

# Memo

**Date:** January 9, 2012  
**To:** Kevin Stewart  
**From:** Markus Ritsch  
**Subject:** December 2011 ALERT Data Analysis

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## I. ALERT Data Source

Raw ALERT data records extracted from the Urban Drainage and Flood Control District's NovaStar base station were analyzed for the period December 1 through December 31, 2011.

## II. General System Analysis Summary

A total of 327,359 ALERT (legacy) data reports were analyzed. Meteorological sensors account for 86 percent, water level sensors 3 percent, and rain sensors 2 percent of the total monthly records.

The system-wide radio traffic loading was 10,560 reports per day with an average hourly loading of 440 reports. The peak hourly traffic loading was 728 reports, which occurred on December 31<sup>st</sup>, between 12:00 PM and 1:00 PM. A plot of monthly average and peak hourly traffic loading is provided.

### A. Specific Issues Identified this Month

Performance of the following sensors (Table 1) was questionable this month.

**Table 1. Rain Sensors with Poor Performance Characteristics**

| Rain ID | Description                               | Timer Performance                              | Event Performance |
|---------|---|--|-------------------|
| 4470    | Little Narrows                            | 37%  | 88%               |
| 140     | Blue Mountain                             | 60%  | 100%              |
| 1440    | Elbert                                    | 61%  | 100%              |
| 1460    | Urban Farm                                | 65%  | 60%               |
| 1520    | Marston Lake North                        | 66%  | 92%               |
| 1570    | Brighton Ditch                            | 66%  | 100%              |
| 1530    | Bear Creek at Lowell                      | Sensors with a large number of invalid reports |                   |
| 2750    | Castle Rock                               |  |                   |
| 2710    | Highlands Ranch WTP                       |  |                   |
| 1423    | Unknown sensor IDs with excessive reports |  |                   |
| 2811    |   |  |                   |
| 1446    |   |  |                   |
| 1453    |   |  |                   |

### B. Continuous Operation of Base Receiver/Decoder

The ALERT/ALERT2/NS5 receiver/decoder was continuously operational for the entire month.

### III. Rain Sensor Timer Reporting Summary

The following analysis assumes that each rain sensor has a 12-hour timer-reporting interval. The worst performing rain sensors for the month are summarized (Table 2).

**Table 2. Monthly Summary of Sensors with Poor Timer Performance (Sensor ID)**

| Jan* | Feb* | Mar* | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct* | Nov* | Dec* |
|------|------|------|------|------|------|------|------|------|------|------|------|
| 1520 | 4710 | 4490 | 1700 | 1700 | 700  | 4300 | 4330 | 4330 | 4330 | 4550 | 4470 |
| 1440 | 1440 | 4270 | 3060 | 700  | 4710 | 4330 | 4850 | 2320 | 3020 | 4270 | 140  |
| 4470 | 4470 | 4330 | 3030 | 540  | 4330 | 2750 | 2750 | 440  | 4790 | 1440 | 1440 |
| 1460 | 1460 | 4510 | 700  | 1710 | 1700 | 2280 | 2950 | 4490 | 4770 | 4490 | 1460 |
| 140  | 140  | 1440 | 3090 | 500  | 4270 | 870  | 540  | 4520 | 4270 | 1460 | 1520 |
| 1570 | 4490 | 4810 | 2970 | 710  | 4300 | 4270 | 2280 | 2270 | 4510 | 4060 | 1570 |

\*. 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.

### IV. 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 3). 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 3. District-Wide Total Tip/Count Statistical Summary**

| Statistical Parameter               | Value | Comments   |
|-------------------------------------|-------|--|
| Mean                                | 13.59 | Only the 1-mm rain sensors were included in the analysis |
| Median                              | 12.00 | Only the 1-mm rain sensors were included in the analysis |
| Standard deviation                  | 9.28  | Only the 1-mm rain sensors were included in the analysis |
| Mean plus three standard deviations | 41.43 | Only the 1-mm rain sensors were included in the analysis |
| Minimum total count                 | 1.00  | Many   |
| Maximum total count                 | 37.00 | ID 4040 (Martin Gulch)                                   |

#### B. Monthly Average Tip/Count Summary

A monthly summary of the District-wide mean total tip/count is presented (Table 4).

**Table 4. 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 |

\*. 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 5).

**Table 5. Sensors with a Jump of 6 or More in Sequential Count**

| Sensor Description  | Sensor ID | Comment |
|---|-----------|---------|
| There were no stations this month that experienced a jump in sequential count of more than 6. |           |         |

### D. Sensor-by-Sensor Incrementing Count Summary

The system-wide reception rate of incrementing, 1-mm tip reports for the month was approximately 91.2 percent. A total of 971 incrementing reports were received and a total of 1,033 reports were expected. The total loss of incrementing reports for the month was approximately 6.0 percent. Those sensors with the worst event transmission performance are summarized (Table 6).

**Table 6. Monthly Summary of Sensors with the Most Missed Tips**

| Jan* | Feb* | Mar** | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct** | Nov* | Dec* |
|------|------|-------|------|------|------|------|------|------|-------|------|------|
| 1420 | 1350 | 2820  | 1700 | 1620 | 2280 | 870  | 2980 | 2980 | 4710  | 4750 | 1460 |
| 1460 | 950  | 2970  | 1620 | 1660 | 4300 | 4300 | 400  | 4490 | 4330  | 4770 | 2980 |
| 4470 | 1320 | 710   | 2930 | 810  | 4330 | 4330 | 4330 | 4330 | 4730  | 1420 | 4490 |
| 4330 | 1330 | 4330  | 2990 | 650  | 4270 | 2980 | 2270 | 4240 | 4790  | 4270 | 4270 |
| 2710 | 840  | 870   | 4330 | 940  | 2980 | 4490 | 2240 | 4470 | 4090  | 4090 | 4830 |
| 1640 | 1720 | 1200  | 2950 | 1900 | 310  | 4790 | 4530 | 330  | 4230  | 2980 | 4330 |

\*-Only sensors that are operational year-round (weather stations and stations in Boulder County) are included for the analysis in these months. \*\*-Due to Spring start-up Fall shut-down the performance values in these months are not accurate.

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.

## V. Heavy Radio Traffic Analysis

Periods exceeding 700 messages per hour were 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 7). Each hour exceeding 700 reports was analyzed to quantify the number of missing rain reports for that hour.

**Table 7. Heavy Radio Traffic Periods**

| Day | Hr | Expected | Received | Total Load | Loss   |
|-----|----|----------|----------|------------|--------|
| 31  | 12 | 2        | 1        | 728        | 50.00% |
| 31  | 8  | 0        | 0        | 704        | 0.00%  |
| 31  | 10 | 9        | 7        | 692        | 22.22% |
| 31  | 13 | 0        | 0        | 684        | 0.00%  |
| 31  | 9  | 0        | 0        | 637        | 0.00%  |
| 31  | 11 | 2        | 2        | 632        | 0.00%  |
| 28  | 8  | 0        | 0        | 623        | 0.00%  |
| 29  | 15 | 0        | 0        | 602        | 0.00%  |
| 29  | 13 | 0        | 0        | 600        | 0.00%  |
| 29  | 16 | 0        | 0        | 597        | 0.00%  |

## 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 8).

**Table 8. Summary of Unknown IDs**

| Description  | Quantity |
|--|----------|
| Total number of unknown IDs (IDs without a device definition)    | 290      |
| Total reports from unknown IDs                                   | 861      |
| Unknown IDs with only a single received report (potential noise) | 171      |
| Total reports from all IDs – RecData Log entire month            | 327,359  |
| Unknown reports as a fraction of total reports                   | 0.26%    |

The total number of reports from unknown sensors is very small relative to the total reports received for the month. Shown below (Table 9) are the total reports received from unknown sensor IDs for each month of the year.

**Table 9. Monthly Summary of Total Reports from Unknown IDs**

| 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   |

The fraction of reports from unknown sensors relative to the total number of reports is shown below (Table 10).

**Table 10. Monthly Percent of Unknown Sensor Reports**

| 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% |

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 11).

**Table 11. Reports Received by Unknown IDs**

| Unknown Sensor ID | Reports |
|-------------------|---------|
| 1423              | 30      |
| 2811              | 21      |
| 1446              | 20      |
| 1453              | 19      |
| 1470              | 16      |
| 1953              | 16      |
| 1954              | 15      |
| 1454              | 14      |
| 2716              | 14      |
| 2745              | 14      |
| 1529              | 13      |
| 1918              | 13      |
| 2239              | 13      |
| 2746              | 13      |
| 1415              | 12      |
| 1919              | 12      |
| 1926              | 12      |
| 1933              | 11      |
| 1951              | 11      |
| 1950              | 10      |
| 2808              | 10      |

|      |   |
|------|---|
| 1443 | 9 |
| 1631 | 9 |
| 1934 | 9 |
| 2748 | 9 |
| 1929 | 8 |
| 2705 | 8 |
| 2768 | 8 |
| 2784 | 8 |
| 1433 | 7 |
| 1481 | 7 |
| 1486 | 7 |
| 1528 | 7 |
| 1534 | 7 |

The “unknown” device reports are analyzed temporally to understand when they are received during the day (Table 12). 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 12. Temporal Distribution of Received Reports**

| Hour (AM)   | Reports | Hour (PM)   | Reports |
|-------------|---------|-------------|---------|
| 0:00-00:59  | 30      | 12:00-12:59 | 29      |
| 1:00-1:59   | 17      | 1:00-1:59   | 32      |
| 2:00-2:59   | 24      | 2:00-2:59   | 19      |
| 3:00-3:59   | 20      | 3:00-3:59   | 8       |
| 4:00-4:59   | 15      | 4:00-4:59   | 22      |
| 5:00-5:59   | 20      | 5:00-5:59   | 53      |
| 6:00-6:59   | 15      | 6:00-6:59   | 55      |
| 7:00-7:59   | 61      | 7:00-7:59   | 44      |
| 8:00-8:59   | 73      | 8:00-8:59   | 51      |
| 9:00-9:59   | 39      | 9:00-9:59   | 52      |
| 10:00-10:59 | 28      | 10:00-10:59 | 51      |
| 11:00-11:59 | 26      | 11:00-11:59 | 84      |

## VII. Sensors with Invalid Reports

The following precipitation sensors had a large number of invalid reports (bit flip/contention errors/random decode):

| Sensor ID | Description            | Apr 2011 | May 2011 | Jun 2011 | Jul 2011 | Aug 2011 | Sep 2011 | Oct 2011 | Nov 2011 | Dec 2011 |
|-----------|------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 140       | Wx-Blue Mountain       | 0        | 4        | 1        | 0        | 0        | 0        | 2        | 1        | 2        |
| 900       | WX-Aurora Reservoir    | 0        | 0        | 0        | 0        | 0        | 0        | 6        | 0        | 0        |
| 920       | Wx-Aurora Town Hall    | 0        | 7        | 1        | 0        | 0        | 0        | 0        | 0        | 1        |
| 1460      | Wx-Urban Farm          | 0        | 5        | 1        | 0        | 1        | 0        | 1        | 1        | 3        |
| 1480      | Third Creek at DIA     | 0        | 0        | 0        | 5        | 0        | 0        | 0        | 0        | 0        |
| 1520      | Wx-Marston Lake North  | 2        | 4        | 1        | 0        | 1        | 0        | 2        | 0        | 1        |
| 1530      | Bear Creek @ Lowell    | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 5        |
| 1920      | Wx-Brighton            | 3        | 3        | 1        | 2        | 1        | 1        | 0        | 1        | 0        |
| 2190      | Wx-Squaw Mountain      | 0        | 8        | 0        | 1        | 0        | 0        | 0        | 0        | 1        |
| 2710      | Wx-Highlands Ranch WTP | 0        | 0        | 0        | 0        | 0        | 0        | 3        | 1        | 3        |
| 2750      | Wx-Castle Rock         | 0        | 0        | 0        | 0        | 0        | 0        | 2        | 3        | 6        |
| 3020      | Wx-West Creek          | 2        | 1        | 3        | 1        | 2        | 0        | 0        | 0        | 0        |
| 4330      | Hansen Rain            | 0        | 5        | 4        | 2        | 3        | 3        | 0        | 3        | 1        |
| 4850      | Porphyry Mtn           | 0        | 0        | 0        | 4        | 1        | 2        | 1        | 1        | 0        |
| 4860      | Fairview Peak          | 0        | 0        | 0        | 0        | 0        | 0        | 4        | 0        | 0        |
| 4840      | SBC@SB Ditch           | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 2        | 0        |



# General System Analysis

**Database Name**

P:\A207-UDFCD-Data-Analysis\2011\12-2011\Novastar\_extract\_2011Nov.mdb

**First Date in Database**

12/1/11 12:00 AM

**Total Days**

31.0

**Last Date in Database**

12/31/11 11:59 PM

**Total Hours**

744.0

**Total Records Analyzed**

327,359

**Records by Group**

|                              |                |             |
|------------------------------|----------------|-------------|
| Wind Gust                    | 61,794         | 19%         |
| Temperature                  | 61,289         | 19%         |
| Relative Humidity            | 58,828         | 18%         |
| Barometric Pressure          | 31,021         | 9%          |
| Wind Speed Average & Azimuth | 25,708         | 8%          |
| Wind Direction               | 18,342         | 6%          |
| Wind Speed Average           | 17,680         | 5%          |
| Battery Voltage              | 11,464         | 4%          |
| Solar Radiation              | 8,400          | 3%          |
| Precipitation                | 5,790          | 2%          |
| Fuel Temperature             | 5,050          | 2%          |
| Fuel Moisture                | 5,015          | 2%          |
| Water Level PT-HSE           | 4,341          | 1%          |
| Water Level Float            | 3,633          | 1%          |
| Soil Moisture                | 2,257          | 1%          |
| Repeater Status Report       | 2,228          | 1%          |
| Water Level PT               | 1,809          | 1%          |
| Wind ALERT                   | 1,057          | 0%          |
| Unknown                      | 861            | 0%          |
| Repeater Pass List           | 564            | 0%          |
| 12Hr Status Report           | 206            | 0%          |
| Solar Power                  | 17             | 0%          |
| Handar 585 ALARM Status      | 4              | 0%          |
| ALERT/A2 Testing             | 1              | 0%          |
| <b>Total</b>                 | <b>327,359</b> | <b>100%</b> |

**Records by Major Group**

|                             |                |     |
|-----------------------------|----------------|-----|
| Meteorologic Sensors        | 283,062        | 86% |
| Soil and Fuel Sensors       | 12,322         | 4%  |
| Water Level Sensors         | 9,783          | 3%  |
| Rain Sensors                | 5,790          | 2%  |
| Sensor Status Transmissions | 3,019          | 1%  |
| <b>Total</b>                | <b>313,976</b> |     |

**Traffic Loading Summary**

|                        |         |                  |
|------------------------|---------|------------------|
| Alert Reports          | 327,359 |                  |
| Average Daily Traffic  | 10,560  |                  |
| Average Hourly Traffic | 440     |                  |
| Median Hourly Traffic  | 444     | hour beginning   |
| Peak Hourly Traffic    | 728     | Dec-31, 12:00 PM |
| 2nd Max                | 704     | Dec-31, 8:00 AM  |
| 3rd Max                | 692     | Dec-31, 10:00 AM |
| 4th Max                | 684     | Dec-31, 1:00 PM  |
| 5th Max                | 637     | Dec-31, 9:00 AM  |



# Rain Timer Performance

Analyze Rain Sensors

| Rain Sensors | Description                  | Rcv | Timer | Exp   | Performance |
|--------------|------------------------------|-----|-------|-------|-------------|
| 4470         | Little Narrows               | 23  | 12:34 | 62.00 | 37%         |
| 140          | Wx-Blue Mountain             | 37  | 15:00 | 62.00 | 60%         |
| 1440         | Wx-Elbert                    | 38  | 18:29 | 62.00 | 61%         |
| 1460         | Wx-Urban Farm                | 40  | 12:21 | 62.00 | 65%         |
| 1520         | Wx-Marston Lake North        | 41  | 13:42 | 62.00 | 66%         |
| 1570         | Wx-Brighton Ditch            | 41  | 14:46 | 62.00 | 66%         |
| 1000         | Maple Grove Resv.            | 42  | 13:35 | 62.00 | 68%         |
| 4870         | SBC @ SB Road                | 42  | 17:00 | 62.00 | 68%         |
| 4330         | Hansen Rain                  | 43  | 14:57 | 62.00 | 69%         |
| 1480         | Third Creek at DIA           | 44  | 16:20 | 62.00 | 71%         |
| 4510         | Pinewood Springs             | 45  | 14:17 | 62.00 | 73%         |
| 4270         | Cannon Mountain              | 48  | 14:53 | 62.00 | 77%         |
| 4180         | Gold Lake                    | 51  | 14:34 | 62.00 | 82%         |
| 4130         | Swiss Peaks                  | 52  | 14:10 | 62.00 | 84%         |
| 2750         | Wx-Castle Rock               | 53  | 12:17 | 62.00 | 85%         |
| 2980         | Dakan Rd                     | 53  | 13:16 | 62.00 | 85%         |
| 4170         | Pine Brook                   | 53  | 13:00 | 62.00 | 85%         |
| 4220         | Fling's                      | 54  | 13:17 | 62.00 | 87%         |
| 4570         | St. Antons                   | 54  | 12:43 | 62.00 | 87%         |
| 4790         | Wx-Button Rock               | 54  | 12:45 | 62.00 | 87%         |
| 4090         | Magnolia                     | 55  | 13:11 | 62.00 | 89%         |
| 4240         | Sunset                       | 55  | 13:09 | 62.00 | 89%         |
| 4850         | Porphory Mtn                 | 55  | 13:01 | 62.00 | 89%         |
| 920          | Wx-Aurora Town Hall          | 56  | 12:40 | 62.00 | 90%         |
| 4010         | Crescent                     | 56  | 12:13 | 62.00 | 90%         |
| 4080         | Twin Sisters                 | 56  | 12:55 | 62.00 | 90%         |
| 4110         | Betasso                      | 56  | 13:31 | 62.00 | 90%         |
| 4150         | Gold Hill                    | 56  | 12:28 | 62.00 | 90%         |
| 4360         | Justice Center               | 56  | 12:56 | 62.00 | 90%         |
| 4710         | Wx-Ward C-1                  | 56  | 13:06 | 62.00 | 90%         |
| 4860         | Fairview Peak                | 56  | 12:45 | 62.00 | 90%         |
| 2190         | Wx-Squaw Mountain            | 57  | 12:26 | 62.00 | 92%         |
| 2320         | Choke Cherry Resvr           | 57  | 12:31 | 62.00 | 92%         |
| 3010         | EPC at Hwy 105               | 57  | 12:28 | 62.00 | 92%         |
| 4060         | Lakeshore                    | 57  | 12:42 | 62.00 | 92%         |
| 4100         | Filter Plant                 | 57  | 12:41 | 62.00 | 92%         |
| 4530         | Winiger Ridge                | 57  | 12:44 | 62.00 | 92%         |
| 700          | Toll Gate @ 6th              | 58  | 12:27 | 62.00 | 94%         |
| 750          | Wx-Quincy Reservoir          | 58  | 12:11 | 62.00 | 94%         |
| 900          | Wx-Aurora Reservoir          | 58  | 12:38 | 62.00 | 94%         |
| 2990         | Wx-Tomah Rd-DougCnty         | 58  | 12:15 | 62.00 | 94%         |
| 3020         | Wx-West Creek WX             | 58  | 12:29 | 62.00 | 94%         |
| 4020         | Rio Grande                   | 58  | 12:27 | 62.00 | 94%         |
| 4160         | Sunshine                     | 58  | 12:37 | 62.00 | 94%         |
| 4200         | Lazy Acres                   | 58  | 12:29 | 62.00 | 94%         |
| 4490         | Apple Valley                 | 58  | 12:11 | 62.00 | 94%         |
| 4770         | Wx-Cal-Wood Ranch            | 58  | 12:40 | 62.00 | 94%         |
| 1660         | SPR at Henderson             | 59  | 12:23 | 62.00 | 95%         |
| 2710         | Wx-Highlands Ranch WTP       | 59  | 11:46 | 62.00 | 95%         |
| 2930         | Wx-Spring Valley Rd-DougCnty | 59  | 12:26 | 62.00 | 95%         |
| 4070         | Bear Peak                    | 59  | 12:12 | 62.00 | 95%         |
| 4140         | Logan Mill                   | 59  | 12:25 | 62.00 | 95%         |
| 4340         | Riverside                    | 59  | 12:26 | 62.00 | 95%         |
| 4520         | Eagle Ridge                  | 59  | 12:26 | 62.00 | 95%         |

|      |                      |    |       |       |      |
|------|----------------------|----|-------|-------|------|
| 4730 | Wx-Sugarloaf         | 59 | 12:26 | 62.00 | 95%  |
| 1640 | SPR at Union Ave.    | 60 | 11:15 | 62.00 | 97%  |
| 1700 | Cherry Cr @ Champa   | 60 | 12:00 | 62.00 | 97%  |
| 2730 | Wx-Salisbury Park    | 60 | 12:12 | 62.00 | 97%  |
| 3030 | WX-Bingham Lake Park | 60 | 12:14 | 62.00 | 97%  |
| 4190 | Slaughterhouse       | 60 | 12:13 | 62.00 | 97%  |
| 4230 | Golden Age           | 60 | 12:10 | 62.00 | 97%  |
| 970  | Pump Sta 3           | 61 | 12:00 | 62.00 | 98%  |
| 4750 | Wx-Louisville Lake   | 61 | 12:00 | 62.00 | 98%  |
| 1420 | Wx-Diamond Hill      | 62 | 11:03 | 62.00 | 100% |
| 4290 | Red Hill             | 63 | 11:04 | 62.00 | 102% |
| 4300 | Big Elk Park         | 64 | 11:15 | 62.00 | 103% |
| 4030 | Red Garden           | 65 | 11:10 | 62.00 | 105% |
| 4350 | Conifer Hill         | 65 | 11:21 | 62.00 | 105% |
| 1810 | Sand Creek at mouth  | 66 | 11:09 | 62.00 | 106% |
| 1920 | Brighton-Wx          | 67 | 10:50 | 62.00 | 108% |
| 4260 | Taylor Mountain      | 67 | 11:32 | 62.00 | 108% |
| 4310 | Johnny Park          | 69 | 10:55 | 62.00 | 111% |
| 4250 | Geer Canyon          | 70 | 10:32 | 62.00 | 113% |
| 4050 | Walker Ranch         | 73 | 10:01 | 62.00 | 118% |
| 4040 | Martin Gulch         | 74 | 10:24 | 62.00 | 119% |
| 2210 | Wx-Hiwan G.C.        | 78 | 9:33  | 62.00 | 126% |
| 4830 | SBC @ San Souci      | 83 | 8:35  | 62.00 | 134% |
| 4820 | Doudy Draw           | 84 | 8:42  | 62.00 | 135% |
| 4810 | Shanahan Ridge       | 88 | 8:46  | 62.00 | 142% |
| 4840 | SBC@S Boulder Ditch  | 88 | 9:12  | 62.00 | 142% |

| Rain Event Performance |             | Reports Received | 971    | Analyze Rain Sensors |        |        |        |         |     |     |      |      |        |  |
|------------------------|-------------|------------------|--------|----------------------|--------|--------|--------|---------|-----|-----|------|------|--------|--|
| Systemwide Avg         |             | Total Tips       | 1,033  |                      |        |        |        |         |     |     |      |      |        |  |
| 94.00%                 |             | Data Loss        | 6.00%  |                      |        |        |        |         |     |     |      |      |        |  |
| Rain ID                | Performance | 1-tips           | 2-tips | 3-tips               | 4-tips | 5-tips | 6-tips | >6-tips | Rcv | Exp | Miss | Hold | Bucket |  |
| 1460                   | 60%         | 2                | 0      | 1                    | 0      | 0      | 0      | 0       | 3   | 5   | 2    | 0    | 0.0394 |  |
| 2980                   | 70%         | 12               | 6      | 1                    | 0      | 0      | 0      | 0       | 19  | 27  | 8    | 0    | 0.0394 |  |
| 4490                   | 73%         | 18               | 4      | 1                    | 1      | 0      | 0      | 0       | 24  | 33  | 9    | 0    | 0.0394 |  |
| 4270                   | 79%         | 8                | 3      | 0                    | 0      | 0      | 0      | 0       | 11  | 14  | 3    | 0    | 0.0394 |  |
| 4830                   | 83%         | 13               | 1      | 1                    | 0      | 0      | 0      | 0       | 15  | 18  | 3    | 0    | 0.0394 |  |
| 4330                   | 84%         | 13               | 3      | 0                    | 0      | 0      | 0      | 0       | 16  | 19  | 3    | 0    | 0.0394 |  |
| 3010                   | 88%         | 24               | 4      | 0                    | 0      | 0      | 0      | 0       | 28  | 32  | 4    | 0    | 0.0100 |  |
| 4470                   | 88%         | 6                | 1      | 0                    | 0      | 0      | 0      | 0       | 7   | 8   | 1    | 0    | 0.0394 |  |
| 4570                   | 88%         | 6                | 1      | 0                    | 0      | 0      | 0      | 0       | 7   | 8   | 1    | 0    | 0.0394 |  |
| 4350                   | 90%         | 8                | 1      | 0                    | 0      | 0      | 0      | 0       | 9   | 10  | 1    | 0    | 0.0394 |  |
| 4360                   | 91%         | 18               | 2      | 0                    | 0      | 0      | 0      | 0       | 20  | 22  | 2    | 0    | 0.0394 |  |
| 4530                   | 91%         | 18               | 2      | 0                    | 0      | 0      | 0      | 0       | 20  | 22  | 2    | 0    | 0.0394 |  |
| 1520                   | 92%         | 10               | 1      | 0                    | 0      | 0      | 0      | 0       | 11  | 12  | 1    | 0    | 0.0394 |  |
| 4010                   | 93%         | 12               | 1      | 0                    | 0      | 0      | 0      | 0       | 13  | 14  | 1    | 0    | 0.0394 |  |
| 4340                   | 93%         | 12               | 1      | 0                    | 0      | 0      | 0      | 0       | 13  | 14  | 1    | 0    | 0.0394 |  |
| 4790                   | 93%         | 12               | 1      | 0                    | 0      | 0      | 0      | 0       | 13  | 14  | 1    | 0    | 0.0394 |  |
| 4840                   | 93%         | 25               | 2      | 0                    | 0      | 0      | 0      | 0       | 27  | 29  | 2    | 0    | 0.0394 |  |
| 1420                   | 94%         | 14               | 1      | 0                    | 0      | 0      | 0      | 0       | 15  | 16  | 1    | 0    | 0.0394 |  |
| 4860                   | 94%         | 14               | 1      | 0                    | 0      | 0      | 0      | 0       | 15  | 16  | 1    | 0    | 0.0100 |  |
| 1000                   | 94%         | 15               | 1      | 0                    | 0      | 0      | 0      | 0       | 16  | 17  | 1    | 0    | 0.0394 |  |
| 3030                   | 94%         | 15               | 1      | 0                    | 0      | 0      | 0      | 0       | 16  | 17  | 1    | 0    | 0.0394 |  |
| 4140                   | 94%         | 15               | 1      | 0                    | 0      | 0      | 0      | 0       | 16  | 17  | 1    | 0    | 0.0394 |  |
| 4310                   | 94%         | 30               | 2      | 0                    | 0      | 0      | 0      | 0       | 32  | 34  | 2    | 0    | 0.0394 |  |
| 4070                   | 94%         | 16               | 1      | 0                    | 0      | 0      | 0      | 0       | 17  | 18  | 1    | 0    | 0.0394 |  |
| 4040                   | 95%         | 33               | 2      | 0                    | 0      | 0      | 0      | 0       | 35  | 37  | 2    | 0    | 0.0394 |  |
| 4030                   | 95%         | 17               | 1      | 0                    | 0      | 0      | 0      | 0       | 18  | 19  | 1    | 0    | 0.0394 |  |
| 4810                   | 95%         | 17               | 1      | 0                    | 0      | 0      | 0      | 0       | 18  | 19  | 1    | 0    | 0.0394 |  |
| 4190                   | 95%         | 18               | 1      | 0                    | 0      | 0      | 0      | 0       | 19  | 20  | 1    | 0    | 0.0394 |  |
| 4150                   | 96%         | 21               | 1      | 0                    | 0      | 0      | 0      | 0       | 22  | 23  | 1    | 0    | 0.0394 |  |
| 4290                   | 96%         | 21               | 1      | 0                    | 0      | 0      | 0      | 0       | 22  | 23  | 1    | 0    | 0.0394 |  |
| 4850                   | 96%         | 22               | 1      | 0                    | 0      | 0      | 0      | 0       | 23  | 24  | 1    | 0    | 0.0100 |  |
| 4200                   | 97%         | 27               | 1      | 0                    | 0      | 0      | 0      | 0       | 28  | 29  | 1    | 0    | 0.0394 |  |
| 140                    | 100%        | 11               | 0      | 0                    | 0      | 0      | 0      | 0       | 11  | 11  | 0    | 0    | 0.0394 |  |
| 700                    | 100%        | 9                | 0      | 0                    | 0      | 0      | 0      | 0       | 9   | 9   | 0    | 0    | 0.0394 |  |
| 750                    | 100%        | 5                | 0      | 0                    | 0      | 0      | 0      | 0       | 5   | 5   | 0    | 0    | 0.0394 |  |
| 900                    | 100%        | 1                | 0      | 0                    | 0      | 0      | 0      | 0       | 1   | 1   | 0    | 0    | 0.0394 |  |
| 920                    | 100%        | 1                | 0      | 0                    | 0      | 0      | 0      | 0       | 1   | 1   | 0    | 0    | 0.0394 |  |
| 970                    | 100%        | 1                | 0      | 0                    | 0      | 0      | 0      | 0       | 1   | 1   | 0    | 0    | 0.0394 |  |
| 1480                   | 100%        | 1                | 0      | 0                    | 0      | 0      | 0      | 0       | 1   | 1   | 0    | 0    | 0.0394 |  |
| 1640                   | 100%        | 7                | 0      | 0                    | 0      | 0      | 0      | 0       | 7   | 7   | 0    | 0    | 0.0394 |  |
| 1660                   | 100%        | 3                | 0      | 0                    | 0      | 0      | 0      | 0       | 3   | 3   | 0    | 0    | 0.0394 |  |
| 1700                   | 100%        | 6                | 0      | 0                    | 0      | 0      | 0      | 0       | 6   | 6   | 0    | 0    | 0.0394 |  |
| 1810                   | 100%        | 10               | 0      | 0                    | 0      | 0      | 0      | 0       | 10  | 10  | 0    | 0    | 0.0394 |  |
| 1920                   | 100%        | 4                | 0      | 0                    | 0      | 0      | 0      | 0       | 4   | 4   | 0    | 0    | 0.0394 |  |
| 2210                   | 100%        | 11               | 0      | 0                    | 0      | 0      | 0      | 0       | 11  | 11  | 0    | 0    | 0.0394 |  |
| 2320                   | 100%        | 16               | 0      | 0                    | 0      | 0      | 0      | 0       | 16  | 16  | 0    | 0    | 0.0394 |  |
| 2710                   | 100%        | 3                | 0      | 0                    | 0      | 0      | 0      | 0       | 3   | 3   | 0    | 0    | 0.0394 |  |
| 2730                   | 100%        | 2                | 0      | 0                    | 0      | 0      | 0      | 0       | 2   | 2   | 0    | 0    | 0.0394 |  |
| 2750                   | 100%        | 6                | 0      | 0                    | 0      | 0      | 0      | 0       | 6   | 6   | 0    | 0    | 0.0394 |  |
| 2930                   | 100%        | 3                | 0      | 0                    | 0      | 0      | 0      | 0       | 3   | 3   | 0    | 0    | 0.0394 |  |
| 2990                   | 100%        | 26               | 0      | 0                    | 0      | 0      | 0      | 0       | 26  | 26  | 0    | 0    | 0.0394 |  |
| 3020                   | 100%        | 18               | 0      | 0                    | 0      | 0      | 0      | 0       | 18  | 18  | 0    | 0    | 0.0394 |  |
| 4020                   | 100%        | 17               | 0      | 0                    | 0      | 0      | 0      | 0       | 17  | 17  | 0    | 0    | 0.0394 |  |
| 4050                   | 100%        | 3                | 0      | 0                    | 0      | 0      | 0      | 0       | 3   | 3   | 0    | 0    | 0.0394 |  |
| 4060                   | 100%        | 12               | 0      | 0                    | 0      | 0      | 0      | 0       | 12  | 12  | 0    | 0    | 0.0394 |  |
| 4080                   | 100%        | 9                | 0      | 0                    | 0      | 0      | 0      | 0       | 9   | 9   | 0    | 0    | 0.0394 |  |
| 4090                   | 100%        | 13               | 0      | 0                    | 0      | 0      | 0      | 0       | 13  | 13  | 0    | 0    | 0.0394 |  |
| 4100                   | 100%        | 7                | 0      | 0                    | 0      | 0      | 0      | 0       | 7   | 7   | 0    | 0    | 0.0394 |  |
| 4110                   | 100%        | 31               | 0      | 0                    | 0      | 0      | 0      | 0       | 31  | 31  | 0    | 0    | 0.0394 |  |
| 4130                   | 100%        | 13               | 0      | 0                    | 0      | 0      | 0      | 0       | 13  | 13  | 0    | 0    | 0.0394 |  |
| 4160                   | 100%        | 3                | 0      | 0                    | 0      | 0      | 0      | 0       | 3   | 3   | 0    | 0    | 0.0394 |  |
| 4170                   | 100%        | 6                | 0      | 0                    | 0      | 0      | 0      | 0       | 6   | 6   | 0    | 0    | 0.0394 |  |
| 4180                   | 100%        | 4                | 0      | 0                    | 0      | 0      | 0      | 0       | 4   | 4   | 0    | 0    | 0.0394 |  |
| 4220                   | 100%        | 25               | 0      | 0                    | 0      | 0      | 0      | 0       | 25  | 25  | 0    | 0    | 0.0394 |  |
| 4230                   | 100%        | 3                | 0      | 0                    | 0      | 0      | 0      | 0       | 3   | 3   | 0    | 0    | 0.0394 |  |
| 4240                   | 100%        | 8                | 0      | 0                    | 0      | 0      | 0      | 0       | 8   | 8   | 0    | 0    | 0.0394 |  |

|      |            |     |    |   |   |   |   |   |     |       |    |   |        |
|------|------------|-----|----|---|---|---|---|---|-----|-------|----|---|--------|
| 4250 | 100%       | 10  | 0  | 0 | 0 | 0 | 0 | 0 | 10  | 10    | 0  | 0 | 0.0394 |
| 4260 | 100%       | 29  | 0  | 0 | 0 | 0 | 0 | 0 | 29  | 29    | 0  | 0 | 0.0394 |
| 4300 | 100%       | 7   | 0  | 0 | 0 | 0 | 0 | 0 | 7   | 7     | 0  | 0 | 0.0394 |
| 4510 | 100%       | 18  | 0  | 0 | 0 | 0 | 0 | 0 | 18  | 18    | 0  | 0 | 0.0394 |
| 4520 | 100%       | 4   | 0  | 0 | 0 | 0 | 0 | 0 | 4   | 4     | 0  | 0 | 0.0394 |
| 4710 | 100%       | 3   | 0  | 0 | 0 | 0 | 0 | 0 | 3   | 3     | 0  | 0 | 0.0394 |
| 4730 | 100%       | 6   | 0  | 0 | 0 | 0 | 0 | 0 | 6   | 6     | 0  | 0 | 0.0394 |
| 4750 | 100%       | 9   | 0  | 0 | 0 | 0 | 0 | 0 | 9   | 9     | 0  | 0 | 0.0394 |
| 4770 | 100%       | 7   | 0  | 0 | 0 | 0 | 0 | 0 | 7   | 7     | 0  | 0 | 0.0394 |
| 4820 | 100%       | 12  | 0  | 0 | 0 | 0 | 0 | 0 | 12  | 12    | 0  | 0 | 0.0394 |
|      | Total Tips | 915 | 51 | 4 | 1 | 0 | 0 | 0 | 971 | 1,033 | 62 | 0 |        |

## 2011 Monthly ALERT Radio Traffic Summary

