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.

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

<table>
<thead>
<tr>
<th>Data Source</th>
<th>Description</th>
<th>Spatial Resolution</th>
<th>Temporal Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coupled Model Intercomparison Project (CMIP-5) output³</td>
<td>Local runoff within HUC-4 watersheds</td>
<td>HUC-4 watersheds</td>
<td>2035-2064 and 2070-2099</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Business Line</th>
<th>Importance Weight (Varies from 1 to 2 for USACE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>700L</td>
<td>Emergency Management</td>
<td>1.4</td>
</tr>
<tr>
<td>700C</td>
<td>Flood Risk</td>
<td>1.7</td>
</tr>
<tr>
<td></td>
<td>Navigation</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>Ecosystem Restoration</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Hydropower</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Recreation</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td>Regulatory</td>
<td>1.5</td>
</tr>
</tbody>
</table>

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.

³ CMIP-5 output is available for download online at: http://gdo-dcp.ucar.org/download_c mip projections/dopinterface.html
⁴ Indicator values were calculated for two scenarios (a wet and a dry future) and two time periods (2035-2064 and 2070-2099).