ATTENDANCE ROSTER

BEAR RIVER COMMISSION
REGULAR MEETING

Salt Lake City, Utah
November 22, 2022

IDAHO COMMISSIONERS
Gary Spackman
Curtis Stoddard
Kerry Romrell

UTAH COMMISSIONERS
Charles Holmgren
Candice Hasenyager
Norm Weston

WYOMING COMMISSIONERS
Adrian Hunolt
Brandon Gebhart
Tim Teichert

ENGINEER-MANAGER & STAFF
Don Barnett
Jacob Barnett

FEDERAL CHAIR
Jody Williams

OTHERS IN ATTENDANCE

IDAHO
Matt Anders, Department of Water Resources
Philip Blankenau, Department of Water Resources
James Cefalo, Department of Water Resources
Christopher Holmes, Department of Water Resources
Ethan Geisler, Department of Water Resources
Mark Ipsen, Alternate Commissioner
Josh Hanks, Bear River Watermaster

UTAH
Todd Adams, Division Natural Resources
Jake Serago, Division of Water Resources
Randy Staker, Division of Water Resources
Teresa Wilhelmsen, State Engineer
Blake Bingham, Deputy State Engineer
Will Atkin, Division of Water Rights
Skyler Buck, Division of Water Rights
John Mackey, Division of Water Quality
Ron Hoffman, Upper Bear River
Bart Argyle, Alternate Commissioner Upper
Ryan Merrill, Alternate Commissioner Lower
Clint Ballard, Lower Bear River

WYOMING
Mike Johnson, State Engineer's Office
Kevin Payne, State Engineer's Office
Mel Fegler, State Engineer's Office
Nick Dayton, Hydrographer Cokeville
Trevor Hurd, State Engineer's Office

OTHERS
Connely Baldwin, PacifiCorp Energy
Buffi Morris, PacifiCorp Energy
Trevor Nielson, Bear River Canal Company
Nathan Daugs, Cache Water District
Lewis Chandler, Bear Lake Watch
Erin Holmes, Bear River Migratory Bird Refuge
John Hutchings, PacifiCorp Energy
Claudia and David Cottle, Bear Lake Watch
Emily Lewis, Bear River Water Users Association
John Mabey, PacifiCorp Energy
Ann Neville, The Nature Conservancy
Claudia Condor

BEAR RIVER COMMISSION
ANNUAL MEETINGS

November 14 and 22, 2022

COMMISSION AND ASSOCIATED MEETINGS

November 14

9:00 a.m.	Water Quality Committee Meeting Board Room – Utah Division of Water Quality	Nelson

November 22

All meetings on November 22nd will be held in person in Room 1040 of the Utah Department of Natural Resources Building (1594 West North Temple Street, Salt Lake City, UT).

9:00 a.m.	Records & Public Involvement Committee Meeting	Holmgren
10:00 a.m.	Operations Committee Meeting	Holmgren
11:30 a.m.	Informal Meeting of Commission	Barnett
11:35 a.m.	State Caucuses	Spackman/Hasenyager/Gebhart
1:30 p.m.	Commission Meeting	Williams

PROPOSED AGENDA
REGULAR COMMISSION MEETING
November 22, 2022

Convene Meeting: 1:30 p.m. **Chair:** Jody Williams

I.	Call to order	Williams
	A. Welcome of guests and overview of meeting	
	B. Approval of agenda	
II.	Approval of minutes of last Commission meeting (April 19, 2022)	Williams
III.	Reports of Secretary and Treasurer	Hasenyager/Staker
	A. 2022 budget closeout	
	B. 2023 expenditures to date	
IV.	2019 Depletions Estimates	Anders
	A. Compact requirements and prior efforts	Barnett
	B. Overview of efforts and introduction	Anders
	C. GIS mapping efforts	Fegler
	D. Supplemental water rights	Payne
	E. Depletion rates (GridET)	Serago
	F. M&I depletions	Anders
	G. 2019 Depletions Estimates results/ TAC recommendations and timeline	Anders
V.	Recommended changes to *Procedures for Depletion Estimates*	Barnett
VI.	Looking ahead – OpenET	Blankenau
VII.	GSL Integrated Basin Study	Serago
VIII.	Water Quality Committee report	Mackey
IX.	Records & Public Involvement Committee report	Stoddard
X.	Operations Committee report	Holmgren
	A. Committee meeting	
	B. 2022 Lower Division operations	Baldwin
	C. PacifiCorp operations	Baldwin
XI.	Technical Advisory Committee report	Anders
XII.	Management Committee report	Hasenyager
XIII.	Engineer-Manager's report	Barnett
XIV.	State reports	
	A. Idaho	Spackman
	B. Utah	Hasenyager
	C. Wyoming	Gebhart
XV.	Other	Williams
XVI.	Next Commission meeting (Tuesday, April 18, 2023, location?)	Williams

Anticipated adjournment: 4:30 p.m.

BEAR RIVER COMMISSION

STATEMENT OF INCOME AND EXPENDITURES
FY2022

FOR THE PERIOD OF July 1, 2021 to June 30, 2022

INCOME	CASH ON HAND	OTHER INCOME	FROM STATES	INCOME
Cash Balance 07-01-21	146,566.21			146,566.21
State of Idaho			45,000.00	45,000.00
State of Utah			45,000.00	45,000.00
State of Wyoming			45,000.00	45,000.00
Water Quality		9,580.41		9,580.41
Interest on Savings		911.54		911.54
Interest on Checking		10.92		10.92
Checking Service Charge		(195.70)		(195.70)
TOTAL INCOME TO 30-Jun-22	146,566.21	10,307.17	135,000.00	291,873.38

DEDUCT OPERATING EXPENSES

		APPROVED BUDGET	UNEXPENDED BALANCE	EXPENDITURES TO DATE
USGS Stream Gages Contract		47,902.00	-	47,902.00
	SUBTOTAL	47,902.00	-	47,902.00
EXPENDED THROUGH COMMISSION				
Personal Services	BIWC	73,163.00	(0.04)	73,163.04
Travel (Eng-Mgr)		1,200.00	164.73	1,035.27
Office Expenses		1,600.00	622.22	977.78
Printing Biennial Report		1,000.00	(211.60)	1,211.60
Treasurer Bond & Audit		1,400.00	1,300.00	100.00
Printing		1,600.00	1,559.90	40.10
Realtime Web Hosting		8,400.00	1,179.01	7,220.99
Clerical		9,485.00	4,077.98	5,407.02
Tour		2,500.00	2,500.00	-
Contingency		2,000.00	2,000.00	-
	SUBTOTAL	102,348.00	13,192.20	89,155.80
TOTAL EXPENSES		150,250.00	13,192.20	137,057.80
CASH BALANCE AS OF 06/30/2022				154,815.58

BEAR RIVER COMMISSION

DETAILS OF EXPENDITURES

R PERIOD ENDING June 30, 2022

3	STONEFLY	1,800.00
6	VOID	
7	BIWC	12,193.84
8	STONEFLY	1,800.00
9	USGS	47,902.00
0	BIWC	6,375.38
1	BIWC	12,811.12
2	STONEFLY	1,800.00
3	C N A SURETY	100.00
4	BIWC	22,055.91
5	STONEFLY	1,820.99
6	BIWC	20,397.04
9	BIWC	6,253.92
0	BIWC	1,747.60

TAL EXPENDITURES 137,057.80

BANK RECONCILIATION

sh in Bank per Statement 06/30/2022	4,650.30
Plus: Intransit Deposits	
Less: Outstanding Checks	
tal Cash in Bank	4,650.30
Plus: Savings Account-Utah State Treasurer	150,165.28
SH BALANCE AS OF 06/30/2022	154,815.58

BEAR RIVER COMMISSION

STATEMENT OF INCOME AND EXPENDITURES
FY2023

FOR THE PERIOD OF July 1, 2022 to Nov 16, 2022

INCOME	CASH ON HAND	OTHER INCOME	FROM STATES	INCOME
Cash Balance 07-01-22	154,815.58			154,815.58
State of Idaho				
State of Utah			45,000.00	45,000.00
State of Wyoming			45,000.00	45,000.00
Water Quality		3,194.67		3,194.67
Interest on Savings		1,165.96		1,165.96
Interest on Checking		48.66		48.66
Checking Service Charge		(365.15)		(365.15)
TOTAL INCOME TO 16-Nov-22	154,815.58	4,044.14	90,000.00	248,859.72

DEDUCT OPERATING EXPENSES

		APPROVED BUDGET	UNEXPENDED BALANCE	EXPENDITURES TO DATE
USGS Stream Gages Contract		47,920.00	-	47,920.00
	SUBTOTAL	47,920.00	-	47,920.00
EXPENDED THROUGH COMMISSION				
Personal Services	BIWC	76,821.00	57,615.75	19,205.25
Travel (Eng-Mgr)		1,200.00	1,200.00	-
Office Expenses		1,600.00	1,450.52	149.48
Printing Biennial Report		1,000.00	1,000.00	-
Treasurer Bond & Audit		1,400.00	1,400.00	-
Printing		1,600.00	1,600.00	-
Realtime Web Hosting		8,400.00	4,800.00	3,600.00
Clerical		10,149.00	10,110.94	38.06
Tour		2,500.00	2,500.00	-
Contingency		2,000.00	2,000.00	-
	SUBTOTAL	106,670.00	83,677.21	22,992.79
TOTAL EXPENSES		154,590.00	83,677.21	70,912.79
CASH BALANCE AS OF 11/06/2022				177,946.93

BEAR RIVER COMMISSION

DETAILS OF EXPENDITURES

FOR PERIOD ENDING Nov 16, 2022

937	USGS	47,920.00
938	Stone Fly	3,600.00
941	BIWC	6,401.75
942	BIWC	6,514.55
943	BIWC	6,476.49

TOTAL EXPENDITURES	70,912.79

BANK RECONCILIATION

Cash in Bank per Statement 11/16/22	(33,384.31)
Plus: Intransit Deposits	
Less: Outstanding Checks	
Total Cash in Bank	(33,384.31)
Plus: Savings Account-Utah State Treasurer	211,331.24
CASH BALANCE AS OF 11/16/2022	177,946.93

2019 Depletion Estimates

Technical Advisory Committee

Bear River Commission Meeting
November 22, 2022
SLC, UT

BEAR RIVER COMMISSION

2019 Depletions Update Outline

- Background
- Introduction
- GIS/ Mapping Update
- Supplemental Acres/Sources
- Depletion Rates/GridET
- Municipal and Industrial
- 2019 Depletion Results
- Timeline
- Depletion Procedures
- OpenET

BEAR RIVER COMMISSION

Background

BEAR RIVER COMMISSION

Amended Compact – Lower Division

ARTICLE V

A. Water rights in the Lower Division acquired under the laws of Idaho and Utah covering water applied to beneficial use prior to January 1, 1976, are hereby recognized and shall be administered in accordance with State law based on priority of rights as provided in Article IV, paragraph A3. Rights to water first applied to beneficial use on or after January 1, 1976, shall be satisfied from the respective allocations made to Idaho and Utah in this paragraph…

BEAR RIVER COMMISSION

Amended Compact – Lower Division (continued)

ARTICLE V

B. Water allocated under the above subparagraphs shall be charged against the State in which it is used regardless of the location of the point of diversion.

C. Water depletions permitted under provisions of subparagraphs (1), (2), (3), and (4) above, shall be calculated and administered by a Commission-approved procedure.

BEAR RIVER COMMISSION

Amended Compact – Above Bear Lake

ARTICLE VI

B. In addition to the rights defined in Paragraph A of this Article, further storage entitlements above Stewart Dam are hereby granted. Wyoming and Utah are granted an additional right to store in any year 70,000 acre-feet of Bear River water for use in Utah and Wyoming to be divided equally; and Idaho is granted an additional right to store 4,500 acre-feet of Bear River water in Wyoming or Idaho for use in Idaho. Water rights granted under this paragraph and water appropriated, including ground water tributary to Bear River, which is applied to beneficial use on or after January 1, 1976, shall not result in an annual increase in depletion of the flow of the Bear River and its tributaries above Stewart Dam of more than 28,000 acre-feet in excess of the depletion as of January 1, 1976. Thirteen thousand (13,000) acre-feet of the additional depletion above Stewart Dam is allocated to each of Utah and Wyoming, and two thousand (2,000) acre-feet is allocated to Idaho.

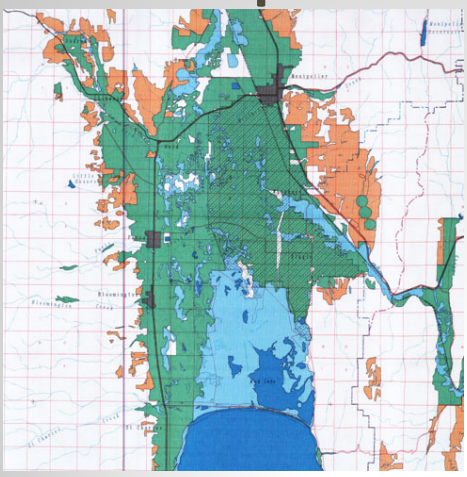
BEAR RIVER COMMISSION

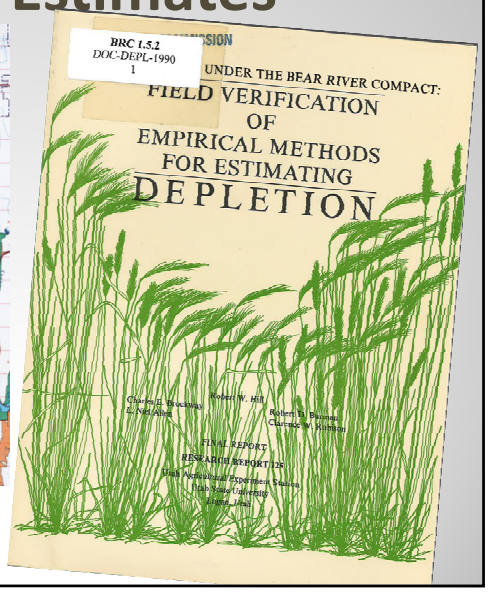
Amended Compact – Above Bear Lake

The additional storage rights provided for in this paragraph shall be subordinate to, and shall not be exercised when the effect thereof will be to impair or interfere with (1) existing direct flow rights for consumptive use in any river division and (2) existing storage rights above Stewart Dam, but shall not be subordinate to any right to store water in Bear Lake or elsewhere below Stewart Dam; provided, however, there shall be no diversion of water to storage above Stewart Dam under this Paragraph B when the water surface elevation of Bear Lake is below 5,911.00 feet, Utah Power & Light Company datum (the equivalent of elevation 5,913.75 feet based on the sea level datum of 1929 through the Pacific Northwest Supplementary Adjustment of 1947). Water depletions permitted under this Paragraph B shall be calculated and administered by a Commission-approved procedure.

BEAR RIVER COMMISSION

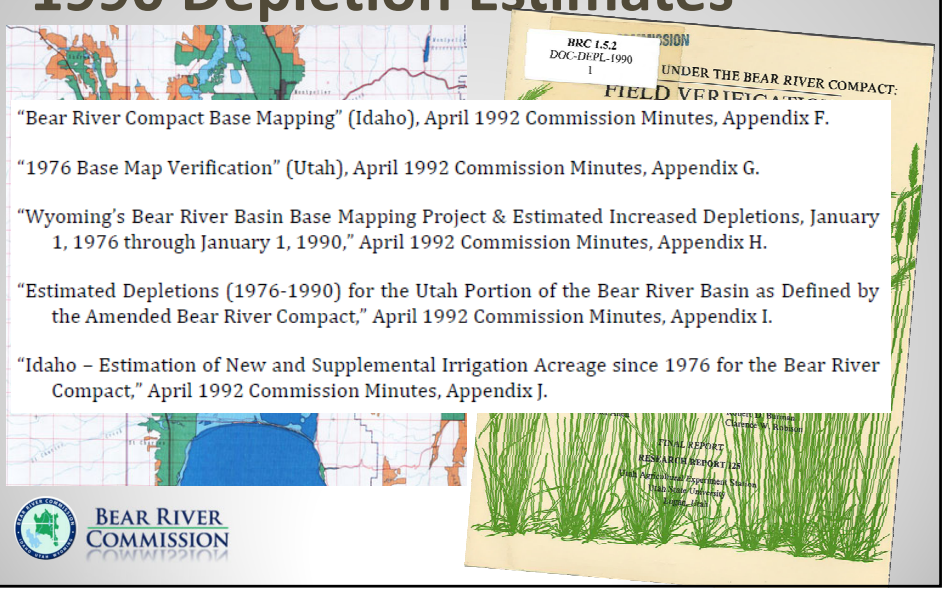
1990 Depletion Estimates





BEAR RIVER COMMISSION

1990 Depletion Estimates



"Bear River Compact Base Mapping" (Idaho), April 1992 Commission Minutes, Appendix F.

"1976 Base Map Verification" (Utah), April 1992 Commission Minutes, Appendix G.

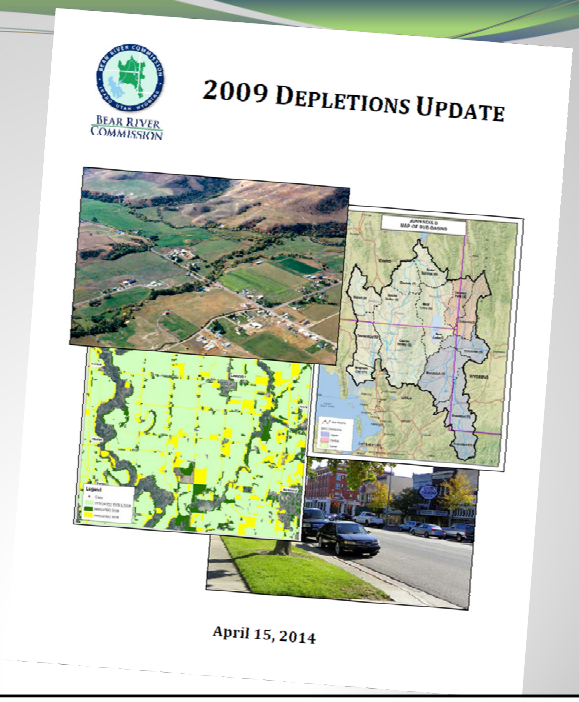
"Wyoming's Bear River Basin Base Mapping Project & Estimated Increased Depletions, January 1, 1976 through January 1, 1990," April 1992 Commission Minutes, Appendix H.

"Estimated Depletions (1976-1990) for the Utah Portion of the Bear River Basin as Defined by the Amended Bear River Compact," April 1992 Commission Minutes, Appendix I.

"Idaho – Estimation of New and Supplemental Irrigation Acreage since 1976 for the Bear River Compact," April 1992 Commission Minutes, Appendix J.

BEAR RIVER COMMISSION

2009 Depletion Estimates



BEAR RIVER COMMISSION

2009 Depletion Estimates

Bear River Commission
Estimated Annual Depletions[1]
Changes from January 1, 1976, to December 31, 2009

ABOVE STEWART DAM

State	Allocation	Agricultural Depletions	M&I Depletions	Reservoir Evaporation	Total Depletions	Remaining Allocation
Utah	13,000	5,935	-5	841	6,771	6,229
Wyoming	13,000	2,407	401	197	3,005	9,995
Idaho	2,000	1,310	3	0	1,313	687

LOWER DIVISION

State	Allocation	Agricultural Depletions	M&I Depletions	Reservoir Evaporation	Total Depletions	Remaining Allocation
Idaho	125,000[2]	8,667	300	11	8,978	116,022
Utah	275,000[3]	-5,771	5,978	0	207	274,793

BEAR RIVER COMMISSION

Introduction

BEAR RIVER COMMISSION

Technical Advisory Committee (TAC)
2019 Depletion Study Update

Matt Anders
Idaho Department of Water Resources

BEAR RIVER COMMISSION

Technical Advisory Committee (TAC) Participants

Bear River Commission
Don Barnett
Jody Williams

Wyoming	Utah	Idaho
• Kevin Payne	• Will Atkin	• Ethan Geisler
• Mike Johnson	• Jake Serago	• Margie Wilkins
• Mel Fegler	• Skyler Buck	• Phil Blankenau
• Travis McInnis	• Thomas Moore	• Mat Weaver
• Sam Swartz	• Clay Lewis	• James Cefalo
• Charlie Ferrantelli		• Cody Parker
		• Matt Anders

BEAR RIVER COMMISSION

What is a Depletion?

- Water that was put to beneficial use on or after January 1, 1976, that reduces the flow of the Bear River and its tributaries.
  - Equivalent to Consumptive Use
- Categories
  - Irrigation
  - Municipal
  - Industrial
  - Reservoir Evaporation
  - Domestic & Stockwater – Exemption in Article VI.E

BEAR RIVER COMMISSION

Agricultural Depletions

- Sources of depletion
  - Water that transpires from plants as they grow.
  - Water that evaporates from the soil surface and foliage.

BEAR RIVER COMMISSION

GIS/ Mapping Update

BEAR RIVER COMMISSION

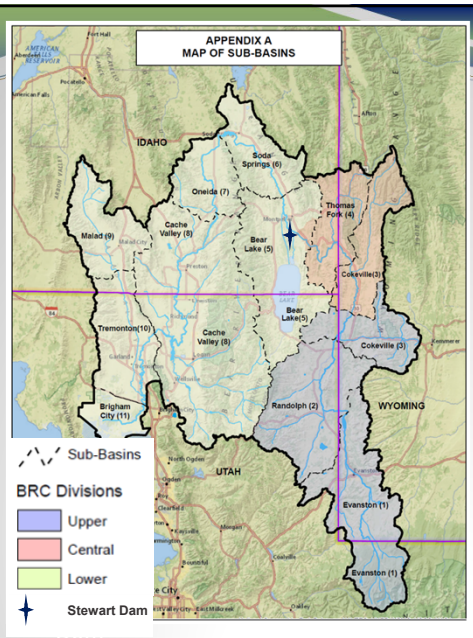
Purpose

- To provide GIS data to ensure the 2019 Bear River Compact water depletion effort resulted in estimates that are the most accurate practicable

Objectives

- To compare the 1976 and 2019 landtype classifications
- Determine what land has come into production since 1976 and what 1976 irrigated land has come out of production
- Note areas of misclassifications in the original map data layer

BEAR RIVER COMMISSION



Divisions and Subbasins

The Area Of Interest (AOI) for this study spans three states:

- Idaho, Utah, and Wyoming
- Three Divisions (Upper, Lower, and Central Divisions)
- Divisions are further split into 11 subbasins

Subdividing 11 subbasins within three Divisions among the three states creates 22 uniquely defined areas.

BEAR RIVER COMMISSION

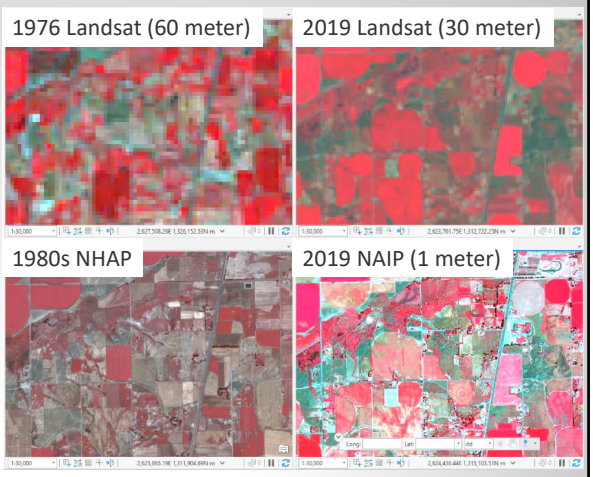
Shared Methods

- Data acquisition
- In-depth data review by states
- Crop Mix Methods created by Utah's GIS Team and used by each state to develop state data sets
- Coordination between states' GIS teams to maintain consistency
- State land classifications finalized and used to calculate depletion calculations using Grid ET

BEAR RIVER COMMISSION

Data Acquisition: Imagery

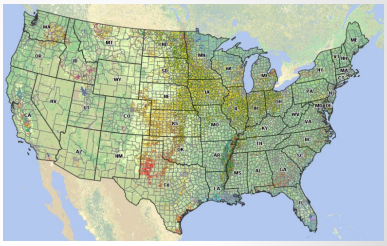
- National Agriculture Imagery Program (NAIP) for all three states (2019 and 2009)
- National High Altitude Photography (NHAP) imagery (1980-1989)
- Digital Ortho Quarter Quads (DOQQs) black and white
- Satellite data – Landsat (1976 and 2019) and Sentinel (2019) and products derived from satellite imagery such as Normalized Difference Vegetative Index (NDVI)



BEAR RIVER COMMISSION

Data Acquisition: GIS Datasets

- The 1976 Bear River Compact (BRC) basemap or the 2009 updated BRC basemap
- USDA's National Agricultural Statistics Service (NASS) Cropland Data Layer (annual, crop-specific land cover data; 30-meter)
- Utah's 2019 Water Related Landuse (WRLU) Program - annual statewide inventory of Utah landuse (expanding, minimally, to include Idaho and Wyoming)
- National Hydrography Database (NHD) – to assist in location of canals, ditches, and streams
- U.S. Fish and Wildlife's Wetlands and In-Land Waters map service



BEAR RIVER COMMISSION

Data Acquisition: Water Right Data

- State-specific water right database information
- As an aside…Idaho's Bear River Basin Adjudication (BRBA) commences this summer/fall

IDAHO Department of Water Resources — Water Right and Adjudication Search
https://research.idwr.idaho.gov/apps/waterrights
See Appendix A for Idaho's detailed updated efforts

Utah Division of Water Rights
https://waterrights.utah.gov/wrinfo/query.asp
See Appendix B for Utah's detailed updated efforts

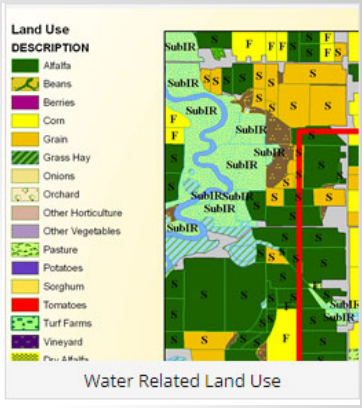
Wyoming e-Permit
http://seoweb.wyo.gov/e-Permit/common
See Appendix C for Wyoming's detailed updated efforts

BEAR RIVER COMMISSION

Appendices referenced to be found in the 2021 Technical Memorandum

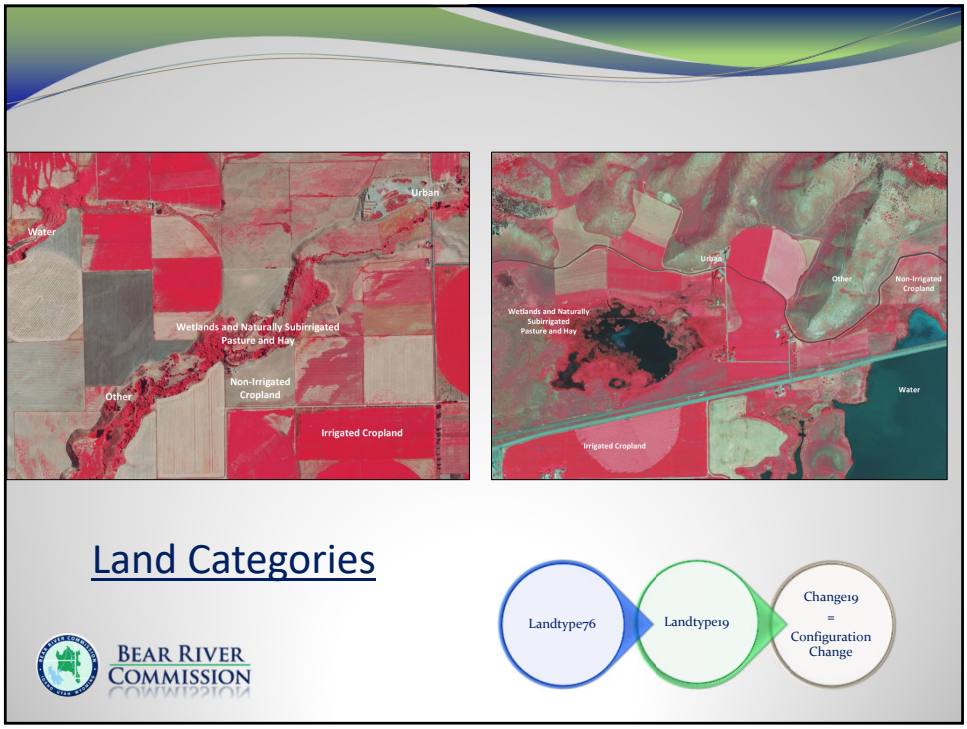
States In-Depth Review

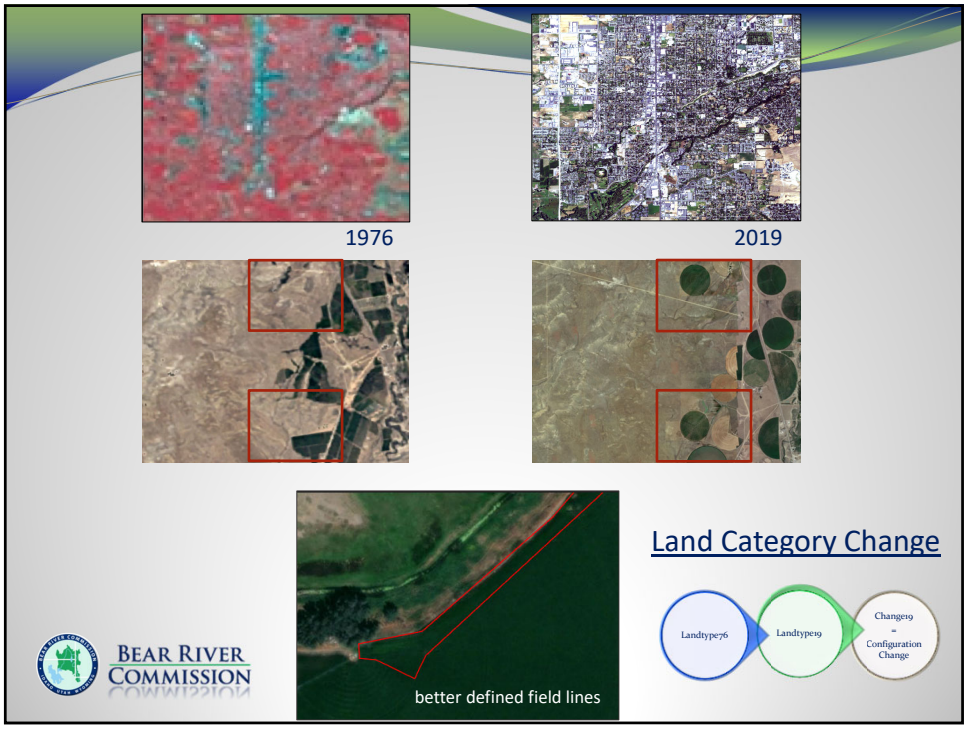
- Utah used their *Water Related Land Use* (WRLU) inventory
- Idaho and Wyoming used the preliminary evaluation from Utah's WRLU survey used as starting point
- Each state conducted their state's land classification review using
  a. photointerpretation methods using supporting GIS data such as the CDL, NHD, imagery, NDVI, etc
  b. water right information either within a GIS-enabled database or by confirmation of appropriate paper water rights
  c. field verification

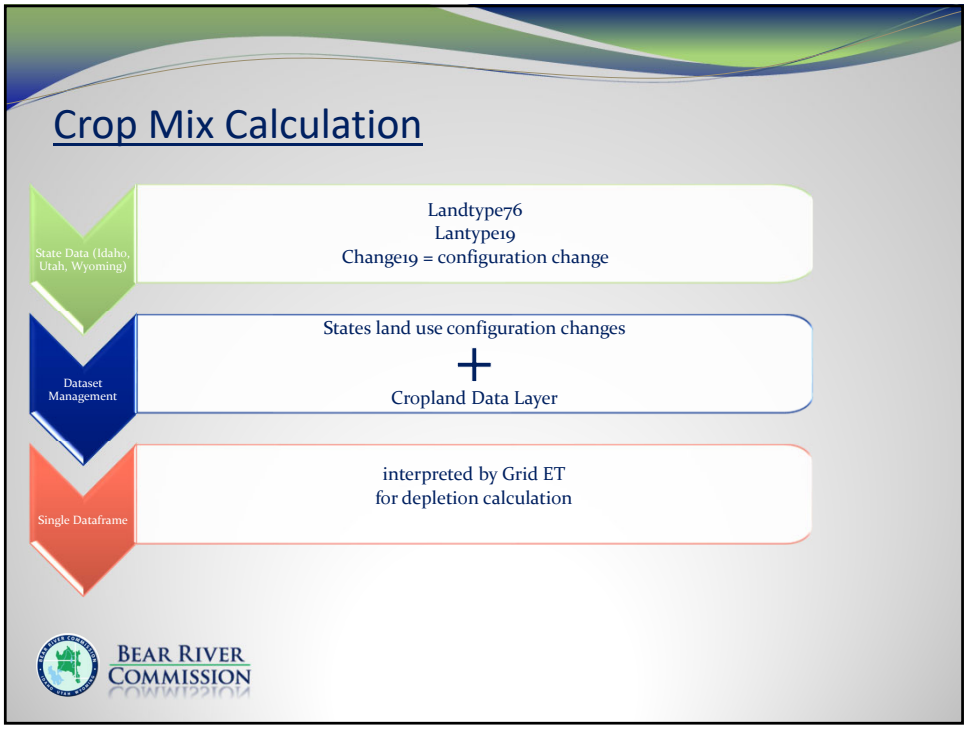


Water Related Land Use

BEAR RIVER COMMISSION


Water
Urban
Wetlands and Naturally Subirrigated Pasture and Hay
Non-Irrigated Cropland
Other
Irrigated Cropland
Urban
Other
Non-Irrigated Cropland
Wetlands and Naturally Subirrigated Pasture and Hay
Water
Irrigated Cropland
Land Categories
BEAR RIVER COMMISSION
Landtype76
Landtype19
Change19 = Configuration Change


1976
2019
better defined field lines
Land Category Change
BEAR RIVER COMMISSION
Landtype76
Landtype19
Change19 = Configuration Change


Crop Mix Calculation
State Data (Idaho, Utah, Wyoming)
Landtype76
Lantype19
Change19 = configuration change
Dataset Management
States land use configuration changes
+
Cropland Data Layer
Single Dataframe
interpreted by Grid ET
for depletion calculation
BEAR RIVER COMMISSION


References
BEAR RIVER COMMISSION

Supplemental Acres/Sources

BEAR RIVER COMMISSION

Supplemental Definitions

- Supplemental Supply is defined as any source supplementing the original water right.
  - Ground Water
  - Post Compact Reservoirs (project/non-project)
  - Non-Compact defined tributaries

BEAR RIVER COMMISSION

Supplemental Acres Background

- The 1992 report utilized shortage rates based on a report by Haws and Hughs titled "Hydrologic Inventory of the Bear River Study Unit"

Sub-basin	Annual Shortage %
Evanston	6.25%
Randolph	9.29%
Cokeville	2.80%
Thomas Fork	2.30%

BEAR RIVER COMMISSION

Supplemental Background 1992.

- The 1992 report specifically mentioned that as

"states approach their depletion allocations, addition empirical studies of supplemental supply needs in the basin may be required".

BEAR RIVER COMMISSION

Supplemental Background 2009

- The 2009 report utilized different methods due to lack of common data.
  - Idaho utilized power records to get a Power Consumption Coefficient (PCC) and applied an efficiency.
  - Utah contacted irrigators and determined use based on irrigators reports of utilization of their supplemental source.
  - Wyoming reviewed the permitted acres and field investigated actual use and applied a ten year average multiplied by and average ET factor based on Penman-Monteith.

BEAR RIVER COMMISSION

Interim efforts

- With the close of the 2009 report it was determined that the states needed to develop a common number or a common method.
  - Wyoming agreed to take the lead in continuing to investigate what this may entail.
  - Lack of updated weather station data was encountered in 2009. Multiple weather stations were installed in this interim period.
  - Additional field scale data was gathered to investigate different methods.

BEAR RIVER COMMISSION

Wyoming Interim Efforts

- Pumping data was investigated to determine if diversion amounts could be directly applied to determine supplemental depletion based on an efficiency?
  - Found soil types directly impacted the amount of water diverted and diversion rates cannot adequately determine depletion.
  - Actual irrigated acre assessments are extremely important to determine depletion.

BEAR RIVER COMMISSION

2019 Supplemental Update

- Common data once again became a problem for a common method although Idaho was able to duplicate Wyoming's method.
- Without the ability to obtain a universal common method it was determined to use a common number based on estimates from the states.
- The depletion estimate is based on 40% of the subbasin depletion total multiplied by the acres being irrigated by the supplemental source.

BEAR RIVER COMMISSION

Future Supplemental Recommendations

- Acres being irrigated by supplemental water needs additional scrutiny.
- 40% is based on an average and on dry years where original supply water is not available supplemental water can drastically be increased.
- As Wyoming continued to evaluate this during the 2021 water year Wyoming found their numbers to over double.

BEAR RIVER COMMISSION

Depletion Rates/GridET

BEAR RIVER COMMISSION

Depletion Rates

- Reference Evapotranspiration
- Depletion = Net irrigation requirement
- Previous approach (1993, 2009)
- Current approach
- Current depletion rates
  - Input data
  - Comparison
  - Added/Subtracted

BEAR RIVER COMMISSION

Reference Evapotranspiration

Question:
What kind of weather dries clothes on a clothesline fastest?

Answer:
Sunny, windy, hot, low humidity

BEAR RIVER COMMISSION

Standardized Reference ET Equation

- ASCE
- Simplify and clarify application
- Standardize computation procedures
- Technically defensible
- ET rate from full-cover alfalfa
  - actively growing
  - not short of soil water
  - expanse of similar vegetation
- Used to predict ET of other crops
- Used for net irrigation requirement (i.e. Depletion Rate)

$$ET_{sz} = \frac{0.408\Delta(R_n - G) + \gamma \frac{C_n}{T+273} u_2 (e_s - e_a)}{\Delta + \gamma(1 + C_d u_2)}$$

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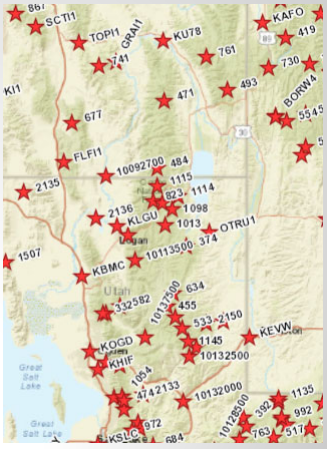
ET for Previous Studies

- Dr. Hill's team at USU
- Computed at 21 locations (NWS)
- Measured precipitation & min/max temperatures
- Fill missing data
- Daily



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Current Study

- Utah in-house team
  - GridET
  - Improved understanding
- Semi-automated
  - Quickly updated
- Spatial and satellite data
  - Adjusted to land observations
- Improved interpolations
- Hourly

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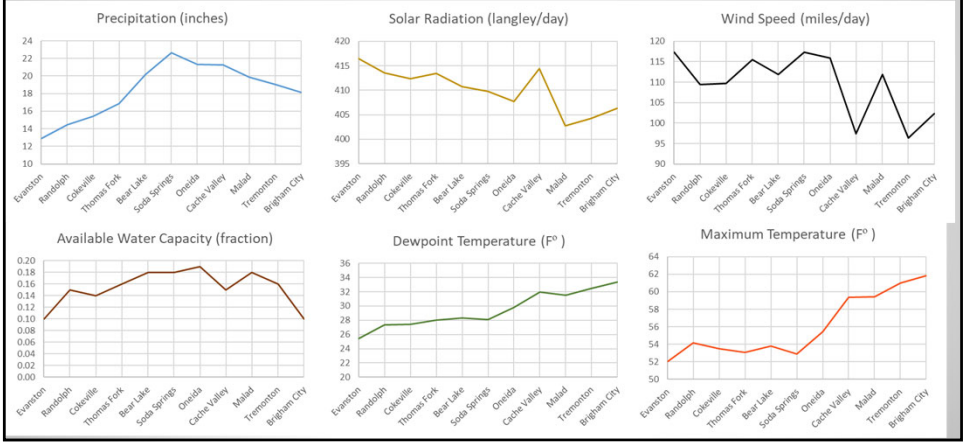
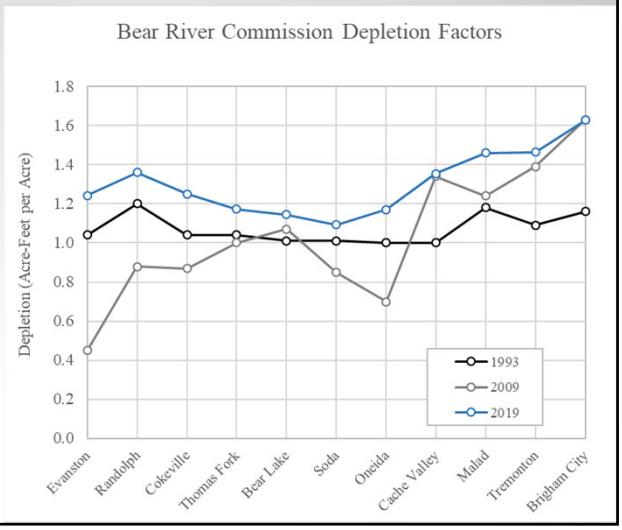
Main Weather Variables

- Average annual per sub-basin



Depletion Rate Comparison

- Increase across all sub-basins
- Reduced range
- Higher confidence
- Higher accuracy



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Final Depletion Rates

ESTIMATED DEPLETION FOR POST JANUARY 1, 1976 LANDS FOR SUBBASINS OF THE BEAR RIVER BASIN

Based on average (2015 - 2019) crop mixes and updated ET rates from Utah Division of Water Resources' GridET program (2022)

		SUBBASIN										
		Evanston 01	Randolph 02	Cokeville 03	Thomas Fork 04	Bear Lake 05	Soda 06	Oneida 07	Cache Valley 08	Malad 09	Tremonton 10(b&c)	Brigham City 10(a)
Added	AF/A	1.24	1.36	1.25	1.17	1.15	1.09	1.17	1.35	1.46	1.46	1.63
Subtracted	AF/A	1.30	1.34	1.28	1.22	1.20	1.09	1.18	1.43	1.52	1.45	1.54

- Field level data
- Different rates for pre-1976
- Unknown crop mix

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Municipal and Industrial

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Municipal Depletions

- A municipal water system supplies potable water and is required to report its activity as part of Safe Drinking Water Act (serves ≥25 people).
- Sources of depletion
  - Water incorporated into products, evaporation from exterior washing, irrigation, etc.

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Municipal Depletions

- Commission found that the availability water usage data varies for municipal water systems. In 2016, the Commission directed the TAC to develop a population-based method for estimating municipal depletions.
- Calculation method
  - Estimate the number of people served by municipal water systems using the 2020 Census
  - Depletion = number of people served by a municipal water system X 0.11 acre-feet

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Industrial Depletions

- Industrial use not included in the municipal depletion.
- Sources of depletion
  - Water consumed by products or processing: Cement plant and phosphate processing.
- Calculation method
  - Depletion was estimated for each facility using water right or water usage data.

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Reservoir Evaporation Depletions

- Evaporation from new reservoir storage since January 1, 1976.
  - Includes new reservoirs and expansion of pre-1976 reservoirs.
- Calculation methods
  - Depletion = surface area X ET (GridET)
  - Woodruff Narrows was estimated using a computer model and ET (GridET)

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2019 Depletion Results

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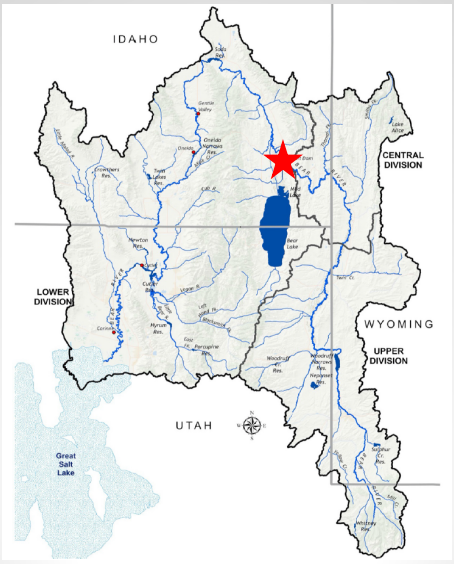
Depletion Study Results



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Depletion Study Results – Irrigation Depletions

Above Stewart Dam

State	1990 Depletion Study (AF)	2009 Depletion Study (AF)	2019 Depletion Study (AF)
Utah	4,309	5,935	6,649
Wyoming	2,429	2,407	5,167
Idaho	1,293	1,310	1,150

Below Stewart Dam

State	1990 Depletion Study (AF)	2009 Depletion Study (AF)	2019 Depletion Study (AF)
Idaho	7,348	8,667	16,387
Utah	2,936	-5,571	-16,054

Depletion Study Results – Municipal Depletions

Above Stewart Dam

State	1990 Depletion Study (AF)	2009 Depletion Study (AF)	2019 Depletion Study (AF)
Utah	-10	-5	1,042
Wyoming	499	664	823
Idaho	0	0	0

Below Stewart Dam

State	1990 Depletion Study (AF)	2009 Depletion Study (AF)	2019 Depletion Study (AF)
Idaho	-48	267	212
Utah	1,073	5,690	16,678

Depletion Study Results – Industrial Depletions

Above Stewart Dam

State	1990 Depletion Study (AF)	2009 Depletion Study (AF)	2019 Depletion Study (AF)
Utah	187	0	0
Wyoming	282	28	3
Idaho	0	3	3

Below Stewart Dam

State	1990 Depletion Study (AF)	2009 Depletion Study (AF)	2019 Depletion Study (AF)
Idaho	0	33	787
Utah	105	288	288

Depletion Study Results – Reservoir Evaporation Depletions

Above Stewart Dam

State	1990 Depletion Study (AF)	2009 Depletion Study (AF)	2019 Depletion Study (AF)
Utah	797	841	361
Wyoming	0	197	193
Idaho	0	0	0

Below Stewart Dam

State	1990 Depletion Study (AF)	2009 Depletion Study (AF)	2019 Depletion Study (AF)
Idaho	0	11	11
Utah	0	0	0

Depletion Study Results – Total Depletions

Above Stewart Dam

State	Allocation (AF)	1990 Depletion Study (AF)	2009 Depletion Study (AF)	2019 Depletion Study (AF)	2019 Remaining Allocation (AF)
Utah	13,000	5,283	6,771	8,052	4,948
Wyoming	13,000	3,210	3,295	6,186	6,814
Idaho	2,000	1,293	1,313	1,153	847

Below Stewart Dam

State	Allocation (AF)	1990 Depletion Study (AF)	2009 Depletion Study (AF)	2019 Depletion Study (AF)	2019 Remaining Allocation (AF)
Idaho	125,000	7,300	8,977	17,397	107,603
Utah	275,000	4,114	407	912	274,088

Timeline

BEAR RIVER COMMISSION

Timeline for Approval

- November 2022 — Present findings and recommendations to the Commission and receive direction to finalize analysis and report.
- March 2023 — Commissioners will receive a draft final version of the 2019 Depletion Study for review.
- April 2023 — Commissioners will vote on the 2019 Depletion Study.

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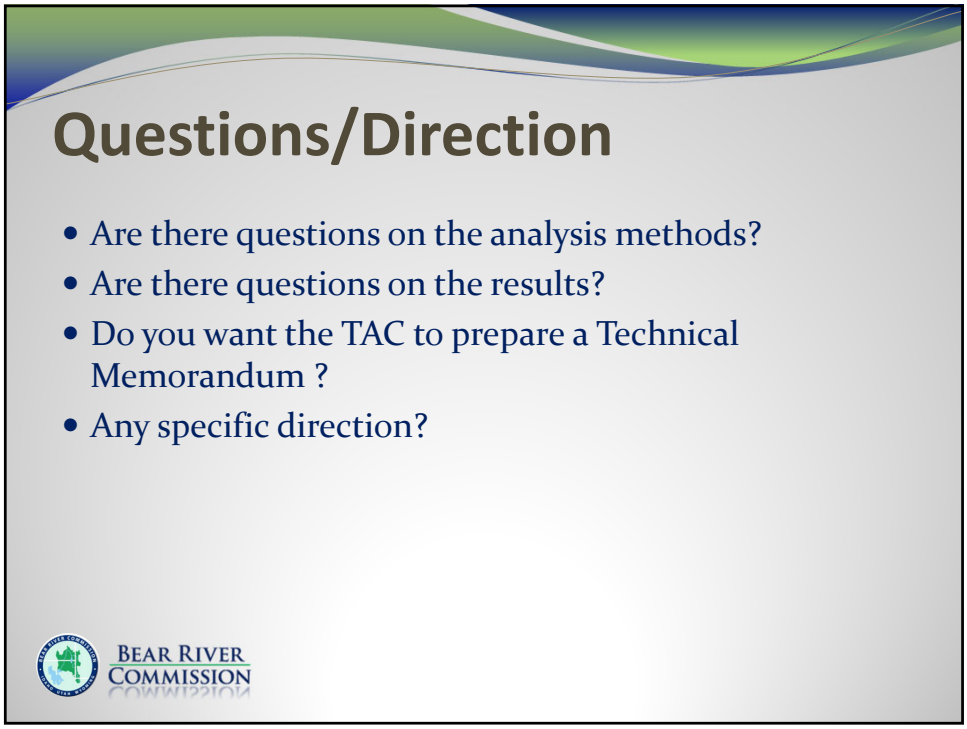
Questions/Direction
• Are there questions on the analysis methods?
• Are there questions on the results?
• Do you want the TAC to prepare a Technical Memorandum ?
• Any specific direction?
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Depletion Procedures

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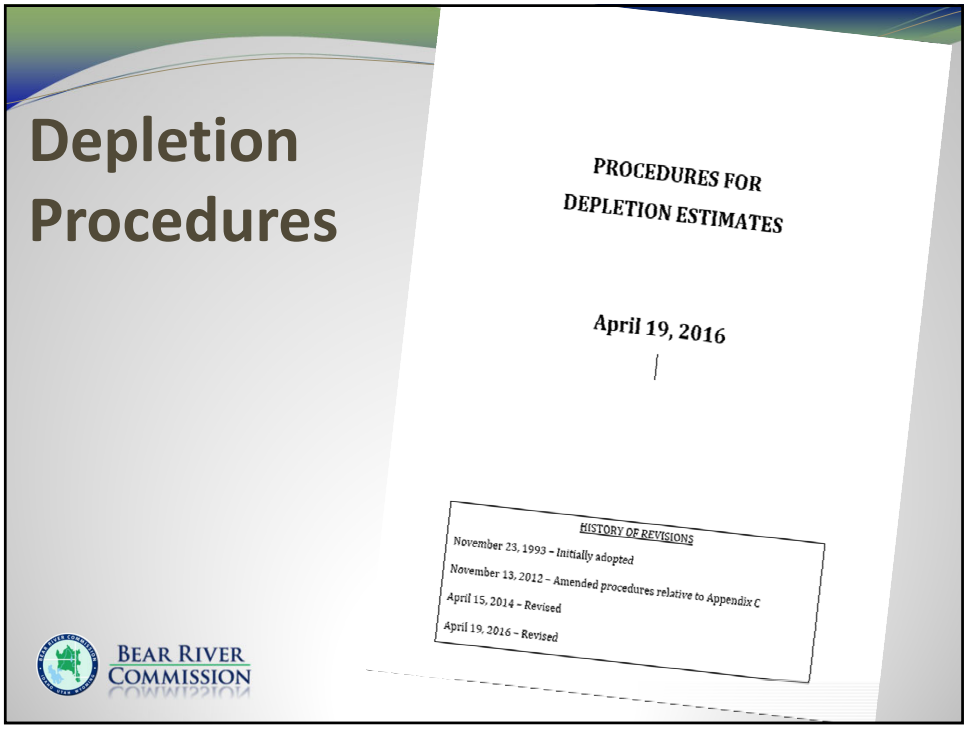

Depletion Procedures

II. DEPLETION PROCEDURES

A. Irrigation Depletion

1. New Irrigated Lands

Depletion amounts from new irrigated lands, put in production since January 1, 1976, will be determined by multiplying the acreage brought into production by the irrigation depletion rate of the crop being irrigated on each field. These values will be summed, and an area-weighted average depletion rate for added acres will be calculated. For irrigated lands retired from irrigation, the number of acres retired will be multiplied by an area-weighted average depletion rate computed from the post January 1, 1976 new acres within a given subbasin. These depletion values by subbasin are summarized in Appendix B. Depletion values from Appendix B will be used unless modified by the Commission. Modifications will require supporting information, and appropriate adjusted tables to verify depletion values. Any modifications made by a state will be documented to the satisfaction of the other two states. Justification as to why the modification was made will be documented in the report and approved by the Commission.

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Depletion Procedures

An example depletion calculation for new acreage brought into irrigated agricultural production is made as follows:

Example area: Thomas Fork Subbasin

Criteria: 40 new acres of irrigation brought into production

40 acres x 1.17 acre-feet* = 46.8 acre-feet of annual depletion

*(Based on Estimated Depletion from Appendix B)

Similar calculations will be made for lands which were irrigated prior to January 1, 1976 lands which have since been retired from irrigation, except that the "Subtracted" depletion value will be used for the respective subbasin. The calculated subtraction depletion value will then be subtracted from the new or added depletion value to determine the net irrigation depletion change since January 1, 1976 for each subbasin.

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Depletion Procedures

b. Other Development

The depletion estimate assigned to the smaller supplemental rights or filings will be made by each state in a manner acceptable to the Commission. Until the Commission develops and adopts a common methodology for estimating the depletions associated with the use of supplemental irrigation water rights, each state will apply the factor of 40% of the full supply depletion rate to acres irrigated with a post-1976 supplemental water right.

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Depletion Procedures

D. Banking Procedures

When determining the net increase of irrigated acres in a subbasin, each state will subtract its post January 1, 1976, decrease in irrigated acres from the post January 1, 1976, increases in irrigated acres to determine a net change in irrigated acres, which it shall report to the Commission. In the alternative, at their discretion, individual states may elect to use either of the following options to account for pre-1976 depletions that are no longer occurring.

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Depletion Procedures

b. Reporting Intervals

Every _____ years, or as determined by the Commission, the States will determine the depletion changes that have occurred.

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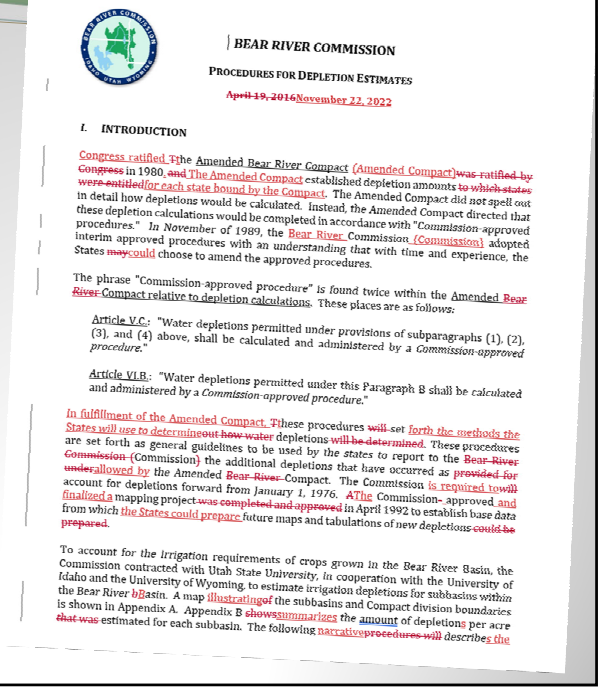
Depletion Procedures – additional edits



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PROCEDURES FOR DEPLETION ESTIMATES

~~April 19, 2016~~November 22, 2022

I. INTRODUCTION

Congress ratified ~~T~~the Amended Bear River Compact (Amended Compact)~~was ratified by Congress~~ in 1980, ~~and~~ The Amended Compact established depletion amounts ~~to which states were entitled~~for each state bound by the Compact. The Amended Compact did not spell out in detail how depletions would be calculated. Instead, the Amended Compact directed that these depletion calculations would be completed in accordance with "Commission-approved procedures." In November of 1989, the Bear River Commission (Commission) adopted interim approved procedures with an understanding that with time and experience, the States ~~may~~could choose to amend the approved procedures.

The phrase "Commission-approved procedure" is found twice within the Amended Bear ~~River~~ Compact relative to depletion calculations. These places are as follows:

Article V.C.: "Water depletions permitted under provisions of subparagraphs (1), (2), (3), and (4) above, shall be calculated and administered by a Commission-approved procedure."

Article VI.B.: "Water depletions permitted under this Paragraph B shall be calculated and administered by a Commission-approved procedure."

In fulfillment of the Amended Compact, ~~T~~these procedures ~~will~~ set forth the methods the States will use to determine~~out how water~~ depletions ~~will be determined~~. These procedures are set forth as general guidelines to be used by the states to report to the ~~Bear River Commission~~ (Commission) the additional depletions that have occurred as ~~provided for under~~allowed by the Amended ~~Bear River~~ Compact. The Commission ~~is required to~~will account for depletions forward from January 1, 1976. ~~A~~The Commission- approved and ~~finalized~~ a mapping project ~~was completed and approved~~ in April 1992 to establish base data from which the States could prepare future maps and tabulations of new depletions ~~could be prepared~~.

To account for the irrigation requirements of crops grown in the Bear River Basin, the Commission contracted with Utah State University, in cooperation with the University of Idaho and the University of Wyoming, to estimate irrigation depletions for subbasins within the Bear River ~~b~~Basin. A map ~~illustrating~~of the subbasins and Compact division boundaries is shown in Appendix A. Appendix B ~~shows~~summarizes the amount of depletions per acre ~~that was~~ estimated for each subbasin. The following narrative~~procedures will~~ describes the

OpenET

BEAR RIVER COMMISSION

BP0

The Future of ET

Phil Blankenau – Evapotranspiration Analyst
Idaho Department of Water Resources

BEAR RIVER COMMISSION

Outline

- Potential ET with crop coefficients
- Actual ET with satellite observed crop coefficients
- Comparison between actual and potential depletions

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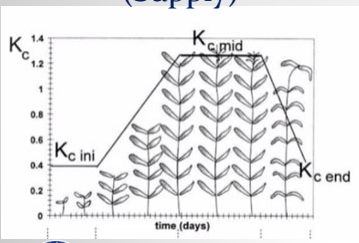
Potential ET with crop coefficients

- Crop coefficients (Kc) represent how much evaporative demand can be met
- Crop coefficients are tabulated for various crops, and they **assume no water shortage**

Crop Coefficient (Supply)



Reference ET (Demand)

$= ET_{potential}$

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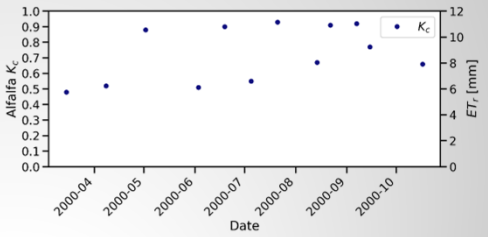
Actual ET with satellite-based crop coefficients



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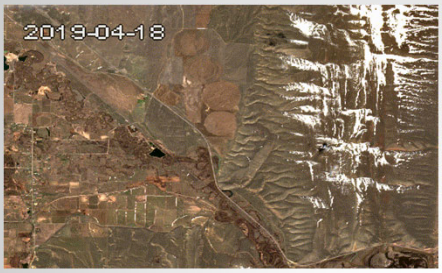
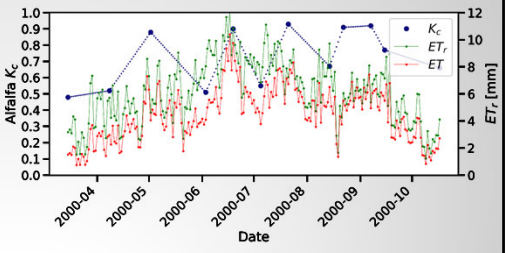
Actual ET with satellite-based crop coefficients





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OpenET actual ET

- A project to create satellite-based ET data for the western United States
  - Modelers: NASA, USGS, USDA, University of Idaho, University of Nebraska, University of Maryland, University of Wisconsin, California State University, Universidade Federal Do Rio Grande Do Sul
- 2016-2022 monthly and daily data are available for six models
- More information available at openetdata.org

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Comparing OpenET (actual) to GridET (potential)

- We compared depletions and not ET directly
- Actual depletions < potential depletions

Model	Area	Units	SUBBASIN										
			Evanston	Randolph	Cokeville	Thomas Fork	Bear Lake	Soda	Oneida	Cache Valley	Malad	Tremonton	Brigham City
GridET	Added	AF/A	1.26	1.34	1.23	1.17	1.17	1.15	1.23	1.35	1.45	1.47	1.60
GridET	Subtracted	AF/A	1.32	1.32	1.28	1.23	1.21	1.15	1.22	1.42	1.51	1.42	1.51
eeMETRIC	Added	AF/A	1.46	0.89	1.06	0.99	0.75	0.98	1.24	0.85	1.07	1.10	1.24
eeMETRIC	Subtracted	AF/A	1.84	1.30	1.21	0.98	0.98	1.15	1.34	1.17	1.15	1.34	1.35
SSEBop	Added	AF/A	1.54	0.96	1.23	1.17	0.75	0.91	1.27	0.79	1.19	1.19	1.26
SSEBop	Subtracted	AF/A	1.90	1.37	1.31	0.98	0.97	1.13	1.38	1.12	1.26	1.39	1.51
Ensemble	Added	AF/A	1.19	0.82	0.97	0.94	0.70	0.78	1.06	0.82	0.97	1.06	1.32
Ensemble	Subtracted	AF/A	1.53	1.19	1.13	0.90	0.92	0.97	1.17	1.13	1.11	1.27	1.41

Table 1. Depletion depths for added and subtracted acres. Green indicates the OpenET value is higher than the corresponding GridET value and red indicates that OpenET is lower.

Conclusions

- We verified that actual depletions are less than potential depletions
- Potential ET is useful as a conservative estimate for planning purposes
- Satellite-based actual ET should be considered for the next depletion study

BEAR RIVER COMMISSION

Questions?

philip.blankenau@idwr.idaho.gov

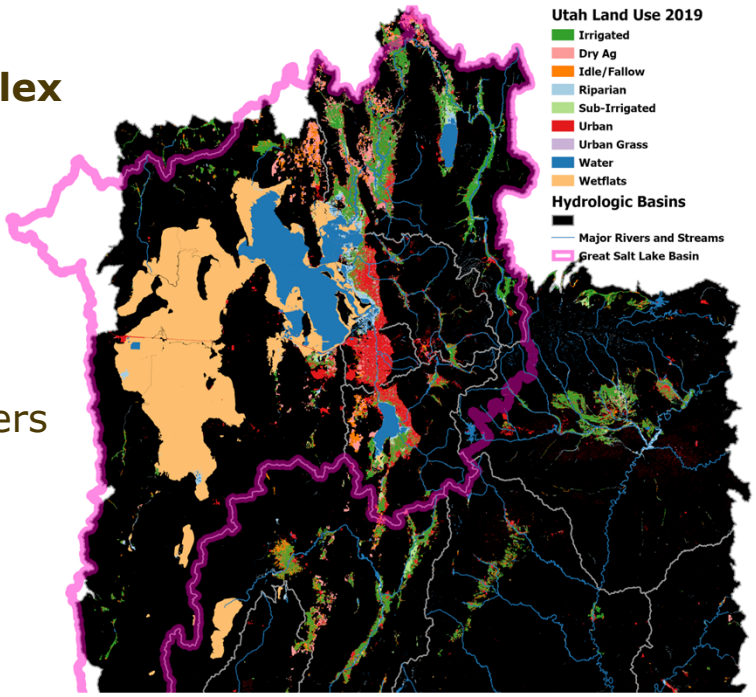
BEAR RIVER COMMISSION

The need for a plan

- Water resources in the basin are stressed
- Multiple previous and current studies/plans
- No consensus on story
- No consensus on data, methods, problem
- Informed decision-making
- Provide vision and steps to make vision reality
- Direction & proactivity
- Never been done at this scale
- The GSL basin is complex

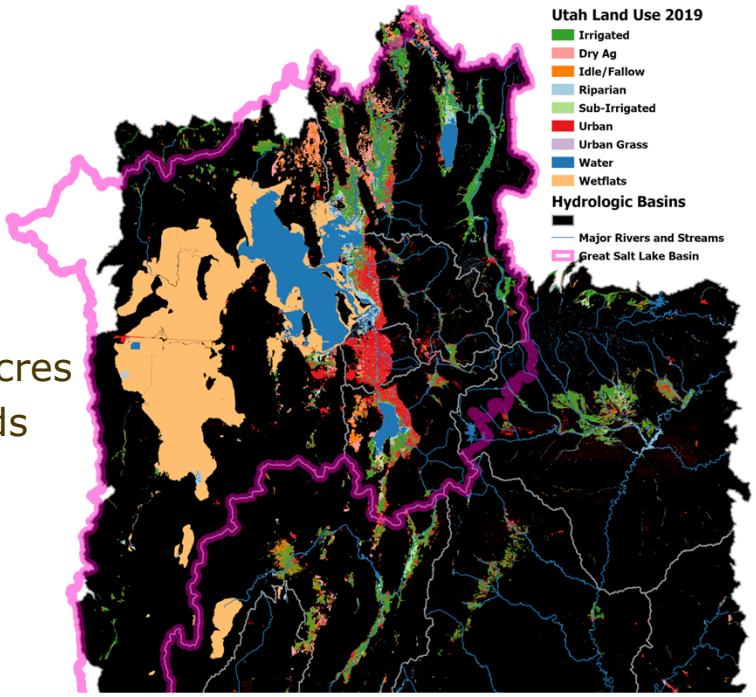
The GSL basin is complex

- 36,000 mi^2
- 4 States
- 18 Counties
- 141 Cities
- 70 Groundwater aquifers
- 1,300 reservoirs
- 150,000 water rights



The GSL basin is complex

- 2.6 million humans
- 1.5 million acres of farmland
- 693 thousand urban acres
- 184,000 acres wetlands
- Behaviors
- Attitudes
- Values

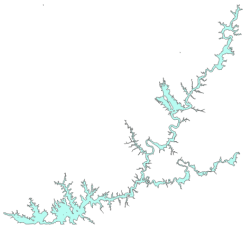


Current Conditions

Lake Powell

24% full (5.8 of 24 maf)

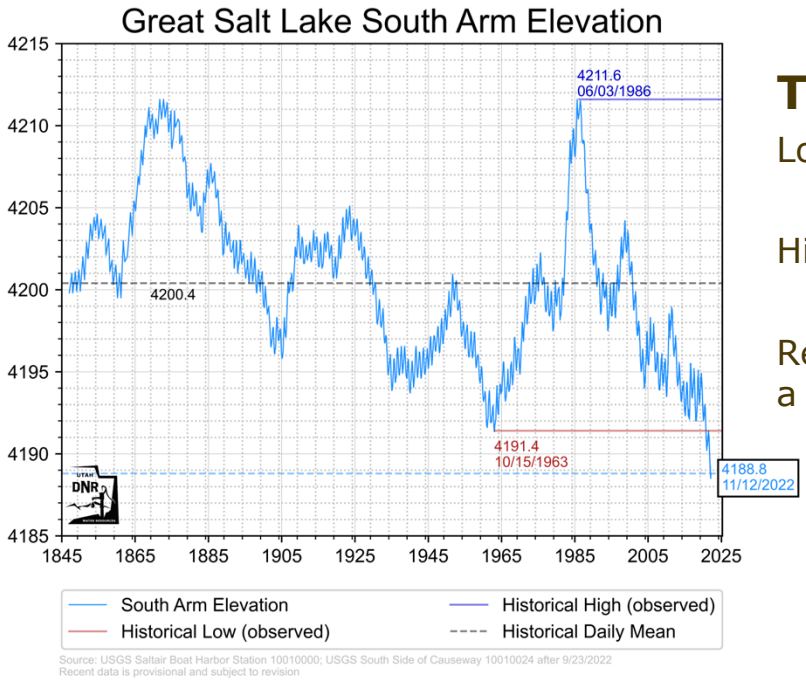
Outflow/Inflow ratio (5-year avg) = 1.2



GSL

22% historic max (7.5 of 34 maf)

Fall/Rise ratio (5-year avg) = 1.5



Temporality

Low to high: 22 yrs

High to new low: 36 yrs

Retirement planning in a watershed

Let's do a basin plan!

Funding

Utah

- Surface and ground water
- Considerable stakeholder involvement
- $ 5 million

Enrolled Copy **H.B. 429**

GREAT SALT LAKE AMENDMENTS

2022 GENERAL SESSION

STATE OF UTAH

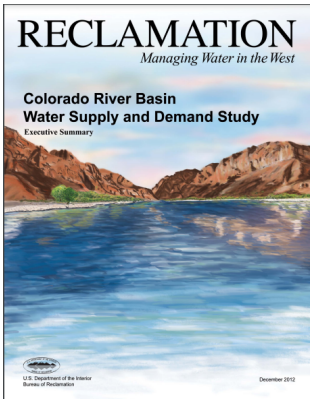
Chief Sponsor: Kelly B. Miles

Senate Sponsor: Scott D. Sandall

Cosponsors:	Timothy D. Hawkes	Mike Schultz
Melissa G. Ballard	Rosemary T. Lesser	Jeffrey D. Stenquist
Brady Brammer	Steven J. Lund	Stephen L. Whyte
Clare Collard	Carol Spackman Moss	Brad R. Wilson
Steve Eliason	Calvin R. Musselman	Mike Winder
Joel Ferry	Doug Owens	
Matthew H. Gwynn	Susan Pulsipher	
Stephen G. Handy		

USBR

- Federal cost-match ($5 million)
- Federal support, project funding
- Stakeholder cost-share



Workplan

- Plan for the plan
- First year
- GSL expert team
- Detail approach
- Define roles and duties
- Organize stakeholder forums
- Outreach and inreach

GSL Integrated Basin Plan

Define reality

- Quantification of existing water supply, demand and environmental condition

Define potential future realities

- State-of-the-art projections of future supply and demand
- An analysis of how the basin's existing water and power operations and infrastructure will perform in the face of changing water realities
- Development of strategies to meet current and future water demands

Identify policy options to achieve desired futures

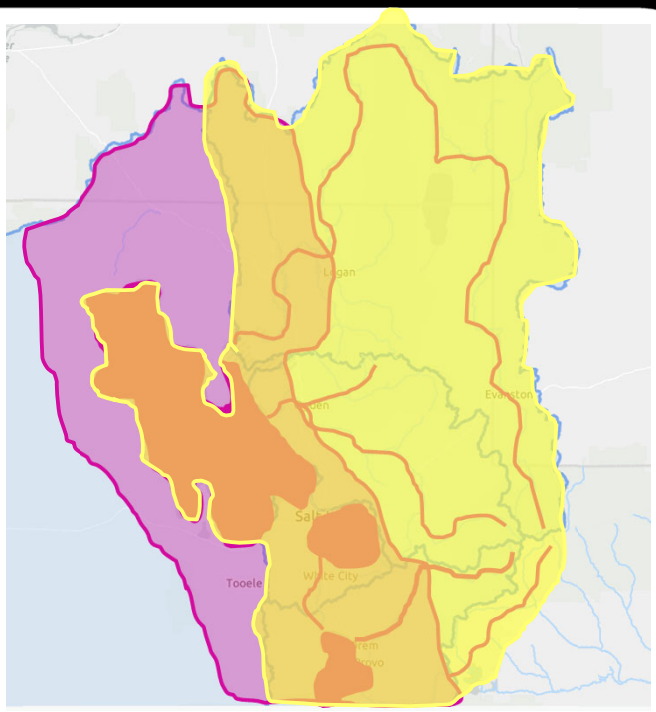
- A trade-off analysis of strategies identified

Recent, ongoing, forthcoming work

- Climate Vulnerability Assessments
- Water supply and development plans
- Water conservation goals and plans
- Supply and Demand Studies
- Utah Lake water quality
- Bear Lake Operations
- GSLIM model improvements
- RRM of GSL Basin
- USGS groundwater model

Existing Models

- Largest river systems
- Stakeholder tools
- Water Rights accounting
- Some gaps
- Full picture of human system



GSL Integrated Basin Plan

Current and Future supply and demand

- Magnitude and frequency of known or anticipated water shortages
- All sources of water supply
- Demands for all types of water uses: agricultural, municipal and industrial, tribal, environmental, recreation, and power generation
- Severity of potential consequences for not addressing imbalances in supply and demand
  - impacts to water delivery
  - crop production
  - hydropower production
  - recreation
  - fish and wildlife habitat
  - endangered, threatened, or candidate species
  - water quality; flow and water dependent ecological resiliency
  - flood control management

GSL Integrated Basin Plan

Analysis of how the basin's existing water and power operations and infrastructure will perform in the face of changing water realities

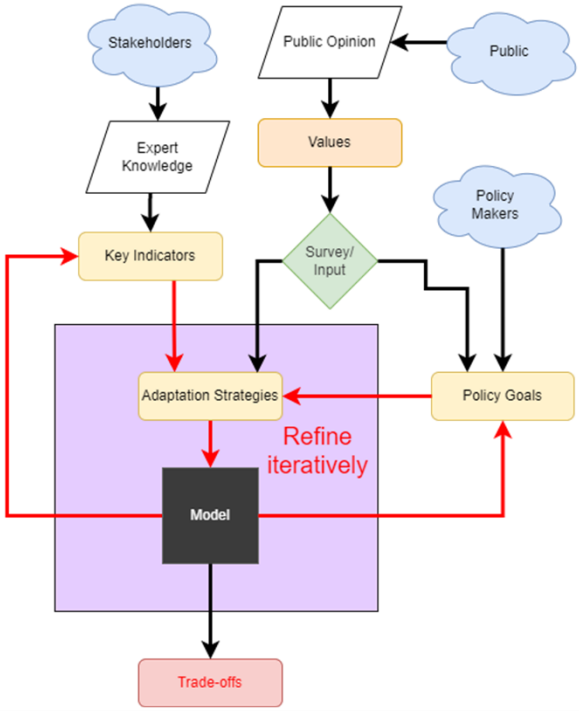
- No Action
- Earlier snow melt
- More rain, less snow
- Hotter and drier
- "Natural" condition
- Changing demands
- Changing irrigation practices
- Change in behavior

GSL Integrated Basin Plan

Development of strategies to meet current and future water demands

Mutual education

Impacts of different goals



Share your thoughts on the future of

GREAT SALT LAKE

Please take part in this Utah State University study and complete this survey! (It should take 20-30 minutes to complete.)

Access the "Future of Great Salt Lake" survey (IRB #13084) with this case-sensitive website link or QR code:

http://bit.ly/SurveyAboutGreatSaltLake

If you have any questions, please contact:

Dr. Lisa Welsh
Survey Manager
435-797-0922
lisa.welsh@usu.edu

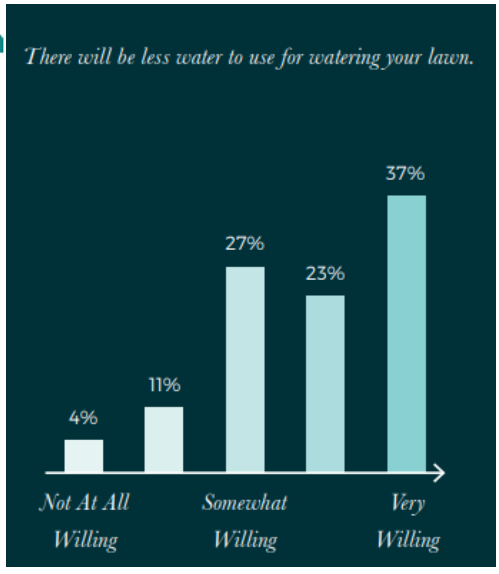
Dr. Joanna Endter-Wada
Principal Investigator
435-797-2487
joanna.endter-wada@usu.edu

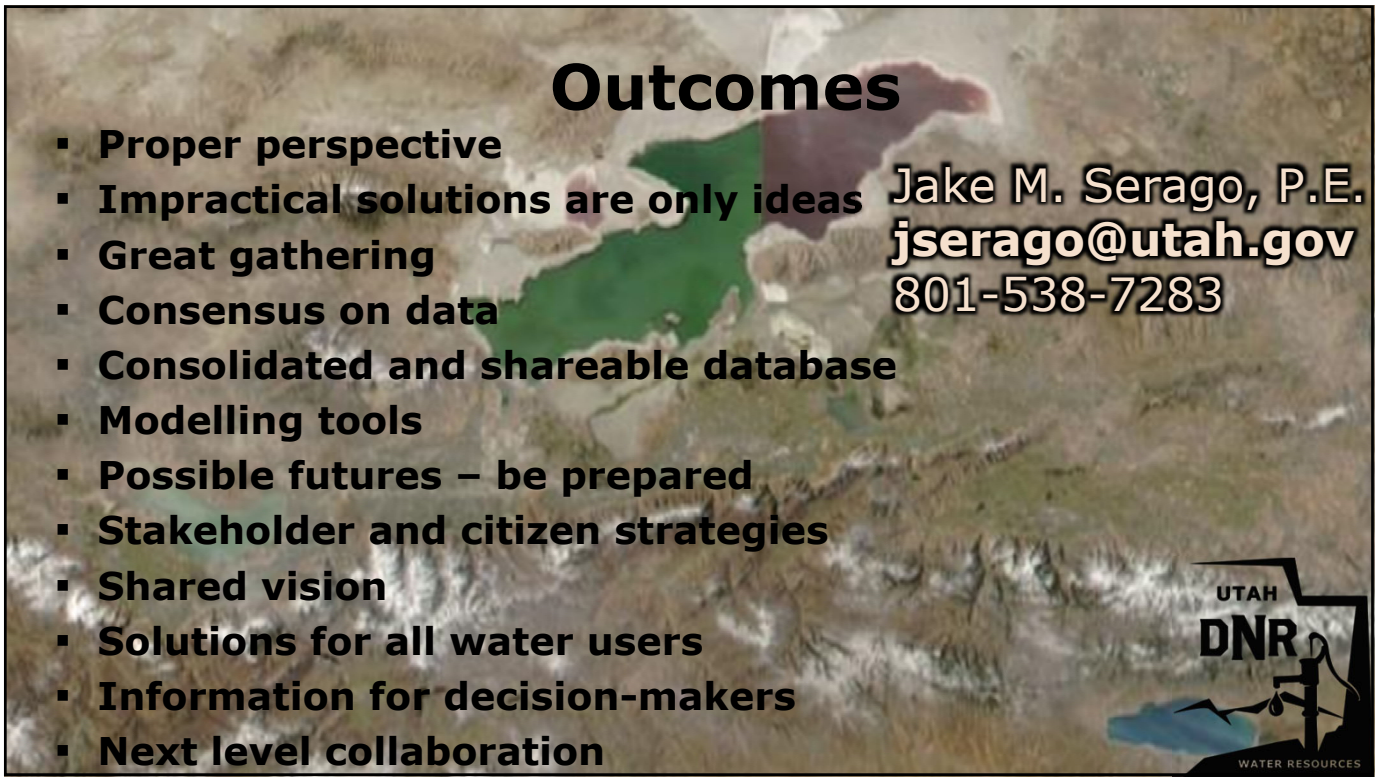
UtahState University

WHAT UTAHNS ARE WILLING TO DO TO EXPAND AGRICULTURE THAT IMPACTS WATER

Envision Utah

There will be less water to use for watering your lawn.




Outcomes
Proper perspective
Impractical solutions are only ideas
Great gathering
Consensus on data
Consolidated and shareable database
Modelling tools
Possible futures – be prepared
Stakeholder and citizen strategies
Shared vision
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WATER RESOURCES

SUMMARY OF WATER YEAR 2022 BEAR LAKE OPERATIONS AND ANTICIPATED 2023 CONDITIONS

Date	Hydrologic Information/Event	Contents (% of Full) Discharge (% of Normal)
10-01-21	Bear Lake Beginning Elevation - 5,912.25 ft.	638,189 af (45%)
10-07-21	Bear Lake Low Elevation - 5,912.21 ft. (see note 1)	635,569 af (45%)
	Rainbow Inlet Canal Discharge	81,476 af (31%)
	Bear River Discharge Below Stewart Dam	3,316 af
	Bear Lake Net Runoff (Computed Total Inflow less Lake Evaporation)	76,700 af (24%)
05-16-22	Bear Lake High Elevation - 5,913.69 ft.	733,317 af (52%)
	Outlet Canal Releases: 5/21-5/31; 6/7-9/22; 9/30-10/12 (133 days irrigation releases)	216,000 af
07-01-22	Outlet Canal Maximum Release - 1,700 cfs	
	Bear Lake Storage Release (see note 2, irrigation release 148,500 acre-feet)	189,000 af
09-30-22	Bear Lake Ending Elevation - 5,910.13 ft.	500,668 af (35%)
	Bear Lake Settlement Agreement "System Loss" Volume	39,805 af

Notes:
1 Low contents prior to start of storage.
2 Net irrigation storage release from Bear Lake, subtracting Rainbow inflow and the decreed adjustment for the natural yield of Bear Lake and Mud Lake area. Includes system loss volume.
3 Due to uncontrolled flow from (welcome) rain events. Whenever water flows below Cutler during the irrigation season any storage water in the system at Cutler is the first water out. Natural flow goes to irrigators.

Current Status

Currently, all inflow is being stored. No high-runoff releases are anticipated during winter 2022-2023. The Bear Lake daily average elevation on November 21, 2022 was 5,909.77 (steady for the last 4 days). The likely seasonal minimum elevation was 5,909.71 feet on November 6, 2022. This represents a 4-foot decrease from the spring high elevation. For context, water year 2021 saw a 4.7-foot decline in Bear Lake. The present Bear Lake equivalent elevation is 5,910.01 feet.

Summary of Water Year 2022

The Bear Lake Irrigation Storage Allocation for 2022 was 225,700 acre-feet. Runoff was below normal, with Bear Lake net runoff at 76,700 acre-feet. Precipitation events increased natural flow and delayed storage releases, such that despite the lower-than-normal spring runoff, the Bear Lake Outlet Canal was opened for steady irrigation deliveries on June 7. Precipitation events in September also allowed for closing the Bear Lake Outlet Canal on Sept 22. Due to the demand for natural flow for the U.S. Fish and Wildlife Service Bear River Migratory Bird Refuge, the Bear Lake Outlet Canal was reopened September 30th, 2022 and Bear River Canal Company used some additional Bear Lake storage water in October (4,000 acre-feet).

Estimated 2023 Irrigation Allocation and Bear Lake Elevations

The estimated 2023 irrigation season allocation ranges from 210,000 acre-feet to 230,000 acre-feet, based on Bear Lake increases from current elevation (5909.77) by 1.5 to 5 feet from current elevation. Note that in the worst year on record (1977), Bear Lake rose only 0.4 feet from the seasonal low, the allocation would be 206,000 acre-feet if that situation recurred. For context, the 2021 lake level increase was 0.9 feet and the 2020 increase was 1.65 feet. The most recent long-range forecasts show "equal chances" for winter 2022-2023 precipitation. Average soil moisture at the basin's SnoTel gages is currently below normal, which could impact 2023 spring runoff efficiency of snow melt, but it is still better than the record-dry fall 2021 conditions.

The following estimates are made to inform the compact restriction on reservoir storage upstream of Bear Lake when the equivalent elevation is below 5,911.0. Using the same elevation range increase noted above to estimate spring 2023 maximum Bear Lake *equivalent* elevations (assuming normal Mud Lake elevations) results in a range from 5,911.5 to 5,915 feet. Hence, it seems likely that the Bear Lake equivalent elevation will rise above 5,911.0 in spring 2023 unless historical worst-case increases recur (0.4 feet as in 1977 or 0.9 feet as in 2021).

Operational Notes

- Bear River Black Canyon Recreational Water Releases occurred as normal except that one event was rescheduled to fall after Labor Day due to a combination of boater desires and fall maintenance at Grace plant. The fall date was coordinated with the Gentile Canal watermaster to reduce the impact.
- Federal Energy Regulatory Commission relicensing efforts are complete at Cutler. The final license application has been filed. The 401 Water Quality Certificate for Cutler Reservoir was received on October 13, 2022 from the Utah Division of Water Quality. We expect a new Federal Energy Regulatory Commission license in approximately 18 months.
- PacifiCorp continues to have Dry Canyon meetings with Federal Energy Regulatory Commission preliminary permit intervenors and Idaho water right transfer application protestants.
- PacifiCorp and the Idaho Department of Environmental Quality have entered into a Compliance Agreement Schedule to collect data on hydroelectric plant cooling water discharges and apply for Idaho Pollutant Discharge Elimination System (IPDES) permits for each Bear River hydro development.

Additional Information

The "Bear Lake Net Runoff" (NR) represents the water available for storage in Bear Lake or for release downstream as natural flow depending on the season. The net runoff represents the contribution of both the Bear River inflow available at Stewart Dam as well as all Mud Lake and Bear Lake natural inflows as reduced by evaporation on Mud Lake and Bear Lake (implicitly, evaporation is not a calculated value), as shown in the table below with water year 2022 values in acre-feet (AF).

Net runoff can be subsequently divided into the net Mud Lake/Bear Lake and Bear River contributions. Since the Bear River inflow into the system is quantified by the Rainbow Inlet Canal, the net contribution by the combined Mud Lake and Bear Lake watershed groundwater, tributary and direct lake precipitation less evaporation can be computed. For water year 2022, the combined Mud Lake and Bear Lake watershed inflow was -4,780 acre-feet, implying that evaporation exceeded all local inflows to Mud Lake and Bear Lake.

Bear Lake Net Runoff Equation and Water Year 2022 Calculations

NR = Bear & Mud Lake Change in Storage + Outlet + Bear River below Stewart Dam

Year-end Bear Lake and Mud Lake Reservoir Contents (AF)	500,668	16,155
Beginning Bear Lake and Mud Lake Reservoir Contents (AF)	642,122	17,125
Change in Bear Lake and Mud Lake Volume (AF)	(141,454)	(970)
Bear Lake Outlet Canal Flow Volume (AF)	215,791	
Bear River below Stewart Dam Volume (AF)	3,316	
Bear River and Bear Lake Net Runoff (AF)	**76,700**	
Rainbow Canal Flow Volume (AF)	81,476	
Computed Bear Lake Net Local Inflow (AF) [Net Runoff less Rainbow Inflow]	*(4,780)*	