



Flood Hazard News

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A Brief History of the Walled Section of Cherry Creek

By Mark Hunter, PE; Bill DeGroot, PE and Dave Lloyd, PE

Robert Speer was elected Mayor of Denver in 1904. His administration began a period of dramatic civic improvement including efforts to control flooding on Cherry Creek. Between 1906 and 1911 parallel concrete walls 10 feet tall and 80 feet apart were constructed from Downing Street to Blake Street to contain Cherry Creek. The termination of the walls at Blake Street left the lower half-mile of Cherry Creek uncontained.

The flood of July 14, 1912 inundated the lower portion of the city and put three feet of water in Union Station. The impact of this flood hastened the completion of the concrete walls the remainder of the way to the South Platte River. With the flood of 1912 still in mind the dimensions of the walls were increased to a height of 12 feet and a width of 88 feet. This final section was completed in 1914. These walls are still in service and provide a continuous walled channel for Cherry Creek for the 3.2 miles from Downing Street to the South Platte River.

Castlewood Dam was constructed on Cherry Creek just south of Franktown in 1890 by a private organization for the purpose of providing irrigation water. Ownership of the dam changed several times over the years but its purpose was always to support the development and sale of irrigated farm and ranch land in Douglas County. Observers downstream in Denver quickly

expressed concern about the leakage and flood safety of the structure. One of the primary issues with Castlewood Dam was the fact that this on-stream reservoir served its irrigation purposes best when it was full of water. This left little room for floodwater storage and meant that the spillway system was regularly called into use.

The fear of the residents of Denver became reality in early August, 1933 when a series of summer thundershowers completely filled the reservoir, overtopped the dam, and eventually breached the structure. Thirty five miles downstream in Denver the flood tore out some of the concrete channel walls, and put a foot of water on the floor of Union Station.

The 1933 flood forced the City of Denver to develop a comprehensive flood control plan for Cherry Creek. This local effort resulted in the construction of Kenwood Dam beginning in 1935. It was located near the intersection of Hampden Avenue and Havana Street just downstream of the current Cherry Creek Dam. A few remnants of the concrete components of Kenwood Dam are still

visible at the Kennedy Golf course.

Flood control specialists quickly recognized the inadequate capacity of Kenwood Dam and by 1940 federal agencies were planning its replacement with what would become the current Cherry Creek Dam. Land was acquired in 1946 and by 1950 the new structure was in operation. In mid-June 1965 the Cherry Creek Dam proved its worth when it impounded the largest flood in the area's history while the uncontrolled South Platte River delivered an unprecedented flood to Denver.

In the years that followed, the channel



The 1933 flood in the walled section of Cherry Creek

fell into disrepair, heavily overgrown with vegetation and a dumping ground for broken concrete, asphalt and other debris. It was an eyesore, had lost much of its flood carrying capacity, and was certainly no asset to the community.

In 1975 the Urban Drainage and Flood Control District, City and County of Denver, City of Glendale and Arapahoe County embarked on an ambitious effort to master plan the Cherry Creek corridor from the South Platte River to Cherry Creek Dam. The master plan was to include flood control, recreation and transportation. The consulting team of Merrick and Co. and Harman, O'Donnell & Henninger Associates (HOH) was selected by the sponsors to develop alternative scenarios, seek public input, and prepare a master plan for the corridor.

Transportation issues ultimately could not be resolved to the satisfaction of the three local government sponsors, and, in order to get the flood control and recreation elements of the plan completed, the transportation portion was dropped.

The flood control study revealed that even with Cherry Creek Dam constructed upstream, a large 100-year flood hazard area existed through the neighborhoods adjacent to the walled section, including the Country Club neighborhood areas of downtown, and portions of the new Auraria campus. A major goal of the study became to contain the 100-year flood to the channel.

The master plan was completed in 1977. Within the walled section the plan called for cleaning out the vegetation and debris, reshaping the bottom of the channel, installing a number of drop structures to control the channel grade, and installing a number of access ramps and a maintenance access trail that would also be used as a recreational trail. Two stair cases were also included.

Most of the other proposed park improvements involved new parks outside the channel walls but close to the creek, and connected to the

maintenance/recreation trail. However there were two areas where the plan proposed removing the walls to create expanded park areas extending from creek level to street level. One site was at approximately Larimer Street to Lawrence Street, and the other was near the confluence with the South Platte River. Ultimately a version of the former was constructed (see below) but the other site was lost to new development.

In the early 1980's the City and County of Denver received discretionary Federal grant money, and then Mayor Bill McNicholls allocated these funds to implementation of the flood control and trail plan in the walled section of the creek. This construction effort provided the basic channel, trail and access ramp configuration that would form the framework for several subsequent projects which are described below.

Two design decisions were made that led to the need for later adjustments. The first was to take the trail out of the bottom of the creek for stretches of several blocks where no traffic conflicts existed, in order to keep some areas of the channel bottom more natural for wildlife habitat. However, walkers, runners and bicyclists quickly decided to stay in the bottom and wore trails through the intended habitat. In 1982 the two gaps in the Cherry Creek trail corridor were filled. About 3000 feet of eight foot wide concrete was installed to complete the trail corridor within the walled section of the creek.

The other decision was to not line the low flow channel. Over time we began to see severe erosion and migration problems and had to address those problems with bank stabilization measures as a function of the District's Maintenance Program. Six phases of low flow channel bank protection were completed by the Maintenance Program between 1984 and 1991. This work was



Top. Artist's concept from the master plan.
Bottom. The channel following initial construction.

primarily boulder edging but also included riprap protection and a couple sections of interlocking articulated concrete blocks. By 1991 low flow channel protection was in place on about 34% of the 3.2 miles of the walled section of Cherry Creek.

In 1989 a bond issue was passed by the Denver voters which included funding for the urban redevelopment of Cherry Creek from Colfax Avenue downstream to Market Street. This project became a public/private partnership when the Downtown Denver Partnership and the Urban Drainage and Flood Control District joined Denver in the effort. The resulting project, known as CreekFront, revitalized Cherry Creek as an urban greenway while preserving the flood carrying capacity. The project included two drop structures, including one formal grouted boulder drop, a second

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Lloyd's Look

by Dave Lloyd

Timely Comment from the District's Executive Director



How fortunate we are to live in the State of Colorado. This has never been more in evidence than over the past year as we've witnessed several natural disasters of epic proportions.

I was just recently reading the cover story in the November 2005 issue of "Natural Hazards Observer." The article points out that in the last year alone, we've experienced a multitude of disasters including winter storms, wildfires, floods, tornadoes, landslides, and most recently Hurricanes Dennis, Katrina, and Rita. Although not directly affecting the United States, the earthquake and tsunami in the Indian Ocean last December claimed over 240,000 lives across 12 countries and injured, displaced or otherwise impacted millions.

In light of this past years events, disaster reduction has once again moved to the infamous "front burner." One product of this has been the report from the Subcommittee on Disaster Reduction, part of the President's National Science and Technology Council, entitled "Grand Challenges for Disaster Reduction." The report was prepared in an effort to establish a framework for future government investment in science and technology

for the purpose of enhancing the United States's resilience and reducing our vulnerability to natural and technological hazards.

As was evidenced along the gulf coast, our communities are still challenged by disaster preparation, response and recovery. Although lives lost to natural disasters each year have been reduced, the annual cost of major disasters continues to rise. The Subcommittee on Disaster Reduction identified four key characteristics of disaster-resilient communities:

- Relevant hazards are recognized and understood
- Communities at risk know when a hazard event is imminent
- Individuals at risk are safe from hazards in their homes and places of work
- Disaster-resilient communities experience minimum disruption to life and economy after a hazard event has passed

From a flood control professionals perspective, these are all very enviable goals to strive for in the area of floodplain management; however, identifying the course of action is only the first step in the process.

Competition for the every decreasing tax dollar is always a daunting task for flood control managers.

Even though the Katrinas and Ritas of this past year go a long way in keeping us focused upon the arena of sound floodplain management, mankind has always proven itself to have a short memory (he says as he sits here trying to remember what he had for breakfast).

In the words of Paul Danish, former Boulder County Commissioner and Director on the District's Board when asked if a devastating flood could occur one day along Boulder Creek: "Not only yes, but hell yes."

Organizational and Staff Changes

This past year we were pleased to create a new program area within the District organization. Kevin Stewart was selected to be the Manager of the District's new Information Services and Flood Warning Program. Earlier this year we hired Chad Kudym to assist Kevin in this new program. Chad brings to the District a wealth of knowledge and experience in the GIS arena and we are pleased to have him on staff (even if he is a Cornhusker).

Kudym joins District staff

Chad Kudym has joined the District as a Project Engineer for the Information Services and Flood Warning Program. Chad has a B.S and M.S. Degree in Geography from the University of Nebraska. He is also a CFM (certified floodplain manager), a national professional certification program administered by the Association of State Floodplain Managers. Chad was

previously employed by HDR Engineering in Denver where he served as their GIS coordinator. He is a much-welcomed addition to our staff as we continue improving our GIS and flood warning capabilities. Chad is also an experienced web designer and familiar with various modern information technologies. His handiwork is clearly evident in the article describing ALERT webserver enhancements.



Master Planning Program Notes

By Ben Urbonas, P.E., Manager, Master Planning Program

Planning Projects

Four planning projects were completed in 2005; 15 projects were under way; and we hope to begin 4 new planning projects in 2006.

We now have a total of over 129 completed watershed-level major drainageway and outfall system plans in our inventory. Some of these are updates of master plans completed in the past.

Urban Storm Drainage Criteria Manual

We no longer publish our Urban Storm Drainage Criteria Manual (USDCM) in printed form. All three volumes of this manual and all of the updates to these three volumes are posted on our web page, namely, www.udfcd.org. You may download any of these free of charge. You can choose to download each volume in its entirety via a self-extracting Zip file or each chapter individually. Each chapter is marked with the revision date to tell you if the one you have is current.

We encourage you to check for latest updates to the manual and related materials on a regular basis. New updates to the manual and new versions of the software, spreadsheets, and AutoCAD drawings to assist you with the calculations and design can be posted at any time. We try to e-mail as many people that we have on record of major new posting, but there is no guarantee that any individual or company will get such a notice because our record may not be complete or out of date.

By the time you read this article, another significant revision to Volume 3 will probably be posted on our web site. In addition, several smaller revisions to Volumes 1 and 2 are in the pipeline.

A major revision was posted in 2005. The porous pavement sections of the Structural BMPs Chapter of Volume 3 were totally rewritten. Instead of one type of porous pavement, criteria for five types of porous pavement are now

STATUS OF PLANNING PROJECTS

Project	Sponsor(s)	Consultant	Status
Lower Brantner Gulch	Adams County, Thornton	Love & Assoc.	Completed in 2005
Third Creek (Lower) MP Updates	Adams Co., Commerce City, Brighton	Kiowa	Completed in 2005
Kinney Creek & Fonder Draw	Douglas Co.	WRC	Completed in 2005
Second Creek Update	Commerce City, Adams Co.	Kiowa	Completed in 2005
Denver Criteria Update	Denver	Wright Water	98% Complete
Douglas Co., Arapahoe Co., Centennial Criteria Update	Douglas Co., Arapahoe Co., Centennial	Muller Eng.	90% Complete
Broomfield & Vicinity	Broomfield & Westminster	Kiowa	98% Complete
Upper Goldsmith OSP	Arapahoe Co. Greenwood Village, Centennial	Moser Assoc.	98% Complete
Massey Draw & SJCD (S)	Jefferson Co., Arapahoe Co.	n/a	98% Complete
Yankee Doodle OSP	Arvada	n/a	90% Complete
Lemon and Scott Gulch OSP	Douglas Co.	CH2MHill	65% Completed
Four Mile Canyon & Wonderland Cr. Updates	Boulder.	Love & Associates	65% Complete
Toll Gate Creek Hydrology	Aurora	Kiowa	60% Completed
Coal Creek in Superior	Superior	n/a	60% Complete
Brighton Watershed Update	Brighton	WRC	30% Complete
Murphy Creek Update	Aurora	Moser Assoc.	20% Completed
Big Dry Cr. (AdCo) North Tributaries Update	Thornton, Adams Co., Broomfield	Wright Water	15% Completed
Clear Creek Update	Wheat Ridge, Jefferson Co., Adams Co., Golden, Denver	n/a	Mapping under way
Dutch Cr./Lilley G. Update	Jefferson Co., Denver, Lakewood	n/a	Mapping under way
Hoffman Drainage	Adams Co. & Thornton	n/a	Mapping under way
Brighton Detention Reassess	Brighton	n/a	Start in 06
Lena G. Update d/s of Maplegrove Reservoir	Wheat Ridge	n/a	Start in 06
Little Dry Cr & Greenwood Gulch u/s of Holly	Douglas Co. Centennial, Greenwood Village, Lone Tree, S. Suburban Parks	n/a	Start in 06
Cottonwood Cr. W.Q Update	Arapahoe Co., Centennial, CCBWQA, Lone Tree, Douglas Co.	n/a	Start in 06

in the manual. The technical issues supporting porous pavement design and maintenance are quite complex and we have yet to see how these types of designs will succeed and survive over time. As a result, we are treating these criteria as interim and may adjust them based on experience with earlier installations. Our goal is to come up with technical recommendations for porous pavements that best fit the climate and the conditions found in eastern high plains of Colorado and regions having similar climatic and geologic (i.e., soil) conditions.

Ken MacKenzie of the Design and Construction Program has authored another major revision of the

spreadsheets for the design of stormwater inlets, analysis of street flow and detention basins. If you have not yet had a chance to download these spreadsheets or others, I urge you to do so. Ken, in cooperation with many cities and counties within the District is negotiating with Colorado State University to do scale modeling for the types of inlets used in the Denver region. We hope this will improve on the design guidance that is in practice today. We now hope to have this testing program under way in 2006.

District's Software

We have completed our effort to integrate the District's *CUHP* software

into a new, Windows-based, EPA's SWMM 5.0.

For the last two years EPA has been working on rewriting the SWMM software and to provide a graphical user interface (GUI). Go to the web page <http://www.epa.gov/ednrmrl/swmm> to download this software free of charge. The District's new CUHP 2005 model now interfaces with the EPA's model and we no longer will support the old versions.

The CUHP model works with the new EPA's software in a similar fashion as the old version, namely, it generates runoff hydrographs that are then routed by SWMM 5.0. The new version, titled CUHP 2005, relies on Microsoft Excel for the preparation and editing of input data and manage the output. It also provides a converter to convert the older CUHP and UDSWM inputs to run under the new software. This model may also

be downloaded free of charge from our website. However, the work continues and we hope to add capabilities in the future to CUHP 2005, such as ability to perform continuous simulation. In addition to the above, new versions of UDPOND and UDSEWER that contain corrections and updates are now available for downloading.

District's April 2005 Seminar

Again our annual seminar series continues to be successful when measured by attendance. On April 28, of 2005, we held a seminar titled: *Emerging Technologies and Practices in Urban Stormwater Management*. It was attended by over 230 participants from municipalities, federal and state governments, consultants and other organizations. The proceedings are available at: http://udfcd.org/conferences/conference_s.htm

Douglas and Arapahoe Counties Criteria Manual Update Project

The District continues to work with the preparation of updated stormwater criteria manuals for Douglas and Arapahoe Counties. The consultant for this project is Muller Engineering Company. Since the project began in 2003, the Cities of Centennial, Lone Tree and Castle Rock have joined this effort. At this time the final versions of this manual are expected to be released in early 2006.

Denver is updating its Stormwater Design and Technical Criteria

Denver's Wastewater Management Division has launched an effort to update its Stormwater Design and Technical Criteria. The District has been managing this project and is working with Denver and Wright Water Engineers, Inc., the project's consultant. At this time look for the release of the completed manual early in 2006.

Cherry Creek (from page 2)

trail for pedestrians only, a block long area where the walls were removed and a formal park was created and installation of an additional 3150 feet of low flow channel protection. Construction of CreekFront was completed in November, 1992.

The redevelopment of Cherry Creek continued in 1994 with the creation of the Punt the Creek project. The purpose of this project was to make the lower 3100 feet of the creek usable for small flat-bottomed boats called punts. Punts are about four feet wide and draw 6" to 8" of water while seating 4 adults. They are powered and steered by the operator using a long pole.

The punts travel up and down the creek on temporary "lakes" created by inflatable hinge crest dams with locks for boat passage. Four sets of locks and five hinge crest dams were required to make this 3100 foot section of Cherry Creek boatable. The dams are inflated in the morning to create the lakes and deflated at night to allow full flow of the creek.

Phase 1 of Punt the Creek began at Market Street which was the downstream end of the CreekFront project. The lower end of phase 1 was at Delgany Street. It was built in 1994 and included 1650 feet of Cherry Creek.

Phase 2 of Punt the Creek went the remaining 1450 feet from Delgany Street down to the confluence with the South Platte River and was finished in 1998. Both phases of this project included lining the low flow channel to protect against erosion and extending the pedestrian trail. Two additional access ramps were also included.

Access ramps were installed on either side of the creek between Broadway and Lincoln when the south bound lanes of Speer Boulevard were placed in a tunnel under Lincoln and

Broadway. Another ramp was installed by Denver at the upstream end of the walls and yet another one is planned for 2007 near 12th Avenue.

Today the walled section of Cherry Creek will contain the 100-year flood. It also contains a three-mile grade separated trail. In the downtown area, which is the highest use area, pedestrians and bikes have separate trails. The trail in the walled section is the busiest stretch of trail in Colorado.



CreekFront park with water wall and public art in background.

Design and Construction Program Notes

By Paul Hindman, P.E., Manager, Design and Construction Program

In 2005, the Design and Construction program continued to assist local governments in designing and building many major flood control projects. Internally, we divide the responsibilities amongst our staff by political boundaries. Laura Kroeger is in charge of Boulder, Adams and Broomfield Counties, Ken Mackenzie is responsible for Denver and Jefferson Counties, and Paul Hindman watches over Douglas and Arapahoe Counties.

Throughout the entire program, in 2005 we committed 6.8 million to projects. As shown in the attached table, the Design and Construction Program continues to manage over 80 projects. Some have been ongoing for many years with multiple phases while others are just getting started.

A couple of projects deserve special recognition. One of those is the Littles Creek project in Littleton. Laura Kroeger, the District's Project Engineer assigned to the Project, was responsible for administering the construction aspects of the project. This was the third phase of improvements to Littles Creek (between Broadway and Apache Road) that Urban Drainage and the City of Littleton teamed up with engineers from ASCG, INC. and constructors from Flatiron Constructors, Inc. to improve the drainageway along the center of Sterne Parkway in Littleton. The \$703,000 project lasted six months and was completed in September.

Following completion of this last phase, all structures between Elati Street and Apache Road will have been removed from the 100-year floodplain. The first two phases in the project consisted of replacing the bridges of several street crossings, and of course, channel improvements. Phase 3 focused on collecting the upstream storm water plus the local storm sewer flows into a 100-year crossing under Sterne Parkway. It was designed with a three-sided

Status of Current District Construction Projects

Project Name	Participating Jurisdiction(s)	Design Status (% complete)	Construction Status (% complete)	Construction Cost (X \$1000)
Adams County				
Brantner Gulch	Adams	10	0	
Dahlia/Kenwood Outfall	Adams	25	0	
Globeville Outfall	Adams	30	0	
Grange Hall Floodplain Delineation	Northglenn	100	NA	
Hoffman Drainageway	Adams	30	0	
Kalcevic Gulch-Dam	Adams	100	100	590
McKay Pond	Adams	100	0	
McKay Pond: Outfall	Adams	100	0	
Niver-Trib L @ Pecos St.	Federal Heights	100		
North Outfall - Baseline Road	Brighton	75	0	
School Trib.	Thornton	50	0	
Silverado II Detention Pond	Aurora/Denver	100	0	
Utah Junction/Clay Street Outfall	Adams	10	0	
Arapahoe County				
Big Dry Creek: Allen WTP LOMR	Englewood	95	NA	
Big Dry Creek Maintenance Trail	Englewood	50	0	
Cherry Creek: Drops #20 & #21	Arapahoe County	90	0	
Cherry Creek: Maintenance Access	Arapahoe County	100	0	
Cherry Crest West	Centennial	100	100	376
Granby Ditch Inlet	Aurora	75	0	
Holly Hills Detention	Arapco.	100	0	
Little Dry Creek at Arapahoe Road	Centennial	95	0	
Little's Creek: Broadway to Apache	City of Littleton	100	100	
Normandy Gulch	Columbine Valley	10	0	
Parker/Jewell	Arapco.	100	100	1010
Parker/Mexico: Phase 2	Arapco.	100	95%	
Piney Creek: u/s of E-470 (Sampson Gulch)	Aurora	95	0	
Quebec / Iliff Outfall	Arapco	100	0	
Quincy Reservoir Drainage	Aurora	100	0	
Sable Detention	Aurora	10	0	
Sand Creek	Aurora	100	90	4,100
Southwood Village Outfall	Centennial	5	0	
Utah Park	Aurora	30	0	
Boulder County				
Drainageway G-Phase 2	Louisville	5	0	
Elmer's Two Mile Greenway Project Phase I	Boulder	20	0	
Erie Reach BP20	Erie	30	0	
Erie Regional Detention Facility No. 1045	Erie	100	0	
Erie Regional Detention Facility No. 1026	Erie	50	0	
Valmont Bridge on South Boulder Creek	Boulder County	100	0	
Wonderland Creek Diagonal Hwy	Boulder	100	50	
Broomfield County				
Quail Creek LOMR	Broomfield/Westminster	90	NA	
Douglas County				
Cherry Creek: Apache Plume	Parker	95	0	
Cherry Creek: Stroh Ranch	Parker	5	0	
Happy Canyon Creek-Phase 2	Douglas County	90	0	
Little Willow Creek	Douglas County	100	100	
Marcy Gulch: Upstream of Broadway	HRMD	100	100	
Newlin Gulch @ W. Parker Rd.	Douglas County	90	0	

precast box and a cast-in-place slab & low-flow channel, several storm sewer improvements ranging from 18" to 48" RCP, and a new intersection with curb, gutter and sidewalk. Amcor produced the 175 linear feet of 28' wide by 5' high side boxes while Flatiron used a 300-ton hydraulic crane to place the boxes (see photo). Notably, the boxes were placed in less than two days without complication.

The second project of note for 2005 was the Tennyson Street Bridge across Lakewood Gulch. Ken MacKenzie oversaw this project for the Urban Drainage and Flood Control District who partnered with the City and County of Denver to complete yet another flood control project on Lakewood Gulch. This was the third bridge replacement along the gulch and was completed in July of this 2005. To see this 1.7 million dollar project a success, civil engineers and landscape design specialists teamed up from select consulting firms such as Kiowa Engineering, Bates Engineering, and Design Concepts. The single span bridge replaced a 7' by 6' box culvert, and has the capacity to pass the 100-year flood. The bike trail parallels Lakewood Gulch underneath the bridge, eliminating the on-grade crossing currently in place. Also, the channel was lined with grouted flagstone, a definite

Denver County

27th Ave. / Federal Blvd. OSP	Denver	100	NA	
30th & Magnolia Phase II	Denver	100	25	
Cherry Creek: Drop No. 24	Denver	100	10	
Globeville / Utah Junction-Phase I	Denver	100	0	
Goldsmith Gulch Retrofit	Denver	50	0	
Harvard Gulch/University-Hills-Phase I	Denver	75	0	
Lakewood Gulch: 10th Ave. bridge	Denver	100	10	
Lakewood Gulch: Tennyson - Sheridan	Denver	30	0	
Lakewood Gulch: Tennyson Bridge	Denver	100	100	1,400
Lakewood Gulch: Wolff Bridge	Denver	75	0	
Montclair OSP	Denver	75	0	
Park Hill Phase III	Denver	100	0	
University / Mexico OSP	Denver	100	NA	

Jefferson County

Arvada Channel	Arvada	100	0	
Bear Creek at Morrison	Morrison	100	100	
Coyote Gulch	Lakewood / Jeffco	50	0	
Green Mountain Drainageway B	Lakewood	85	0	
Hays Lake Outfall	Arvada	95	0	
Kenney's Run	Golden	100	0	2,000
Lakewood Gulch u/s Van Gordon	Lakewood	100	100	242
Lakewood Gulch-Welchester Park	Jeffco	5	0	
Lena Gulch: 10th Ave. through Orion St.	Jefferson County	100	50	
Lena Gulch-Isabell	Jeffco	50	0	
Lena Gulch-Mountainside	Jeffco	100	100	1,391
Leyden Dam	Arvada	100	95	1,576
Massey Draw-Wadsworth	Jeffco	100	100	240
Raccoon Creek	Jeffco	10	0	
Ralston Creek LOMR	Arvada	100	NA	
South Lakewood Gulch: CCU Detention Pond	Lakewood	95	0	
Van Bibber	Arvada	100	80	9,174

Other Projects

Storm Sewer Inlet Study	All	5	NA	
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compliment to the surrounding area. This feature is just another part of the new improvements Design and Construction continues to test out in the Denver area.



Little Creek at Apache Road.



Tennyson Street Bridge at Lakewood Gulch

Floodplain Management Program Notes

By Bill DeGroot, P.E., Manager, Floodplain Management Program

Program reorganization

In January a new program, Information Systems and Flood Warning Program was established. Kevin Stewart moved from the Floodplain Management Program to become manager of this new program, and he took the flood warning activity with him.

The remaining major activities within the program are interfacing with the National Flood Insurance Program, maintenance eligibility, flood hazard area delineation, master plan implementation by others and public information.

Our maintenance eligibility program continues to flourish under David Mallory's direction. See David's column elsewhere in this issue. Following is a discussion of significant accomplishments in the other areas.

DFIRM conversion projects

In late 2003 we began Digital Flood Insurance Rate Map (DFIRM) conversion projects for the City and County of Denver and Northern Douglas County. The Douglas County DFIRM became effective on September 30, 2005 and the Denver DFIRM became effective November 17, 2005.

The Boulder County DFIRM conversion is being managed by the CWCB. The contractor is PBS&J. Revised preliminary maps have been provided to the local governments. The expected effective date is September 30, 2006.

Last year we received FEMA DFIRM conversion grants of \$480,000 each for Adams County and Arapahoe County. The District has contributed \$70,000 for each county and the CWCB has contributed \$50,000 each.

The contractor for Adams County is ICON Engineering, and for Arapahoe County it is Merrick and Co. Preliminary maps and Flood Insurance Studies for each county were distributed to the local governments for comment on September 30. The formal 90-day

appeal period is set to begin on January 1, 2006.

A Jefferson County DFIRM was completed by Michael Baker, Jr. in 2003. Unfortunately, it was completed in NGVD 29 datum, while the other DFIRMs have been converted to NAVD 88. The District has received a \$240,000 grant from FEMA, to be matched by \$30,000 each from the District and CWCB, to convert the Jefferson County DFIRM to the new datum. This is probably not enough money to complete all of the required work and publish new panels, but it will be a good start.

While we are at it we will use digital flood hazard area delineation study reports completed or underway to supplement or replace older data sources in the DFIRM. This will include Ralston Creek, Leyden Creek, Massey Draw and North Tributary, SJCD (South) and Tributaries, Clear Creek, and Dutch Creek and Tributaries. Consultant selection for this effort was underway at the time this was written. Work should begin in January.

Realistically, by September, 2006 we should have all of the District's area covered with DFIRMs. Our next challenge will be to convince FEMA to delegate to the District the responsibility for maintaining all aspects of the DFIRMs for the District's seven counties, including base map revisions, Letters of Map Revision (LOMRs) and new floodplain delineations..

LOMC pilot project

On July 1, 2001 we began a pilot project with FEMA to assume the responsibility to review requests for Letters of Map Change for the 32 communities within the District that are participating in the National Flood Insurance Program. We begin 2006 with a new grant to continue the project. Our final reports to FEMA on the results of the first three years are available on our web site. The fourth year report will be posted in early 2006.

We completed a DFIRM maintenance pilot project, using the Broomfield DFIRM to get a feel for what is involved in map maintenance, including incorporating new LOMRs into the DFIRM, adding new information to the base map, adding a new floodplain to the DFIRM and adjusting to receipt of more accurate data. Our report to FEMA on this project is on our web site.

Floodplain delineation

We completed two flood hazard area delineation (FHAD) studies this year: South Platte River in Adams County, and Upper Goldsmith Gulch in Arapahoe County,

We have FHADs underway for Clear Creek through Adams County, Clear Creek in Jefferson County, Massey Draw and SJCD (South) in Jefferson County, and Dutch Creek and Tributaries in Jefferson County.

All of these studies are prepared in digital form compatible with FEMA's DFIRM specifications, and have been or will be incorporated into the appropriate DFIRMs.

Implementation efforts

Implementation of portions of our master plans, particularly regional detention facilities, is always a challenge. We are currently negotiating an Intergovernmental Agreement (IGA) with Denver and the Rocky Mountain Arsenal (RMA) for the construction, operation and maintenance of a number of facilities on the RMA. We are also negotiating an IGA with Denver and Aurora regarding the implementation of regional detention facilities in the Upper Second Creek watershed.

David Mallory's column includes an example of a private sector implementation project.

FasTracks Coordination

Last year voters in the Denver metro area approved a proposed sales tax increase (called FasTracks) for the

Regional Transportation District (RTD) to add over 100 miles of new light rail, commuter rail and bus rapid transit corridors to its system. As you can imagine, these transit corridors will cross, or in some cases parallel, many major drainageways, requiring close coordination to minimize potential conflicts.

The first corridor scheduled for implementation is light rail along the West Corridor. It extends from downtown Denver to Golden, passing through Denver, Lakewood and

Jefferson County on the way. Major conflicts will be encountered at the South Platte River, Lakewood Gulch and Dry Gulch.

We have been meeting frequently with RTD and local government officials to coordinate the potential implementation of District master plans in these areas in coordination with and ahead of the rail construction.

We have established a West Corridor working group that meets monthly, and

have also discussed the next three corridors with RTD representatives.

Check these out on our web site

We have a photo album showing what we consider to be good examples for others to emulate. We also have an Activity Summary map that identifies all District studies completed or in progress. We update the status of all our studies quarterly. It would be a good idea for anyone working on a drainage study in the District to check this map for existing or on-going studies that might affect their work.

Stormwater Permitting Support Activities

By John T. Doerfer, Project Hydrologist, Master Planning Program

The District hosted quarterly meetings to discuss stormwater issues in 2005. These meetings served as a forum to exchange ideas, set up workgroups, and report on accomplishments. Activities of this group in 2005 are described below. In addition to the local governments within the District, a number of other cities, counties, and special districts throughout Colorado that are required by law to have Clean Water Act permits for their municipal separate storm sewer system (MS4) discharges actively participated in these meetings.

Municipal Operations Video. A 20-minute video showing best management practices (BMPs) for municipal shops, fueling areas, public streets, and de-icing operations was created for educational purposes. This video is available for purchase through Excal Visual in Boulder at www.excalvisual.com.

Power Washing Brochure. Proper methods for disposing water used for power washing of equipment, kiosks, bleachers, buildings, etc. was developed under the leadership of Kevin Lewis, City and County of Denver. This brochure will be printed in 2006.

BMP Operation & Maintenance. Guidance on operation and maintenance (O&M) of structural BMPs was initiated in 2005. When completed in 2006, these O&M guidelines and will be useful for private owners of structural

BMPs, such as Homeowner Associations, as well as local government staff.

Low Impact Development. Miranda Maupin with the City of Seattle Public Works Department made a presentation on opportunities for retrofitting low-impact development BMPs into urban settings.

Grand Valley Stormwater Utility. Mesa County and the City of Grand Junction described their current management programs and efforts to form a stormwater utility among various entities in the Grand Valley.

Arvada's Public Education Program. Sandra McDonald shared the comprehensive public education program developed by the City of Arvada, including their mascot "Fillip A. Can" with the message to dispose of trash properly.

Industrial Activities Brochure. Aurora, Denver, Lakewood, and the District prepared a booklet and poster for industrial and commercial activities as part of MS4 permit requirements in 2005.

EPA Compliance Inspection. The City of Lakewood was

subject to a comprehensive evaluation of its stormwater management programs for permit compliance by the U.S. Environmental Protection Agency. Results of this audit should be available in 2006.

Stormwater Monitoring. The District manages a storm-event monitoring program of the South Platte River and tributaries for Aurora, Denver, and Lakewood. The U.S. Geological Survey collected water-quality samples for a total of seven storms in 2005.

The District's program to monitor and test structural BMPs continued in 2005. Seven storms were sampled at an extended-detention basin at Grant Ranch (Photo), nine storms at a porous-concrete pavement site in Lakewood, and four storms at an underground sand filter in Lakewood.



Maintenance Program Activities

By Mark R. Hunter, P.E., Manager, Maintenance Program

The Urban Drainage and Flood Control District (District) Maintenance Program committed a total of \$5.6 million in 2005 to maintaining drainageways in the Denver metropolitan area. The bulk of the drainageways we maintain are open channels with native-grass-lined banks, riprap or vegetative erosion protection, and rock or concrete grade control 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 2005 we awarded nine contracts for debris pickups and native-grass mowing under our routine maintenance program. Five contracts were awarded through a competitive bid process in March. The remaining four contracts were awarded as renewals of the prior year contract. The value of each of these renewed contracts was adjusted to match the movement in the regional Consumer Price Index over the prior year.

The mowing and debris pick-up work was done on 270 different sections of urban native-grass-lined drainageways within the District's boundaries. The contractual value of the work was \$657,770. The table below summarizes the miles of drainageways within each county in the District on which we performed regularly scheduled mowing and/or debris pickup maintenance.

Routine Maintenance Summary for 2005

Adams County	20.9 miles
Arapahoe County	39.7 miles
Boulder County	17.6 miles
Broomfield County	0.2 miles
Denver County	44.4 miles
Douglas County	11.4 miles
Jefferson County	30.4 miles
TOTAL	164.5 miles

Construction Activities

In 2005 \$4,942,000 of work was performed under our various construction contracts. The smaller projects typically address isolated drainage problems where the construction will cost from a few hundred dollars up to \$200,000. Within this cost range seventy-nine individual activities were completed under our restoration contracts. Projects in this category of work are directly awarded to a single contractor or bid among all contractors from our group of six contractors who have won open-ended contracts with the District. A major advantage of work under the open-ended contracts is the ability to use them to react quickly to local drainage needs.

When project construction will cost more than \$200,000 the work is designed by a private consultant and then put out for public bid to be built by a private contractor. These larger projects typically address severe problems that have occurred on previously improved urban drainageways. Fifteen large projects were at various stages of design or construction during 2005. Our major projects for the year are summarized in the accompanying table titled "STATUS OF MAJOR MAINTENANCE PROJECTS."

It used to be that when the last piece of construction equipment left the work site the project was finished. Permit regulations now often require that the revegetation of a completed project be monitored and documented for several years. The goal is to ensure that vegetation and habitat are restored to pre-construction levels. These annual site inspections and reports require our on-going attention plus the services of qualified vegetation specialists.

Channel Repairs

In last year's *Flood Hazard News* we described a project on **Grange Hall Creek** between Grant Street and I-25 in the City of Northglenn. Some improvements had been constructed in the past, but they were deteriorating. A

contributing factor appeared to be inadequate energy dissipation as the creek discharged from the culvert under I-25. A drop structure near I-25 has been rebuilt and others added in order to control the erosion. The channel has also been regraded and a trail has been added.

High energy at culvert outlets appears to contribute to erosion at other sites as well. On **Kettle Tributary to Willow Creek** west of Yosemite Street in Centennial we rebuilt the outlet area and regraded the area downstream. Similarly, on **Little Dry Creek** between Hoyt and Kipling in Arvada, the erosion we repaired was worse immediately downstream of roadway crossings.

The low flow channel of **Cherry Creek** is confined between vertical concrete walls for its lower three miles before it joins the **S. Platte River**. Over the past 20 years we have placed thousands of linear feet of boulders to reduce bank erosion. Recently we have also installed wrapped soil lifts to control bank erosion of the low flow channel. Getting the vegetation to take hold in the soil lifts requires determination, but so far the installation has performed well.

Multi-purpose Projects

In 2005 we again joined forces with other local governments to fund multi-purpose projects. Drainageways and parks often share the same corridor. Dave Bennetts, Senior Project Engineer, coordinated with staff from Denver Parks to design improvements to **West Harvard Gulch** at Clay Street, **West Harvard Gulch** at the South Platte River, and **Sanderson Gulch** at Florida Avenue. Each site had unique hydraulic and right-of-way problems and different residential/recreational needs. **Sanderson Gulch** is now under construction and is being administered in the field by Mike Sarmiento, Senior Construction Manager.

Two projects in Lakewood made use of combined funding to repair severe erosion to residential backyards.

Stacked boulders were used to limit the channel width and still maintain the flow capacity of **McIntyre Gulch** west of Holland Street. Boulders and riprap were used to make repairs to **Lena Gulch** east of Youngfield where the contractor had to deal with difficult access conditions. On both projects the City of Lakewood managed easement acquisition in addition to participating in the project funding.

Multi-purpose projects occasionally take us into irrigated bluegrass parks. In Broomfield we used wrapped soil lifts reinforced with vegetation to provide low flow bank protection on **City Park Drainageway** south of Midway Boulevard. Since we were in an improved park a narrow concrete "mow strip" was installed behind the upper soil lift to provide an edge for the bluegrass and a solid surface for mower wheels.

Detention Ponds and Sediment Control

The hydraulic designs of urban drainageways are generally intolerant to sedimentation and aggradation. A change in bottom elevation of just a foot can have a dramatic impact on the flow characteristics and the associated floodplain of an urban grass-lined stream. Concrete-lined channels can be even more sensitive to aggradation where even a couple inches of sediment is visible and can support undesirable vegetation. In the past year the maintenance Program carried out significant sediment removals on **Grange Hall Creek** in Thornton from 108th Avenue to Colorado Boulevard, and at the sediment trap on **Willow Creek** south of Dry Creek Road in Centennial.

We have removed sediment several times from the low flow channel of an on-stream detention pond on **Wildcat Ridge Tributary** to **Big Dry Creek** in Douglas County. We are assessing the upstream sediment sources to determine if we should construct a sediment trap which would make maintenance much easier.

Making changes to drainageway configurations in urban areas is often a balancing act. Flowing water has a mind of its own and if you try to confine

STATUS OF MAJOR MAINTENANCE PROJECTS

Project	Jurisdiction	Cost	Status
ADAMS COUNTY			
Grange Hall Creek – 108 th Av. to Colorado Remove substantial sediment buildup	Thornton	Design	4,280 100%
		Const	61,226 100%
Grange Hall Creek – Grant St. to I-25 Build small drops and repair channel	Northglenn	Design	86,387 100%
		Const	398,810 100%
Niver Creek – York St. at Coronado Pkwy Remove sediment and repair pipe outfalls	Adams County	Design	18,345 80%
		Const	next year 0%
ARAPAHOE COUNTY			
Coon Creek – West of Platte Canyon Road Local channel and bank repair	Arapahoe County	Design	44,459 100%
		Const	139,676 100%
Little Dry Creek – East of Colorado Blvd Local small drops and channel repair	Centennial	Design	57,963 90%
		Const	next year 0%
Little Dry Creek – Orchard & Brook Val Repair vertical bank & rebuild channel	Centennial	Design	40,362 100%
		Const	98,015 100%
Willow Creek, Foxhills – S of Dry Ck Rd Rebuild drops and repair channel	Centennial	Design	In-house 100%
		Const	216,963 100%
Willow Creek, Kettle Tr – W. of Yosemite Rebuild pipe outlet and repair channel	Centennial	Design	In-house 100%
		Const	116,330 100%
BOULDER COUNTY			
Boulder Crk – West of 9 th St, Eben Fine Pk Rebuild river rock drops, repair erosion	Boulder	Design	In-house 100%
		Const	108,026 100%
Dry Creek #2 – N.E. of 55 th St. & Arap. Replace 3 broad drop structures	Boulder	Design	82,204 100%
		Const	338,161 5%
Rock Creek – Farm west of Hwy. #287 Channel repair, drops, trails, and plants	Boulder County w/Boulder Co	Design	76,178 100%
		Const	681,835 100%
BROOMFIELD COUNTY			
City Park D'way – Emerald to Midway Channel and bank repair	Broomfield	Design	70,769 100%
		Const	293,298 100%
DENVER COUNTY			
Cherry Creek – U/s & d/s of 11 th & Speer Soil lifts and plants to protect low flow	Denver	Design	11,013 100%
		Const	105,708 100%
Goldsmith Gulch – Iliff to Yale at Monaco Repair channel, trash rack and det. pond	Denver	Design	69,130 60%
		Const	next year 0%
Montbello Channels – N.E. of I-70&Peoria Ongoing replacement of concrete channel	Denver	Design	Previous 100%
		Const	167,084 100%
Sanderson Gulch – At Florida Avenue Repair banks and add & repair drops	Denver	Design	100,138 100%
		Const	775,000 100%
West Harvard Gulch – Platte R to Railroad Drops, channel repair, and trails	Denver with Denver	Design	149,413 90%
		Const	857,377 0%
West Harvard Gulch – Zuni St. to Clay St. Corridor study, drops, channel repair	Denver with Denver	Design	176,268 100%
		Const	572,000 0%
DOUGLAS COUNTY			
Big Dry Ck, Wildcat Trib – W of Quebec Sediment removal & design sed. trap	Douglas County	Design	14,299 50%
		Const	21,144 10%
Happy Canyon Ck – At Oak Hills Drive Add a drop to protect upstream drop	Douglas County	Design	44,334 100%
		Const	196,945 100%
Sulphur Gulch – SE Main & Stonehenge Add 2 more drops to stabilize channel	Parker	Design	23,960 100%
		Const	173,625 100%
JEFFERSON COUNTY			
Coon Creek – S.E. of Bowles and Jay Ct Drops and repair channel & water line	Jefferson County partic. w/Den.Water	Design	51,310 100%
		Const	246,790 100%
Lena Gulch – From 20 th Av to Youngfield Drops and repair channel	Lakewood w/Lakewood	Design	50,300 100%
		Const	210,000 100%
Little Dry Creek – Hoyt/Kipling, N of 80 th Drops and channel repair	Arvada	Design	56,580 100%
		Const	192,680 100%
McIntyre Gulch – West of Holland St. Repair eroded channel banks	Lakewood w/Lakewood	Design	76,800 100%
		Const	474,000 100%
Tucker Gulch – Ford St. at 7 th Place Repair narrow urban channel	Golden	Design	23,400 40%
		Const	next year 0%

it too much in one area it may respond by popping out in a nearby area. An off-channel detention pond was constructed for **Goldsmith Gulch** at Iliff Avenue in Denver several years ago. The pond is immediately upstream of a long box culvert that goes under a shopping center parking lot. Each runoff event brings with it its own set of stream flow characteristics. Ideally, flow in the box culvert will be maximized before stormwater starts spilling into the detention pond. Also, the detention pond should fill with water before any flow overtops the box culvert and flows through the parking lot. Goldsmith Gulch has often disregarded this logic and as a result we are participating in a study to reconfigure these sensitive elements of the drainageway.

Drop Structures

Last year we mentioned that drop structures can fail when water flows through, under, or around them due to an inadequate cutoff wall. Drop structures can also be damaged in another way. When the channel bottom downstream from a drop is steeper than its equilibrium slope nature will try to flatten the slope by eroding upstream. If enough elevation is available for the stream the erosion can eventually undermine the foundation of a drop structure. In the Town of Parker we added two drop structures on **Sulphur Gulch** south of Main Street to flatten the longitudinal slope and reduce the threat to a recently built sculpted concrete drop structure. A similar structure was built on **Happy Canyon Creek** at Oak Hills Drive in Douglas County to stop erosion that was undermining the energy dissipation basin of a drop structure built several years ago. The close coordination of multiple interests on both projects was guided by Cindy Thrush, Senior Project Engineer. Jeff Fisher, Senior Construction Manager kept all the parties informed and coordinated while overseeing the construction.

A large stand of cattails and other wetland plants exists on **Dry Creek No.2** east of 55th Street in Boulder. This environment was created by three wide drop structures made up of large stacked concrete blocks. These blocks have

shifted enough that water now flows through the structures and has caused an undesirable combination of sedimentation and erosion. Our project will rebuild the drop structures to restore the water table, reduce the sediment deposition, and better manage the low flows and stormwater flows.



Lena Gulch in Lakewood between 20th Avenue and Youngfield Street. Boulder edge channel built within a confined backyard drainageway easement



Little Dry Creek north of 80th Avenue in Arvada. This grouted boulder drop structure has stabilized the channel within the park and protects a sanitary sewer line that had been completely exposed by erosion.

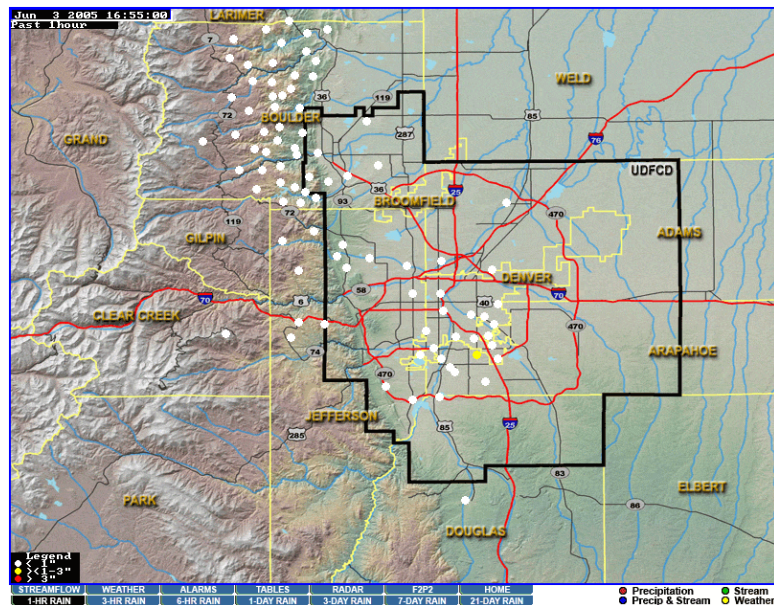
ALERT Webserver Enhancements

By Chad Kudym, Project Engineer, Information Systems and Flood Warning Program

In Spring of 2005 the District's ALERT webserver <http://alert.udfcd.org> was updated with GIS-based mapping of topography, hydrography, roads and ALERT gages, as well as drill-down capabilities that enhance data access. This update helps users visualize features that influence flood threats and facilitates quick access to a variety of displays.

The map illustrates the utility of the updated ALERT webserver for the June 3, 2005 storm. This is the default image displayed when a user requests a map. Although no rainfall amounts are shown, it does provide a very clear snapshot of current 1-hour rainfall activity for the entire ALERT network. The map automatically updates every five minutes if no browser activity is sensed. The map includes a shaded relief topography map, county boundaries, major highways, major streams and water bodies, and the District boundary as background features to assist with data assessment. White dots indicate rainfall activity with less than one inch falling in the past hour. Yellow dots highlight rainfall activity reflecting one to three inches of rain, and red dots warn of rainfall greater than three inches for the same 1-hour time period. Tabs along the bottom of the map provide a dashboard of options for accessing critical information related to weather and flood-related threats.

At 4:55pm, the yellow dot near I-25 and Hampden indicates that localized flooding may be occurring that deserves a closer look. The user can click on the map where the highlighted dot is located and the browser will display a more detailed map showing the location of the gage with the total rainfall amount measured for the past hour. More detailed maps can be viewed by clicking on each subsequent map until the desired scale is found or the best available map is finally reached. The user can then hover the mouse pointer over the gage of interest and a popup will appear showing the station name and the gage ID number.



Clicking on the rainfall readout associated with the station will launch a separate browser window with a table of the last 100 data reports for the gage. The data table lists the date/time of the bucket tip along with corresponding cumulative precipitation totals since the data transmitter was last reset. The table also lists a "raw" data value that reveals missing bucket tips and a column that indicates when alarm thresholds are exceeded. Other summary tables that list daily amounts and storm totals can be obtained from links provided in the left frame of the map window.

All maps include browser navigation that not only allows you to quickly drill-down to more detailed maps, but also to move to adjacent maps. The streamflow maps function very similarly to rainfall maps and use the same background images. Useful weather maps are also available. The District wants to encourage local agencies to use this website to develop a level of comfort with the tools that are available. Of course, any feedback you have is always welcome.

Another more recent enhancement that Internet users will start noticing is the substantially improved speed at which these webpages are now rendered. In

late November we switched communications from a dedicated ISDN connection to a high speed T-1 line. We trust that this will be another welcomed change, but we are not done yet. Currently we are working on PDA-friendly webpages that will allow convenient wireless access to many useful, easy to interpret displays.

Urban Drainage and Flood Control District ALERT Web Server				
620 Quincy/Highline				
Date	Time	inches	Raw	Alarm
06/03/2005	16:59:34	5.12	130	alarm
06/03/2005	16:56:18	5.08	129	alarm
06/03/2005	16:53:47	5.04	128	alarm
06/03/2005	16:52:45	5.00	127	alarm
06/03/2005	16:51:57	4.96	126	alarm
06/03/2005	16:51:15	4.92	125	alarm
06/03/2005	16:50:39	4.88	124	alarm
06/03/2005	16:50:10	4.84	123	alarm
06/03/2005	16:48:35	4.72	120	alarm
06/03/2005	16:48:08	4.69	119	alarm
06/03/2005	16:47:44	4.65	118	alarm
06/03/2005	16:47:21	4.61	117	alarm
06/03/2005	16:46:56	4.57	116	alarm
06/03/2005	16:46:31	4.53	115	alarm
06/03/2005	16:45:42	4.45	113	alarm
06/03/2005	16:45:12	4.41	112	alarm
06/03/2005	16:44:44	4.37	111	alarm
06/03/2005	16:44:20	4.33	110	alarm
06/03/2005	16:43:28	4.25	108	
06/03/2005	16:42:34	4.17	106	
06/03/2005	16:42:02	4.13	105	
06/03/2005	16:40:42	4.06	103	
06/03/2005	16:39:12	4.02	102	
06/03/2005	16:38:31	3.98	101	
06/03/2005	16:37:57	3.94	100	
06/03/2005	16:37:18	3.90	99	
06/03/2005	16:35:58	3.86	98	
06/03/2005	16:34:46	3.82	97	
06/03/2005	15:02:01	3.78	96	
06/03/2005	14:48:29	3.70	94	
06/03/2005	11:07:15	3.66	93	
06/02/2005	23:07:30	3.66	93	

Maintenance Eligibility Program Notes

By David Mallory, P.E., Senior Project Engineer, Floodplain Management Program

Construction Plan Reviews

We continued to see a large number of construction plan submittals again this year. The eastern E-470 and northern I-25 corridors have attracted the largest development interest for both commercial and residential development. Providing timely reviews is always challenging and this year was no exception. Terri Fead, PE, CFM has supplemented District staff throughout the year. Terri's involvement has been a tremendous benefit to the Maintenance Eligibility Program and I'm happy to announce she will be part of the program again next year. The District's maintenance eligibility database, updated bi-monthly, and the *Guidelines for Maintenance Eligibility Of Flood Control Facilities Constructed By Others* (Maintenance Eligibility Guidelines) have been available online throughout the year.

The District and Army Corps of Engineers (ACOE) have made a concerted effort to coordinate our maintenance eligibility and the ACOE's Section 404 permit programs. To that end we are encouraging joint meetings and site visits. While these programs have different goals and purposes; there are definitely shared objectives. The District has long promoted preservation of floodplains, which also avoids

impacts to waters of the United States and associated wetlands. However, not all projects follow the preservation model. The District/ACOE coordination helps to facilitate and streamline the approval process. The other essential partner is of course local government. Throughout the year we have moved towards larger representation at project meetings with positive results.

Private land development projects are responsible for constructing perhaps one-half to two-thirds of the Denver metropolitan area's major drainageway infrastructure. In working with local governments, developers and their consultants, we have also been mindful that major drainageways must be attractive, provide a community asset and represent a "sense of place" in addition to functioning hydraulically. Michelle Leach and I presented papers on this subject at the District's April workshop and CASFM's annual conference in September. Many projects require floodplain revisions through the Federal Emergency Management Agency's letter of map revision (LOMR) process. We spend a lot of time mentoring development applicants and their consultants in preparation of LOMRs for development projects.

In the field

One of the truly rewarding and enlightening aspects of my position is field operations. I see a lot of projects over the course of a year and some stand out in terms of design and construction execution. One project I'd like to share is the Parker Auto Plaza. As the name implies, the project is located in the Town of Parker, along Baldwin Gulch, approximately 2,000 feet from South Parker Road to Twenty Mile Road. The Town of Parker has committed to using sculptured concrete drop structures after very successful public projects along Sulphur and Tallman Gulches (in cooperation with the District's Design and Construction, and Maintenance Programs). Baldwin Gulch was realigned and stabilized with four, five-foot, 100-year capacity sculpted concrete drop structures. Kiowa Engineering Corporation was retained to produce the construction plans. This was the first sculpted concrete drop project approved through the District's Maintenance Eligibility Program. I took a lot of pot shoots at the "natural" drop structures in the "natural" engineered channel, next to the "natural" auto dealership as opposed to our previously stated preservation preference. However, the design included several effective components, which made all the difference as I'll discuss below.



Concrete placement on April 8, 2005, for the largest of the sculpted concrete drops started at 7:00 am and was completed in the late afternoon. The entire workforce of Naranjo Civil Constructors was involved. This brings new meaning to the term, teamwork.



Matt Erichsen with Kiowa Engineering Corporation and Chris Castelli with Farnsworth Group (center foreground) provided interactive construction observation. The final surface treatment cannot be completely conveyed through design drawings, rather through skilled field control and a willing contractor.

The Town of Parker and the District agreed to involve the Farnsworth Group in the construction observation of the sculpted drops, based on their previous performance with the Sulphur Gulch project. Another veteran of the Sulphur Gulch Project was Naranjo Civil Constructors. They were again contracted (through a subcontractor arrangement with the site general contractor) to build the channel improvements. Kiowa Engineering Corporation was retained to provide construction observation for the remaining channel improvements. All consultant and construction costs were born by the developer, as is customary in Parker. Several other subcontractors were hired for the Twenty Mile Road crossing.

Concrete placement for sculpted drops is unique. The drop structure featured in the accompanying pictures required 230 cubic yards of concrete. The Naranjo placement team numbered 25 and required a lot of teamwork. Field engineers from both Farnsworth and Kiowa were present for the entire pour. Concrete delivery proved to be the critical path and stretched the placement time for this largest and final drop to 8 hours. A similar grouted sloping boulder drop would have resulted in half the quantity of grout and placement time. Therefore, cold or hot weather placement could become a significant factor with sculpted drops. An overhead power line through the middle of this site necessitated the use of two concrete pumper trucks, and each pumper crew included the operator, a power line spotter and supervisor. Concrete delivery was staged at two locations and included supervisors and quality control personnel in addition to truck drivers. The general contractor sent a delegation to observe the concrete placement, as did the Town of Parker. Altogether I counted 50 people on site. Obviously, a lot of expertise, coordination and teamwork are required to successfully execute a sculpted drop design. We are told the sculpted concrete drops are similar in cost to comparable grouted sloping boulder drops.

Several other features of this project are worth noting. First, the Twenty Mile Road crossing was designed as a single-



View from the top of the completed drop towards the Twenty Mile Road culvert crossing. Note the grouted boulder transition and open three-sided concrete box culvert section.



View of the completed project looking upstream from Twenty Mile Road. The large drop structure is in the immediate foreground. The extended approach section is for underground utility protection. The mature cottonwood trees identify the preserved oxbow location.

span, three-sided concrete box culvert with a pedestrian trail and grouted boulder low flow channel. Notice in the included picture how open the section is, allowing continuous sheet flow from the trail to the low flow channel. The benefits in terms of increased light, safety and appearance, and reduced maintenance are obvious. Another important feature in overall corridor experience is landscape design. I think thoughtful and skilled surface restoration is essential to the overall project success. And finally, the design consultant team was able to preserve one of the pre-project stream oxbows. It is outside of the realigned low flow

channel, but within the 100-year floodplain and receives sustaining water from storm sewer outlets.

My compliments to everyone involved in the Parker Auto Plaza for creating a channelization project that sets the bar for excellence in future major drainageway projects.

Flood Warning Program Notes

By Kevin G. Stewart, P.E., Manager, Information Services and Flood Warning Program

Introduction

This year brought a number of interesting changes to the District. As noted in the Executive Director's column, our information services and flood warning (IS/FW) activities were elevated to full program status and we doubled our full-time staff to a grand total of two with the addition of Chad Kudym. Derrick Schauer helps us out as our part-time IT consultant and Stephanie LaCrue assists us in-between her studies at the Colorado School of Mines and helping Mark Hunter with the District's Maintenance Program. What a team!

IS/FW activities are not new for the District, but both are heavily driven by information technology. Consequently, our system support requirements have steadily increased and the need to adapt to new technologies never ends. One of our main program objectives is to keep pace with our local governments, consultants and other partners while striving to meet the demands of a modern office and an electronically informed public. Another growing need is to provide our Floodplain Management Program with GIS and IT support for FEMA map revisions and DFIRM conversions (see Bill DeGroot's column). Other District programs also utilize GIS and require periodic staff training and assistance.

Over the past two decades we have accumulated a sizable archive of electronic information. Better strategies, procedures and facilities are needed to effectively manage and protect these resources. IT infrastructure improvements will be in place early next year to help us meet this challenge.

The IS/FW program is also responsible for documenting floods that impact the District. This activity turned out to be one of our lesser chores this past year. In fact, the 2005 flood season may be considered one of the District's least active in its 36-year history. In spite of this reprieve, the interest in local flood response and recovery has never been higher. It is so high that I was tempted

to devote the remainder of this column to the headline: *In the Aftermath of Katrina*.

The gulf coast hurricane disasters continue to be a hot topic for headline news and magazines across the Country. The catastrophic flood losses and death toll have caused many communities to ask the question—could this happen here? Dave Lloyd answered this very well in his column and yes, we are very fortunate to live in Colorado, but we should never forget our flood history as current events remind us of how vulnerable we really are.

District communities prepare for the inevitable

As our nation deals with the recent gulf coast catastrophe, the elevated fear factor has caused District communities to reevaluate their current capabilities, identify weaknesses and take prudent steps to become more disaster-resilient. The City of Boulder and University of Colorado at Boulder are currently developing comprehensive disaster mitigation assistance plans. Once completed, FEMA will regard Boulder and CU as a disaster resistant community/university. This designation will qualify them for federal mitigation funding to further reduce their risks. These plans are intended to address all hazards, but the flood risk is considered their primary threat.

Denver is also focusing on improving flood response capabilities by undertaking a detailed review and update of their standard operating procedures. Efforts are also underway to prepare a comprehensive flood recovery assistance plan. AMEC is providing consulting services for Denver and the Boulder/CU projects. The District is participating in these activities.

Flood safety information online

The flood safety information website <http://floodsafety.com/colorado> project was started in 2003 as a cooperative effort between the District and the City of Boulder. The project was later expanded to address Jefferson County

flood hazards and very soon, the second phase for Boulder will be underway. Project funding to date has been provided by the District, Boulder, Jefferson County, the Colorado Water Conservation Board, University of Colorado, U.S. Geological Survey, FEMA through the Colorado Office of Emergency Management, and the Public Entity Risk Institute. The multimedia website features flood videos, testimonials, descriptions of past floods, aerial photographs, flood inundation maps and a media kit for use by local newspapers and TV stations. More community involvement is planned for Boulder's second phase as well as a feature length video production for possible PBS broadcast.

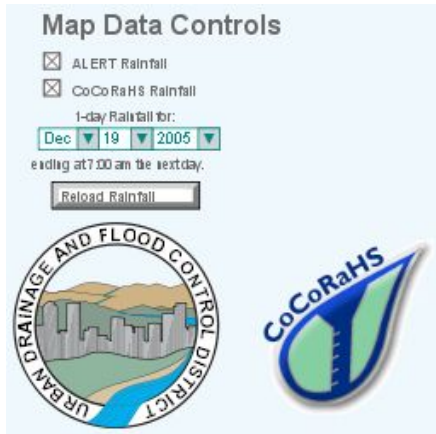
Is my property in or near a floodplain?

This frequently asked question has motivated the District to develop more effective ways to help people find the answer. With the Internet being the vehicle of choice, we wanted to keep the procedure as open as possible, minimize our system support requirements, avoid costly software acquisitions, and leverage available Internet resources. Bruce Rindahl with Leonard Rice Engineers (LRE) developed a procedure for the District that utilizes an open source Internet program language known as Scalable Vector Graphics (SVG). The address locator is powered by Google. The USGS and Microsoft's Terraserver are the source for background images. GIS shape files are used to render transparent floodplain overlays, roads, hydrography, county boundaries and the District boundary. LRE is hosting the website. An SVG demonstration webpage link can be found on the District's homepage www.udfcd.org.

CoCoRaHS update

The District has been a CoCoRaHS sponsor since 2002. CoCoRaHS stands for Community Collaborative Rain, Hail and Snow Network. It was started by the Colorado Climate Center at Colorado State University following the 1997 Fort Collins flood. Nolan Doesken heads this nationally

recognized project that includes cooperative observers from neighboring states. Anyone interested in becoming a CoCoRaHS observer or learning more about this program should visit their newly improved website www.cocorahs.org.



CoCoRaHS/ALERT web display

LRE used SVG to develop an improved CoCoRaHS/ALERT combined data display for the District. The interface is identical to the floodplain mapping procedure described previously and can be run from the same website. Real-time data is accessed directly from XML files generated by the two source websites. Rainfall for the previous day is then rendered for the browser. The application also includes an historic data retrieval feature. A free plugin from Adobe is required for Internet Explorer users. The latest version of Mozilla Firefox does not require a plugin.

EMWIN-Denver update

EMWIN is a National Weather Service satellite downlink/rebroadcast system that stands for Emergency Managers Weather Information Network. It allows communities to develop their own unique applications including civil emergency messaging. This low-cost system is being activated this month and was made possible by a partnership between local emergency managers, the District, the NWS and Xcel Energy. Skywarn Systems, Inc. of Fort Worth, Texas is the project consultant. DHS grant monies were used to acquire 31 EMWIN receiver systems. Additional DHS funds have already been approved for expanding the radio coverage next year. More information about this

project can be found at www.udfcd.org/emwin.

ALERT System News

The District’s 173-station ALERT system includes:

- 151 rain gages
- 84 stream gages
- 18 weather stations
- 7 repeaters
- 6 base stations
- 2 web servers

Five new stations experienced their first full year of operation in 2005: Aurora FS-12, Flying J, Murphy Creek, Shop Creek and Iliff Pond. The first 3 stations are located in the Upper Sand Creek basin in Aurora. The Shop Creek rain gage is a relocated site near Quincy Ave. and Parker Road in Aurora. The previous Shop Creek station was installed in 1990. The Iliff Pond station is located on Goldsmith Gulch in Denver.

The newest station to come on line is the Stapleton weather station, which was formerly located at the Urban Farm and discontinued in 2003. The new site is just east of the old site near Havana and Smith Road.

By spring of 2006, we are anticipating four additional stations: two on Boulder Creek in the City of Boulder, one on Lakewood Gulch in Denver and another near the Colfax Ave. crossing of Sand Creek in Aurora. New system expansion projects are anticipated for Aurora, Parker and Douglas County, and the District is investigating the possibility of installing an ALERT rain gage at NCAR’s precipitation measurement test site located south of Boulder near Marshall. OneRain of Longmont provided the 2005 ALERT maintenance services for the 14th consecutive year.

Our Internet website has been improved substantially this year. Be sure to read Chad Kudym’s article to learn the details.

Meteorological Support

The District’s 27-year-old flash flood prediction program (a.k.a. F2P2) provides daily forecasts and flood threat notifications to District local

governments from April 15 through September 15. HDR Engineering of Denver provided the operational support for 2005. John Henz was HDR’s project manager and lead meteorologist. This was the fifth consecutive year for HDR as the District’s meteorological services provider.

2005 District floods

The 2005 flood season was the fourth consecutive year deemed below average with regard to the number of observed threat days, 22 compared to an average annual number of 28. No messages were needed during the months of April, May and September, which is quite unusual. June 2-3 kicked-off the flood season with flash flood warnings being issued for both days. Following this two-day threat period, subsequent storms produced only minor nuisance flooding with the threat remaining low until August. Flash flood watches were issued for August 3 and 10. July was abnormally hot and dry with few thunderstorms. Only four July days had any real flood potential, of which three received some street flooding rains. The late arrival of the Arizona monsoon (July 18) was identified by HDR as the reason for the odd July weather. Their report also notes that this was the second latest appearance of the monsoon in the past 50 years and that the Colorado monsoon season did not begin until August. In looking back at Colorado’s flood history, the last week in July through the first week in August has been a notoriously deadly flash flood period. Once again, the District was fortunate to make it through another year relatively unscathed.

Days with Flood Potential

June	2-3,9-10,12,16,20-21,23-25	11
July	4,15,24-25	4
August	3-5,9-11,16,21-23	10

The following briefly describes the more notable rainfall events of 2005:

Thursday, June 2

This was the first message day of the year for the F2P2. A localized intense thunderstorm over DIA dropped copious amounts of pea-size hail, clogging inlets and causing street flooding along Pena



June 3 street flooding in southwest Aurora

Blvd. This storm prompted the NWS to issue a flash flood warning. The eastern plains received the more serious weather with softball-size hail reported near Limon.

Friday, June 3

This storm resulted in the District’s worst flooding of 2005, disrupting yet another Friday afternoon rush hour. This happens a lot! This time the heaviest rain fell in Denver and Aurora with storm totals approaching 2.5-inches over parts of lower Cherry Creek, Goldsmith Gulch, Westerly Creek and Toll Gate Creek. The majority of the rain fell within a 30 to 45-minute period. The Littleton area was also impacted by street flooding and large hail. The ALERT system reported 30 rainfall alarms between 4:30 and 6:30 p.m.

The Horseshoe Park stream gage on West Toll Gate Creek set a new high water record with a peak flow of 1,900 cfs just after 6 p.m. Goldsmith Gulch overtopped Iliff Avenue in Denver while the side-channel detention basin at that location filled to a depth of 6.1 feet. Residential flooding in Denver’s Hampden Heights East subdivision was the subject of many follow-up news reports.

Monday, July 25

The heaviest rainfall this day missed the District, but hit the ALERT gages in the Jamestown area of Boulder County between 4 and 5 p.m., causing a return of mudslides in the burn area impacted by the 2003 Overland Fire. The storm

triggered nine ALERT rainfall alarms from measurements that approached 1.5-inches in less than 30 minutes. From a statewide perspective, the rainfall activity was particularly noteworthy with total amounts exceeding 2-inches in eastern Colorado and more than 3-inches in Kansas and Nebraska. Based

on CoCoRaHS data, the State Climate Office estimated that the volume of rainwater that fell on this day would be equivalent to one-third of an inch depth of water over an area of 450,000 square miles. That is one very impressive hydrologic event!

Wednesday/Thursday, August 3-4

A cold front accompanied by weak steering winds prompted the issuance of a flash flood watch on the morning of August 3. Heavy rains arrived that afternoon with rainfall alarms occurring in Brighton and at Red Garden in Eldorado Canyon State Park. The Brighton weather station measured the highest rain total of 1.50 inches. Less heavy rains continued overnight causing concern about possible stream and river flooding. By morning, rainfall amounts were approaching 3-inches at some locations and streams like Cherry Creek and the South Platte River were running high.

The events described above represent the most interesting storm days of 2005. Heavy rainfall capable of causing minor flooding was verified by HDR for 17 additional days: June 9, 10, 12, 16, 20, 21, 23, 24; July 15, 24, 25; and August 9, 10, 11, 16, 21, 22. More information about the 2005 flood season and ALERT system operations can be obtained by reading the HDR Engineering and OneRain annual reports. Links to these documents and other useful material can be found on the bulletin board webpage at alert.udfcd.org.

2005 Peak Flows

Date/Time	Location	Peak cfs Depth ft.
June 3 17:01	Harvard Gulch at Jackson Street	410 Depth 3.1
June 3 17:07	Slaughterhouse Gulch at Grant Street	88 Depth 6.8
June 3 17:11	Goldsmith Gulch at DTC/Temple Pond	450 Depth 6.9
June 3 17:11	Goldsmith Gulch at Eastman Ave.	540 Depth 3.5
June 3 17:27	West Toll Gate Creek above Confluence Pond	440 Depth 1.6
June 3 17:32	Goldsmith Gulch at Iliff Pond	TBD Depth 8.5
June 3 17:37	Confluence Pond on West Toll Gate Creek	940 Depth 3.4
June 3 17:39	Sable Ditch at 18 th Ave.	180 Depth 2.3
June 3 18:08	Horseshoe Park Drop on West Toll Gate Creek	* 1910 Depth 3.2
June 3 18:35	Powers Park on Slaughterhouse Gulch	TBA Depth 7.2
June 3 18:42	Iliff Pond detention basin for Goldsmith Gulch	Depth 6.1
June 3 18:52	Utah Park on Westerly Creek	177 Depth 6.5
June 3 19:29	Toll Gate Creek at 6th	730 Depth 3.2
June 3 19:33	Cherry Creek at Champa Street	1950 Depth 5.5
June 3 19:33	Sand Creek at Mouth	2570 GageHt 6.7
June 3 20:15	Cherry Creek at Steele Street	1430 Depth 2.9
June 3 20:17	Granby Ditch at 6 th Ave.	38 Depth 6.3
Aug 4 05:49	South Platter River at 3 rd Ave.	2820 GageHt 4.1
Aug 4 06:07	South Platte River at 19th Street	5510 GageHt 8.3
Aug 4 15:35	Kelly Road Dam on Westerly Creek	82 Depth 10.3
Aug 4 16:25	Englewood Dam on Willow Creek	160 Depth 19.6
Aug 4 18:53	South Platte River at Henderson	5670 GageHt 8.4

* New Record

District Project wins CASFM Honor Award

David Bennetts, P.E., Senior Project Engineer, Maintenance Program

A project jointly sponsored by the District and the City of Denver won a CASFM Honor award at the 16th Annual Colorado Association of Stormwater and Floodplain Managers (CASFM) conference held in Steamboat Springs in September. A brief description of the project is given below.

The Hutchinson Park and Goldsmith Gulch Channel Improvements was a joint project sponsored by the Denver Parks Department and the District's Maintenance Program. Construction of the project was completed in late summer of 2004. The 17.5-acre project site has a large wetland area with a formal park on one side and a boardwalk trail along the drainageway. The wetland was starting to degrade due to channel incising, which was lowering the water surface. Drop structures were needed to repair the degraded channel and elevate the water surface back up to its original elevation. The Parks Department wanted to upgrade the trail system in the park and connect it to the regional trail as well as improve the playground and install new equipment.

The \$1.2 million project included construction of faux rock drop structures providing a place to sit next to the water; channel stabilization and rehabilitation; installation of a recycled pedestrian bridge salvaged from another District project, providing the opportunity to view wetlands and wildlife; an upgraded trail system connecting to the regional trail; and irrigation and playground improvements. The project also removed several condominium buildings from the floodplain. Although they were not in the official floodplain, hydraulic modeling for the project showed them to be.

One unique feature of this project was the construction of a water quality pond to capture and treat stormwater runoff from a large parking area. Over the top of the water quality pond is a new boardwalk that appears to float over the wetland as if bridging the area without support. This was achieved through a



Faux rock drop structure sculpted to resemble rock outcropping.

center pier design. Ironwood, known for its 50-year lifespan, was used for decking; and Alaskan Cedar was used to develop the curved alignment and enhance the edges of the boardwalk. It also provided an element of safety, while concealing the foundation.



The "floating bridge" over the water quality pond.

South Platte River Program Notes

By Bryan Kohlenberg, P.E., Senior Project Engineer

Forty years ago, last June, I stood in the early evening hours with my dad atop the McClellan Reservoir Dam, just east of Santa Fe Drive at County Line Road. Earlier that day, he had been advised to leave work at Martin-Marietta and return home across the South Platte River prior to the arrival of a massive "wall of water" moving down Plum Creek toward the river. Sure enough, the valley below us filled quickly with floodwaters and debris that soon raced towards Denver devastating everything in its way. It was not until several days later we learned that the "Flood of 1965" had taken 21 lives and caused \$540 million in damage.

It was this flood that inspired the creation of the District and ultimately led to the formation of the South Platte River Program in 1987. In my mind, however, the Program began in June of 1965. Now that I have been given the responsibility of managing the South Platte River Program I feel fortunate to have seen the flood event that started it all. Today the Program consists of myself as Senior Project Engineer and Steve Materkowski as Senior Construction Manager. Next year we will have the services of a student intern to assist with routine maintenance inspections.

Capital Projects

Globeville Phase 3 Project

The construction phase of Denver's project to remove approximately 200 acres of highly urbanized lands in north Denver from the 100-year floodplain is underway. Lawrence Construction was awarded the project based upon interviews and cost proposals. Under agreement to the District, Love and Associates and their sub-consultants are providing construction management services for Denver. Construction is scheduled to last 810 days and should be complete in the late winter of 2008.

Floodplain Acquisition

The District continues to look for opportunities to partner with Adams County and other jurisdictions to

acquire lands within the South Platte River floodplain.

Zuni/Sun Valley Reach Project

Unfortunately for this project, Congress has again failed to enact the Water Resources Development Act (WRDA), which includes \$18.9 million for this project. Even though it is doubtful that this project will receive Federal funding any time soon, Denver and the District are committed to implementing this project.

In 2005 the U. S. Army Corps of Engineers, Denver and the District were able to pull together enough funding to move the final design of this environmental enhancement project slightly forward. This work allowed Denver to start actively pursuing real estate and utility relocation needs along this reach of the South Platte River between 8th Avenue and Lower Colfax Avenue.

Maintenance Activities

Routine Maintenance

In 2005, South Platte River routine maintenance efforts included:

- 192 river miles (equivalent) of trash and debris pickup and removal
- 3.6 acres of string-trim mowing at access ramps and rest areas
- 78 miles (equivalent) of recreation/maintenance trail edge mowing
- 9.1 miles of tree pruning along the trail
- Removal of dead trees and other large items from the river
- Participation in annual NIMBY ("Not In My Backyard") FEST volunteer trash cleanup event

This year over \$260,000 was spent to perform these services along the 41 miles of river between C-470 and the Adams/Weld County Line. Colorado Total Maintenance (CTM), Inc. was hired once again to perform these services.

The 2005 routine maintenance contract utilized color aerial photos of the river corridor in GIS format. This provided more detail and better annotation for our

contractors. These aerial photos were converted to pdf format and posted on our web site (www.udfcd.org) to provide local governments and other agencies with the ability to download them.

Noxious Weed Management

We continue to be aggressive in controlling the many varieties of invasive vegetation that have taken hold along the River. This vegetation includes both noxious weeds and noxious trees. We continue to assist local governments in the control of such weeds as Purple Loosestrife, Thistle (various species), Knapweed and other species. Our Senior Construction Manager, Steve Materkowski, was invited to speak to several youth groups, including Earth Force, regarding the District's efforts in controlling noxious weeds and habitat rehabilitation.

Working closely with local governments, we have removed Tamarisk (a.k.a. salt cedar), Russian Olive, Chinese Elm and a variety of noxious weeds through cutting, and selective and careful application of herbicides, when needed. This is followed by the plantings of native Plains Cottonwood, Willow, shrubs and various native dry land grasses.

This year undesirable trees have met their match with the addition of a new piece of equipment to the CTM lineup. The "Tree Shear" is a piece of tractor-mounted equipment that allows the operator to hold the tree while hydraulic shears cut the tree near ground level (See photo 1). The tractor can then move the cut tree to a staging area or directly to the chipper. By using this equipment, our contractor is able to remove more trees in less time than traditional methods allow. As always, herbicide, with dye, is immediately applied to the cut stump.

Our efforts in Denver and Arapahoe Counties have significantly reduced the quantity of Tamarisk adjacent to the South Platte River. These plants are

found either individually or in small stands scattered throughout the river

corridor. In Adams County, we continue to find, control and eliminate significant populations of Tamarisk. We also continued working with the Northeast Colorado Tamarisk Task Force (NoCoTTF). For more information about the NoCoTTF or effective Tamarisk control measures, contact Kelly Uhing, Adams County Weed Specialist, at (303) 637-8115 or KUhing@co.adams.co.us.

Restoration Maintenance

In 2005, the following restoration maintenance projects were completed:

- Construction of a new recreation/maintenance trail underpass at 104th Avenue by L&M Enterprises, jointly funded by Adams County (See photo 2).
- Removal of artificial levee adjacent to an old mining operation downstream of 74th Avenue in Adams County. This removal effectively reconnected the floodplain overbank to the main channel. Excavation from the levee removal was used to re-contour the lake bank and to create adjacent wetlands and cottonwood gallery.
- Replacement of the old wooden pedestrian bridge near 1st Avenue (extended) in Denver (See photo 3). The new 10-foot wide steel bridge, visible from Interstate 25, now incorporates a modified bridge approach ramp that is ADA compliant. This bridge represents the last of six wooden bridges along the river trail replaced in the last 12 years.
- Replaced severely cracked or heaved concrete recreation/maintenance trail sections in Denver.

Several restorative maintenance projects that are now being constructed or will be next year include:

- Restoration and stabilization of 1100 feet of highly erosive west riverbank near 164th Avenue extended in Brighton.
- Lowering of the riverbank levee and restoration/stabilization of the west riverbank at the new South Platte Fishing Lakes & Open Space just north of 104th Avenue in Adams County.

- Repair of failing riprap revetment toe at two locations within the Army Corps of Engineer's channelized section between Coal Mine Road and Hampden Avenue along Englewood Golf Course and the east riverbank 1200 feet upstream of Oxford Avenue.
- Repair of several riverbank stabilization and wildlife habitat rehabilitation structures within South Platte Park in Littleton.
- Construction of 1000 feet of east riverbank restoration/stabilization adjacent to the new Ken Mitchell Lakes facility currently being constructed by the City of Brighton. This project is in response to on-going lateral river migration that threatens to bypass the Brighton Ditch diversion structure.

Cooperative Projects with Private Property Owners

Cooperative projects are constructed on flowage and maintenance access easements dedicated to the District by private property owners adjacent to the river in exchange for river restoration work. This year we obtained an additional 73 acres of easement area. To date over 730 acres of such easements have been dedicated, resulting in over 31 bank stabilization and/or river grade controls and riparian revegetation projects since 1987. Several of these easements now contain the river recreation trail, which doubles as river maintenance access.

One new cooperative project was completed this year. Narano Civil Constructors constructed an additional 1000 feet of buried riprap bank restoration/stabilization along the west bank approximately 1300 feet upstream of 104th Avenue. Aggregate Industries dedicated the easement upon which this project was built. The project will help keep the river from migrating into the adjoining future water storage facility. Currently the west bank of the river at the McIntosh Farm Company south of 120th Avenue is under construction. Left Hand Excavating is installing buried riprap along the bank in order to help protect the over 100-year old dairy farm operations. The McIntosh's dedicated 31 acres of riparian area in order to get District assistance along their property.

Next year we hope to have the following cooperative projects constructed:

- Henderson Reservoir - East riverbank restoration/stabilization on property owned by Aggregate Industries just north of 104th Avenue
- Stagecoach Stop Pit - East riverbank restoration/stabilization on property owned by LaFarge Inc. north of 124th Avenue
- Worthing Pit - East riverbank restoration/stabilization on property owned by Henderson Aggregates Inc. (Albert Frei and Sons) just south of 132nd Avenue



Photo 1: The "Tree Shear"



Photo 2: Newly completed 104th Avenue Trail Underpass

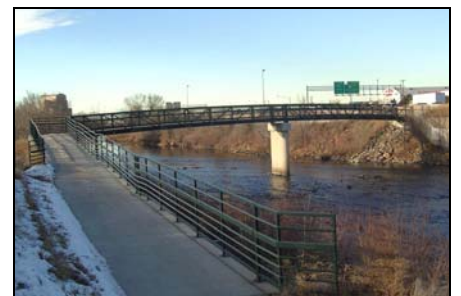


Photo 3: New pedestrian bridge near 1st Avenue (extended) in Denver

2005 Professional Activities of District Staff

Dave Lloyd, Executive Director

- *Chairman, Board of Advisors, Urban Watersheds Research Institute
- *Attended National Association of Flood and Stormwater Management Agencies (NAFSMA) 2005 annual meeting in Anchorage, AK in August.
- *Attended Colorado Association of Stormwater and Floodplain Managers (CASFM) 2005 annual meeting in Steamboat Springs in September
- *Member of American Public Works Association (APWA) and CASFM

Bill DeGroot, Manager, Floodplain Management Program

- *Member of the Board of Directors and Chair of the Floodplain Management Committee of the National Association of Flood and Stormwater Management Agencies (NAFSMA).
- *Attended NAFSMA's annual meeting in Anchorage, AK in August. Chaired the Floodplain Management Committee meeting, and gave a progress report to a plenary session.
- *Presented a paper on map modernization issues in a plenary session at the Association of State Floodplain Managers annual conference in Madison, WI in June.
- *Participated in a workshop entitled "FIRMS, What Every Community Needs to Know" at the annual meeting of the Colorado Association of Stormwater and Floodplain Managers in Steamboat Springs in September.
- *Member of NAFSMA's working group on Multi-Hazard Map Modernization CTP Training.
- *Member of Association of State Floodplain Managers (ASFPM), American Society of Civil Engineers (ASCE), and Colorado Association of Stormwater and Floodplain Managers (CASFM).

Kevin Stewart, Manager, Information Services and Flood Warning Program

- *Chairperson of the National Hydrologic Warning Council (NHWC)
- *Member of the U.S. Department of the Interior's Advisory Committee on Water Information, Subcommittee on Hydrology
- *Member of Steering Committee for the American Meteorological Society's Commission on the Weather and Climate Enterprise
- *Invited speaker at the New Mexico Floodplain Managers Association Spring Conference in Socorro, NM in May
- *Speaker & moderator at the Sixth NHWC National Conference and Exposition in Sacramento, CA in May
- *Attended Governor's Annual Conference on Emergency Management in Breckenridge in August
- *Attended Annual CASFM Conference in Steamboat Springs in September
- *Member of ASCE, ASFPM, CASFM and the Colorado Emergency Managers Association

Ben Urbonas, Manager, Master Planning & South Platte River Programs

- *Gave a talk at the District's April 28th one-day seminar focused on porous pavements.
- *Continues to serve on the Board of Directors of the Cherry Creek Basin Water Quality Authority.
- *Serves on the Water Environment Research Foundation's (WERF) Research Council.
- *Serves as Chairman on two of WERF's Project Steering Committees for research projects on *Quantification of Solids in Stormwater* and the development of the *International BMP Database*.
- *Serves as Co-chair of WERF's Project Steering Committee for research project on *Impacts of Urbanization on Receiving Waters*.
- *Served as a member of WERF's Project Steering Committee for research project on *Critical Assessment of BMPs*.
- *Was one of the teachers at training workshops in June and July on *EPA's SWMM 5.0 Software and CUHP Interface*, and was the lead instructor at a workshop on *BMP Selection and Design* in December.
- *Serves on the Water Environment Foundation's (WEF's) committee to update the Manual of Practice on Stormwater Management.
- *Serves on the program advisory committee for the Civil Engineering Department of Colorado State University.
- *Attended the National Association of Flood and Stormwater Management Agencies (NAFSMA) annual meeting and participated in its Stormwater Committee meetings in Anchorage, Alaska.
- *Co-authored, with John Doerfer, "Master planning for stream protection in urban watersheds," *Water Science and Technology*, Vol. 51, No. 2, pp 239-247, IWA Publishing, London, England.

Paul Hindman, Manager, Design and Construction Program

- *Co-Chair of Cherry Creek Stewardship Partners Annual Conference
- *Chair of the 2011 Denver Site Committee for the American Public Works Association (APWA) International Public Works Congress and Exposition.
- *Committee Member of National APWA Awards and Review Committee
- *Chapter Delegate, APWA Colorado Chapter

Cindy Thrush, Senior Project Engineer, Maintenance Program

- *Co-authored and co-presented with ASCG Inc, on "Multi-Use Greenways with No Adverse Impact – Colorado Examples" at the 2005 Association of State Floodplain Managers Conference in Madison, Wisconsin.
- *Presented a paper "Monitoring Stream Restoration Projects, Why We Should Always Look Back" at the 16th Annual Colorado Association of Stormwater and Floodplain Managers Conference in September in Steamboat Springs.

Bryan Kohlenberg, Senior Project Engineer, South Platte River Program

*Continued as NSPE's scoring coordinator for the Jefferson Chapter and Colorado State MATHCOUNTS competitions for 7th and 8th graders.

John Doerfer, Project Hydrologist, Master Planning Program

*Chairman, Municipal Stormwater Workgroup, Colorado Stormwater Task Force.
*Member, Impacted Water Supplies Advisory Committee, Colorado Water Quality Forum.
*Member, Urban Water Resources Research Council, Environment and Water Resources Institute (EWRI), ASCE.
*Member, Standards Committee - Management Practice for Control of Erosion and Sediment, EWRI/ASCE.
*Member, Stormwater and Watershed Management Subscriber Committees, Water Environment Research Foundation.
*Co-authored, with Ben Urbonas, "Master planning for stream protection in urban watersheds," *Water Science and Technology*, Vol. 51, No. 2, pp 239-247, IWA Publishing, London, England.

Mark Hunter, Manager, Maintenance Program

*Co-Chairman, International Erosion Control Association (IECA) Stream Restoration Technology Section.
*Member of IECA Technical Review Committee.
*Member of IECA Awards Committee.
*Committee member for the Mountain States Chapter of IECA.
*Editor of newsletter for the Mountain States Chapter of IECA.
*Member of Board of Directors and on the Operations Committee of the Metro Wastewater Reclamation District

David Mallory, Senior Project Engineer, Floodplain Management Program

*Co-presented with Michelle Leach "Sense of Place in Major Drainageway Design" at the UDFCD April Workshop.
*Co-presented with Michelle Leach "Bridging the Gap Between Function and Beauty in Drainageway Design" at the 16th Annual CASFM Conference.
*Attended the Second Annual Conference on Sustainable Urbanism.
*Serves on CASFM's Board of Directors as Treasurer.
*Member of CASFM and ASFPM.

David Bennetts, Senior Project Engineer, Maintenance Program

*Program Chair for the 16th Annual CASFM Conference in Steamboat Springs in September
*Speaker at CASFM Conference in Steamboat Springs in September
*Council Member, CU Denver Engineering Leadership Council
*Committee Member, Urban Infrastructure Committee, CU Denver
*Member of ASCE, APWA, and CASFM

Ken McKenzie, Project Engineer, Design and Construction Program

*Presented "Massey Draw Stream Stabilization / Water Quality Improvement Project" at the CASFM *Conference in Steamboat Springs in September.
*Served on ASCE's Urban Water Resources Research Council.
*Served on the Metropolitan State College of Denver Engineering Technology Advisory Board.
*Served on the Board of Directors of the Urban Watershed Research Institute.
*Taught courses on flood detention design and storm sewer design .
*Member of ASCE and CASFM.

Jeff Fisher, Senior Construction Manager, Maintenance Program

*Co-Chairman for the annual Inspector's Conference for the Colorado Chapter of the American Public Works Association (APWA) in Denver, Colorado.

Mike Sarmento, Senior Construction Manager, Maintenance Program

*Received Applied Science Degree in Water Quality Management from Red Rocks Community College
*Received certification as a Senior Engineering Technician in Heavy & Highway Construction from NICET
*Received certification in Land Management and Erosion Control from NICET
*Received certificate of completion for Water Quality Laboratory Analysis for Water and Wastewater Technology from Red Rocks Community College
*Attended 2005 APWA Construction Inspector's Conference
*Accepted award on behalf of the District for Purple Loosetrife Control from the Colorado Division of Wildlife

Steve Materkowski, Senior Construction Manager, South Platte River Program

*Graduated from the University of Colorado, Denver, with his B.S. in Civil Engineering
*Spoke to various youth groups, including Earth Force, regarding various UDFCD activities including Noxious Weed Control and Habitat Restoration.



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Color versions of all of the photographs in this issue, and additional photos and figures, can be seen on our web site at:

www.udfcd.org

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FLOOD HAZARD NEWS

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Administrative Services

Sandy Gonzalez, Manager

Galene Bushor, Sr. Admin. Asst.

Margaret Corkery, Admin. Asst.

Geanesia Hinton, Receptionist



Public Service Co. (now Xcel Energy) substation at the Confluence of Cherry Creek and the South Platte River, circa 1970



The same view taken in August, 2005, showing the latest addition to Confluence Park.