



Indicators and Metrics Workshop

July 10, 2025

Russian River Watershed Resilience Plan

Meeting Objectives

- Provide an overview of the working draft **Indicators and Metrics** for use in the Russian River Watershed Resilience Pilot
- Receive input from Watershed Network members
- Seek alignment on measures moving into the vulnerability assessment process



Agenda

- Overview of Indicators and Metrics
- Review Working Draft Indicators and Metrics
- Receive Comments from Watershed Network Members
- Schedule for Finalization of Vulnerability Indicators and Metrics
- Next Steps



Today is a Working Session

- **WORKING DRAFT**
 - Working draft of Indicators and Metrics – work is continuing
 - Sharing current Project Team efforts
 - Engaging interested members of the Watershed Network early to help shape assessment
- **WORKING SESSION**
 - Be constructive
 - Be productive
 - Be open minded
 - Assume positive intent
 - More comments can be provided following the session
- **After Today's Session**
 - Comments from Network members by end of July
 - Finalize indicators by late August
 - Initial Vulnerability Assessment (primarily qualitative) discussion at Sep. 16 meeting



What are Water Resource Indicators and Metrics?

- **Indicators** – The observable aspects of our water resource sectors in the watershed that inform us about their existing condition, the projected condition, and how they respond to adaptation. Informs our decision making.
 - What makes a good indicator?
 - Easy to measure, readily available data.
 - **Examples:**
 - Water Supply Reliability
 - Natural/Ecological Flows
 - Population Exposure to 100-yr Flood Event
 - Water Quality Impairments
- **Metrics-** The quantitative measurement of the indicator.
 - **Examples:**
 - Change in Monthly and Annual Flow Distribution
 - Change in Distribution of Hydrological Conditions for Minimum Flows
 - Population at Risk in 100-yr Floodplain
 - Water Temperature and Dissolved Oxygen



How can Indicators and Metrics be Used?

- Measure and track watershed resilience over time
- Monitor effects of existing actions
- **Measure current and projected vulnerability of water resource systems**
- **Measure likely performance of future adaptation strategies**
- Can be categorized as:
 - **Primary (PR)** - “primary” in that the indicators and metrics can be used to measure “vital signs” or “move the needle” related to resilience
 - **Secondary (SC)** - “secondary” in that they are more specific measures that “peel the onion” further,
 - **Performance (PE)** – “performance” in that the metrics can be useful to measure the performance of strategies during their development and selection, and
 - **Trend (TR)** – “trend” in that the indicators and metrics can demonstrate trend over years and decades



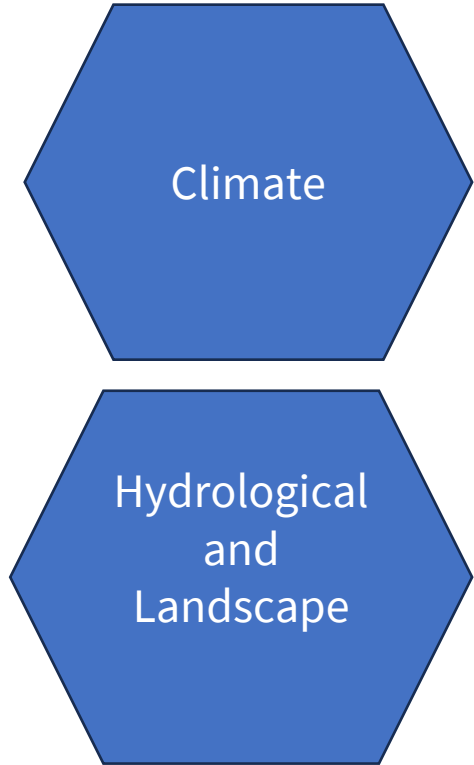
Various Indicators & Metrics

Water Resource Sectors

Identify vulnerabilities, assess strategies, track state of watershed resources

Climate, Hydrological, and Landscape

Communicate trends and changes in natural system



Focus of Today!



Climate Metrics – How we communicate trends and change in climate

- Climate scenarios:
 - Ensemble range and 3 ensemble-informed scenarios
- Temperature
 - Change in annual and seasonal temperature
 - Extreme heat days ($T_{max} > 95F$ and $T_{max} > T_{98th}$)
- Precipitation
 - Change in annual and seasonal precipitation
 - Changes in wet-dry transitions (duration and frequency change)
 - Extreme precipitation 1% annual exceedance probability
- Sea Level
 - Projections consistent with latest CA Coastal Commission 2024 sea level rise guidance

Hydrological and Landscape Metrics – How we communicate trends and change in hydrology and landscape

- Hydrology
 - Annual and season runoff volumes
 - High and low flow extremes (distribution)
 - Streamflow timing
 - Wet-dry transition changes based on natural flow
 - Drought severity and duration
 - Evaporative demand (PET)
- Landscape
 - Soil moisture
 - Anticipated vegetation changes
 - Wildfire probability and burn area

Vulnerability Indicators and Metrics – **Surface Water Supply**

- **Indicators:**

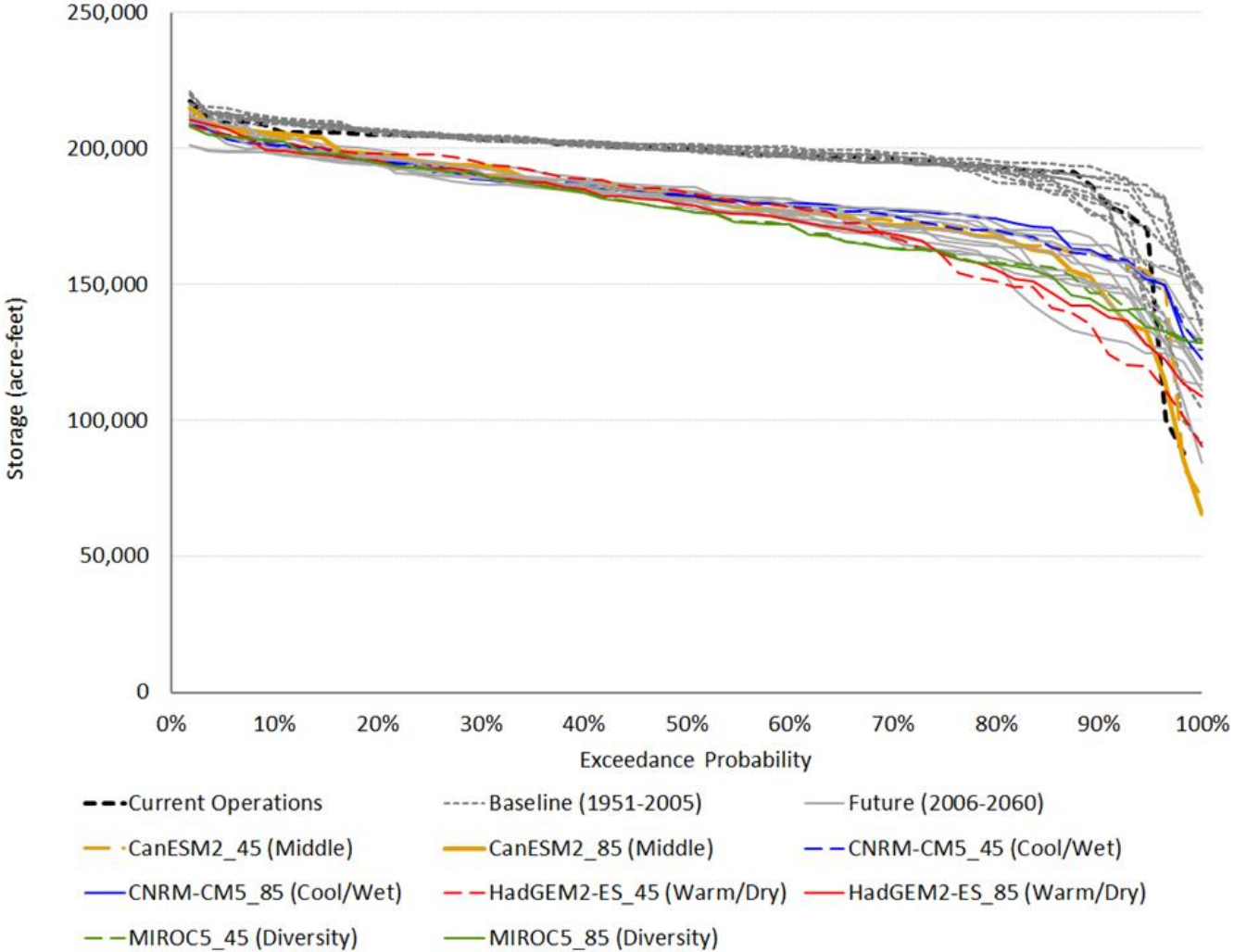
- River and tributary flows
- Water delivery reliability
- Reservoir condition

- **Sample Metrics:**

- Monthly and annual flow distribution
- Delivery reliability as percent of demand
- Reservoir storage and frequency



EXAMPLE - Projected End-of-September Lake Sonoma Storage for Period of 2006-2060





Vulnerability Indicators and Metrics – Groundwater Supply

- **Indicators:**

- Groundwater levels
- Groundwater storage
- Groundwater quality

- **Sample Metrics:**

- Groundwater level
- Groundwater storage
- Achievement or exceedance of GSP sustainability criteria





Vulnerability Indicators and Metrics – Flood Management

- **Indicators:**

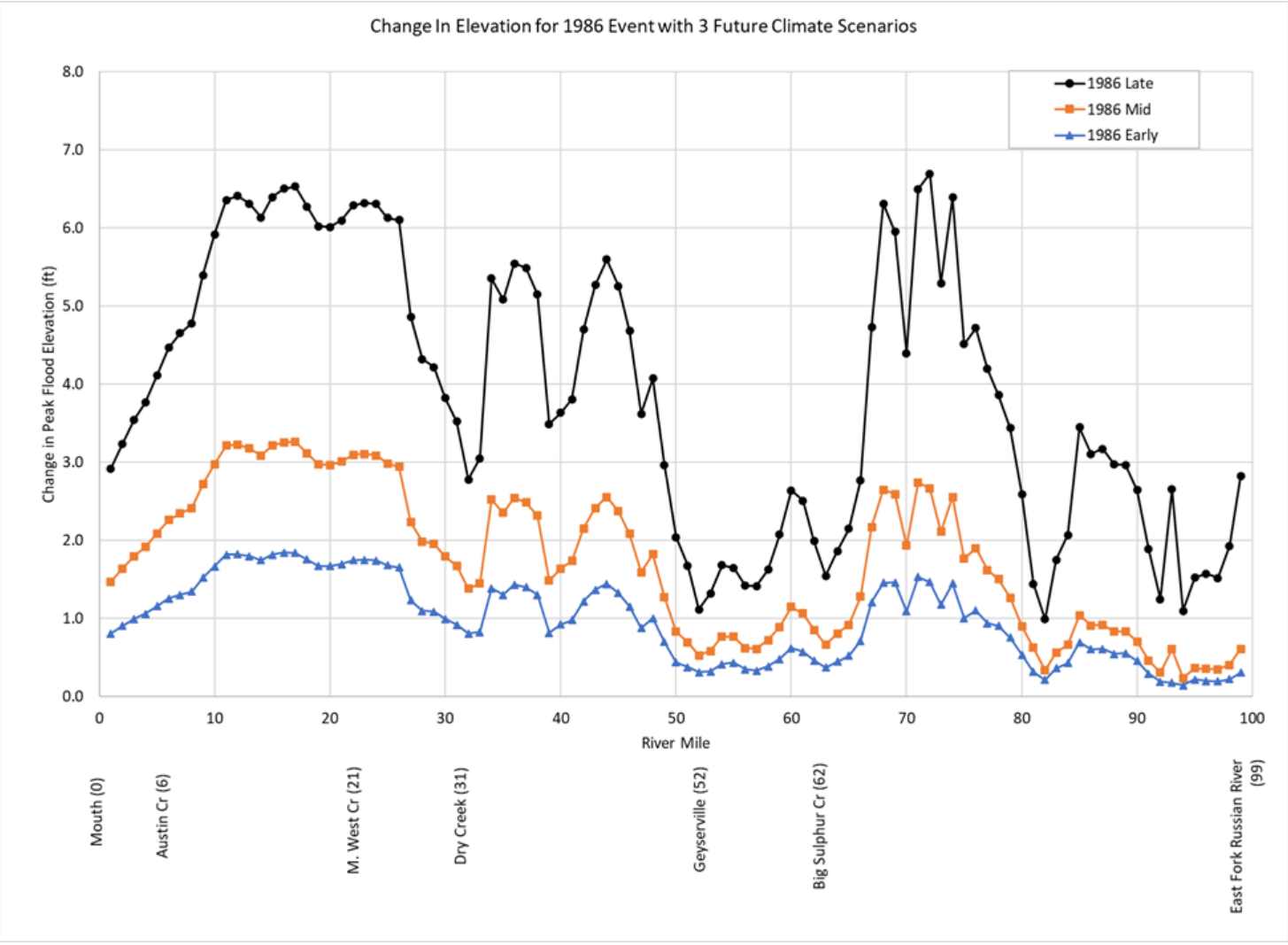
- Flood Stage
- Population Exposure to Flood Events
- Asset Exposure to Flood Events
- Reservoir Condition

- **Sample Metrics:**

- Flow in Russian River and tributaries
- Population at risk in 100-yr and 500-yr floodplain
- Value of assets Impacted in 100- and 500-yr Floodplain
- Maximum pool and uncontrolled spill frequency for Lake Mendocino and Lake Sonoma



EXAMPLE - Simulated Change in Russian River Flood Stage under Three Future Scenarios



Vulnerability Indicators and Metrics – Ecosystem

- **Indicators:**

- Natural/Ecological Flows
- Wildfire threat
- Water Quality Impairments

- **Sample Metrics:**

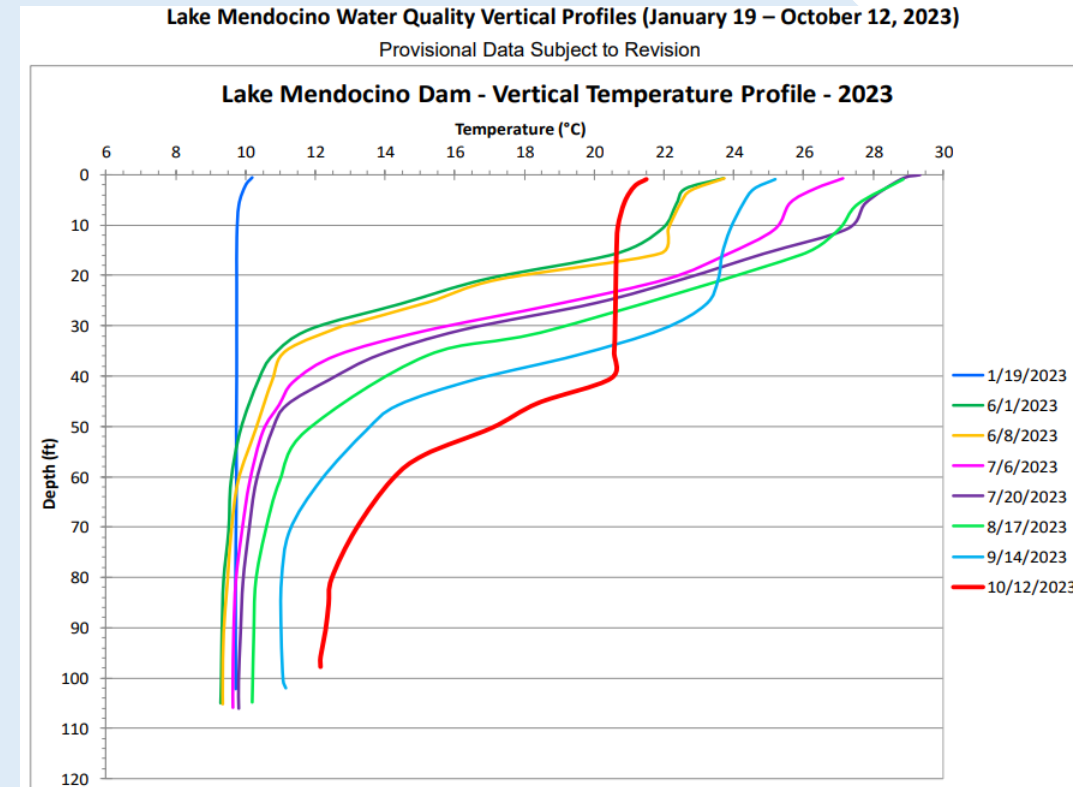
- Hydrological flow regimes for Russian R and tributaries
- Wildfire burn probability and burn area
- Stream temperature and dissolved oxygen
- Floodplain inundation regime





Vulnerability Indicators and Metrics – Water Quality

- **Indicators:**
 - Water Quality Impairments
- **Sample Metrics:**
 - Natural receiving water temperature
 - Dissolved oxygen
 - Conditions leading to algal blooms



Vulnerability Indicators and Metrics – Recreation

- **Indicators:**

- Recreational Uses

- **Sample Metrics:**

- Water levels in Lake Mendocino benefiting recreational opportunities
- Flows suitable for River recreational access and boating
- Cyanotoxins conditions





Vulnerability Indicators and Metrics – Hydropower

- **Indicators:**

- Hydropower Generation

- **Sample Metrics:**

- Hydropower production Coyote Valley Dam
- Hydropower production at Warm Springs Dam





Vulnerability Indicators and Metrics – Equity

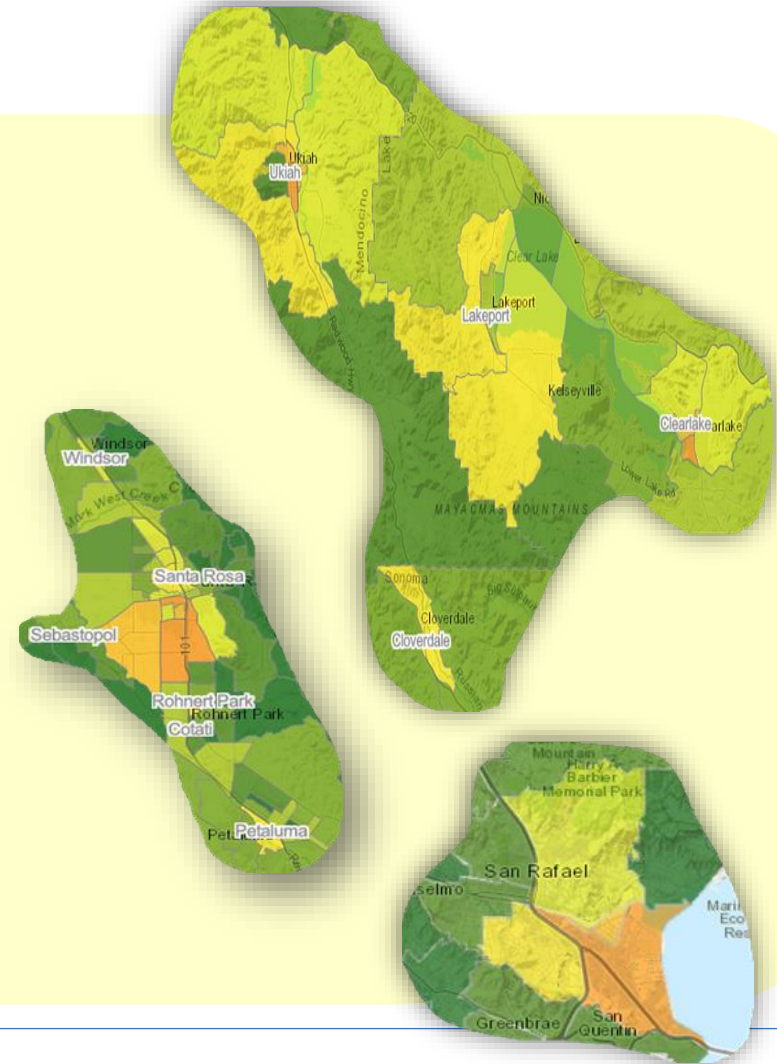
- **Indicators**

- Population Exposure to Risks

- **Sample Metrics:**

- **Change in population exposure to risks**

- Surface Water Supply
- Flood risk
- Extreme heat
- Wildfires
- Groundwater Supply



Next Steps

- Receive comment from Network member on working draft indicators and metrics – July 31
- Finalize selection and description of indicators and metrics for vulnerability assessment – Late August
- Review initial progress on qualitative vulnerability assessment – September 16

