New Streamflow Indicators and Changes to River-Floodplain Connectivity Indicator

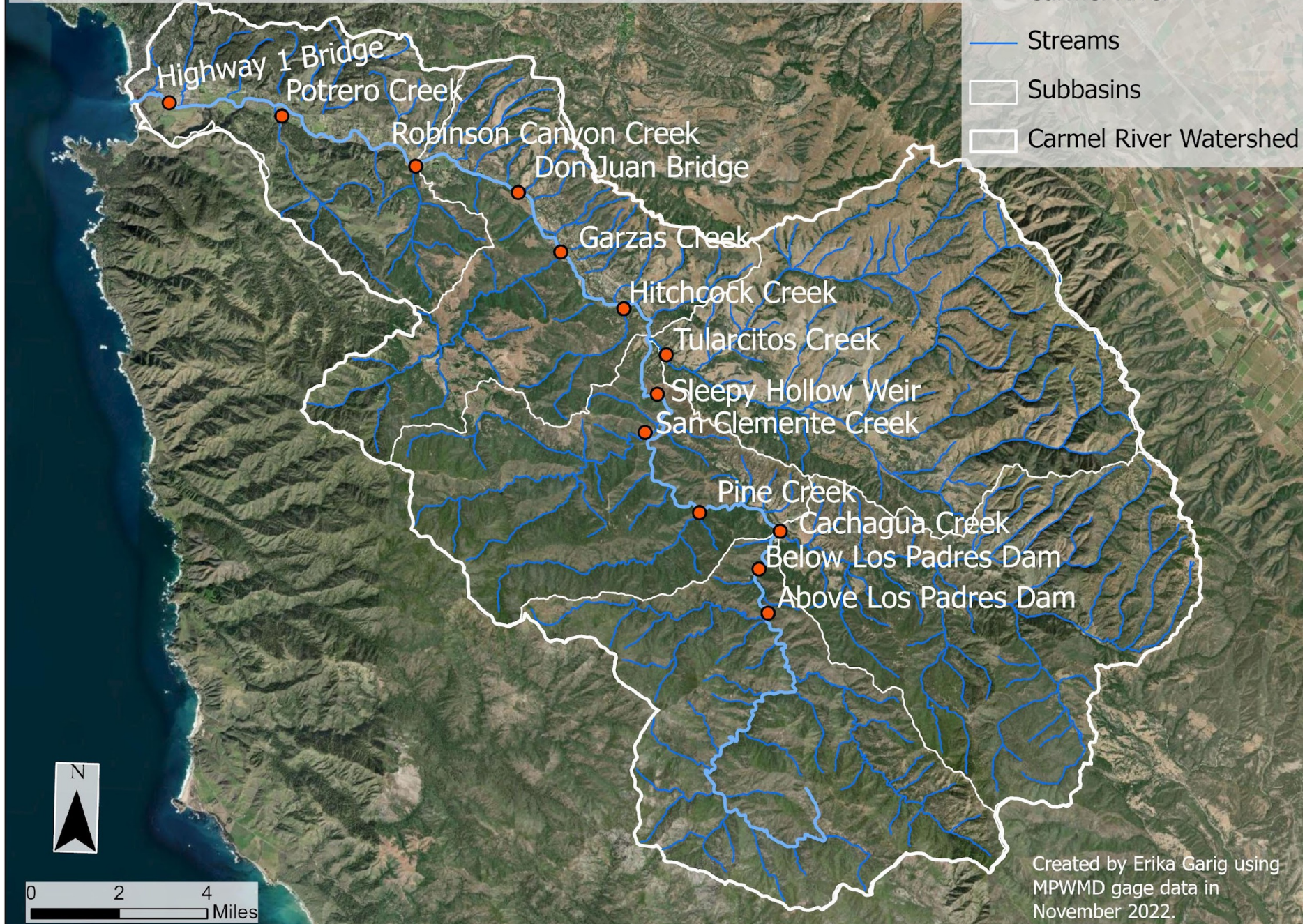Presented By Erika Garig
May 2023

Environmental Flows

- We combined unimpaired streamflow and the tributary streamflow indicators into one assessment looking at environmental flows (E-flows)

- Looks at seasonal changes

- We examined 3/5 E-flow variables

Key Terms for 3 Functional Flow Variables

- Dry-season baseflow: flow only sustained by groundwater inputs

- Wet-season peak-flow: coincides with the largest storms in winter

- Wet-season baseflow: sustained by overland and shallow subsurface flow in the periods between winter storms

- *Not included: Fall pulse and spring recession*

Gage Sites for Streamflow Indicator

Legend:
- MPWMD Gages
- Carmel River
- Streams
- Subbasins
- Carmel River Watershed

Highway 1 Bridge
Potrero Creek
Robinson Canyon Creek
Don Juan Bridge
Garzas Creek
Hitchcock Creek
Tularcitos Creek
Sleepy Hollow Weir
San Clemente Creek
Pine Creek
Cachagua Creek
Below Los Padres Dam
Above Los Padres Dam

N

0   2   4
Miles

Created by Erika Garig using MPWMD gage data in November 2022.

Stream classifications based on E-flows from CEFF and UC Davis

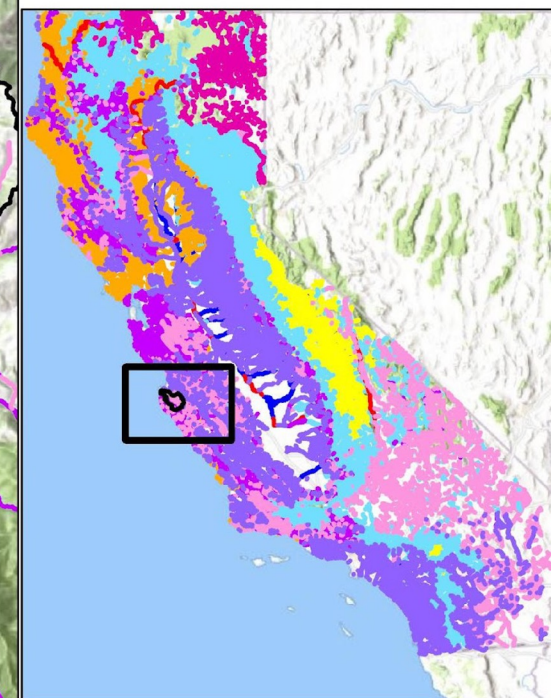- CRW is mainly Perennial groundwater rain
- & Flashy ephemeral rain
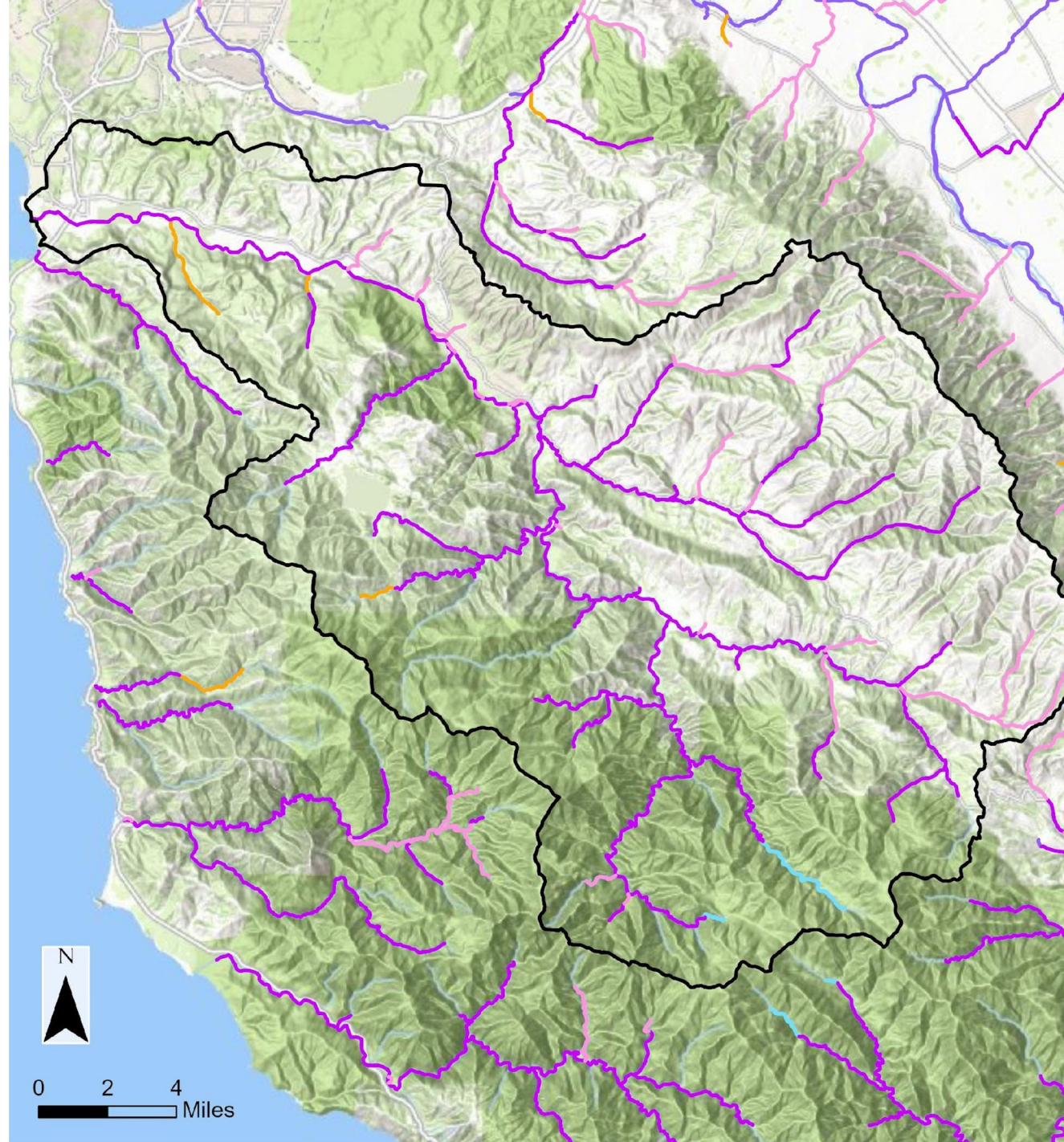
California Stream Class

Classifications

- Snowmelt
- High-volume snowmelt and rain
- Low-volume snowmelt and rain
- Rain and seasonal groundwater
- Winter storms
- Groundwater
- Perennial groundwater and rain
- Flashy, ephemeral rain
- High elevation, low precipitation

N

0 2 4 Miles

Map created by Erika Garig January 2023 using E-flows from UC Davis.

How We Calculated the Streamflow Updates

- We compared predicted to observed flows: If the 50th percentile observed functional flows was in between the predicted 10th and 90th percentile
- Example of this in the next few slides using the gage below Los Padres Dam

Observed is within Predicted

Observed is not within Predicted

Predicted

Observed

Predicted

Observed
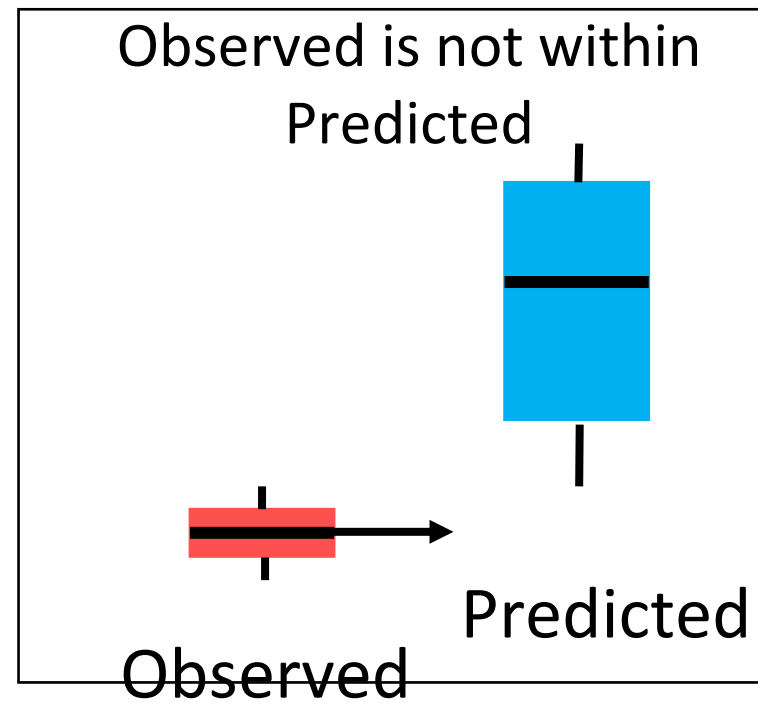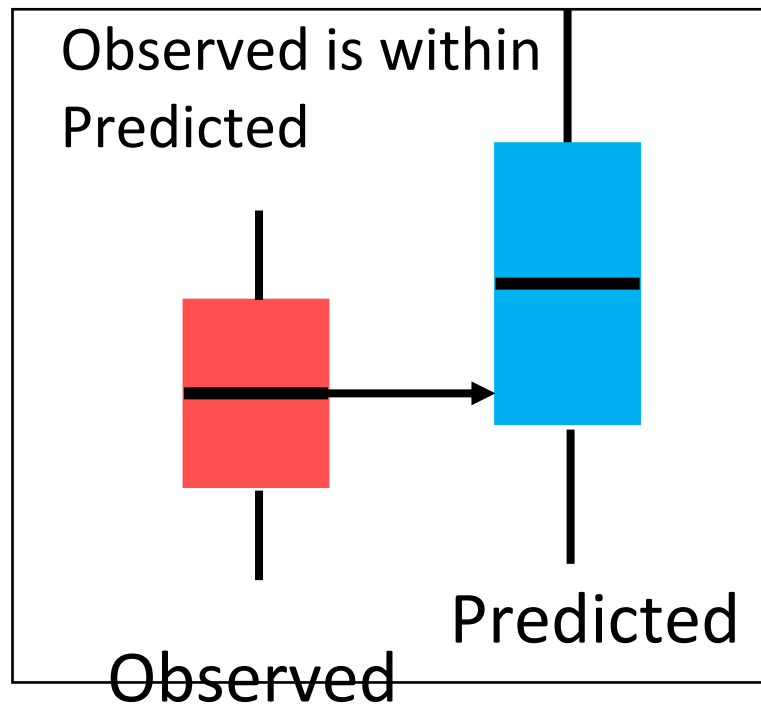
More key terms for functional flow metrics

Peak flow: The maximum rate of discharge during the period of runoff caused by a storm
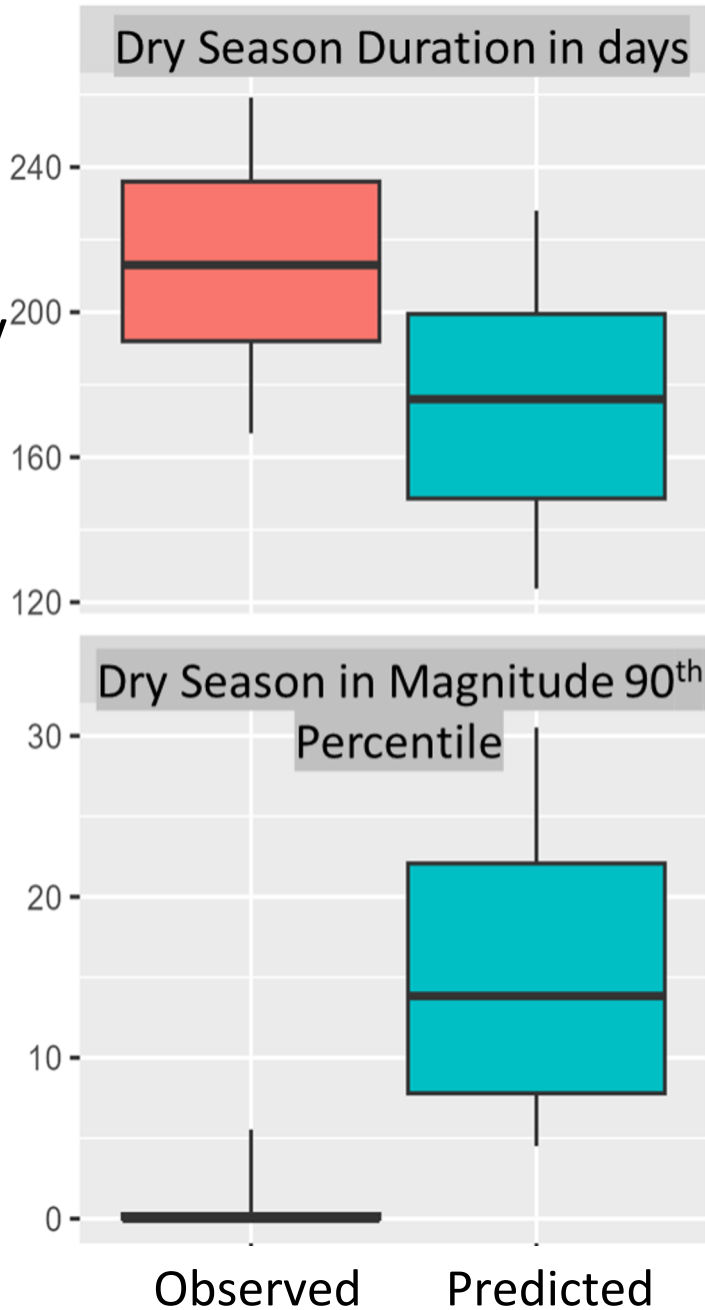
Magnitude: The amount of water passing a fixed point in the river at a specific point in time.

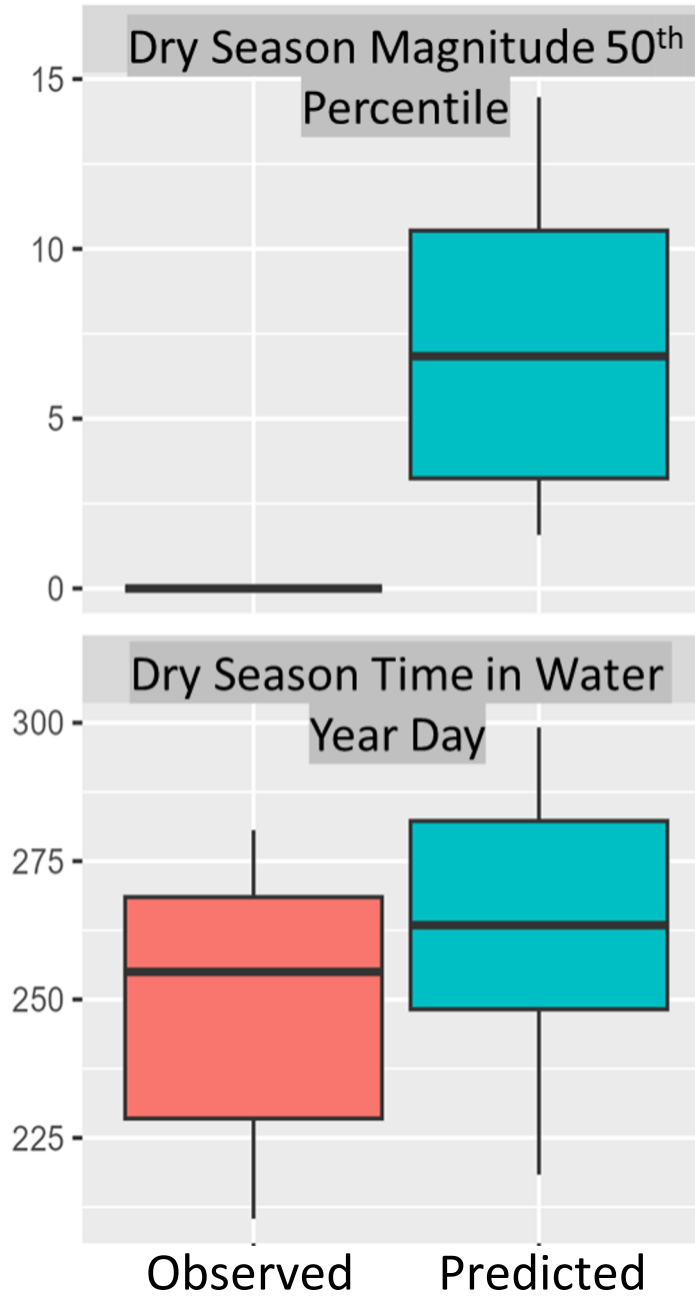Peak flow frequency: The number of occurrences of peak flow

Below Los Padres Dam Gage Example for Dry-Season
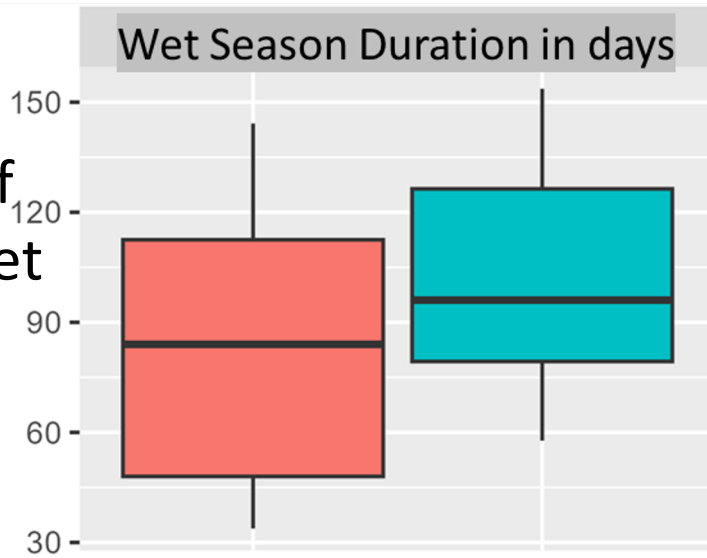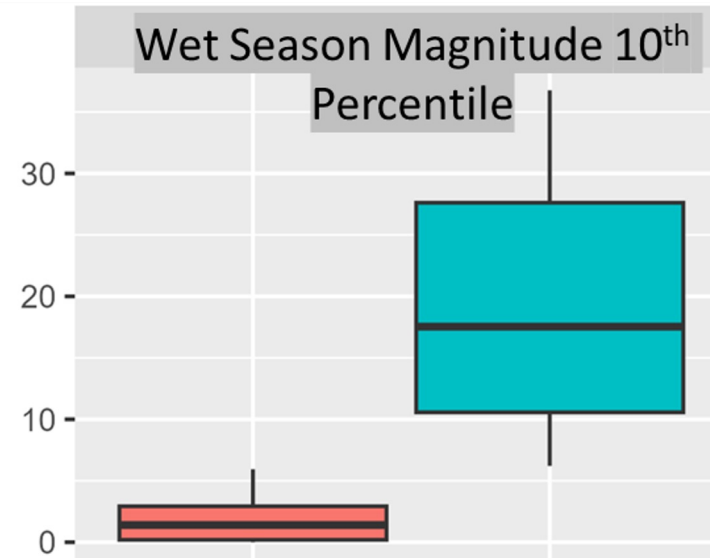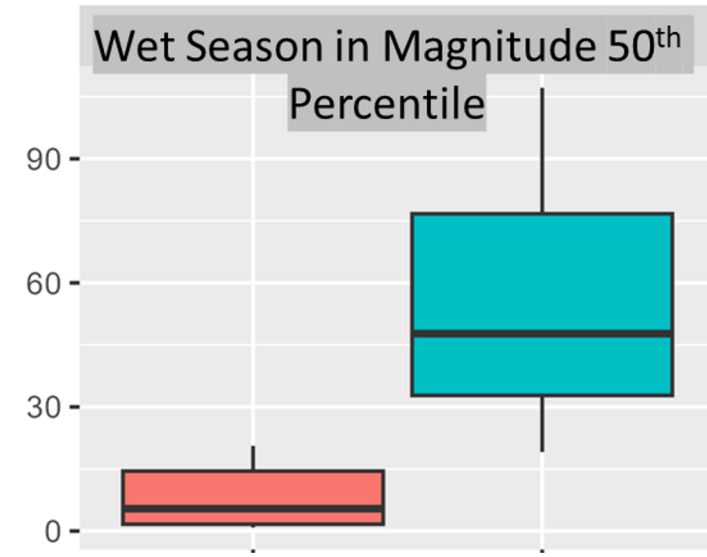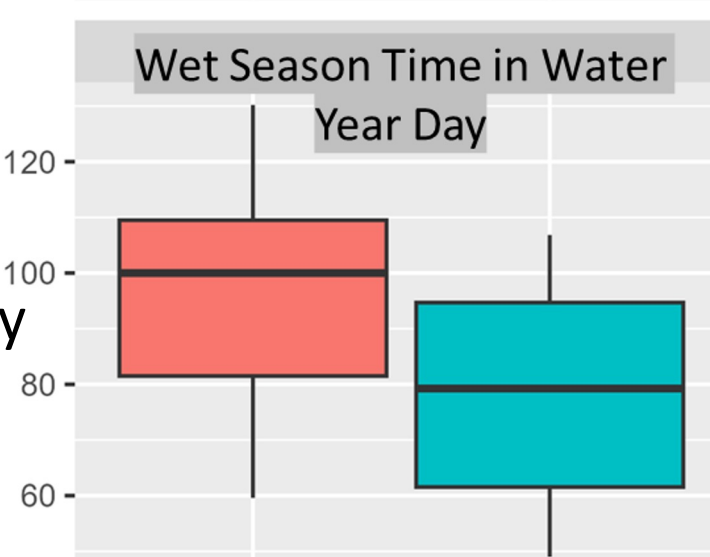
Below Los Padres Dam Gage Wet Season
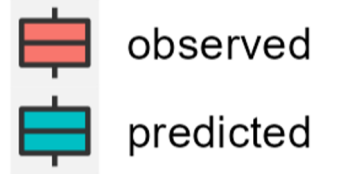
Below Los Padres Dam Gage Wet Season Continued

Peak Frequency Metrics for COMID 17600789
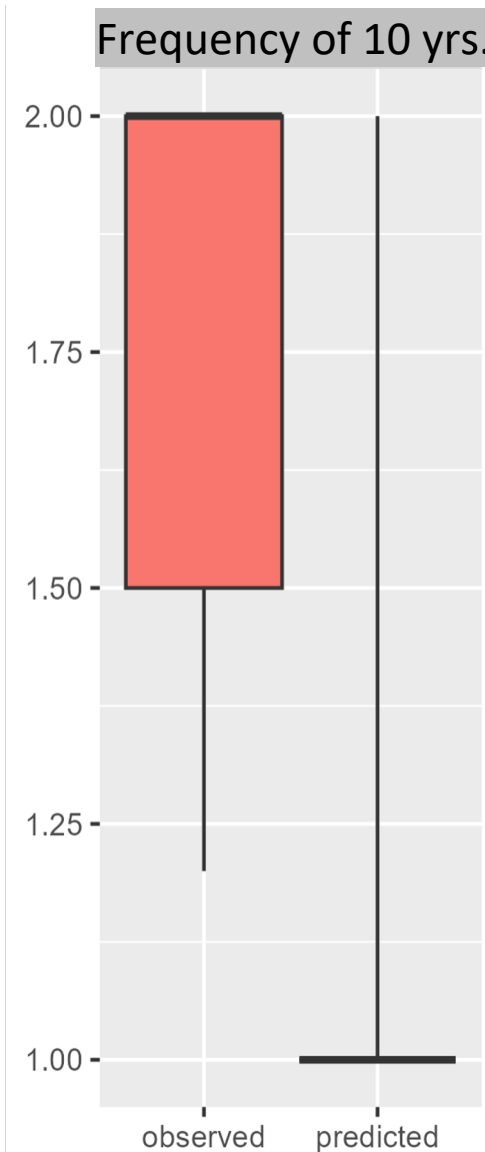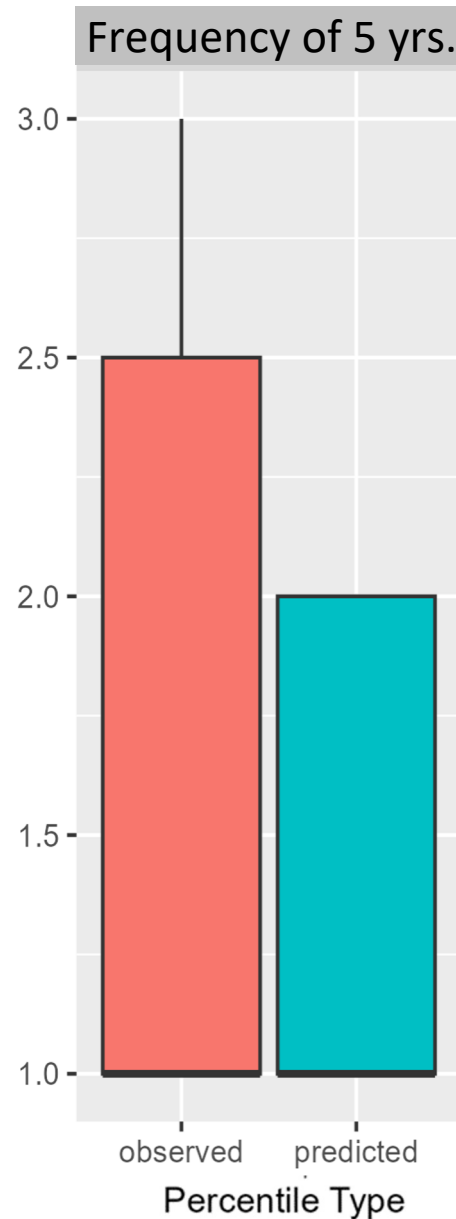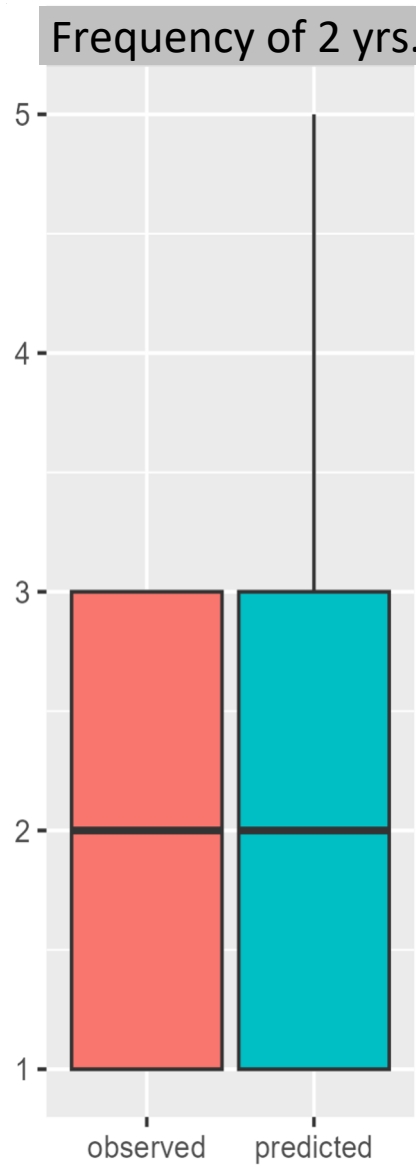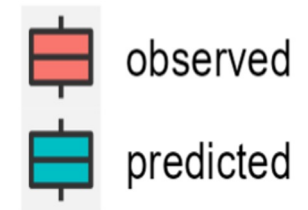
Below Los Padres Dam Gage Wet Season Continued

Peak Magnitude Metrics for COMID 17600789
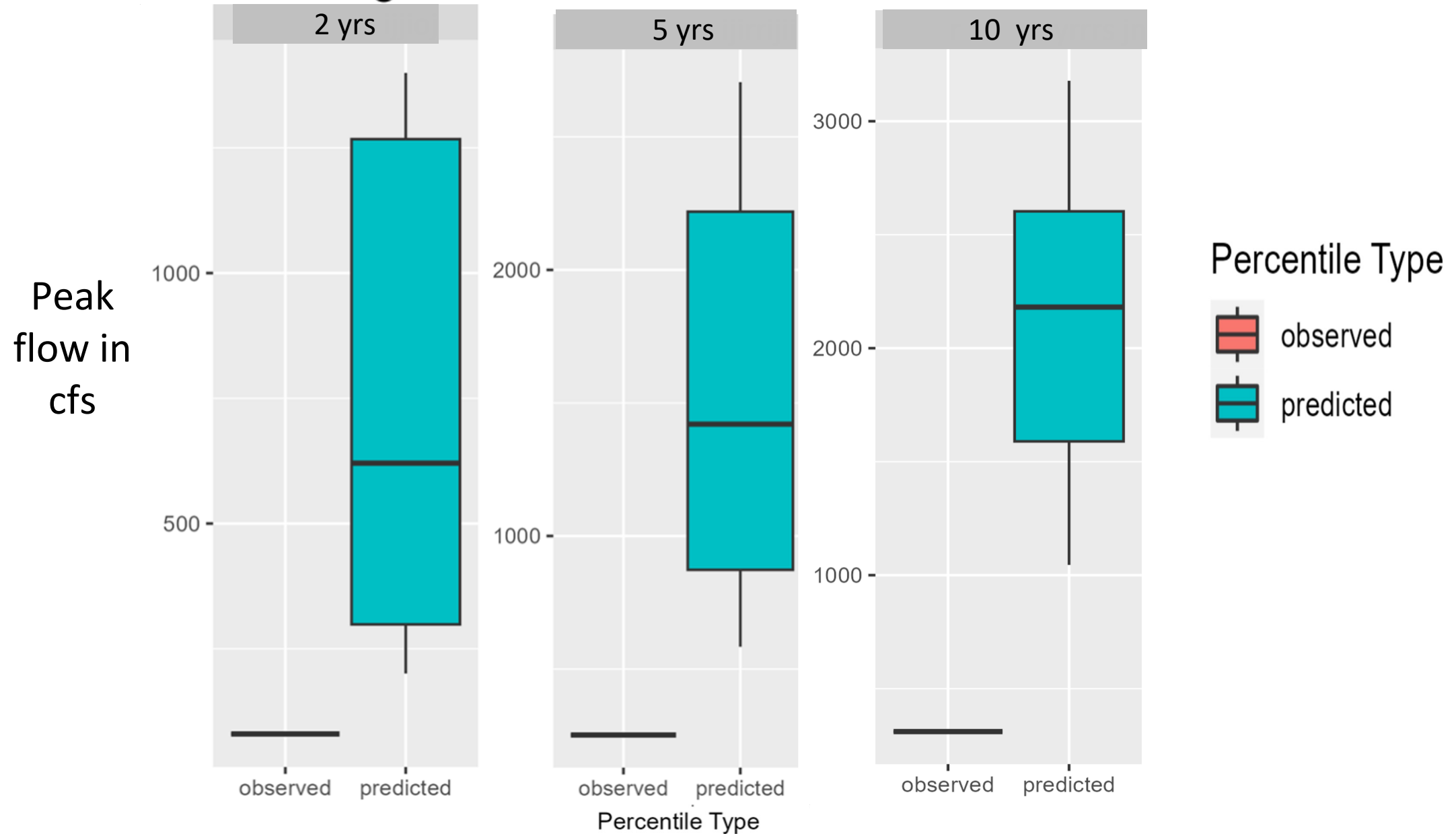
Below Los Padres Dam Gage Wet Season Continued

Peak Duration Metrics for COMID 17600789

Peak flow duration in days
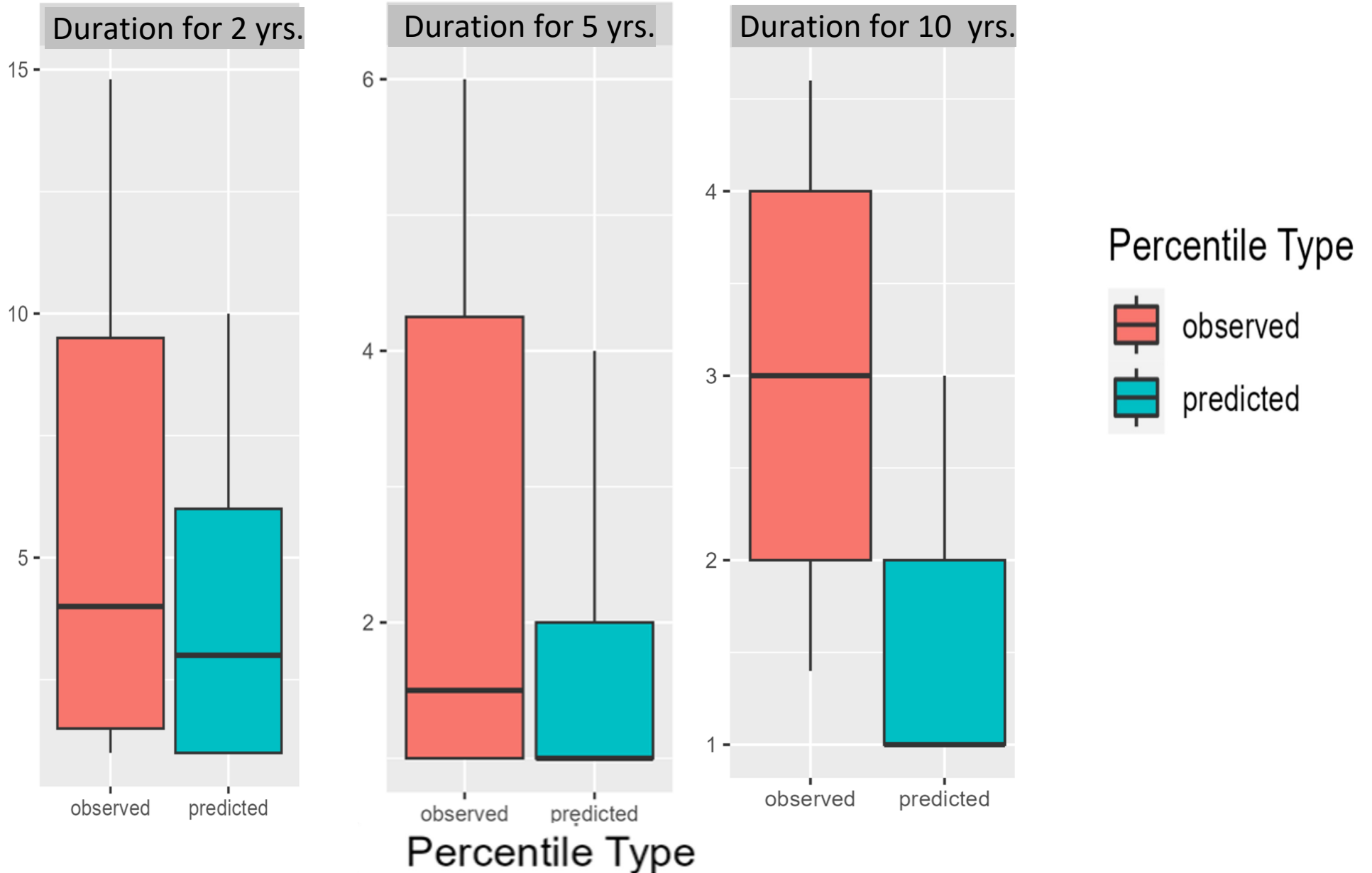
Within expected Wet Season Magnitude 50th Percentile in cfs metric or not

Highway 1 Bridge
Potrero Creek
Robinson Canyon Creek
Don Juan Bridge
Garzas Creek
Hitchcock Creek
Tularcitos Creek
Sleepy Hollow Weir
San Clemente Creek
Pine Creek
Cachagua Creek
Below Los Padres Dam

Greater Magnitude for the 50th percentile for the wet season than expected

Magnitude of 50th percentile within expected for wet season

Lower Magnitude for the 50th percentile in wet season than expected

N

0   2   4
Miles

Created by Erika Garig in January 2023.
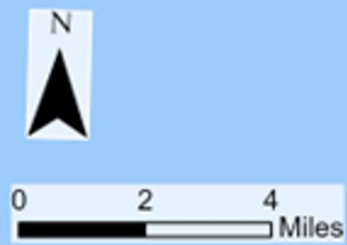
Dry Season Metrics: Which are **within predicted**, and which are **less than** or **greater than** predicted?

Gage Sites	Dry Season Duration in days	Dry-season 50th Percentile Magnitude	Dry-season 90th Percentile Magnitude	Dry-season start day
	Metrics			
Highway 1	Within predicted	Lower magnitude than predicted	Lower magnitude than predicted	Within predicted
Potrero Creek	Within predicted	Lower magnitude than predicted	Lower magnitude than predicted	Within predicted
Robinson Canyon	More days in dry season	Lower magnitude than predicted	Within predicted	Within predicted
Don Juan Bridge	Within predicted	Within predicted	Within predicted	Within predicted
Garzas Creek	Within predicted	Lower magnitude than predicted	Lower magnitude than predicted	Within predicted
Hitchcock Creek	More days in dry season	Lower magnitude than predicted	Within predicted	Within predicted
Tularcitos Creek	Within predicted	Lower magnitude than predicted	Lower magnitude than predicted	Within predicted
Sleepy Hollow Weir	Within predicted	Within predicted	Within predicted	Within predicted
San Clemente Creek	Within predicted	Within predicted	Within predicted	Within predicted
Pine Creek	Within predicted	Within predicted	Within predicted	Within predicted
Cachagua Creek	Within predicted	Lower magnitude than predicted	Lower magnitude than predicted	Within predicted
Below Los Padres Dam	Within predicted	Lower magnitude than predicted	Lower magnitude than predicted	Within predicted

Wet Season Metrics: Which are **within predicted**, and which are **less than** or **greater than** predicted?

	Metrics			
Gage Sites	Wet-season Duration in days	Wet-season 10th Percentile Magnitude	Wet-season 50th Percentile Magnitude	Wet-season start day
Highway 1	Within predicted	Within predicted	Within predicted	Within predicted
Potrero Creek	Within predicted	Lower magnitude than predicted	Greater magnitude than predicted	Within predicted
Robinson Canyon	Within predicted	Lower magnitude than predicted	Within predicted	Within predicted
Don Juan Bridge	Within predicted	Within predicted	Within predicted	Within predicted
Garzas Creek	Within predicted	Within predicted	Greater magnitude than predicted	Within predicted
Hitchcock Creek	Within predicted	Lower magnitude than predicted	Within predicted	Within predicted
Tularcitos Creek	Within predicted	Lower magnitude than predicted	Lower magnitude than predicted	Within predicted
Sleepy Hollow Weir	Within predicted	Within predicted	Within predicted	Within predicted
San Clemente Creek	Within predicted	Within predicted	Within predicted	Within predicted
Pine Creek	Within predicted	Within predicted	Within predicted	Within predicted
Cachagua Creek	Within predicted	Within predicted	Within predicted	Within predicted
Below Los Padres Dam	Within predicted	Lower magnitude than predicted	Lower magnitude than predicted	Within predicted

Peak-flow Metrics: Which are **within predicted**, and which are **less than** or **greater than** predicted?

Gage Sites	Peak-flow magnitude for 2 years in cfs	Peak-flow magnitude for 5 years in cfs	Peak-flow magnitude for 10 years in cfs
Highway 1	Within Predicted	Within Predicted	Within Predicted
Potrero Creek	Within Predicted	Within Predicted	Within Predicted
Robinson Canyon	Within Predicted	Within Predicted	Within Predicted
Don Juan Bridge	Within Predicted	Within Predicted	Within Predicted
Garzas Creek	Within Predicted	Within Predicted	Within Predicted
Hitchcock Creek	Within Predicted	Within Predicted	Within Predicted
Tularcitos Creek	Lower magnitude than predicted	Lower magnitude than predicted	Lower magnitude than predicted
Sleepy Hollow Weir	Within Predicted	Within Predicted	Within Predicted
San Clemente Creek	Within Predicted	Within Predicted	Within Predicted
Pine Creek	Within Predicted	Within Predicted	Within Predicted
Cachagua Creek	Lower magnitude than predicted	Lower magnitude than predicted	Lower magnitude than predicted
Below Los Padres Dam	Lower magnitude than predicted	Lower magnitude than predicted	Lower magnitude than predicted

Questions?

Shifting from Streamflow Indicators to River-Floodplain Connectivity Indicator

A New Way to Calculate River to Floodplain Connectivity

- The previous way was looking at the natural vegetation versus anthropogenic structures (buildings, roads, dams)

- The new way involves comparing elevation models for the river to floodplain height.

- It compares twice the bankfull height (expected) to the floodplain height (observed)

- Bankfull height: the elevation at which water has filled the principal channel and just begins to flow onto the floodplain.

If Floodplain Height (FPH) is less than or equal to twice the Bankfull Height (2xBFH) then it is connected

2xBFH

FPH

Stream Channel
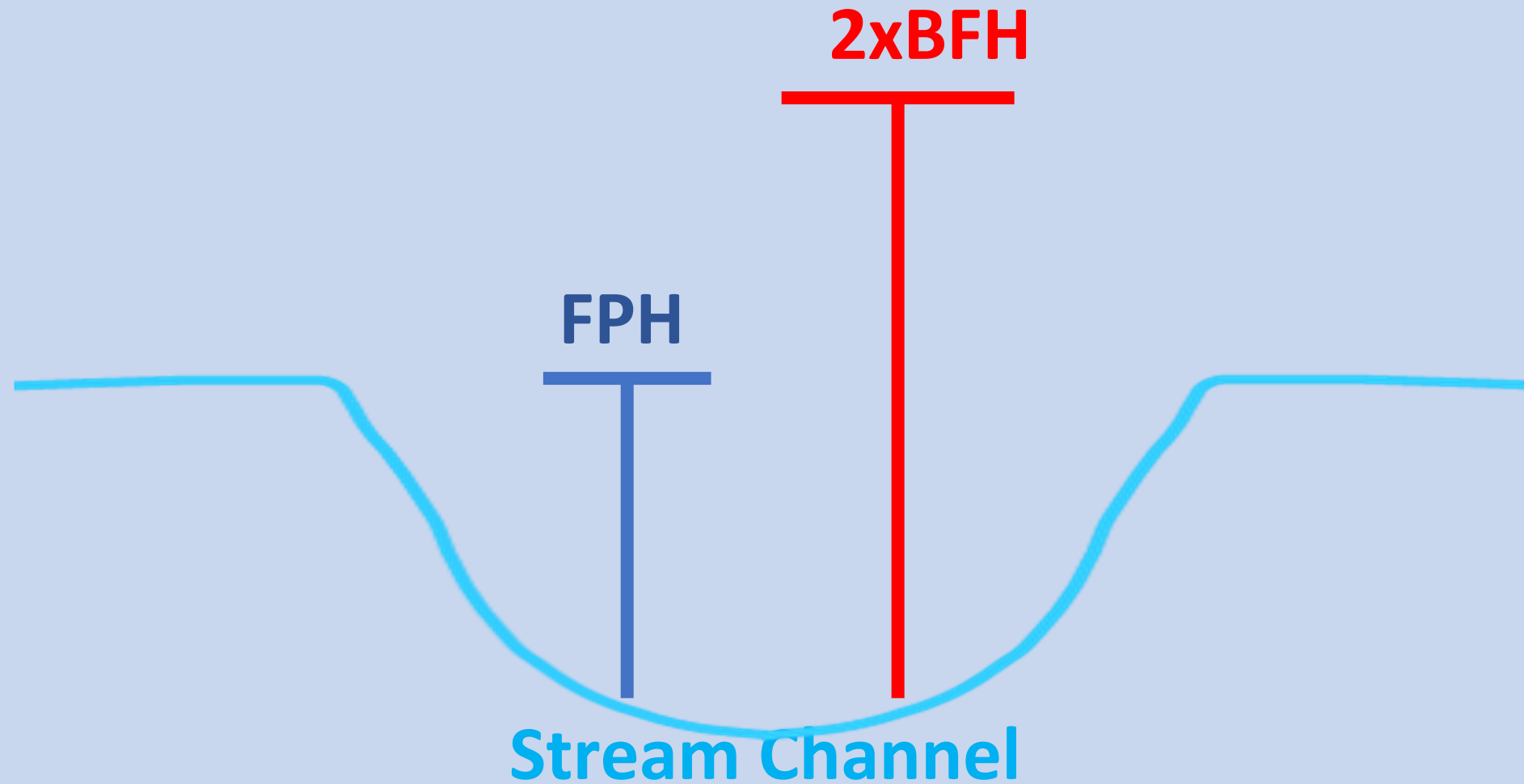
FPH <= 2x**BSH** is connected

If Floodplain Height (FPH) is greater than twice the Bankfull Height (2xBFH) then it is not connected

FPH

2xBFH

Stream Channel

FPH > 2xBFH not connected

Is the stream segment connected?

— Not Connected
— Connected

Highway 1 Bridge
Potrero Creek
Robinson Canyon Creek
Don Juan Bridge
Garzas Creek
Hitchcock Creek
Tularcitos Creek
Sleepy Hollow Weir
San Clemente Creek
Pine Creek
Cachagua Creek
Below Los Padres Dam

Elevation
Meters
1
750
1330

Created by Erika Garig in April 2023
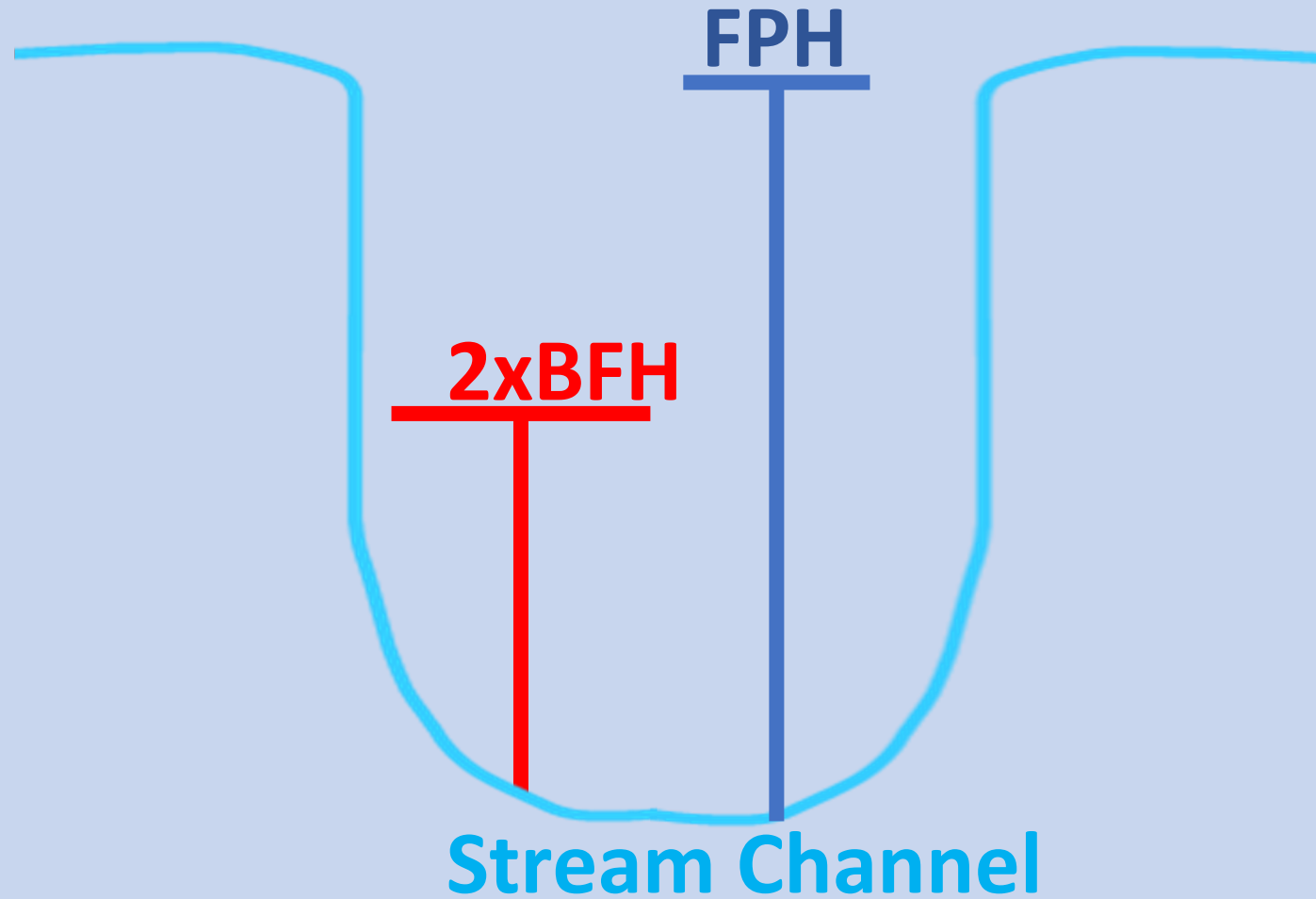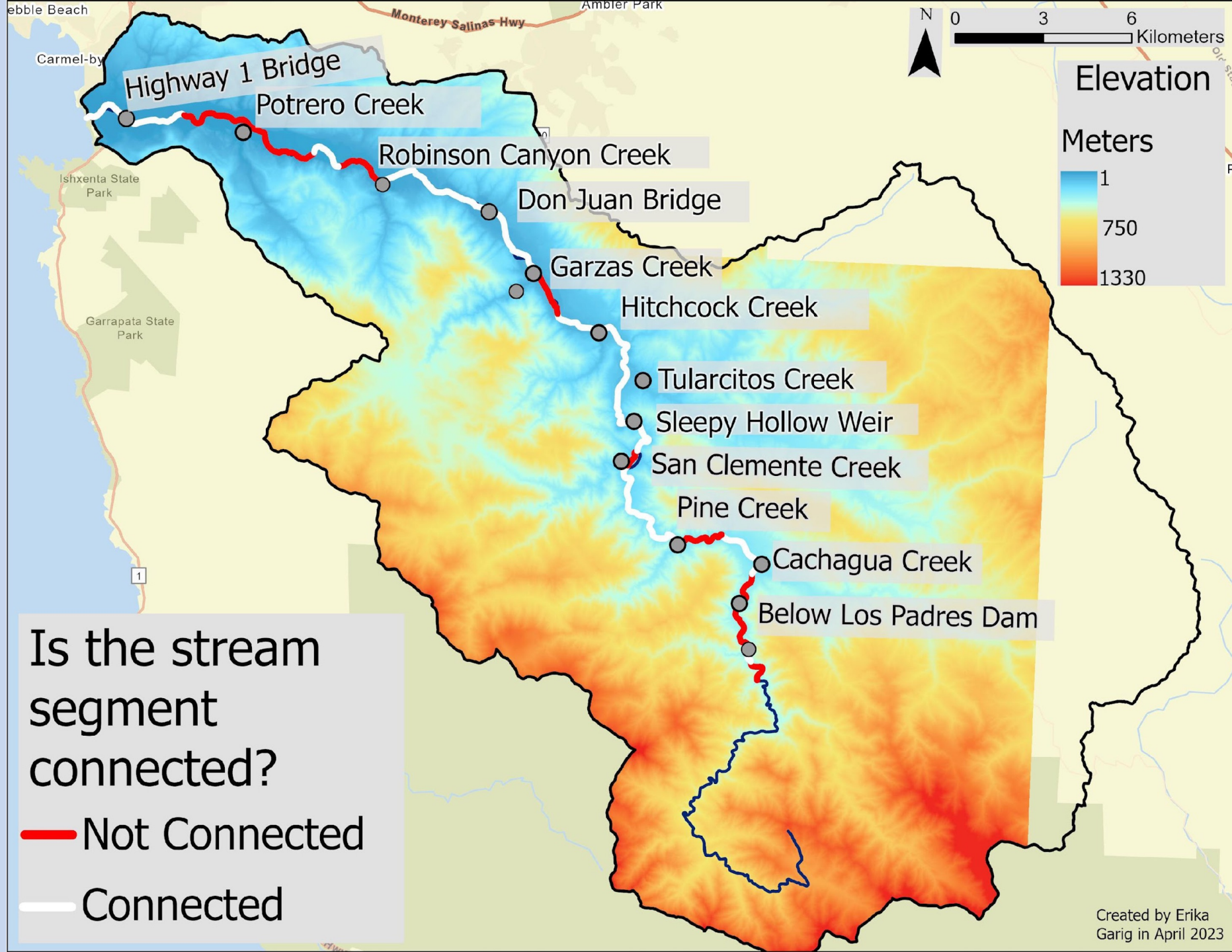
EEAs	Objectives	Indicators	Condition
Chemical & Physical	Improve and maintain water quality necessary for supporting healthy aquatic ecosystems.	Benthic macroinvertebrate communities	78
		Surface water chemistry (dissolved oxygen, conductivity, turbidity, temperature, pH)	97
		Nutrients and pesticides	74
	Manage water supply to provide sufficient flows for supporting aquatic life.	Dry-season streamflow	**67**
		Wet-season streamflow	**87**
Biotic & Ecological	Monitor and protect the California Central Coast steelhead population.	Adult steelhead count	12
		Juvenile steelhead population density	100
	Monitor and protect other native aquatic species such as the California red-legged frog	Native aquatic species such as the California Red-legged frog	
	Monitor and manage invasive riparian and aquatic species.	Aquatic invasive animal species such as the Brown trout, Striped bass, and New Zealand mudsnails	54
	Protect native bird populations.	Bird species diversity	96
Landscape	Enhance aquatic habitat connectivity.	Aquatic habitat barrier density	73
		River-floodplain connectivity	**32**
	Protect upland habitat connectivity.	Percentage of natural land	96
Natural Disturbance	Restore fire frequency to natural levels to protect human communities while allowing natural fire disturbance to support native flora and fauna.	Fire frequency	29