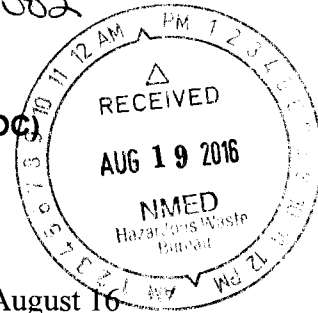




ENTERED

HWB 15-002

DEPARTMENT OF THE AIR FORCE  
27TH SPECIAL OPERATIONS CIVIL ENGINEER SQUADRON (AFSOC)  
CANNON AIR FORCE BASE NEW MEXICO



18 August 16

Sheen Thomas Kottkamp  
Environmental Program Manager/Scientist  
27 SOCES/CEIER  
402 S. Chindit Blvd.  
Cannon AFB NM 88103-5003

Mr. Gabriel Acevedo  
Environmental Scientist & Specialist-Operational  
New Mexico Environment Department  
Hazardous Waste Bureau  
2905 Rodeo Park Drive East, Bldg. 1  
Santa Fe NM 87501

Dear Mr. Acevedo

Cannon Air Force Base is pleased to provide the "*Responses to NMED Comments, Technical Memorandum – Proposed Well Rehabilitation Activities 16 August 16*" and supportive documentation as requested by NMED in the 19 July 2016 e-mail correspondence.

Cannon AFB appreciates the valued working relationship established with you and your department. If you have further comments or questions pertaining to the referenced documentation, please contact Sheen T. Kottkamp, [sheen.kottkamp.ctr@us.af.mil](mailto:sheen.kottkamp.ctr@us.af.mil) (575) 904-6743 or Brian Renaghan, [brian.renaghan@us.af.mil](mailto:brian.renaghan@us.af.mil), (210) 395-0710.

Sincerely

Sheen Thomas Kottkamp

Attachments:

Responses to NMED Comments, Technical Memorandum – Proposed Well Rehabilitation Activities 16 August 16

AIR COMMANDOS

**RESPONSES TO NMED COMMENTS**  
**TECHNICAL MEMORANDUM - PROPOSED WELL REHABILITATION ACTIVITIES**  
**DATED 07 JULY 2016**  
**CANNON AFB, NEW MEXICO**

Comments by Gabriel Acevedo, dated 19 July 2016.

**Comment 1.** In the Table 1 well completion information it looks like the screen was adjusted upwards to compensate for the sump. However, I did notice a possible discrepancy in sump information given for MW-F and MW-H. An example of this is MW-F where the boring log notes a T.D. at 375'. The well screen interval is 355' to 370'. Filter sand is noted from 350 to 375'. The well completion log (Figure 2) I have does not note a sump. Could the extra 5 feet be a result of over drilling the boring? Also, there is only 15 foot of screen in the well completion log (Figure 4) for MW-H. Can you double check this information for MW-F, MW-H, MW-Na, MW-Oa, and MW-Pa?

**Response:** Remarks in the right hand column of the drilling logs for MW-F and MW-H indicate that a 5 foot sediment trap was located beneath the screen. Therefore, a 5 foot sump was included on the bottom of the well in the well construction information. Monitoring well identification reports for MW-Na, MW-Oa, and MW-Pa indicate a five foot difference between the bottom of the screened interval and the bottom of the well casing. Therefore, a 5 foot sump was included on the bottom of the well in the well construction information. The monitoring well identification reports for MW-Na, MW-Oa, and MW-Pa are attached for your review.

**Comment 2.** Can you recheck the screen interval information where it appears to have been adjusted upwards to compensate for the sump for all wells where this new information has been incorporated? As I see it at this time the sump would only result in a loss of screen at the bottom of the well where screen was previously noted or the extension of the sump in the direction of the well T.D., not an adjustment of the top of screen upwards. Can you clarify this?

**Response:** The total depth of the boring was considered separately from the total depth of the well. The total depth of the boring was recorded from information provided in boring logs and monitoring well identification reports. As the casing of the wells at Cannon AFB extend above the ground surface (i.e. "stick-up wells") the total depth of the casing has been impacted by the repair activities completed over time to the surface portions of the well. The total depth of the well had varied in multiple historical reports presented to URS. Based on this inconsistency the wells were resurveyed in 2014. The survey included re-measuring the total depth of the wells and the elevation of the top of casing and ground surface. All measurements reported after July 2014 were based upon the 2014 re-survey data.

Based on the repair activities, the elevation of the well components could not be determined from the historical data. Therefore, total depth of the well was calculated by subtracting the total depth of the well (as measured in 2014) from the top of casing elevation. The length of the screen/sumps was not measured in 2014. These measurements were

calculated by reviewing the historical data available. These measurements were recalculated for the tech memo utilizing boring logs and monitoring well identification reports. While the ground surface and top of casing elevations listed in the reports were deemed to be incorrect, the elevations were utilized to determine the total length of the screens and sumps. The reasoning is that the elevation measurements would have been utilized as the starting point for calculating the elevation of the components through subtraction based on the length of each section of the well. Therefore, while the elevations are no longer correct, they would be accurate for use in the calculation of the length of the screen and sumps. The bottom of the sump (if present) was then identified as the bottom of the well as measured in 2014. The depths of the well sump and screen were then utilized to determine the well construction details presented in the table.

For example, the total depth of well casing at MW-S was listed as 3898.83. The depth of the bottom of the screen was listed as 3939.81. The top of the screen was listed as 3979.83. These numbers were utilized to calculate the length of the screen ( $3979.83 - 3939.81 = 40.02$ ). As screens generally come in increments of 5 to 10 feet, the total length of the screen was listed as 40 feet. The length of the sump was calculated by subtracting the bottom of the screen from the bottom of the well casing  $3939.81 - 3898.83 = 40.98$ . As casing sections generally come in increments of 5 to 10 feet, the total length of the screen was listed as 40 feet. The bottom of the sump was assumed to be equal with the bottom of MW-S as measured in 2014 (366.8 feet bgs). Therefore the bottom of the screen was identified as being 40 feet above the bottom of the well sump at 326.8 feet bgs. The top of the screen was identified as being 40 feet above the bottom of the screen at 286.8 feet bgs.

Following NMED approval of the information provided in the technical memorandum, new well tags will be attached to the exterior riser covers of the wells to reflect the updated construction information.

**Comment 3.** Can you provide the well completion record information for monitoring wells MW-Na, Oa, and Pa? These records were not provided in the November 2015 Biennial Groundwater Monitoring Report (Appendix F).

**Response:** Boring logs were not identified for these wells. Boring logs for these wells should have been provided directly to NMED by the USGS at the time the wells were installed. These records are not contained in available Cannon AFB records. The monitoring well identification reports for these wells are attached for your review.

**Comment 4.** I am also seeing a 15 foot discrepancy between the top of the screen for MW-V, W, and X between Table 1 and 2. I concur with the 5 foot sump on these wells. Also, the well record and November 2015 Groundwater Monitoring Report sample records for MW-V and MW-W indicate a well screen length of 60 feet. Can you double check the Table 1 information provided or clarify this for me?

**Response:** The total lengths of the screens for MW-V and MW-W have been updated to reflect 60 feet of screened interval. The data in the tables has been revised to incorporate changes identified in these RTCs and eliminate any and all discrepancies between the two tables.

**Comment 5.** It looks like there are discrepancies between the monitor well records and Table 1 well completion information for some of the wells. A good example of this is MW-A. The top of the screen in the well construction log is documented as 328' and the bottom is noted as 343'. Is this a result of the new top of casing and/or survey information or any other new information collected?

**Response:** The well construction elevations were updated based on revised data. Please see the response to Comment 2 for an explanation of how the information presented in Table 1 was calculated.

**Comment 6.** Do you have any information in regards to surrounding irrigation water wells, any new calculations for average drop in water table over time, and area irrigation well pumping conditions that may affect any new monitoring wells at SWMU 113? Also, do you have general information on where the top of the Dockum begins in the area?

**Response:** Historical information regarding irrigation wells and wells at Cannon AFB can be reviewed in the following United States Geological Survey (USGS) publication:

**Ground-Water Hydrology and Water Quality of the Southern High Plains Aquifer, Cannon Air Force Base, Curry County, New Mexico, 1994–2005. Scientific Investigations Report 2006-5280, US Department of the Interior, United States Geological Survey, in cooperation with the United States Air Force, Cannon Air Force Base.**

Additional information regarding groundwater decline at Cannon AFB is provided by the link (<https://pubs.er.usgs.gov/publication/sim3352>) to the following document *Potentiometric surfaces, summer 2013 and winter 2015, and select hydrographs for the Southern High Plains aquifer, Cannon Air Force Base, Curry County, New Mexico.*

We have no other information concerning irrigation wells beyond this USGS report. Information provided by USGS representatives indicated the purpose of MW-S, MW-T, and MW-U was to determine the extent of the Ogallala aquifer. The boring logs from these wells were not available for review. While data is not available, the Dockum Group (which consists of the Chinle, Redonda, and Santa Rosa Sandstone Formations) is anticipated to underlay the Ogallala near the depth of these borings (approximately 365 feet bgs).

**Comment 7.** Beyond the well record, was there any other investigation of the 40 foot sumps on MW-S, T, and U?

**Response:** An interview was completed via telephone with USGS employee Frederick Gebhardt, who oversaw several well installations for the USGS at Cannon AFB. The wells were installed with the sumps with the intention of perforating the sumps at a later date when the water levels had dropped below the bottom of the screen. The wells were never perforated and contractors contacted regarding this process have indicated it is not practical to accomplish without affecting the integrity of the well if it is possible at all. Therefore, it does not appear to be a viable option for these wells.

**Comment 8.** Can you take a look at the available well information and see if the pumps are set within the screened intervals? It is looking like some of the pumps are not set within the screened interval or

are set just barely below the screen. I am seeing this for monitoring wells MW-B, C, D, E, F, G. There is no data for MW-Na. Having the pumps set within the screen interval is key to low flow sampling properly. I understand the priority is to get the well situation at SWMU 113 resolved. However, If this is the case it will need to be considered for the wells that are scheduled for sampling in the future. Is there any recent data for this if you have already addressed this?

**Response:** Based on the data previously provided in historical groundwater monitoring reports, MW-S, MW-T, and MW-U were not sampled from within the screened interval due to the confusion regarding the depth of the screen. The approved groundwater sampling addendum indicates that the pumps will be set within the screened interval of the respective wells during the purging and collection of the groundwater samples. This protocol was followed for the 2016 sampling event as indicated in the attached sample collection field sheets. All future sampling events will utilize the well construction information provided in this document to ensure the groundwater samples are collected from within the screened intervals of the wells.

# **TECHNICAL MEMORANDUM**

## **Proposed Well Rehabilitation Activities**

**To:** Mr. Brian Renaghan, Contracting Officer's Representative, AFCEC/CZRX  
Mr. Sheen Kottkamp, Environmental Program Manager/Scientist, AGEISS  
Inc.

**From:** FPM Remediations Inc.  
URS Group, Inc.

**Date:** 16 August 2016

**Subject:** Well Construction Details for Wells MW-S, MW-T, and MW-U at Cannon  
AFB, New Mexico  
New Mexico – Arizona Group Performance Based Remediation (PBR)  
Cannon AFB, New Mexico  
Contract No. FA8903-13-C-0008  
Site: LF005  
SubCLIN(s) 0007AB

---

URS attempted to sample eleven monitoring wells at Cannon AFB using low-flow purging and sampling methods as part of a biennial groundwater sampling effort. Three wells (MW-S, MW-T, and MW-U) could not be sampled due to excessive drawdown and the inability to achieve stable water levels. Based on discussions between AFCEC and FPM/URS, the decision was made to complete well rehabilitation using scrub and bail methods to see if well performance could be restored such that these three wells could be sampled.

During development of a scope of work to provide to drilling subcontractors for well rehabilitation services, FPM/URS obtained monitoring well reports that indicated monitoring wells MW-S, MW-T, and MW-U were installed with 40-foot long sumps beneath the screens. FPM/URS were also able to determine the wells were installed by the by the United States Geological Survey (USGS).

The USGS monitoring well reports were signed by a USGS employee (Mr. Frederick Gebhardt). FPM/URS contacted Mr. Gebhardt and confirmed these three wells were constructed with 40-foot long sumps. Previous groundwater monitoring reports provided to FPM/URS indicated these wells were installed with the screens at the bottom of wells.

Mr. Gebhardt stated the wells were constructed in this manner due to declining groundwater levels (two to three feet per year) and the New Mexico Environment Department not wanting excessively long well screens. The USGS received permission to construct the wells with the sumps with the intent that the sumps would be perforated after the water levels declined below the bottom of the screened intervals.

This technical memorandum presents a brief summary of the well designs and impacts on previous groundwater sampling efforts at wells MW-S, MW-T, and MW-U. The locations of all the monitoring wells are shown on **Figure 1**.

---

**Technical Memorandum**

**Proposed Monitoring Well Rehabilitation NM-AZ Group PBR**

**NM-AZ-Group PBR – Cannon AFB**

**FA8903-13-C-0008**

Q:\23446539\Tech Memos\Well Construction Details\Ver 2\Tech Memo\_Monitoring Wells\_August 2016.docx

## 1.0 WELL CONSTRUCTION DETAILS

As stated above, wells MW-S, MW-T and MW-U were constructed with 40-foot sumps below the screens. This indicates these wells were installed as water table monitoring wells. The request by NMED to install water table wells would be fulfilled by replacing these wells.

Due to conflicting information in previous reports, FPM/URS searched all available historical records on well construction details. Several USGS groundwater monitoring reports have apparently been recently uploaded to the AFCEC online administrative record (AR). No USGS reports were found for Cannon AFB on the AR in a search completed in the fall of 2015 or during earlier searches.

Historical boring logs and well construction diagrams were compiled when located. We were unable to locate a complete set of borings or well construction diagrams for all wells. Copies of the well construction details and boring logs we could locate are included in **Attachment 1**.

**Table 1** summarizes well construction details for all groundwater monitoring wells installed at Cannon AFB. As can be seen in **Table 1**, several wells have sumps of varying lengths. The sumps at wells MW-S, MW-T and MW-U are the only ones that appear to have impacted groundwater sampling efforts.

## 2.0 PREVIOUS WATER LEVEL MEASUREMENTS AND ANALYTICAL RESULTS

A review of water levels measured in 2014 (FPM/URS 2016) show water levels from MW-S, MW-T, and MW-U were similar to water levels in adjacent wells MW-C, MW-D and MW-B. This indicates the groundwater level dropped beneath the screened intervals after 2014. The May 2016 water level in well MW-U is similar to the water level in well MW-B. However, when MW-U was purged in May 2016, it drew down to 350 feet below top of casing and did not recover. This indicates the water level in 2014 was very close to the bottom of the screen in 2014 but went dry sometime after that sampling event. The exact depth of the screened interval is not clear from previous records due well maintenance activities and other discrepancies noted between historical reports. Water levels from 2014 through April 2016 are shown on **Table 2**. Sample depths for the low flow groundwater samples collected in 2016 are included in the sample collection field sheets in **Attachment 2**.

Based on the previous groundwater monitoring reports, groundwater samples for wells MW-S, MW-T, and MW-U were likely collected from within the sumps from the 2012 and 2014 sampling events. The samples would have been collected from stagnant water in the sump and the analytical results may not have been reflective of formation conditions at the time of sampling. This is based on reports going back to 2008 that indicate the well screen at MW-T had a 40-foot long screen but contains no mention of a sump.

Water level measurements from the 2012 groundwater sampling event (Bhate and Trinity 2012) indicate the water levels in MW-S, MW-T, and MW-U were within a foot of the bottom of the screens in these wells. Water level measurements for the 2014 groundwater sampling event

(FPM/URS 2014) indicate water levels were several feet below the bottom of the screens at the time water levels were measured. However, the pump for both events were likely set near the middle of the sump since the 40-foot screen was presumed to be at the bottom of the well. It should be noted that Bhate and Trinity (2012) was not the first reference to misstate the construction of the three wells.

The water levels measured for the 2014 and 2016 sampling efforts were below the bottom of the screened intervals in wells MW-S, MW-T, and MW-U. A review of the 2014 event indicates the water level did stabilize during purging, indicating water was flowing into the sump. This would likely only be possible if there was a leaking joint or fracture in the sump, or if the reported depth of the bottom of the screened interval is not correct.

In addition to the well construction details provided in the USGS monitoring well identification reports, chemical analytical data indicates TCE was detected in wells MW-C and MW-D, located adjacent to LF005 nearly every year from 1999 to 2006, though never above an MCL. Well MW-D is located upgradient of LF005 and MW-C is located south of LF005. Analytical results for TCE for wells MW-C, MW-S, MW-T, and MW-U were reported as nondetect for 2012 and 2014 sampling efforts. Previous semiannual sampling prior to 2014 did not always include wells from LF005.

### **3.0 WELL PERFORATION**

FPM/URS does not believe perforating the PVC casing is a viable option to salvage the wells. We consulted with several geologists in different offices within FPM and URS, along with a few drilling companies and have not found anyone who has successfully completed such an operation or who feels the technique will result in a viable well.

We could not find any advertised tools for perforating PVC pipe in an installed well smaller than six inches in diameter. Pipe can be perforated to crack the well for well abandonment purposes but not to create a screen from solid pipe. Additionally, any proposed method would likely result in too big of a slot size for the formation materials typically encountered at Cannon AFB.

### **4.0 RECOMMENDATIONS**

Wells MW-S, MW-T, and MW-U are recommended for abandonment because the water table is below the screened intervals based on our understanding of how the wells were constructed and their inability to produce water. Historical records indicate these three wells were installed as compliance monitoring wells for LF005. In effect, they were water table monitoring wells. However, recent contractors, including FPM/URS, were unaware of the unusual well design and were not sampling within the screened portion of these wells. Previous groundwater monitoring results listed in the USGS reports show TCE has been detected in wells at LF005. The need for replacement wells will require input from NMED.



TABLE 1

MONITORING WELL  
CONSTRUCTION DETAILS  
CANNON AFB, NEW MEXICO

Well Identification	Date Installed	TOC Elevation (feet amsl) (NAVD 88)	Concrete Pad Elevation (feet amsl) (NAVD 88)	Top of Screen (feet bgs)	Top of Screen (feet BTOC)	Bottom of Screen (feet bgs)	Bottom of Screen (feet BTOC)	Screen Length (feet)	Sump length (feet)	Bottom of Well (feet bgs)	Bottom of Well (feet BTOC)	Boring Depth (feet bgs)
MW-A	1/7/1985	4268.72 <sup>1</sup>	4267.01 <sup>1</sup>	325.13	326.84	340.13	341.84	15.00	--	340.13	341.84	365.00
MW-B	11/30/1984	4266.80 <sup>1</sup>	4265.19 <sup>1</sup>	347.90	349.50	362.90	364.50	15.00	--	362.90	364.50	362.90
MW-C	1/11/1985	4268.90 <sup>1</sup>	4267.00 <sup>1</sup>	346.60	348.50	361.60	363.50	15.00	--	361.60	363.50	362.00
MW-D	12/16/1984	4266.90 <sup>1</sup>	4265.20 <sup>1</sup>	340.00	341.70	355.00	356.70	15.00	--	355.00	356.70	356.75
MW-E	11/17/1985	4284.96 <sup>1</sup>	4282.92 <sup>1</sup>	334.09	336.14	349.09	351.14	15.00	--	349.09	351.14	373.00
MW-F	11/19/1985	4280.84 <sup>1</sup>	4278.09 <sup>1</sup>	349.55	352.30	364.55	367.30	15.00	5	369.55	372.30	375.00
MW-G	11/10/1985	4281.55 <sup>1</sup>	4279.65 <sup>1</sup>	350.90	352.80	365.90	367.80	15.00	--	365.90	367.80	372.00
MW-H	11/18/1985	4281.18 <sup>1</sup>	4279.18 <sup>1</sup>	324.80	326.80	344.80	346.80	20.00	5	349.80	351.80	375.00
MW-I	8/12/1988	4262.36 <sup>2</sup>	--	273.00	--	293.00	--	20.00	10	303.00	--	305.00
MW-J	8/16/1988	4262.70 <sup>2</sup>	--	261.00	--	281.00	--	20.00	--	305.00	--	305.00
MW-K	--	--	--	--	--	--	--	--	--	--	--	--
MW-L 4	6/2/1992	4264.72 <sup>2</sup>	4262.67 <sup>2</sup>	261.15	--	281.15	--	20.00	4	285.15	--	290.15
MW-L 6		4264.72 <sup>2</sup>	4262.67 <sup>2</sup>	261.15	--	281.15	--	20.00	4	285.15	--	290.15
MW-M	2/5/1992	4264.29 <sup>2</sup>	4262.57 <sup>2</sup>	262.48	--	282.48	--	20.00	5	287.48	--	287.48
MW-N	12/13/1994	4269.70 <sup>2</sup>	4267.59 <sup>2</sup>	268.00	--	298.00	--	30.00	--	303.00	--	303.00
MW-O	10/30/1994	4273.10 <sup>2</sup>	4271.00 <sup>2</sup>	273.90	--	303.90	--	30.00	--	304.30	--	304.30
MW-Q	2/24/1996	4266.89 <sup>2</sup>	--	266.59	--	296.59	--	30.00	--	296.59	--	297.59
MW-Na	12/16/2004	4270.51 <sup>1</sup>	4269.42 <sup>1</sup>	290.81	291.90	350.81	351.90	60.00	5	--	356.90	382.40
MW-Oa	2/29/2004	4273.96 <sup>1</sup>	4273.29 <sup>1</sup>	301.20	301.87	361.20	361.87	60.00	5	--	366.87	370.96
MW-Pa	2/21/2004	4274.73 <sup>1</sup>	4274.07 <sup>1</sup>	296.54	297.20	356.54	357.20	60.00	5	--	362.20	370.97
MW-R	--	--	--	--	--	--	--	--	--	--	--	--
MW-Ra	7/7/2001	4265.19 <sup>2</sup>	4262.19 <sup>2</sup>	280.56	--	309.81	--	29.25	--	310.50	--	313.00
MW-Rb	10/4/2012	4277.73 <sup>1</sup>	4275.41 <sup>1</sup>	301.39	303.71	331.39	333.71	30.00	--	331.39	333.71	350.00
MW-S	12/6/1998	4265.75 <sup>1</sup>	4263.81 <sup>1</sup>	284.87	286.80	324.87	326.80	40.00	40	364.87	366.80	365.00
MW-T	12/10/1998	4265.72 <sup>1</sup>	4263.90 <sup>1</sup>	284.57	286.40	324.57	326.40	40.00	40	364.57	366.40	365.00
MW-U	12/13/1998	4267.30 <sup>1</sup>	4265.43 <sup>1</sup>	284.14	286.00	324.14	326.00	40.00	40	364.14	366.00	365.00
MW-V	8/8/2001	4329.90 <sup>1</sup>	4328.27 <sup>1</sup>	305.11	306.74	365.11	366.74	60.00	5	370.11	371.74	370.00
MW-W	6/1/2002	4302.22 <sup>1</sup>	4300.15 <sup>1</sup>	300.94	303.00	360.94	363.00	60.00	5	365.94	368.00	381.50
MW-X	2/26/2004	4269.23 <sup>1</sup>	4268.02 <sup>1</sup>	291.64	292.85	331.64	332.85	40.00	5	336.64	337.85	340.00

Notes:

<sup>1</sup> = Elevation surveyed in September 2014 by FPM/AECOM.

<sup>2</sup> = Elevation obtained from historical boring logs obtained from Cannon AFB administrative records.

-- = No information was identified in the records available.

AFB = Air Force Base

amsl = above mean sea level

bgs = below ground surface

BTOC = below top of casing

NA = Not Applicable

NAVD 88 = North American Vertical Datum 1988

TOC = top of casing

**TABLE 2**  
**MONITORING WELL**  
**CONSTRUCTION DETAILS**  
**CANNON AFB, NEW MEXICO**

Well Identification	Site Association	TOC Elevation (feet amsl) (NAVD 88) <sup>2</sup>	Concrete Pad Elevation (feet amsl) (NAVD 88) <sup>2</sup>	Depth to Top of Screen (feet BTOC)	Depth to Bottom of Screen (feet BTOC)	June 2014 Well Depth <sup>1</sup> (feet BTOC)	June 2014 Depth to Water <sup>1</sup> (feet BTOC)	July 2014 Depth to Water <sup>1</sup> (feet BTOC)	May 2015 Depth to Water <sup>1</sup> (feet BTOC)	April 2016 Depth to Water <sup>1</sup> (feet BTOC)
MW-A	LF005	4268.72	4267.01	326.84	341.84	341.84	318.42	318.77	318.60	317.22
MW-B	LF005	4266.80	4265.19	349.50	364.50	364.50	330.35	330.49	331.01	330.36
MW-C	LF005	4268.90	4267.00	348.50	363.50	363.50	333.42	333.87	334.23	334.12
MW-D	LF005	4266.90	4265.20	341.70	356.70	356.70	327.53	327.71	328.15	327.49
MW-E	SI101	4284.96	4282.92	336.14	351.14	351.14	319.50	319.65	320.65	321.08
MW-F	SI101	4280.84	4278.09	352.30	367.30	372.30	317.32	317.80	318.67	319.11
MW-G	SI101	4281.55	4279.65	352.80	367.80	367.80	321.56	321.16	321.73	321.93
MW-H	SI101	4281.18	4279.18	326.80	346.80	351.80	320.95	321.44	321.95	322.12
MW-Na	LF004	4270.51	4269.42	291.90	351.90	356.90	NM <sup>3</sup>	312.35	312.12	312.55
MW-Oa	LF003	4273.96	4273.29	301.87	361.87	366.87	324.66	325.12	324.36	325.19
MW-Pa	LF025	4274.73	4274.07	297.20	357.20	362.20	315.31	315.60	316.15	316.24
MW-Rb	LF025	4277.73	4275.41	303.71	333.71	333.71	NM <sup>4</sup>	315.14	315.90	316.22
MW-S	LF005	4265.75	4263.81	286.80	326.80	366.80	332.60	332.98	337.49	337.00
MW-T	LF005	4265.72	4263.90	286.40	326.40	366.40	334.70	335.60	342.23	342.24
MW-U	LF005	4267.30	4265.43	286.00	326.00	366.00	330.73	330.95	333.90	331.29
MW-V	Background	4329.90	4328.27	306.74	366.74	371.74	349.31	349.79	350.51	350.60
MW-W	Background	4302.22	4300.15	303.00	363.00	368.00	334.74	335.50	336.79	337.22
MW-X	Background	4269.23	4268.02	292.85	332.85	337.85	286.60	287.04	287.13	286.5

Notes:

<sup>1</sup> = Measured by URS.

<sup>2</sup> = Elevation surveyed in September 2014.

<sup>3</sup> = Dedicated pump could not be removed and water level indicator could not be lowered past a depth of 268 feet BTOC.

<sup>4</sup> = Did not have key to access at time of June 2014 maintenance activities.

AFB = Air Force Base

amsl = above mean sea level

BTOC = below top of casing

NA = Not Applicable

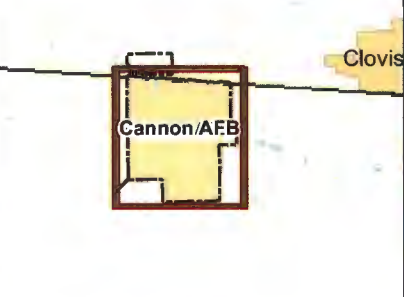
NAVD 88 = North American Vertical Datum 1988

TOC = top of casing



Site ID	Site Name
LF002	Landfill 2
LF003	Landfill 3
LF004	Landfill 4
LF005	Landfill 5 (cell 3)
LF025	Landfill 25
SI101	Wastewater Lagoons 1 & 2
FT006	Fire Training Area 1
SD012	Storm Water Collection Point (South Playa)
SD015	ACE Drainage Ditch
SD017	Entomology Rinse Area
SD020	Northeast Storm Water Drainage Area
SW002	Recovered Diesel Tank No. 108
SW004	Recovered Diesel Tank No. 109
SW006	Petroleum < Oil and Lubricants Tank No. 129
WL102	Wastewater Treatment Effluent Discharge

**Locator Map**



**Legend**

- Monitoring Well Location Included in in Optimized Sampling Plan
  - Monitoring Well Location
  - Base Boundary
  - Site Boundary
  - General Groundwater Flow Direction (Based on data from 2012 Biennial Report (Bhate 2013))
- Map projection: NAD83 State Plane Feet New Mexico East (FIPS 3001)



**Groundwater Monitoring Well Locations  
Cannon Air Force Base, New Mexico**

Drawn By: DPG	Date: 6/20/2016	Project No. 23446539	Figure 1
Checked By: MS	Revision: 0		

# **ATTACHMENT 1**

---

---

**Technical Memorandum**  
**Proposed Monitoring Well Rehabilitation NM-AZ Group PBR**  
**NM-AZ-Group PBR – Cannon AFB**  
**FA8903-13-C-0008**

Q:\23446539\Tech Memos\Well Construction Details\Ver 2\Tech Memo\_Monitoring Wells\_August 2016.docx

## MONITORING WELL IDENTIFICATION REPORT

NEW MEXICO ENVIRONMENT DEPARTMENT  
HAZARDOUS AND RADIOACTIVE MATERIALS BUREAU  
525 CAMINO DE LOS MARQUEZ, SUITE 4  
SANTA FE, NEW MEXICO 87502

FACILITY NAME	<u>Cannon Air Force Base</u>	
EPA I.D. NUMBER	<u>NM 7572124454</u>	
COUNTY	<u>Curry</u>	
WELL NUMBER	<u>Oa</u>	
WELL LOCATION (LONGITUDE)	<u>103° 17' 50.6"</u>	
WELL LOCATION (LATITUDE)	<u>34° 23' 0.33"</u>	
AQUIFER NAME	<u>Ogallala</u>	
AQUIFER CONFINED	<u>UNCONFINED</u>	<u>X</u>
WELL INSTALLATION DATE	<u>02/26/2004-02/29/2004</u>	
DRILLING METHOD	<u>HYDRT (mud rotary)</u>	
INNER CASING DIAMETER	<u>4 inches</u>	
BOREHOLE DIAMETER	<u>8 inches</u>	
CASING MATERIAL	<u>PVC (schedule 80)</u>	
METHOD OF DEVELOPMENT	<u>BAILD</u>	
ELEV BOTTOM OF BOREHOLE	<u>3,900.11 feet above MSL</u>	
ELEV BOTTOM OF WELL CASING	<u>3,905.11 feet above MSL</u>	
ELEV BOTTOM OF SCREENED INT	<u>3,910.11 feet above MSL</u>	
ELEV OF TOP OF SCREENED INT	<u>3,970.11 feet above MSL</u>	
MEASURING POINT CORRECTION	<u>0.96 feet</u>	
SURVEYED ELEV OF CASING TOP	<u>4,271.07 feet above MSL</u>	

**MONITORING WELL IDENTIFICATION REPORT**

NEW MEXICO ENVIRONMENT DEPARTMENT  
HAZARDOUS AND RADIOACTIVE MATERIALS BUREAU  
525 CAMINO DE LOS MARQUEZ, SUITE 4  
SANTA FE, NEW MEXICO 87502

FACILITY NAME Cannon Air Force Base

EPA ID. NUMBER NM 7572124454

COUNTY Curry

WELL NUMBER Pa

WELL LOCATION (LONGITUDE) 103° 18' 8.27"

WELL LOCATION (LATITUDE) 34° 23' 10.5"

AQUIFER NAME Ogallala

AQUIFER CONFINED UNCONFINED X

WELL INSTALLATION DATE 02/18/2004-02/21/2004

DRILLING METHOD HYDRT (mud rotary)

INNER CASING DIAMETER 4 inches

BOREHOLE DIAMETER 8 inches

CASING MATERIAL PVC (schedule 80)

METHOD OF DEVELOPMENT BAILD

ELEV BOTTOM OF BOREHOLE 3,900.85 feet above MSL

ELEV BOTTOM OF WELL CASING 3,910.85 feet above MSL

ELEV BOTTOM OF SCREENED INT 3,915.85 feet above MSL

ELEV OF TOP OF SCREENED INT 3,975.85 feet above MSL

MEASURING POINT CORRECTION 0.97 feet

SURVEYED ELEV OF CASING TOP 4,271.82 feet above MSL



MONITORING WELL IDENTIFICATION REPORT

NEW MEXICO ENVIRONMENT DEPARTMENT  
HAZARDOUS AND RADIOACTIVE MATERIALS BUREAU  
525 CAMINO DE LOS MARQUEZ, SUITE 4  
SANTA FE, NEW MEXICO 87502

FACILITY NAME Cannon Air Force Base

EPA I.D. NUMBER NM 7572124454

COUNTY Curry

WELL NUMBER S -- Landfill-5

WELL LOCATION (LONGITUDE) 103 ° 18 ' 10.58 "

WELL LOCATION (LATITUDE) 34 ° 21 ' 57.02 "

AQUIFER NAME Ogallala

AQUIFER CONFINED \_\_\_\_\_ UNCONFINED X

WELL INSTALLATION DATE 12 -02 to 06 -1998

DRILLING METHOD HYDRT (mud rotary)

INNER CASING DIAMETER 4 inches

BOREHOLE DIAMETER 12 inches

CASING MATERIAL PVC (Schedule-80)

METHOD OF DEVELOPMENT BAILD

ELEV BOTTOM OF BOREHOLE 3898.83 feet above MSL

ELEV BOTTOM OF WELL CASING 3898.83 feet above MSL

ELEV BOTTOM OF SCREENED INT 3939.81 feet above MSL

ELEV OF TOP OF SCREENED INT 3979.83 feet above MSL

SURVEYED ELEV OF CASING TOP 4263.83 feet above MSL

DATE OF REPORT 09-15-2003 SIGNATURE *Fredrick E. Gebhardt*

NAME (TYPED) Fredrick E. Gebhardt



MONITORING WELL IDENTIFICATION REPORT

NEW MEXICO ENVIRONMENT DEPARTMENT  
HAZARDOUS AND RADIOACTIVE MATERIALS BUREAU  
525 CAMINO DE LOS MARQUEZ, SUITE 4  
SANTA FE, NEW MEXICO 87502

FACILITY NAME Cannon Air Force Base

EPA I.D. NUMBER NM 7572124454

COUNTY Curry

WELL NUMBER T -- Landfill-5

WELL LOCATION (LONGITUDE) 103 ° 18 ' 09.33 "

WELL LOCATION (LATITUDE) 34 ° 22 ' 00.10 "

AQUIFER NAME Ogallala

AQUIFER CONFINED \_\_\_\_\_ UNCONFINED X

WELL INSTALLATION DATE 12 -6 to 10 -1998

DRILLING METHOD HYDRT (mud rotary)

INNER CASING DIAMETER 4 inches

BOREHOLE DIAMETER 12 inches

CASING MATERIAL PVC (Schedule-80)

METHOD OF DEVELOPMENT BAILD

ELEV BOTTOM OF BOREHOLE 3898.69 feet above MSL

ELEV BOTTOM OF WELL CASING 3898.69 feet above MSL

ELEV BOTTOM OF SCREENED INT 3939.69 feet above MSL

ELEV OF TOP OF SCREENED INT 3979.69 feet above MSL

SURVEYED ELEV OF CASING TOP 4263.69 feet above MSL

DATE OF REPORT 09-15-2003 SIGNATURE *Fredrick E. Gebhardt*

NAME (TYPED) Fredrick E. Gebhardt

MONITORING WELL IDENTIFICATION REPORT

NEW MEXICO ENVIRONMENT DEPARTMENT  
HAZARDOUS AND RADIOACTIVE MATERIALS BUREAU  
525 CAMINO DE LOS MARQUEZ, SUITE 4  
SANTA FE, NEW MEXICO 87502

FACILITY NAME Cannon Air Force Base

EPA I.D. NUMBER NM 7572124454

COUNTY Curry

WELL NUMBER U -- Landfill-5

WELL LOCATION (LONGITUDE) 103 ° 18 ' 09.84 "

WELL LOCATION (LATITUDE) 34 ° 22 ' 04.88 "

AQUIFER NAME Ogallala

AQUIFER CONFINED \_\_\_\_\_ UNCONFINED X

WELL INSTALLATION DATE 12 -10 to 13 -1998

DRILLING METHOD HYDRT (mud rotary)

INNER CASING DIAMETER 4 inches

BOREHOLE DIAMETER 12 inches

CASING MATERIAL PVC (Schedule-80)

METHOD OF DEVELOPMENT BAILD

ELEV BOTTOM OF BOREHOLE 3900.26 feet above MSL

ELEV BOTTOM OF WELL CASING 3900.26 feet above MSL

ELEV BOTTOM OF SCREENED INT 3941.26 feet above MSL

ELEV OF TOP OF SCREENED INT 3981.26 feet above MSL

SURVEYED ELEV OF CASING TOP 4265.26 feet above MSL

DATE OF REPORT 09-15-2003 SIGNATURE *Fredrick E. Gebhardt*

NAME (TYPED) Fredrick E. Gebhardt

# **ATTACHMENT 2**

---

---

**Technical Memorandum**  
**Proposed Monitoring Well Rehabilitation NM-AZ Group PBR**  
**NM-AZ-Group PBR – Cannon AFB**  
**FA8903-13-C-0008**

Q:\23446539\Tech Memos\Well Construction Details\Ver 2\Tech Memo\_Monitoring Wells\_August 2016.docx

# WATER SAMPLE COLLECTION FIELD SHEET

**URS**

**GENERAL INFORMATION**

SITE NAME: CANNON AFB PROJECT NO: 23446540  
 SAMPLE NO: MWC-5-2016 WELL NO: MW-C  
 DATE/TIME COLLECTED: 5/18/2016 / 0910 PERSONNEL: K. Klocner, S. Carritt  
 SAMPLE METHOD: Low flow- Bladder Pump

SAMPLE MEDIA: Groundwater Surface Water

SAMPLE QA SPLIT: YES  NO SPLIT SAMPLE NO: N/A  
 SAMPLE QC DUPLICATE: YES  NO DUPLICATE SAMPLE NO: NA  
 MS/MSD REQUESTED: YES  NO

**SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS**

Sample Container	Preservative	Analysis Requested
(3) 40 mL VOA	4°C, HCl	Volatile Organic Compounds (8260B)
(1) 250 mL HDPE	4°C, HNO <sub>3</sub>	Total Analyte List (TAL) Metals (7470A) (6020A)
(1) 250 mL HDPE	4°C, Ammonium Sulfate Buffer Solution	Hexavalent Chromium (7199)
(1) 125 mL HDPE	4°C	Perchlorate (6850)
(1) 250 mL HDPE	4°C	Chloride, Sulfate, Nitrate, Nitrite (9056)
(1) 250 mL HDPE	4°C, H <sub>2</sub> SO <sub>4</sub>	Ammonia (SM 4500 NH <sub>3</sub> )
(1) 125 mL HDPE	4°C, HCL	Total Organic Carbon (9060A)

**WELL PURGING DATA**

Date: 5/18/2016 Well Depth (ft BTOC): 363.50  
 Time Started: 0825 Depth to Water (ft BTOC): 333.92  
 Time Completed: 0905 Water Column Length (ft): 29.58  
 Volume of Water in Well (L): 73.06  
 Stabilized Purge Rate (L/min): 0.3  
 Stabilized Level of Drawdown (ft BTOC): 333.94  
 Total Amount Purged (L): 12.0

Background: *ND*  
 Breathing Zone:  
 Well Head:  
 Purge Water:

**FIELD MEASUREMENTS**

Time	Amount Purged (L)	pH	Temperature (Celsius)	Specific Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Water Level (ft BTOC)	Purge Rate (L/min)
0825	0	7.03	13.16	0.654	5.38	169	110	333.95	0.3
0830	1.5	7.11	14.84	0.655	5.05	146	86.7	333.94	0.3
0835	3.0	7.09	14.96	0.655	4.70	131	66.6	333.94	0.3
0840	4.5	7.04	15.09	0.654	4.88	122	55.2	333.94	0.3
0845	6.0	7.11	14.96	0.655	4.61	118	38.0	333.94	0.3
0850	7.5	7.10	14.95	0.654	4.75	108	23.9	333.94	0.3
0855	9.0	7.08	14.99	0.655	4.70	104	8.1	333.94	0.3
0900	10.5	7.12	14.94	0.655	4.71	105	6.7	333.94	0.3
0905	12.0	7.11	14.97	0.654	4.60	97	5.9	333.94	0.3

*K. W. Klocner*

**FIELD EQUIPMENT AND CALIBRATION**

Water Level Probe: *Herron Dippert* Model: *Herron Dippert* Calibration: *5/18/2016*  
 Water Quality Meter: *Hanna U-52* Calibration: *5/18/2016*

**GENERAL COMMENTS**

Field Parameters Measured in Flow-Through Cell  
 Pump Placement Depth = *356 Feet BTOC*  
 Well Diameter = 5 inches  
 Screen Interval = 363.50-348.50 ft BTOC

# WATER SAMPLE COLLECTION FIELD SHEET



## GENERAL INFORMATION

SITE NAME: CANNON AFB PROJECT NO.: 23446540  
 SAMPLE NO.: MWF-5-2016 WELL NO.: MW-F  
 DATE/TIME COLLECTED: 5/16/2016 / 1145 PERSONNEL: K. Kleber, J. Carr:tt  
 SAMPLE METHOD: Low flow- Bladder Pump  
 SAMPLE MEDIA:  Groundwater  Surface Water  
 SAMPLE QA SPLIT: YES  NO SPLIT SAMPLE NO: N/A  
 SAMPLE QC DUPLICATE: YES  NO DUPLICATE SAMPLE NO: NA  
 MS/MSD REQUESTED: YES  NO

## SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(3) 40 mL VOA	4°C, HCl	Volatile Organic Compounds (8260B)
(1) 250 mL HDPE	4°C, HNO <sub>3</sub>	Total Analyte List (TAL) Metals (7470A) (6020A)
(1) 250 mL HDPE	4°C, Ammonium Sulfate Buffer Solution	Hexavalent Chromium (7199)
(1) 125 mL HDPE	4°C	Perchlorate (6850)
(1) 250 mL HDPE	4°C	Chloride, Sulfate, Nitrate, Nitrite (9056)
(1) 250 mL HDPE	4°C, H <sub>2</sub> SO <sub>4</sub>	Ammonia (SM 4500 NH <sub>3</sub> )
(1) 125 mL HDPE	4°C, HCL	Total Organic Carbon (9060A)

## WELL PURGING DATA

Date: 5/16/2016 Well Depth (ft BTOC): 372.30  
 Time Started: 1100 Depth to Water (ft BTOC): 318.94  
 Time Completed: 1140 Water Column Length (ft): 53.36  
 Volume of Water in Well (L): 131.79  
 PID Measurements: Stabilized Purge Rate (L/min): 0.3  
 Background: Stabilized Level of Drawdown (ft BTOC): 318.94  
 Breathing Zone: ~~ND~~ Total Amount Purged (L): 12.0  
 Well Head: ~~ND~~  
 Purge Water:

## FIELD MEASUREMENTS

Time	Amount Purged (L)	pH	Temperature (Celsius)	Specific Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Water Level (ft BTOC)	Purge Rate (L/min)
1100	0	7.72	17.93	0.852	15.85	159	5.8	318.94	0.3
1110	3.0	7.76	18.05	0.854	9.89	119	9.0	318.94	0.3
1115	4.5	7.74	18.78	0.858	10.36	114	8.7	318.94	0.3
1120	6.0	7.73	18.47	0.847	9.76	111	6.5	318.94	0.3
1125	7.5	7.72	18.52	0.852	10.06	110	7.4	318.94	0.3
1130	9.0	7.69	18.52	0.852	10.29	114	5.6	318.94	0.3
1135	10.5	7.67	18.54	0.852	10.42	120	6.1	318.94	0.3
1140	12.0	7.73	18.50	0.853	10.34	121	4.1	318.94	0.3

## FIELD EQUIPMENT AND CALIBRATION

Water Level Probe: Model: Herron Dippert Calibration: 5/16/2016  
 Water Quality Meter: Horiba U-52 Calibration: 5/16/2016

## GENERAL COMMENTS

Field Parameters Measured in Flow-Through Cell  
 Pump Placement Depth = 365 Feet + BTOC  
 Well Diameter = 4 inches  
 Screen Interval = 372.30-357.30 ft BTOC

# WATER SAMPLE COLLECTION FIELD SHEET

**URS**

**GENERAL INFORMATION**

SITE NAME: CANNON AFB PROJECT NO: 23446540  
 SAMPLE NO: MWG-5-2016 WELL NO: MW-G  
 DATE/TIME COLLECTED: 5/16/2016/1520 PERSONNEL: K. Kellow, S. Carritt  
 SAMPLE METHOD: Low flow- Bladder Pump  
 SAMPLE MEDIA:  Groundwater  Surface Water  
 SAMPLE QA SPLIT: YES  NO  SPLIT SAMPLE NO: N/A  
 SAMPLE QC DUPLICATE:  YES  NO DUPLICATE SAMPLE NO: MWG-5-2016-AE 1530  
 MS/MSD REQUESTED: YES  NO

**SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS**

Sample Container	Preservative	Analysis Requested
ZV (3) 40 mL VOA	4°C, HCl	Volatile Organic Compounds (8260B)
Zx (1) 250 mL HDPE	4°C, HNO <sub>3</sub>	Total Analyte List (TAL) Metals (7470A) (6020A)
Zx (1) 250 mL HDPE	4°C, Ammonium Sulfate Buffer Solution	Hexavalent Chromium (7199)
Zx (1) 125 mL HDPE	4°C	Perchlorate (6850)
Zx (1) 250 mL HDPE	4°C	Chloride, Sulfate, Nitrate, Nitrite (9056)
Zx (1) 250 mL HDPE	4°C, H <sub>2</sub> SO <sub>4</sub>	Ammonia (SM 4500 NH <sub>3</sub> )
Zx (1) 125 mL HDPE	4°C, HCL	Total Organic Carbon (9060A)

**WELL PURGING DATA**

Date: 5/16/2016 Well Depth (ft BTOC): 367.80  
 Time Started: 1430 Depth to Water (ft BTOC): 321.90  
 Time Completed: 1515 Water Column Length (ft): 45.9  
 PID Measurements: Volume of Water in Well (L): 113.73  
 Background: Stabilized Purge Rate (L/min): 0.3  
 Breathing Zone: Stabilized Level of Drawdown (ft BTOC): 321.96  
 Well Head: -ND- Total Amount Purged (L): 16.5  
 Purge Water: -ND-

**FIELD MEASUREMENTS**

Time	Amount Purged (L)	pH	Temperature (Celsius)	Specific Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Water Level (ft BTOC)	Purge Rate (L/min)
1430	0	7.10	28.89	0.862	8.34	115	2.9	321.90	0.3
1440	3.0	7.19	26.26	0.851	11.09	102	0.0	321.90	0.3
1500	12.0	7.24	21.92	0.847	9.81	105	0.0	321.90	0.3
1505	13.5	7.25	21.39	0.853	9.80	108	0.0	321.90	0.3
1510	15.0	7.25	21.31	0.854	9.80	112	0.0	321.90	0.3
1515	16.5	7.25	21.34	0.854	9.94	116	0.0	321.90	0.3

*K. Kellow*

**FIELD EQUIPMENT AND CALIBRATION**

Water Level Probe: Model: *Hiiron Dippert* Calibration: 5/16/2016  
 Water Quality Meter: *Hanna U-52* Calibration: 5/16/2016

**GENERAL COMMENTS**

Field Parameters Measured in Flow-Through Cell  
 Pump Placement Depth = 360.0  
 Well Diameter = 4 inches  
 Screen Interval = 367.80-352.80 ft BTOC

# WATER SAMPLE COLLECTION FIELD SHEET

**URS**

**GENERAL INFORMATION**

SITE NAME: CANNON AFB PROJECT NO: 23446540  
 SAMPLE NO: MWNa-5-2016 WELL NO: MW-Na  
 DATE/TIME COLLECTED: 5/12/2016 / 0930 PERSONNEL: K. Klobewer  
 SAMPLE METHOD: Low flow- Dedicated Bladder Pump J. Carritt

SAMPLE MEDIA: Groundwater Surface Water

SAMPLE QA SPLIT: YES  SPLIT SAMPLE NO: N/A  
 SAMPLE QC DUPLICATE: YES  NO DUCPLICATE SAMPLE NO: MWNa-5-2016-A @ 0940  
 MS/MSD REQUESTED: YES

**SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS**

Sample Container	Preservative	Analysis Requested
Zx (3) 40 mL VOA	4°C, HCl	Volatile Organic Compounds (8260B)
Zx (1) 250 mL HDPE	4°C, HNO <sub>3</sub>	Total Analyte List (TAL) Metals (7470A) (6020A)
Zx (1) 250 mL HDPE	4°C, Ammonium Sulfate Buffer Solution	Hexavalent Chromium (7199)
Zx (1) 125 mL HDPE	4°C	Perchlorate (6850)
Zx (1) 250 mL HDPE	4°C	Chloride, Sulfate, Nitrate, Nitrite (9056)
Zx (1) 250 mL HDPE	4°C, H <sub>2</sub> SO <sub>4</sub>	Ammonia (SM 4500 NH <sub>3</sub> )
Zx (1) 125 mL HDPE	4°C, HCL	Total Organic Carbon (9060A)

**WELL PURGING DATA**

Date	5/12/2016	Well Depth (ft BTOC)	Unknown 356.9
Time Started	0845	Depth to Water (ft BTOC)	313.15
Time Completed	0925	Water Column Length (ft)	43.75
<u>PID Measurements</u>		Volume of Water in Well (L)	108.06
Background	ND	Stabilized Purge Rate (L/min)	0.3
Breathing Zone		Stabilized Level of Drawdown (ft BTOC)	313.15
Well Head		Total Amount Purged (L)	12.5
Purge Water			

**FIELD MEASUREMENTS**

Time	Amount Purged (L)	pH	Temperature (Celsius)	Specific Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Water Level (ft BTOC)	Purge Rate (L/min)
0845	0	7.69	15.06	0.622	13.50	159	22.5	313.15	0.3
0850	1.5	7.70	16.03	0.613	8.48	122	12.5	313.15	0.3
0855	3.0	7.74	16.13	0.612	8.40	112	4.2	313.15	0.3
0900	4.5	7.77	16.25	0.613	8.67	102	4.3	313.15	0.3
0905	6.0	7.81	16.41	0.614	8.43	99	4.5	313.15	0.3
0910	7.5	7.79	16.89	0.613	<del>8.63</del> 8.26	96	4.0	313.15	0.3
0920	11.0	7.80	16.99	0.615	7.95	98	0.0	313.15	0.3
0925	12.5	7.77	16.97	0.615	8.16	96	0.0	313.15	0.3

*[Handwritten Signature]*

**FIELD EQUIPMENT AND CALIBRATION**

Water Level Probe	Model	Calibration
Water Quality Meter	Herron Dippert Horiba U-52	5/12/2016 5/12/2016

**GENERAL COMMENTS**

Field Parameters Measured in Flow-Through Cell  
 Pump Placement Depth = 326 Feet BTOC  
 Well Diameter = 4 inches  
 Screen Interval = Unknown 296.9-356.9

# WATER SAMPLE COLLECTION FIELD SHEET

**URS**

**GENERAL INFORMATION**

SITE NAME: CANNON AFB PROJECT NO.: 23446540  
 SAMPLE NO.: MWOa-5-2016 WELL NO.: MW-0a  
 DATE/TIME COLLECTED: 5/12/2016/1345 PERSONNEL: K. Kloewer  
 SAMPLE METHOD: Low flow- Dedicated Bladder Pump J. Caritz

SAMPLE MEDIA: Groundwater Surface Water

SAMPLE QA SPLIT: YES  NO  SPLIT SAMPLE NO: N/A  
 SAMPLE QC DUPLICATE: YES  NO  DUPLICATE SAMPLE NO: N/A  
 MS/MSD REQUESTED:  YES  NO

**SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS**

Sample Container	Preservative	Analysis Requested
3x (3) 40 mL VOA	4°C, HCl	Volatile Organic Compounds (8260B)
1x (1) 250 mL HDPE	4°C, HNO <sub>3</sub>	Total Analyte List (TAL) Metals (7470A) (6020A)
1x (1) 250 mL HDPE	4°C, Ammonium Sulfate Buffer Solution	Hexavalent Chromium (7199)
1x (1) 125 mL HDPE	4°C	Perchlorate (6850)
1x (1) 250 mL HDPE	4°C	Chloride, Sulfate, Nitrate, Nitrite (9056)
1x (1) 250 mL HDPE	4°C, H <sub>2</sub> SO <sub>4</sub>	Ammonia (SM 4500 NH <sub>3</sub> )
1x (1) 125 mL HDPE	4°C, HCL	Total Organic Carbon (9060A)

**WELL PURGING DATA**

Date: 5/12/2016 Well Depth (ft BTOC): 366.87  
 Time Started: 1305 Depth to Water (ft BTOC): 325.12  
 Time Completed: 1340 Water Column Length (ft): 41.75  
 Volume of Water in Well (L): 103.12  
 PID Measurements: Stabilized Purge Rate (L/min): 0.3  
 Background: Stabilized Level of Drawdown (ft BTOC): 325.10  
 Breathing Zone: Total Amount Purged (L): 10.5  
 Well Head: *ND*  
 Purge Water: *ND*

**FIELD MEASUREMENTS**

Time	Amount Purged (L)	pH	Temperature (Celsius)	Specific Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Water Level (ft BTOC)	Purge Rate (L/min)
1305	0	7.53	20.62	1.37	16.36	131	1.4	325.10	0.3
1310	1.5	7.36	18.71	1.39	9.28	116	0.0	325.10	0.3
1315	3.0	7.37	18.54	1.38	7.97	110	0.0	325.10	0.3
1325	6.0	7.34	18.18	1.41	8.99	107	0.0	325.10	0.3
1330	7.5	7.31	18.32	1.41	7.60	107	0.0	325.10	0.3
1335	9.0	7.24	18.23	1.42	7.34	109	0.0	325.10	0.3
1340	10.5	7.29	18.26	1.41	7.63	115	0.0	325.10	0.3

*K. Kloewer*

**FIELD EQUIPMENT AND CALIBRATION**

Water Level Probe: Model: *Herron D'ppuT* Calibration: *5/12/2016*  
 Water Quality Meter: *Hanna U-52* Calibration: *5/12/2016*

**GENERAL COMMENTS**

Field Parameters Measured in Flow-Through Cell  
 Pump Placement Depth = *346 Feet BTOC*  
 Well Diameter = 4 inches  
 Screen Interval = 366.87-306.87 ft BTOC



# WATER SAMPLE COLLECTION FIELD SHEET



## GENERAL INFORMATION

SITE NAME: CANNON AFB PROJECT NO: 23446540  
 SAMPLE NO: MWPa-5-2016 WELL NO: MW-Pa  
 DATE/TIME COLLECTED: 5/12/2016 / 1545 PERSONNEL: K. Kloewer  
 SAMPLE METHOD: Low flow- Dedicated Bladder Pump J. Carritt  
 SAMPLE MEDIA: Groundwater Surface Water  
 SAMPLE QA SPLIT: YES  NO SPLIT SAMPLE NO: N/A  
 SAMPLE QC DUPLICATE: YES  NO DUPLICATE SAMPLE NO: N/A  
 MS/MSD REQUESTED: YES  NO

## SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(3) 40 mL VOA	4°C, HCl	Volatile Organic Compounds (8260B)
(1) 250 mL HDPE	4°C, HNO <sub>3</sub>	Total Analyte List (TAL) Metals (7470A) (6020A)
(1) 250 mL HDPE	4°C, Ammonium Sulfate Buffer Solution	Hexavalent Chromium (7199)
(1) 125 mL HDPE	4°C	Perchlorate (6850)
(1) 250 mL HDPE	4°C	Chloride, Sulfate, Nitrate, Nitrite (9056)
(1) 250 mL HDPE	4°C, H <sub>2</sub> SO <sub>4</sub>	Ammonia (SM 4500 NH <sub>3</sub> )
(1) 125 mL HDPE	4°C, HCL	Total Organic Carbon (9060A)

## WELL PURGING DATA

Date	5/12/2016	Well Depth (ft BTOC)	362.20
Time Started	1505	Depth to Water (ft BTOC)	316.42
Time Completed	1545	Water Column Length (ft)	45.78
<u>PID Measurements</u>		Volume of Water in Well (L)	113.08
Background	- ND -	Stabilized Purge Rate (L/min)	0.3
Breathing Zone		Stabilized Level of Drawdown (ft BTOC)	316.42
Well Head		Total Amount Purged (L)	12.0
Purge Water			

## FIELD MEASUREMENTS

Time	Amount Purged (L)	pH	Temperature (Celsius)	Specific Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Water Level (ft BTOC)	Purge Rate (L/min)
1505	0	7.62	23.13	0.841	7.12	113	0.0	316.42	0.3
1510	1.5	7.63	22.75	0.833	5.85	121	0.0	316.42	0.3
1515	3.0	7.62	23.32	0.837	8.24	126	0.0	316.42	0.3
1520	4.5	7.60	23.54	0.839	8.29	127	0.0	316.42	0.3
1525	6.0	7.64	20.26	0.826	9.81	131	0.0	316.42	0.3
1530	7.5	7.64	19.43	0.832	8.77	129	0.0	316.42	0.3
1535	9.0	7.62	21.59	0.835	8.95	129	0.0	316.42	0.3
1540	10.5	7.64	21.66	0.834	8.87	128	0.0	316.42	0.3
1545	12.0	7.63	21.58	0.835	8.74	129	0.0	316.42	0.3

*K. Kloewer*

## FIELD EQUIPMENT AND CALIBRATION

	<u>Model</u>	<u>Calibration</u>
Water Level Probe	Heron Dippert	5/12/2016
Water Quality Meter	Hanna U-52	5/12/2016

## GENERAL COMMENTS

Field Parameters Measured in Flow-Through Cell  
 Pump Placement Depth = 332 Feet + BTOC  
 Well Diameter = 4 inches  
 Screen Interval = 362.20-302.20 ft BTOC

# WATER SAMPLE COLLECTION FIELD SHEET



## GENERAL INFORMATION

SITE NAME: CANNON AFB PROJECT NO: 23446540  
 SAMPLE NO: MWRb-5-2016 WELL NO: MW-Rb  
 DATE/TIME COLLECTED: 5/17/2016 / 0850 PERSONNEL: K. Klocner, J. Carritt  
 SAMPLE METHOD: Low flow- Bladder Pump  
 SAMPLE MEDIA: Groundwater Surface Water  
 SAMPLE QA SPLIT: YES  NO SPLIT SAMPLE NO: N/A  
 SAMPLE QC DUPLICATE: YES  NO DUPLICATE SAMPLE NO: N/A  
 MS/MSD REQUESTED: YES  NO

## SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
(3) 40 mL VOA	4°C, HCl	Volatile Organic Compounds (8260B)
(1) 250 mL HDPE	4°C, HNO <sub>3</sub>	Total Analyte List (TAL) Metals (7470A) (6020A)
(1) 250 mL HDPE	4°C, Ammonium Sulfate Buffer Solution	Hexavalent Chromium (7199)
(1) 125 mL HDPE	4°C	Perchlorate (6850)
(1) 250 mL HDPE	4°C	Chloride, Sulfate, Nitrate, Nitrite (9056)
(1) 250 mL HDPE	4°C, H <sub>2</sub> SO <sub>4</sub>	Ammonia (SM 4500 NH <sub>3</sub> )
(1) 125 mL HDPE	4°C, HCL	Total Organic Carbon (9060A)

## WELL PURGING DATA

Date	5/17/2016	Well Depth (ft BTOC)	333.71
Time Started	0810	Depth to Water (ft BTOC)	<del>318.44</del> 316.44
Time Completed	0845	Water Column Length (ft)	17.27
PID Measurements		Volume of Water in Well (L)	47.66
Background		Stabilized Purge Rate (L/min)	0.3
Breathing Zone		Stabilized Level of Drawdown (ft BTOC)	316.50
Well Head		Total Amount Purged (L)	10.5
Purge Water	ND		

## FIELD MEASUREMENTS

Time	Amount Purged (L)	pH	Temperature (Celsius)	Specific Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Water Level (ft BTOC)	Purge Rate (L/min)
0810	0	6.78	12.51	0.767	10.01	161	0.0	316.50	0.3
0820	3.0	7.60	13.59	0.768	7.44	116	0.0	316.50	0.3
0825	4.5	7.54	14.14	0.766	7.82	96	0.0	316.50	0.3
0830	6.0	7.52	14.16	0.770	7.78	89	0.0	316.50	0.3
0835	7.5	7.53	14.15	0.771	7.32	84	0.0	316.50	0.3
0840	9.0	7.49	14.21	0.770	7.49	81	0.0	316.50	0.3
0845	10.5	7.56	14.19	0.770	7.32	77	0.0	316.50	0.3

*K. Klocner*

## FIELD EQUIPMENT AND CALIBRATION

Water Level Probe	Model: Hannon Dippert	Calibration: 5/17/2016
Water Quality Meter	Hanna U-52	5/17/2016

## GENERAL COMMENTS

Field Parameters Measured in Flow-Through Cell  
 Pump Placement Depth = ~~328.44~~ 328 Feet BTOC  
 Well Diameter = 4 inches  
 Screen Interval = 333.71-303.71 ft BTOC

# WATER SAMPLE COLLECTION FIELD SHEET

**URS**

**GENERAL INFORMATION**

SITE NAME: CANNON AFB PROJECT NO. 23446540  
 SAMPLE NO. MWX-5-2016 WELL NO. MW-X  
 DATE/TIME COLLECTED: 5/10/2016 / 1030 PERSONNEL: K. Klocner  
 SAMPLE METHOD: Low flow- Bladder Pump S. Carritt  
 SAMPLE MEDIA:  Groundwater  Surface Water  
 SAMPLE QA SPLIT: YES  NO SPLIT SAMPLE NO. N/A  
 SAMPLE QC DUPLICATE: YES  NO DUPLICATE SAMPLE NO. N/A  
 MS/MSD REQUESTED: YES  NO

**SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS**

Sample Container	Preservative	Analysis Requested
(3) 40 mL VOA	4°C, HCl	Volatile Organic Compounds (8260B)
(1) 250 mL HDPE	4°C, HNO <sub>3</sub>	Total Analyte List (TAL) Metals (7470A) (6020A)
(1) 250 mL HDPE	4°C, Ammonium Sulfate Buffer Solution	Hexavalent Chromium (7199)
(1) 125 mL HDPE	4°C	Perchlorate (6850)
(1) 250 mL HDPE	4°C	Chloride, Sulfate, Nitrate, Nitrite (9056)/Ammonia (SM 4500 NH <sub>3</sub> )
(1) 250 mL Amber 11	4°C, HCL	Total Organic Carbon (9060A)

**WELL PURGING DATA**

Date: 5/10/2016 Well Depth (ft BTOC): 337.85  
 Time Started: 0950 Depth to Water (ft BTOC): 286.74  
 Time Completed: 1025 Water Column Length (ft): 57.11  
 Volume of Water in Well (L): 126.24  
 PID Measurements: Stabilized Purge Rate (L/min): 0.3  
 Background: Stabilized Level of Drawdown (ft. BTOC): 286.70  
 Breathing Zone: Total Amount Purged (L): 10.5  
 Well Head: -ND-  
 Purge Water: -ND-

**FIELD MEASUREMENTS**

Time	Amount Purged (L)	pH	Temperature (Celsius)	Specific Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Water Level (ft BTOC)	Purge Rate (L/min)
0950	0	7.29	23.96	0.576	9.24	141	0.0	286.74	0.3
0955	0.5	7.39	20.33	0.552	8.91	124	0.0	286.74	0.3
1000	3.0	7.37	20.38	0.551	10.31	121	0.0	286.74	0.3
1005	4.5	7.36	20.35	0.551	9.60	119	0.0	286.70	0.3
1015	7.5	7.39	20.49	0.551	8.29	115	0.0	286.70	0.3
1020	9.0	7.38	20.52	0.551	8.39	116	0.0	286.70	0.3
1025	10.5	7.38	20.44	0.551	8.37	118	0.0	286.70	0.3

*[Handwritten Signature]*

**FIELD EQUIPMENT AND CALIBRATION**

Water Level Probe: Model: Herron Dippot Calibration: 5/10/2016  
 Water Quality Meter: Horba U-52 Calibration: 5/10/2016

**GENERAL COMMENTS**

Field Parameters Measured in Flow-Through Cell  
 Pump Placement Depth = ~ 307.85  
 Well Diameter = 4 inches  
 Screen Interval = 337.85-277.85 ft BTOC