

Memo



Date: April 8, 2008
To: Kevin Stewart and Chad Kudym
From: Markus Ritsch
Subject: **March 2008 ALERT Data Analysis**

I. ALERT Data Source

Raw ALERT data records extracted from the Urban Drainage and Flood Control District's Nova Star 4.0 base station (ALERT 2) were analyzed for the period March 1 through March 31, 2008.

II. General System Analysis Summary

A total of 248,449 individual ALERT data records were analyzed from the ALERT 2 base station. Meteorological sensors account for 82 percent, water level sensors 6 percent, and rain sensors 4 percent of the total monthly transmissions.

Ninety-nine percent of the received data reports were flagged as "good" by the Nova Star validation process. Roughly 2,607 reports were flagged as "bad". Of these "bad" reports, 1,088 originated from Quincy Reservoir (ID 757-Wind Gust and ID 755), 436 invalid reports came from Aurora Reservoir (ID 908-Solar Radiation), and 61 invalid reports came from Ralston Reservoir (ID 113).

The system-wide radio traffic loading this month was 8,014 reports per day with an average hourly loading of 334 reports. The peak hourly traffic loading was 692 reports, which occurred on March 8th between 11:00 AM and 12:00 PM. A plot of monthly average and peak hourly traffic loading is provided.

A total of 365 reports were received from the Hayman gages this month. The Hayman gages are winterized and won't return to operation until April 1, 2008.

The sensors reporting most frequently this month are mostly wind sensors and include:

1. Quincy Reservoir (ID 749 - Wind Gust) with 6,528 reports,
2. Ward C-1 (ID 4707 - ALERT wind) with 3,868 reports,
3. Cal-Wood Ranch (ID 4764 - Wind Gust) with 3,224 reports
4. Castle Rock (ID 2747 - ALERT wind) with 4,207 reports, and
5. Salisbury Park (ID 2727 - ALERT wind) with 3,940 reports.

The reports from the above sensors are distributed evenly throughout the month.

The sensors reporting infrequently this month include:

1. Boulder Jail (ID 4555) with 1 report,
2. Stapleton (ID 1469) with 1 report,
3. Horseshoe Park Drop (ID 714) with 1 report,
4. Croke Pump Station (ID 124) with 1 report, and
5. Boulder Falls (ID 4390 and 4395) with 2 reports.

Note that many stations are shut-down over the winter and the reporting for these stations is minimal or non-existent.

III. Rain Sensor Timer Reporting Summary

The following analysis assumes that each rain sensor has a 12-hour timer reporting interval. System-wide the ALERT 2 base station received approximately 74 percent of the non-incrementing timer reports. The worst performing rain sensors for the month are summarized (Table 1).

Table 1. Monthly Summary of Sensors with Poor Timer Performance (Sensor ID)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2190	1660	1350									
140	2190	110									
4150	140	2190									
4060	4170	1370									
4470	4150	620									
4530	4530	840									

Note that many stations are put back into service during March which influences their timer reporting performance because only a partial month of data is available for analysis.

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.

Sensor ID 1460 has a 24-hour timer reporting interval and is not included in the timer reporting analysis.

Sensor ID 1810 has an 18-hour timer reporting interval and is not included in the timer reporting analysis.

IV. Rain Sensor Event Reporting Summary

A. District-Wide Total Tip/Count Statistics

The incrementing reports from all 1-mm rain sensors (excluding Hayman sensors) are analyzed to quantify the District-wide statistical total monthly tip summary (Table 2).

Table 2. District-Wide Total Tip/Count Statistical Summary

Statistical Parameter	Value	Comments
Mean	12.26	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	9.08	Only the 1-mm rain sensors were included in the analysis
Mean plus three standard deviations	39.49	Only the 1-mm rain sensors were included in the analysis
Minimum total count	1	Many sensors
Maximum total count	37	Shanahan Ridge Precipitation

The highest reporting rain sensors were Shanahan Ridge (ID 4810) and Johnny Park (ID 4310). No sensors reported more than the system-wide mean plus 3 standard deviations. Data from sensors reporting more than the system-wide mean plus three standard deviations are inspected manually.

A monthly summary of the District-wide mean total tip/count is presented (Table 3).

Table 3. 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										

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

Several sensors had a jump in sequential count of more than six this month (Table 4). These large jumps are a result of random corrupt transmissions (typically bit flip errors) or substantial contention losses in periods of heavy radio traffic.

Table 4. Sensors with a Jump of More than 6 in Sequential Count

Sensor Description	Sensor ID	Comment
Squaw Mountain	2190	4 corrupt transmissions (bit flip errors)
Cal-Wood Ranch	4770	5 corrupt transmissions (bit flip errors)
Harvard Gulch Park	600	3 corrupt transmissions (bit flip errors)
Flying J	850	3 corrupt transmissions (bit flip errors)
Apple Valley	4490	2 corrupt transmissions (bit flip errors)
Lakeshore	4060	2 corrupt transmissions (bit flip errors)
Louisville Lake	4750	2 corrupt transmissions (bit flip errors)
Evergreen Lake	2220	2 corrupt transmissions (bit flip errors)
Denver Zoo	1360	1 corrupt transmission (bit flip error)
Doudy Draw	4820	1 corrupt transmission (bit flip error)
Fling's	4220	1 corrupt transmission (bit flip error)
Harvard at Jackson	610	1 corrupt transmission (bit flip error)
Sand Creek at Colfax	860	1 corrupt transmission (bit flip error)
Aurora Town Hall Weather	920	1 corrupt transmission (bit flip error)
Diamond Hill	1420	1 corrupt transmission (bit flip error)
Marston Lake North	1520	1 corrupt transmission (bit flip error)
Twin Sisters	4080	1 corrupt transmission (bit flip error)
Magnolia	4090	1 corrupt transmission (bit flip error)
Betasso	4110	1 corrupt transmission (bit flip error)

C. Sensor-by-Sensor Incrementing Count Summary

The system-wide reception rate of incrementing, 1-mm tip reports for the month was approximately 95 percent. A total of 1,794 incrementing reports were received and a total of 1,888 were expected. The total loss of incrementing reports for the month was approximately 5 percent. Those sensors with the worst rain event transmission performance characteristics are summarized (Table 5).

Table 5. Monthly Summary of Sensors with the Most Missed Tips

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1640	4520	2930									
2190	4820	540									
750	4530	2730									
4570	4470	2210									
2990	4810	110									
--	700	1350									

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.

The incrementing data series for those sensors with an event performance of less than 70 % is manually inspected.

a. Spring Valley Road – Douglas County (ID 2930)

This sensor has a continuous series for the entire month. A large number of reports were not received on March 20th, which corresponds to a day when field maintenance and calibration activities were performed at the site.

b. Parker/Mississippi (ID 540)

This sensor has a continuous series for the entire month and a total of 4 reports were not received on March 16th.

c. Salisbury Park (ID 2730)

This sensor has a continuous series for the entire month. Two reports were not received at the base on March 19th, which corresponds to a day when field maintenance and calibration activities were performed at the site.

d. Hiwan G.C. (ID 2210)

This sensor has a continuous series for the entire month and a total of 3 reports were not received on March 26th.

e. Ralston Reservoir (ID 110)

This sensor has a continuous series for the entire month and a total of 2 reports were not received on March 30th.

f. Chatfield COE (ID 1350)

This sensor has a continuous series for the entire month. A total of 4 reports were not received at the base between March 15th and March 18th.

V. Heavy Radio Traffic Analysis

For each month, periods exceeding 700 messages per hour are analyzed independently in an attempt to identify rain tip sequences where 3 or more, sequential messages are lost.

A. The Heaviest Traffic Periods This Month

The hourly periods of highest radio traffic this month include:

- 3/8/2008 from 11:00 am to 12:00 pm (692 reports)
- 3/8/2008 from 10:00 am to 11:00 am (680 reports)
- 3/8/2008 from 12:00 pm to 1:00 pm (678 reports)
- 3/8/2008 from 9:00 am to 10:00 am (664 reports)

B. March 8, 2008

The distribution of hourly traffic around the peak hour is summarized:

- 9:00 am to 10:00 am – 664 reports
- 10:00 am to 11:00 am – 680 reports
- 11:00 am to 12:00 pm – 692 reports
- 12:00 pm to 1:00 pm – 678 reports
- 1:00 pm to 2:00 pm – 618 reports

Incrementing rain records from the 1-mm gages for the heavy radio traffic period were examined to characterize the loss of sequential incrementing tip transmissions (Table 6). Overall, 0% of the incrementing tip reports were lost during this period.

Table 6. Peak Traffic Analysis - Loss of Incrementing Tip Reports

Heavy Traffic Period (Mar 8, 2008)	Occurrences of lost sequential tip reports during period			
	Loss of 2 sequential tips	Loss of 3 sequential tips	Loss of 4 sequential tips	Loss of 5 sequential tips
9:00 am to 2:00 pm	0	0	0	0

VI. 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 7).

Table 7. Summary of Unknown IDs

Description	Quantity
Total number of unknown IDs (IDs without a device definition)	218
Total reports from unknown IDs	1,962
Unknown IDs with only a single received report (potential noise)	134
Total reports from all IDs – RecData Log entire month	248,449
Unknown reports as a fraction of total reports	0.79%

The total number of reports from unknown sensors is small relative to the total reports received for the month.

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 8).

Table 8. Reports Received by Unknown IDs

Unknown Sensor	Reports
632	226
631	224
205	111
4762	105
1383	93
4765	89
4763	60
635	60
117	59
505	58
116	55

114	55
118	55
112	55
111	53
1402	37
1401	37
1406	30
1408	29
1404	26
1407	24

The “unknown” device reports are analyzed temporally to understand when they are received during the day (Table 9). The goal of this analysis is to determine a pattern of occurrence that may correspond to a source of noise in the system, such as the use of a wireless microphone nearby.

Table 9. Temporal Distribution of Unknown Reports

Hour (AM)	Reports	Hour (PM)	Reports
0:00-00:59	49	12:00-12:59	124
1:00-1:59	43	1:00-1:59	67
2:00-2:59	91	2:00-2:59	46
3:00-3:59	88	3:00-3:59	85
4:00-4:59	99	4:00-4:59	64
5:00-5:59	107	5:00-5:59	25
6:00-6:59	131	6:00-6:59	21
7:00-7:59	64	7:00-7:59	20
8:00-8:59	129	8:00-8:59	132
9:00-9:59	159	9:00-9:59	96
10:00-10:59	74	10:00-10:59	55
11:00-11:59	110	11:00-11:59	83

Reports from unknown sensors occur each hour of the day.

VII. Issues Identified this Month

Sensors with a large number of invalid reports:

1. Quincy Reservoir (ID 757) - Wind Gust with 998 invalid reports,
2. Aurora Reservoir (ID 908) - Solar Radiation with 436 invalid reports,
3. Squaw Mountain (ID 2192) - Temperature with 154 reports,
4. Elbert (ID 1439) - Wind Gust with 100 invalid reports,
5. Quincy Reservoir (ID 755) - Battery Voltage with 90 reports,
6. Ralston Reservoir (ID 113) - Water Level PT with 61 reports,
7. Leyden Reservoir (ID 203) - Water Level PT with 19 reports,
8. Temple Pond at DTC (ID 633) - Water Level PT with 17 reports, and
9. WTG above Confluence Pond (ID 723) - Water Level PT with 17 reports.

Sensors reporting frequently:

10. Quincy Reservoir (ID 749) - Wind Gust with 6,528 reports,
11. Ward C-1 (ID 4707) - ALERT Wind with 3,868 reports,
12. Castle Rock (ID 2747) - ALERT Wind with 4,207 reports, and
13. Salisbury Park (ID 2727) - ALERT Wind with 3,940 reports.

Sensors reporting infrequently (under reporting):

14. Boulder Jail (ID 4555) with 1 report,
15. Stapleton (ID 1469) with 1 report,
16. Horseshoe Park Drop (ID 714) with 1 report,
17. Croke Pump Station (ID 124) with 1 report, and
18. Boulder Falls (ID 4390 and 4395) with 2 reports.

Poor timer reporting:

The following sensors reported for the entire month and showed poor timer performance.

19. **Chatfield COE (ID 1350)** - Only 60% of the timer reports received for the entire month.
20. **Ralston Reservoir (ID 110)** - Only 77% of the timer reports received for the entire month.
21. **Squaw Mountain (ID 2190)** - Only 63% of the timer reports were received from this sensor.
22. **West Metro FS13 (ID 1370)** - Only 65% of the timer reports were received from this sensor.
23. **Quincy/Highline (ID 620)** - Only 68% of the timer reports were received from this sensor
24. **Fire Station 12 (ID 840)** - Only 76% of the timer reports were received from this sensor.

Poor event reporting:

The following sensors reported for the entire month and showed poor event performance.

25. **Chatfield COE (ID 1350)** - Only 75% of the event reports were received.
26. **Ralston Reservoir (ID 110)** - Only 75% of the event reports were received.
27. **Spring Valley Road Douglas County (ID 2930)** - Only 55% of the event reports were received.
28. **Parker/Mississippi (ID 540)** - Only 67% of the event reports were received.

29. **Salisbury Park (ID 2730)** - Only 67% of the event reports were received.
30. **Hiwan G.C. (ID 2210)** - Only 71% of the event reports were received.

Low rain total:

31. **Squaw Mountain (ID 2190)** - This sensor recorded only 1 tip for the entire month. Nothing suspicious in the data series. Surrounding stations also had low monthly totals.
32. **Smoky Hill (ID 740)** - This sensor recorded only 1 tip for the entire month.
33. **Aurora Reservoir (ID 900)** - This sensor recorded only 1 tip for the entire month.
34. **Holly Dam (ID 1610)** - This sensor recorded only 1 tip for the entire month.

High rain total:

35. **Shanahan Ridge (ID 4810)** - This was the highest recording sensor for the month with a total of 37 tips. Nothing suspicious was identified in the incrementing series.
36. **Red Hill (ID 4290)** - This was the highest recording sensor for the month with a total of 36 tips.
37. **Johnny Park (ID 4310)** - This was the highest recording sensor for the month with a total of 36 tips.
38. **Conifer Hill (ID 4350)** - This was the highest recording sensor for the month with a total of 36 tips.

Large Jump in Sequential Count (bit flip errors/contention loss):

39. **Squaw Mountain (ID 2190)** - This sensor experienced several large jumps in count that are due to transmission corruptions (bit flip errors).
40. **Cal-Wood Ranch (ID 4770)** - This sensor experienced several large jumps in count that are due to transmission corruptions (bit flip errors).

Reports from “Unknown Sensors”:

41. The following table shows the “unknown” sensor IDs and the total number of reports received during the month. These reports indicate the existence of transmitters that are sending information on an ID that is not currently defined within NovaStar.

Unknown Sensor	Reports
632	226
631	224
205	111
4762	105
1383	93
4765	89
4763	60
635	60
117	59
505	58
116	55
114	55
118	55
112	55
111	53
1402	37
1401	37
1406	30
1408	29
1404	26
1407	24

General System Analysis

Database Name P:\A207-UDFCD-Data-Analysis\2008_Mar\Novastar_extract_2008Mar.mdb

First Date in Database	3/1/08 12:00 AM	Total Days	31.0
Last Date in Database	3/31/08 11:59 PM	Total Hours	744.0

Total Records Analyzed 248449

Records by Group

Wind Gust	50978	21%
Temperature	36841	15%
Relative Humidity	34785	14%
Wind Speed Average & Azimuth	25779	10%
Wind Direction	19766	8%
Wind Speed Average	16090	6%
Water Level PT-HSE	10290	4%
Precipitation	10011	4%
Barometric Pressure	9824	4%
Solar Radiation	8711	4%
Battery Voltage HSE	5801	2%
Battery Voltage Digital	4418	2%
Battery Voltage Analog	4030	2%
Longmont Flow Gage	2214	1%
Water Level PT	1581	1%
Water Level Float	1178	0%
Fuel Moisture	736	0%
Fuel Temperature	731	0%
Repeater Pass List	604	0%
Repeater Status Report	477	0%
Battery	392	0%
Hayman Precipitation	365	0%
Precipitation - Test	243	0%
Hayman Battery	241	0%
Longmont Water Level PT	214	0%
12Hr Status Report	179	0%
Handar 585 ALARM Status	65	0%
Soil Moisture	61	0%
Battery Voltage	8	0%
Precipitation-Old	1	0%
Solar Power	1	0%
Total	246615	

Records by Major Group

Meteorologic Sensors	202774	82%
Sensor Status Transmissions	15575	6%
Water Level Sensors	15477	6%
Rain Sensors	10011	4%
Soil and Fuel Sensors	1528	1%
Total	245365	

Records by Validation Type

Good	0	245842	99%
Questionable	1	2607	1%
Total		248449	

Sensors With Most Invalid Data

Description	Sensor	Reports
Quincy Reservoir	757/755	1088
Aurora Reservoir	908	436
Squaw Mountain	2192/2191	224
Elbert	1439/1437	199
Ralston Reservoir	113	61

Traffic Loading Summary

Alert Reports	248449	
Average Daily Traffic	8014	
Average Hourly Traffic	334	
Median Hourly Traffic	339	hour beginning
Peak Hourly Traffic	692	3/8/08 11:00 AM
2nd Max	680	3/8/08 10:00 AM
3rd Max	678	3/8/08 12:00 PM
4th Max	664	3/8/08 9:00 AM
5th Max	654	3/8/08 1:00 AM

Rain Timer Performance

Analyze Rain Sensors

systemwide average (days)

0.5102

74%

age

Sensors	Description	Rcvd	Average Timer Interval	Exp	Performance
100	Carr Street	62	11:46	62.00	100%
110	Ralston Reservoir	48	15:15	62.00	77%
120	West Woods	58	12:13	62.00	94%
130	Simms Street	5	11:57	62.00	8%
140	Blue Mountain	51	13:25	62.00	82%
150	Nott Creek	9	9:34	62.00	15%
210	Leyden Confluence	59	12:12	62.00	95%
220	Upper Leyden	59	12:28	62.00	95%
300	Van Bibber Park	60	12:12	62.00	97%
310	Guy Hill Ranch	6	11:57	62.00	10%
320	Sports Complex	59	12:26	62.00	95%
330	Van Bibber @ Hwy 93	7	11:57	62.00	11%
400	Montview Park	36	12:44	62.00	58%
410	Kelly Dam	13	11:58	62.00	21%
420	Expo Park	54	12:29	62.00	87%
440	Fire Station #7	57	12:40	62.00	92%
500	Havana Park	57	12:13	62.00	92%
510	Virginia Court	52	13:46	62.00	84%
520	Jewell Detention	55	13:09	62.00	89%
530	Fire Station #19	60	11:59	62.00	97%
540	Parker/Mississippi	33	16:32	62.00	53%
600	Harvard Gulch Park	63	11:05	62.00	102%
610	Harvard @ Jackson	22	10:45	62.00	35%
620	Quincy/Highline	42	16:38	62.00	68%
630	Temple Pond at DTC	55	13:12	62.00	89%
640	Goldsmith @ Eastman	56	11:33	62.00	90%
650	Iliff Pond	52	12:14	62.00	84%
700	Toll Gate @ 6th	58	12:43	62.00	94%
710	Horseshoe Park Drop	22	11:57	62.00	35%
720	Confluence Pond	39	12:56	62.00	63%
730	No Name @ Quincy	19	13:17	62.00	31%
740	Smoky Hill	58	12:39	62.00	94%
750	Quincy Reservoir	57	12:52	62.00	92%
760	Mission Viejo Park	57	12:26	62.00	92%
800	Sable Ditch @ 18th	57	12:55	62.00	92%
810	Granby Ditch @ 6th	58	11:59	62.00	94%
820	ETG @ Buckley	60	12:11	62.00	97%
830	Side Creek Park	54	13:25	62.00	87%
840	Fire Station 12	47	14:04	62.00	76%
850	Flying J	52	12:01	62.00	84%
860	Sand Cr at Colfax	59	7:30	62.00	95%
870	Murphy Creek GC	42	12:37	62.00	68%
900	Aurora Reservoir	51	14:13	62.00	82%
920	Aurora Town Hall Wx	56	12:01	62.00	90%
1000	Maple Grove Resv.	40	12:18	62.00	65%
1010	Denver West	61	11:59	62.00	98%
1020	Lena @ Nolte Pond	41	11:59	62.00	66%
1030	NREL/S. Table Mtn.	61	12:11	62.00	98%
1040	Lena @ U.S. Hwy 6	58	12:29	62.00	94%
1050	Jeffco Fairgrounds	61	11:58	62.00	98%
1060	Heritage Square	60	12:12	62.00	97%
1100	Louisville Rec Ctr	5	11:59	62.00	8%
1110	Gunbarrel	6	15:57	62.00	10%
1200	Broomfield 3207	35	13:57	62.00	56%
1300	Hidden Lake	39	11:58	62.00	63%
1310	LDC at 64th	59	12:24	62.00	95%
1320	SPR at 3rd Ave	50	11:59	62.00	81%

1330	Roslyn	61	12:01	62.00	98%
1340	Sanderson at Xavier	61	12:01	62.00	98%
1350	Chatfield COE	37	15:46	62.00	60%
1360	Denver Zoo	60	12:01	62.00	97%
1370	West Metro FS13	40	16:01	62.00	65%
1400	Upper Sloan Det.	68	10:42	62.00	110%
1420	Diamond Hill	53	12:01	62.00	85%
1440	Elbert	61	12:10	62.00	98%
1460	Stapleton	30	0:02	62.00	48%
1480	Third Creek at DIA	59	12:26	62.00	95%
1500	Powers Park	11	13:09	62.00	18%
1520	Marston Lake North	56	13:01	62.00	90%
1530	Bear Creek @ Lowell	60	12:11	62.00	97%
1540	Sanderson at Xavier	61	11:59	62.00	98%
1550	Lakewood CC	43	11:57	62.00	69%
1570	Brighton Ditch Wx	59	12:14	62.00	95%
1600	Englewood Dam	13	11:57	62.00	21%
1610	Holly Dam	12	11:58	62.00	19%
1620	Slaughterhouse Glch	13	11:58	62.00	21%
1640	SPR at Union Ave.	60	12:01	62.00	97%
1660	SPR at Henderson	51	14:37	62.00	82%
1700	Cherry Cr @ Champa	59	12:26	62.00	95%
1710	Shop Creek	12	0:00	62.00	19%
1800	Sand Creek Park	36	14:26	62.00	58%
1810	Sand Creek at mouth	39	19:05	62.00	63%
1900	Niver Detention	33	13:36	62.00	53%
1920	Brighton	61	12:01	62.00	98%
2190	Squaw Mountain	39	15:54	62.00	63%
2210	Hiwan G.C.	58	12:38	62.00	94%
2220	Evergreen Lake	58	12:19	62.00	94%
2230	Bear Cr below Cub	8	11:58	62.00	13%
2240	Cold Sprg Glch conf	8	11:58	62.00	13%
2250	Rosedale	9	11:57	62.00	15%
2260	Brook Forest	7	11:58	62.00	11%
2270	Cub Cr below Blue	7	14:21	62.00	11%
2280	Kinney Peak	8	11:58	62.00	13%
2310	Genesee Village	11	11:58	62.00	18%
2330	Morrison	62	11:35	62.00	100%
2340	El Rancho	8	11:57	62.00	13%
2350	Idledale	8	11:57	62.00	13%
2360	Indian Hills	9	14:21	62.00	15%
2370	Red Rocks Park	8	11:57	62.00	13%
2710	Highlands Ranch WTP	64	11:34	62.00	103%
2730	Salisbury Park	64	11:24	62.00	103%
2750	Castle Rock	64	11:54	62.00	103%
2810	Pine Cliff Road	28	10:33	62.00	45%
2820	Haskins Gulch Conf	58	12:41	62.00	94%
2920	West Cherry Head-Douglas Cnty	59	11:45	62.00	95%
2930	Spring Valley Rd - DougCnty	56	11:45	62.00	90%
2940	Willow Creek - DougCnty	64	11:12	62.00	103%
2990	Tomah Rd-Douglas Cnty	57	11:30	62.00	92%
4010	Crescent	56	12:45	62.00	90%
4020	Rio Grande	59	12:26	62.00	95%
4030	Red Garden	58	12:16	62.00	94%
4040	Martin Gulch	57	12:57	62.00	92%
4050	Walker Ranch	57	12:42	62.00	92%
4060	Lakeshore	49	14:08	62.00	79%
4070	Bear Peak	59	12:13	62.00	95%
4080	Twin Sisters	56	12:14	62.00	90%
4090	Magnolia	55	12:32	62.00	89%
4100	Filter Plant	59	12:14	62.00	95%
4110	Betasso	57	12:33	62.00	92%

4130	Swiss Peaks	56	12:17	62.00	90%
4140	Logan Mill	58	12:28	62.00	94%
4150	Gold Hill	56	13:01	62.00	90%
4160	Sunshine	60	12:13	62.00	97%
4170	Pine Brook	51	12:18	62.00	82%
4180	Gold Lake	58	12:30	62.00	94%
4190	Slaughterhouse	54	12:48	62.00	87%
4200	Lazy Acres	60	12:15	62.00	97%
4220	Fling's	59	11:28	62.00	95%
4230	Golden Age	61	11:59	62.00	98%
4240	Sunset	49	14:13	62.00	79%
4250	Geer Canyon	56	11:59	62.00	90%
4260	Taylor Mountain	58	12:14	62.00	94%
4270	Cannon Mountain	53	13:54	62.00	85%
4290	Red Hill	58	12:13	62.00	94%
4300	Big Elk Park	60	12:13	62.00	97%
4310	Johnny Park	58	12:46	62.00	94%
4330	Indian Ruins	54	13:24	62.00	87%
4340	Riverside	59	11:59	62.00	95%
4350	Conifer Hill	59	12:29	62.00	95%
4360	Justice Center	59	12:28	62.00	95%
4470	Little Narrows	57	12:45	62.00	92%
4490	Apple Valley	56	12:14	62.00	90%
4510	Pinewood Springs	57	12:29	62.00	92%
4520	Eagle Ridge	61	11:47	62.00	98%
4530	Winiger Ridge	52	12:37	62.00	84%
4560	Lyons Diversion NSV	53	13:37	62.00	85%
4570	St. Antons	48	12:35	62.00	77%
4710	Ward C-1	52	12:58	62.00	84%
4730	Sugarloaf	56	12:31	62.00	90%
4750	Louisville Lake	56	12:45	62.00	90%
4770	Cal-Wood Ranch	69	10:02	62.00	111%
4790	Button Rock	53	13:37	62.00	85%
4810	Shanahan Ridge	72	9:57	62.00	116%
4820	Doudy Draw	75	9:14	62.00	121%
4830	SBC @ San Souci	65	10:52	62.00	105%
4840	SBC@S Boulder Ditch	74	9:43	62.00	119%
4850	Porphory Mtn	55	13:01	62.00	89%
4860	Fairview Peak	49	13:24	62.00	79%

Rain Event Performance				Analyze Rain Sensors										
		Reports Received	1794											
	Systemwide Avg	Total Tips	1888											
	94%	Data Loss	4.98%											
ID	Performance	1-tips	2-tips	3-tips	4-tips	5-tips	6-tips	>6-tips	Rcv	Exp	Miss	Hold	Bucket	
100	100%	11	0	0	0	0	0	0	11	11	0	0	0.0393701	
110	75%	2	1	0	0	0	0	0	3	4	1	0	0.0393701	
120	100%	15	0	0	0	0	0	0	15	15	0	0	0.0393701	
140	100%	12	0	0	0	0	0	0	12	12	0	0	0.0393701	
150	86%	5	1	0	0	0	0	0	6	7	1	0	0.0393701	
210	88%	6	1	0	0	0	0	0	7	8	1	0	0.0393701	
220	100%	8	0	0	0	0	0	0	8	8	0	0	0.0393701	
300	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701	
310	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701	
320	100%	10	0	0	0	0	0	0	10	10	0	0	0.0393701	
330	100%	6	0	0	0	0	0	0	6	6	0	0	0.0393701	
400	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701	
410	100%	4	0	0	0	0	0	0	4	4	0	0	0.0393701	
420	100%	8	0	0	0	0	0	0	8	8	0	0	0.0393701	
440	100%	6	0	0	0	0	0	0	6	6	0	0	0.0393701	
500	100%	9	0	0	0	0	0	0	9	9	0	0	0.0393701	
510	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701	
520	100%	5	0	0	0	0	0	0	5	5	0	0	0.0393701	
530	100%	9	0	0	0	0	0	0	9	9	0	0	0.0393701	
540	67%	5	0	0	1	0	0	0	6	9	3	0	0.0393701	
600	100%	9	0	0	0	0	0	3	9	9	0	0	0.0393701	
610	100%	2	0	0	0	0	0	1	2	2	0	0	0.0393701	
620	90%	8	1	0	0	0	0	0	9	10	1	0	0.0393701	
630	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701	
640	100%	6	0	0	0	0	0	0	6	6	0	0	0.0393701	
650	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701	
700	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701	
710	100%	2	0	0	0	0	0	0	2	2	0	0	0.0393701	
720	100%	2	0	0	0	0	0	0	2	2	0	0	0.0393701	
730	100%	3	0	0	0	0	0	0	3	3	0	0	0.0393701	
740	100%	1	0	0	0	0	0	0	1	1	0	0	0.0393701	
750	100%	3	0	0	0	0	0	0	3	3	0	0	0.0393701	
760	100%	6	0	0	0	0	0	0	6	6	0	0	0.0393701	
800	100%	6	0	0	0	0	0	0	6	6	0	0	0.0393701	
810	100%	9	0	0	0	0	0	0	9	9	0	0	0.0393701	
820	100%	2	0	0	0	0	0	0	2	2	0	0	0.0393701	
830	100%	3	0	0	0	0	0	0	3	3	0	0	0.0393701	
840	100%	6	0	0	0	0	0	0	6	6	0	0	0.0393701	
850	100%	4	0	0	0	0	0	3	4	4	0	0	0.0393701	
860	100%	11	0	0	0	0	0	1	11	11	0	0	0.0393701	
870	100%	4	0	0	0	0	0	0	4	4	0	0	0.0393701	
900	100%	1	0	0	0	0	0	0	1	1	0	0	0.0393699	
920	100%	7	0	0	0	0	0	1	7	7	0	0	0.0393701	
1000	100%	14	0	0	0	0	0	0	14	14	0	0	0.0393701	
1010	100%	15	0	0	0	0	0	0	15	15	0	0	0.0393701	
1030	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701	
1040	93%	24	2	0	0	0	0	0	26	28	2	0	0.0393701	
1050	100%	8	0	0	0	0	0	0	8	8	0	0	0.0393701	
1060	100%	8	0	0	0	0	0	0	8	8	0	0	0.0393701	
1100	100%	4	0	0	0	0	0	0	4	4	0	0	0.0393701	
1110	100%	4	0	0	0	0	0	0	4	4	0	0	0.0393701	
1200	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701	
1300	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701	
1310	100%	4	0	0	0	0	0	0	4	4	0	0	0.0393701	
1320	89%	7	1	0	0	0	0	0	8	9	1	0	0.0393701	
1330	92%	11	1	0	0	0	0	0	12	13	1	0	0.0393701	
1340	100%	15	0	0	0	0	0	0	15	15	0	0	0.0393701	
1350	75%	8	0	0	1	0	0	0	9	12	3	0	0.0393701	
1360	90%	16	2	0	0	0	0	1	18	20	2	0	0.0393701	
1370	90%	17	0	1	0	0	0	0	18	20	2	0	0.0393701	
1400	100%	18	0	0	0	0	0	0	18	18	0	1	0.0393701	
1420	100%	7	0	0	0	0	0	1	7	7	0	0	0.0393701	
1440	100%	4	0	0	0	0	0	0	4	4	0	1	0.0393701	
1460	100%	8	0	0	0	0	0	0	8	8	0	0	0.0393701	
1480	100%	4	0	0	0	0	0	0	4	4	0	0	0.0393701	

1500	100%	2	0	0	0	0	0	0	2	2	0	0	0.0393701
1520	100%	11	0	0	0	0	0	1	11	11	0	0	0.0393701
1530	100%	13	0	0	0	0	0	0	13	13	0	0	0.0393701
1540	100%	6	0	0	0	0	0	0	6	6	0	0	0.0393701
1550	100%	14	0	0	0	0	0	0	14	14	0	0	0.0393701
1570	100%	3	0	0	0	0	0	0	3	3	0	0	0.0393701
1600	100%	4	0	0	0	0	0	0	4	4	0	1	0.0393701
1610	100%	1	0	0	0	0	0	0	1	1	0	0	0.0393701
1620	100%	2	0	0	0	0	0	0	2	2	0	0	0.0393701
1640	100%	8	0	0	0	0	0	0	8	8	0	0	0.0393701
1660	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701
1700	100%	4	0	0	0	0	0	0	4	4	0	0	0.0393701
1710	100%	2	0	0	0	0	0	0	2	2	0	0	0.0393701
1800	100%	10	0	0	0	0	0	0	10	10	0	0	0.0393701
1810	100%	8	0	0	0	0	0	0	8	8	0	0	0.0393701
1900	100%	4	0	0	0	0	0	0	4	4	0	0	0.0393701
1920	100%	12	0	0	0	0	0	0	12	12	0	0	0.0393701
2190	100%	1	0	0	0	0	0	4	1	1	0	0	0.0393701
2210	71%	4	0	1	0	0	0	0	5	7	2	0	0.0393701
2220	25%	0	0	0	1	0	0	1	1	4	3	0	0.0393701
2230	100%	5	0	0	0	0	0	0	5	5	0	0	0.0393701
2240	89%	7	1	0	0	0	0	0	8	9	1	0	0.0393701
2250	100%	10	0	0	0	0	0	0	10	10	0	0	0.0393701
2260	86%	5	1	0	0	0	0	0	6	7	1	0	0.0393701
2270	86%	5	1	0	0	0	0	0	6	7	1	0	0.0393701
2280	82%	8	0	1	0	0	0	0	9	11	2	0	0.0393701
2310	86%	5	1	0	0	0	0	0	6	7	1	0	0.0393701
2320	100%	17	0	0	0	0	0	0	17	17	0	0	0.0393701
2330	100%	33	0	0	0	0	0	0	33	33	0	0	0.0393701
2340	100%	5	0	0	0	0	0	0	5	5	0	0	0.0393701
2350	100%	6	0	0	0	0	0	0	6	6	0	0	0.0393701
2360	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701
2370	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701
2710	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701
2730	67%	1	1	0	0	0	0	0	2	3	1	0	0.0393701
2750	32%	3	1	0	0	1	2	0	7	22	15	0	0.0393701
2810	100%	3	0	0	0	0	0	0	3	3	0	0	0.0393701
2820	100%	10	0	0	0	0	0	0	10	10	0	0	0.0393701
2920	92%	10	1	0	0	0	0	0	11	12	1	0	0.0393701
2930	55%	4	1	0	0	1	0	0	6	11	5	0	0.0393701
2940	83%	4	1	0	0	0	0	0	5	6	1	0	0.0393701
2990	88%	14	0	1	0	0	0	0	15	17	2	0	0.0393701
4010	86%	10	2	0	0	0	0	0	12	14	2	0	0.0393701
4020	100%	9	0	0	0	0	0	0	9	9	0	0	0.0393701
4030	95%	20	1	0	0	0	0	0	21	22	1	0	0.0393701
4040	100%	29	0	0	0	0	0	0	29	29	0	0	0.0393701
4050	93%	13	1	0	0	0	0	0	14	15	1	0	0.0393701
4060	100%	18	0	0	0	0	0	2	18	18	0	0	0.0393701
4070	96%	24	1	0	0	0	0	0	25	26	1	0	0.0393701
4080	100%	11	0	0	0	0	0	1	11	11	0	0	0.0393701
4090	100%	20	0	0	0	0	0	1	20	20	0	0	0.0393701
4100	100%	11	0	0	0	0	0	0	11	11	0	0	0.0393701
4110	100%	26	0	0	0	0	0	1	26	26	0	0	0.0393701
4130	95%	17	1	0	0	0	0	0	18	19	1	0	0.0393701
4140	100%	26	0	0	0	0	0	0	26	26	0	0	0.0393701
4150	96%	25	1	0	0	0	0	0	26	27	1	0	0.0393701
4160	100%	31	0	0	0	0	0	0	31	31	0	0	0.0393701
4170	94%	16	1	0	0	0	0	0	17	18	1	0	0.0393701
4180	86%	11	0	1	0	0	0	0	12	14	2	0	0.0393701
4190	97%	30	1	0	0	0	0	0	31	32	1	0	0.0393701
4200	94%	28	2	0	0	0	0	0	30	32	2	0	0.0393701
4220	94%	15	1	0	0	0	0	1	16	17	1	0	0.0393701
4230	100%	16	0	0	0	0	0	0	16	16	0	0	0.0393701
4240	92%	10	1	0	0	0	0	0	11	12	1	0	0.0393701
4250	97%	30	1	0	0	0	0	0	31	32	1	0	0.0393701
4260	93%	13	1	0	0	0	0	0	14	15	1	0	0.0393701
4270	80%	3	1	0	0	0	0	0	4	5	1	0	0.0393701
4290	92%	31	1	1	0	0	0	0	33	36	3	0	0.0393701
4300	100%	14	0	0	0	0	0	0	14	14	0	0	0.0393701
4310	97%	34	1	0	0	0	0	0	35	36	1	0	0.0393701

4330	97%	27	1	0	0	0	0	0	28	29	1	0	0.0393701
4340	100%	21	0	0	0	0	0	0	21	21	0	0	0.0393701
4350	100%	36	0	0	0	0	0	0	36	36	0	0	0.0393701
4360	97%	29	1	0	0	0	0	0	30	31	1	0	0.0393701
4470	97%	31	1	0	0	0	0	0	32	33	1	0	0.0393701
4490	90%	16	2	0	0	0	0	2	18	20	2	0	0.0393701
4510	94%	29	2	0	0	0	0	0	31	33	2	0	0.0393701
4520	100%	16	0	0	0	0	0	0	16	16	0	0	0.0393701
4530	96%	21	1	0	0	0	0	0	22	23	1	0	0.0393701
4570	87%	11	2	0	0	0	0	0	13	15	2	0	0.0393701
4710	96%	21	1	0	0	0	0	0	22	23	1	0	0.0393701
4730	100%	16	0	0	0	0	0	0	16	16	0	0	0.0393701
4750	100%	11	0	0	0	0	0	2	11	11	0	0	0.0393701
4770	100%	15	0	0	0	0	0	4	15	15	0	0	0.0393701
4790	84%	17	4	0	0	0	0	0	21	25	4	0	0.0393701
4810	100%	37	0	0	0	0	0	0	37	37	0	0	0.0393701
4820	94%	14	1	0	0	0	0	1	15	16	1	0	0.0393701
4830	96%	21	1	0	0	0	0	0	22	23	1	0	0.0393701
4840	96%	22	1	0	0	0	0	0	23	24	1	0	0.0393701
	Total Tips	1726	55	6	3	2	2	32	1794	1888	94	3	

