

Memo

Date: December 2, 2011
To: Kevin Stewart
From: Markus Ritsch
Subject: November 2011 ALERT Data Analysis

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 November 1 through November 30, 2011.

II. General System Analysis Summary

A total of 342,819 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 11,427 reports per day with an average hourly loading of 476 reports. The peak hourly traffic loading was 969 reports, which occurred on November 6, between 1:00 AM and 2:00 AM. 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
4330	Hansen Rain	0.85	0.80
4550	Boulder Jail	0.40	1.0
4270	Cannon Mountain	0.73	0.50
4750	Wx-Louisville Lake	0.98	0.36
4770	Wx-Cal-Wood Ranch	1.00	0.36
1420	Wx-Diamond Hill	0.95	0.44
4090	Magnolia	0.90	0.57
2980	Dakan Road	0.97	0.64
2190	Wx-Squaw Mt	0.95	0.67
1929/1923	Unknown sensor IDs with excessive reports		
1423			
1470			

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	
1440	1440	4270	3060	700	4710	4330	4850	2320	3020	4270	
4470	4470	4330	3030	540	4330	2750	2750	440	4790	1440	
1460	1460	4510	700	1710	1700	2280	2950	4490	4770	4490	
140	140	1440	3090	500	4270	870	540	4520	4270	1460	
1570	4490	4810	2970	710	4300	4270	2280	2270	4510	4060	

*. 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	10.41	Only the 1-mm rain sensors were included in the analysis
Median	10.0	Only the 1-mm rain sensors were included in the analysis
Standard deviation	6.27	Only the 1-mm rain sensors were included in the analysis
Mean plus three standard deviations	29.21	Only the 1-mm rain sensors were included in the analysis
Minimum total count	1	ID 920 (WX-Aurora Town Hall)
Maximum total count	28	ID 4750 (WX-Louisville Lake)

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		

*. 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
Wx-Louisville Lake	4750	Large jump occurred on November 10, 2011
Wx-Cal-Wood Ranch	4770	Large jump occurred on November 1, 2011
Wx-Diamond Hill	1420	Large jump occurred on November 21, 2011
There were three 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 1,549 incrementing reports were received and a total of 1,698 reports were expected. The total loss of incrementing reports for the month was approximately 8.8 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	950	2970	1620	1660	4300	4300	400	4490	4330	4770	
4470	1320	710	2930	810	4330	4330	4330	4330	4730	1420	
4330	1330	4330	2990	650	4270	2980	2270	4240	4790	4270	
2710	840	870	4330	940	2980	4490	2240	4470	4090	4090	
1640	1720	1200	2950	1900	310	4790	4530	330	4230	2980	

*-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 the 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
6	1	0	0	969	0.00%
3	13	154	148	698	3.89%
12	11	0	0	680	0.00%
3	12	119	114	672	4.20%
30	22	0	0	661	0.00%
12	14	0	0	641	0.00%
5	21	0	0	630	0.00%
12	10	0	0	621	0.00%
12	15	0	0	611	0.00%
3	14	48	47	611	2.08%

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)	286
Total reports from unknown IDs	747
Unknown IDs with only a single received report (potential noise)	158
Total reports from all IDs – RecData Log entire month	342,819
Unknown reports as a fraction of total reports	0.22%

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	

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%	

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
1929	16
1423	15
1470	15
1923	13
1954	13
2748	12
1415	11
1453	11
1926	11
2771	11
1446	10
1449	10
2811	10
1933	9
1953	9
2768	9

1430	8
1454	8
1934	8
1951	8
2776	8
1419	7
1918	7
1949	7
2745	7
2784	7
2808	7
4469	7
1950	6
2706	6
2716	6
2760	6
3015	6
4509	6

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	31	12:00-12:59	18
1:00-1:59	35	1:00-1:59	21
2:00-2:59	34	2:00-2:59	25
3:00-3:59	25	3:00-3:59	2
4:00-4:59	43	4:00-4:59	41
5:00-5:59	36	5:00-5:59	37
6:00-6:59	21	6:00-6:59	36
7:00-7:59	37	7:00-7:59	38
8:00-8:59	33	8:00-8:59	29
9:00-9:59	18	9:00-9:59	38
10:00-10:59	34	10:00-10:59	59
11:00-11:59	27	11:00-11:59	40

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
140	Wx-Blue Mountain	0	4	1	0	0	0	2	1
900	WX-Aurora Reservoir	0	0	0	0	0	0	6	0
920	Wx-Aurora Town Hall	0	7	1	0	0	0	0	0
1460	Wx-Urban Farm	0	5	1	0	1	0	1	1
1480	Third Creek at DIA	0	0	0	5	0	0	0	0
1520	Wx-Marston Lake North	2	4	1	0	1	0	2	0
1920	Wx-Brighton	3	3	1	2	1	1	0	1
2190	Wx-Squaw Mountain	0	8	0	1	0	0	0	0
2710	Wx-Highlands Ranch WTP	0	0	0	0	0	0	3	1
2750	Wx-Castle Rock	0	0	0	0	0	0	2	3
3020	Wx-West Creek	2	1	3	1	2	0	0	0
4330	Hansen Rain	0	5	4	2	3	3	0	3
4850	Porphyry Mtn	0	0	0	4	1	2	1	1
4860	Fairview Peak	0	0	0	0	0	0	4	0
4840	SBC@SB Ditch	0	0	0	0	0	0	0	2

General System Analysis

Database Name

P:\A207-UDFCD-Data-Analysis\2011\11-2011\Novastar_extract_2011Nov.mdb

First Date in Database

11/1/11 12:00 AM

Total Days

30.0

Last Date in Database

11/30/11 11:59 PM

Total Hours

720.0

Total Records Analyzed

342,819

Records by Group

Wind Gust	63,763	19%
Temperature	61,241	18%
Relative Humidity	59,328	17%
Wind Speed Average & Azimuth	31,497	9%
Barometric Pressure	29,355	9%
Wind Direction	19,871	6%
Wind Speed Average	19,435	6%
Battery Voltage	12,421	4%
Solar Radiation	8,746	3%
Water Level PT-HSE	6,721	2%
Precipitation	6,429	2%
Fuel Moisture	5,475	2%
Fuel Temperature	5,462	2%
Water Level Float	3,447	1%
Soil Moisture	2,583	1%
Repeater Status Report	2,406	1%
Water Level PT	1,608	0%
Wind ALERT	1,461	0%
Repeater Pass List	579	0%
Unknown	747	0%
12Hr Status Report	193	0%
Handar 585 ALARM Status	25	0%
Solar Power	16	0%
Water Level	10	0%
Total	342,819	

Records by Major Group

Meteorologic Sensors	293,236	86%
Soil and Fuel Sensors	13,520	4%
Water Level Sensors	11,776	3%
Rain Sensors	6,429	2%
Sensor Status Transmissions	3,219	1%
Total	328,180	

Traffic Loading Summary

Alert Reports	342,819	
Average Daily Traffic	11,427	
Average Hourly Traffic	476	
Median Hourly Traffic	479	hour beginning
Peak Hourly Traffic	969	Nov-06, 1:00 AM
2nd Max	698	Nov-03, 1:00 PM
3rd Max	680	Nov-12, 11:00 AM
4th Max	672	Nov-03, 12:00 PM
5th Max	661	Nov-30, 10:00 PM

Rain Timer Performance

Analyze Rain Sensors

Rain Sensors	Description	Rcv	Timer	Exp	Performance
4550	Boulder Jail	24	12:59	60.00	40%
4270	Cannon Mountain	44	15:55	60.00	73%
1440	Wx-Elbert	48	14:58	60.00	80%
4490	Apple Valley	48	13:58	60.00	80%
1460	Wx-Urban Farm	50	13:43	60.00	83%
4060	Lakeshore	50	13:56	60.00	83%
140	Wx-Blue Mountain	51	13:43	60.00	85%
4330	Hansen Rain	51	13:53	60.00	85%
4180	Gold Lake	51	14:01	60.00	85%
900	Wx-Aurora Reservoir	52	13:28	60.00	87%
4220	Fling's	52	13:14	60.00	87%
4050	Walker Ranch	52	13:54	60.00	87%
2730	Wx-Salisbury Park	53	12:56	60.00	88%
1520	Wx-Marston Lake North	53	12:56	60.00	88%
4530	Winiger Ridge	53	13:23	60.00	88%
4310	Johnny Park	53	13:08	60.00	88%
4150	Gold Hill	53	12:55	60.00	88%
4080	Twin Sisters	53	12:53	60.00	88%
4570	St. Antons	54	12:44	60.00	90%
4360	Justice Center	54	13:26	60.00	90%
4240	Sunset	54	13:19	60.00	90%
4090	Magnolia	54	12:52	60.00	90%
3020	Wx-West Creek WX	55	13:08	60.00	92%
2750	Wx-Castle Rock	55	12:39	60.00	92%
4820	Doudy Draw	55	12:24	60.00	92%
4810	Shanahan Ridge	55	12:56	60.00	92%
4350	Conifer Hill	55	12:40	60.00	92%
4340	Riverside	55	12:52	60.00	92%
4290	Red Hill	55	12:37	60.00	92%
4110	Betasso	55	12:53	60.00	92%
4040	Martin Gulch	55	13:10	60.00	92%
4790	Wx-Button Rock	56	12:27	60.00	93%
1570	Wx-Brighton Ditch	56	12:25	60.00	93%
4250	Geer Canyon	56	12:36	60.00	93%
4230	Golden Age	56	12:50	60.00	93%
4170	Pine Brook	56	12:11	60.00	93%
4140	Logan Mill	56	12:52	60.00	93%
2190	Wx-Squaw Mountain	57	12:12	60.00	95%
2930	Wx-Spring Valley Rd-DougCnty	57	12:38	60.00	95%
2710	Wx-Highlands Ranch WTP	57	12:25	60.00	95%
1420	Wx-Diamond Hill	57	12:26	60.00	95%
3030	Wx-Bingham Lake Park	57	12:26	60.00	95%
4840	SBC@S Boulder Ditch	57	11:56	60.00	95%
4830	SBC @ San Souci	57	12:38	60.00	95%
4190	Slaughterhouse	57	12:36	60.00	95%
4160	Sunshine	57	12:38	60.00	95%
4130	Swiss Peaks	57	12:25	60.00	95%
4030	Red Garden	57	12:24	60.00	95%
4020	Rio Grande	57	12:23	60.00	95%
4010	Crescent	57	12:23	60.00	95%
4710	Wx-Ward C-1	58	11:58	60.00	97%
4730	Wx-Sugarloaf	58	12:11	60.00	97%
750	Wx-Quincy Reservoir	58	12:11	60.00	97%
2210	Wx-Hiwan G.C.	58	12:11	60.00	97%

1920	Wx-Brighton	58	12:11	60.00	97%
4850	Porphory Mtn	58	11:58	60.00	97%
4470	Little Narrows	58	11:56	60.00	97%
4300	Big Elk Park	58	12:09	60.00	97%
2980	Dakan Rd	58	12:13	60.00	97%
4750	Wx-Louisville Lake	59	12:26	60.00	98%
920	Wx-Aurora Town Hall	59	12:11	60.00	98%
4860	Fairview Peak	59	12:11	60.00	98%
4510	Pinewood Springs	59	11:30	60.00	98%
4260	Taylor Mountain	59	11:56	60.00	98%
4200	Lazy Acres	59	11:58	60.00	98%
4100	Filter Plant	59	12:11	60.00	98%
4070	Bear Peak	59	12:09	60.00	98%
2990	Wx-Tomah Rd-DougCnty	60	11:58	60.00	100%
4520	Eagle Ridge	60	11:58	60.00	100%
3010	Wx-EPC at Hwy 105	61	11:57	60.00	102%
4770	Wx-Cal-Wood Ranch	63	11:29	60.00	105%
2320	Choke Cherry Resvr	54	13:23	60.00	90%
1900	Niver Detention	4	11:58	60.00	7%
1810	Sand Creek at mouth	70	9:46	60.00	117%
1720	Cherry Cr @ Steele	6	11:57	60.00	10%
1700	Cherry Cr @ Champa	57	12:26	60.00	95%
1660	SPR at Henderson	58	12:22	60.00	97%
1640	SPR at Union Ave.	55	12:29	60.00	92%
1530	Bear Creek @ Lowell	16	11:52	60.00	27%
1480	Third Creek at DIA	48	14:20	60.00	80%
1370	West Metro FS13	12	14:30	60.00	20%
1360	Denver Zoo	4	12:00	60.00	7%
1350	Chatfield COE	12	14:18	60.00	20%
1340	Sanderson at Xavier	16	11:55	60.00	27%
1320	SPR at 3rd Ave	38	12:16	60.00	63%
1200	Broomfield 3207	18	11:53	60.00	30%
1110	Gunbarrel	26	12:56	60.00	43%
1100	Louisville Rec Ctr	16	13:35	60.00	27%
1060	Heritage Square	27	14:18	60.00	45%
1050	Jeffco Fairgrounds	34	12:18	60.00	57%
1040	Lena @ U.S. Hwy 6	35	11:57	60.00	58%
1030	NREL/S. Table Mtn.	24	15:01	60.00	40%
1010	Denver West	33	12:42	60.00	55%
1000	Maple Grove Resv.	24	13:06	60.00	40%
970	Pump Sta 3	59	11:58	60.00	98%
700	Toll Gate @ 6th	56	12:40	60.00	93%
650	Iliff Pond	5	15:57	60.00	8%
640	Goldsmith @ Eastman	16	11:53	60.00	27%
630	Temple Pond at DTC	15	12:57	60.00	25%
620	Quincy/Highline	16	11:52	60.00	27%
610	Harvard @ Jackson	6	11:57	60.00	10%
600	Harvard Gulch Park	4	11:57	60.00	7%
540	Parker/Mississippi	6	11:56	60.00	10%
530	Fire Station #19	6	11:57	60.00	10%
330	Van Bibber @ Hwy 93	23	13:41	60.00	38%
220	Upper Leyden	22	13:45	60.00	37%
200	Leyden Reservoir	21	15:02	60.00	35%
120	West Woods	23	13:42	60.00	38%

		Rain Event Performance			Analyze Rain Sensors										
			Reports Received	616											
		Systemwide Avg	Total Tips	708											
		87.01%	Data Loss	12.99%											
Description	ID	Performance	1-tips	2-tips	3-tips	4-tips	5-tips	6-tips	>6-tips	Rcv	Exp	Miss	Hold	Bucket	
Wx-Louisville Lake	4750	36%	8	1	0	0	1	0	1	10	28	18	0	0.0393701	
Wx-Cal-Wood Ranch	4770	36%	4	1	0	0	0	0	1	5	14	9	0	0.0393701	
Wx-Diamond Hill	1420	44%	11	0	0	0	0	0	1	11	25	14	0	0.0393701	
Cannon Mountain	4270	50%	2	1	0	1	0	0	0	4	8	4	0	0.0393701	
Magnolia	4090	57%	3	0	0	1	0	0	0	4	7	3	0	0.0393701	
Dakan Rd	2980	64%	4	5	0	0	0	0	0	9	14	5	0	0.0393701	
Wx-Squaw Mountain	2190	67%	1	1	0	0	0	0	0	2	3	1	0	0.0393701	
Little Narrows	4470	79%	9	1	1	0	0	0	0	11	14	3	0	0.0393701	
Doudy Draw	4820	80%	6	2	0	0	0	0	0	8	10	2	0	0.0393701	
Hansen Rain	4330	80%	6	2	0	0	0	0	0	8	10	2	0	0.0393701	
Red Garden	4030	80%	13	2	1	0	0	0	0	16	20	4	0	0.0393701	
Pine Brook	4170	83%	4	1	0	0	0	0	0	5	6	1	0	0.0393701	
SBC @ San Souci	4830	84%	14	1	1	0	0	0	0	16	19	3	0	0.0393701	
Wx-Button Rock	4790	86%	10	2	0	0	0	0	0	12	14	2	0	0.0393701	
Gold Lake	4180	86%	10	2	0	0	0	0	0	12	14	2	0	0.0393701	
Pinewood Springs	4510	88%	13	2	0	0	0	0	0	15	17	2	0	0.0393701	
Swiss Peaks	4130	89%	7	1	0	0	0	0	0	8	9	1	0	0.0393701	
Crescent	4010	89%	7	1	0	0	0	0	0	8	9	1	0	0.0393701	
Bear Peak	4070	90%	8	1	0	0	0	0	0	9	10	1	0	0.0393701	
Justice Center	4360	91%	18	2	0	0	0	0	0	20	22	2	0	0.0393701	
Red Hill	4290	92%	10	1	0	0	0	0	0	11	12	1	0	0.0393701	
Rio Grande	4020	92%	10	1	0	0	0	0	0	11	12	1	0	0.0393701	
Apple Valley	4490	92%	11	1	0	0	0	0	0	12	13	1	0	0.0393701	
Lazy Acres	4200	92%	11	1	0	0	0	0	0	12	13	1	0	0.0393701	
Gold Hill	4150	92%	11	1	0	0	0	0	0	12	13	1	0	0.0393701	
Logan Mill	4140	92%	11	1	0	0	0	0	0	12	13	1	0	0.0393701	
Johnny Park	4310	93%	13	1	0	0	0	0	0	14	15	1	0	0.0393701	
Winiger Ridge	4530	94%	14	1	0	0	0	0	0	15	16	1	0	0.0393701	
Conifer Hill	4350	94%	14	1	0	0	0	0	0	15	16	1	0	0.0393701	
Fling's	4220	94%	14	1	0	0	0	0	0	15	16	1	0	0.0393701	
Betasso	4110	94%	14	1	0	0	0	0	0	15	16	1	0	0.0393701	
Shanahan Ridge	4810	96%	21	1	0	0	0	0	0	22	23	1	0	0.0393701	
Wx-West Creek WX	3020	100%	4	0	0	0	0	0	0	4	4	0	0	0.0393701	
Wx-Ward C-1	4710	100%	11	0	0	0	0	0	0	11	11	0	0	0.0393701	
Wx-Urban Farm	1460	100%	5	0	0	0	0	0	0	5	5	0	0	0.0393701	
Wx-Tomah Rd	2990	100%	6	0	0	0	0	0	0	6	6	0	0	0.0393701	
Wx-Sugarloaf	4730	100%	5	0	0	0	0	0	0	5	5	0	0	0.0393701	
Wx-Spring Valley Rd	2930	100%	1	0	0	0	0	0	0	1	1	0	0	0.0393701	
Wx-Salisbury Park	2730	100%	3	0	0	0	0	0	0	3	3	0	0	0.0393701	
Wx-Quincy Reservoir	750	100%	5	0	0	0	0	0	0	5	5	0	0	0.0393701	
Wx-Marston Lake North	1520	100%	8	0	0	0	0	0	0	8	8	0	0	0.0393701	
Wx-Hiwan G.C.	2210	100%	5	0	0	0	0	0	0	5	5	0	0	0.0393701	
Wx-Highlands Ranch WT	2710	100%	4	0	0	0	0	0	0	4	4	0	0	0.0393701	
Wx-Elbert	1440	100%	3	0	0	0	0	0	0	3	3	0	0	0.0393701	
Wx-Castle Rock	2750	100%	4	0	0	0	0	0	0	4	4	0	0	0.0393701	
Wx-Brighton Ditch	1570	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701	
Wx-Brighton	1920	100%	5	0	0	0	0	0	0	5	5	0	0	0.0393701	
Wx-Blue Mountain	140	100%	5	0	0	0	0	0	0	5	5	0	1	0.0393701	
Wx-Bingham Lake Park	3030	100%	9	0	0	0	0	0	0	9	9	0	0	0.0393701	
Wx-Aurora Town Hall	920	100%	1	0	0	0	0	0	0	1	1	0	0	0.0393701	
SBC@S Boulder Ditch	4840	100%	25	0	0	0	0	0	0	25	25	0	0	0.0393701	
St. Antons	4570	100%	10	0	0	0	0	0	0	10	10	0	0	0.0393701	
Boulder Jail	4550	100%	11	0	0	0	0	0	0	11	11	0	0	0.0393701	
Eagle Ridge	4520	100%	6	0	0	0	0	0	0	6	6	0	0	0.0393701	
Riverside	4340	100%	8	0	0	0	0	0	0	8	8	0	0	0.0393701	
Big Elk Park	4300	100%	10	0	0	0	0	0	0	10	10	0	0	0.0393701	
Taylor Mountain	4260	100%	14	0	0	0	0	0	0	14	14	0	0	0.0393701	
Geer Canyon	4250	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701	
Sunset	4240	100%	5	0	0	0	0	0	0	5	5	0	0	0.0393701	
Golden Age	4230	100%	2	0	0	0	0	0	0	2	2	0	0	0.0393701	
Slaughterhouse	4190	100%	13	0	0	0	0	0	0	13	13	0	0	0.0393701	
Sunshine	4160	100%	12	0	0	0	0	0	0	12	12	0	0	0.0393701	
Filter Plant	4100	100%	5	0	0	0	0	0	0	5	5	0	0	0.0393701	
Twin Sisters	4080	100%	4	0	0	0	0	0	0	4	4	0	0	0.0393701	
Lakeshore	4060	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701	
Walker Ranch	4050	100%	3	0	0	0	0	0	0	3	3	0	0	0.0393701	

Martin Gulch	4040	100%	20	0	0	0	0	0	0	20	20	0	0	0.0393701
Wx-Aurora Reservoir	900	100%	4	0	0	0	0	0	0	4	4	0	0	0.0393699
		TOTAL	569	41	3	2	1	0	3	616	708	92	1	
Wx-EPC at Hwy 105	3010	93%	12	1	0	0	0	0	0	13	14	1	0	0.01
Fairview Peak	4860	93%	24	2	0	0	0	0	0	26	28	2	2	0.01
Porphory Mtn	4850	92%	33	3	0	0	0	0	0	36	39	3	0	0.01
Cherry Cr bl Bayou Glch	2850	100%	1	0	0	0	0	0	0	1	1	0	0	0.0393701
Choke Cherry Resvr	2320	100%	9	0	0	0	0	0	0	9	9	0	0	0.0393701
Niver Detention	1900	100%	1	0	0	0	0	0	0	1	1	0	0	0.0393701
Sand Creek at mouth	1810	100%	8	0	0	0	0	0	0	8	8	0	0	0.0393701
Cherry Cr @ Steele	1720	100%	10	0	0	0	0	0	0	10	10	0	0	0.0393701
Cherry Cr @ Champa	1700	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701
SPR at Henderson	1660	100%	6	0	0	0	0	0	0	6	6	0	0	0.0393701
SPR at Union Ave.	1640	85%	10	0	1	0	0	0	0	11	13	2	0	0.0393701
Englewood Dam	1600	100%	1	0	0	0	0	0	0	1	1	0	0	0.0393701
Bear Creek @ Lowell	1530	100%	11	0	0	0	0	0	0	11	11	0	0	0.0393701
Powers Park	1500	100%	3	0	0	0	0	0	0	3	3	0	0	0.0393701
Third Creek at DIA	1480	100%	3	0	0	0	0	0	0	3	3	0	0	0.0393701
Upper Sloan Det.	1400	100%	6	0	0	0	0	0	0	6	6	0	0	0.0393701
West Metro FS13	1370	63%	4	0	0	1	0	0	0	5	8	3	0	0.0393701
Denver Zoo	1360	100%	9	0	0	0	0	0	0	9	9	0	0	0.0393701
Chatfield COE	1350	100%	6	0	0	0	0	0	0	6	6	0	0	0.0393701
Sanderson at Xavier	1340	92%	10	1	0	0	0	0	0	11	12	1	0	0.0393701
SPR at 3rd Ave	1320	91%	9	1	0	0	0	0	0	10	11	1	0	0.0393701
Broomfield 3207	1200	100%	4	0	0	0	0	0	0	4	4	0	0	0.0393701
Gunbarrel	1110	80%	6	2	0	0	0	0	0	8	10	2	0	0.0393701
Louisville Rec Ctr	1100	100%	1	0	0	0	0	0	0	1	1	0	0	0.0393701
Heritage Square	1060	100%	1	0	0	0	0	0	0	1	1	0	0	0.0393701
Jeffco Fairgrounds	1050	67%	1	1	0	0	0	0	0	2	3	1	0	0.0393701
Lena @ U.S. Hwy 6	1040	100%	8	0	0	0	0	0	0	8	8	0	0	0.0393701
NREL/S. Table Mtn.	1030	100%	2	0	0	0	0	0	0	2	2	0	0	0.0393701
Denver West	1010	100%	4	0	0	0	0	0	0	4	4	0	0	0.0393701
Maple Grove Resv.	1000	100%	9	0	0	0	0	0	0	9	9	0	0	0.0393701
Pump Sta 3	970	100%	1	0	0	0	0	0	0	1	1	0	0	0.0393701
Toll Gate @ 6th	700	100%	6	0	0	0	0	0	0	6	6	0	0	0.0393701
Iliff Pond	650	100%	6	0	0	0	0	0	0	6	6	0	0	0.0393701
Goldsmith @ Eastman	640	80%	3	1	0	0	0	0	0	4	5	1	0	0.0393701
Temple Pond at DTC	630	100%	11	0	0	0	0	0	0	11	11	0	0	0.0393701
Quincy/Highline	620	100%	8	0	0	0	0	0	0	8	8	0	0	0.0393701
Harvard @ Jackson	610	100%	14	0	0	0	0	0	0	14	14	0	0	0.0393701
Harvard Gulch Park	600	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701
Parker/Mississippi	540	100%	9	0	0	0	0	0	0	9	9	0	0	0.0393701
Fire Station #19	530	100%	6	0	0	0	0	0	0	6	6	0	0	0.0393701
Van Bibber @ Hwy 93	330	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701
Upper Leyden	220	100%	2	0	0	0	0	0	0	2	2	0	0	0.0393701
Leyden Reservoir	200	50%	1	0	1	0	0	0	0	2	4	2	0	0.0393701
West Woods	120	100%	7	0	0	0	0	0	0	7	7	0	0	0.0393701

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