Memo

Water & Earth Technologies, Inc.
Water Resources and Environmental Consulting

Date: September 3, 2008

To: Kevin Stewart and Chad Kudym

From: Markus Ritsch

Subject: **August 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 August 1 through August 31, 2008.

II. General System Analysis Summary

A total of 357,774 data records were analyzed from the ALERT 2 base station. Meteorological sensors account for 57 percent, water level sensors 12 percent, and rain sensors 6 percent of the total monthly records.

More than ninety-nine percent (99.75%) of the received data reports were flagged as "good" by the Nova Star validation process. Roughly 884 reports were flagged as "bad". Of these "bad" reports, 160 originated from Third Creek at DIA (IDs 1483 and 1484).

The system-wide radio traffic loading was 11,541 reports per day with an average hourly loading of 481 reports. The peak hourly traffic loading was 1,595 reports, which occurred on August 16, between 10:00 AM and 11:00 AM. A plot of monthly average and peak hourly traffic loading is provided.

A total of 2,592 reports were received from the Hayman rain sensors this month. These reports make up less than 2% of the total reports for the month.

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 89 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	1710	1600	1600	1600	4130				
140	2190	110	540	540	110	1660	4560				
4150	140	2190	1600	1710	950	4140	4240				
4060	4170	1370	1350	4080	1710	1350	4570				
4470	4150	620	710	4060	540	1710	1710				
4530	4530	840	4330	4150	4530	4530	4080				

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 this site has shown poor timer performance in August of only 51%.

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 and excluding Aurora Town Hall-920) were 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	90.20	Only the 1-mm rain sensors were included in the analysis
Median	83	Only the 1-mm rain sensors were included in the analysis
Standard deviation	27.82	Only the 1-mm rain sensors were included in the analysis
Mean plus three standard deviations	173.65	Only the 1-mm rain sensors were included in the analysis
Minimum total count	39	Genesee Village (ID 2310)
Maximum total count	227	Expo Park (ID 420)

The highest reporting rain sensor this month was Expo Park (ID 420) with 227 tips. This sensor is influenced by irrigation sprinklers.

Other than Expo Park, no sensor reported more than the system-wide mean plus 3 standard deviations.

B. Monthly Average Tip/Count Summary

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	20.57	54.82	26.06	16.43	90.20					

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

Several sensors had a jump in sequential count of more than six (Table 4). These large jumps are investigated manually by inspecting the count series.

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

Sensor Description	Sensor ID	Comment
Englewood Dam	1600	This sensor experienced a large jump in count on August 16 between 10:23 AM and 11:04 AM during a large storm.
Louisville Rec Center	1100	This sensor experienced a large jump in count on August 16 between 10:08 AM and 11:17 AM during a large storm.
Salisbury Park	2730	This sensor experienced a large jump in count on August 28 between 12:22 AM and 11:02 AM.
Murphy Creek GC	870	This sensor experienced a large jump in count on August 8 after 8:10 PM during a large storm that occurred that evening.

D. Sensor-by-Sensor Incrementing Count Summary

The system-wide reception rate of incrementing, 1-mm tip reports for the month was approximately 86 percent. A total of 11,623 incrementing reports were received and a total of 13,439 were expected. The total loss of incrementing reports for the month was approximately 14 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	1710	1600	1600	1660	1600				
2190	4820	540	1600	2320	2750	4820	1100				
750	4530	2730	540	4150	2710	4080	1660				
4570	4470	2210	700	1710	310	2340	870				
2990	4810	110	110	4710	4090	2330	1710				
--	700	1350	840	1350	4170	4060	410				

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. Englewood Dam (ID 1600)

This sensor recorded data for the entire month. Nothing suspicious was noted in the data series other than a large number of tips were missing during the heavy rain period on August 16, 2008.

V. Heavy Radio Traffic Analysis

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 Hourly Traffic Periods This Month

The hourly periods of highest radio traffic this month include:

Peak Traffic Periods	Reports/hour	Hour Beginning
Peak Hourly Traffic	1,595	8/16/08 10:00 AM
2nd Max	1,447	8/16/08 11:00 AM
3rd Max	1,231	8/8/08 8:00 PM
4th Max	1,178	8/15/08 3:00 AM
5th Max	1,039	8/16/08 12:00 PM

B. August 16, 2008

The heaviest traffic period occurred on August 16th. The distribution of hourly traffic around the peak hour is summarized:

- August 16 from 7:00 AM to 8:00 AM (821 reports)
- August 16 from 8:00 AM to 9:00 AM (967 reports)
- August 16 from 9:00 AM to 10:00 AM (1,027 reports)
- August 16 from 10:00 AM to 11:00 AM (1,595 reports)
- August 16 from 11:00 AM to 12:00 PM (1,447 reports)
- August 16 from 12:00 PM to 1:00 PM (1,039 reports)
- August 16 from 1:00 PM to 2:00 PM (797 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). During the heavy traffic period, a total of 2,589 reports were expected and only 2,082 were received yielding a loss of approximately **19.58%** of the incrementing transmissions.

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

	Occurrences of lost sequential tip reports during period			
Heavy Traffic Period (Aug 16, 2008)	**Loss of 3 sequential tips**	**Loss of 4 sequential tips**	**Loss of 5 sequential tips**	**Loss of 6 or more sequential tips**
7:00 AM to 2:00 PM	16	5	4	2

August 16th, 2008 from 7:00 AM to 2:00 PM represents a critical period due to the fact that only 80% of the incrementing rain reports were received on the ALERT2 base station during this period. The true number of data transmissions occurring between 10:00 AM and 11:00 AM on August 16th may have exceeded 2,000 reports.

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)	186
Total reports from unknown IDs	299
Unknown IDs with only a single received report (potential noise)	155
Total reports from all IDs – RecData Log entire month	302,215
Unknown reports as a fraction of total reports	0.10%

The total number of reports from unknown sensors is very 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

Sensor ID	Reports
8102	21
8101	19
8100	19
1663	13
819	13
2809	4
4858	3
4775	3
4094	3
319	3
2239	3

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	7	12:00-12:59	13
1:00-1:59	13	1:00-1:59	21
2:00-2:59	6	2:00-2:59	17
3:00-3:59	10	3:00-3:59	17
4:00-4:59	11	4:00-4:59	28
5:00-5:59	11	5:00-5:59	11
6:00-6:59	2	6:00-6:59	20
7:00-7:59	10	7:00-7:59	17
8:00-8:59	9	8:00-8:59	9
9:00-9:59	7	9:00-9:59	5
10:00-10:59	16	10:00-10:59	19
11:00-11:59	14	11:00-11:59	6

VII. Issues Identified this Month

Sensors with a large number of invalid reports:

1. **Third Creek at DIA (ID 1483)** – Water level with 100 reports,
2. **Third Creek at DIA (ID 1484)** – Water level with 60 reports,
3. **Castle Rock Weather (ID 2744)** – Wind Gust with 39,
4. **Havana Park (ID 503)** – Water level with 36 reports,
5. **Quincy Reservoir (ID 755)** – Battery voltage with 36 reports, and
6. **Highland Ranch WTP (ID 2704)** - Wind Gust with 29 reports.

Sensors reporting frequently (over reporting):

7. **Quincy Reservoir (ID 749 - Wind)** with 5,376 reports,
8. **Third Creek at DIA (ID 1484 - Water Level)** with 3,659,
9. **Salisbury Park (ID 2727 - Wind)** with 3,088 reports, and
10. **Castle Rock (ID 2747 – Wind**) with 3,147 reports.

Sensors reporting infrequently (under reporting):

11. **Rowena (ID 4433**) with 9 reports,
12. **LDC at 64th (ID 1313**) with 9 reports,
13. **Stapleton (ID 1468)** with 31 reports, and
14. **Van Bibber @ Highway 93 (ID 333)** with 34 reports.

Poor timer reporting:

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

15. **Sand Creek at Mouth (ID 1810) –** Only 51% of the timer reports received for the entire month.
16. **Swiss Peaks (ID 4130) -** Only 73% of the timer reports received for the entire month.
17. **Lyons Diversion NSV (ID 4560) –** Only 73% of the timer reports received for the entire month.
18. **Sunset (ID 4240) –** Only 74% of the timer reports received for the entire month.
19. **St. Antons (ID 4570)** – Only 74% of the timer reports received for the entire month.
20. **Shop Creek (ID 1710)** – Only 77% of the timer reports were received from this sensor.
21. **Twin Sisters (ID 4080)** – Only 77% of the timer reports received for the entire month.
22. **Gold Hill (ID 4150)** – Only 79% of the timer reports received for the entire month.
23. **Winiger Ridge (ID 4530)** – Only 79% of the timer reports received for the entire month..

Poor event reporting:

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

24. **Englewood Dam (ID 1600)** – Only 68% of the event reports were received.
25. **Louisville Rec Center (ID 1100)** – Only 70% of the event reports were received.
26. **SPR at Henderson (ID 1660)** – Only 71% of the event reports were received.
27. **Murphy Creek GC (ID 870)** – Only 71% of the event reports were received.

28. **Shop Creek (ID 1710)** – Only 72% of the event reports were received.
29. **Kelly Dam (ID 410)** – Only 72% of the event reports were received.
30. **Toll Gate at 6th (ID 700)** – Only 73% of the event reports were received.
31. **Gunbarrel (ID 1110)** – Only 73% of the event reports were received.

Low rain total:

32. **Genesee Village (ID 2310**) – This sensor recorded 39 tips for the month.
33. **Apple Valley (ID 4490)** – This sensor recorded 48 tips for the month.

High rain total:

34. **Expo Park (ID 420) –** This sensor recorded a total of 227 tips for the month. This station is noted for being influenced by sprinkler irrigation.

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

35. **Englewood Dam (ID 1600)** – This sensor experienced a large jump in count on August 16 between 10:23 AM and 11:04 AM during a large storm.
36. **Louisville Rec Center (ID 1100)** – This sensor experienced a large jump in count on August 16 between 10:08 AM and 11:17 AM during a large storm.
37. **Murphy Creek GC (ID 870) –** This sensor experienced a large jump in count on August 8 after 8:10 PM during a large storm that occurred that evening.
38. **Salisbury Park (ID 2730) –** This sensor experienced a large jump in count on August 28 between 12:22 AM and 11:02 AM. This jump is not attributable to a large storm event. It is not clear what caused this jump.

Reports from "Unknown Sensors":

39. 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.

Sensor ID	Reports
8102	21
8101	19
8100	19
1663	13
819	13
2809	4
4858	3
4775	3
4094	3
319	3
2239	3

General System Analysis

Database Name P:\A207-UDFCD-Data-Analysis\2008_Aug\Novastar_extract_2008Aug.mdb

First Date in Database	8/1/08 12:00 AM	**Total Days**	31.0
Last Date in Database	8/31/08 11:59 PM	**Total Hours**	744.0

Total Records Analyzed 357774

Records by Group

None-ALERT-ID	53983	15%
Wind Gust	46104	13%
Temperature	41081	11%
Relative Humidity	41061	11%
Water Level PT-HSE	34586	10%
Precipitation	20807	6%
Wind Direction	19931	6%
Barometric Pressure	18599	5%
Wind Speed Average	16005	4%
Wind Speed Average & Azimuth	13734	4%
Solar Radiation	8835	2%
Battery Voltage HSE	7300	2%
Water Level Float	5271	1%
Fuel Temperature	3682	1%
Fuel Moisture	3671	1%
Battery Voltage Analog	3446	1%
Battery Voltage Digital	3232	1%
Water Level PT	3120	1%
Soil Moisture	2897	1%
Precipitation - Mean	2653	1%
Hayman Precipitation	2592	1%
Repeater Pass List	618	0%
Repeater Status Report	481	0%
12Hr Status Report	343	0%
Precipitation - Test	247	0%
Battery	240	0%
Battery Voltage	115	0%
Longmont Flow Gage	111	0%
Handar 585 ALARM Status	59	0%
Longmont Water Level PT	55	0%
Total	354859	

Records by Major Group

Meteorologic Sensors	205350	57%
Water Level Sensors	43143	12%
Rain Sensors	20807	6%
Sensor Status Transmissions	15479	4%
Soil and Fuel Sensors	10250	3%
Total	295029	

Records by Validation Type

Good	0	356890	99.75%
Questionable	1	884	0%
	Total	357774	

Sensors With Most Invalid Data

Description	Sensor	Reports
Third Creek at DIA	1483	100
Third Creek at DIA	1484	60
Castle Rock	2744	39
Havana Park	503	36
Quincy Reservoir	755	36

Traffic Loading Summary

Alert Reports	357774	
Average Daily Traffic	11541	
Average Hourly Traffic	481	
Median Hourly Traffic	455	hour beginning
Peak Hourly Traffic	1595	8/16/08 10:00 AM
2nd Max	1447	8/16/08 11:00 AM
3rd Max	1231	8/8/08 8:00 PM
4th Max	1178	8/15/08 3:00 AM
5th Max	1039	8/16/08 12:00 PM

Rain Timer Performance

Analyze Rain Sensors

systemwide average (days)			89%
0.5205			

Rain Sensors	Description	Rcv	Interval	Exp	Performance
100	Carr Street	58	12:13	62.00	94%
110	Ralston Reservoir	53	13:01	62.00	85%
120	West Woods	57	12:27	62.00	92%
130	Simms Street	54	13:19	62.00	87%
140	Blue Mountain	59	12:15	62.00	95%
150	Nott Creek	57	12:15	62.00	92%
200	Leyden Reservoir	58	12:42	62.00	94%
220	Upper Leyden	54	13:21	62.00	87%
300	Van Bibber Park	55	13:27	62.00	89%
310	Guy Hill Ranch	54	12:16	62.00	87%
320	Sports Complex	56	12:30	62.00	90%
330	Van Bibber @ Hwy 93	59	12:11	62.00	95%
410	Kelly Dam	51	12:31	62.00	82%
420	Expo Park	57	12:18	62.00	92%
440	Fire Station #7	58	12:27	62.00	94%
500	Havana Park	57	12:58	62.00	92%
520	Jewell Detention	58	12:34	62.00	94%
530	Fire Station #19	61	11:57	62.00	98%
540	Parker/Mississippi	55	12:58	62.00	89%
600	Harvard Gulch Park	56	12:57	62.00	90%
610	Harvard @ Jackson	60	12:11	62.00	97%
620	Quincy/Highline	57	12:26	62.00	92%
630	Temple Pond at DTC	57	12:44	62.00	92%
640	Goldsmith at Eastman	59	12:14	62.00	95%
650	Iliff Pond	54	12:30	62.00	87%
700	Toll Gate @ 6th	57	12:00	62.00	92%
710	Horseshoe Park Drop	54	12:13	62.00	87%
720	Confluence Pond	58	12:30	62.00	94%
730	No Name @ Quincy	58	11:57	62.00	94%
740	Smoky Hill	61	11:59	62.00	98%
750	Quincy Reservoir	54	12:13	62.00	87%
760	Mission Viejo Park	58	13:06	62.00	94%
800	Sable Ditch @ 18th	55	12:30	62.00	89%
810	Granby Ditch @ 6th	60	12:13	62.00	97%
820	ETG @ Buckley	69	9:35	62.00	111%
830	Side Creek Park	57	12:27	62.00	92%
840	Fire Station 12	55	12:32	62.00	89%
850	Flying J	50	12:34	62.00	81%
860	Sand Cr at Colfax	118	6:13	124.00	95%
870	Murphy Creek GC	50	13:34	62.00	81%
900	Aurora Reservoir	60	12:00	62.00	97%
920	Aurora Town Hall Wx	60	11:43	62.00	97%
940	Sampson Gulch	54	13:08	62.00	87%
950	Piney at Liverpool	58	12:29	62.00	94%
1000	Maple Grove Resv.	60	11:57	62.00	97%
1010	Denver West	57	12:27	62.00	92%
1020	Lena @ Nolte Pond	58	12:37	62.00	94%
1030	NREL/S. Table Mtn.	55	12:56	62.00	89%
1040	Lena @ U.S. Hwy 6	55	12:47	62.00	89%
1050	Jeffco Fairgrounds	57	12:41	62.00	92%
1060	Heritage Square	59	12:26	62.00	95%
1100	Louisville Rec Ctr	50	13:23	62.00	81%
1110	Gunbarrel	54	13:31	62.00	87%
1300	Hidden Lake	59	12:12	62.00	95%
1310	LDC at 64th	57	12:31	62.00	92%
1320	SPR at 3rd Ave	56	12:42	62.00	90%
1330	Roslyn	58	12:13	62.00	94%

1340	Sanderson at Xavier	55	13:54	62.00	89%
1350	Chatfield COE	52	14:17	62.00	84%
1360	Denver Zoo	61	12:00	62.00	98%
1370	West Metro FS13	55	12:15	62.00	89%
1420	Diamond Hill	60	12:00	62.00	97%
1440	Elbert	57	12:00	62.00	92%
1460	Stapleton	30	23:59	31.00	97%
1480	Third Creek at DIA	62	11:57	62.00	100%
1500	Powers Park	58	12:18	62.00	94%
1520	Marston Lake North	57	12:14	62.00	92%
1530	Bear Creek @ Lowell	57	11:57	62.00	92%
1540	Sanderson at Xavier	59	11:57	62.00	95%
1550	Lakewood CC	59	12:40	62.00	95%
1570	Brighton Ditch Wx	58	12:15	62.00	94%
1600	Englewood Dam	52	13:00	62.00	84%
1610	Holly Dam	59	12:22	62.00	95%
1620	Slaughterhouse Glch	60	11:58	62.00	97%
1630	SPR at Dartmouth	57	12:49	62.00	92%
1660	SPR at Henderson	52	14:08	62.00	84%
1700	Cherry Cr @ Champa	51	12:12	62.00	82%
1710	Shop Creek	48	14:50	62.00	77%
1720	Cherry Cr @ Steele	57	12:43	62.00	92%
1810	Sand Creek at mouth	21	13:12	41.00	51%
1900	Niver Detention	58	12:02	62.00	94%
1920	Brighton	59	12:14	62.00	95%
2190	Squaw Mountain	56	12:54	62.00	90%
2210	Hiwan G.C.	56	12:16	62.00	90%
2220	Evergreen Lake	62	11:58	62.00	100%
2230	Bear Cr below Cub	55	12:50	62.00	89%
2240	Cold Sprg Glch conf	57	12:29	62.00	92%
2250	Rosedale	58	11:57	62.00	94%
2260	Brook Forest	57	12:14	62.00	92%
2270	Cub Cr below Blue	57	12:14	62.00	92%
2280	Kinney Peak	56	12:13	62.00	90%
2310	Genesee Village	60	12:12	62.00	97%
2330	Morrison	58	12:26	62.00	94%
2340	El Rancho	56	12:36	62.00	90%
2350	Idledale	50	13:11	62.00	81%
2360	Indian Hills	57	12:45	62.00	92%
2370	Red Rocks Park	58	12:27	62.00	94%
2710	Highlands Ranch WTP	60	11:57	62.00	97%
2730	Salisbury Park	56	12:47	62.00	90%
2750	Castle Rock	57	12:16	62.00	92%
2810	Pine Cliff Road	61	11:34	62.00	98%
2820	Haskins Gulch Conf	59	12:15	62.00	95%
2840	Sulphur Gulch	57	12:45	62.00	92%
2850	Cherry Cr bl Bayou Glch	58	11:59	62.00	94%
2920	West Cherry Head-Douglas Cnty	58	12:16	62.00	94%
2930	Spring Valley Rd - DougCnty	59	12:16	62.00	95%
2940	Willow Creek - DougCnty	58	12:16	62.00	94%
2990	Tomah Rd-Douglas Cnty	56	12:16	62.00	90%
4010	Cresent	50	14:37	62.00	81%
4020	Rio Grande	58	12:32	62.00	94%
4030	Red Garden	57	12:29	62.00	92%
4040	Martin Gulch	59	12:13	62.00	95%
4050	Walker Ranch	53	13:54	62.00	85%
4060	Lakeshore	50	13:32	62.00	81%
4070	Bear Peak	59	12:13	62.00	95%
4080	Twin Sisters	48	14:33	62.00	77%
4090	Magnolia	53	12:14	62.00	85%
4100	Filter Plant	59	12:14	62.00	95%
4110	Betasso	58	12:44	62.00	94%

4130	Swiss Peaks	45	13:07	62.00	73%
4140	Logan Mill	56	12:32	62.00	90%
4150	Gold Hill	49	12:35	62.00	79%
4160	Sunshine	59	11:58	62.00	95%
4170	Pine Brook	51	14:13	62.00	82%
4180	Gold Lake	55	12:34	62.00	89%
4190	Slaughterhouse	59	12:13	62.00	95%
4200	Lazy Acres	52	14:27	62.00	84%
4220	Fling's	51	13:17	62.00	82%
4230	Golden Age	58	12:28	62.00	94%
4240	Sunset	46	14:08	62.00	74%
4250	Geer Canyon	60	12:13	62.00	97%
4260	Taylor Mountain	59	11:58	62.00	95%
4270	Cannon Mountain	56	12:31	62.00	90%
4290	Red Hill	57	12:13	62.00	92%
4300	Big Elk Park	57	12:30	62.00	92%
4310	Johnny Park	55	13:03	62.00	89%
4340	Riverside	54	12:36	62.00	87%
4350	Conifer Hill	57	11:58	62.00	92%
4360	Justice Center	59	12:12	62.00	95%
4470	Little Narrows	52	12:48	62.00	84%
4490	Apple Valley	59	11:58	62.00	95%
4510	Pinewood Springs	55	12:30	62.00	89%
4520	Eagle Ridge	56	13:16	62.00	90%
4530	Winiger Ridge	49	14:01	62.00	79%
4550	Boulder Jail	3	0:00	62.00	5%
4560	Lyons Diversion NSV	45	15:33	62.00	73%
4570	St. Antons	46	13:52	62.00	74%
4710	Ward C-1	54	12:00	62.00	87%
4730	Sugarloaf	54	12:00	62.00	87%
4750	Louisville Lake	53	13:52	62.00	85%
4770	Cal-Wood Ranch	57	12:15	62.00	92%
4790	Button Rock	56	12:32	62.00	90%
4810	Shanahan Ridge	53	13:21	62.00	85%
4820	Doudy Draw	52	13:21	62.00	84%
4830	SBC @ San Souci	57	12:42	62.00	92%
4840	SBC@S Boulder Ditch	58	12:41	62.00	94%
4850	Porphory Mtn	53	12:19	62.00	85%
4860	Fairview Peak	51	12:19	62.00	82%

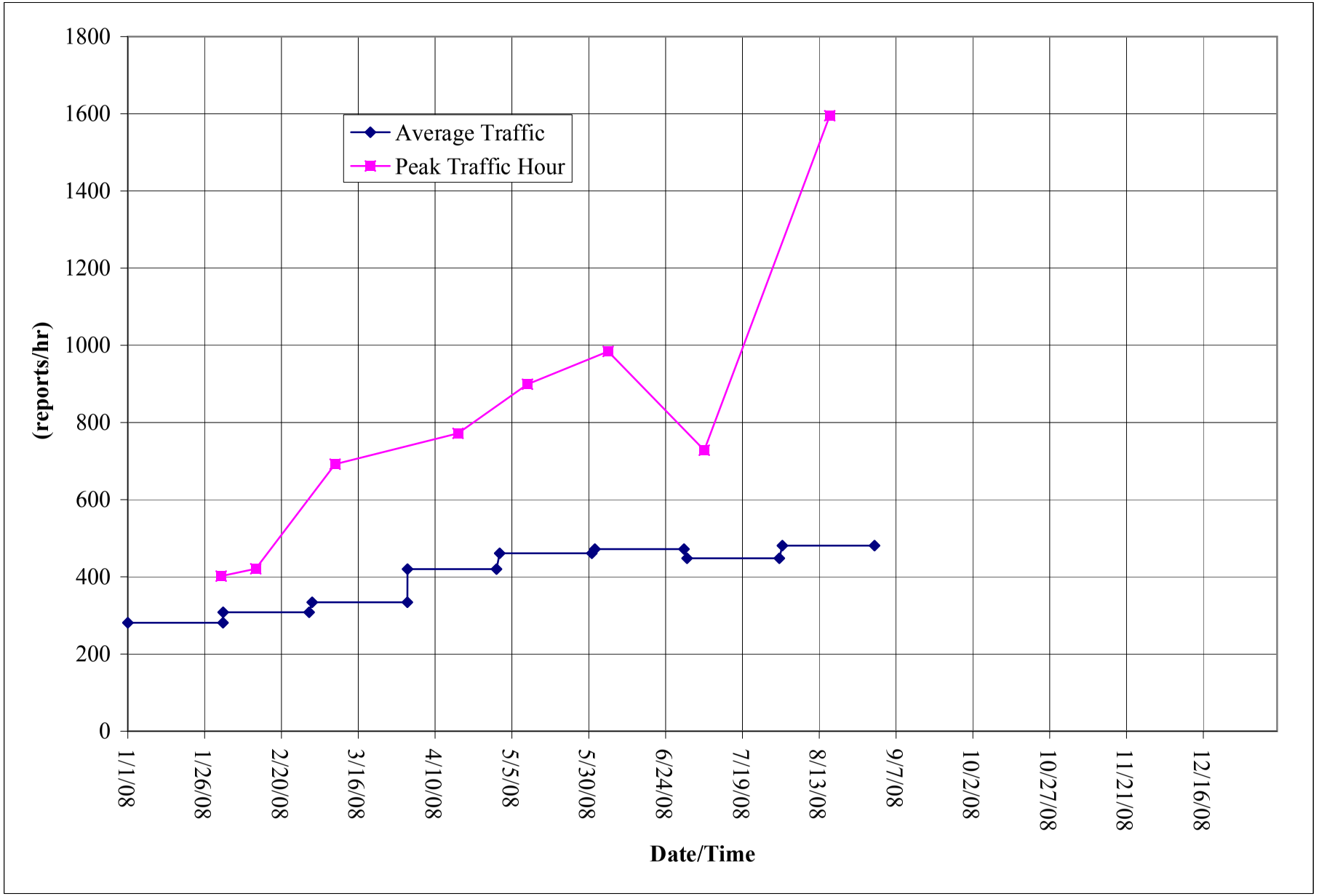
Rain Event Performance

Analyze Rain Sensors

	Reports Received	11623	
Systemwide Avg	Total Tips	13439	
86%	Data Loss	13.51%	

Sensor	Performance	1-tips	2-tips	3-tips	4-tips	5-tips	6-tips	>6-tips	Rcv	Exp	Miss	Hold	Bucket
1600	68%	32	9	2	0	0	0	1	43	63	20	0	0.0393701
1100	70%	34	14	0	0	0	0	1	48	69	21	0	0.0393701
1660	71%	43	8	5	0	0	1	0	57	80	23	0	0.0393701
870	71%	81	6	5	0	0	0	1	92	129	37	2	0.0393701
1710	72%	53	14	4	1	1	0	0	73	102	29	0	0.0393701
410	72%	65	16	2	3	0	1	0	87	121	34	0	0.0393701
700	73%	79	13	5	5	0	0	0	102	140	38	0	0.0393701
1110	73%	37	7	4	1	0	0	0	49	67	18	0	0.0393701
4470	74%	39	6	3	2	0	0	0	50	68	18	0	0.0393701
4510	74%	36	12	3	0	0	0	0	51	69	18	0	0.0393701
530	75%	83	14	6	2	1	0	0	106	142	36	0	0.0393701
650	75%	83	17	4	2	1	0	0	107	142	35	0	0.0393701
4010	77%	54	12	1	1	1	0	0	69	90	21	0	0.0393701
2730	77%	65	10	0	1	0	0	1	76	99	13	0	0.0393701
4830	77%	37	13	1	0	0	0	0	51	66	15	0	0.0393701
4060	78%	59	13	3	1	0	0	0	76	98	22	0	0.0393701
4570	78%	58	15	2	1	0	0	0	76	98	22	0	0.0393701
720	78%	74	11	4	1	1	0	0	91	117	26	0	0.0393701
620	78%	49	8	2	0	0	1	0	60	77	17	0	0.0393701
4170	78%	37	7	3	0	0	0	0	47	60	13	0	0.0393701
4750	78%	34	13	0	0	0	0	0	47	60	13	0	0.0393701
4530	78%	47	9	0	1	1	0	0	58	74	16	0	0.0393701
1900	78%	48	11	3	0	0	0	0	62	79	17	0	0.0393701
4140	79%	48	9	2	1	0	0	0	60	76	16	0	0.0393701
520	79%	106	17	2	3	1	0	0	129	163	34	1	0.0393701
730	80%	55	14	2	0	0	0	0	71	89	18	0	0.0393701
540	80%	93	19	5	0	0	0	0	117	146	29	0	0.0393701
710	80%	73	14	1	2	0	0	0	90	112	22	0	0.0393701
4240	80%	59	12	3	0	0	0	0	74	92	18	0	0.0393701
2840	81%	63	14	1	1	0	0	0	79	98	19	0	0.0393701
750	81%	53	7	2	0	1	0	0	63	78	15	0	0.0393701
4730	81%	52	7	4	0	0	0	0	63	78	15	0	0.0393701
840	81%	57	7	3	1	0	0	0	68	84	16	0	0.0393701
900	81%	71	10	3	0	1	0	0	85	105	20	1	0.0393699
4790	81%	42	8	2	0	0	0	0	52	64	12	0	0.0393701
810	81%	70	16	2	0	0	0	0	88	108	20	0	0.0393701
820	82%	52	8	0	2	0	0	0	62	76	14	0	0.0393701
1620	82%	57	13	0	1	0	0	0	71	87	16	0	0.0393701
440	82%	82	15	2	1	0	0	0	100	122	22	0	0.0393701
4220	82%	58	9	1	0	1	0	0	69	84	15	0	0.0393701
800	82%	59	14	1	0	0	0	0	74	90	16	0	0.0393701
950	82%	55	6	4	0	0	0	0	65	79	14	0	0.0393701
1720	82%	46	8	2	0	0	0	0	56	68	12	0	0.0393701
2330	82%	56	13	1	0	0	0	0	70	85	15	2	0.0393701
420	82%	156	23	7	1	0	0	0	187	227	40	0	0.0393701
940	83%	79	14	3	0	0	0	0	96	116	20	0	0.0393699
1520	83%	59	6	4	0	0	0	0	69	83	14	1	0.0393701
1340	83%	50	8	2	0	0	0	0	60	72	12	0	0.0393701
830	83%	91	10	3	0	0	1	0	105	126	21	0	0.0393701
860	84%	65	11	2	0	0	0	0	78	93	15	0	0.0393701
4080	84%	59	9	2	0	0	0	0	70	83	13	0	0.0393701
4840	85%	46	10	0	0	0	0	0	56	66	10	0	0.0393701
4820	85%	63	9	2	0	0	0	0	74	87	13	0	0.0393701
1010	85%	60	7	1	1	0	0	0	69	81	12	0	0.0393701
4180	85%	91	12	0	2	0	0	0	105	123	18	1	0.0393701
4150	85%	72	7	2	1	0	0	0	82	96	14	0	0.0393701
2370	86%	42	5	0	1	0	0	0	48	56	8	0	0.0393701
760	86%	100	14	0	0	0	1	0	115	134	19	0	0.0393701
110	86%	54	6	2	0	0	0	0	62	72	10	0	0.0393701
630	86%	112	9	1	3	0	0	0	125	145	20	0	0.0393701
2340	86%	50	6	0	1	0	0	0	57	66	9	0	0.0393701
1480	86%	57	4	3	0	0	0	0	64	74	10	0	0.0393701
1460	87%	60	3	2	1	0	0	0	66	76	10	0	0.0393701
1550	87%	57	8	1	0	0	0	0	66	76	10	0	0.0393701
4810	87%	66	5	1	0	1	0	0	73	84	11	0	0.0393701
2930	87%	95	8	4	0	0	0	0	107	123	16	0	0.0393701
2280	87%	47	6	1	0	0	0	0	54	62	8	0	0.0393701
920	87%	124	10	5	0	0	0	0	139	159	20	0	0.0393701
500	88%	131	17	2	0	0	0	0	150	171	21	0	0.0393701
4290	88%	52	6	1	0	0	0	0	59	67	8	0	0.0393701
2850	88%	118	15	0	1	0	0	0	134	152	18	1	0.0393701
4130	88%	73	7	2	0	0	0	0	82	93	11	0	0.0393701
2250	88%	66	10	0	0	0	0	0	76	86	10	0	0.0393701
1040	88%	63	4	1	1	0	0	0	69	78	9	0	0.0393701
1360	89%	65	1	4	0	0	0	0	70	79	9	0	0.0393701
2210	89%	70	6	2	0	0	0	0	78	88	10	1	0.0393701
1320	89%	77	7	2	0	0	0	0	86	97	11	1	0.0393701
1570	89%	105	11	2	0	0	0	0	118	133	15	0	0.0393701
740	89%	71	8	1	0	0	0	0	80	90	10	0	0.0393701

4250	89%	51	5	1	0	0	0	0	57	64	7	0	0.0393701
4710	89%	102	10	2	0	0	0	0	114	128	14	0	0.0393701
850	89%	82	5	3	0	0	0	0	90	101	11	1	0.0393701
1050	89%	60	6	1	0	0	0	0	67	75	8	0	0.0393701
4070	89%	59	8	0	0	0	0	0	67	75	8	0	0.0393701
4200	90%	48	4	1	0	0	0	0	53	59	6	0	0.0393701
1310	90%	56	7	0	0	0	0	0	63	70	7	0	0.0393701
1350	91%	60	7	0	0	0	0	0	67	74	7	0	0.0393701
330	91%	43	5	0	0	0	0	0	48	53	5	0	0.0393701
4360	91%	61	7	0	0	0	0	0	68	75	7	1	0.0393701
220	91%	70	8	0	0	0	0	0	78	86	8	0	0.0393701
1530	91%	70	8	0	0	0	0	0	78	86	8	0	0.0393701
600	91%	81	5	2	0	0	0	0	88	97	9	0	0.0393701
1370	91%	63	5	1	0	0	0	0	69	76	7	0	0.0393701
300	91%	63	7	0	0	0	0	0	70	77	7	0	0.0393701
1300	91%	64	5	1	0	0	0	0	70	77	7	0	0.0393701
4110	91%	55	6	0	0	0	0	0	61	67	6	0	0.0393701
4020	91%	84	7	1	0	0	0	0	92	101	9	0	0.0393701
320	91%	67	5	1	0	0	0	0	73	80	7	0	0.0393701
1920	91%	107	5	3	0	0	0	0	115	126	11	0	0.0393701
2230	91%	57	6	0	0	0	0	0	63	69	6	0	0.0393701
100	91%	67	7	0	0	0	0	0	74	81	7	0	0.0393701
4520	91%	49	3	1	0	0	0	0	53	58	5	0	0.0393701
2260	91%	69	5	1	0	0	0	0	75	82	7	0	0.0393701
2810	92%	90	5	2	0	0	0	0	97	106	9	0	0.0393701
4090	92%	69	7	0	0	0	0	0	76	83	7	0	0.0393701
2710	92%	52	1	2	0	0	0	0	55	60	5	0	0.0393701
1700	92%	52	3	1	0	0	0	0	56	61	5	0	0.0393701
4100	92%	51	5	0	0	0	0	0	56	61	5	0	0.0393701
4340	92%	72	7	0	0	0	0	0	79	86	7	0	0.0393701
2990	92%	95	7	1	0	0	0	0	103	112	9	0	0.0393701
1500	92%	121	4	2	1	0	0	0	128	139	11	0	0.0393701
4300	92%	75	7	0	0	0	0	0	82	89	7	0	0.0393701
4270	92%	78	5	1	0	0	0	0	84	91	7	0	0.0393701
4030	92%	89	8	0	0	0	0	0	97	105	8	0	0.0393701
4770	92%	57	3	1	0	0	0	0	61	66	5	0	0.0393701
640	92%	90	8	0	0	0	0	0	98	106	8	0	0.0393701
2940	93%	116	8	1	0	0	0	0	125	135	10	0	0.0393701
4040	93%	93	8	0	0	0	0	0	101	109	8	0	0.0393701
120	93%	86	5	1	0	0	0	0	92	99	7	0	0.0393701
610	93%	86	5	1	0	0	0	0	92	99	7	0	0.0393701
4260	93%	66	2	0	1	0	0	0	69	74	5	0	0.0393701
2190	93%	77	6	0	0	0	0	0	83	89	6	2	0.0393701
4350	93%	66	3	1	0	0	0	0	70	75	5	0	0.0393701
1420	93%	79	4	1	0	0	0	0	84	90	6	0	0.0393701
2240	94%	67	5	0	0	0	0	0	72	77	5	0	0.0393701
150	94%	70	3	1	0	0	0	0	74	79	5	0	0.0393701
4160	94%	69	5	0	0	0	0	0	74	79	5	0	0.0393701
4490	94%	43	1	1	0	0	0	0	45	48	3	0	0.0393701
4310	94%	70	5	0	0	0	0	0	75	80	5	0	0.0393701
1540	94%	58	4	0	0	0	0	0	62	66	4	0	0.0393701
2920	94%	105	5	1	0	0	0	0	111	118	7	0	0.0393701
2270	94%	61	4	0	0	0	0	0	65	69	4	0	0.0393701
1000	95%	66	4	0	0	0	0	0	70	74	4	0	0.0393701
1030	95%	68	4	0	0	0	0	0	72	76	4	0	0.0393701
4050	95%	68	4	0	0	0	0	0	72	76	4	0	0.0393701
2350	95%	54	3	0	0	0	0	0	57	60	3	0	0.0393701
1060	95%	73	2	1	0	0	0	0	76	80	4	0	0.0393701
1440	95%	111	6	0	0	0	0	0	117	123	6	1	0.0393701
2820	95%	98	5	0	0	0	0	0	103	108	5	0	0.0393701
1810	96%	62	3	0	0	0	0	0	65	68	3	0	0.0393701
2360	96%	65	3	0	0	0	0	0	68	71	3	0	0.0393701
4190	96%	70	1	1	0	0	0	0	72	75	3	1	0.0393701
310	97%	60	2	0	0	0	0	0	62	64	2	0	0.0393701
1330	97%	60	2	0	0	0	0	0	62	64	2	0	0.0393701
2310	97%	37	1	0	0	0	0	0	38	39	1	0	0.0393701
2750	98%	114	3	0	0	0	0	0	117	120	3	0	0.0393701
200	98%	83	2	0	0	0	0	0	85	87	2	0	0.0393701
140	98%	97	2	0	0	0	0	0	99	101	2	0	0.0393701
4230	98%	55	1	0	0	0	0	0	56	57	1	0	0.0393701
	Total Tips	**10212**	**1137**	**209**	**49**	**11**	**5**	**4**	**11623**	**13439**	**1806**	**17**	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1600
1400
1200
1000
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600
400
200
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(reports/hr)
Average Traffic
Peak Traffic Hour
1/1/08
1/26/08
2/20/08
3/16/08
4/10/08
5/5/08
5/30/08
6/24/08
7/19/08
8/13/08
9/7/08
10/2/08
10/27/08
11/21/08
12/16/08
Date/Time