White Tanks FRS #3 Outfall Channel

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Overview

- FCDMC maintains 22 dams
- Structure rehabilitation in process
- WT FRS#3 needed an outlet
- Link to County Trail System
Community Involvement

Buckeye Park & Ride

Arroyo Mountain Estates
Project Statistics

Design flows: 295 – 800 cfs
Collect tributary drainage: ~ 3 square miles
Project length: 4.7 miles
Construction Cost: $18,037,673
9 box culverts
16 grade control/restriction structures
12,181 lf 18”-78” pipes
790,000 cy earthwork
24,400 cy riprap
2,500 trees
Design Constraints

- Fissure risk zone
- Emergency spillway crossing
- Tributary drainage
- Detention basin
- Steep site slopes
- Earthwork

FRS No. 3
Camelback Rd
Indian School Rd
FRS No. 3 Outfall Channel Alignment
Thomas Rd
McDowell Rd
Jackrabbit Trail
FRS No. 4

Hoskin Ryan
Creative Engineering Solutions
Design Constraints

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- Detention basin
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Design Features

- Principal spillway extension
- Fissure risk zone
- Emergency spillway crossing
- Meandering earthen channel
- Box culverts
- Sediment basins
- Grade control structures
- Broken-back box culvert
- Stepped spillway
Principal Spillway Extension

Extension Structure
Directing flow to outfall channel

Wasteway
Directing flow to Beardsley Canal
Design Features

- Principal spillway extension
- Fissure risk zone
- Emergency spillway crossing
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- Box culverts
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- Grade control structures
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- Stepped spillway
Fissure Risk Zone

Possibility of subsidence and fissures in the area of FRS#3

HDPE was used for its flexibility
Joints welded to resist tensile force
Design Features

Principal spillway extension
Fissure risk zone
Emergency spillway crossing
Meandering earthen channel
Box culverts
Sediment basins
Grade control structures
Broken-back box culvert
Stepped spillway
Emergency Spillway Crossing

66-inch & 78-inch CIIP crossing
Emergency Spillway
20-feet scour depth - Launchable riprap upstream and downstream of the pipe crossing for scour protection

26,000 cfs
Design Features

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Grade control structures
Broken-back box culvert
Stepped spillway
FRS #3
Emergency Spillway Crossing
O&M Access
Tributary Inflow
Low Flow Channel
Sediment Basin
Trail
Design Features

Principal spillway extension
Fissure risk zone
Emergency spillway crossing
Meandering earthen channel
Box culverts
Sediment basins
Grade control structures
Broken-back box culvert
Stepped spillway
Box Culvert

(8) 16’x7’ box culverts

(1) - 2-10’x7’ box culverts
Design Features

- Principal spillway extension
- Fissure risk zone
- Emergency spillway crossing
- Meandering earthen channel
- Box culverts
- Sediment basins
- Grade control structures
- Broken-back box culvert
- Stepped spillway
Sediment Basin

* Sediment basins were provided at confluences with 4 significant tributary washes (300 cfs – 700 cfs)
* Volume to accommodate sediment load from a 100-year event
* Wash load – MUSLE method
* Bed load – Zeller-Fullerton equation
Design Features

Principal spillway extension
Fissure risk zone
Emergency spillway crossing
Meandering earthen channel
Box culverts
Sediment basins
Grade control structures
Broken-back box culvert
Stepped spillway
Grade Control Structure

* Non-erosive velocity – 3 ft/s for sandy loam
* Design channel slope – 0.1%
* Site slope – 0.5%
* 16 grade control structures
* $ millions saved over riprap channel
Design Features

Principal spillway extension
Fissure risk zone
Emergency spillway crossing
Meandering earthen channel
Box culverts
Sediment basins
Grade control structures
Broken-back box culvert
Stepped spillway
Broken-Back Box Culvert

* Broken-back to avoid conflict with sewer main
* Hydraulic jump contained within box culvert

Proposed Sewer Main
Design Features

- Principal spillway extension
- Fissure risk zone
- Emergency spillway crossing
- Meandering earthen channel
- Box culverts
- Sediment basins
- Grade control structures
- Broken-back box culvert
- Stepped spillway
Stepped Spillway

* For significant offsite flow (90-330 cfs)
* Unit flow rate ~ 8 cfs/ft
* Nappe flow or skimming flow

\[ L/y_0 = 14, \]
\[ y_0 = \left(0.5*C_t*q^2/SIN(\text{ATÂN}(h/l))/g\right)^{1/3} \]
\[ C_t = 0.18 \text{ (Rajaraman, 1990)} \]
\[ x_1 = \sqrt{\frac{2Q(V_d - V_0)}{mg} + d^2 - x_0} \]
Project Benefits

Principal Spillway inundation – eliminated
Jackrabbit Wash floodplain – contained
Beardsley Wash floodplain – flow reduced
County trail system – looped
September 8th 2014 Event

2.74 inches in 3 hours (average) > 2.4 inches (100-Year)

3.16 inches in 6 hours (average) > 2.6 inches (100-Year)
September 8th 2014 Event
September 8th 2014 Event
September 8th 2014 Event
September 8th 2014 Event
Questions?