

March 27, 2008

Mr. Kevin Stewart
Project Manager
Urban Drainage and Flood Control District
2480 West 26th Ave., Suite 156B
Denver, CO 80211

Subject: 2008 Spring Start-Up Activities for Stations in Douglas County

Dear Kevin,

Enclosed please find our field maintenance records for the spring start-up work performed by Water & Earth Technology, Inc. during the month of March. The following stations are active and fully functional for the upcoming flood season:

- Highlands Ranch WTP Weather (2710)
- Salisbury Park Weather (2730)
- Castle Rock Weather (2750)
- Pine Cliff Road (2810)
- Haskins Gulch (2820)
- Sulphur Gulch (2840)
- West Cherry Head (2920)
- Spring Valley Road (2930)
- Willow Creek (2940)
- Tomah Road (2990)

The radio repeater at West Creek is functional but we were not able to conduct a site visit due to the amount of snow that still exists in the Rampart Range. We plan to visit the West Creek repeater as soon as possible in April.

In early April, we plan to visit the base station at Skyview Weather to check the radio equipment and base station software.

Two pressure transducers were re-calibrated. The new coefficients are summarized below.

Table 1. Spring 2008 Pressure Transducer Calibration Results

Location	Station ID	Sensor ID	Slope	Offset	Std Error
Sulphur Gulch	2840	2843	0.0103	-0.0479	0.0284
Pine Cliff Road	2810	2813	0.0089	-0.1039	0.0412

The USGS water level sensor at Haskins Gulch is no longer connected to the ALERT transmitter. This site currently only reports rainfall and battery. The District should consider installing a new pressure transducer at this location to continue the reporting of water level information. Please let me know if you require a cost estimate to install a District-owned pressure transducer at this location.

Tipping bucket rain gages were calibrated and the results are summarized below.

Table 2. Spring 2008 Rain Gage Calibration Results

Location	Sensor ID	Calibration Results
Highlands Ranch WTP Weather	2710	-1.7 %
Salisbury Park Weather	2730	-3.9 %
Castle Rock Weather	2750	+2.8%
Pine Cliff Road	2810	Calibrated by OneRain prior to installation
Haskins Gulch	2820	Could not enter the building, need key
Sulphur Gulch	2840	Calibrated by OneRain prior to installation
West Cherry Head	2920	-4.7 %
Spring Valley Road	2930	-2.2 %
Willow Creek	2940	-2.5 %
Tomah Road	2990	-3.8 %

We plan to calibrate the rain gage at Haskins Gulch during the April site visit. We will contact Greg O'Neill to obtain a key for the building prior to the next site visit.

Ambient weather conditions were noted at each weather station and are summarized below. Air temperature and relative humidity were measured using a sling psychrometer.

Table 3. Spring 2008 Ambient Weather Conditions

Location	Date/Time	Wet Bulb Temp	Dry Bulb Temp	Relative Humidity
Highlands Ranch WTP Weather	3/19 8:27 am	38 F	50 F	27 %
Salisbury Park Weather	3/19 10:14 am	41 F	55 F	24 %
Castle Rock Weather	3/19 2:43 pm	42 F	61 F	11 %

We appreciate the opportunity to work with UDFCD and please feel to call me any time you have questions.

Regards,



Markus Ritsch, P.E.
Vice-President
Principal Engineer/Hydrologist

Enclosures (Maintenance Records #7 through #17/Station Inventory)

MAINTENANCE RECORD
Douglas County/UDFCD
Water & Earth Technology, Inc.

Service Log			
Site Name:	Highlands Ranch WT	Date:	19-Mar-08
Service Type:	Start Up	Technician:	RJN/RTW
		Time:	8:27
		Status:	OK

Configuration Changes	
Part #	Location
TM-2318	2710
TB-S9807	2710
BY-WET01	2710

Transducer Calibration			
Sensor ID	Slope	Calib Offset	Std Error

Tx Maintenance				
Part #	Ref V	Freq Err	Deviation	ROM Batt

Settings and Performance	
Switches:	
Jumpers:	
Eprom:	
Tx Freq:	169.525
Rx Freq:	
Fwd Power:	4.1
Rev Power:	0.01
SWR	1.11

Test Transmission				
Port	Time	Count	Measure	Predicted

Battery Tests		
Battery #	V Quiescent	V Load
BY-WET01	13.65	13.13

Problem

- Action Taken:**
- early morning, clear, sunny
 - clean bucket and funnel
 - clean solar panel
 - calibrate bucket w/948ml - 12 tips + 16ml = -1.7%
 - wind dir 150
 - psychrometer Wb 38, Db 50 = RH 27%, DP < 33
 - read 27% RH from station
 - Battery Lifetester score 72 - Bad
 - Solar w/o 13.81V, w/l 3.21V, 0.058A, Dark 0.00A
 - Regulator in 20.16V, out 13.82V

Site Notes:

Follow-Up

MAINTENANCE RECORD
Douglas County/UDFCD
Water & Earth Technology, Inc.

Service Log

Site Name: **Salisbury Park** Date: **19-Mar-08** Time: **10:14**
 Service Type: **Start Up** Technician: **RJN/RTW** Status: **OK**

Configuration Changes

Part #	Location
TM-2317	2730
TB-S9805	2730
BY-WET02	2730

Transducer Calibration

Sensor ID	Slope	Calib Offset	Std Error

Tx Maintenance

Part #	Ref V	Freq Err	Deviation	ROM Batt

Settings and Performance

Switches:
 Jumpers:
 Eprom:
 Tx Freq: **169.525**
 Rx Freq:
 Fwd Power: **4.9**
 Rev Power: **0.01**
 SWR **1.1**

Test Transmission

Port	Time	Count	Measure	Predicted

Battery Tests

Battery #	V Quiescent	V Load
BY-WET02	11.92	11.18

Problem

Action Taken: - mid morning, calm, sunny
 - clean bucket and funnel
 - clean solar panel
 - calibrate bucket w/ 948ml - 12 tips + 37ml = -3.9%
 - psychrometer Wb 41, Db 55, RH 23.5%, Dp < 33
 - read 24% RH from station
 - wind direction 255
 - battery Lifetester score 24 - Bad
 - solar w/o 14.24V, w/l 3.39V, 0.061A, Dark 0.00A
 - regulator in 12.76V, out 12.05V

Site Notes:**Follow-Up**

MAINTENANCE RECORD
Douglas County/UDFCD
Water & Earth Technology, Inc.

Service Log

Site Name: **Sulphur Gulch** Date: **19-Mar-08** Time: **11:38**
 Service Type: **Start Up** Technician: **RJN/RTW** Status: **OK**

Configuration Changes

Part #	Location
TM-4398	2840
TB-S0204	2840
BY-WET03	2840

Transducer Calibration

Sensor ID	Slope	Calib Offset	Std Error
2843	0.010	-0.0479	0.0284

Tx Maintenance

Part #	Ref V	Freq Err	Deviation	ROM Batt

Settings and Performance

Switches:
 Jumpers:
 Eprom:
 Tx Freq: **169.525**
 Rx Freq:
 Fwd Power: **5.5**
 Rev Power: **0.01**
 SWR **1.09**

Test Transmission

Port	Time	Count	Measure	Predicted
2843	12:01	1977	20.33 ftH2	0
2843	12:02	1493	15.54 ftH2	0
2843	12:03	1061	11.23 ftH2	0
2843	12:05	773	8.22 ftH2	0
2843	12:06	470	5.12 ftH2	0
2843	12:07	181	2.35 ftH2	0
2843	12:08	53	1.07 ftH2	0
2843	12:09	0	0.00 ftH2	0
2843	10:57	7	0.00 ftH2	-36
2843	10:58	2047	21.00 ftH2	2044
2843	10:58	1020	10.50 ftH2	1004

Battery Tests

Battery #	V Quiescent	V Load
BY-WET03	12.47	12.27

Problem

Action Taken: - installed bucket calibrated by OneRain
 - no battery in transmitter, installed a WET battery
 - battery Lifetester score 238 - Good
 - flush riser pipe with several buckets of water
 {Auto Entry: Calibrated sensor 2843 by linear regression. Modified calibration data. New calibration [Slope(0.0103), Calibration Offset(-0.0479), Std Error(0.0284), Calibration Date(3/24/2008 10:59:13 AM)]}.

Site Notes: - no solar panel

Follow-Up - no reports at base, may require a follow-up trip to troubleshoot

MAINTENANCE RECORD
Douglas County/UDFCD
Water & Earth Technology, Inc.

Service Log			
Site Name:	Castle Rock	Date:	19-Mar-08
Service Type:	Start Up	Technician:	RJN/RTW
		Time:	14:43
		Status:	OK

Configuration Changes	
Part #	Location
TM-2240	2750
TB-S9808	2750
BY-81105	2750

Transducer Calibration			
Sensor ID	Slope	Calib Offset	Std Error

Tx Maintenance				
Part #	Ref V	Freq Err	Deviation	ROM Batt

Settings and Performance	
Switches:	
Jumpers:	
Eprom:	
Tx Freq:	169.525
Rx Freq:	
Fwd Power:	8.1
Rev Power:	0.01
SWR	1.08

Test Transmission				
Port	Time	Count	Measure	Predicted

Battery Tests		
Battery #	V Quiescent	V Load
BY-81105	12.25	11.89

Problem

- Action Taken:**
- clean bucket and funnel
 - clean solar panel
 - wind dir 0
 - calibrate bucket w/ 948ml - 13 tips + 27ml = +2.8%
 - psychrometer Wb 42, Db 61, RH 10.5%, Dp < 33
 - read 18% from station
 - battery Lifetester score 70 - Bad
 - solar w/o 14.24V, w/l 2.98V, 3mA, Dark 0A
 - regulator in 13.05 V, out 12.37V

Site Notes:

Follow-Up

MAINTENANCE RECORD
Douglas County/UDFCD
Water & Earth Technology, Inc.

Service Log			
Site Name:	Pine Cliff Road	Date:	19-Mar-08
Service Type:	Start Up	Technician:	RJN/RTW
		Time:	16:39
		Status:	OK

Configuration Changes	
Part #	Location
TM-4195	2810
BY-WET04	2810

Transducer Calibration			
Sensor ID	Slope	Calib Offset	Std Error
2813	0.009	-0.1039	0.0412

Tx Maintenance				
Part #	Ref V	Freq Err	Deviation	ROM Batt

Settings and Performance	
Switches:	
Jumpers:	
Eprom:	
Tx Freq:	169.525
Rx Freq:	
Fwd Power:	28.0
Rev Power:	0.05
SWR	1.09

Test Transmission				
Port	Time	Count	Measure	Predicted
2813	17:12	2047	19.95 ftH2	0
2813	17:13	1608	14.28 ftH2	0
2813	17:14	1116	9.89 ftH2	0
2813	17:15	717	6.31 ftH2	0
2813	17:16	379	3.28 ftH2	0
2813	17:17	211	1.76 ftH2	0
2813	17:18	9	0.00 ftH2	0

Battery Tests		
Battery #	V Quiescent	V Load
BY-WET04	12.31	11.90

Problem

- Action Taken:**
- cleaned bucket mounting top
 - replaced silicon at PT conduit entry at standpipe
 - installed bucket calibrated by OneRain
 - battery Lifetester score 249 - Best

{Auto Entry: Calibrated sensor 2813 by linear regression. Modified calibration data. New calibration [Slope(0.0089), Calibration Offset(-0.1039), Std Error(0.0412), Calibration Date(3/19/2008 5:18:40 PM)]}.

Site Notes:

- Follow-Up**
- flushed riser pipe with several buckets of water but could not find PT intake line in the stream??
 - locking mechanism missing on bucket top

MAINTENANCE RECORD
Douglas County/UDFCD
Water & Earth Technology, Inc.

Service Log			
Site Name:	Tomah Road	Date:	19-Mar-08
Service Type:	Start Up	Technician:	RJN/RTW
		Time:	18:01
		Status:	OK

Configuration Changes	
Part #	Location

Transducer Calibration			
Sensor ID	Slope	Calib Offset	Std Error

Tx Maintenance				
Part #	Ref V	Freq Err	Deviation	ROM Batt

Settings and Performance	
Switches:	
Jumpers:	
Eprom:	
Tx Freq:	171.100
Rx Freq:	
Fwd Power:	3.9
Rev Power:	0.10
SWR	1.38

Test Transmission				
Port	Time	Count	Measure	Predicted

Battery Tests		
Battery #	V Quiescent	V Load
BY-03	12.78	12.55

Problem

- Action Taken:**
- cleaned bucket
 - fixed military plug for rain gage
 - fixed spring on bucket platform
 - calibrated bucket w/ 948ml - 12 tips + 36ml = -3.8%
 - had to init unit because of strange clock and battery readings
 - battery Lifetester score 220 - Good

Site Notes:

Follow-Up

MAINTENANCE RECORD
Douglas County/UDFCD
Water & Earth Technology, Inc.

Service Log			
Site Name:	Haskins Gulch Conf	Date:	20-Mar-08
Service Type:	Start Up	Technician:	RJN/RTW
		Time:	8:30
		Status:	OK

Configuration Changes	
Part #	Location

Transducer Calibration			
Sensor ID	Slope	Calib Offset	Std Error

Tx Maintenance				
Part #	Ref V	Freq Err	Deviation	ROM Batt

Settings and Performance
Switches:
Jumpers:
Eprom:
Tx Freq:
Rx Freq:
Fwd Power:
Rev Power:
SWR

Test Transmission				
Port	Time	Count	Measure	Predicted

Battery Tests		
Battery #	V Quiescent	V Load

Problem

Action Taken: - need key to enter the transmitter enclosure
 - cleaned stage intake

Site Notes: Contact Greg O'Neil from the USGS to gain entry/keys (303) 236-4882 x284

Follow-Up - get key(s) and think about re-establishing the ALERT stream gage at the next maintenance round

MAINTENANCE RECORD
Douglas County/UDFCD
Water & Earth Technology, Inc.

Service Log			
Site Name:	West Cherry Head	Date:	20-Mar-08
Service Type:	Start Up	Technician:	RJN/RTW
		Time:	9:45
		Status:	OK

Configuration Changes	
Part #	Location

Transducer Calibration			
Sensor ID	Slope	Calib Offset	Std Error

Tx Maintenance				
Part #	Ref V	Freq Err	Deviation	ROM Batt

Settings and Performance	
Switches:	
Jumpers:	
Eprom:	
Tx Freq:	171.100
Rx Freq:	
Fwd Power:	3.8
Rev Power:	0.01
SWR	1.11

Test Transmission				
Port	Time	Count	Measure	Predicted

Battery Tests		
Battery #	V Quiescent	V Load
BY-04	12.65	12.44

Problem

- Action Taken:**
- cleaned bucket and funnel
 - calibrated bucket w/ 948ml - 12 tips + 45ml = -4.7%
 - adjusted bucket screws up
 - recalibrate - 12 tips + 3ml = -0.3%
 - battery life tester score 225 - Good

Site Notes:

Follow-Up

MAINTENANCE RECORD
Douglas County/UDFCD
Water & Earth Technology, Inc.

Service Log			
Site Name:	Spring Valley Road	Date:	20-Mar-08
Service Type:	Start Up	Technician:	RJN/RTW
		Time:	10:51
		Status:	OK

Configuration Changes	
Part #	Location

Transducer Calibration			
Sensor ID	Slope	Calib Offset	Std Error

Tx Maintenance				
Part #	Ref V	Freq Err	Deviation	ROM Batt

Settings and Performance	
Switches:	
Jumpers:	
Eprom:	
Tx Freq:	171.100
Rx Freq:	
Fwd Power:	5.3
Rev Power:	0.10
SWR	1.32

Test Transmission				
Port	Time	Count	Measure	Predicted

Battery Tests		
Battery #	V Quiescent	V Load
BY-02	13.85	13.58

Problem

- Action Taken:**
- partly cloudy
 - clean bucket and funnel
 - clean solar panel
 - calibrate bucket w/ 948ml - 12 tips + 21ml = -2.2%
 - battery lifetester score 248 - Best
 - solar w/o 14.03V, w/l 12.2V, 15mA, Dark 0A
 - regulator in 21.52V, out 14.01

Site Notes:

Follow-Up

MAINTENANCE RECORD
Douglas County/UDFCD
Water & Earth Technology, Inc.

Service Log			
Site Name:	Willow Creek	Date:	20-Mar-08
Service Type:	Start Up	Technician:	RJN/RTW
		Time:	11:50
		Status:	OK

Configuration Changes	
Part #	Location

Transducer Calibration			
Sensor ID	Slope	Calib Offset	Std Error

Tx Maintenance				
Part #	Ref V	Freq Err	Deviation	ROM Batt

Settings and Performance	
Switches:	
Jumpers:	
Eprom:	
Tx Freq:	171.100
Rx Freq:	
Fwd Power:	4.5
Rev Power:	0.01
SWR	1.1

Test Transmission				
Port	Time	Count	Measure	Predicted

Battery Tests		
Battery #	V Quiescent	V Load
BY-01	13.80	13.36

Problem

- Action Taken:**
- windy, partly cloudy
 - cleaned bucket and funnel
 - cleaned solar panel
 - calibrated bucket w/ 948ml - 12 tips + 24ml = -2.5%
 - battery lifetester score - 248 - Best
 - solar w/o 13.86V, w/l 13.74V, 15mA, Dark 0A
 - regulator in 21.3V, out 13.81V

Site Notes:

Follow-Up

MAINTENANCE RECORD
Douglas County/UDFCD
Water & Earth Technology, Inc.

Service Log			
Site Name:	Sulphur Gulch	Date:	25-Mar-08
Service Type:	Service Call	Technician:	MLR/RJN
		Time:	10:53
		Status:	OK

Configuration Changes	
Part #	Location

Transducer Calibration			
Sensor ID	Slope	Calib Offset	Std Error

Tx Maintenance				
Part #	Ref V	Freq Err	Deviation	ROM Batt

Settings and Performance
Switches:
Jumpers:
Eprom:
Tx Freq:
Rx Freq:
Fwd Power:
Rev Power:
SWR

Test Transmission				
Port	Time	Count	Measure	Predicted

Battery Tests		
Battery #	V Quiescent	V Load

Problem

- Action Taken:**
- setup test station from service truck parked at the park&ride at Surrey Ridge off Interstate 25
 - setup mock 2840 Site with 4.25W forward and 0.01 Reflected on 169.525 MHz
 - Elevation 6410 at Surrey Ridge
 - Repeater did not pass 2840 ID
 - Repeater did pass 2825 from this location
 - Move to the Sulphur Gulch location and repeat the same test procedure, Same story at Sulphur Gulch.....
 - Markus Ritsch talked with Kevin Stewart
 - Leave station as is

Site Notes:

- Follow-Up**
- OneRain to check repeater pass list at Blue Mountain which handles the radio traffic for Sulphur Gulch

INVENTORY BY SITE
Douglas County/UDFCD
Water & Earth Technology, Inc.

Site	Type	Part #	Manufacturer	Model	Serial #	Notes
2710 Highlands Ranch WTP	Battery	BY-WET01				12V-12Ah
	Tipping Bucket	TB-S9807	Hydrolynx	5054TS	S9807	1mm
	Transmitter	TM-2318	Hydrolynx	5096	2318	Ritron 15033
2730 Salisbury Park	Battery	BY-WET02				12V-12Ah
	Tipping Bucket	TB-S9805	Hydrolynx	5054TS	S9805	1mm
	Transmitter	TM-2317	Hydrolynx	5096	2317	Ritron 15034
2750 Castle Rock	Battery	BY-81105			81105	12V-12Ah
	Tipping Bucket	TB-S9808	Hydrolynx	5054TS	S9808	1mm
	Transmitter	TM-2240	Hydrolynx	5096	2240	Repco radio 45051T

Site	Type	Part #	Manufacturer	Model	Serial #	Notes
2810 Pine Cliff Road	Battery	BY-WET04				12V-12Ah
	Transmitter	TM-4195	High Sierra	3206	4195	Johnson radio w/ amp
2840 Sulphur Gulch	Battery	BY-WET03				12V-12Ah
	Tipping Bucket	TB-S0204	Hydrolynx	5054TS	S0204	1mm
	Transmitter	TM-4398	High Sierra	3206	4398	Ritron 15930
2920 West Cherry Head	Battery	BY-04	Universal Battery	UB12120	BY-04	12V-12Ah
	Tipping Bucket	TB-04	Hydrolynx	5054TS	TB-04	1mm
	Transmitter	TM-2871	Hydrolynx	5096-54	2871	Originally Hayman Gage 5920 Maxon SD125 # 2553

Site	Type	Part #	Manufacturer	Model	Serial #	Notes
2930 Spring Valley Road	Battery	BY-02	Universal Battery	UB12120	BY-02	12V-12Ah
	Solar Panel	SP-0708-02	ALPS	AP-NB5W	0708-02	300mA 5W Panel Pakton Regulator SN 59375
	Tipping Bucket	TB-02	Hydrolynx	5054TS	TB-01	1mm
	Transmitter	TM-3901	Hydrolynx	5096-90	3901	Midland SD125 5W Radio SN 4971
2940 Willow Creek	Battery	BY-01	Universal Battery	UB12120	BY-01	12V-12Ah
	Solar Panel	SP-0708-01	ALPS	AP-NB5W	0708-01	300mA 5W Panel Pakton Regulator SN 59372
	Tipping Bucket	TB-01	Hydrolynx	5054TS	TB-01	1mm
	Transmitter	TM-3900	Hydrolynx	5096-90	3900	Midland SD125 5W Radio SN 5031

Site	Type	Part #	Manufacturer	Model	Serial #	Notes
2990	Tomah Road					
	Battery	BY-03	Universal Battery	UB12120	BY-03	12V-12Ah
	Tipping Bucket	TB-03	Hydrolynx	5054TS	TB-03	1mm
	Transmitter	TM-2644	Hydrolynx	5096-81	2644	Originally Hayman Gage 5750 Radio w/ Freq Selector