

December 22, 1998

Mr. Kevin Stewart
Urban Drainage and Flood Control District
2480 W. 26th Avenue, Suite 156B
Denver, Colorado 80211

Dear Kevin:

Maintenance work on the ALERT Gauging Network for 1998 has been completed under Agreement 98-01.15. During the 1998 operating season, DIAD generated 648 maintenance reports for the combined UDFCD/Boulder County network. Of these, 57 (8.8%) were unscheduled service calls, while the remainder documented standard maintenance activities.

Site damage and vandalism were significant in the UDFCD network in 1998. The Grandby Ditch standpipe was demolished in May, when a CDOT earthmover "accidentally" knocked it down during road widening activities on 6th Avenue. The transmitter survived, but the PT cable was corrupted. A complete reinstallation was performed. After the reinstallation, erosion from July storms left the entire length of PT cable conduit exposed. According to CDOT, the slope between the standpipe and the PT housing was supposed to be sodded or seeded in late summer or early fall, but as of November, the slope was still barren and the conduit still uncovered.

Vandalism occurred at Horseshoe Park twice. The first instance involved a broken mast. Less than one week later, the replacement mast had again been torn down. In addition, the YAGI antenna was destroyed and the antenna cable was cut. The remaining equipment was removed until a sturdier mast box could be fabricated and installed. At Havana Park, the conduit housing the PT cable was used as a lever to extricate the concrete slab in the ground to which the conduit was anchored, and the conduit and PT cable was breached. The PT was replaced and the PT housing was reinstalled in such a manner that will prevent vandals from using the conduit as a lever. At Shop Creek, the lock hasp on the building exterior was torn off the door, leaving the equipment inside free for the taking (none was). Minor vandalism occurred at Broomfield, where the whip antenna and the ground planes were all bent towards the ground.

The possibility exists that vandalism was responsible for damages at the Blue Mountain and Goldsmith-Eastman sites. At Blue Mountain, damage was caused by a very powerful force exerted on sensor cabling, resulting in a direct short between power and the wrap-around braid in the cable. The short fried the fuel temperature/moisture sensor

and the connector interface board of the 555, and caused problems with the wind speed sensor. It seems unlikely that the damage was caused by vandals, due to the extreme pulling force required to produce a cable breach like the one found. We believe that an animal (probably a cow) somehow became entangled in exposed fuel moisture/temperature sensor cabling, and tore itself free. (The FT/FM sensor is now enclosed in a 4' x 4' x 4' wire mesh enclosure to repel 4-legged rowdies.) The RF power out on the replacement 555 at Blue Mountain had to be reduced because it was destructively interfering with the BM repeater. Also, prior to the "cable" incident, the RH sensor was replaced.

At Goldsmith-Eastman, flooding and subsequent bank caving are believed to have generated sufficient force to rupture the PT cable conduit and sever the PT cable, but vandalism certainly cannot be ruled out. The PT housing and PT cabling were replaced. Shortly afterwards, the PT died and was replaced. Due to a series of storms in the month of July, significant channel widening via bank erosion continued after the new housing was installed, exposing an additional 18 inches of the concrete "jetty" structure on which the PT housing is currently anchored. Engineered structural improvements will be necessary in order to prevent further channel widening, and to ensure adequate protection of the current PT housing.

The UDFCD network expanded in 1998. Installations were completed at five new sites in Douglas County. Weather stations were installed at Castle Rock, Highlands Ranch, and Salisbury Park, and rain-stage suites were planted at Pine Cliff and Castle Oaks. The new weather station in Louisville (site ID 4750, site name "Lafayette") was installed in July, just east of the City of Louisville Water facility. Additionally, customized South Platte River "piggyback" installations were completed at the four USGS "water quality" gauging stations at Union Avenue, 19th Street, Sand Creek @ Burlington Ditch, and Henderson. The old Sand Creek site @ Brighton Boulevard was shut down and dismembered for parts, and the Cherry Creek @ Market Street site was relocated to Champa Street. Brighton was modified from a rain-only site to a weather station.

The recent additions or changes to the system produced residual problems that still need to be resolved. The Douglas County sites do not report as consistently as they should, which hints at RF path problems. Initially, they were sent through Smokey Hill. PROM changes were later made on the repeater pass lists to try and determine if performance would improve through Blue Mountain. After the PROM change, there was no general improvement (or degradation) in performance. Boosting transmit power output with PA's, and experimenting with directionality of repeater antenna elements are other logical tests to perform to see if Douglas County site performance can be improved. Ultimately, another repeater may be necessary to ensure reliable data capture for these sites.

The SPR and Cherry Creek @ Champa sites appear to report consistently, with a caveat. We have experienced some problems related to multi-user unfamiliarity with procedures required to ensure that the ALERT DCP is not disabled. (To be fair, the USGS has suffered similar problems with the GOES DCP due to procedural unfamiliarity on our part.) The obvious fix here involves posting specific procedural instructions at each site for personnel to follow when they visit to download GOES data. However, we anticipate this problem will not completely disappear. There are many different individuals in the Survey that collect data at these sites. Those who perform the task infrequently will be more likely to err, even with specific instructions. Still others have

expressed displeasure at having to accommodate another DCP, despite the simplicity involved in doing so.

The Brighton site is experiencing no path problems, but wind run data are underreporting (peak wind data are fine). The output voltage of the installed anemometer is about twice as low at a given rotational rate than observed with a working anemometer. Due to the abnormally low output voltages generated at lower wind speeds, the operational amplifier output on the logic board is not kicking in, inhibiting rotational counts from being recognized, resulting in undercounting and less frequent transmission of wind data. After replacing the anemometer, the problem persists; we believe the replacement sensor is also defective.

Repeater/Controller issues also need to be resolved. The Controller at Diamond Hill fails to remotely switch the Smokey Hill repeater into pass all mode. The second Controller can switch Smokey Hill to pass all mode from Blue Mountain. However, in order to accommodate the troubleshooting, testing and repair of the Blue Mountain controller processor board and controller interconnect board, the second Controller box has been returned to HSE.

The following encapsulates other problems of note in the UDFCD system during 1998. Shaft encoder drift at Morrison continues. We have reached a point with this problem where every realistic, logical fix has been attempted, to no avail. Abandoning the SE and installing a stage sensor appears to be the best remaining alternative. At Castle Rock, spurious temperature data is being generated. Either the sensor or the transmitter needs to be fixed. Access to the site has been temporarily suspended, as the UDFCD lock was removed from the gate by person(s) unknown. At Highlands Ranch, the new Ritron radio died only a few days after the weather station was activated. At Sand Creek Park, another Ritron radio died, and a new PT was installed (replacing a failed PT from 1997). The PT at Gunbarrel died and was replaced. The signal conditioning board died and was replaced at Temple Pond. At Diamond Hill, the transmitter locked up, and incoming rain data was flaky. RH and temperature data were also intermittent. After installing the replacement transmitter, temperature data began fluctuating wildly. Removal of a capacitor on the logic board fixed the problem, which relates to the uniqueness of the temperature probe at Diamond Hill. Coincidentally, plugged PT intakes and dead batteries were problems at both Cherry Creek @ Steele and at Bear Creek @ Cub (the problems are not related to one another). The interface between the vertical riser and the horizontal intake at Bear Creek @ Cub will require complete dismantling and reinstallation, because the current installation does not allow for the complete removal of sediments. This will otherwise be a recurring, persistent problem. At Quincy Reservoir, a Handar 555 had to be removed and sent in for repair due to a malfunctioning wind input. PT calibrations consistently drift at Maple Grove, Niver Detention, and at Expo Park (one of the two PT's); these PT's should be replaced. At Nolte Pond, the PT housing was tampered with and needs to be repaired. The PT tested OK but we have had long term calibration stability problems here; this needs to be closely monitored. Denver Wastewater had problems receiving Smokey Hill earlier in the flood season. A 40-watt power amplifier was installed at Smokey Hill, as RF testing revealed no obvious path problems. This apparently has fixed their receive problem. A bad decoder was also discovered there and replaced. RF issues remain at Shop Creek. Smokey Hill needs replacement mast brackets, as the current brackets show signs of fatigue.

No vandalism was observed at any sites in the Boulder County system during the past year. Three EG&G transmitters died at the Walker Ranch, Geer Canyon and Sunset sites. The transmitters at Walker and Geer had logic board failures, while the PA in the Sunset transmitter exhibited excessive current draw. Walker Ranch also suffered from a plugged funnel. At Button Rock, the RH/AT sensor went south and was replaced, and a 5096 was installed. At Button Rock Outlet, the City of Longmont reinstallation was wired incorrectly, and subsequently fixed. The logic board from the Fourmile transmitter failed and was returned for repair by the manufacturer. The site was kept active with an older revision logic board in the meantime. Like Brighton, Hills Mills was underreporting wind run data. Unlike Brighton, the replacement anemometer clearly fixed the problem. Mast brackets sheared off from wind fatigue at the Eagle Ridge site, resulting in excessive mast sway. Replacement brackets were reinstalled. The Eagle Ridge transmitter radio also died in May and was replaced.

EPROM upgrades were performed on 3206 transmitters at nine Boulder County stage sites. The upgrades give greater flexibility in choosing an appropriate resolution of event-based stage data reporting at individual sites. The new EPROM allows the stage sensor values to be transmitted after a 10 count accumulator difference from the previously reported accumulator value. The old EPROM's only allowed event-based transmissions after a change of 5 counts, or a change of 20 counts, which for many of these sites results in either too frequent or infrequent reporting of stage data.

Preliminary efforts were made to locate a second primary repeater site for the Boulder County network, as the Lee Hill repeater remains a single point of failure for the system. Nugget Hill is a potential site approximately 2 miles NW of Lee Hill, and is attractive in terms of high elevation and visibility, but physical access to the site is highly questionable on a year-round basis due to primitive road conditions and snow accumulation. Resolution of this issue remains a high priority.

6th and Tollgate will be outfitted with a new PT housing, 5 psi PT and an 11 bit A/D transmitter. The housing shall consist of a 12 inch diameter PVC stilling well to increase resolution of year round stage data and to enable water quality measurement/analysis capabilities.

DIAD would like to thank you for your professionalism, Kevin, and we look forward to the possibility of continuing to work with you and supporting the UDFCD.

Sincerely,

Robert J. Benedict