



Characteristics of Arid West Effluent Dependent Waters

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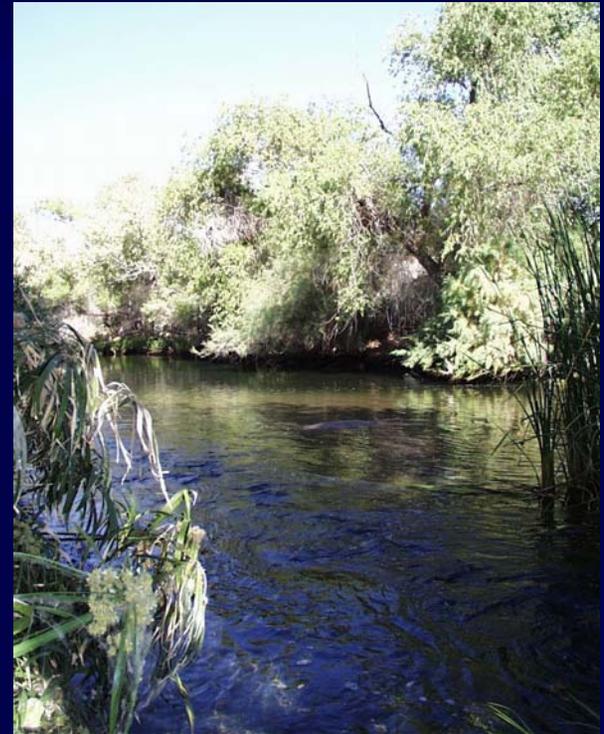
**Nevada Water Resources Association
Mesquite, Nevada**

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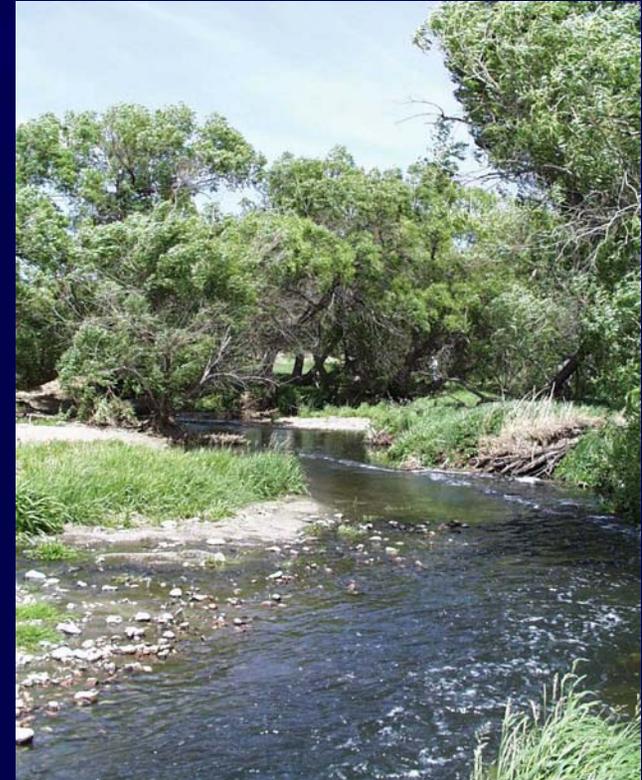
Acknowledgements

- 💧 **Research conducted by the Arid West Water Quality Research Project**
- 💧 **Funded by the U.S. EPA; administered by Pima County Wastewater Management Department**
- 💧 **Ed Curley, Project Director; Karen Ramage, Program Manager, Pima County Wastewater Management Department**
- 💧 **Project Purpose: Improve scientific basis for regulation of water quality and protection of species, habitats and uses of effluent dependent and ephemeral waters in the arid West**



Habitat Characterization Study

- Conduct historical data review and reconnaissance level field evaluation of the physical, chemical and biological characteristics of ten effluent dependent waters in the arid west
- *Effluent Dependent Waters* = Surface waters where majority of flow comprised of treated effluent



Habitat Characterization Study Project Team

- ◆ Pima County Wastewater Management Department
- ◆ URS Corporation
- ◆ Camp Dresser & McKee, Inc.
- ◆ Environmental Planning Group
- ◆ Risk Sciences, Inc., Nashville, TN
- ◆ U.S. Geological Survey, Tucson, AZ Desert Laboratory
- ◆ University of Arizona, School of Renewable Natural Resources
- ◆ Colorado State University, Department of Civil Engineering
- ◆ Chadwick Ecological Consulting, Inc., Littleton, CO
- ◆ Law Offices of Tad Foster, Colorado Springs, CO

Habitat Characterization Study Sites

- Salt/Gila Rivers near Phoenix, AZ
- Santa Cruz River near Nogales, AZ
- Santa Cruz River near Tucson, AZ
- Santa Ana River near San Bernardino, CA
- Fountain Creek near Colorado Springs, CO
- South Platte River near Denver, CO
- Santa Fe River near Santa Fe, NM
- Las Vegas Wash near Las Vegas, NV
- Crow Creek near Cheyenne, WY
- Carrizo Creek near Carrizo Springs, TX



Upstream of discharge



5 miles downstream of discharge



Below discharge

**Santa Fe River
Santa Fe, New Mexico**

Key Findings of the Habitat Characterization Study

- ◆ **Habitat quality limitations imposed by disequilibrium between effluent discharge and channel characteristics and channel modifications, especially for flood control**
- ◆ Receiving water quality closely linked to effluent quality and/or ratio of effluent to instream flow
- ◆ Aquatic community expectations limited - as a result of habitat and water quality limitations
- ◆ Discharge of effluent can create riparian community with ancillary benefits to wildlife



Habitat Modifiers in Santa Cruz River, Tucson, AZ



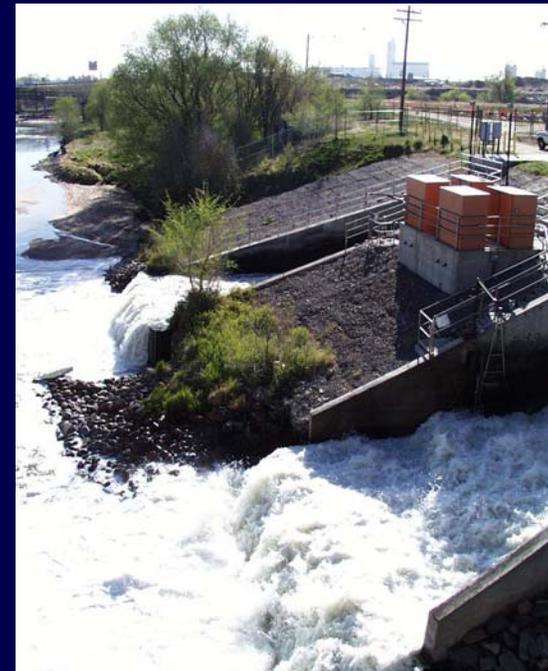
Bridge Crossing

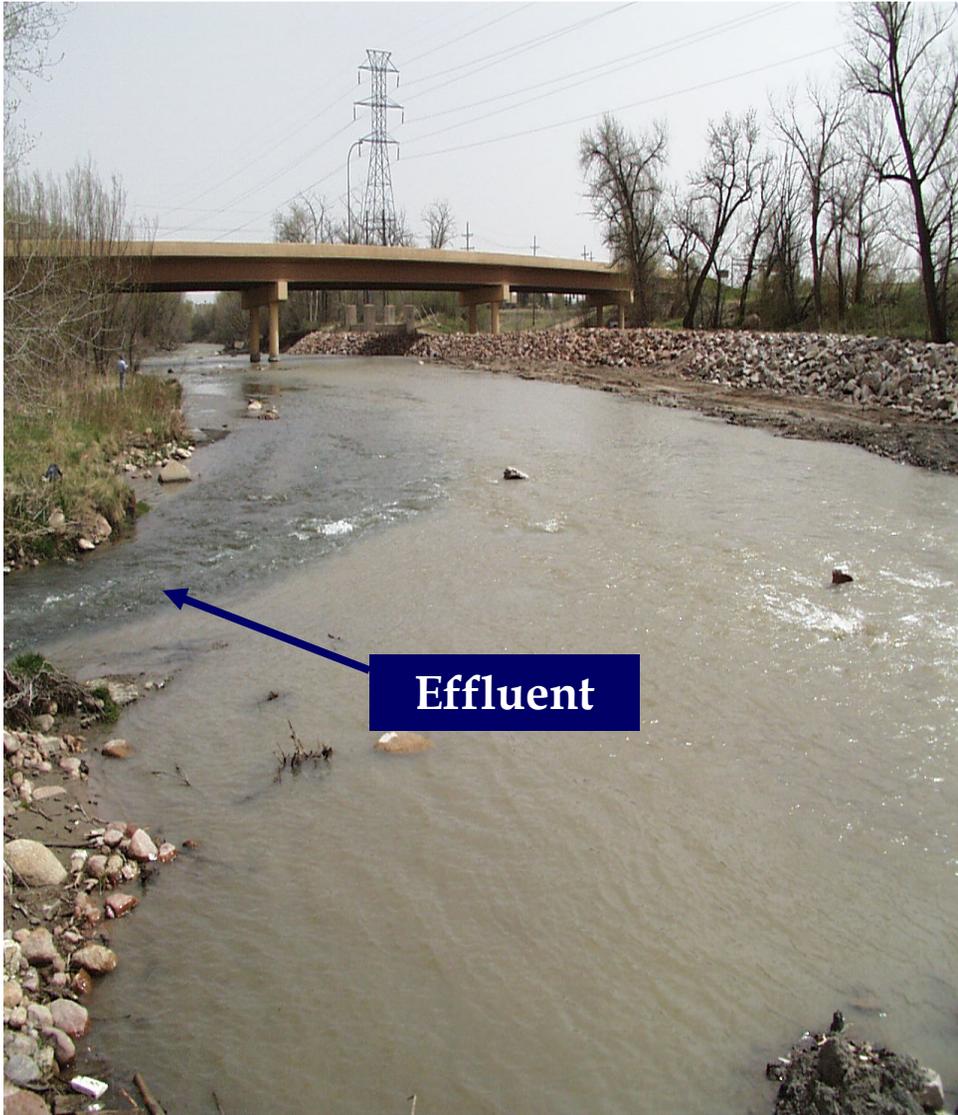
Flood Control Channel

Erosion Control Structure

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Effluent

**Fountain Creek, Colorado –
Upstream Intermittent**



**Santa Fe River, New Mexico –
Upstream Ephemeral**

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Treatment Level vs. Macroinvertebrates – Spring 2000

	Treatment Level	Taxa Richness	Percent Cleanwater Taxa
Higher quality effluent ↓	Chlorination with no dechlorination	Significant decline below discharge	None present
	Chlorination with dechlorination; nitrification with denitrification	Increase or decrease below discharge	None to low percentage present (ca. 10%)
	Chlorination with dechlorination; nitrification with denitrification; filtration	Decrease below discharge	Consistently present (17- 95+%) – but, few taxa

Key Findings of the Habitat Characterization Study

- ◆ Habitat quality limitations imposed by disequilibrium between effluent discharge and channel characteristics as well as channel modifications, especially for flood control
- ◆ Receiving water quality closely linked to effluent quality and/or ratio of effluent to instream flow
- ◆ Aquatic community expectations limited - as a result of habitat and water quality limitations
- ◆ **Discharge of effluent can create riparian community with ancillary benefits to wildlife**





Upstream of discharge



**1.5 miles downstream
of discharge**



**100 meters below
discharge**

**Santa Cruz River
Nogales, Arizona**

Conceptual Model of an Effluent-Dependent Stream Ecosystem



**WWTP
Discharge =
Discontinuity**

Physical:	Region of physical disequilibrium	Tends toward physical equilibrium
Chemical:	Area of oxygen sag	Natural processes modify water quality
Biological:	Limited aquatic community potential	Increasing aquatic community potential

Key Implications of Project Findings

- 💧 **Consideration of physical/chemical limitations associated with effluent dependent waters is important for establishing biological expectations**
- 💧 **Biological expectations for natural and created streams likely differ**
- 💧 **Focusing only on the water column, as is the norm under water quality regulatory programs, may be short-sighted especially given the riparian community benefits achieved by having instream flow**



Project Research Activities

- **Survey of Municipal Dischargers in the Arid and Semi-arid West – Spring 2000**
- **Habitat Characterization Study – Summer 2002**
- **Extant Criteria Evaluation – Executive Summary, Fall 2003; SETAC to publish full report in 2004**
- **Biotic Ligand Model for Copper – Begins in spring 2004**
- **Evaluation of WET Testing as an Indicator of Aquatic Health – Joint project with Water Environment Research Foundation, begins spring 2004**

To obtain reports contact Karen Ramage, 520-740-6344, or visit www.co.pima.az.us/wwwm/wqrp