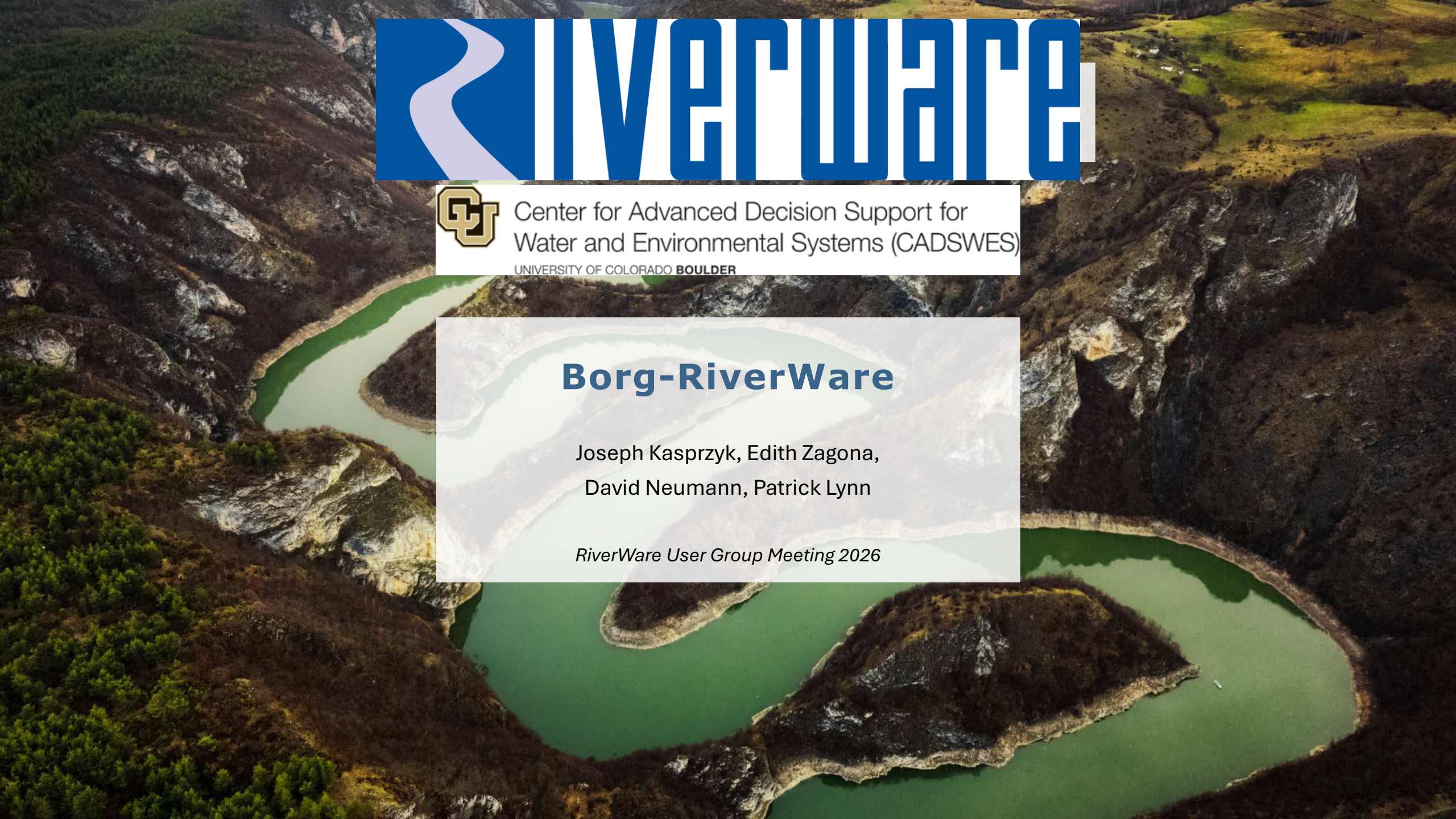


RiverWare

Center for Advanced Decision Support for Water and Environmental Systems (CADSWES)

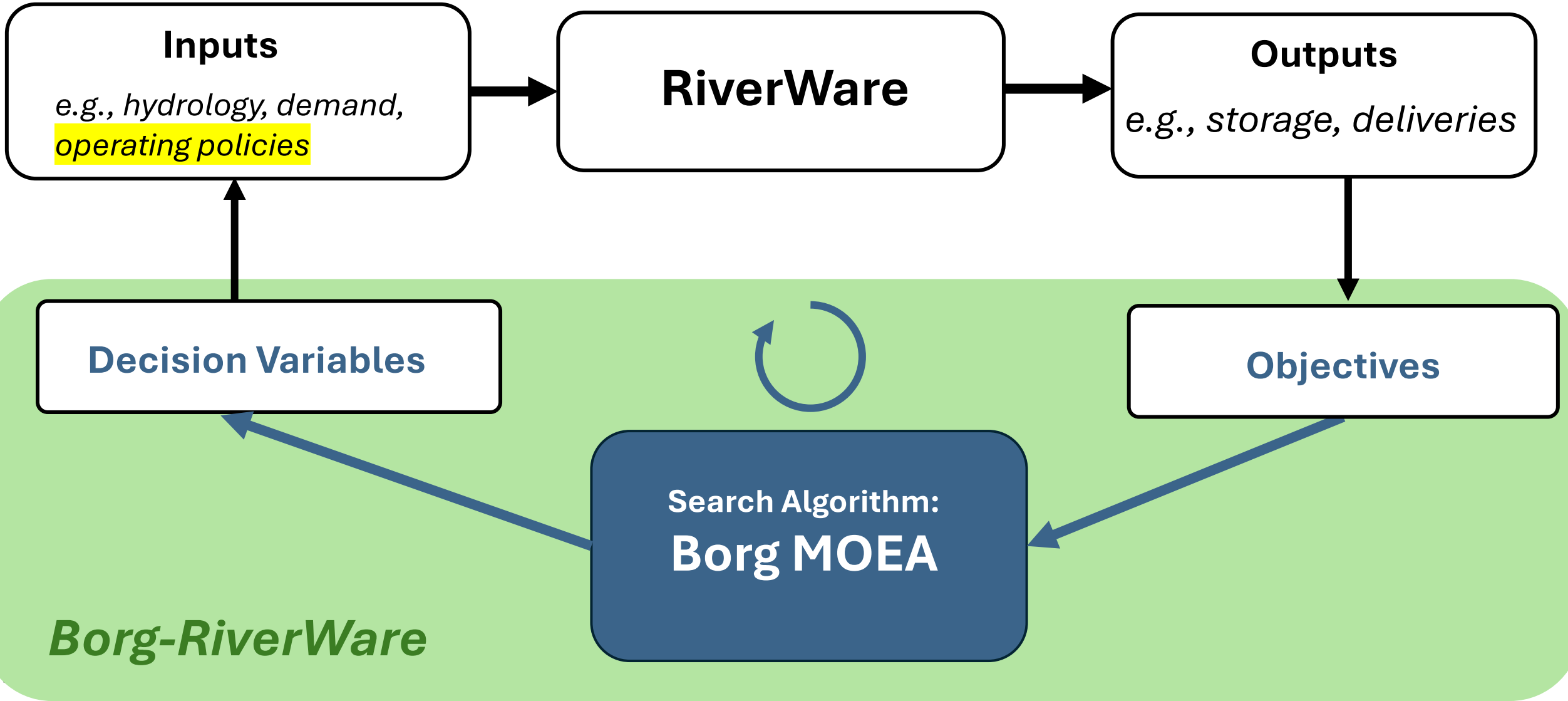
UNIVERSITY OF COLORADO **BOULDER**

Borg-RiverWare

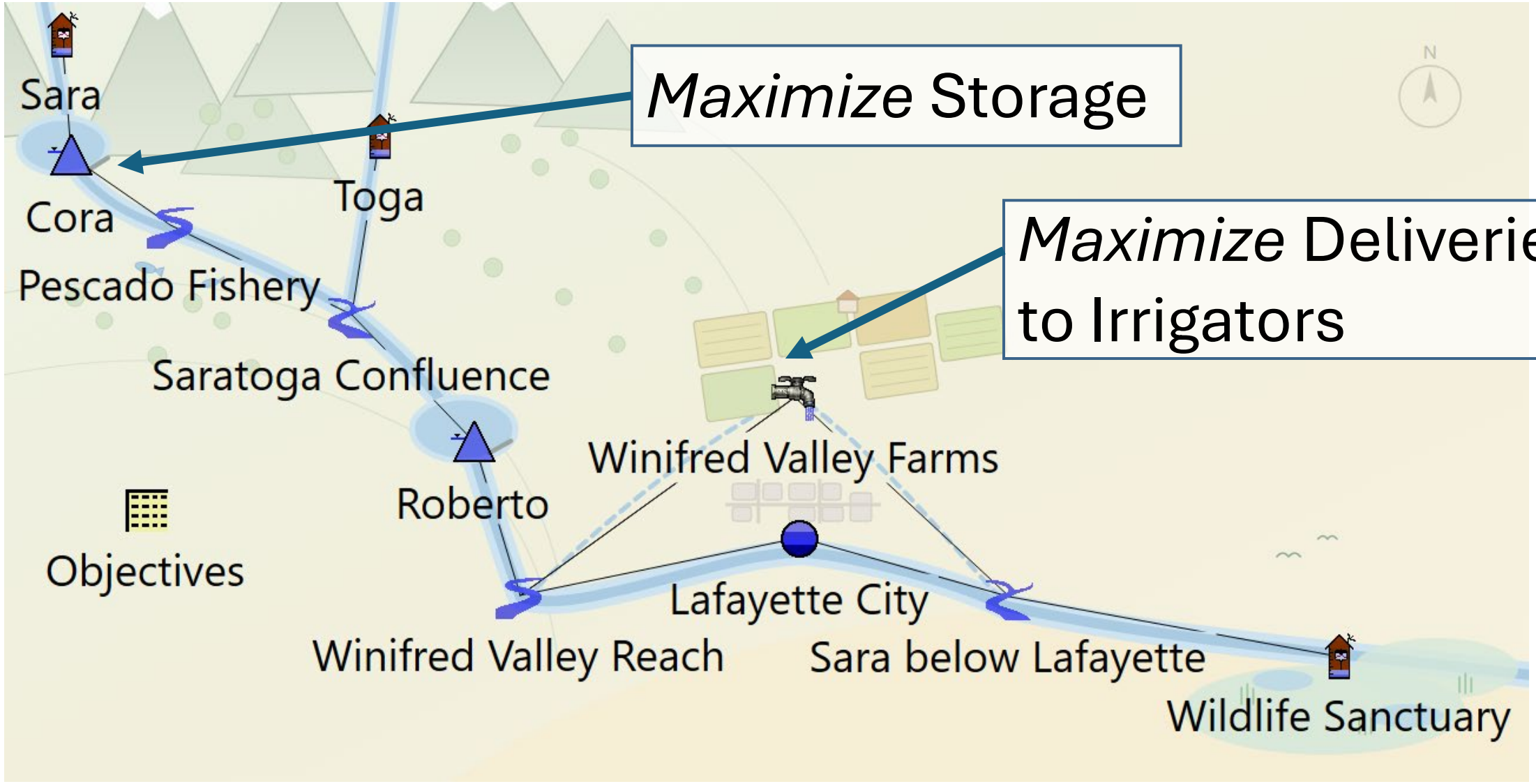
Joseph Kasprzyk, Edith Zagona,
David Neumann, Patrick Lynn

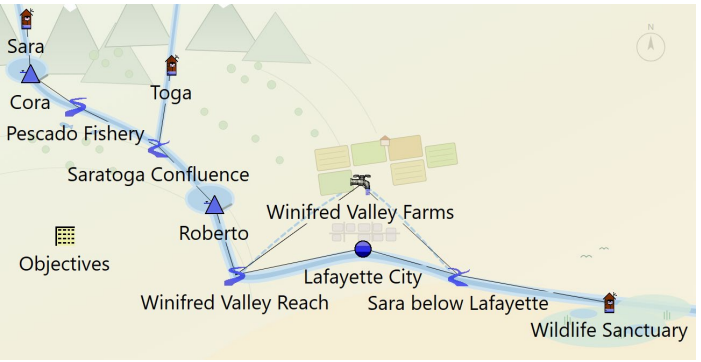
RiverWare User Group Meeting 2026

Borg-RiverWare is software that searches for policies that perform well in multiple objectives.



Example: Two Conflicting Objectives





Parallel Coordinates plot: balancing objectives

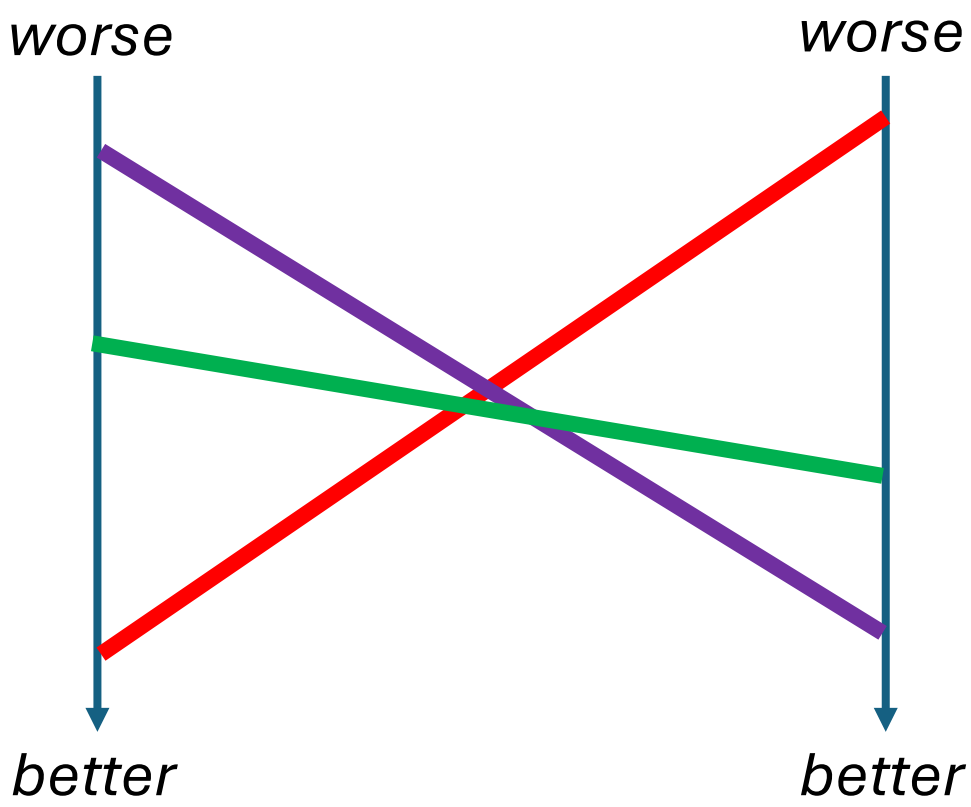
Solution A: *high shortages, to protect storage*

Solution B: *no shortages*

Solution C: *compromise*

Maximize Storage

Maximize Deliveries to Irrigators



RiverWare

Use Borg-RiverWare in 5 easy steps!

1. Build a rule-based simulation model

- A custom table slot
- Referenced in a rule
- With hand-created values

	Pool Elevation m	Shortage Fraction decimal
0: No Restrictions	2,173.00	0.00
1: Level 1 Restrictions	2,154.00	0.15
2: Level 2 Restrictions	2,144.00	0.18
3: Dead Pool	2,140.00	1.00

2. Modify the model to prepare for search: **decisions**

	Pool Elevation m	Shortage Fraction decimal
0: No Restrictions	2,173.00	0.00
1: Level 1 Restrictions	2,154.00	0.15
2: Level 2 Restrictions	2,144.00	0.18
3: Dead Pool	2,140.00	1.00

*Pool Elevation and Shortage Fraction values are designated as **decision slots***

Decision slots define the policy:
Level 1 at 2160, 0.05 shortage
Level 2 at 2145, 0.20 shortage
or
Level 1 at 2170, 0.10 shortage
Level 2 at 2160, 0.30 shortage
etc

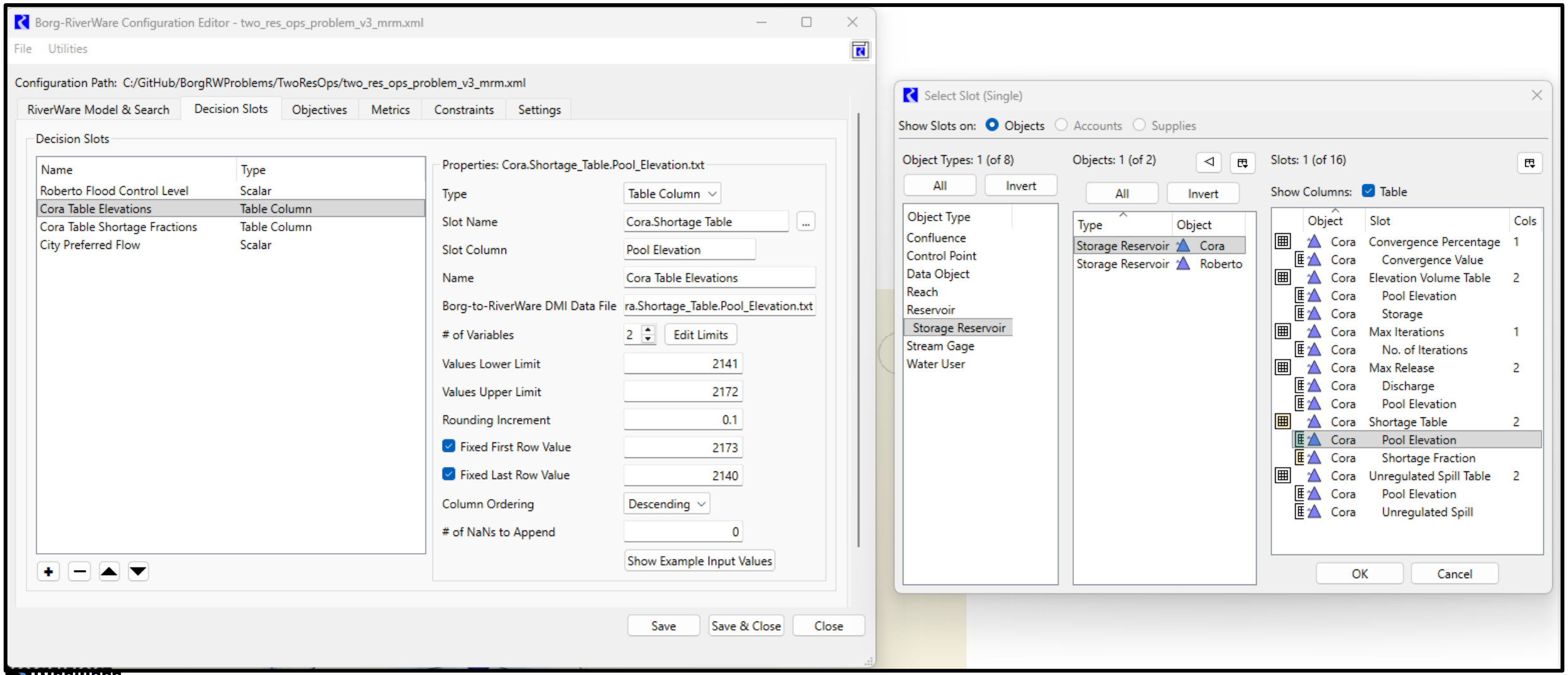
2. Modify the model to prepare for search: **objectives**

Calculations made within scalar expression slots:

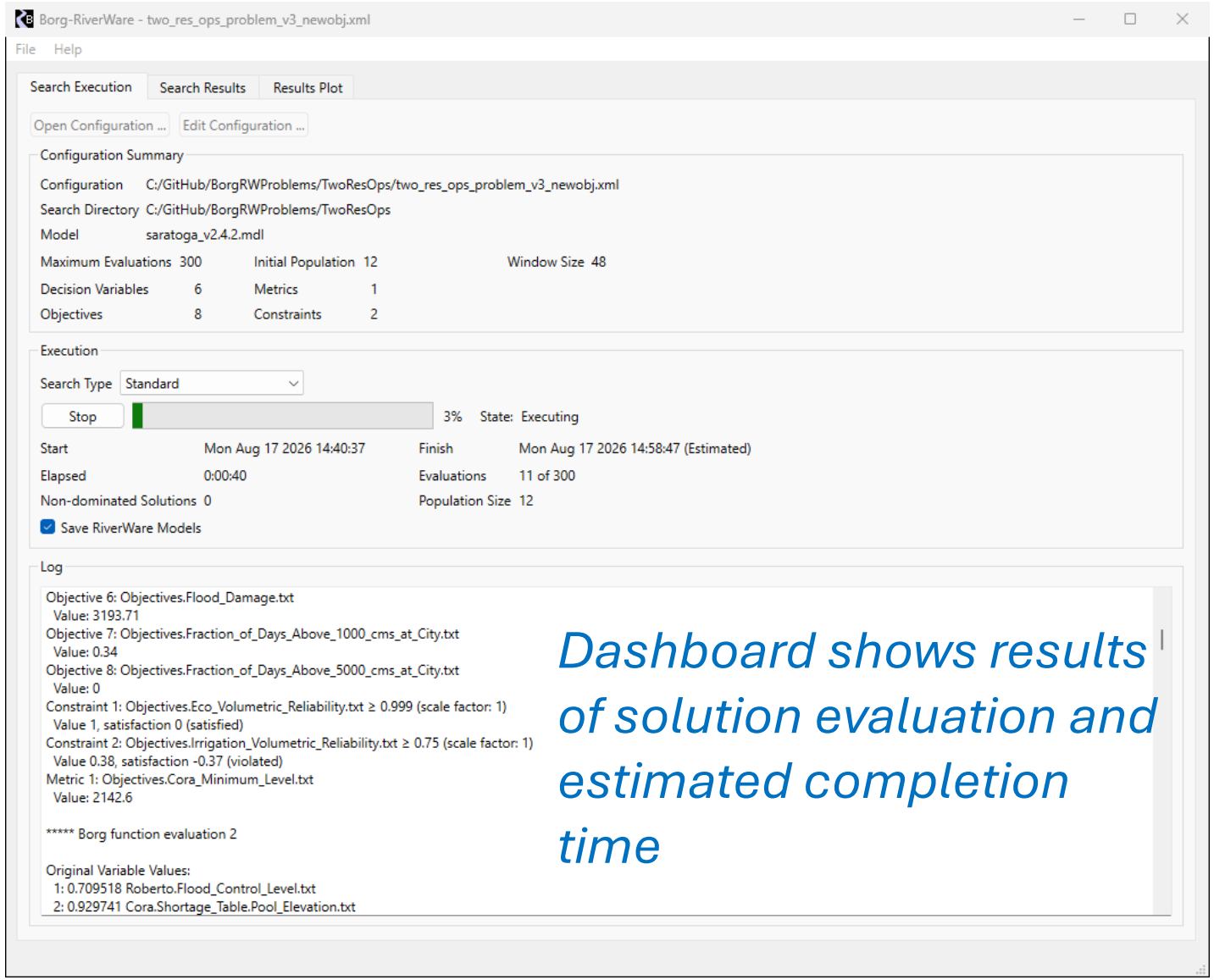
sense	Objective	Description
maximize	Cora Avg Storage	Maximize the average storage, in volume units, across the simulation

sense	Objective	Description
maximize	Irrigation Volumetric Reliability	Maximize the proportion of Winifred Valley Irrigators' Diversion Request that was actually received

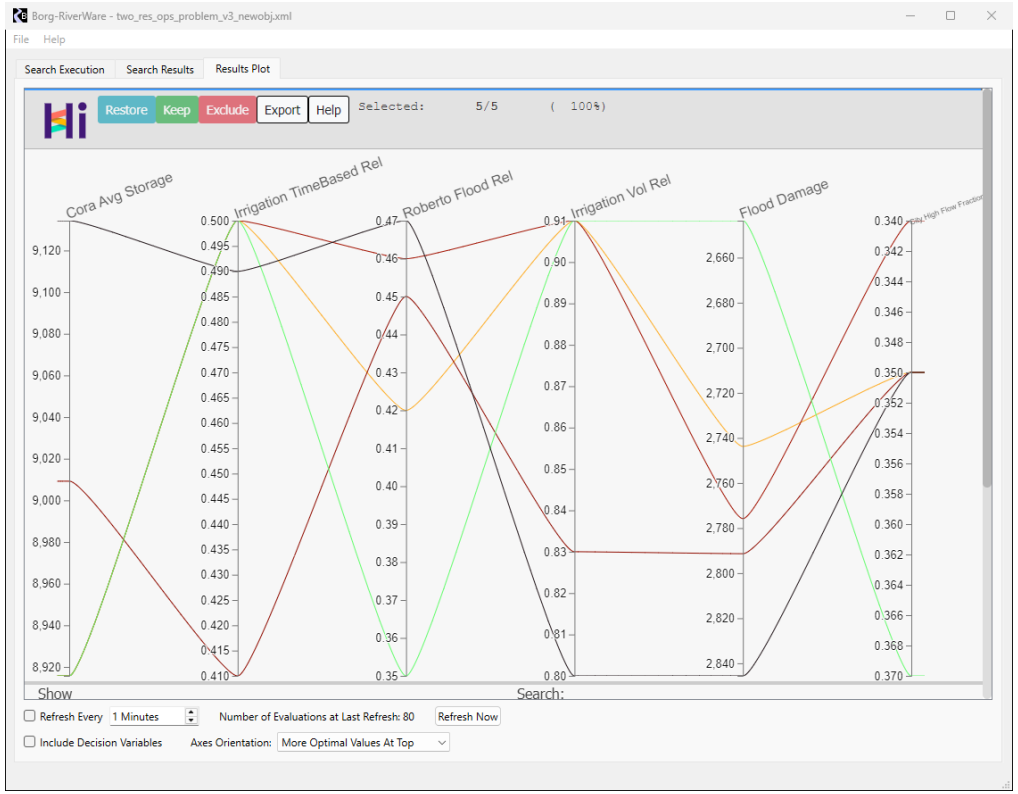
3. Create the search configuration using the **Configuration Editor** in RiverWare



4. Perform the search in the Borg-RiverWare program



Dashboard shows results of solution evaluation and estimated completion time



An interactive parallel coordinate plot is also visible during the search

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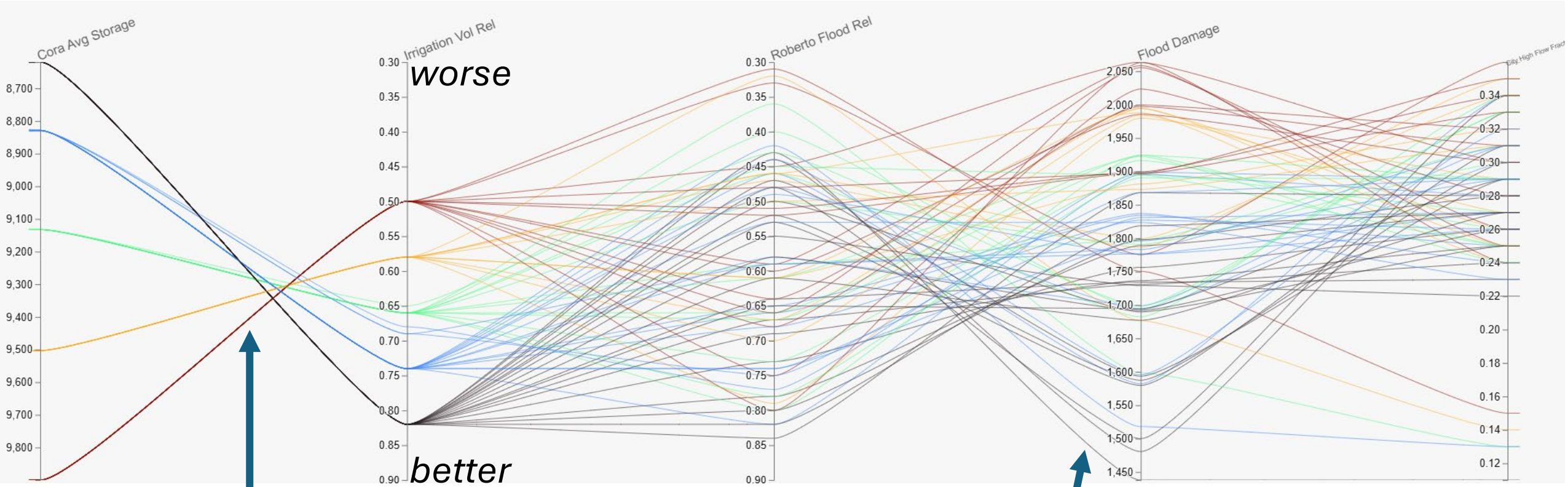
5. Analyze results: **tradeoffs**

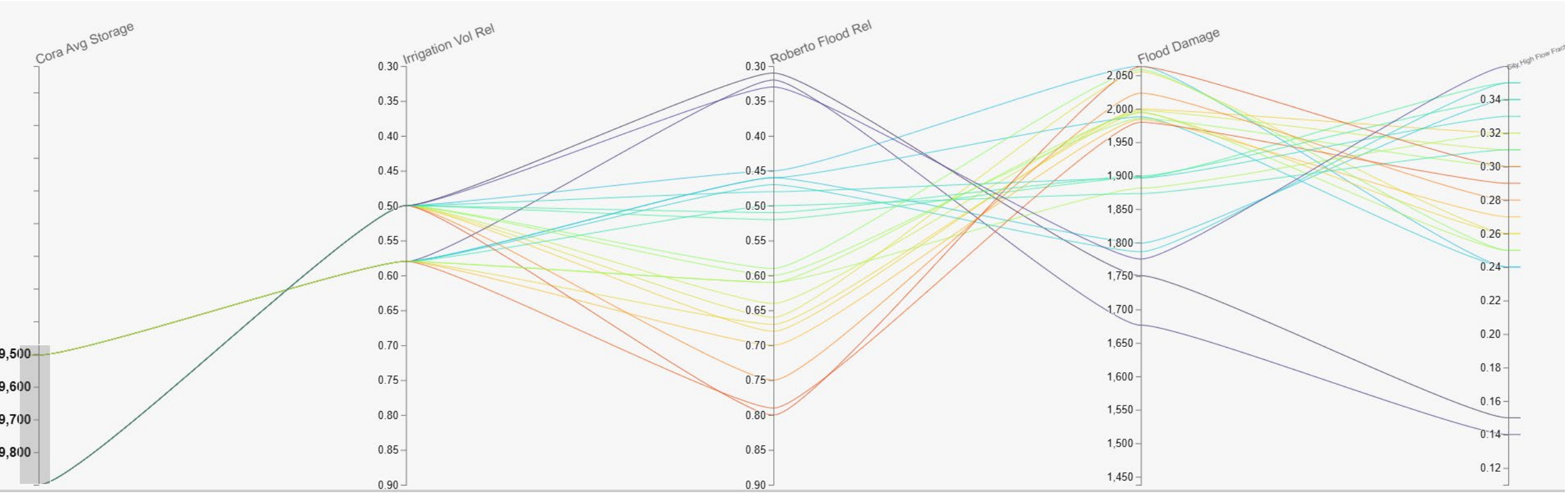


Conflict between:
Maximize Storage
and
Maximize Deliveries

Dark blue colored solutions reveal relationship between protecting reservoir storage and preventing downstream flooding

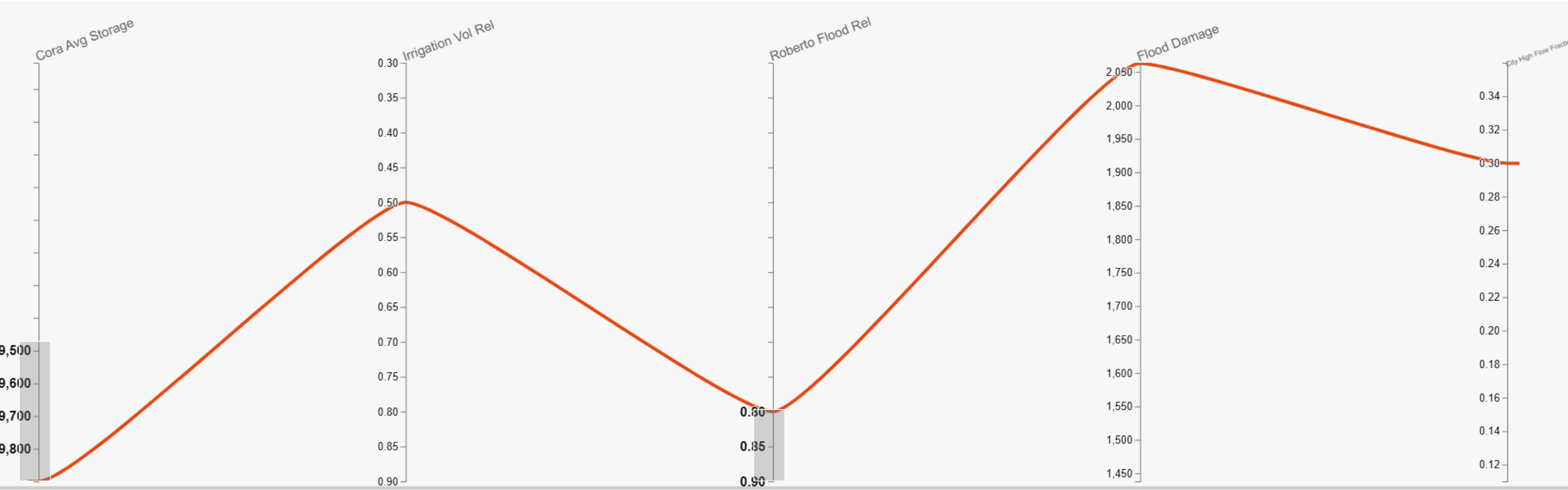
RiverWare

5. Analyze results: **brushing**



Drag the mouse on the ‘Cora Avg Storage’ objective to isolate solutions with > 9500 MCM average storage

5. Analyze results: **view individual solution**



Show 10 entries

Search:

Solution ID	Roberto Flood Control Level	Cora Table Elevations Var 1	Cora Table Elevations Var 2	Cora Table Shortage Fractions Var 1	Cora Table Shortage Fractions Var 2	City Preferred Flow	Cora Avg Storage	Roberto Flood Rel	Irrigation Vol Rel	Flood Damage	City High Flow Fraction	Cora Minimum Level
2334	1872	2153	2145	0.01	0.01	2000	9899.73	0.8	0.5	2062.87	0.2999999999999999	2141.91

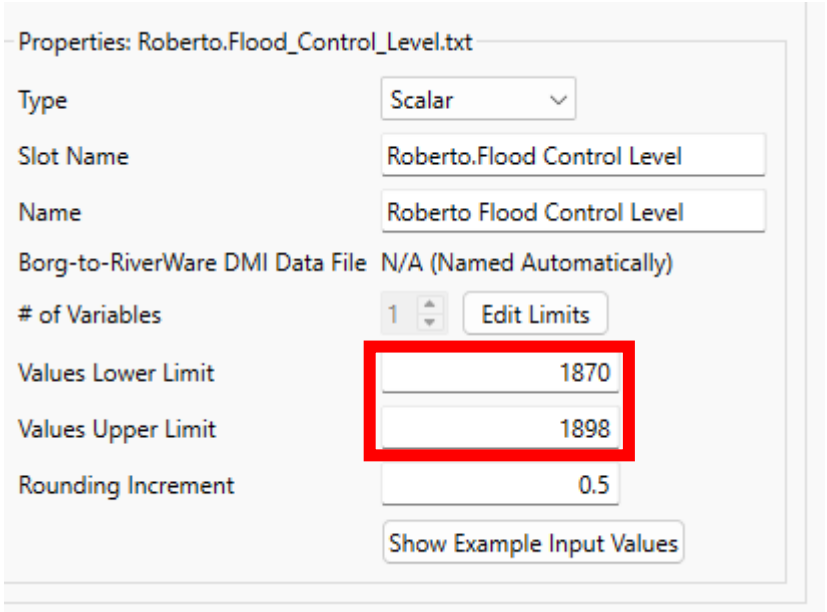
Showing 1 to 1 of 1 entries

Previous 1 Next

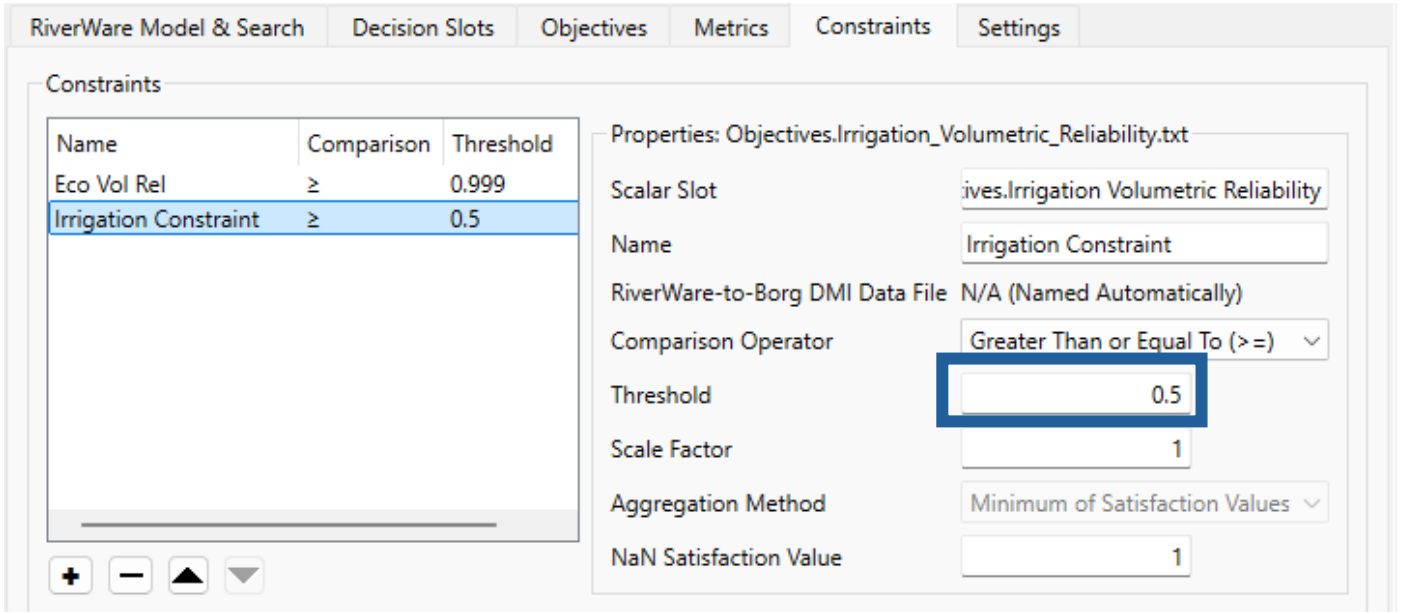
Borg-RiverWare supports **saving solution model files** so you can load the model into RiverWare for further analysis!

RiverWare

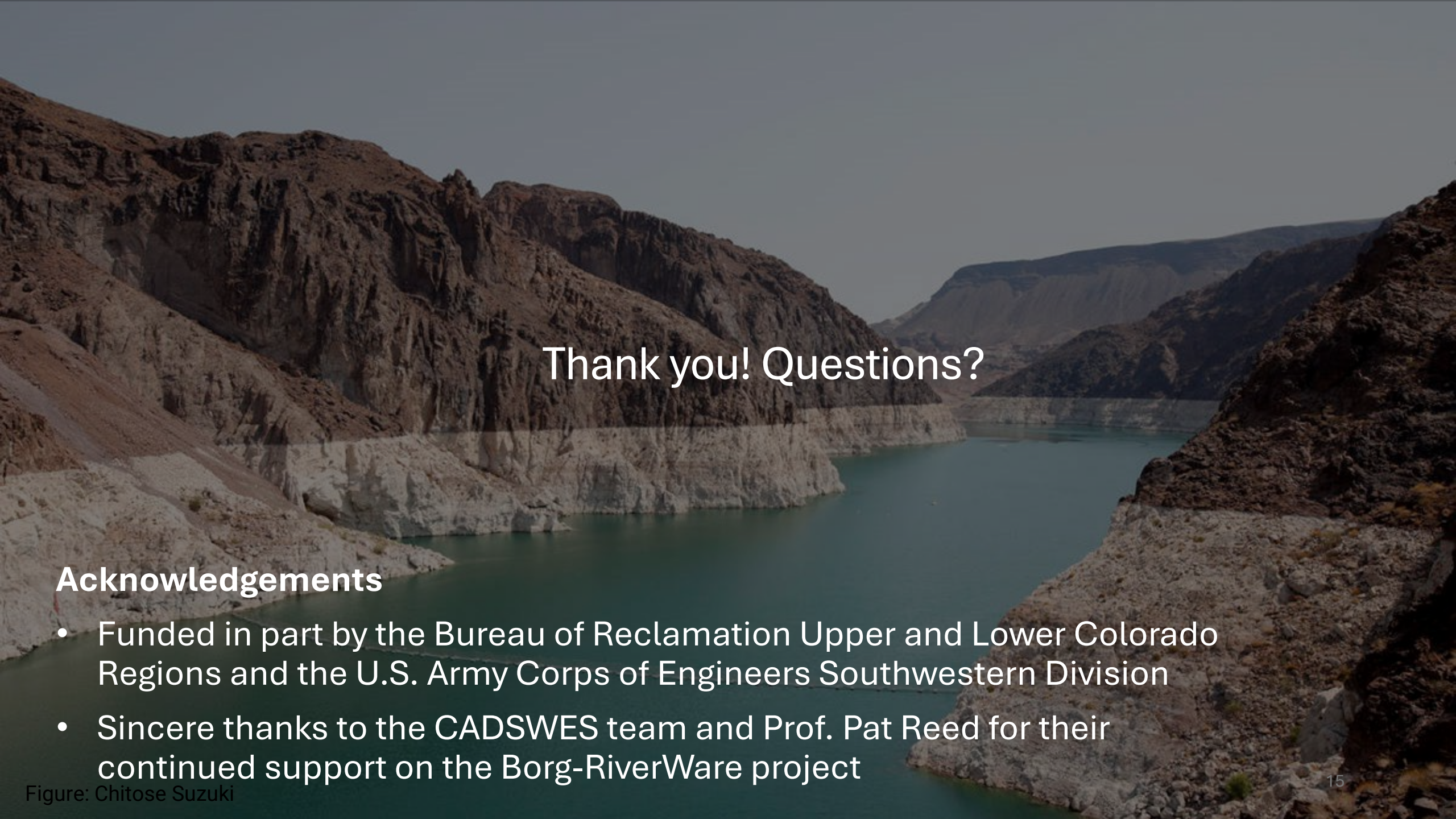
You can easily change the problem formulation and optimize again to explore more.



Change upper and lower bounds of decision variables



Raise or lower the threshold used in the constraint



Thank you! Questions?

Acknowledgements

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Figure: Chitose Suzuki