

Using RiverWare to Support the Accounting and Operations of the Central Utah Project

Rachel Musil, PE, Water Supply Manager Central Utah Water Conservancy District
Tony Powell, PE, Precision Water Resources Engineering

Contents

- I. Introduction
 - A. Overview of Central Utah Water Conservancy
 District (CUWCD), the Central Utah Project (CUP), and
 the Central Water Project (CWP)
 - B. Challenges in managing and accounting for water in a large, complex system
- II. The Utah Lake Jordanelle Exchange Model
 - A. Purpose of the Model
 - B. Overview of the exchange between Utah Lake and Jordanelle
- III. Results and Impact
 - A. CWP Water Service Agreement
 - B. Utilized the model for EA analysis
 - C. Continued development







What is Central Utah Water Conservancy District (CUWCD)?

"With 62% of our growing state living in Central Utah Water's boundaries we are dedicated to planning for the future by developing, delivering and efficiently using our limited water resources. Thank you for your trust."

— GENE SHAWCROFT, GENERAL MANAGER



\$3.5 billion in infrastructure



than 100 million gallons per day



Serving 1.5
million
people
every day



Maintaining
178 miles
of canals,
tunnels and
pipelines



Delivering more than 400,000 acre-feet annually



Storing
565 billion
gallons
in reservoirs

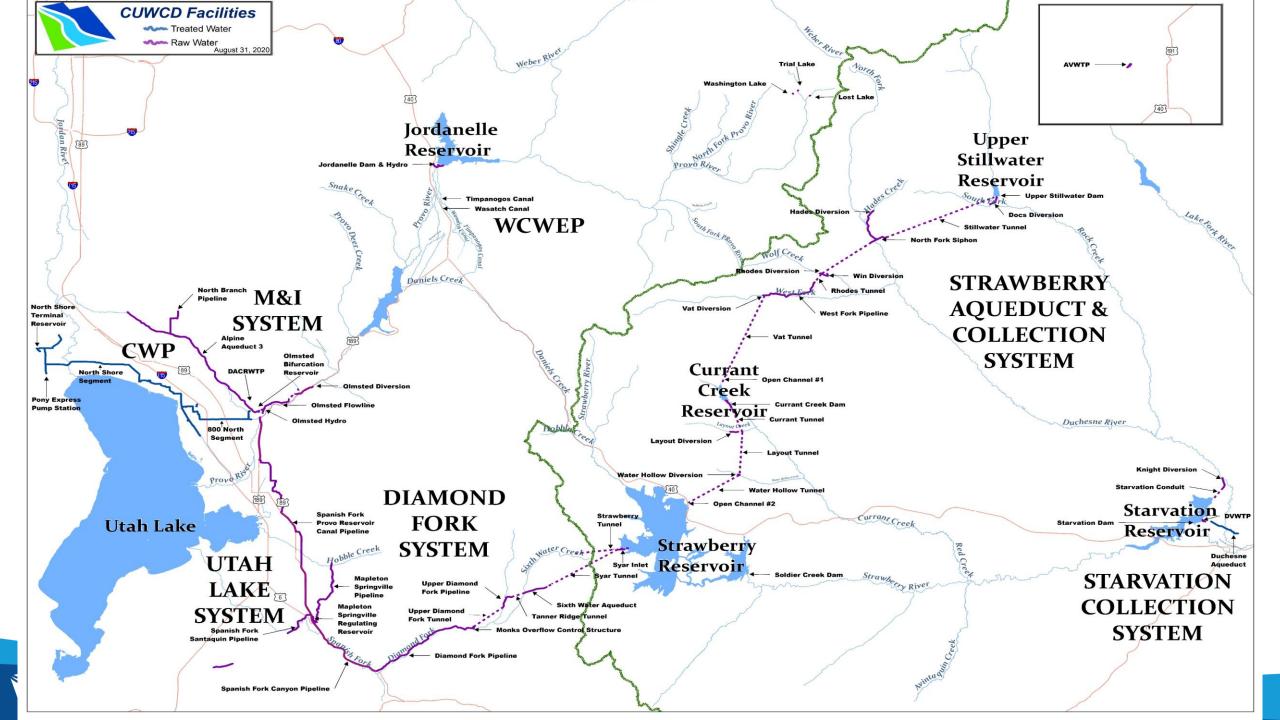
Provide: Culinary & Agricultural Water, Recreational Resources, Hydroelectric Power, Environmental Protections, Flood Control, and more.



Colorado

Nevada

Nevada



CUWCD Annual Water Supply and Deliveries

Central Utah Project:

• M&I 154,750 A-F

Some turned back for instream flows

• Irrigation Water 39,500 A-F

• Instream Flow (Uinta Basin) 44,400 A-F

• Total CUP 238,650 A-F

Non-CUP Water Conveyed in CUP facilities ~100,000 A-F (varies)

 Instream Flows Also Delivered to Provo and Spanish Fork rivers

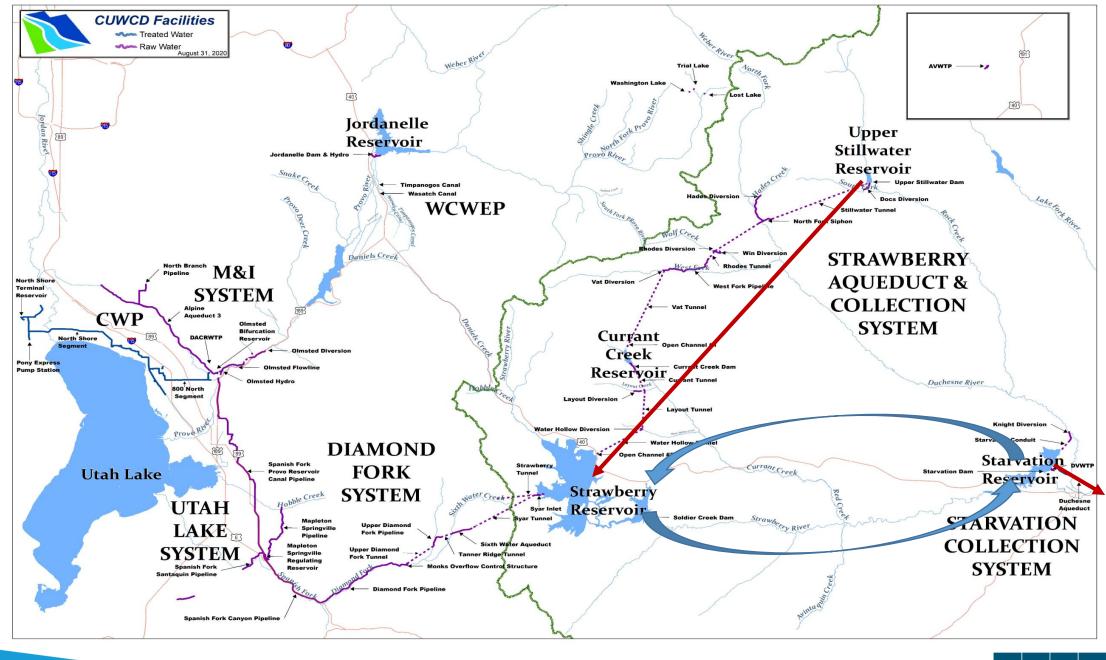
Central Water Project:

• M&I 53,600 A-F

Strawberry Valley Project:

Irrigation Water
 61,000 A-F





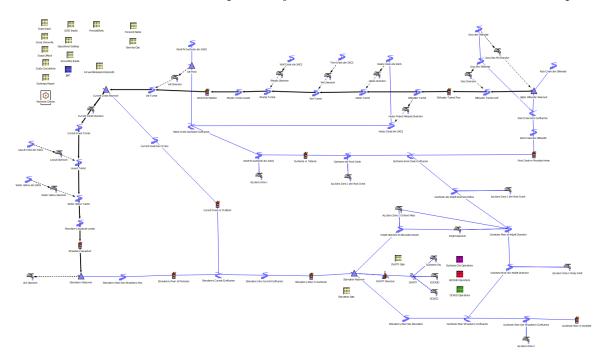
2020 WORKSHEET							2020 WORKSHI	FT											
2020 WORKOILE I	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	15th	16th	17th	18th	19th	20th	21st
	Week	Week	Week	Week	Week	Week	Week	Week	Week	Week	Week	Week	Week	Week	Week	Week	Week	Week	Week
Monday through Sunday Year: 2020 6	-8 to 6-14	6-15 to 6-21	6-22 to 6-28	6-29 to 7-5	7-6 to 7-12	7-13 to 7-19	7-20 to 7-26	7-27 to 8-2	8-3 to 8-9	8-10 to 8-16	8-17 to 8-23	8-24 to 8-30	8-30 to 9-6	9-7 to 9-13	9-14 to 9-20	9-21 to 9-2	9-28 to 10-4	10-5 to 10-11	10-12 to 10-18
ROCK CREEK & So Fk INFLOW (AF)	7,170	4,566	3,419		1,765	1,329	1,043	1,002	770	672	647	706	601	617	524	452	413	375	403
- Total RELEASE (AF)	403	476	403	403	746	873	732	670	897	916	849	696	694	555		403	403	403	403
ROCK CREEK TOTAL (AF) ======>	6,768	4,090	3,017	2,087	1,019	456	311	331	C	0	0	10	0	61	121	50	10	0	0
HADES DIVERSION (AF) =====>	496	410	284	180	0	0	0	0	C	0	0	0	0	0	0	1	2	0	0
WIN DIVERSION (AF) ======>	65	52	37	30	2	0	0	0	C	0	0	0	0	0	0	4	4	3	3
RHODES DIVERSION (AF) ====>	149	91	65	56	3	0	0	0	C	0	0	0	0	0	0	25	4	25	25
VAT DIVERSION (AF) =====>	577	260	42	2	0	0	0	0	C	0	0	0	0	0	0	0	0	0	0
CURRANT CR RES INFLOW (AF)	6,283	5,394	4,962	4.763	3,097	515	371	263	197	244	3,311	3,671	3,589	3,624	493	161	90	121	128
- DIV. ABOVE H/W/R/V (AF)	1,288	812	4,902	268	5,097	0	0	203	197	244	3,311	0,071	0,009	0,024	493	30	11	28	28
	333	333	333	333	333	333	333	333	333	333	333	333	321	319	319	319	218	123	125
- RELEASES (AF) - DIV. STILW TUNNEL (AF)	3,578	3,777	3,882	3,919	2,725	428	155	262	75	240	3,364	3,897	3,818	3,826	349	38	~	14	14
CURRANT CREEK TOTAL (AF) (Inflow + Tunne	1,084	473	320	242	33	0	0	0	C	0	0	0	0	0	0	0	0	0	0
TOTAL OPEN CH FLOW (AF)	5.937	5,393	4.953	4,371	2,758	375	485	210	64	63	2.601	3.144	3,247	3,294	348	73	135	62	63
- CURRANT C DIV (AF)	5,802	5,222	4,754	4,249	2,662	252	250	58	(0	2,559	3,096	3,132	3,168	272	0	·	0	0
LAYOUT DIV. (AF) ======>	24	24	24	24	23	22	22	21	21	21	21	21	21	21	22	22	22	21	21
WATER HOLLOW DIV (AF)===>	56	46	44	44	39	36	35	36	31	29	23	24	24	24	24	24	~	24	24
TOTAL OF LAYOUT, WATER HOLLOW (AF)	79	70	68	67	61	58	57	58	52	50	44	44	44	44	46	46	45	44	44
Accounting for Open Channel (Tunnel make for lower aqueduct - Include in total when																			
deemed valid)	56	101	131	55	35	65	178	95	12	13	(1)	3	71	82	30	27	89	18	19
BETWEEN DAMS (AF)=======>	286	286	286	167	120	120	120	98	44	44	44	44	6	0	0	0	18	145	145
TOTAL AQUEDUCT FOR REPLACEMENT (AF)	9,504	5,730	4,118	2,831	1,239	634	488	487	96	94	88	98	50	106	167	125	84	218	217
STARVATION RESERVOIR			······································			,								,					
STRAWBERRY RIVER INFLOW (AF)	1,811	1,601	1,680	1,870	1,109	974	1,137	845	916	581	801	1,031	1,023	1,240	946	1,047	960	825	821
USGS INFLOW (Strawberry River) (AF)	1,966	1,676	1,648	1,559	1,287	1,190	1,158	1,109	1,035	995	954	997	1,040	1,197	1,080	1,042	1,021	858	0
+ KNIGHT INFLOW (AF) -REGULATION (AF)	466	730	147	323	256	383	577	490	198	204	173	214	180	361	393	490	635	694	1,012
STARVATION TOTAL IN (AF) ======>	2,432	2,406	1,827	2,193	1,543	1,573	1,735	1,599	1,233	1,199	1,126	1,246	1,221	1,601	1,473	1,537	1,656	1,552	1,833
Total Starv. and Aqueduct for exchange(AF \$	11,936	8,136 \$\$\$\$\$\$\$\$\$\$\$	5,945	5,024 \$\$\$\$\$\$\$\$\$\$\$\$	2,782 \$\$\$\$\$\$\$\$\$	2,207	2,223 \$\$\$\$\$\$\$\$\$\$\$\$	2,086	1,329	1,293	1,214	1,344 \$\$\$\$\$\$\$\$\$\$\$\$	1,271 \$\$\$\$\$\$\$\$\$\$	1,707	1,640 \$\$\$\$\$\$\$\$\$\$\$	1,662	1,740	1,770 \$\$\$\$\$\$\$\$\$\$\$\$	2,050
FLOW FOR NEXT WEEK CFS/DAY	854.0	580.0	421.9	355.6	193.8	152.3	153.2	143.6	88.5	85.0	80.5	90.0	83.4	114.9	109.9	111.2	116.1	120.7	141.3
\$\$\$\$\$\$\$\$ \$\$\$\$\$\$\$\$\$\$\$\$\$\$\$ \$\$\$\$\$\$\$\$\$\$\$\$\$	\$\$\$\$\$\$\$\$\$	\$\$\$\$\$\$\$\$\$\$\$\$\$	\$\$\$\$\$\$\$\$\$\$\$\$	\$\$\$\$\$\$\$\$\$\$\$	5\$\$\$\$\$\$\$\$\$	\$\$\$\$\$\$\$\$\$\$\$	\$\$\$\$\$\$\$\$\$\$\$\$\$	555555555	\$\$\$\$\$\$\$\$								\$		\$\$\$\$\$\$\$\$\$\$\$\$
Project from Upper Stillwater (AF)				i					3	232	188	·	·	64 65.6		·			
Project from Hades Turnout (AF)		0.0	0.0			4.070.0	0.040.0	0.000.0	0.000	4400.0	0.004.0	114		65.6					
Draigat Mater (AE)	0.0	0.0	0.0	0.0	0.0 2,193	1,873.0	2,612.0	2,398.0	_	4,102.0	3,891.0	3,679.0	2,884.0	2,200.0	755.0	729.0	333.0	0.0	4.55
Project Water (AF)	0.400	0.400				1,543	1,573	1,735	1,599	1,233	1,199	1,126	1,246	1,221	1,601	1,473	1,537	1,656	1,552
LAST WEEKS INFLOW STARV (AF)	3,400	2,432	2,406	1,827	2,193		.,,	.,	**										
LAST WEEKS INFLOW STARV (AF) +REGULATION (AF)									**		2 510			1 813					⊿ 71
LAST WEEKS INFLOW STARV (AF) +REGULATION (AF) RELEASED STARV. CFS (Mon.thru Sunday)	1,019	1,900	2,266	2,417	2,333	2,347	2,439	2,330	2,548	2,621	2,519 1 199	2,384	2,063	1,813 1 221	1,237	1,194	1,083	760	
LAST WEEKS INFLOW STARV (AF) +REGULATION (AF)									**		2,519 1,199 94			1,813 1,221 50					471 934 0

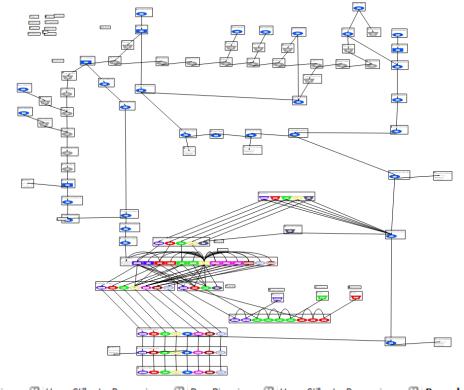
Upper Stillwater Dam Operation Report

								NTRAL UTAH PRO: ILLWATER DAM O									
August 2020																Operated i	by: CUWC
					RELEA	SES (CFS)			I	DIVERSION	S (CFS)	П	NFLOW (CF	rs)			
	RES.	TOTAL	CHANGE IN	ROCK	SOUTH	SEEPAGE	TOTAL	EVAPORATION	ROCK	SOUTH	STILLWATER	ROCK	SOUTH	TOTAL	PRECIP.	MAX.	MIN
	ELEV.	STORAGE	RESERVOIR	CREEK	FORK			(CFS)	CREEK	FORK	TUNNEL	CREEK	FORK			TEMP.	TEMI
DATE		A-F	A-F							(DOCS)			(DOCS)			_	
01-Aug-20	8,157.66	27,660	-8	48	8	0	56	1	10	3	13	55	11	66		83	59
02-Aug-20	8,157.63	27,652	-12	48	8	0	56	1	10	3	13	53	11	64		82	56
03-Aug-20	8,157.59	27,640	-17	48	8	0	56	1	11	2	13	51	10	61		82	58
04-Aug-20	8,157.53	27,623	-21	48	8	0	56	1	11	2	13	49	10	59		79	56
05-Aug-20	8,157.46	27,602	-27	55	8	0	63	1	4	2	6	46	10	56		78	55
06-Aug-20	8,157.37	27,575	-37	62	8	0	70	1	0	2	2	44	10	54		76	55
07-Aug-20	8,157.24	27,538	-41	62	8	0	70	1	0	2	2	42	10	52		76	51
08-Aug-20	8,157.10	27,497	-33	62 50	8	0	70 67	1	0	1	1	46 42	9	55		77	51
09 Aug 20	8,156.99	27,464	-35 -37		8	0	69 Y	1	0	1	1	43	9	51 52		77 78	53 54
10-Aug-20	8,156.87 8,156.74	27,429 27,392	-57 -55	61	8	0	68	1	7	1	8	40	9	49		75	54
11-Aug-20 12-Aug-20	8,156.55	27,392	-33 -76	57	8	0	65	1	22	1	23	42	9	51		75	55
13-Aug-20	8,156.29	27,261	-79	57	8	0	65	1	22	1	23	40	9	49		78	53
14-Aug-20	8,156.02	27,182	-84	57	8	0	65	1	21	1	22	37	9	46		76	52
15-Aug-20	8,155.73	27,098	-79	57	8	0	65	1	22	0	22	40	8	48		78	54
16-Aug-20	8.155.46	27,019	-87	57	8	0	65	1	22	0	22	36	8	44)	81	53
17-Aug-20	8,155.16	26,932	-213	56	8	0	64	1	85	0	85	35	8	43		83	55
18-Aug-20	8,154.42	26,719	-458	52	8	0	60	1	214	0	214	36	8	44		84	58
19-Aug-20	8,152.83	26,261	-577	53	8	0	61	1	280	0	280	41	8	49		82	58
20-Aug-20	8,150.80	25,684	-564	53	8	0	61	1	278	0	278	39	8	47	0.30	76	60
21-Aug-20	8,148.79	25,120	-559	53	8	0	61	1	280	0	280	42	8	50		81	54
22-Aug-20	8,146.77	24,561	-606	53	8	0	61	1	281	0	281	40	8	48		80	58
23-Aug-20	8,144.55	23,955	-583	52	8	0	60	1	278	0	278	37	8	45		77	60
24-Aug-20	8,142.39	23,372	-567	51	8	0	59	1	274	0	274	40	8	48	0.04	77	56
25-Aug-20	8,140.27	22,805	-543	40	8	0	48	1	282	0	282	49	8	57	0.23	76	57
26-Aug-20	8,138.22	22,262	-541	25	8	0	33	1	294	0	294	47	8	55	0.05	78	53
27-Aug-20	8,136.16	21,721	-564	40	8	0	48	1	286	0	286	43	8	51		78	55
28-Aug-20	8,133.99	21,157	-569	50	8	0	58	1	280	0	280	44	8	52	0.00	77	53
29-Aug-20	8,131.77	20,588	-561	47	8	0	55 50	1	276	0	276	41	8	49	0.02	75 72	57 54
30-Aug-20 31-Aug-20	8,129.56 8,127.34	20,027 19,472	-555 -577	42 42	8	0	50 50	1	273 276	0	273 276	36 28	8	44 36	0.19	72 63	54 46
01-Sep-20	8,125.00	18,895	-3//	72	0	V	30	1	270	U	270	20	0	30	0.19	03	40
						,				,							
		AVERAGE IN	CFS	52	8	0	60	1	132	1	133	42	9	51			
		TOTALS IN A	\-F	3,187	492	0	3,679	61	8,130	46	8,176	2,586	538	3,124			
		NOVEMBER 2	2010														
		INO VENIBER 2	2019														



Strawberry Aqueduct Collection System Accounting RiverWare Model

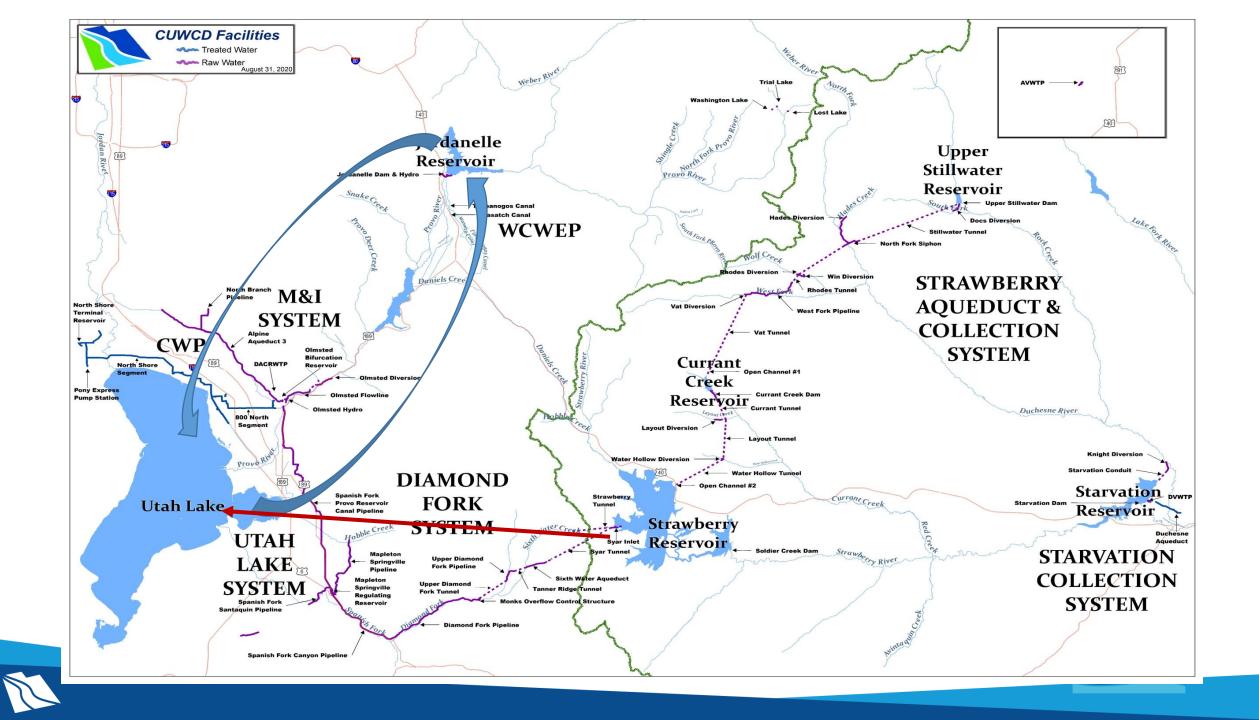




08-10-2023 Thu
08-11-2023 Fri
08-12-2023 Sat
08-13-2023 Sun
08-14-2023 Mon
08-15-2023 Tue
08-16-2023 Wed
08-17-2023 Thu
08-18-2023 Fri

	Upper Stillwater Reservoir Pool Elevation	Upper Stillwater Reservoir Storage acre-ft	Outflow	Outflow	Upper Stillwater Reservoir Evaporation acre-ft	Upper Stillwater Reservoir .Diversion	Docs Diversion Diversion	Upper Stillwater Reservoir Inflow Sum	Jocs abv Stillwater
	it .		CIS	CIS		CIS	CIS	CIS	
Thu	8,157.00 O 33	27,467.00 O 33	21.00 R 36	8.00 O 36	2.64 O 33	67.35 R 33	5.62 O 44	89.68 O 33	13.62 O 0
Fri	8,157.00 O 33	27,467.00 O 33	21.00 R 36	8.00 O 36	2.64 O 33	65.12 R 33	5.35 O 44	87.45 O 33	13.35 O 0
Sat	8,157.00 O 33	27,467.00 O 33	21.00 R 36	8.00 O 36	2.64 O 33	63.00 R 33	5.10 O 44	85.33 O 33	13.10 O 0
Sun	8,157.00 O 33	27,467.00 O 33	21.00 R 36	8.00 O 36	2.64 O 33	60.99 R 33	4.85 O 44	83.32 O 33	12.85 O 0
Mon	8,157.00 O 33	27,467.00 O 33	21.00 R 36	8.00 O 36	2.64 O 33	59.09 R 33	4.62 O 44	81.42 O 33	12.62 O 0
Tue	8,157.00 O 33	27,467.00 O 33	21.00 R 36	8.00 O 36	2.64 O 33	57.28 R 33	4.40 O 44	79.61 O 33	12.40 O 0
Wed	8,157.00 O 33	27,467.00 O 33	21.00 R 36	8.00 O 36	2.64 O 33	55.56 R 33	4.19 O 44	77.89 O 33	12.19 O 0
Thu	8,157.00 O 33	27,467.00 O 33	21.00 R 36	8.00 O 36	2.64 O 33	53.93 R 33	3.99 O 44	76.26 O 33	11.99 O 0
Fri	8,157.00 O 33	27,467.00 O 33	21.00 R 36	8.00 O 36	2.64 O 33	52.38 R 33	3.80 O 44	74.71 O 33	11.80 O 0





Utah Lake Jordanelle Exchange Model Project Overview

- Utah Lakes Rights
- 189,307 A-F Primary Water Rights
- 16,862 CUWCD
- 7,900 Reclamation for CUP
- 112,739 A-F Secondary Water Rights
- 57,073 CUWCD
- 302,046 A-F Total Utah Lake (Storage Rights)
- 81,835 total CUWCD or CUP
- Import Water
- CUP Strawberry Reservoir
- \sim 115,707 A-F currently
- PRP Weber and Duchesne Rivers

Develop a tool in the model to analyze and show the reliance Jordanelle has on Utah Lake Water Rights and Trans-Basin water and if there is any available water that can be used for other purposes.

- What happens if we use our 16,862 Acre-feet of Primary Storage for other purposes?
- How much of the CUP Strawberry Water in Utah Lake can be used for other purposes?
- What if operations change and instream flow requirements are reduced?
- Are there operations to best use CUP Import Water?
- How do future Operational and Hydrological Parameter changes to the system impact CUWCD Operations?



Utah Lake Jordanelle Exchange Model

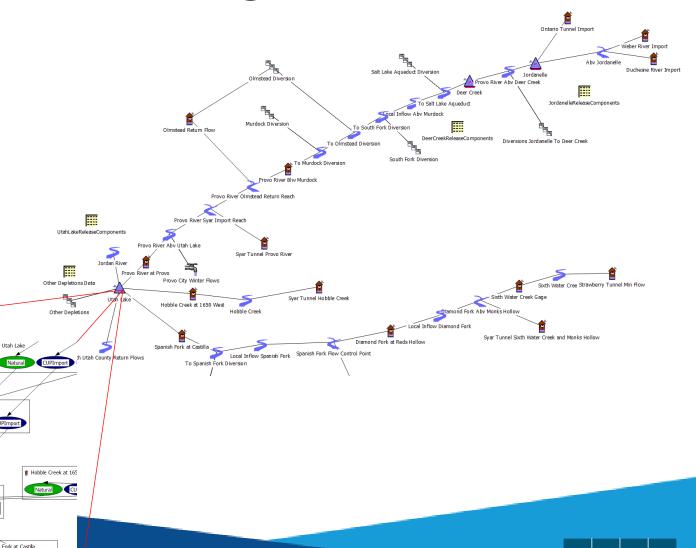
System Natural

South Utah County Return Flows

- Monthly Timestep
- Integrated Accounting
- Planning tool to determine reliability of water rights and import water in Utah Lake

CUWCD Run Controls

Other Depletions Data





System

CUP Imports

Utah Lake Jordanelle Exchange Model

RiverWare Advantages

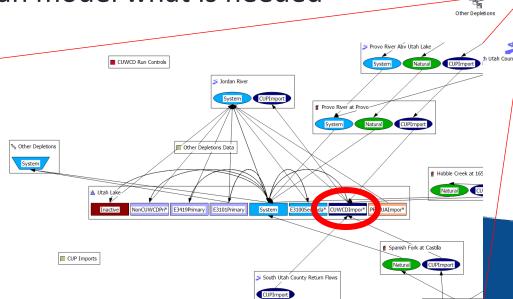
Develop a historical characterization

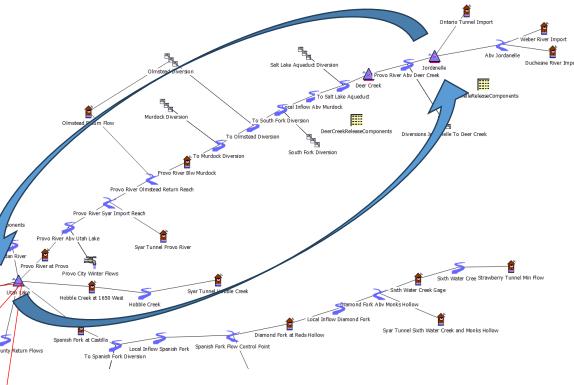
Physical and Accounting

• Easily Reviewable/Verifiable

Limited to the questions being asked

Can model what is needed







Utah Lake Jordanelle Exchange Model

Natural

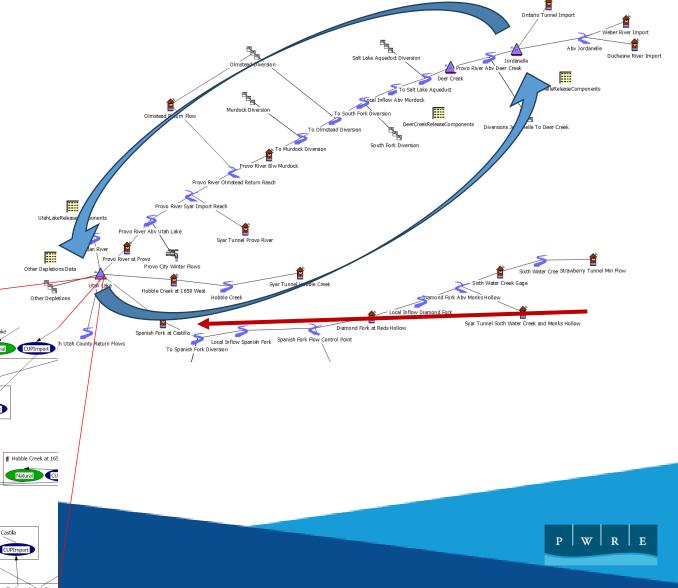
RiverWare Advantages

 Built to answer many "what if" questions easily and efficiently

CUWCD Run Controls

Other Depletions Data

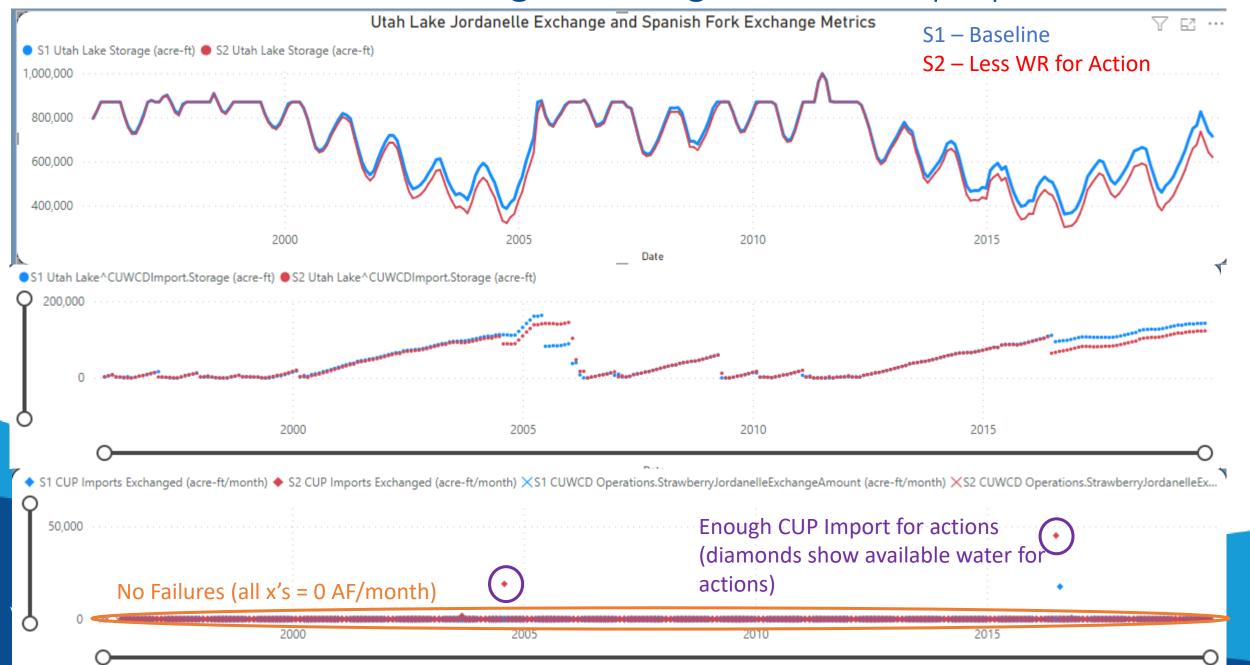
NonCUWCDPri* E3419Primary E3101Primary System





System

Simulation/Results – Using Water Rights for other purposes



Results and Impact

How much of the CUP Strawberry Water in Utah Lake can be used for other purposes?

- CWP Water Service Agreement will utilize up to 6,000
 AF annually of the import water in Utah Lake
- Model results were used to draft NEPA document for CWP

Planning efforts on the Spanish Fork River to look at utilizing CUWCD water rights in Utah Lake for Exchange

Ongoing development to look at other impacts to Jordanelle and Utah Lake and the CUP Water Supply

Finding of No Significant Impact

Final Environmental Assessment

CENTRAL WATER PROJECT— WATER SERVICE AGREEMENT

June 2023

Joint Lead Agencies

Central Utah Water Conservancy District U.S. Department of the Interior, CUPCA Office







Questions and Discussion



