

South Platte River - History and Mechanics



1806 to 2012

**Interim Water Resources
Review Committee**

August 14th, 2012

Steamboat Springs, CO

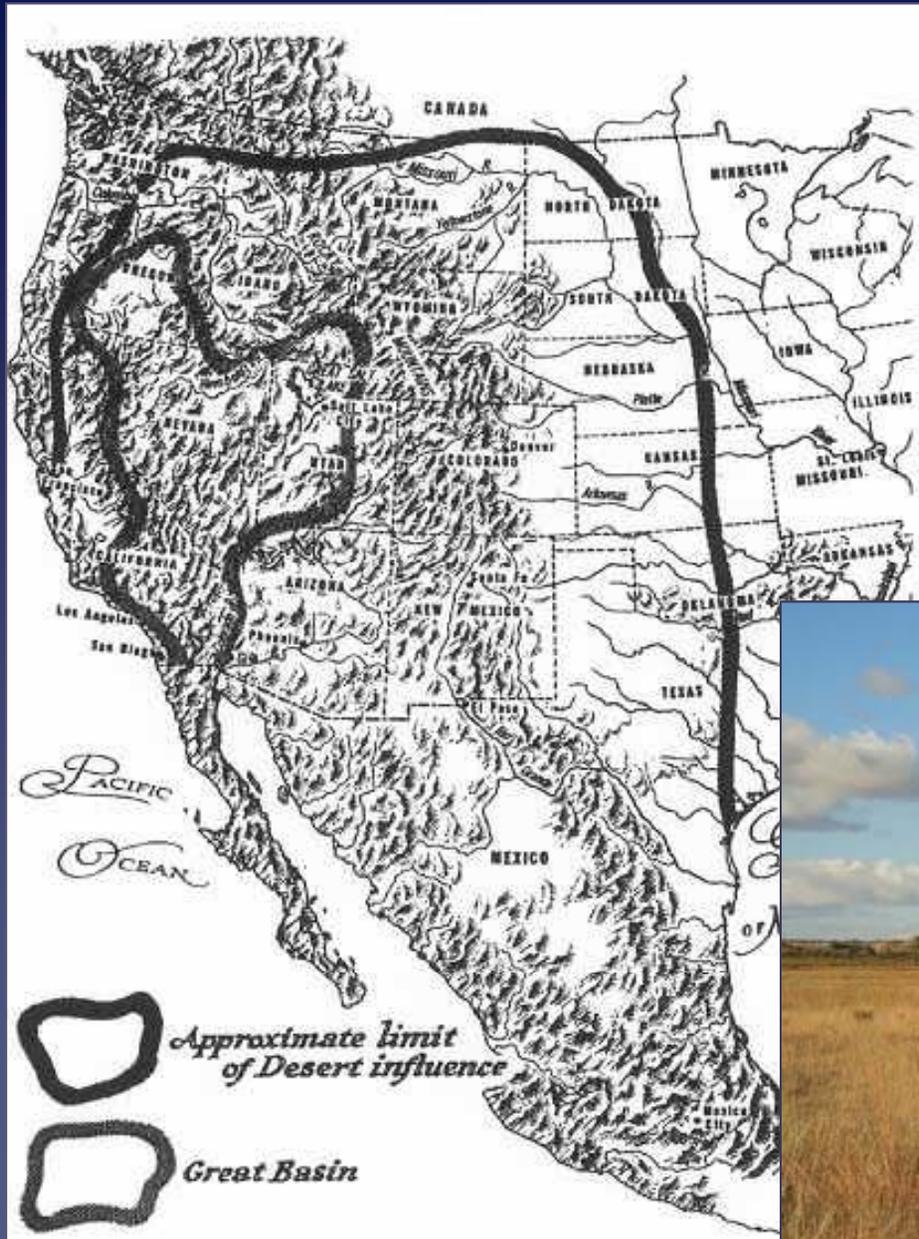


Fig. 8.—Crook river station showing river running slush ice. This flow is all seepage or return water to the river.

Jim Yahn, North Sterling Irrigation District

Joe Frank, Lower South Platte Water Conservancy District¹

The Great American Desert





Lt. Zebulon Pike

“these vast plains of the western hemisphere may become in time equally celebrated with the sandy deserts of Africa.” - 1806



Major Stephen Long

“a barren region unfit for the habitation of civilized man.” - 1820

- “The Platte! That’s the sorriest river in America. You’ve heard all the jokes about the Platte. Too thick to drink, too thin to plow. That’s a nothing river.”
- “Good God! I couldn’t help myself. The South Platte was the most miserable river in the West, a trickle in summer when it’s water was needed, a raging torrent in spring. It was muddy, often more island than river, and prior to the introduction of irrigation, it had never served a single useful purpose in it’s halting career.”

- James A. Michener-
Centennial

Water Fact...

Average Annual Precipitation....

Northeastern Colorado
14-16 inches

Northeastern United States
40-50 inches

South Platte Water Rights Development

- Mining 1850's - 1860's
- Irrigation Direct Ditches 1860's – 1900's
- Irrigation Reservoirs 1900's – 1910's
- Irrigation Wells 1930's – 1970's
- Irrigation Well Augmentation – 1970's - Today
- Municipal and Industrial - Ongoing

Colorado Gold Rush - 1859



Union Colony (1870) - Irrigation and The Mutual Ditch Company



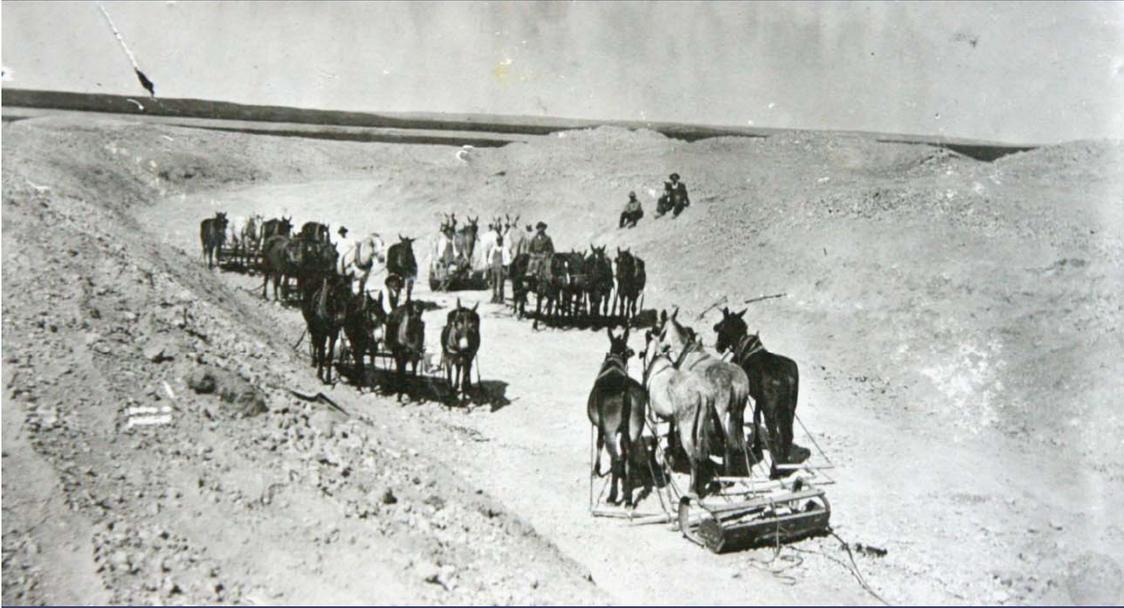


Colorado Water Law

- Doctrine of Prior Appropriations
 - First In Time = First in Right
- Water Right: a right to put water to beneficial use when available in priority
- Water Rights are decreed in Water Court
- Water Rights may be conditional or absolute

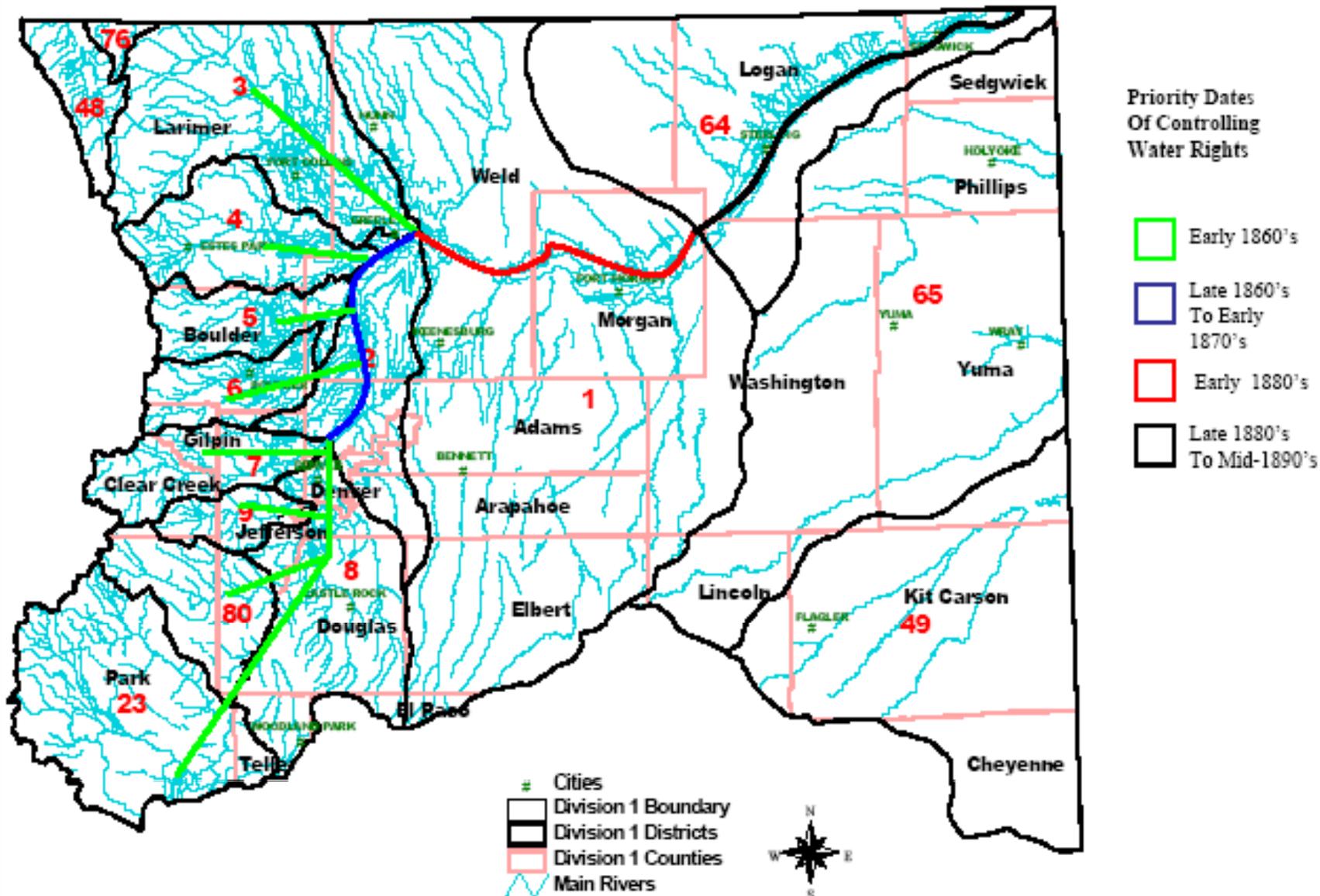


Direct Flow Ditches of the late 1800s

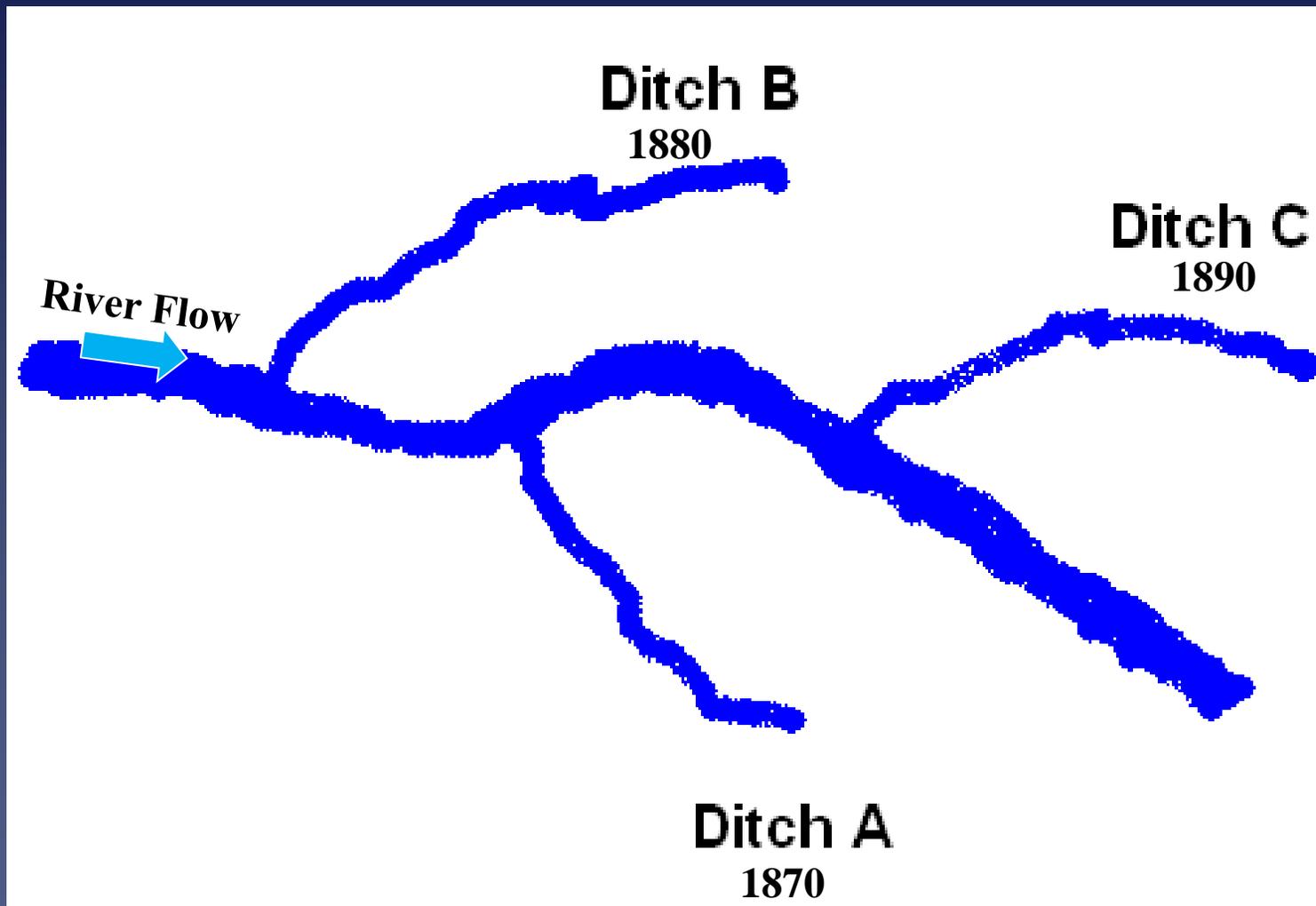


Development of Direct Flow Water Rights

State of Colorado, Division of Water Resources, Division 1, South Platte River Drainage.



Surface Diversion Interaction Example



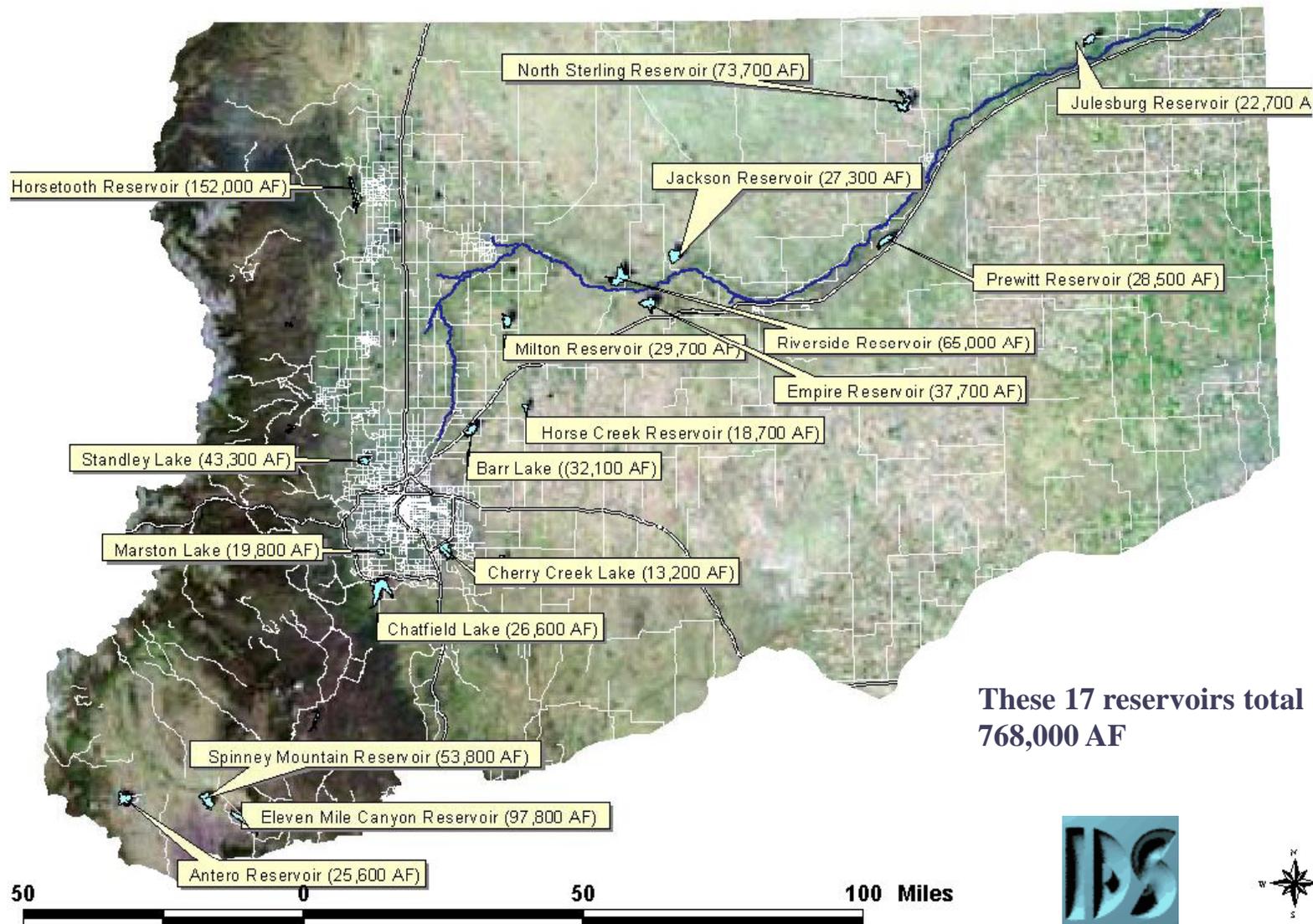
Plains Reservoirs of the early 1900s



Dam of North Sterling Irrigation District.



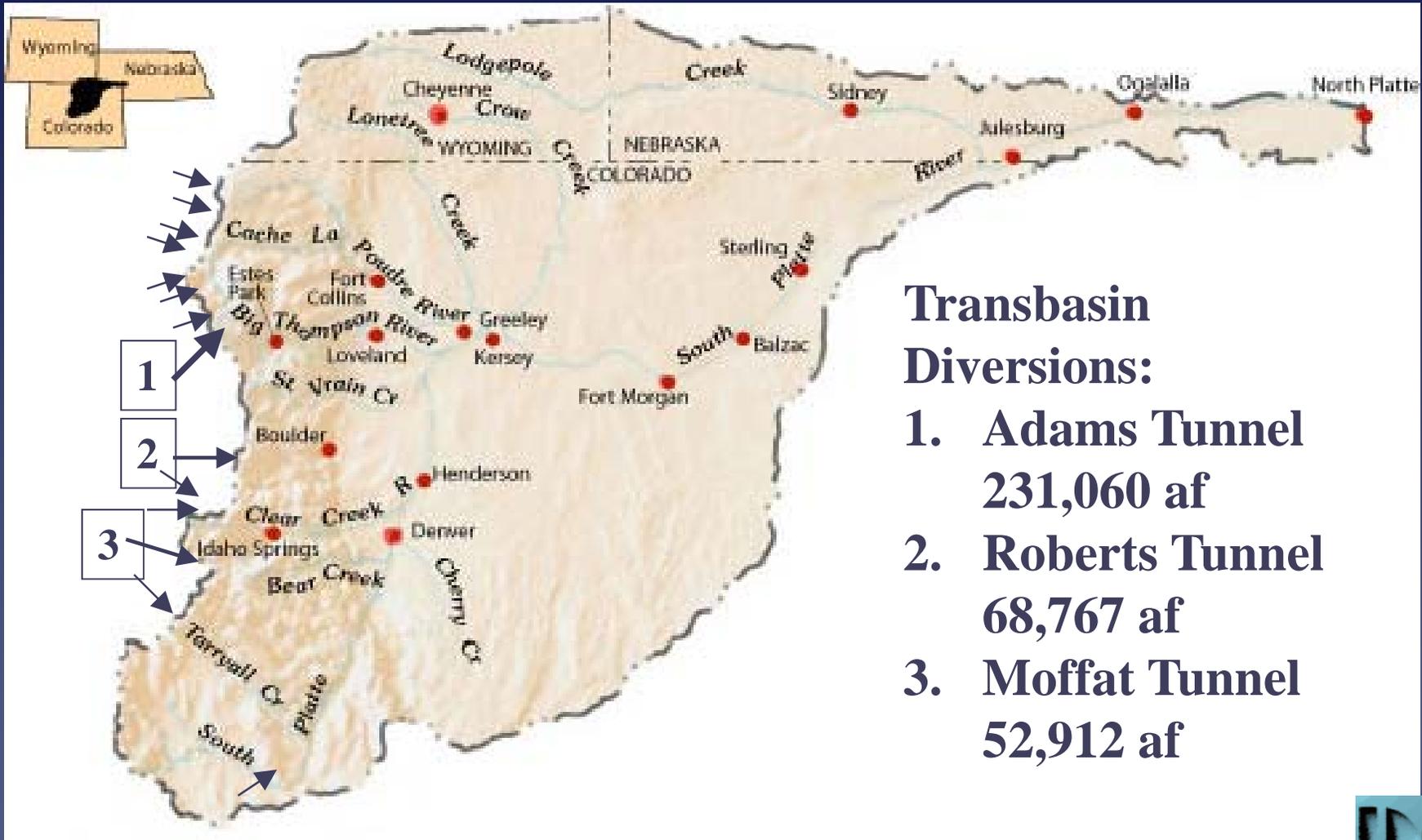
South Platte Major Storage Projects



Post Surface Irrigation Development



Transbasin Diversions



Transbasin Diversions:

1. Adams Tunnel
231,060 af
2. Roberts Tunnel
68,767 af
3. Moffat Tunnel
52,912 af

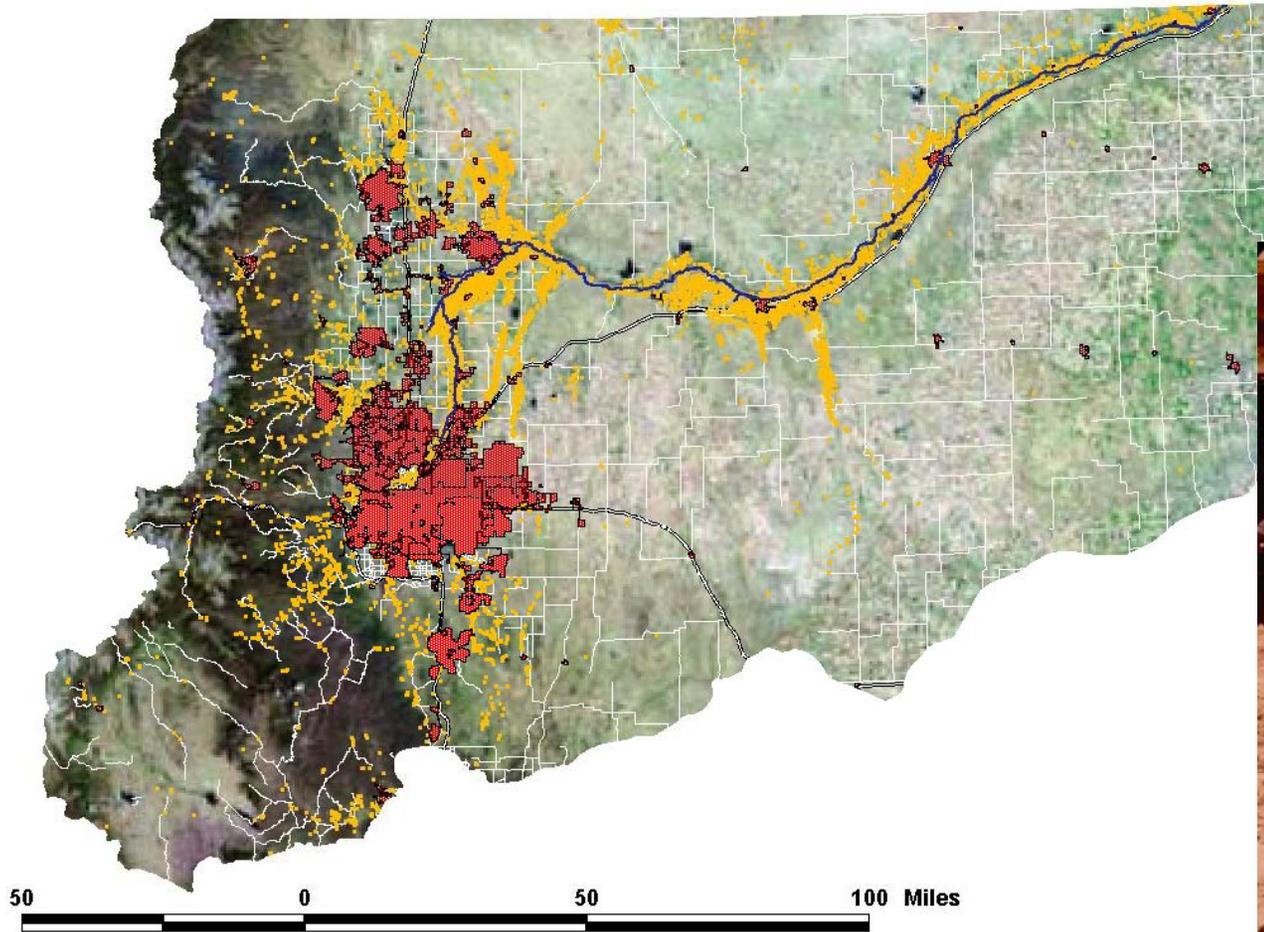


South Platte River Basin Hydrology

- Native Flows for total basin estimated to be 1,400,000 acre feet annually by the USGS
- Transbasin water provides approximately another 400,000 acre feet per year.
- Total annual surface water diversions equal approximately 4,000,000 acre feet.

Information taken from Division 1 Engineer power point presentation for CFWE tour of South Platte, July 19, 2008

South Platte Large Capacity Wells



Alluvial Wells of the 1930's to 1970's



Well Development

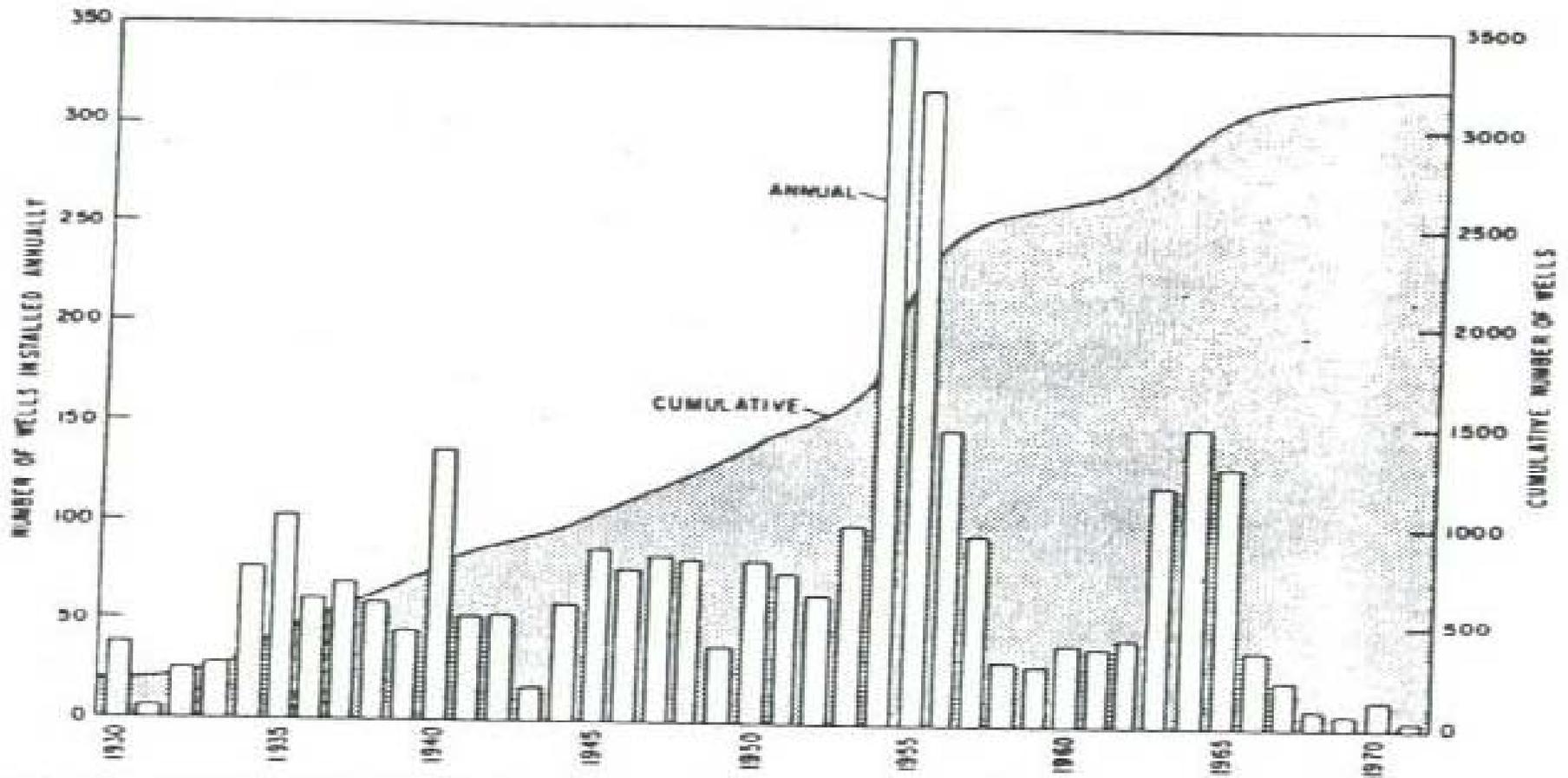


Fig. 2. Annual installation and cumulative number of irrigation wells in the South Platte River valley study area

Ralph Parshall in 1922

Return of Seepage Water to the Lower South Platte River in Colorado
Ralph Parshall (Colorado Ag. College now Colorado State University)
December, 1922.

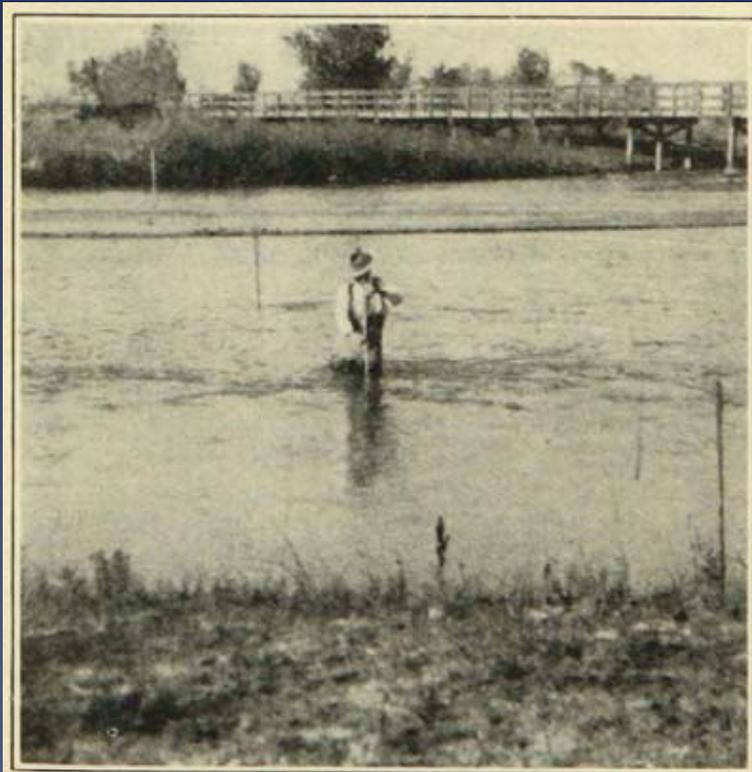


Fig. 23.—River station at Beetland showing a discharge of 300 second-feet which is all seepage or return flow to the river.

Bulletin 279

December, 1922

The Agricultural Experiment Station
OF THE
Colorado Agricultural College

RETURN OF SEEPAGE WATER
TO THE
LOWER SOUTH PLATTE RIVER
IN
COLORADO

By RALPH L. PARSHALL



COOPERATION BETWEEN THE DIVISION OF AGRICULTURAL ENGINEERING, BUREAU OF PUBLIC ROADS, U. S. DEPARTMENT OF AGRICULTURE, COLORADO AGRICULTURAL EXPERIMENT STATION, STATE ENGINEER OF COLORADO, AND THE COUNTIES OF WATER DISTRICTS NOS. 1 AND 64 OF COLORADO

PUBLISHED BY THE EXPERIMENT STATION
FORT COLLINS, COLORADO
1922

Ralph Parshall in 1922

The Phenomenon of Return Waters

- Return flows were increasing over time and continued to increase, mostly due to the general rise of the water-table over greater areas.
- The water table has risen each year (since the early stages of irrigation development) as much as 100 feet in some areas.
- The artificial application of water to the cultivated fields, caused the ground to be filled with water, resulting in this general rise of the water-table.
- This annual rise and changing slope of the water-table creates a greater pressure on the water beneath, which, in turn, overcomes the normal resistance of the soil and finally permits the displacement of the water in adjacent areas.
- As the practice of irrigation continued and greater areas were affected, it ultimately so increased the pressure that there has resulted, due to the action of gravity, a greater flow through the underground strata; but on account of the great resistance set up by the soil particles, the rate of travel of this underground current is exceedingly slow.”

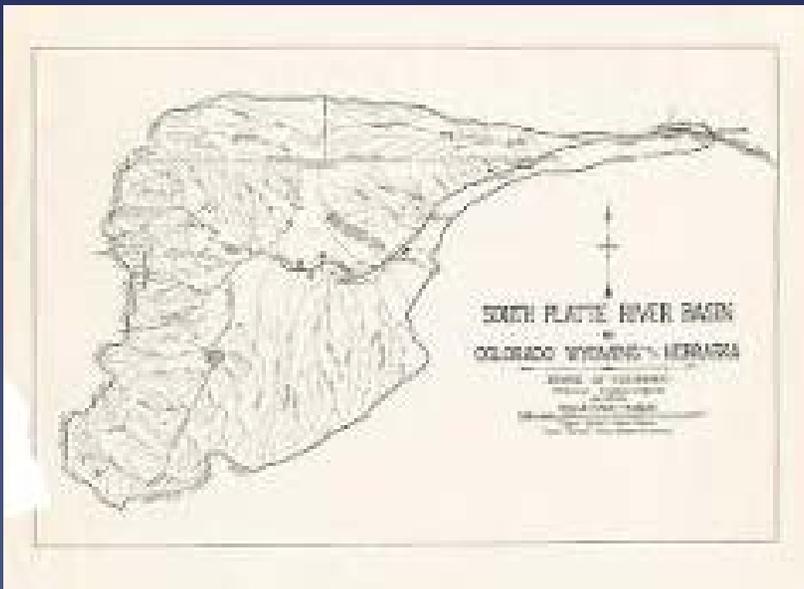
Ralph Parshall in 1922

Other Findings

- Value of return flows were huge, more than \$2,000,000 or \$3,000 per second-foot.
- Return flows varied from 2 to 8 ½ second-foot per mile and averaged 5 ¼ second-foot per mile.
- Reservoirs contribute about 20% of return flows.
- Ratio of return seepage to irrigated area is approx 1 second-foot to 275 acres.
- There is a yearly increase in seepage return.
- The diversions from the river after the spring floods have subsided are practically all from seepage or return water, and only during summer floods or freshets is the river flow increased.

Delph Carpenter in 1925

South Platte River Compact



Signed by CO and NE in 1923



Signed by CO Governor Clarence J. Morley in 1925

Nature of return flows in the South Platte

“The flow was excessive in May and June and disappeared entirely during the summer. The river frequently became dry for months of each year to points as far west as the present city of Fort Morgan.” – **Prior to surface irrigation.**

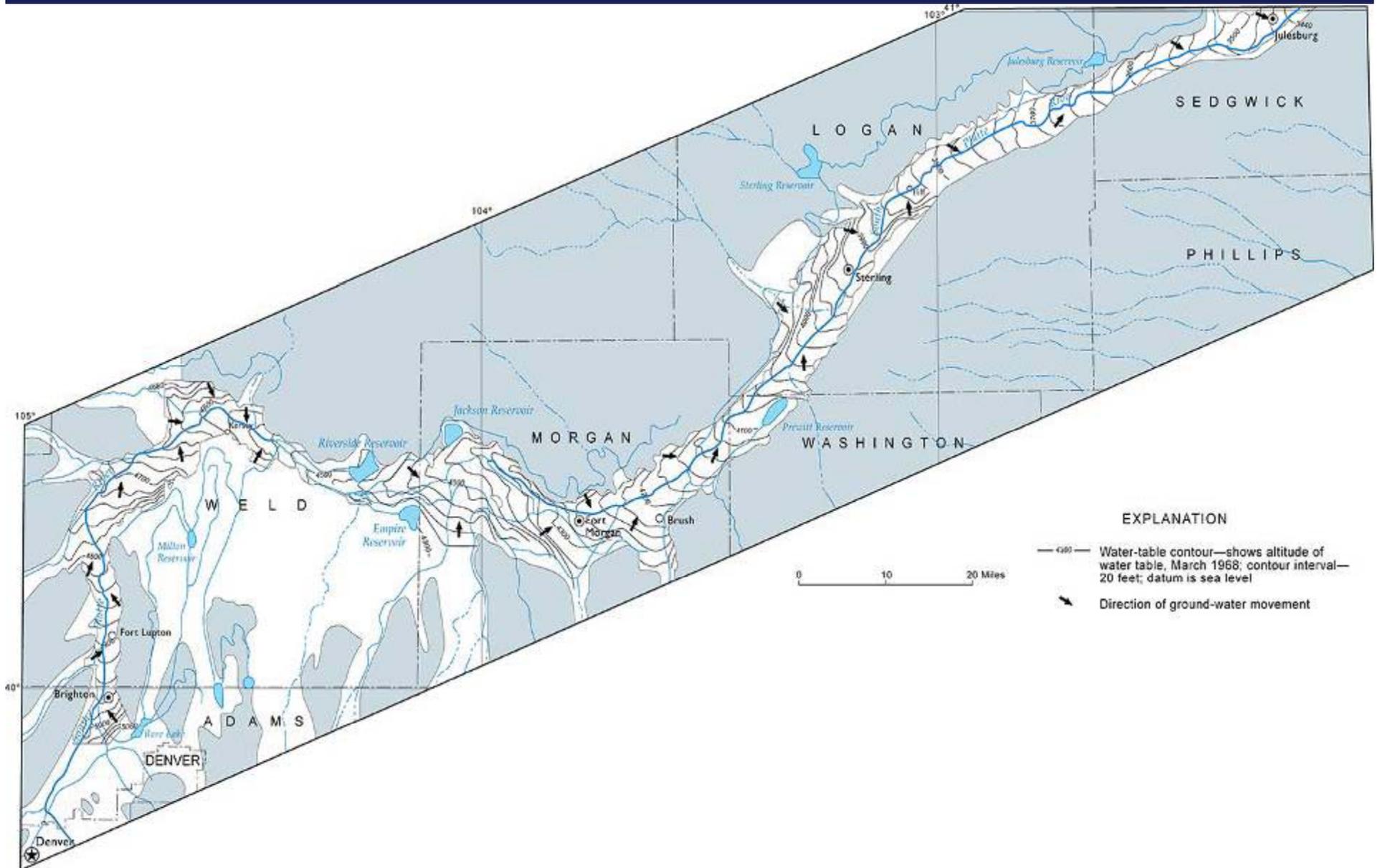
“The flow of return and seepage waters coming back to the river from irrigation of Colorado lands, has resulted in a constant supply at the interstate line.” – **After surface irrigation development.**

“This flow is increasing and will soon be sufficient to care for the full demands of Nebraska as determined by the compact, while great quantities of water annually flow to waste across the interstate line, during the flood season and winter months.....”

“ The once “disappearing” flood stream has been converted into one of constant flow making possible the development in both states.”

Delph Carpenter, 1925 letter to CO Governor

South Platte Alluvium



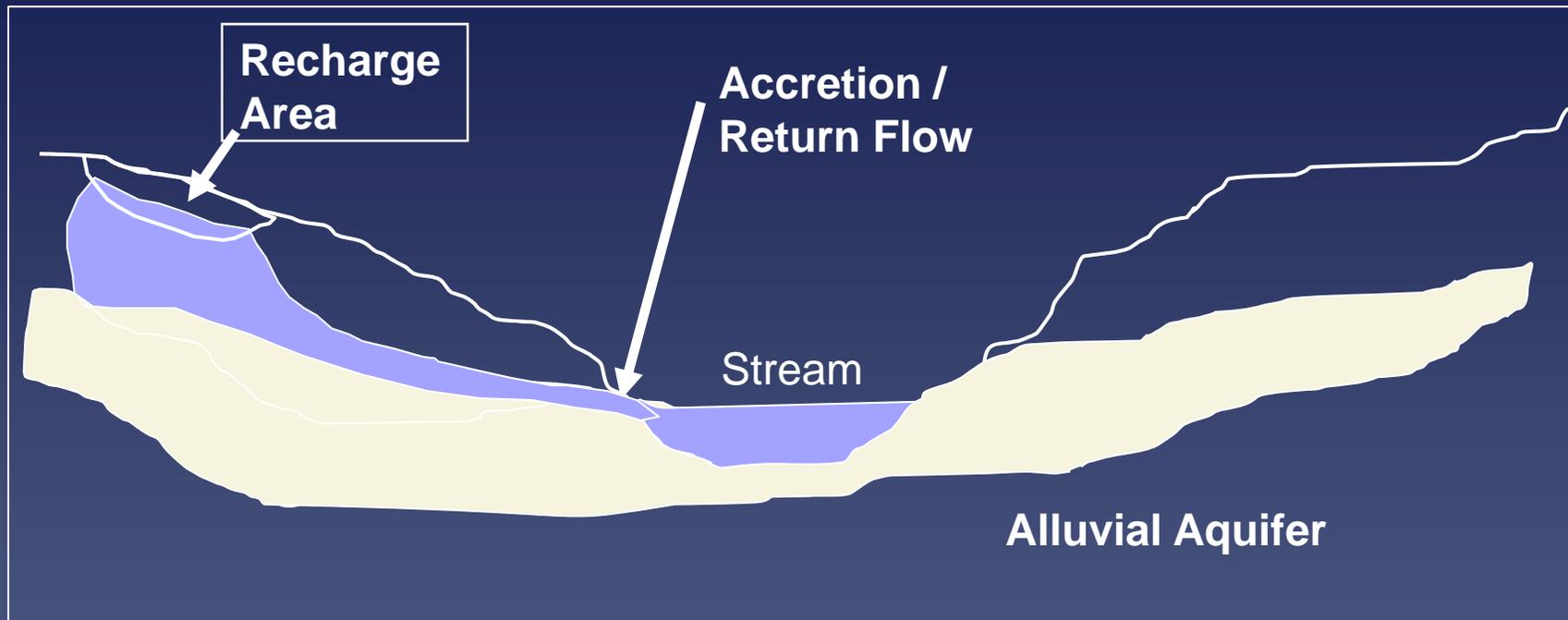
The Water Problem

Ralph Parshall's address to Ft. Collins Rotary Club

August 29th, 1956

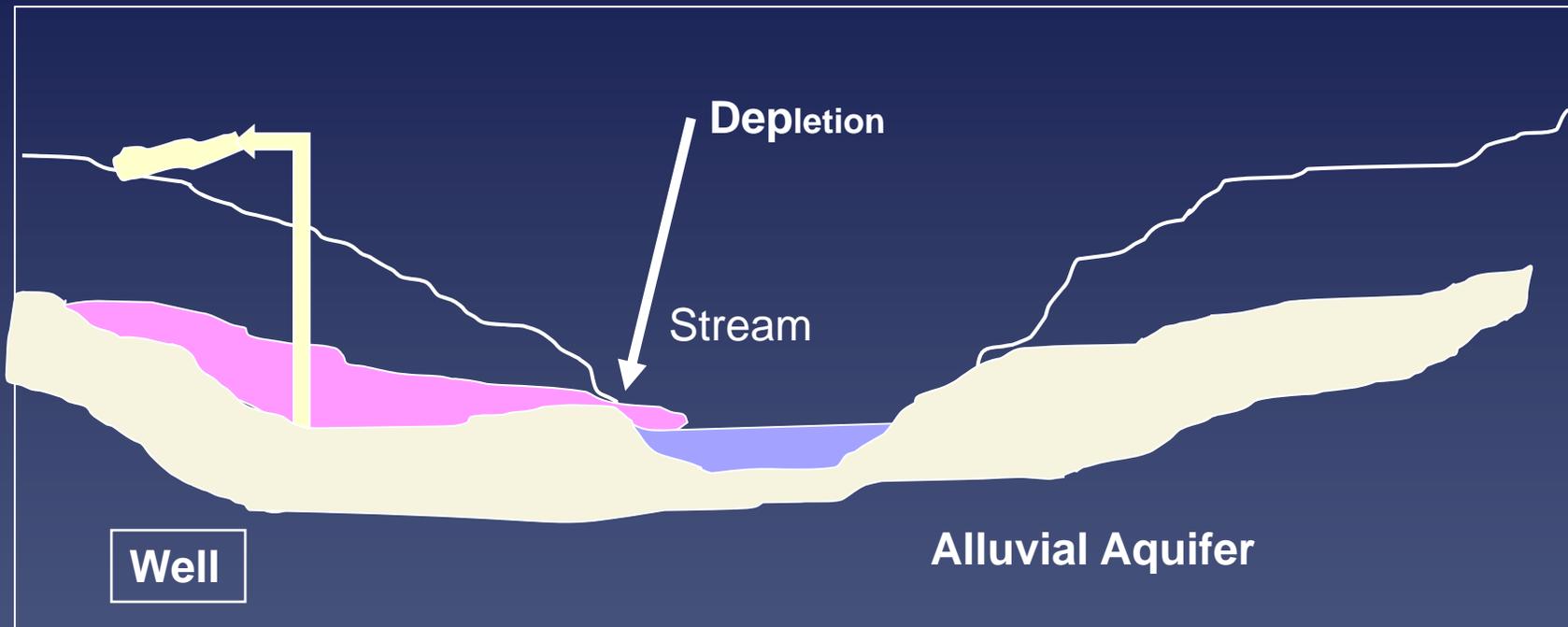
- Several issues impacting the dwindling river and hydrologic conditions.
- Assisted Bureau of Reclamation with C-BT economic report in 1932-1933 and together concluded: that about one-third of the season use of 300,000 acre-feet (from C-BT) in direct irrigation would result in some 100,000 ac-ft in the return flow.
- Return flows have been investigated since the early 1880s and these past records strongly indicated a steady increase in the return flow to the river.
- In 1956 found that seepage return was practically nil.
- Partly due in the fact, that between Kersey and Julesburg, more than 4000 irrigation wells pumped to deliver enough water to fill Horsetooth Reservoir four times during the season of 1955 (584,000 ac-ft).
- Appeared obvious that we cannot continue depleting the underground reservoir at that rate.

Return Flows and Accretions



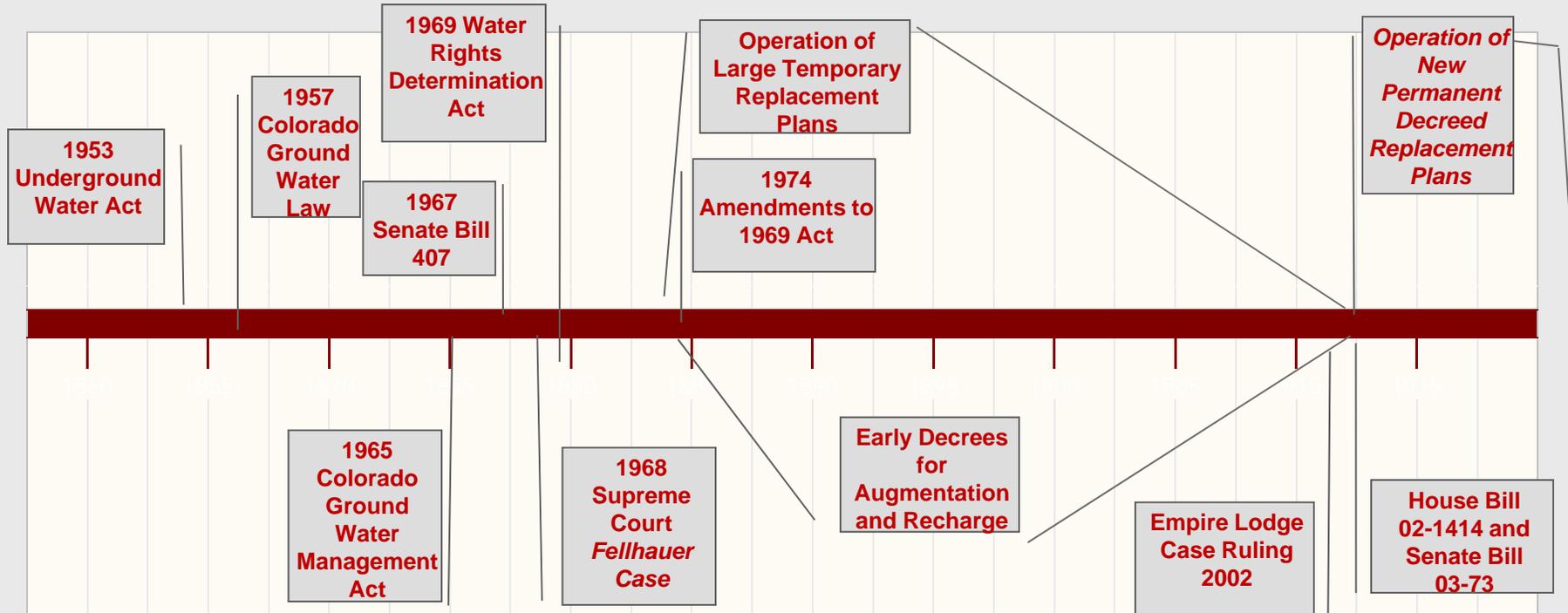
Ditch, Reservoir and on-farm seepage - “Recharge” or fill up the aquifer which slowly makes its way back to river. The volume released to the river is the “return flow or “accretion” amount.

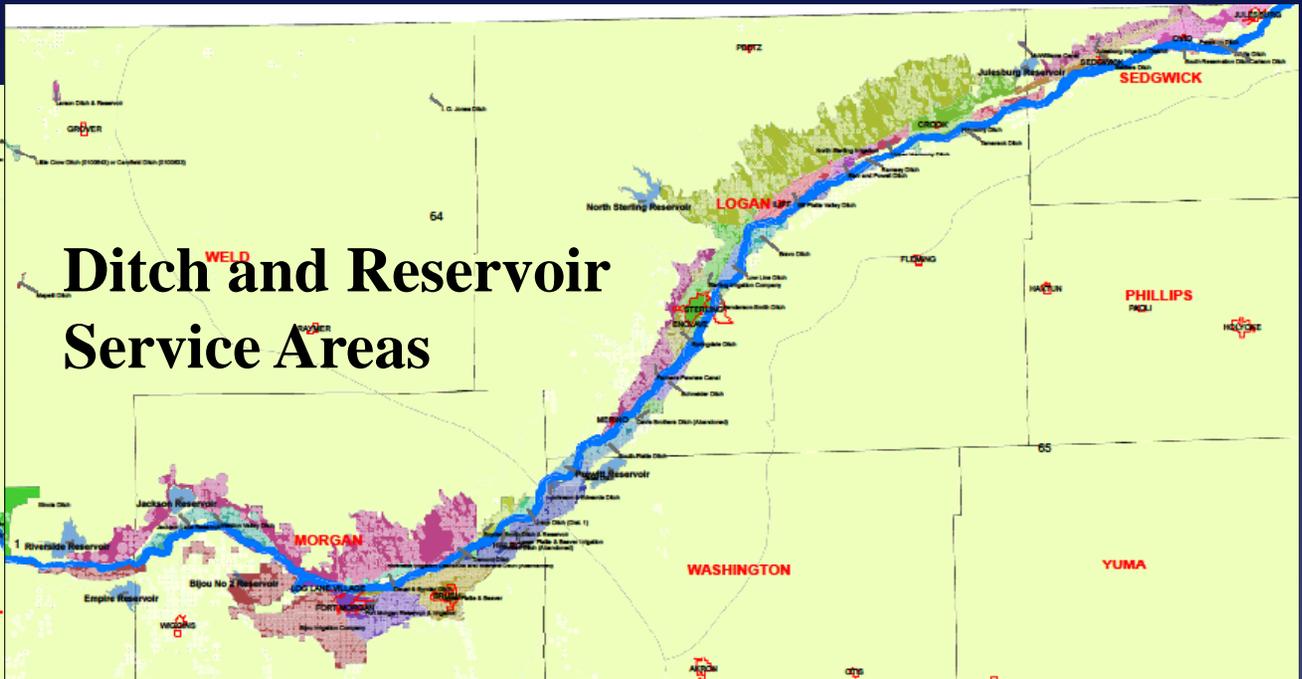
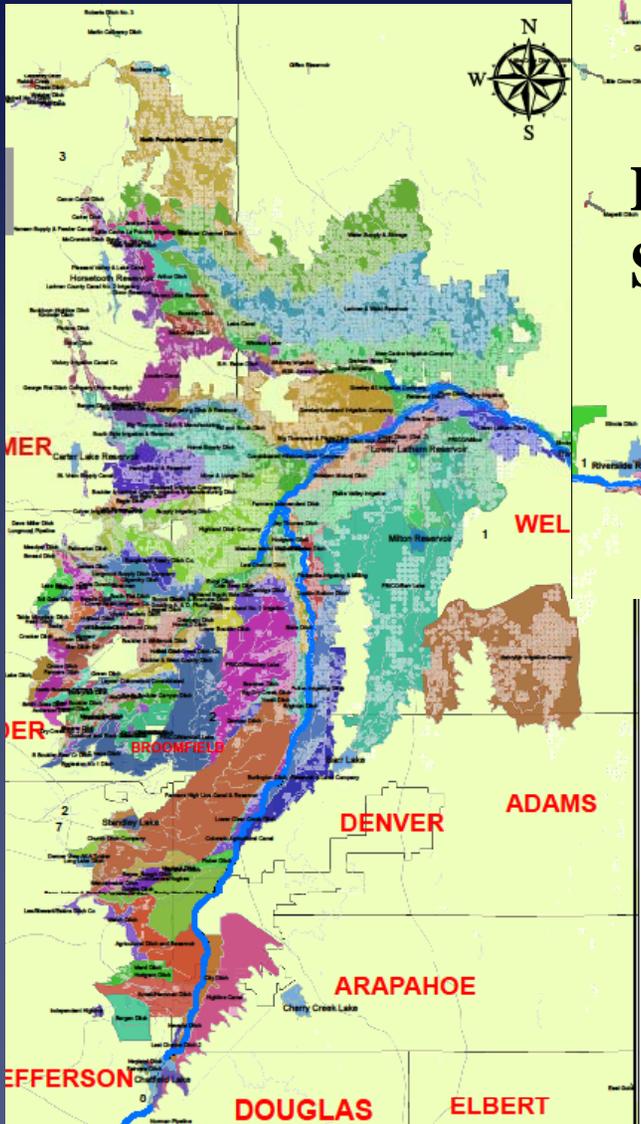
Pumping and Depletions



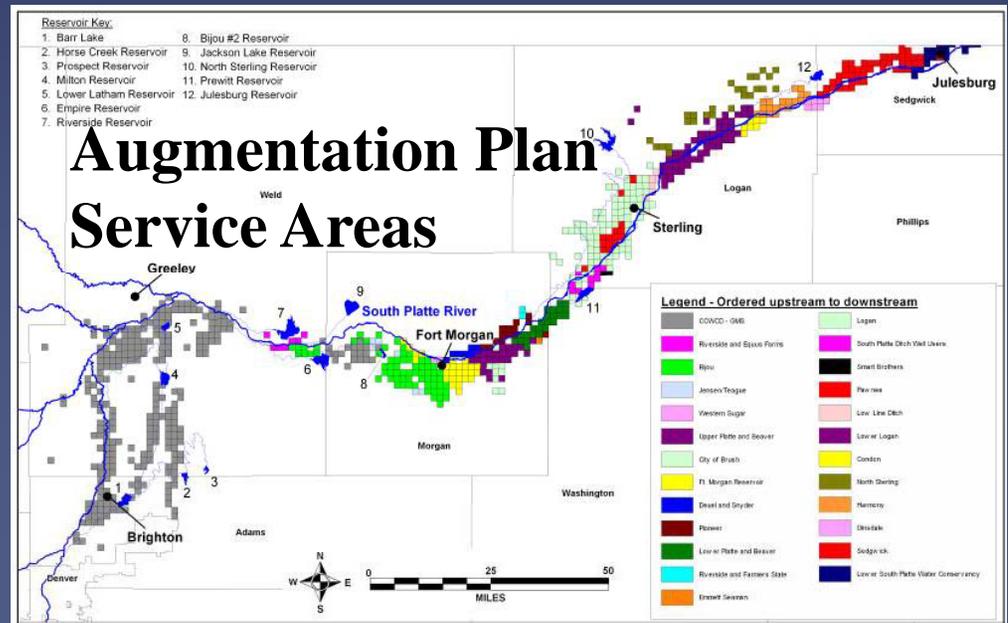
An alluvial well used, typically, for irrigation.
Pumping “depletes” or “intercepts return flows” which impacts river flow.

South Platte Well Administration Timeline





Ditch and Reservoir Service Areas



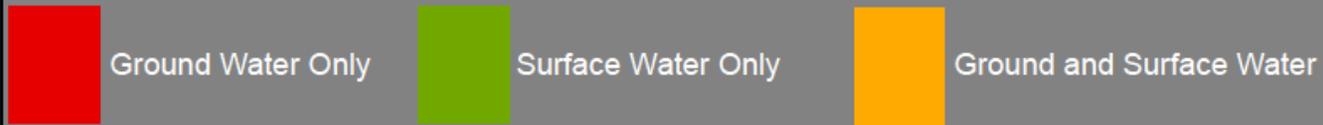
Augmentation Plan Service Areas

SOUTH PLATTE DECISION SUPPORT SYSTEM

Historic Irrigation Sources

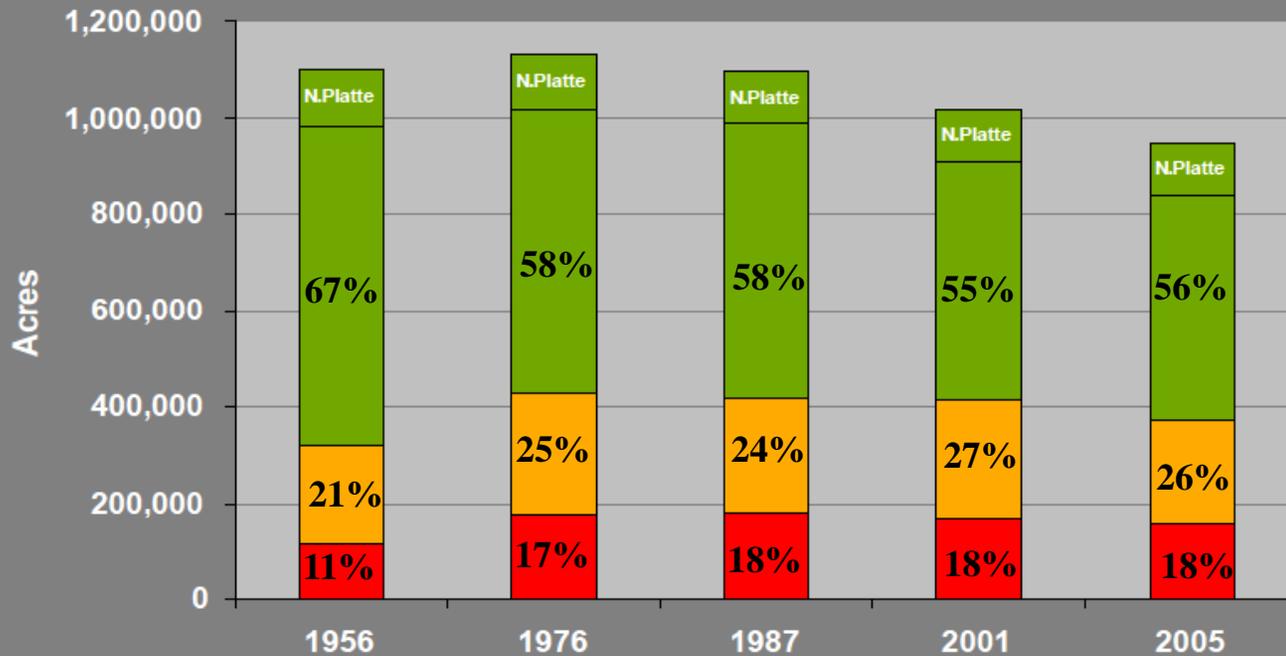


SPDSS Irrigated Acreage Water Sources



*The North Platte River Basin is not displayed on the maps. The North Platte Basin is irrigated almost entirely by surface water.

Water Source Comparison South and North Platte River Basins



Questions?

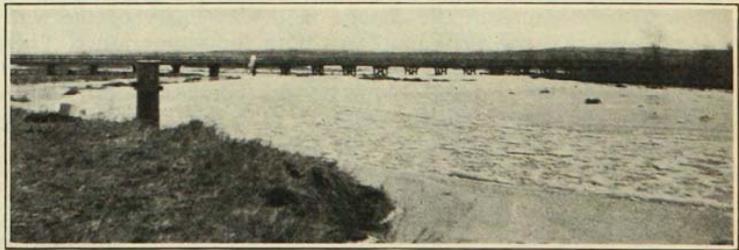


Fig. 8.—Crook river station showing river running slush ice. - This flow is all seepage or return water to the river.

