

Maintenance Program Activities

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The Urban Drainage and Flood Control District (District) Maintenance Program committed a total of \$5.8 million in 2004 to maintaining drainageways in the Denver metropolitan area. Most of these drainageways have been improved sometime in the past as part of a subdivision development or a capital improvement project. The bulk of the drainageways we maintain are open channels with grass-lined banks, riprap erosion protection, and rock or concrete drop structures.

Our maintenance work covers the spectrum of drainageway work. It includes debris pick-up and mowing, localized repair to damaged and eroded channels or detention facilities, and consultant-designed rehabilitation to long reaches of deteriorated drainageways.

Mowing and Debris Pick-up

For the year 2004 we awarded eight contracts for mowing and debris pickups under our routine maintenance program. Seven of those contracts were awarded as renewals of the prior year contract. The value of each contract was adjusted to match the movement in the regional Consumer Price Index over the prior year. The other contract was awarded through a competitive bid process.

Adams County	20.9 miles
Arapahoe County	39.3 miles
Boulder County	17.6 miles
Broomfield County	0.2 miles
Denver County	44.7 miles
Douglas County	7.3 miles
Jefferson County	30.3 miles
TOTAL	160.2 miles

The mowing and debris pick-up work was done on 261 different sections of urban drainageways within the District's boundaries. The contractual value of the work was \$702,144. The table above summarizes the miles of drainageways within each county in the District on which we performed regularly scheduled mowing and/or debris pickup maintenance.

Restoration Maintenance

In 2004, \$3,305,600 of work was performed under our restoration contracts. Restoration projects typically address isolated drainage problems where the construction will cost from a few hundred dollars up to \$200,000. Ninety-five individual activities were completed during the year. Several major restoration projects are shown in the accompanying table titled "STATUS OF MAJOR MAINTENANCE PROJECTS." A major advantage of the restoration program is the ability to react quickly to local drainage needs.

Rehabilitation Maintenance

Fifteen rehabilitation projects were at various stages of design or construction during 2004. Those projects are included in the accompanying table titled "STATUS OF MAJOR MAINTENANCE PROJECTS." Rehabilitation projects typically are designed by private consultants and built by private contractors. They are intended to correct severe problems that have occurred on a previously improved urban drainageway. By the end of 2004 the District will have spent about \$1,842,300 on rehabilitative design and construction for the year.

Channel Repairs

In last year's *Flood Hazard News* we described a recent extension of Federal Boulevard in Westminster that crossed **Big Dry Creek** at 122nd Avenue. Erosion was threatening the Federal Boulevard right-of-way at a severe bend in the creek that included a 25-foot tall near-vertical bank. After consulting with the permitting agencies the solution was to relocate a short portion of the creek so the erosive energy of the flow was not directed toward Federal Boulevard. The project was delayed for three months during the spring nesting season while bank swallows made use of the steep bank. The completed project included a backwater wetland at the base of the steep bank. Keeping all the parties informed and coordinated required close management of the work by Mike Sarmiento, Engineering Inspector.

The Montbello area of Denver is tributary to **Montbello Drainage** and to **Irondale Gulch**. Nearly 10 miles of concrete-lined drainage channels collect the storm runoff from Montbello. These channels were constructed over the last 25 years as the subdivisions were built. Their top widths vary from 12 feet up to 35 feet with depths ranging from 4 to 10 feet. For the last seven years we have been setting aside funds to replace the worst block-long sections. Our replacement concrete panels include weep holes and steel reinforcement while most of the original panels did not.

Much of the length of **Grange Hall Creek** has been improved over the last 15 years. One of the upper reaches of the creek is within the City of Northglenn and extends from Grant Street on the east to I-25 on the west. Some improvements had been constructed in the past, but they are now deteriorating or being buried by sediment. This corridor has enough width and enough change of elevation to allow a straight-forward design. However, the drainageway revealed a major surprise when surveying and utility locations were done. Buried in the sediment was a storm sewer outlet that drained stormwater from several blocks of residences. The pipe outlet is well below the proposed grade of the channel so the design team is now reviewing options for how to deal with the storm sewer.

Multi-purpose Projects

In 2004 we again joined forces with other local governments to fund multi-purpose projects. The result of this combined funding is projects that meet a variety of community needs. The City of Morrison wanted to improve the appearance, drainage function, and urban usefulness of **Mount Vernon Creek** at its confluence with **Bear Creek**. All these goals were met through a focused design and concentrated effort by Cindy Thrush, Senior Project Engineer, and Jeff Fisher, Engineering Inspector.

STATUS OF MAJOR MAINTENANCE PROJECTS

A similar multi-purpose project at the confluence of **Cherry Creek** and the **South Platte River** brought together funds from the Maintenance Program, the South Platte River Program, the City and County of Denver, and the Greenway Foundation. The project created an urban park at the edge of the two streams that are considered to be the birthplace of the city.

Boulder County has a very different problem with **Rock Creek** which enjoys a broad open-space corridor on the west side of Highway No. 287. This section of the creek has seen very little direct impact from humans. The exception is that in-stream erosion has damaged the natural habitat of the corridor. The close coordination of multiple interests has been guided by David Bennetts, Senior Project Engineer. We will participate by funding the drop structures to limit the down-cutting of the creek while Boulder County will contribute toward the bank shaping and restoration of the habitat.

Detention Ponds and Sediment Control

In remote areas such as the Canyonlands of Utah or the Grand Canyon of Arizona erosion and sedimentation are normal occurrences. Even if the resultant changes are severe they are a natural and expected component of the environment. Urban settings are far less tolerant of aggradation and sedimentation. A change in elevation of a few feet can have a dramatic impact of the flow characteristics and the associated floodplain of an urban stream. In the past year the maintenance Program carried out significant sediment removals on **Harvard Gulch** from University Boulevard to Colorado Boulevard, on **Grange Hall Creek** from 108th Avenue to Colorado Boulevard, and at the sediment trap on **Willow Creek** south of Dry Creek Road. Additional sediment removals were also done on 10 to 15 other channels and detention ponds within the District. Concrete-lined channels can be even more sensitive to aggradation where even a couple inches of sediment is visible and can support undesirable vegetation.

Project	Jurisdiction		Cost	Status
<u>ADAMS COUNTY</u>				
Big Dry Creek – 122 nd Ave and Federal	Westminster	Design	\$36,560	100%
Repair vertical bank and protect road.		Const.	107,191	100%
Grange Hall Creek – 108 th to Colorado	Thornton	Design	4,280	100%
Remove substantial sediment buildup.		Const.	55,590	50%
Grange Hall Creek – Grant St. to I-25	Northglenn	Design	41,766	70%
Build small drops and repair channel.		Const.	Next year	0%
<u>ARAPAHOE COUNTY</u>				
Big Dry Creek – Progress Pk. to Lehow	Englewood	Design	local gov	100%
Coordinate channel repair & trail work.		Const.	78,549	100%
Greenwood Gulch – U/S Highline Canal	Greenwood Village	Design	In-house	100%
Add sheet pile to drops built in 1999.		Const.	46,000	100%
Little Dry Creek – E. of Colorado Blvd	Centennial	Design	54,963	50%
Build drop structures & repair channel.		Const.	Next year	0%
Westerly Creek – SE of Miss. & Moline	Aurora	Design	In-house	100%
Rebuild drop in concrete channel.		Const.	75,000	100%
Willow Creek – South of Dry Ck. Road	Centennial	Design	In-house	100%
Annual cleaning of sediment trap.		Const.	26,183	100%
<u>BOULDER COUNTY</u>				
Boulder Crk – West of 9 th St, E. Fine Pk	Boulder	Design	In-house	100%
Rebuild river rock drops, rep. erosion.		Const.	100,000	20%
Dry Creek #2 – N.E. of 55 th St. & Arap.	Boulder	Design	43,875	85%
Replace 3 broad drop structures.		Const.	Next year	0%
Rock Creek – Farm west of Hwy. #287	Boulder County	Design	70,516	100%
Channel, bank repair and trails, partic.		Const.	300,000	0%
<u>BROOMFIELD COUNTY</u>				
City Park D'way – Emerald to Midway	Broomfield	Design	44,678	100%
Channel and bank repair.		Const.	315,000	0%
<u>DENVER COUNTY</u>				
Cherry Creek – South Platte confluence	Denver	Design	Included	100%
Bank repair and access, participation.		Const.	75,000	100%
Goldsmith Gulch – North of Hampden	Denver	Design	66,480	100%
Channel and bank repair, participation.		Const.	800,000	100%
Montbello Channels – N.E. I-70&Peoria	Denver	Design	Previous	100%
Ongoing replacement of concrete chan.		Const.	150,000	100%
Sanderson Gulch – At Florida Avenue	Denver	Design	53,066	90%
Repair banks and add & repair drops.		Const.	Next year	0%
West Harvard Gulch – Platte R. to R.R.	Denver	Design	79,913	75%
Drops, channel repair, and trails, partic.		Const.	Next year	0%
West Harvard Gulch – Zuni to Clay St.	Denver	Design	73,579	90%
Corridor study, drops, channel repair.		Const.	500,000	0%
<u>DOUGLAS COUNTY</u>				
Happy Canyon Ck – At Oak Hills Drive	Douglas County	Design	32,830	90%
Add a drop to protect upstream drop.		Const.	100,000	0%
Long's Way Trib – W of Dransfeldt Rd.	Parker	Design	Previous	100%
Repair eroded detention pond.		Const.	73,660	100%
Tallman Gulch – At Siebert Circle	Parker	Design	106,443	100%
Drops, channel repair, and trails, partic.		Const.	375,187	100%
<u>JEFFERSON COUNTY</u>				
Dutch Creek – Sheridan Blvd. to Eaton	Jefferson County	Design	49,941	85%
Drops and repair channel.		Const.	Next year	0%
Lakewood Gulch – Van Gordon-Welch	Lakewood	Design	Included	100%
Drops and repair channel, participation.		Const.	207,271	100%
Lena Gulch – From 20 th to Youngfield	Lakewood	Design	25,000	95%
Drops and repair channel, participation.		Const.	200,000	0%
McIntyre Gulch – West of Holland St.	Lakewood	Design	Stalled	90%
Repair channel banks, participation.		Const.	265,000	0%
Mount Vernon Ck – Confl. w/Bear Ck	Morrison	Design	30,800	100%
Repair narrow urban channel, partic.		Const.	120,000	100%

A detention pond was built in the late 1990s on the **Long's Way Tributary** near it's confluence with Cherry Creek in Parker. At the downstream end of this pond a lowered micro-pool had been installed to trap sediments and provide a maintainable feature that

would improve the quality of the water discharged from the pond. The five foot elevation drop from the trickle channel into the micro-pool was made of graded earth. When the pond would detain water the elevation difference was drowned out by the water and little or

no erosion occurred. However, at lower flow rates erosion was occurring as the water dropped into the micro-pool. Our solution was to restore the micro-pool by creating a sculpted concrete drop structure with a concrete cutoff wall to separate the main detention pond from the micro-pool.

Drop Structures

Drop structures can fail when water flows through, under, or around them due to an inadequate cutoff wall. We repaired several drops in 2004 that suffered from poor cutoff walls. Grouted boulder drops were built on **Greenwood Gulch** north of Orchard Road in Greenwood Village in 1999. The excavated trench for the original grout curtain simply did not extend to the depth called for in the plans. We repaired 4 of these drops a couple years ago and repaired an additional one in

2004. We were able to clean up the upstream side of the boulders and then drive sheet pile and grout it in place to bind the whole structure together.

Westerly Creek is one of several drainageways in Aurora that have been constructed as trapezoidal concrete channels. Vertical concrete drop structures were installed where necessary. Some of the drops did not have satisfactory foundations to support the vertical wall of the structure. The weak foundation allowed differential movement among the concrete panels which, in turn, allowed water to flow under and around the structure and pick up soil particles. The result was that the concrete panels near the drop structure became undermined and eventually collapsed. Last year we rebuilt one of these drops north of Mississippi Avenue. This year we reconstructed the

structure that is southeast of Mississippi Avenue and Moline Street. The redesigned drops have also improved upon the existing underdrain systems which protect the foundations of the drop structures by controlling the ground water.

Over the last 15 years the City of Boulder has used rounded river boulders to build attractive drop structures in **Boulder Creek**. Those drops that were not grouted have experienced movement of some of the boulders. As the boulders tumble out of their configuration the drop structure loses its integrity. We re-used the rounded boulders and locked them in place with a grouted cutoff wall. We also restored any damaged stream banks in the vicinity of the drops.



Left: Willow Creek sediment trap at Dry Creek Road. The pond is full with 800 to 1000 cubic yards of sediment. One of our indicators for when it is time to remove the sediment is when people start having picnics on our "beach." Right: The left side of photo shows the Willow Creek channel. The freshly cleaned sediment trap is on the right. The diversion boards are still in place to keep water out of the sediment trap while it is being cleaned.



Long's Way Tributary sculpted concrete drop structure.



Greenwood Gulch drop structure. The sheet pile cutoff wall is hidden behind the grouted boulder drop structure.