Local Flood Warning, Preparedness, Events & Projects

by
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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 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.

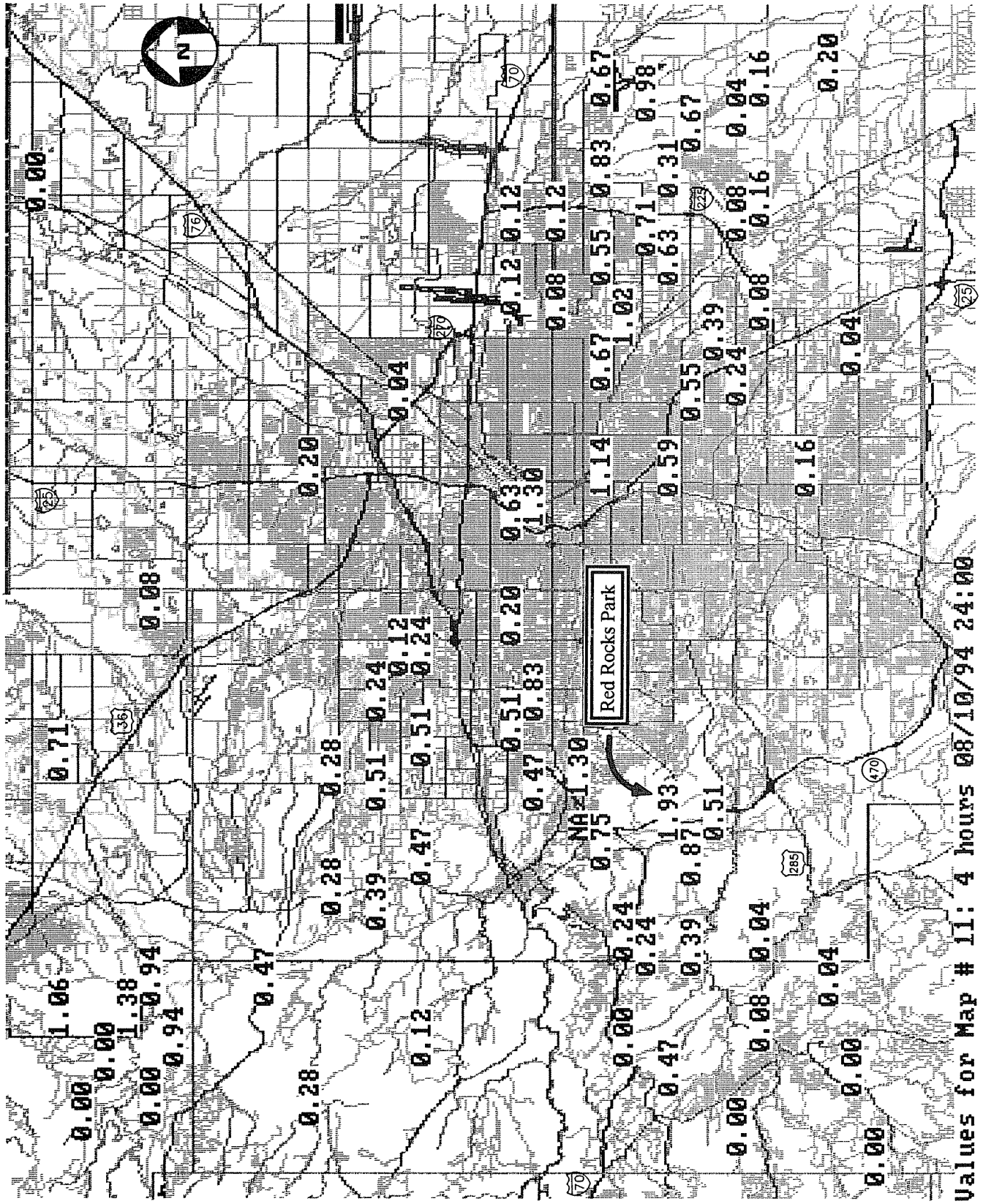
1994 SIGNIFICANT EVENT SUMMARY TABLES

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


Red Rocks Park
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 it's 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

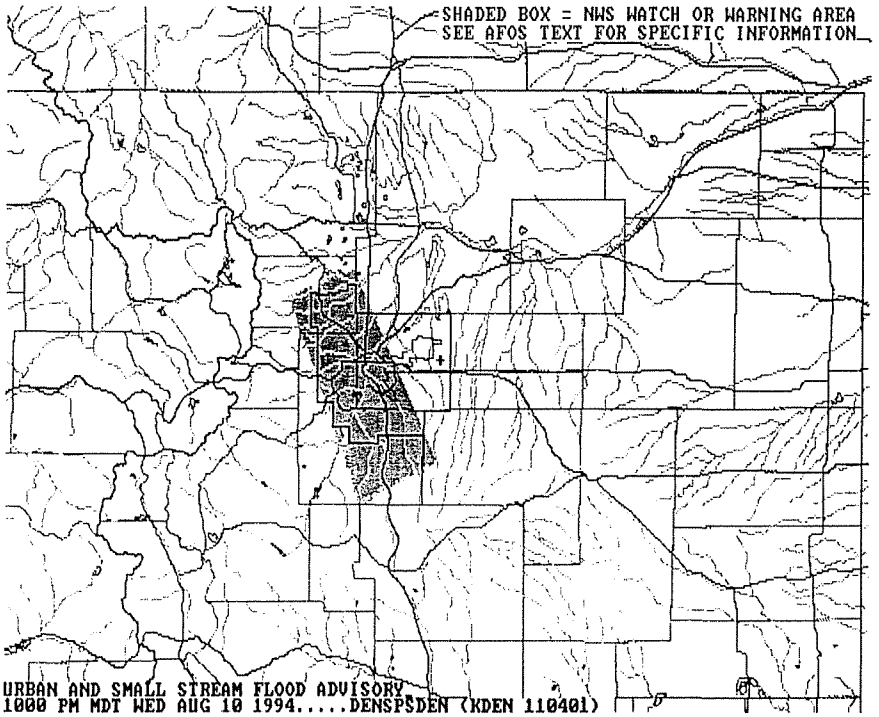
ALERT base stations currently have the capability to display NWS watch and warning areas on a custom base map for Northeast Colorado. Similar products will soon be available on a regional scale using weather information generated by the District's Flash Flood Prediction Program. Ultimately, remote users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



Example of Bulletin Board graphic showing area covered by an NWS advisory.

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 hardward 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 a 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.