700L & 700C

LOW FLOW REDUCTION FACTOR

USACE CLIMATE PREPAREDNESS AND RESILIENCE

Background

- The low flow reduction factor represents how low flow (i.e., the monthly flow exceeded 90% of the time) is predicted to change in the future.
  - In watersheds with indicator values less than 1, the magnitude of low flow events (i.e., how low the stream levels are) is predicted to decrease. These watersheds will need to prepare for increased stress on water supply and other potential impacts.
  - In watersheds with indicator values greater than 1, the magnitude of low flow levels is predicted to increase (i.e., activities dependent on minimum flow levels will be less vulnerable).
- Decreases in low flow can have adverse effects on species that require a minimum level of flow to survive. For example, reduced summer low flows can adversely affect salmon populations.[1]
- Increased temperatures may lead to reduced summer low flows, which may stress a water supply when demand is highest. This reduction in low flows could result in conflicts among different water users, such as hydropower, agriculture, and ecosystem restoration.[2]
- Lower values suggest higher vulnerability relative to other watersheds.

THIS INDICATOR MEASURES THE CHANGE IN LOW RUNOFF, I.E., THE RATIO OF INDICATOR 570L/C (MONTHLY RUNOFF EXCEEDED 90 PERCENT OF THE TIME) TO 570L/C IN THE BASE PERIOD.

Local vs. Cumulative

- The interpretation of flow-based indicators depends on where the flow originates.
- The vulnerability assessment tool uses two versions of this indicator:
  - Local (700L): Reflects flow generated only within one 4-digit hydrologic code (HUC-4) watershed.
  - Cumulative (700C): Reflects all flow generated within a HUC-4 watershed and any upstream watersheds.

Data Sources

Data Source	Description	Spatial Resolution	Temporal Resolution
Coupled Model Intercomparison Project (CMIP-5) output[3]	Local runoff within HUC-4 watersheds	HUC-4 watersheds	2035-2064 and 2070-2099

These Indicators Were Used to Assess the Vulnerability of Some of USACE's Eight Business Lines

Indicator	Business Line	Importance Weight (Varies from 1 to 2 for USACE)
700L	Emergency Management	1.4
700C	Flood Risk	1.7
	Navigation	1.5
	Ecosystem Restoration	1
	Hydropower	1
	Recreation	1.3
	Regulatory	1.5

Calculation

- Use local runoff values from 47 CMIP-5 climate model traces specific to each future scenario.[4]
- Calculate the flood runoff for the base period (1950-2004), and a future scenario (2035-2064 or 2070-2099).
  - For indicator 700L, use local low runoff values (indicator 570L) in the base and future periods.
  - For indicator 700C, use cumulative low runoff values (indicator 570C), in the base and future periods.
- Divide the future value of low runoff by the base period value to obtain the low flow reduction factor.

[1] Mantua, N., Tohver, I., and A. Hamlet. 2010. Climate Change Impacts on Streamflow Extremes and Summertime Stream Temperature and Their Possible Consequences for Freshwater Salmon Habitat in Washington State. Climatic Change. 102(1-2): 187-223.
[2] Madani, K., and J. R. Lund. 2010. Estimated Impacts of Climate Warming on California's High-elevation Hydropower. Climatic Change. 102(3-4): 521-538.
[3] CMIP-5 output is available for download online at: http://gdo-dcp.ucllnl.org/downscaled_cmip_projections/dcpInterface.html
[4] Indicator values were calculated for two scenarios (a wet and a dry future) and two time periods (2035-2064 and 2070-2099).

LOW INDICATOR VALUE
Watersheds with low indicator values may experience more extreme low flow levels in the future.

The photo shows Lake Mead during the 2014 drought, where water levels reached historic lows.

Lake Mead - Courtesy of USBR