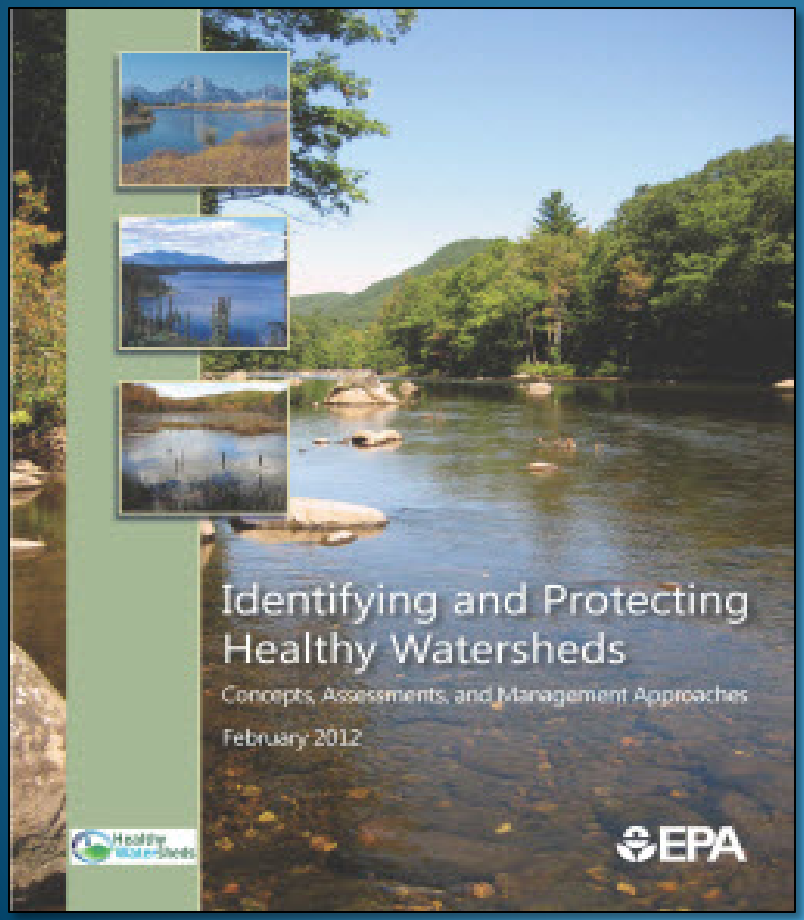
Healthy Watersheds in Region 6



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HWI Regional Coordinator
EPA Region 6

Flow

- Flows maintain the ecological integrity of an ecosystem by regulating:
  - Biotic factors
  - Geology
  - Chemistry
  - Energy inputs/outputs

Flow Regimes

- The components of a natural flow regime are an integral part of every healthy watershed
  - Magnitude
  - Duration
  - Frequency
  - Timing
  - Rate of Change

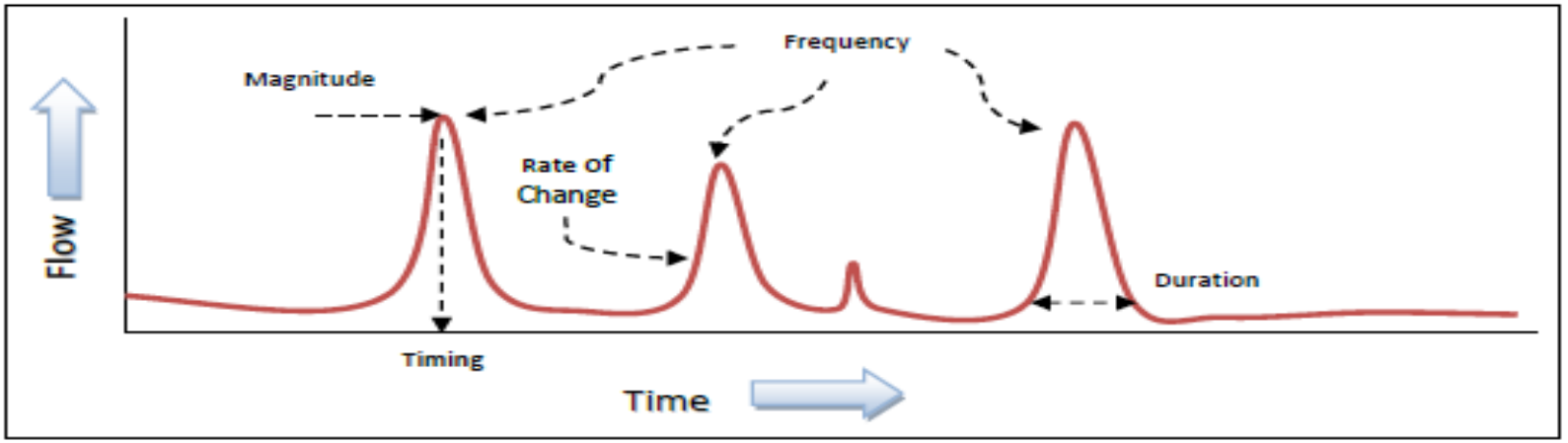
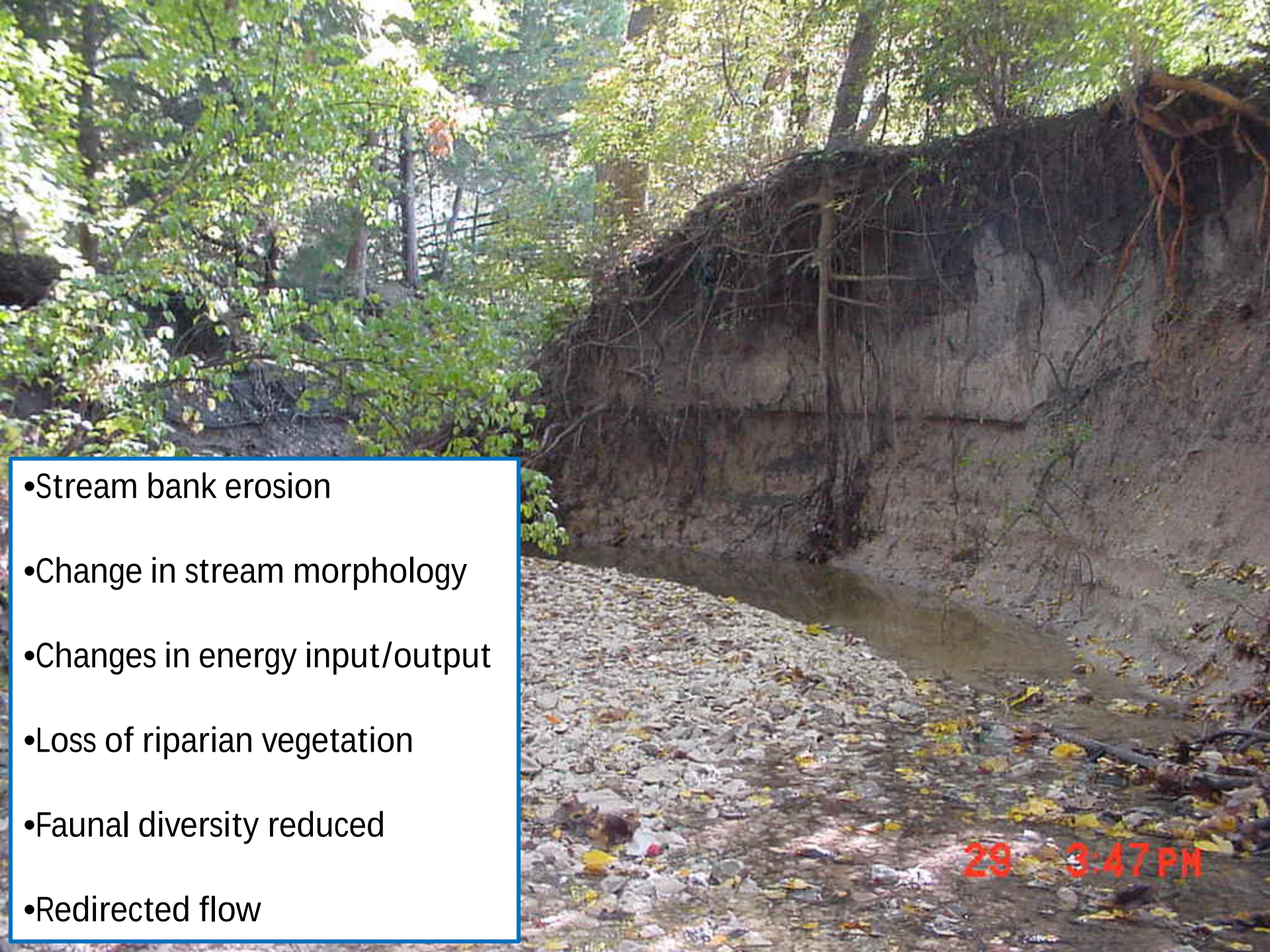


Figure 1. Illustration of the 5 characteristics of the natural flow regime (magnitude, frequency, duration, timing, and rate of change) for high flow events.

Flow Regimes

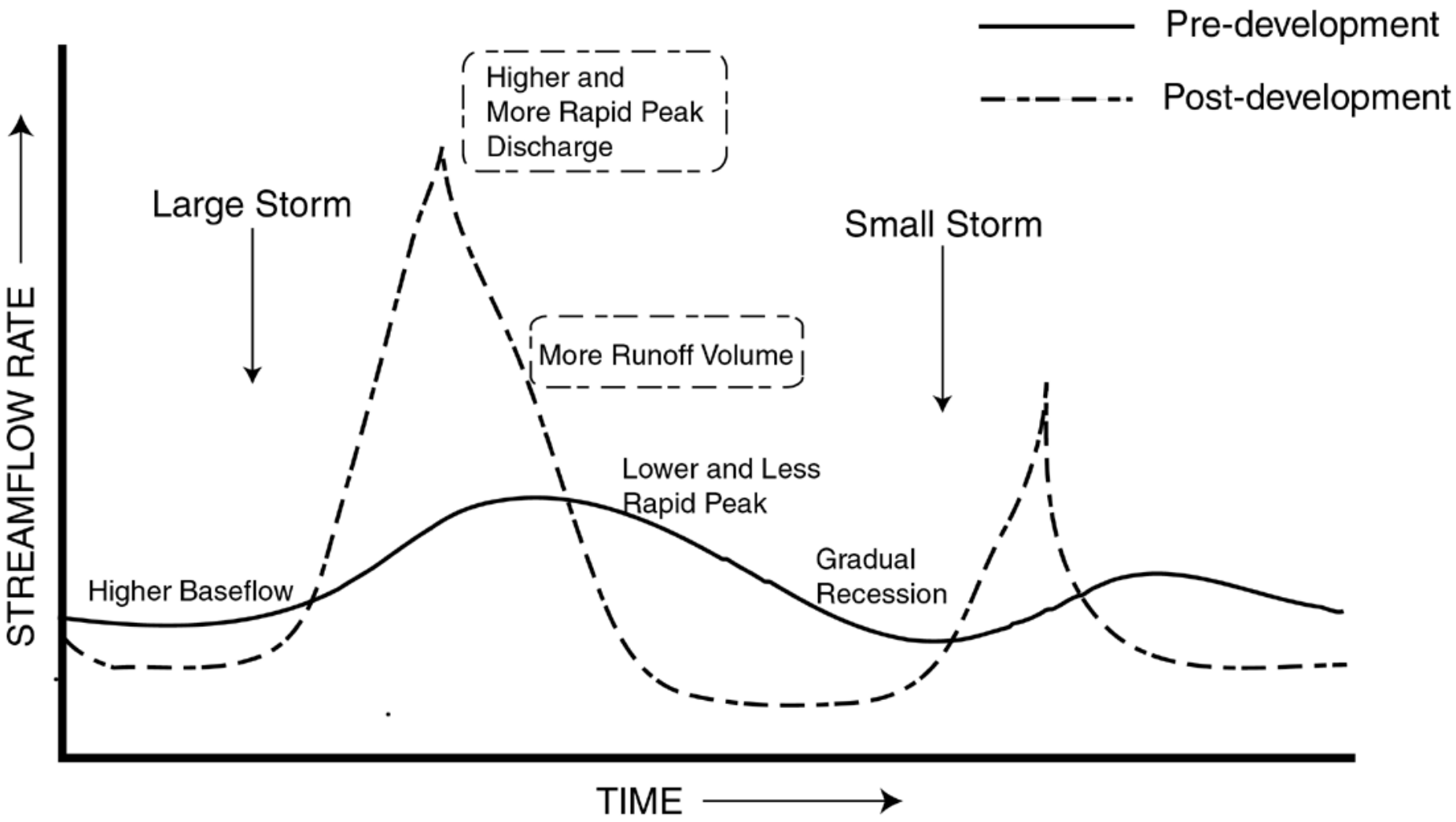
- Flow regimes can be altered through many processes:
  - Dams
  - Groundwater withdrawals
  - Diversions
  - Urban development
  - Drought

- Hydrologic alteration of any of these components can lead to a host of detrimental effects

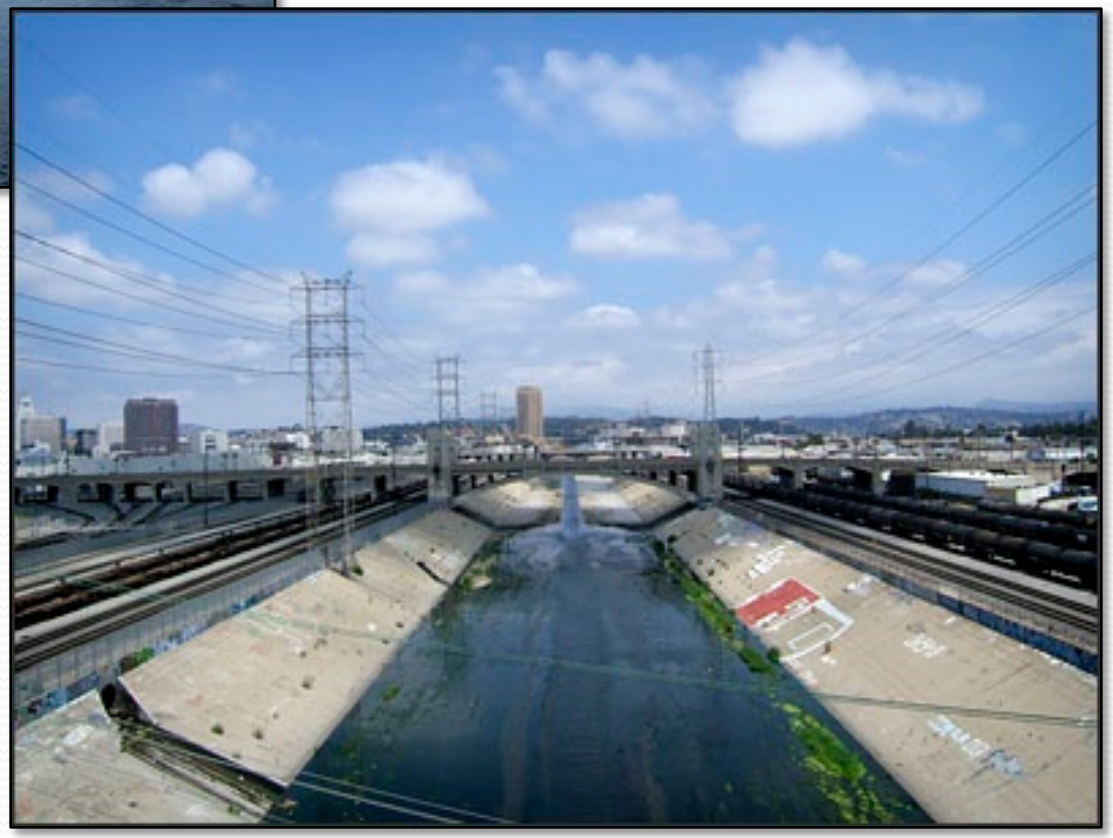


- Stream bank erosion
- Change in stream morphology
- Changes in energy input/output
- Loss of riparian vegetation
- Faunal diversity reduced
- Redirected flow

Human Impacts on Flows

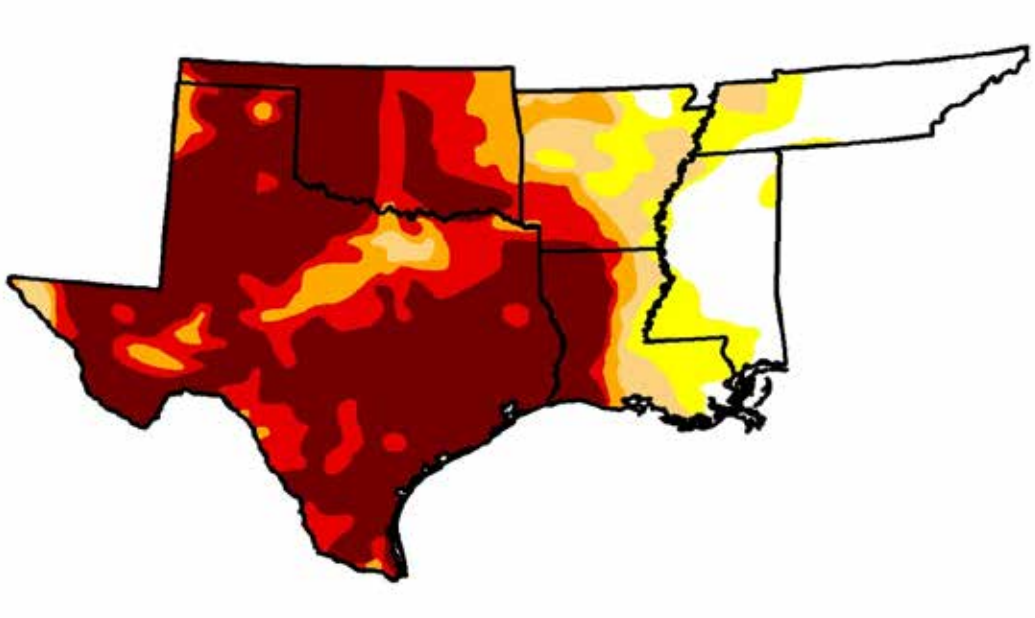


Changes in stream hydrology as a result of urbanization (Schueler, 1992).



Natural Impacts on Flow

- Drought exacerbates these problems
- Drought conditions in Fall of 2011:



Drought Severity

D0 - Abnormally Dry

D1 Drought - Moderate

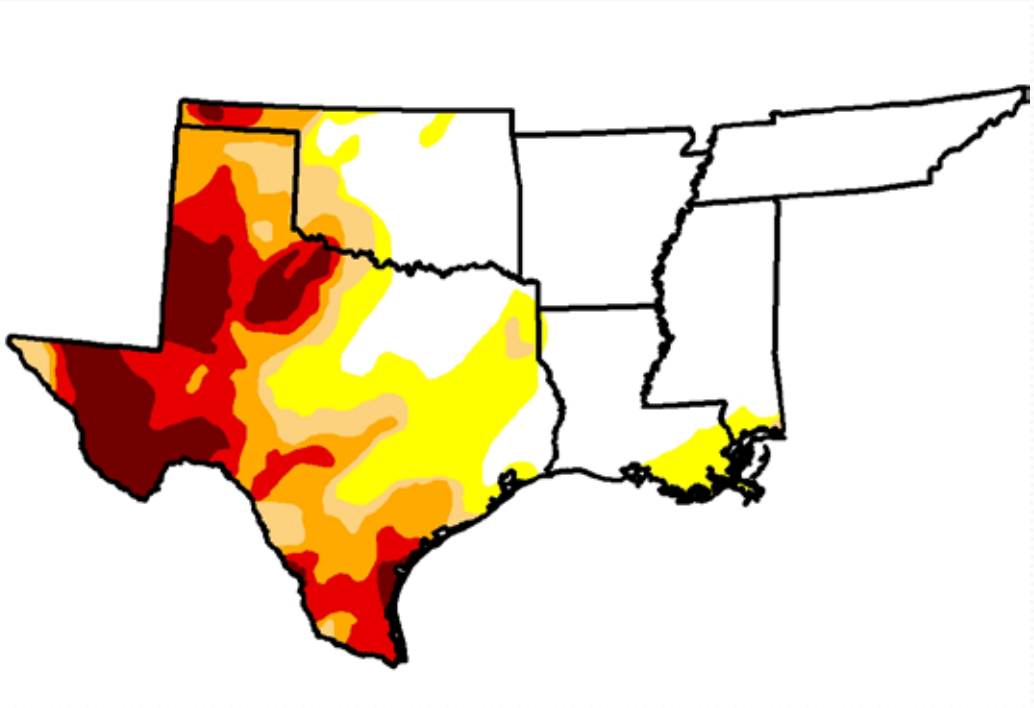
D2 Drought – Severe

D3 Drought - Extreme

D4 Drought - Exceptional

Natural Impacts on Flow

- Drought exacerbates these problems
- Drought conditions in Spring 2012:



Drought Severity

D0 - Abnormally Dry

D1 Drought - Moderate

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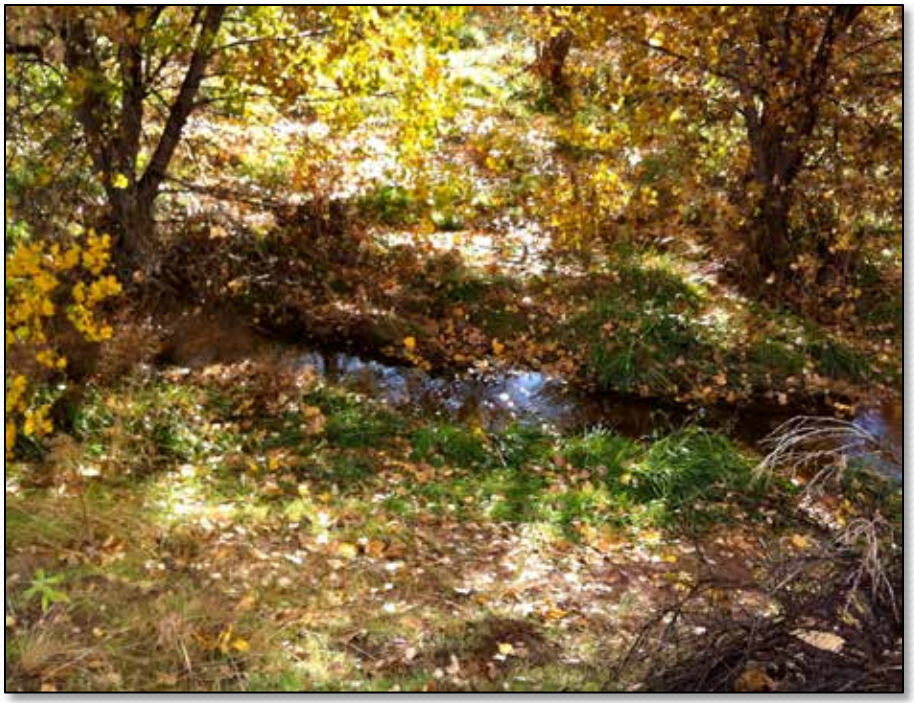
Healthy Watersheds in Region 6

- Ecologically sound management recommendations and assessment methodologies for the protection and restoration of natural flow regimes are of great interest to EPA Region 6
  - Water Quality Standards
  - Protective Flow Criteria



Healthy Watersheds in Region 6

- As drought conditions continue it is increasingly important to understand how we impact flows
  - Climate Change
  - Groundwater Withdrawals
  - Diversions and Dams
  - Hydraulic Fracturing Water Use

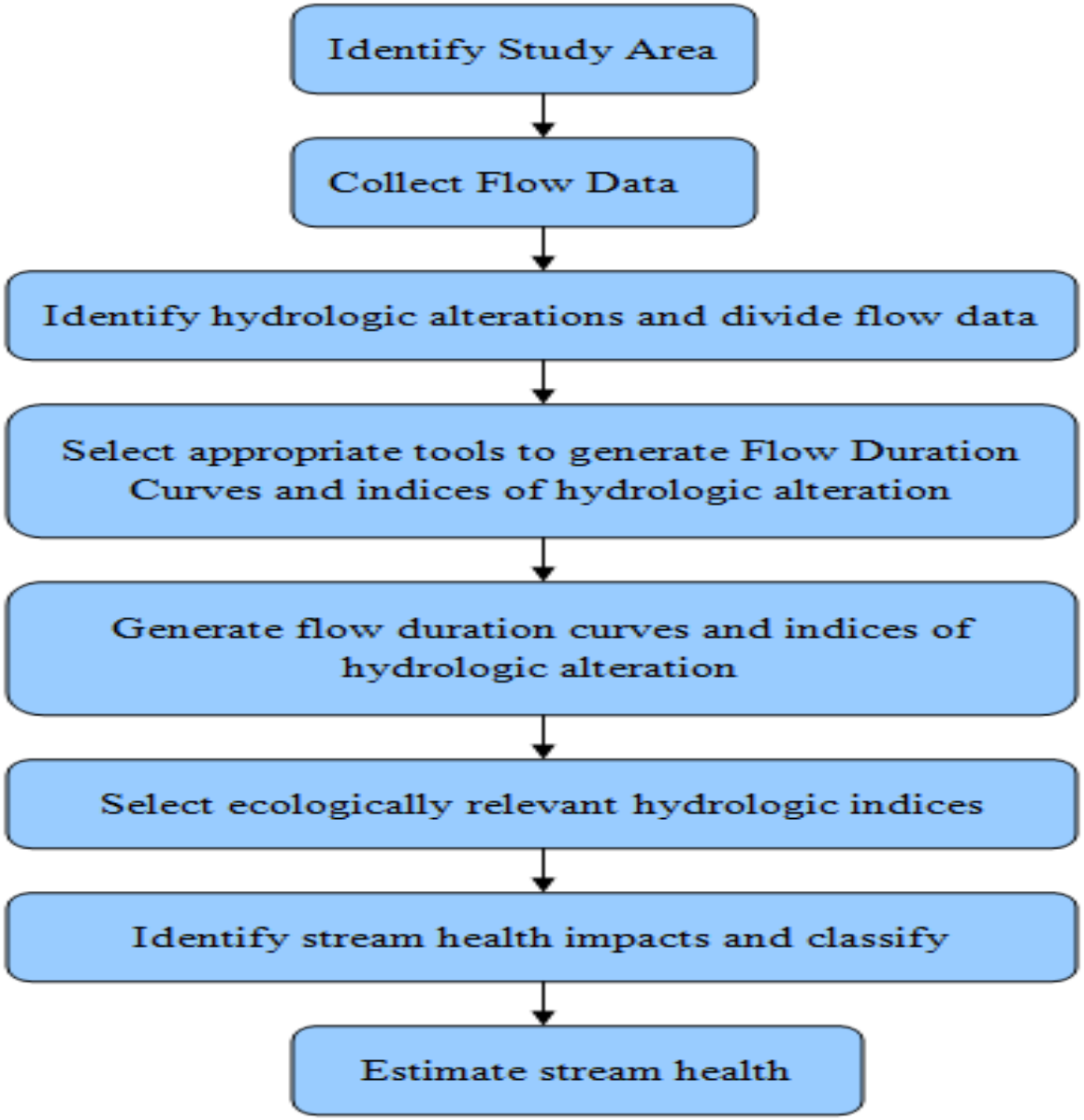
Project Summaries

Flow Duration Curve Development

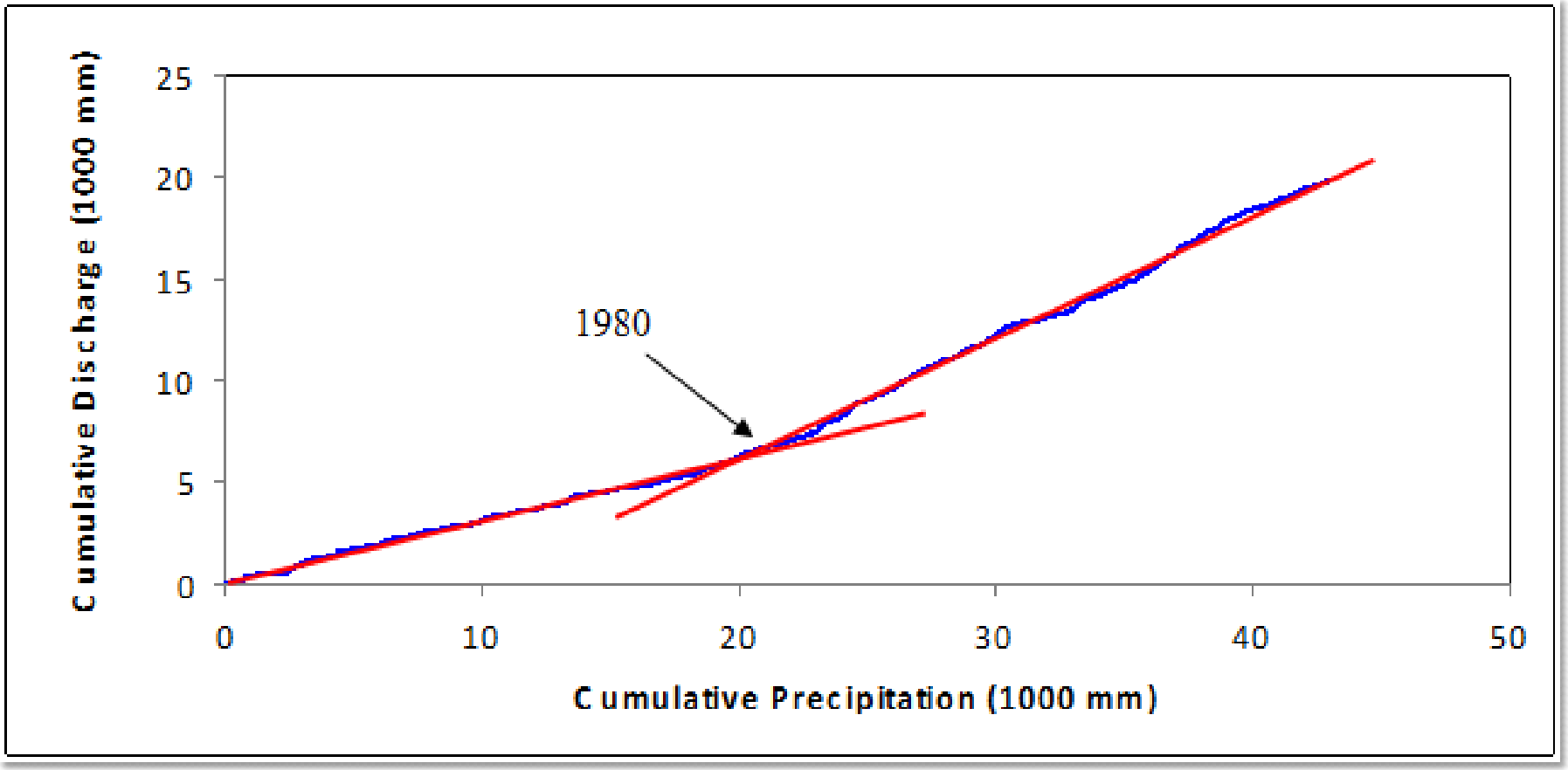
- Project Goal
  - Flow duration curves define altered and natural hydrologic conditions
  - This document seeks to aid EPA and other agencies in the development and use of flow duration curves
  - Describes a developed protocol to establish stream flow based goals to maintain or restore stream health

Flow Duration Curve Development

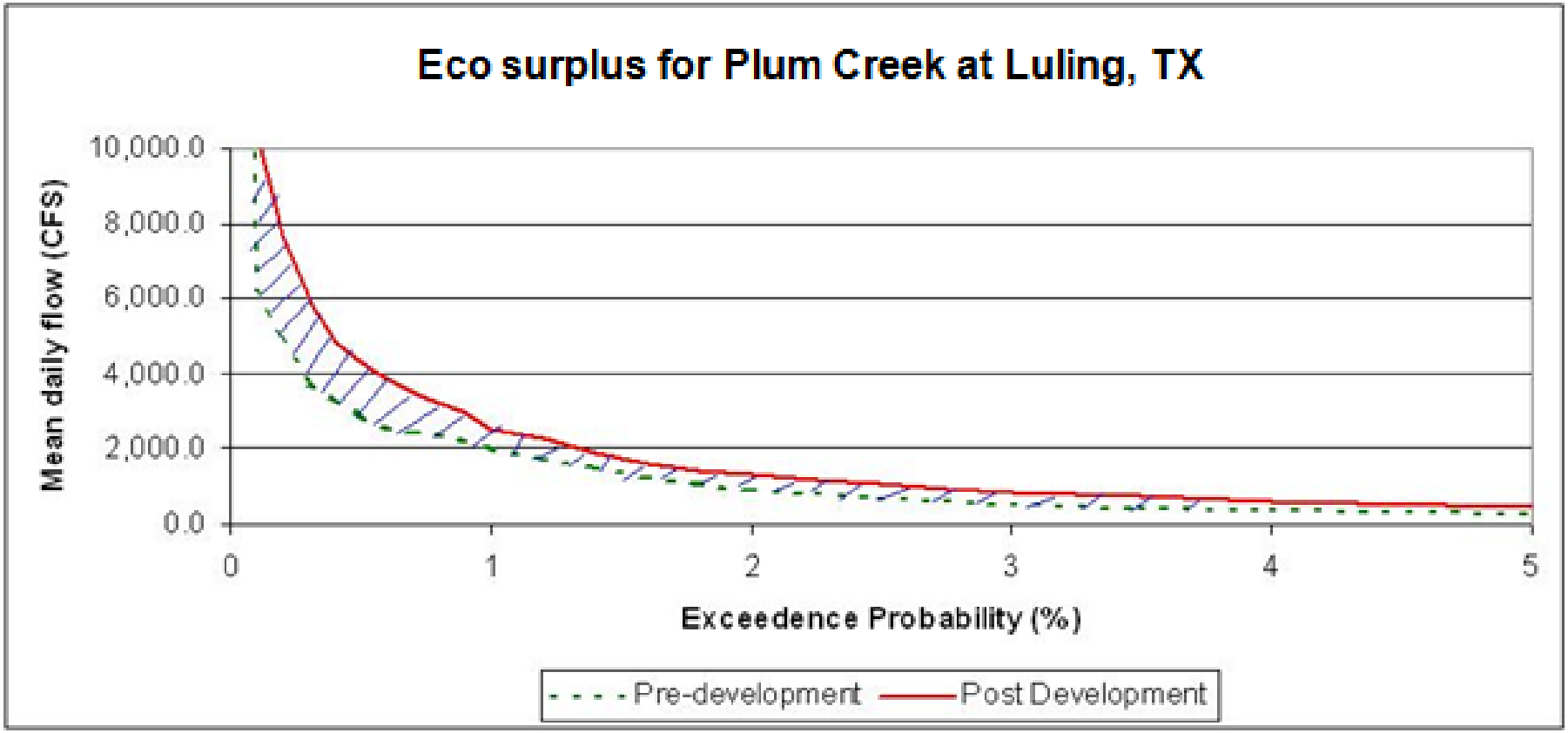
- Summary
  - Describes the steps needed to generate a flow duration curve and provides some resources to look for data on flows
  - Describes how to link flow characteristics with hydrologic indices (IHA, ELOHA, etc.) to better understand ecological impacts of hydrologic alteration


Identify Study Area
Collect Flow Data
Identify hydrologic alterations and divide flow data
Select appropriate tools to generate Flow Duration Curves and indices of hydrologic alteration
Generate flow duration curves and indices of hydrologic alteration
Select ecologically relevant hydrologic indices
Identify stream health impacts and classify
Estimate stream health

Identify Hydrologic Alteration Event

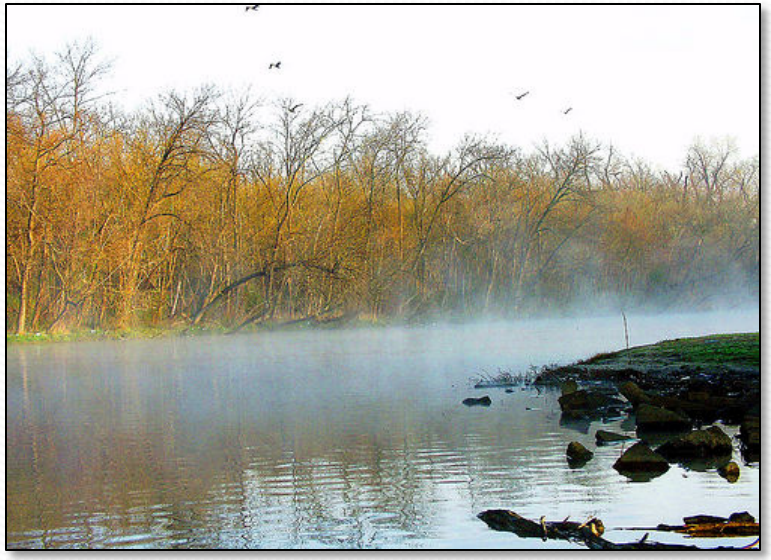


Flow Duration Curves



Flow Duration Curve Development

- Summary
  - Includes two examples of developing and interpreting flow duration curves.
  - Both streams had hydrologic alterations impacting the natural flow regime of the ecosystem
    - TX- Plum Creek (rural) and White Rock Creek (urban, Dallas)

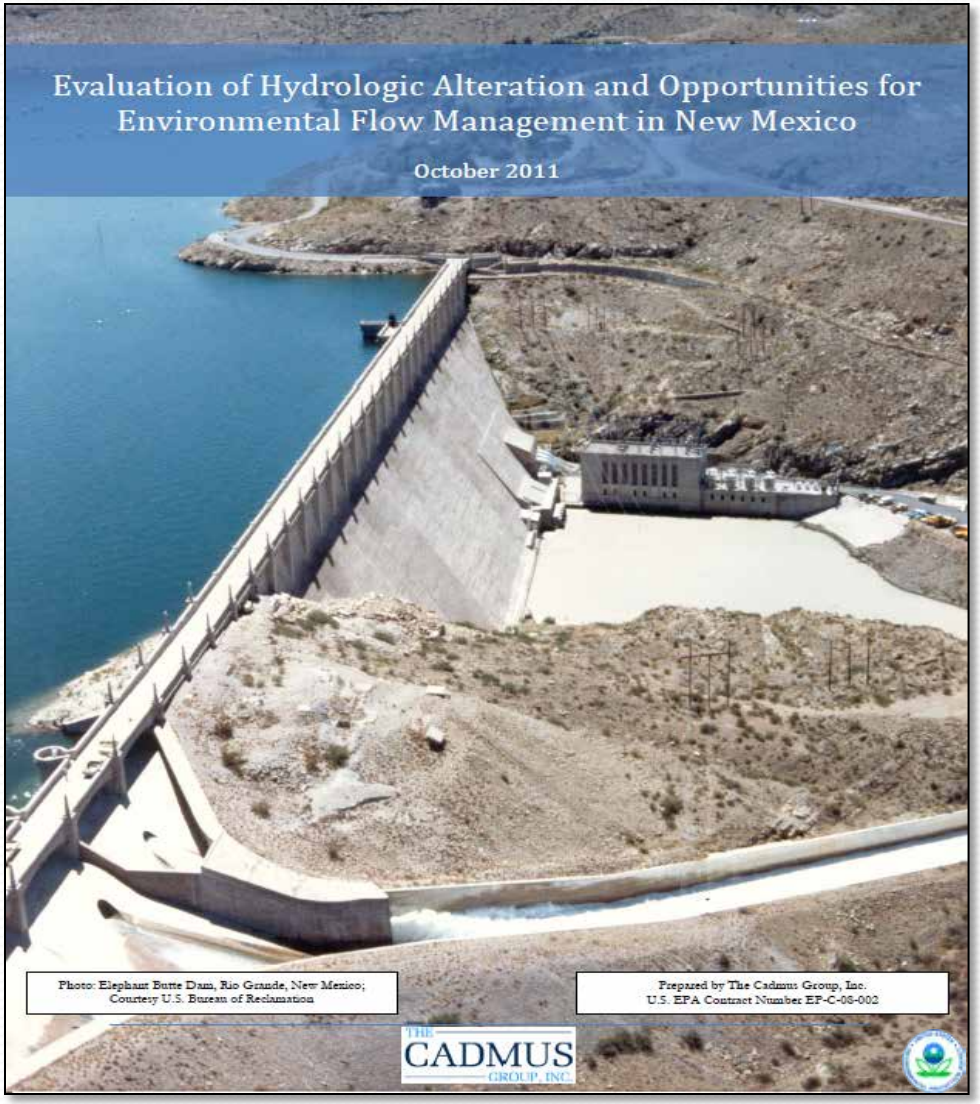


Flow Duration Curve Development

- Future uses
  - Guide restoration activities of watershed groups by targeting healthy flow regimes
  - Could be used to develop flow targets for watershed based plans and/or TMDLs
  - Could be used to identify hydrologic criteria for water quality standards and flow criteria development
  - Excellent tool for COGs and state and municipal planning authorities to take a proactive role in protecting urban flow regimes as development increases

Hydrologic Alteration in New Mexico

- Project Goal
  - To allow EPA and State Agencies to assess the extent and impact of hydrologic alteration on flow regimes in New Mexico using Indicators of Hydrologic Alteration (IHA) analysis
  - 2010 pilot project for the Healthy Watersheds Initiative



Hydrologic Alteration in New Mexico

- New Mexico's streams and rivers range from small mountain headwaters to major river systems

- New Mexico's waters are used for:
  - Drinking water
  - Irrigation
  - Recreation

- Municipal and agricultural impacts on flow regimes:
  - Diversions
  - Dams and reservoirs
  - Levees and other channelization structures
  - Ground water withdrawal

Hydrologic Alteration in New Mexico

- The ecological implications of hydrologic alteration include:
  - Riparian vegetation reduction
  - Invasive species
  - Habitat loss and fragmentation
  - Reductions in biodiversity
  - Streambank erosion
  - Water quality impairments
  - Loss of recreational waters

Hydrologic Alteration in New Mexico

- Summary
  - Document examines long term flow records for 32 sites in New Mexico to assess relative health of streams and extent of human alteration on hydrology
  - Used several metrics of watershed health in conjunction with Indicators of Hydrologic Alteration (IHA) analysis
  - Incorporated input from New Mexico Flows Technical Team

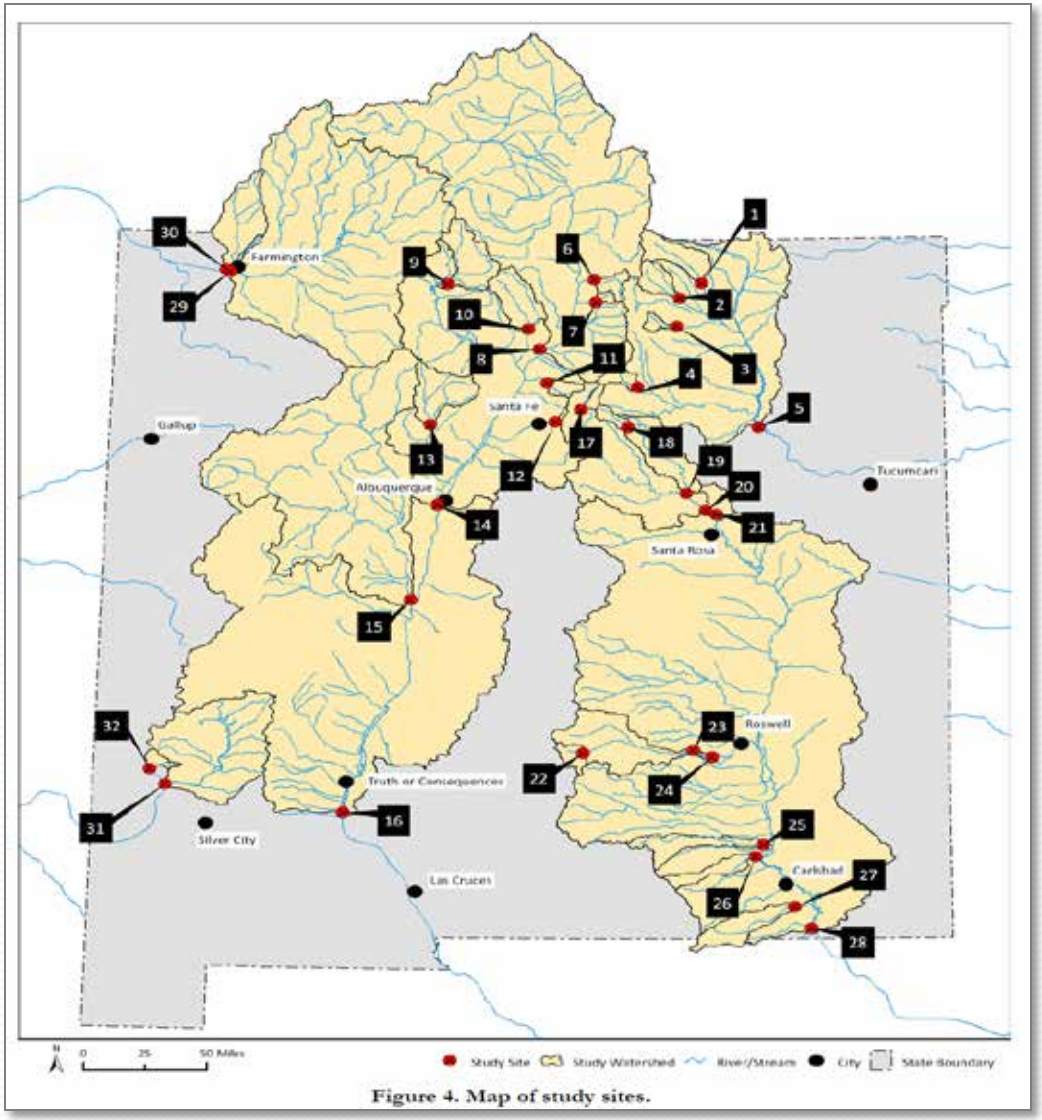
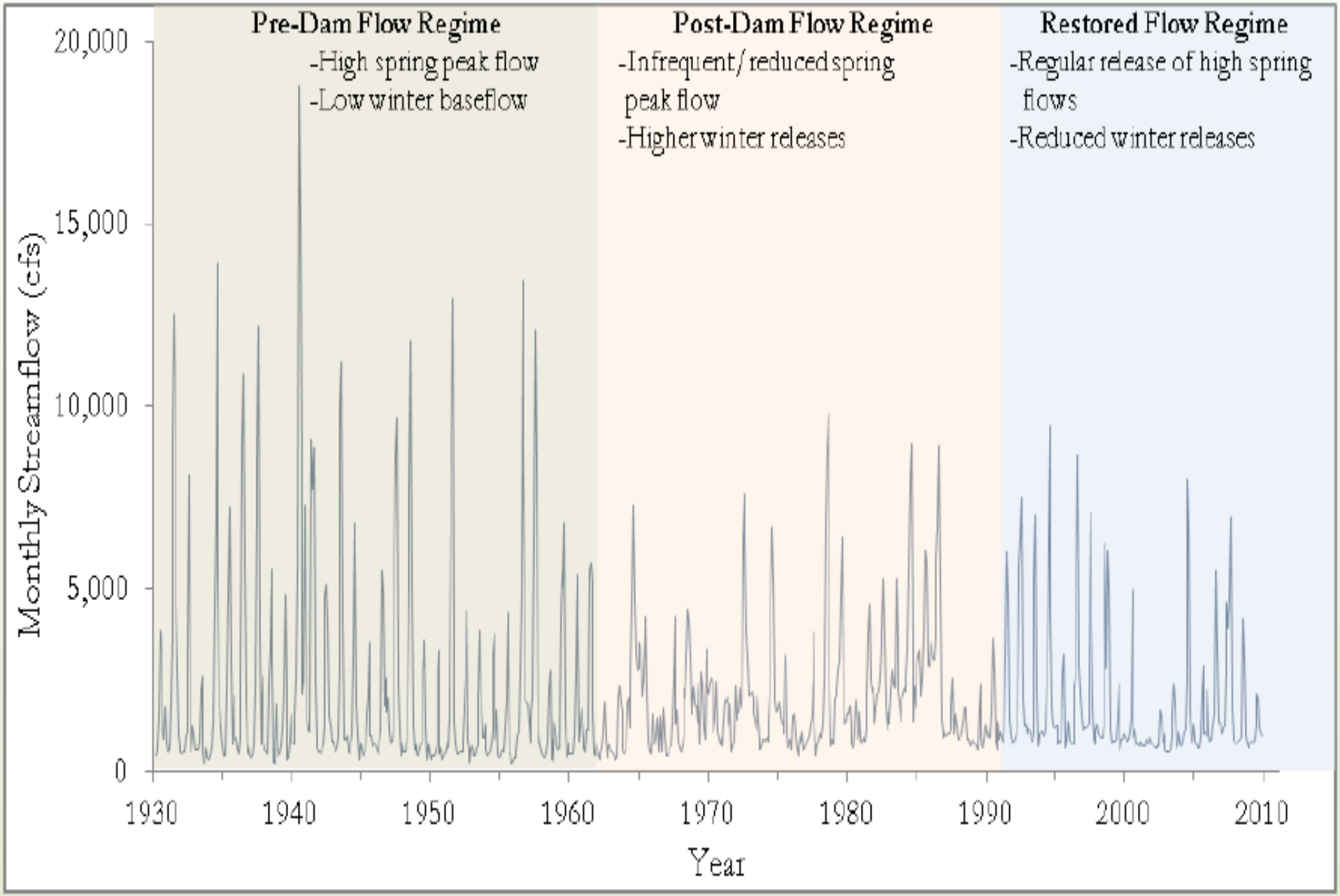


Figure 4. Map of study sites.

Hydrologic Alteration in New Mexico

- Results
  - Flow alteration from dams, groundwater diversions, and withdrawals resulted in shifts in magnitude, frequency, timing, and duration of both high and low flow events



San Juan River (at Farmington) monthly streamflow over the period 1930-2010.

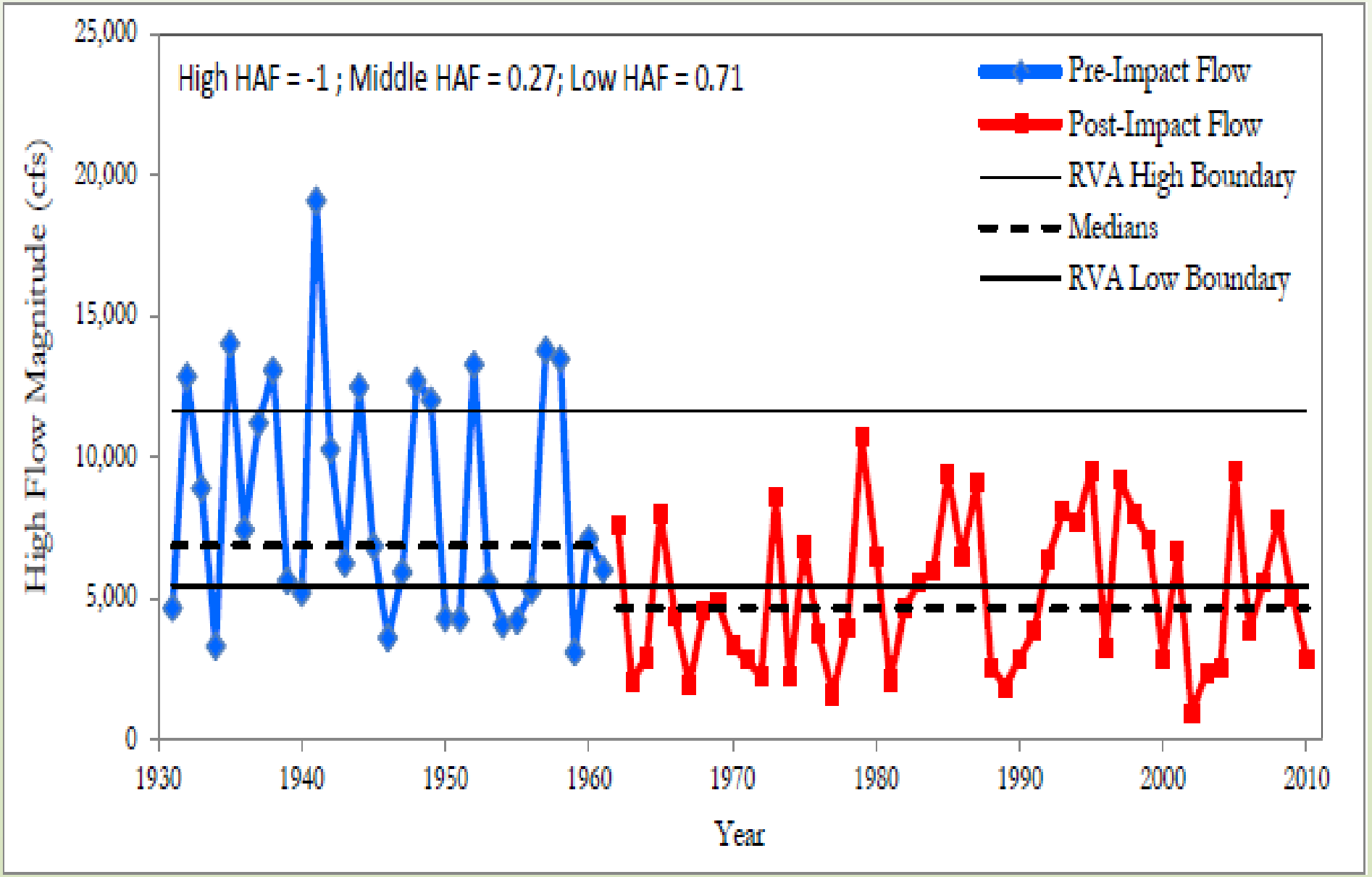


Figure 6. Example of Range of Variability (RVA) data for San Juan River high flow magnitude.

Hydrologic Alteration in New Mexico

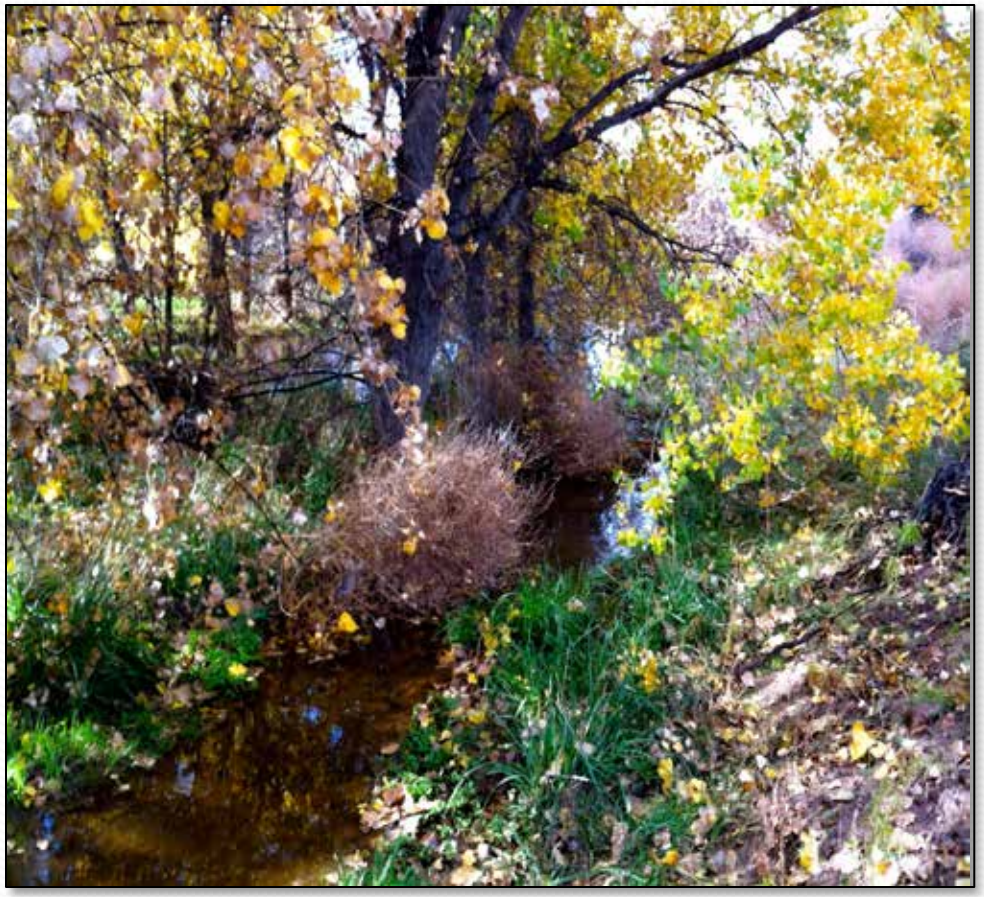
- Results
  - 28 of 32 sites demonstrated alteration in at least one flow component
  - Many displayed changes in flow regime consistent with effects from upstream river management (diversions, groundwater wells)
    - Reduced high flow magnitude
    - Increased low flow magnitude
  - IHA analysis indicates that hydrologic alteration is widespread in New Mexico and not confined only to streams impacted by dams and other large-scale human impacts

Hydrologic Alteration in New Mexico

- Future uses
  - Identify and prioritize vulnerable waters in New Mexico
  - Develop flow ecology relationships
  - Provide information to guide planning and implementation goals of environmental efforts to protect the waters of New Mexico
  - Provides baseline data to understand the effects of increased agricultural water demand as drought conditions persist

Region 6 Flow Projects

- Target Users and Applications
  - EPA
  - State 319 Agencies
  - Watershed Groups
  - River Authorities
  - COGs
  - Local Regulation (MS4 permittees)
  - Watershed-based planning
  - Zoning agencies
  - Flood control
  - Conservation groups



Acknowledgments

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To Download:

http://www.epa.gov/region6/water/ecopro/watershd/nonpoint/projects-index.html