Memo

Date: February 5, 2015
To: Kevin Stewart
From: Markus Ritsch
Subject: **January 2015 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 January 1 through January 31, 2015.

II. General System Analysis Summary

In 2015 data will be received at the District through both the legacy ALERT channel and through the ALERT2 (concentrator plus A2 self-reports) channel. The following (Table 1) quantifies the data reception through each telemetry source. The West Creek repeater in Douglas County processes both incoming legacy and ALERT2 but passes on only concentrator ALERT2 format messages to Diamond Hill. All other repeaters in the system send data on both legacy and ALERT2 channels.

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

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Legacy	216,461											
Concentrator	366,229											
ALERT2	172,927											
TOTAL	**755,617**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Conc+A2	539,156											
Conc/Leg	1.69											
DataChron	529,216											

The District operates two redundant NovaStar5 base stations: a primary base station (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 (DiamondHill)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Legacy	216,461									
Concentrator	366,229									
ALERT2	172,927									
NS5B (Greenhouse)										
Legacy	244,232									
Concentrator	409,951									
ALERT2	191,784									
Diff (NS5a-NS5b)										
Legacy	-27,771									
Concentrator	-43,722									
ALERT2	-18,857									

In January the number of total legacy, concentrator and ALERT2 reports received by ns5a and ns5b is not consistent. The reason being……a hard disk failure on ns5a stopped data collection for three days in January.

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

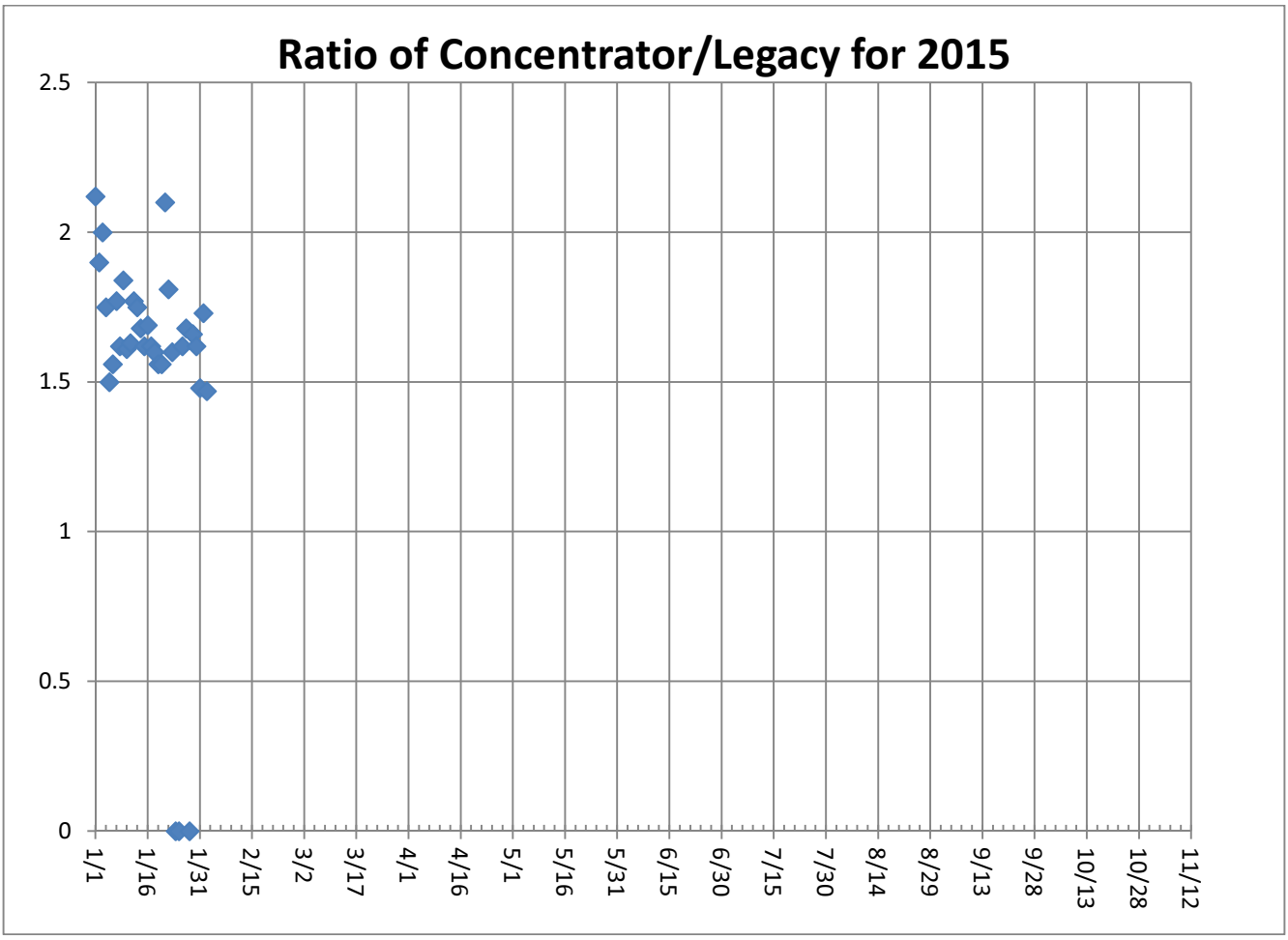


Figure 1. Daily Ratio of Concentrator Reports to Legacy Reports

On January 24, 2015 the hard disk employed by the ns5a (Diamond Hill) server developed errors. The drive did not crash but enough errors were detected by the operating system that writing to the disk was prohibited. NovaStar5 was not able to write data to the disk. A reboot of the system was required and a manual repair of the hard disk was conducted by Derrick Schauer using the "fsck" Linux command. The disk went down on Saturday, January 24 and the manual repair was conducted on Monday, January 26th. An attempt to restore the lost data from the RecDataLog on ns5a was attempted on Tuesday, January 27th but was not possible. The entire database was then restored from the ns5b machine on January 28th which is why data reception on ns5a was again down for this day.

The fact that the ns5a hard disk developed errors may be a precursor to a near term hard disk failure. This situation should be monitored closely and the District should be ready to replace the hard disk if needed.

Several days in January experienced ratios exceeding 2.0. These are typically very cold days when the legacy feed from the Blue Mountain repeater is impaired which increases the ratio.

A. Continuous Operation of Base Receiver/Decoder

The ns5 base stations were NOT in continuous operation for the entire month. The ns5a server was inoperable on January 24, 25 and 28th due to a hard disk problem. The ns5b server was in continuous operation for the entire month.

B. Specific Issues Identified this Month

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

Table 3. Sensors with Poor Performance Characteristics

Sensor ID	Description	Timer	Event	Comments
2330	Morrison	47%	93%	Poor performance for entire month
4470	Little Narrows	34%	64%	Poor performance for entire month
4330	Hansen	60%	79%	Poor performance for entire month
700	Toll Gate @ 6th	37%	75%	

C. Performance of New A2 Sites

In 2015 this section of the report will be modified to 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 will provide useful insight into site performance and general network health. In January, scripts will be developed on the ns5 servers to populate the APDUID into the monthly RecDataLog so that automated analyzes can be performed (Table 4).

Table 4. Performance of New A2 Sites by Source Address

Description	ID	West Creek (6001)	Smoky Hill (6502)	Blue Mt. (6503)	Lee Hill (6505)	Gold Hill (6505)	Magnolia (6507)
Carr Street (10012)	100						
Maple Grove (10013)	1000						
Murphy Creek (10019)	870						
Heritage Regional Park	3090						
Newlin Gulch	3070						
Blackstone	100100						
ETG @ Hampden	100110						
Upper Sellers	100140						
Haystack Road	100150						
Sand Cr at Colfax	100160						
Havana Pond	100230						
Westerly Creek Dam	100240						

D. ALERT2 Repeater Loading

The ALERT2 architecture utilizes 5 repeaters with a single transmit frequency to Diamond Hill on 170.300 MHz. 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 5). 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 5. ALERT2 Repeater Architecture

Repeater	Slot Size (sec)	Slot Offset (sec)	Source Address	ALERT2 Input Frequency (MHz)	ALERT2 Output Frequency (MHz)
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 analysis summarizes the total number of reports received by time slot for the month (Table 6). This is valuable to understand repeater loading for the ALERT2 backbone. Note that the time stamp in the RecDataLog for concentrator reports is the time assigned by the repeater upon receipt of the legacy report at the repeater. The time stamp for ALERT2 self-reports is the time assigned at the remote site when reading was taken. What is not currently known is when the report was transmitted by the repeater or when the report was received at the base station. In February, WET will modify the RecDataLog to include the time of reception at the base station of all ALERT2 messages. This will allow for correct repeater loading calculations as well as data latency analyses. *Table 6 will be modified beginning in February to reflect time reports were received at the base station.*

Table 6. ALERT2 Repeater Loading by Time Slot

Rptr	West Cr.		Smoky			Blue Mt.				Lee Hill			Gold Hill			Magnolia				
Slot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Jan	131,767	64,558	13,824	15,434	17,899	20,812	19,397	17,441	12,813	14,405	17,606	23,055	32,142	23,053	16,004	18,814	24,328	20,644	18,998	16,162
Tot	196,325		47,157			70,463				55,066			71,199			98,946				

The following analysis summarizes the total number of reports received by repeater source address.

Table 7. ALERT2 Reports Received by Repeater

	West Creek (6001)	Smoky (6502)	Blue Mt. (6503)	Lee Hill (6505)	Gold Hill (6506)	Magnolia (6507)
Concentrator	136,708	64,826	92,637	26,103	45,955	0
Self-Reports	0	44,501	44,636	44,783	39,007	0

E. 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 8).

Table 8. Monthly Summary of Sensors with Poor Timer Performance (Sensor ID)

Jan*	Feb*	Mar*	Apr	May	Jun	Jul	Aug	Sep	Oct*	Nov*	Dec*
4470											
700											
2330											
4240											
3010											
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 9). 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 9. District-Wide Total Tip/Count Statistical Summary

Statistical Parameter	Value	Comments
Mean	9.88	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	5.03	Only the 1-mm rain sensors were included in the analysis
Mean plus three standard deviations	24.96	Only the 1-mm rain sensors were included in the analysis
Minimum total count	1	Wx-Elbert (1440)
Maximum total count	28	Shanahan Ridge (4810)
Sensors showing **NO** rain for the month		Several
Sensors greater than 3 SD (over reporting)	1	Shanahan Ridge (4810)

B. Monthly Average Tip/Count Summary

A monthly summary of the District-wide mean total tip/count is presented (Table 10).

Table 10. 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	35.54
2015	9.88												

***- 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 11).

Table 11. Sensors with a Jump of 6 or More in Sequential Count

Sensor Description	Sensor ID	Comment
None		None 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 97 percent. A total of 710 incrementing reports were received and a total of 731 reports were expected. The total loss of incrementing reports for the month was approximately 3 percent. Those sensors with the worst event transmission performance are summarized (Table 12).

Table 12. Monthly Summary of Sensors with the Worst Performance

Jan*	Feb*	Mar*	Apr	May	Jun	Jul	Aug	Sep	Oct*	Nov*	Dec*
4470											
700											
4750											
4330											
2790											
4870											

***-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. Heavy Radio Traffic Analysis – ALERT2

The ALERT2 channel is analyzed independently in an attempt to quantify data loss rates from rain sensors using their sequential tip count series.

A. The Heaviest Hourly Traffic Periods This Month

The hourly periods of highest radio traffic this month are shown (Table 13). The five heaviest hours of radio traffic are analyzed to quantify the number of missing rain reports for that hour.

Table 13. Periods of Heavy Radio Traffic (only A2 reports)

Day	Hour	Expected	Received	Total Load	Loss
29	16	0	0	312	0.00%
29	11	0	0	309	0.00%
29	12	0	0	309	0.00%
5	14	16	16	296	0.00%
29	15	0	0	296	0.00%

V. 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 14).

Table 14. Summary of Unknown IDs

Description	Concentrator	Legacy
Total number of unknown IDs (IDs without a device definition)	217	249
Total reports from unknown IDs	542	526
Unknown IDs with only a single received report (potential noise)	118	168
Total reports from all IDs – RecData Log entire month	366,229	216,461
Unknown reports as a fraction of total reports	0.15%	0.24%

The total number of reports from unknown sensors is very small relative to the total reports received for the month. Shown below (Table 15) are the total reports received from unknown sensor IDs for each month of the year.

Table 15. 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											

The fraction of reports from unknown sensors relative to the total number of reports is shown below (Table 16).

Table 16. 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%											

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 17).

Table 17. Reports Received by Unknown IDs

Concentrator		Legacy ALERT		
Unknown ID	**Reports**	**Unknown ID**	**Reports**	**Comment**
1470	22	1470	22	
1534	14	1534	14	
1423	11	1423	12	
1446	11	1446	10	
2239	10	2239	10	
4472	9	4472	9	
1419	8	1531	8	

VI. Sensors with Invalid Reports

The sensors below (Table 18 and Table 19) 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 18. Rain Sensors with the Most Invalid Reports

Sensor ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Bear Creek @ Lowell 1530	5											
Pine Cliff Road 2810	4											
Wx-Diamond Hill 1420	3											
Roslyn 1580	2											
Red Garden 4030	2											
Wx-Brighton Ditch 1570	2											

Table 19. Level Sensors with the Most Invalid Reports

Sensor ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ferril Lake 1383	666											
Little Narrows 4473	33											
Wx-W.CC 2793	6											
Green Ditch 4593	4											
SPR at Henderson 1663	4											
Bear Creek @ Lowell 1533	4											

VII. 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.

ID	Description	Alarm Description	Date/Time	Threshold (in)	Total Rain (in)
	None this month				

General System Analysis

Database Name	P:\A207-UDFCD-Data-Analysis\2015\01-2015\Novastar_extract_2015Jan.mdb

First Date in Database	1/1/15 12:00 AM	**Total Days**	31.0
Last Date in Database	1/31/15 11:59 PM	**Total Hours**	744.0

Total Records Analyzed 366,229

Records by Group	Concentrator Reports	Percent	Legacy Reports	Percent
Wind Data	154,934	42%	86,374	40%
Temperature	62,763	17%	32,310	15%
Relative Humidity	56,501	15%	32,433	15%
Barometric Pressure	31,025	8%	18,316	8%
Battery Voltage	15,764	4%	7,740	4%
Water Level	10,765	3%	9,844	5%
Solar Radiation	9,716	3%	9,202	4%
Fuel Moisture	5,208	1%	4,827	2%
Fuel Temperature	5,204	1%	4,851	2%
Precipitation	4,888	1%	4,184	2%
Wind Direction (W. CC Weather)	3,581	1%	1	0%
Soil Moisture	2,629	1%	2,297	1%
Repeater Status Report	1,718	0%	2,183	1%
ET-Hourly	646	0%	648	0%
Unknown	542	0%	526	0%
12Hr Status Report	178	0%	156	0%
Repeater Pass List	55	0%	476	0%
Not Used	48	0%	49	0%
ET-Daily	27	0%	27	0%
GPS Lock	17	0%	0	0%
Solar Power	12	0%	11	0%
Handar 585 ALARM Status	5	0%	6	0%
ALERT/A2 Testing	3	0%	0	0%
Total	**366,229**	**100%**	**216,461**	**100%**

Traffic Loading Summary	Concentrator		Legacy	
Alert Reports	366,229		216,461	
Average Daily Traffic	11,814		6,983	
Average Hourly Traffic	492		291	
Median Hourly Traffic	554	hour beginning	334	hour beginning
Peak Hourly Traffic	772	Jan 5, 10:00 AM	523	Jan 5, 10:00 AM
2nd Max	754	Jan 5, 2:00 PM	515	Jan 5, 11:00 AM
3rd Max	749	Jan 5, 9:00 AM	514	Jan 5, 8:00 AM
4th Max	740	Jan 5, 11:00 AM	507	Jan 5, 9:00 AM
5th Max	736	Jan 5, 8:00 AM	496	Jan 5, 2:00 PM

Rain Timer Performance

Analyze Rain Sensors

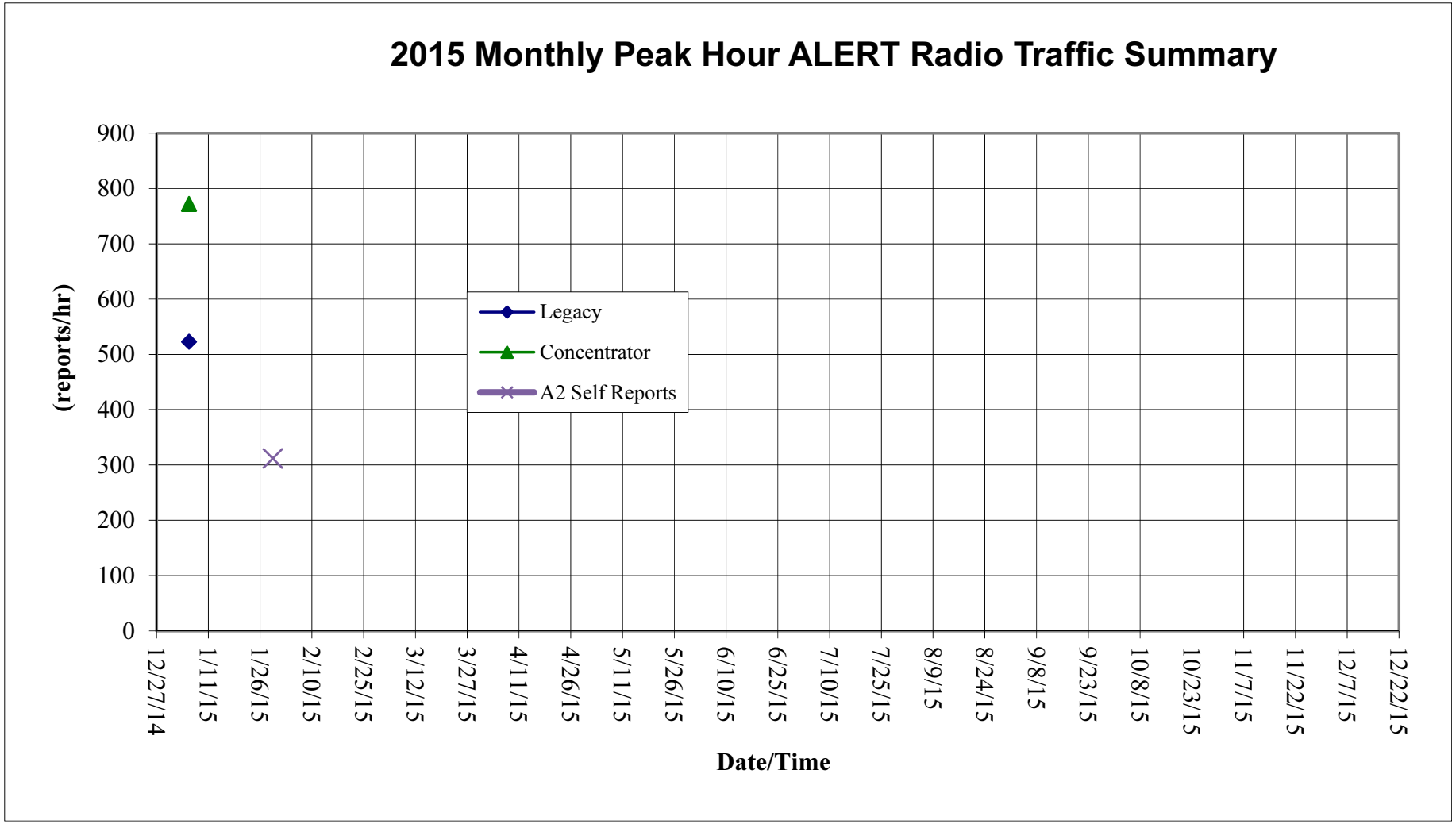
Rain Sensors	Description	Rcv	Timer	Exp	Performance
870	A2-Murphy Creek GC	58	0:58	792	7%
1200	Broomfield 3207	15	0:01	62	24%
4470	Little Narrows	21	15:17	62	34%
700	Toll Gate @ 6th	23	19:16	62	37%
2330	Morrison	29	22:16	62	47%
4240	Sunset	29	19:08	62	47%
3010	WX-EPC at Hwy 105	34	18:24	62	55%
4870	SBC @ SB Road	35	19:26	62	56%
4330	Hansen Rain	37	17:33	62	60%
4140	Logan Mill	43	16:41	62	69%
4820	Doudy Draw	44	16:03	62	71%
4180	Gold Lake	44	14:10	62	71%
4810	Shanahan Ridge	44	16:22	62	71%
4080	Twin Sisters	44	16:15	62	71%
4550	Boulder Jail	45	16:27	62	73%
4150	Gold Hill	45	15:31	62	73%
4060	Lakeshore	45	15:57	62	73%
4830	SBC @ San Souci	45	15:57	62	73%
1660	SPR at Henderson	45	15:49	62	73%
2320	Choke Cherry Resvr	46	14:55	62	74%
4170	Pine Brook	46	15:38	62	74%
4570	St. Antons	46	13:27	62	74%
4530	Winiger Ridge	46	15:44	62	74%
4710	Wx-Ward C-1	46	13:34	62	74%
4010	Cresent	47	15:06	62	76%
4510	Pinewood Springs	47	15:33	62	76%
4750	Wx-Louisville Lake	47	15:37	62	76%
4220	Fling's	48	15:40	62	77%
4090	Magnolia	48	14:48	62	77%
4270	Cannon Mountain	49	14:41	62	79%
4860	Fairview Peak	49	15:08	62	79%
4840	SBC@S Boulder Ditch	49	15:23	62	79%
4130	Swiss Peaks	49	14:43	62	79%
2980	Dakan Rd	50	14:41	62	81%
4730	Wx-Sugarloaf	50	15:00	62	81%
2790	Wx-W. Cherry Creek	50	14:56	62	81%
4490	Apple Valley	51	14:11	62	82%
4070	Bear Peak	51	14:36	62	82%
4350	Conifer Hill	51	11:58	62	82%
4250	Geer Canyon	52	14:05	62	84%
1440	Wx-Elbert	52	13:55	62	84%
4110	Betasso	53	13:54	62	85%
1700	Cherry Cr @ Champa	53	13:54	62	85%
4310	Johnny Park	53	13:31	62	85%
4200	Lazy Acres	53	14:04	62	85%
4020	Rio Grande	53	14:04	62	85%
4340	Riverside	53	13:43	62	85%
4050	Walker Ranch	53	13:45	62	85%
3030	WX-Bingham Lake Park	53	13:42	62	85%
140	Wx-Blue Mountain	53	12:15	62	85%
1920	Wx-Brighton	53	13:55	62	85%
4790	Wx-Button Rock	53	14:00	62	85%
2930	Wx-Spring Valley Rd-DougCnty	53	13:45	62	85%
6601	A2-Magnolia WX-Precip	81	8:00	93	87%

4300	Big Elk Park	54	13:38	62	87%
4520	Eagle Ridge	54	13:30	62	87%
4100	Filter Plant	54	13:40	62	87%
4360	Justice Center	54	13:44	62	87%
4290	Red Hill	54	13:29	62	87%
4190	Slaughterhouse	54	13:43	62	87%
1640	SPR at Union Ave.	54	13:38	62	87%
4160	Sunshine	54	11:58	62	87%
4260	Taylor Mountain	54	13:38	62	87%
900	Wx-Aurora Reservoir	54	13:36	62	87%
920	Wx-Aurora Town Hall	54	13:35	62	87%
1570	Wx-Brighton Ditch	54	13:35	62	87%
2750	Wx-Castle Rock	54	13:40	62	87%
1520	Wx-Marston Lake North	54	13:45	62	87%
750	Wx-Quincy Reservoir	54	13:34	62	87%
1460	Wx-Urban Farm	54	13:40	62	87%
4230	Golden Age	55	11:57	62	89%
4320	Lee Hill Rain 2012	55	13:27	62	89%
4040	Martin Gulch	55	13:27	62	89%
970	Pump Sta 3	55	13:20	62	89%
4030	Red Garden	55	13:27	62	89%
4880	Whispering Pines	55	13:25	62	89%
4770	Wx-Cal-Wood Ranch	55	13:24	62	89%
1420	Wx-Diamond Hill	55	13:26	62	89%
2710	Wx-Highlands Ranch WTP	55	13:26	62	89%
2210	Wx-Hiwan G.C.	55	13:28	62	89%
2730	Wx-Salisbury Park	55	13:23	62	89%
2990	Wx-Tomah Rd-DougCnty	55	13:36	62	89%
3020	Wx-West Creek WX	55	13:31	62	89%
200	Leyden Reservoir	56	13:24	62	90%

Rain Event Performance

	Reports Received	Reports Received	710		Analyze Rain Sensors				0 <<show stations with zero rain (1-yes, 0-no)										
	Systemwide Avg	Total Tips	731																
	97.13%	Data Loss	2.87%																
Description	**Sensor**	**Performance**	**1-tips**	**2-tips**	**3-tips**	**4-tips**	**5-tips**	**6-tips**	**>6-tips**	**Rcv**	**Exp**	**Miss**	**Hold**	**Bucket**					
Little Narrows	4470	64%	5	3	1	0	0	0	0	9	14	5	0	0.03937					
Toll Gate @ 6th	700	75%	2	1	0	0	0	0	0	3	4	1	0	0.03937	Mean	9.878378			
Wx-Louisville Lake	4750	75%	2	1	0	0	0	0	0	3	4	1	0	0.03937	Median	9			
Hansen Rain	4330	79%	14	0	0	0	1	0	0	15	19	4	0	0.03937	St. Dev	5.028556			
Wx-W. Cherry Creek	2790	83%	4	1	0	0	0	0	0	5	6	1	0	0.03937	Mean plus	24.96405			
SBC @ SB Road	4870	83%	4	1	0	0	0	0	0	5	6	1	0	0.03937	Min	1	Wx-Elbert	1440	
Red Garden	4030	85%	9	2	0	0	0	0	0	11	13	2	0	0.03937	Max	28	Shanahan Ridge	4810	
St. Antons	4570	90%	8	1	0	0	0	0	0	9	10	1	0	0.03937					
Choke Cherry Resvr	2320	91%	9	1	0	0	0	0	0	10	11	1	0	0.03937					
Winiger Ridge	4530	92%	11	1	0	0	0	0	0	12	13	1	0	0.03937					
Morrison	2330	93%	13	1	0	0	0	0	0	14	15	1	0	0.03937					
Johnny Park	4310	93%	13	1	0	0	0	0	0	14	15	1	0	0.03937					
Conifer Hill	4350	94%	16	1	0	0	0	0	0	17	18	1	0	0.03937					
Wx-Blue Mountain	140	100%	7	0	0	0	0	0	0	7	7	0	0	0.03937					
Leyden Reservoir	200	100%	10	0	0	0	0	0	0	10	10	0	0	0.03937					
Wx-Quincy Reservoir	750	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937					
Wx-Diamond Hill	1420	100%	5	0	0	0	0	0	0	5	5	0	0	0.03937					
Wx-Elbert	1440	100%	1	0	0	0	0	0	0	1	1	0	0	0.03937					
Wx-Urban Farm	1460	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937					
Wx-Marston Lake North	1520	100%	8	0	0	0	0	0	0	8	8	0	0	0.03937					
SPR at Union Ave.	1640	100%	3	0	0	0	0	0	0	3	3	0	0	0.03937					
Cherry Cr @ Champa	1700	100%	3	0	0	0	0	0	0	3	3	0	0	0.03937					
Wx-Brighton	1920	100%	2	0	0	0	0	0	0	2	2	0	0	0.03937					
Wx-Hiwan G.C.	2210	100%	9	0	0	0	0	0	0	9	9	0	0	0.03937					
Wx-Highlands Ranch WTP	2710	100%	4	0	0	0	0	0	0	4	4	0	0	0.03937					
Wx-Salisbury Park	2730	100%	3	0	0	0	0	0	0	3	3	0	0	0.03937					
Wx-Castle Rock	2750	100%	7	0	0	0	0	0	0	7	7	0	0	0.03937					
Wx-Spring Valley Rd-DougCnty	2930	100%	6	0	0	0	0	0	0	6	6	0	0	0.03937					
Wx-Tomah Rd-DougCnty	2990	100%	18	0	0	0	0	0	0	18	18	0	0	0.03937					
Wx-West Creek WX	3020	100%	9	0	0	0	0	0	0	9	9	0	0	0.03937					
WX-Bingham Lake Park	3030	100%	11	0	0	0	0	0	0	11	11	0	0	0.03937					
Cresent	4010	100%	9	0	0	0	0	0	0	9	9	0	0	0.03937					
Rio Grande	4020	100%	10	0	0	0	0	0	0	10	10	0	0	0.03937					
Martin Gulch	4040	100%	19	0	0	0	0	0	0	19	19	0	0	0.03937					
Walker Ranch	4050	100%	9	0	0	0	0	0	0	9	9	0	0	0.03937					
Lakeshore	4060	100%	9	0	0	0	0	0	0	9	9	0	0	0.03937					
Bear Peak	4070	100%	14	0	0	0	0	0	0	14	14	0	0	0.03937					
Twin Sisters	4080	100%	6	0	0	0	0	0	0	6	6	0	0	0.03937					
Magnolia	4090	100%	13	0	0	0	0	0	0	13	13	0	0	0.03937					
Filter Plant	4100	100%	7	0	0	0	0	0	0	7	7	0	0	0.03937					
Betasso	4110	100%	14	0	0	0	0	0	0	14	14	0	0	0.03937					
Swiss Peaks	4130	100%	10	0	0	0	0	0	0	10	10	0	0	0.03937					
Logan Mill	4140	100%	12	0	0	0	0	0	0	12	12	0	0	0.03937					
Gold Hill	4150	100%	18	0	0	0	0	0	0	18	18	0	0	0.03937					
Sunshine	4160	100%	9	0	0	0	0	0	0	9	9	0	0	0.03937					
Pine Brook	4170	100%	9	0	0	0	0	0	0	9	9	0	0	0.03937					
Gold Lake	4180	100%	8	0	0	0	0	0	0	8	8	0	0	0.03937					
Slaughterhouse	4190	100%	16	0	0	0	0	0	0	16	16	0	0	0.03937					
Lazy Acres	4200	100%	16	0	0	0	0	0	0	16	16	0	0	0.03937					
Fling's	4220	100%	13	0	0	0	0	0	0	13	13	0	0	0.03937					
Golden Age	4230	100%	10	0	0	0	0	0	0	10	10	0	0	0.03937					
Sunset	4240	100%	13	0	0	0	0	0	0	13	13	0	0	0.03937					
Geer Canyon	4250	100%	18	0	0	0	0	0	0	18	18	0	0	0.03937					
Taylor Mountain	4260	100%	11	0	0	0	0	0	0	11	11	0	0	0.03937					
Cannon Mountain	4270	100%	7	0	0	0	0	0	0	7	7	0	0	0.03937					
Red Hill	4290	100%	11	0	0	0	0	0	0	11	11	0	0	0.03937					
Big Elk Park	4300	100%	5	0	0	0	0	0	0	5	5	0	0	0.03937					
Lee Hill Rain 2012	4320	100%	10	0	0	0	0	0	0	10	10	0	0	0.03937					
Riverside	4340	100%	11	0	0	0	0	0	0	11	11	0	0	0.03937					
Justice Center	4360	100%	8	0	0	0	0	0	0	8	8	0	0	0.03937					
Apple Valley	4490	100%	8	0	0	0	0	0	0	8	8	0	0	0.03937					
Pinewood Springs	4510	100%	16	0	0	0	0	0	0	16	16	0	0	0.03937					
Eagle Ridge	4520	100%	6	0	0	0	0	0	0	6	6	0	0	0.03937					
Boulder Jail	4550	100%	7	0	0	0	0	0	0	7	7	0	0	0.03937					
Wx-Ward C-1	4710	100%	11	0	0	0	0	0	0	11	11	0	0	0.03937					
Wx-Sugarloaf	4730	100%	11	0	0	0	0	0	0	11	11	0	0	0.03937					
Wx-Cal-Wood Ranch	4770	100%	5	0	0	0	0	0	0	5	5	0	0	0.03937					
Wx-Button Rock	4790	100%	6	0	0	0	0	0	0	6	6	0	0	0.03937					

Shanahan Ridge	4810	100%	28	0	0	0	0	0	0	28	28	0	0	0.03937				
Doudy Draw	4820	100%	7	0	0	0	0	0	0	7	7	0	0	0.03937				
SBC @ San Souci	4830	100%	15	0	0	0	0	0	0	15	15	0	0	0.03937				
SBC@S Boulder Ditch	4840	100%	14	0	0	0	0	0	0	14	14	0	0	0.03937				
Whispering Pines	4880	100%	9	0	0	0	0	0	0	9	9	0	0	0.03937				
Wx-Aurora Reservoir	900	100%	1	0	0	0	0	0	0	1	1	0	0	0.03937				
		Total Tips	**693**	**15**	**1**	**0**	**1**	**0**	**0**	**710**	**731**	**21**	**0**					
WX-EPC at Hwy 105	3010	86%	24	0	0	0	1	0	0	25	29	4	0	0.01				
Fairview Peak	4860	100%	12	0	0	0	0	0	0	12	12	0	0	0.01				
A2-Magnolia WX-Precip	6601	94%	30	0	1	0	0	0	0	31	33	2	0	0.01				


2015 Monthly Peak Hour ALERT Radio Traffic Summary
(reports/hr)
900
800
700
600
500
400
300
200
100
0
Legacy
Concentrator
A2 Self Reports
12/27/14
1/11/15
1/26/15
2/10/15
2/25/15
3/12/15
3/27/15
4/11/15
4/26/15
5/11/15
5/26/15
6/10/15
6/25/15
7/10/15
7/25/15
8/9/15
8/24/15
9/8/15
9/23/15
10/8/15
10/23/15
11/7/15
11/22/15
12/7/15
12/22/15
Date/Time