

# Memo



**Date:** September 8, 2016  
**To:** Kevin Stewart  
**From:** Markus Ritsch  
**Subject:** August 2016 ALERT Data Analysis

## I. ALERT Data Source

Raw ALERT data records extracted from the Urban Drainage and Flood Control District's NovaStar 5 base station were analyzed for the period August 1 through August 31, 2016.

## II. General System Analysis Summary

The District receives data through both the legacy ALERT channel and through the ALERT2 (concentrator plus A2 self-reports) channel. The following (Table 1) quantifies the data reports received by each channel.

**Table 1. Reception of Data at Diamond Hill (Legacy, ALERT2 and Concentrator Reports from Recdatalog)**

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Tot
Legacy	118,519	264,375	241,517	266,465	245,856	254,744	262,732	257,816					1,912,024
Concentrator	194,948	418,430	407,965	435,747	416,968	423,152	423,762	409,121					3,130,093
ALERT2	136,144	399,530	505,195	540,654	508,036	509,129	473,766	571,162					3,643,616
<b>TOTAL</b>	<b>449,611</b>	<b>1,082,335</b>	<b>1,154,677</b>	<b>1,242,866</b>	<b>1,170,860</b>	<b>1,187,025</b>	<b>1,160,260</b>	<b>1,238,099</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>8,685,733</b>
Conc/Leg	1.64	1.58	1.69	1.64	1.70	1.66	1.61	1.59	1.00	1.00	1.00	1.00	1.64
DataChron	645,913	662,847	674,426	742,749	732,116	776,223	757,956	775,073					5,767,303

The District operates two NovaStar5 base stations: the primary (ns5a) at Diamond Hill and a redundant base (ns5b) at Greenhouse Data. Additional analyses are conducted on the data received by these two base stations (Table 2). The data received by both base stations for the month are shown below.

**Table 2. Comparison of Data Reception by ns5a and ns5b**

NS5A (Diamond Hill)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Tot
Legacy	118,519	264,375	241,517	266,465	245,856	254,744	262,732	257,816					1,912,024
Concentrator	194,948	418,430	407,965	435,747	416,968	423,152	423,762	409,121					3,130,093
ALERT2	136,144	399,530	505,195	540,654	508,036	509,129	473,766	571,162					3,643,616
NS5B (Greenhouse)													
Legacy	118,610	264,516	263,959	266,509	264,138	258,435	262,307	258,034					1,956,508
Concentrator	194,968	418,532	446,510	435,558	447,154	428,264	422,702	409,148					3,202,836
ALERT2	136,330	399,841	552,747	540,161	544,926	515,425	472,516	571,519					3,737,465
<b>Diff (NS5a-NS5b)</b>													
Legacy (Digi One)	-91	-141	-22,442	-44	-18,282	-3,691	425	-218	0	0	0	0	-44,484
Concentrator (B2010)	-20	-102	-38,545	189	-30,186	-5,112	1,060	-27	0	0	0	0	-72,743
ALERT2 (B2010)	-186	-311	-47,552	493	-36,890	-6,296	1,250	-357	0	0	0	0	-89,849
Comments	Recdatalog format changed...missing 1/3 of the month		DH base was down for a period		DH server was down at the end of May		First month that DH has better reception than GH						

The reception rates between Diamond Hill and Greenhouse are fairly consistent this month. The Greenhouse server seems to consistently receive a few more reports each month relative to Diamond Hill. A comparison between Diamond Hill and Greenhouse is made below in order to better understand the difference in ALERT2 reports between the two base stations.

**Table 3. Difference in ALERT2 Reports Received at Diamond Hill and Greenhouse (sorted by repeater)**

	<b>West Creek (6001)</b>	<b>Smoky Hill (6502)</b>	<b>Blue Mt (6503)</b>	<b>Lee Hill (6505)</b>	<b>Gold Hill (6506)</b>	<b>Total</b>
Diamond Hill	48,323	130,660	123,482	136,746	131,951	571,162
Greenhouse	48,323	130,666	123,827	136,746	131,957	571,519
Difference	0	-6	-345	0	-6	- 357
Comments			The majority of difference is attributable to Blue Mt.			

The following shows the distribution of the difference between originating source address.

**Table 4. Difference in ALERT2 Reports Received at Diamond Hill and Greenhouse (sorted by station)**

	<b>Maple Grove (10013)</b>	<b>West Creek Fire (10027)</b>	<b>Diamond Hill Wx (10028)</b>	<b>Side Creek Park (10033)</b>	<b>West Creek Wx (10037)</b>	<b>Little Dry Creek (10038)</b>	<b>Total</b>
Diamond Hill	8,629	16,929	71,085	492	13,554	9,015	119,704
Greenhouse	8,901	16,928	71,097	494	13,555	9,086	120,061
Difference	-272	1	-12	-2	-1	-71	- 357
Comments	The majority of the differences are from Maple Grove						

The daily ratio of concentrator to legacy reports is shown.

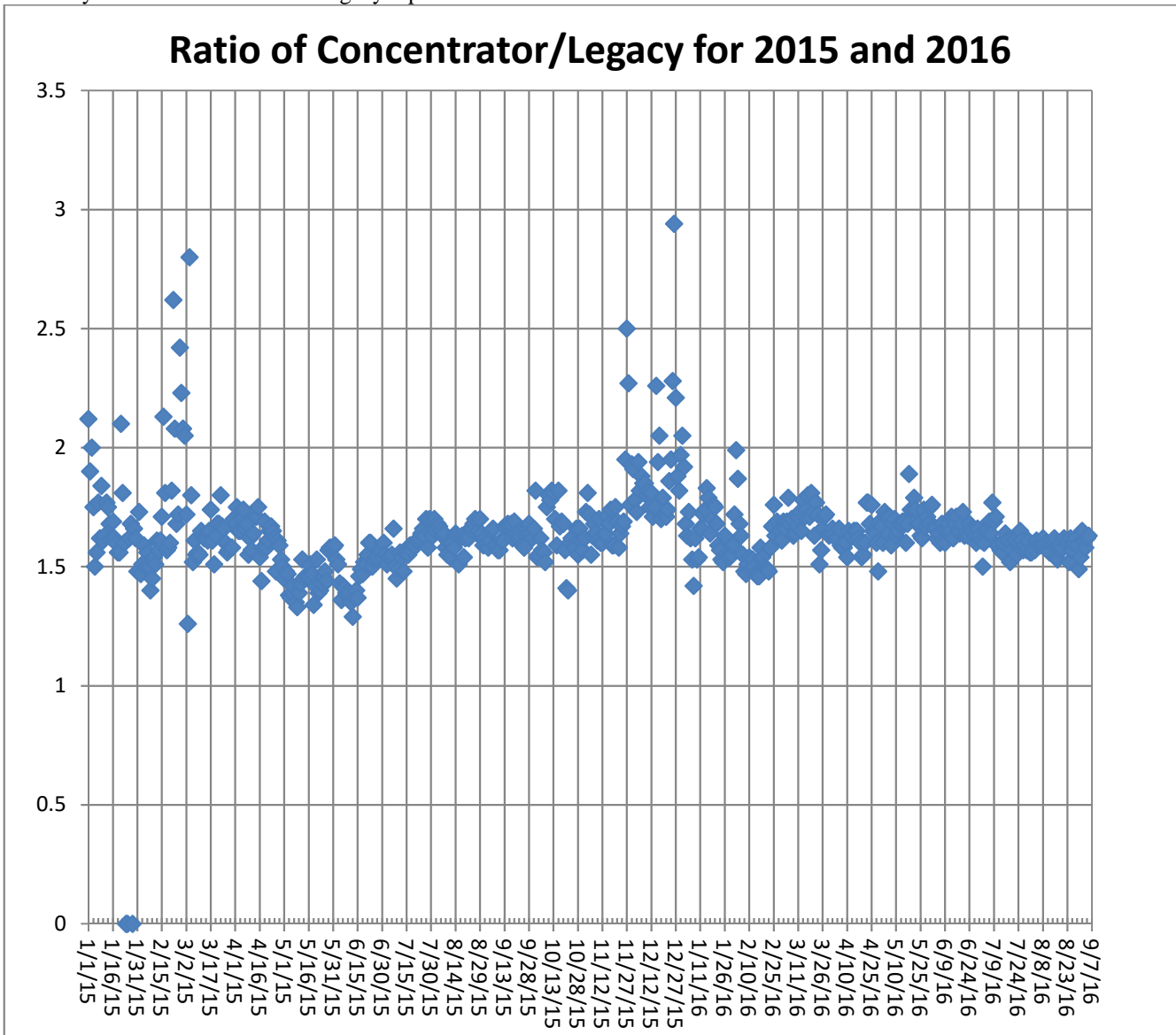


Figure 1. Daily Ratio of Concentrator Reports to Legacy Reports

The ratio becomes more volatile in the cold months as the Blue Mountain repeater has problems with legacy ALERT reporting when the temperature drops.

## **A. Continuous Operation of Base Receiver/Decoder**

The base station was in continuous operation for the entire month. Data was collected on a continuous basis for every hour of every day for a total of 744 hours of operation. Outages of less than one hour are not identified.

## **B. Specific Issues Identified**

Performance of the following sensors (Table 5) was questionable this month.

**Table 5. Sensors with Poor Performance Characteristics**

<b>Sensor ID</b>	<b>Description</b>	<b>Comments</b>
2790	Wx-W. Cherry Creek	Poor performance
2360	Indian Hills	Poor performance
4470	Little Narrows	Poor performance
2980	Dakan Road	Poor Performance
430	Utah Park	Poor performance
1710	Shop Creek	Poor performance
4330	Hansen Rain	Poor performance
2330	Morrison	Poor performance
6601	Wx-Magnolia	Station died on or about June 27 and started again on July 12
2271, 2272, 2274	Unknown IDs	Possibly coming from Cub Creek below Blue (2270)
623	Unknown ID with a large number of reports	Quincy/Highline
2283	Unknown ID with a large number of reports	Kinney Peak
443	Unknown ID with a large number of reports	Aurora FS #7
1430	Unknown ID with a large number of reports	

## C. Performance of New A2 Sites

This section of the report will look at specific reporting characteristics of the new A2 sites by analyzing their APDUID (Application PDU Identifier). The APDUID is a cyclical, incrementing counter from 0 to 6. Tracking skipped values and restarts of the application control byte counter provides useful insight into site performance and general network health. The performance of the cyclical counter is quantified for each A2 self-reporting site and repeater path (Table 6).

**Table 6. APDUID Performance of A2 Sites by Source Address**

Description	ID	W. Creek (6001)	Smoky Hill (6502)	Blue Mt. (6503)	Lee Hill (6505)	Gold Hill (6506)
Newlin Gulch	3070		0.95	0.96	0.96	0.95
Heritage Regional Park	3090		0.93	0.93	0.93	0.91
Magnolia	6601		0.88	0.85	0.89	0.87
Blackstone	10010		0.95	0.95	0.75	0.93
ETG @ Hampden	10011		0.86	0.86	0.85	0.86
Carr Street (100)	10012		0.83	0.98	0.96	0.92
Maple Grove (1000)	10013		0.94	0.99	0.99	0.99
Upper Sellers	10014	0.89				
Haystack Road	10015	0.91				
Sand Cr at Colfax	10016		0.99	0.98	0.98	0.98
James Creek	10017		0.29	--	0.99	0.95
Lower Left Hand (4453)	10018		0.99	--	1.00	0.10
Murphy Creek (870)	10019		0.99	0.99	0.99	0.96
OneRain Weather	10020		0.79	0.95	0.81	0.93
S. St. Vrain at Berry Ridge	10021		--	--	0.99	--
Arvada/Blunn Reservoir	10022		0.97	0.97	0.96	0.96
Havana Pond	10023		0.99	0.99	0.99	0.99
Westerly Creek Dam	10024		0.99	0.99	0.99	0.99
Lena @ Nolte Pond (1023)	10025		0.83	1.00	0.99	0.40
Trumbull (Hayman)	10026	0.92				
West Creek (Hayman)	10027	0.86				
Diamond Hill (1420)	10028		0.87	0.87	0.87	0.87
Plum Creek at Sedalia	10029	0.96				
Coal Creek at McCaslin	10030		0.98	1.00	1.00	0.98
Boulder Cr. Broadway (4583)	10031		0.97	0.10	0.91	0.99
Weir Gulch	10032		0.82	0.91	0.93	0.23
Side Creek Park (830)	10033		0.90	0.82	0.89	0.90
Not Used	10034		--	--	--	--
Sanderson Gulch (1340)	10035		0.99	0.99	0.99	0.99
Porphyry Mtn (4850)	10036		0.96	--	0.96	0.89
West Creek WX (3020)	10037	0.87				
Little Dry Creek at 64 <sup>th</sup> (1310)	10038		0.94	0.96	0.94	0.96

## D. ALERT2 Repeater Loading

The District's ALERT2 architecture utilizes 5 repeaters with a single transmit frequency (170.300 MHz) to Diamond Hill. The repeaters utilize a 20 second frame where each repeater is allocated a slot of specific size and an offset within the frame. The slot allocated to each repeater is sized appropriately to accommodate the total number of existing and future remote sites routed through that repeater. Each repeater is shown along with its designated slot (Table 7). Currently there is no pass-listing for the ALERT2 repeaters. Any remote ALERT2 site can be received by all repeaters and re-broadcast to the base except for West Creek which has an input frequency unique to Douglas County.

**Table 7. ALERT2 Repeater Architecture**

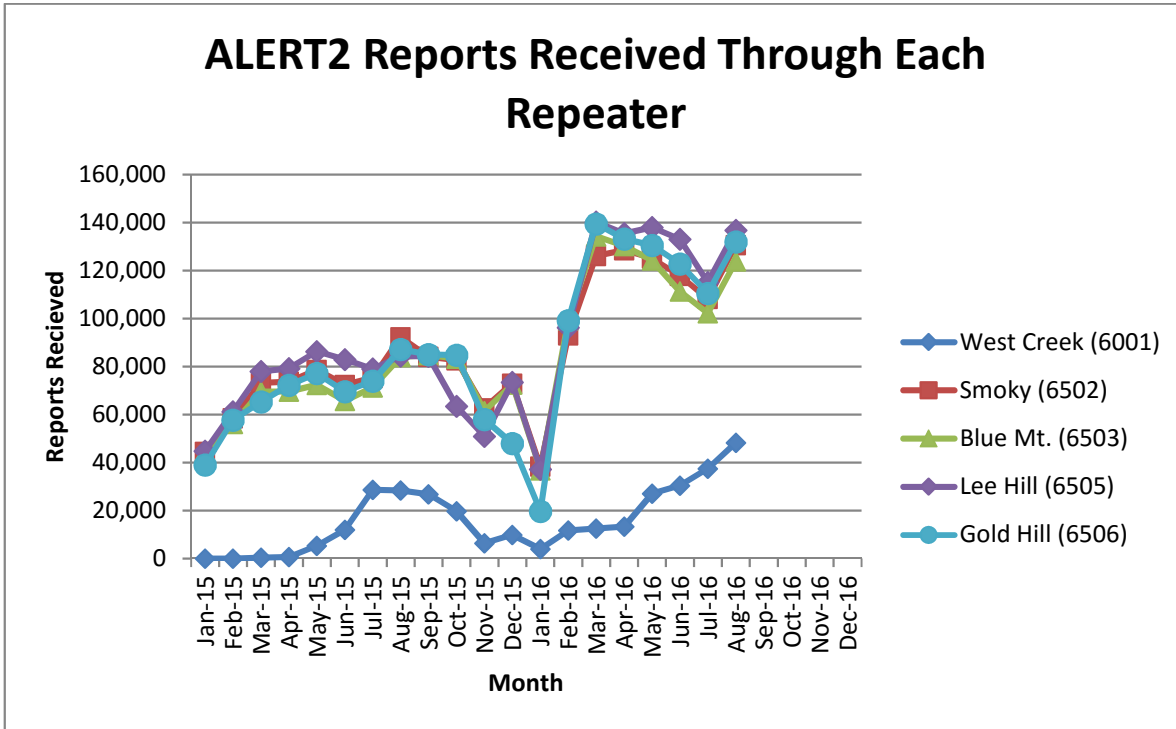
Repeater	Slot Size (sec)	Slot Offset (sec)	Source Address	ALERT2 Input Frequency (MHz)	ALERT2 Output Frequency (MHz) – received at Diamond Hill
West Creek	2	0	6001	169.425	170.300
Smoky	3	2	6502	169.525	170.300
Blue Mt.	4	5	6503	169.525	170.300
Lee Hill	3	9	6505	169.525	170.300
Gold Hill	3	12	6506	169.525	170.300
Magnolia	5	15	6507		170.300
Frame Size	20				

The following tables summarize the total number of reports received through each repeater (Table 8). This helps to quantify repeater loading for the ALERT2 backbone.

**Table 8. ALERT2 Reports Received through Each Repeater (Only A2 Self Reports)**

Month-Yr	West Creek (6001)	Smoky (6502)	Blue Mt. (6503)	Lee Hill (6505)	Gold Hill (6506)	TOTAL
Jan-15	0	44,501	44,636	44,783	39,007	172,927
Feb-15	0	58,543	56,150	61,160	57,764	233,617
Mar-15	346	73,198	69,604	77,968	65,323	286,439
Apr-15	595	73,711	69,568	79,215	72,310	295,399
May-15	5,259	78,694	72,340	86,297	77,174	319,764
June-15	11,987	72,449	65,742	82,998	69,570	302,746
July-15	28,595	75,379	71,394	79,026	74,041	328,435
Aug-15	28,409	92,299	84,057	84,363	87,211	376,339
Sep-15	26,809	84,143	84,776	84,289	85,123	365,140
Oct-15	19,775	82,683	83,390	63,475**	84,825	334,148
Nov-15	6,438	62,615	61,477	50,888	58,004	239,422
Dec-15	9,835	72,886	72,465	73,431	47,996	276,613
Jan-16	4,034	38,348	36,826	37,168	19,768	138,160
Feb-16	11,732	93,120	99,206	96,284	99,188	399,530
Mar-16	12,533	126,123	134,329	140,226	139,536	552,747
Apr-16	13,262	128,473	130,223	135,499	133,197	540,654
May-16	27,002	125,098	124,280	138,033	130,513	544,926
Jun-16	30,405	117,877	111,309	133,036	122,798	515,425
Jul-16	37,492	108,334	102,335	115,028	110,577	473,766
Aug-16	48,323	130,666	123,827	136,746	131,957	571,519

\*\* - The number of reports coming through Lee Hill declined in October



**Figure 2. Reports received through each repeater (ALERT2 Only)**

A convenient mechanism to track repeater performance throughout the year is to monitor total ALERT2 reports passed by each repeater. In general, each of the primary repeaters in the District process an equivalent number of ALERT2 reports because pass/block filtering is not being used. Several months are evident where the throughput of one repeater is not consistent with the other three.

The Magnolia Weather station was down from June 27 through July 12. This weather station reports on a frequency of 5 minutes and it reports up to ten total parameters. On a typical day it may send 2,500 total reports. It was not reporting for at least eleven days in July which resulted in a total loss of up to 25,000 reports. This likely explains the drop in total throughput for the months of June and July.

The following tables summarize the system-wide latency of ALERT2 self-reports (Table 9 and Table 10).

**Table 9. System-Wide Latency of ALERT2 Self-Reports (seconds)**

Statistical Parameter	Value (sec)	Comments
Mean	52.47	The average time it took a report from the field to reach the base
Minimum	-20	The minimum time it took for a report to go from the field to the base
Maximum	288	The maximum time it took for a report to go from the field to the base

**Table 10. Summary of ALERT2 System-Wide Latency (seconds)**

Statistical Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	66.17	72.6	75.36	67.48	53.36	57.42	55.99	52.47				
Minimum	3	2	1	3	2	2	3	-20				
Maximum	300	261	521	745	262	226	280	288				
Station with Max Latency	Magnolia WX (6602)	Magnolia WX (6607)	Sand Cr (10016)	Magnolia WX (6601)	Magnolia WX (6605)	Westerly Cr Dam (10024)	West Cr WX (3019)	West Cr WX (3019)				

The large latency of 288 seconds and the minimum latency of -20 seconds came from West Creek WX (3019).



### ***E. TDMA Time Slot Size***

ALERT2 networks will have problems with missing timed station reports when they have transmit times at some stations that exceeded the TDMA slot size. For example, a test transmission from a site may be received when it's sent manually from the site but the timed transmissions are not received. This is a problem with the station preceding the missing station exceeding its slot size in the TDMA assignment.

A program is written for the UDFCD that checks the receive data log files looking for station reports that are too long. For example, the MANT TS=... the Length=# or the data packet size should not be more than 45 bytes. The only stations found to exceed the 45 byte limit were repeaters.....which is acceptable since their slot size is much larger than 0.5 seconds. No stations were found with a slot length exceeding 45 bytes.

### ***F. Inefficient ALERT2 Packets***

An inefficient ALERT2 packet contains multiple (MANT) data packets per air link packet. ALERT2 supports the composition of air link packets containing multiple data values in a single MANT packet. Using a single MANT packet for each data packet is an efficient use of the ALERT2 protocol and should be avoided. The following sites were identified as possibly being configured inefficiently:

- ) Newlin Gulch (3070) – Campbell Scientific – this transmitter was updated with a new EPROM that allows for MSR reporting
- ) OneRain Weather (10020) – Campbell Scientific
- ) Diamond Hill (10028) – not sure what transmitter is being used here.
- ) Plum Creek at Sedalia (10029) – Campbell Scientific

## G. Rain Sensor Timer Reporting Summary

The following analysis assumes that each legacy rain sensor has a 12-hour timer-reporting interval and each A2 rain sensor has a 1-hour timer-reporting interval. The worst performing rain sensors for the month are summarized (Table 11).

**Table 11. Monthly Summary of Sensors with Poor Timer Performance (Sensor ID)**

Jan*	Feb*	Mar*	Apr	May	Jun	Jul	Aug	Sep	Oct*	Nov*	Dec*
10026	3020	4470	4850	2790	2790	2790	2790				
4550	4520	2790	2790	1620	430	1530	2360				
2330	2790	4850	2360	2750	4330	430	2330				
4270	4850	5940	1420	2330	2330	4270	1530				
1660	10026	10023	4270	5860	10026	1710	2230				
4330	10020	10026	4520	2360	2360	4330	1620				

\*- Only sensors that operate year-round (weather stations and stations in Boulder County) are included for the analysis in these months.

Sensors identified as having poor timer performance in multiple months are shaded with unique colors. A developing trend can thus be identified from the color shading as the year progresses.

## III. Rain Sensor Event Reporting Summary

### A. District-Wide Total Tip/Count Statistics

The incrementing reports from all 1-mm rain sensors were analyzed to quantify the District-wide statistical total monthly tip summary (Table 12). For the months of January, February, March, October, November and December only the stations that operate year-round are included in the rain event analysis. These stations include all weather stations and the stations in Boulder County.

**Table 12. District-Wide Total Tip/Count Statistical Summary**

Statistical Parameter	Value	Comments
Mean	31.0	Only the 1-mm rain sensors were included in the analysis
Median	26	Only the 1-mm rain sensors were included in the analysis
Standard deviation	20.3	Only the 1-mm rain sensors were included in the analysis
Mean plus three standard deviations	91.8	Only the 1-mm rain sensors were included in the analysis
Mean minus two standard deviations	--	Only the 1-mm rain sensors were included in the analysis
Minimum total count	1	Leyden Confluence (210)
Maximum total count	115	Powers Park (1500)
Sensors showing <b>NO</b> rain for the month		
Sensors greater than 3 SD (over reporting)		Powers Park (1500), Filter Plant (4100), W Cherry Head (2920), Hackett Mountain (5880)

## B. Monthly Average Tip/Count Summary

A monthly summary of the District-wide mean total tip/count is presented (Table 13).

**Table 13. Monthly Summary of District-Wide Mean Total 1-mm Tip/Count**

Year	Jan*	Feb*	Mar*	Apr	May	Jun	Jul	Aug	Sep	Oct*	Nov*	Dec*	Ave
2006	4.62	5.92	18.39	20.47	19.44	13.75	74.03	46.89	24.17	41.13	5.04	16.45	<b>24.19</b>
2007	11.56	5.40	29.75	65.03	68.30	15.87	36.20	46.38	22.13	29.50	6.54	11.29	<b>29.00</b>
2008	4.05	7.38	12.26	20.57	54.82	26.06	16.43	90.20	37.54	19.59	2.82	9.24	<b>25.08</b>
2009	6.33	3.11	11.37	59.26	63.45	68.00	65.00	20.00	27.29	30.24	11.00	5.60	<b>30.89</b>
2010	5.97	11.90	32.54	70.57	39.63	56.04	50.23	31.01	4.18	18.31	8.30	3.31	<b>27.67</b>
2011	6.78	7.45	7.54	33.94	92.68	39.42	90.87	18.25	37.67	25.73	10.41	13.59	<b>32.03</b>
2012	4.89	13.57	2.35	30.17	38.97	19.35	73.03	11.31	48.81	22.32	2.98	4.18	<b>22.66</b>
2013	2.96	14.31	21.86	35.96	45.87	16.39	52.33	50.63	229.74	29.64	5.86	4.00	<b>42.46</b>
2014	6.88	11.86	25.91	29.30	77.30	29.16	99.73	43.59	50.96	29.26	13.36	8.11	<b>35.45</b>
2015	9.88	24.42	20.78	69.75	143.07	86.93	54.59	29.95	7.16	53.28	22.08	10.80	<b>44.39</b>
2016	4.68	9.91	32.30	52.10	49.40	40.50	24.20	31.00					
<b>Ave</b>	<b>6.24</b>	<b>10.48</b>	<b>19.55</b>	<b>44.28</b>	<b>62.99</b>	<b>37.41</b>	<b>57.88</b>	<b>38.11</b>	<b>44.51</b>	<b>27.18</b>	<b>8.04</b>	<b>7.87</b>	<b>28.53</b>

\*- Only sensors that operate year-round (weather stations and stations in Boulder County) are included for the analysis in these months.

## C. Sensors with a Jump of Six or More in the Sequential Count

Several sensors experienced a large jump in the sequential tip count (Table 14).

**Table 14. Sensors with a Jump of 6 or More in Sequential Count**

Sensor Description	Sensor ID	Comment
W. Cherry Creek	2790	Several large jumps in count were identified this month
Sellers Gulch at Haystack	10015	Two jumps were identified this month

## D. Sensor-by-Sensor Incrementing Count Summary

The system-wide reception rate of incrementing, 1-mm tip reports for the month was approximately 94 percent. A total of 5,694 incrementing reports were received and a total of 6,039 reports were expected. The total loss of incrementing reports for the month was approximately 6 percent. Those sensors with the worst event transmission performance are summarized (Table 15).

**Table 15. Monthly Summary of Sensors with the Worst Performance**

Jan*	Feb*	Mar*	Apr	May	Jun	Jul	Aug	Sep	Oct*	Nov*	Dec*
1530	4270	2790	2790	2790	2790	2790	2790				
4550	10026	10026	5900	4330	4270	2360	4870				
1640	2790	5940	4260	1620	1620	4470	2360				
4180	4240	4790	950	4470	4330	2970	1710				
1660	5940	4510	2330	2230	2330	4330	4470				
4840	4510	4870	1480	2980	10026	1620	1620				

\*-Only sensors that are operational year-round (weather stations and stations in Boulder County) are included for the analysis in these months.

Sensors identified as having poor event performance in multiple months are shaded with unique colors. A developing trend can thus be identified from the color shading as the year progresses.

## IV. Unknown Device Analysis – Received Data Log

The ALERT IDs present in the audio signal received by the decoder are compared against a list of “active” device IDs that are defined within NovaStar. Those IDs received by the decoder that are not defined within NovaStar are considered to be “unknown” and may be the result of radio noise or problems with the telemetry system. The reception of “unknown” device reports for the month is summarized (Table 16).

**Table 16. Summary of Unknown IDs**

Description	Concentrator	Legacy	A2
Total number of unknown IDs (IDs without a device definition)	233	220	0
Total reports from unknown IDs	2,029	2,041	0
Unknown IDs with only a single received report (potential noise)	164	170	0
Total reports from all IDs – RecData Log entire month	409,148	258,034	571,519
Unknown reports as a fraction of total reports	0.50%	0.79%	0%

The total number of reports from unknown sensors is very small relative to the total reports received for the month. Shown below (Table 17) are the total reports received from unknown sensor IDs for each month of the year.

**Table 17. Monthly Summary of Total Reports from Unknown IDs (Concentrator)**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2010	1,220	1,474	1,276	1,174	721	5,707	610	1,738	442	533	2,857	6,396
2011	1,231	2,165	3,065	1,254	2,051	439	489	456	191	683	747	861
2012	692	750	1,575	977	5,469	11,016	453	683	774	2,657	3,854	5,466
2013	4,265	994	1,100	2,589	3,623	6,973	5,230	1,070	4,429	781	13,459	1,213
2014	870	4,284	2,399	2,104	25,746	1,832	3,983	268	369	448	470	1,099
2015	542	9,137	1,524	1,007	946	699	1,179	1,860	1,153	1,063	600	619
2016	323	1,241	3,085	3,586	1,268	945	1,408	2,029				

The fraction of reports from unknown sensors relative to the total number of reports is shown below (Table 18).

**Table 18. Monthly Percent of Unknown Sensor Reports (Concentrator)**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2010	0.42%	0.56%	0.38%	0.32%	0.20%	1.61%	0.17%	0.49%	0.13%	0.16%	0.93%	1.88%
2011	0.39%	0.73%	0.90%	0.37%	0.58%	0.12%	0.12%	0.05%	0.12%	0.18%	0.22%	0.26%
2012	0.30%	0.25%	0.43%	0.26%	1.37%	2.74%	0.11%	0.18%	0.20%	0.72%	1.15%	1.62%
2013	1.40%	0.31%	0.29%	0.60%	0.37%	0.61%	0.82%	0.21%	0.96%	0.31%	5.37%	0.23%
2014	0.14%	0.94%	0.40%	0.34%	3.95%	0.34%	0.66%	0.03%	0.03%	0.07%	0.11%	0.26%
2015	0.15%	2.25%	0.34%	0.22%	0.19%	0.14%	0.26%	0.42%	0.29%	0.24%	0.15%	0.15%
2016	0.10%	0.30%	0.69%	0.82%	0.28%	0.22%	0.33%	0.50%				

Any month shaded in yellow has an excessive number of reports from unknown sensors.

A number of “unknown” sensors had multiple reports, which may indicate the existence of a transmitter that is sending information on an ID that is not currently defined within NovaStar. The unknown IDs with multiple reports including the number of reports received by each are shown (Table 19).

**Table 19. Reports Received by Unknown IDs**

Concentrator		Legacy ALERT		Comment
Unknown ID	Reports	Unknown ID	Reports	
623	1153	623	1095	
--	--	0, 1, 2	117, 52, 52	Only on the legacy channel
1430	115	1430	105	
443	60	443	58	
2283	50	2283	49	
2271, 2272, 2274	48, 48, 48	2271, 2272, 2274	48, 47, 46	

## V. Sensors with Invalid Reports

The sensors below (Table 20 and Table 21) have the largest number of invalid decodes as determined by the validation process defined at the District NovaStar5 base station. These invalid reports may indicate poor radio paths (bit flip/contention errors/random decode) or validation criteria that do not match the physical installation at the site.

**Table 20. Rain Sensors with the Most Invalid Reports**

Sensor ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1310-LDC at 64th	--	--	--	--	--	49	264	0				
1530-Bear Cr. At Lowell	8	5	10	3	1	0	0	0				
2810-Pine Cliff Rd.	--	18	11	8	9	6	0	3				
2750-Wx-Castle Rock	10	24	0	0	1	3	1	2				
2790-Wx-W. Cherry Creek	--	--	--	--	8	4	0	1				
2980-Dakan Road	--	--	--	8	9	6	2	3				
2990-Tomah Rd.	--	12	2	2	2	2	1	0				
3010-Wx-EPC @ 105	--	--	8	10	11	11	6	2				
3020-Wx-West Creek	9	103	96	111	149	178	50	0				
3050-E/W Trailhead	--	--	8	7	7	8	1	4				
3070-Newlin Gulch	10	52	5	0	0	1	0	0				
3090-Heritage Reg.	--	--	--	--	--	38	0	1				
4030-Red Garden	23	41	3	4	2	2	0	3				
4330-Hansen Rain	--	--	--	--	5	2	4	2				
4770-Cal-Wood Ranch	--	--	--	--	--	--	--	10				
5730-West Creek	--	--	--	--	22	0	0	0				
10014-Upper Sellers	--	--	--	--	--	--	--	6				
10015-Sellers Haystack	--	--	--	--	--	--	--	10				

Little Dry Creek at 64<sup>th</sup> (1310) was out of service for the entire month of July and thus it has a lot of invalid reports. It was placed back into service on August 2, 2016. West Creek WX (3020) was also out of service for most of the month. It was upgraded to a full ALERT2 station on July 19.

Upper Sellers (10014) and Sellers at Haystack Road (10015) had a number of maintenance reports in early August. Cal-Wood Ranch (4770) also had maintenance reports toward the end of August.

**Table 21. Level Sensors with the Most Invalid Reports**

Sensor ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
203-Leyden Res	11	22	37	15	1	0	0	0				
633-Temple Pond at DTC	--	--	--	--	--	13	0	3				
653-GG at Iliff Pond	--	--	--	15	1	1	0	2				
713-Horseshoe Park Drop	--	--	--	12	0	0	0	0				
853-Flying J	--	36	57	58	58	59	61	0				
1203-Brmfld 3207/Pond6	--	--	--	--	--	--	--	10				
1323-SPR at 3 <sup>rd</sup> Ave	--	--	--	78	1	0	5	1				
1383-Ferril Lake	747	703	686	714	683	721	225	0				
1623-Slaughterhouse Gulch	--	--	--	--	13	10	4	5				
1663-SPR at Henderson	--	--	--	--	9	8	5	7				
2813-Pine Cliff Road	--	--	--	--	1,172*	26	42	5				
2873-Cottonwood	--	--	85	2,807*	2,764*	0	0	0				
3013-EPC@Hwy 105	7	19	11	4	2	17	6	11				
3043-CC@Russelville	--	--	22	5	0	0	1	1				
3093-Heritage Reg. Park	--	--	--	--	--	54	1	0				
4433-Rowena	--	--	--	--	--	--	23	10				
4563-Lyons Diversion	--	13	13	10	3	3	4	4				
4593-Green Ditch	--	--	--	--	--	--	--	9				
10029-Plum Creek at Sedalia	--	--	--	--	--	--	--	8				

\*These stations are out-of-service for the month

Ferril Lake and Flying J were placed back into service on the NovaStar base station on August 2, 2016.

## VI. Rainfall Alarms and Intensity Analysis

The following rainfall rate alarms from the Urban Drainage and Flood Control District NovaStar 5.0 Web Server were identified this month.

Sensor	Name	Alarm Trigger	Date/Time
2930	Spring Valley Road Precipitation-DG	Douglas County 10 minute rainfall	8/6/2016 21:27
2910	East Cherry Creek Road Precipitation-DG	Douglas County 10 minute rainfall	8/6/2016 21:52
1370	West Metro Fire Station 13 Precipitation-JF	Jefferson County 10 minute rainfall	8/19/2016 17:39
1350	Chatfield COE Precipitation-JF	Jefferson County 10 minute rainfall	8/19/2016 17:52
2710	Highlands Ranch WTP Precipitation-DG	Douglas County 10 minute rainfall	8/19/2016 17:57
2920	West Cherry Head Precipitation-DG	Douglas County 10 minute rainfall	8/28/2016 22:34
2920	West Cherry Head Precipitation-DG	Douglas County 1 hour-1 Inch rainfall	8/28/2016 22:35
4770	Cal-Wood Ranch Precipitation-BO	Boulder County 10 minute rainfall	8/29/2016 11:44
2970	Rampart Range Road Precipitation-DG	2970 Rampart Range Road 0.2" in 30 Minutes Rainfall	8/29/2016 14:15
2970	Rampart Range Road Precipitation-DG	2970 Rampart Range Road 0.4" in 1 Hour Rainfall	8/29/2016 14:15
1360	Denver Zoo Precipitation-DN	Plains 1 hour rainfall	8/30/2016 19:47
1710	Shop Creek Precipitation-AR	Plains 10 minute rainfall	8/30/2016 20:15
1710	Shop Creek Precipitation-AR	Plains 1 hour rainfall	8/30/2016 20:20
1900	Niver Detention Precipitation-AD	Plains 10 minute rainfall	8/30/2016 20:21
1710	Shop Creek Precipitation-AR	Plains 10 minute rainfall	8/30/2016 20:26
1060	Heritage Square Precipitation-JF	Jefferson County 1 hour rainfall	8/30/2016 20:39
1060	Heritage Square Precipitation-JF	Jefferson County 10 minute rainfall	8/30/2016 20:39
140	Blue Mountain Precipitation	Jefferson County 10 minute rainfall	8/30/2016 20:44
4100	Filter Plant Precipitation-BO	Boulder County 10 minute rainfall	8/30/2016 20:50
4100	Filter Plant Precipitation-BO	FMC-BA 0.50" in 30 Min Rainfall	8/30/2016 20:50
140	Blue Mountain Precipitation	Jefferson County 1 hour rainfall	8/30/2016 20:51
4100	Filter Plant Precipitation-BO	FMC-BA 0.75" in 1 Hour Rainfall	8/30/2016 20:52
4100	Filter Plant Precipitation-BO	Boulder County 1 hour rainfall	8/30/2016 20:56
1310	Little Dry at 64th Precipitation-AD	Plains 10 minute rainfall	8/30/2016 20:58
1310	Little Dry at 64th Precipitation-AD	Plains 1 hour rainfall	8/30/2016 21:00
4100	Filter Plant Precipitation-BO	Boulder County 10 minute rainfall	8/30/2016 21:01
4110	Betasso Precipitation-BO	FMC-BA 0.50" in 30 Min Rainfall	8/30/2016 21:11
4100	Filter Plant Precipitation-BO	Boulder County 10 minute rainfall	8/30/2016 21:12
4030	Red Garden Precipitation-BO	Boulder County 1 hour rainfall	8/30/2016 21:14
4110	Betasso Precipitation-BO	FMC-BA 0.75" in 1 Hour Rainfall	8/30/2016 21:16
4110	Betasso Precipitation-BO	Boulder County 10 minute rainfall	8/30/2016 21:17
4040	Martin Gulch Precipitation-BO	Boulder County 10 minute rainfall	8/30/2016 21:17
4110	Betasso Precipitation-BO	Boulder County 1 hour rainfall	8/30/2016 21:19
4100	Filter Plant Precipitation-BO	Boulder County 10 minute rainfall	8/30/2016 21:24
4100	Filter Plant Precipitation-BO	Boulder County 2 hour rainfall	8/30/2016 21:44
4100	Filter Plant Precipitation-BO	FMC-BA 0.75" in 1 Hour Rainfall	8/30/2016 21:55
4100	Filter Plant Precipitation-BO	Boulder County 1 hour rainfall	8/30/2016 22:03

# General System Analysis

**Database Name** P:\A207-UDFCD-Data-Analysis\2016\08-2016\Novastar\_extract\_2016Aug-Conc.mdb

<b>First Date in Database</b>	7/31/16 11:59 PM	<b>Total Days</b>	31.0
<b>Last Date in Database</b>	8/31/16 11:59 PM	<b>Total Hours</b>	744.0

Summarize

**Total Records Analyzed** 409,148

Records by Group	Concentrator	Percent	Legacy	Percent	ALERT2	Percent
Wind Data	154,439	37.7%	88,648	34.4%	163,166	28.5%
Temperature	68,159	16.7%	37,752	14.6%	84,473	14.8%
Relative Humidity	60,722	14.8%	37,074	14.4%	82,087	14.4%
Barometric Pressure	32,256	7.9%	21,375	8.3%	1,320	0.2%
Battery Voltage	25,619	6.3%	13,790	5.3%	70,234	12.3%
Water Level	16,713	4.1%	14,615	5.7%	56,068	9.8%
Precipitation	16,417	4.0%	12,199	4.7%	45,077	7.9%
Solar Radiation	11,101	2.7%	10,882	4.2%	0	0.0%
Fuel Temperature	6,016	1.5%	6,036	2.3%	0	0.0%
Fuel Moisture	5,937	1.5%	5,883	2.3%	0	0.0%
Soil Moisture	2,954	0.7%	2,899	1.1%	0	0.0%
Hayman Battery	2,372	0.6%	0	0.0%	0	0.0%
Repeater Status Report	2,333	0.6%	2,720	1.1%	0	0.0%
Unknown	2,029	0.5%	2,041	0.8%	0	0.0%
ET-Hourly	737	0.2%	731	0.3%	0	0.0%
12Hr Status Report	337	0.1%	322	0.1%	2,389	0.4%
Not Used	318	0.1%	285	0.1%	740	0.1%
Wind Direction	262	0.1%	0	0.0%	13,509	2.4%
GPS Lock	153	0.0%	18	0.0%	28,532	5.0%
Water Temp	117	0.0%	117	0.0%	0	0.0%
Handar 585 ALARM Status	64	0.0%	63	0.0%	0	0.0%
Repeater Pass List	62	0.0%	553	0.2%	0	0.0%
ET-Daily	31	0.0%	31	0.0%	0	0.0%
Dew Point Temperature	0	0.0%	0	0.0%	8,850	1.5%
Wind Chill	0	0.0%	0	0.0%	8,850	1.5%
Flasher Status	0	0.0%	0	0.0%	6,224	1.1%
<b>Total</b>	<b>409,148</b>	<b>100.0%</b>	<b>258,034</b>	<b>100.0%</b>	<b>571,519</b>	<b>100.0%</b>

Traffic Loading Summary	Concentrator		Legacy		ALERT2	
Alert Reports	409,148		258,034		571,519	
Average Daily Traffic	12,786		8,324		17,860	
Average Hourly Traffic	533		347		744	
Median Hourly Traffic	540	hour beginning	340	hour beginning	765	hour beginning
Peak Hourly Traffic	1,005	Aug 30, 8:00 PM	768	Aug 30, 8:00 PM	977	Aug 30, 8:00 PM
2nd Max	966	Aug 19, 5:00 PM	716	Aug 30, 9:00 PM	944	Aug 30, 7:00 PM
3rd Max	925	Aug 30, 9:00 PM	614	Aug 30, 7:00 PM	884	Aug 30, 9:00 PM
4th Max	886	Aug 30, 7:00 PM	575	Aug 19, 5:00 PM	880	Aug 19, 4:00 PM
5th Max	824	Aug 19, 4:00 PM	546	Aug 29, 2:00 PM	877	Aug 24, 6:00 PM



# Rain Timer Performance

Analyze Rain Sensors

Rain Sensors	Description	Rcv	Timer	Exp	Performance	Comment
2790	West Cherry Creek - WX	5.00		64.00	8%	
2360	Indian Hills	26.00	17:17	64.00	41%	
2330	Morrison	43.00	16:24	64.00	67%	
1530	Bear Creek @ Lowell	44.00	17:34	64.00	69%	
2230	Bear Cr below Cub	44.00	14:21	64.00	69%	
1620	Slaughterhouse Glch	46.00	14:18	64.00	72%	
1710	Shop Creek	46.00	15:30	64.00	72%	
1660	SPR at Henderson	48.00	13:40	64.00	75%	
4870	SBC @ SB Road	48.00	14:06	64.00	75%	
2270	Cub Cr below Blue	49.00	13:13	64.00	77%	
3010	WX-EPC at Hwy 105	49.00	13:45	64.00	77%	
4270	Cannon Mountain	49.00	14:20	64.00	77%	
5720	Four Mile Creek	49.00	15:16	64.00	77%	
100260	Wx-A2-Trumbull (Hayman) - Precip	571.00		744.00	77%	
100140	A2-Upper Sellers Gulch Precip	573.00		744.00	77%	Partial Month of Data
4330	Hansen Rain	50.00	13:14	64.00	78%	
100150	A2-Sellers Gulch at Haystack Precip	590.00		744.00	79%	
2280	Kinney Peak	51.00	13:51	64.00	80%	
4510	Pinewood Springs	51.00	14:48	64.00	80%	
2350	Idledale	53.00	12:14	64.00	83%	
2890	Spruce Mt - Douglas	53.00	12:18	64.00	83%	
4790	Wx-Button Rock	53.00	12:50	64.00	83%	
1520	Wx-Marston Lake North	54.00	12:45	64.00	84%	
2320	Choke Cherry Resvr	54.00	12:32	64.00	84%	
4470	Little Narrows	54.00	12:48	64.00	84%	
2980	Dakan Rd	55.00	13:03	64.00	86%	
1480	Third Creek at DIA	56.00	12:56	64.00	88%	
2750	Wx-Castle Rock	56.00	12:31	64.00	88%	
3040	CC @ Russelville Road Precip	56.00	13:19	64.00	88%	
4290	Red Hill	56.00	12:38	64.00	88%	
110	Ralston Reservoir	57.00	12:27	64.00	89%	
540	Parker/Mississippi	57.00	12:41	64.00	89%	
1350	Chatfield COE	57.00	12:42	64.00	89%	
1360	Denver Zoo	57.00	12:29	64.00	89%	
1400	Upper Sloan Det.	57.00	12:59	64.00	89%	
1440	Wx-Elbert	57.00	12:43	64.00	89%	
1550	Lakewood CC	57.00	13:00	64.00	89%	
1640	SPR at Union Ave.	57.00	12:27	64.00	89%	
1720	Cherry Cr @ Steele	57.00	12:42	64.00	89%	
2860	CC at Stroh Rd	57.00	12:12	64.00	89%	
2880	Happy Canyon at N Surrey Dr	57.00	12:11	64.00	89%	
2900	Russelville Gulch-Douglas	57.00	12:45	64.00	89%	
4040	Martin Gulch	57.00	12:26	64.00	89%	
5940	Log Jumper	57.00	12:17	64.00	89%	
210	Leyden Confluence	58.00	12:36	64.00	91%	
320	Sports Complex	58.00	12:27	64.00	91%	
520	Jewell Detention	58.00	12:12	64.00	91%	
650	Iliff Pond	58.00	12:43	64.00	91%	
840	Fire Station 12	58.00	12:41	64.00	91%	
940	Aurora Regional Pond	58.00	12:37	64.00	91%	
1030	NREL/S. Table Mtn.	58.00	12:27	64.00	91%	
1050	Jeffco Fairgrounds	58.00	12:27	64.00	91%	
1060	Heritage Square	58.00	12:41	64.00	91%	
1700	Cherry Cr @ Champa	58.00	12:56	64.00	91%	
2310	Genesee Village	58.00	12:43	64.00	91%	
3030	WX-Bingham Lake Park	58.00	12:14	64.00	91%	
4260	Taylor Mountain	58.00	11:58	64.00	91%	
4360	Justice Center	58.00	12:40	64.00	91%	
4490	Apple Valley	58.00	12:40	64.00	91%	
5880	Hackett Mountain	58.00	11:42	64.00	91%	
120	West Woods	59.00	11:58	64.00	92%	
140	Wx-Blue Mountain	59.00	12:00	64.00	92%	
150	Nott Creek	59.00	11:57	64.00	92%	
300	Van Bibber Park	59.00	12:40	64.00	92%	
310	Guy Hill Ranch	59.00	12:39	64.00	92%	
530	Fire Station #19	59.00	12:11	64.00	92%	
600	Harvard Gulch Park	59.00	12:33	64.00	92%	
610	Harvard @ Jackson	59.00	12:11	64.00	92%	
630	Temple Pond at DTC	59.00	12:16	64.00	92%	
640	Goldsmith @ Eastman	59.00	11:58	64.00	92%	
1010	Denver West	59.00	12:26	64.00	92%	

1300	Hidden Lake	59.00	12:16	64.00	92%
1370	West Metro FS13	59.00	12:26	64.00	92%
1460	Wx-Urban Farm	59.00	12:13	64.00	92%
1500	Powers Park	59.00	11:57	64.00	92%
2240	Cold Sprg Glch conf	59.00	11:58	64.00	92%
2840	Sulphur Gulch	59.00	12:13	64.00	92%
2850	Cherry Cr bl Bayou Glch	59.00	12:30	64.00	92%
3060	Fire Sta 47	59.00	12:13	64.00	92%
4030	Red Garden	59.00	12:25	64.00	92%
4190	Slaughterhouse	59.00	12:27	64.00	92%
4310	Johnny Park	59.00	11:57	64.00	92%
4350	Conifer Hill	59.00	12:13	64.00	92%
4570	St. Antons	59.00	12:15	64.00	92%
4810	Shanahan Ridge	59.00	12:12	64.00	92%
4820	Doudy Draw	59.00	12:12	64.00	92%
5810	Stump Bump	59.00	12:00	64.00	92%
3090	A2-Highland Heritage Park	692.00		744.00	93%
220	Upper Leyden	60.00	12:00	64.00	94%
330	Van Bibber @ Hwy 93	60.00	12:11	64.00	94%
410	Kelly Dam	60.00	12:11	64.00	94%
620	Quincy/Highline	60.00	12:11	64.00	94%
710	Horseshoe Park Drop	60.00	12:10	64.00	94%
760	Mission Viejo Park	60.00	12:11	64.00	94%
830	Side Creek Park	60.00	11:59	64.00	94%
920	Wx-Aurora Town Hall	60.00	12:00	64.00	94%
1040	Lena @ U.S. Hwy 6	60.00	12:10	64.00	94%
1200	Broomfield 3207	60.00	11:58	64.00	94%
1570	Wx-Brighton Ditch	60.00	12:14	64.00	94%
2210	Wx-Hiwan G.C.	60.00	12:00	64.00	94%
2250	Rosedale	60.00	12:13	64.00	94%
2260	Brook Forest	60.00	11:57	64.00	94%
2340	El Rancho	60.00	11:57	64.00	94%
2370	Red Rocks Park	60.00	12:13	64.00	94%
2820	Haskins Gulch Conf	60.00	12:13	64.00	94%
2910	East Cherry Cr-Douglas	60.00	12:14	64.00	94%
2920	West Cherry Head-Douglas Cnty	60.00	12:00	64.00	94%
2940	Willow Creek - DougCnty	60.00	12:00	64.00	94%
4010	Crescent	60.00	11:58	64.00	94%
4050	Walker Ranch	60.00	11:58	64.00	94%
4060	Lakeshore	60.00	12:11	64.00	94%
4070	Bear Peak	60.00	11:57	64.00	94%
4090	Magnolia	60.00	12:27	64.00	94%
4100	Filter Plant	60.00	11:59	64.00	94%
4110	Betasso	60.00	11:59	64.00	94%
4130	Swiss Peaks	60.00	12:13	64.00	94%
4180	Gold Lake	60.00	11:56	64.00	94%
4200	Lazy Acres	60.00	11:59	64.00	94%
4220	Fling's	60.00	12:14	64.00	94%
4340	Riverside	60.00	12:13	64.00	94%
4530	Winiger Ridge	60.00	12:27	64.00	94%
4750	Wx-Louisville Lake	60.00	12:13	64.00	94%
4770	Wx-Cal-Wood Ranch	60.00	10:41	64.00	94%
4830	SBC @ San Souci	60.00	11:58	64.00	94%
5730	West Creek	60.00	12:15	64.00	94%
5740	Trail Creek	60.00	12:00	64.00	94%
200	Leyden Reservoir	61.00	12:10	64.00	95%
420	Expo Park	61.00	12:11	64.00	95%
440	Fire Station #7	61.00	12:10	64.00	95%
500	Havana Park	61.00	12:11	64.00	95%
510	Virginia Court	61.00	11:57	64.00	95%
700	Toll Gate @ 6th	61.00	12:00	64.00	95%
720	Confluence Pond	61.00	11:58	64.00	95%
730	No Name @ Quincy	61.00	12:10	64.00	95%
750	Wx-Quincy Reservoir	61.00	11:56	64.00	95%
800	Sable Ditch @ 18th	61.00	11:57	64.00	95%
810	Granby Ditch @ 6th	61.00	11:57	64.00	95%
820	ETG @ Buckley	61.00	12:10	64.00	95%
850	Flying J	61.00	12:00	64.00	95%
900	Wx-Aurora Reservoir	61.00	12:00	64.00	95%
950	Piney at Liverpool	61.00	11:57	64.00	95%
970	Pump Sta 3	61.00	12:00	64.00	95%
1320	SPR at 3rd Ave	61.00	11:14	64.00	95%
1420	Wx-A2-Diamond Hill	61.00	12:00	64.00	95%
1600	Englewood Dam	61.00	11:58	64.00	95%
1800	Sand Creek Park	61.00	11:58	64.00	95%
1920	Wx-Brighton	61.00	12:12	64.00	95%

2710	Wx-Highlands Ranch WTP	61.00	11:45	64.00	95%
2950	DC Public Works	61.00	12:00	64.00	95%
2960	Indian Creek	61.00	12:00	64.00	95%
3050	East/West Trailhead	61.00	12:00	64.00	95%
4020	Rio Grande	61.00	11:58	64.00	95%
4080	Twin Sisters	61.00	11:58	64.00	95%
4140	Logan Mill	61.00	11:58	64.00	95%
4150	Gold Hill	61.00	11:58	64.00	95%
4160	Sunshine	61.00	11:58	64.00	95%
4170	Pine Brook	61.00	11:57	64.00	95%
4240	Sunset	61.00	11:58	64.00	95%
4300	Big Elk Park	61.00	11:57	64.00	95%
4520	Eagle Ridge	61.00	12:00	64.00	95%
4710	Wx-Ward C-1	61.00	12:00	64.00	95%
4730	Wx-Sugarloaf	61.00	12:00	64.00	95%
4840	SBC@S Boulder Ditch	61.00	11:57	64.00	95%
4860	Fairview Peak	61.00	12:00	64.00	95%
4880	Whispering Pines	61.00	11:57	64.00	95%
5860	Cedar Mountain	61.00	12:00	64.00	95%
100100	A2-Blackstone Precip	61.00	12:00	64.00	95%
100110	A2-ETG @ Hampden Precip	61.00	12:00	64.00	95%
100200	Wx-A2-OneRain Weather - Precipitation	61.00	12:00	64.00	95%
430	Utah Park	62.00	11:58	64.00	97%
1110	Gunbarrel	62.00	11:58	64.00	97%
1900	Niver Detention	62.00	11:57	64.00	97%
2810	Pine Cliff Road	62.00	11:34	64.00	97%
2870	Cottonwood (Apache)	62.00	11:35	64.00	97%
2930	Wx-Spring Valley Rd-DougCnty	62.00	11:31	64.00	97%
4230	Golden Age	62.00	11:57	64.00	97%
4320	Lee Hill Rain 2012	62.00	11:58	64.00	97%
4550	Boulder Jail	62.00	11:57	64.00	97%
2730	Wx-Salisbury Park	63.00	11:34	64.00	98%
6601	Wx-A2-Magnolia WX-Precip	94.00	7:20	95.00	99%
100270	Wx-A2-WestCreek (Hayman) - Precip	739.00		744.00	99%
100290	Wx-A2-PlumCr at Sedalia - Precip	739.00		744.00	99%
1000	A2-Maple Grove Resv.	742.00		744.00	100%
1310	LDC at 64th	742.00		744.00	100%
3070	A2-Newlin Gulch Precip	742.00		744.00	100%
4850	Porphory Mtn	742.00		744.00	100%
100320	A2-Weir Gulch - Precip	742.00		744.00	100%
100	A2-Carr Street	743.00		744.00	100%
870	A2-Murphy Creek GC	743.00		744.00	100%
1340	Sanderson at Xavier	743.00		744.00	100%
100160	A2-Sand Creek at Colfax Precip	743.00		744.00	100%
100230	A2-Havana Pond Precip	743.00		744.00	100%
100240	A2-Westerly Cr Dam Precip	743.00		744.00	100%
100300	A2-CoalCreek at McCaslin - Precip	743.00		744.00	100%
2970	Rampart Range Rd-Satellite	235.00		235.00	100%
2990	Wx-Tomah Rd-DougCnty	64.00	11:19	64.00	100%
3080	Tallman Gulch	64.00	11:22	64.00	100%
4250	Geer Canyon	65.00	11:17	64.00	102%
3020	Wx-West Creek WX	758.00		744.00	102%
1100	Louisville Rec Ctr	67.00	10:57	64.00	105%
5900	Horse Creek-Satellite	1237.00		744.00	166%

Rain Event Performance															
	Reports Received	Reports Received	5,694	Analyze Rain Sensors						0	<<show stations with zero rain (1=yes, 0=no)				
	Systemwide Avg	Total Tips	6,039												
	94.29%	Data Loss	5.71%												
Description	Sensor	Performance	1-tips	2-tips	3-tips	4-tips	5-tips	6-tips	>6-tips	Rcv	Exp	Miss	Hold	Bucket	
Wx-W. Cherry Creek	2790	40%	2	2	3	0	1	0	1	8	20	12	0	0.03937	
SBC @ SB Road	4870	59%	6	2	1	1	0	0	0	10	17	7	0	0.03937	
Indian Hills	2360	63%	18	4	1	0	1	1	0	25	40	15	0	0.03937	
Shop Creek	1710	69%	29	7	2	1	1	0	0	40	58	18	0	0.03937	
Little Narrows	4470	71%	16	4	1	1	0	0	0	22	31	9	0	0.03937	
Martin Gulch	4040	71%	27	5	1	1	1	0	0	35	49	14	0	0.03937	
Cannon Mountain	4270	73%	29	7	0	1	1	0	0	38	52	14	0	0.03937	
Slaughterhouse Glch	1620	77%	18	4	0	1	0	0	0	23	30	7	0	0.03937	
Harvard @ Jackson	610	81%	13	4	0	0	0	0	0	17	21	4	0	0.03937	
Ralston Reservoir	110	82%	14	4	0	0	0	0	0	18	22	4	0	0.03937	
Expo Park	420	82%	13	0	0	1	0	0	0	14	17	3	0	0.03937	
Rampart Range Rd-Satellite	2970	83%	36	1	0	1	1	0	0	39	47	8	0	0.03937	
Van Bibber @ Hwy 93	330	83%	20	5	0	0	0	0	0	25	30	5	0	0.03937	
Idledale	2350	84%	41	3	3	0	0	0	0	47	56	9	0	0.03937	
Red Rocks Park	2370	84%	41	4	1	1	0	0	0	47	56	9	0	0.03937	
Van Bibber Park	300	84%	14	1	1	0	0	0	0	16	19	3	0	0.03937	
SBC @ San Souci	4830	84%	14	1	1	0	0	0	0	16	19	3	0	0.03937	
Cub Cr below Blue	2270	85%	31	1	1	1	0	0	0	34	40	6	0	0.03937	
A2-Upper Sellers Gulch Pre	100140	86%	17	0	0	1	0	0	0	18	21	3	0	0.03937	
Wx-Brighton Ditch	1570	86%	10	2	0	0	0	0	0	12	14	2	0	0.03937	
Kelly Dam	410	87%	11	2	0	0	0	0	0	13	15	2	0	0.03937	
Chatfield COE	1350	87%	23	4	0	0	0	0	0	27	31	4	0	0.03937	
Wx-A2-Trumbull (Hayman)	100260	87%	30	3	1	0	0	0	0	34	39	5	0	0.03937	
Red Hill	4290	88%	6	1	0	0	0	0	0	7	8	1	0	0.03937	
Kinney Peak	2280	88%	46	3	2	0	0	0	0	51	58	7	0	0.03937	
Guy Hill Ranch	310	88%	20	3	0	0	0	0	0	23	26	3	0	0.03937	
A2-Sellers Gulch at Haystack	100150	89%	29	1	0	1	0	0	2	31	35	4	0	0.03937	
Red Garden	4030	89%	43	4	1	0	0	0	0	48	54	6	0	0.03937	
Wx-West Creek WX	3020	89%	38	1	0	0	1	0	0	40	45	5	0	0.03937	
Bear Cr below Cub	2230	89%	30	1	0	1	0	0	0	32	36	4	1	0.03937	
Parker/Mississippi	540	89%	21	3	0	0	0	0	0	24	27	3	0	0.03937	
Sulphur Gulch	2840	89%	7	1	0	0	0	0	0	8	9	1	0	0.03937	
Bear Peak	4070	89%	37	3	1	0	0	0	0	41	46	5	0	0.03937	
Choke Cherry Resvr	2320	89%	29	4	0	0	0	0	0	33	37	4	0	0.03937	
Gold Lake	4180	90%	33	1	0	1	0	0	0	35	39	4	0	0.03937	
Dakan Rd	2980	90%	24	3	0	0	0	0	0	27	30	3	0	0.03937	
SPR at Henderson	1660	90%	8	1	0	0	0	0	0	9	10	1	0	0.03937	
WX-Bingham Lake Park	3030	90%	25	3	0	0	0	0	0	28	31	3	0	0.03937	
Heritage Square	1060	91%	52	6	0	0	0	0	0	58	64	6	0	0.03937	
Gunbarrel	1110	91%	19	0	1	0	0	0	0	20	22	2	0	0.03937	
Pinewood Springs	4510	91%	18	2	0	0	0	0	0	20	22	2	0	0.03937	
Nott Creek	150	91%	38	4	0	0	0	0	0	42	46	4	0	0.03937	
Wx-Castle Rock	2750	91%	19	2	0	0	0	0	0	21	23	2	0	0.03937	
SPR at 3rd Ave	1320	92%	20	2	0	0	0	0	0	22	24	2	0	0.03937	
Toll Gate @ 6th	700	92%	10	1	0	0	0	0	0	11	12	1	0	0.03937	
Hansen Rain	4330	92%	32	1	1	0	0	0	0	34	37	3	0	0.03937	
Denver West	1010	92%	21	2	0	0	0	0	0	23	25	2	0	0.03937	

SPR at Union Ave.	1640	92%	22	0	1	0	0	0	0	23	25	2	0	0.03937
Wx-Brighton	1920	92%	21	2	0	0	0	0	0	23	25	2	0	0.03937
Cherry Cr @ Champa	1700	92%	22	2	0	0	0	0	0	24	26	2	0	0.03937
Cottonwood (Apache)	2870	92%	11	1	0	0	0	0	0	12	13	1	0	0.03937
Wx-Aurora Reservoir	900	92%	11	1	0	0	0	0	0	12	13	1	0	0.03937
Hidden Lake	1300	93%	48	4	0	0	0	0	0	52	56	4	0	0.03937
Iliff Pond	650	93%	12	1	0	0	0	0	0	13	14	1	0	0.03937
Wx-Salisbury Park	2730	93%	12	1	0	0	0	0	0	13	14	1	0	0.03937
Walker Ranch	4050	93%	38	3	0	0	0	0	0	41	44	3	0	0.03937
West Metro FS13	1370	94%	42	3	0	0	0	0	0	45	48	3	1	0.03937
Russelville Gulch-Douglas	2900	94%	42	3	0	0	0	0	0	45	48	3	0	0.03937
Fire Station #19	530	94%	28	2	0	0	0	0	0	30	32	2	0	0.03937
Geer Canyon	4250	94%	28	2	0	0	0	0	0	30	32	2	0	0.03937
Temple Pond at DTC	630	94%	72	5	0	0	0	0	0	77	82	5	0	0.03937
Leyden Reservoir	200	94%	15	1	0	0	0	0	0	16	17	1	0	0.03937
Wx-Button Rock	4790	94%	15	1	0	0	0	0	0	16	17	1	0	0.03937
Wx-Cal-Wood Ranch	4770	94%	31	2	0	0	0	0	1	33	35	2	0	0.03937
Sports Complex	320	95%	17	1	0	0	0	0	0	18	19	1	0	0.03937
A2-Highland Heritage Park	3090	95%	17	1	0	0	0	0	0	18	19	1	0	0.03937
Powers Park	1500	95%	103	6	0	0	0	0	0	109	115	6	0	0.03937
Four Mile Creek	5720	95%	54	3	0	0	0	0	0	57	60	3	0	0.03937
West Creek	5730	95%	38	2	0	0	0	0	0	40	42	2	0	0.03937
Rosedale	2250	95%	39	2	0	0	0	0	0	41	43	2	0	0.03937
Wx-Tomah Rd-DougCnty	2990	95%	20	1	0	0	0	0	0	21	22	1	0	0.03937
Genesee Village	2310	96%	42	2	0	0	0	0	0	44	46	2	0	0.03937
East Cherry Cr-Douglas	2910	96%	44	2	0	0	0	0	0	46	48	2	0	0.03937
Goldsmith @ Eastman	640	96%	23	1	0	0	0	0	0	24	25	1	0	0.03937
NREL/S. Table Mtn.	1030	96%	23	1	0	0	0	0	0	24	25	1	0	0.03937
Wx-Highlands Ranch WTP	2710	96%	47	2	0	0	0	0	0	49	51	2	0	0.03937
Betasso	4110	96%	72	3	0	0	0	0	0	75	78	3	1	0.03937
Harvard Gulch Park	600	96%	48	2	0	0	0	0	0	50	52	2	0	0.03937
Log Jumper	5940	96%	48	2	0	0	0	0	0	50	52	2	0	0.03937
Willow Creek - DougCnty	2940	96%	24	1	0	0	0	0	0	25	26	1	0	0.03937
CC @ Russelville Road Pre	3040	96%	24	1	0	0	0	0	0	25	26	1	0	0.03937
Denver Zoo	1360	96%	50	2	0	0	0	0	0	52	54	2	0	0.03937
Indian Creek	2960	96%	25	1	0	0	0	0	0	26	27	1	0	0.03937
Filter Plant	4100	96%	102	4	0	0	0	0	0	106	110	4	2	0.03937
Taylor Mountain	4260	97%	54	2	0	0	0	0	0	56	58	2	0	0.03937
Shanahan Ridge	4810	97%	27	1	0	0	0	0	0	28	29	1	0	0.03937
Wx-A2-WestCreek (Haymar	100270	97%	27	1	0	0	0	0	0	28	29	1	0	0.03937
West Woods	120	97%	28	1	0	0	0	0	0	29	30	1	0	0.03937
Conifer Hill	4350	97%	28	1	0	0	0	0	0	29	30	1	0	0.03937
Spruce Mt - Douglas	2890	97%	59	2	0	0	0	0	0	61	63	2	0	0.03937
Broomfield 3207	1200	97%	30	1	0	0	0	0	0	31	32	1	0	0.03937
El Rancho	2340	97%	31	1	0	0	0	0	0	32	33	1	0	0.03937
Bear Creek @ Lowell	1530	97%	32	1	0	0	0	0	0	33	34	1	0	0.03937
Cherry Cr @ Steele	1720	97%	32	1	0	0	0	0	0	33	34	1	0	0.03937
Slaughterhouse	4190	97%	33	1	0	0	0	0	0	34	35	1	0	0.03937
Lakeshore	4060	97%	37	1	0	0	0	0	0	38	39	1	0	0.03937
Sunset	4240	97%	37	1	0	0	0	0	0	38	39	1	0	0.03937
Horse Creek-Satellite	5900	98%	41	1	0	0	0	0	0	42	43	1	0	0.03937
Big Elk Park	4300	98%	43	1	0	0	0	0	0	44	45	1	0	0.03937
Lee Hill Rain 2012	4320	98%	44	1	0	0	0	0	0	45	46	1	0	0.03937

Fling's	4220	98%	46	1	0	0	0	0	0	47	48	1	0	0.03937
Hackett Mountain	5880	98%	95	2	0	0	0	0	0	97	99	2	0	0.03937
Lakewood CC	1550	98%	49	1	0	0	0	0	0	50	51	1	0	0.03937
Wx-Spring Valley Rd-DougC	2930	98%	55	1	0	0	0	0	0	56	57	1	0	0.03937
Trail Creek	5740	98%	61	1	0	0	0	0	0	62	63	1	0	0.03937
Wx-Ward C-1	4710	99%	81	1	0	0	0	0	0	82	83	1	0	0.03937
West Cherry Head-Douglas	2920	100%	109	0	0	0	0	0	0	109	109	0	0	0.03937
Cedar Mountain	5860	100%	88	0	0	0	0	0	0	88	88	0	0	0.03937
LDC at 64th	1310	100%	58	0	0	0	0	0	0	58	58	0	3	0.03937
Wx-Blue Mountain	140	100%	54	0	0	0	0	0	0	54	54	0	0	0.03937
Brook Forest	2260	100%	53	0	0	0	0	0	0	53	53	0	0	0.03937
St. Antons	4570	100%	49	0	0	0	0	0	0	49	49	0	0	0.03937
Stump Bump	5810	100%	48	0	0	0	0	0	0	48	48	0	0	0.03937
Swiss Peaks	4130	100%	45	0	0	0	0	0	0	45	45	0	0	0.03937
Magnolia	4090	100%	44	0	0	0	0	0	0	44	44	0	0	0.03937
Wx-A2-PlumCr at Sedalia -	100290	100%	43	0	0	0	0	0	0	43	43	0	0	0.03937
Cold Sprg Glch conf	2240	100%	38	0	0	0	0	0	0	38	38	0	0	0.03937
Gold Hill	4150	100%	36	0	0	0	0	0	0	36	36	0	0	0.03937
Crescent	4010	100%	35	0	0	0	0	0	0	35	35	0	0	0.03937
Rio Grande	4020	100%	35	0	0	0	0	0	0	35	35	0	0	0.03937
Riverside	4340	100%	35	0	0	0	0	0	0	35	35	0	0	0.03937
Wx-Sugarloaf	4730	100%	34	0	0	0	0	0	0	34	34	0	0	0.03937
Niver Detention	1900	100%	32	0	0	0	0	0	0	32	32	0	0	0.03937
Golden Age	4230	100%	32	0	0	0	0	0	0	32	32	0	0	0.03937
Whispering Pines	4880	100%	31	0	0	0	0	0	0	31	31	0	0	0.03937
Twin Sisters	4080	100%	30	0	0	0	0	0	0	30	30	0	0	0.03937
Logan Mill	4140	100%	30	0	0	0	0	0	0	30	30	0	0	0.03937
Virginia Court	510	100%	28	0	0	0	0	0	0	28	28	0	0	0.03937
Quincy/Highline	620	100%	27	0	0	0	0	0	0	27	27	0	0	0.03937
Wx-Aurora Town Hall	920	100%	27	0	0	0	0	0	0	27	27	0	0	0.03937
Wx-Hiwan G.C.	2210	100%	27	0	0	0	0	0	0	27	27	0	0	0.03937
Lazy Acres	4200	100%	27	0	0	0	0	0	0	27	27	0	0	0.03937
A2-Weir Gulch - Precip	100320	100%	27	0	0	0	0	0	0	27	27	0	0	0.03937
Cherry Cr bl Bayou Glch	2850	100%	26	0	0	0	0	0	0	26	26	0	0	0.03937
Happy Canyon at N Surrey	2880	100%	26	0	0	0	0	0	0	26	26	0	0	0.03937
A2-Carr Street	100	100%	25	0	0	0	0	0	0	25	25	0	0	0.03937
Jeffco Fairgrounds	1050	100%	25	0	0	0	0	0	0	25	25	0	0	0.03937
Englewood Dam	1600	100%	25	0	0	0	0	0	0	25	25	0	0	0.03937
Upper Sloan Det.	1400	100%	24	0	0	0	0	0	0	24	24	0	0	0.03937
Louisville Rec Ctr	1100	100%	23	0	0	0	0	0	1	23	23	0	0	0.03937
Sanderson at Xavier	1340	100%	23	0	0	0	0	0	0	23	23	0	0	0.03937
CC at Stroh Rd	2860	100%	23	0	0	0	0	0	0	23	23	0	0	0.03937
DC Public Works	2950	100%	23	0	0	0	0	0	0	23	23	0	0	0.03937
A2-Maple Grove Resv.	1000	100%	22	0	0	0	0	0	0	22	22	0	0	0.03937
Pine Cliff Road	2810	100%	22	0	0	0	0	0	0	22	22	0	0	0.03937
Winiger Ridge	4530	100%	22	0	0	0	0	0	0	22	22	0	0	0.03937
Wx-Elbert	1440	100%	21	0	0	0	0	0	0	21	21	0	0	0.03937
East/West Trailhead	3050	100%	21	0	0	0	0	0	0	21	21	0	0	0.03937
Johnny Park	4310	100%	21	0	0	0	0	0	0	21	21	0	0	0.03937
Justice Center	4360	100%	21	0	0	0	0	0	0	21	21	0	0	0.03937
Boulder Jail	4550	100%	21	0	0	0	0	0	0	21	21	0	0	0.03937
Sand Creek Park	1800	100%	20	0	0	0	0	0	0	20	20	0	0	0.03937
A2-Havana Pond Precip	100230	100%	19	0	0	0	0	0	0	19	19	0	0	0.03937

A2-Westerly Cr Dam Precip	100240	100%	19	0	0	0	0	0	0	19	19	0	0	0.03937
Upper Leyden	220	100%	18	0	0	0	0	0	0	18	18	0	0	0.03937
Pine Brook	4170	100%	18	0	0	0	0	0	0	18	18	0	0	0.03937
Doudy Draw	4820	100%	18	0	0	0	0	0	0	18	18	0	0	0.03937
Havana Park	500	100%	17	0	0	0	0	0	0	17	17	0	0	0.03937
Fire Sta 47	3060	100%	17	0	0	0	0	0	0	17	17	0	0	0.03937
A2-Newlin Gulch Precip	3070	100%	17	0	0	0	0	0	0	17	17	0	0	0.03937
Wx-Urban Farm	1460	100%	16	0	0	0	0	0	0	16	16	0	0	0.03937
A2-CoalCreek at McCaslin	100300	100%	16	0	0	0	0	0	0	16	16	0	0	0.03937
Jewell Detention	520	100%	15	0	0	0	0	0	0	15	15	0	0	0.03937
Flying J	850	100%	15	0	0	0	0	0	0	15	15	0	0	0.03937
Wx-A2-Diamond Hill	1420	100%	15	0	0	0	0	0	0	15	15	0	0	0.03937
Wx-Marston Lake North	1520	100%	15	0	0	0	0	0	0	15	15	0	0	0.03937
A2-Blackstone Precip	100100	100%	15	0	0	0	0	0	0	15	15	0	0	0.03937
Pump Sta 3	970	100%	14	0	0	0	0	0	0	14	14	0	0	0.03937
Sable Ditch @ 18th	800	100%	13	0	0	0	0	0	0	13	13	0	0	0.03937
Haskins Gulch Conf	2820	100%	13	0	0	0	0	0	0	13	13	0	0	0.03937
Tallman Gulch	3080	100%	13	0	0	0	0	0	0	13	13	0	0	0.03937
Eagle Ridge	4520	100%	13	0	0	0	0	0	0	13	13	0	0	0.03937
SBC@S Boulder Ditch	4840	100%	12	0	0	0	0	0	0	12	12	0	0	0.03937
Fire Station #7	440	100%	11	0	0	0	0	0	0	11	11	0	0	0.03937
Piney at Liverpool	950	100%	10	0	0	0	0	0	0	10	10	0	0	0.03937
Aurora Regional Pond	940	100%	10	0	0	0	0	0	0	10	10	0	0	0.03937
Granby Ditch @ 6th	810	100%	9	0	0	0	0	0	0	9	9	0	0	0.03937
Apple Valley	4490	100%	9	0	0	0	0	0	0	9	9	0	0	0.03937
A2-Sand Creek at Colfax Pr	100160	100%	9	0	0	0	0	0	0	9	9	0	0	0.03937
Fire Station 12	840	100%	8	0	0	0	0	0	0	8	8	0	0	0.03937
A2-ETG @ Hampden Precip	100110	100%	8	0	0	0	0	0	0	8	8	0	0	0.03937
Wx-Quincy Reservoir	750	100%	7	0	0	0	0	0	0	7	7	0	0	0.03937
ETG @ Buckley	820	100%	7	0	0	0	0	0	0	7	7	0	0	0.03937
Third Creek at DIA	1480	100%	7	0	0	0	0	0	0	7	7	0	0	0.03937
Wx-Louisville Lake	4750	100%	7	0	0	0	0	0	0	7	7	0	0	0.03937
No Name @ Quincy	730	100%	6	0	0	0	0	0	0	6	6	0	0	0.03937
Side Creek Park	830	100%	6	0	0	0	0	0	0	6	6	0	0	0.03937
A2-Murphy Creek GC	870	100%	6	0	0	0	0	0	0	6	6	0	0	0.03937
Mission Viejo Park	760	100%	5	0	0	0	0	0	0	5	5	0	0	0.03937
Sunshine	4160	100%	5	0	0	0	0	0	0	5	5	0	0	0.03937
Horseshoe Park Drop	710	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937
Morrison	2330	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937
Confluence Pond	720	100%	3	0	0	0	0	0	0	3	3	0	0	0.03937
Lena @ U.S. Hwy 6	1040	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937
Leyden Confluence	210	100%	1	0	0	0	0	0	0	1	1	0	0	0.03937
		Total Tips	5426	222	24	14	7	1	5	5694	6039	345	8	
Porphyry Mtn	4850	97%	142	4	0	0	0	0	0	146	150	4	4	0.01
Fairview Peak	4860	99%	164	2	0	0	0	0	0	166	168	2	13	0.01
Wx-A2-Magnolia WX-Precip	6601	99%	122	1	0	0	0	0	0	123	124	1	5	0.01
Wx-A2-OneRain Weather -	100200	94%	71	5	0	0	0	0	0	76	81	5	1	0.01
WX-EPC at Hwy 105	3010	89%	101	10	2	0	0	0	1	113	127	14	0	0.03937

## 2016 Monthly Peak Hour ALERT Radio Traffic Summary

