

Memo

Date: March 9, 2016
To: Kevin Stewart
From: Markus Ritsch
Subject: February 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 February 1 through February 29, 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											118,519
Concentrator	194,948	418,430											194,948
ALERT2	136,144	399,530											136,144
TOTAL	449,611	1,082,335	0	0	0	0	0	0	0	0	0	0	449,611
Conc/Leg	1.64	1.58	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.64
DataChron	645,913	662,847											645,913

The District operates two redundant 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											382,894
Concentrator	194,948	418,430											613,378
ALERT2	136,144	399,530											535,674
NS5B (Greenhouse)													
Legacy	118,610	264,516											383,126
Concentrator	194,968	418,532											613,500
ALERT2	136,330	399,841											536,171
Diff (NS5a-NS5b)													
Legacy (Digi One)	-91	-141	0	0	0	0	0	0	0	0	0	0	-232
Concentrator (B2010)	-20	-102	0	0	0	0	0	0	0	0	0	0	-122
ALERT2 (B2010)	-186	-311	0	0	0	0	0	0	0	0	0	0	-497
Comments	Recdatalog format changed...missing 1/3 of the month												

The reception rates between Diamond Hill and Greenhouse are very similar.

The daily ratio of total concentrator reports received versus total legacy ALERT reports received is shown (Figure 1).

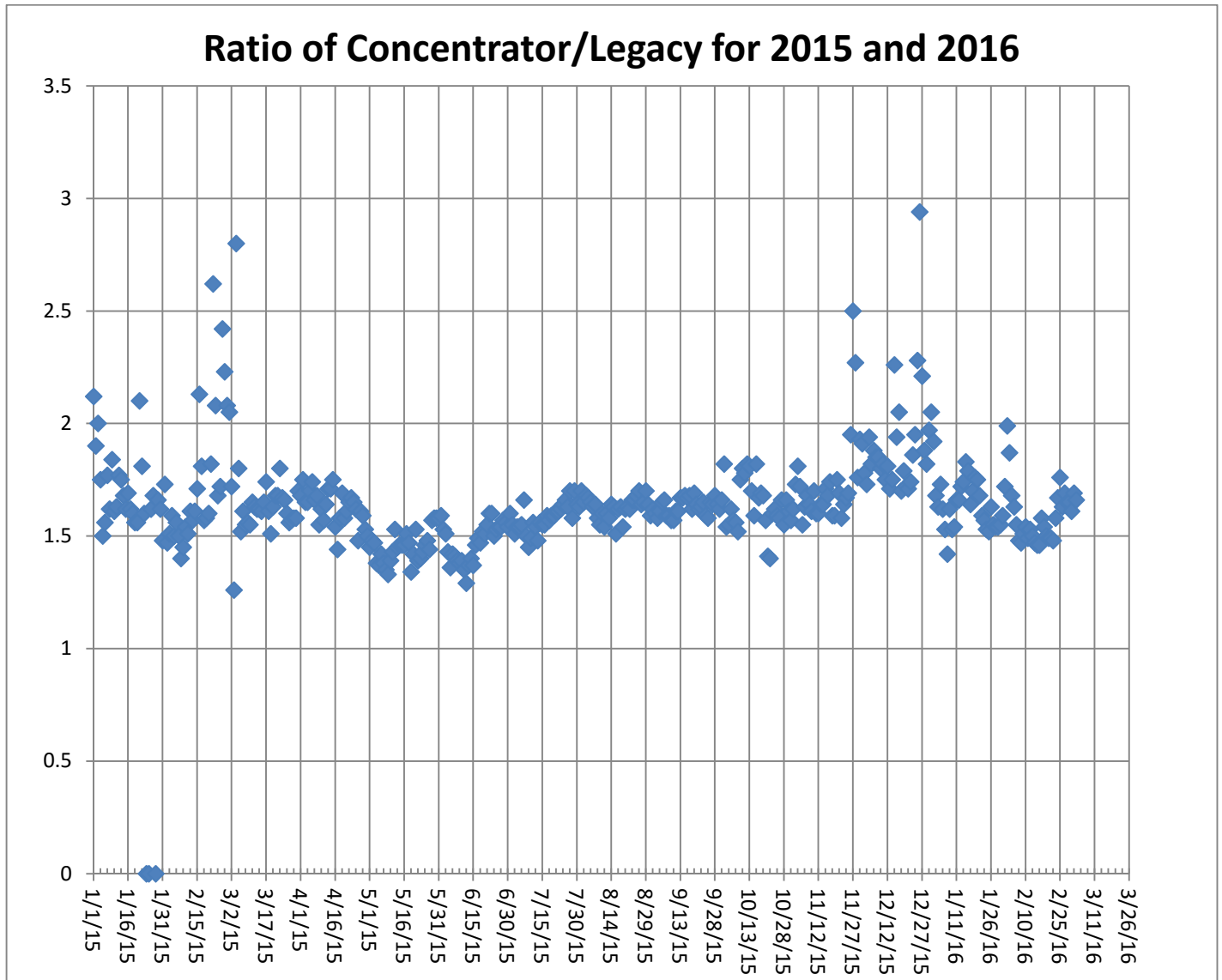


Figure 1. Daily Ratio of Concentrator Reports to Legacy Reports

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. A total of 696 hours of data were present in the NovaStar5 database (DataChron). A total of 29 days with data reception for 24 hours each day yields a total of 696 hours of operation. Outages of less than one hour are not identified.

B. Specific Issues Identified

Performance of the following sensors (Table 3) was questionable this month.

Table 3. Sensors with Poor Performance Characteristics

Sensor ID	Description	Comments
10027	West Creek Hayman	This station stopped reporting in November...WET to investigate
10026	Trumbull Hayman	Poor timer and event reporting
3020	West Creek Weather	Poor timer and event reporting.....very noisy
4270	Cannon Mt.	Poor event reporting
416, 411, 412, 414, 417	Unknown IDs	Possible coming from Kelly Dam (410)
4028	Unknown ID with a large number of reports	This ID is received only on the legacy ALERT channel....it is not received as a concentrator report.

Also this month the amount of unknown IDs received on the legacy channel is higher than normal. February is typically a pretty quiet month and the number of unknown IDs received has increased by approximately 80% over the same month last year (Table 4).

Table 4. Unknown IDs with only a single report (may indicate noisy channel)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015	168	165	213	256	270	239	159	174	161	289	226	138
2016	142	297										

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 5).

Table 5. 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					
Heritage Regional Park	3090					
Magnolia	6602		0.988	0.997	0.997	0.997
Blackstone**	100100					
ETG @ Hampden**	100110					
Carr Street (100)	100120					
Maple Grove (1000)	100130		0.941	0.941	0.932	0.924
Upper Sellers	100140					
Haystack Road	100150					
Sand Cr at Colfax	100160					
James Creek	100177			--		
Lower Left Hand (4453)	100180					
Murphy Creek (870)	100190					
OneRain Weather	100200		0.547	0.792	0.679	0.773
S. St. Vrain at Berry Ridge	100210		--	--		
Arvada/Blunn Reservoir	100227		1.00	1.00	0.906	--
Havana Pond	100230					
Westerly Creek Dam	100240		0.978	0.978	0.975	0.978
Lena @ Nolte Pond (1020)	100250					
Trumbull (Hayman)	100260	0.889				
West Creek (Hayman)	100270	--				
Diamond Hill (1420)	100280		0.994	0.990	0.942	0.986
Plum Creek at Sedalia	100290	0.979				
Coal Creek at McCaslin	100300		0.890	0.977	0.967	0.963
Boulder Cr. Broadway (4583)	100310		--	0.726	0.962	1.00
Weir Gulch	100320					
Side Creek Park	100330					

**the APDUID is disabled for these sites.....these are original HSE A2 transmitters and may not support the APDUID

D. ALERT2 Repeater Loading

The 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 6). 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 6. 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 7). This helps to quantify repeater loading for the ALERT2 backbone.

Table 7. 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

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

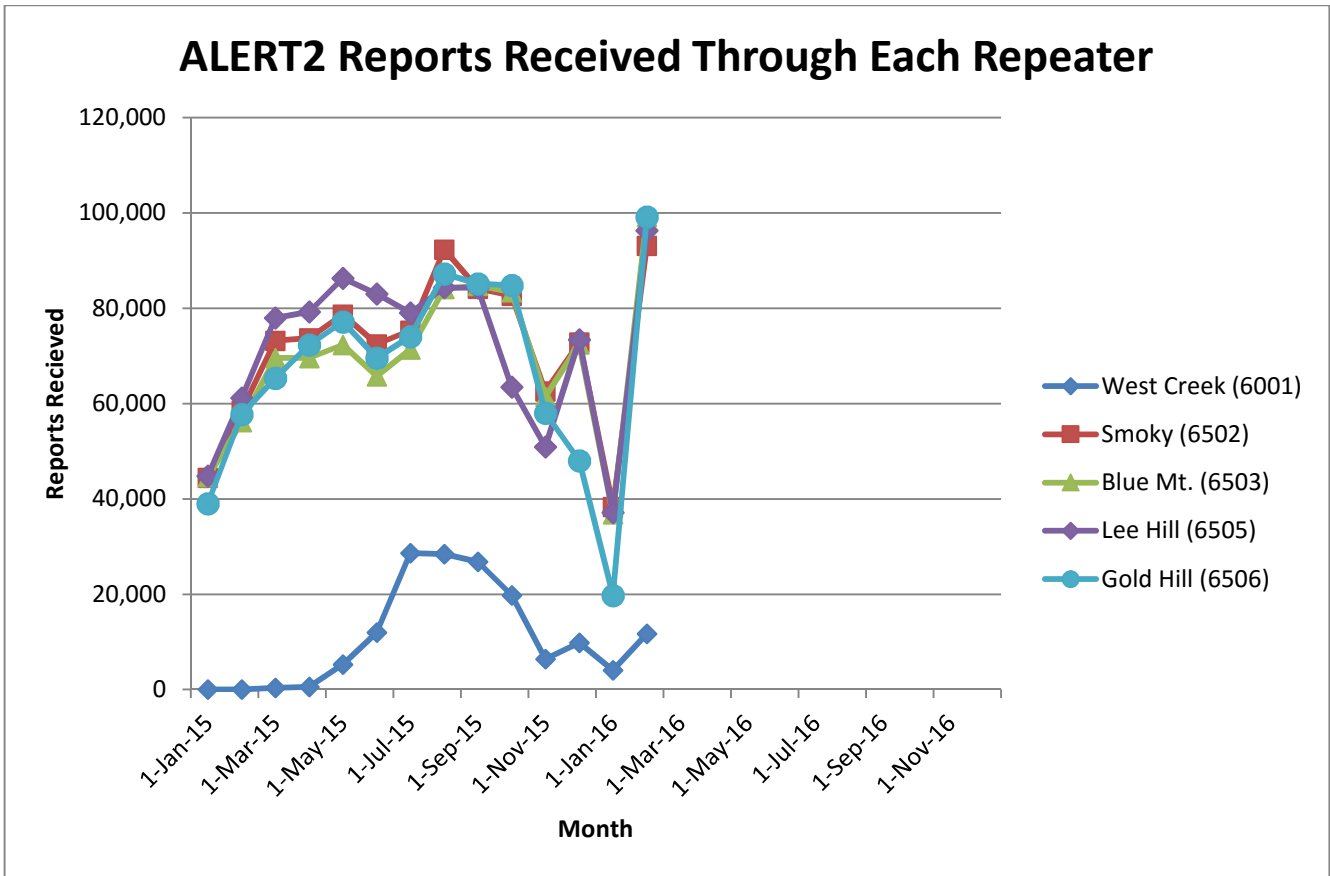


Figure 2. Reports received through each repeater (ALERT2 Only)

In general each of the primary repeaters in the District process an equivalent number of ALERT2 reports. Several months are evident where the throughput of one repeater is not consistent with the other three. The reduction of ALERT2 reports through Lee Hill in October is evident (Figure 2) as is the reduction of ALERT2 reports through Gold Hill in December. A convenient mechanism to track repeater performance throughout the year is to monitor total ALERT2 reports passed by each repeater.

The following tables summarize the system-wide latency of ALERT2 self-reports (Table 8 and Table 9).

Table 8. System-Wide Latency of ALERT2 Self-Reports (seconds)

Statistical Parameter	Value (sec)	Comments
Mean	72.6	The average time it took a report from the field to reach the base
Minimum	2	The minimum time it took for a report to go from the field to the base
Maximum	261	The maximum time it took for a report to go from the field to the base
Crazy	26000	Noticed several ALERT2 transmissions from SA 100260 with very large latencies

Table 9. 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										
Minimum	3	2										
Maximum	300	261										
Station with Max Latency	Magnolia WX (6602)	Magnolia WX (6607)										
Station with Crazy Latency		Trumbull WX – Hayman (100260)										

The weather station at Trumbull (10026) had two very large latencies. The worst latency was for a report time of 2/19/2016 5:02:40 AM with a corresponding receive time at the base station of 2/19/2016 12:16:00 PM. It took almost 7 hours for this report to go from transmitter to base station. This was the only occurrence of this magnitude. Another rain report with a report time of 2/29/2016 5:05:20 AM was received at 2/29/2016 5:26:01 AM. This report took almost 20 minutes to be received. The raw data records for these two reports are provided below. Both reports were invalidated by the NovaStar5 base station software as they were identified as “bad” reports. Note the “fl” field in the raw records shows values of “00” and “10”.....these are invalid flags. The “F” is format where: 1=unsigned integer and 0=reserved. The “I” is data bytes: 0=zero bytes.

Feb 19 12:16:00 udfcd-ns5a nsreodata[4116]: Line: 4 SA: 10026,6001 Time: 02/19/2016 12:16:00 PDU TBRGR Tipping Bucket Rain Gage Report type=2 length=2
 Feb 19 12:16:00 udfcd-ns5a nsreodata[4116]: Line: 4 SA: 10026,6001 Time: 02/19/2016 12:16:00 PDU TBRGR id=0 fl=00 accum=0
 Feb 19 12:16:00 udfcd-ns5a nsreodata[4116]: Line: 4 SA: 10026,6001 Time: 02/19/2016 12:16:00 PDU TBRGR id=0 rawData=0 toffset=0 reportTime=02/19/2016 05:02:40
Feb 19 12:16:00 udfcd-ns5a nsreodata[4116]: Line: 4 SA: 10026,6001 Time: 02/19/2016 05:02:40 ID: 100260 Data: 0 Scaled: 0.00 Action: insert

Feb 29 05:26:01 udfcd-ns5a nsreodata[4116]: Line: 4 SA: 10026,6001 Time: 02/29/2016 05:26:01 PDU TBRGR Tipping Bucket Rain Gage Report type=2 length=2
 Feb 29 05:26:01 udfcd-ns5a nsreodata[4116]: Line: 4 SA: 10026,6001 Time: 02/29/2016 05:26:01 PDU TBRGR id=0 fl=10 accum=0
 Feb 29 05:26:01 udfcd-ns5a nsreodata[4116]: Line: 4 SA: 10026,6001 Time: 02/29/2016 05:26:01 PDU TBRGR id=0 rawData=0 toffset=0 reportTime=02/29/2016 05:05:20
Feb 29 05:26:01 udfcd-ns5a nsreodata[4116]: Line: 4 SA: 10026,6001 Time: 02/29/2016 05:05:20 ID: 100260 Data: 0 Scaled: 0.00 Action: insert

This could be a faulty transmitter and WET will talk with the hardware manufacturer.

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 will 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 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, when you look at lines with MANT TS=... the Length=# is the data packet size. It should not be more than 45 bytes.

The following stations exceeded the allowable 0.5ms time slot.

This aspect of the analysis report will be developed and included in next month's analysis.

F. Inefficient ALERT2 Packets

These packets contain a single data packet per air link packet. ALERT2 supports the composition of air link packets containing multiple data packets. Using a single air link packet for each data packet is an efficient use of the ALERT2 protocol and should be avoided. This portion of the analysis will determine which transmitters may be configured to send only single data packets in a single air link packet. WET is working on this feature of the monthly analysis and expects to quantify information starting next month.

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 10).

Table 10. Monthly Summary of Sensors with Poor Timer Performance (Sensor ID)

Jan*	Feb*	Mar*	Apr	May	Jun	Jul	Aug	Sep	Oct*	Nov*	Dec*
10026	3020										
4550	4520										
2330	2790										
4270	4850										
1660	10026										
4330	10020										

*- 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 11). 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 11. District-Wide Total Tip/Count Statistical Summary

Statistical Parameter	Value	Comments
Mean	9.91	Only the 1-mm rain sensors were included in the analysis
Median	9	Only the 1-mm rain sensors were included in the analysis
Standard deviation	6.06	Only the 1-mm rain sensors were included in the analysis
Mean plus three standard deviations	28.11	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	Many stations
Maximum total count	25	SBC @ SB Road (4870)
Sensors showing NO rain for the month		--
Sensors greater than 3 SD (over reporting)		None this month

B. Monthly Average Tip/Count Summary

A monthly summary of the District-wide mean total tip/count is presented (Table 12).

Table 12. 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	24.19
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	29.00
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	25.08
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	30.89
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	27.67
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	32.03
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	22.66
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	42.46
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	35.45
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	44.39
2016	4.68	9.91											

*- 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 13).

Table 13. Sensors with a Jump of 6 or More in Sequential Count

Sensor Description	Sensor ID	Comment
Red Garden	4020	Very noisy data in the early part of the month....seems to have cleared up on the 23rd
Wx- Castle Rock	2750	Noisy data in the early part of the month....cleared up on the 24th

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 744 incrementing reports were received and a total of 771 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 14).

Table 14. Monthly Summary of Sensors with the Worst Performance

Jan*	Feb*	Mar*	Apr	May	Jun	Jul	Aug	Sep	Oct*	Nov*	Dec*
1530	4270										
4550	10026										
1640	2790										
4180	4240										
1660	5940										
4840	4510										

*-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 15).

Table 15. Summary of Unknown IDs

Description	Concentrator	Legacy	A2
Total number of unknown IDs (IDs without a device definition)	306	521	0
Total reports from unknown IDs	1,241	2,279	0
Unknown IDs with only a single received report (potential noise)	162	297	0
Total reports from all IDs – RecData Log entire month	418,430	264,375	399,530
Unknown reports as a fraction of total reports	0.30%	0.86%	0%

The total number of reports from unknown sensors is very small relative to the total reports received for the month. Shown below (Table 16) are the total reports received from unknown sensor IDs for each month of the year.

Table 16. 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										

The fraction of reports from unknown sensors relative to the total number of reports is shown below (Table 17).

Table 17. 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%										

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 18).

Table 18. Reports Received by Unknown IDs

Concentrator		Legacy ALERT		Comment
Unknown ID	Reports	Unknown ID	Reports	
416	78	416	77	Unknown IDs all coming from Kelly Dam (410)
411	71	411	71	Unknown IDs all coming from Kelly Dam (410)
414	70	414	68	Unknown IDs all coming from Kelly Dam (410)
412	68	412	67	Unknown IDs all coming from Kelly Dam (410)
417	65	417	61	Unknown IDs all coming from Kelly Dam (410)
4028	0	4028	61	Only being received on the legacy channel....no concentrator reports

V. Sensors with Invalid Reports

The sensors below (Table 19 and Table 20) 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 19. Rain Sensors with the Most Invalid Reports

Sensor ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1530-Bear Cr. At Lowell	8	5										
2810-Pine Cliff Rd.	--	18										
2750-Wx-Castle Rock	10	24										
2990-Tomah Rd.	--	12										
3020-Wx-West Creek	9	103										
3070-Newlin Gulch	10	52										
4030-Red Garden	23	41										

Investigation of the large number of invalid reports from Newlin Gulch (which has not yet been installed for the season) revealed an interesting issue which was resolved on March 8, 2016. Newlin Gulch is an ALERT2 site. The NovaStar5 base station can receive and insert data from multiple sources including legacy ALERT and ALERT2. On NovaStar5 for the definition of the Newlin Gulch rain ID (3070) the remote ID was set to zero (0). The remote ID is not used to file ALERT2 reports but is used to file legacy reports. There exists a legacy transmitter in the District's network that is sending data with ID=0. These reports were being filed to the Newlin Gulch rain ID (3070) because the remote ID was set to zero. The solution to this problem was to enable the preferred source of data for the Newlin Gulch site. NovaStar5 will allow for a station to receive data only on a specified channel.....so for this case the Newlin Gulch station definition was altered to accept data reports only from the ALERT2 channel and to disregard reports on the legacy channel.

WET plans to convert the West Creek weather station to ALERT2 in the coming months in order to eliminate the high number of invalid reports.

The Castle Rock weather station was fixed on February 24th.

Table 20. 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										
413-Kelly Dam	--	70										
853-Flying J	--	36										
1383-Ferril Lake	747	703										
3013-EPC@Hwy 105	7	19										
4563-Lyons Diversion	--	13										
1803-Sand Creek Park	--	9										

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.

There were no rainfall alarms this month.

General System Analysis

Database Name P:\A207-UDFCD-Data-Analysis\2016\02-2016\Novastar_extract_2016Feb.mdb

First Date in Database	1/31/16 11:59 PM	Total Days	29.0
Last Date in Database	2/29/16 11:59 PM	Total Hours	696.0

Summarize

Total Records Analyzed 418,430

Records by Group	Concentrator	Percent	Legacy	Percent	ALERT2	Percent
Wind Data	191,554	45.8%	118,721	44.9%	212,947	53.3%
Temperature	67,783	16.2%	35,897	13.6%	65,890	16.5%
Relative Humidity	59,046	14.1%	35,188	13.3%	64,867	16.2%
Barometric Pressure	32,724	7.8%	19,261	7.3%	421	0.1%
Battery Voltage	18,908	4.5%	9,746	3.7%	21,428	5.4%
Water Level	10,470	2.5%	9,703	3.7%	11,385	2.8%
Solar Radiation	10,425	2.5%	9,952	3.8%	0	0.0%
Dew Point Temperature	0	0.0%	0	0.0%	8,309	2.1%
Precipitation	6,554	1.6%	5,749	2.2%	8,470	2.1%
Fuel Temperature	5,535	1.3%	5,340	2.0%	0	0.0%
Fuel Moisture	5,524	1.3%	5,304	2.0%	0	0.0%
Soil Moisture	2,788	0.7%	2,623	1.0%	0	0.0%
Wind Direction	2,368	0.6%	0	0.0%	0	0.0%
Repeater Status Report	2,117	0.5%	2,572	1.0%	0	0.0%
Unknown	1,241	0.3%	2,279	0.9%	0	0.0%
ET-Hourly	683	0.2%	671	0.3%	0	0.0%
Hayman Battery	194	0.0%	0	0.0%	0	0.0%
12Hr Status Report	139	0.0%	125	0.0%	0	0.0%
Water Temp	113	0.0%	92	0.0%	0	0.0%
GPS Lock	81	0.0%	144	0.1%	5,813	1.5%
Repeater Pass List	65	0.0%	519	0.2%	0	0.0%
Not Used	46	0.0%	42	0.0%	0	0.0%
Handar 585 ALARM Status	34	0.0%	34	0.0%	0	0.0%
ET-Daily	28	0.0%	28	0.0%	0	0.0%
Solar Power	8	0.0%	8	0.0%	0	0.0%
ALERT/A2 Testing	2	0.0%	377	0.1%	0	0.0%
Total	418,430	100.0%	264,375	100.0%	399,530	100.0%

Traffic Loading Summary	Concentrator	Legacy	ALERT2
Alert Reports	418,430	264,375	399,530
Average Daily Traffic	13,948	9,116	13,777
Average Hourly Traffic	581	380	574
Median Hourly Traffic	596	hour beginning	381
Peak Hourly Traffic	1,013	Feb 18, 4:00 PM	673
2nd Max	912	Feb 18, 5:00 PM	605
3rd Max	901	Feb 18, 2:00 PM	564
4th Max	827	Feb 18, 3:00 PM	531
5th Max	815	Feb 18, 12:00 PM	520
			hour beginning
		Feb 18, 4:00 PM	646
		Feb 18, 2:00 PM	733
		Feb 18, 5:00 PM	732
		Feb 18, 3:00 PM	732
		Feb 15, 2:00 PM	731
			hour beginning
		Feb 28, 12:00 AM	733
		Feb 29, 8:00 PM	732
		Feb 29, 7:00 PM	732
		Feb 25, 8:00 PM	732
		Feb 28, 1:00 AM	731

Rain Timer Performance

Analyze Rain Sensors

Rain Sensors	Description	Rcv	Timer	Exp	Performance
3020	Wx-West Creek WX	5	12:00	60	8%
4520	Eagle Ridge	15	12:00	60	25%
2790	Wx-W. Cherry Creek	19	9:45	60	32%
4850	Porphory Mtn	33	16:08	60	55%
100260	Wx-A2-Trumbull (Hayman) - Precip	418		696	60%
100200	A2-OneRain Weather - Precipitation	37	12:00	60	62%
4330	Hansen Rain	40	14:24	60	67%
4270	Cannon Mountain	41	15:50	60	68%
2330	Morrison	42	16:19	60	70%
5940	Log Jumper	44	15:23	60	73%
4550	Boulder Jail	46	14:18	60	77%
1660	SPR at Henderson	46	14:27	60	77%
4510	Pinewood Springs	47	14:33	60	78%
2750	Wx-Castle Rock	71	9:29	87	82%
2980	Dakan Rd	49	13:44	60	82%
4030	Red Garden	50	12:55	60	83%
3070	A2-Newlin Gulch Precip	50	13:01	60	83%
4870	SBC @ SB Road	51	13:01	60	85%
2990	Wx-Tomah Rd-DougCnty	52	12:46	60	87%
4490	Apple Valley	52	12:29	60	87%
4300	Big Elk Park	52	12:59	60	87%
4040	Martin Gulch	52	12:31	60	87%
2320	Choke Cherry Resvr	52	12:31	60	87%
1640	SPR at Union Ave.	52	12:57	60	87%
2710	Wx-Highlands Ranch WTP	53	12:56	60	88%
4770	Wx-Cal-Wood Ranch	53	12:00	60	88%
1920	Wx-Brighton	53	12:28	60	88%
100150	A2-Sellers Gulch at Haystack Precip	53	12:55	60	88%
100140	A2-Upper Sellers Gulch Precip	53	12:55	60	88%
3090	A2-Highland Heritage Park	53	12:55	60	88%
4790	Wx-Button Rock	54	12:14	60	90%
4360	Justice Center	54	12:41	60	90%
4350	Conifer Hill	54	12:40	60	90%
4310	Johnny Park	54	12:13	60	90%
4240	Sunset	54	12:12	60	90%
4220	Fling's	54	12:27	60	90%
4080	Twin Sisters	54	12:41	60	90%
700	Toll Gate @ 6th	54	12:43	60	90%
1460	Wx-Urban Farm	55	12:00	60	92%
4750	Wx-Louisville Lake	55	12:27	60	92%
3010	WX-EPC at Hwy 105	55	12:31	60	92%
900	Wx-Aurora Reservoir	55	12:26	60	92%
4860	Fairview Peak	55	12:00	60	92%
4820	Doudy Draw	55	12:25	60	92%
4260	Taylor Mountain	55	12:25	60	92%
4250	Geer Canyon	55	12:25	60	92%
4200	Lazy Acres	55	12:29	60	92%
4180	Gold Lake	55	12:12	60	92%
4070	Bear Peak	55	12:27	60	92%
4020	Rio Grande	55	12:12	60	92%
4010	Cresent	55	12:26	60	92%
1700	Cherry Cr @ Champa	55	12:28	60	92%
110	Ralston Reservoir	55	12:25	60	92%
2930	Wx-Spring Valley Rd-DougCnty	56	12:00	60	93%

1520	Wx-Marston Lake North	56	12:14	60	93%
3030	WX-Bingham Lake Park	56	12:13	60	93%
4830	SBC @ San Souci	56	12:10	60	93%
4810	Shanahan Ridge	56	12:12	60	93%
4320	Lee Hill Rain 2012	56	12:12	60	93%
4290	Red Hill	56	12:11	60	93%
4230	Golden Age	56	12:10	60	93%
4110	Betasso	56	11:57	60	93%
4060	Lakeshore	56	12:26	60	93%
4710	Wx-Ward C-1	57	12:00	60	95%
4730	Wx-Sugarloaf	57	12:00	60	95%
750	Wx-Quincy Reservoir	57	11:56	60	95%
2210	Wx-Hiwan G.C.	57	12:00	60	95%
1440	Wx-Elbert	57	12:00	60	95%
1570	Wx-Brighton Ditch	57	12:00	60	95%
140	Wx-Blue Mountain	57	12:00	60	95%
920	Wx-Aurora Town Hall	57	12:00	60	95%
4530	Winiger Ridge	57	11:57	60	95%
4880	Whispering Pines	57	11:57	60	95%
4840	SBC@S Boulder Ditch	57	11:57	60	95%
4340	Riverside	57	11:58	60	95%
4190	Slaughterhouse	57	11:57	60	95%
4170	Pine Brook	57	11:57	60	95%
4160	Sunshine	57	11:58	60	95%
4150	Gold Hill	57	11:58	60	95%
4140	Logan Mill	57	11:58	60	95%
4130	Swiss Peaks	57	11:59	60	95%
4100	Filter Plant	57	11:59	60	95%
4090	Magnolia	57	11:58	60	95%
4050	Walker Ranch	57	11:58	60	95%
1420	A2-Wx-Diamond Hill	57	12:00	60	95%
970	Pump Sta 3	57	12:00	60	95%
200	Leyden Reservoir	57	12:04	60	95%
2730	Wx-Salisbury Park	58	11:32	60	97%
4570	St. Antons	58	11:46	60	97%
100290	Wx-A2-PlumCr at Sedalia - Precip	682	0:00	696	98%
6601	A2-Magnolia WX-Precip	86	8:00	87	99%
100300	A2-CoalCreek at McCaslin - Precip	695	0:00	696	100%
1000	A2-Maple Grove Resv.	695		696	100%
840	Fire Station 12	36	11:38	60	60%
440	Fire Station #7	35	11:57	60	58%
850	Flying J	34	12:00	60	57%
760	Mission Viejo Park	34	11:57	60	57%
540	Parker/Mississippi	34	12:20	60	57%
520	Jewell Detention	33	12:21	60	55%
1710	Shop Creek	29	14:46	60	48%
410	Kelly Dam	29	9:40	60	48%
1050	Jeffco Fairgrounds	28	11:29	60	47%
530	Fire Station #19	28	11:57	60	47%
510	Virginia Court	28	12:25	60	47%
220	Upper Leyden	28	11:02	60	47%
1030	NREL/S. Table Mtn.	27	11:58	60	45%
300	Van Bibber Park	27	11:28	60	45%
1350	Chatfield COE	25	12:31	60	42%
1060	Heritage Square	25	11:57	60	42%
620	Quincy/Highline	25	13:00	60	42%
1010	Denver West	24	13:03	60	40%
150	Nott Creek	24	12:37	60	40%

310	Guy Hill Ranch	23	12:32	60	38%
420	Expo Park	22	12:32	60	37%
1360	Denver Zoo	15	21:13	60	25%
1900	Niver Detention	10	11:57	60	17%
330	Van Bibber @ Hwy 93	9	13:27	60	15%
1800	Sand Creek Park	8	10:15	60	13%
1310	LDC at 64th	8	13:40	60	13%
1300	Hidden Lake	8	11:58	60	13%
500	Havana Park	8	11:57	60	13%
1370	West Metro FS13	4	11:57	60	7%
810	Granby Ditch @ 6th	1		60	2%
100240	A2-Westerly Cr Dam Precip	277		696	40%

Rain Event Performance																
	Reports Received	Reports Received	744	Analyze Rain Sensors						0	<<show stations with zero rain (1=yes, 0=no)					
	Total Tips	Total Tips	771													
	96.50%	Data Loss	3.50%													
Description	Sensor	Performance	1-tips	2-tips	3-tips	4-tips	5-tips	6-tips	>6-tips	Rcv	Exp	Miss	Hold	Bucket		
Cannon Mountain	4270	38%	2	0	0	0	0	1	0	3	8	5	0	0.03937		
Wx-A2-Trumbull (Hayman) - Precip	100260	64%	5	1	0	1	0	0	0	7	11	4	0	0.03937	Mean	9.91
Wx-W. Cherry Creek	2790	75%	2	1	0	0	0	0	0	3	4	1	0	0.03937	Median	9.00
Sunset	4240	83%	4	1	0	0	0	0	0	5	6	1	0	0.03937	St. Dev	6.07
Log Jumper	5940	88%	6	1	0	0	0	0	0	7	8	1	0	0.03937	Mean plus 3 SD	28.11
Pinewood Springs	4510	89%	14	2	0	0	0	0	0	16	18	2	0	0.03937	Min	1.00
Martin Gulch	4040	90%	18	0	1	0	0	0	0	19	21	2	0	0.03937	Max	25.00
Hansen Rain	4330	91%	9	1	0	0	0	0	0	10	11	1	0	0.03937		
Wx-Marston Lake North	1520	92%	11	1	0	0	0	0	0	12	13	1	0	0.03937		
Geer Canyon	4250	92%	11	1	0	0	0	0	0	12	13	1	0	0.03937		
Red Garden	4030	94%	16	1	0	0	0	0	3	17	18	1	0	0.03937		
Justice Center	4360	95%	19	1	0	0	0	0	0	20	21	1	0	0.03937		
Wx-Ward C-1	4710	100%	1	0	0	0	0	0	0	1	1	0	0	0.03937		
Wx-Urban Farm	1460	100%	3	0	0	0	0	0	1	3	3	3	1	0.03937		
Wx-Tomah Rd-DougCnty	2990	100%	12	0	0	0	0	0	0	12	12	0	0	0.03937		
Wx-Sugarloaf	4730	100%	8	0	0	0	0	0	0	8	8	0	0	0.03937		
Wx-Spring Valley Rd-DougCnty	2930	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937		
Wx-Salisbury Park	2730	100%	2	0	0	0	0	0	1	2	2	0	0	0.03937		
Wx-Louisville Lake	4750	100%	5	0	0	0	0	0	0	5	5	0	0	0.03937		
Wx-Hiwan G.C.	2210	100%	1	0	0	0	0	0	0	1	1	0	0	0.03937		
Wx-Highlands Ranch WTP	2710	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937		
Wx-Elbert	1440	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937		
Wx-Castle Rock	2750	100%	1	0	0	0	0	0	1	1	1	0	0	0.03937		
Wx-Cal-Wood Ranch	4770	100%	7	0	0	0	0	0	0	7	7	0	0	0.03937		
Wx-Button Rock	4790	100%	9	0	0	0	0	0	0	9	9	0	0	0.03937		
Wx-Brighton	1920	100%	3	0	0	0	0	0	0	3	3	0	0	0.03937		
Wx-Blue Mountain	140	100%	6	0	0	0	0	0	0	6	6	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%	1	0	0	0	0	0	0	1	1	0	0	0.03937		
Winiger Ridge	4530	100%	10	0	0	0	0	0	0	10	10	0	0	0.03937		
A2-CoalCreek at McCaslin - Precip	100300	100%	16	0	0	0	0	0	0	16	16	0	0	0.03937		
A2-OneRain Weather - Precipitation	100200	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937		
Whispering Pines	4880	100%	11	0	0	0	0	0	0	11	11	0	0	0.03937		
SBC @ SB Road	4870	100%	25	0	0	0	0	0	0	25	25	0	0	0.03937		
SBC@S Boulder Ditch	4840	100%	18	0	0	0	0	0	0	18	18	0	0	0.03937		
SBC @ San Souci	4830	100%	15	0	0	0	0	0	0	15	15	0	0	0.03937		
Doudy Draw	4820	100%	9	0	0	0	0	0	0	9	9	0	0	0.03937		
Shanahan Ridge	4810	100%	16	0	0	0	0	0	0	16	16	0	0	0.03937		
St. Antons	4570	100%	9	0	0	0	0	0	0	9	9	0	0	0.03937		
Boulder Jail	4550	100%	12	0	0	0	0	0	0	12	12	0	0	0.03937		
Eagle Ridge	4520	100%	3	0	0	0	0	0	0	3	3	0	0	0.03937		
Apple Valley	4490	100%	11	0	0	0	0	0	0	11	11	0	0	0.03937		
Conifer Hill	4350	100%	15	0	0	0	0	0	0	15	15	0	0	0.03937		
Riverside	4340	100%	9	0	0	0	0	0	0	9	9	0	0	0.03937		
Lee Hill Rain 2012	4320	100%	10	0	0	0	0	0	0	10	10	0	0	0.03937		
Johnny Park	4310	100%	20	0	0	0	0	0	0	20	20	0	0	0.03937		
Big Elk Park	4300	100%	7	0	0	0	0	0	0	7	7	0	0	0.03937		
Red Hill	4290	100%	20	0	0	0	0	0	0	20	20	0	0	0.03937		
Taylor Mountain	4260	100%	10	0	0	0	0	0	0	10	10	0	0	0.03937		
Golden Age	4230	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937		
Fling's	4220	100%	15	0	0	0	0	0	0	15	15	0	0	0.03937		
Lazy Acres	4200	100%	19	0	0	0	0	0	0	19	19	0	0	0.03937		
Slaughterhouse	4190	100%	16	0	0	0	0	0	0	16	16	0	0	0.03937		
Gold Lake	4180	100%	5	0	0	0	0	0	0	5	5	0	0	0.03937		
Pine Brook	4170	100%	7	0	0	0	0	0	0	7	7	0	0	0.03937		
Sunshine	4160	100%	8	0	0	0	0	0	0	8	8	0	0	0.03937		

Gold Hill	4150	100%	9	0	0	0	0	0	0	9	9	0	0	0.03937
Logan Mill	4140	100%	8	0	0	0	0	0	0	8	8	0	0	0.03937
Swiss Peaks	4130	100%	7	0	0	0	0	0	0	7	7	0	0	0.03937
Betasso	4110	100%	24	0	0	0	0	0	0	24	24	0	0	0.03937
Filter Plant	4100	100%	12	0	0	0	0	0	0	12	12	0	0	0.03937
Magnolia	4090	100%	12	0	0	0	0	0	0	12	12	0	0	0.03937
Twin Sisters	4080	100%	8	0	0	0	0	0	0	8	8	0	0	0.03937
Bear Peak	4070	100%	16	0	0	0	0	0	0	16	16	0	0	0.03937
Lakeshore	4060	100%	9	0	0	0	0	0	0	9	9	0	0	0.03937
Walker Ranch	4050	100%	6	0	0	0	0	0	0	6	6	0	0	0.03937
Rio Grande	4020	100%	6	0	0	0	0	0	0	6	6	0	0	0.03937
Crescent	4010	100%	13	0	0	0	0	0	0	13	13	0	0	0.03937
	TOTAL		726	14	1	2	0	1	7	744	771	30	2	
Morrison	2330	85%	9	2	0	0	0	0	0	11	13	2	0	0.03937
Choke Cherry Resv	2320	100%	8	0	0	0	0	0	0	8	8	0	0	0.03937
Niver Detention	1900	60%	2	0	1	0	0	0	0	3	5	2	0	0.03937
Sand Creek Park	1800	80%	3	1	0	0	0	0	0	4	5	1	0	0.03937
Shop Creek	1710	83%	4	1	0	0	0	0	0	5	6	1	2	0.03937
Cherry Cr @ Champa	1700	100%	3	0	0	0	0	0	0	3	3	0	0	0.03937
SPR at Henderson	1660	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937
SPR at Union Ave.	1640	100%	6	0	0	0	0	0	0	6	6	0	0	0.03937
A2-Wx-Diamond Hill	1420	91%	9	1	0	0	0	0	0	10	11	1	0	0.03937
West Metro FS13	1370	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937
Denver Zoo	1360	78%	6	0	1	0	0	0	1	7	9	2	0	0.03937
Chatfield COE	1350	33%	1	0	0	0	1	0	0	2	6	4	0	0.03937
Hidden Lake	1300	60%	3	2	1	0	0	0	0	6	10	4	1	0.03937
Heritage Square	1060	57%	2	1	1	0	0	0	0	4	7	3	1	0.03937
Jeffco Fairgrounds	1050	90%	8	1	0	0	0	0	0	9	10	1	1	0.03937
NREL/S. Table Mtn.	1030	86%	5	1	0	0	0	0	0	6	7	1	0	0.03937
Denver West	1010	100%	7	0	0	0	0	0	0	7	7	0	1	0.03937
A2-Maple Grove Resv.	1000	100%	14	0	0	0	0	0	0	14	14	0	0	0.03937
Flying J	850	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937
Fire Station 12	840	100%	5	0	0	0	0	0	0	5	5	0	1	0.03937
Granby Ditch @ 6th	810	100%	4	0	0	0	0	0	1	4	4	0	0	0.03937
Sable Ditch @ 18th	800	100%	3	0	0	0	0	0	0	3	3	0	0	0.03937
Mission Viejo Park	760	100%	1	0	0	0	0	0	0	1	1	0	0	0.03937
Toll Gate @ 6th	700	100%	5	0	0	0	0	0	0	5	5	0	1	0.03937
Quincy/Highline	620	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937
Parker/Mississippi	540	100%	3	0	0	0	0	0	0	3	3	0	0	0.03937
Fire Station #19	530	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937
Jewell Detention	520	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937
Virginia Court	510	83%	4	1	0	0	0	0	0	5	6	1	0	0.03937
Havana Park	500	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937
Fire Station #7	440	100%	3	0	0	0	0	0	0	3	3	0	0	0.03937
Utah Park	430	100%	1	0	0	0	0	0	0	1	1	0	0	0.03937
Expo Park	420	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937
Kelly Dam	410	100%	6	0	0	0	0	0	1	6	6	0	0	0.03937
Van Bibber @ Hwy 93	330	29%	1	0	0	0	0	1	0	2	7	5	0	0.03937
Guy Hill Ranch	310	75%	5	0	1	0	0	0	0	6	8	2	0	0.03937
Van Bibber Park	300	86%	5	1	0	0	0	0	0	6	7	1	0	0.03937
Upper Leyden	220	90%	8	1	0	0	0	0	0	9	10	1	2	0.03937
Leyden Reservoir	200	100%	10	0	0	0	0	0	0	10	10	0	0	0.03937
Nott Creek	150	100%	13	0	0	0	0	0	0	13	13	0	0	0.03937
Ralston Reservoir	110	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937
A2-Westerly Cr Dam Precip	100240	67%	1	1	0	0	0	0	0	2	3	1	0	0.03937
WX-EPC at Hwy 105	3010	97%	31	1	0	0	0	0	0	32	33	1	0	0.01
A2-Magnolia WX-Precip	6601	100%	38	0	0	0	0	0	0	38	38	0	0	0.01
Fairview Peak	4860	94%	14	1	0	0	0	0	1	15	16	1	0	0.01
Porphyry Mtn	4850	60%	4	1	0	1	0	0	0	6	10	4	1	0.01

2016 Monthly Peak Hour ALERT Radio Traffic Summary

