

Sharing the Challenge - A Challenge To Local Governments

by

Bill DeGroot, P.E., Chief, Floodplain Management Program

Introduction

The federal government has just completed a thorough review of federal floodplain management policies in response to the 1993 midwest floods. The result of that review is the report *Sharing The Challenge: Floodplain Management Into The 21st Century*. While there are many good ideas and recommendations in the report, it falls very much short in one important area: how the federal government interferes with the ability of local governments to use their own resources to correct their own problems in order to protect their own citizens. In fact, *Sharing The Challenge* includes recommendations which, if implemented, will make it even tougher for local governments to solve their own problems.

My fear is that federal policy, formulated in response to flooding on the Mississippi, will adversely impact the ability of local governments to run their own affairs. I do not have a concern about the concepts presented in the report. I have a major concern over how implementation of the recommendations in the report will be brought about by federal bureaucrats who are given a place at the table, who have no money, who have no responsibility for flood loss reduction, but who have de facto veto power over flood loss reduction alternatives proposed by local governments.

The Existing Situation

Existing federal laws and regulations do not distinguish between preventive projects and remedial ones. Preventive means to keep new problems from being created by keeping structures from being built in flood hazard areas. Remedial means fixing past mistakes to reduce existing

flood hazard potential. Remedial efforts include the construction of flood control facilities, as well as so-called non-structural measures such as floodproofing and acquisition and relocation of structures. While federal laws and regulations, and federal agencies, can assist us in the preventive area by making it more difficult for developers to get into the floodplain; they also make it more difficult, more expensive and more time consuming for us to implement remedial projects, even when we are using our own funds.

It is at least as difficult, and sometimes more difficult, for local governments to get the necessary federal government approvals to construct a remedial project which protects people and property as it is for a developer to get the approvals to move into and disturb an undeveloped floodplain. Logically, it should be easier for local governments to remove existing structures from the floodplain

than it is for developers to put new structures in the floodplain, even if the new development is done in accordance with National Flood Insurance Program (NFIP) floodplain management requirements. These federal agencies, laws and regulations act together to the detriment of long term hopes to reduce the existing flood vulnerability of so many structures throughout the country.

There are now instances where we have to meet up to six requirements: a floodplain development permit from the local government, a 404 permit from the Corps of Engineers, a construction stormwater discharge permit from the Colorado Department of Health (CDH), a construction dewatering permit from the CDH, a Conditional Letter of Map Revision from the Federal Emergency Management Agency (FEMA), and a survey for an endangered orchid. Only after all these

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Most people would like to see this kind of treatment of our drainageways, but . . .

1994 Professional Activities of District Staff

Scott Tucker, Executive Director

- *Chaired program on Stormwater Management at National Association of Flood and Stormwater Management Agencies (NAFSMA) annual conference, in Seattle WA in October.
- *Chaired session on Institutional Issues at Engineering Foundation Conference (EFC) on *NPDES Related Stormwater Monitoring Needs*, in Crested Butte, CO in August.
- *Speaker at session on Education: Stormwater Management at the Colorado Association of Stormwater and Floodplain Managers (CASFM) annual conference in Estes Park, CO in July.
- *Speaker at King County Regional Needs Assessment Workshop at Bellevue, WA in October.
- *Chairman, History and Heritage Committee, Colorado Section, American Society of Civil Engineers.
- *Guest lecturer at Environmental Science Class, Metro State College, Spring and Fall Semesters, 1994, in Denver.
- *Chapter Delegate for Colorado Chapter of American Public Works Association.

Bill DeGroot, Chief, Floodplain Management Program

- *Completed term as Region 8 Director of the Association of State Floodplain Managers (ASFPM).
- *Secretary of the Colorado Natural Hazards Mitigation Foundation.
- *Member of the Colorado Natural Hazards Mitigation Council.

Kevin Stewart, Project Engineer, Floodplain Management Program

- *Chairman of the National Hydrologic Warning Council representing the Southwestern Association of ALERT Systems (SAAS).
- *Member of Colorado Natural Hazards Mitigation Council's (CNHMC) Dam Safety and Warning Subcommittee.
- *Speaker at the ALERT Users Group annual conference in Pacific Grove California in May and at the SAAS annual conference in San Antonio, Texas in October. Completed term as director of SAAS.
- *Session moderator and speaker, "Floodplain Managers and the Future" at the ASFPM annual conference in Tulsa, OK in May.
- *Focus group consultant to FEMA and the National Weather Service, "Developing Training Courses for Emergency Managers on Severe Weather and Floods," Emergency Management Institute, Emmitsburg, Maryland, December, 1993.
- *"The Evolution of Local Flood Warning Systems: The Denver Experience and Networking User's Groups," at the 74th Annual Meeting of the American Meteorological Society in Nashville, Tennessee in January.
- *"Future Applications for Real-Time Hydrologic Modeling," Stormwater Management Conference, Univ. of Colorado in June.
- *"Arvada Flood Preparedness and Recovery Plan," at the CASFM conference in July
- *"Accessing Weather Data, forecasts and Warnings for Emergency Management - Present and Future," and "Self-Help for Floodplain Occupants," at Colorado Emergency Management conference in Golden in September.

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

- *Organized and chaired the conference on *NPDES Related Stormwater Monitoring Needs* in Crested Butte, CO, in August.
- *Continues to Chair the Urban Gauging Networks Committee of the Urban Water Resources Research Council of ASCE.
- *Continues to serve as a member to the national Board of Directors of the APWA's Institute for Water Resources.
- *Developed and put on a 20 hour short course titled *Urban Stormwater Detention and Best Management Practices* that was offered in October and November of 1994 by the Continuing Education Department of University of Colorado at Denver.
- *Continues to serve as a member of the control group of the Urban Water Resources Research Council of the ASCE.
- *Served as the facilitator of a *Urban Water Issues* session at the ASCE Water Resources Planning and Management Division Specialty Conference in Denver, Colorado in May, 1994.
- *Co-presented with Jon Sorensen, CH2MHill, a paper on the use of computerized methods in drainage and flood control planning projects at the APWA International Convention in Chicago, IL in September. Also served as session moderator for that session.
- *Was notified by ASCE Journal of Water Resources and Planning of the acceptance of a paper titled, "Recommended Parameters to Report With BMP Monitoring Data" for publication in February, 1995.

John Doerfer, Project Hydrologist, Master Planning Program

- *Guest Speaker, "Receiving Water and Bottom-Sediment Chemistry," ASCE course on Stormwater Planning in Denver in April.
- *Session Recorder at the EFC on *NPDES Related Stormwater Monitoring Needs* in Crested Butte, CO in August.
- *Guest Speaker, "Nonstructural BMPs," UCD continuing education course on Stormwater Detention and BMPs in October.

Mark Hunter, Chief, Maintenance Program

- *Member of ASCE Task Committee on Urban Drainage Rehabilitation Programs and Techniques.
- *Member of International Erosion Control Association standards committee on riprap, standards committee on articulating blocks, and the by-laws committee.

Paul Hindman, Project Engineer, Design and Construction Program

- *Vice-Chairman of the Institute of Water Resources of the Colorado Chapter of APWA.
- *Organized "Alternate Pipe Materials" Conference, sponsored by Colorado Chapter of APWA, in January.

Dave Lloyd, Chief, Design & Construction Program

- *"Upper Sloan Lake Basin - A Small Community Experience In Implementing A Multi-Objective Flood Control Project," with Bob Martin, City of Edgewater, presented at the ASFPM conference in Tulsa in May.
- *Submitted and presented "Upper Sloan Lake Basin" for award in the category of Flood Control/Flood Hazard Mitigation at the CASFM annual conference in July. The project received the Grand Award for Engineering Excellence.

Tucker-Talk

by L. Scott Tucker

Timely Comment from the District's Executive Director



Twenty Five Years Young

July, 1994 marked the 25th anniversary of the Urban Drainage and Flood Control District (UDFCD). It was in 1969 when the Colorado Legislature passed the Urban Drainage and Flood Control Act with Senator Joe Shoemaker as Senate sponsor and Representative Bastien as House sponsor. The first Board meeting was called to order on July 28, 1969 by Richard S. Shannon, acting mayor of Denver who was serving in the absence of Mayor W. H. McNichols, Jr. who was ill. Interestingly, Justice Donald Kelly went to Mayor McNichols' home prior to the meeting to administer the oath of office to the Mayor. There were no policies, no precedents, no office or office equipment, no money in the bank, no budget, no cash flow, no staff, or anything else in place when the organization was formed, but with that July 1969 meeting the organization was launched.

The Denver area at that time consisted of the City and County of Denver, five surrounding counties, and 30 towns and cities of various size located in the five counties. The Denver area was a growing community of over one million people, and the cities and counties were finding that they could not address drainage and flood control problems individually. That is why they supported the creation of the UDFCD.

One of the unique characteristics of the UDFCD is that it is multi-county in nature with all or parts of six counties included in its boundaries. There are many flood control districts in the United States, but few of them, if any, consist of more than one county. The Denver area is similar today as it was 25 years ago in terms of governmental makeup, but it has about doubled in size to over two million people.

Looking back at the minutes of those early meetings is interesting. There was a mix of many drainage and non-drainage decisions to be made. For example, at their November 1969 meeting the Board accepted the offer of

the Denver Regional Council of Governments' (DRCOG) drainage technical committee to be the Urban Storm Drainage Advisory Committee of the UDFCD, and they adopted the *Urban Storm Drainage Criteria Manual* as a model for the Denver area. Also in November, 1969 they retained Joe Shoemaker as legal counsel to the District. In February, 1970 the Board hired the first staff person, Executive Director James R. Quinn. In May, 1970 the Board retained Wright-McLaughlin Engineers to advise them on technical issues.

I started with the District as Executive Director in March, 1972. At that time the staff consisted of myself and a secretary. The 1970 budget of \$290,000 adopted in December 1969 was short and sweet, consisting of two revenue and five expenditure items. After receiving bids the Board accepted a 4.75% \$165,000 loan from Central Bank to fund District operations for 1970. The District could levy up to 0.1 mill but the District was formed too late to levy a tax in 1969 so this would not be done until 1970, with property tax revenues to be received in 1971. The 1970 budget also included a federal loan request of \$125,000 so the only real operating money for 1970 was the \$165,000 loan. The 1995 budget by comparison consists of eight governmental funds and totals \$19.3 million. What a difference a quarter of a century makes.

Initially the District was limited to a 0.1 mill levy that could be used for engineering and operations. Based on an assessed valuation of \$2,765,500,000 in 1970 this generated approximately \$276,500 in 1971. With this limited funding the Board decided to concentrate on planning. One of the first major activities of the District, dubbed Project REUSE (Renewing the Environment through Urban System Analysis), was to inventory drainage basins, identify problems, define an approach to addressing the problems, and set priorities. This effort led to a master planning program, coordinated

by the District and jointly funded by the District and local governments involved, that was designed to develop specific plans for specific drainageways. I am not sure of the exact mileage, but over 800 miles of drainageway master planning has been completed at a cost in the \$5 million range.

Project REUSE also helped define the combined remedial and preventive strategy that was to be pursued by the District. The study indicated that about 25% of the floodplains for the major drainageways were developed and the 1972 cost for addressing the remedial needs for these drainageways was over \$113,000,000. If effective preventive measures could be taken on the remaining 75% of the floodplains which were undeveloped, the need for significant future expenditures could be avoided.

As a result the District developed a comprehensive floodplain management program. The cornerstone of this program was to define the location of floodplains and floodways and to regulate subsequent floodplain development. Whenever a master plan is developed the 100-year floodplain that can be used for regulatory purposes is also developed. Again, while I am not sure of the exact mileage something over 1000 miles of floodplains have been defined. These floodplain delineations have been used by local governments and the District to manage development in the floodplains.

As the District eased its way into the drainage and flood control business one thing led to another. After a few master plans were initiated and completed it was apparent that implementation would be difficult without adequate funding. The 0.1 mill levy provided funding for planning, floodplain delineation, and related activities, but it did not provide funding for construction of flood control and drainage improvements. Legislation was introduced in 1973 to increase the District's levy to 0.5 mill to provide authorization to levy an additional 0.4

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DESIGN AND CONSTRUCTION NOTES

By
David W. Lloyd, P.E.
Chief, Design and Construction Program

This past year in the design and construction program saw more funds committed to capital improvement projects than ever before in the District's history. Current estimates indicate that over \$8.2 million will be encumbered in 1994 for drainage and flood control projects throughout the District.

A great deal of this funding is attributed to the Lower Goldsmith Gulch Project. At the beginning of 1994, we began the final design of improvements along Goldsmith Gulch from its confluence with Cherry Creek to the Dartmouth Avenue crossing at the south end of Bible Park. Two separate construction contracts totalling over \$6.4 million are now in various stages of the bidding and award process. The two contracts will be under construction simultaneously during 1995, with contract completions set to occur in early 1996. This long awaited drainage and flood control project will remove approximately 100 homes and 13 businesses from the 100-year flood plain as well as provide relief from frequent street flooding in the basin.

Construction of improvements along Little Dry Creek from 64th Avenue to Clear Creek in Adams County was completed this past year. The improvements consisted of a new crossing structure at 64th Avenue which directs flows into an abandoned gravel pit purchased by the District and Adams County in 1993. Flows are then discharged through a spillway into Clear Creek. Its hoped that, by passing these flows through a water body of several acres, water quality benefits will result. This has proven to be one of the more interesting sites in the metro area for wildlife. The improvements necessitated the County obtaining an individual 404 permit. A condition of the permit required the mitigation of the loss of 0.7 acres of existing wetlands in the spillway area along Clear Creek. Three separate areas of wetland mitigation were established around the pond which are

STATUS OF DISTRICT DESIGN PROJECTS

Project	Participating Jurisdiction(s)	Status
Lower Goldsmith Gulch	Denver	Complete
Ralston / Leyden Feasibility	Arvada, Corps of Engineers	On hold
Van Bibber Feasibility	Arvada, Corps of Engineers	Complete
Clear Creek @ 52nd Avenue	Denver	98% Complete
Irondale -Dahlia/80th Ave.	Adams County, Commerce City	Prelim. - Complete
Happy Canyon Creek	Arapahoe County	75% Complete
Lone Tree, Windmill, Dove	Arapahoe County	Prelim. - Complete
Sanderson @ Green Gables	Jefferson County, Lakewood	Complete
Lone Tree Creek	Arapahoe County	5% Complete
Bear Canyon Creek	Boulder	Complete
Knox Court Outfall	Arapahoe County	80% Complete

STATUS OF DISTRICT CONSTRUCTION PROJECTS

Project	Jurisdiction(s)	Cost	Status
Brighton North Outfall	Brighton	\$600,000	Complete
Granby / Sable	Aurora	752,000	40% Complete
Chateaux Beaumar	Littleton	350,000	80% Complete
I-25 / 40th & Inca	Denver	600,000	25% Complete
North Branch Sloan Lake	Edgewater, Wheat Ridge	2,150,000	Complete
University/Mexico	Denver	800,000	90% Complete
Big Dry Cr. @ Orchard	Greenwood Village	150,000	Complete
Goose Creek	Boulder	3,300,000	90% Complete
Drainageway No. 4	Lafayette	300,000	Complete
Yale/Lamar	Denver, Lakewood	850,000	Complete
Newlin Gulch	Douglas County	60,000	Complete
Lena @ Isabell	Jefferson County	405,000	Complete
Meadowlark Drainage	Westminster	665,000	Complete
SJCD @ Kendall	Jefferson County	370,000	Complete
Sand Creek-Buckley/Colfax	Aurora	1,230,000	85% Complete
Happy Canyon/Badger Gulch	Douglas County	592,000	Complete
Slaughterhouse Gulch	Littleton	1,016,000	Complete
Spring Creek	Arapahoe County	360,000	Complete
Lena Gulch - Lewis Meadows	Wheat Ridge	70,000	50% Complete
Grange Hall Creek	Thornton	360,000	Complete
Bear Canyon Creek	Boulder	700,000	50% Complete
Williamette Detention Pond	East Cherry Creek Valley	520,000	Complete
Dry Gulch	Lakewood	1,500,000	Complete

now flourishing. Even at this early stage of establishment, the ecological diversity of the project site is significantly enhanced by construction of the wetlands. There has been an increase in the numbers and/or amount of use by Cormorants, Ducks, Redwing Blackbirds, Blue Herons and frogs.

Nineteen Ninety-four also saw the completion of Slaughterhouse Gulch storm sewer improvements in Littleton, as well as completion of the first phase of improvements along Slaughterhouse Gulch in Unincorporated Arapahoe County upstream of the Grant Street detention pond. We continue to complete segments of this project which originated in 1985. The next phase of construction in Arapahoe County is scheduled for 1996.

Improvements to Goose Creek in Boulder from Foothills Parkway to 30th Street are nearing completion after

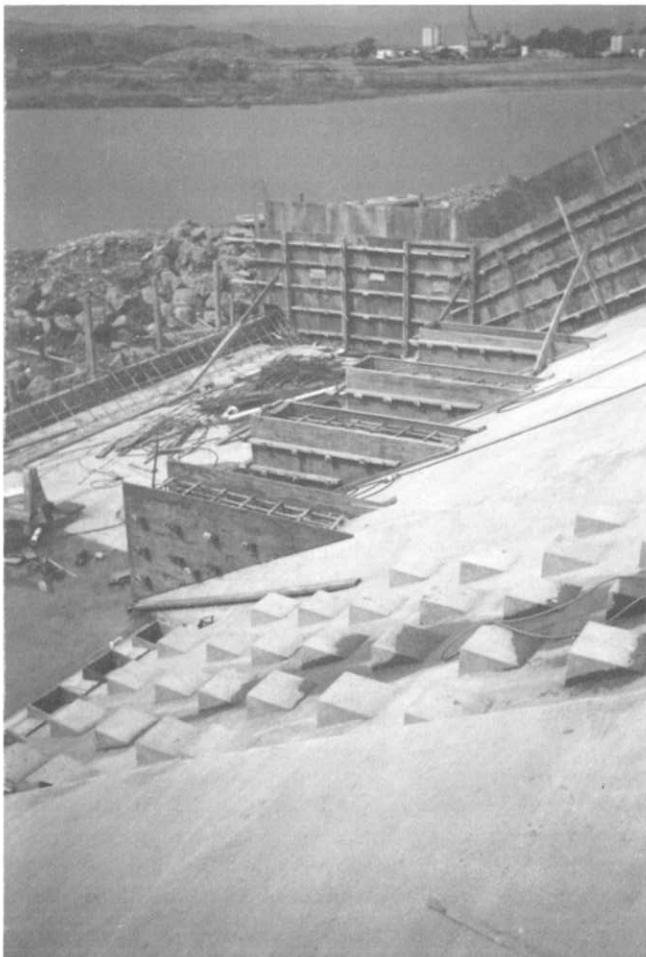
almost two years of construction activity. Another project underway in Boulder is the Bear Canyon Creek project from Martin to Moorhead in which the capital program is participating in the construction of new cross drainage structures at Martin and Moorhead. These improvements along with channel improvements being constructed by the City and the District's Maintenance Program will remove approximately seventy residences from the 100-year floodplain. This work is expected to be completed in the spring of 1995.

Another project of interest in 1994 was the construction of drainage and flood control improvements in the Chateaux Beaumar area of Littleton (see related article in this issue of *Flood Hazard News*). This project consisted of open channel, storm sewer and detention pond construction located on the

Goddard Middle School property. The project required a great deal of cooperation between Littleton Public Schools, the City of Littleton and the District. Design was completed last spring and bid such that construction could occur over the summer months while school was out. Construction was substantially complete by the time school was back in session in August. The largest element of the project was a detention pond located in an area which was formerly of no value to the school. Construction of the dry detention pond provided an additional play area for the school. The school contributed the installation of an irrigation system which allowed for the pool area to be seeded to turf grass and provide this much needed play area.



Construction of a two-tiered, 12 foot high, sheet pile and rock drop structure on Sand Creek downstream from Colfax Ave. The drop structure is part of a \$1.1 million project sponsored by Aurora and the District.



Little Dry Creek - Construction of a spillway leading from culverts under 64th Ave. down to the abandoned gravel pit next to Clear Creek.



Outlet structures at newly completed Williamette Pond detention facility.



Goose Creek at 30th Street in Boulder.

PLANNING PROGRAM ACTIVITIES

by
Ben Urbonas
Chief, Master Planning Program

Planning Projects

The table titled "Status Of Planning Projects" lists the projects that were under way or completed in 1994 and the ones we hope to begin in 1995. In December of 1994 we were in the process of selecting consulting engineers for two new projects, the Weaver Creek Tributary project in Jefferson County and the Arapahoe and Magpie Gulches Area project in the City of Golden and Jefferson County.

With our local government partners, namely, Douglas and Arapahoe Counties and the cities of Englewood, Greenwood Village and Littleton, we selected an engineering firm for the Big Dry Creek (ARAPCO) project which will begin early in 1995. For all of the 1995 projects we will begin consultant selection only after the funding agreements for each project are finalized between the District and the project's local sponsors. It looks like we will again be busy with planning activities in 1995.

Most of our new planning projects are either updates of older major drainageway plans or new outfall system plans for the urbanizing areas of the District. Drainage and flood control issues remain paramount in these new plans; however, we also place much emphasis on stream stability, riparian wetland habitat preservation and protection and the community's needs for greenbelts and recreational facilities.

We have always included all of these and other related considerations in our planning process. Much greater emphasis and focus is now given to these issues by the District and its local sponsors as we develop and select drainageway alternatives. This is good and we need to continue to address stream stability, open space and recreational needs, habitat preservation, etc. as we develop drainageway plans to serve our many communities and their needs. We should not lose sight, however, that drainage and flood problems are what we need to continue to solve and prevent as our urban area expands and older portions redevelop.

STATUS OF PLANNING PROJECTS

Project	Sponsor(s)	Consultant	Status
Box Elder Creek	Aurora Arapahoe Co. Adams Co.	CH2MHill	75% Complete
Columbine Basin	Arvada & Wheat Ridge	Muller Engineering	90% Complete
Dry Gulch Update	Lakewood	Muller Engineering	75% Complete
Moon Gulch	Jefferson Co. & Arvada	Kiowa Engineering	Completed in 1994
Newlin/Baldwin Gulches	Parker Douglas Co.	Kiowa Engineering	Completed in 1994
Stapleton Drainage	Denver	McLaughlin Water Engineers	75% Complete
Upper Lena Gulch Update	Jefferson Co., Lakewood & Golden	Boyle Engineering	Completed in 1994
Upper Weir Gulch Update	Lakewood & Jefferson Co.	Kiowa Engineering	Completed in 1994
Westerly Cr. u/s of Havana	Aurora	Merrick	65% Complete
Arapahoe & Magpie Gulches	Golden Jefferson Co.	n/a	Engineer selection started in 1994
Big Dry Cr. (ARAPCO) Update	Arapahoe Co. Douglas Co. Greenwood Village Englewood Littleton	n/a	Mapping awarded and engineer selection started in 1994
Weaver Creek Tributary	Jefferson Co.	n/a	Mapping awarded and engineer selection started in 1994
Luisville Update	Louisville Boulder Co.	n/a	Scheduled for 1995
Willow/Little Willow Cr.	Douglas Co.	n/a	Scheduled for 1995
Niver, Brantner & Grange Hall Cr. Updates	Thornton Adams Co.	n/a	Scheduled for 1995

Technology Transfer

In the last issue of *Flood Hazard News* we described a new training program offered by Red Rocks Community College addressing stormwater management and erosion control technology during construction activities. Since then the Colorado Department of Transportation has taken steps to require a *certified trained erosion control specialist* to be present on all of CDOT's future construction projects. Red Rocks will be offering this certification (see a related article). Contact Scott Olson at Red Rocks for further information. His telephone is 988-6160, X282.

Software

In the last twelve months Curtis Neufeld, a student intern working at

the District, has modified the CUHPE/PC code to include a method that accounts for rainfall losses when a watershed has a reduced level of directly connected impervious area. This package will be known as CUHPF/PC. Curt has also developed for us a menu-driven user interface that operates under Windows® for inputting and editing the CUHPF/PC basin parameters. Both packages are being distributed as beta test versions. Contact us if you already own the CUHPE/PC software and want to evaluate the new version and/or the input editing software. I expect both packages will be released in final form by May, 1995.

The District has recently executed a software distributing and support agreement with *Computer Software Library, Inc.* Anyone

wanting to order the software developed under the support of the District and several of its local government partners (i.e., CUHPE/PC, UDSWM-pc, UDSEWER, UDINLET, OPCHFLOW, RATIONAL, HYDRO POND, FREQ) should contact CSL by mail at P.O. Box 27517, Denver, CO, 80227, by telephone at (303) 947-3413 or by FAX at (303) 985-8882.

Stormwater NPDES Activities

There is very little new to report on this topic since last year. The Clean Water Act (CWA) amendments are stalled in Congress and no one can predict if they will move forward in 1995. In the meantime, the exemption of municipalities with population less than 100,000 from having to obtain separate stormwater discharge permits expired in October, 1994. As a result, all municipalities are required by the current CWA to have

a separate stormwater discharge permit. This despite the fact that EPA has not yet issued regulations concerning how these smaller municipalities are to apply for their permits and what conditions they will need to abide by. At the same time EPA says that it cannot exempt anyone from the CWA requirements and that any municipality can be sued by third parties for failure to apply. Each municipality needs to assess their status under the CWA and decide how it will deal with their separate stormwater permit issue.

TECHNICAL HINT

FINDING SEDIMENT DEPOSITION DEPTH IN A BMP POND

By: Ben Urbonas

To find the maintenance cycle of a detention pond or a retention basin it is necessary to estimate the rate of sediment accumulation within this type of a stormwater quality best management practice (BMP). If it can be assumed that there is no soil land erosion occurring within the tributary watershed, this can be done by simply estimating the amount of the total suspended solids (TSS) retained in the BMP on an annual basis.

This can be done using the following equation:

$$V_p = 1.45 \cdot 10^{-6} \cdot \frac{h \cdot TSS \cdot f_r}{R}$$

in which,

V_p = average annual depth of bottom sediment deposit in millimeters (mm)

h = average annual excess precipitation in millimeters (mm)

TSS = average annual concentration of TSS in runoff in milligrams per liter (mg/l)

f_r = fraction of TSS retained in pond.

R = pond's surface area / tributary watershed area.

Example:

Given: Pond's surface area = 1.3 acres

Tributary watershed area = 550 acres w/:

runoff coefficient: $C = 0.28$

annual runoff producing precip. = 12.8 inches or 352 mm

TSS concentration in runoff: TSS = 400 mg/l

Fraction of TSS retained in the pond: $f_r = 0.80$

Find: The annual sediment depth accumulation on the bottom.

Solution:

We first find the annual runoff depth from the watershed,

namely, $h = 0.28 \times 352 \text{ mm} = 99 \text{ mm}$. Then,

$$V_p = 1.45 \cdot 10^{-6} \cdot \frac{99 \cdot 400 \cdot 0.80}{0.0024} = 19 \text{ mm}$$

The average annual depth of sediment accumulation on this pond's bottom is 19 millimeters, or 0.75 inches. At this rate it will take twelve years to accumulate nine inches of sediment on the bottom. However, if soil land erosion is taking place in the upstream watershed, sediment accumulation rates can easily be ten, or more, times this rate and the pond will need to be cleaned out frequently if it is to retain its water quality enhancement volume.

South Platte River Program Notes

by
Bryan Kohlenberg, P. E., Project Engineer, and
Ben Urbonas, P. E., Chief
South Platte River Program

Maintenance

In 1994 the South Platte River routine maintenance work included an equivalent of 67 miles of mowing, 7 miles of tree trimming and pruning, and 123 miles of trash and debris pickup and removal. It is estimated that a total of 35 truck loads of trash and debris were removed and taken to a landfill. Restoration projects along the river during 1994 included repair of erosion damage along the maintenance trail; repairs to the trail and maintenance access bridges; and stabilization, restoration, and revegetation of approximately 1800 feet of river bank. Bank restoration projects occurred in Brighton, Adams County and Denver.

Cooperative Activities

Two Carlson projects that included a total of 1200 feet of bank stabilization, restoration and revegetation were completed this year. The two photographs show before and after views for one of these projects. The latter was taken before revegetation began to grow. We expect the appearance to improve dramatically once the grasses and willow root and have a chance to grow for two to four years. This project also retarded continued bank erosion that threatened to breach an earth berm separating the river and an adjacent old gravel mine pit.

We also entered into a cooperative project agreement with Cooley Gravel Company to restore and stabilize several hundred feet of river bank and to install a channel bottom degradation check structure, both located north of 88th Avenue in Commerce City. A 27 acre easement for maintenance access and flowage right-of-way will be dedicated to the District through this cooperative project. Cooley

Gravel will provide construction equipment and labor while the District will essentially pay for the materials.

Other cooperative projects this year include flowage and maintenance access easement dedications to the District by Mobile Premix Concrete, Inc. and by Mr. and Mrs. Jack Rogers. These easements provide for maintenance access by the District and an advance approval by the District of any construction activities by the property owner within the easement.

Capital Improvement Activities

The pedestrian/maintenance access bridge at the Globeville Landing Park in north Denver was replaced early in 1994 through a jointly funded project with the City and County of Denver Parks and Recreation Department. The existing abutments and piers were topped off with a new Continental CorTen steel bridge with concrete deck. Both approaches were widened and upgraded to current ADA standards.

The City and County of Denver's Lower Central Platte Valley-South Platte River improvements project adjacent to the new Elitch Gardens Amusement Park finally got under construction last spring. This \$7.0 million project will widen the river channel 80 to 100 feet and rebuild the diversion structure and the boat chute/fish bypass structure at Confluence Park. As a part of channel widening, approximately 300 trees, 3700 shrubs and 16,000 indigenous live willow stakes will be planted to establish a much expanded riparian zone.

The District also contributed funds to the City and County of Denver to widen the Confluence Park

Pedestrian/Maintenance Access bridge and adjacent approaches. This will provide a substantial improvement for maintenance access and will upgrade the bridge and ramps to current ADA and safety standards.

The District is currently investigating funding arrangements for the Upper Central Platte Valley-South Platte River Improvements (8th Avenue to I-25). It is hoped that design could begin in 1995. Also, the possibility of funding the Globeville and North Areas project, namely flood control improvements between I-70 and the Metro Wastewater Reclamation Plant, is also being investigated. This project would affect many of north Denver and south Adams County neighborhoods located adjacent to the river.

Other News

The City of Denver has requested District maintenance funds to help restore and stabilize the west bank of the South Platte River within the proposed Rockmont Park area just downstream of the 20th Street overpass. We hope to begin this work early in 1995 after the necessary permits are obtained.

The City of Littleton, South Suburban Parks and Recreation District, and the Ken Caryl Water and Sanitation District have requested the District to buttress a large exposed sanitary sewer crossing just downstream of C-470. We hope to begin the work in 1995 and install a rock buttress that will incorporate a fish and boat passage chute. The river has experienced significant river bottom degradation in this reach and, as a result, the District will fund most of this work using its South Platte River maintenance funds.



Before and after photos of Carlson cooperative bank restoration/stabilization project in Adams County.

Another Multi-Use Design Success Story

by

Paul A. Hindman, P.E.

Design and Construction Program

Background

In April, 1985, the Urban Drainage and Flood Control District (District), the City of Littleton (City) and other local governments published an outfall systems plan titled "Columbine Valley Outfall Study." The study proposed several detention ponds along Drainageway A in the vicinity of Goodard Middle School (Goodard) to control flooding of the Chateaux Beaumar residential community and street flooding along West Berry Avenue and Lowell Boulevard. On the east side of Goodard there existed a gravel playing field which was large enough in size to allow all of the ponds to be combined into one pond (see before picture). In 1993, the City requested that the District's Capital Construction Program jointly fund the final design and construction of the pond for the 1994 calendar year. The City realized other entities may have an interest in the site for uses other than a detention pond. In January of 1994, the City organized a meeting with the District, Littleton Public Schools (LPS), and the South Suburban Recreation and Parks District (SSRPD). The meeting outlined the following objectives of the four different entities.

- City and District - Alleviate continual flooding of downstream residents and streets.
- LPS - Grass the existing gravel field to the west of Goodard thereby providing practice fields for the PE classes. At the current time, the students had to walk approximately one-third mile round trip to get to the auxiliary field which was grassed.
- SSRPD - Obtain grassed practice fields for the youth soccer and baseball leagues which were in short supply in the area.

The Plan

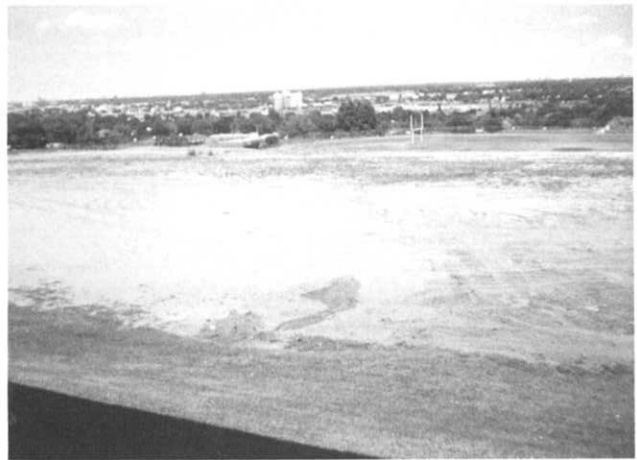
After receiving comments from the above agencies, it was determined a detention pond could be built on LPS property if their goals were met. It wasn't until April of 1994 that the City and the District contracted with WRC, Inc. to design the improvements. A kickoff meeting was held to solicit all of the desires of the four entities involved. The following items defined the project.

- The pond would encompass the entire gravel field area, even though only a portion of it was needed for flood control.
- All of the low flows would be contained in a piped system connected to the storm sewer in West Berry Avenue. Only flows in excess of a 2-year event would be allowed to flood the field, thereby keeping the field dry the majority of the time.
- An easement would be granted to the City by LPS for no fee thereby saving the City and District tens of thousands of dollars.
- The City and District would pay for seeding the entire field with a sod forming mix.
- The City and District would pay up to \$10,000 for irrigation materials if LPS installed the system.
- All construction needed to be performed during the summer months while school was out.
- LPS would take over all maintenance of the grassed field after completion of construction.

The Construction

The race was on. WRC, Inc. finished the design by the end of April and the City let it out for public bid in May. Adam II, Inc. was the low bidder and received their notice to proceed the 9th of June, exactly one week after school was let out. Adam II, Inc. worked diligently through the summer and made the deadline of

Goddard Detention Pond/Playground



Before, and ...



After (Note low embankment with trail on top in front of goal post).

substantial completion before school opened on August 25.

On December 15, 1994, the after picture shown herein was taken which illustrates the turfed playing field. Goodard's physical education classes no longer have a long walk down the street to get to a grassed playing field. At the same time, the objectives of the District and City of reduced flood problems, and the need of SSRPD for more play fields have been addressed.

Local Flood Warning, Preparedness, Events & Projects

by

Kevin G. Stewart, Project Engineer
Floodplain Management Program

Arvada Prepares for Next Major Flood

The City of Arvada is home to 90,000 people and no one recalls ever experiencing a disastrous flood in Arvada. With an estimated 1,300 properties within mapped floodplains, city officials consider themselves very fortunate but know that good fortune has its limits, particularly where floods are concerned. With this understanding and a little money, Arvada has taken a major step forward in preparing for the inevitable flood by cooperating with the District in developing a Flood Protection Handbook for residents and a Post-Flood Recovery Assistance Plan to help residents restore their lives after a flood disaster.

This two-part project was completed in 1994 and may well serve as a model for many other flood-prone communities. The primary project consultant was French & Associates, Ltd. of Park Forest, Illinois. The Mitigation Assistance Corporation, located in Boulder, was principally responsible for the recovery assistance plan. To help formulate ideas and provide technical input during the initial project development phase, a volunteer advisory committee met periodically and made recommendations concerning draft documents. This committee contributed significant time and energy to this project, and deserves much credit for its successful outcome. The following organizations were represented on the committee:

- American Red Cross
- Boulder/Boulder County Office of Emergency Management
- City of Fort Collins Engineering Department
- Colorado Association of Stormwater and Floodplain Managers
- Colorado Office of Emergency Management
- Colorado Water Conservation Board
- Federal Emergency Management Agency
- McLaughlin Water Engineers, Inc.
- Army Corps of Engineers

The Flood Protection Handbook contains information about Arvada's flood hazards, government programs and floodproofing techniques that homeowners can implement. The handbook is very easy to read and

understand. Illustrations, photographs, tables, important phone numbers and highlighted captions are used to guide residents on what to do before, during and after a major flood. Emphasis is placed on flood safety and the importance of having an emergency action plan. There is no charge for the handbook and Arvada intends to publicize its availability before each flood season by distributing a nicely prepared brochure with city water bills.

The Post-Flood Recovery Assistance Plan is aimed at guiding city actions to help residents after a flood by lending assistance with damage recovery and advising residents on what steps they can take to protect themselves from future floods. The plan describes: sources of outside assistance; how to work with the media to deliver important public information; how to assess damages and maintain records; restoring critical services, facilities, and infrastructure; city mitigation opportunities; and financial assistance programs. This plan will be updated annually, in very much the same manner as Arvada's *Unusual Occurrence Manual*, which contains emergency operation procedures and responsibilities for various city agencies.

Many communities which were victims of the 1993 mid-west floods know that they were not well prepared for the massive tasks associated with flood recovery. Developing post-flood recovery plans was one of many recommendations made in the aftermath of this historic event. Arvada has postured themselves nicely for flood recovery without having learned the hard way. The

District wants to encourage other local governments within the Denver area to consider taking similar steps. Assistance is available from the District.

Significant Hydrologic Events

Serious flooding continues to plague many parts of the United States, resulting in high public expenditures for disaster assistance and recovery. Major flood events in Georgia and Texas captured the attention of the news media in 1994 while the aftermath of the 1993 mid-west floods has caused much debate for policy-makers and special committees in our nation's capitol. In Colorado, the Colorado Springs and Pueblo areas were the hardest hit with heavy rains and flooding in 1994, according to the Colorado Water Conservation Board, while the Denver area appears to have once again been spared. Other Colorado communities which reported serious flooding include: Canon City, Lyons, Fort Collins and Idaho Springs.

Although a major flood disaster has not occurred in the Denver



Flood Protection Handbook



Engineering Division
Department of Public Works
City of Arvada, Colorado



Urban Drainage and
Flood Control District
Denver, Colorado

area for many years, we can never escape the impact of annual nuisance floods and associated severe weather. For example, a hail storm on October 1 caught many by surprise causing property damages exceeding \$250 million. The heaviest measured rainfall event for the year occurred during the evening of August 10, activating ALERT system alarms for nine gaging stations in Boulder, Jefferson, Denver and Arapahoe Counties. A rain gage located in Jefferson County near the entrance to Red Rocks Park was the winner measuring 1.93 inches between 9 and 10 p.m. At this location the event had an estimated return period of 25-years. Due to very dry antecedent conditions, the runoff from this event was insignificant in the foothills. Once the storm moved over the urban area, the runoff was very impressive causing the Cherry Creek gage at Wazee Street in Denver to report its highest level since ALERT telemetry was first added to this site in 1990. See the map on the next page for rainfall totals for this event.

The rush-hour "flood-of-the-year" occurred only three days later on August 13, closing I-25 in Denver for more than two hours. Fortunately, the weekday work crowd lucked-out this time since this event occurred on a Saturday. While events like these make interesting news headlines, highway and street closures are relatively common inconveniences that Denverites have become somewhat accustomed to, particularly on hot summer afternoons.

The Significant Event Summary Tables list peak flows and maximum water level depths for some of 1994's more notable events. More detailed statistical data summaries are contained in annual reports in the District's library. Records are also kept of weather forecasts and flood predictions for each day of the flood season between April 15 and September 15. Permanent digital archives of ALERT data are maintained and specific information may be provided to outside users upon request. Anyone interested in obtaining ALERT data should contact Kevin Stewart at (303) 455-6277 or fax your request to 455-7880.

Boulder County

The Boulder County Sheriff's Department continued to improve their real-time weather monitoring capabilities in 1994 by upgrading two rain gages to full weather stations and

installing a new ALERT rain gage at the Public Safety Building in Boulder. The new weather stations are located at the Justice Center and at a high-elevation site known as Fling's located approximately three miles northeast of Ward. With these additions, Boulder County now collects data from four weather stations, 44 rain gages and 15 stream gages. Weather stations provide year-round benefits and are particularly useful for many fire weather applications, which is a major concern in Boulder County.

The Regional Communications Center is another focal point for implementing system improvements. The County is developing a custom software package which will collect and analyze data from the ALERT system and automatically generate system status displays as one of its many functions. In a hands-free environment and with minimal training, 911 dispatchers will be able to quickly identify problems and pass along critical information to key emergency management officials.

With 1994 being the 100th anniversary of Boulder's "100-year flood," local officials used many creative techniques to publicize flood dangers and capitalize on this historic flood of record, which had an estimated peak discharge of 13,000 cfs through the City of Boulder. Flood simulations were conducted on Boulder Creek to exercise many aspects of flood warning, ranging from the earliest notification of flood potential and emergency decision-making, to warning the public and implementing evacuation plans. Public schools, the University of Colorado, local government agencies, the news media and many others participated in a variety of activities. An excellent flood safety video was produced by Boulder's Cable TV Station 8 and broadcast to the public. The Boulder City Council, County Commissioners, their staffs, CU Police, the American Red Cross, the Salvation Army, the media and all participants deserve much congratulations and thanks. Boulder's public information and flood preparedness efforts are clearly a model for other highly flood-prone communities.

Jefferson County

The Bear Creek flood detection network was completed in 1994 at a total cost of \$102,650. This network of ALERT gages (1 weather

1994 SIGNIFICANT EVENT SUMMARY TABLES

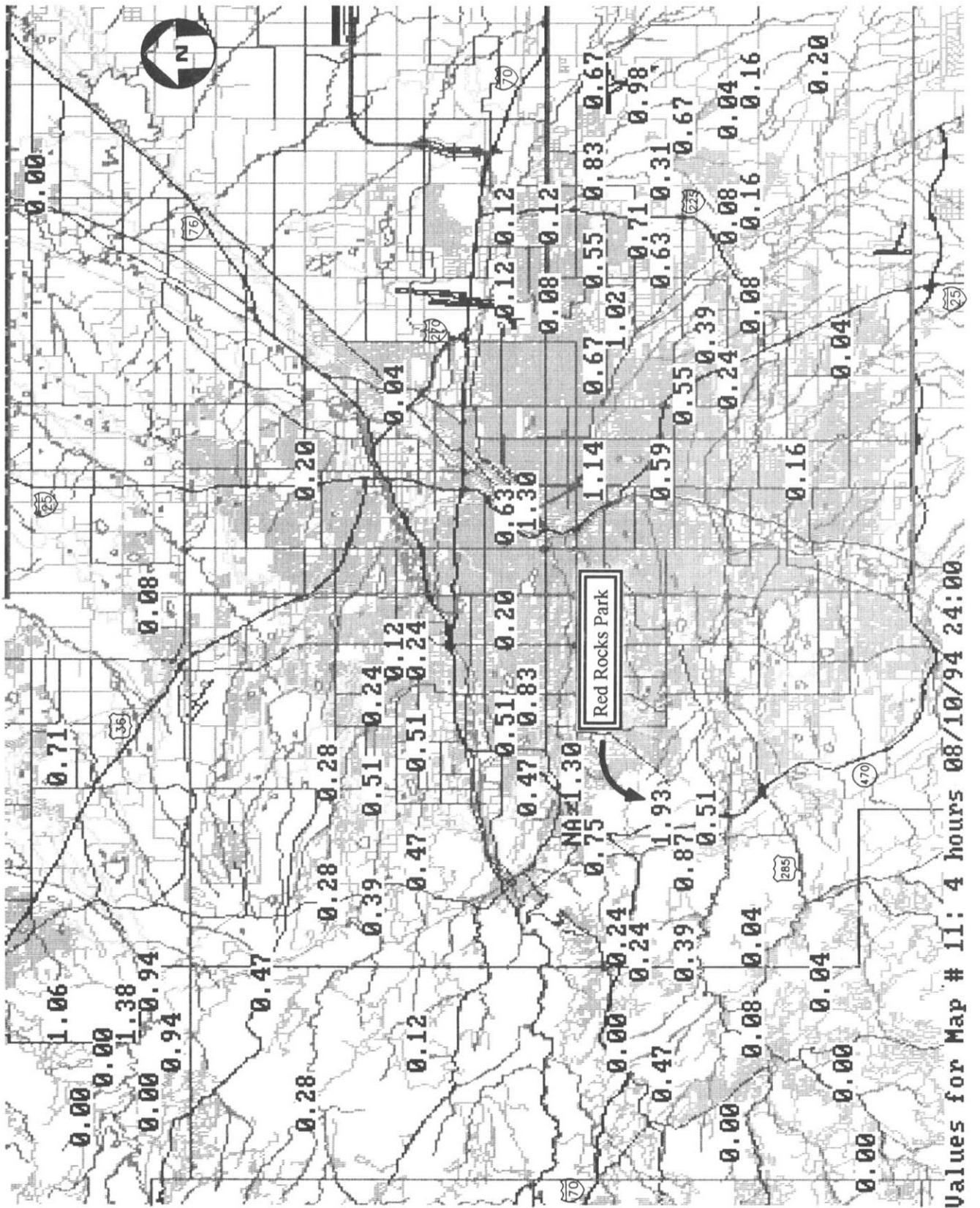
Stream Gages

Location	Peak (cfs)	Date
Cherry Creek at Steele St.	850	August 13
Cherry Creek at Wazee St.	1770	August 10
Cherry Creek at Wazee St.	820	August 13
Goldsmith Gulch at Eastman Ave.	760	August 13
Harvard Gulch at Jackson St.	580	August 13
Harvard Gulch at Logan St.	410	June 21
Ralston Creek at Carr St.	880	April 25
Sand Creek at Brighton Blvd.	670	August 13
Westerly Creek at Montview Blvd.	470	October 1

Detention Basin Gages

Location	Depth (ft.)	Date
Englewood Dam on Willow Creek	9.0	June 22
Granby Ditch at E. 6th Ave.	4.5	August 13
Gunbarrel Detention Basin	2.9	June 20
Havana Park on Easterly Creek	5.7	June 18
Holly Dam on Little Dry Creek	9.6	June 22
Kelly Dam on Westerly Creek	3.8	April 25
Louisville Rec. Center	5.9	August 10
Niver Creek at 88th & I-25	8.5	May 9
Temple Pond on Goldsmith Gulch	3.1	August 13

station, 14 rain gages, 6 stream gages) reports data from the watershed above Bear Creek Lake. The data is routinely monitored by meteorologists responsible for providing flash flood predictions directly to local governments within the District. The data is also available to the National Weather Service. Bear Creek and Mount Vernon Creek are the primary flood hazards concerning the District within the upper basin area. The Town of Morrison has a frightening history of past floods and the population which regularly uses the canyons presents an ever-increasing concern. The Jefferson County Office of Emergency Preparedness lists Bear Creek near the top of all potential hazards in the county.



Values for Map # 11: 4 hours 08/10/94 24:00

The project was first recommended in a flash flood warning planning study completed for Bear Creek in 1981 and subsequently funded for implementation in 1989. Jefferson County, Lakewood, Morrison and the District were the project participants. A flood warning plan was developed in 1992 as part of the Bear Creek flood detection project. This plan is one of seven similar basin-specific flood warning plans which are updated and practiced annually by the District.

Douglas County

The District amended its 5-year Capital Improvement Program to include an early flood detection project for Douglas County in 1996. A study was completed in 1994 recommending a network of three weather stations and three stream gages, including rain gages at each station. As Douglas County continues to make headlines as the fastest growing county in Colorado, the concern for public safety is not being taken lightly. The County's Emergency Management Director, Joe Ashby, deserves much credit for his proactive stance on flood warning and many other issues.

LAN Base Station Operational at District

Local Area Networks or LANs have become common for conducting private and government business nearly everywhere. Driven by increased demands for information sharing, faster communications, task management and fault tolerance; the District upgraded its ALERT base station in 1994 from a single PC to a two-node LAN running a networked version of the QNX operating system. Both nodes are PCs with 486DX micro-processors which independently collect ALERT data and host many other functions. Together the LAN has 20 serial ports and shares peripheral equipment like printers. Remote terminal access capabilities have essentially doubled by adding the second node and multi-tasking operations are more easily managed. This configuration should serve the District well into the future.

NovaStar and QNX Upgrades Scheduled

After December 31, 1995, ALERT base stations using the QNX 2.1x operating system or old version will not operate properly. The District plans to assist local governments with software upgrades in 1995 by installing QNX 2.21 and NovaStar software.

NovaStar (NS) will replace the Enhanced ALERT (EA) software which was first used with IBM-PC/XT computers in 1985. Many features of EA will be available with NS and the data displays will be driven by familiar custom menus. This will make a smooth transition for most operators. System managers, however, should anticipate the learning curve as is commonly experienced with any software change. Similar upgrades will be required for users of NWS "Hydromet" software. The District and the City of Aurora are currently running the latest version of NovaStar and will complete the final testing and customizing this winter.

Weather Bulletin Board Graphics

ALERT base stations currently have the capability to display NWS watch and warning areas on a custom base map for Northeast Colorado. Similar products will soon be available on a regional scale using weather information generated by the District's Flash Flood Prediction Program. Ultimately, remote users will have access to these easy to interpret products via computer and phone modem.

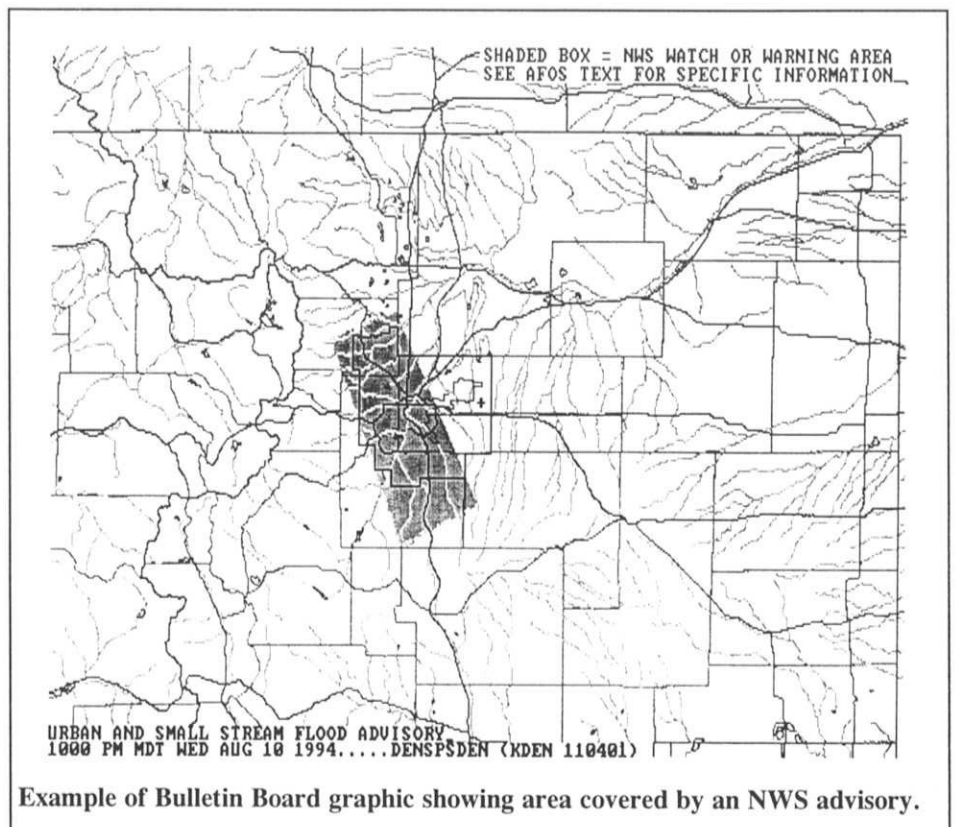
ALERT Base Station at NWS-Denver

The Denver National Weather Service (NWS) Forecast Office acquired their first ALERT base station

in 1994. This system is similar to other District base stations but runs the Hydromet software package developed by the NWS California-Nevada River Forecast Center in Sacramento. District staff assisted NWS technicians with the initial setup. In past years, NWS forecasters used phone modem communications with the District base station to view only alpha-numeric products. Now, NWS forecasters will hear alarms generated by Hydromet and be able to view area maps and other graphics products. The Hydromet workstation will also receive weather information from their AFOS computer and selected products will be automatically relayed to the District's Weather Bulletin Board. In other words, bulletin board uploads will no longer be a manual operation for NWS forecasters who become very busy with other responsibilities during threatening weather.

FSL Workstation Test Underway

The District and the Boulder/Boulder County Office of Emergency Management have agreed to participate in an information exchange experiment with the National Oceanic and Atmospheric Administration's Forecast Systems Laboratory (FSL) in Boulder and the NWS Forecast Office in Denver. One primary objective of this test is to help define, on a national scale, how state and local governments



will exchange meteorological and hydrological information with future NWS Warning and Forecast Offices (WFOs). WFOs will eventually be configured with Advanced Weather Interactive Processing System (AWIPS) workstations as one of the critical components of the NWS multibillion dollar modernization and restructuring program, and two-way communications with local governments is considered an important systems design requirement for AWIPS. The federal government

anticipates spending \$1.5 million on this research project over the next two years.

NEXRAD Doppler Radar Commissioned

On July 13, 1994, the National Weather Service commissioned the Denver WSR-88D (NEXRAD Doppler Radar) which is located at Front Range Airport northeast of Watkins. The radar is now the official NWS weather radar covering northeast Colorado.

The old radar at Limon will continue to operate until the Pueblo NEXRAD radar is commissioned in mid-1995. The new Denver NEXRAD has already proven itself a very useful tool in the District's Flash Flood Prediction Program. The District congratulates the NWS on their successful implementation of the new radar and we look forward to improving our flood prediction services in partnership with the NWS.

ALERT System Maintenance Database

by
Don Van Wie, DIAD, Inc.

Keeping adequate records of ALERT gaging network maintenance activities has been a priority for the UDFCD since the inception of the program. These records serve three important functions: First, they are the primary evidence that maintenance is being performed as scheduled and required. Second, complete records of field activity are necessary to maintain the accuracy of the ALERT database. It is through the maintenance records that transmissions from sites being serviced or tested can be identified in the ALERT database. Third, well kept records are valuable in troubleshooting. When a difficult problem arises, being able to identify prior actions taken and equipment involved is often the key to a quick solution.

DIAD, Inc., the consultant and maintenance contractor for the UDFCD network, has developed a maintenance tracking system which uses a PC-based relational database manager. Each field activity at each site, whether an installation, scheduled maintenance, or response to a problem report, is the basis of a maintenance record. In addition to basic maintenance parameters, each record includes:

- Each transfer of equipment - sensors, transmitters, and batteries
- Calibrations and performance checks, switch settings, program versions, battery voltages, current draws and other diagnostic measurements
- Each transmission made into the network
- Narrative comments and observation
- Follow-up action required
Telemetry data from maintenance activity is captured

directly through a receiver-decoder connected to the notebook computer containing the maintenance database. The other parts of the maintenance record can be entered directly while at the site, or later from field notes, depending on technician preference or field conditions.

The database also contains complete information about each site (location, ownership and access, contact names and numbers, radio licensing information) and about each major piece of hardware (cost, project, manufacturer, date, etc.).

The advantage of the relational database manager approach is that we can run previously prepared or ad hoc queries that will answer virtually any question that arises about system operation. We can reconstruct a complete inventory of system hardware, determine the location of a particular piece of equipment on any date in the past, or get a list of all follow-up actions that are outstanding. We can ask to see what batteries have experienced a greater-than-expected voltage drop during seasonal service, so that we can test, and possibly retire, these batteries before they cause a field failure. We can ask to see what radio licenses expire in the next year, identify hardware failures by manufacturer, or evaluate the stability of pressure transducer calibrations over several years.

Reports are printed on demand by the database manager. Each database maintenance record is the basis of a one page report, and the collection of reports for each year is kept in a reference binder at the District.

District Wins Accounting Award Again

For the sixth year in a row the District has received a "Certificate of Achievement for Excellence in Financial Reporting" from the Government Finance Officers Association of the United States and Canada. The certificate is presented to government units whose comprehensive annual financial reports achieve the highest standards in government accounting and financial reporting.

Congratulations to Frank Dobbins and Darla Schulz, the District's finance and accounting team.

WELCOME TO NEW STAFF MEMBERS

Bryan Kohlenberg, P.E., has joined the District as a project engineer in the South Platte River and Master Planning Programs. He has a bachelor's degree in Civil Engineering from Colorado State University, which he has supplemented over time with several graduate courses in Business Administration at the University of Colorado-Denver. Bryan comes to us from Centennial Engineering, Inc. with twelve years of work experience in drainage design and water resources engineering. Bryan is an active member of the National Society of Professional Engineers - Professional Engineers of Colorado. We are delighted that he has joined the District staff this year and look forward to working with him.

Marlene Sauerwein has joined Finance and Accounting as a Jr. Accountant. Prior to joining the District she worked as an accountant for a small C.P.A. firm for 10 years. She is a single parent with a nine year old son and a five year old daughter. She enjoys reading, running, skiing and is learning to play golf.

Floodplain Management Program Notes

by

Bill DeGroot, P.E.

Chief, Floodplain Management Program

The year in review

This has been a very busy year in many respects. Several activities in the flood warning area are discussed elsewhere in this issue by Kevin Stewart. The development boom was huge in 1994. The number of referrals we reviewed and commented on was the most in many years, if not ever.

The District's maintenance eligibility program also received quite a workout with a large number of projects constructed by developers this year. Boyle Engineering Corporation is observing construction for us and making recommendations regarding acceptance of constructed projects for District maintenance eligibility. We expect to close out approximately 30 projects this year, with another 40 projects in the pipeline and more development proposals coming in the door every day.

Many developers have recognized the benefits of staying out of floodplains and other sensitive areas, while others still insist on "reclaiming the floodplain." The positive aspect from my point of view is that new structures are simply not being allowed in the 100-year floodplain, whether it is the natural floodplain or a modified one.

Random Thoughts on other issues

We receive and review a large number of professional articles, newsletters, and brochures at the District. In reviewing a number of these I had a few thoughts that I wanted to pass along to readers of this column.

ASFPM and NPS brochure.

A brochure extolling the benefits of Multi-Objective Management, produced by the Association of State Floodplain Managers and National Park Service, includes this definition: "Multi-Objective Management (MOM) is a means of developing mutual agreements on use and management of river corridors through a process that involves all interested parties to ensure that their needs and goals are met."

The brochure lists "Key Steps for MOM to Work," and the first two steps listed are: "Initiate at local level" and "Identify local problems, needs and goals (multiple objectives)." I agree fully with this approach of local

initiation and local identification of problems, needs and goals. However, that is not how the Federal government operates.

The brochure also lists "Results from MOM" including "Locally initiated and driven process ensures local needs met," "Local citizens and officials have 'ownership'," and "Process based on specific/unique needs of the local community." Again, I agree with these stated results, but this is not how the Federal government works.

The Iowa State University experience. The definition of floodplain management that I learned in 1973 was: ". . . all measures for planning and action which are needed to determine, implement, revise and update comprehensive plans for the wise use of flood plain lands and their related water resources for the welfare of our nation" (from *Flood Plain Management, Iowa's Experience* by Merwin Dougal, Iowa State University Press, 1969).

In the late 1960's and early 1970's Iowa State University built the Iowa State Center complex in the floodplain but protected to the 100-year flood standard. In 1993 that complex was flooded. The following appeared in the September, 1993, *The Iowa Stater*: "In spite of the recent flood damage (Warren) Madden (vice president for business and finance) said the university has benefited greatly from the facilities that were built on the flood plain. 'I believe Iowa State, in the 25 years those buildings have been in existence, has gotten the programmatic benefits and value from having them there. In my judgment, all of that is worth more than \$7.7 million (in damages).'"

Is this experience an example of what Merwin Dougal's definition was all about? They built to the 100-year flood standard, used the land for 25 years and then suffered damage from a larger flood. To them, the value received from the use of the land was worth the cost in flood damage and will continue to be so in the future.

Now, however, as Multi-Objective Management, watershed management and "natural and beneficial values" become entrenched in federal law and regulations; we can expect more federal bureaucrats to intrude on the local decision making process. These terms have come to mean trails, parks, wetlands, wildlife habitat, etc.; all of which are good uses of the floodplain and all of which we

encourage; but which should not necessarily be the only uses of floodplains.

The direction we will be heading is not totally clear, but if Merwin Dougal were alive today he might have to revise his definition, and I think that would be unfortunate.

National Wetlands

Newsletter. In the September/October, 1994, *National Wetlands Newsletter* Gene Whitaker, director of the National Wetlands Conservation Alliance, writes: "Implementing the (*Sharing the Challenge*) recommendations (see cover article) will provide a balanced approach to floodplain management. It will avoid and reduce future losses while protecting and enhancing the natural resources and functions of wetlands and floodplains. The challenge for all of us will be to make sure that the balance is maintained; to be sure that permanent non-structural measures to reduce future flood losses and restore floodplain ecosystems receive their deserved priority (emphasis added).

What does that mean?

Knowing the way the Feds operate I think it will mean that if we can afford a structural solution to an existing flood hazard, but we can't afford to "restore the floodplain ecosystem" we will not be allowed to solve the flood hazard.

To respond to Mr. Whitaker, the challenge for all of us will be to make sure, in already developed floodplains in urban areas, that there is **not** a balance between reducing flood losses and restoring floodplain ecosystems. The health, safety and welfare of our citizens, living breathing human beings, should take precedence over restoring floodplain ecosystems. If an enhanced ecosystem can be a part of a project, so much the better; but don't define people's safety as being only equal to restoration of ecosystems. The effect of doing so will be to mandate that they be flooded and then bought out, rather than protected before the flood.

The New Congress

The Republicans who will hold leadership positions in the new Congress are saying that they will address unfunded mandates early in 1995. I hope they follow through on that promise. We need to get back to the point where local governments have the ability to set their own priorities for spending their money and developing their communities.

Tucker (from page 3)

mill for a design and construction program. The legislature approved the legislation and the District established the program in 1974. The Board decided on a pay as you go approach and required at least a 50% match by local government for capital improvement projects. The property tax revenues available for construction projects in 1974 was \$3,356,000 which has risen to \$4,600,000 in 1995. From 1974 through 1994 the District has spent \$67,200,000 on drainage and flood control projects, which amount has been more than matched by local governments and others.

The Board's approach since the beginning has been to avoid the development of a large public works operation. This objective has given direction to the way the District has developed its organization and operating approaches. For example, all completed construction projects are owned by the participating local governments, giving them the basic and long term responsibility for the facilities. When the construction program was initiated the intention was for local government to own, operate, and maintain the completed facilities. Good idea but it did not work. They owned the facilities, but maintenance of the drainageways was always a low priority and basically was given minimum attention or none at all.

Recognizing the importance of maintenance and the need for a stable source of funding the Legislature in 1979 was requested to authorize the District to levy up to another 0.4 mill for maintenance. The case was made, the Legislature concurred, the District established a maintenance program, and the Board could now levy up to 0.9 mill. Following the modus operandi of contracting with the private sector for virtually all services, a process for contracting for maintenance activities was developed. You can count on one hand the facilities owned by the District, so most of the District's maintenance efforts are on facilities owned by cities and counties within the District. Routine, restoration, and rehabilitation maintenance projects are conducted annually on drainageways throughout the Denver area. Some 250 maintenance projects estimated to cost \$4,679,000 are defined in the 1995 work program. The Legislature approved the 0.4 mill levy for a three year period, so in 1983 legislation was introduced and passed that made the

levy permanent. We have been truly fortunate to have had such an excellent relationship with the Legislature.

By 1983, funding was in place on a permanent basis to support a comprehensive drainage and flood control program. The District had an active master planning program, floodplain management program, capital improvement program, and maintenance program. These four main programs continued to keep us busy, but more changes were still to come. Up until the mid-1980's the District concentrated on the tributaries to the South Platte River and little attention was paid to the South Platte, which is the major natural drainageway within the District. In 1986, the District once again approached the Legislature, this time to authorize the Board to levy up to 0.1 mill for maintaining and improving the South Platte River. The Legislature again responded positively and approved the legislation. A South Platte River Program was established in 1987, and has been operating since then at a funding level of about one million dollars per year. The program has included planning, design, construction and maintenance of projects along the forty some miles of River running through the District. This funding authorization has allowed the District to develop and begin to implement a long term strategy of maintaining and improving the South Platte.

The Denver area had been continuously growing since the District was created in 1969, and there were some boundary problems. One was created by the annexation by Denver of approximately 45 square miles of land in Adams County that included both areas within and without the District. The purpose of the annexation was for the construction of a new airport to be named Denver International Airport or DIA. This meant that part of Denver was in the District and part of it was not. The same situation was also true for Aurora, which had annexed large portions of land east of the District boundary in anticipation of the construction of the new airport. Finally, the municipality of Parker had been incorporated in Douglas County since the District was created in 1969, and part of Parker was in the District and part of it was not. What to do? Back to the Legislature, of course, and in 1989 the Legislature amended the District's boundaries by adding 408 square miles to the east and south bringing the total area to 1608 square miles.

In 1969, when the UDFCD was created, flooding or water quantity was the primary concern. However, since 1972, when Congress passed the Federal Water Pollution Control Act, the quality of stormwater has slowly evolved as an issue. Via a tortuous and convoluted path that is only possible through a federal program and bureaucracy, municipal stormwater was declared a point source of pollution and therefore a permit was needed for rainwater discharge. The problem, solutions, benefits, and costs were ill-defined, but that was irrelevant to Congress and some 220 cities with populations over 100,000, including Denver, Aurora, and Lakewood in the Denver metropolitan area are now seeking permits for the discharge of rainwater falling on their cities.

This 20 plus year odyssey has resulted in stormwater becoming a quantity and quality issue and the focus has changed accordingly from flooding to flooding and quality. The District has responded to this shift in focus and has become active in stormwater quality issues both locally and nationally. For example, the District coordinated the preparation of stormwater NPDES (National Pollution Discharge Elimination System) permit applications for Denver, Lakewood, and Aurora, and has committed to continued support of the three cities and other communities in the region when they fall victim to the NPDES hammer regarding compliance with permit requirements. Stormwater quality has become and will continue to be an integral part of the District's overall program.

That brings us to 1994. The UDFCD has grown from a gleam in the eye of the Colorado State Legislature to a mature organization that now has a history. In its 25 years the District has gradually increased its capabilities with all activities including stormwater quality being carried out through one of five programs: Master Planning, Floodplain Management, Design and Construction, Maintenance, and South Platte River. The staff is relatively small in numbers for the scope of the District's operation and is at a current level of 18. It has been a truly unique experience to participate in the development of an organization essentially from the beginning.

In terms of the future there will be increased emphasis on the preservation of natural drainageways where possible, multiple uses of urban drainageways, and stormwater quality. It has been a

vision of the District since the beginning to use the drainageways as open green corridors to the maximum extent possible. Most of our projects have public access and multiple use flows naturally when the public can access streams and open drainageways. The increasing environmental sensitivity of the public will continue to shift the emphasis to "naturalization" of urban stream corridors wherever possible. Because less will be done in a structural sense, erosion control in natural streams

will become an even more important activity than it is today.

Better working relationships will have to be developed between federal, state, and local levels of government. At this point in time the pendulum has shifted heavily to federal control through Congressional mandates and regulations. Local governments are being forced to react to a strong command and control approach of the EPA and others. This has created an adversarial relationship and has

inhibited the development of federal/state/local partnerships particularly in the environmental and water quality areas. Since we all represent the same constituency, "the people," logic would seem to dictate that eventually we will turn away from the top down, heavy handed, command and control approach now employed by the federal level to one of true partnership and cooperation. Oh come on, don't be cynical, it could happen, couldn't it?

Training Program in Stormwater Management During Construction

By Scott Olson, Red Rocks Community College

In the fall of 1992, Red Rocks Community College (RRCC), the Urban Drainage and Flood Control District (UDFCD) and the Colorado Department of Transportation (CDOT) met to discuss developing a course in Stormwater Management During Construction. The program was to focus on the installation and maintenance of erosion and sediment control during construction. The three organizations worked together to establish training objectives and materials including a manual for the

course. A half day field trip was also included in the program to provide some actual construction examples. The City of Lakewood helped to identify local sites to visit for the field trip.

In December, 1992, a trial class was held for a group of participants that included representatives from the Colorado Department of Health, local cities and counties, construction contractor associations, business, UDFCD and CDOT. Reedback received from this group was used to develop the final course.

Since the trial course in 1992, eight well-attended classes have been conducted. Course offerings in 1995 will be expanded and will include two classes to be held at off-campus locations. Also, CDOT is planning the

implementation of a Certified Erosion Control Supervisor program. All contractors working with CDOT will be required to have an erosion control supervisor who has completed a certification program such as this. Presently, this course is the only one in Colorado that offers certification.

Following are the dates and locations for the next five classes: Feb. 16 & 17, Apr. 27 & 28 and Oct. 5 & 6 at RRCC; May 19 in Pueblo and May 26 in Grand Junction.

To register for a class, or to obtain more information, contact Scott Olson, Red Rocks Community College, 13300 W. Sixth Ave., Lakewood, CO 80401-5398, (303) 988-6160, X282.

Mosquito Mania - Your Federal Government at Work

by Bill DeGroot, P.E.

Here is an example of how the federal government has so inserted itself into every aspect of our lives that three federal agencies have to sign off on a local effort to get rid of some mosquitoes. Here is some background information to set the stage.

Kelly Road Dam is a flood control dam built on Westerly Creek to provide flood protection for Denver and Aurora. It was built by the Corps of Engineers on Lowry Air Force Base. Aurora was the local sponsor for the project, although the dam is located in Denver. Aurora is responsible for maintenance of the dam, but the District has assisted with the maintenance for several years.

During the summer of 1994 residents of Denver north of the dam began complaining about mosquitoes

invading their neighborhood from a wetland area which had developed behind the dam when a storm sewer outlet channel became blocked and stormwater was diverted to an adjacent low area. The District was asked to help by eliminating the blockage, which may have dried up some of the habitat.

Because a wetland was involved the District had to obtain a 404 Permit from the Corps of Engineers before any work could commence. Before the Corps can issue a Permit the District must conduct a survey for an endangered orchid. The District's orchid survey consultant determined that the Kelly Road Dam wetland "could" support the orchid. Since it "could" support the orchid the District had to wait until the orchid blooming season, which is from mid-July to the end of August. During that time the orchid consultant visited the site to look for blooming orchids. None were found, and the consultant wrote a report to that effect.

The report was then submitted to the U.S. Fish and Wildlife Service (USFWS) for their approval. The USFWS accepted the report, and the District submitted the report and the USFWS concurrence letter to the Corps to complete the Permit application. The Corps offered to grant the permit with the condition that if there was any loss of wetland the District would have to replace it. Since the proposed maintenance work was expected to reduce the size of the wetland, it didn't make sense to agree to that condition. And besides, even if the Corps had issued the permit, the Environmental Protection Agency still had the power to veto the permit.

Under those conditions the District decided not to seek the permit. The ultimate solution to the 1994 mosquito problem is that they have all frozen to death. What will happen in 1995 is anyone's guess. Stay tuned.

Challenge (From page 1)

requirements are met are we allowed to build a project, or maintain a facility, which provides protection for our citizens.

The federal government has been burdening cities with unfunded mandates for many years. For example, Denver, Aurora, Lakewood and the Urban Drainage and Flood Control District (UDFCD) have just spent over \$2,000,000 preparing applications for stormwater discharge permits. It is estimated that once the permits are issued it will cost the three cities in excess of \$10,000,000 over the next five years to comply with the permit requirements. Another example is Superfund requirements with regard to environmental cleanup which encourage developers to develop existing farm or range land at the fringe of the urban area, rather than to attempt to reuse already developed land within the core area. This results in the extension of infrastructure further and further out, and then we hear complaints about the adverse environmental effects of urban sprawl. Also, since the core cities are generally located in low lying areas, encouraging new development to go outside the core areas often results in increased runoff from those areas which increases the flood hazard in the core city

Other concerns include the way in which federal policies adversely impact the ability of local governments to adequately and economically maintain flood control facilities. For example, inadvertent wetlands in the arid west, which are newly created by runoff from new subdivisions, suddenly become federally protected "waters of the United States" overnight. It is hard to believe that these so-called wetlands are what the Congress had in mind with the Clean Water Act but the federal bureaucrats in the field treat them as sacred. Again, costs to the local governments to perform simple maintenance activities go up.

The federal government does not come to the table as an equal partner in this process. The federal government comes to the table with the veto power of permit denial. You do what they want or you don't do the

project. This is particularly detrimental in the case of remedial projects which are locally funded and are intended to reduce the flood hazard for existing structures in flood hazard areas. Federal agencies like the Environmental Protection Agency (EPA) and the U.S. Fish and Wildlife Service (USFWS) have no responsibility for flood loss reduction, and when they are given a place at the table and a veto over local desires, the whole basis for local initiative is destroyed.

In summary, current federal regulations make remedial projects more expensive by requiring the sign-offs noted above, they divert local funds away from remedial projects to other activities through unfunded mandates, and they simply eliminate some alternatives from consideration. *Sharing The Challenge* proposes even more federal interference in remedial projects by recommending even more consideration for non-flood control issues, even in local funding situations. These recommendations, if implemented, will give even more control of local projects to federal agencies which have no stake in flood loss reduction for the nation.

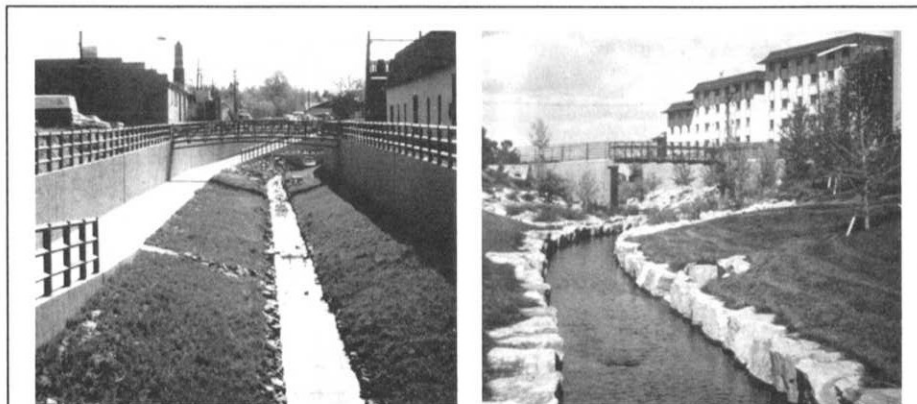
How *Sharing The Challenge* recommendations could make things worse

Sharing The Challenge was released with much fanfare in July, 1994; and there are many good ideas and recommendations in the report. Let me make that clear. However, there are also recommendations which are troubling with regard to the ability of local governments to use their own

funds to protect their own citizens. When you have experienced increasing problems in doing your job because of the constant interference of federal bureaucrats, who have no interest in or concern for flood loss reduction; and you see a report which has many recommendations for increased interference by those very bureaucrats, you get nervous. Or at least you should! Following are the report recommendations which are most troubling to me as a local floodplain manager.

The report recommends: "Establish as the new, co-equal objectives for planning water resources projects under Principles and Guidelines: To enhance national economic development by increasing the value of the Nation's output of goods and services and improving national economic efficiency; and, To enhance the quality of the environment by the management, conservation, preservation, creation, restoration, or improvement of the quality of natural and cultural resources and ecological systems."

It *may* be appropriate for some regions of the country, including the upper midwest which was the "laboratory" used in defining many of the report's recommendations, to put environmental concerns such as the restoration of the quality of natural resources and ecological systems on an equal plain with mitigation of flood hazards; but the Federal government's "one size fits all" mentality doesn't work everywhere. It is safe to say that the people of the Denver area would not want any of the gulches and creeks in their neighborhoods "restored" to



There are occasions when local governments must use options such as these to protect their citizens from flood hazards.

their previous condition, because their previous condition was a dry, incised, barren gash on the high plains, with not a tree in sight. Settlement of the Denver area has resulted in the planting of hundreds of thousands of trees that would not otherwise exist, and many of the formerly dry creeks and gulches (with names like Dry Creek, Little Dry Creek (3 of them), Big Dry Creek (2 of them), and Dry Gulch) now have significant base flows as the result of human activity.

Putting restoration, and even creation, of natural resources on an equal plain with flood loss reduction is clearly anti-city because it will invariably increase the costs of structural alternatives to the point where they are either no longer viable, or at the absolute minimum, fewer projects will be completed because each project will cost more. This leaves more urban areas already in floodplains at risk for longer periods of time and ultimately will lead to flood damage and loss of life that would otherwise have been prevented. It will also make it more difficult for local governments to promote and encourage redevelopment which is beneficial and sometimes necessary for the economic viability of the community. Add these problems to the other federal burdens and you see more problems for cities to deal with.

For example, in the mid-1980's the UDFCD and the City of Westminster constructed a concrete lined 100-year capacity flood control channel for a portion of Little Dry Creek. We built a concrete lined channel because it was the only affordable option for providing 100-year flood protection to the already developed area of the 100-year floodplain, and that's what the local government wanted. Today we would probably not be able to build that channel. We would be told that we had to restore it to what it was at some unspecified time in the past, and/or we would have to acquire and relocate the structures, including apartment buildings, from the floodplain, and/or we would have to provide wetlands or wildlife habitat or recreational trails or whatever else federal agencies can dream up and extract from the local

governments in return for federal permits.

The report introduces the standard project flood as a potential requirement for protection of population centers and critical infrastructure. The idea that cities (population centers) should have to meet a higher standard than in the past, or than the rest of the country, is bothersome and can work against any type of structural mitigation alternative. Again, this seems to be anti-city.

Chapter 8 of the report, which is titled "Minimizing the Vulnerability of Existing Development" actually gives relatively little attention to "before the flood" remedial projects, other than levees; talking instead mostly about buyouts and other programs after the flood. It does briefly talk about the array of potential solutions and the need for a systems approach which "brings to the forefront the ecosystem effects of flood damage reduction projects, and it allows for avoiding, minimizing, and compensating for adverse effects and capitalizing on environmental opportunities." Translation: It is going to cost you more to do a given project because you are the only one bringing money to the table.

The report calls for the enactment of a "Floodplain Management Act" by Congress. The potential for this proposed legislation to develop into another unfunded mandate is a real concern. While the bottom-up approach is supported in the report, our experience has been quite the opposite in terms of federal initiatives such as the Clean Water Act, Safe Drinking Water Act, etc. For example, the proposed Act would require states to develop floodplain management plans and would require federal projects to be consistent with those plans. Of course the Act would then specify what "essential elements are required for a state floodplain management plan to receive federal approval." Bottom-up becomes top-down very quickly under those circumstances.

The perspective of the report is driven by the 1993 midwest floods. This was a large flood on a large river system. Our agency perspective is on problems in smaller watersheds ranging in size from a square mile to twenty or

thirty square miles. The report lacks any discussion of such small urban watersheds, even though it has been reported elsewhere that about 30% of claims under the NFIP are located outside mapped 100-year floodplains, many of which are the smaller urban watersheds. Our attempts to solve these problems, which is also a benefit to the NFIP, are hampered by federal regulations., etc., as noted above, and this report doesn't address these areas in any positive way.

We are not a zero population growth country, and as our population grows, we have to have more housing, jobs, etc. Many federal environmental laws and regulations discourage reuse of land in core urban areas, and consequently encourage developers to go to the fringe areas of metropolitan areas. The environmental consequences of this include loss of open space and poorer air quality, to name just two. *Sharing The Challenge* will only accelerate the federally mandated move to the suburbs.

I am not opposed to efforts to increase opportunities for restoration or creation of natural resources and ecological systems. I am opposed to having these efforts imposed on us by those who have no interest in flood loss reduction

It would be enormously helpful to local governments if a distinction could be made between the preventive and the remedial, such that protection of people's lives and property in already developed floodplains would be given a higher priority than the environmental regulations. Unfortunately, *Sharing the Challenge* goes in exactly the opposite direction because it recommends putting restoration, and even creation, of natural resources and ecological systems on an equal footing with flood protection (protecting people).

What Should Be Done

The Urban Drainage and Flood Control District should be held up as a model of how to reduce flood losses across the nation. Instead, the federal government continues to make it more and more difficult for the UDFCD to succeed. When the UDFCD was created, one of its first actions was to inventory the situation to

see what problems and opportunities were there. The result of that inventory was the adoption of a policy of fixing past mistakes while preventing new mistakes from being created.

During the last 20 years the population of the UDFCD has grown from 1,250,000 people to 2,000,000, along with all of the structures (homes, businesses) which accompany that kind of population growth. In the same period of time, the UDFCD and the local governments within the UDFCD have reduced the total number of structures in the identified 100-year floodplains by several thousand. This has been accomplished by an aggressive effort to keep new development out of the floodplain while implementing in excess of \$125,000,000 in remedial projects. We have built grass-lined channels, concrete-lined channels, soil cement-lined channels. We have built dams, and rehabilitated dams. We have built underground conduits. We have participated in acquisition and relocation projects. We have done all of this in order to remove existing structures from existing flood hazard areas. We have done all of this not only with local government support but with local government financial participation. This is a record of success that should be emulated by the federal government, not punished by more and more federal intrusion in local affairs.

While this was happening in Denver, flood losses and flood damage potential throughout the nation continued to increase. With this kind of record you would think that an enlightened federal government might want to look at the UDFCD experience as a model. Instead, they have been captured by environmental interests who wish to attach their agendas to the problem of reducing flood losses, to the detriment of our efforts, and the efforts of many others as well.

What Can We Do?

While floodplain managers should be promoting multi-objective management (MOM) and protecting natural and beneficial values in undeveloped floodplains, we should also be fighting to preserve and protect our ability to construct remedial projects without being bogged down

chasing objectives and values which make the projects too expensive to implement.

“The Floodplain Management Act,” would codify many of the recommendations in *Sharing the Challenge*, and there are a number of ideas which would be good for the cause if implemented. The recommendations would probably improve the effectiveness of the federal government’s efforts in floodplain management. However, I am concerned that there are also recommendations in the report that will cause problems for local agencies responsible on a day-to-day basis for addressing local flood control issues, and will probably cause local agencies more problems in dealing with ongoing remedial and maintenance activities. The lack of attention to small urban watersheds where many of the nation’s flood losses occur, the higher standards to be applied to population centers, and the likelihood of additional unfunded federal mandates are all of great concern. It is important for local governments to gear up now to oppose those aspects of the act which will limit their ability to protect their citizens.

Unfunded mandates divert local government funds from flood damage mitigation projects. For example, the local government funding for NPDES permit applications, stormwater monitoring and compliance with permit conditions is coming directly out of funding that would otherwise go for planning, design, and construction of drainage and flood control facilities. The decision made in Washington is that cleaner stormwater is more important than safer cities, since stormwater permits are mandated and remedial flood protection is not. Even the recommendations in *Sharing The Challenge* don’t mandate safer cities, but they do mandate higher costs for remedial projects in order to address environmental concerns.

Related to the mandates is the fact that federal permits are needed for very small projects which should not have the legitimate status to be scrutinized by the feds. I truly believe it is ludicrous for us, or any local government or private party, to have to get the permission of the federal government in order to work on a

parcel of land 0.25 acres in size which was semi-desert until an uphill subdivision sent some water down on it and turned it into a so-called wetland or waters of the United States.

I’m really not looking for a lot. Local governments should be allowed to maintain existing drainage and flood control facilities at a reasonable cost. They should be able to use their own funds to construct their own remedial projects to protect their own citizens. If other agencies want to impose their non-flood loss reduction goals on remedial flood control projects, they should be required to provide their own funding. They should not be allowed to force their desires onto local projects simply by withholding federal permits.

I am all for MOM, natural and beneficial values, watershed planning, wetlands protection, and wildlife habitat. However, I’m also for local control, providing flood protection for people who are already in the floodplain, reasonable maintenance costs, and preservation of our cities. The problem is that we can’t afford every one of these items in every case. We need to be able to decide what we want and what we can afford in each case. When some of these items have the benefit of federal protection or regulation or mandate, those that don’t fall behind.

In the case of remedial projects which are intended to mitigate existing flood damage potential, environmental considerations should not be automatically given equal weight with the mitigation effort. At the same time, preventive programs should definitely have a strong environmental (MOM, natural and beneficial values) component.

We also must realize that we are bankrupting this country. We are loading a ton of debt on our kids. We can’t have everything we want that would be nice to have. We need to be able to make choices. *Sharing The Challenge* will require us to either sacrifice flood protection in favor of the federally identified priority of restored floodplain ecosystems, and/or load more and more debt on our kids.

MAINTENANCE PROGRAM ACTIVITIES

by
Mark R. Hunter, P.E.
Chief, Maintenance Program

Program Direction

Changes continue to occur in the restoration program. The increased use of consultants for restoration design has been a positive step for us. With consultants doing the designs and quantity take-offs for many of our restoration projects district staff now spends more time securing permits and managing our relationship with federal regulators, the local governments, and the contractors.

The additional engineering capacity allowed us to take better advantage of the competitive process for our construction projects. We were able to bid among the restoration contractors about 90% of the dollar volume of our 1994 restoration projects.

Routine Maintenance

Under the routine program \$458,000 was spent for mowing and debris pickups on approximately 183 different sections of drainageways within the District boundaries. A portion of that amount was awarded to a non-profit contractor whose goal was to provide jobs for struggling teens. He accomplished the mowing and debris pickups on the drainageways in the Montbello development of Denver and on a portion of Cherry Creek through downtown Denver.

Restoration Maintenance

In 1994 the restoration program completed \$2.07 million of work. Restoration projects typically address isolated drainage problems where the solution involves small scale construction. About 86 individual activities were completed during the year. Approximately two dozen of those activities were for silt removals from detention ponds, sediment traps, and manmade channels. Federal regulations dictate that this type of work be done under the authorization of Section 404 of the Clean Water Act. This means that we individually applied to the Corps of Engineers for permission under Section 404 to carry out each of these activities.

Except for a few minor drainageways in Arapahoe, Douglas, and Denver Counties each of these silt removal sites also had to be surveyed to determine the presence or absence of

STATUS OF MAINTENANCE REHABILITATION PROJECTS

Project	Jurisdiction(s)	Cost	Status
<u>ADAMS COUNTY</u>			
Westerly Creek	Aurora	Design- \$44,395	70%
Replace pipe with channel		Const.- \$240,000	0%
<u>ARAPAHOE COUNTY</u>			
Big Dry Creek	Arapahoe Co.	Design- \$129,680	100%
Branch 2		Const.- \$379,230	100%
South Platte - Col. Valley	Columbine Valley	Design- by others	100%
Trickle channel		Const.- \$20,000	0%
West Harvard Gulch	Englewood	Design- \$13,790	30%
Pipe replacement		Const.- \$200,000	0%
West Toll Gate Creek	Arapahoe Co.	Design- by others	100%
Peakview pond repiar		Const.- \$88,704	95%
Lee Gulch	Littleton	Design- by others	100%
Trail participation		Const.- \$10,000	100%
<u>BOULDER COUNTY</u>			
Bear Canyon Creek	Boulder	Design- \$30,000	100%
drops, bank repair w/city		Const.- \$197,000	75%
Bear Canyon Creek	Boulder	Design- \$30,000	0%
Martin Park drops, banks		Const.- \$120,000	0%
Goose Cr.-Elmer's 2-Mile	Boulder	Design- \$20,617	100%
Trickle Channel		Const.- \$56,889	100%
<u>DENVER COUNTY</u>			
Cherry Creek	Denver	Design- \$54,150	100%
Drop structure at Monaco		Const.- \$201,159	50%
Cherry Creek - Babi Yar	Denver	Design- \$25,000	90%
Drops, bank repair		Const.- \$130,000	0%
Cherry Creek Delgany/Market	Denver	Design- \$26,850	95%
Bank repair		Const.- \$241,650	0%
Goldsmith Gulch	Denver	Design- \$63,021	100%
Rosamond Park		Const.- \$360,597	50%
Lakewood Gulch	Denver	Design- \$29,491	95%
Channel repair		Const.- \$391,000	0% Ph 3
Montbello Drainage (w/city)	Denver	Design- by others	50%
Concrete channel repair		Const.- \$50,000	0%
<u>DOUGLAS COUNTY</u>			
Dad Clark Gulch (w/HR Met)	Douglas Co.	Design- by others	100%
Kistler drop structure		Const.- \$45,893	0%
<u>JEFFERSON COUNTY</u>			
Airport Creek	Arvada	Design- \$28,315	90%
Eaton and 112th		Const.- \$200,000	0%
Lena Gulch	Lakewood	Design- \$13,470	75%
From 20th to Youngfield		Const.- \$200,000	0%
Little Dry Creek	Arvada	Design- \$29,284	100%
Wadsworth to Club Crest		Const.- \$92,382	100% Ph 2
Little Dry Creek (Phase 3)	Arvada	Design- \$25,000	Postponed
Wadsworth to Club Crest		Const.- unknown	Postponed
SJCD (S)	Jefferson Co.	Design- \$39,361	100%
Columbine Knolls South		Const.- \$132,369	100%
SJCD (S)	Jefferson Co.	Design- \$28,335	95%
Carr to Estes		Const.- \$250,000	0%

the Ute Ladies' Tresses Orchid. This is an endangered plant that tends to occupy sites along drainageways. This survey, required by the federal government, must be performed by a certified specialist. We had about 50 individual orchid surveys performed for maintenance activities in 1994 at a total cost of nearly \$20,000. No orchids were found.

Rehabilitation Maintenance

Twenty-two projects were at various levels of design or construction

during 1994. Those projects are listed in the accompanying table titled "STATUS OF MAINTENANCE REHABILITATION PROJECTS". Rehabilitation projects usually take the form of consultant-designed improvements that are intended to solve multiple drainage problems on a previously improved drainageway. Each county had one or more rehabilitation projects that were under design or construction in 1994. By the end of 1994 we will have spent about \$1.55 million on rehabilitative design

and construction for the year. A few of the unique projects are discussed below.

In Jefferson County southwest of Ken Caryl Avenue and Pierce Street a portion of a drainageway known as **SJCD South** had degraded to a depth of four to eight feet in a vertical-sided channel about 15 feet wide. The solution called for a series of drop structures to stop the degradation. The immediate goal was to stabilize the channel bottom and prevent the erosion from continuing upstream. The long-term purpose was to provide protection to a large wetland and open space area.

Design and construction continues on **Cherry Creek** through Denver. An existing sheet pile and timber drop structure downstream from Monaco Street is being rebuilt into a sloping grouted boulder drop and will be completed in early 1995. The multi-year work of edging the low flow channel with boulders through downtown continues with the reach from Delgany Street to Market Street scheduled to be built in early 1995. This work will be accomplished by others as part of a recreational development proposed for the same reach of Cherry Creek.

Immediately south of Stapleton International Airport a portion of **Westerly Creek**, contained in a large diameter pipe, passes under some parking lots. The pipe is collapsing in several places. Through the input of a landscape architect and with the help of the City of Aurora we chose to acquire easements and return the drainageway to an open channel rather than

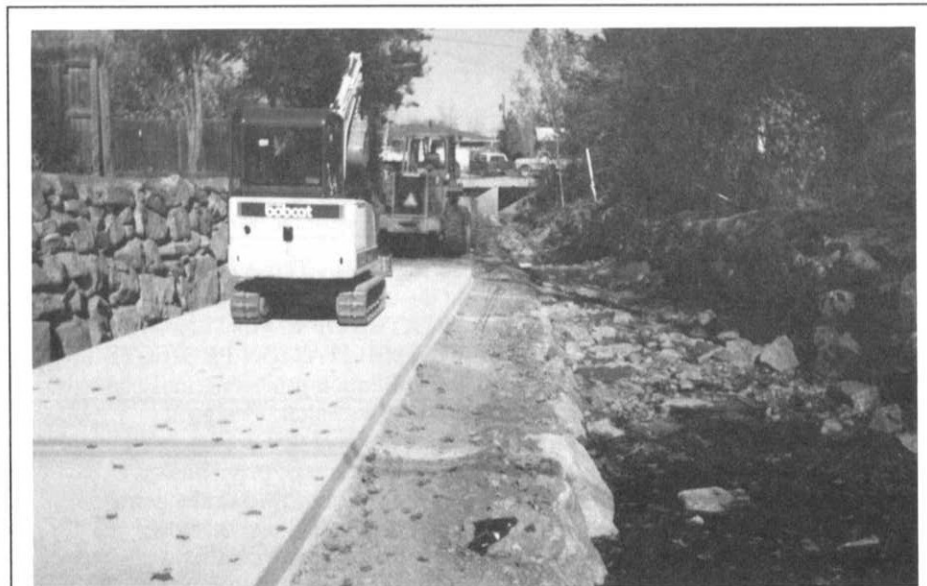
Foxhill Tributary in Arapahoe County was completed in late 1993.



Degradation of the low flow channel was causing formation of tall vertical banks which caused a safety hazard.



The rehabilitation project consisted of installation of grade control structures and laying back the vertical banks. Notice how the project protected many of the existing trees near the low flow channel.



Bear Canyon Creek in Boulder.

replacing the deteriorated pipe with another pipe.

On a very different project in Westminster a landscape architect is the prime consultant for the rehabilitation of **Airport Creek** at 112th Avenue and Harlan Street. The creek is experiencing aggradation at the upper end and degradation at the lower end of the reach. This creek is in a 100 foot wide corridor which permits the consultant to make use of the gently graded open space for drainage repairs and aesthetic enhancements.

In the southern part of the City of Boulder, **Bear Canyon Creek** from Moorhead Avenue to Martin Drive is sandwiched in a 35 foot wide easement. The maintenance program is funding the channel erosion protection and the replacement of the drop structures. This is being done in cooperation with the design and construction program and the City of Boulder who are

funding the bridges and the flood conveyance improvements.

From 20th Avenue to Youngfield in Lakewood the maintenance program is going to install erosion protection and grade control on **Lena Gulch** at individual problem areas. This is not a unique approach to the problem. What is unique, however, is that the parties involved decided not to build a flood capacity improvement which would have required easements, heavy construction, and much disruption in the neighborhood. Instead, they decided on a maintenance project which will include localized erosion prevention features. The erosion protection and grade controls will reduce the erosion that occurs during runoff events but will not remove any of the existing buildings from the 100-year floodplain.

As the Smoky Hill area of Arapahoe County has developed many regional detention ponds have been installed. We have rehabilitated four of these ponds in the past. On a tributary to **West Toll Gate Creek** we are about to complete work on another detention pond with improvements to the trickle channels, the spillway, and the piped outlet.

Goldsmith Gulch through Rosamond Park in south Denver is being rebuilt to eliminate steep banks and to reduce the frequency of the runoff events that escape the confines of the low flow channel and deposit silt in the park. The solution calls for a wider low flow channel. The edges of the low flow channel will be defined with large boulders and riprap will be used to protect the bottom of the channel.



A problem for 1995. Erosion of the Clear Creek banks near its confluence with the South Platte River in Adams County.

This is a past maintenance project on Grange Hall Creek in Northglenn



Before: Degradation of the low flow channel was causing vertical banks.



Right After: The project was completed in early 1991. The banks were laid back and a boulder lining was installed along the low flow channel.



By 1993: The vegetation has been re-established and the banks are stable.

District Awards

The District was involved in two projects which received awards from the Colorado Association of Stormwater and Floodplain Managers.

The District and City of Edgewater received the "1994 Grand Award for Engineering Excellence in the Field of Flood Control/Flood Hazard Mitigation" for completion of Upper Sloan Lake Basin. Congrats to Dave Lloyd from the District and Bob Martin from Edgewater.

The City and County of Denver and the District received the "Merit Award for Outstanding Achievement in the Field of Flood Control/Flood Hazard Mitigation" for the Creekfront project along Cherry Creek in downtown Denver. Congratulations to Mark Hunter from the District and consultants Wenk Associates, Muller Engineering Co. and Taggart Engineering Associates.

Wenk Associates also received a Merit Award from the Colorado Chapter of the American Society of Landscape Architects for the Creekfront project.

Donald H. Godi & Associates also received a Merit Award for their completion of "Design Workbook for Establishment of Natural Vegetation." This project was completed for the District's Maintenance Program.

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