Memo

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

Date: June 2, 2008

To: Kevin Stewart and Chad Kudym

From: Markus Ritsch

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

II. General System Analysis Summary

A total of 343,279 data records were analyzed from the ALERT 2 base station. Meteorological sensors account for 60 percent, water level sensors 11 percent, and rain sensors 5 percent of the total monthly records.

Ninety-nine percent of the received data reports were flagged as "good" by the Nova Star validation process. Roughly 1,922 reports were flagged as "bad". Of these "bad" reports, 651 originated from Aurora Reservoir (ID 908-Solar Radiation), 589 invalid reports came from Third Creek at DIA (ID 1484-Water Level PT and ID 1483-Water Level), and 45 invalid reports came from Salisbury Park (ID 2724-Wind Gust).

The system-wide radio traffic loading was 11,074 reports per day with an average hourly loading of 461 reports. The peak hourly traffic loading was 899 reports, which occurred on May 10, between 2:00 AM and 3:00 AM. A plot of monthly average and peak hourly traffic loading is provided.

A total of 817 reports were received from the Hayman rain sensors this month. These reports make up less than 1% 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 88 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							
140	2190	110	540	540							
4150	140	2190	1600	1710							
4060	4170	1370	1350	4080							
4470	4150	620	710	4060							
4530	4530	840	4330	4150							

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 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	54.82	Only the 1-mm rain sensors were included in the analysis
Median	55	Only the 1-mm rain sensors were included in the analysis
Standard deviation	12.92	Only the 1-mm rain sensors were included in the analysis
Mean plus three standard deviations	93.6	Only the 1-mm rain sensors were included in the analysis
Minimum total count	14	No Name @ Quincy (ID 730)
Maximum total count	95	Temple Pond @ DTC (ID 630)

The highest reporting rain sensor was Aurora Town Hall (ID 920) with 252 reports. The data from this sensor was not included in the above analysis.

One sensor reported more than the system-wide mean plus 3 standard deviations and that was Temple Pond @ DTC. Data from sensors reporting more than the system-wide mean plus three standard deviations are inspected manually.

B. Temple Pond @ DTC (ID 630)

This sensor reported 95 incrementing transmissions for the month. Nothing suspicious is evident in the incrementing count series, other than a lot of tips were recorded. This sensor may be affected by lawn irrigation.

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								

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 through a manual inspection of 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 has multiple jumps in count on May 7 and 8.
Choke Cherry Reservoir	2320	This sensor has multiple jumps in count on May 13.
Ward C-1	4710	This sensor has multiple jumps in count on May 16.

D. Sensor-by-Sensor Incrementing Count Summary

The system-wide reception rate of incrementing, 1-mm tip reports for the month was approximately 92 percent. A total of 7,764 incrementing reports were received and a total of 8,442 were expected. The total loss of incrementing reports for the month was approximately 8 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							
2190	4820	540	1600	2320							
750	4530	2730	540	4150							
4570	4470	2210	700	1710							
2990	4810	110	110	4710							
--	700	1350	840	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. Englewood Dam (ID 1600)

This sensor has a continuous record from May 1 through May 31. This sensor has a large number of missing reports throughout the month with particular large data gaps on May 7th and May 8th.

b. Choke Cherry Reservoir (ID 2320)

This sensor has a continuous record from May 1 through May 31. A large number of reports were not received on May 13th.

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 Hourly Traffic Periods This Month

The hourly periods of highest radio traffic this month include:

- May 10 from 2:00 AM to 3:00 AM (899 reports)
- May 10 from 1:00 AM to 2:00 AM (810 reports)
- May 12 from 8:00 PM to 9:00 PM (769 reports)
- May 7 from 8:00 AM to 9:00 AM (741 reports)
- May 12 from 7:00 PM to 8:00 PM (722 reports)

B. May 10, 2008

The heaviest traffic period occurred on May 10th. The distribution of hourly traffic around the peak hour is summarized:

- May 10 from 12:00 AM to 1:00 AM (535 reports)
- May 10 from 1:00 AM to 2:00 AM (810 reports)
- May 10 from 2:00 AM to 3:00 AM (899 reports)
- May 10 from 3:00 AM to 4:00 AM (632 reports)
- May 10 from 4:00 AM to 5:00 AM (549 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, 9.5% of the incrementing tip reports were lost during this period.

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

	Occurrences of lost sequential tip reports during period			
Heavy Traffic Period (May 10, 2008)	**Loss of 2 sequential tips**	**Loss of 3 sequential tips**	**Loss of 4 sequential tips**	**Loss of 5 sequential tips**
12:00 AM to 5:00 AM	2	1	1	0

One sensor, Virginia Court (ID 510) lost three sequential incrementing reports during the period.

Date/Time	Sensor ID	Count
5/10/2008 12:18:15 AM	510	44
5/10/2008 2:17:44 AM	510	48
5/10/2008 2:26:37 AM	510	49
5/10/2008 2:40:00 AM	510	50

One sensor, Flying J (ID 850) lost four sequential incrementing reports due to a bit-flip error.

Date/Time	Sensor ID	Count
5/10/2008 1:54:32 AM	850	36
5/10/2008 2:02:32 AM	850	1541
5/10/2008 3:21:24 AM	850	41

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)	200
Total reports from unknown IDs	1,850
Unknown IDs with only a single received report (potential noise)	133
Total reports from all IDs – RecData Log entire month	291,184
Unknown reports as a fraction of total reports	0.64%

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 Id	No. Reports
4753	334
1635	63
205	62
335	62
2355	62
2315	61
2255	61
1665	61
2375	60
2245	60
135	60
2285	60
505	60
155	60
2235	59
1650	59
635	57
2265	56
1725	56
1655	56
1385	56
1115	55
4749	9
4766	8

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	29	12:00-12:59	64
1:00-1:59	15	1:00-1:59	45
2:00-2:59	8	2:00-2:59	35
3:00-3:59	3	3:00-3:59	33
4:00-4:59	21	4:00-4:59	47
5:00-5:59	63	5:00-5:59	98
6:00-6:59	84	6:00-6:59	119
7:00-7:59	97	7:00-7:59	117
8:00-8:59	137	8:00-8:59	136
9:00-9:59	142	9:00-9:59	113
10:00-10:59	135	10:00-10:59	95
11:00-11:59	124	11:00-11:59	90

VII. Issues Identified this Month

Sensors with a large number of invalid reports:

1. **Aurora Reservoir (ID 908)** - Solar Radiation with 651 invalid reports,
2. **Third Creek at DIA (ID 1484)** - Water Level PT with 359 reports,
3. **Third Creek at DIA (ID 1483)** - Water Level PT with 230 reports,
4. **Salisbury Park (ID 2724)** - Wind Gust with 45 reports,
5. **Cal-Wood Ranch (ID 4774)** - Barometric Pressure with 42 reports, and
6. **Squaw Mountain (ID 2192)** - Temperature with 27 reports.

Sensors reporting frequently (over reporting):

7. **Quincy Reservoir (ID 749 - Wind)** with 6,634 reports,
8. **Boulder Creek at Broadway (ID 4583 - Water Level)** with 4,376 reports,
9. **Castle Rock (ID 2747 - Wind)** with 3,671 reports, and
10. **Salisbury Park (ID 2727 - Wind)** with 4,022 reports.

Sensors reporting infrequently (under reporting):

11. **Stapleton (ID 1469 – Solar Power)** with 1 report,
12. **Stapleton (ID 1463 – Barometric Pressure)** with 3 reports,
13. **Gunbarrel (ID 1113 – Water Level)** with 6 reports,
14. **Cold Spring Gulch Conf (ID 2236 – Handar 585 alarm status)** with 3 reports, and
15. **Van Bibber @ Hwy 93 (ID 333 – Water Level)** with 8 reports.

Poor timer reporting:

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

16. **Englewood Dam (ID 1600)** - Only 31% of the event reports were received.
17. **Parker/Mississippi (ID 540)** - Only 63% of the event reports were received.
18. **Shop Creek (ID 1710) -** Only 65% of the timer reports received for the entire month.
19. **Twin Sisters (ID 4080) -** Only 68% of the timer reports received for the entire month.
20. **Lakeshore (ID 4060)** - Only 76% of the timer reports were received from this sensor.
21. **Gold Hill (ID 4150)** - 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.

22. **Englewood Dam (ID 1600)** - Only 27% of the event reports were received.
23. **Choke Cherry Reservoir (ID 2320)** - Only 71% of the event reports were received.
24. **Gold Hill (ID 4150)** - Only 75% of the event reports were received from this sensor
25. **Shop Creek (ID 1710) -** Only 78% of the timer reports received for the entire month.

Low rain total:

26. **No Name @ Quincy (ID 730) -** This sensor recorded only 14 tips for the entire month.

27. **Elbert (ID 1440) -** This sensor recorded only 18 tips for the entire month.

High rain total:

28. **Aurora Town Hall Wx (ID 920)** - This was the highest recording sensor for the month with a total of 252 tips. This sensor was also the highest reporting sensor from last month.
29. **Temple Pond at DTC (ID 630)** - This sensor recorded a total of 95 tips for the month.
30. **Sanderson at Xavier (ID 1340)** - This sensor had a total of 94 tips for the month.
31. **Shanahan Ridge (ID 4810)** - This sensor had a total of 88 tips for the month.

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

32. **Englewood Dam (ID 1600)** - This sensor experienced several large jumps in count on May 7th and May 8th.
33. **Choke Cherry Res (ID 2320)** - This sensor experienced several large jumps in count on May 13th.
34. **Ward C-1 (ID 4710)** - This sensor experienced several large jumps in count on May 16th.
35. **Flying J (ID 850)** – This sensor experienced a large jump in count due to a bit-flip error on May 10th.

Reports from "Unknown Sensors":

36. 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 Id	No. Reports
4753	334
1635	63
205	62
335	62
2355	62
2315	61
2255	61
1665	61
2375	60
2245	60
135	60
2285	60
505	60
155	60
2235	59
1650	59
635	57
2265	56
1725	56
1655	56
1385	56
1115	55
4749	9
4766	8

General System Analysis

Database Name P:\A207-UDFCD-Data-Analysis\2008_May\Novastar_extract_2008May.mdb

First Date in Database	5/1/08 12:00 AM	**Total Days**	31.0
Last Date in Database	5/31/08 11:59 PM	**Total Hours**	744.0

Total Records Analyzed 343279

Records by Group

None-ALERT-ID	51304	15%
Wind Gust	48608	14%
Relative Humidity	39292	11%
Temperature	37733	11%
Water Level PT-HSE	29611	9%
Wind Direction	19952	6%
Wind Speed Average & Azimuth	19269	6%
Precipitation	17543	5%
Wind Speed Average	16621	5%
Barometric Pressure	15640	5%
Solar Radiation	9016	3%
Battery Voltage HSE	6288	2%
Water Level Float	4697	1%
Fuel Temperature	3661	1%
Fuel Moisture	3642	1%
Water Level PT	3564	1%
Battery Voltage Digital	3497	1%
Battery Voltage Analog	3390	1%
Precipitation - Mean	2433	1%
Soil Moisture	1223	0%
Hayman Precipitation	817	0%
Longmont Water Level PT	750	0%
Repeater Pass List	622	0%
Repeater Status Report	497	0%
12Hr Status Report	347	0%
Precipitation - Test	245	0%
Battery	239	0%
Longmont Flow Gage	192	0%
Handar 585 ALARM Status	65	0%
Solar Power	1	0%
Total	340759	

Records by Major Group

Meteorologic Sensors	206131	60%
Water Level Sensors	38814	11%
Rain Sensors	17543	5%
Sensor Status Transmissions	14707	4%
Soil and Fuel Sensors	8526	2%
Total	285721	

Records by Validation Type

Good	0	341357	99%
Questionable	1	1922	1%
	Total	343279	

Sensors With Most Invalid Data

Description	Sensor	Reports
Aurora Reservoir	908	651
Third Creek at DIA	1484	359
Third Creek at DIA	1483	230
Salisbury Park	2724	45
Cal-Wood Ranch	4774	42

Traffic Loading Summary

Alert Reports	343279	
Average Daily Traffic	11074	
Average Hourly Traffic	461	
Median Hourly Traffic	455	hour beginning
Peak Hourly Traffic	899	5/10/08 2:00 AM
2nd Max	810	5/10/08 1:00 AM
3rd Max	769	5/12/08 8:00 PM
4th Max	741	5/7/08 8:00 AM
5th Max	722	5/12/08 7:00 PM

Rain Timer Performance

Analyze Rain Sensors

			systemwide average (days) 0.5203		rage 88%
Rain Sensors	**Description**	**Rcvd**	**Average Timer Interval**	**Exp**	**Performance**
1600	Englewood Dam	19	6:54	62.00	31%
1460	Stapleton	32	22:19	62.00	52%
540	Parker/Mississippi	39	17:56	62.00	63%
1810	Sand Creek at mouth	39	19:09	62.00	63%
1710	Shop Creek	40	15:45	62.00	65%
4080	Twin Sisters	42	15:09	62.00	68%
4060	Lakeshore	47	14:17	62.00	76%
4150	Gold Hill	47	14:12	62.00	76%
4570	St. Antons	47	14:06	62.00	76%
1200	Broomfield 3207	48	13:48	62.00	77%
4560	Lyons Diversion NSV	48	14:19	62.00	77%
4730	Sugarloaf	48	15:52	62.00	77%
4180	Gold Lake	49	14:17	62.00	79%
4530	Winiger Ridge	49	14:04	62.00	79%
4820	Doudy Draw	49	14:25	62.00	79%
4850	Porphory Mtn	49	15:27	62.00	79%
1350	Chatfield COE	50	13:45	62.00	81%
2830	Castle Oaks Road	50	12:51	62.00	81%
4140	Logan Mill	50	13:30	62.00	81%
110	Ralston Reservoir	51	14:24	62.00	82%
440	Fire Station #7	51	13:57	62.00	82%
4510	Pinewood Springs	51	12:11	62.00	82%
4860	Fairview Peak	51	13:36	62.00	82%
1100	Louisville Rec Ctr	52	13:06	62.00	84%
1110	Gunbarrel	52	13:06	62.00	84%
1420	Diamond Hill	52	12:32	62.00	84%
2730	Salisbury Park	52	12:00	62.00	84%
4170	Pine Brook	52	13:11	62.00	84%
4470	Little Narrows	52	13:06	62.00	84%
4750	Louisville Lake	52	10:02	62.00	84%
620	Quincy/Highline	53	13:03	62.00	85%
840	Fire Station 12	53	13:38	62.00	85%
900	Aurora Reservoir	53	12:00	62.00	85%
2340	El Rancho	53	12:33	62.00	85%
4010	Cresent	53	12:49	62.00	85%
4090	Magnolia	53	13:30	62.00	85%
4240	Sunset	53	13:43	62.00	85%
4830	SBC @ San Souci	53	13:17	62.00	85%
1720	Cherry Cr @ Steele	54	12:29	62.00	87%
2270	Cub Cr below Blue	54	13:45	62.00	87%
2920	est Cherry Head-Douglas Cı	54	13:52	62.00	87%
4130	Swiss Peaks	54	13:13	62.00	87%
4810	Shanahan Ridge	54	13:45	62.00	87%
410	Kelly Dam	55	12:59	62.00	89%
420	Expo Park	55	12:37	62.00	89%
710	Horseshoe Park Drop	55	13:00	62.00	89%
730	No Name @ Quincy	55	13:12	62.00	89%
820	ETG @ Buckley	55	13:14	62.00	89%
850	Flying J	55	12:31	62.00	89%
1060	Heritage Square	55	12:59	62.00	89%
1530	Bear Creek @ Lowell	55	13:16	62.00	89%
1900	Niver Detention	55	13:12	62.00	89%
2220	Evergreen Lake	55	13:04	62.00	89%
2330	Morrison	55	12:45	62.00	89%
2750	Castle Rock	55	13:18	62.00	89%
4220	Fling's	55	13:08	62.00	89%
4350	Conifer Hill	55	12:53	62.00	89%

4710	Ward C-1	55	12:19	62.00	89%
4790	Button Rock	55	12:18	62.00	89%
100	Carr Street	56	12:30	62.00	90%
400	Montview Park	56	12:43	62.00	90%
530	Fire Station #19	56	12:43	62.00	90%
920	Aurora Town Hall Wx	56	12:00	62.00	90%
1000	Maple Grove Resv.	56	12:43	62.00	90%
1440	Elbert	56	12:45	62.00	90%
1620	Slaughterhouse Glch	56	12:28	62.00	90%
1660	SPR at Henderson	56	12:27	62.00	90%
2190	Squaw Mountain	56	12:49	62.00	90%
2260	Brook Forest	56	12:31	62.00	90%
4070	Bear Peak	56	12:14	62.00	90%
4160	Sunshine	56	12:15	62.00	90%
4250	Geer Canyon	56	12:44	62.00	90%
4770	Cal-Wood Ranch	56	13:21	62.00	90%
500	Havana Park	57	12:39	62.00	92%
640	Goldsmith @ Eastman	57	12:29	62.00	92%
650	Iliff Pond	57	12:27	62.00	92%
720	Confluence Pond	57	12:28	62.00	92%
810	Granby Ditch @ 6th	57	12:13	62.00	92%
830	Side Creek Park	57	12:12	62.00	92%
1010	Denver West	57	12:27	62.00	92%
1030	NREL/S. Table Mtn.	57	12:13	62.00	92%
1040	Lena @ U.S. Hwy 6	57	12:14	62.00	92%
1310	LDC at 64th	57	12:29	62.00	92%
1360	Denver Zoo	57	13:04	62.00	92%
1550	Lakewood CC	57	12:27	62.00	92%
1800	Sand Creek Park	57	12:42	62.00	92%
2250	Rosedale	57	11:57	62.00	92%
2280	Kinney Peak	57	12:46	62.00	92%
2310	Genesee Village	57	12:30	62.00	92%
4030	Red Garden	57	12:46	62.00	92%
4050	Walker Ranch	57	12:29	62.00	92%
4190	Slaughterhouse	57	12:14	62.00	92%
4230	Golden Age	57	12:13	62.00	92%
4290	Red Hill	57	12:45	62.00	92%
4300	Big Elk Park	57	12:47	62.00	92%
4490	Apple Valley	57	12:29	62.00	92%
130	Simms Street	58	12:35	62.00	94%
300	Van Bibber Park	58	12:26	62.00	94%
310	Guy Hill Ranch	58	12:13	62.00	94%
520	Jewell Detention	58	12:14	62.00	94%
630	Temple Pond at DTC	58	11:58	62.00	94%
700	Toll Gate @ 6th	58	12:00	62.00	94%
760	Mission Viejo Park	58	11:57	62.00	94%
800	Sable Ditch @ 18th	58	12:26	62.00	94%
870	Murphy Creek GC	58	12:30	62.00	94%
1020	Lena @ Nolte Pond	58	12:25	62.00	94%
1050	Jeffco Fairgrounds	58	12:40	62.00	94%
1630	SPR at Dartmouth	58	12:35	62.00	94%
2210	Hiwan G.C.	58	11:44	62.00	94%
2240	Cold Sprg Glch conf	58	12:12	62.00	94%
2360	Indian Hills	58	12:31	62.00	94%
4020	Rio Grande	58	12:32	62.00	94%
4100	Filter Plant	58	12:14	62.00	94%
4270	Cannon Mountain	58	11:57	62.00	94%
120	West Woods	59	11:58	62.00	95%
200	Leyden Reservoir	59	12:44	62.00	95%
510	Virginia Court	59	12:14	62.00	95%
750	Quincy Reservoir	59	12:12	62.00	95%
1320	SPR at 3rd Ave	59	12:13	62.00	95%

1400	Upper Sloan Det.	59	12:13	62.00	95%
1640	SPR at Union Ave.	59	12:00	62.00	95%
2840	Sulphur Gulch	59	11:59	62.00	95%
2930	Spring Valley Rd - DougCnty	59	12:00	62.00	95%
4360	Justice Center	59	12:22	62.00	95%
4840	SBC@S Boulder Ditch	59	12:41	62.00	95%
140	Blue Mountain	60	12:00	62.00	97%
150	Nott Creek	60	12:11	62.00	97%
210	Leyden Confluence	60	12:12	62.00	97%
220	Upper Leyden	60	12:28	62.00	97%
320	Sports Complex	60	12:12	62.00	97%
330	Van Bibber @ Hwy 93	60	12:12	62.00	97%
600	Harvard Gulch Park	60	12:12	62.00	97%
610	Harvard @ Jackson	60	12:11	62.00	97%
1370	West Metro FS13	60	12:14	62.00	97%
1500	Powers Park	60	11:58	62.00	97%
1540	Sanderson at Xavier	60	12:13	62.00	97%
1610	Holly Dam	60	12:10	62.00	97%
1700	Cherry Cr @ Champa	60	12:00	62.00	97%
2230	Bear Cr below Cub	60	11:58	62.00	97%
2370	Red Rocks Park	60	12:12	62.00	97%
2810	Pine Cliff Road	60	12:14	62.00	97%
2820	Haskins Gulch Conf	60	11:35	62.00	97%
4040	Martin Gulch	60	11:58	62.00	97%
4110	Betasso	60	11:59	62.00	97%
4310	Johnny Park	60	11:57	62.00	97%
4340	Riverside	60	12:13	62.00	97%
1300	Hidden Lake	61	12:12	62.00	98%
1330	Roslyn	61	12:00	62.00	98%
1340	Sanderson at Xavier	61	12:15	62.00	98%
1520	Marston Lake North	61	12:00	62.00	98%
1570	Brighton Ditch Wx	61	12:00	62.00	98%
2350	Idledale	61	11:57	62.00	98%
2710	Highlands Ranch WTP	61	12:00	62.00	98%
2940	Willow Creek - DougCnty	61	12:00	62.00	98%
2990	Tomah Rd-Douglas Cnty	61	12:00	62.00	98%
4200	Lazy Acres	61	11:45	62.00	98%
4260	Taylor Mountain	61	12:13	62.00	98%
4520	Eagle Ridge	61	11:45	62.00	98%
740	Smoky Hill	62	11:59	62.00	100%
1920	Brighton	62	12:00	62.00	100%
1480	Third Creek at DIA	63	12:00	62.00	102%
860	Sand Cr at Colfax	111	6:36	62.00	179%

Rain Event Performance

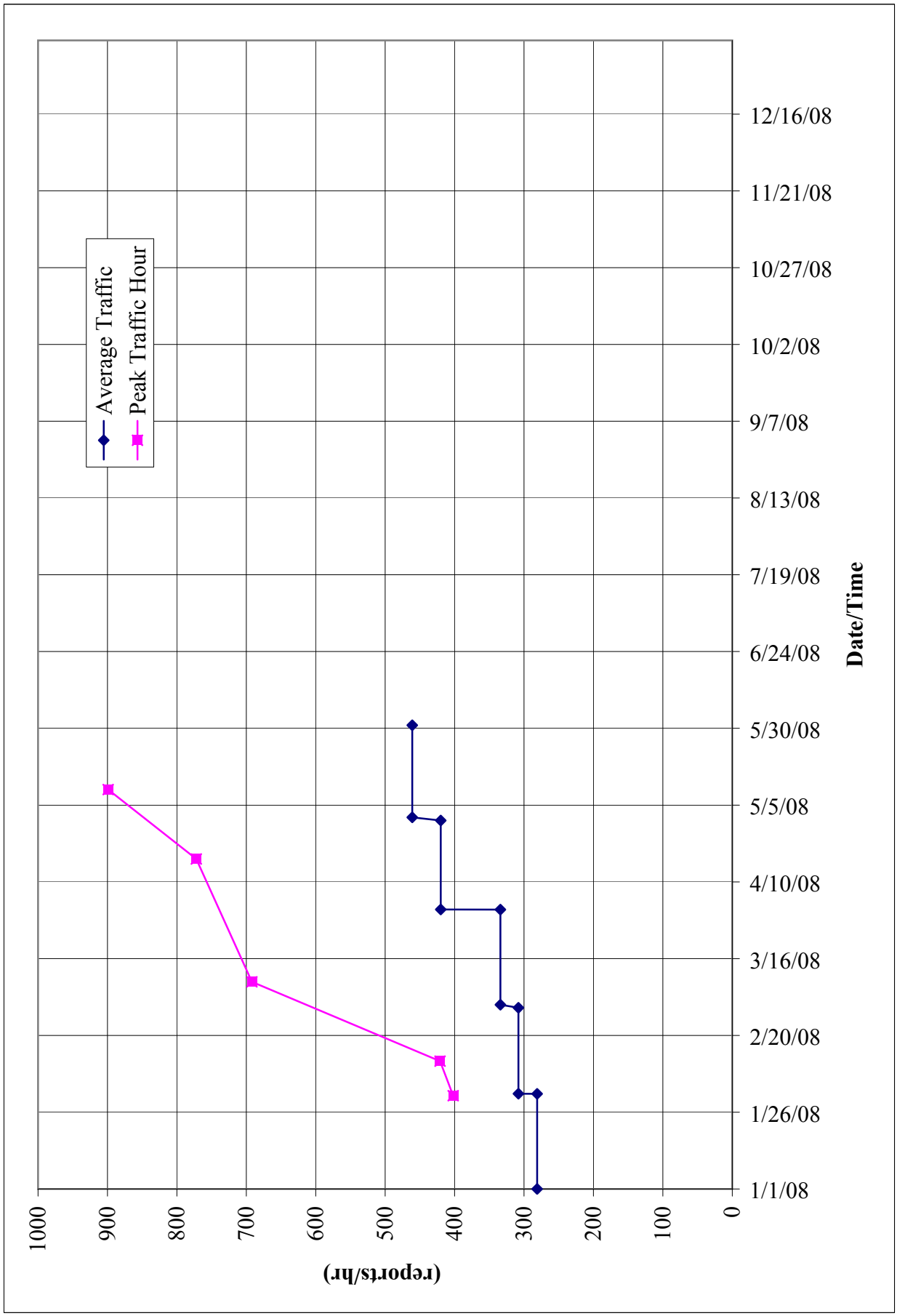
Analyze Rain Sensors

		Reports Received	7764
	Systemwide Avg	Total Tips	8442
	92%	Data Loss	8.03%

Rain Sensor	Performance	1-tips	2-tips	3-tips	4-tips	5-tips	6-tips	>6-tips	Rcvd	Exp	Miss	Holdoff	Bucket
1600	27%	4	4	3	1	1	0	2	13	48	35	0	0.0393701
2320	71%	39	5	1	0	0	1	1	46	65	19	0	0.0393701
4150	75%	38	6	5	0	0	0	0	49	65	16	0	0.0393701
1710	78%	28	7	0	1	0	0	0	36	46	10	0	0.0393701
4710	79%	47	7	0	0	0	0	1	54	68	14	0	0.0393701
1350	81%	40	2	0	1	0	1	0	44	54	10	0	0.0393701
4750	82%	40	3	1	0	0	1	0	45	55	10	0	0.0393701
850	82%	33	2	1	0	1	0	0	37	45	8	0	0.0393701
4530	83%	52	8	1	1	0	0	0	62	75	13	0	0.0393701
840	83%	38	5	2	0	0	0	0	45	54	9	0	0.0393701
4470	84%	43	8	1	0	0	0	0	52	62	10	0	0.0393701
4080	84%	38	9	0	0	0	0	0	47	56	9	0	0.0393701
700	84%	31	5	1	0	0	0	0	37	44	7	0	0.0393701
620	84%	32	5	1	0	0	0	0	38	45	7	0	0.0393701
4820	85%	53	6	1	1	0	0	0	61	72	11	0	0.0393701
860	85%	32	7	0	0	0	0	0	39	46	7	0	0.0393701
1530	86%	59	8	0	1	0	0	0	68	79	11	0	0.0393701
540	86%	28	3	1	0	0	0	0	32	37	5	0	0.0393701
4010	87%	51	5	2	0	0	0	0	58	67	9	0	0.0393701
440	87%	35	4	1	0	0	0	0	40	46	6	0	0.0393701
1000	88%	38	3	0	1	0	0	0	42	48	6	0	0.0393701
410	88%	32	2	0	1	0	0	0	35	40	5	0	0.0393701
800	88%	31	3	1	0	0	0	0	35	40	5	0	0.0393701
2280	88%	44	5	1	0	0	0	0	50	57	7	0	0.0393701
2370	88%	44	5	1	0	0	0	0	50	57	7	0	0.0393701
2240	88%	50	8	0	0	0	0	0	58	66	8	0	0.0393701
2340	88%	44	7	0	0	0	0	0	51	58	7	0	0.0393701
1900	88%	33	3	1	0	0	0	0	37	42	5	0	0.0393701
4520	88%	46	5	1	0	0	0	0	52	59	7	1	0.0393701
310	88%	40	4	1	0	0	0	0	45	51	6	0	0.0393701
720	88%	26	4	0	0	0	0	0	30	34	4	0	0.0393701
2730	88%	26	4	0	0	0	0	0	30	34	4	0	0.0393701
2810	88%	47	5	1	0	0	0	0	53	60	7	0	0.0393701
1330	89%	41	6	0	0	0	0	0	47	53	6	0	0.0393701
2330	89%	58	6	1	0	0	0	0	65	73	8	1	0.0393701
760	89%	44	4	1	0	0	0	0	49	55	6	0	0.0393701
4170	89%	44	6	0	0	0	0	0	50	56	6	0	0.0393701
110	89%	37	5	0	0	0	0	0	42	47	5	0	0.0393701
830	89%	38	3	1	0	0	0	0	42	47	5	0	0.0393701
1620	89%	45	6	0	0	0	0	0	51	57	6	0	0.0393701
4570	90%	54	7	0	0	0	0	0	61	68	7	0	0.0393701
4810	90%	70	9	0	0	0	0	0	79	88	9	0	0.0393701
1100	90%	40	3	1	0	0	0	0	44	49	5	0	0.0393701
1550	90%	48	6	0	0	0	0	0	54	60	6	0	0.0393701
1040	90%	41	3	1	0	0	0	0	45	50	5	0	0.0393701
2830	90%	26	1	1	0	0	0	0	28	31	3	0	0.0393701
2920	90%	25	3	0	0	0	0	0	28	31	3	0	0.0393701
650	90%	35	2	1	0	0	0	0	38	42	4	0	0.0393701
630	91%	78	7	1	0	0	0	0	86	95	9	0	0.0393701
4090	91%	54	2	2	0	0	0	0	58	64	6	0	0.0393701
2250	91%	62	5	1	0	0	0	0	68	75	7	0	0.0393701
1720	91%	36	2	1	0	0	0	0	39	43	4	0	0.0393701
1460	91%	37	2	1	0	0	0	0	40	44	4	1	0.0393701
4240	91%	36	4	0	0	0	0	0	40	44	4	0	0.0393701
1520	91%	63	8	0	0	0	0	0	71	78	7	0	0.0393701
510	91%	48	2	0	1	0	0	0	51	56	5	0	0.0393701
2930	91%	28	3	0	0	0	0	0	31	34	3	0	0.0393701
4510	91%	58	4	1	0	0	0	0	63	69	6	0	0.0393701
900	91%	40	2	1	0	0	0	0	43	47	4	1	0.0393699
4350	92%	49	5	0	0	0	0	0	54	59	5	1	0.0393701
150	92%	40	4	0	0	0	0	0	44	48	4	0	0.0393701
1400	92%	42	4	0	0	0	0	0	46	50	4	0	0.0393701
2260	92%	55	2	0	1	0	0	0	58	63	5	0	0.0393701
4730	92%	57	3	1	0	0	0	0	61	66	5	0	0.0393701
810	92%	45	4	0	0	0	0	0	49	53	4	0	0.0393701
4140	93%	58	3	1	0	0	0	0	62	67	5	0	0.0393701
4180	93%	47	2	1	0	0	0	0	50	54	4	0	0.0393701
1800	93%	35	3	0	0	0	0	0	38	41	3	0	0.0393701
220	93%	47	4	0	0	0	0	0	51	55	4	0	0.0393701
4230	93%	36	3	0	0	0	0	0	39	42	3	0	0.0393701

420	93%	62	3	1	0	0	0	0	66	71	5	0	0.0393701
4840	93%	65	5	0	0	0	0	0	70	75	5	0	0.0393701
4200	93%	52	4	0	0	0	0	0	56	60	4	0	0.0393701
320	93%	39	3	0	0	0	0	0	42	45	3	0	0.0393701
2360	93%	53	4	0	0	0	0	0	57	61	4	0	0.0393701
4130	94%	55	2	1	0	0	0	0	58	62	4	0	0.0393701
4790	94%	54	4	0	0	0	0	0	58	62	4	0	0.0393701
1310	94%	56	4	0	0	0	0	0	60	64	4	0	0.0393701
100	94%	42	3	0	0	0	0	0	45	48	3	0	0.0393701
1370	94%	42	3	0	0	0	0	0	45	48	3	0	0.0393701
750	94%	43	3	0	0	0	0	0	46	49	3	0	0.0393701
2210	94%	59	4	0	0	0	0	0	63	67	4	0	0.0393701
4830	94%	60	2	1	0	0	0	0	63	67	4	0	0.0393701
4070	94%	60	4	0	0	0	0	0	64	68	4	0	0.0393701
4220	94%	45	3	0	0	0	0	0	48	51	3	0	0.0393701
520	94%	46	3	0	0	0	0	0	49	52	3	0	0.0393701
2310	94%	63	2	1	0	0	0	0	66	70	4	0	0.0393701
1640	94%	48	1	1	0	0	0	0	50	53	3	0	0.0393701
1440	94%	16	1	0	0	0	0	0	17	18	1	0	0.0393701
4250	95%	65	4	0	0	0	0	0	69	73	4	0	0.0393701
1060	95%	50	3	0	0	0	0	0	53	56	3	0	0.0393701
4030	95%	70	4	0	0	0	0	0	74	78	4	0	0.0393701
2750	95%	35	2	0	0	0	0	0	37	39	2	0	0.0393701
1320	95%	53	3	0	0	0	0	0	56	59	3	0	0.0393701
740	95%	55	3	0	0	0	0	0	58	61	3	0	0.0393701
4050	95%	55	3	0	0	0	0	0	58	61	3	0	0.0393701
1700	95%	37	2	0	0	0	0	0	39	41	2	0	0.0393701
4110	95%	56	3	0	0	0	0	0	59	62	3	0	0.0393701
2840	95%	38	2	0	0	0	0	0	40	42	2	0	0.0393701
200	95%	39	2	0	0	0	0	0	41	43	2	0	0.0393701
210	95%	39	2	0	0	0	0	0	41	43	2	0	0.0393701
500	95%	59	3	0	0	0	0	0	62	65	3	0	0.0393701
2270	95%	60	3	0	0	0	0	0	63	66	3	0	0.0393701
120	95%	40	2	0	0	0	0	0	42	44	2	0	0.0393701
530	95%	40	2	0	0	0	0	0	42	44	2	0	0.0393701
2190	95%	40	2	0	0	0	0	0	42	44	2	0	0.0393701
2350	96%	62	3	0	0	0	0	0	65	68	3	0	0.0393701
820	96%	42	2	0	0	0	0	0	44	46	2	0	0.0393701
4770	96%	42	2	0	0	0	0	0	44	46	2	0	0.0393701
2230	96%	64	3	0	0	0	0	0	67	70	3	0	0.0393701
4260	96%	43	2	0	0	0	0	0	45	47	2	0	0.0393701
330	96%	44	2	0	0	0	0	0	46	48	2	0	0.0393701
1050	96%	44	2	0	0	0	0	0	46	48	2	0	0.0393701
1920	96%	44	2	0	0	0	0	0	46	48	2	0	0.0393701
4040	96%	69	3	0	0	0	0	0	72	75	3	0	0.0393701
1200	96%	46	2	0	0	0	0	0	48	50	2	0	0.0393701
1300	96%	51	2	0	0	0	0	0	53	55	2	0	0.0393701
1360	96%	51	2	0	0	0	0	0	53	55	2	0	0.0393701
2990	96%	51	2	0	0	0	0	0	53	55	2	0	0.0393701
4100	96%	51	2	0	0	0	0	0	53	55	2	0	0.0393701
1110	96%	52	2	0	0	0	0	0	54	56	2	0	0.0393701
870	97%	55	2	0	0	0	0	0	57	59	2	0	0.0393701
2820	97%	55	2	0	0	0	0	0	57	59	2	0	0.0393701
4490	97%	56	2	0	0	0	0	0	58	60	2	0	0.0393701
1420	97%	57	2	0	0	0	0	0	59	61	2	0	0.0393701
2710	97%	58	2	0	0	0	0	0	60	62	2	0	0.0393701
4190	97%	58	2	0	0	0	0	0	60	62	2	0	0.0393701
1340	97%	88	3	0	0	0	0	0	91	94	3	0	0.0393701
4060	97%	60	0	1	0	0	0	0	61	63	2	0	0.0393701
4310	97%	59	2	0	0	0	0	0	61	63	2	0	0.0393701
4360	97%	60	2	0	0	0	0	0	62	64	2	0	0.0393701
4020	97%	66	2	0	0	0	0	0	68	70	2	0	0.0393701
4290	97%	68	2	0	0	0	0	0	70	72	2	0	0.0393701
1480	97%	35	1	0	0	0	0	0	36	37	1	0	0.0393701
400	97%	36	1	0	0	0	0	0	37	38	1	0	0.0393701
2940	98%	39	1	0	0	0	0	0	40	41	1	0	0.0393701
710	98%	41	1	0	0	0	0	0	42	43	1	0	0.0393701
600	98%	42	1	0	0	0	0	0	43	44	1	0	0.0393701
640	98%	42	1	0	0	0	0	0	43	44	1	0	0.0393701
300	98%	43	1	0	0	0	0	0	44	45	1	0	0.0393701
1030	98%	47	1	0	0	0	0	0	48	49	1	0	0.0393701
140	98%	48	1	0	0	0	0	0	49	50	1	0	0.0393701
1010	98%	49	1	0	0	0	0	0	50	51	1	0	0.0393701
1570	98%	53	1	0	0	0	0	0	54	55	1	0	0.0393701
1540	98%	54	1	0	0	0	0	0	55	56	1	0	0.0393701

4160	98%	62	1	0	0	0	0	0	63	64	1	0	0.0393701
1500	99%	76	1	0	0	0	0	0	77	78	1	0	0.0393701
4270	100%	51	0	0	0	0	0	0	51	51	0	0	0.0393701
4340	100%	49	0	0	0	0	0	0	49	49	0	0	0.0393701
1810	100%	48	0	0	0	0	0	0	48	48	0	0	0.0393701
4300	100%	45	0	0	0	0	0	0	45	45	0	0	0.0393701
610	100%	44	0	0	0	0	0	0	44	44	0	0	0.0393701
1660	100%	44	0	0	0	0	0	0	44	44	0	0	0.0393701
730	100%	14	0	0	0	0	0	0	14	14	0	0	0.0393701
Totals		**7208**	**488**	**53**	**10**	**2**	**3**	**4**	**7764**	**8442**	**678**	**5**	


Average Traffic
Peak Traffic Hour
12/16/08
11/21/08
10/27/08
10/2/08
9/7/08
8/13/08
7/19/08
6/24/08
5/30/08
5/5/08
4/10/08
3/16/08
2/20/08
1/26/08
1/1/08
Date/Time
1000
900
800
700
600
500
400
300
200
100
0
(reports/hr)