Feasibility and Design of a Multi-Objective Stream Restoration in a Highly Constrained Urban Environment:

Escondido Creek in Escondido, CA

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The Escondido Creek Watershed – Overview

Source: Carlsbad Watershed Management Area Water Quality Improvement Plan (WQIP, 2016)
Existing Conditions – Escondido Creek Transect

Photos all taken on same day in mid-August 2018
Existing Conditions – Water Quality Concerns

• 2010 CWA Section 303(d) Listing:
  • Enterococcus, fecal coliform, manganese, phosphate, selenium, sulfates, TDS, N, DDT, toxicity

• Water Quality Improvement Plan:
  • Highest Priority Water Quality Condition: riparian habitat degradation:
    • Non-native vegetation
    • Concrete-lined channels
    • Dry weather flows
    • Trash
    • Water quality concerns
Existing Conditions - Escondido Creek at Grape Day Park

- Escondido Creek
- Grape Day Park
- Parking lot
- City Hall

ArcGIS World Imagery

cbec drone image
Past Restoration / Stormwater BMP Considerations

- City of Escondido Creeks Hydraulic Study (Michael Baker)
  - Four Alternatives:
    - Vegetate channel bottom (about 34 ft wide)
    - Grade control (rock weirs) + minor vegetation
    - Grade control + greater vegetation
    - Vegetate 10 ft width of channel bottom
  - Outcomes
    - Varying levels of percolation for dry season flows
    - Increases in 100-year flood WSE by 2.2 – 11.7 ft, necessitating channel widening of up to over 4x existing width
  - Alternative Compliance / LID:
    - Parking lot: underground BMP for stormwater retention, infiltration
Current Restoration Considerations

• Possibilities for Design
  • Sloped, vegetated side wall
    • Relatively little land needed
    • Increases flow area
  • Inset floodplain:
    • Naturalized bed for percolation
    • Raised floodplain feature for high flows
      • Allows for flow expansion
      • Can double as recreation space
  • Connected side channel:
    • Limits flood impacts by retaining FCC structure
    • Natural bed for percolation, habitat
    • Most land, cost intensive
Inset Floodplain Concept – Hydraulic Modeling

As-built designs (1965)

FG HEC-RAS 1D-2D Model

2.5 ft cells

Results

EG HEC-RAS 1D-2D Model
Shifting to Side Channel Concept

• Inset floodplain likely infeasible
  • With FCC design flow discharges of ~ 30 ft/s in supercritical flow regime...
    • Hydraulic jump forms at location of floodplain
    • Validated with 1-D modeling as well

• Side channel concept progressed
  • Multi-objective considerations
    • Maintain flood capacity of FCC
    • Incorporate into existing plans for Grape Day Park
    • Provide for recreation activities / public access
    • Urban habitat
    • Water quality
    • Economics / Redevelopment
Potential for Alternative Compliance

Portion of storm drainage network
Minneapolis: “City by Nature,” “City of Lakes,” “City of Parks”

Elements:
- Urban nature / recreation
- Branding / economic dev.
Vision and Inspirations – San Luis Obispo, CA

Development along creek corridor

Elements:
- Urban stream restoration
- Economic redevelopment
Vision and Inspirations – Davis, CA

Elements:
- Highly managed, pseudo-natural system
- Blend of recreation opportunities
- Habitat
- Stormwater management

UC Davis Arboretum

Historic Putah Creek Channel