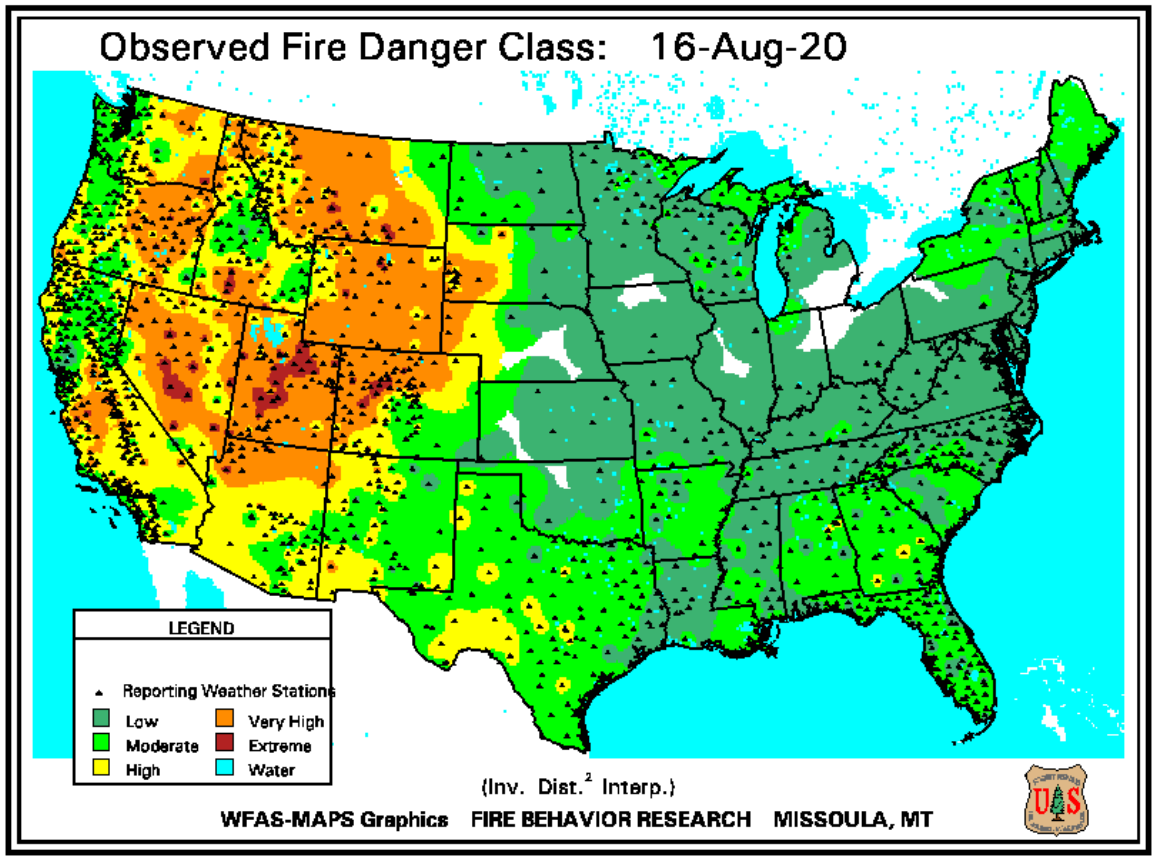
Wildland Fires: Impacts on Water Quality and Supply

Patrick E. Haas
Larimer County Taxpayer
24 August 2020
Presentation at Larimer County Commissioners NISP 1041 Meeting

“The number of large fires has almost doubled in the last 30 years, and, since the 1970s fires over 10,000 acres have increased seven fold”

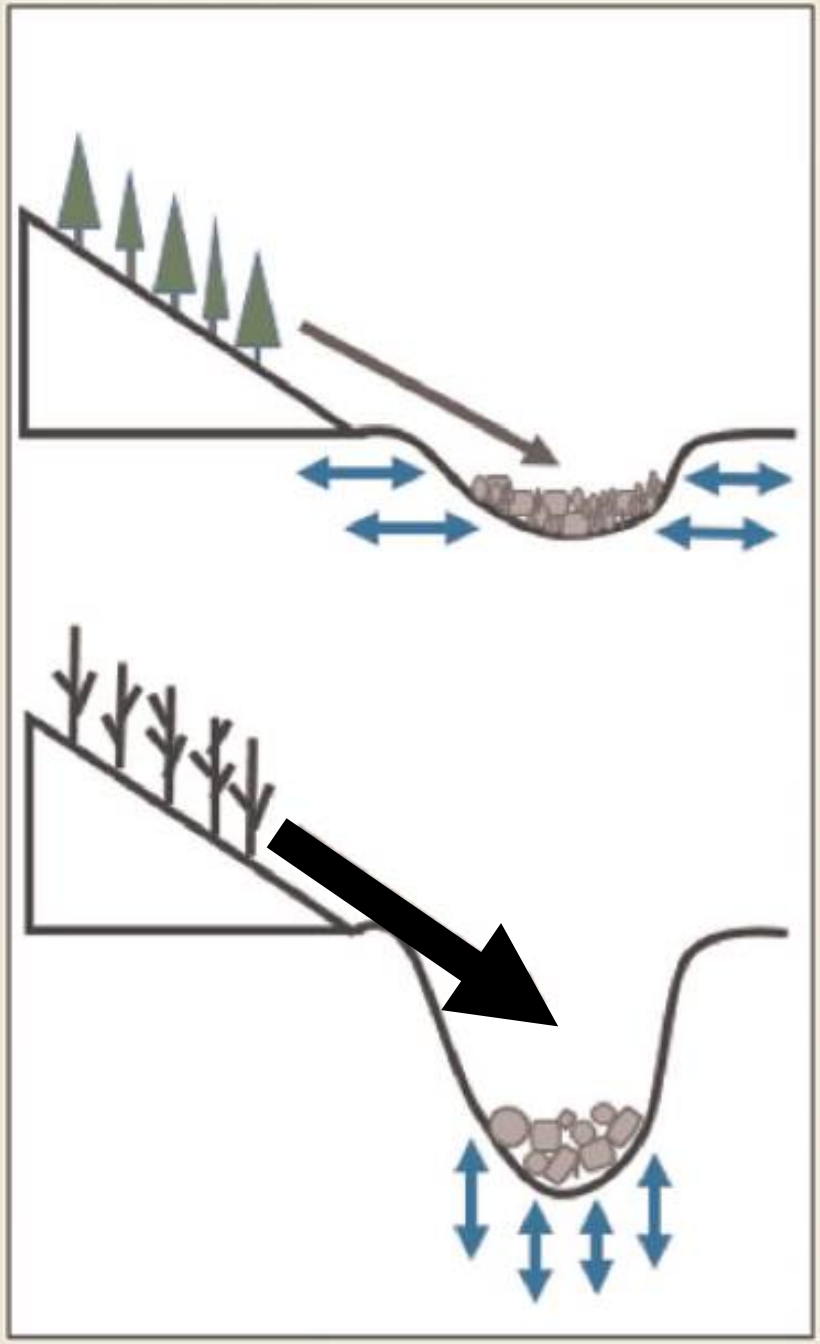
FireRescue Magazine, Issue 10, Volume 11, 2016




Before High Park Fire
Photo: Aug09


After High Park Fire
Photo: 02Jul12

High Park Fire Burn Scar March 2020
“No Trees after 8 years”



Unburned streams
Low N & high C input from uplands
High in-stream biological N demand
Low Stream N export

Burned streams
Low C & high N input from uplands
Reduced in-stream biological N demand & increased physical retention
High stream N export

Source: USDA, 2017


P. E. Haas®
Photo: 06Jul12

Seaman Reservoir was officially added to the 303(d) list of impaired waters in 2010

Figure 24. An aerial view of Seaman Reservoir captures the high chlorophyll-a concentrations that resulted from the 2012 mid-summer algal bloom.

(Source: Oropeza, 2013)

Summary

Wildfires will shutdown Reservoirs and Drinking Water systems – Colorado-Big Thompson and Poudre

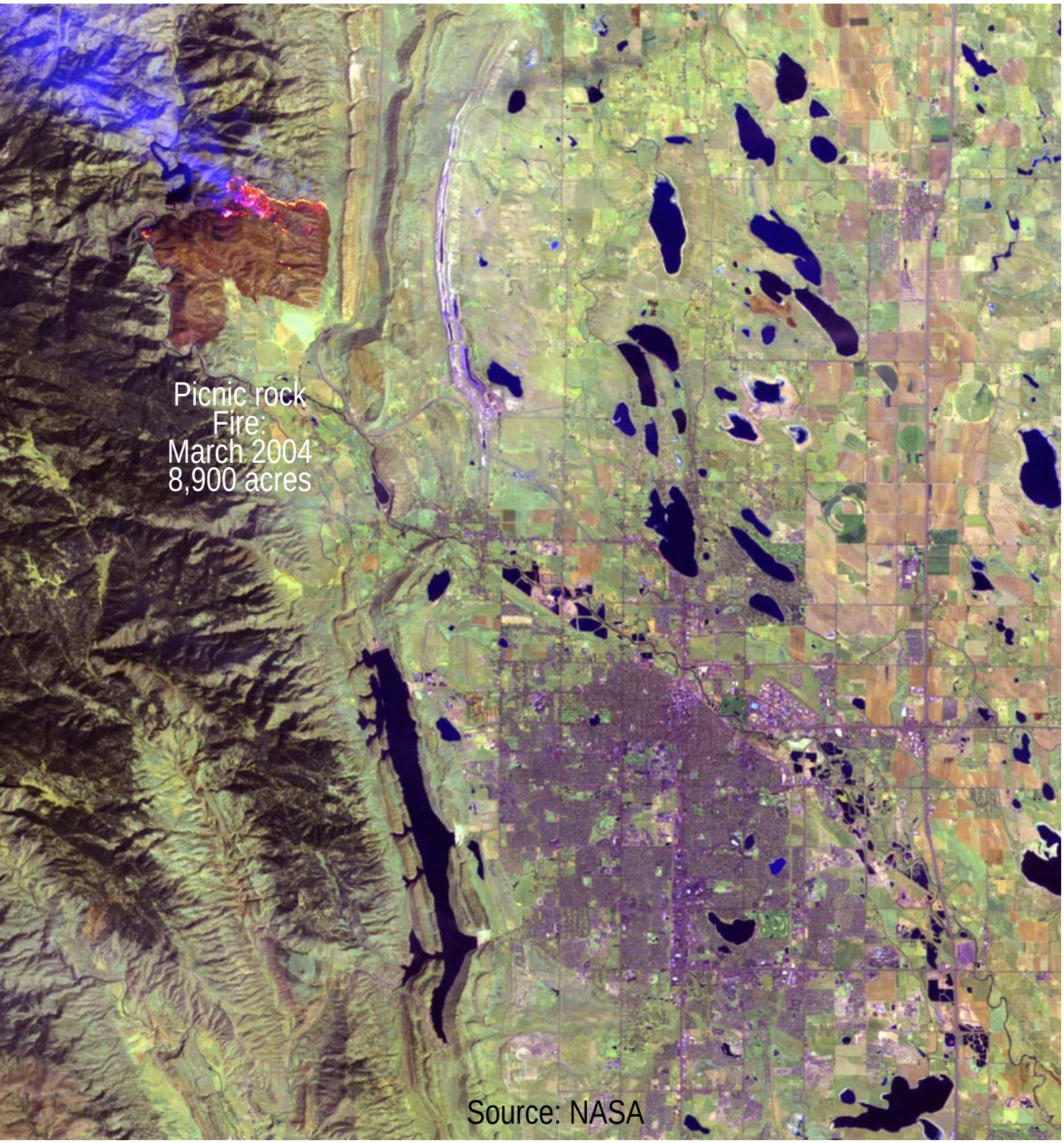
- Noncompliance with 1041 Permit Criteria 7: Will not be subject to significant risk from natural hazards including floods, wildfire or geologic hazards Effects may persist for decades;
- Degraded water and Disinfection byproducts
- Noncompliance with 1041 Permit Criteria 6: Public health and safety

- **Groundwater and subsurface water storage is needed that bring resiliency to address fire, floods, and drought**
  - Large evaporative reservoirs like Glade are not the best Alternative – 1041 Permit Criteria 2

Summary (cont)

- **Both minimal flows and major flushing events are required for river health and ash/sediment flushing**
  - Allowing upstream large water grabs (NISP, Thornton, etc.) compromise long-term water security
    - Cannot let every moneyed interest to go to the “front of the line”
  - Long term water security and health is better maintained by tapping and developing water downstream
    - which means keeping all parts of the Poudre Watershed healthy

- **Take the billion dollar Reservoir burden off the taxpayers’ back!**
  - **Better alternatives exist**



We already have Enough Reservoirs?

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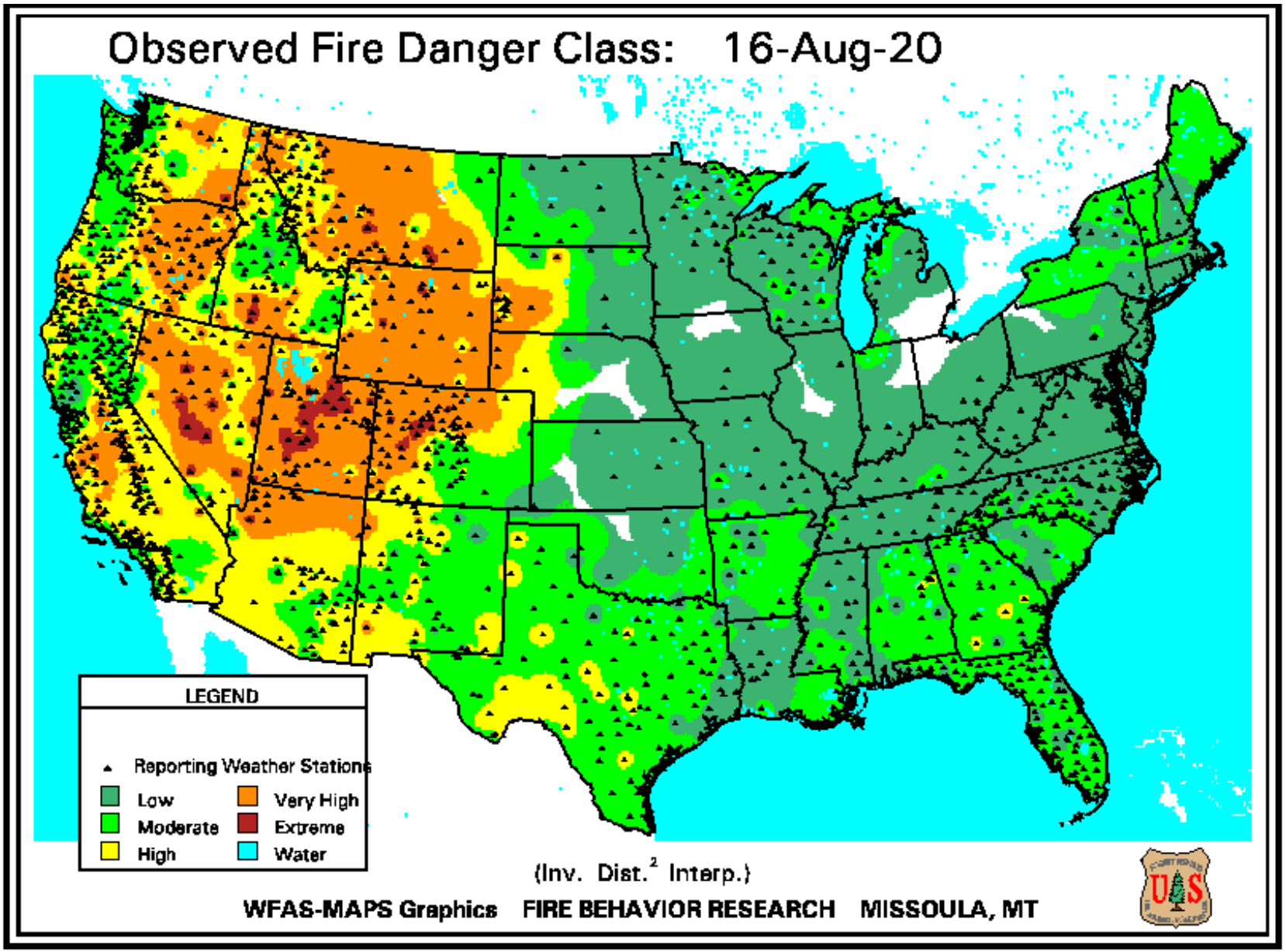
Supplemental Slides



"The number of large fires has almost doubled in the last 30 years, and since the 1970s fires over 10,000 acres have increased seven fold"

FireRescue Magazine, Issue 10, Volume 11, 2016

High Park Fire: Examples of ash, sediment, and debris in drainage tributary of Poudre River

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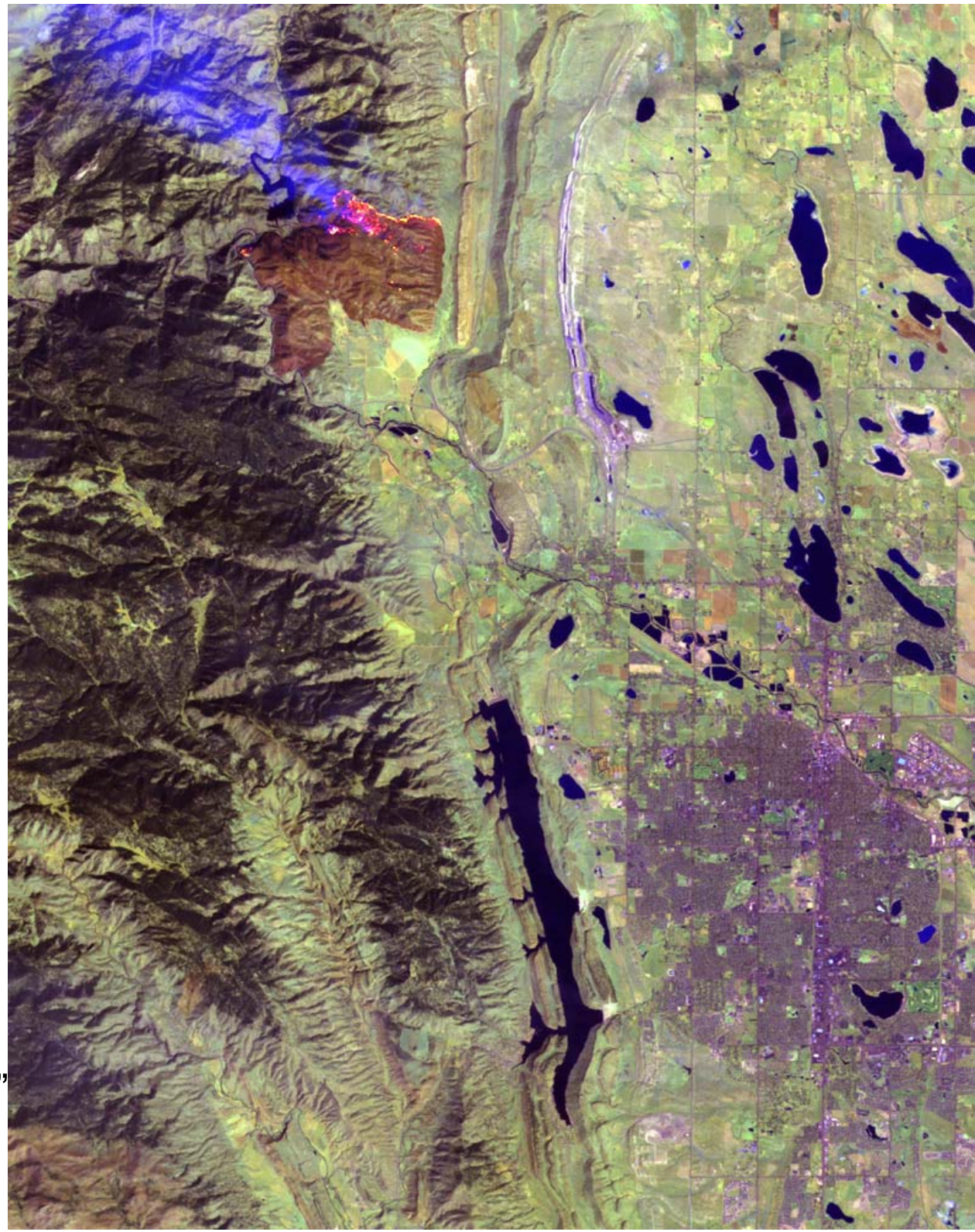
High Park Fire: 2012 Reconstruction of private roads that washed out into the Poudre River

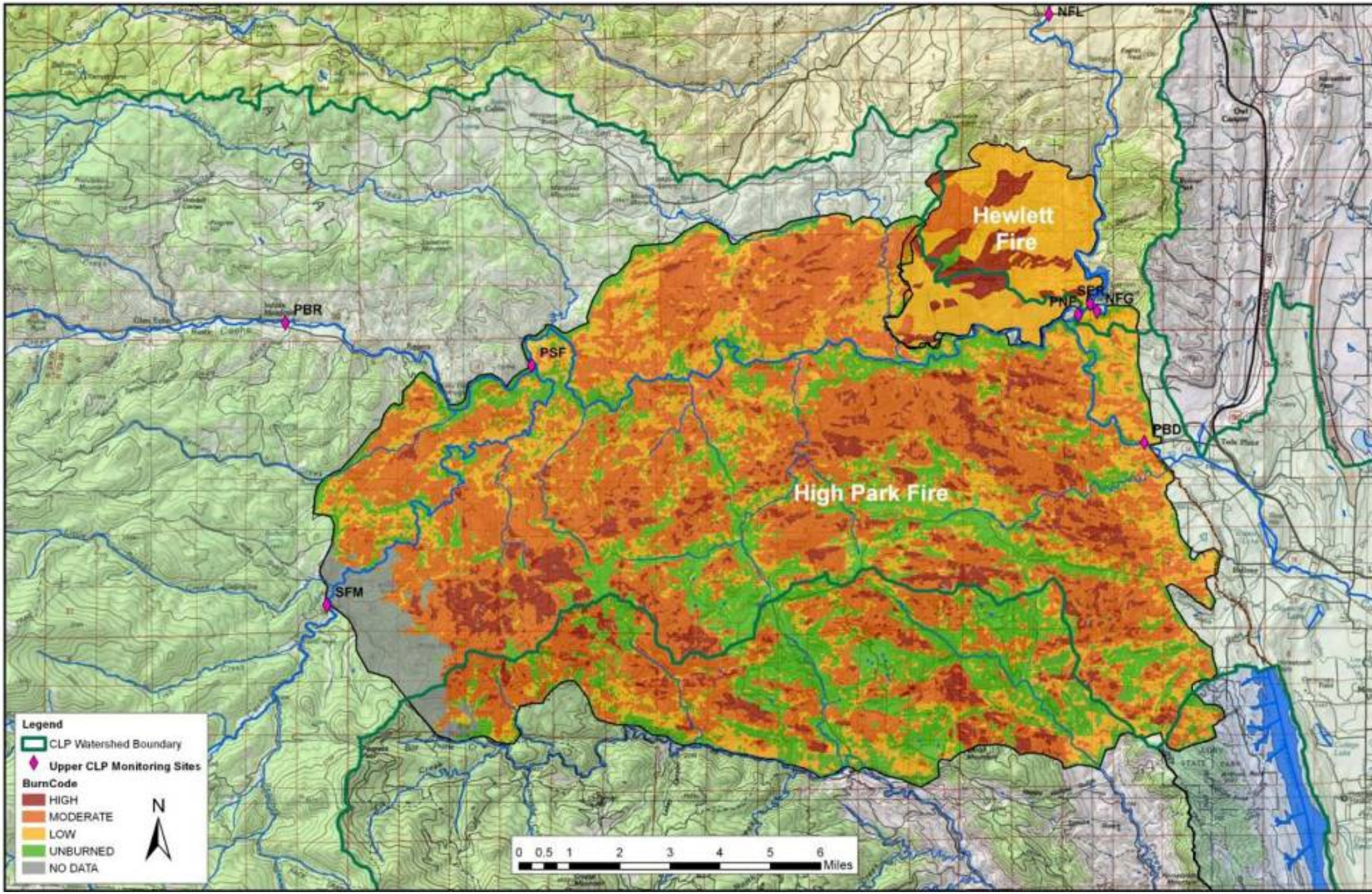
High Park Fire: Examples of private roads that washed out into the Poudre River

Picnic rock Fire: March 2004 8,900 acres



“Don’t forget the 2002 Haygood Fire”

High Park and Hewlett Burn Scars

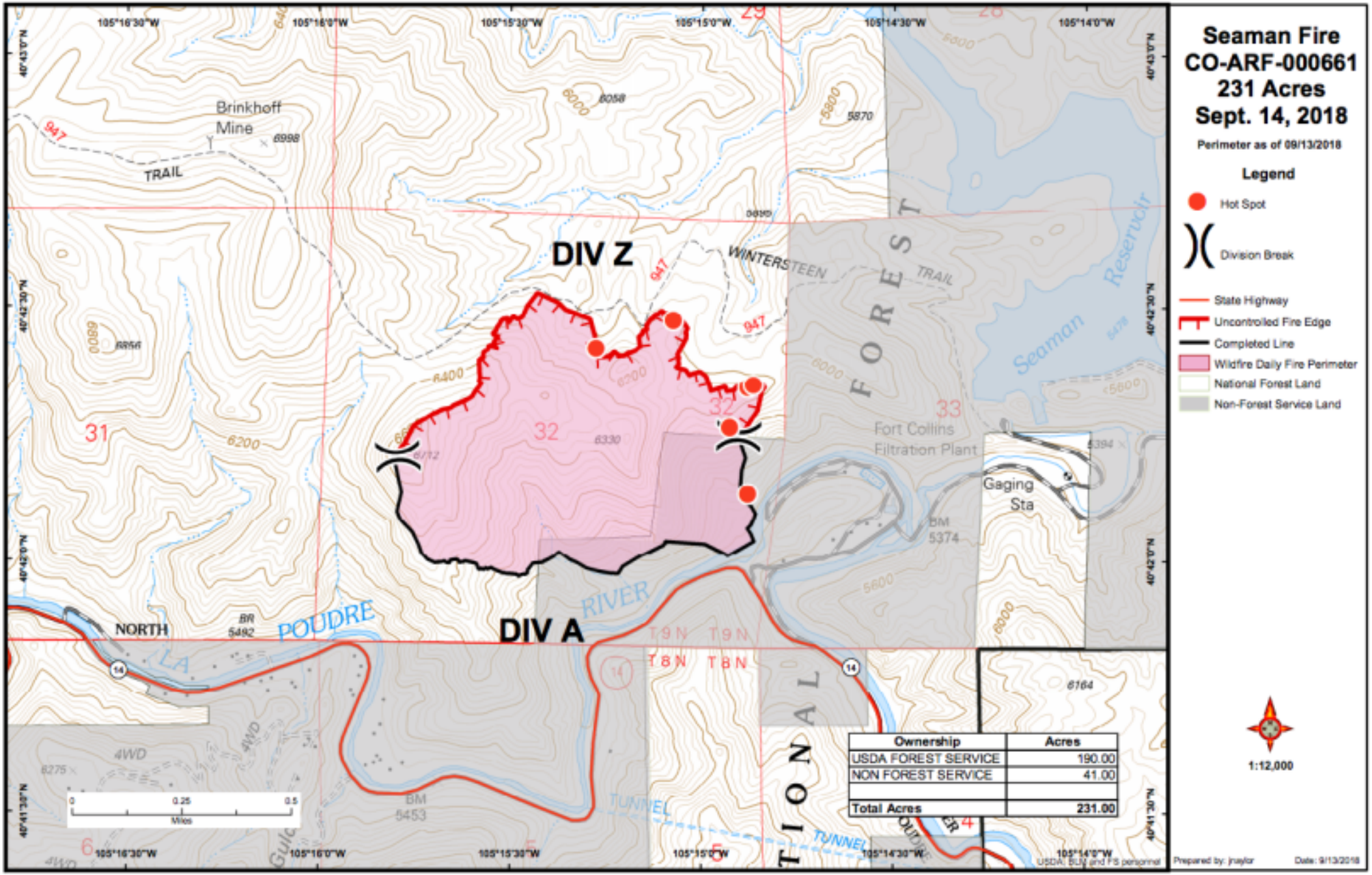


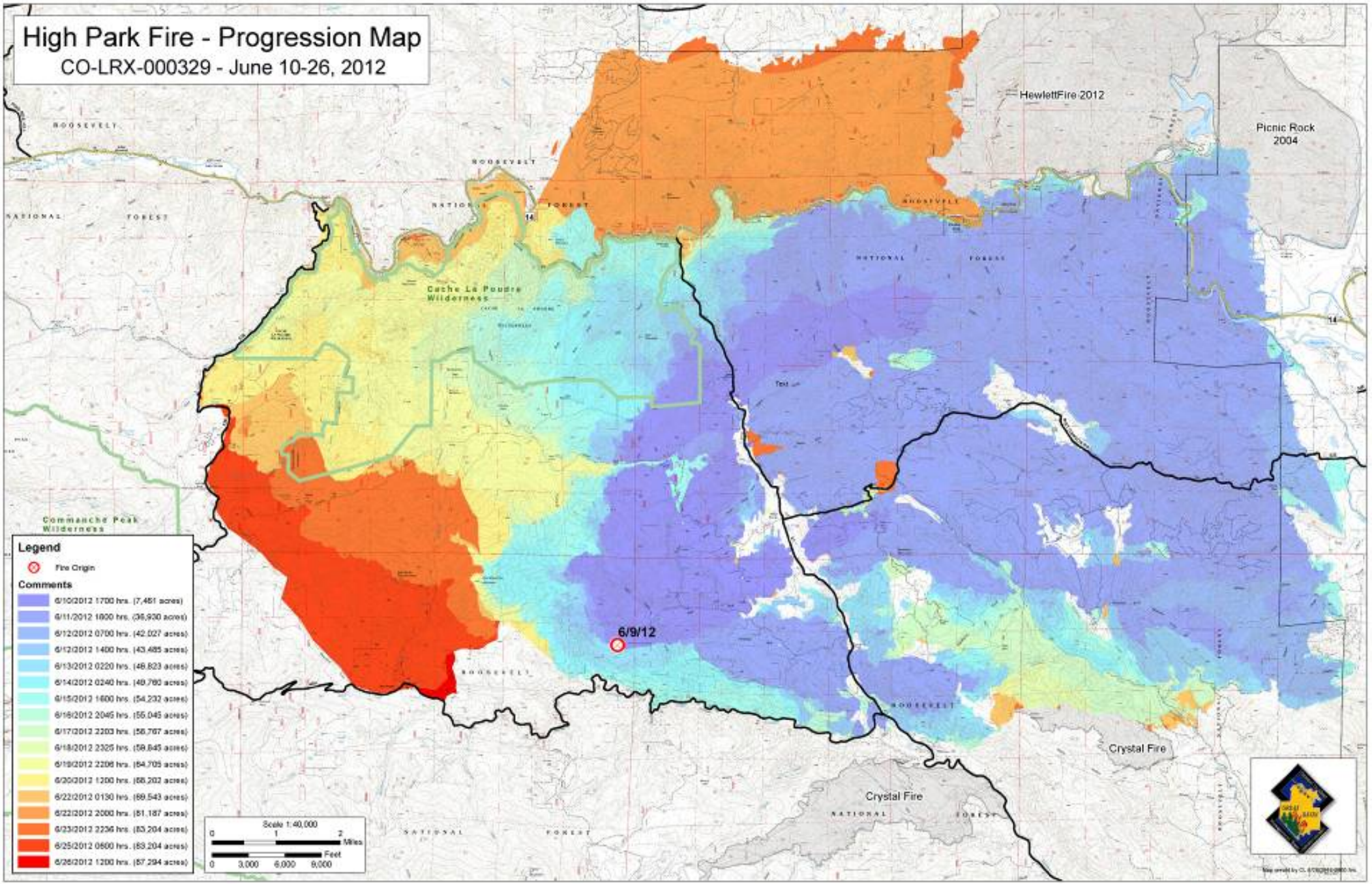
The Galena Fire Causes Concern for Greeley's Water Supply

LEIGH AUERBACH · SEPTEMBER 5, 2013

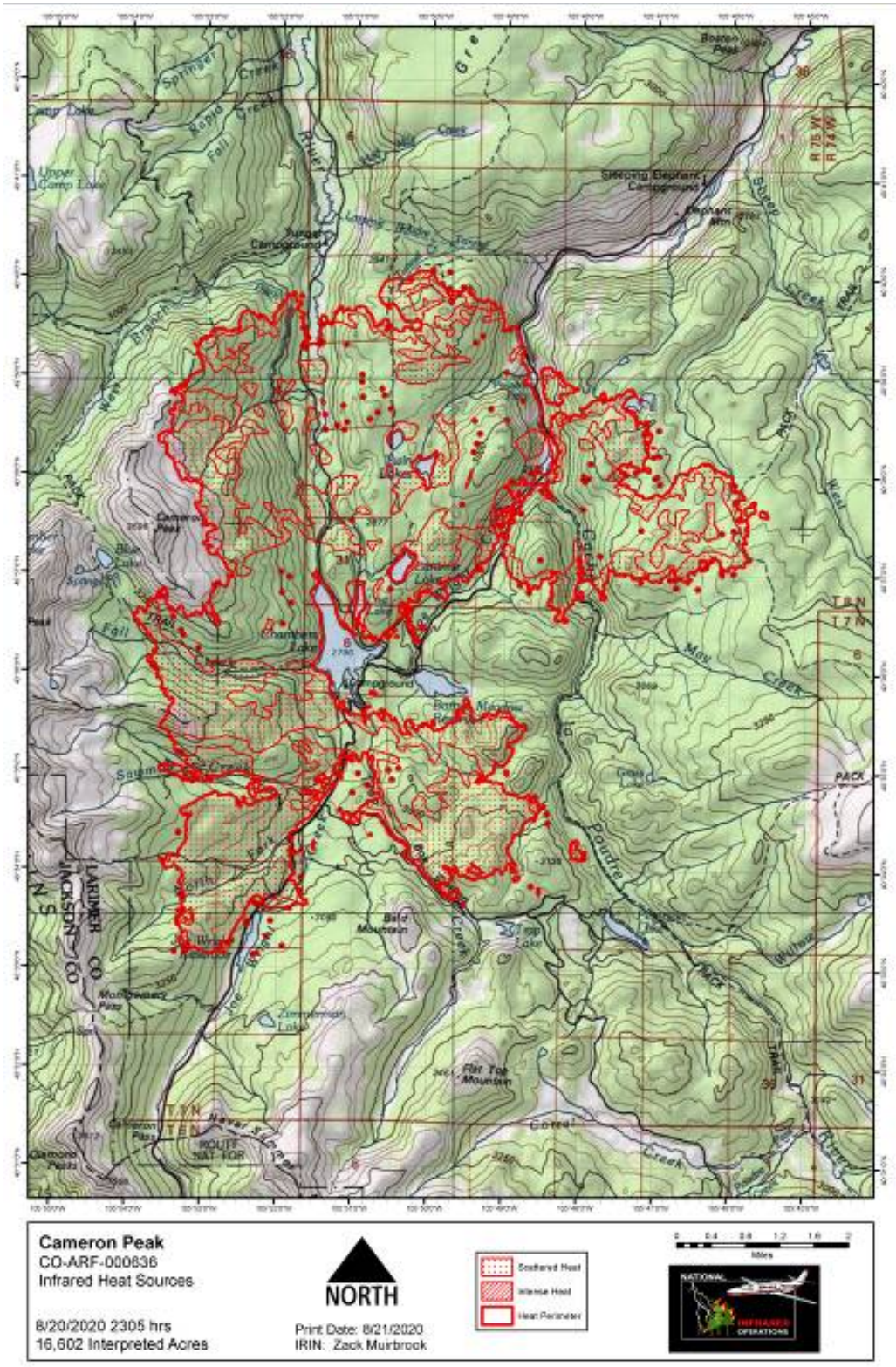
http://duwaterlawreview.com/the-galena-fire-causes-concern-for-greeleys-water-supply/

Greeley water officials are once again concerned about the effects of wildfire on the city's water supply. The Galena fire that started on March 15, 2013 burned 1,348 acres of land west of Fort Collins before full containment five days later. This fire was reminiscent of the nearby High Park fire of last June that burned 87,284 acres, destroyed 259 homes, killed one person, and cost millions of dollars to clean the Poudre River.


Seaman Fire
CO-ARF-000661
231 Acres
Sept. 14, 2018
Perimeter as of 09/13/2018
Legend
Hot Spot
Division Break
State Highway
Uncontrolled Fire Edge
Completed Line
Wildfire Daily Fire Perimeter
National Forest Land
Non-Forest Service Land
DIV Z
DIV A
Brinkhoff Mine
TRAIL
WINTERSTEEN TRAIL
Seaman Reservoir
FOREST
Fort Collins Filtration Plant
Gaging Sta
NORTH POUDRE RIVER
TUNNEL
Ownership | Acres
USDA FOREST SERVICE | 190.00
NON FOREST SERVICE | 41.00
Total Acres | 231.00
1:12,000
Prepared by: jruaylor
Date: 9/13/2018
USDA, BLM and FS personnel


High Park Fire - Progression Map
CO-LRX-000329 - June 10-26, 2012
HewlettFire 2012
Picnic Rock 2004
Crystal Fire
Crystal Fire
6/9/12
Cache La Poudre Wilderness
Comanche Peak Wilderness
ROOSEVELT NATIONAL FOREST
Legend
Fire Origin
Comments
6/10/2012 1700 hrs. (7,461 acres)
6/11/2012 1800 hrs. (36,930 acres)
6/12/2012 0700 hrs. (42,027 acres)
6/12/2012 1400 hrs. (43,485 acres)
6/13/2012 0220 hrs. (46,823 acres)
6/14/2012 0240 hrs. (49,760 acres)
6/15/2012 1600 hrs. (54,232 acres)
6/16/2012 2045 hrs. (55,045 acres)
6/17/2012 2203 hrs. (56,767 acres)
6/18/2012 2325 hrs. (58,845 acres)
6/19/2012 2206 hrs. (64,705 acres)
6/20/2012 1200 hrs. (68,202 acres)
6/22/2012 0130 hrs. (69,543 acres)
6/22/2012 2000 hrs. (81,187 acres)
6/23/2012 2236 hrs. (83,204 acres)
6/25/2012 0600 hrs. (83,204 acres)
6/26/2012 1200 hrs. (87,294 acres)
Scale 1:40,000
0 1 2 Miles
0 3,000 6,000 9,000 Feet

Cameron Peak Fire: Chambers Lake, Barnes Meadow Reservoirs 22Aug20: 17,000 acres and growing



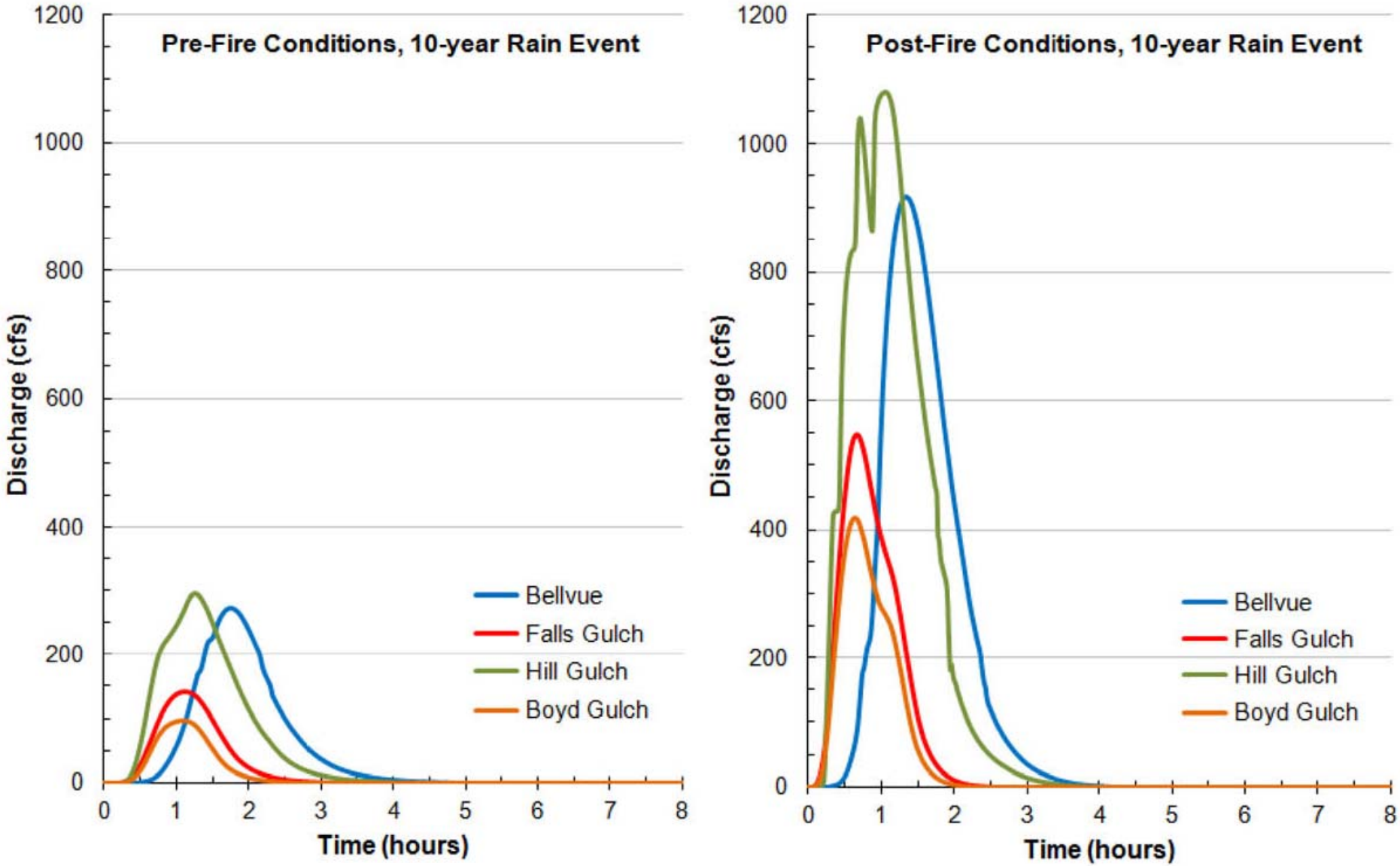
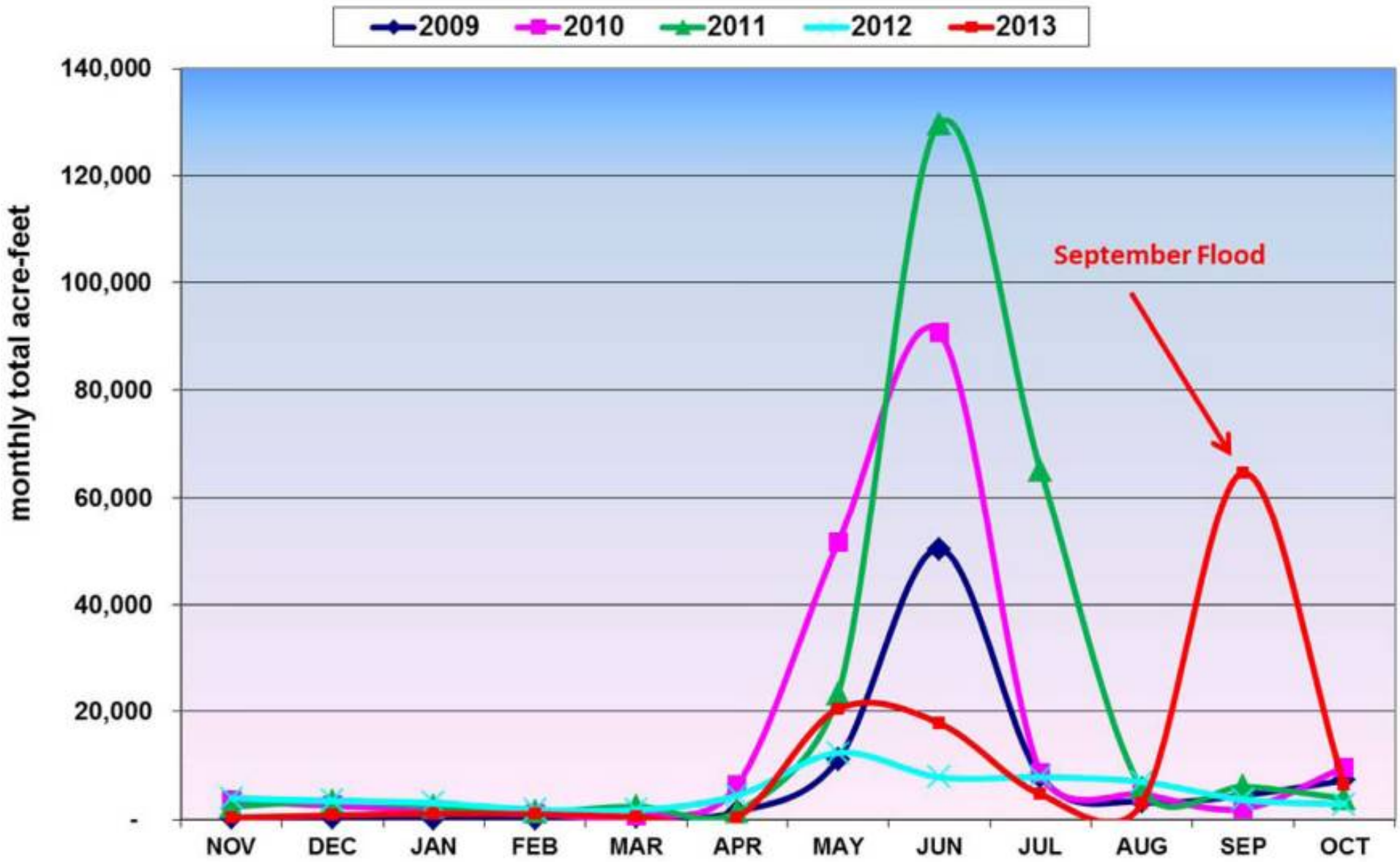


Figure 3. Pre-fire and post-fire discharge (cfs) in four key drainages in the High Park burn area under a simulated 10-yr rain event (Yochum, 2012).



2009 – 2013 Comparative monthly flows at the Lincoln St Gage


P. E. Haas®
Photo: 06Jul12

2014 Water Samples

2 years after High Park Fire

0.3 inch rain event

A series of water samples from the Poudre River starting right before a storm, when the turbidity is low. In the first year or two after the High Park Fire, the rainfall intensity needed to produce turbidity spikes was only on the order of an annual or semi-annual storm. Over time, there is an increase in intensity of rainfall required to generate high turbidity This sequence of suspended sediment samples was collected by an automated water quality sampler at Hill Gulch between 7/13/14 19:00 and 7/14/14 00:50. This was after 0.3 inch of rain fell over 30 and 60 minutes, based on USGS data from Rist Canyon and Stove Prairie gages. (photo by S. Ryan).

Source: USDA, 2017

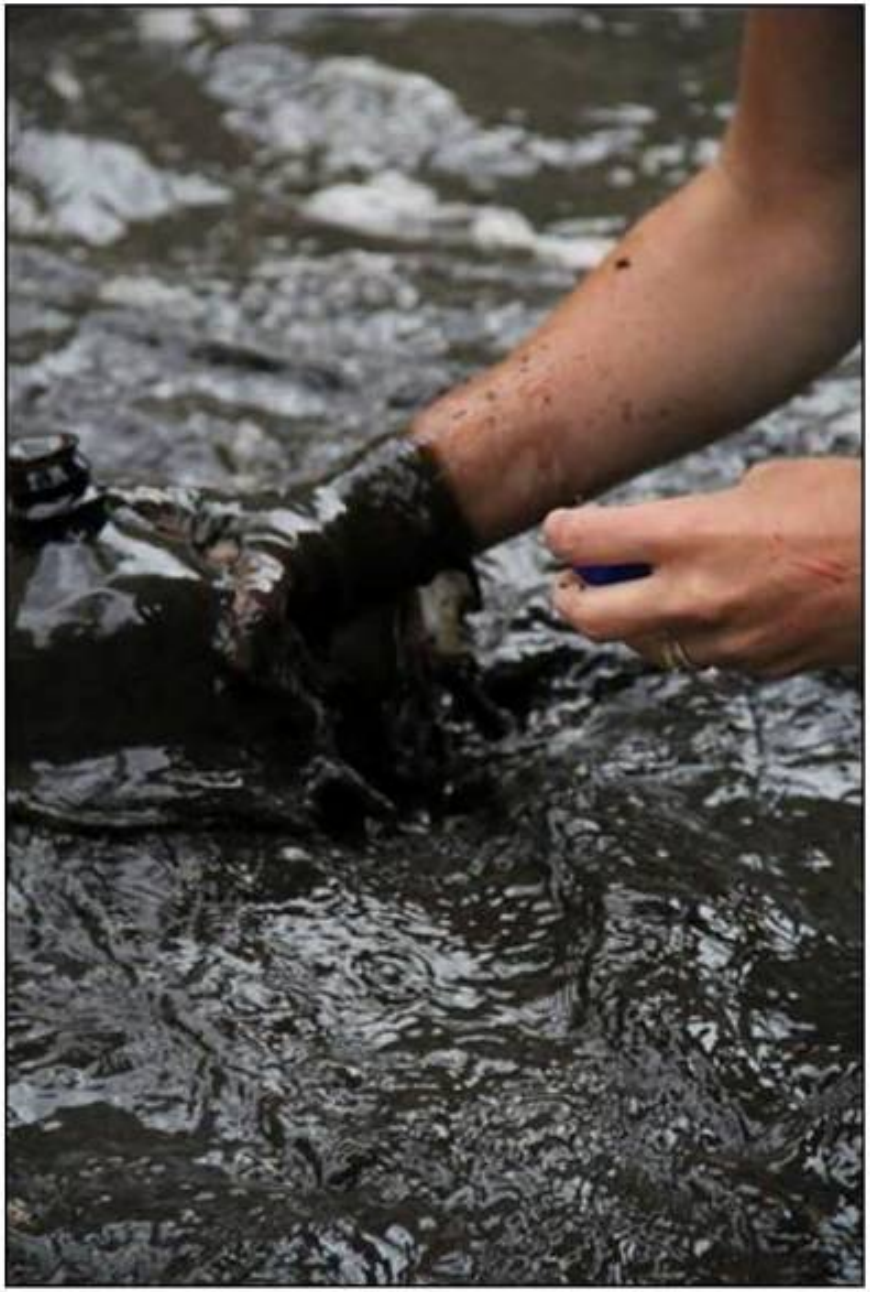
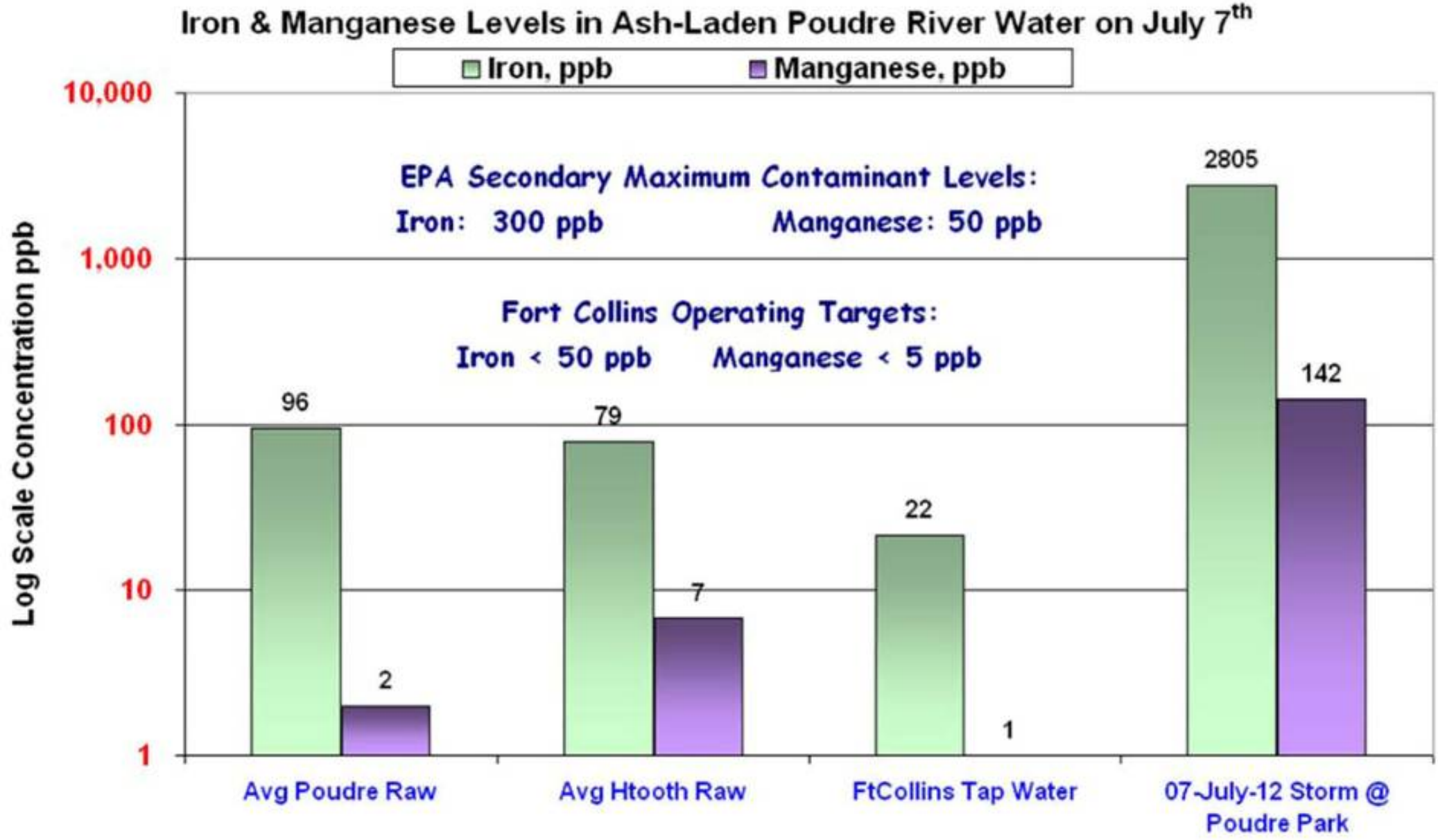
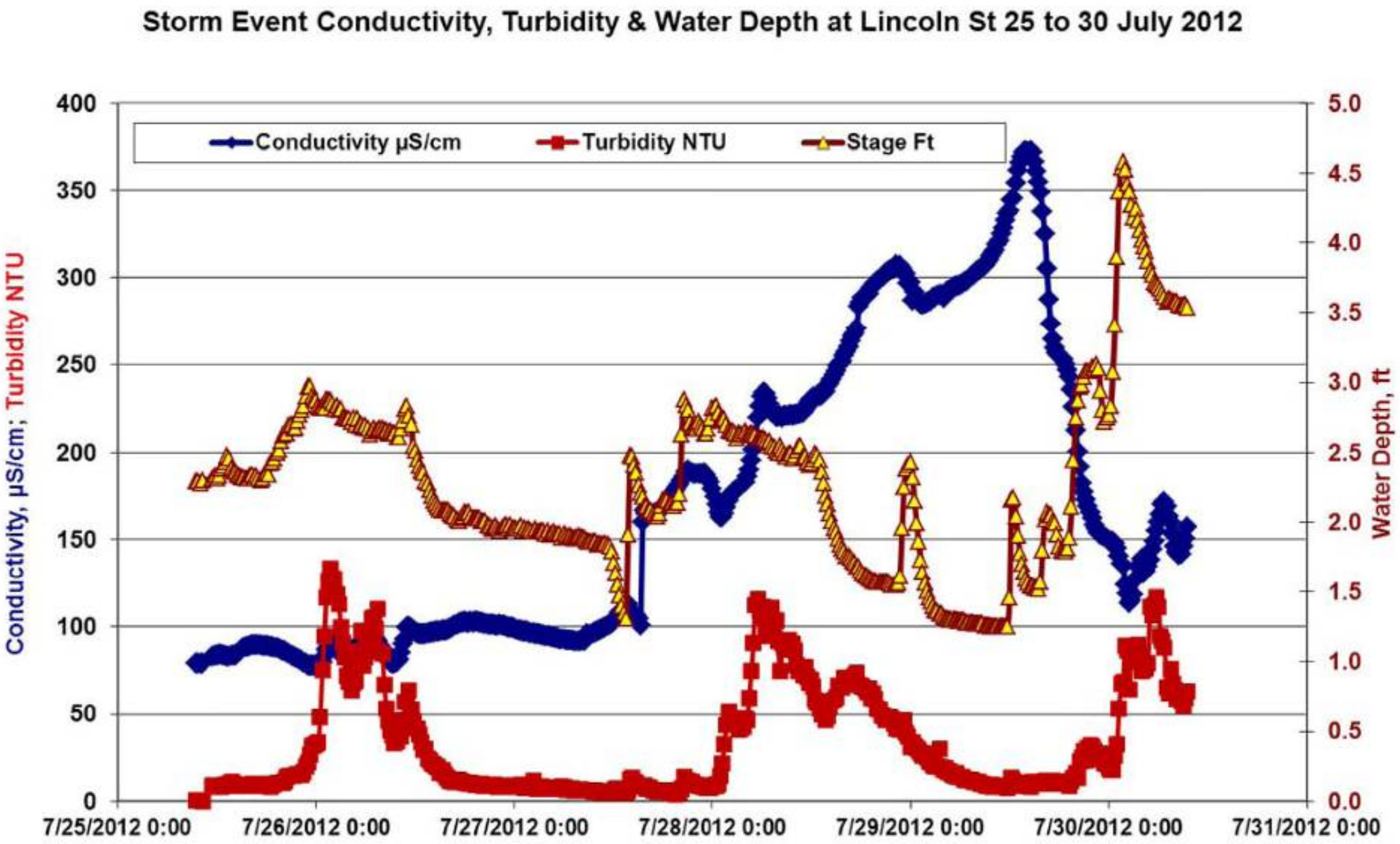


Figure 2.6 – Water quality sample collected following a storm event on July 12, 2013.

Negative Impacts to Public Health and Safety

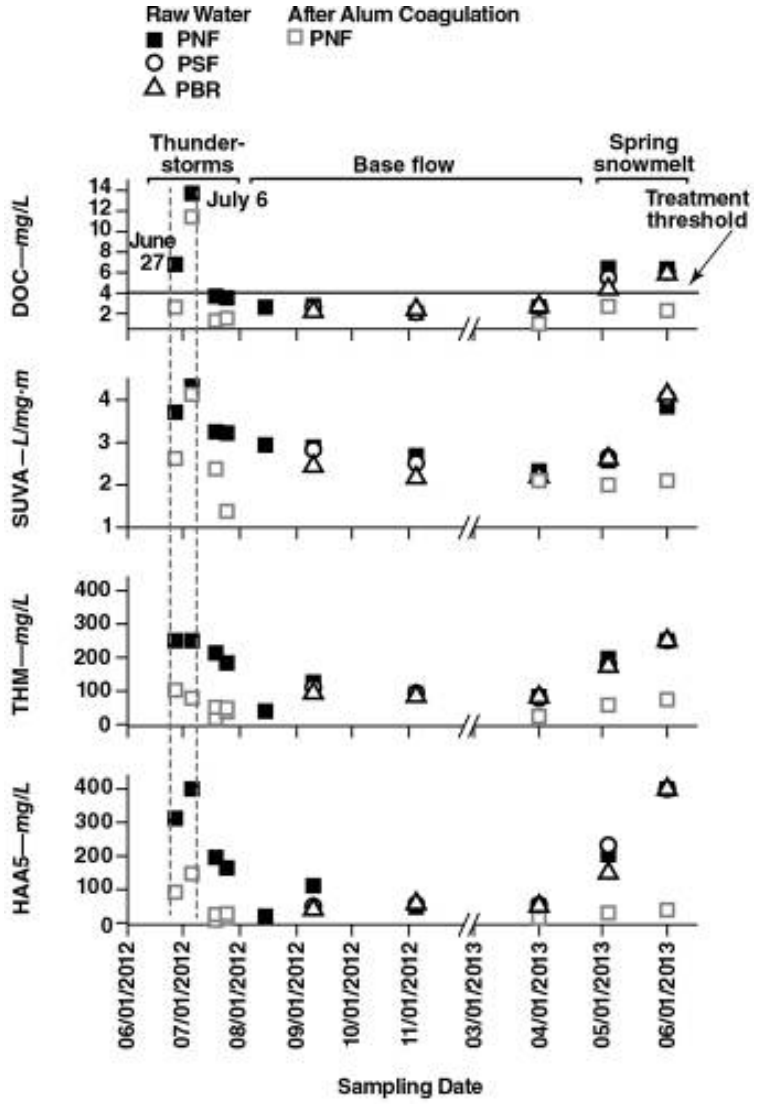


(City of Fort Collins, 2012)

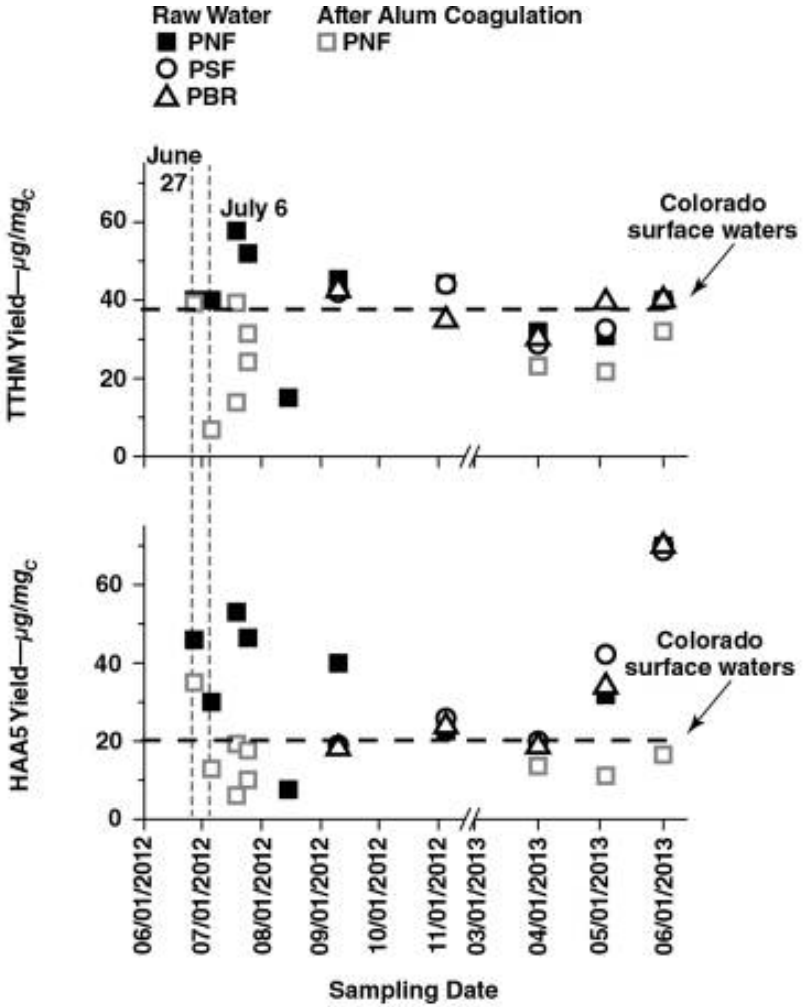


2012 City of Fort CollinsLower Cache la Poudre River & Urban Creek Water Quality Report.
City of Fort Collins

Negative Impacts to Public Health and Safety



DOC—dissolved organic carbon, HAA5—the sum of five haloacetic acids, PBR—sampling site upstream from areas affected by the High Park Wildfire, PNF—sampling site upstream from the confluence of the North Fork of the Poudre River at the city of Fort Collins drinking water intake, PSF—sampling site below the burned area at the confluence between the main stem and South Fork of the Cache la Poudre River, TTHM—total trihalomethane, SUVA—specific ultraviolet absorbance at 254 nm



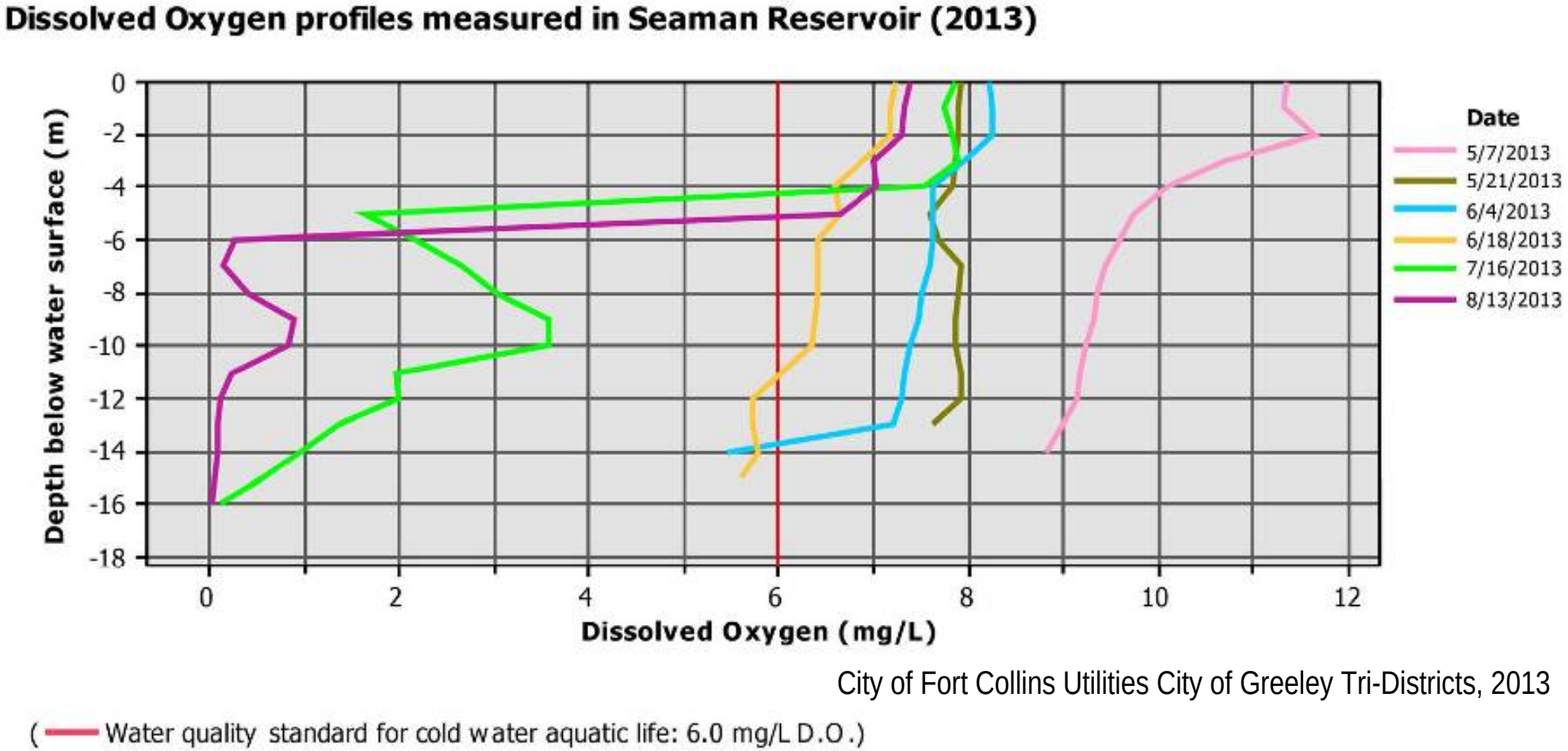
C—carbon, HAA5—the sum of five haloacetic acids, PBR—sampling site upstream from areas affected by the High Park Wildfire, PNF—sampling site upstream from the confluence of the North Fork of the Poudre River at the city of Fort Collins drinking water intake, PSF—sampling site below the burned area at the confluence between the main stem and South Fork of the Cache la Poudre River, TTHM—total trihalomethane

Value for Colorado surface waters based on an average of 30 surface waters sampled in 2010 (Hohner, 2012).

High Dissolved Organic Carbon causes high concentrations of toxic disinfection byproducts

Journal AWWA, Volume: 106, Issue: 4, Pages: E189-E199, First published: 01 April 2014, DOI: (10.5942/jawwa.2014.106.0055)

Dissolved Oxygen in Seaman Reservoir



City of Fort Collins Utilities City of Greeley Tri-Districts, 2013

Reservoir was officially added to the 303(d) list of impaired waters in 2010 due to occurrences of D.O. below 6 mg/L (adequate refuge for fish is not available in these types of situations)

Reservoir Hypoxia

- Wildland fires increase ash and sediment deposition in reservoirs
- Ash and Sediment progressively accumulates in reservoirs
- Algal blooms and degraded water results making water unacceptable for drinking water use or downstream discharge → Conditions worsen via stagnation
- Discharges from dam spillways can cause fish kills and sediment accumulation in rivers, streams, canals, pipelines, etc.
- “The bottom of Glade reservoir would become hypoxic in most years” (USACE EIS, 2018)

Evaporation

- Glade Reservoir surface area:1,640 acres (2.6 square miles); Water surface elevation: 5,527 feet.
- Evaporative losses 20-30 acre-ft/day (7-10 mgd). Could be larger! (Grossman, 2018)
- That's why we do not have natural lakes around here

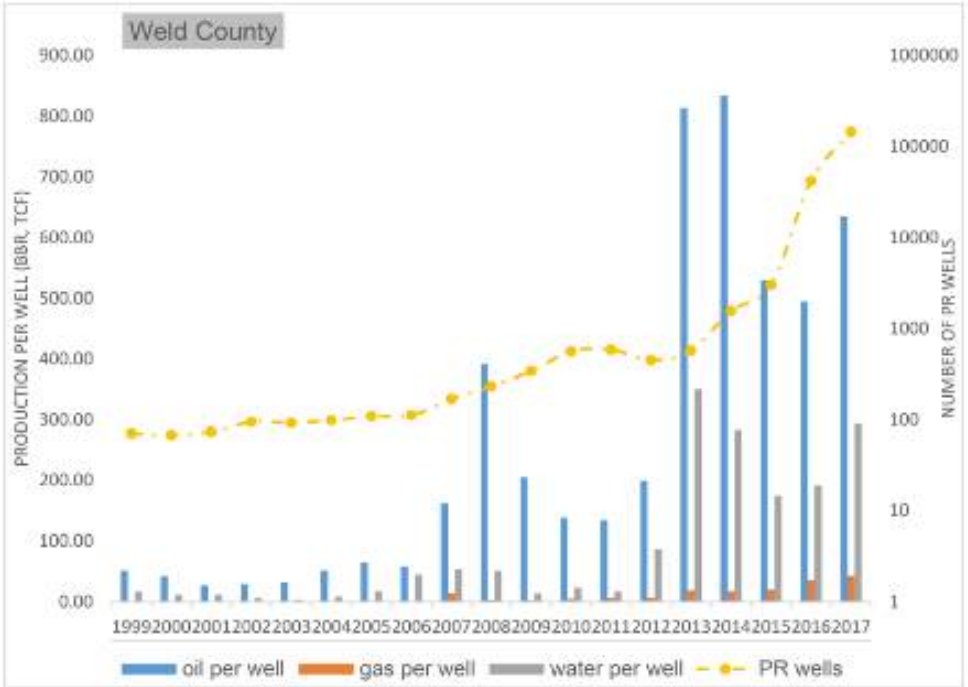
Table 2-9. Estimated average annual evaporation, Alternative 2M.

Reservoir	Current Conditions Hydrology (AFY)	Future Conditions Hydrology (AFY)
Glade	2,800	2,700
Upper Galeton	4,000	4,100

Source: Northern Water 2017a.

Water Demands

Greeley's combined drinking water treatment capacity, Bellvue and Boyd Lake Plants, is up to 70 million gallons per day which is equal to drill and frack proximately 21 wells using gel fracking or 7 wells using slick water fracking.



Li, 2018

Issues: Poudre River Reservoirs

- 1891, Chambers Lake dam fails
- “In 1996 when North Poudre released water from Halligan Reservoir so the State Engineer could perform a safety check on the dam’s gates. 7,500 cubic yards of sediment from the bottom of the reservoir flooded the Poudre's North Fork, killing fish and insects and destroying miles of fish habitat. In some places the sediment was more than ten feet deep.” (Laflin, 2005)
- 2010 – Seaman Reservoir placed on 303(d) list of impaired waters

Summary (cont)

- Preferred Glade Reservoir (2M) is an inefficient use of water and energy
  - 30,000 HP pumping system
    - "It's like trading in your Prius® for a steam locomotive"
  - Evaporative losses substantial 20-30 acre-ft/day or more
  - Seepage losses will "high" or "very high" based on site geology and hydraulic head
- Larimer County has more large reservoirs than any other Colorado County
  - "The time for more large downstream reservoirs in Larimer County is over"

Summary (cont)

- Glade Reservoir is not good for Larimer County
  - We want to see hogbacks, ridgelines, cows, and green crop circles from Ted's Place not a 300-foot dam and industrial complex (i.e. 100 acre Forebay)
  - Too many tax dollars spent, and to be spent, on proposed Grey Mountain, Glade, and Gallatin Reservoirs
  - Opportunity for public input highly deficient
  - Taxpayers should not have to pay extra for a desolate drive down 287
  - We really do not need a wind-blown, skinny, ski boat lake built and run on tax dollars
- Larimer County Commissioners should "save" 3 sections of beautiful, scenic, agricultural land – Hook and Moore Glade
- Small businesses (e.g. Forks Lumber, KOA, ranchers, farmers, etc.) should be allowed to thrive (Larimer Co. Master Plan)

Summary (cont)

- Larimer County Master Plan and Commissioners should “save” 3 sections of beautiful, scenic, agricultural land
- Small businesses (e.g. Forks Lumber, KOA, ranchers, farmers, etc.) should be allowed to thrive (Larimer Co. Master Plan)

Larimer County
SENIOR VOICE
34 • May, 1991

Historic Ranch in Larimer County

By Josephine Clements

John Long Routt holds special distinction in Colorado history. Appointed by President Ulysses S. Grant to replace Edward McCook in the turbulent times of the Territory of Colorado, Routt was the last territorial governor and then was elected first state governor following the admission of Colorado to statehood August 1, 1876, serving 1877-79.

In 1883, Routt was elected mayor of Denver and served a 2-year term. Then he was again elected governor and served a second term 1891-93.

He played a unique role in Colorado history. That he owned for 20 some years a fine ranch northwest of LaPorte in Larimer County is a bit of history not widely known.

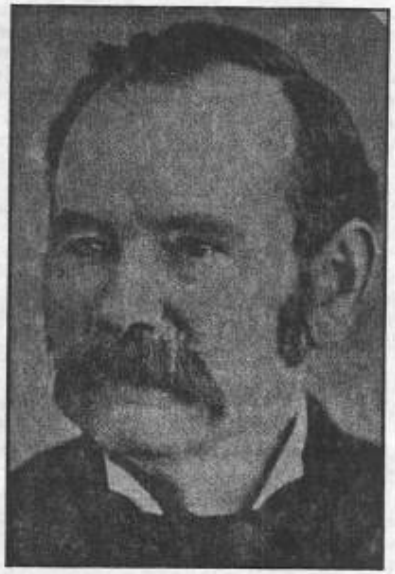
The land of this ranch had already Holladay's stage line swing stations, where the stagecoach teams were changed.

From Routt, the ranch went to Nathaniel Cushman Alford, an important figure in early Larimer County history. In 1877, when Routt was governor, Alford served as a member of the first state legislature. Like Routt, Alford was a Republican. From Maine, he was an uncle of my grandfather, John H. Payson, and so my great-great uncle.

In 1903 Alford bought Routt's ranch for his daughter Abbie and son-in-law, Richard A. Maxfield, as a wedding present. For family stability, he made his son, Fred C. Alford, a partner of Maxfield's in the ranch enterprise. The ranch remained in the Alford-Maxfield family for 40 years, and my family often visited there during that

which later sold for $1 million. Perhaps it was Morning Star silver that Routt used to buy up the land in Larimer County that he molded into the ranch. It was in the 1880s that he was acquiring these claims, some at tax sales, from early settlers with the names of Howell, Meldrum, Vandewark, Post and others of the earliest pioneers.

Later owners of the property sold off some pieces or acquired others, but the ranch remained basically the same. The Alford-Maxfield family built a home at the south end of the ranch, not far above the present intersection of Highways 287 and 14 where Ted's Place stood for many years. There, too, Bill and Ruby Kremers built their home and maintained the ranch as one of the finest cattle operations in the county



Gov. John Routt had a ranch near Ft. Collins

Colorado's last territorial, first State Governor ranched Hook and Moore Glade

Graves in Hook and Moore Glade

NOT FOUND

According to the map accompanying the 2003 edition of *Ranch Histories*, the Kremers Ranch was located on the west side of U.S. 287 north of Ted's Place. (See the "Bibliography" for a complete citation for *Ranch Histories*.) In her chapter, Ruby Kremers indicates that part of the Kremers Ranch includes the "natural feeding ground" known locally as the "Hook and Moore Glade" and that the "far northern ridges of the ranch" were sold to the Ingleside Limestone Company in 1908 by N. C. Alford.

The online homestead records of the Bureau of Land Management at www.gloredords.blm.gov indicate that Charles W. Howell purchased the following 120 acres from the U.S. Government on 30 June 1880: The West Half of the Southwest quarter and the Southwest Quarter of the Northwest Quarter of Section 13 of Township 8 North, Range 70 West, 6th Prime Meridian.

Chances are that both Bill Howell and his sister were children of Charles Howell and that Bill's sister is buried on these 120 acres near the location of Howell family's home.

"Cemeteries and Remote Burials in Larimer County". http://www.lcgsco.org/wp-content/uploads/2015/07/Larimer-Graves-Index-and-Intro_LCGS.pdf

1041 Permit Review Criteria

1. Consistent with the master plan and applicable Intergovernmental agreements affecting land use and developments
2. The applicant has presented reasonable siting and design alternatives or explained why no reasonable alternatives are available
3. Conforms with adopted county standards, review criteria and mitigation requirements concerning environmental impacts, including but not limited to those contained in this Code
4. Will not have a significant adverse effect on or will adequately mitigate significant adverse effects on the land or its natural resources, on which the proposal is situated and on lands adjacent to the proposal
5. Will not adversely affect any sites and structures listed on the State or National Registers of Historic Places
6. Will not negatively impact public health and safety

1041 Permit Review Criteria

7. Will not be subject to significant risk from natural hazards including floods, wildfire or geologic hazards
8. Adequate public facilities and services are available for the proposal or will be provided by the applicant, and the proposal will not have a significant adverse effect on the capability of local governmental to provide services or exceed the capacity of service delivery
9. The applicant will mitigate any construction impacts to county roads, bridges and related facilities. Construction access will be re-graded and re-vegetated to minimize environmental impacts
10. The benefits of the proposed development outweigh the losses of any natural resources or reduction of productivity of agricultural land as a result of the proposed development
11. Demonstrates a reasonable balance between the costs to the applicant to mitigate significant adverse effects and the benefits achieved by such mitigation
12. The recommendations of staff and referral agencies have been addressed to the satisfaction of the county commissioners

Larimer County Master Plan (1997)

- GM-10 The protection of agricultural land and water in Larimer County shall be based on a combination of incentives, voluntary participation and measures to strengthen the viability of agriculture
  - Glade Reservoir would consume roughly 2,000 acres (3.1 square miles) of prime agricultural land

Larimer County Master Plan (1997)

- ER-16 Larimer County will explore options to protect and provide adequate water resources for present and future uses in the County, in partnership with other affected interests
  - Poudre River water is already overallocated
  - Northern Water only seeks access to highest quality source water for export outside of Larimer County
  - Evaporate losses from reservoirs – Unacceptably high – 20-30 acre-feet/day
  - Substantial high quality ground water resources exist near NISP participants that were not explored by Northern
  - Northern Water only proposed large surface reservoirs as “technical solution”
  - 30,000 Horse Power pumping systems – Inefficient, consumptive of natural resources

1041 Permit Criteria 2

The applicant has presented reasonable siting and design alternatives or explained why no reasonable alternatives are available

- The only alternatives presented in a positive light include constructing Glade reservoir
  - Same strategy used on proposed Grey Mountain Reservoir
  - Quietly buy up land, limit public involvement, produce a “Reservoir Infomercial”

1041 Permit Criteria 6

- Will not negatively impact public health and safety
  - Wildfire ash degrades water supply and quality short-term and long-term
  - Reservoirs, like Seaman Reservoir, become 303(d) Impaired Water Bodies
  - Disinfection byproducts (trihalomethanes, haloacetic acids, chloroform, etc.)
- The only water hydrant available to Livermore Fire Protection District is at Ted's Place
  - 287 reroute will dramatically compromise fire fighting operations due to increased length of route. Additionally, higher capacity water tender trucks must travel at speeds less than 15 mph around turns due to their high centers of gravity. Water haul round trip transit times will quadruple
  - Livermore Fire's area of fire fighting responsibility includes northern sections of Hook and Moore Glade
    - Additional taxpayer resources needed by Livermore Fire
    - Livermore Fire was not mentioned in Northern Water's "Fire Mitigation Plan", a careless oversight
- 287 suffers from a high incidence of accidents and deaths. Reroute will exacerbate this tragic problem.

1041 Permit Criteria 6

- Infectious COVID-19 Virus (SARS-CoV-2) is expected to be present in treated municipal wastewater
- "We hypothesize that SARS-CoV-2 is transmitted via sewage into the natural aquatic environment where wildlife become infected"
  - Franklin, A. B. and Bevins, S. 2020. *Spillover of SARS-CoV-2 into novel wild hosts in North America: A conceptual model for perpetuation of the pathogen* Science of The Total Environment Volume 733, 1 September 2020.