

Climate Change and Decreasing Levels in Lake Mead: Modeling Changes in Thermal Structure and Water Quality

NVWRA

Las Vegas, NV
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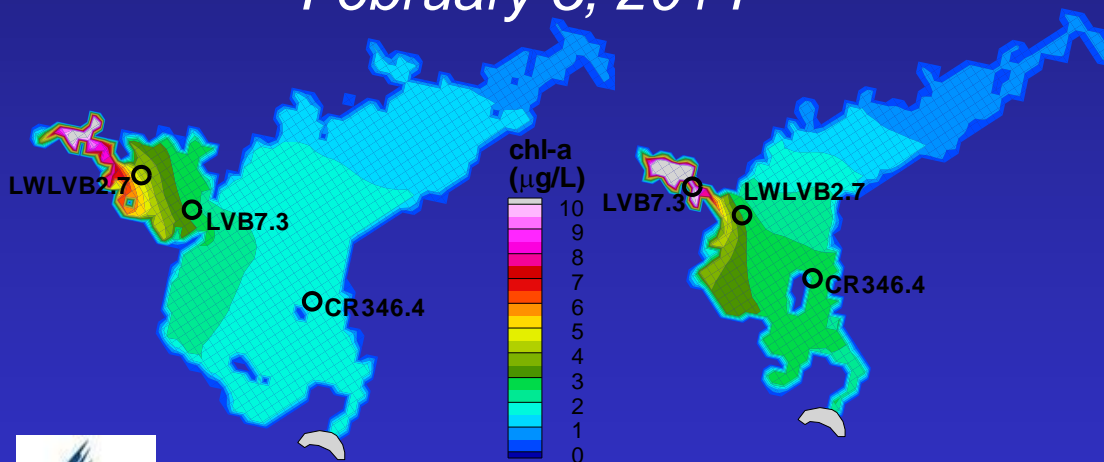
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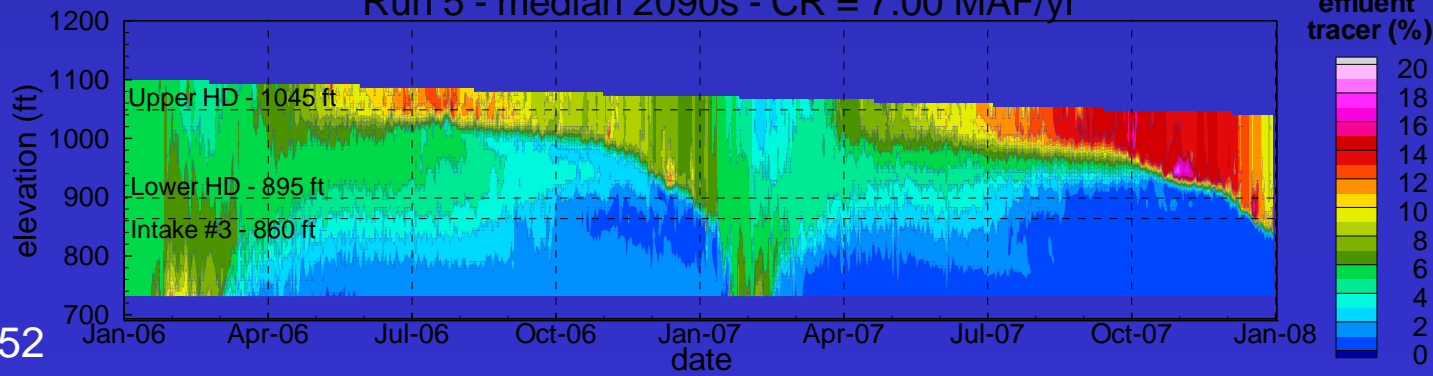
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1. Flow Science Incorporated

2. Southern Nevada Water Authority



Run 5 - median 2090s - CR = 7.00 MAF/yr



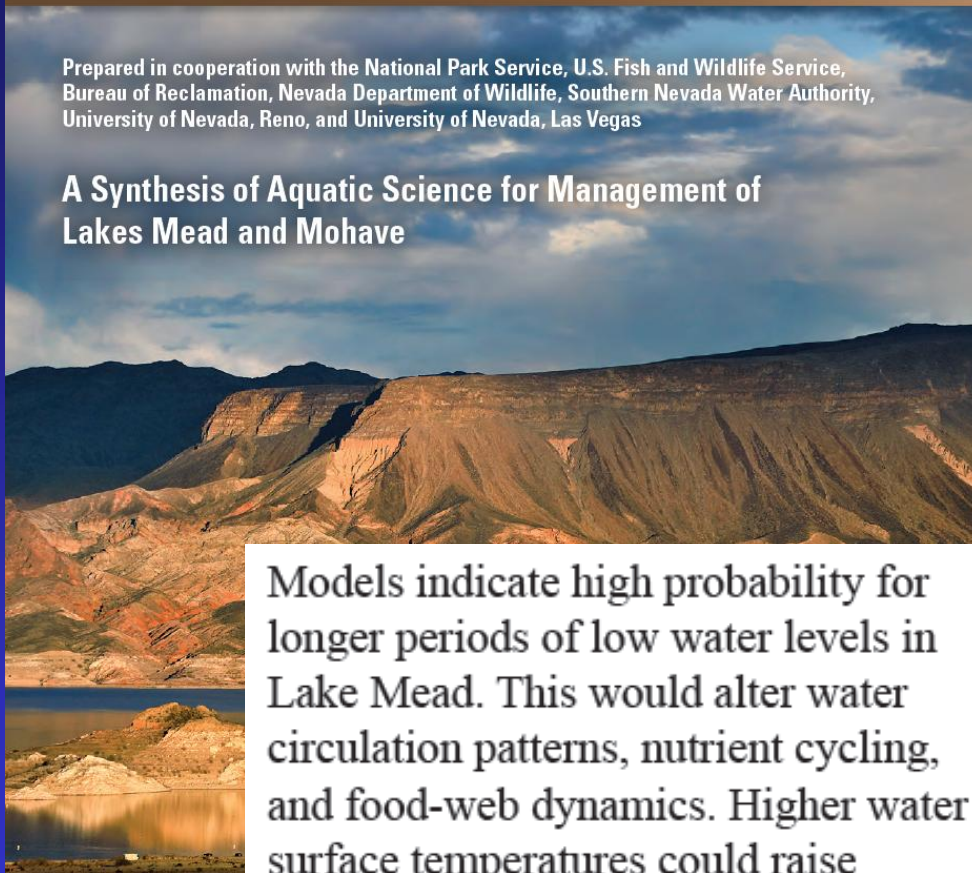
Agreement # R11AP81452

Information Needed



Prepared in cooperation with the National Park Service, U.S. Fish and Wildlife Service, Bureau of Reclamation, Nevada Department of Wildlife, Southern Nevada Water Authority, University of Nevada, Reno, and University of Nevada, Las Vegas

A Synthesis of Aquatic Science for Management of Lakes Mead and Mohave



Circular 1381

U.S. Department of the Interior
U.S. Geological Survey

Models indicate high probability for longer periods of low water levels in Lake Mead. This would alter water circulation patterns, nutrient cycling, and food-web dynamics. Higher water surface temperatures could raise productivity, and also raise the risk of pathogenic organisms to thrive.

Information needed for Lakes Mead and Mohave relates to potential impacts of low flows, lower water levels, increased air temperatures, and increased water temperatures on limnology, ecosystems, fish and wildlife, and recreation and potential pathogens.

Lake Mead



Las Vegas Wash
effluent, nutrients,
TOC, bromide

Colorado River
dilution, DO
lower future flows?



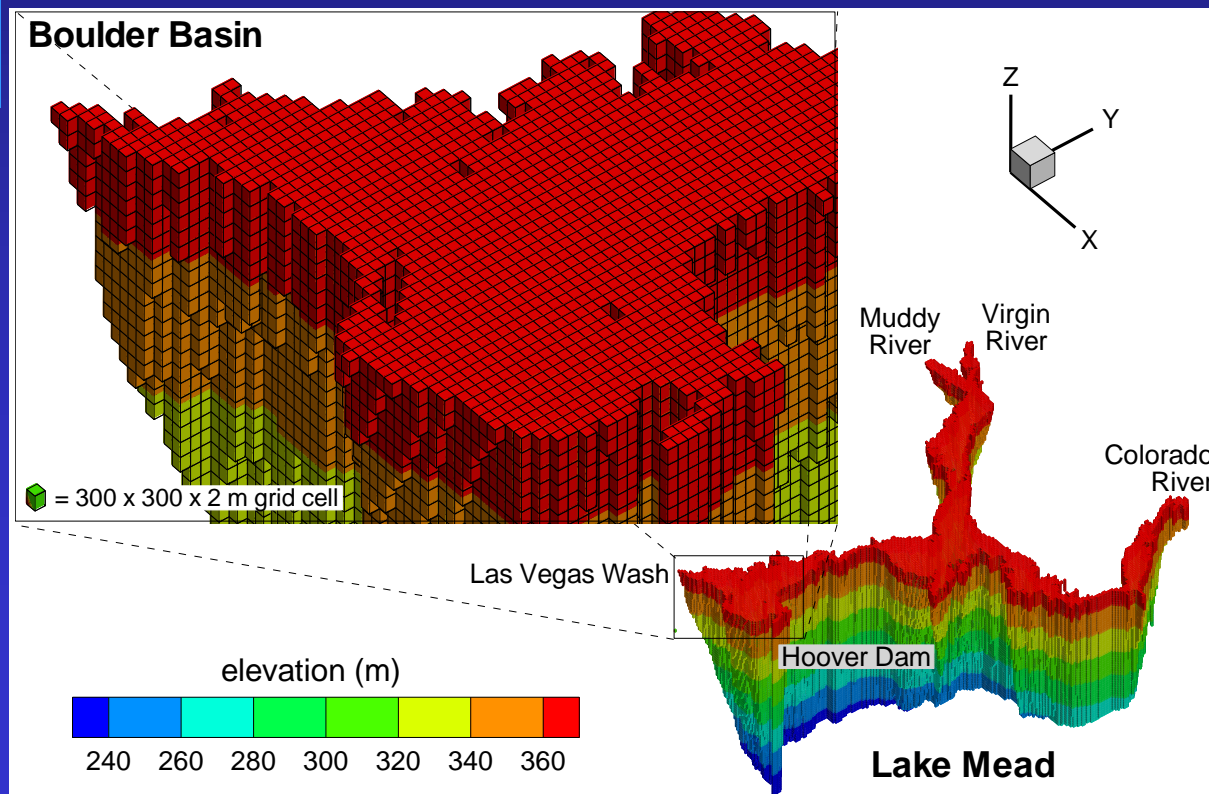
Hoover Dam
outflow elevations

Nevada

California, Arizona, Mexico

Lake Mead Model

- Lake Mead Model (LMM) uses ELCOM/CAEDYM codes
- ELCOM
 - 3-D hydrodynamic model, stratification, wind mixing, temperature, salinity, conservative tracers
- CAEDYM
 - Water quality module, algae (chl-a), nutrients, TOC, DO, pH



- ELCOM/CAEDYM developed by Centre for Water Research (UWA)
- LMM Funded by Clean Water Coalition, SNWA and National Park Service

Adjustment of LMM inputs

■ Air temperature

■ Inflow water temperature

} Primary drivers

} CMIP3 projections

■ Inflow rates

■ WSEL

} Difficult to quantify. Uncertainty.
Upstream inflows are controlled.
Examined extremes.

■ Inflow water quality

} Difficult to quantify.
Not considered.

■ Wind speed

■ Rainfall

} Climate projections indicate
generally small changes.
Not considered.

■ Relative humidity

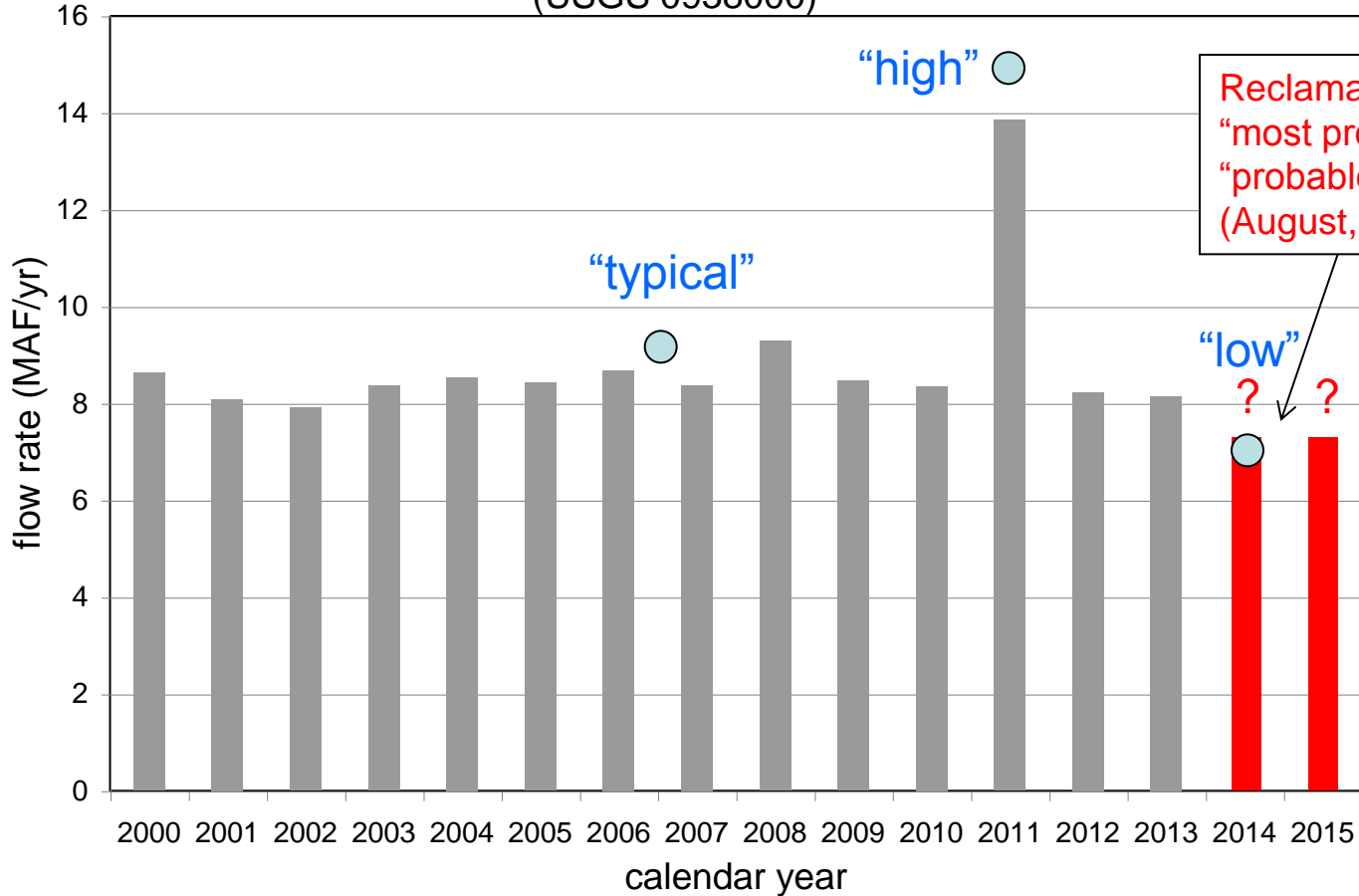
■ Solar radiation / cloud cover

} Climate projections
did not provide direct
information.

Not considered.

Variable Future Colorado River Inflows

Colorado River at Lees Ferry
(USGS 0938000)



Reclamation projections
"most probable" and
"probable minimum"
(August, 2013)

Colorado River
dilution, DO
lower future flows?



Nevada

Hoover Dam
outflow elevations

California, Arizona, Mexico

3 simulations;
 "typical" 9.23 MAF/yr
 "high" 14.78 MAF/yr
 "low" 7.00 MAF/yr

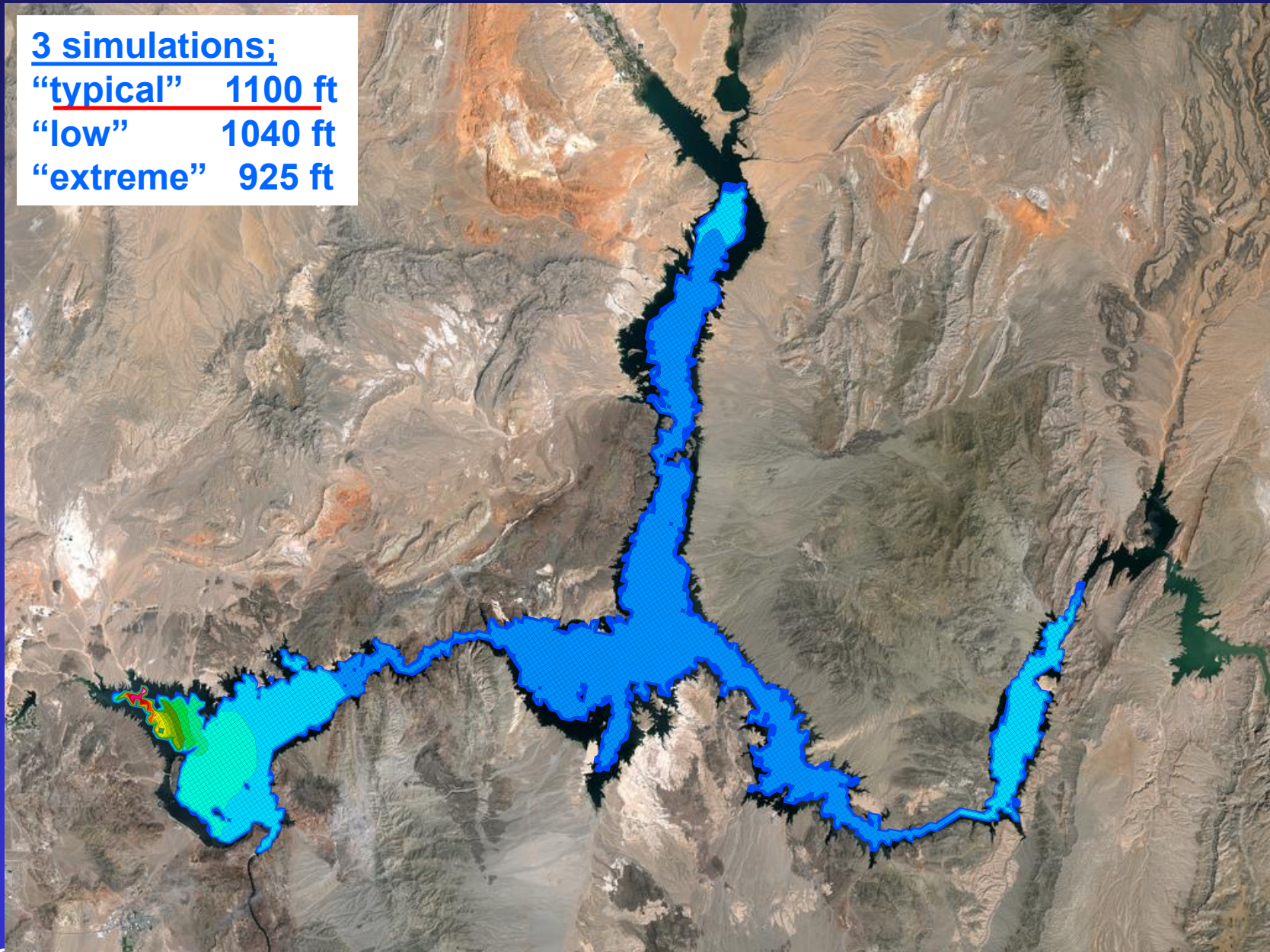
Lower Water Surface Elevation

3 simulations;

“typical” 1100 ft

“low” 1040 ft

“extreme” 925 ft



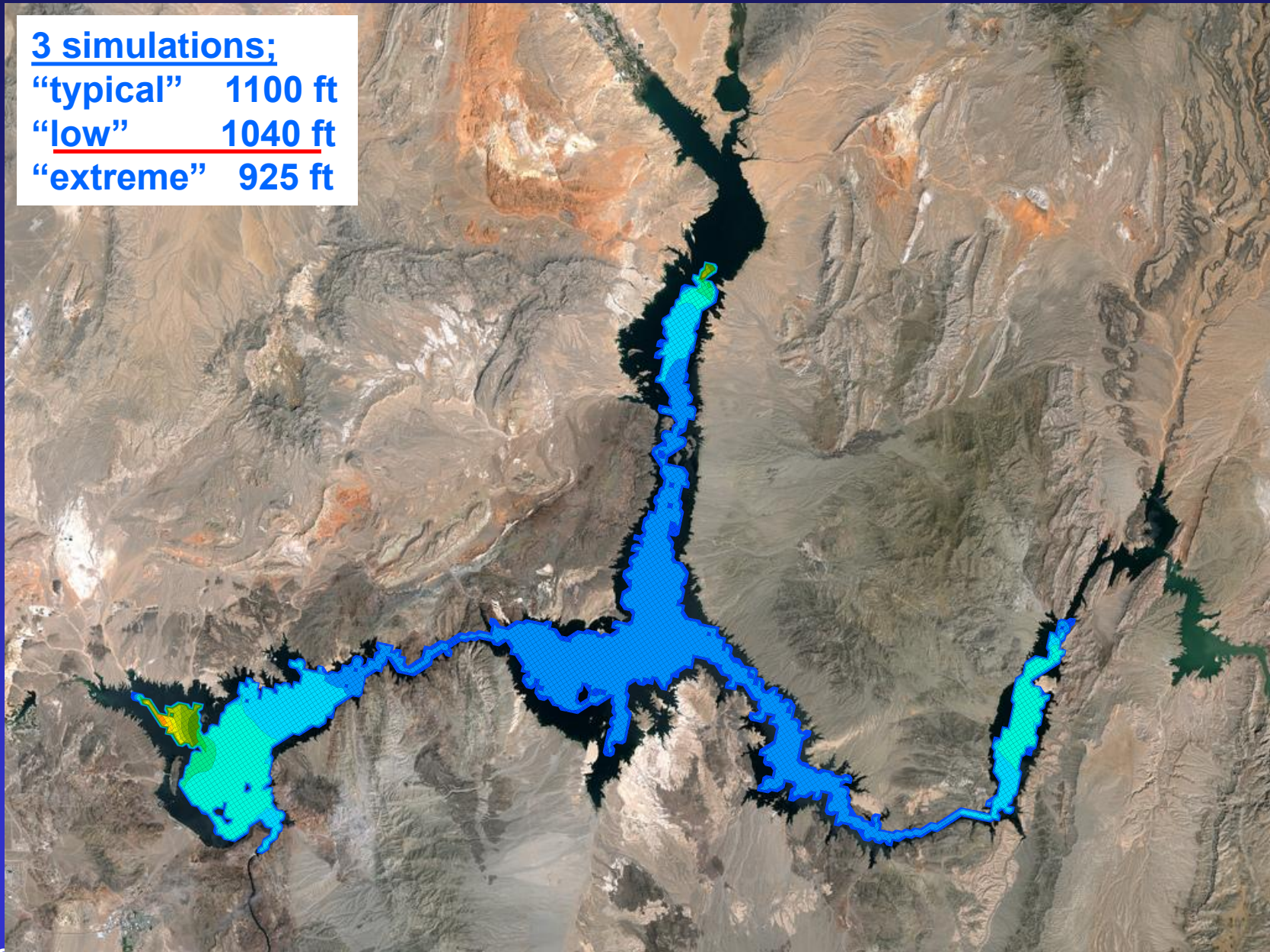
Lower Water Surface Elevation

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Lower Water Surface Elevation

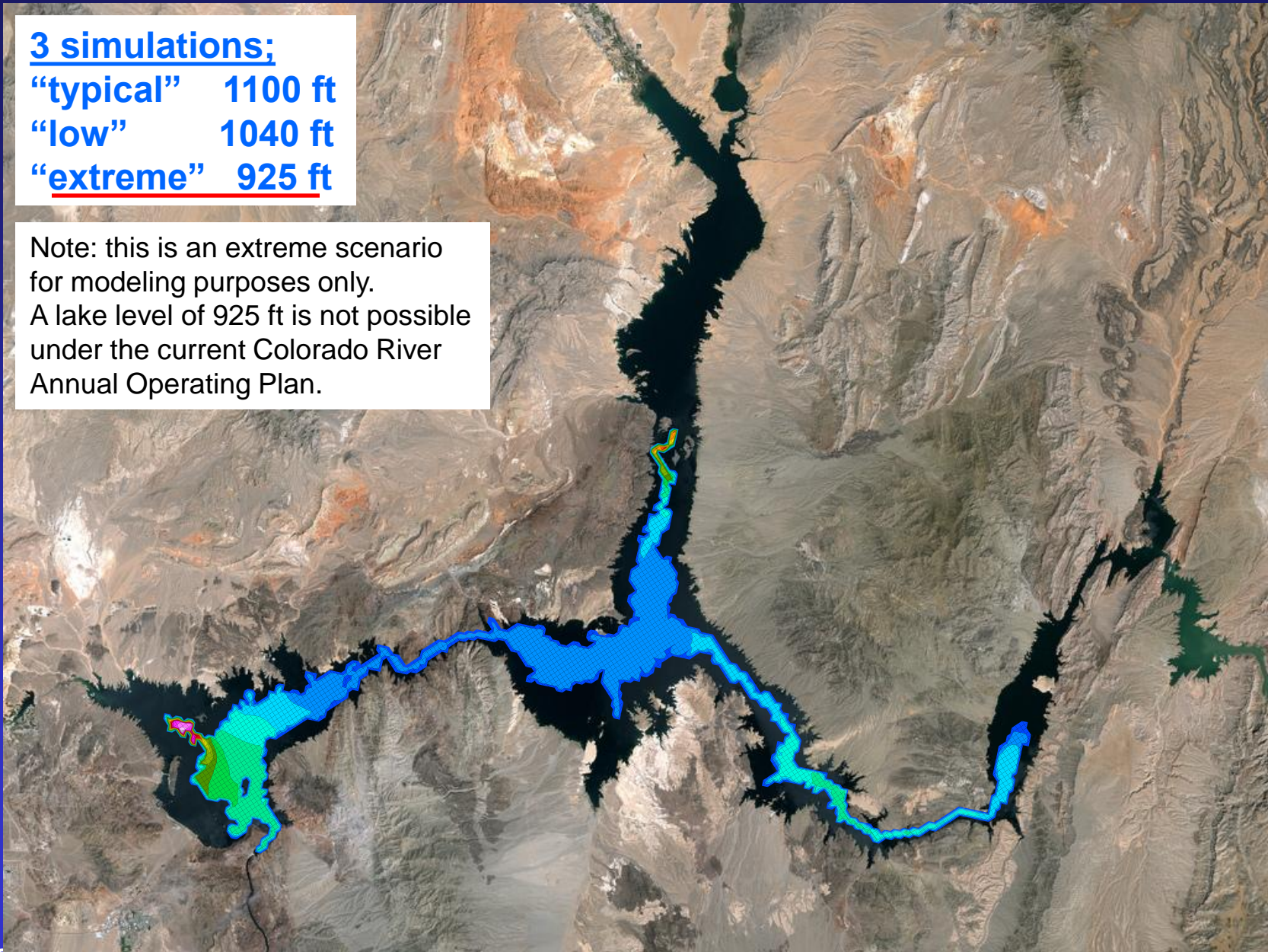
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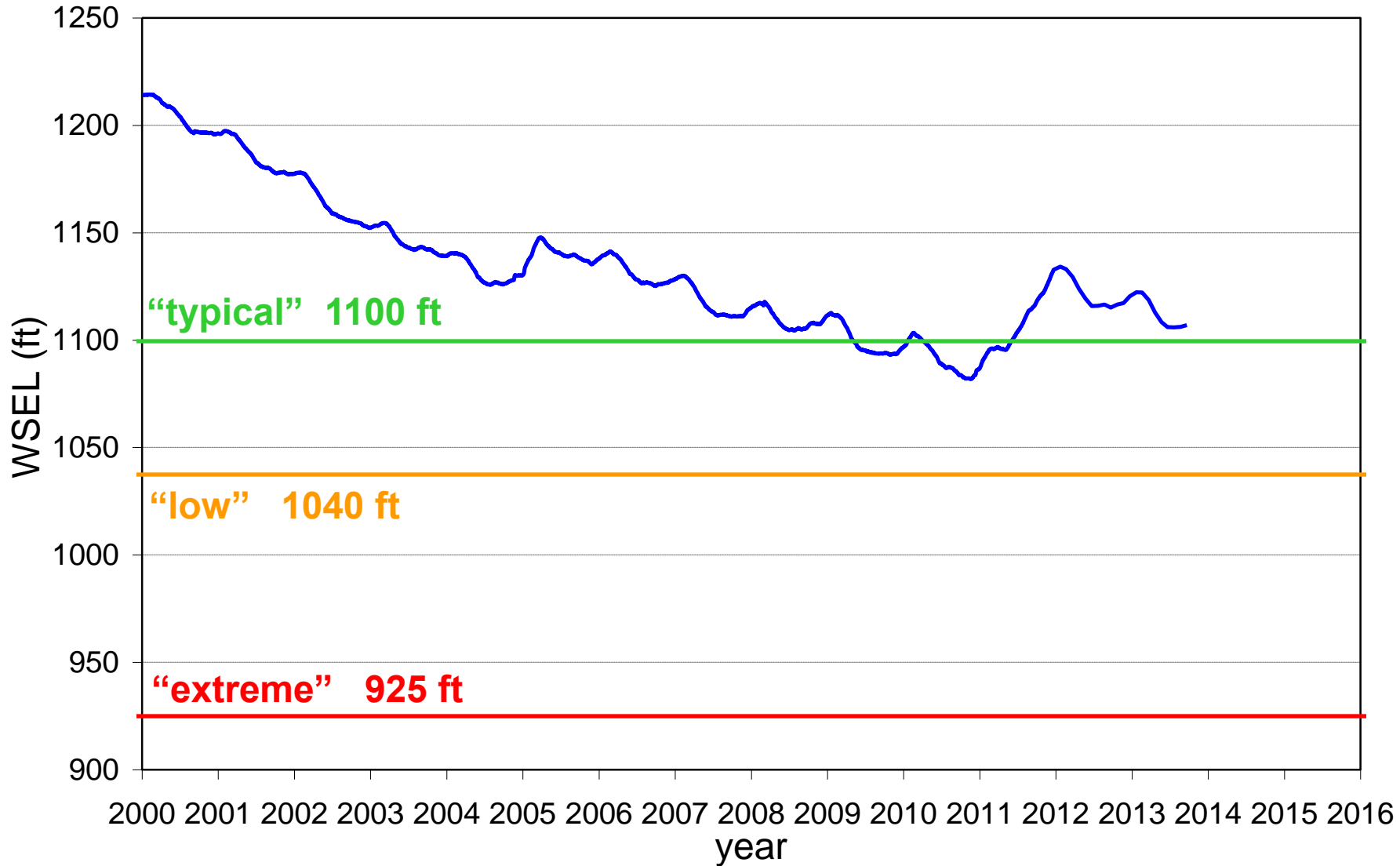
“extreme” 925 ft

Note: this is an extreme scenario for modeling purposes only. A lake level of 925 ft is not possible under the current Colorado River Annual Operating Plan.



Lower Water Surface Elevation

Lake Mead Water Surface Elevation



Lower Water Surface Elevation

Lake Mead Water Surface Elevation

