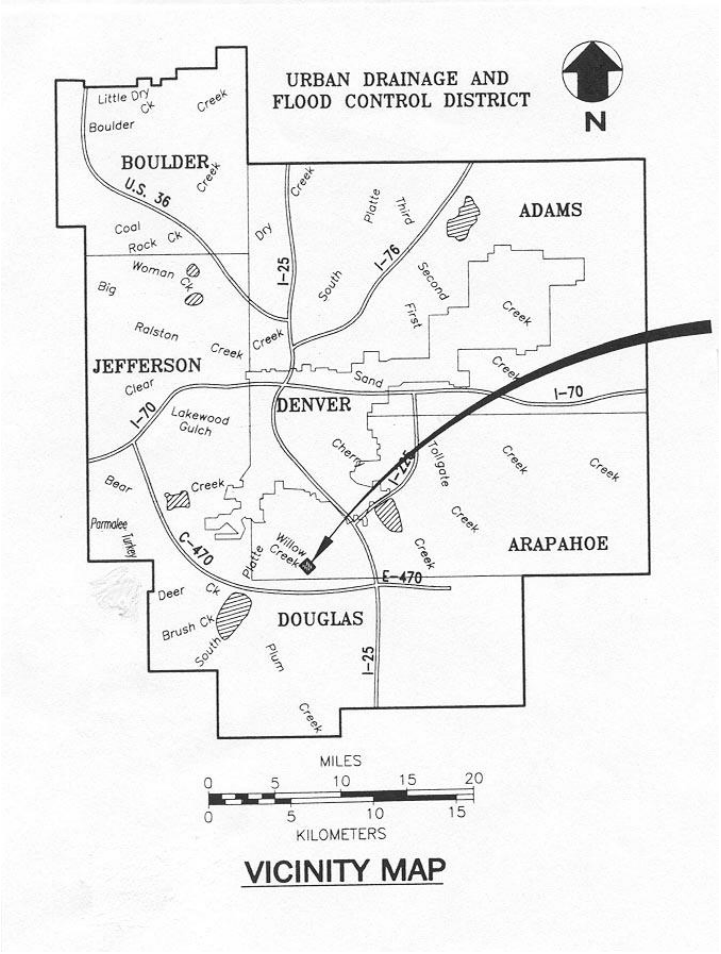
2009 CASFM Annual Conference Plenary Session - A Look Back at 1999 CASFM Grand Award 2000 ASFPM James Lee Witt Award

Willow Creek Channel Improvements and Sedimentation Pond

Urban Drainage & Flood Control District
South Suburban Park and Recreation District
Arapahoe County
Muller Engineering Company
Wenk Associates

Located in Arapahoe County, South of Dry Creek Road, West of Quebec



Willow Creek Watershed

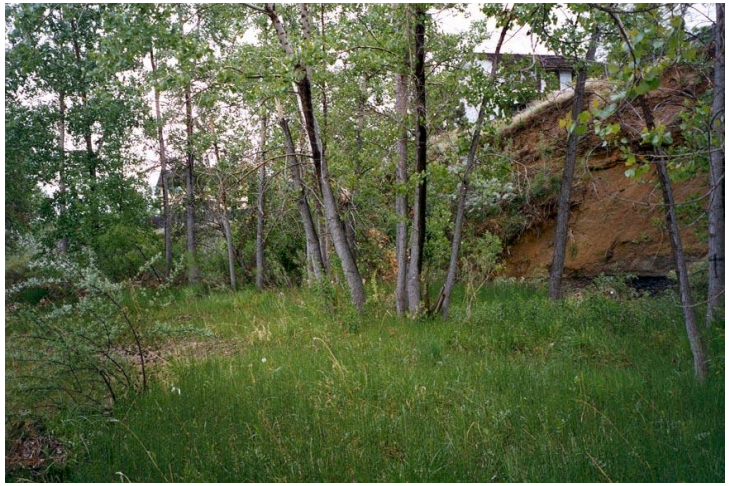
- Creek Characteristics:
  - Drainage basin tributary to site is 8.10 square miles
  - Creek bank full capacity 300 cfs
  - Base flow in creek is 5 cfs
  - 2 year storm is 1,650 cfs, 100 year storm is 6,100 cfs
- Design in 1997-98, Construction in 1998-99

Project Goals and Objectives

- Repair Steep eroded bank and Replace Pedestrian Crossings
- Use bioengineering techniques and several types of erosion control fabrics
- Water Quality Enhancement Facility

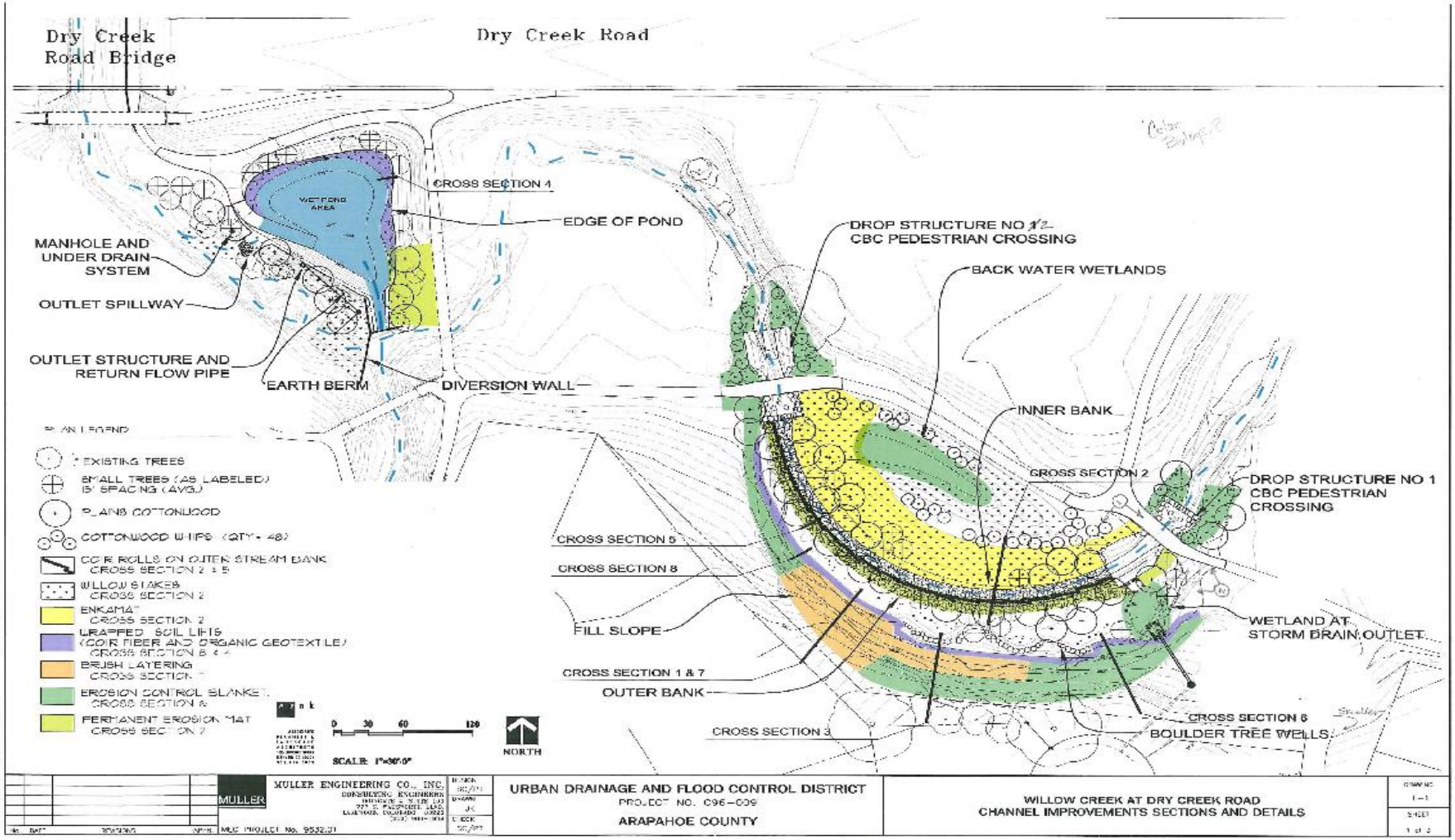
Desire for Innovative Solutions

- **Channel Stabilization:** Grade Control, Low Flow Crossings, Channel Relocation
- **Cliff Stabilization:** Bio-engineering Techniques
- **Sedimentation Pond:** Water Quality Retrofit



Before Channel Relocation After

Engineering Plan Overview



Drop Structures & Pedestrian Crossings

After Construction

Year 1, 1999

Year 4, 2002

Year 10, 2009

Cliff Stabilization - Fill Slope Area

- Wrapped Soil Lifts
- Brush Layering
- Erosion Control Blanket

Cliff Stabilization - Fill Slope Area

After Construction

Year 1, 1999

Year 4, 2002

Year 10, 2009

Inner and Outer Channel Banks

- Coir Rolls
- Permanent Erosion Control Mat
- Permanent Geotextile

Inner and Outer Channel Banks

After Construction

Year 1, 1999

Year 4, 2002

Year 10, 2009

Wetland Areas

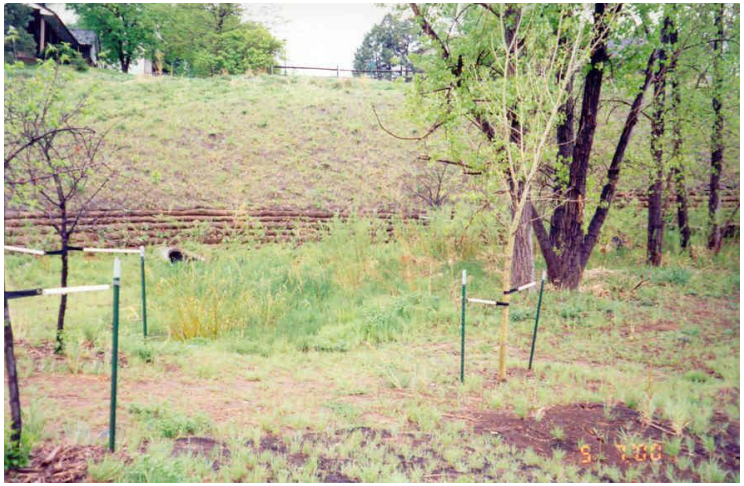
- One area located at storm pipe outlet

- One “backwater” wetland area with gravity low flow pipe to help establishment

Wetland Areas

Year 1, 1999, Backwater Wetland

Year 4, 2002, Backwater Wetland



Year 2, 2000, Pipe Wetland

Year 10, 2009, Backwater Wetland

Willow Creek Sedimentation Pond Criteria Constraints

- Size of existing site could not accommodate capture volume needed for “Wet Pond”(70 ac-ft) or “Sediment Forebay” (5.5 ac-ft)
- Outlet Structure could not be designed for 40 hour emptying time.
- Decision time: do the best we could with the space we have available? How effective will the facility be?

Sediment Pond Location Before Construction

“Retrofit” (Best we can)- Design Parameters

- Pond capacity and sediment storage volume is 1000 cubic yards-0.62 ac-ft. Pond designed to trap sediment for base flow and stormwater.
- Base flow of 5 cfs had sediment load estimated at 850 cy per year.
- Permanent pool depth of 8.6 ft
- On Stream Pond with diversion structure, concrete bottom and under drain system

Pond Construction

Unstable Subsurface Conditions

Underdrain Construction

Pond Lining Construction

Stream Diversion Wall

Return Flow System

Overflow Spillway

Pond Construction Complete

Pond During Runoff Event

Sediment Pond Maintenance

- Construction complete in March 1999.
- Sediment pond was full (1000 cy) by July 1999.
- Sediment removed in August 1999, cost was about $20,000.
- Sediment removed two times a year from 2000-2006, about $18,000 each time and 1000 cy removed each time.
- Sediment removed one time a year from 2007-2009, 1000 cy each time, less volume due to channel stabilization upstream?

Pond Maintenance Access

Pond Full of Sediment, Drained, and Ready to be Cleaned

Sediment Pond Cleaning

Sediment Pond 10 years Later

Sediment Pond in 2009 – Diversion Wall Barely shows

Sediment Pond 10 years Later

Concluding Thoughts

- Project was monitored for several years. No “failures” using “softer” approach. Verified design and construction assumptions.
- Project success lead to modifications in District’s Criteria Manuals.
- Sediment pond operation and maintenance has been very successful in keeping sediment from entering Englewood Dam Flood Pool.