

# Memo

**Date:** November 4, 2016  
**To:** Kevin Stewart  
**From:** Markus Ritsch  
**Subject:** October 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 October 1 through October 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	241,485	251,914			2,405,423
Concentrator	194,948	418,430	407,965	435,747	416,968	423,152	423,762	409,121	391,806	411,402			3,933,301
ALERT2	136,144	399,530	505,195	540,654	508,036	509,129	473,766	571,162	545,138	504,889			4,693,643
<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>1,178,429</b>	<b>1,168,205</b>	<b>0</b>	<b>0</b>	<b>11,032,367</b>
Conc/Leg	1.64	1.58	1.69	1.64	1.70	1.66	1.61	1.59	1.62	1.63	1.00	1.00	1.64
DataChron	645,913	662,847	674,426	742,749	732,116	776,223	757,956	775,073	743,446	723,613			7,234,362

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	241,485	251,914			2,405,423
Concentrator	194,948	418,430	407,965	435,747	416,968	423,152	423,762	409,121	391,806	411,402			3,933,301
ALERT2	136,144	399,530	505,195	540,654	508,036	509,129	473,766	571,162	545,138	504,889			4,693,643
NS5B (Greenhouse)													
Legacy	118,610	264,516	263,959	266,509	264,138	258,435	262,307	258,034	241,558	251,684			2,449,750
Concentrator	194,968	418,532	446,510	435,558	447,154	428,264	422,702	409,148	391,647	410,868			4,005,351
ALERT2	136,330	399,841	552,747	540,161	544,926	515,425	472,516	571,519	545,439	504,304			4,783,208
Diff (NS5a-NS5b)													
Legacy (Digi One)	-91	-141	-22,442	-44	-18,282	-3,691	425	-218	-73	230	0	0	-44,327
Concentrator (B2010)	-20	-102	-38,545	189	-30,186	-5,112	1,060	-27	159	534	0	0	-72,050
ALERT2 (B2010)	-186	-311	-47,552	493	-36,890	-6,296	1,250	-357	-301	585	0	0	-89,565
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	51,170	111,105	110,038	116,087	116,489	504,889
Greenhouse	51,095	110,952	109,980	115,933	116,344	504,304
Difference	75	153	58	154	145	585
Comments						

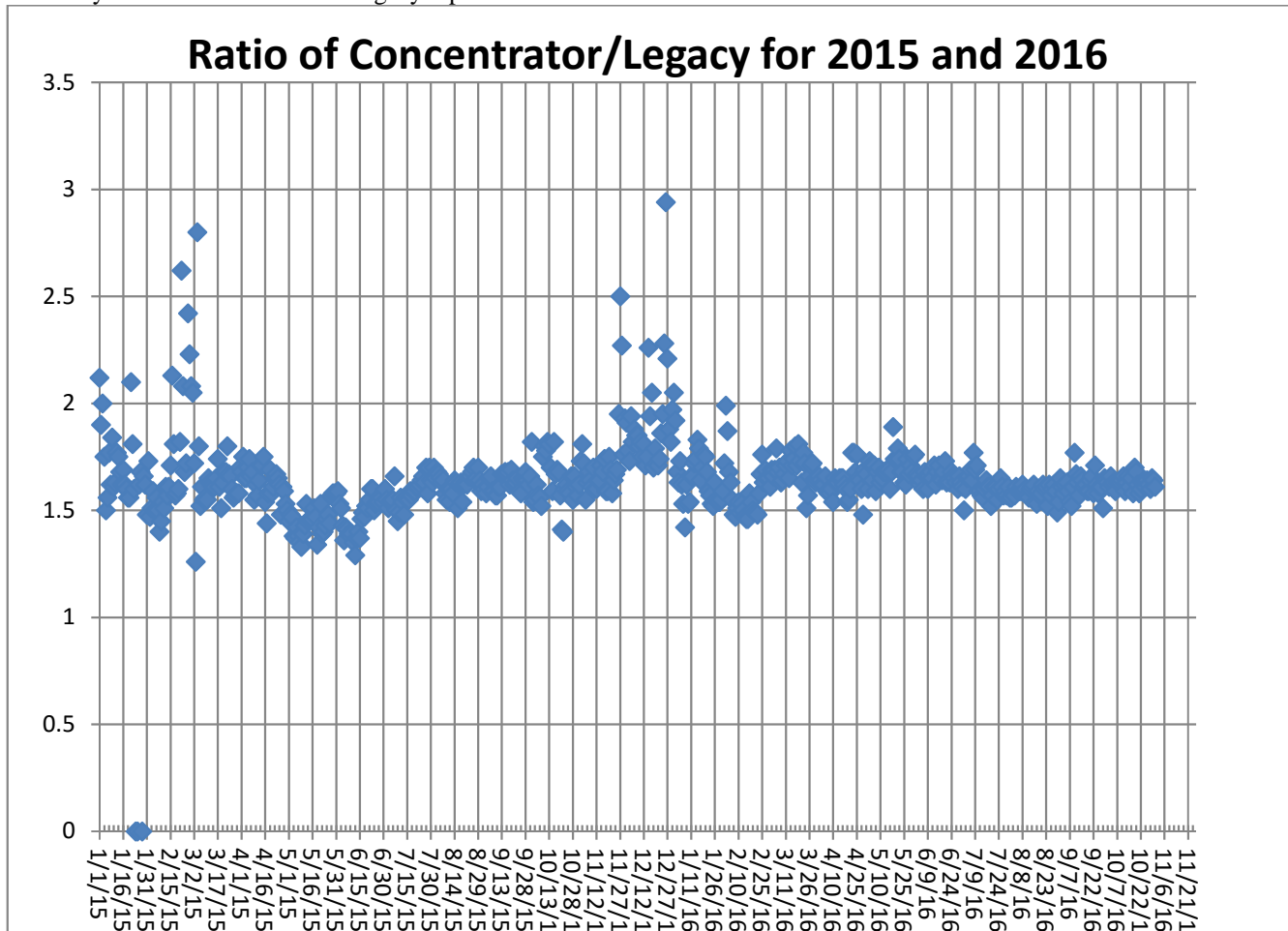
The following shows the distribution of the difference in ALERT2 reports received through the Blue Mountain repeater (6503) between originating source address.

**Table 4. Difference in ALERT2 Reports Received through Blue Mt. (sorted by station)**

	<b>Maple Grove (10013)</b>	<b>OneRain WX (10020)</b>	<b>Diamond Hill Wx (10028)</b>	<b>Side Creek Park (10033)</b>	<b>Little Dry Creek (10038)</b>	<b>Magnolia Wx (6601)</b>	<b>Total</b>
Diamond Hill	2256	17975	17842	112	1759	49675	89,619
Greenhouse	2321	17951	17818	112	1771	49611	89,584
Difference	-65	24	24	0	-12	64	35
Comments							

Overall this month the distribution of the difference is not concentrated to a single repeater or to a single station. The difference is distributed across a larger range of sensors and repeaters than in past months.

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. The ratio stays very consistent all the way through October in 2016 which may be due to the fact the air temperatures have been warm.

## **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
4270	Cannon Mountain	Poor performance
4330	Hansen Rain	Poor performance
4490	Apple Valley	Poor performance
3010	EPC at Hwy 105	Poor performance
1440	Elbert Weather	Poor performance
623	Unknown ID with a large number of reports	Quincy/Highline
443	Unknown ID with a large number of reports	Aurora FS #7
3071	Unknown ID with a large number of reports	Newlin Gulch
1495	Unknown ID	

## 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		0.97	0.98	0.97	0.96
Heritage Regional Park	3090		0.46	0.85	0.83	0.94
Magnolia	6601		0.84	0.80	0.85	0.83
Blackstone	10010		0.94	0.94	0.61	0.94
ETG @ Hampden	10011		0.71	0.71	0.71	0.69
Carr Street (100)	10012		0.83	0.99	0.95	0.88
Maple Grove (1000)	10013		0.95	0.92	0.95	0.96
Upper Sellers	10014	0.92				
Haystack Road	10015	0.93				
Sand Cr at Colfax	10016		0.95	0.94	0.93	0.96
James Creek	10017		--	--	--	--
Lower Left Hand (4453)	10018		--	--	--	--
Murphy Creek (870)	10019		0.99	0.98	0.98	0.99
OneRain Weather	10020		0.80	0.67	0.76	0.78
S. St. Vrain at Berry Ridge	10021		--	--	--	--
Arvada/Blunn Reservoir	10022		0.95	0.95	0.94	0.95
Havana Pond	10023		0.90	0.90	0.90	0.90
Westerly Creek Dam	10024		0.95	0.95	0.95	0.95
Lena @ Nolte Pond (1023)	10025		0.97	0.99	0.97	0.93
Trumbull (Hayman)	10026	0.83				
West Creek (Hayman)	10027	0.91				
Diamond Hill (1420)	10028		0.8	0.8	0.78	0.8
Plum Creek at Sedalia	10029	0.97				
Coal Creek at McCaslin	10030		0.99	1.00	0.99	0.97
Boulder Cr. Broadway (4583)	10031		0.99	0.32	0.95	1.00
Weir Gulch	10032		0.18	0.97	0.92	0.04
Side Creek Park (830)	10033		1.00	1.00	1.00	0.96
Not Used	10034		--	--	--	--
Sanderson Gulch (1340)	10035		0.99	0.99	0.97	0.94
Porphyry Mtn (4850)	10036		0.99	--	0.99	0.93
West Creek WX (3020)	10037	0.87				
Little Dry Creek at 64 <sup>th</sup> (1310)	10038		0.98	0.97	0.94	0.98

## 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**

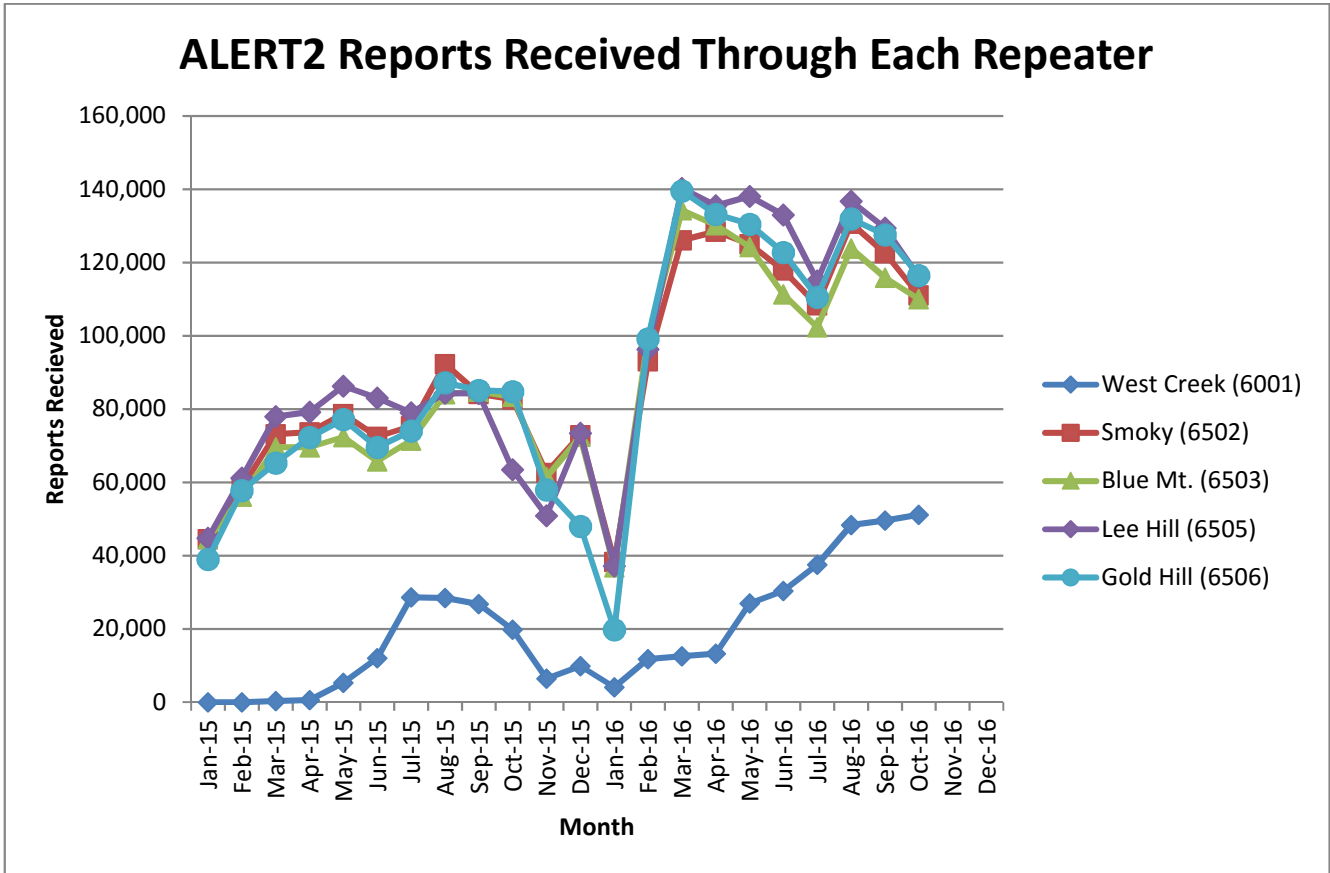
Repeater	Slot Size (sec)	Slot Offset (sec)	Source Address	ALERT2 Input Frequency (MHz)	ALERT2 Output Frequency (MHz) – received at Diamond Hill
West Creek	2	0	6001	169.425	170.300
Smoky	3	2	6502	169.525	170.300
Blue Mt.	4	5	6503	169.525	170.300
Lee Hill	3	9	6505	169.525	170.300
Gold Hill	3	12	6506	169.525	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
Sep-16	49,555	122,625	115,898	129,454	127,606	545,138
Oct-16	51,170	111,105	110,038	116,087	116,489	504,889

\*\* - 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	49.09	The average time it took a report from the field to reach the base
Minimum	-23	The minimum time it took for a report to go from the field to the base
Maximum	43180	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	48.33	49.09		
Minimum	3	2	1	3	2	2	3	-20	-20	-23		
Maximum	300	261	521	745	262	226	280	288	43180	43180		
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)	West Cr WX (3019)	West Cr WX (3019)		

The large latency of 43180 seconds and the minimum latency of -23 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	2790	2790		
4550	4520	2790	2790	1620	430	1530	2360	2360	4270		
2330	2790	4850	2360	2750	4330	430	2330	1710	4330		
4270	4850	5940	1420	2330	2330	4270	1530	2330	5720		
1660	10026	10023	4270	5860	10026	1710	2230	2230	4490		
4330	10020	10026	4520	2360	2360	4330	1620	4330	4870		

\*- 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	7.51	Only the 1-mm rain sensors were included in the analysis
Median	8	Only the 1-mm rain sensors were included in the analysis
Standard deviation	3.51	Only the 1-mm rain sensors were included in the analysis
Mean plus three standard deviations	18.0	Only the 1-mm rain sensors were included in the analysis
Mean minus two standard deviations	0.51	Only the 1-mm rain sensors were included in the analysis
Minimum total count	0	Many sites
Maximum total count	20	Wx-Ward C-1 (4710)
Sensors showing <b>NO</b> rain for the month		Many as this month was very dry.
Sensors greater than 3 SD (over reporting)		Wx-Ward C-1 (4710)

## 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	8.86	7.51			
<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>45.32</b>	<b>27.86</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
Hiwan GC	2210	Received one bad data transmission

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

The system-wide reception rate of incrementing, 1-mm tip reports for the month was approximately 96 percent. A total of 570 incrementing reports were received and a total of 593 reports were expected. The total loss of incrementing reports for the month was approximately 4 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	2790	5900		
4550	10026	10026	5900	4330	4270	2360	4870	2310	3010		
1640	2790	5940	4260	1620	1620	4470	2360	540	1440		
4180	4240	4790	950	4470	4330	2970	1710	4490	4270		
1660	5940	4510	2330	2230	2330	4330	4470	2350	2710		
4840	4510	4870	1480	2980	10026	1620	1620	1370	4290		

\*-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)	225	183	0
Total reports from unknown IDs	753	774	0
Unknown IDs with only a single received report (potential noise)	121	110	0
Total reports from all IDs – RecData Log entire month	411,402	251,914	504,889
Unknown reports as a fraction of total reports	0.18%	0.31%	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	1,413	753		

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%	0.36%	0.18%		

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	110	623	107	
443	33	443	33	
3071	31	3071	0	Only on the concentrator channel
1495	26	1495	23	
1430	25	1430	19	
3044	23	0, 1, 2	58, 58, 137	

## 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	0	0		
1530-Bear Cr. At Lowell	8	5	10	3	1	0	0	0	0	1		
2810-Pine Cliff Rd.	--	18	11	8	9	6	0	3	5	11		
2750-Wx-Castle Rock	10	24	0	0	1	3	1	2	0	2		
2790-Wx-W. Cherry Creek	--	--	--	--	8	4	0	1	0	4		
2980-Dakan Road	--	--	--	8	9	6	2	3	3	2		
2990-Tomah Rd.	--	12	2	2	2	2	1	0	0	1		
3010-Wx-EPC @ 105	--	--	8	10	11	11	6	2	1	0		
3020-Wx-West Creek	9	103	96	111	149	178	50	0	0	0		
3050-E/W Trailhead	--	--	8	7	7	8	1	4	3	7		
3070-Newlin Gulch	10	52	5	0	0	1	0	0	0	0		
3090-Heritage Reg.	--	--	--	--	--	38	0	1	0	0		
4030-Red Garden	23	41	3	4	2	2	0	3	3	4		
4330-Hansen Rain	--	--	--	--	5	2	4	2	1	0		
4770-Cal-Wood Ranch	--	--	--	--	--	--	--	10	0	0		
5730-West Creek	--	--	--	--	22	0	0	0	0	0		
10014-Upper Sellers	--	--	--	--	--	--	--	6	0	0		
10015-Sellers Haystack	--	--	--	--	--	--	--	10	0	0		

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

Sensor ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
133-Simms Street	--	--	--	--	--	--	--	--	11	2		
203-Leyden Res	11	22	37	15	1	0	0	0	1	5		
323-Sports Complex	--	--	--	--	--	--	--	--	10	1		
633-Temple Pond at DTC	--	--	--	--	--	13	0	3	0	6		
653-GG at Iliff Pond	--	--	--	15	1	1	0	2	0	1		
713-Horseshoe Park Drop	--	--	--	12	0	0	0	0	0	2		
853-Flying J	--	36	57	58	58	59	61	0	0	0		
1203-Brmfld 3207/Pond6	--	--	--	--	--	--	--	10	0	0		
1323-SPR at 3 <sup>rd</sup> Ave	--	--	--	78	1	0	5	1	0	7		
1383-Ferril Lake	747	703	686	714	683	721	225	0	0	3		
1623-Slaughterhouse Gulch	--	--	--	--	13	10	4	5	0	2		
1649-SPR at 19 <sup>th</sup> Street	--	--	--	--	--	--	--	--	--	193		
1663-SPR at Henderson	--	--	--	--	9	8	5	7	6	3		
2253-Rosedale	--	--	--	--	--	--	--	--	17	0		
2813-Pine Cliff Road	--	--	--	--	1,172*	26	42	5	2	6		
2873-Cottonwood	--	--	85	2,807*	2,764*	0	0	0	0	0		
3013-EPC@Hwy 105	7	19	11	4	2	17	6	11	3	3		
3043-CC@Russelville	--	--	22	5	0	0	1	1	0	0		
3093-Heritage Reg. Park	--	--	--	--	--	54	1	0	0	0		
4433-Rowena	--	--	--	--	--	--	23	10	8	0		
4563-Lyons Diversion	--	13	13	10	3	3	4	4	9	8		
4593-Green Ditch	--	--	--	--	--	--	--	9	5	8		
10029-Plum Creek at Sedalia	--	--	--	--	--	--	--	8	12	3		

\*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.

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There were no rainfall alarms this month.

# General System Analysis

**Database Name** P:\A207-UDFCD-Data-Analysis\2016\10-2016\Novastar\_extract\_2016Oct-Working.mdb

<b>First Date in Database</b>	10/1/16 12:00 AM	<b>Total Days</b>	31.0
<b>Last Date in Database</b>	10/31/16 11:59 PM	<b>Total Hours</b>	744.0

Summarize

**Total Records Analyzed** 411,402

Records by Group	Concentrator	Percent	Legacy	Percent	ALERT2	Percent
Wind Data	172,568	41.9%	96,089	38.1%	162,779	32.2%
Temperature	68,563	16.7%	38,418	15.3%	85,550	16.9%
Relative Humidity	59,663	14.5%	37,565	14.9%	82,427	16.3%
Barometric Pressure	32,962	8.0%	21,728	8.6%	1,382	0.3%
Battery Voltage	23,495	5.7%	10,464	4.2%	51,476	10.2%
Water Level	11,787	2.9%	10,392	4.1%	34,548	6.8%
Solar Radiation	11,297	2.7%	10,860	4.3%	0	0.0%
Precipitation	8,737	2.1%	6,484	2.6%	28,054	5.6%
Fuel Temperature	5,982	1.5%	5,890	2.3%	0	0.0%
Fuel Moisture	5,952	1.4%	5,853	2.3%	0	0.0%
Soil Moisture	2,959	0.7%	2,913	1.2%	0	0.0%
Repeater Status Report	2,372	0.6%	2,795	1.1%	0	0.0%
Hayman Battery	2,302	0.6%	0	0.0%	0	0.0%
Unknown	753	0.2%	774	0.3%	0	0.0%
ET-Hourly	754	0.2%	733	0.3%	0	0.0%
Wind Direction	640	0.2%	0	0.0%	14,002	2.8%
12Hr Status Report	205	0.0%	192	0.1%	1,163	0.2%
GPS Lock	125	0.0%	0	0.0%	21,442	4.2%
Water Temp	120	0.0%	119	0.0%	0	0.0%
Repeater Pass List	62	0.0%	552	0.2%	0	0.0%
Not Used	60	0.0%	52	0.0%	0	0.0%
ET-Daily	32	0.0%	30	0.0%	0	0.0%
Handar 585 ALARM Status	5	0.0%	5	0.0%	0	0.0%
ALERT/A2 Testing	3	0.0%	3	0.0%	0	0.0%
Solar Power	3	0.0%	3	0.0%	0	0.0%
Dew Point Temperature	0	0.0%	0	0.0%	8,758	1.7%
Wind Chill	0	0.0%	0	0.0%	8,758	1.7%
Flasher Status	0	0.0%	0	0.0%	4,550	0.9%
Evapotranspiration	1	0.0%	0	0.0%	0	0.0%
<b>Total</b>	<b>411,402</b>	<b>100.0%</b>	<b>251,914</b>	<b>100.0%</b>	<b>504,889</b>	<b>100.0%</b>

Traffic Loading Summary	Concentrator	Legacy	ALERT2
Alert Reports	411,402	251,914	504,889
Average Daily Traffic	13,271	8,126	15,778
Average Hourly Traffic	553	339	657
Median Hourly Traffic	545	hour beginning	333
Peak Hourly Traffic	792	Oct 17, 1:00 PM	496
2nd Max	791	Oct 17, 2:00 PM	482
3rd Max	785	Oct 6, 7:00 AM	482
4th Max	772	Oct 6, 12:00 PM	480
5th Max	771	Oct 17, 3:00 PM	472



# Rain Timer Performance

Analyze Rain Sensors

Rain Sensors	Description	Rcv	Timer	Exp	Performance
2790	Wx-W. Cherry Creek	8	16:48	62	13%
4270	Cannon Mountain	45	15:45	62	73%
4330	Hansen Rain	49	14:40	62	79%
4490	Apple Valley	52	13:44	62	84%
5720	Four Mile Creek	52	14:09	62	84%
4870	SBC @ SB Road	53	13:45	62	85%
100260	Wx-A2-Trumbull (Hayman) - Precip	645		744	87%
1520	Wx-Marston Lake North	54	12:57	62	87%
4340	Riverside	55	12:55	62	89%
4510	Pinewood Springs	55	13:22	62	89%
3010	WX-EPC at Hwy 105	56	12:28	62	90%
3030	WX-Bingham Lake Park	57	12:39	62	92%
4290	Red Hill	57	12:10	62	92%
2750	Wx-Castle Rock	58	12:38	62	94%
4020	Rio Grande	58	12:38	62	94%
4040	Martin Gulch	58	12:25	62	94%
4180	Gold Lake	58	12:38	62	94%
4350	Conifer Hill	58	12:24	62	94%
4790	Wx-Button Rock	58	12:40	62	94%
4830	SBC @ San Souci	58	12:52	62	94%
5940	Log Jumper	58	12:38	62	94%
1460	Wx-Urban Farm	59	12:13	62	95%
2710	Wx-Highlands Ranch WTP	59	12:25	62	95%
4030	Red Garden	59	12:12	62	95%
4060	Lakeshore	59	12:36	62	95%
4160	Sunshine	59	12:24	62	95%
4250	Geer Canyon	59	12:11	62	95%
4300	Big Elk Park	59	12:36	62	95%
5810	Stump Bump	59	12:12	62	95%
920	Wx-Aurora Town Hall	60	12:00	62	97%
1440	Wx-Elbert	60	12:12	62	97%
1920	Wx-Brighton	60	12:12	62	97%
2730	Wx-Salisbury Park	60	12:12	62	97%
2990	Wx-Tomah Rd-DougCnty	60	12:12	62	97%
4010	Crecent	60	12:10	62	97%
4050	Walker Ranch	60	12:22	62	97%
4070	Bear Peak	60	11:57	62	97%
4100	Filter Plant	60	12:12	62	97%
4190	Slaughterhouse	60	12:10	62	97%
4260	Taylor Mountain	60	11:58	62	97%
4310	Johnny Park	60	12:11	62	97%
4530	Winiger Ridge	60	12:09	62	97%
4730	Wx-Sugarloaf	60	12:12	62	97%
4820	Doudy Draw	60	12:10	62	97%
4860	Fairview Peak	60	12:13	62	97%
5730	West Creek	60	12:00	62	97%
5880	Hackett Mountain	60	12:12	62	97%
140	Wx-Blue Mountain	61	12:00	62	98%
2210	Wx-Hiwan G.C.	61	11:47	62	98%
2930	Wx-Spring Valley Rd-DougCnty	61	12:00	62	98%
4080	Twin Sisters	61	12:10	62	98%
4110	Betasso	61	12:12	62	98%
4130	Swiss Peaks	61	11:57	62	98%
4140	Logan Mill	61	11:58	62	98%
4170	Pine Brook	61	11:57	62	98%
4200	Lazy Acres	61	11:59	62	98%
4220	Fling's	61	11:58	62	98%
4230	Golden Age	61	11:57	62	98%
4360	Justice Center	61	12:10	62	98%
4520	Eagle Ridge	61	11:58	62	98%
4550	Boulder Jail	61	11:57	62	98%
4570	St. Antons	61	11:59	62	98%
4710	Wx-Ward C-1	61	12:00	62	98%
4750	Wx-Louisville Lake	61	12:00	62	98%
4770	Wx-Cal-Wood Ranch	61	12:00	62	98%
4810	Shanahan Ridge	61	11:57	62	98%
4840	SBC@S Boulder Ditch	61	11:57	62	98%

4880	Whispering Pines	61	11:57	62	98%
5740	Trail Creek	61	12:00	62	98%
5860	Cedar Mountain	61	12:00	62	98%
100200	Wx-A2-OneRain Weather - Precipitation	61	12:00	62	98%
100270	Wx-A2-WestCreek (Hayman) - Precip	734		744	99%
100320	A2-Weir Gulch - Precip	741		744	100%
4850	Porphory Mtn	743		744	100%
100290	A2-PlumCr at Sedalia - Precip	743		744	100%
100300	A2-CoalCreek at McCaslin - Precip	743		744	100%
1420	Wx-A2-Diamond Hill	62	11:37	62	100%
4090	Magnolia	62	11:58	62	100%
4150	Gold Hill	62	11:58	62	100%
4240	Sunset	62	11:58	62	100%
5900	Horse Creek-Satellite	1216		1216	100%
750	Wx-Quincy Reservoir	63	11:44	62	102%
1570	Wx-Brighton Ditch	63	11:35	62	102%
4320	Lee Hill Rain 2012	63	11:47	62	102%
3020	Wx-West Creek WX	761		744	102%
900	Wx-Aurora Reservoir	64	11:42	62	103%
6601	Wx-A2-Magnolia WX-Precip	92	8:00	62	148%
3090	A2-Highland Heritage Park	543		744	73%
3080	Tallman Gulch	49	11:44	62	79%
3070	A2-Newlin Gulch Precip	588		744	79%
3060	Fire Sta 47	387		744	52%
3050	East/West Trailhead	45	12:50	62	73%
3040	CC @ Russelville Road Precip	38	12:00	62	61%
2980	Dakan Rd	48	13:35	62	77%
2970	Rampart Range Rd-Satellite	123	3:54	62	198%
2960	Indian Creek	44	12:00	62	71%
2950	DC Public Works	37	12:20	62	60%
2940	Willow Creek - DougCnty	35	12:21	62	56%
2920	West Cherry Head-Douglas Cnty	36	12:42	62	58%
2910	East Cherry Cr-Douglas	33	12:46	62	53%
2900	Russelville Gulch-Douglas	35	12:45	62	56%
2890	Spruce Mt - Douglas	34	13:36	62	55%
2880	Happy Canyon at N Surrey Dr	43	13:10	62	69%
2870	Cottonwood (Apache)	31	12:24	62	50%
2860	CC at Stroh Rd	46	12:30	62	74%
2850	Cherry Cr bl Bayou Gich	48	12:00	62	77%
2840	Sulphur Gulch	33	11:59	62	53%
2820	Haskins Gulch Conf	35	12:43	62	56%
2810	Pine Cliff Road	36	12:21	62	58%
2370	Red Rocks Park	37	11:58	62	60%
2330	Morrison	44	16:05	62	71%
2320	Choke Cherry Resvr	56	12:38	62	90%
1900	Niver Detention	52	11:04	62	84%
1800	Sand Creek Park	6	11:58	62	10%
1720	Cherry Cr @ Steele	19	12:42	62	31%
1710	Shop Creek	31	13:42	62	50%
1700	Cherry Cr @ Champa	58	12:13	62	94%
1660	SPR at Henderson	53	13:42	62	85%
1640	SPR at Union Ave.	60	12:10	62	97%
1620	Slaughterhouse Glch	19	14:04	62	31%
1600	Englewood Dam	20	11:58	62	32%
1550	Lakewood CC	38	12:19	62	61%
1530	Bear Creek @ Lowell	25	11:57	62	40%
1500	Powers Park	24	11:58	62	39%
1480	Third Creek at DIA	8	11:59	62	13%
1400	Upper Sloan Det.	37	13:25	62	60%
1370	West Metro FS13	26	12:29	62	42%
1360	Denver Zoo	20	12:00	62	32%
1350	Chatfield COE	26	12:05	62	42%
1340	Sanderson at Xavier	490		744	66%
1320	SPR at 3rd Ave	44	10:54	62	71%
1310	LDC at 64th	588		744	79%
1300	Hidden Lake	50	11:42	62	81%
1200	Broomfield 3207	11	13:27	62	18%
1110	Gunbarrel	12	11:58	62	19%
1100	Louisville Rec Ctr	10	11:59	62	16%
1060	Heritage Square	37	12:18	62	60%
1050	Jeffco Fairgrounds	23	12:33	62	37%
1040	Lena @ U.S. Hwy 6	23	13:06	62	37%

1030	NREL/S. Table Mtn.	20	13:57	62	32%
1010	Denver West	24	11:57	62	39%
1000	A2-Maple Grove Resv.	742		744	100%
970	Pump Sta 3	62	11:47	62	100%
950	Piney at Liverpool	13	11:57	62	21%
940	Aurora Regional Pond	12	11:57	62	19%
870	A2-Murphy Creek GC	230		744	31%
850	Flying J	6	15:00	62	10%
840	Fire Station 12	7	10:46	62	11%
830	Side Creek Park	51	12:00	62	82%
820	ETG @ Buckley	49	12:29	62	79%
810	Granby Ditch @ 6th	6	11:57	62	10%
800	Sable Ditch @ 18th	6	11:57	62	10%
760	Mission Viejo Park	34	12:21	62	55%
730	No Name @ Quincy	17	11:58	62	27%
720	Confluence Pond	37	11:58	62	60%
710	Horseshoe Park Drop	51	11:46	62	82%
700	Toll Gate @ 6th	61	12:00	62	98%
650	Iliff Pond	20	11:59	62	32%
640	Goldsmith @ Eastman	19	11:57	62	31%
630	Temple Pond at DTC	20	11:56	62	32%
620	Quincy/Highline	24	11:57	62	39%
610	Harvard @ Jackson	31	12:22	62	50%
600	Harvard Gulch Park	32	11:58	62	52%
540	Parker/Mississippi	20	11:57	62	32%
530	Fire Station #19	20	11:57	62	32%
520	Jewell Detention	32	11:57	62	52%
510	Virginia Court	8	11:56	62	13%
500	Havana Park	8	11:57	62	13%
440	Fire Station #7	36	11:57	62	58%
430	Utah Park	32	11:58	62	52%
420	Expo Park	7	13:57	62	11%
410	Kelly Dam	7	13:57	62	11%
330	Van Bibber @ Hwy 93	63	11:46	62	102%
320	Sports Complex	5	11:58	62	8%
310	Guy Hill Ranch	2	11:57	62	3%
300	Van Bibber Park	3	11:57	62	5%
220	Upper Leyden	4	12:00	62	6%
210	Leyden Confluence	4	11:57	62	6%
200	Leyden Reservoir	60	12:09	62	97%
150	Nott Creek	3	11:57	62	5%
120	West Woods	46	12:49	62	74%
110	Ralston Reservoir	61	11:58	62	98%
100	A2-Carr Street	588		744	79%
100240	A2-Westerly Cr Dam Precip	82	1:00	744	11%
100230	A2-Havana Pond Precip	108	1:00	744	15%
100160	A2-Sand Creek at Colfax Precip	84	1:00	744	11%
100150	A2-Sellers Gulch at Haystack Precip	460		744	62%
100140	A2-Upper Sellers Gulch Precip	335		744	45%
100110	A2-ETG @ Hampden Precip	20	12:00	744	3%
100100	A2-Blackstone Precip	13	11:49	744	2%

Rain Event Performance																	
	Reports Received	Reports Received	570	Analyze Rain Sensors							0	<<show stations with zero rain (1=yes, 0=no)					
	Systemwide Avg	Total Tips	593														
	96.12%	Data Loss	3.88%														
Description	Sensor	Performance	1-tips	2-tips	3-tips	4-tips	5-tips	6-tips	>6-tips	Rcv	Exp	Miss	Hold	Bucket			
Horse Creek-Satellite	5900	50%	1	0	1	0	0	0	0	1	3	2	0	0.03937			
WX-EPC at Hwy 105	3010	63%	3	1	1	0	0	0	0	5	8	3	0	0.03937	Mean	7.51	
Wx-Elbert	1440	75%	7	1	1	0	0	0	0	9	12	3	2	0.03937	Median	8	
Cannon Mountain	4270	75%	4	2	0	0	0	0	0	6	8	2	0	0.03937	St. Dev	3.51	
Wx-Highlands Ranch WTP	2710	80%	3	1	0	0	0	0	0	4	5	1	0	0.03937	Mean plus 3 SD	18	
Red Hill	4290	80%	3	1	0	0	0	0	0	4	5	1	0	0.03937	Min	1	
SBC @ SB Road	4870	82%	7	2	0	0	0	0	0	9	11	2	0	0.03937	Max	20	
Wx-Marston Lake North	1520	83%	8	2	0	0	0	0	0	10	12	2	2	0.03937			
Taylor Mountain	4260	86%	5	1	0	0	0	0	0	6	7	1	0	0.03937			
Lakeshore	4060	86%	5	1	0	0	0	0	0	6	7	1	0	0.03937			
Rio Grande	4020	86%	5	1	0	0	0	0	0	6	7	1	0	0.03937			
Winiger Ridge	4530	88%	6	1	0	0	0	0	0	7	8	1	0	0.03937			
Geer Canyon	4250	89%	7	1	0	0	0	0	0	8	9	1	0	0.03937			
Pinewood Springs	4510	90%	8	1	0	0	0	0	0	9	10	1	0	0.03937			
Gold Lake	4180	92%	10	1	0	0	0	0	0	11	12	1	0	0.03937			
Wx-West Creek WX	3020	100%	9	0	0	0	0	0	0	9	9	0	0	0.03937			
Wx-Ward C-1	4710	100%	20	0	0	0	0	0	0	20	20	0	0	0.03937			
Wx-W. Cherry Creek	2790	100%	1	0	0	0	0	0	0	1	1	0	0	0.03937			
Wx-Urban Farm	1460	100%	6	0	0	0	0	0	0	6	6	0	0	0.03937			
Wx-Tomah Rd-DougCnty	2990	100%	8	0	0	0	0	0	0	8	8	0	0	0.03937			
Wx-Sugarloaf	4730	100%	9	0	0	0	0	0	0	9	9	0	0	0.03937			
Wx-Spring Valley Rd-DougCnty	2930	100%	1	0	0	0	0	0	0	1	1	0	0	0.03937			
Wx-Salisbury Park	2730	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937			
Wx-Quincy Reservoir	750	100%	14	0	0	0	0	0	0	14	14	0	0	0.03937			
Wx-Louisville Lake	4750	100%	7	0	0	0	0	0	0	7	7	0	0	0.03937			
Wx-Hiwan G.C.	2210	100%	5	0	0	0	0	0	1	5	5	0	0	0.03937			
Wx-Castle Rock	2750	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937			
Wx-Button Rock	4790	100%	12	0	0	0	0	0	0	12	12	0	0	0.03937			
Wx-Brighton Ditch	1570	100%	10	0	0	0	0	0	0	10	10	0	0	0.03937			
Wx-Brighton	1920	100%	6	0	0	0	0	0	0	6	6	0	0	0.03937			
Wx-Blue Mountain	140	100%	5	0	0	0	0	0	0	5	5	0	0	0.03937			
WX-Bingham Lake Park	3030	100%	3	0	0	0	0	0	0	3	3	0	0	0.03937			
Wx-Aurora Town Hall	920	100%	9	0	0	0	0	0	0	9	9	0	0	0.03937			
Wx-Aurora Reservoir	900	100%	7	0	0	0	0	0	0	7	7	0	0	0.03937			
Wx-A2-WestCreek (Hayman) - Precip	100270	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937			
Wx-A2-Trumbull (Hayman) - Precip	100260	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937			
Wx-A2-Diamond Hill	1420	100%	12	0	0	0	0	0	0	12	12	0	0	0.03937			
Log Jumper	5940	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937			
Hackett Mountain	5880	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937			
Cedar Mountain	5860	100%	1	0	0	0	0	0	0	1	1	0	0	0.03937			
Stump Bump	5810	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937			
Trail Creek	5740	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937			
West Creek	5730	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937			
Four Mile Creek	5720	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937			
Whispering Pines	4880	100%	10	0	0	0	0	0	0	10	10	0	0	0.03937			
SBC@S Boulder Ditch	4840	100%	7	0	0	0	0	0	0	7	7	0	0	0.03937			
SBC @ San Souci	4830	100%	6	0	0	0	0	0	0	6	6	0	0	0.03937			
Doudy Draw	4820	100%	3	0	0	0	0	0	0	3	3	0	0	0.03937			
Shanahan Ridge	4810	100%	9	0	0	0	0	0	0	9	9	0	0	0.03937			
St. Antons	4570	100%	9	0	0	0	0	0	0	9	9	0	0	0.03937			



Rampart Range Rd-Satellite	2970	100%	6	0	0	0	0	0	0	0	6	6	0	0	0.03937
Indian Creek	2960	100%	5	0	0	0	0	0	0	0	5	5	0	0	0.03937
DC Public Works	2950	100%	2	0	0	0	0	0	0	0	2	2	0	0	0.03937
Willow Creek - DougCnty	2940	100%	2	0	0	0	0	0	0	0	2	2	0	0	0.03937
West Cherry Head-Douglas Cnty	2920	80%	3	1	0	0	0	0	0	0	4	5	1	0	0.03937
East Cherry Cr-Douglas	2910	100%	3	0	0	0	0	0	0	0	3	3	0	0	0.03937
Russelville Gulch-Douglas	2900	100%	3	0	0	0	0	0	0	0	3	3	0	0	0.03937
Spruce Mt - Douglas	2890	100%	3	0	0	0	0	0	0	0	3	3	0	0	0.03937
Happy Canyon at N Surrey Dr	2880	100%	4	0	0	0	0	0	0	0	4	4	0	0	0.03937
Cottonwood (Apache)	2870	100%	3	0	0	0	0	0	0	0	3	3	0	0	0.03937
CC at Stroh Rd	2860	100%	3	0	0	0	0	0	0	0	3	3	0	0	0.03937
Cherry Cr bl Bayou Glch	2850	100%	2	0	0	0	0	0	0	0	2	2	0	0	0.03937
Sulphur Gulch	2840	100%	3	0	0	0	0	0	0	0	3	3	0	0	0.03937
Haskins Gulch Conf	2820	100%	3	0	0	0	0	0	0	0	3	3	0	0	0.03937
Pine Cliff Road	2810	100%	3	0	0	0	0	0	0	0	3	3	0	0	0.03937
Red Rocks Park	2370	83%	4	1	0	0	0	0	0	0	5	6	1	0	0.03937
Morrison	2330	100%	1	0	0	0	0	0	0	1	1	1	0	0	0.03937
Choke Cherry Resvr	2320	83%	4	1	0	0	0	0	0	0	5	6	1	0	0.03937
Niver Detention	1900	100%	6	0	0	0	0	0	0	0	6	6	0	0	0.03937
Cherry Cr @ Steele	1720	73%	6	1	1	0	0	0	0	0	8	11	3	0	0.03937
Shop Creek	1710	60%	2	0	1	0	0	0	0	0	3	5	2	0	0.03937
Cherry Cr @ Champa	1700	89%	7	1	0	0	0	0	0	0	8	9	1	0	0.03937
SPR at Henderson	1660	63%	3	1	1	0	0	0	0	0	5	8	3	0	0.03937
SPR at Union Ave.	1640	100%	7	0	0	0	0	0	0	0	7	7	0	0	0.03937
Slaughterhouse Glch	1620	80%	3	1	0	0	0	0	0	0	4	5	1	0	0.03937
Englewood Dam	1600	100%	3	0	0	0	0	0	0	0	3	3	0	0	0.03937
Lakewood CC	1550	100%	10	0	0	0	0	0	0	0	10	10	0	0	0.03937
Bear Creek @ Lowell	1530	100%	7	0	0	0	0	0	0	0	7	7	0	0	0.03937
Powers Park	1500	95%	18	1	0	0	0	0	0	0	19	20	1	0	0.03937
Third Creek at DIA	1480	88%	6	1	0	0	0	0	0	0	7	8	1	0	0.03937
Upper Sloan Det.	1400	92%	11	1	0	0	0	0	0	0	12	13	1	0	0.03937
West Metro FS13	1370	71%	4	0	1	0	0	0	0	0	5	7	2	0	0.03937
Denver Zoo	1360	67%	9	0	0	0	0	0	1	0	10	15	5	0	0.03937
Chatfield COE	1350	100%	6	0	0	0	0	0	0	0	6	6	0	0	0.03937
Sanderson at Xavier	1340	100%	9	0	0	0	0	0	0	0	9	9	0	0	0.03937
SPR at 3rd Ave	1320	100%	7	0	0	0	0	0	0	0	7	7	0	0	0.03937
LDC at 64th	1310	100%	9	0	0	0	0	0	0	0	9	9	0	0	0.03937
Hidden Lake	1300	92%	10	1	0	0	0	0	0	0	11	12	1	0	0.03937
Broomfield 3207	1200	100%	11	0	0	0	0	0	0	0	11	11	0	0	0.03937
Gunbarrel	1110	100%	7	0	0	0	0	0	0	0	7	7	0	0	0.03937
Louisville Rec Ctr	1100	75%	8	0	0	1	0	0	0	0	9	12	3	0	0.03937
Heritage Square	1060	86%	5	1	0	0	0	0	0	0	6	7	1	0	0.03937
Jeffco Fairgrounds	1050	100%	7	0	0	0	0	0	0	0	7	7	0	0	0.03937
Lena @ U.S. Hwy 6	1040	100%	1	0	0	0	0	0	0	0	1	1	0	0	0.03937
NREL/S. Table Mtn.	1030	89%	7	1	0	0	0	0	0	0	8	9	1	0	0.03937
Denver West	1010	100%	8	0	0	0	0	0	0	0	8	8	0	0	0.03937
A2-Maple Grove Resv.	1000	80%	6	2	0	0	0	0	0	0	8	10	2	0	0.03937
Pump Sta 3	970	100%	8	0	0	0	0	0	0	0	8	8	0	0	0.03937
Piney at Liverpool	950	100%	5	0	0	0	0	0	0	0	5	5	0	0	0.03937
Aurora Regional Pond	940	100%	3	0	0	0	0	0	0	0	3	3	0	0	0.03937
A2-Murphy Creek GC	870	100%	9	0	0	0	0	0	0	0	9	9	0	0	0.03937
Flying J	850	100%	2	0	0	0	0	0	0	0	2	2	0	0	0.03937
Side Creek Park	830	100%	8	0	0	0	0	0	0	0	8	8	0	0	0.03937
ETG @ Buckley	820	100%	7	0	0	0	0	0	0	0	7	7	0	0	0.03937
Mission Viejo Park	760	100%	10	0	0	0	0	0	0	0	10	10	0	0	0.03937

No Name @ Quincy	730	100%	7	0	0	0	0	0	0	0	7	7	0	0	0.03937
Confluence Pond	720	92%	10	1	0	0	0	0	0	0	11	12	1	0	0.03937
Horseshoe Park Drop	710	100%	7	0	0	0	0	0	0	0	7	7	0	0	0.03937
Toll Gate @ 6th	700	100%	7	0	0	0	0	0	0	0	7	7	0	0	0.03937
Iliff Pond	650	100%	4	0	0	0	0	0	0	0	4	4	0	0	0.03937
Goldsmith @ Eastman	640	100%	4	0	0	0	0	0	0	0	4	4	0	0	0.03937
Temple Pond at DTC	630	100%	14	0	0	0	0	0	0	0	14	14	0	0	0.03937
Quincy/Highline	620	70%	6	0	0	1	0	0	0	0	7	10	3	0	0.03937
Harvard @ Jackson	610	100%	4	0	0	0	0	0	0	0	4	4	0	0	0.03937
Harvard Gulch Park	600	100%	10	0	0	0	0	0	0	0	10	10	0	0	0.03937
Parker/Mississippi	540	80%	3	1	0	0	0	0	0	0	4	5	1	0	0.03937
Fire Station #19	530	100%	6	0	0	0	0	0	0	0	6	6	0	0	0.03937
Jewell Detention	520	100%	6	0	0	0	0	0	0	0	6	6	0	0	0.03937
Virginia Court	510	100%	1	0	0	0	0	0	0	0	1	1	0	0	0.03937
Havana Park	500	100%	2	0	0	0	0	0	0	0	2	2	0	0	0.03937
Fire Station #7	440	100%	9	0	0	0	0	0	0	0	9	9	0	0	0.03937
Expo Park	420	100%	2	0	0	0	0	0	0	0	2	2	0	0	0.03937
Van Bibber @ Hwy 93	330	100%	5	0	0	0	0	0	0	0	5	5	0	0	0.03937
Guy Hill Ranch	310	80%	3	1	0	0	0	0	0	0	4	5	1	0	0.03937
Van Bibber Park	300	38%	2	0	0	0	0	1	0	0	3	8	5	0	0.03937
Upper Leyden	220	100%	2	0	0	0	0	0	0	0	2	2	0	1	0.03937
Leyden Reservoir	200	100%	5	0	0	0	0	0	0	0	5	5	0	0	0.03937
Nott Creek	150	100%	1	0	0	0	0	0	0	0	1	1	0	0	0.03937
West Woods	120	100%	7	0	0	0	0	0	0	0	7	7	0	0	0.03937
Ralston Reservoir	110	100%	4	0	0	0	0	0	0	0	4	4	0	0	0.03937
A2-Carr Street	100	100%	10	0	0	0	0	0	0	0	10	10	0	0	0.03937

## 2016 Monthly Peak Hour ALERT Radio Traffic Summary

