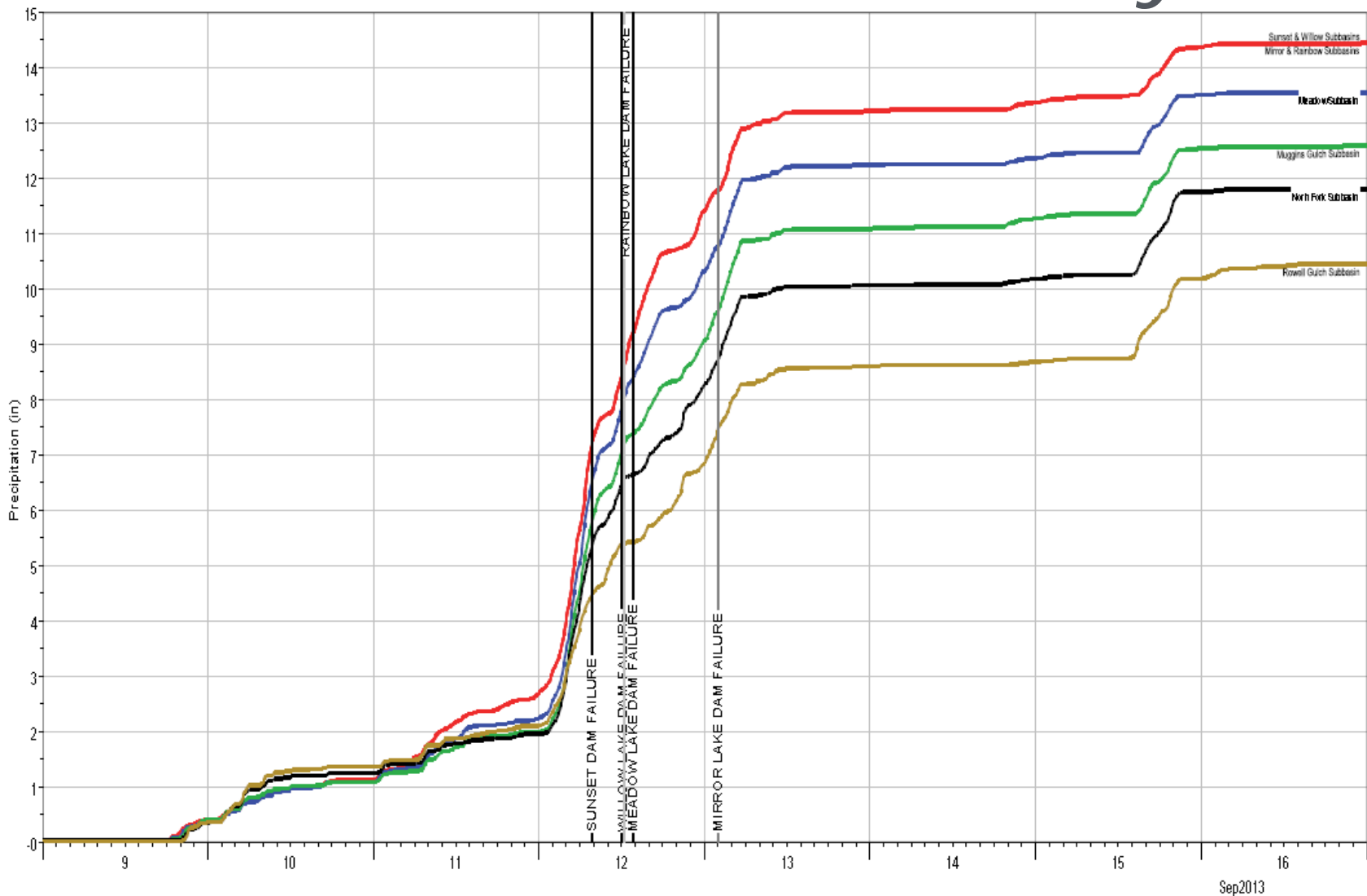
Kevin G. Rein, P.E.
State Engineer/Director

Big Elk Meadows Dams - Rainfall



Rain hard and fast early

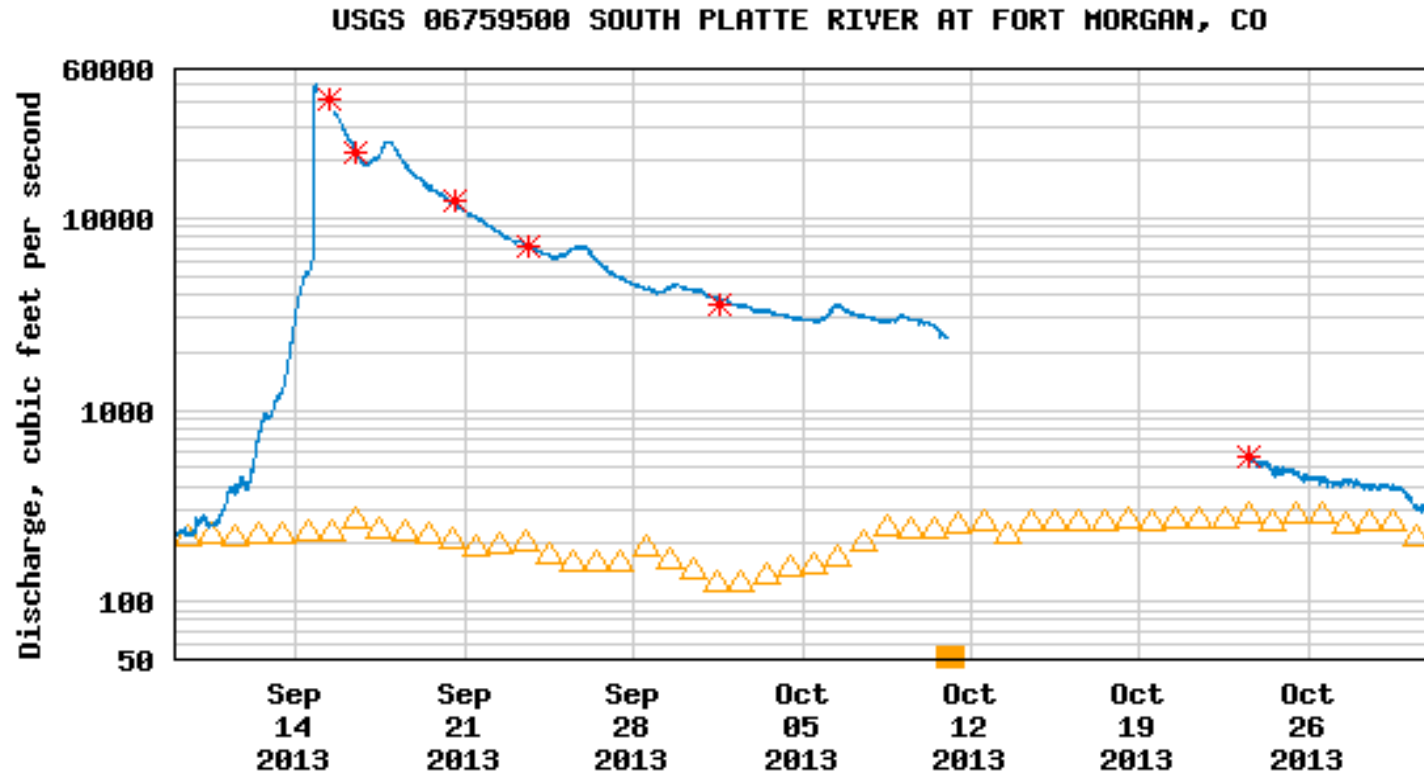
LITTLE THICK SINK RIVER WATERSHED
 SEPTEMBER 2013 CUMULATIVE RAINFALL



SEPTEMBER 9 - 16, 2013

- SUNSET_SUBBASIN RUN:FLOOD PRECIP-CUM
- RAINBOW_SUBBASIN RUN:FLOOD PRECIP-CUM
- WILLOW_SUBBASIN RUN:FLOOD PRECIP-CUM
- MIRROR_SUBBASIN RUN:FLOOD PRECIP-CUM
- MEADOW_SUBBASIN RUN:FLOOD PRECIP-CUM
- MUGGINSGULCH_SUBBASIN RUN:FLOOD PRECIP-CUM
- NORTH FORK_SUBBASIN RUN:FLOOD PRECIP-CUM
- ROWELL_GULCH_SUBBASIN RUN:FLOOD PRECIP-CUM

Rain hard and fast early

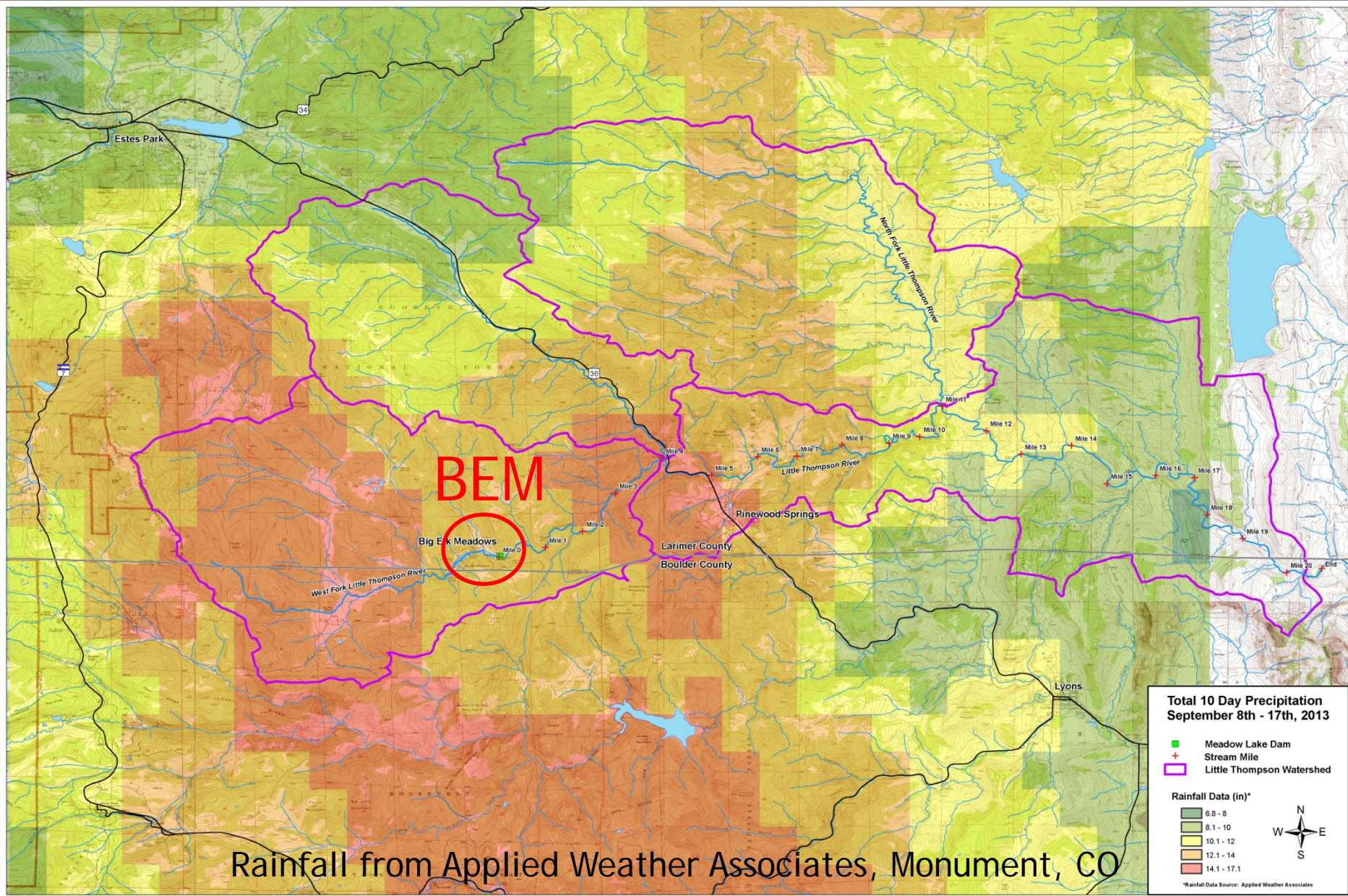


----- Provisional Data Subject to Revision -----

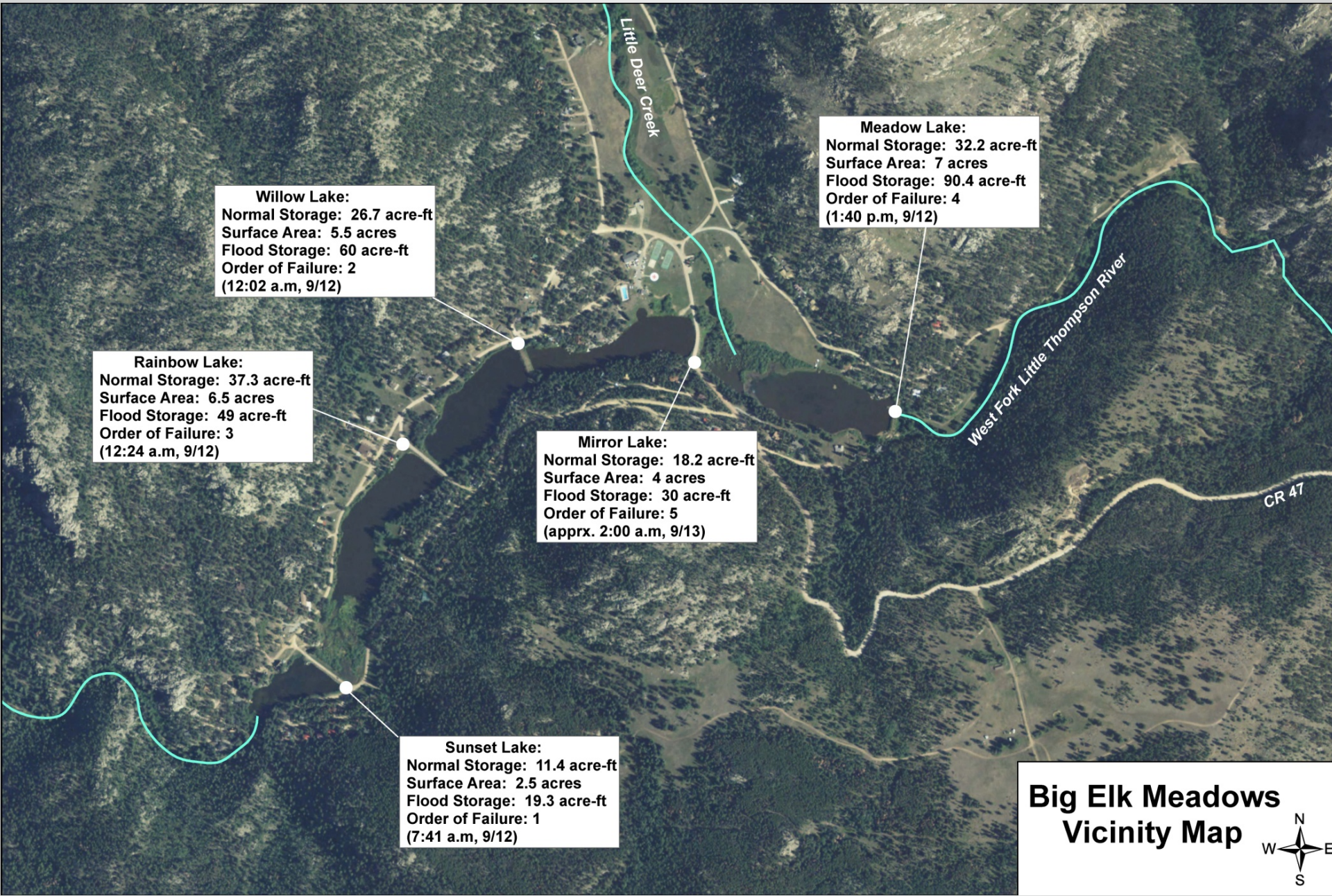
- △ Median daily statistic (25 years)
- Data temporarily unavailable
- Discharge
- * Measured discharge



Big Elk Meadows Dams - Rainfall



Minor, Low Hazard Dams Hit Hard



Meadow Lake Dam



Mirror Lake Dam



Willow Lake Dam



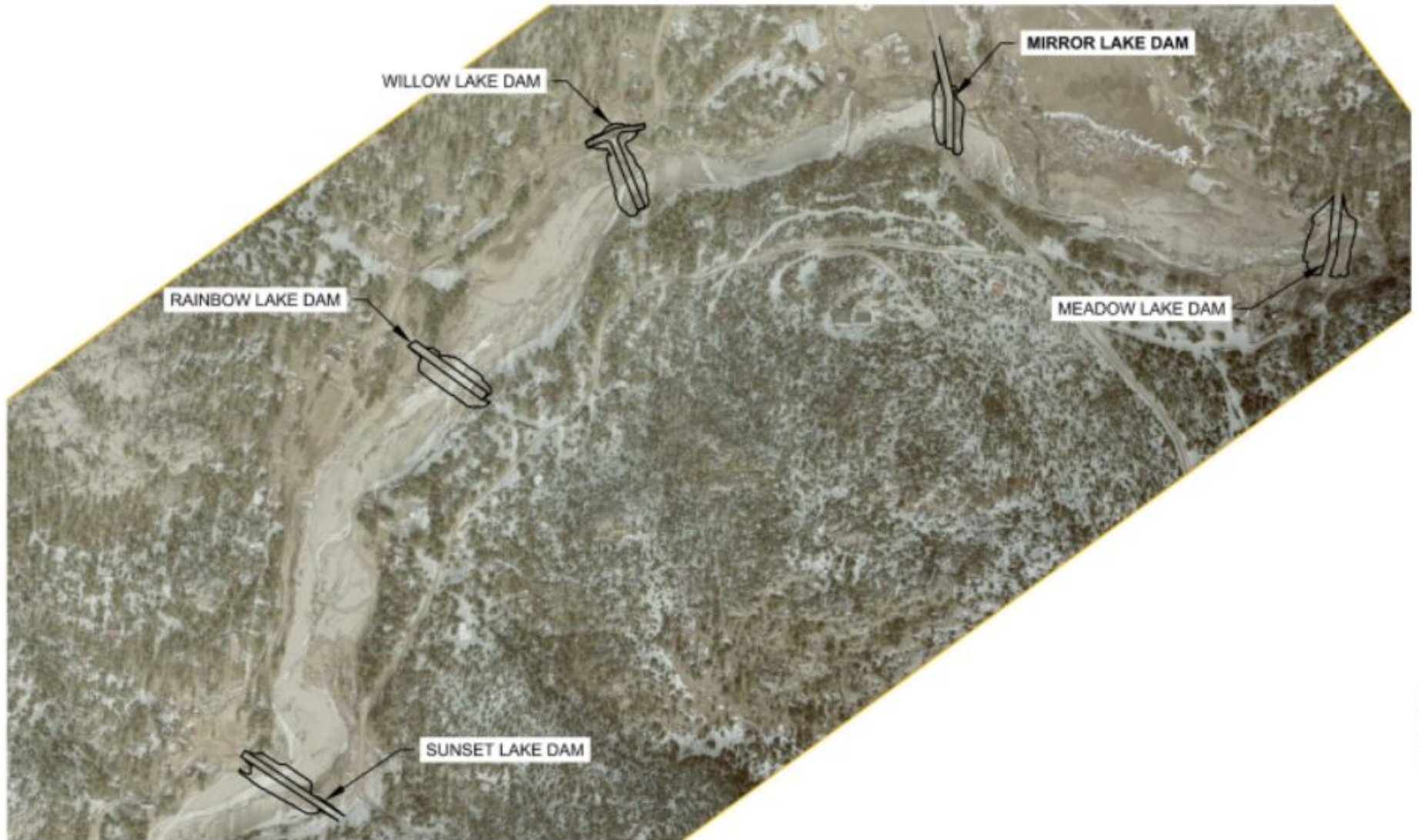
Rainbow Lake Dam



Sunset Dam



Plans for Construction



Mirror Lake Dam



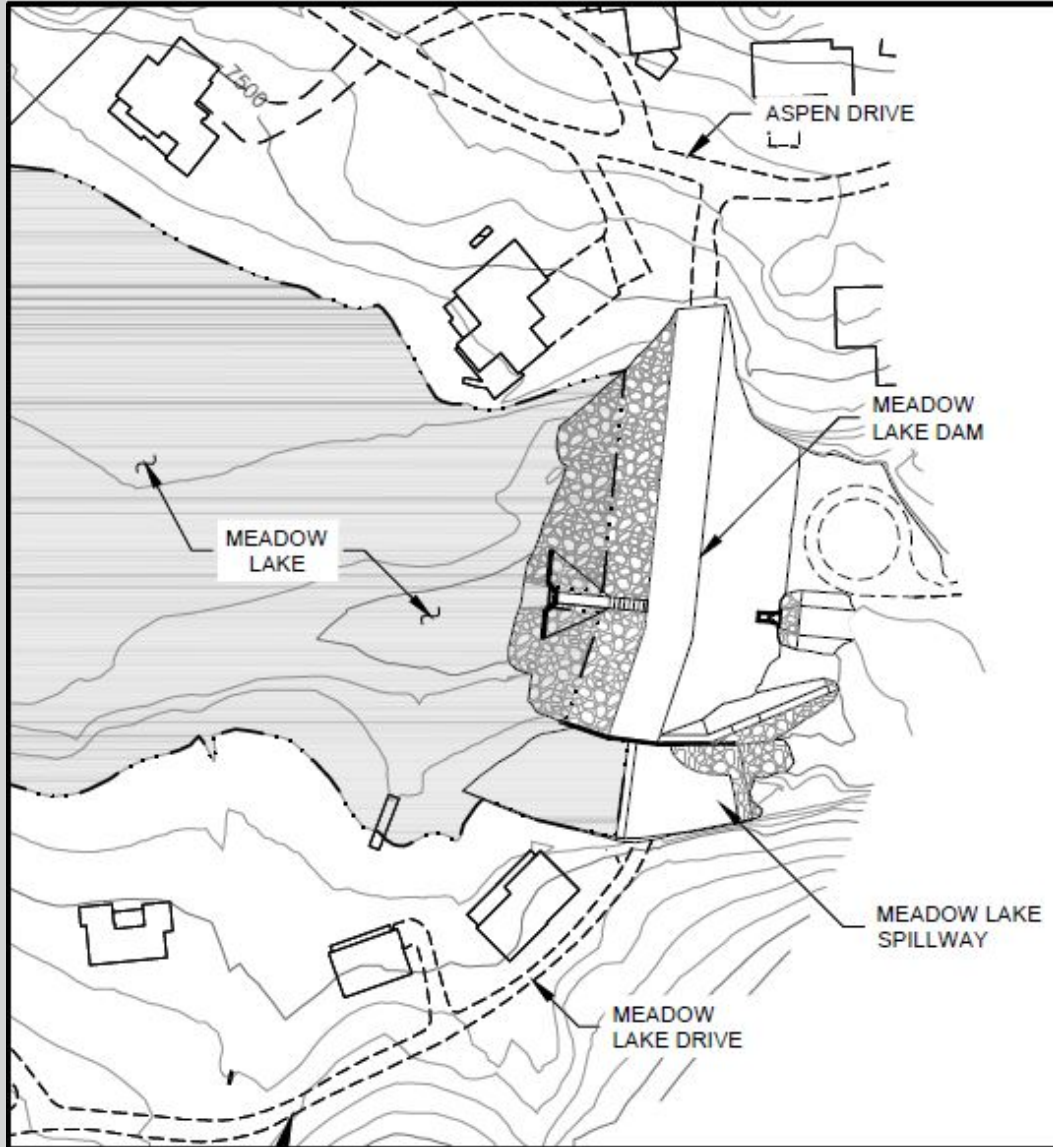
Rainbow Lake Dam



Willow Lake Dam



Meadow Lake Dam



*Approved, 2016
Funded, 2017
Construction, 2018*

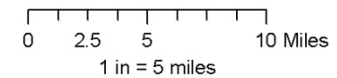
Emergency Dam Inspections - Why?

- Massive Infrastructure damage happening, roads/water/wastewater/homes/businesses
- Uncertainty Regarding Exposure of dams to rainfall above design requirements
- Public Anxiety over status of dams
 - Erroneous reports of dams failing
 - Real reports of dams failing
 - Public “on edge” over impacts of flooding
- Need to move from Emergency Response to Recovery as quickly as possible

Emergency Inspections - Where/How Many?

Dams Requiring Emergency Inspection

Hazard Class	Assessment Status	Rainfall Return Interval
□ High	□ Awaiting Assessment	□ 1 - 30 (yrs)
○ Significant	■ Safe For Normal Operation	■ 30 - 100
△ Low	■ Functional; Some Repairs	■ 100 - 300
◇ NJ	■ Potential Safety Issues	■ 300 - 500
	■ Urgent	■ 500 - 1000



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Rainfall ARI data provided by MetStat, Inc, Ft Collins, CO, 9/15/13

Emergency Inspections - Why Not?

- Numerous engineers reaching out to help

but...How?

- Scope Documents - Duties, Safety
- Waiver (AG's office)
- Volunteer "hiring" (HR/Purchasing)
- Dam Inspection Selection Process
- Dam Lists, Dam information
- Inspection Assignments
- Group Managers
- Reporting

Emergency Dam Inspections Program - Who?

Emergency Dam Inspections Program Statistics

Participants	Number	Comments
Volunteer Engineers	113	Teams of two, all lead by a Colo. Professional Engineer
Federal Agencies	4	NRCS, USACE, USBR, FERC
State Agencies	1	Wyoming
Engineering Firms	27	From up and down Front Range

Spillway Flows 9/20/13 (70)



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Emergency Dam Inspections - How'd it go?

Emergency Dam Inspections Program Progress				
Inspection Activity	Number	Percent Complete		
		9/27/13	10/1/13	10/10/13
Inspections Required	207	100%	100%	100%
Inspections Assigned	207	100%	100%	100%
Assignments Confirmed	207	100%	100%	100%
Inspections Scheduled	207	100%	100%	100%
Condition Assessments Submitted		66%	93%	100%

- Owners of all 207 dams notified of conditions, with EIR sent by 11/7/2013

CO Flooding 2013 - Lessons Learned

- In disasters, engineers are going to want to help, they just are!
- The affected public is going to need to have reasons for confidence in infrastructure
- Public officials and engineering professionals can do real good and build public confidence by working together
- There are ways in each organization (public and private) to set these relationships up ahead of time
- The shorter we can make the time between emergency response and recovery, the greater the good for those affected

Diversion Structures

Section 37-86-111, C.R.S. (2013)

- In case the *channel of any natural stream becomes so cut out, lowered, turned aside, or otherwise changed from any cause, as to prevent* any ditch, canal, or feeder of any reservoir *from receiving the proper inflow of water* to which it may be entitled from such natural stream, the *owners* of such ditch, canal, or feeder *have the right to extend* the head of such ditch, canal, or feeder *to such distance up the stream* which supplies the same as may be necessary for *securing a sufficient flow of water into the same*. For that purpose they have the same right to maintain proceedings for condemnation of right-of-way for such extension as in case of constructing a new ditch. The *priority* of right to take water from such stream through such ditch, canal, or feeder as to any such ditch, canal, or feeder shall *remain unaffected* in any respect by reason of such extension; but *no such extension* shall *interfere* with the complete use or enjoyment of any ditch, canal, or feeder.

Diversion Structures

Section 37-86-111, C.R.S. (2014)

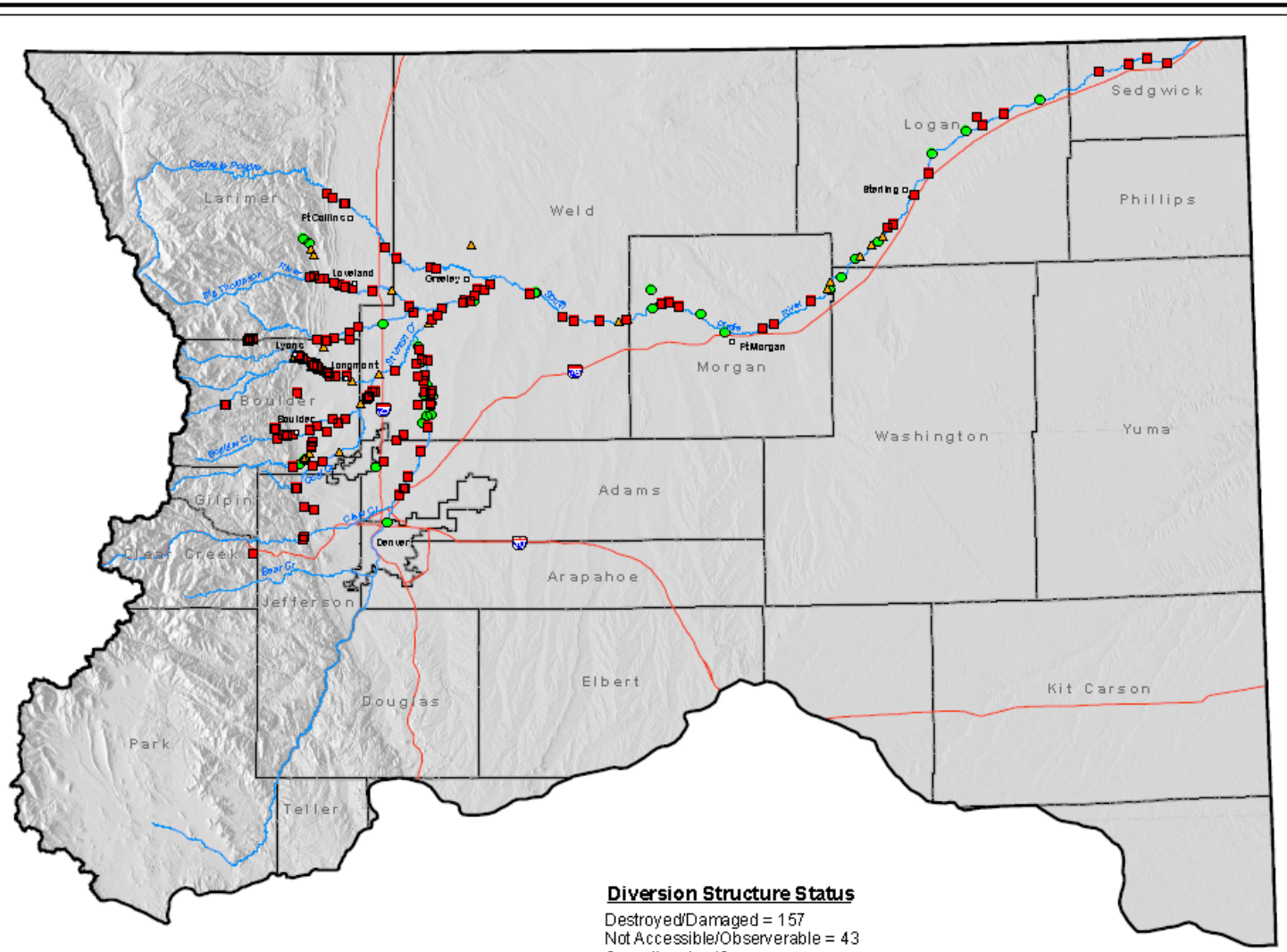
- (1) In case the channel of a natural stream becomes so cut out, lowered, turned aside, or otherwise changed from any cause as to prevent any ditch, canal, or feeder of any reservoir from receiving the proper inflow of water to which it may be entitled from the natural stream, the owners of the ditch, canal, or feeder have the right to relocate the head of the ditch, canal, or feeder to such distance to the stream that supplies it as may be necessary for securing a sufficient flow of water into the ditch, canal, or feeder. For that purpose they have the same right to maintain proceedings for condemnation of a right-of-way for the relocation as in the case of constructing a new ditch. The priority of right to take water from a stream through such ditch, canal, or feeder remains unaffected in any respect by reason of the relocation; ***but the relocation must not physically interfere with the complete use or enjoyment of any absolute or decreed conditional water right.***

Diversion Structures

Section 37-86-111, C.R.S. (2014)

- (2) If an owner of a water right relocates a surface diversion structure to a new surface point of diversion in compliance with subsection (1) of this section, the owner does not need to file a change of water right application for the new surface point of diversion.

Diversion Structures



Diversion Structure Status
 Destroyed/Damaged = 157
 Not Accessible/Observable = 43
 Operational = 40

Map Date: 9/27/13

State of Colorado
 Division of Water Resources
**Flood Affected
 Diversion Structures
 in the South Platte
 Basin**

Legend

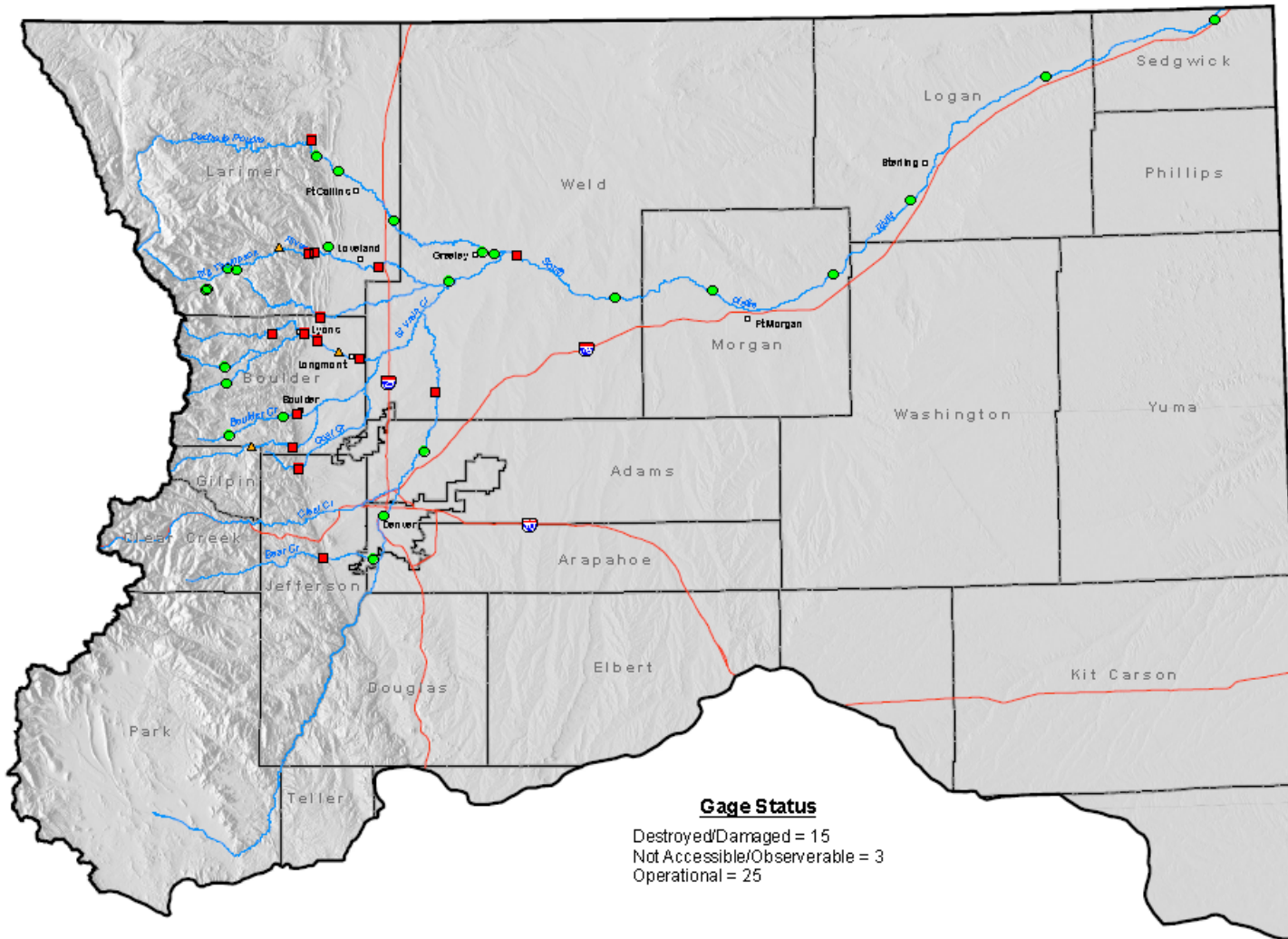
- Diversion Structure Status**
- Operational
 - ▲ Not Accessible/Observable
 - Destroyed/Damaged



0 9 18 Miles
 1" = 18 Miles



Diversion Structures



Gage Status

Destroyed/Damaged = 15
 Not Accessible/Observable = 3
 Operational = 25

State of Colorado
 Division of Water Resources
**Flood Affected Stream
 Gages in the South Platte
 Basin**

Legend

Gage Status

- Operational
- ▲ Not Accessible/Observable
- Destroyed/Damaged



0 9 18 Miles
 1" = 18 Miles



Diversion Structures and Ditches

Fort Morgan Canal



Diversion Structures and Ditches

*2013 Flood at
Bijou Ditch
Diversion*



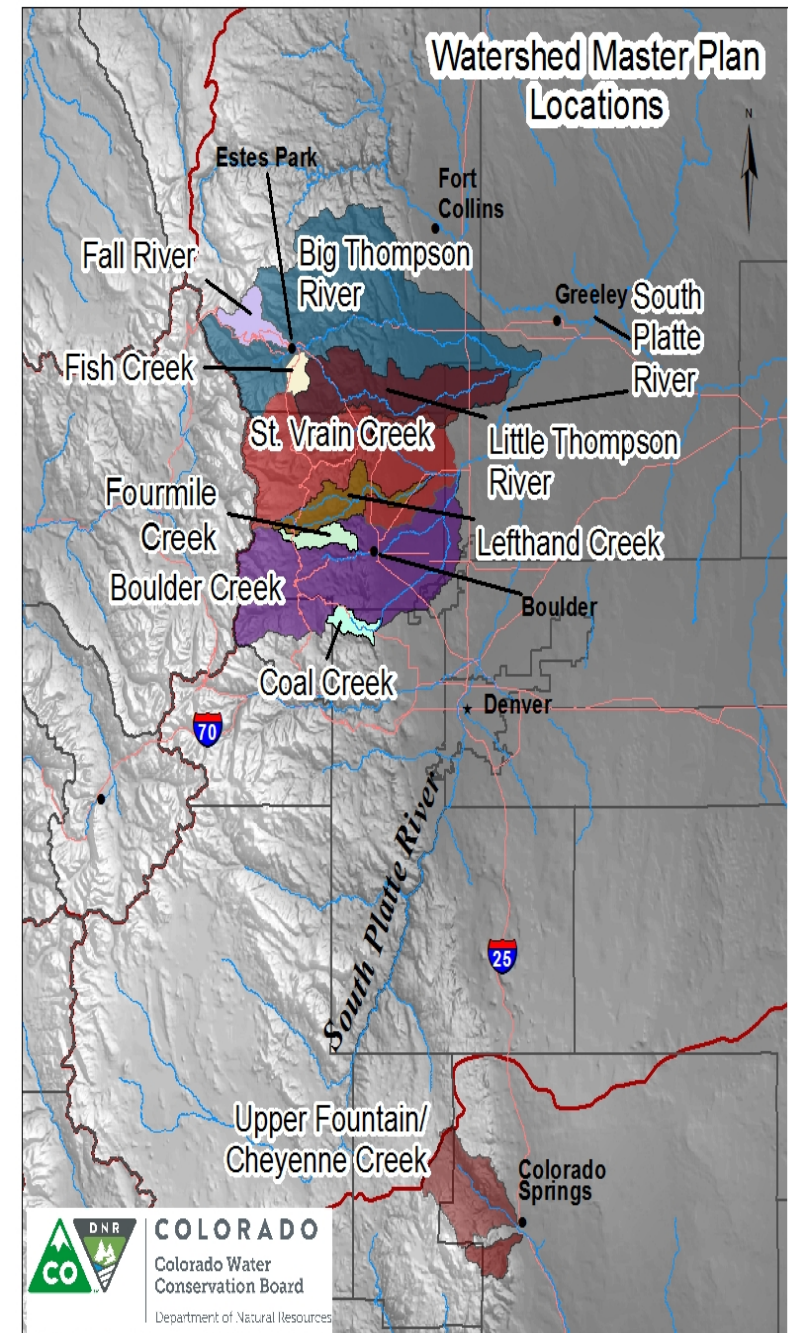
Diversion Structures

*Pawnee Ditch
Headgate*



Watershed Coalitions

- Estes Valley Watershed Coalition
- Big Thompson River Restoration Coalition
- Little Thompson Watershed Restoration Coalition
- St. Vrain Creek Coalition
- Fourmile Watershed Coalition
- Left Hand Watershed Oversight Group
- Coal Creek Canyon Watershed Partnership
- Middle South Platte River Alliance
- El Paso County Regional Watershed Collaborative



2013 Colorado Flood Recovery Phase II NRCS Emergency Watershed Protection (EWP) Program

Purpose: Implement emergency recovery measures to protect life and property in watersheds impaired by a natural disaster

Funding: \$63.2 mil. total/ \$47.4 mil. federal

State Sponsor: Colorado Water Conservation Board

Local Sponsors: Counties, cities/towns, watershed coalitions, others

Timeline: August 2018 technical assistance agreement ends



Opportunities for Multiple Benefits

- Protect Life and Property
- Stabilize channel banks
- Reconnect floodplains with streams
- Manage sediment
- Reduce hazards and improve flood conveyance
- Improve habitat
- Enhance recreational opportunities











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