PacifiCorp Bear River and Bear Lake System

History, Hydrology and Operations

Connely Baldwin

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Outline

- History of Bear Lake and Bear River Development
- Agreements and Contracts
- Hydrology and Operations

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Bear Lake Development

- April 6, 1889 - Bear Lake became “U.S. Reservoir No. 1”
- Oct 1888 and Aug 1889 - John R. Bothwell blocks the natural 60’ wide outlet and raises the natural berm (but later becomes dilapidated)
- Aug 19, 1889 – U.S. Senate Hearings on about the “Bothwell situation”
- 1890 - passage of a revised bill that allowed Bothwell to continue to develop Bear Lake (but work did not recommence).

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Bear Lake Development

- In 1898, many years after Bothwell's first efforts, Nunn and Bothwell re-examined the situation
- Nunn's engineer recommended a 3 ½ mile tunnel through Logan canyon.
- Bothwell's engineer recommended the inlet and pump idea that Nunn's engineer settled on as well.

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Bear Lake Development

- Bear Lake project began in 1909 and was completed in 1918.
- 1912 Contract transferred ownership from Bear River Canal Company predecessor to PacifiCorp's predecessor
- Project completion allowed for the storage and release of Bear River and Bear Lake tributary flows in Bear Lake.
- Project **not** licensed under Federal Energy Regulatory Commission (no direct power generation).

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Bear River Development

- Construction of hydro-electric plants began in 1904 at Grace and was completed at Cutler in 1927.
- Other plants included Cove, Oneida and Soda.
- Projects were licensed under FERC.
- Relicensed in 2004.
- Cove decommissioned in 2006.

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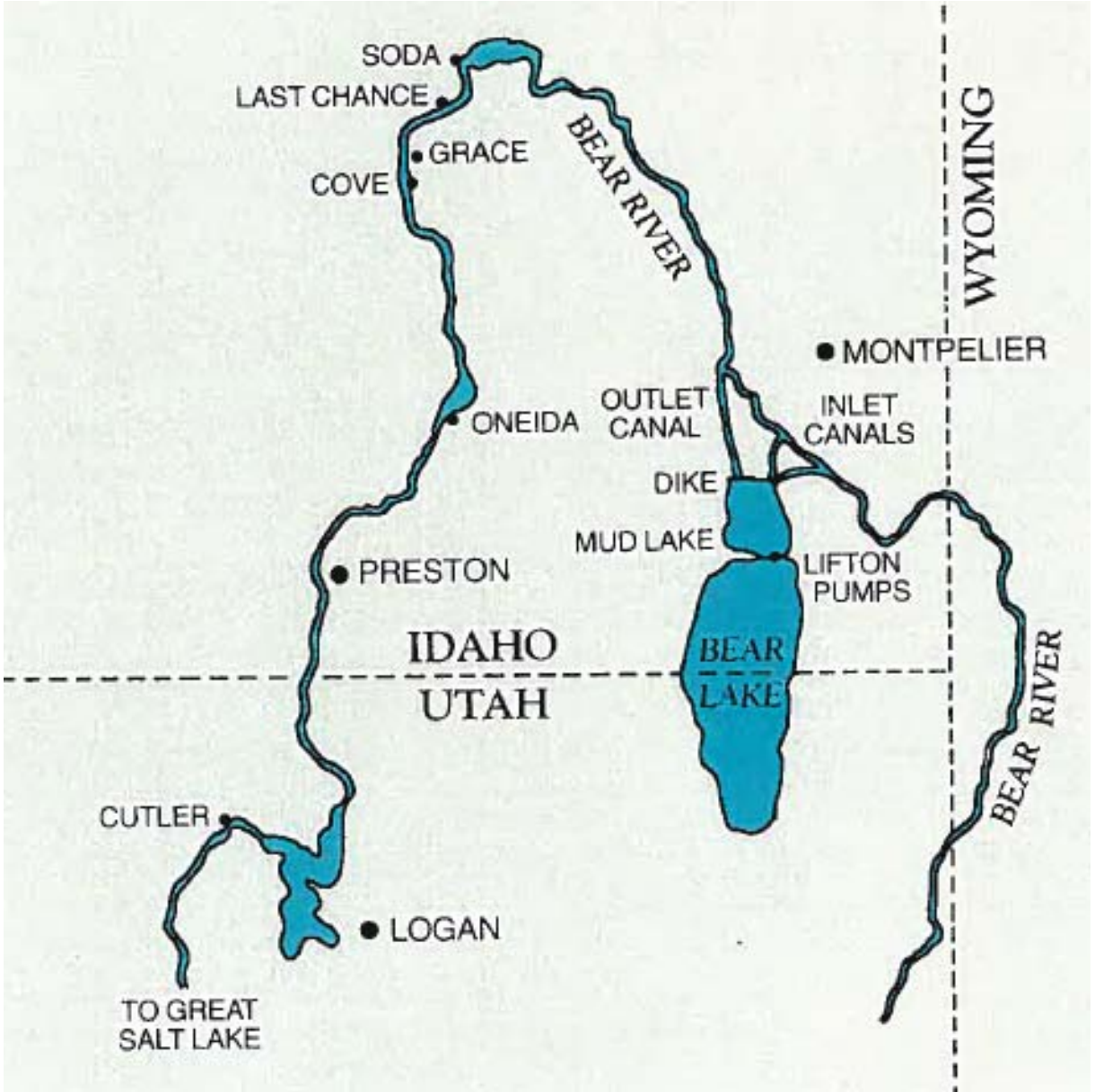
Bear River Hydroelectric Plants

- 1907 Grace
- 1915 Oneida
- 1917 Cove (decomm. 2006)
- 1924 Soda
- 1927 Cutler



Summary of Agreements and Contracts

- 1912 Bear River Canal Company Conveyance & Agreement
- 1916 through 1919 three additional irrigation agreements
- 1968 Bear Lake National Wildlife Refuge agreement
- 1955 Bear River Compact
- 1980 Amended Bear River Compact
- 1995 Bear Lake Settlement Agreement
- 1999/2000 Agreements between PacifiCorp, Utah, Idaho and Wyoming – Maintain historic operations of Bear Lake with Hydro Generation an *incidental* use of BL water
- 2004 Allocation Addendum to 1995 BL Settlement Agreement

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TIMELINE OF KEY DOCUMENTS, CONTRACTS & AGREEMENTS

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1912-1919 IRRIGATION CONTRACTS

- PacifiCorp entered into contracts with Bear River Canal Company, West Cache Canal Co., Last Chance Canal Co. and Cub River Irrigation Co. to receive Bear Lake storage water.

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1920 DIETRICH DECREE IN IDAHO

- Granted water rights for irrigation in the Idaho portion of the Bear River.
- Granted PacifiCorp the exclusive right to store up to 5500 CFS of the flow of the Bear River in Bear Lake and 500 CFS of the flow of Bear Lake and Mud Lake tributaries.
- Allowed the release of the stored water for irrigation and power purposes.

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1922 KIMBALL DECREE IN UTAH

- Granted water rights for irrigation in the Utah portion of the Bear River.
- Recognized PacifiCorp's rights to store Bear River water in Bear Lake.

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1958 BEAR RIVER COMPACT

- Established an upper, central and lower division in the Bear River basin.
- Granted storage rights of 36,500 acre feet above Bear Lake.
- Established an irrigation reserve in Bear Lake up to 5914.7 feet.
- Established commission authority to regulate water between Utah, Idaho and Wyoming in the upper and central divisions during water shortages.

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1968 AGREEMENT WITH US FWS –MUD LAKE OPERATION

- Provided elevation and other operating guidelines to enhance habitat and wildlife propagation within the National Wildlife Refuge boundaries.

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1971-72 and 1983-86 FLOODING LAWSUITS (PROPERTY OWNERS VS UP&L)

- 1970's case based on strict liability standard – PacifiCorp lost case
- 1980's case based on negligence standard – PacifiCorp won case
- Lawsuits established flood control obligations in the operation of Bear Lake & Bear River

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1980 AMENDED BEAR RIVER COMPACT

- Reaffirmed the irrigation reserve elevation in Bear Lake
- Granted additional storage rights of 74,500 acre feet above Bear Lake.
- Additional rights to store were subject to Bear Lake elevation reaching 5911 feet.

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1980 AMENDED BEAR RIVER COMPACT

- Granted rights to develop additional water supplies in the lower division amounting to 1 million acre feet as follows:
  - Idaho – first 125,000 acre feet
  - Utah – next 275,000 acre feet
  - Idaho – remaining 30% and Utah remaining 70%
- New developments were granted subject to existing water rights

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1989 STORAGE CONTRACTS WITH INDIVIDUAL IRRIGATORS

- PacifiCorp entered into contracts with 125 individual irrigators to receive storage water from Bear Lake.
- Subsequently became the Bear River Small Irrigators groups, one in Utah, one in Idaho

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1994 IDAHO WATER RESOURCE BOARD FILING IN BEAR LAKE

- Allowed Idaho the right to Bear Lake water below the historic low elevation of 5902 feet for fish enhancement, aesthetics and recreation.
- Assuring PacifiCorp would not release storage water below 5902 feet. Preserved about 4 million acre feet of water in the lake.

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1995 BEAR LAKE SETTLEMENT AGREEMENT

- Agreement reached between Bear River Water Users Association, PacifiCorp and Bear Lake interests.
- Dismissed lawsuit by Bear Lake interests against EPA and Corps of Engineers
- Adoption of storage allocations in Bear Lake based on Bear Lake elevations.
  - Allocations varied from 230,000 ac. ft. above irrigation reserve of 5914.7 ft. to 55,000 ac. ft. at 5905 ft.
  - No storage water allocated below 5904 ft.

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1995 BEAR LAKE SETTLEMENT AGREEMENT

- Created the Bear Lake Preservation Advisory Committee to:
  - Promote water conservation and efficient use practices
  - Promote more reliable water supplies for all users
  - Promote soil and energy conservation and improved water quality
  - Pursue means other than litigation to resolve conflicts
  - Periodically review the allocation plan and propose changes if needed
  - Promote a single allocation model for administration of water

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2004 AMENDED AND RESTATED BEAR LAKE SETTLEMENT AGREEMENT

- Account for System Losses
- Recognize Bear River Water Users Association allocations
- Recognize Small Irrigator allocations

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1999 & 2000 OPERATIONS AGREEMENTS

- The compact states sought assurance that Bear Lake operations would not change after Scottish Power acquisition
- Executed a preliminary agreement in 1999 and a final operations agreement in 2000
  - No delivery call for hydropower
  - Outline flood control operations at Bear Lake
  - Maintain historic operations
- Renewed at the time of the MidAmerican Energy Holdings company acquisition.

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HYDROLOGY AND OPERATIONS

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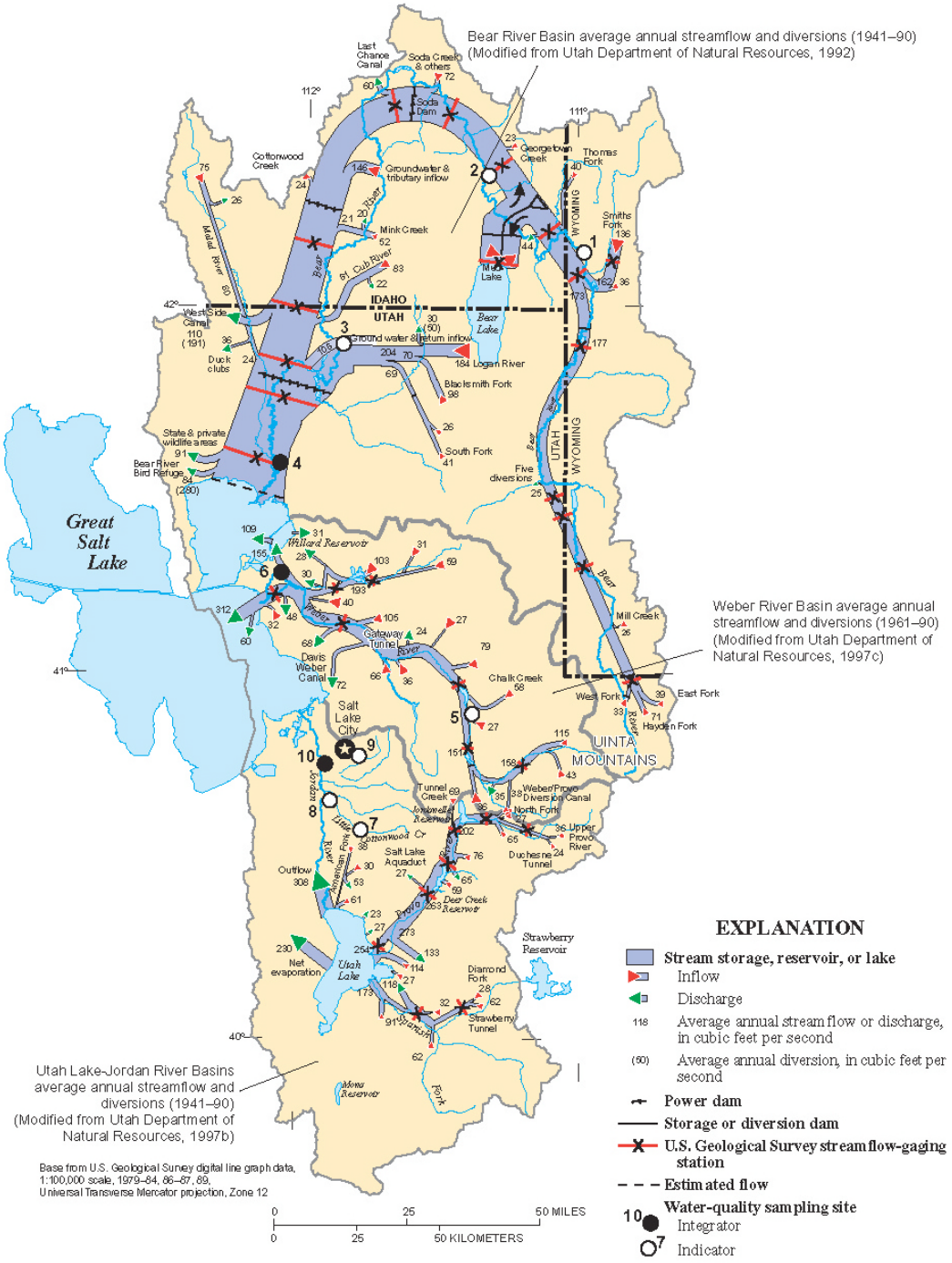
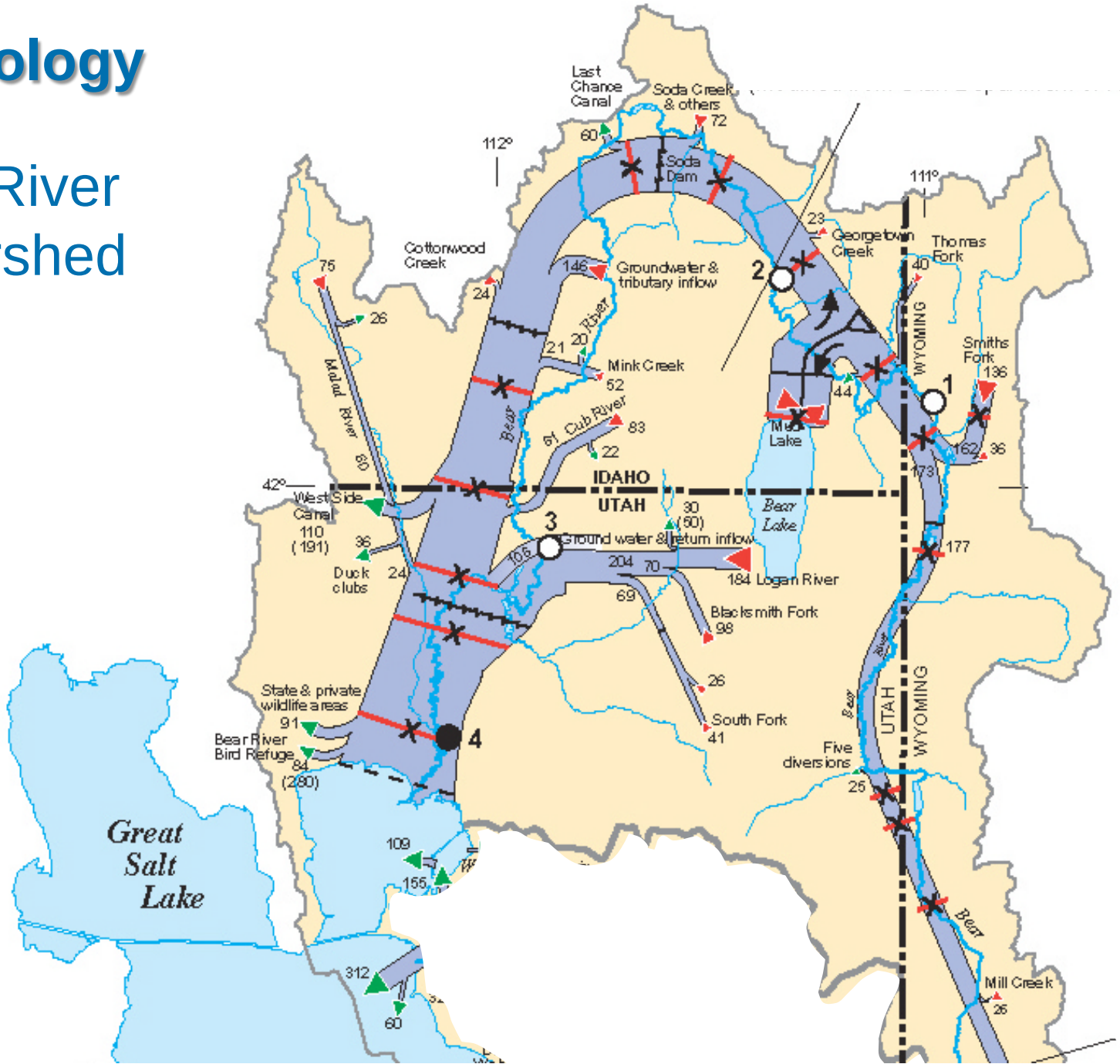
Hydrology

Great Salt Lake Watershed



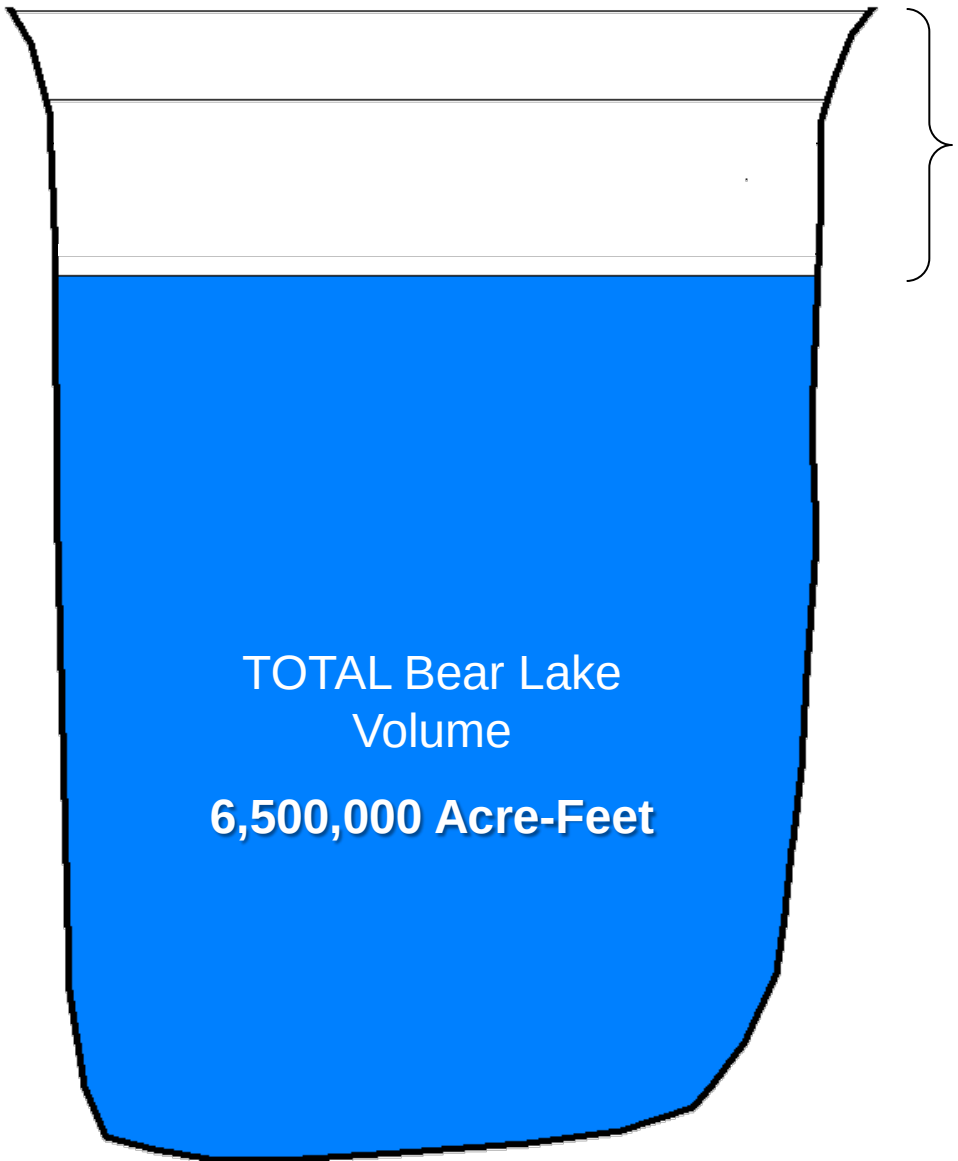
Hydrology

Bear River Watershed



Bear Lake

Active Reservoir Storage 1,302,000 Acre-Feet



5923.65 feet

Reservoir Portion

5902 feet

Other information:

Maximum Depth 208 feet

Max Length 18.8 miles

Max Width 7.4 miles

Area 110 sq. mi when full.

Age of Lake 500,000 to 6 Million Years

Water Temperature 32 to 69 F

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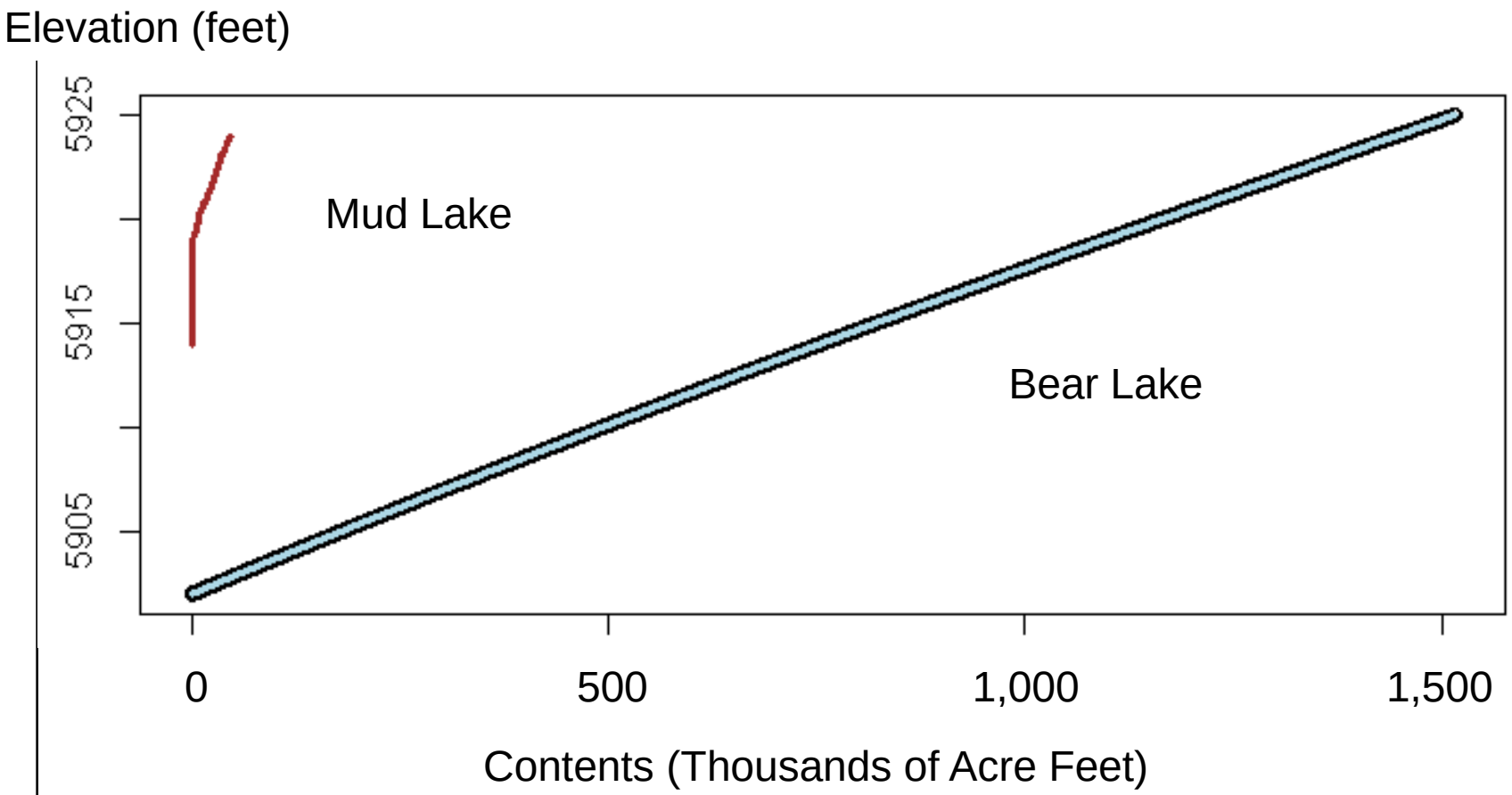
Relative Bear Lake/Mud Lake Contents



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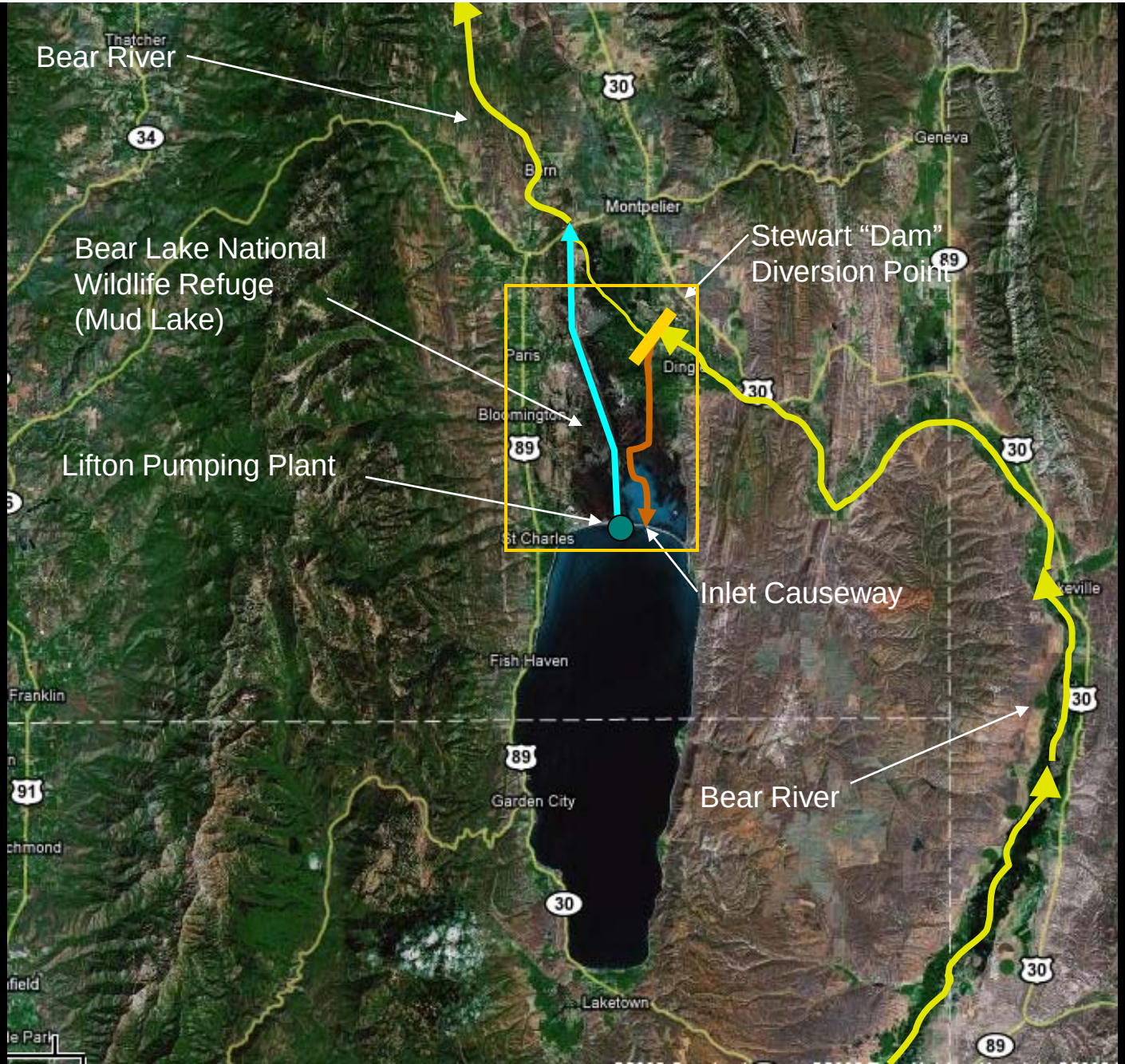
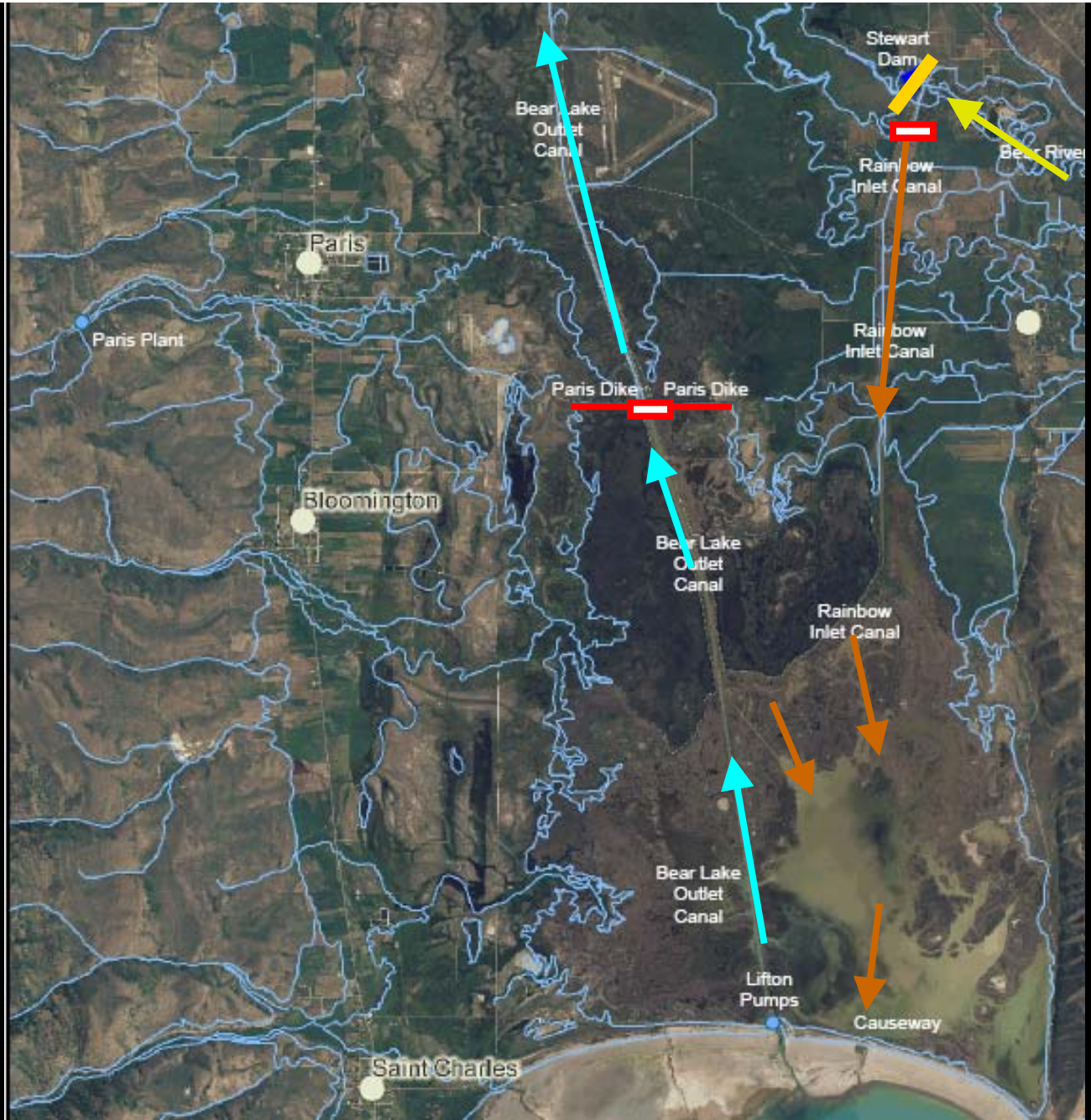
Bear River/Bear Lake Water Paths - Overview



Bear River/Bear Lake Water Paths - Detail



Diversion Dam (Stewart Dam)

Rainbow Inlet Canal Control Gates

Rainbow Inlet Canal

Bear Lake Inlet Causeway

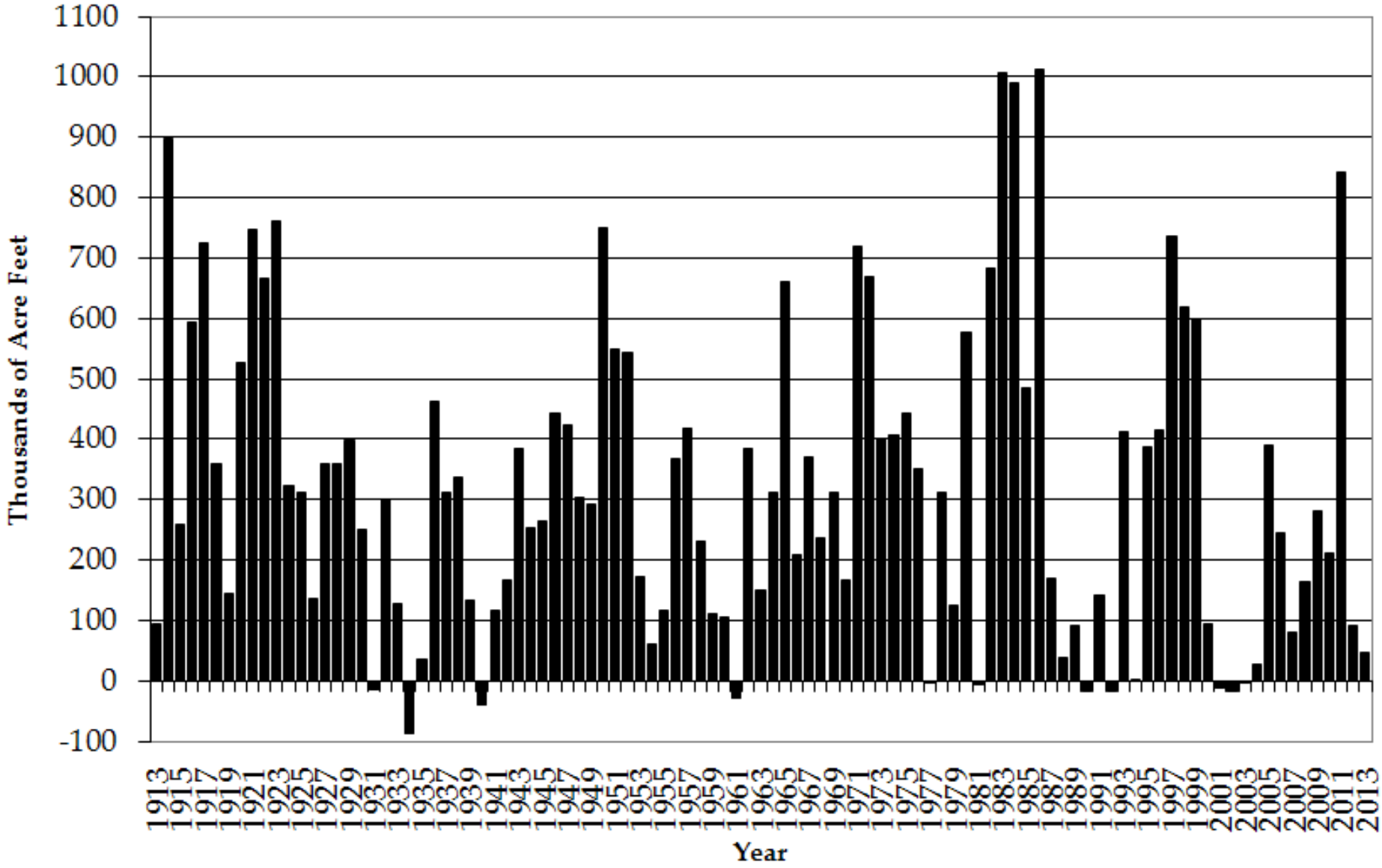
Lifton Pumping Plant

Inside Lifton Pumping Plant

Bear Lake Outlet Canal and Control Structure on Paris Dike

Bear Lake Outlet Canal

Bear Lake Annual Flow Available for Storage



Bear Lake Operation Modes

- **Irrigation**
  - By April 10th each year - set irrigation allocation based on forecast of maximum elevation of Bear Lake
  - Release supplemental flow as needed
- **Flood Control**
  - August 1 - set the flood control target elevation for the following April 1st
  - Sept 1 through March 1 - monthly evaluations of target elevation
  - Release water to meet target elevation without exceeding downstream channel capacity and minimizing ice-jam in the coldest parts of the winter season.

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Typical Seasonal Bear Lake Operations

- Spring Runoff – Store all water possible up to flood control target
- Late Spring – Release inflow for irrigation or flood control
- Summer – Pump Bear Lake for irrigation or flood control
- Fall – evaluate need to evacuate flood control storage
- Winter – store or release for flood control. Releases must be steady and unchanging due to downstream icing concerns.
- Power generation at Bear River hydro-electric plants is incidental to irrigation and flood control operations in all seasons

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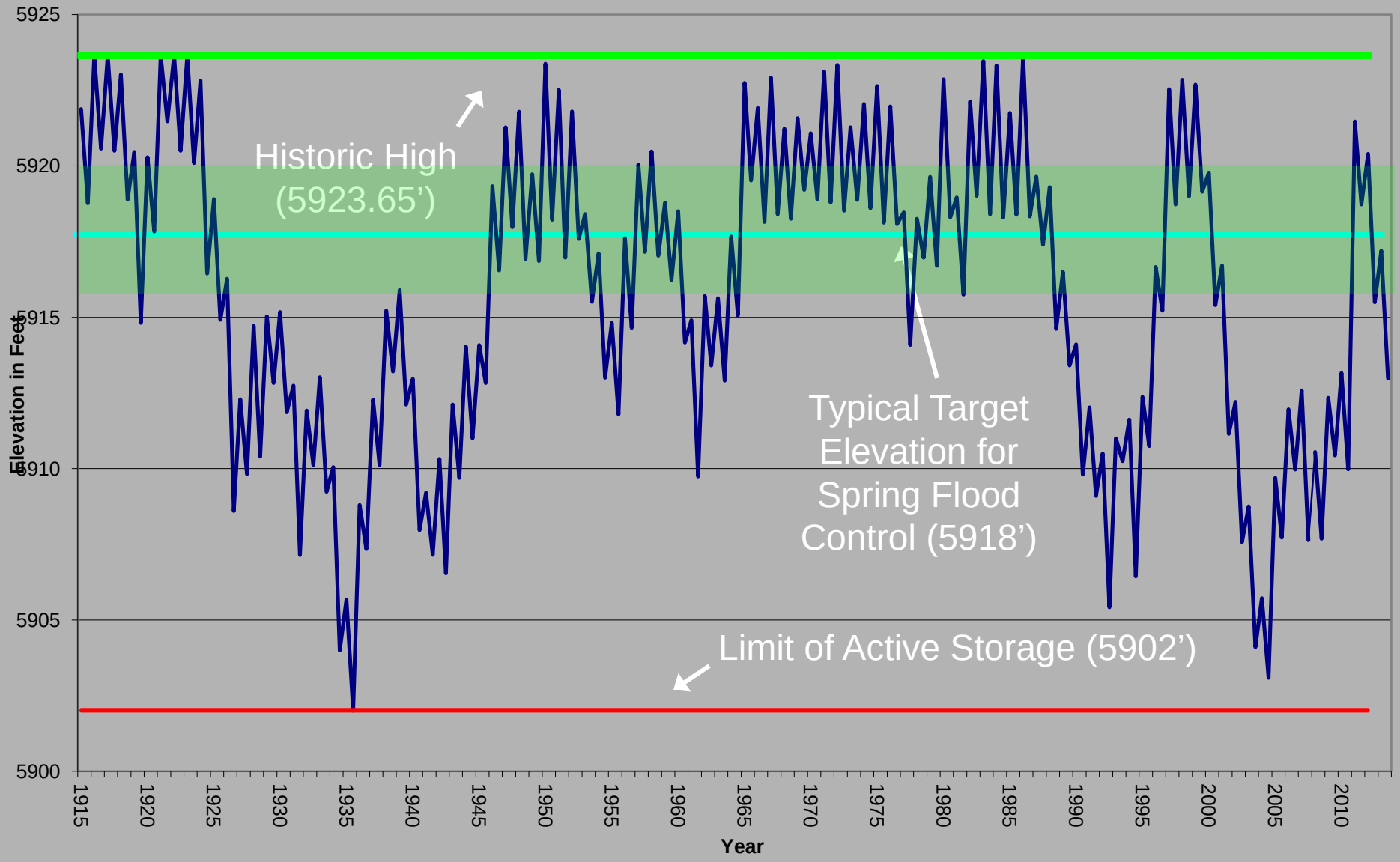
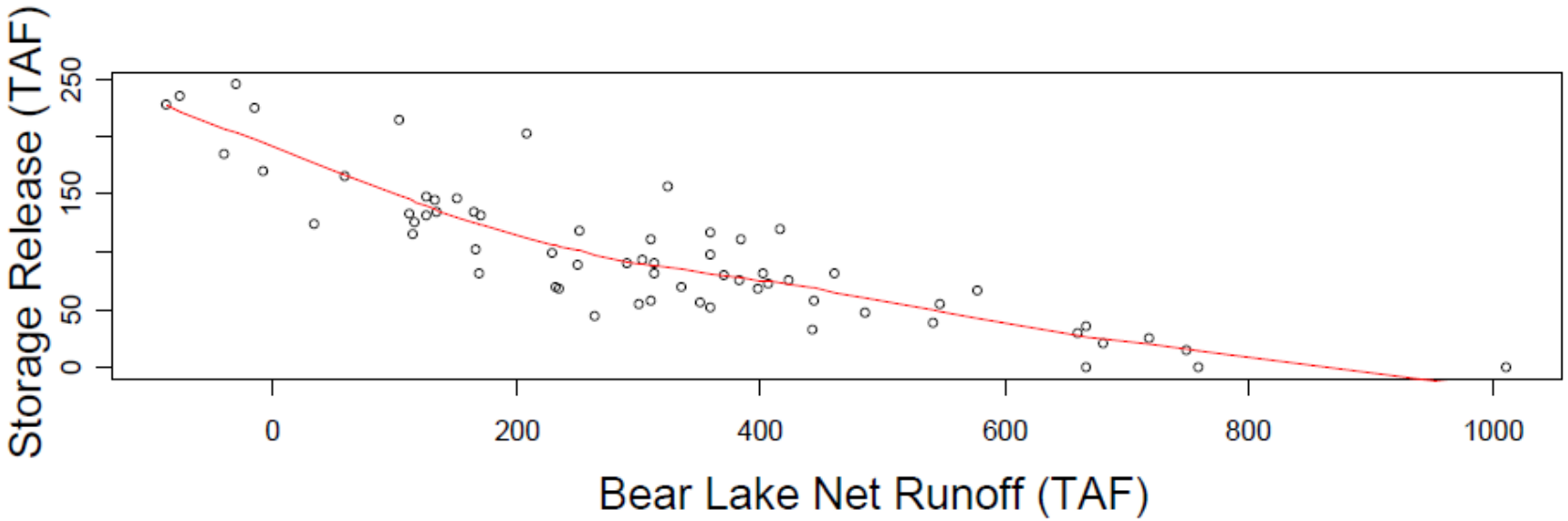
Bear Lake Annual High & Low Elevations
Spring 1915 to Fall 2013



Bear Lake Storage Release v. Natural Runoff



"Bear Lake Net runoff" = Computed net inflow (implicitly accounts for all surface tributary flow, groundwater inflow and evaporation)

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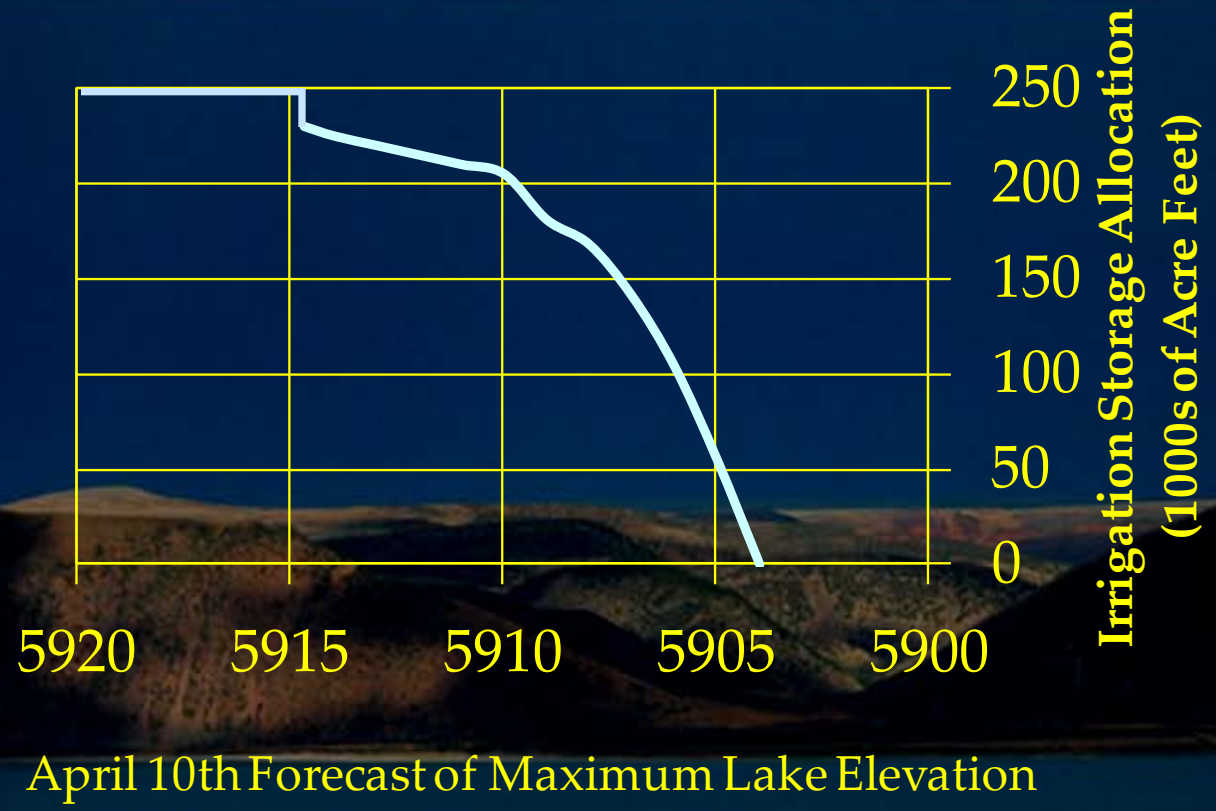
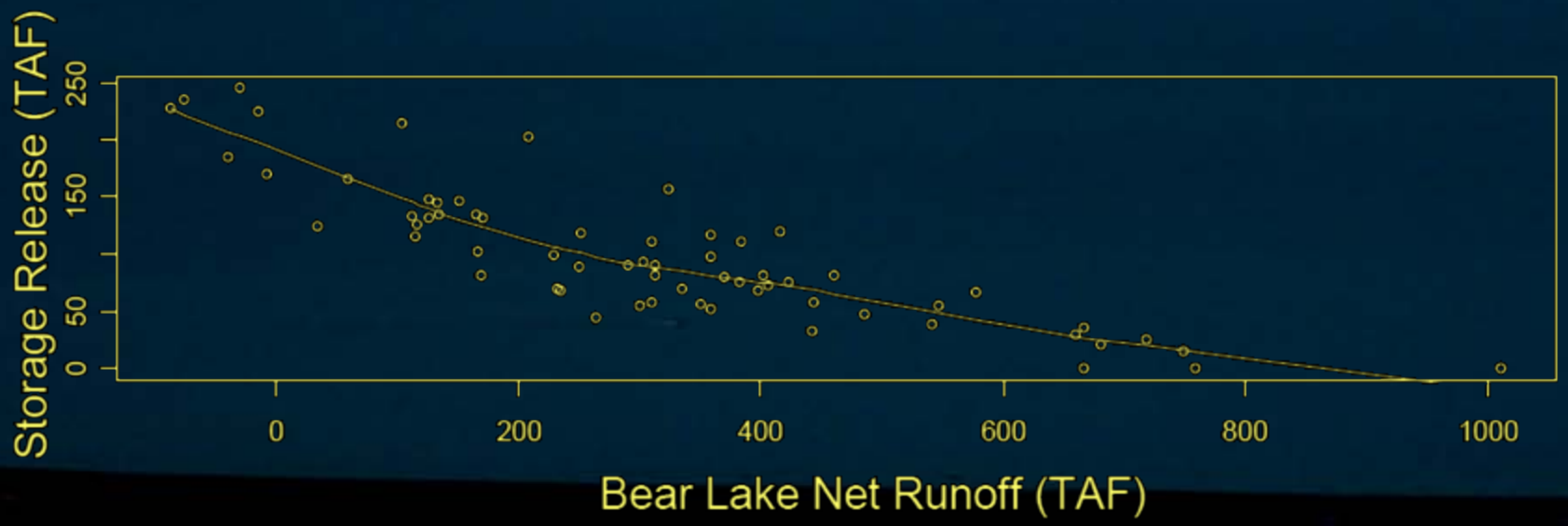
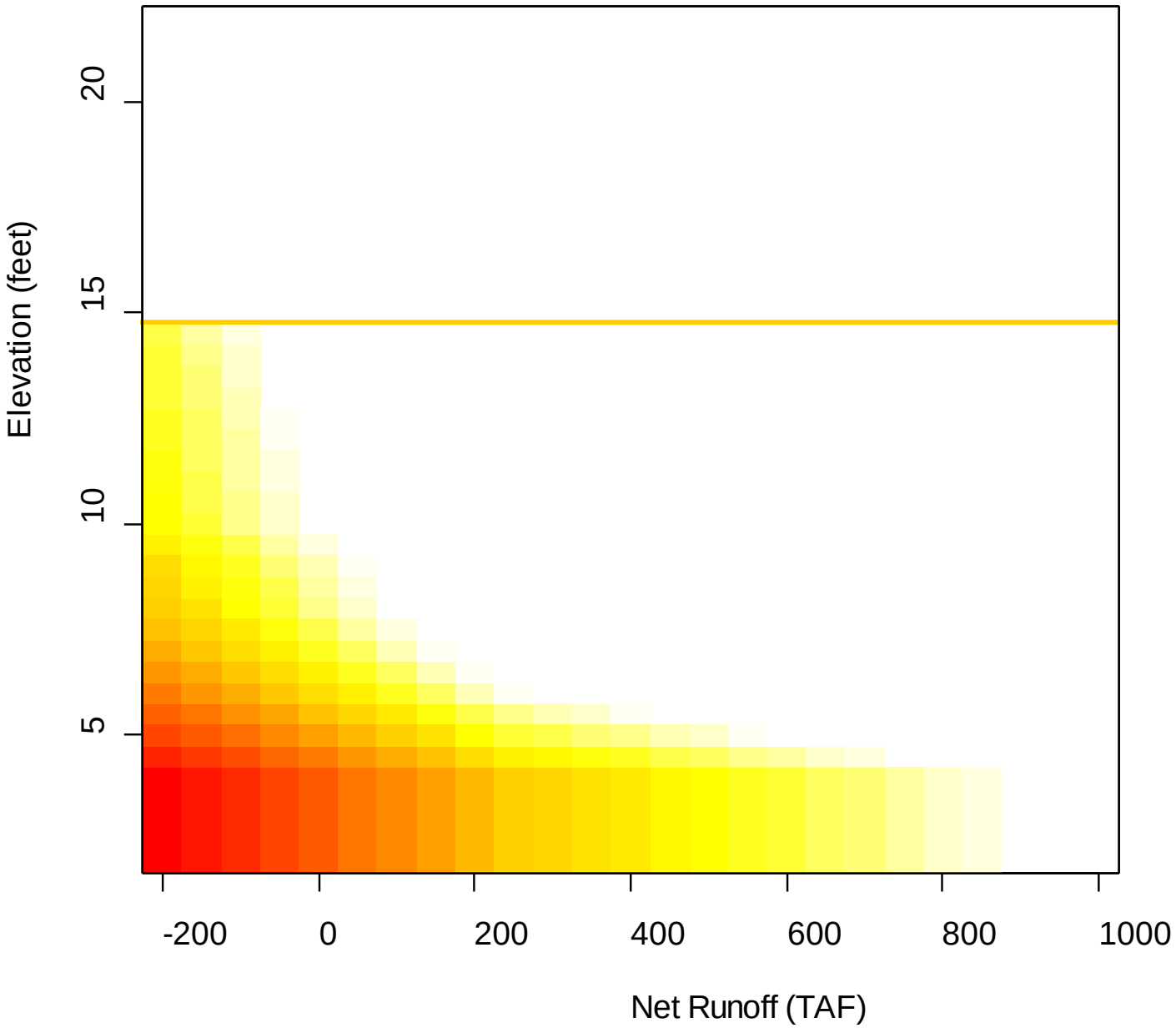
Rationed Irrigation Supply

and

Demand Curve






Elevation (feet)
20
15
10
5
-200
0
200
400
600
800
1000
Net Runoff (TAF)

Questions

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