Simulating the New York Canal (part II)

Stephen Hundt

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Last Time …

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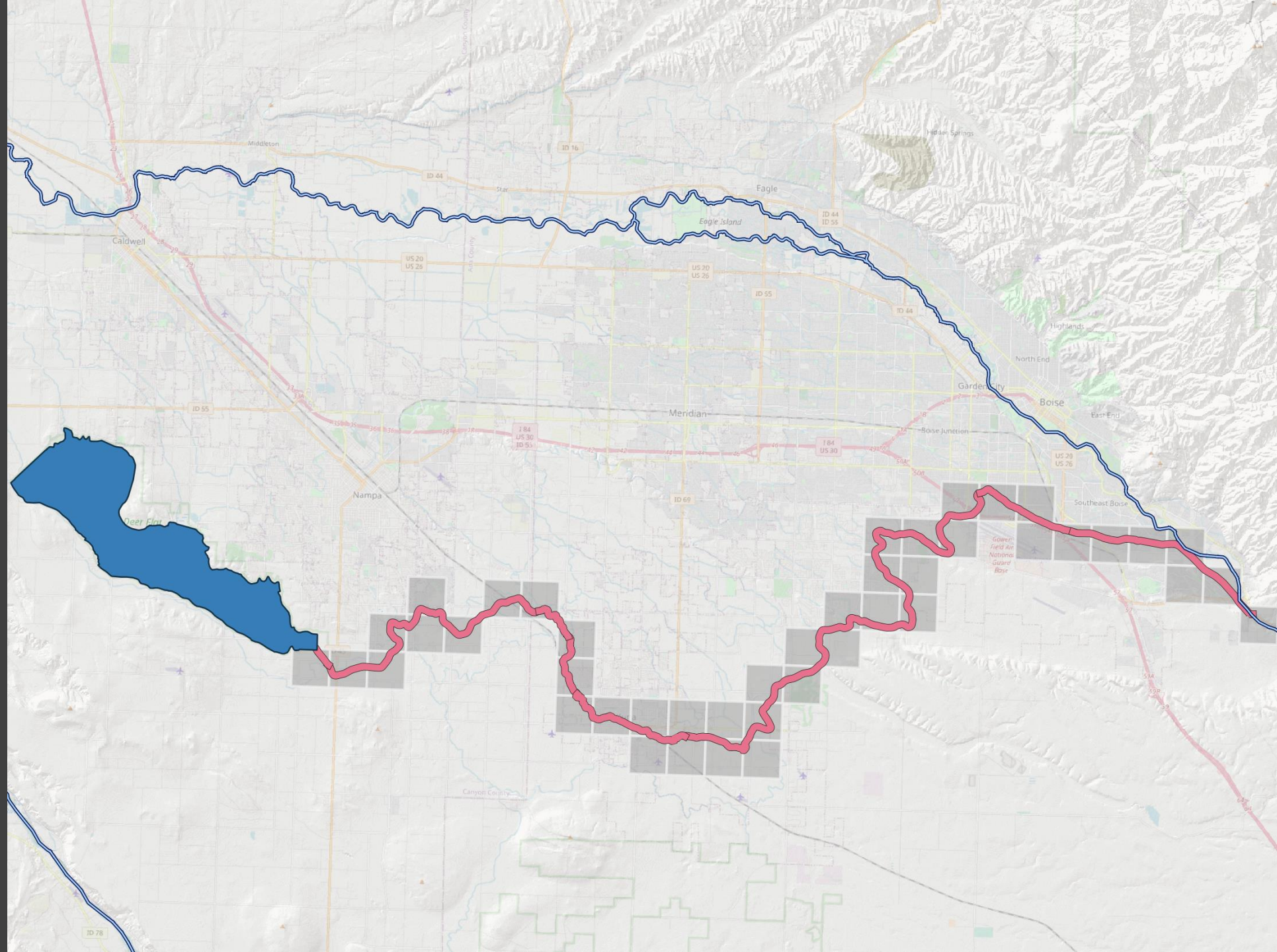
Location

Intersecting model cells



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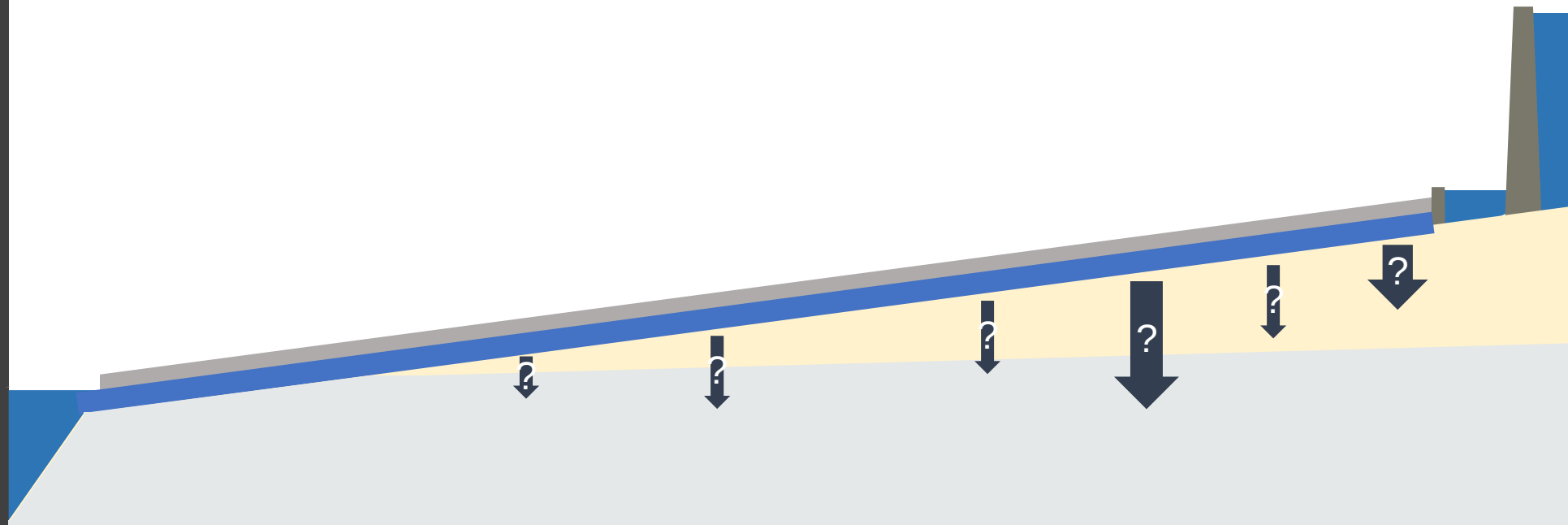
Conceptual Model

Spatial distribution is probably not uniform, but is also not known.



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Seepage Measurements

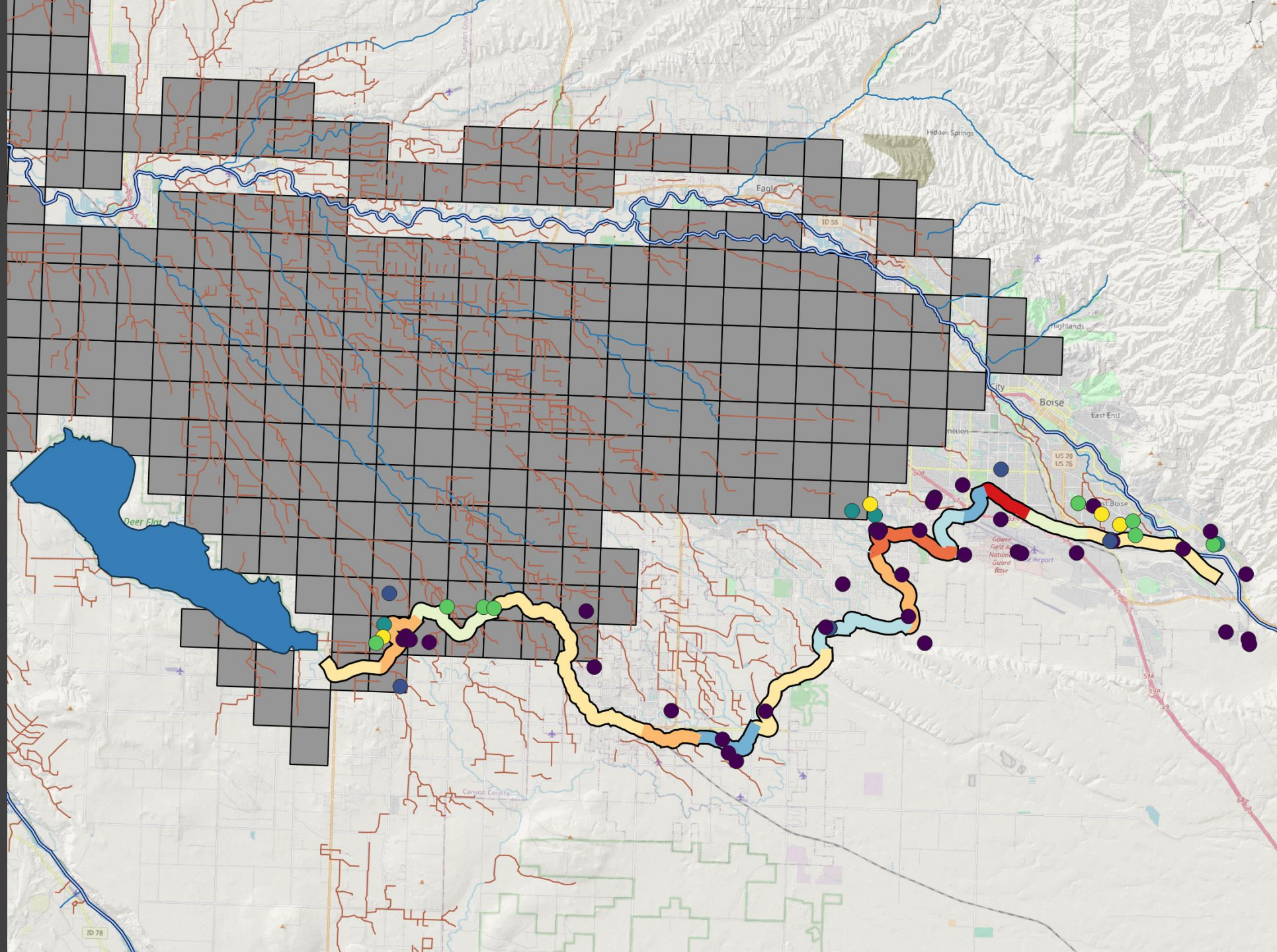
March 20-21 & 27-28, 1997

New York Canal seepage

- losing: 53 - 75 cfs
- losing: 35 - 53 cfs
- losing: 18 - 35 cfs
- losing: 0 - 18 cfs
- gaining: 0 - 18 cfs
- gaining: 18 - 35 cfs
- gaining: 35 - 53 cfs
- gaining: 53 - 75 cfs

Minimum depth to water

- 0 - 10 ft
- 10 - 20 ft
- 20 - 30 ft
- 30 - 40 ft
- > 40 ft



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Seepage Measurements

Measured seepage > 5% of discharge

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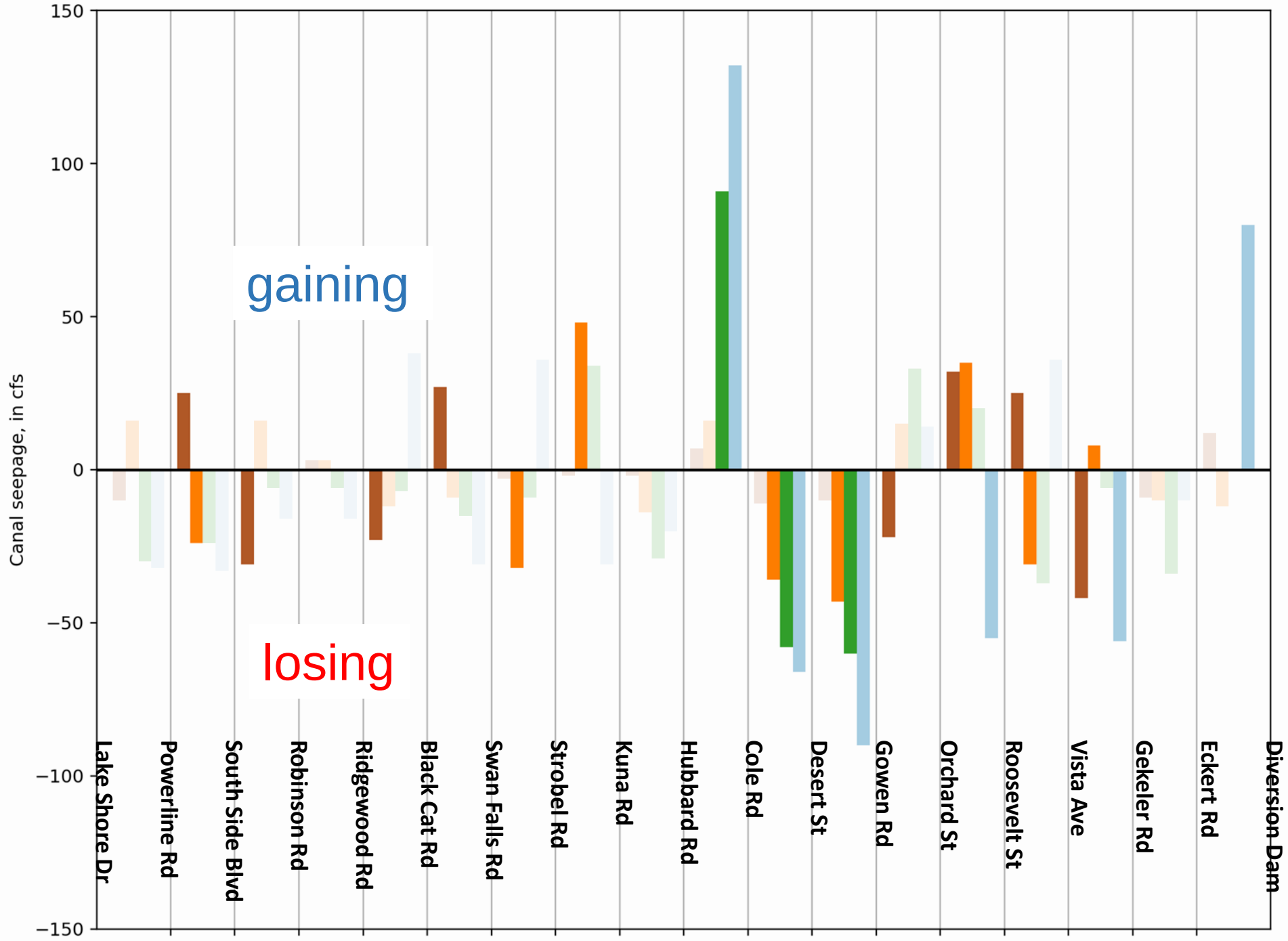

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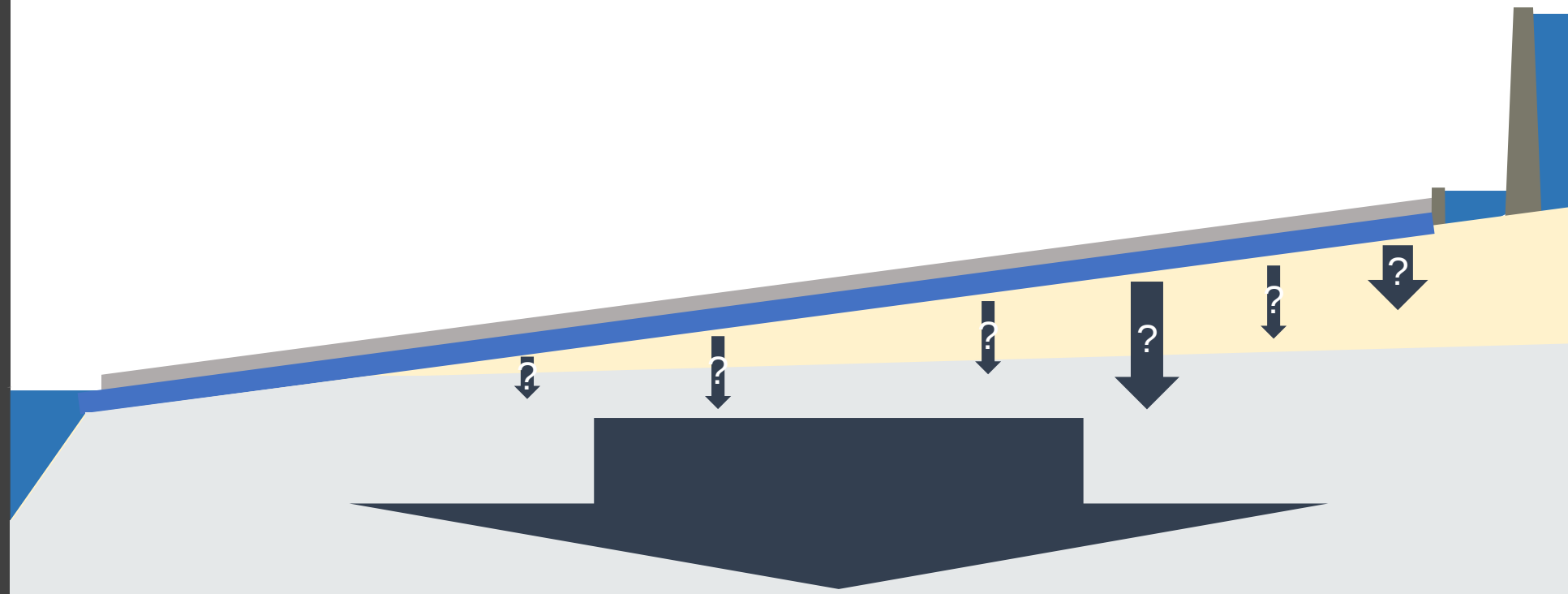
Proposal: Specified Flux

Spatial Distribution



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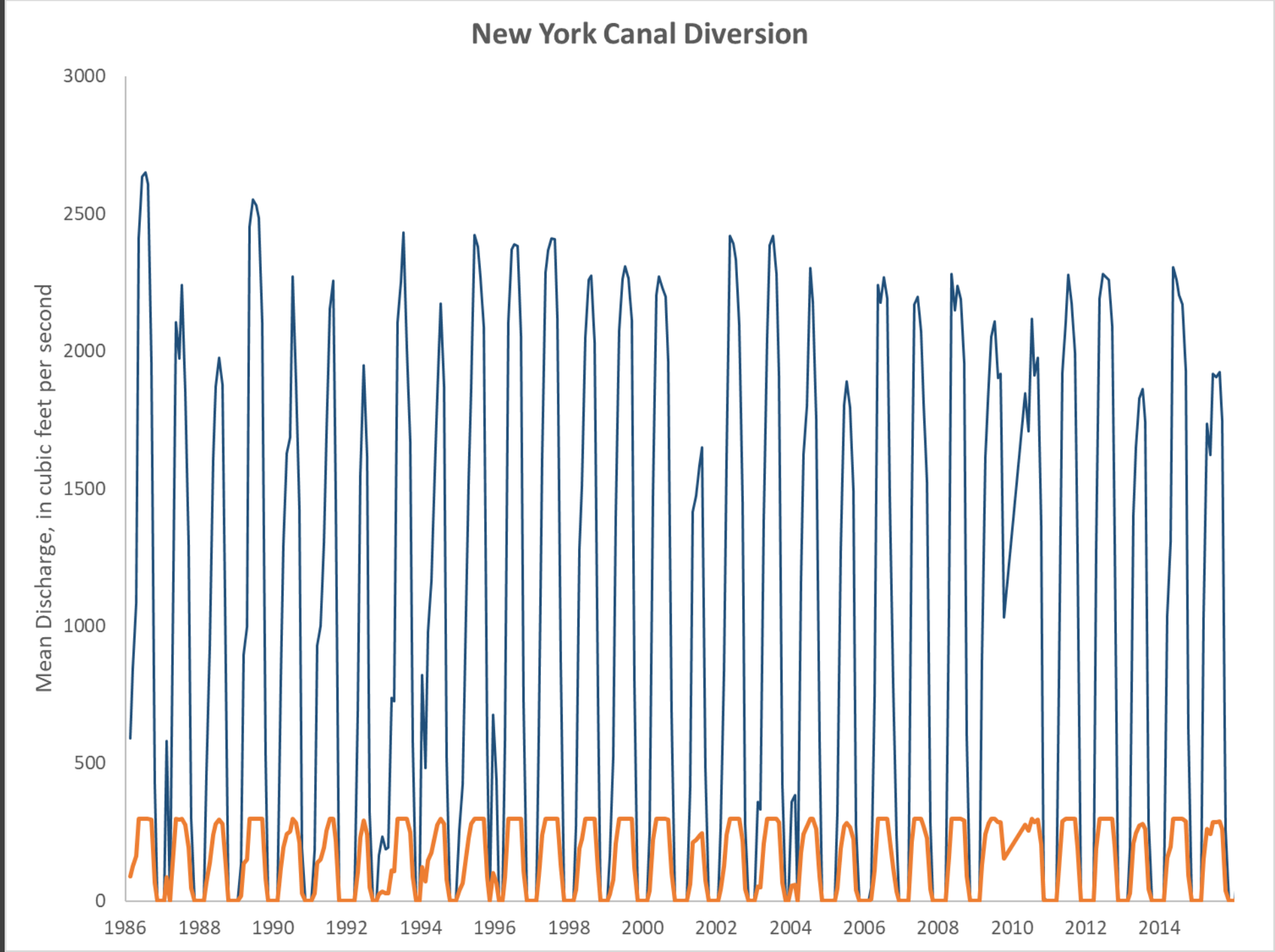
Proposal: Specified Flux

Leakage Estimate

- Seepage runs insufficient
- Total seepage as % of total diversion?
  - Estimable parameter



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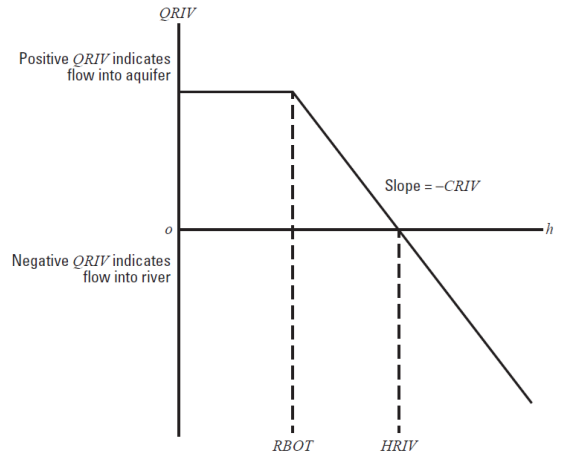
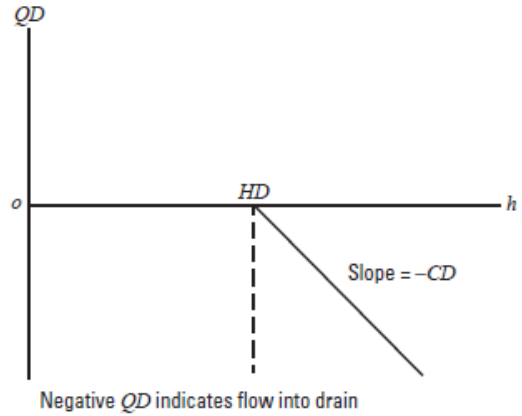
Head Dependent Flux

- Fits conceptually
- Not recommended
  - Where canal above water table, flux is constant and determined by parameters
  - Our choice of parameters would not be driven by observation data
  - Would be specifying fluxes, just in a more complicated way
  - Where canal is connected to aquifer, flux calculation is same as DRN package





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Goals?

Considerations

In choosing how to represent the NY Canal

What is our **conceptual** understanding of the system?

What **model output and scenarios** will depend on this component of the model?

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How does this affect the rest of the model & **other model objectives**?

How much **time and effort** will this take to implement?

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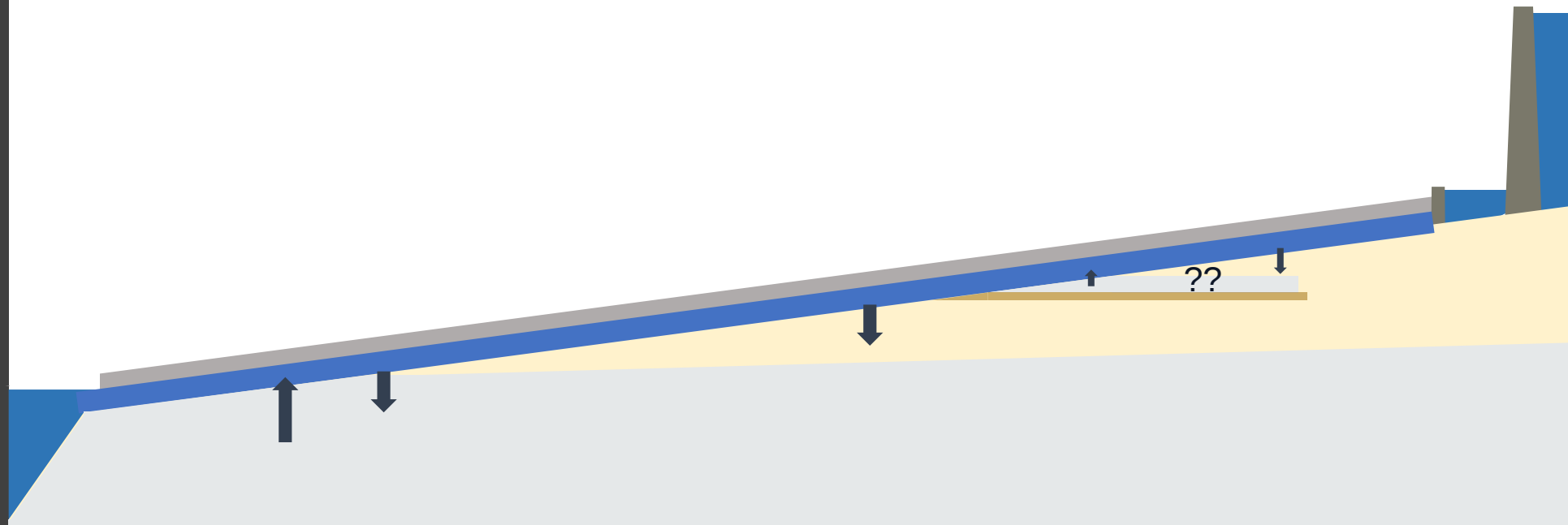
Conceptual Model



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Scenario Modelling

A **head-dependent flux boundary** would:

- be more consistent with conceptual understanding
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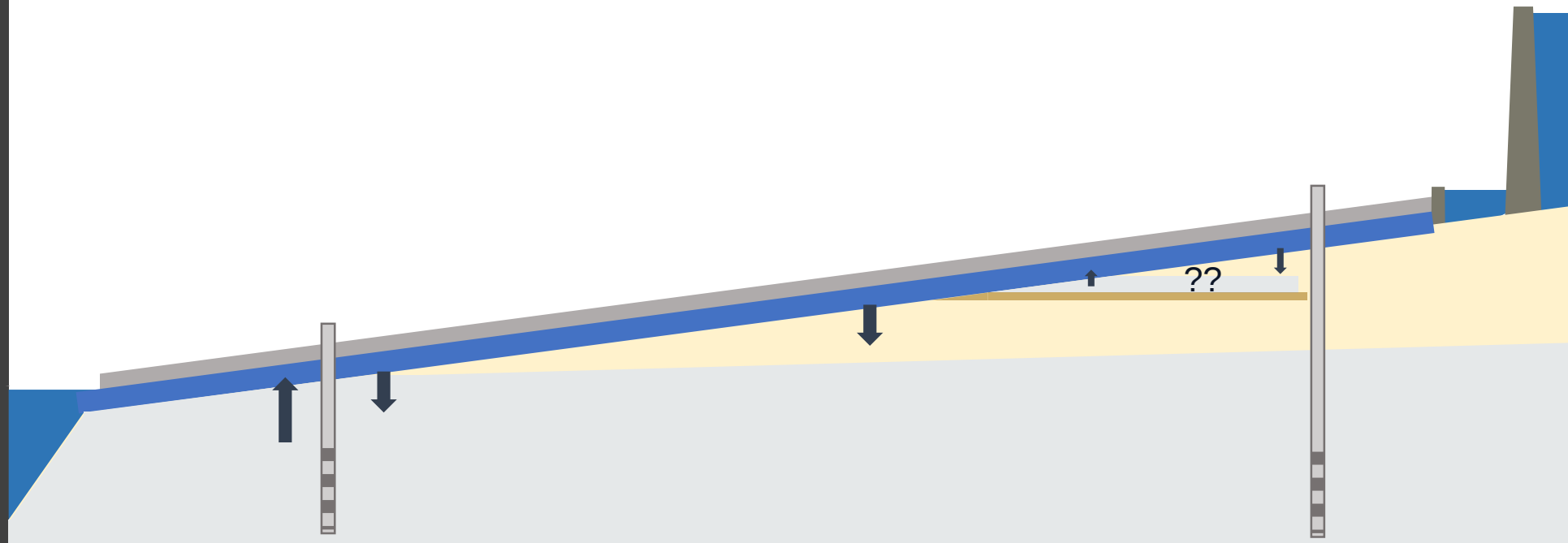

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Available Data

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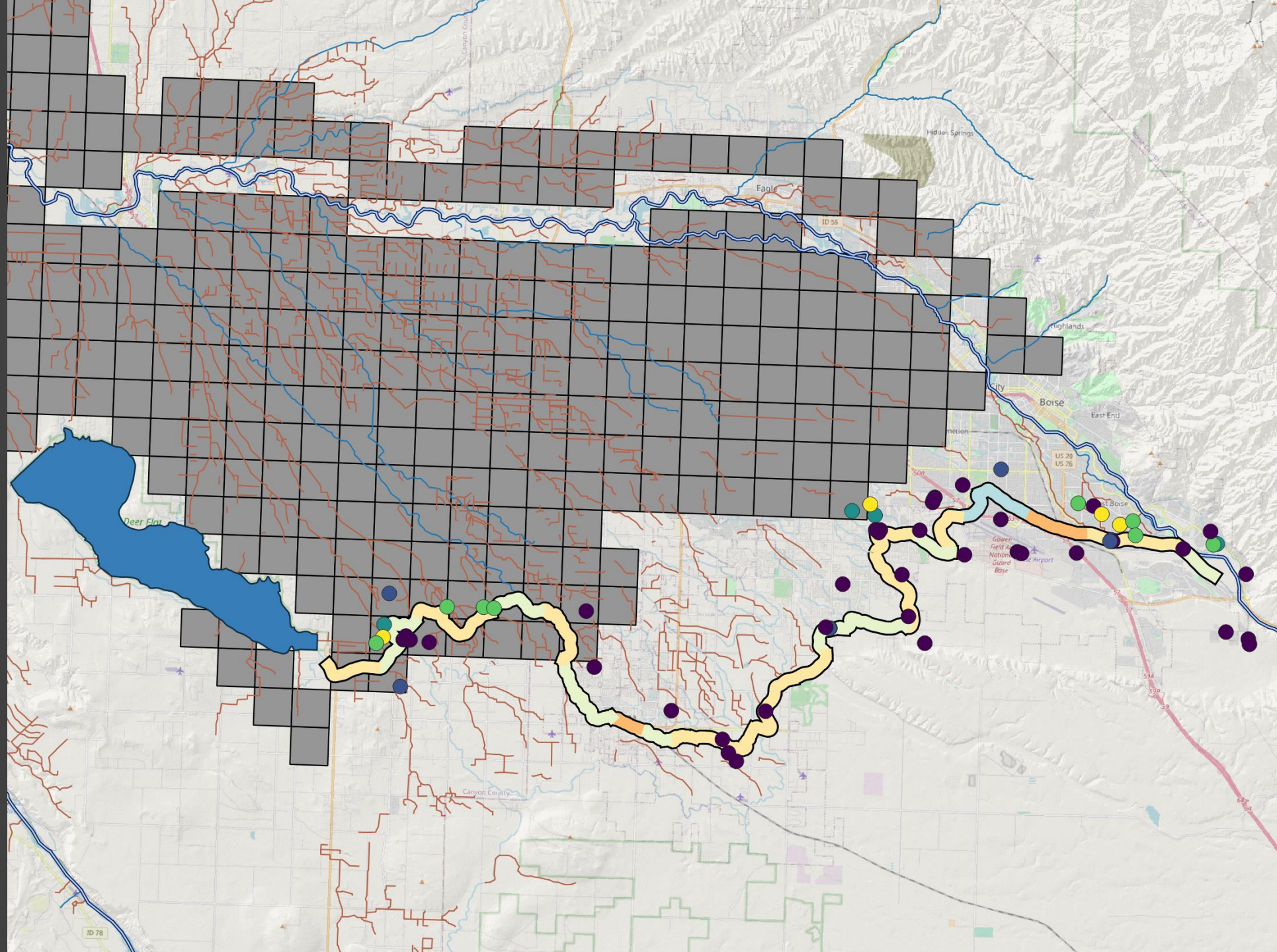

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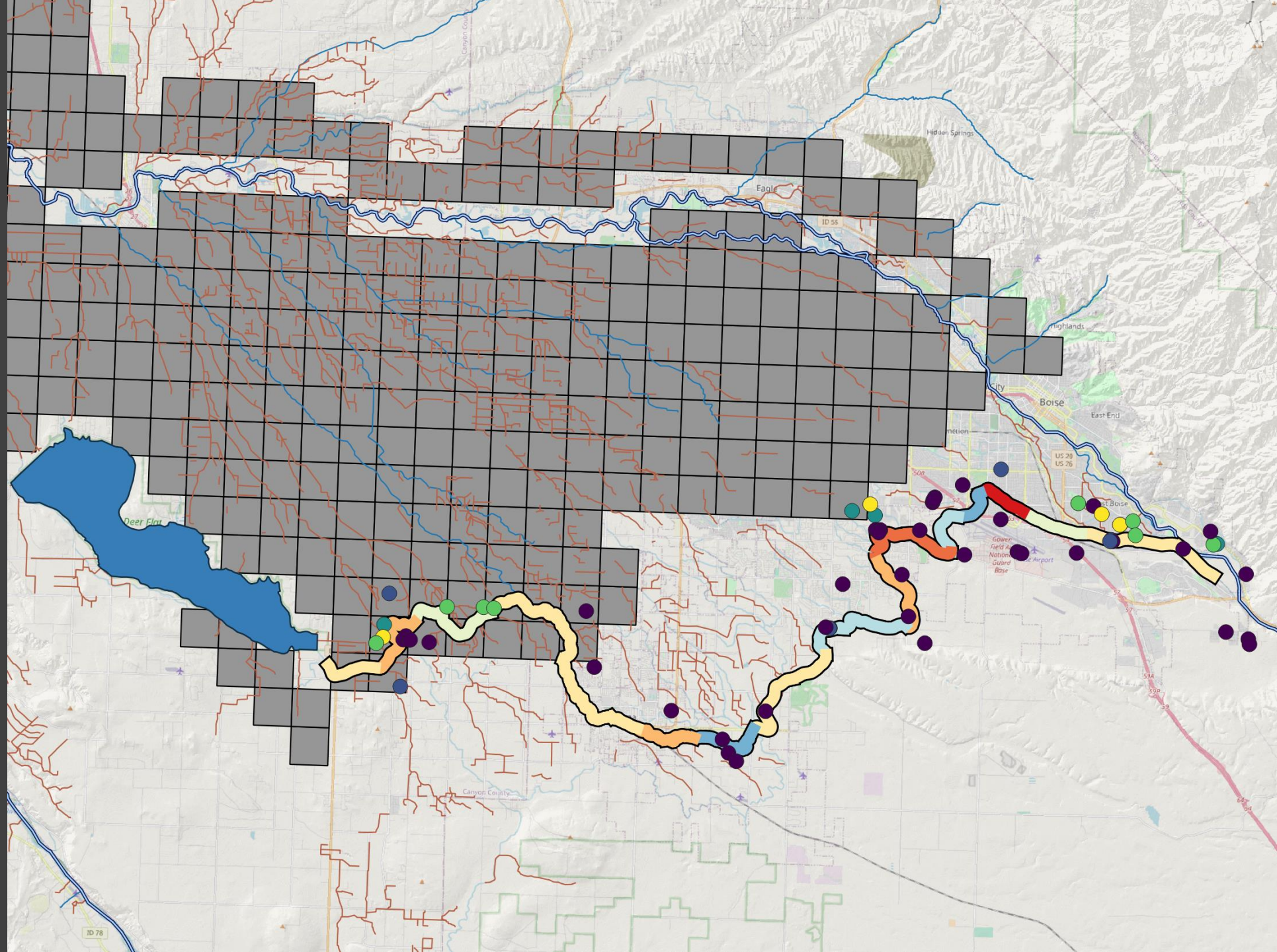

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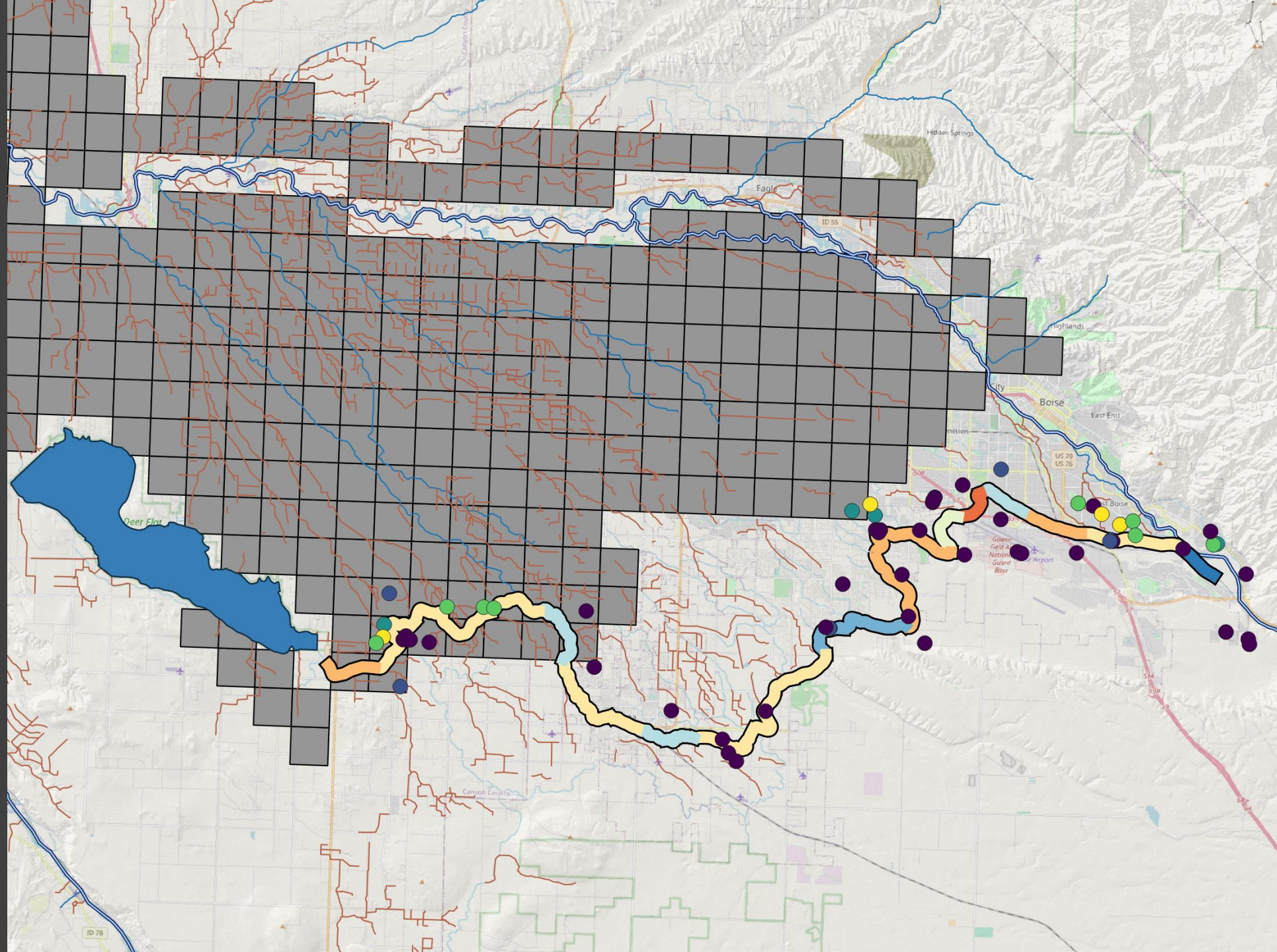

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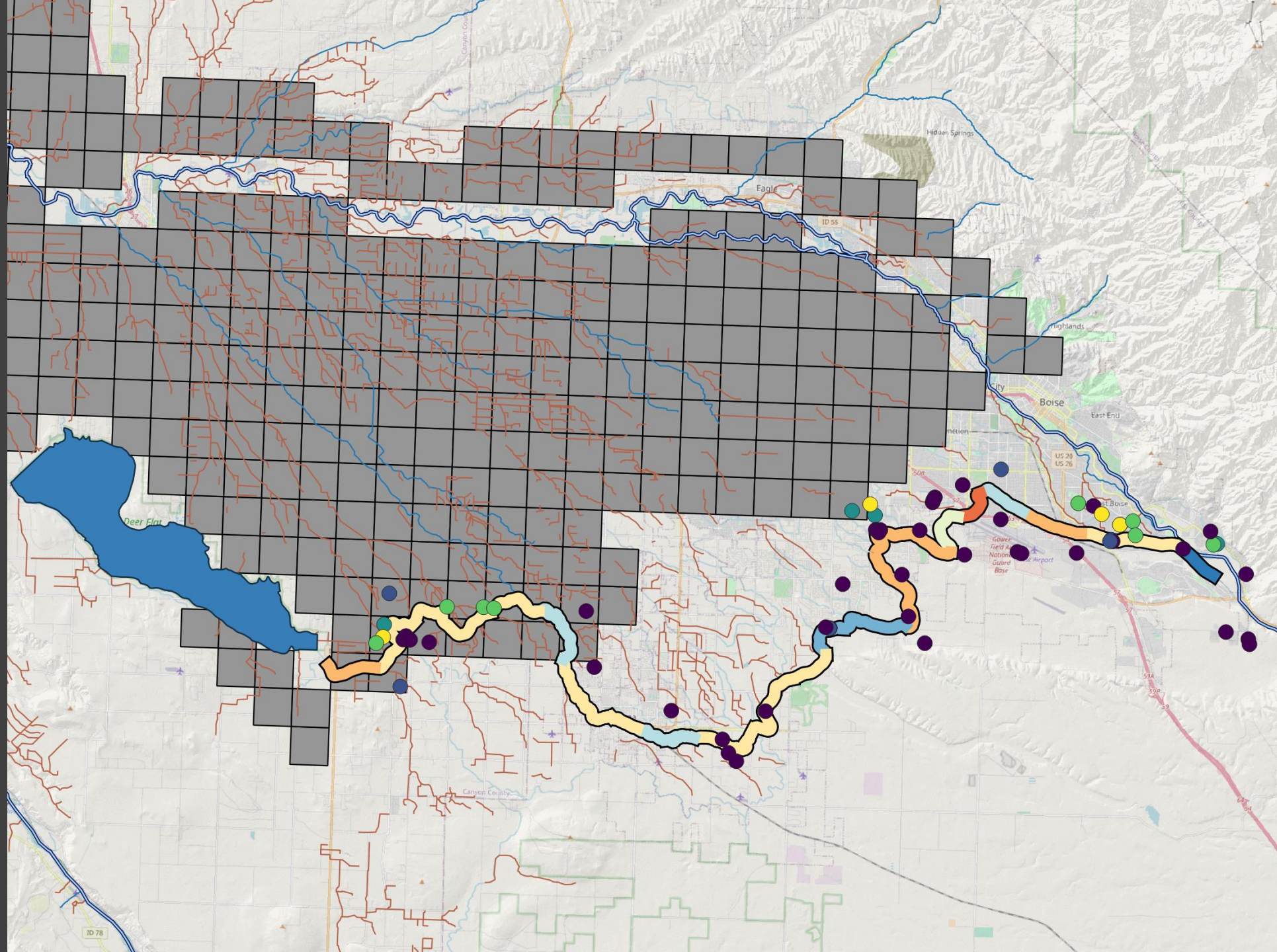

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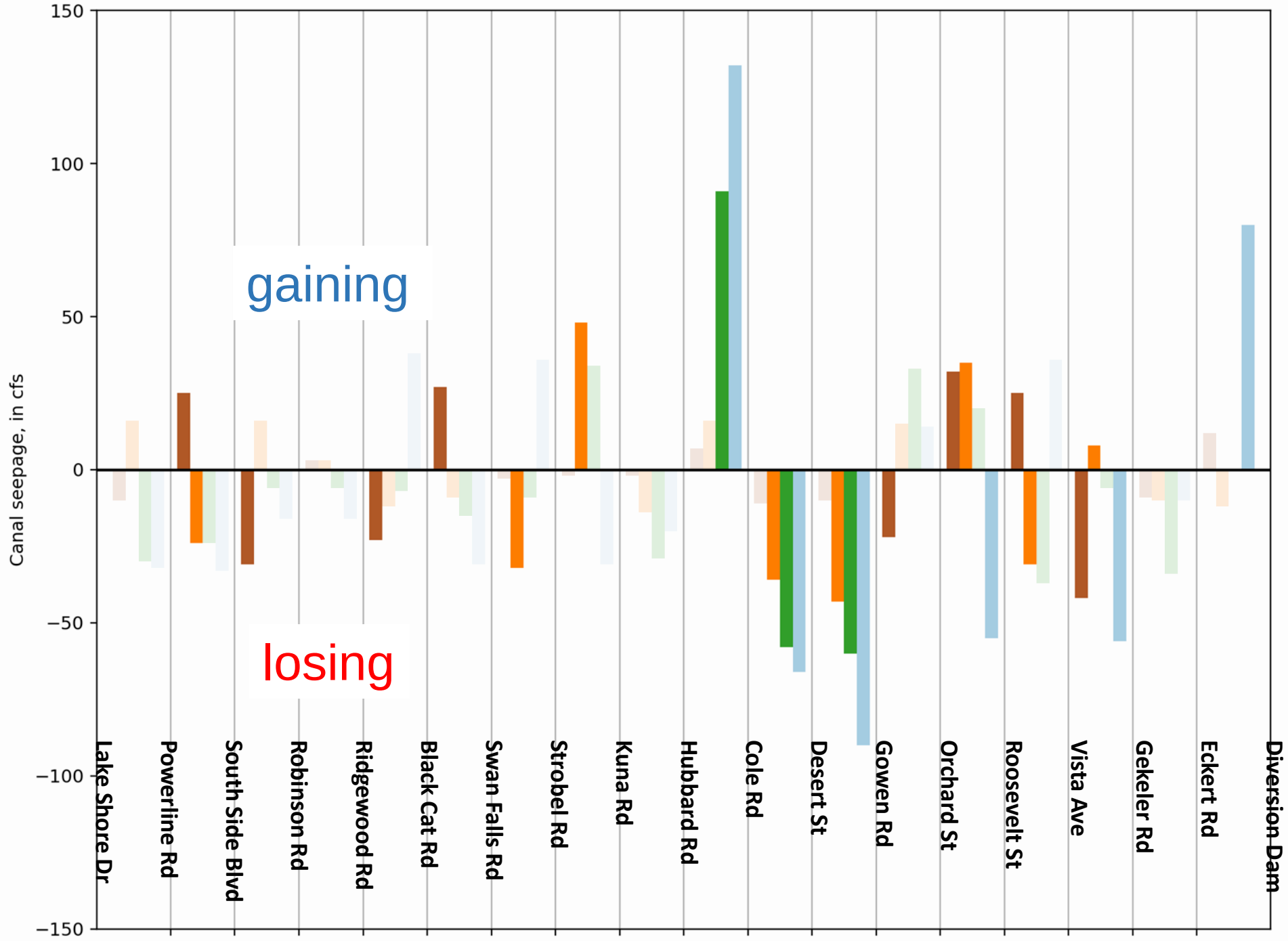

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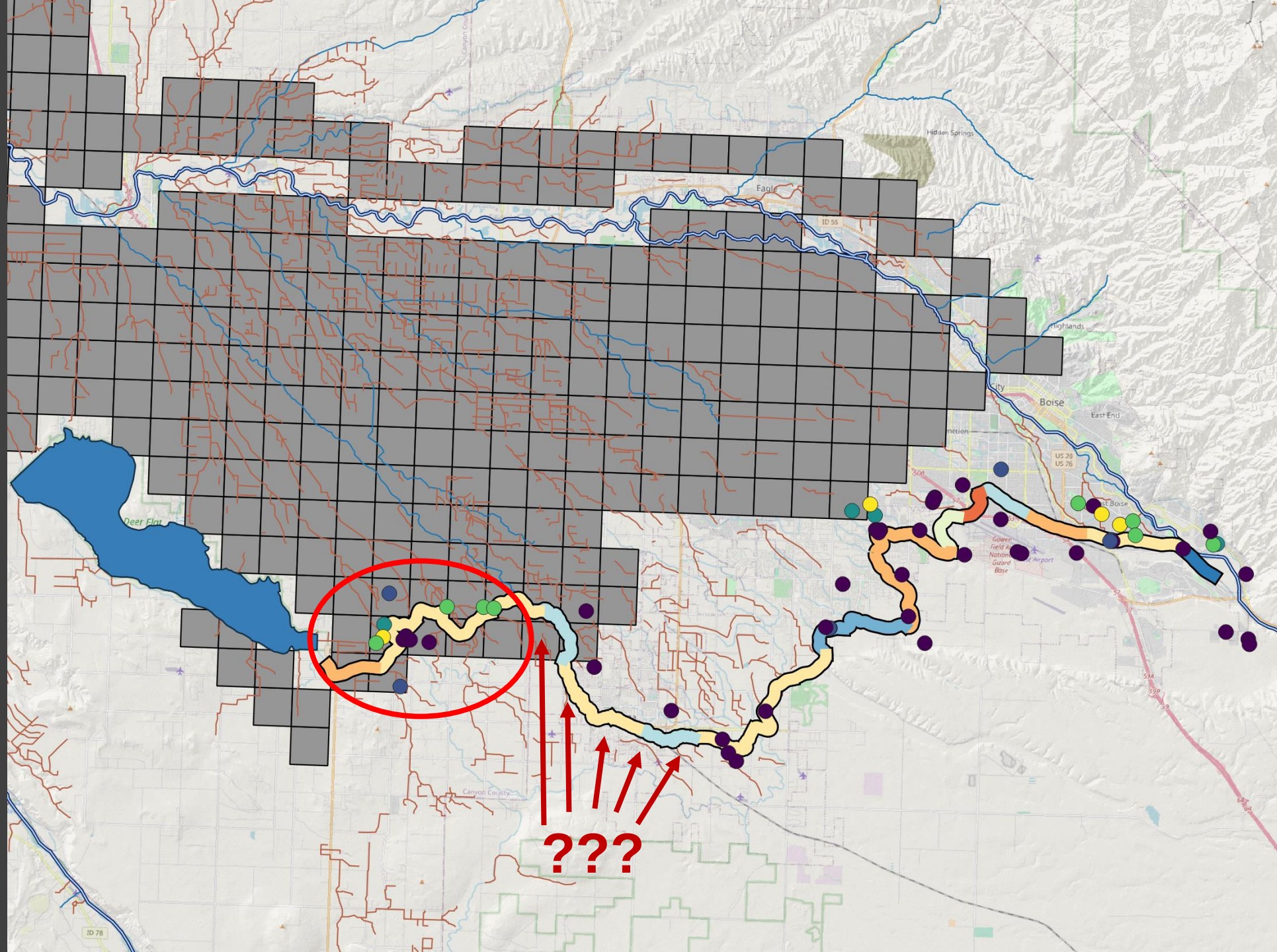
Water Levels & Drain Locations



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BPBC Lake Lowell Budget

LAKE LOWELL RESERVOIR	2015										
LATERAL	SOURCE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTO
INFLOW											
Main Canal #6	M.S.	-	-	47,525	42,193	33,226	27,545	22,535	28,703	47,199	
End Teed & Ramsey	2.7				262	376	327	420	310	360	
W.W. To Indian Creek	N.M.				422	151	51	-	-	-	
Golden W.W.	3.9				8	61	56	61	61	60	
Burke W.W.	N.M.				221	286	142	67	132	300	
Mora #1 W.W.	3.1				-	-	-	-	-	-	
Total Infeed to Canal		-	-	47,525	43,106	34,100	28,121	23,083	29,266	47,919	
LESS											
S. Nampa Feeder	N.M.				-	-	-	-	-	-	
Heron Bray Feeder	3.9				-	-	200	64	-	-	
Robinson Lateral	3.9				294	369	487	754	565	368	
Deer Flat Highline #1	M.S.				8,477	9,041	5,062	5,504	5,534	4,443	
Other											
Loss 3% Of M.C. #6		-	-	1,426	1,266	997	826	676	861	1,416	
Total Deductions		-	-	1,426	10,037	10,407	6,575	6,998	6,960	6,227	
Balance M.C. #10		-	-	46,099	33,069	23,693	21,546	16,085	22,306	41,692	
Deer Flat Highline W.W. #1	4.1				-	-	-	-	-	-	
Deer Flat Highline W.W. #3	4.1				4,527	4,006	2,421	2,426	2,684	4,119	
Garland W.W.	4.1				539	762	853	1,109	1,059	791	
Ridenbaugh Canal W.W.	N.M.				742	672	398	489	492	961	
TOTAL INFLOW		-	-	**46,099**	**38,877**	**29,133**	**25,218**	**20,109**	**26,541**	**47,563**	
OUTFLOW											
Deer Flat Lowline #1	M.S.				35,614	44,597	38,855	38,440	37,994	33,228	
Deer Flat North	M.S.				931	1,162	1,759	1,928	1,533	663	
Deer Flat Caldwell	M.S.				1,024	1,356	1,906	1,818	1,758	835	
Deer Flat Nampa	3.9				1,294	1,967	1,960	2,040	1,979	1,653	
Notus Feeder	DAYBK				-	-	-	-	-	-	
Blickenstaff Pump	4.1				-	-	397	409	61	-	
Less D.F. Nampa		-	-	-	37,569	47,115	42,917	42,595	41,346	34,726	
TOTAL OUTFLOW		-	-	-	**38,863**	**49,082**	**44,877**	**44,635**	**43,325**	**36,379**	
Storage-End Last Month		92,603	91,000	90,672	135,374	144,425	144,685	117,502	90,458	75,871	
Add Inflow		-	-	46,099	38,877	29,133	25,218	20,109	26,541	47,563	
Total Available		92,603	91,000	136,771	174,251	173,558	169,903	137,611	116,999	123,434	
Less Outflow		-	-	-	38,863	49,082	44,877	44,635	43,325	36,379	
Theoretical Storage		92,603	91,000	136,771	135,388	124,476	125,026	92,976	73,674	87,055	
Actual Storage		91,000	90,672	135,374	144,425	144,685	117,502	90,458	75,871	97,095	
Gain or Loss		(1,603)	(328)	(1,397)	9,037	20,209	(7,524)	(2,518)	2,197	10,040	
Lake Lowell Elevation		2,514.66	2,522.69	2,528.45	2,529.51	2,529.54	2,526.26	2,522.66	2,520.55	2,523.58	
Precip. for Month	L.L.	0.92	0.83	0.47	0.51	0.75	0.23	0.63	0.07	-	
Remarks											

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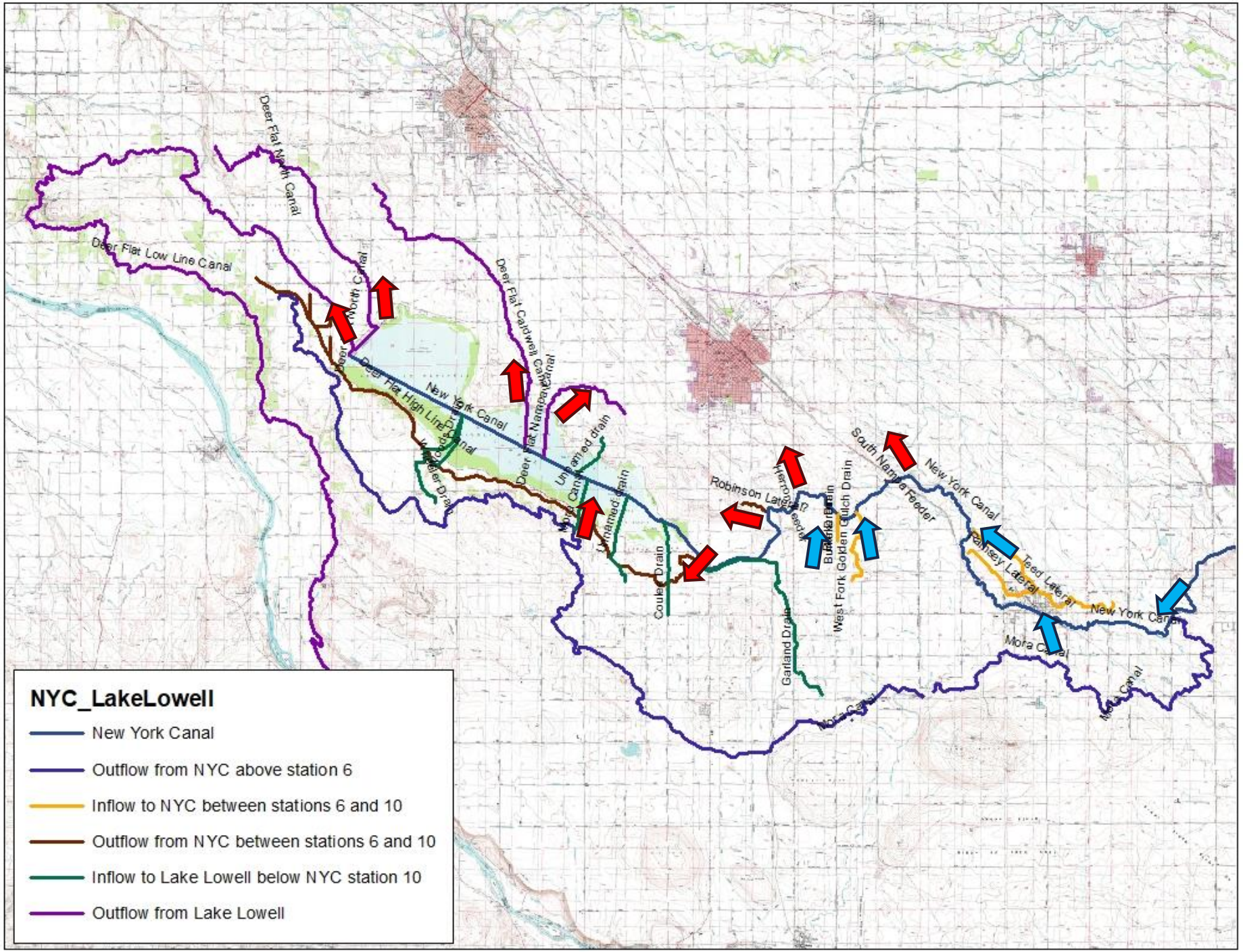
BPBC Lake Lowell Budget



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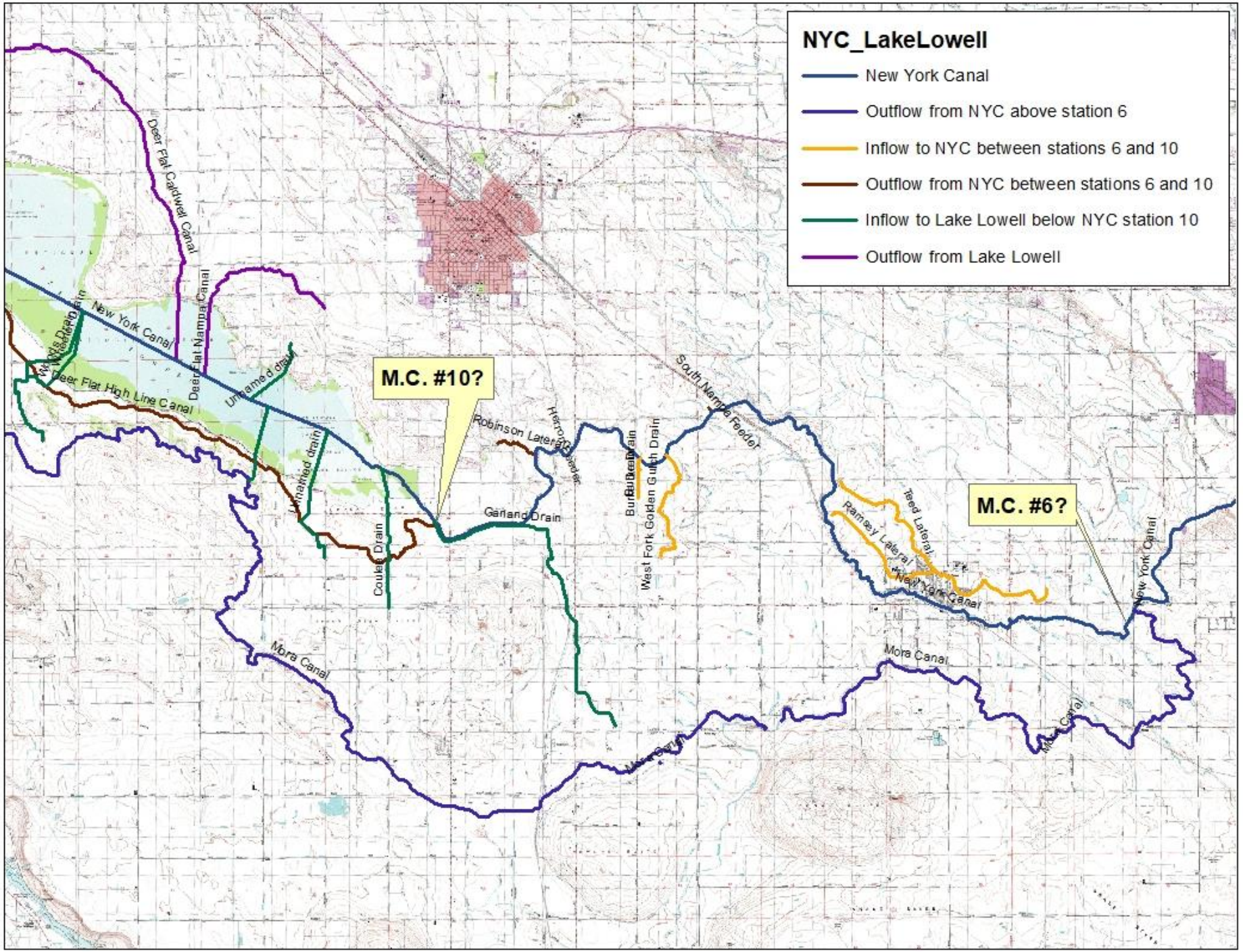

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BPBC Lake Lowell Budget

LAKE LOWELL RESERVOIR	2015				
LATERAL	SOURCE	AUGUST	SEPTEMBER	OCTOBER	TOTALS
INFLOW					
Main Canal #6	M.S.	28,703	47,199	8,702	257,628
End Teed & Ramsey	2.7	310	360	58	2,173
W.W. To Indian Creek	N.M.	-	-	-	624
Golden W.W.	3.9	61	60	-	307
Burke W.W.	N.M.	132	300	-	1,148
Mora #1 W.W.	3.1	-	-	-	-
Total Infeed to Canal		29,266	47,919	8,760	261,880
LESS					
S. Nampa Feeder	N.M.	-	-	-	-
Heron Bray Feeder	3.9	-	-	-	264
Robinson Lateral	3.9	565	368	48	2,885
Deer Flat Highline #1	M.S.	5,534	4,443	692	38,753
Other					-
Loss 3% Of M.C. #6		861	1,416	261	7,729
Total Deductions		6,960	6,227	1,001	49,631
Balance M.C. #10		22,306	41,692	7,759	212,249
Deer Flat Highline W.W. #1	4.1	-	-	-	-
Deer Flat Highline W.W. #3	4.1	2,684	4,119	205	20,388
Garland W.W.	4.1	1,059	791	105	5,218
Ridenbaugh Canal W.W.	N.M.	492	961	-	3,754
TOTAL INFLOW		**26,541**	**47,563**	**8,069**	**241,609**

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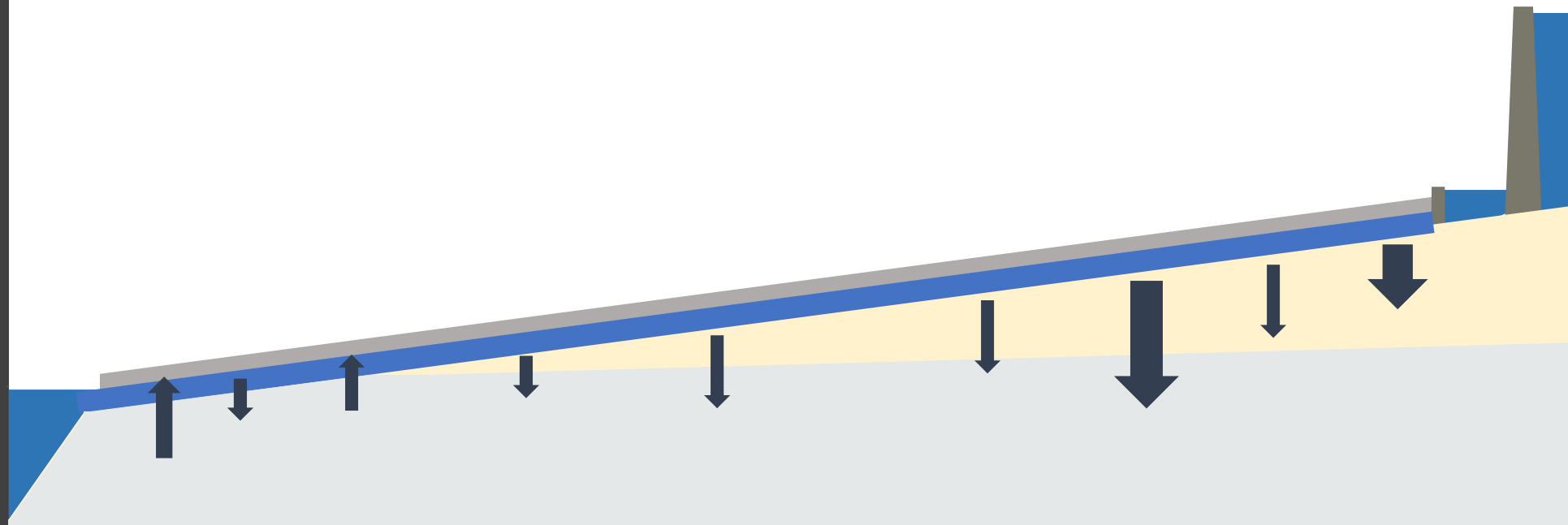
Proposal

Old Proposal: Specified Flux

- Estimate leakage rates in New York Canal cells
- Specified flux values into those cells
- ~~Gains of water in lower reaches can be captured in drain cells~~



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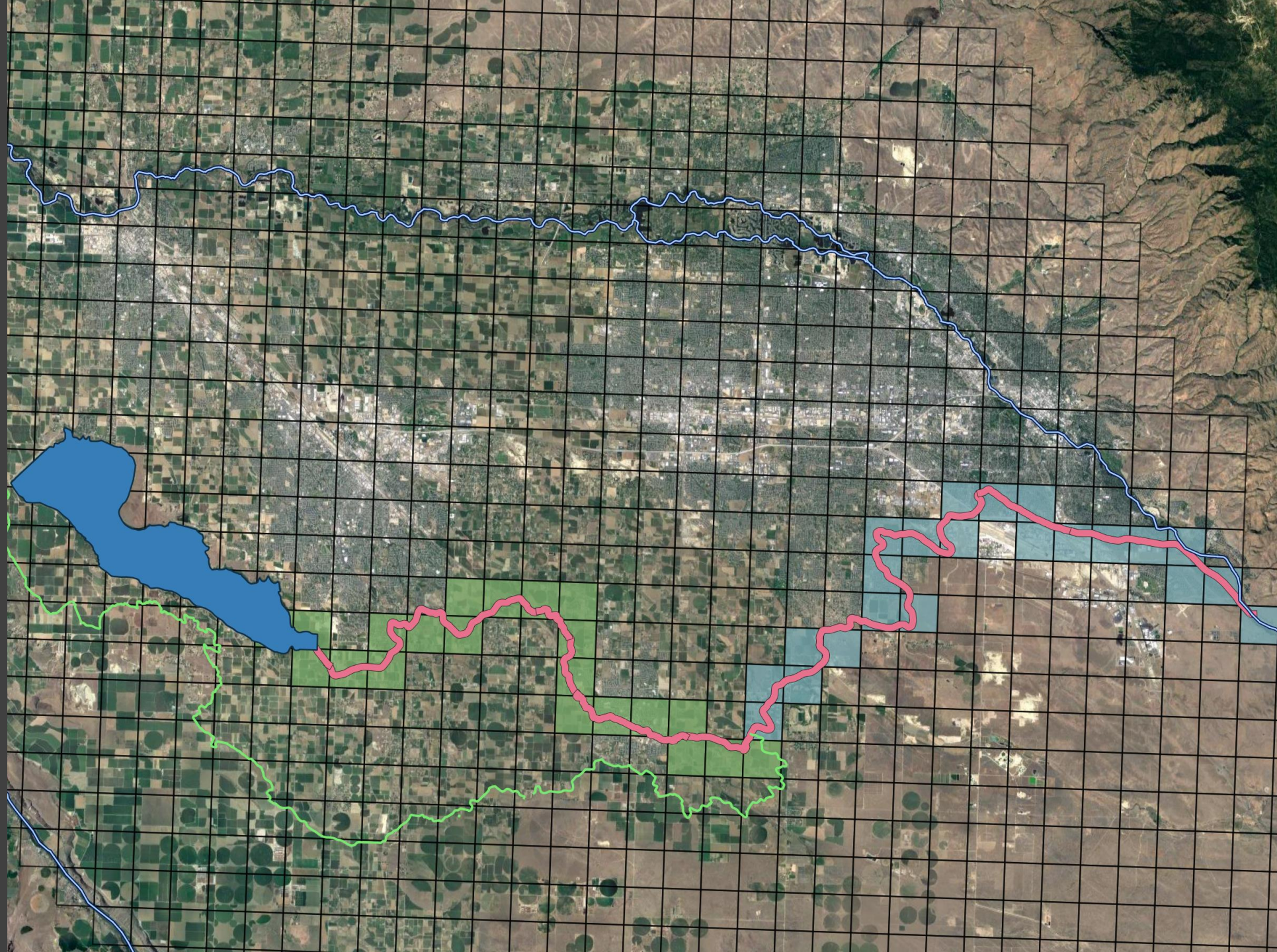
Proposal: Upper vs. Lower Canal



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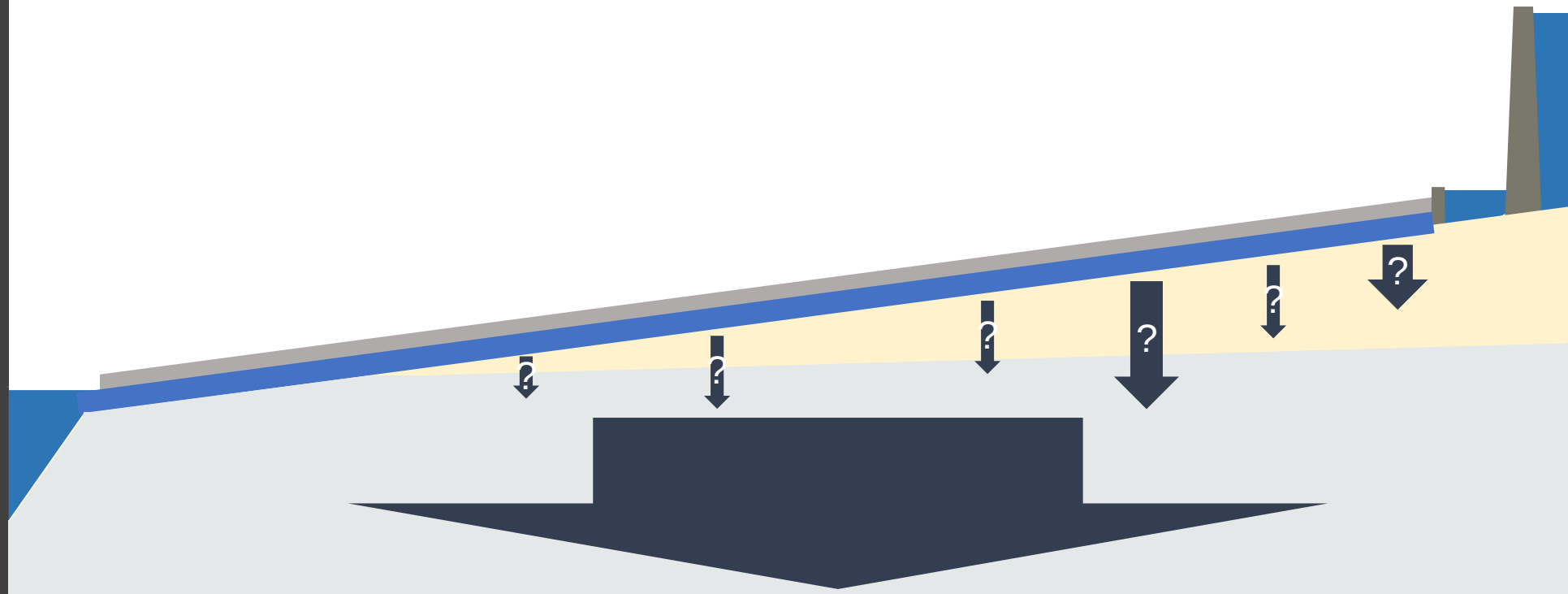
Upper Canal: Specified Flux

Uniform Spatial Distribution:
Cell flux is proportional to length of canal in cell



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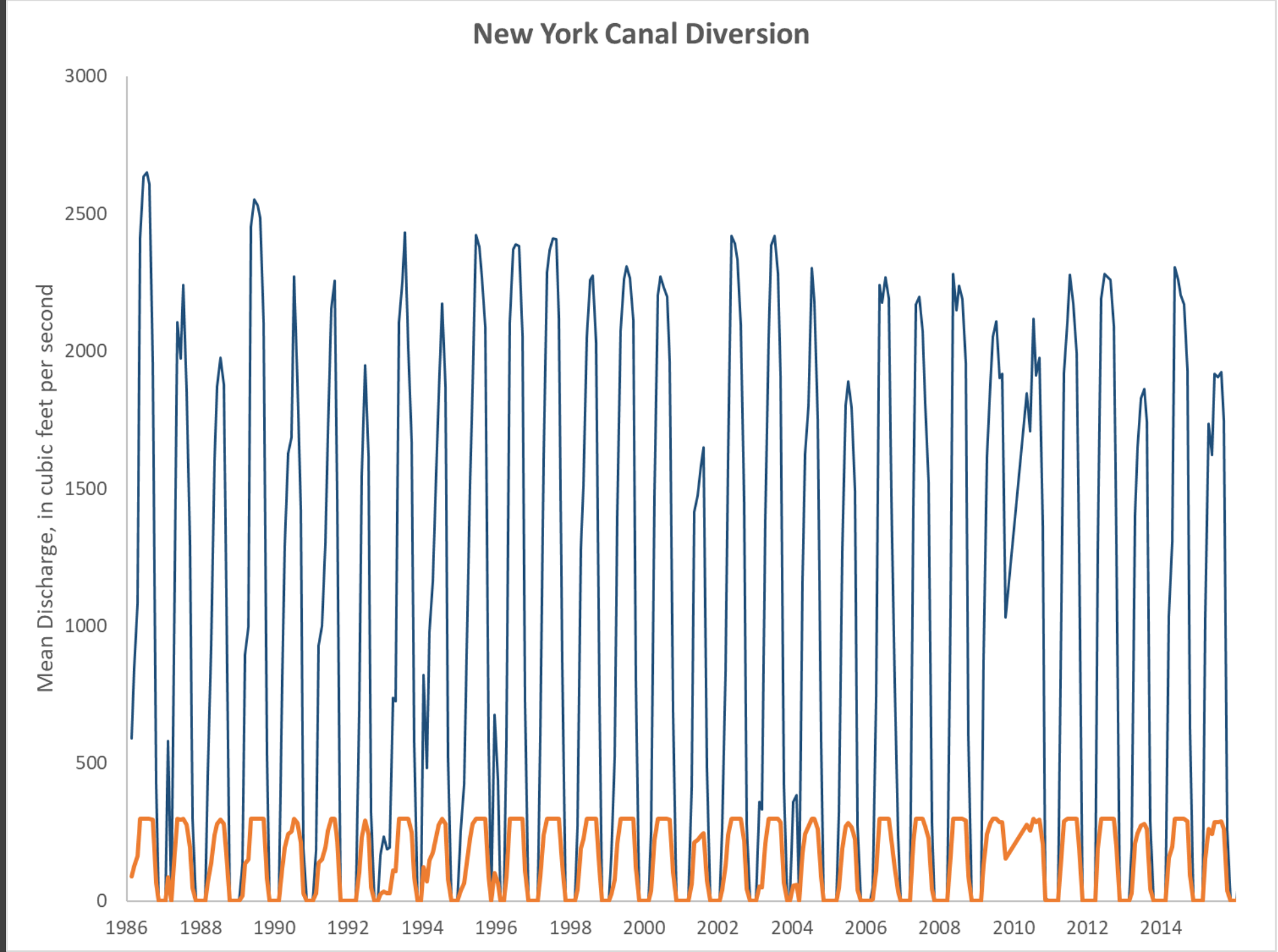
Upper Canal: Specified Flux

Rates and Temporal Variation:
Proportional to total diversion



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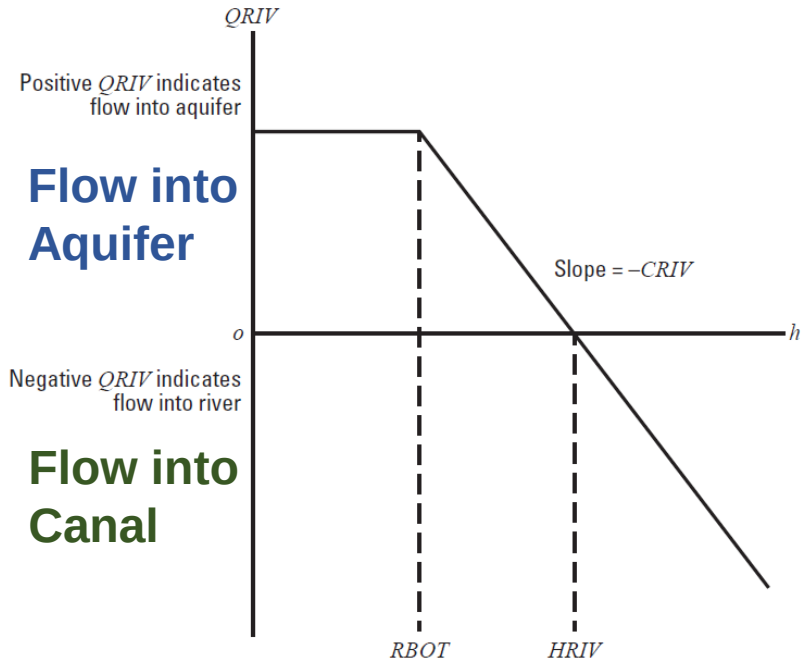
Lower Canal: 'River' boundary

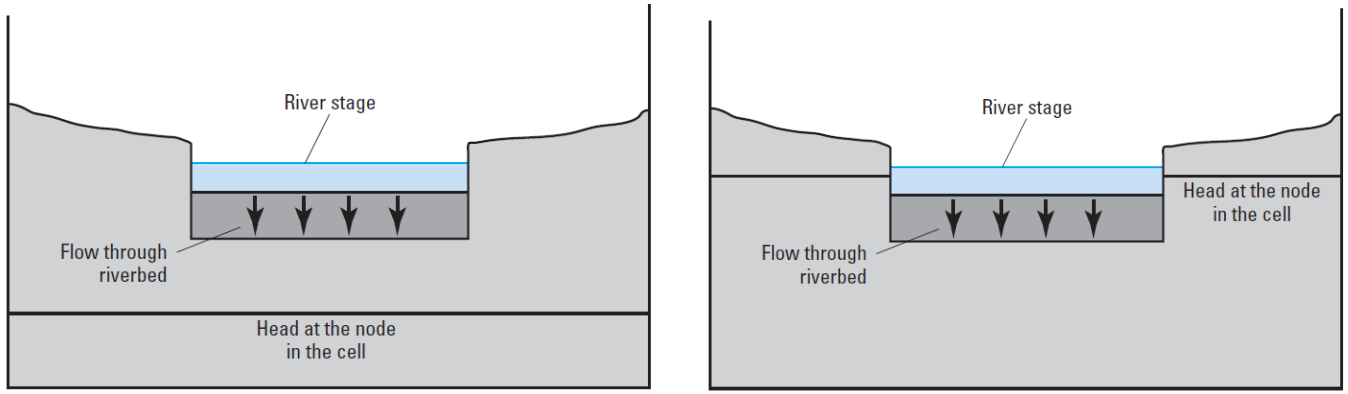
Water can flow either way

Recharge and discharge

Flow proportional to head difference when head above a certain elevation; Flow is constant when below

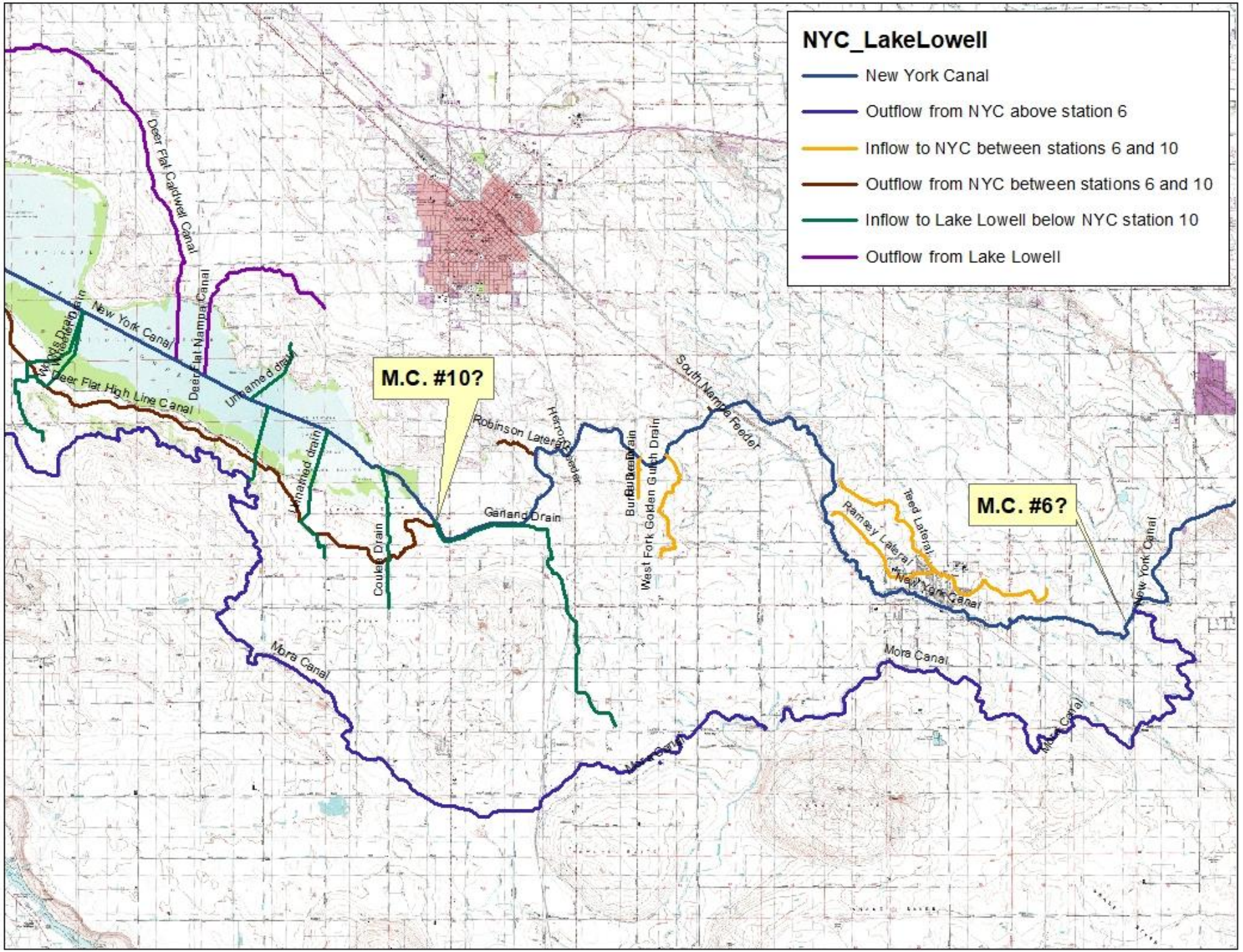
$$QRIV_{nb} = CRIV_{nb}\,(HRIV_{nb} - h_n)\,, \qquad h_n > RBOT_{nb}$$
$$QRIV_{nb} = CRIV_{nb}\,(HRIV_{nb} - RBOT_{nb})\,, \qquad h_n \le RBOT_{nb}$$





Lower Canal: ‘River’ boundary

Behave differently when canal dry versus flowing



Lower Canal: 'River' boundary

Flowing

$$QRIV_{nb} = CRIV_{nb}\,(HRIV_{nb} - h_n)\,, \qquad h_n > RBOT_{nb}$$
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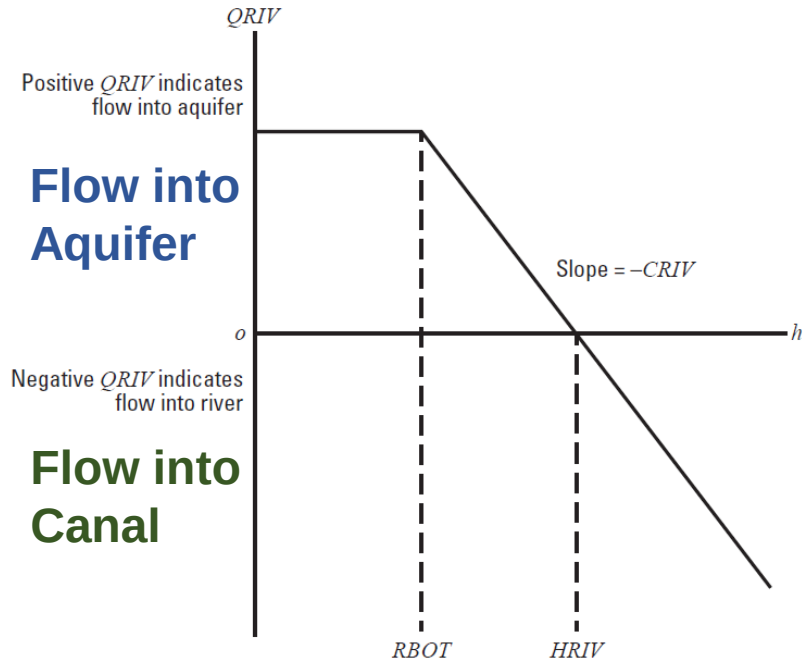
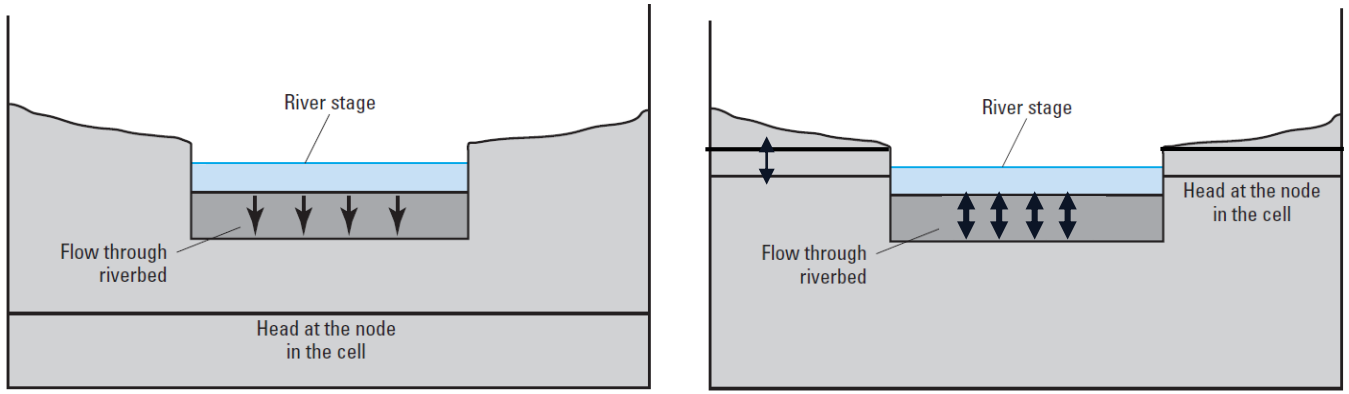


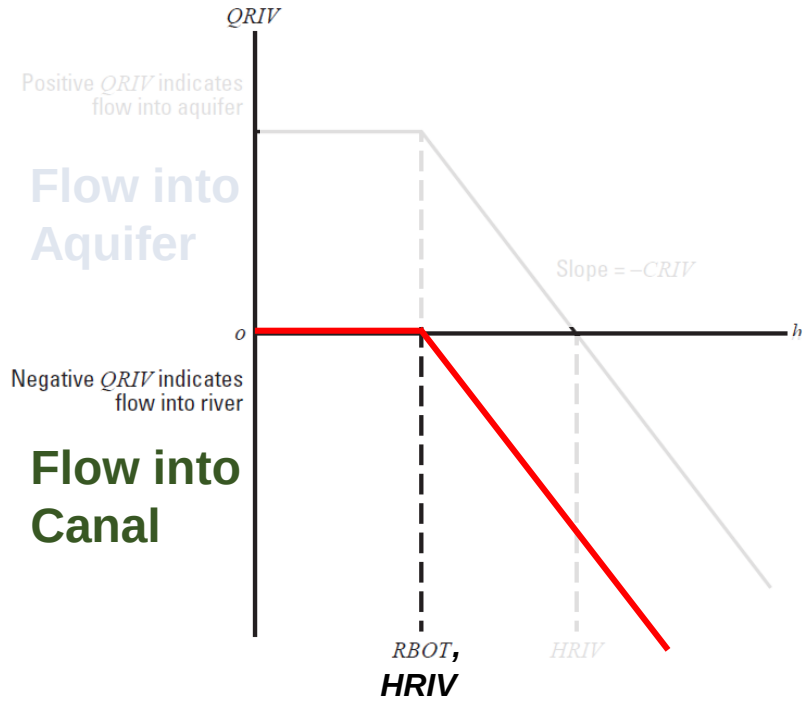


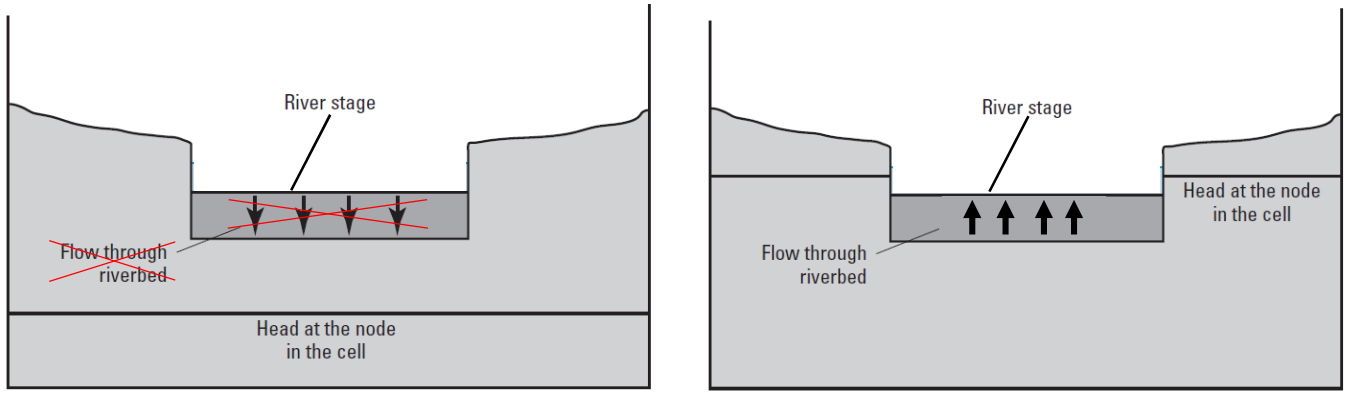
Lower Canal: 'River' boundary

Dry

$$QRIV_{nb} = CRIV_{nb}\,(HRIV_{nb} - h_n)\,, \qquad h_n > RBOT_{nb}$$

$$QRIV_{nb} = CRIV_{nb}\,(HRIV_{nb} - RBOT_{nb})\,, = 0 \qquad h_n \le RBOT_{nb}$$

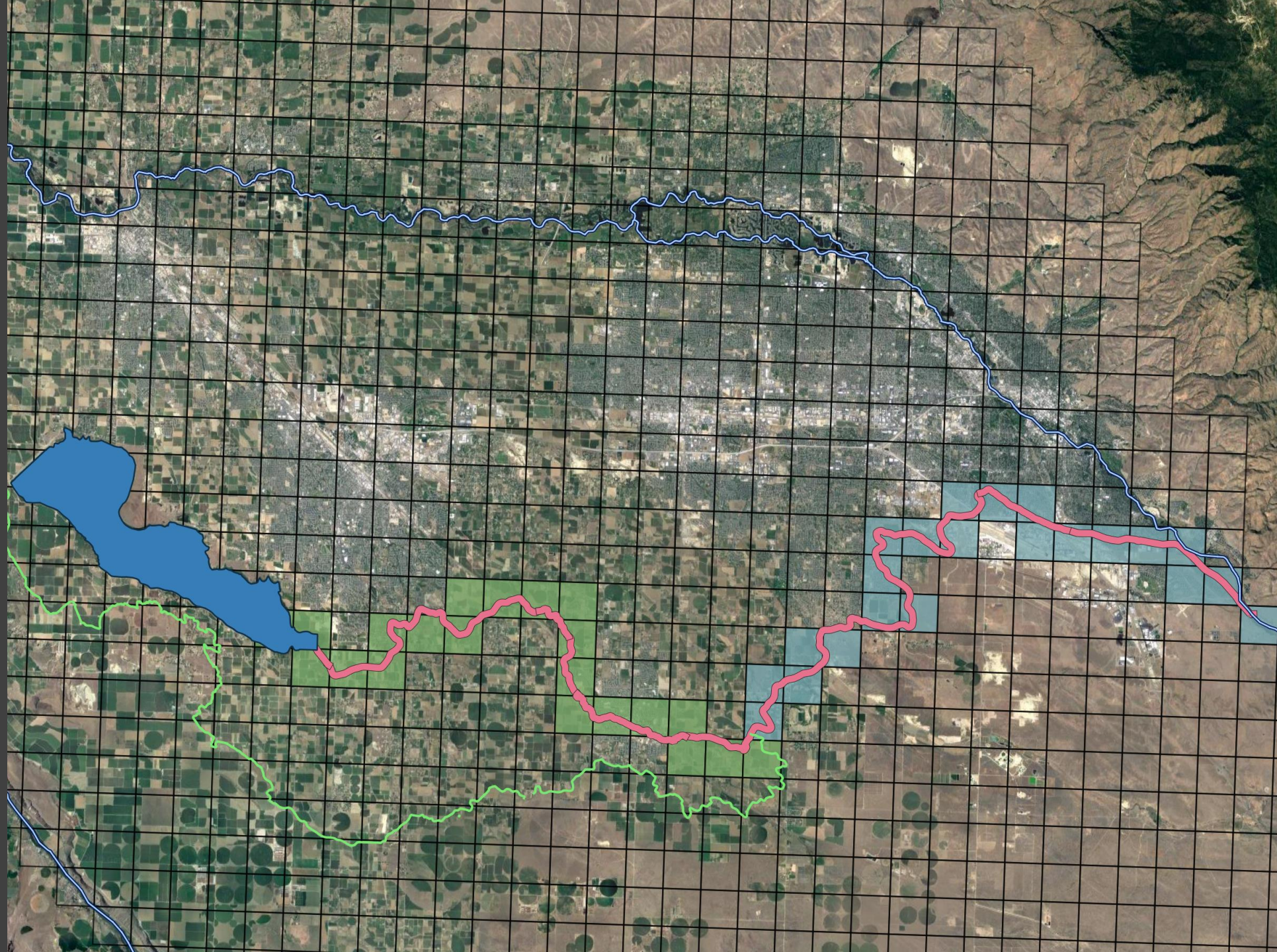




Summary

Upper:
- specified flux (WEL) boundary
- rate as percentage of diversion

Lower:
- head-dependent flux (RIV) boundary
- remove drain cells
- losing or gaining, varies with head
- no losses when dry
- net flux target as 3% of flow blw Mora



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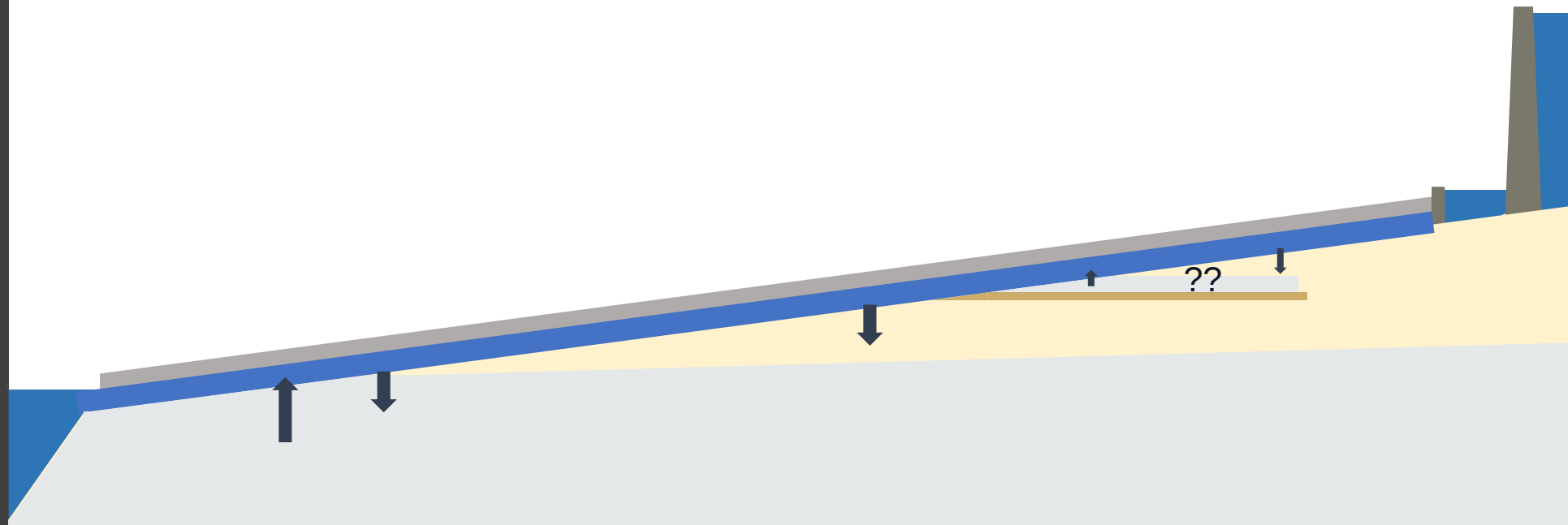

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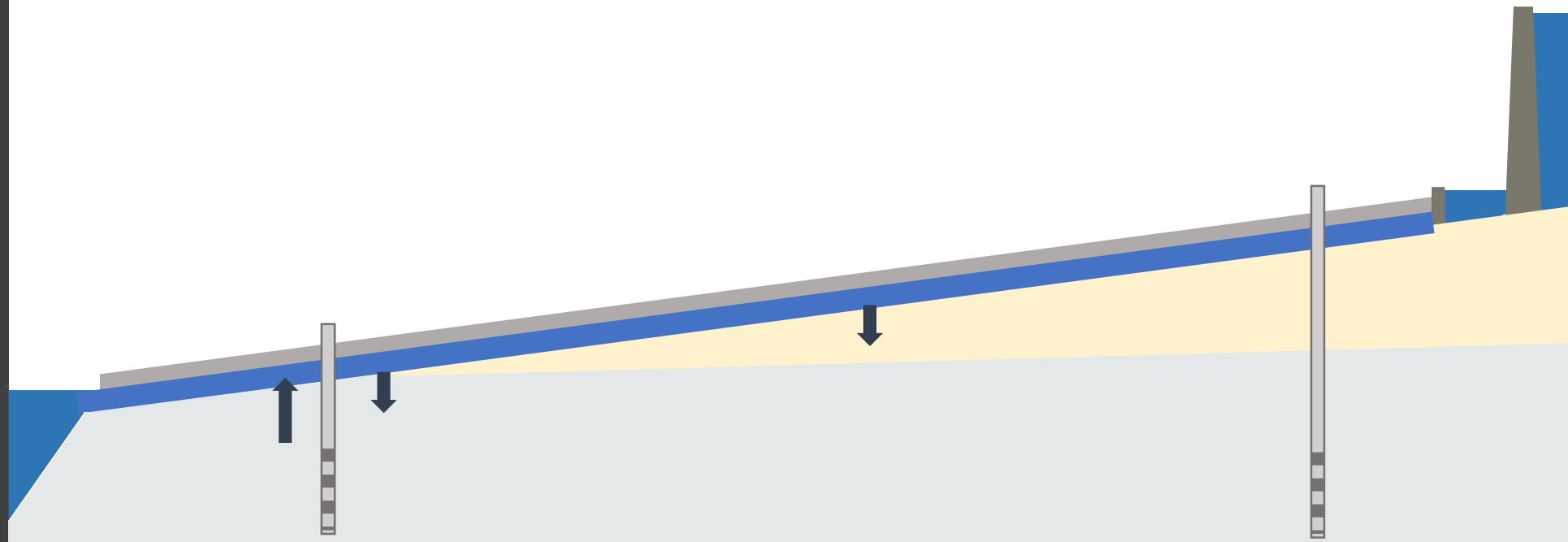

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Golden W.W.	3.9	61	60	-	307
Burke W.W.	N.M.	132	300	-	1,148
Mora #1 W.W.	3.1	-	-	-	-
Total Infeed to Canal		29,266	47,919	8,760	261,880
LESS					
S. Nampa Feeder	N.M.	-	-	-	-
Heron Bray Feeder	3.9	-	-	-	264
Robinson Lateral	3.9	565	368	48	2,885
Deer Flat Highline #1	M.S.	5,534	4,443	692	38,753
Other					-
Loss 3% Of M.C. #6		861	1,416	261	7,729
Total Deductions		6,960	6,227	1.,001	49,631
Balance M.C. #10		22,306	41,692	7,759	212,249
Deer Flat Highline W.W. #1	4.1	-	-	-	-
Deer Flat Highline W.W. #3	4.1	2,684	4,119	205	20,388
Garland W.W.	4.1	1,059	791	105	5,218
Ridenbaugh Canal W.W.	N.M.	492	961	-	3,754
TOTAL INFLOW		**26,541**	**47,563**	**8,069**	**241,609**

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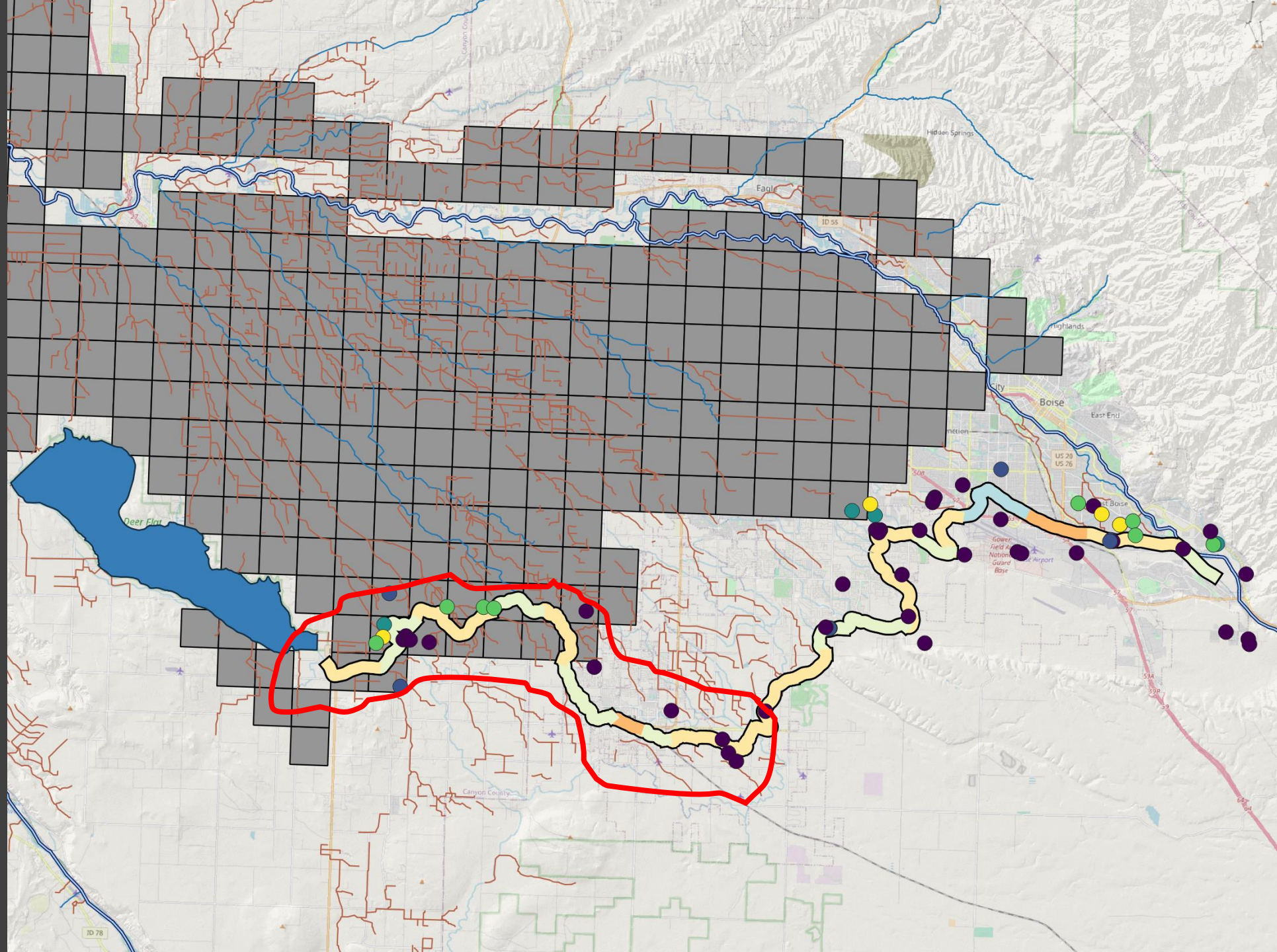
Seepage Measurements

January 28-29, 2004



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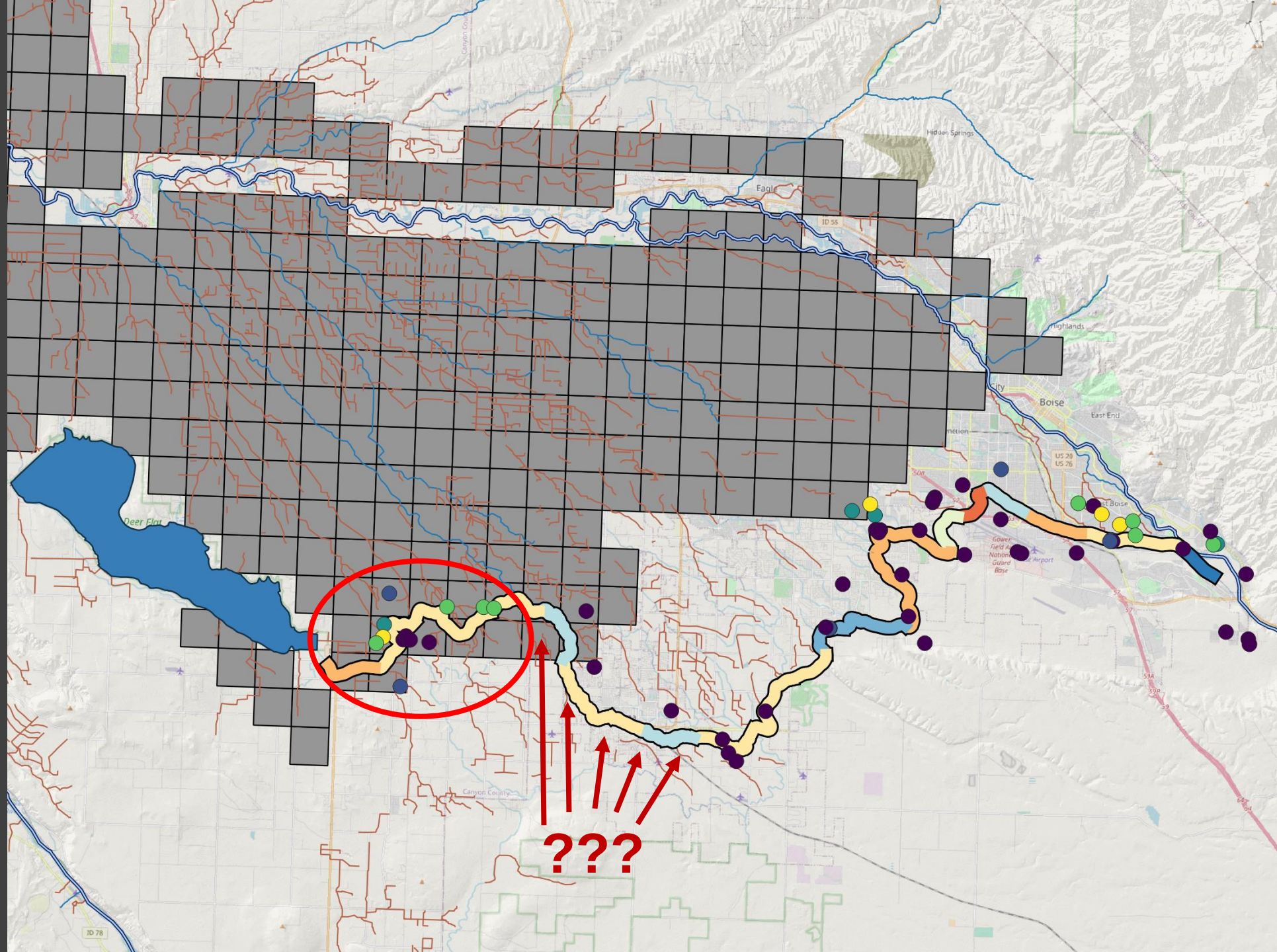
Data: Water Levels



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Considerations

In choosing how to represent the NY Canal

What is our **conceptual** understanding of the system?

What **data** do we have to support conceptual understanding and numerical representation?

What **model output and scenarios** will depend on this component of the model?

How does this affect the rest of the model & **other model objectives**?

How much **time and effort** will this take to implement?

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Thanks for listening!

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