PLANNING CONSIDERATIONS FOR DAM REMOVALS

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DAM REMOVALS

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SAPILLO CREEK BELOW LAKE ROBERTS DAM, GILA, NM

JEMEZ DAM, SANTA ANA PUEBLO, NM

PONDEROSA DAM, PONDEROSA, NM
Introduction

- Only option to restore natural stream conditions
- Careful and detailed planning is required

Three approaches to removal:
- Complete
- Partial
- Staged

Operating rules and management

"Water is the most critical resource issue of our lifetime and our children’s lifetime. The health of our waters is the principal measure of how we live on the land."

-Luna Leopold
Dam Construction Impacts

- Large Dams
  - Control all but extreme floods
  - Stratification of reservoir
  - Cold water release
  - Sediment sorting & organics deposition
  - Hungry water releases
Dam Construction Impacts

- Small Dams
  - Capture only minor floods
  - Large sediment deposition only
  - Well mixed storage by bigger flows
  - Sediment movement around and out of reservoir
  - Minor floodplain effects

Beaver Dam
Dam Construction Impacts

- Stream Equilibrium
  - Pre-removal
  - Post-removal

- Size of dam –vs- stream flow

- Purpose of dam –vs- flow regime

- Different ecological effects between large & small dams

Lake Delhi Dam break
River Corridor Response

- Physical
  - Depth and Width
  - Coarse material moves by dispersal. No sediment pulse.
  - Fine material movement – pulse wavelength increases and amplitude decreases downstream
  - Debris transport and accumulation across cross-section
  - Cut bank and terrace formation

Isleta Dam on Rio Grande, Albuquerque, NM
River Corridor Response

- Hydrologic
  - Timing of removal vs. high flow periods
  - Natural river flow regime
  - 2 or 3-D velocity and sediment distribution across channel modeling
  - Temporal flow variations – flow duration, peak frequency, flow mass curves
  - In-stream flow requirements – pre- and post dam removal

- Environmental
  - Deferential rates of deposition and scour over space and time
  - Sediment transport variability with flows
  - Heterogeneous water quality
  - Bio-diversity & population density increase
  - Debris island habitat formation
  - Relationship between wash, suspended, and bed loads
  - Flow volume + ground water recharge + floodplain soil wetting determine species diversity
Reservoir Sediment Accumulation

- Delta formation
  - Main stream and tributaries
  - New channel evolution

Sediment sorting

- Coarse vs. fine
- Sources of post-dam removal sediment

Hondo Arroyo Dam built in 1900’s is silted to the top, Santa Fe, NM
Reservoir Water Quality

- Nutrient processing
  - Related to fine sediment disposition
  - DO availability
  - Sediment re-suspension
- Temperature variations
  - Reservoir velocity current circulation
  - Stratification
  - Bank vegetation

Farmington Lake, NM - water storage and quality
Existing Geomorphology

- **Reservoir**
  - Water Storage cycles
  - Velocity currents
  - Bank erosion
  - Island formation
  - Delta stabilization

- **Stream**
  - Water release cycles
  - Bar formation
  - Pools and riffles
  - Meanders

Galisteo Creek, New Mexico
Existing Habitats

- Soils
- Vegetation
- Ecozones
- Biota

"Riparian areas are those plant communities adjacent to and affected by surface or ground water of perennial or ephemeral water bodies such as rivers, streams, lakes, ponds, playas, or drainage ways. These areas have distinctly different vegetation than adjacent areas or have species similar to surrounding areas that exhibit a more vigorous or robust growth form."
Expected Geomorphology

- Sediment characterization
- Toxic or poor quality sediment, depth and extent
- Sediment disturbance/initiating movement
- Sediment transport
- Dispersal and deposition
- Stream response
- Long term monitoring
- River aggradation
- Flood plain impacts

Grand Canyon, AZ
Expected Habitats

- Soils and nutrients
- Suspended sediment concentrations and turbidity
- Vegetation transforms
- Ecozones/terraces
- Biota, opportunistic and succession
- Water quality protection
- Short term control of dust and erosion

Quality habitats support an entire biological community
Stream Water Quality

- Expected Changes
  - temperature
  - nutrients
  - dissolved oxygen
  - other contaminants

Many benefits of good water quality; FISH!
Developing The Plan

- Baseline inventory
- Stakeholder involvement
- Restoration designs
- Permitting and licensing issues
- Plan formulation
- Evolution of outcomes
- Benefits vs. risks
- Plan development
- Implementation

Defining Your Project
- Project people
- Project scope & focal targets

Using Results to Adapt & Improve

Developing Strategies & Measures

Implementing Strategies & Measures
Thank you!

- DAM REMOVAL DESIGN
- STORMWATER MANAGEMENT
- RIVER RESTORATION
- HYDROLOGY AND HYDRAULICS

Do something that the world would care about for decades after you have passed on.
Lorrin L. Lee