



Photograph courtesy of Tim Tonge

**2008**  
**UDFCD FLASH FLOOD PREDICTION**  
**PROGRAM - ANNUAL REPORT**

Submitted by  
**Genesis Weather Solutions, LLC & Skyview Weather**  
**303-927-6522**

**DRAFT**

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## **1.0 Introduction**

The Urban Drainage and Flood Control District (District or UDFCD) has used the forecasting and notification services of a private sector meteorologist for the Flash Flood Prediction Program (F2P2) since 1979. The services of a Private Meteorological Service (PMS) supplement the forecast and warning services of the National Weather Service (NWS) in Boulder, Colorado for the seven-county District area. This year is the 30<sup>th</sup> year UDFCD has funded the F2P2.

The UDFCD forecast area supported by the PMS is shown in Figure 1 and contains a population of approximately 2.8 million people. The forecast area of approximately 3,000 square miles includes the upper basin areas of watercourses that flow into the District. Terrain in the forecast area varies in elevation of around 5,000 feet above sea level to as high as 10,500 feet above sea level.

A team comprised of Genesis Weather Solutions, a Highlands Ranch, Colorado based company and Skyview Weather, a Castle Rock, Colorado based company was selected as the 2008 PMS.

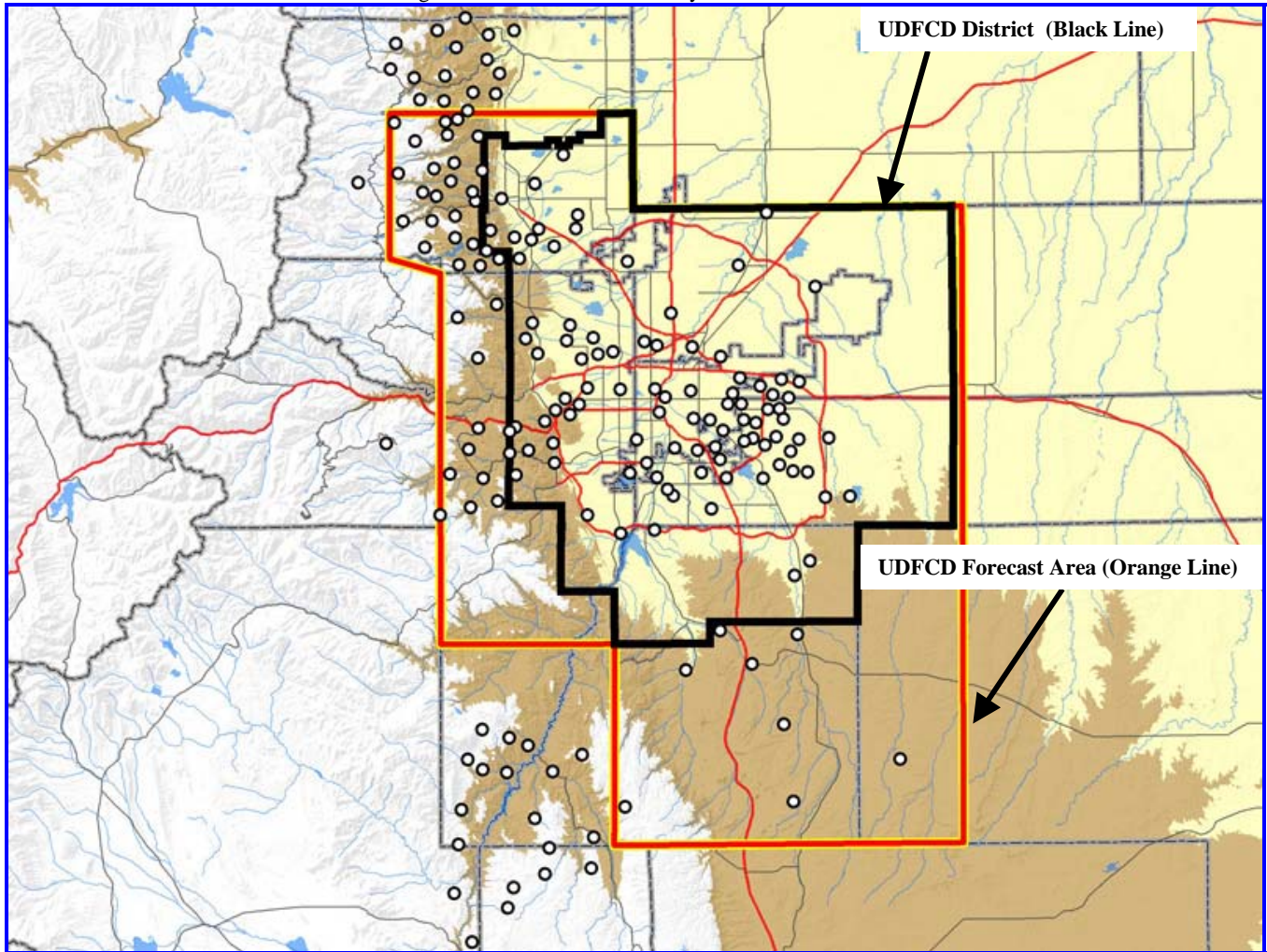
Weather prediction personnel Bryan Rappolt, Tim Tonge, Brad Simmons, Dann Cianca, Chris Anderson and Nick Tarantola provided the F2P2 prediction and notification services. Bryan Rappolt was as the Project Manager and Chief Operational Meteorologist.

Bryan Rappolt worked his 15<sup>th</sup> season on the F2P2 while Tim Tonge worked his 3<sup>rd</sup>, Brad Simmons his 2<sup>nd</sup>, and Dann Cianca, Chris Anderson and Nick Tarantola all worked their 1<sup>st</sup> season.

## **2.0 2008 Operational Season**

The 2008 F2P2 season began on April 15 and concluded on September 15; a total of 154 operational days. Normal operational hours were from 7:00 AM to 10:00 PM. A total of 1150 man-hours were expended by the PMS providing operational support during normal operational hours. During the time period from 10:00 PM to 7:00 AM the PMS provided an additional 208 man-hours of operational support.

Figure 1: The UDFCD boundary and forecast area.



### 3.0 2008 Operational Products

The F2P2 is designed to provide rainfall prediction and notification services of urban flooding and flash flooding threats to the seven District counties and the cities and towns within those counties. Direct support is provided to the District basin-specific flood warning plans, which include the Westerly Creek, Boulder Creek, Toll Gate Creek, Lena Gulch, Ralston Creek, Goldsmith/Harvard Gulch, and the Bear Creek drainage basins.

Five specific F2P2 products were produced by the PMS. The products included the Heavy Precipitation Outlook (HPO), the Internal Message Status (IMS), the Quantitative Precipitation Forecast (QPF), Storm Track (ST), and Messages. Table 1 provides a description of the first 4 products and Table 2 provides a description of Messages. Table 3 depicts the number of F2P2 products that were produced and the number of communication contacts made or received by the PMS in 2008.



Table 1. F2P2 products description.

**Heavy Precipitation Outlook (HPO)/Internal Message Statement (IMS).** This HPO is available by 11:00 AM every day during our primary flood season as noted above. It provides a weather forecast for the District with emphasis on possible rainfall amounts and where storms are most likely to occur. When flood potentials threaten the District, the HPO will be revised and renamed "Internal Message Status" or IMS. This report will indicate the message status for each primary contact point within the District. The contact points include the counties of Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas and Jefferson, and the City of Aurora.

**Quantitative Precipitation Forecast (QPF).** This text product is only available on days when the rainfall potential exceeds 1.5 inches in one-hour or less. The QPF product contains more basin-specific information than the HPO or IMS, and requires some knowledge of the regional major drainage basins, streams and associated flood hazards that impact the District. Storm types, expected rainfall totals, storm duration, peak intensities and associated probabilities of occurrence are presented in this forecast product.

**Storm Track (ST).** This combination map/text product is a short lead-time forecast showing where a storm has formed or is forming, the approximate size of the storm(s), the direction (or track) of the storm(s), and the estimated arrival times along the forecast track(s). This is probably the most-anticipated hard copy product of the F2P2, but keep in mind that generally it is only available within an hour or less of storm impact. Also, the Storm Track is not prepared for storms that do not pose a flood threat. The map includes a captured radar image whenever possible.

All of the above products were delivered to F2P2 participants using Premiere Global Services, an Internet-based broadcast facsimile and e-mail service, as well as and made available on the UDFCD ALERT web site, <http://f2p2.udfcd.org/>.

Voice communication is the principal means of disseminating F2P2 threat Messages. Three hundred forty-two (342) telephone contacts were made to eleven F2P2 communication points by the PMS for subsequent fan-out.

Denver Office of Emergency Management and Denver Wastewater received notification of the issuance of Messages and Storm Tracks through pagers and by Short Message Service (SMS) email. There were a total of 44 text pages and SMS disseminations made to these two organizations.

Table 2: Message definitions.



## URBAN DRAINAGE AND FLOOD CONTROL DISTRICT FLASH FLOOD PREDICTION PROGRAM (F2P2) MESSAGE DEFINITIONS

### **MESSAGE 1** (*Nuisance Flood Advisory*)

This advisory message is to inform key people that weather conditions are such that nuisance flooding of streets, low-lying areas, and small streams could develop later in the day. It will be issued by PMS after consultations with NWS. If PMS considers the threat imminent, the message will be identified as a **RED FLOOD ALERT**.

### **MESSAGE 2** (*Flash Flood Watch*)

This advisory message is to inform key people that either a Flash Flood Watch has been issued by NWS or PMS believes that weather conditions are such that a life-threatening flash flood may occur later in the day. Significant stream flooding and property damage is possible. PMS will add any additional information that is available.

### **MESSAGE 3** (*Flash Flood Warning*)

This warning message will be issued to inform key people that a Flash Flood Warning has been issued by NWS or PMS feels that a life-threatening flash flood is imminent. Significant stream flooding and property damage is expected. PMS will add any additional information that is available. This warning message should be disseminated as quickly as possible.

### **MESSAGE UPDATE**

This message will be used by PMS to update any of the previous messages. For example, this message can be used to narrow a watch or warning area as more information becomes available, or to provide more site-specific data and direction during an event. If PMS considers the threat imminent, the message will be identified as a **RED FLOOD ALERT**.

### **MESSAGE 4** (*All Clear*)

This message cancels the flood potential status. It is issued by PMS after consultation with NWS and other entities involved with direct PMS communications.

### CONCERNING RED FLOOD ALERT

The term **RED FLOOD ALERT** is used when PMS believes that a flooding rainstorm is imminent. When a MESSAGE 2 is in effect, **RED FLOOD ALERT** may be used with a MESSAGE UPDATE to indicate imminent nuisance flooding that does not warrant a MESSAGE 3. When a MESSAGE 3 is in effect, **RED FLOOD ALERT** may be used with a MESSAGE UPDATE to indicate that an approaching storm is expected to cause nuisance flooding outside the warning area. In summary, **RED FLOOD ALERTS** are short lead notifications of imminent flood threats (low to moderate risk to life and property) that should be disseminated as quickly as possible.

### ABBREVIATIONS:

NWS ..... National Weather Service  
PMS ..... Private Meteorological Service

**NOTE:** For Boulder County only, MESSAGE Numbers **1, 2, 3 and 4** will be issued as **A, B, C and D** respectively to avoid confusion with their MACS operational "MODE" Numbers 1-4.

Table 3: 2008 product/communication summary.

<b>Product/Communication</b>	<b>Number</b>
Heavy Precipitation Outlook (HPO)	166
Messages and Red Flood Alerts	193
Internal Message Status (IMS)	42
Basin-Specific Quantitative Precipitation Forecasts (QPF)	34
Storm Tracks (ST)	36
Message Potential SMS E-Mails (UDFCD Listserv)	164
Weather Update E-mail (SMS) and Text Pages (Denver County Specific)	44
PMS Initiated Telephone Contacts	342
F2P2 Participant Initiated Telephone Contacts	43
<b>Total</b>	<b>1,067</b>

One hundred sixty-four (164) emails identifying daily Message potential were disseminated to F2P2 participants. The SMS email included a convenient link to the morning HPO for those wanting more information.

#### **4.0 2008 Message Statistics**

The primary service provided to F2P2 participants is early prediction and notification of the potential for flash flooding, urban and small stream flooding, and locally heavy rainfall events that can initiate nuisance flooding. The PMS indicated the potential for these events in a series of products issued to F2P2 participants by phone, facsimile, email and Internet.

##### **4.1 Message Verification**

This year marks the third year in the 30-year history of the F2P2 in which Message statistics have been determined by UDFCD and not the PMS. A Message day is defined as any day in which a Message 1, Message 2 or Message 3 is issued based on the criteria depicted in Table 4. Messages were issued on 26 days during the 2008 F2P2 between April 15 and September 15, 2008. Of the 26 Message days, 20 of the days were Message 1 days. Of the 20 Message 1 days 14 of these days had at least one Message verify, based on the criteria listed in Table 4. The result was a 70% verification rate of Message 1 days on a District-wide basis. Table 5 depicts the number of Message 1 days and the number of Message 1's issued and verified for each month of the 2008 F2P2.

Message 2's were issued on 6 days during the 2008 F2P2. Of the 6 Message 2 days, none of these days had a Message 2 verify (Message 3 was issued and Flash Flooding was observed). Two of the 6 Message 2 days experienced nuisance flooding which prompted Message 1 Red Flood Alert's.





Table 4: Message Criteria.

<b>Message 1 “Nuisance Flood Advisory” Criteria (Boulder County Message A)</b>
<ul style="list-style-type: none"><li>• <b>Message-1</b> (Nuisance street or gutter flooding): <b>0.50"/10 minutes or 1.00"/60 minutes</b></li><li>• <b>Message-1</b> (Significant urban street and stream flooding): <b>1.00 to &lt;3.00"/ 60 minutes</b></li><li>• <b>Red Flood Alert:</b> Rainfall intensity: <b>0.50"/10 minutes or 1.00"/60 min AND occurrence is imminent</b></li></ul>
<b>Message 2 Flash Flood Watch Criteria (Boulder County Message B)</b>
<ul style="list-style-type: none"><li>• Option A: National Weather Service issues a Flash Flood Watch affecting the District</li><li>• Option B: PMS predicts rainfall that will equal/exceed <b>3.00"/hour (No NWS Flash Flood Watch exists)</b></li></ul>
<b>Message 3 Flash Flood Warning Criteria (Boulder County Message C)</b>
<ul style="list-style-type: none"><li>• Option A: National Weather Service issues a Flash Flood Warning affecting the District</li><li>• Option B: PMS issues a Flash Flood Warning for a specific District river/stream/drainageway (<b>No NWS Flash Flood Warning exists</b>)</li></ul>
<b>Message 4 (Boulder County Message D)</b>
<ul style="list-style-type: none"><li>• Message 4 (“All Clear”) is issued whenever Messages are rescinded before their expiration time.</li></ul>

There were 4 “nearby hit” days where a Message 1 was issued for a portion of the District and Message level rainfall was not observed within the District; however Message level rainfall was observed within the “nearby hit” zone outside of the District. Including “near hit” days in the Message 1 day statistics results in a 90% verification rate of Message 1 level rainfall being observed within or near the District on the 20 Message 1 days.

Of the 20 Message 1 days, only 1 of these days had no Message level rainfall observed within the District or within the “nearby hit” zone.

There was 1 day (5/7) where Message 1 level rainfall was observed within a portion of the District and a Message 1 was issued with short lead-time (< 30 minutes) or zero lead-time.

There was 1 day (7/8) where Message 1 level rainfall was observed within a portion of the District and no Message 1 was issued by the PMS for that location. On this day Message 1’s were issued for other portions of the District where the potential existed for heavy rainfall and nuisance flooding.

There were 0 days where a Message 1 was issued for a portion of the District, the Message 1 was rescinded and then re-issued due a renewed threat of Message 1 level rainfall.

Table 5: Monthly Message 1 verification.

Month	Number of Message 1 Days	Verified Message 1 Days	Percent of Verifying Message 1 Days	Message 1's Issued	Verified Message 1's	Percent of Verified Message 1's
April	0	0	0%	0	0	0%
May	2	0	0%	12	5	42%
June	3	2	67%	22	8	36%
July	8	6	75%	46	25	54%
August	7	6	86%	37	28	76%
September	0	0	0%	0	0	0%
<b>Total</b>	<b>20</b>	<b>14</b>	<b>70%</b>	<b>117</b>	<b>66</b>	<b>56%</b>

A Red Flood Alert was issued when the PMS felt that there is a 90% or greater probability that Message 1 level rainfall will be observed across a portion of the District. There were a total of 8 Red Flood Alert days, of which 8 of these Red Flood Alert days verified somewhere within the District; resulting in a verification rate of 100%.

The 20 Message 1 days is the lowest number of Message days in the 30-year history of the F2P2. The second lowest number of Message 1 days was 23, which occurred in 2000 and 2003.

There were 4 Flash Flood Watch days and subsequently the same number of Message 2 days. In addition there were 2 Flood Watch days and subsequently the same number of Message 2 days. Six Message 2 days is two more than the average number (4 days) of Message 2 days in the 30-year history of the F2P2.

The National Weather Service in Boulder issued 1 Flash Flood Warning for portions of the District. The Flash Flood Warning was issued on August 8 due to very heavy rainfall that initiated isolated flash flooding and significant urban flooding across portions of Denver County, Arapahoe County and the City of Aurora. Message 1's were issued for most of the District on this day; however Message 2's were not issued due to the fact that the National Weather Service did not issue a Flash Flood Watch.

#### 4.2 County/City Message Statistics

Each Message issued within the F2P2 is disseminated to a primary contact point in which flooding potential has been predicted. The counties and cities that receive Messages are listed in Table 6.

A Message is verified as a "hit" when a rainfall event meeting the Message criteria depicted in Table 4 is observed in the District-portion of that City/County or in the drainage area of a watercourse that flows into the jurisdiction. Table 6 contains the results of the Message 1 verification on a City/County basis.

Verification of Message 1's issued for the City of Aurora and Denver International Airport (DIA) are included in the County statistics because Aurora is a primary contact point and Denver County is segmented into two sections which includes the City and County of Denver and northeast Denver County (DIA). The cities of Arvada, Lakewood and Wheat Ridge receive Message 1 notifications from Jefferson County dispatch, but also receive Red Flood Alerts, Message 2's and Message 3's directly from the PMS.

Table 6: County/City Message 1 Verification.

Primary Message Contact Points	Message 1's Issued	Message 1 Hits	% Message 1 Hits	Red Flood Alerts Issued	Red Flood Alert Hits	% Message Red Flood Alert Hits	Events Missed	Event < 30 min Lead Time
Adams	16	9	56%	5	5	100%	0	0
Arapahoe	18	12	67%	7	6	86%	0	0
Aurora	17	11	65%	5	4	80%	0	0
Boulder	8	4	50%	5	5	100%	0	0
Broomfield	7	3	43%	3	3	100%	0	0
Denver	11	5	45%	6	5	83%	1	0
DIA	13	2	15%	2	2	100%	0	0
Douglas	16	11	69%	4	4	100%	0	0
Jefferson	11	9	82%	6	6	100%	0	0
<b>TOTAL</b>	<b>117</b>	<b>66</b>	<b>56%</b>	<b>43</b>	<b>40</b>	<b>93%</b>	<b>1</b>	<b>0</b>
Red Flood Alert Contact Points	Message 1's Issued	Message 1 Hits	% Message 1 Hits	Red Flood Alerts Issued	Red Flood Alert Hits	% Message Red Flood Alert Hits	Events Missed	Event < 30 min Lead Time
Arvada	N/A	N/A	N/A	3	3	100%	0	0
Lakewood	N/A	N/A	N/A	2	2	100%	0	0
Wheat Ridge	N/A	N/A	N/A	2	1	50%	0	0
<b>TOTAL</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>					
<b>GRAND TOTAL</b>	<b>117</b>	<b>66</b>	<b>56%</b>	<b>50</b>	<b>46</b>	<b>92%</b>	<b>1</b>	<b>0</b>

A total of 117 Message 1's were issued to the 8 primary contact points within the District. Of the 117 Message 1's that were issued, 66 verified, resulting in a verification rate of 56%. Jefferson County had the highest verification rate, 82%, while Northeast Denver County (Denver International Airport) had the lowest verification rate of 15%. The lowest County verification rate was Broomfield County, which had a verification rate of 43%.

A total of 50 Red Flood Alert's were issued. Of the 50 Red Flood Alerts issued, 46 of them verified, resulting in a verification rate of 92%. Adams, Boulder, Broomfield, Douglas and Jefferson Counties had the highest Red Flood Alert verification rates, 100%, while the City of Wheat Ridge had the lowest Red Flood Alert verification rate, 50%.

The PMS prepared a cloud-to-ground lightning climatology that covered the forecast period of April 15, 2008 through September 15, 2008. Archived cloud-to-ground lightning data was reviewed for each of the 154 operational days of the F2P2. The climatology revealed that of the 154 days, 77 of the days (50% of the total days) cloud-to-ground was observed within or near the District. Of the 77 "thunderstorm days" within the District only 26 (34% of the total days of the F2P2) the days had Messages issued for them. The cloud-to-ground lightning climatology can be found in Appendix A.

## 5.0 Notable Flooding Events

The spring and summer of 2008 was less active than normal with respect to the number of thunderstorms and precipitation that was observed within the District. There were a few notable flooding events, however flood damage was minimal. Some of the notable flooding events observed during the 2008 F2P2 are listed below:

**May 7<sup>th</sup>:** A spring storm system that moved through New Mexico initiated a north/south line of strong thunderstorms across Denver, Arapahoe and Douglas Counties during the very early morning hours (4-6 AM). Heavy rainfall of 0.75” to 1.50” produced nuisance flooding across the central portion of the District. Additional thunderstorms produced light to moderate rainfall across the entire District during the morning and early afternoon.

**June 4<sup>th</sup> and 5<sup>th</sup>:** A potent slow-moving spring storm system initiated strong thunderstorms that trained across northern Jefferson, southeast Boulder and northwest Adams Counties that produce heavy rainfall of 0.75” to 1.60” over a 2.5 hour period. The storm system initiated a general rain with embedded rain showers overnight that lasted into the afternoon of June 5<sup>th</sup>. Rainfall of 0.40” to as much 2.25” was observed across the District over a 36-hour period.

**August 5<sup>th</sup>:** A Denver cyclone convergence zone developed during the afternoon across eastern Douglas, central Arapahoe and central Adams Counties. Strong and severe thunderstorms develop across the convergence zone that moved slowly to the northeast producing heavy rainfall and large hail. A northwestward moving outflow boundary from these thunderstorms initiated additional strong thunderstorms across southeast Denver County and the City of Aurora that produced heavy rainfall. In addition the northwestward moving outflow boundary initiated additional strong thunderstorms across northwest Jefferson and southwest Boulder Counties that produced heavy rainfall.

**August 8<sup>th</sup>:** Multiple thunderstorm outflow boundaries collided over Denver County and the City of Aurora initiated a very strong and large thunderstorm complex that moved slowly to the east. The thunderstorm complex produced very heavy rainfall of 2.00” to 3.75” across southeast Denver County and western Aurora. Message 3’s were issued in response to a Flash Flood Warning issued by the National Weather Service for southeast Denver County and western Aurora. Significant street and urban flooding was experienced (figure 4) as well as flash flooding of some small streams. Several swift water rescues (Figure 5) were performed across the warning area by emergency response agencies of people who were caught in floodwaters.

Figure 2: Street and urban flooding at Broadway and Virginia Streets on August 8, 2008. (Courtesy KUSA).



Figure 3: Swift water rescue on Cherry Creek due to flash flooding on August 8, 2008. (Courtesy KUSA).



**August 24<sup>th</sup>:** On the first days the Democratic National Convention being held in Denver, a Denver cyclone convergence zone developed during the afternoon across eastern Douglas, central Arapahoe and central Adams Counties. Strong and sever thunderstorms develop across the convergence zone that moved very slowly to the north producing heavy rainfall, large hail and tornadoes (Figure 6 and 7) across eastern Douglas, central Arapahoe and central Adams Counties.



Figure 4: Tornado in Parker Colorado on August 24, 2008.



Figure 5: Tornado in Castle Rock Colorado on August 24, 2008 (Courtesy of Tim Tonge).

## 6.0 Recommendations

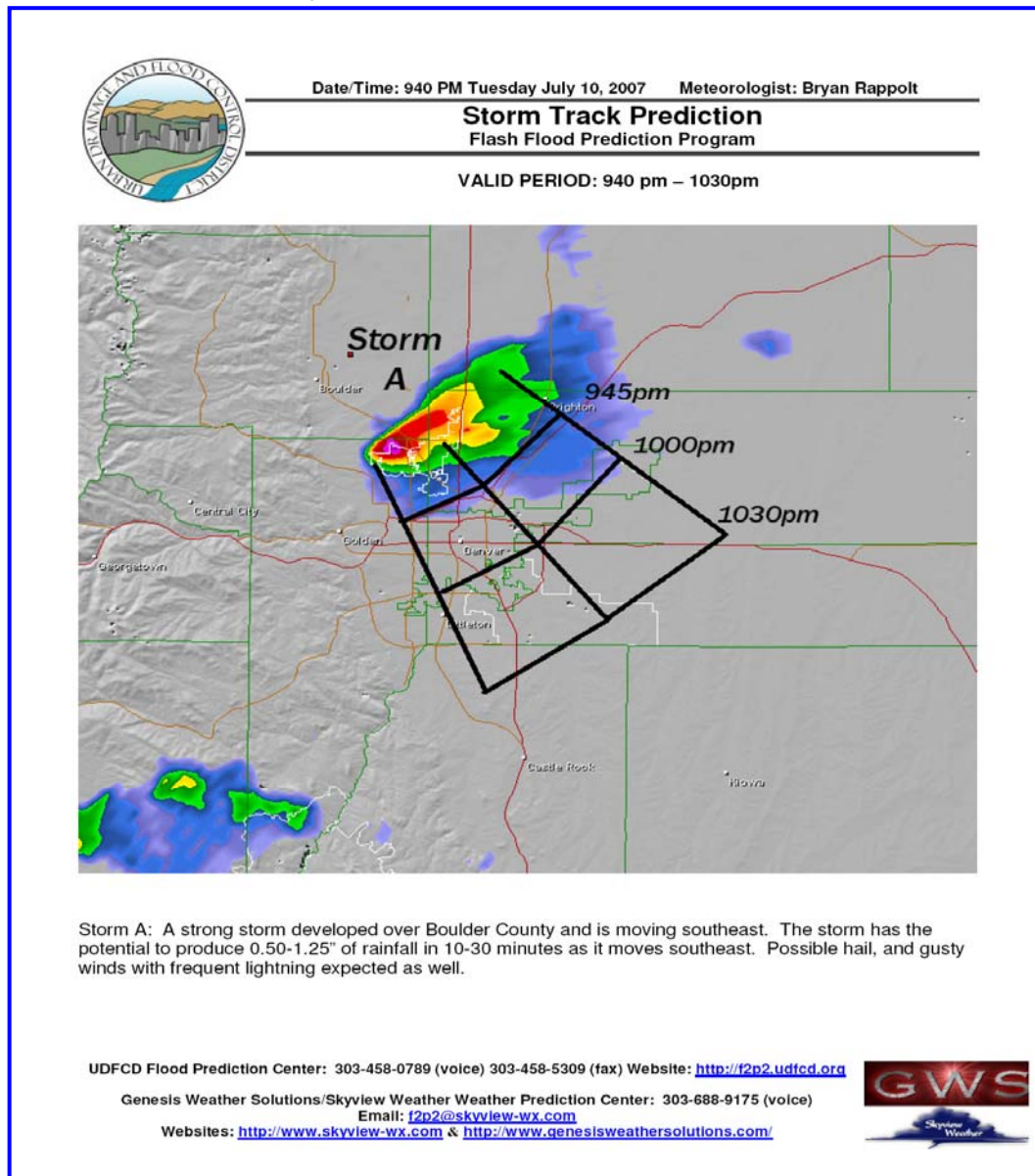
The PMS has made the following recommendations for future improvements to the F2P2:

### Storm Track

The PMS recommends that a back-up Storm Track application be put in place that would be used if the primary GIS-based Storm Track application fails. The PMS experienced latency issues of the GIS-based WDT radar data that is overlaid on the UDFCD Storm Track application. The PMS developed a Storm Track product alternative using GRLevel, a level II and level III radar display application that both UDFCD and the PMS subscribes to and was used operationally within the 2008 F2P2. Perhaps this Storm Track product could be specified as a back up to the storm track application. Figure 8 is an example of a storm track produced by GRLevel software.



Figure 6: GRLevel Storm Track



## Flood Prediction Equipment

The PMS recommends that the one “older” computer in the northeast corner of the FPC be replaced with a new computer that can provide video to multiple (two or more) LCD monitors simultaneously. The new computer should be used to produce Storm Tracks with ArcGIS and view Doppler radar using GRLevel simultaneously.

# APPENDIX A

Table 7: 2008 F2P2 Thunderstorm (TRW) Days

Date	Comments	Adco	Arapco	Boco	Bmco	Denco	Dougco	Jeffco	Denco	Daily Total
	2008 Metro Denver/UDFCD Thunderstorm Days									
15-Apr	No Lightning									0
16-Apr	No Lightning									0
17-Apr	No Lightning									0
18-Apr	No Lightning									0
19-Apr	No Lightning									0
20-Apr	No Lightning									0
21-Apr	No Lightning									0
22-Apr	No Lightning									0
23-Apr	No Lightning									0
24-Apr	No Lightning									0
25-Apr	No Lightning									0
26-Apr	No Lightning									0
27-Apr	No Lightning									0
28-Apr	No Lightning									0
29-Apr	No Lightning									0
30-Apr	No Lightning									0
1-May	No Lightning									0
2-May	No Lightning									0
3-May	No Lightning									0
4-May	No Lightning									0
5-May	No Lightning									0
6-May	TStrms developed over Dgls Cnty late PM, drifted N into Arap Cnty		1				1		1	3
7-May	Strng Tstorms with Hvy Rains developed 5-6am, widespread lightning	1	1	1	1	1	1	1	1	8
8-May	Strong TStrms Jeffco and moved across Dgls Cnty	1	1				1	1	1	6
9-May	No Lightning									0
10-May	Weak TStrms occasional lightning		1			1			1	3
11-May	No Lightning									0
12-May	Late day TStrm developing behind cold front	1	1			1	1	1	1	6
13-May	No Lightning									0
14-May	No Lightning									0
15-May	No Lightning									0
16-May	No Lightning									0
17-May	No Lightning									0
18-May	No Lightning									0
19-May	No Lightning									0
20-May	Nothing Denver, PM Storms COS area									0
21-May	No Lightning									0
22-May	Widespread Storms	1	1	1	1	1	1	1	1	8
23-May	Scattered Tstorms						1		1	2
24-May	No Lightning									0
25-May	No Lightning									0
26-May	Weak TStrms			1				1		2
27-May	Weak TStrms little lightning	1			1			1		3
28-May	Scattered Tstorms	1	1						1	3
29-May	No Lightning									0
30-May	No Lightning									0
31-May	Scattered Tstorms lots heavy lightning South	1			1		1		1	4
1-Jun	Only one strike Golden area							1		1
2-Jun	Most Lightning In Northern Denver	1	1		1	1			1	5
3-Jun	Widespread Tstorms w/ lightning	1	1	1	1	1	1	1	1	8
4-Jun	Widespread lightning esp. in Northern metro	1	1	1	1	1	1	1	1	8
5-Jun	Few scattered lightning in Metro Strong Storms in COS						1		1	2
6-Jun	No Lightning									0
7-Jun	No Lightning									0
8-Jun	Scattered Tstorms		1			1	1		1	4
9-Jun	One Lightning Strike in COS									0
10-Jun	No Lightning									0
11-Jun	Couple isolated strikes						1	1		2
12-Jun	No Lightning									0
13-Jun	No Lightning									0

Date	Comments	Adco	Arapco	Boco	Brmco	Denco	Dougco	Jeffco	Denco	Daily Total
14-Jun	No Lightning									0
15-Jun	No Lightning									0
16-Jun	Scattered T-storms with Lightning					1	1	1	1	4
17-Jun	Lightning in COS area									0
18-Jun	Scattered lightning mainly in Northern and Southern CO		1	1			1	1	1	5
19-Jun	Widespread lightning	1	1	1	1	1	1	1	1	8
20-Jun	Widespread lightning in the East and South	1	1			1	1		1	5
21-Jun	No Lightning									0
22-Jun	Scattered Lightning			1			1	1	1	4
23-Jun	Widespread Scattered Lightning		1	1			1	1	1	5
24-Jun	Scattered Lightning	1	1	1			1	1	1	6
25-Jun	Widespread lightning	1	1	1		1	1	1	1	7
26-Jun	Scattered Lightning						1	1	1	3
27-Jun	Lightning in Southern Metro						1			1
28-Jun	Lightning in southern co									0
29-Jun	No Lightning									0
30-Jun	Scattered Lightning to the west and south						1	1	1	3
1-Jul	LOTS of lightning		1	1	1	1	1	1	1	7
2-Jul	Widespread lightning	1		1	1	1	1	1	1	7
3-Jul	Lightning mostly scattered across South									0
4-Jul	No Lightning						1	1	1	3
5-Jul	Scattered lightning to the West			1			1	1	1	3
6-Jul	WIDESPREAD Lightning	1	1	1		1	1	11	1	17
7-Jul	Scattered Lightning			1	1			1		3
8-Jul	widespread lightning	1	1	1	1	1	1	1	1	8
9-Jul	Very few isolated strikes							1		1
10-Jul	Lightning only by eagle rock									0
11-Jul	No Lightning									0
12-Jul	No Lightning									0
13-Jul	No Lightning									0
14-Jul	Very little isolated lightning in Southern Colorado									0
15-Jul	Scattered lightning in Southern CO									0
16-Jul	Scattered lightning in South		1				1		1	3
17-Jul	Isolated strikes throughout Western CO with heavy lightning in East	1	1	1						3
18-Jul	Heavy lightning throughout central and eastern CO	1	1			1	1	1	1	6
19-Jul	Little lightning	1		1	1		1	1	1	6
20-Jul	Very few strikes in Northwest									0
21-Jul	Scattered lightning in West									0
22-Jul	Lightning in North west with isolated strikes in south			1				1		2
23-Jul	Extremely widespread lightning throughout entire state	1	1	1	1		1	1	1	7
24-Jul	Widespread lightning	1	1			1	1	1	1	6
25-Jul	Scattered Lightning	1	1	1	1	1	1	1	1	8
26-Jul	Very few strikes near Estes and Granby with one strike in Douglas						1			1
27-Jul	Scattered lightning with a couple strikes in metro	1	1		1		1	1	1	6
28-Jul	Heavy lightning in Western CO with moderate lightning in East	1	1			1			1	4
29-Jul	Very little lightning in Jefferson	1						1		2
30-Jul	No Lightning									0
31-Jul	No Lightning									0
1-Aug	No Lightning									0
2-Aug	Small scattered lightning			1			1	1		3
3-Aug	Scattered lightning	1	1	1	1		1	1	1	7
4-Aug	Small Scatterings of lightning	1					1	1	1	4
5-Aug	Heavy T-storms	1	1			1	1	1	1	6
6-Aug	Widespread lightning and Tstorms	1	1	1	1	1	1	1	1	8
7-Aug	No Lightning									0
8-Aug	Widespread Lightning and Heavy T-storms	1	1	1		1	1	1	1	7
9-Aug	Scattered Lightning missing metro Denver						1	1		2
10-Aug	Isolated strikes Metro Denver	1		1			1	1	1	5
11-Aug	Isolated strikes Metro Denver, widespread Dgls, El Paso Cnty	1	1	1			1	1	1	6
12-Aug	Isolates strikes	1				1	1	1	1	5
13-Aug	Very isolated El Paso Cnty									0
14-Aug	Widespread lightning	1	1	1		1	1	1	1	7
15-Aug	Widespread lightning	1	1	1		1	1	1	1	7

Date	Comments	Adco	Arapco	Boco	Bmco	Denco	Dougco	Jeffco	Denco	Daily Total
16-Aug	Widespread lightning	1	1	1	1	1	1	1	1	8
17-Aug	Widespread lightning S and SE of Denver		1			1	1	1	1	5
18-Aug	No Lightning									0
19-Aug	No Lightning									0
20-Aug	Moderate Lightning		1	1		1	1	1	1	6
21-Aug	No Lightning									0
22-Aug	Lightning SW		1			1	1	1	1	5
23-Aug	Widespread Lightning		1	1	1		1	1	1	6
24-Aug	Widespread Lightning	1	1				1	1	1	5
25-Aug	Widespread Lightning	1	1	1		1	1	1	1	7
26-Aug	Widespread Lightning	1	1	1	1	1	1	1	1	8
27-Aug	No Lightning									0
28-Aug	No Lightning									0
29-Aug	Areas south						1			1
30-Aug	Minimal Lightning						1			1
31-Aug	Moderate Lightning	1	1	1		1	1	1	1	7
1-Sep	Isolated Lightning Boulder only			1					1	2
2-Sep	No Lightning									0
3-Sep	Isolated Lightning						1	1	1	3
4-Sep	Heavy lightning areas East	1	1			1			1	4
5-Sep	No Lightning									0
6-Sep	No Lightning									0
7-Sep	No Lightning									0
8-Sep	No Lightning									0
9-Sep	No Lightning Denver, isltd lightning foothills									0
10-Sep	No Lightning Denver, isltd lightning foothills									0
11-Sep	No Lightning Denver, isltd lightning foothills							1		1
12-Sep	No Lightning Denver, isltd lightning foothills									0
13-Sep	Very isolated El Paso Cnty				1			1	1	3
14-Sep	No Lightning									0
15-Sep	No Lightning									0
										0
Totals:		42	45	37	22	35	61	69	60	
% Thunderstorm Days in or near District:		27.5	29.4	24.2	14.4	22.9	39.9	45.1	39.2	