Quality Assurance Project Plan
Edwards AFB

Site Inspections of Aqueous Film Forming Foam Usage at Multiple United States Air Force Installations in U.S. EPA Regions 6 and 9
Contract # W912BV-15-C-0082

Figure 14
Former Main Base STP

Revision: 1	By: EC	Date: 03/23/2016

U.S. Army Corps of Engineers
Tulsa District

for

Air Force Civil Engineer Center

Legend

- Existing GW Monitoring Well
- Proposed GW Sampling Location
- Proposed Soil Boring Location
- Stormwater Line
- Water Line
- Preliminary Assessment (July, 2015) Site Boundary
- Groundwater Flow Direction (AECOM, 2008 Biennial Groundwater Monitoring Report for Site 29, 2009)

AFB = Air Force Base
GW = Groundwater
STP = Sewage Treatment Plant
U.S. EPA = United States Environmental Protection Agency

Approximate Scale in Feet

0 500 1,000

OTIE
An Oneida Nation Company

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5618073

Quality Assurance Project Plan
Edwards AFB

Site Inspections of Aqueous Film Forming Foam Usage at Multiple United States Air Force Installations in U.S. EPA Regions 6 and 9
Contract # W912BV-15-C-0082

Figure 15
Former Nozzle Spray Test Area

Revision: 1	By: EC	Date: 03/23/2016

U.S. Army Corps of Engineers
Tulsa District

for

Air Force Civil Engineer Center

Legend

- Proposed Soil Boring Location
- Stormwater Line
- Water Line
- Preliminary Assessment (July, 2015) Site Boundary
- Regional Groundwater Flow Direction (CH2M Hill, Preliminary Assessment, July, 2015)

AFB = Air Force Base
U.S. EPA = United States Environmental Protection Agency

Approximate Scale in Feet

0 100 200

OTIE
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Quality Assurance Project Plan
Edwards AFB

Site Inspections of Aqueous Film Forming Foam Usage at Multiple United States Air Force Installations in U.S. EPA Regions 6 and 9
Contract # W912BV-15-C-0082

Figure 16
Refractometer Spray Test Area

Revision: 1	By: EC	Date: 03/23/2016

U.S. Army Corps of Engineers
Tulsa District

for

Air Force Civil Engineer Center

Legend

- Proposed Soil Boring Location
- Stormwater Line
- Preliminary Assessment (July, 2015) Site Boundary
- Regional Groundwater Flow Direction (CH2M Hill, Preliminary Assessment, July, 2015)

AFB = Air Force Base
U.S. EPA = United States Environmental Protection Agency

Approximate Scale in Feet

0 300 600

OTIE
An Oneida Nation Company

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5618075

Quality Assurance Project Plan
Edwards AFB

Site Inspections of Aqueous Film Forming Foam Usage at Multiple United States Air Force Installations in U.S. EPA Regions 6 and 9
Contract # W912BV-15-C-0082

Figure 17
Muroc Golf Course

Revision: 1	By: EC	Date: 03/23/2016

U.S. Army Corps of Engineers
Tulsa District

for

Air Force Civil Engineer Center

Legend

- Proposed GW Gauging Location
- Proposed Sediment Sampling Location
- Stormwater Line
- Water Line
- Preliminary Assessment (July, 2015) Site Boundary
- Regional Groundwater Flow Direction (CH2M Hill, Preliminary Assessment, July, 2015)

AFB = Air Force Base
GW = Groundwater
U.S. EPA = United States Environmental Protection Agency

Approximate Scale in Feet

0 500 1,000

OTIE
An Oneida Nation Company

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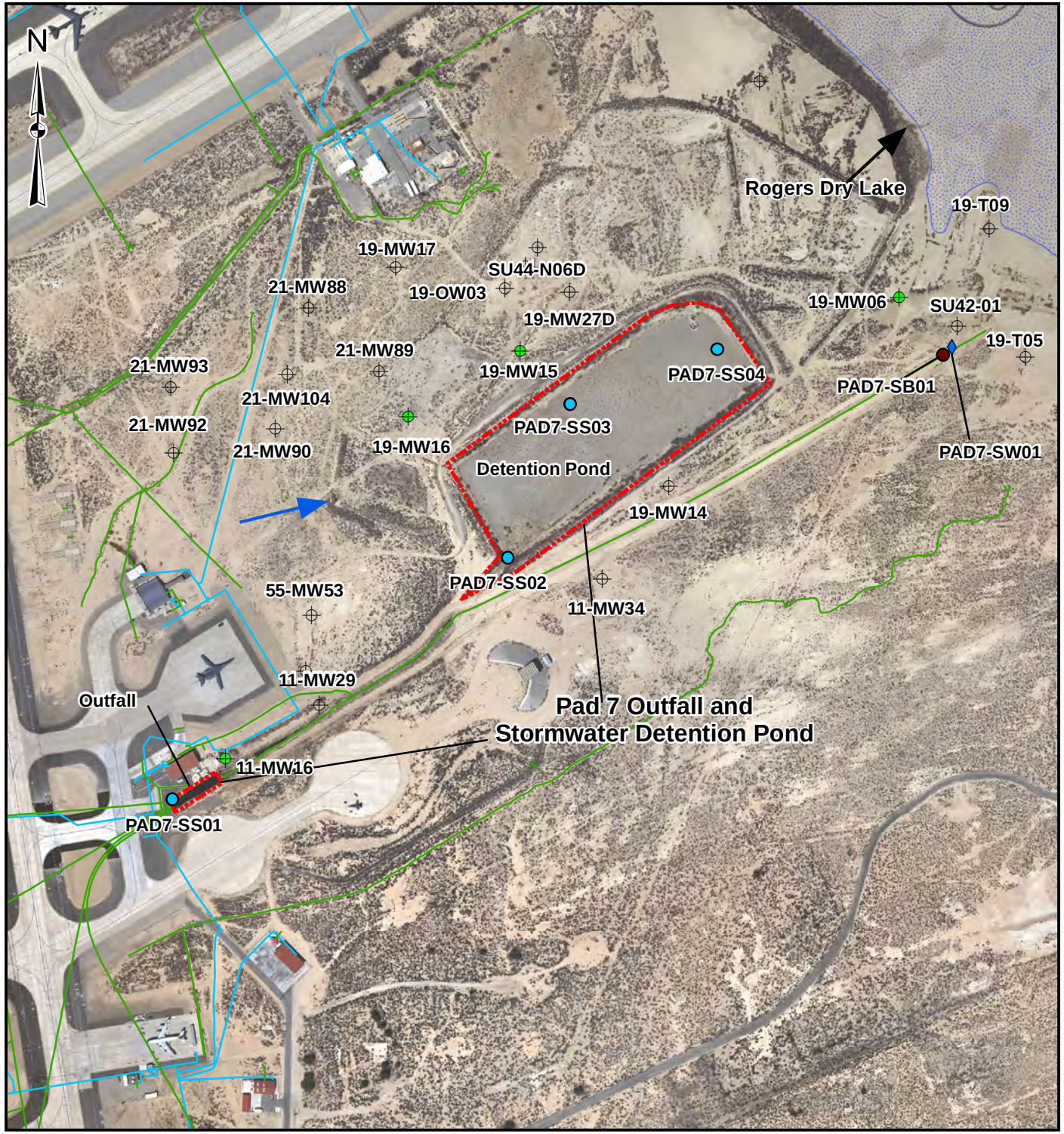

Quality Assurance Project Plan
Edwards AFB

Site Inspections of Aqueous Film Forming Foam Usage at Multiple United States Air Force Installations in U.S. EPA Regions 6 and 9
Contract # W912BV-15-C-0082

Figure 18
Pad 7 Outfall/SW Detention Pond

Revision: 1	By: EC	Date: 03/24/2016

U.S. Army Corps of Engineers
Tulsa District

for

Air Force Civil Engineer Center

Legend

- Existing GW Monitoring Well
- Proposed GW Sampling Location
- Proposed Soil Boring Location
- Proposed Sediment Sampling Location
- Proposed Surface Water Sampling Location
- Stormwater Line
- Water Line
- Preliminary Assessment (July, 2015) Site Boundary
- Rogers Dry Lake
- Regional Groundwater Flow Direction (CH2M Hill, Preliminary Assessment, July 2015)

AFB = Air Force Base
GW = Groundwater
SW = Stormwater
U.S. EPA = United States Environmental Protection Agency

Approximate Scale in Feet

0 500 1,000

OTIE
An Oneida Nation Company

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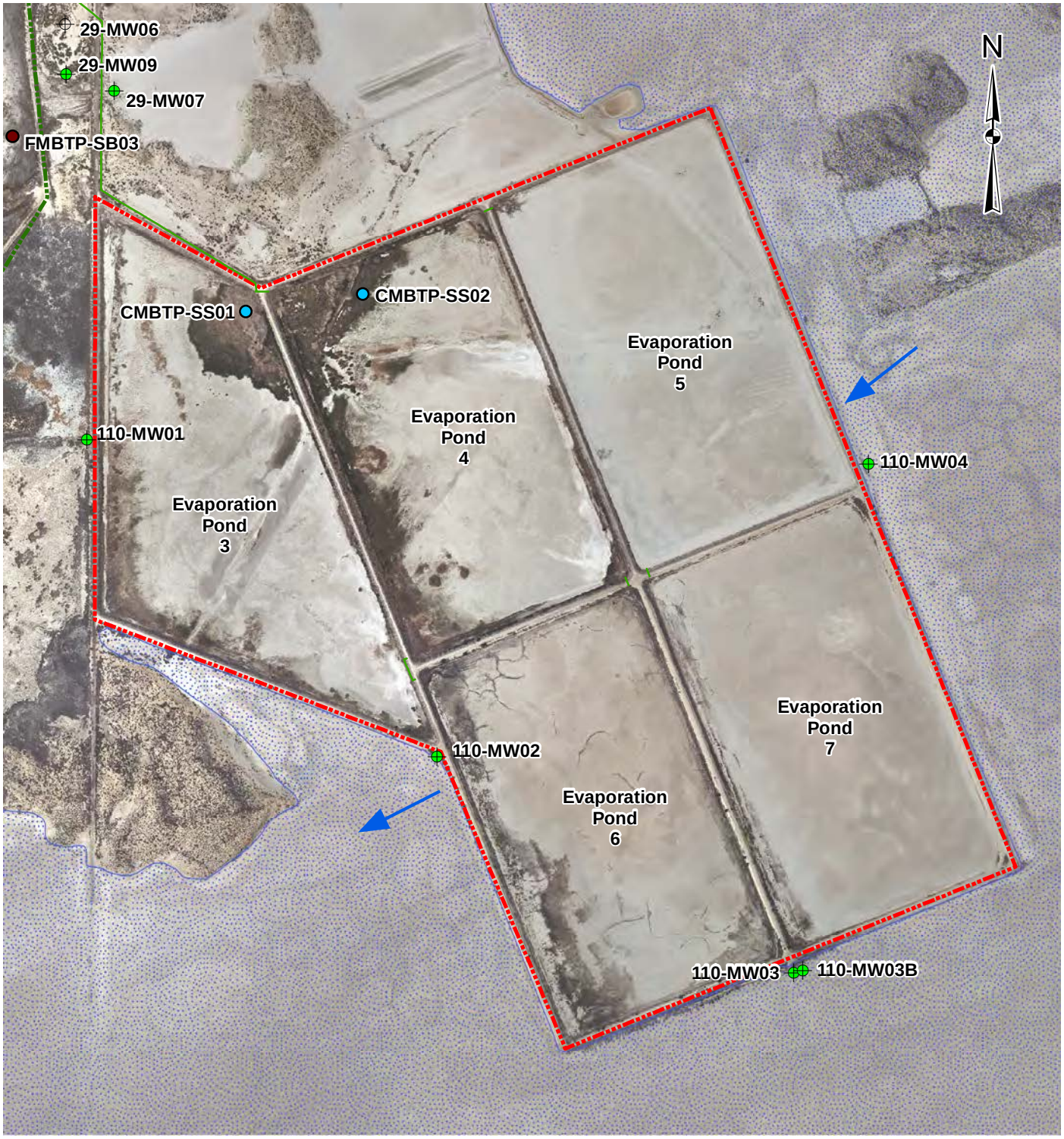
5618077



Quality Assurance Project Plan
Edwards AFB

Site Inspections of Aqueous Film Forming Foam Usage at Multiple United States Air Force Installations in U.S. EPA Regions 6 and 9
Contract # W912BV-15-C-0082

Figure 19
Current Main Base STP

Revision: 1	By: MW	Date: 02/10/2017

U.S. Army Corps of Engineers
Tulsa District

for

Air Force Civil Engineer Center

Legend

- Existing GW Monitoring Well
- Proposed GW Sampling Location
- Proposed Sediment Sampling Location
- Proposed Soil Boring Location
- Stormwater Line
- Former Main Base Preliminary Assessment (July 2015) Site Boundary
- Current Main Base Preliminary Assessment Site Boundary
- Rogers Dry Lake
- Groundwater Flow Direction (National O&M Inc, 2016)

AFB = Air Force Base
GW = Groundwater
STP = Sewage Treatment Plant
U.S. EPA = United States Environmental Protection Agency

Approximate Scale in Feet

0 700 1,400

OTIE
An Oneida Nation Company

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Draft Final QAPP Addendum for Edwards AFB PFC Site Investigation

Document – Response to Comments and Redline Draft Final QAPP Addendum for Site Inspections of Aqueous Film Forming Foam Usage at Edwards AFB, Oneida Total Integrated Enterprises, August 2016
Reviewed By – Alonzo Poach, PG
Organization – The California Regional Water Quality Control Board, Lahontan Region
Date Review Completed – 24 January 2017

General Comments:

Item	General Comment	Response
1	Air Force Response to Water Board General Comment 6 – The response does not adequately address the comment. Water Board staff reviewed historical and current Waste Discharge Requirements (WDRs) issued for Edwards AFB. Associated historical WDRs include Board Order Nos. 6-86-12, 6-86-54, and 6-94-52 (see Enclosures). Relevant sections of the WDRs are highlighted in yellow. Review of the historical WDRs (Board Order No. 6-86-54) issued for the Fire Fighting Training Facility (prior to conversion to propane fire system) indicate that the only authorized discharge sites were the training pads and the sanitary sewer system for firefighting foams and wastewater. Recycled water use from the Edwards AFB Main Base Wastewater Treatment Plant (WWTP) was authorized in 1994 with revised WDRs (Board Order No. 6-94-52). The current WWTP disposal ponds (ponds 3 through 7) were constructed in 1986. From 1986 to 1994, the only authorized disposal sites for the WWTP were ponds 3 through 7. Therefore, it is very likely that wastewater containing firefighting foam was discharged to disposal ponds 3 through 7 between 1986 and 1994; since they were the only authorized disposal sites. (continued on next page)	Agree. The Current Main Base STP (CMBTP) will be added as an SI Area and included for sampling in the QAPP Addendum.. Groundwater monitoring wells 110-MW02, 110-MW03, and 110- MW04 will be sampled and sediment samples will be collected from Ponds 3 and 4. These two ponds were filled before water was sent to the other ponds (Operation and Maintenance Manual, Wastewater Lagoons, Edwards AFB, California. 1989) and, therefore, receive the majority of the treated water from the CMBTP during the period from 1986 to 1994. Samples will be analyzed for PFASs. The SI QAPP has been updated to include these locations, which are shown on new Figure 19. Disagree. Surface water samples will not be collected at CMBTP due to the ubiquitous nature of PFAS detections in surface waters of North America; this is in keeping with sampling proposed at several other SI Areas, including the Muroc Golf Course.

Item	General Comment	Response
1 Cont'd	The Water Board reiterates our request to add the current WWTP (sewage) disposal ponds as a potential per- and polyfluoroalkyl substances / perflorinated compounds (PFAS/PFC) release site. Water Board staff suggest that groundwater monitoring wells 110-MW02, 110-MW03 and 110- MW04, as well as surface soil and surface water be sampled and analyzed for PFAS (as applicable) from the ponds.	

Draft Final QAPP Addendum for Edwards AFB PFC Site Investigation

Document – Draft Final QAPP Addendum for Site Inspections of Aqueous Film Forming Foam Usage at Edwards AFB, Oneida Total Integrated Enterprises, December 2016
Reviewed By – Christopher Dirscherl
Organization – United States Environmental Protection Agency
Date Review Completed – 23 January 2017
General Comments:

Item	General Comment	Response
8	**Original General Comment (GC) 8:** The SI QAPP and Program QAPP indicate that PFC analysis will be performed by Maxxam based upon a modified version of the EPA method for perfluorinated alkyl acids in drinking water (EPA Method 537). However, not all of the modifications to the method are discussed in the SOP. Also, equivalency study information to support the fact that these modifications do not adversely affect method reliability are not provided or referenced. For example, Maxxam quantifies PFCs by isotope dilution (ID) whereas EPA 537 uses the internal standard quantification method exclusively. While use of isotope dilution may be acceptable, equivalency information should be provided to demonstrate that this and other modifications do not adversely impact the method's ability to reliably identify and quantify the analytes of interest. Please revise the SI QAPP to provide a complete list of modifications as well as the supporting equivalency information. **Evaluation of the Response to General Comment 8:** The response partially addresses the comment. Worksheet #19 & 30 lists the modifications to the analytical methods for PFCs made by Maxxam; however, not all of the modifications to the methods are discussed. For example, Method 537 indicates the calibration curve should be forced through zero, but this is not required for the Maxxam method. As another example, the Maxxam method has a different analyte list than Method 537. Please revise the QAPP to provide a complete discussion of the method modifications as well as the supporting equivalency information where applicable.	**Original Response to GC 8:** Agree: Worksheet #19 & 30 from the Program QAPP was added to the SI QAPP and revised to describe the method modifications. All method modifications have undergone an initial demonstration of capability (validation). **Response to Evaluation Comment GC 8:** Agree. Worksheet #19 & 30 has been revised to complete the method modifications, as well as describing the equivalency information for method modifications.

Item	General Comment	Response
11	The data validation to be performed on the PFC results is not clearly defined. The following issues should be addressed in the SI QAPP: a. The level(s) of validation to be performed should be consistently specified. Worksheet #11, Step 11.6, indicates that 100 percent (%) of the data will have Stage 2B verification and 10% of the data will be validated at Stage IV. In addition, the text of in Worksheet #36 of the Program QAPP states that 10% of the number of normal field samples and associated field QC samples will be validated. However, this contradicts the table in Worksheet #36, which indicates that 100% of the data will be validated (90% of the data will be validated at Level 2 and 10% of the data will be validated at Level 4). b. It is unclear what each level of validation will include (e.g., the QC checks to be evaluated, raw data reviewed, etc.). The requirements of the different levels/stages of validation should be clearly defined or referenced (e.g., this section should reference Guidance for Labeling Externally Validated Data for Superfund Use [USEPA, 2009] for this information). **Original GC 11c:** It is unclear how the 10% of the data will be selected for validation or Level 4 validation (e.g., critical samples, randomly, etc.). **Evaluation of the Response to GC 11c:** The response partially addresses the comment. The statement added to Section 11.6 is incomplete. Please revise this statement to clarify that the Stage 4 validation will be performed on the first analytical batches.	Agree/Clarification: a. Section 11.6 Step 6 (Step 5 in the Draft Final SI QAPP), sixth bullet of the SI QAPP was revised to include the following text:: "100% of the data will be validated (90% of the data will be validated at Stage 2B and 10% of the data will be validated at Stage 4)." b. Reference to Guidance for Labeling Externally Validated Data for Superfund Use (EPA 2009) was added to the sixth bullet in Section 11.6, Step 6. **Original Response to GC 11c:** The following text was added to the sixth bullet in Section 11.6, Step 6: "Data for Stage validation will be selected by selecting the first batch of each matrix (water or soil)." **Response to Evaluation Comment GC 11c:** Agree. The following statement has been added to Worksheet #11, Step 6: "Stage 4 validation will be prformed on every tenth (10^{th}) sample of each matrix (water or soil)."

Item	General Comment	Response
11	**Original GC 11d:**The table in Program QAPP Worksheet #36 indicates that data validation procedures will be provided in the site specific work plans and/or QAPPs, with the Department of Defense Quality Systems Manual (DOD QSM) and EM 200-1-10 providing guidance for any gaps in the QAPP validation procedures; however, this QAPP does not include data validation procedures for analyses of PFCs. In addition, the text of Worksheet #36 states that data will be validated a. according to the laboratory method as well as the DOD QSM. The SI QAPP should provide data validation procedures describing how samples will be qualified (e.g., when samples will be qualified estimated/rejected and if individual or all samples in a batch will be qualified) to ensure the PFC results are consistently and appropriately qualified. Please revise the SI QAPP to clearly and consistently define the validation to be performed on the PFC results, and to provide data validation checklists. **Evaluation of the Response to GC 11d:** The response partially addresses the comment. The response states that data validation will be described and a validation checklist was added as Appendix C.20, but Appendix C.20 does not include data validation procedures that describe how samples will be qualified based on quality control (QC) exceedances (e.g., when samples will be qualified estimated/rejected and if individual or all samples in a batch will be qualified). Instead, Appendix C.20 lists the parameters that will be validated. Please revise the QAPP to provide data validation procedures that describe how samples will be qualified based on QC exceedances.	**Original Response to GC 11d**. Data validation will be described and a checklist was added (Appendix C.20, PFC Data Validation Record) to describe how samples will be qualified. **Response to Evaluation Comment GC 11d:** Agree. The QAPP has been revised by the addition of a Worksheet #36 to provide data validation procedures that describe how samples will be qualified based on QC exceedances.

Item	General Comment	Response
12	**Original GC 12:** The QC samples and checks that will be performed for analyses of PFCs by Method 537 are incomplete. Worksheets #12 and #28 in the Program QAPP do not include the field reagent blank. In addition, Worksheet #28 in the Program QAPP for Maxxam is missing surrogates, internal standards, and the peak asymmetry factor. Please revise the SI QAPP to include all QC checks and associated measurement performance criteria and corrective actions for Method 537. **Evaluation of the Response to GC 12:** The response partially addresses the comment. The response indicates that the field reagent blank is included in Worksheet #20, but Worksheet #12 should include this QC sample to identify the measurement performance criteria (MPC) that will be used to assess the field reagent blank results. In addition, the MPC in Worksheet #28 are not always clearly identified. For example, the table indicates that the MPC for the surrogates is accuracy in the field samples, so it appears that the Method 537 limits of 70-130% will be used. Please revise the QAPP to include the field reagent blank in Worksheet #12 and to clarify the project specific MPC in Worksheet #28 (i.e., if the MPC are the same as the Method/SOP Acceptance Criteria).	**Original Response to GC 12.** Clarification: The purpose of the field reagent blank (FRB) is to identify PFC contamination arising during the sampling process. Our understanding is that the field conditions with respect to airborne PFCs will be the same throughout the base. This pertains to field conditions during both water and soil collection. Therefore, one FRB will represent the potential aerial contamination at the base. The FRB is listed in Worksheet #20 of the SI QAPP. Agree: Worksheet #28 Laboratory QC has been added to the SI QAPP to include surrogates, internal standards and peak asymmetry factor. **Response to Evaluation Comment GC 12:** Clarification/Agree. DoD defines blank samples as negative control samples, which typically include field blank samples and laboratory blank samples. The performance criteria specified in the DoD standard (Appendix B, Table B-15) for method blank will be applied to field blanks: <½ LOQ. This criterion has been added to Worksheet #12. (Worksheet #28 has not been modified because the FRB is a field QC element, not a laboratory QC element. Assessment of the FRB will be performed by OTIE as per Worksheet #12.)

Item	General Comment	Response
13	**Original GC 13:** The SI QAPP and Program QAPP do not include complete information for all of the analyses. For example, the Program QAPP does not include waste characterization samples in Worksheet #19 & 30 and the SOPs for these analyses are not listed in Worksheet #23. In addition, QAPP Worksheet #18 indicates soil samples will be collected for analyses for pH by SW 9045C, total organic carbon (TOC) by SM5310 B-Modified 2000, and grain size by ASTM D422. However, additional information for these samples and methods are not included in the SI QAPP. For example, the pH, TOC, and grain size data should be included in Worksheet #11 as an information input, and Worksheet #11 should specify how the data will be used. Also, Worksheet #19 & 30 should include the sample collection, preservation, and holding time requirements for these samples, as well as specify which laboratory will analyze these samples. Further, laboratory specific SOPs for all of these methods should be provided. Please revise the SI QAPP to include all proposed analyses in applicable worksheets, and ensure the applicable worksheets for all proposed methods are provided when this information is not presented in the Program QAPP. **Evaluation of the Response to GC 13:** The response partially addresses the comment. The waste characterization samples and analyses have not been included in Worksheet #19 & 30 to specify how these samples should be containerized and preserved. In addition, the SOPs provided for waste characterization are not listed in the QAPP (e.g., in Worksheet #23). Please revise the QAPP to include this information for the waste characterization samples to be collected. Further, Worksheet #19 & 30 should indicate that samples for analyses of pH will be analyzed as soon as possible after collection. Please revise the QAPP to specify that the holding time for samples to be analyzed for pH is as soon as possible.	**Original Response to GC 13.** Agree: Laboratory SOPs for pH, TOC, and grain size determination have been provided in Appendix B. Worksheet #19 & 30 has been added to include information on these analyses for sample containers and specifies the laboratory. Worksheet #11 has been revised to include pH, TOC and grain size determination. **Response to Evaluation Comment GC 13:** Agree. QAPP Worksheet #19 & 30 has been revised to specify that the holding time for samples to be analyzed for pH is as soon as possible.

Item	General Comment	Response
17	**Original GC 17:** The SI QAPP does not discuss how data will be reported and managed. Worksheet #36 in the Program QAPP indicates that a Level IV data package will be required, but does not specify what will be included in this report. It is also unclear if a database will be used, and how validated results are entered into the database and reviewed for accuracy to ensure qualifications are considered when using the database (i.e., especially a concern if data are rejected during validation). Further, the SI QAPP should discuss the length of time project documents and files will be stored before archival/disposal, and the location of the archive should be specified. Please revise the SI QAPP to discuss the data management, reduction and reporting tasks as per Section 3.5, Data Management Tasks, of the UFP QAPP Manual. **Evaluation of the Response to GC 17:** The response does not address the comment. The response indicates the requested data management, reduction, and reporting information would be included in Worksheet #17, but this worksheet does not discuss this information. Please revise the QAPP to discuss the data management, reduction and reporting tasks (e.g., Level IV data package requirements, database procedures, storage and archive procedures, etc.).	**Original Response to GC 17.** Agree: Data validation will be described in Worksheet #17 and a checklist will be added to describe how samples will be qualified (Appendix C.20). Data management, reduction and reporting tasks will be discussed in Worksheet #17. **Response to Evaluation Comment GC 17:** Clarification. Data management, reduction and reporting tasks, including data package requirements, are discussed in Worksheet #14 Project Tasks.

Specific Comments on the SI QAPP:

Item	Section	Page	Line	Specific Comment on SI QAPP	Response
10	WS#15	32-33		**Original Specific Comment (SC) 10:** This worksheet does not define PALs for many of the compounds and does not discuss how results for analytes without PALs will be evaluated and assessed. Please revise Worksheet #15 to discuss how the results for analytes without PALs will be evaluated and assessed. **Evaluation of the Response to SC 10:** The response addresses the comment; however, this information should be added to Worksheet #15. Please revise Worksheet #15 to include the discussion in the response regarding the available project action limits for PFCs and the reasoning for including the additional analyte results.	**Original Response to SC10.** Currently, PALs are only applicable for PFOA and PFOS based on the Tier III RfD from the U.S. EPA Office of Water health advisories and for PFBS based on the Tier II RfD from the U.S. EPA PPRTV. Additional PFCs, however, are quantitated by the analytical laboratories at no additional charge per the various modifications to U.S. EPA Method 537. While these analytes will not be screened against formal PALS, they do provide ancillary information suggestive of the formulation(s) of AFFF released and inform the overall conceptual site model (see Anderson et al. 2016; Chemosphere). Ultimately, this information will be useful in the RI phase. Consequently, it's prudent to generate these data now. **Response to Evaluation Comment SC 10:** Agree. The discussion above regarding the available PALs for PFASs and the reasoning for including the additional analyte results was included in the Notes for Worksheet #15.

Item	Section	Page	Line	Specific Comment on SI QAPP	Response
12	WS#17	34		**Original SC 12:**A data validation report will be generated for each sample delivery group and will summarize the results of the validation, but it is unclear what details will be included in this summary. Please revise the SI QAPP to ensure that data validation reports will present a discussion of all QC parameters evaluated, the acceptance criteria used to evaluate each QC parameter, a list of all QC exceedances as well as the extent of the exceedance, the samples associated with each exceedance, and the qualifiers applied. **Evaluation of the Response to SC 12:** The response does not address the comment. The information to be included in the data validation reports (DVRs) is not provided in Worksheet #17 (i.e., Section 17.3). Please revise Section 17.3 to indicate that the DVRs will present a discussion of all QC parameters evaluated, the acceptance criteria used to evaluate each QC parameter, a list of all QC exceedances as well as the extent of the exceedance, the samples associated with each exceedance, and the qualifiers applied.	**Original Response to SC 12.** Agree: Data validation will be described and a checklist will be added (Appendix C.20) to describe how samples will be qualified. **Response to Evaluation Comment SC 12:** Agree. The QAPP has been revised by the addition of a Worksheet #36 to provide data validation procedures that describe how samples will be qualified based on QC exceedances.

Item	Section	Page	Line	Specific Comment on SI QAPP	Response
13	WS#17 & 20	34 & 53		**Original SC 13:** According to Worksheet #17, "Field duplicate samples will be collected at a rate of 10 % of the native samples for each area;" however, in Worksheet #20, the rate of field duplicates is applied to the entire project, rather than individual sites. Similarly, Worksheet #17 indicates a rate of 5% for matrix spike/matrix spike duplicate (MS/MSD) samples at each site, while Worksheet #20 applies the rate of MS/MSD to the total number of samples collected for the project. Please revise the SI QAPP to resolve this discrepancy. **Evaluation of the Response to SC 13:** The response does not address the comment. Worksheet #17, Section 17.2 still indicates that the frequencies for collection of the field duplicate and matrix spike/matrix spike duplicate samples will apply to each area instead of the entire project as indicated in Worksheet #20. Please revise Worksheets #17 and #20 to provide consistent information for the frequencies that the QC samples will be collected.	**Original Response to SC 13.** Agree: Worksheets #17 and 20 have been harmonized. QC will be collected at these percentages for the entire project. **Response to Evaluation Comment SC 13:** Clarification/ Agree. The field duplicates and MS/MSD collection frequency will apply to the entire project. However, these samples will generally be distrubted evenly across the Areas. The text in the first paragraph of Worksheet #17, Section 17.2 was revised to read: "Field duplicate samples will be collected at a rate of 10 % of the normal samples for the entire project. Matrix Spike/Matrix Spike Duplicate (MS/MSD) samples are collected at a rate of 5% of the normal samples for the entire project. Duplicate and MS/MSD sample collection will be generally distributed evenly across the Areas."

Item	Section	Page	Line	Specific Comment on SI QAPP	Response
17	WS#17, Table 17.1 & Figure 2	36		**Original SC 17:** Table 17.1 indicates that well 5/14-MW-166 is proposed for sampling at Former/Current FTA, but this well is located slightly upgradient of cross-gradient. It is unclear why well 14-MW05, located downgradient of the Former/Current FTA, is not proposed for sampling instead. Please revise the SI QAPP to propose sampling of well 14-MW05 instead of well 5/14-MW-166. **Evaluation of the Response to SC 17:** The response addresses the comment; however, Table 17.1 was revised to replace well 5/14-MW166 with well 14-MW05. Figure 02 indicates that well 14-MW05 will be sampled and well 5/14-MW166 will only be gauged. Please revise the responses to resolve this discrepancy.	**Original Response to SC 17.** Clarification. Well 5/14-MW-166 was chosen because it is immediately adjacent to the Former FTA and in the overspray area. No revision was made in response to this comment. **Response to Evaluation Comment SC 17:** The updated response: Agree: The SI QAPP was revised to sample well 14-MW05 instead of well 5/14-MW166.

Item	Section	Page	Line	Specific Comment on SI QAPP	Response
19	WS#17, Table 17.1	41		**Original SC 19:** Table 17.1 indicates that soil borings at the 1984 Boeing 720 Controlled Impact Demonstration (CID) are "concentrating in the southern portion of the area," but does not explain why the southern portion is the only focus of the sampling effort. Please revise Table 17.1 to explain why samples are only proposed in the southern portion of the 1984 Boeing 720 CID area. **Evaluation of the Response to SC 19:** The response does not address the comment. While it is understood that "sample locations were biased towards locations of observed drainage channels or natural accumulation points," it is unclear why no drainage channels or accumulation points were identified in the northern portion of the 1984 Boeing 720 Controlled Impact Demonstration (CID). For example, if there were no drainage channels in the northern two/thirds of the site, the text should state this. Please revise the Redline QAPP to explain why no drainage channels or accumulation points were identified in the northern portion of the 1984 Boeing 720 CID area.	**Original Response to SC 19.** Clarification. The CID area is very large, measuring approximately 1,500 feet by 2,700 feet (see Figure 13). The sample locations were biased towards locations of observed drainage channels or natural accumulation points. Borings are concentrated in the southern portion of the area. This is explained in Table 17.1. No revision was made in response to this comment. **Response to Evaluation Comment SC 19** Agree. The sampling locations were reevaluated and the locations have redistributed for more uniform special coverage across the SI Area. These new locations are shown on revised Figure 13 and will be located in the accumulation points and drainage channels in the central and northern portion of the SI Area.

Item	Section	Page	Line	Specific Comment on SI QAPP	Response
22	WS#20	53		**Original SC 22:** This table indicates that only one field reagent blank (FRB) will be collected for groundwater samples, but it is unclear why only one is proposed. Section 8.3 in Method 537 states, "A FRB must be handled along with each sample set. The sample set is composed of samples collected from the same sample site and at the same time." Therefore, it is unclear why a FRB will not be collected at each site. In addition, it is unclear why the FRB will only be associated with the groundwater samples. Please revise this table to include a FRB at all sites and for all matrices, or to provide justification for why a FRB is not needed. **Evaluation of the Response to SC 22:** The response does not address the comment. According to the response, "the field conditions with respect to airborne PFCs will be the same throughout the base;" however, there is no basis for this assumption. Therefore, it does not appear that one field reagent blank (FRB) sample would be sufficient. FRB samples evaluate whether there are PFAS or other interfering compounds in the field environment. That environment could be different in different parts of Edwards Air Force Base (AFB), depending on where a site is located in relation to a location where PFAS may be present in blowing dust. In some areas of Edwards AFB, AFFF was released to the surface, but in other areas it was not. Some areas of Edwards AFB are paved, so many years of rainfall might have washed most pavement clean. As a result, it cannot be concluded that the potential for PFAS exposure is uniform for all locations across Edwards AFB. Please revise the Redline QAPP to include additional FRB samples.	**Original Response to SC 22.** Disagree: The purpose of the FRB is to identify PFC contamination arising during the sampling process. Our understanding is that the field conditions with respect to airborne PFCSs will be the same throughout the base. This pertains to field conditions during both water and soil collection. Therefore, one FRB will represent the potential aerial contamination at the base. **Response to Evaluation Comment SC 22:** Agree. The SI QAPP Worksheet #20 was revised to include two additional FRB samples, based on the rationale that theSI Areas can be generally be grouped into three areas: • North Base is generally greater industrial use per area • South Base is generally greater unpaved and/or undeveloped land use • The AFRL, which is generally isolated based on proximity from the remainder of Edwards AFB. One FRB will be collected from each of these regions. A brief summary of the rationale above was included in the Notes for Worksheet #20.

Item	Section	Page	Line	Specific Comment on SI QAPP	Response
25	Figure 6			**Original SC 25:** Figure 6 depicts both proposed borings 1874-SB01 and 1874-SB02 located adjacent to the AFFF tank house at Hanger Building 1874; however, it is unclear why one of these borings is not proposed for installation adjacent to the AFFF system discharge pipe, located approximately 100 feet to the northeast. In addition, no wells downgradient of Hanger Building 1874 are proposed for sampling. If no existing wells are present, then a boring should be installed for collection of a grab groundwater sample. Without sampling groundwater downgradient of Hanger Building 1874, no conclusions can be drawn about PFAS in groundwater in the event the results from existing well 24-MW09 are non-detect. Please revise the SI QAPP to include installation of a boring adjacent to the AFFF system discharge pipe at Hanger Building 1874. Please also revise the SI QAPP to include sampling of a well downgradient of Hanger Building 1874. If no suitable downgradient wells are available, then please propose an additional boring for the collection of a groundwater grab sample.	**Original Response to SC 25.** <u>Clarification:</u> During the Site Visit staining was observed on the ground near 1874-SB01 and 1874-SB02. Table 17.1 states in the fourth column: "Staining was observed on the pavement south of the building. Cracks in the asphalt were also observed within the stained areas. " and in the fifth column states: "Two soil borings (1874-SB01 and 1874-SB02) in significant cracks in the asphalt in areas of staining, near the south of the pump house where the release occurred." Samples collected from Hangar 1881 serve as downgradient sample locations for Hangar 1874.

Item	Section	Page	Line	Specific Comment on SI QAPP	Response
25 (cont.)				**Evaluation of the Response to SC 25:** The response partially addresses the comment. According to the response, "Samples collected from Hangar 1881 serve as downgradient sample locations for Hangar 1874;" however, it is unclear how it will be determined whether any detections at these locations are associated with Hanger 1874 or Hanger 1881. Please revise the Redline QAPP to clarify how it will be determined whether any detections at these locations are associated with Hanger 1874 or Hanger 1881 if the samples collected from Hanger 1881 are intended to serve as downgradient samples for Hanger 1874.	**Response to Evaluation Comment SC 25:** Agree. The text in Table 17.1 for soil borings was revised to read: **Soil Boring with Soil and Grab Groundwater Sampling** • Two soil borings (1874-SB01 and 1874-SB02) in significant cracks in the asphalt in areas of staining, near the south of the pump house where the release occurred. No groundwater samples will be collected from soil boring 1874-SB01 because it is very close to 1874-SB02, from which a groundwater sample will be collected. • One soil boring (1874-SB03) in the F-22 Facility parking lot south of the facility fence and where cracks in the asphalt were observed in a potential accumulation area downgradient of the pump house. • One soil boring (1874-SB04), upgradient of Hangar 1881 and downgradient of Hangar 1874, will be advanced to groundwater and sampled for groundwater only to determine whether detections in groundwater samples from Hangar 1881 borings are associated with Hangar 1881 or Hangar 1874. In addition, the last sentence in the Groundwater Sampling bullet for Building 1874which read "Note, there are no wells screened at the appropriate depth immediately downgradient of Hangar 1874." was deleted.

Minor Comments on the SI QAPP:

Item	Section	Page	Line	Minor Comment on SI QAPP	Response
1	WS#17, Table 17.1	41		**Original Minor Comment (MC) 1.** The entry for the Muroc Golf Course in the "Information from Site Visit" column of Table 17.1 references page 14; however, page 14 of the SI QAPP does not include any information regarding the Muroc Golf Course. Please revise the reference to specify the correct page number. **Evaluation of the Response to Minor Comment (MC) 1:** The response addresses the comment, but the revised reference to page 55 does not appear to be correct. Page 55 includes discussion of sample containers and shipment (Section 17.4.9) and well destruction and restoration (Section 7.4.10). Please revise the reference in Table 17.1 to specify the correct page number.	**Original Response to MC 1.** Agree. The entry for Muroc Golf Course in "Information from Site Visit" column of Table 17.1 was revised to specify the correct page number. **Response to Evaluation Comment MC 1:** Clarification. The intended reference was to text above this one in the Main Base STP row of Table 17.1. However, the extra lines in the Redline version shifted the page numbers. To prevent inconsistencies in the future, this page reference was removed.
2	WS#18	43		**Original MC 2.** Worksheet #18 states that, "A total of 65 groundwater samples will be collected (Table 18.2);" however, a total of 66 groundwater samples are proposed for collection in Table 18.2. Please revise Worksheet #18 to resolve this discrepancy. **Evaluation of the Response to MC 2:** The response appears to address the comment, but the number of groundwater samples specified in the QAPP remains inconsistent. Table 18.1 lists 68 groundwater samples, while Worksheet #20 specifies 67 groundwater samples. Please revise the Redline QAPP to consistently identify the number of groundwater samples proposed for collection.	**Original Response to MC 2.** Agree. Worksheet#18 text was revised to indicated 66 groundwater samples will be collected. **Response to Evaluation Comment MC 2:** Agree. Worksheet #20 was revised to consistently identify the number of groundwater samples proposed for collection.

Specific Comments on the Program QAPP:

Item	Section	Page	Line	Specific Comment on Program QAPP	Response
2	WS#19 & 30	58		**Original SC 2.** Worksheet #18 states that, "A total of 65 groundwater samples will be collected (Table 18.2);" however, a total of 66 groundwater samples are proposed for collection in Table 18.2. Please revise Worksheet #18 to resolve this discrepancy. The information for the preservation and holding times in the Program QAPP for water samples is not consistent with the analytical method. Section 8.5 of Method 537 indicates that water samples should be extracted as soon as possible, but no later than 14 days after collection. This same section states, "Extracts must be stored at room temperature and analyzed within 28 days after extraction." However, Worksheet #19 & 30 include a 45 day analytical holding time, and do not specify that extracts must be stored at room temperature. Please revise the SI QAPP to address these discrepancies and ensure that sample collection, preservation and holding time information is consistent with the analytical method. **Evaluation of the Response to SC 2:** The response partially addresses the comment. The provided Worksheet #19 & 30 does not indicate that the water extracts will be stored at room temperature as indicated in Section 8.5 of Method 537. Please revise this worksheet to indicate that extracts for water samples will be stored at room temperature.	**Original Response to SC 2.** See response to Minor Comment 2 on the SI QAPP. Agree: Worksheet #19 & 30 was added to the SI QAPP in response to this comment. Sample collection, preservation and holding time information, consistent with the method, has been included in Worksheet #19 & 30. **Response to Evaluation Comment SC 2:** Agree. Worksheet #19 & 30 has been revised to state that extracts for water samples will be stored at room temperature.

Item	Section	Page	Line	Specific Comment on Program QAPP	Response
5	WS#37			**Original SC 5.** The Program QAPP text states that the results of the data usability evaluations will be discussed in the project report. However, the contents of the data usability report are not sufficiently detailed. The data usability report should discuss how the evaluations (e.g., of data quality indicators and biases) were performed along with sufficient information to support the data usability conclusions. In addition, the data usability assessment should include an assessment of overall trends in the QC results (e.g., variable precision over all sample delivery groups). Please revise the SI QAPP to indicate that the data usability report will discuss how data quality indicators, trends and biases were evaluated and will provide sufficient information to support the data usability conclusions. **Evaluation of the Response to SC 5:** The response does not address the comment. The QAPP should specify what information from the data usability evaluation will be included in the final report(s) for the investigation. For example, the final report should describe how the data quality indicators (DQIs) were evaluated, along with the results of these evaluations and sufficient information to support the data usability conclusions. In addition, the final report should discuss the assessment of overall trends in the QC results (e.g., variable precision over all sample delivery groups). This information can be discussed as a section in the final report or provided in a Data Usability Report, which is included with the final report. Please revise the QAPP to indicate that the final report(s) will discuss how data quality indicators, trends and biases were evaluated and will provide sufficient information to support the data usability conclusions.	**Original Response to SC 5.** Clarification: The data usability evaluation is based on the data quality indicators: completeness, precision, accuracy, representativeness, comparability and sensitivity. Completeness is a percentage of project-specific data that are valid. Precision and accuracy (bias) will be evaluated quantitatively through the collection of the field and laboratory QC samples listed in Worksheet #20. Precision and accuracy goals for these QC samples are listed in Worksheet #12. Representative data will be obtained through selection of sampling locations and analytical parameters in accordance with the DQOs presented in Worksheet #11. Comparability of data will be achieved by consistently following standard field and laboratory procedures. Sensitivity goals are listed in Worksheet #15. No change was made to the SI QAPP in response to this comment. **Response to Evaluation Comment SC 5:** Agree. A Worksheet #37, Data Usability Assessment, was added to the SI QAPP to discuss how evaluations of the DQIs are to be made and reported.

Item	Section	Page	Line	Specific Comment on Program QAPP	Response
6	WS#37			**Original SC 6.** The text of the Program QAPP indicates that statistical tests that are appropriate for the task will be performed, but the tests are not identified in the QAPP. Please revise the SI QAPP to discuss why statistical tests are acceptable for this sampling effort. Please also revise the SI QAPP to indicate that the data usability report will provide a discussion on the selected statistical tests, including why the statistical tests were deemed appropriate (e.g., the assumptions behind the statistical test, and whether the data met those assumptions), as well as sufficient information to verify any statistical calculations. **Evaluation of the Response to SC 6:** The response addresses the comment; however, the information in the response has not been included in the QAPP. Please revise the QAPP (e.g., in Worksheet #17.3) to specify that the statistical tests for outliers discussed in Worksheet #37 of the Program QAPP will not be conducted for this project.	**Original Response to SC 6.** Clarification: For this SI QAPP, statistical tests for outliers will not be applied. All acceptable validated data will be used to assess project quality objectives. Potential outliers will only be removed if a review of the associated data indicates that the results have an assignable cause that renders them invalid. A description of data validation was added to Workheet #17 of the SI QAPP. **Response to Evaluation Comment SC 6:** Agree: The Program QAPP will be revised to specify that the statistical tests for outliers discussed in Worksheet #37 of the Program QAPP will not be conducted for this project.

Reference:

Environmental Protection Agency (EPA). 2009. Guidance for Labeling Externally Validated Data for Superfund Use. 13 January.

EPA,. 2016. Fact Sheet, PFOA & PFOS Drinking Water, Health Advisories. EPA 800-F-16-003. May.

Document – Response to Comments and Draft Final QAPP Addendum for Site Inspections of Aqueous Film Forming Foam Usage at Edwards AFB, Oneida Total Integrated Enterprises, August 2016
Reviewed By – Kevin Depies
Organization – Department of Toxic Substances Control
Date Review Completed – 7 October 2016
General Comments:

Item	General Comment	Response
Letter		The Air Force appreciates the prompt review of the Draft Final UFP-QAPP.
1st Paragraph of Letter	This document was distributed to DTSC electronically only on 17 August 2016 and identified as a "Draft Final", however, DTSC considers it a Draft for the purposes of regulatory review. The standard schedule per the EAFB Federal Facilities Agreement (FFA) is for 60 day regulator review, followed by the issuance of a Draft Final within 60 days to allow the regulators to be assured that comments were adequately addressed prior to finalizing the document. We assume a draft final will be provided to DTSC for concurrence.	The FFA is not applicable in this case because the PA/SI workplans/reports are not considered Primary Documents. This work is being done voluntarily given the lack of ARARS or other legal driver. Consequently, the USAF is the lead agency. DTSC has been, nonetheless, given an opportunity to review. Subsequent to the revisions made from this review, the document will be final.
1	DTSC recognizes that PFCs are not currently regulated under CERCLA, that the Air Force is conducting this work as a voluntary action as a result of relatively recent information indicating that PFCs may be hazardous to human health and biota, and appreciates the Air Force involving DTSC in the scoping of the work. However, the PA was performed with no input by DTSC and the site inspection was scoped with only limited DTSC input. These concerns were expressed to the Air Force in DTSC comments on the Final PA , in the 13 May 2016 teleconference, and in comments on the SOF. Based on the discussion during the teleconference, DTSC understands that the SI scope is limited to providing an indication of whether PFCs were released in the areas to be investigated. The Air Force noted that the work scope limitation is due to several factors, but mostly because of funding availability and that substantial resources would be required to conduct a comprehensive investigation. However as discussed in our comments on the PA, DTSC would like to again caution the Air Force that	Comment acknowledged.

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	because the investigation is of such limited scope, the absence of detectable levels of PFCs in the proposed soil, sediment, and groundwater samples may not adequately demonstrate that PFCs are not present in the areas (sites) being investigated or that there may be release areas at EAFB other than those identified in the Plan.	
2	Although DTSC asked it not be used for EAFB workplans and sampling plans, the Plan is prepared utilizing the UFP-QAPP format, which DTSC has found to present information in a complex, unintuitive way with key/critical information "buried" in various "Worksheets" rather than in easy-to-locate and up-front document sections. Also, the various UFP-QAPPs presented for EAFB activities have been frequently inconsistent in presenting information, making our reviews difficult and likely making it difficult for the public to understand what we are doing. Goals/objectives are sometimes presented in Worksheet 11, 14, 17, or 18; field methodology is sometimes presented in Worksheets 14, 17, or in Attachments; and other critical information is presented in various worksheets. To accommodate the problems DTSC has identified with the UFP-QAPP format, EAFB previously agreed to put important key information [specifically, the purpose, goal(s), and objectives, and a listing of the work to be performed] into an "Introduction" section so a reader did not have to search through various worksheets for this critical information. This was not done for the Plan. The Plan in particular presents information in locations considerably different than many of the other EAFB UFP-QAPPs, unnecessarily complicating our review and requiring much more of our time trying to understand the proposed work. Review and understanding of the document would be more efficient if the Plan followed a more traditional workplan format. Several significant issues with the Plan, probably as a result of the use of the UFP-QAPP format, identified by DTSC are expressed below. a. The Plan lacks clear purposes, goal(s), and objectives. Although the first sentence of the eighth paragraph in the Executive Summary begins with "The objectives for this investigation…" it appears to be referring to a nationwide activity, rather than objectives for the EAFB PFC Site Inspections. Additionally, the sentence is describing a goal, not "objectives". The first sentence of Section 10.2.1 describes an "overall objective" to conduct Site Inspections at various Air Force installations	The UFP-QAPP format is being used for all the PFAS SIs at multiple Air Force bases. A traditional work plan format will not be provided for this project. However, a list of work to be performed is provided in Worksheet 14 and 16. a. Agree. The following text in the Executive Summary "The goal of the SI is to confirm the presence or absence of PFASs from Air Force-mediated AFFF releases at the 23 SI areas. The objective is to sample environmental media for PFASs and evaluate concentrations with respect to applicable criteria (listed below)." and Note that Section 10.2.1 was moved to Worksheet 11, Develop the Plan for Obtaining Data (STEP 7). Worksheet #11 Section 11.1, Project Statement (STEP 1) was revised to include the following: "The purpose is to protect human health and the environment

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	where PFCs may be found. This is an overall goal, or may be construed as a purpose, but it is not an objective nor is it specific to the work being presented in the Plan. Worksheet 11 is supposed to have Data Quality Objectives (DQOs), but none are provided. Although the first sentence of Section 11.2 uses the term "objectives", it instead again presents a goal for the overall nationwide program. The first paragraph of Worksheet 17 states that sample locations will target areas to achieve the DQOs in Worksheet 11. No DQOs are presented in Worksheet 11, but DTSC did find some DQOs at scattered locations in Worksheets 10, 17, and 18. The document needs to clearly explain the goals, purposes, and objectives of the investigation. Specific DQOs also need to be provided in a single location (presumably Worksheet 11). DTSC Response: A review of the redline/track-mode version shows that significant changes have been made to provide the requested information and in a more logical format mostly consistent with other recent EAFB UFP QAPPs. DTSC still considers format cumbersome, overly complex and unintuitive but the information is now provided as needed. Comment addressed.	from PFASs released as a result of Air Force-mediated AFFF releases at Edwards AFB. The goal of the SI is to confirm the presence or absence of PFASs from Air Force-mediated AFFF releases at the 23 SI areas." Clarification: Specific DQOs are provided in Table 17.1. The following text was added to Worksheet 11, Section 11.3, Identify Information Inputs (STEP 3), 8th bullet: "DQOs for sample locations, including well selection, are provided in Worksheet 11, Section 11.7, Sampling Rationale; Worksheet 17, Table 17.1, column 5, Proposed Investigation Approach; and Worksheet 17, Table 17.2, column 12, Selection Rationale for Wells Proposed for Sampling." **Air Force Response**. Comment acknowledged.
	b. It was our understanding, based on what we were previously told by the Air Force, the UFP-QAPP is the document staff will use in the field to conduct the field work. Based on all the other EAFB UFP-QAPPs we have so far seen, Worksheet 14 should contain a detailed description of all work to be performed and specific to the location where the work will be performed. However, Worksheet 14 instead provides a simple table identifying "OTIE and Subcontractors" as doing the various tasks and directing the reader to the project schedule for start/completion dates. This table provides nothing of substance. Add to Worksheet 14 a clear description of all field activities specific to the work that will be performed at the areas being investigated. Specific detailed methodology can (and is in the Plan) be provided in an Appendix. We noted that many, but not all, of the field activities are presented in a generalized format in Worksheet 17. However, by being presented in a generalized format not specific to EAFB, the Plan does not clearly	b. Agree. Table 17.1 in Worksheet 17 and Table 18.1 in Worksheet 18 provide a detailed description of all work to be performed and specific locations where the work will be performed. In addition, a task list is provided in the table at the beginning Worksheet 14 & 16, This table was also revised to include estimated start and finish dates for tasks. Agree. Worksheet 17, Sections 17,1 through 17.4 have been added to define the sampling approach. Agree. The sampling specifics from Worksheet 18 were either removed or moved to Worksheet 14. Only the Sampling Locations and Methods table (Former Table 18.2, renumbered as Table 18.1) remains in Worksheet 18. Depth to water information was moved from Worksheet 18 to Worksheet 10.1, in the second column under Physical Profile,

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	specify the sampling approach or take into account how sampling for each site will vary due to the complicated and varying hydrogeologic environment at EAFB. We noted that some (sampling) specifics are also inserted in Worksheet 18, which just adds to the lack of clarity on what the Air Force will do in the field. For example, although Worksheet 18 notes that depth to first groundwater (dtw) at EAFB ranges from 9 to 120 feet below ground surface (information that belongs in the background section in Worksheet 10 and is applicable to the DQO section in Worksheet 11), unexplained is the impact this has on attempts to collect groundwater samples from borings at specific proposed sampling locations. Please note also that at EAFB, dtw is greater than 250 feet below ground surface; perhaps this has a bearing on the investigation but it is unclear since the dtw information is presented generically rather than on a site-specific basis. Worksheet 17 implies that groundwater sampling will be achieved using hollow stem augur (HSA) drilling. However, this does not take into consideration that at some sites, groundwater sampling will not be possible because groundwater is only in bedrock and HSA cannot penetrate bedrock. Provide in Worksheet 14 all field activities specific to the sites to be investigated. Also, in Worksheet 11, or perhaps 18 provide your expectations for successfully collecting soil boring groundwater samples based on the drilling technique, anticipated dtw, and anticipated depth to bedrock. DTSC Response: Comment addressed. c. The "Proposed Investigation Approach" column in Table 17.2 implies that groundwater samples will be collected in the stated monitoring wells (which is clear), but also implies groundwater samples will only be collected from the soil borings. Furthermore, the identifications for borings for groundwater sampling in Table 18.2 do not match with those of the borings listed in Table 17.1 or on the sample location figures. We did, however, notice that sediment sample locations are consistently identified on figures and in tables. Provide a clear identification of where groundwater sampling will likely occur, use consistent IDs for borings in	Hydrogeology and was repeated in Worksheet 10, Section 10.2.3, Hydrogeologic Setting. Agree. Field activities specific to the sites to be investigated have been added to Worksheet 14. Agree. The low likelihood of collecting a groundwater sample in borings drilled to bedrock has been discussed in Worksheet 11. **Air Force Response**. Comment acknowledged. c. Agree. The following note was added to Table 17.2: "Grab groundwater samples will be collected from all borings unless specifically stated otherwise in this table." Agree. Boring identifications in Table 17.1, Table 18.1, and figures were corrected so that all boring locations now match. In addition, the well symbols on the figures were changed to differentiate between wells that will be sampled and wells that will be gauged only. d. Agree. Additional informational inputs have been added to Worksheet 11, Section 11.3 Identify Information Inputs (STEP 3). Please see response to General Comment 2, Item b for further information regarding DQOs. Agree. The last sentence in the second paragraph of Worksheet 18 was removed.

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	tables/figures, and make it clear on figures which borings/wells will be sampled. DTSC Response: Much improved, thank you. d. A critical "location-specific" DQO ("Borings shall be advanced at locations where PFC contamination is deemed most likely based on initial site visit and information presented in the PA") is provided in an apparent random location at the end of the second paragraph in Worksheet 18. This statement explains the rationale for where borings are located. Also discussed in Worksheet 18 are soil and groundwater samples to be collected from these borings. Based on what we have seen in other EAFB UFP-QAPPs, this information should be in Worksheet 11. Also, lacking are specific DQOs for monitoring wells to be sampled. We found several general but important DQOs such as "Soil and groundwater samples will be collected from boring locations near the AFF release points and downgradient areas") in Worksheet 10.2 (which should instead be in Worksheet 11), but no specific DQOs for the various sampling locations. For example, the DQO for why Site 14 monitoring well 14-MW05 is to be sampled is presumably because 1) it is a water table well, 2) located close to and downgradient of the potential release area, 3) will provide data to determine if groundwater has been impacted by PFCs, and 4) will aid in determining if a PFC release occurred in the upgradient potential release area. Similarly, well 5/14-MW166, presumably also screened across the water table, is in close proximity but sidegradient to the potential release area and was likely selected because it could provide groundwater data on the presence of PFCs directly below the release area. However, the rationale for the selection of specific wells is not provided	**Air Force Response**. Comment acknowledged. Agree. The text from former Section 10.2.1 was moved to Worksheet 11, Section 11.7, Develop the Plan for Obtaining Data (STEP 7). Agree/Clarification: The following DQOs have been added to Worksheet 11, Section 11.7, under Environmental Media to be Sampled, • Existing monitoring wells were selected for groundwater sampling based on the following DQOs and the weight of evidence from site-specific information summarized in Tables 17.1 and 17.2: o Well locations will provide data to determine if groundwater contains PFAS above the detection limit and aid in determining if a PFAS release occurred in the potential release area; o Well screened across the water table; o Well downgradient of potential release area or below potential accumulation area; and o Well in close proximity to potential release area. The rationale for the selection of specific sample locations, including wells, is provided in Table 17.1. Wells were selected based on the DQOs added to Worksheet 11 above and the depth to water, screened interval, and orientation and proximity to the potential release area listed in newly added Table 17.2. See response to General Comment 8a through 8u for additional explanations for sampling location selection.

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	in the Plan. This information needs to be conveyed for each sample location. DTSC Response: Comment addressed.	**Air Force Response**. Comment acknowledged.
3	Because release areas are not described or shown on figures, DTSC assumed that potential release locations are wherever soil borings and sediment samples are shown on figures, which is implied in Worksheet 18. However, a reader should not have to go back to the PA to determine the locations of suspected release areas. Please show potential release locations (possibly using color shading or a cross-hatched pattern) on each of the sample location figures. DTSC Response: No further comment.	Disagree. While sampling will occur at sites with documented releases, in some cases the documentation does not identify the exact release location and surface flow path(s). Also, although sampling may confirm a PFAS release, figures with shading and hatching may be mistaken for the extent of the release. Therefore, shading or hatching will not be added to figures. **Air Force Response**. Comment acknowledged.
4	Add a table of well construction data, similar to those provided in groundwater monitoring reports, for all the wells shown on the figures and in tables so that this critical information is available to reviewers and workers doing the fieldwork. The table should Include approximate depth to water, date the water level was measured, and depth to bedrock so that well screen depth interval relative to depth of groundwater water and bedrock is apparent. DTSC Response: Comment mostly addressed. The table provides depth to water below top of well casing rather than depth below ground surface. While depth below casing is of use when calculating groundwater elevation it provides only limited understanding of actual depth to water below ground surface. Please either replace depth to water below top of casing with depth to water below ground surface (less desirable) or add depth to water below ground surface to the table (more desireable).	Agree. A well construction table with depth to water, screened intervals and depth to bedrock, when available, has been added to Worksheet 17 as Table 17.2. **Air Force Response**. Clarification: Ground surface-to-top-of-casing information (stickup) is not available for most wells. While it is agreed that it would be desirable to have both types of depth measurements in the table, depth-to-water below top of casing provides an adequate approximation of depth below ground surface for the purposes of the SI as proposed. In addition, groundwater depths from nearby wells, as available, will be measured in the field during the SI to obtain the most recent depth information. Stickup height can be measured at that time. A list of groundwater wells proposed to be gauged for each SI area is provided in Table 17.2 in Worksheet 17.
5	For wells to be sampled/gauged, please identify the screen interval depth relative to dtw to provide us with an indication if the wells are screened across the water table. DTSC Response: Please see General Comment 4.	See response to General Comment 4. **Air Force Response**. Please see response to General Comment 4.
6	For logistical reasons, the Plan should make it easier for the reader to determine	Agree. OUs will be identified on Table 17.1 and Table 17.2

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	the locations of the proposed PFC sites with respect to Operable Units (OUs); existing groundwater investigation areas within Operable Units such as the "Southern OU 1 Groundwater Plume" or the "South Air Force Research Laboratory (AFRL) groundwater area; and any nearby sites should be shown on figures. For example, it is not clear where Site 26 is relative to the OUs at the AFRL or whether any Installation Restoration Program (IRP) sites are nearby. In fact, it is difficult to even tell if this site is at the AFRL. This makes it extremely difficult to determine the location of this site and identify other sources of environmental data derived from other investigations conducted in the area. Through extensive email communication with EAFB staff, we were able to determine that this site is north of Site 13 in the South AFRL groundwater area in OU 4/9. Please add to Table 17.1 in the second column, the OU and Groundwater Area (such as "South AFRL", or "Northern OU 1 plume") so that the relative location of each PFC site to other CERCLA sites is readily apparent to the reader. This is a relatively simple addition to the table and is an alternative to providing this information on each of the PFC investigation area figures. DTSC Response: Comment addressed, thank you.	in Worksheet 17. **Air Force Response**. Comment acknowledged.
7	Site figures showing proposed sampling locations don't always show all wells in the area depicted on the figures. For each site figure, please ensure that all wells that are located within the area being depicted are shown. We have identified some in comments below. Also, identify which wells were dry during the latest period when water level measurements were made. Last, consistent with Comment 1c above, on the figures show which wells will be sampled rather than just "gauged". DTSC Response: Comment addressed.	Clarification. The figures show all wells available through GIS and ERPIMS. Agree. Dry wells will be identified on the figures. Agree. Figures were revised to indicate which wells are proposed for sampling and which wells are proposed for gauging only. In addition, Table 17.2, added to Worksheet 17, summarizes this information. **Air Force Response**. Comment acknowledged.
8	Based on a statement in Worksheet 10.2, sampling is to be performed from wells inferred to be downgradient of suspected release areas (this is a DQO better suited to Worksheet 11). DTSC conducted a review of proposed monitoring well sample locations presented in the Plan that included a detailed assessment of likely groundwater flow directions for each area. EAFB is aware of DTSC's position that groundwater flow in bedrock at EAFB is	The text from former Section 10.2.1 was moved to Worksheet 11, under Develop the Plan for Obtaining Data (STEP 7).

Item	General Comment	Response
	highly controlled by directional fractures and flows along preferential pathways which are not well identified using traditional kriging methods for developing potentiometric surface (water level) figures. Kriging provides only generalized potentiometric surface contours and flow directions rather than detailed local flow directions in bedrock at EAFB. DTSC has found the Triangular Irregular Network (TIN) method more reliable than kriging for determining groundwater flow paths in the bedrock at EAFB. Other factors can be used to aid in determining GW flow directions are regional and local site hydrogeology including surface topography, above and below-ground bedrock configuration, faults, surface water traces, and water chemistry. This type of review for determining local flow directions is resource and time intensive, but is necessary to ensure that groundwater samples are truly collected from downgradient locations and are most likely to achieve DQOs. Below are the results of our assessment and comments on or recommended changes to the Plan. Note that DTSC did not have the time to develop and review TIN water level figures for OU 1, so the review of OU 1 sites is based on a 2015 Air Force water level (WL) figure provided to DTSC. a. Site 14. Located in the northern portion of OU 2. This site is near the lakebed and DTSC utilized the 2015 WL figure for assessing flow direction. Local flow direction is impacted by the presence of injection/extraction wells in the area. Wells that appear relatively unimpacted by the remedial activities indicate a general southeasterly groundwater flow direction, somewhat different than the east-southeast direction shown on Figure 2. Well 14-MW04 appears to be a reasonable downgradient sampling location, but well 56/14-MW166 is sidegradient (although close to) a suspected release location. Based on the southeast flow direction, well 14-MW05 appears to be downgradient of the western suspected release area and might be a more appropriate sampling location. b. Hangar Buildings 151 and 160. Located in OU 2 between Sites 5/14 and 76. We have no groundwater (GW) monitoring well data for this area to independently verify the GW flow direction shown on Figure 4. Based on Sites 5/14 and 76 data, GW flow direction is probably in the alluvium and towards the southeast, as shown on Figure 4. Based on Table 18.2,	a. Agree. Well 5/14-MW-166 will be replaced by well 14-MW05. All text, tables, and figures were updated to reflect this change. b. Agree. During the scoping meeting, it was agreed that existing wells were too far from the potential release areas to provide useful groundwater data. The legend on Figure 4 was modified to reflect that no existing wells are proposed for sampling. Note that three borings will be advanced with a hollow stem auger (HSA) drill rig and one boring

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	we assume GW sampling will only be performed at the four proposed borings near these buildings. Due to the uncertainty regarding direction of groundwater flow, a data gap for downgradient groundwater quality will likely remain after the sampling has been completed. c. Site 26. Located in South AFRL. Review of a prior TIN figure prepared by DTSC confirms a southeast groundwater flow direction as shown on Figure 3, although we lack good control so there is some uncertainty in this determination. As proposed in the Plan, well 26-MW08 appears to be a good downgradient well candidate for sampling, assuming it is a water table well. We noted that Table 18.2 indicates that water samples will be collected from the borings at this site using HSA. However, since groundwater is likely only in bedrock below the alluvium, it seems unlikely that sampling the borings for groundwater will be successful. The Plan should discuss this. d. Hangar 1600. Located in OU 1 near Sites 17 and 49. The 2015 WL Figure shows generalized flow direction to the southeast while the Plan (Figure 5) shows an east-southeast direction. A closer look at the water levels for wells in the area show a fairly complicated flow regime (probably due to extraction or injection of Site 49 wells), making the selection of appropriate downgradient wells problematic. Table 18.2 indicate that wells 49-MW03 and 48-MW16 will be sampled. Regardless of whether flow direction is southeast or east-southeast (as discussed above) 48-MW16 is sidegradient of the suspected source areas and of questionable use for meeting a DQO of obtaining downgradient water samples. Recommend instead sampling downgradient well 52-MW15. **DTSC Response.** The response indicates that 52-MW15 will be shown on the figure and as being sampled, however Figure 5 does not show this area so the well cannot be (and is not) shown on the figure. DTSC does not recommend increasing the figure scale to show the well; recommend instead changing the size of the figure to 11 x 17 inches to show the well. e. Hangar Building 1608. Located in OU 1 generally near Site 17. See Hangar 1600 discussion above for groundwater flow directions. The Plan proposes sampling well 17-MW02, which appears to be slightly sidegradient of the area immediately downgradient of the potential	(160-SB04) will be advanced with a hand auger in the retention pond due to steep in slope making drilling with a HSA drill rig impossible. c. Agree. Comment noted and the text of Worksheet 11, Study Boundaries (STEP 4) was updated to clarify methodology for collecting a groundwater sample where groundwater is in the granitic bedrock. The following text was added to Section 11.4, Study Boundaries (STEP 4): "At areas were groundwater is present in granitic bedrock, sonic drilling technology will be used to advance borings into bedrock and install temporary wells for groundwater sampling. All other borings will be advanced using hand auger or hollow stem auger (HSA) drilling technology. Table 17.2 in Worksheet 17 indicates depth to water and depth to bedrock." d. Agree. The groundwater flow direction will be revised to east-southeast as shown in Groundwater Monitoring Sampling Report (GMSR) (AECOM Technical Services, Inc.[AECOM] 2015 Clarification. Well 49-MW03 is proposed for sampling and is downgradient of Hangar 1600. Well 52-MW15 will be added to the figure and will be sampled under Hangar 1624. Table 17.1 was revised for Hangar 1600 to read: "• Collect a groundwater sample from groundwater monitoring well 49-MW03, downgradient from Hangar 1600, and well 48-MW16, located in a downslope accumulation area" **Air Force Response**. The Figure 5 submitted with the first Air Force response to this comment was sized as 11x17 and shows well 52-MW15 on the east side of the figure. Perhaps the reviewer inadvertently printed it as 8.5x11. e. See response to Specific Comment 8d above.

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	release area. The sampling of well 17-MW02 may therefore not provide sufficient downgradient water quality information, but DTSC was unable to identify any alternative wells for sampling. f. Hangar Building 1624. Within Site 49 in OU 1. See Hangar 1600 discussion above for groundwater flow directions. The Plan proposes sampling well 49-MW04, which is very close to the suspected release area and a good candidate for assessing potential impact from a PFC release that occurred east of Building 1624. DTSC recommends also sampling 52-MW05, which would provide additional downgradient coverage. **DTSC Response.** The response is correct. g. Hangar Building 1870. Just southwest of Site 20 in OU 1. Based on the proposed soil boring locations, the potential release area appears to be just to the north and northwest of Hanger 1870. The OU 1 2015 WL map shows flow direction to the southeast and east-southeast. There are no nearby directly downgradient wells. The Plan proposes sampling an upgradient well, 61-MW40A, which conflicts with the DQO for well sampling. The nearest potential downgradient well is 18-MW15, although it does not appear to be directly downgradient of the potential release area. Wells 18-MW13 and 18-MW14 are about the same distance from the potential release area as 18-MW15 and may also be downgradient. A more ideal location for groundwater sampling would be the area between wells 18-MW13 and MW14 and well 18-MW15. Instead of well 61-MW40, DTSC recommends samples be collected from 18-MW13/MW14 and 18-MW15. Figure 6 should show that wells 18-MW10, 18-T02 and 18-T04 are dry. Associated with Hangar 1870, based on proposed sediment sample F22-SS01 (shown on Figure 6) is a potential release location east of Building 1864. We noted that no associated GW wells are proposed to be sampled, presumably because there do not appear to be any wells directly downgradient of this area. Please confirm this and discuss in the text. h. Hanger Building 1874. Located in OU 1, west of Site 18. Based on the soil boring locations on Figure 6, we assume the suspected release area is	f. Clarification: It is assumed that the reviewer meant to recommend sampling additional well "52-MW15", instead of "52-MW05" because 52-MW05 could not be located on Plate 1 of the 2012 GMSR (AECOM 2015). Agree. Table 17.1 was revised for Hangar 1624 to read: "Collect groundwater samples from source area groundwater monitoring well 49-MW04 and downgradient groundwater monitoring well 52-MW15." Table 18.1 and Worksheet 20 were also revised to accommodate this well. **Air Force Response**. Comment acknowledged. g. Clarification: Well 61-MW40A was selected for sampling because it is the nearest groundwater monitoring well to the area (Hangar 1870) and is in a potential accumulation area based on the ground surface observed during the site visit to be sloping downward toward 61-MW40A. Wells 18-MW14 was dry in October 2006 and 18-MW15 had a 1 foot water column in August 2012. Well 18-MW13 is not screened across the water table and is, therefore, not appropriate for sampling PFASs because they would be concentrated at the top of water column. Agree. Figure 6 was revised to show that 18-T02 and 18-T04 are dry. Well 18-MW10 is not screened at the same depth as these wells and is not proposed for sampling or gauging. Agree. No wells are proposed downgradient Hangar 1864 because there are no nearby downgradient wells screened at the appropriate depth. The following text was added to Table 17.1 under Hangar Building 1874: "Note, there are no wells screened at the appropriate depth immediately downgradient of Hangar 1864." h. Disagree. Well 24-MW09 was selected because it is close to Hangar 1874. All downgradient wells were a significant

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	immediately south of Hangar 1874. Based on an easterly flow direction (confirmed by reviewing the OU 1 2015 water level map), there are no good wells downgradient from this suspected release area. However, well 18-MW47 possibly could be downgradient and should be sampled. The text in the Plan notes a potential accumulation area a few hundred feet south of the hangar building and proposes sampling well 24-MW09. Unclear to DTSC is the location of the potential accumulation area. Possibly this is the dirt area shown on Figure 6 a few hundred feet south of Building 1874? If so, then well 24-MW09 is not downgradient. Well 18-T19 appears to be the best candidate for being downgradient of this area and should be sampled. Until the potential accumulation point is presented on Figure 6, DTSC is unable to determine whether well 24-MW09 or well 18-T19 would be the best candidate to sample. **DTSC Response.** The response indicates that 18-T19 is too far downgradient to meet project DQOs and indicates that 24-MW09 is to be sampled because it is close to the Hanger 1874 potential release location. However, based on the groundwater flow direction, 24-MW09 is side-gradient and potentially upgradient of the identified potential release area, so DTSC questions if the project DQOs can be met with the planned groundwater sampling regime. i. Hanger Building 1881. Located in OU 1 near Site 18. The 2015 OU 1 water level map shows groundwater flow direction to the east. The Plan proposes sampling well 18-MW47, but this well is south-southeast of the building, which places it sidegradient of any PFC plume that might originate from the potential release area. A better candidate would be well 18-T02, but this well was dry in 2015. There are no good relatively close downgradient wells. The best options for downgradient wells are somewhat distant wells 18-T10 and 18-DEW08. We recommend one of these be sampled. DTSC Response. While DTSC agrees 18-MW47 is in the general vicinity of Hanger Building 1881, DTSC disagrees that it is hydraulically downgradient and believes the QAPP text should not state it is "downgradient" of the hangar.	distance away. The goal of the SI is to confirm the presence or absence of PFASs from Air Force-mediated AFFF releases at the 23 SI areas. Clarification. As stated in Table 17.1, the potential accumulation area downgradient of the pump house is at soil boring 1874-SB03 in the F-22 Facility parking lot south of the facility fence and where cracks in the asphalt were observed during the Site Visit. **Air Force Response**. Clarification: While well 24-MW09 is potentially side-gradient, this location was selected for sampling because staining from AFFF release to the asphalt was observed approximately 250 feet north of well 24-MW09 in a topographically upslope location. Therefore, the Air Force believes that well 24-MW09 may provide source area groundwater data. i. Clarification. The Air Force agrees that there are no good relatively close downgradient wells. Disagree. Well 18-MW47 is close to Hangar Building 1881 and is the most likely well to contain PFASs, if present in groundwater from this Hangar. The text in Table 17.1 was revised to state: "Collect a groundwater sample from downgradient groundwater monitoring well 18-MW47." **Air Force Response**. Agree: The text in Tables 17.1 has been modified to read, "Collect a groundwater sample from existing groundwater monitoring well 18-MW-47." The cell with the selection rationale text for this well in Table 17.2 in Worksheet 17 was expanded to make all text visible.

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	j. Hangar Buildings 4801 and 4802. Located in OU 6. Figure 7 shows two soil/sediment sample locations which we assume are the suspected release areas. The first is a drainage outfall southeast of Building 4801, where a sediment sample (4801-SS01) will be collected. The second is east of the main taxiway and a few thousand feet southeast of 4801/4802 where a soil boring will be drilled. Based on a review of water levels provided in the OU 6 2015 Remedy Performance Report, DTSC concurs with the mostly easterly groundwater flow direction depicted on Figure 7. No groundwater sampling is proposed for the drainage outfall area, but there are wells in the area that are not shown on Figure 7, including N4-MW01, N1-MW06 and N1-MW07. N1-MW07 and N1-MW06 are immediately downgradient of the drainage outfall and at least one of these should be sampled. Since N1-MW07 has the higher TCE concentrations of the three, we assume it is the water table well and should be sampled. As for the second potential release location, the Plan identifies well N4-NW03 to be sampled, which appears to be an appropriate downgradient well. **DTSC Response.** Considering the concentrations of TCE present (less than DNAPL conditions) and the general flow regimes at EAFB (limited vertical gradients), the fact that there are higher concentrations of TCE in deeper screened well N1-MW07 relative to water table screened N1-MW06 is the opposite of what would be expected. DTSC isn't necessarily questioning the Air Force's rationale to sample N1-MW06 rather than N1-MW07, but the decision to sample MW06 instead of MW07 needs to be better explained in light of the unexpected inverted TCE concentrations in these wells. Perhaps it is due to a strong downward vertical gradient and/or a complicated source configuration, or possibly due to remedial activities. Regardless, the CSM needs to be more fully explained so that greater confidence is made in the decision to sample MW06 instead of MW07. k. Buildings 4826 and 4840. Located in OU 6. The OU 6 2015 Remedy Performance Report does not show this area so we were unable to verify well locations or groundwater flow direction at Buildings 4826 and 4840.	j. Clarification: As stated in Table 17.1, • Sediment sample location 4801-SS01 is proposed in an unpaved area downslope and southwest of the pavement in the direction of surface runoff from Buildings 4801 and 4802 to Rogers Dry Lake. • Sediment sample location 4801-SS02 is proposed at the discharge point from drain system from Buildings 4801 and 4802 to Rogers Dry Lake via storm water lines. Agree: Well N1-MW06 was added to the sampling plan. This well is screened across the water table and is downgradient of the discharge point from the drain system from Buildings 4801 and 4802 (near sediment sample 4801-SS02). Well N1-MW07 is not suitable for sampling as it is not screened across the water table. The following text was added to Table 17.1 for Hangar Building 4801: **"Existing Monitoring Well Groundwater Sampling** Collect a groundwater sample from nearby existing downgradient groundwater monitoring well N1-MW06." **Air Force Response**. Clarification: While it is understood that the hydrogeology in the region may be complex, the chemical composition of PFASs significantly differs from that of TCE, and the aquatic geochemical interactions governing their fate and behavior should not be considered analogous to those of chlorinated solvents, even in the dissolved phase. No change was made to the QAPP in response to this comment. k. Clarification/Agree. Well N6-MW01 was selected because it is in a potential runoff/accumulation area near Building

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	The plan proposes the sampling of well N6-MW01, which is side gradient of the suspected release area. The final OU 6 Second Five Year Review shows wells N1-MW02 and N1-MW04 east-southeast of Building 4840. Those two wells appear to be more appropriate candidates for groundwater sampling than well N6-MW01. Since the Remedy Performance Report and Five Year Review do not show any wells near building 4826 (including N1-MW01 shown on Figure 8), we are relying on the Plan to show all potential wells in the vicinity of this building. Based on its proximity to the potential release location, well N1-MW01 appears to be an appropriate well for sampling. l. Fire Station 3 (Building 250). There appear to be no monitoring wells downgradient from this site, which will likely result in a data gap for PFC site characterization. m. Fire Station 5 (Building 4456). Located in OU 5/10. The Plan needs to explain why no soil/sediment sampling is proposed for this site. This might be inferred from information in Table 17.2 (sic), but is not clearly stated. Groundwater is in alluvium in this area. Based on a review of the 2014 GW monitoring report water level figures, the proposed sampling of 240-MW22, 240-MW31, and 240-MW37 appear to serve as adequate downgradient sampling locations. DTSC has no alternate recommendations. n. Former Fire Station (Building 1850). Located in the southern portion of OU 6. Three borings are proposed in areas we assume are potential release locations. Table 18.2 identifies only one groundwater sample (18-TW01), which we presume is actually boring 1850-SB01. This single sample provides only limited site characterization, which will likely result in a data gap for PFC characterization. One very interesting observation resulted from our review of the water level and water quality figures in the OU 6 Remedy Performance Report and OU 6 Second Five Year Review. We noted that the TCE plume has a very odd/complicated configuration in the area east of the Fire Station. Elevated TCE concentrations in well N4-MW16, located a distance downgradient, imply the Fire Station may be a TCE source. In addition	4840. Well N1-MW02 is not suitable because it is not screened across the water table. Groundwater samples will be collected from soil borings 4840-SB01 and 4840-SB02. In addition, groundwater sample from well N1-MW04, approximately 375 feet downgradient of Building 4840, has been added for sampling. l. Comment acknowledged. m. Clarification. No sediment/soil samples are proposed because, as stated in Table 17.1, in the fourth column, Information from Site Visit, "Runoff water ponds and evaporates on the cement and does not flow to unpaved area, as the dirt is upslope from the cement pad." The fifth column, Proposed Investigation Approach, contains only proposed sampling locations. Therefore, it would be inappropriate to add this information there. No change was made in response to this comment. n. Clarification. As described in Table 17.1, one boring (1850-SB01) is proposed in the potential release location, "the concrete driveway/apron where vehicles were refilled and washed." Two additional soil borings 1850-SB02 and 1850-SB03 will be advanced using a hand auger at accumulation points in the permanent drainage feature on either side of the driveway/apron, downslope from the vehicle refilling and wash down area." No groundwater samples are proposed from these hand auger soil borings. Disagree. This is outside the scope of the SI. Groundwater samples will not be collected for TCE analysis from downgradient wells.

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	to PFC sampling, groundwater downgradient of the site should also be sampled for TCE. **DTSC Response**. No downgradient groundwater sampling will likely result in a data gap for this site. Additionally, we understand the scope of the work is limited to PFC/PFOA compounds, we were just bringing to the attention to the Air Force that the fire station may be a source of TCE contamination and since a groundwater sample is being collected from 1850-SB01 then it would be in the Air Force's best interest to "piggyback" on a sample for VOC analyses rather than have to rescope and mobilize for a separate sampling effort to provide information for the OU 6 ROD remedy evaluation.	**Air Force Response**. Comment acknowledged.
	o. 1970 Aero Spacelines 377 MGT. DTSC is unable to determine which OU this site is located and so are unable to independently assess groundwater flow directions or whether there are wells in the area. There is no basis for the groundwater flow direction arrow on Figure 12 (the figure references "TetraTech, Basewide GMSR, 2012"), but this reference is not provided in the references in Section 10.2.7 of the Plan. Also, the flow direction on Figure 12 appears to conflict with the direction shown on regional Figure 1B. Figure 12 does not show any wells in the area, so no downgradient GW sampling will be performed, which may result in a data gap for PFC characterization. **DTSC Response.** Because of the unclear response, DTSC contacted the Air Force for a better explanation since the flow direction shown on Figure 12 in the redline/track-mode (draft final) report has no support (the revised figure now simply references the PA for flow direction) and flow direction contradicts the direction shown on reference Figure 1B. The Air Force responded that the flow direction on Figure 12 was inadvertently not changed to be consistent with Figure 1B as stated in the response to this comment and will correct this with the final QAPP. As for the flow direction reference, the Air Force provided the specific location in the PA that describes groundwater flow direction for a different site; Hangers 161 and 160 where it states "The groundwater flow at Edwards AFB is generally toward Rogers Dry Lake…" The QAPP should not provide such a convoluted process for a reader to try	o. Clarification. This area is located in OU2 (South Base) based on the OU Map in the Basewide Groundwater Monitoring, Sampling and Analysis Plan (Tetra Tech, Inc. 2016). Agree. The groundwater flow direction and the reference on Figure 12 were revised to be consistent with Figures 1B and 3 (nearby Hangars 161 and 160). The reference in Figure 12 was revised to reflect the corrected reference (CH2M Hill, Preliminary Assessment 5/29/15). **Air Force Response**. Clarification. The PA also describes groundwater flow direction for 1970 Aero Spacelines 377 MGT in the second paragraph in Section 3.3.1.3.1 in the same way as was done for Hangars 151 and 160. The revised Figure 12 shows groundwater flow direction toward the lake and is consistent with Figure 1B. The groundwater flow direction reference was not changed. Clarification. The goal of the SI is to confirm the presence or absence of PFASs from Air Force-mediated AFFF releases at the SI areas. Therefore, the Air Force believes the project DQOs will be met by the proposed sample locations.

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	and figure out the derivation of the flow direction for the 377 MGT site. To rectify this, please instead simply note in the QAPP that the flow direction for the 377 MGT site is estimated based on this generalized assumption of groundwater flow directions at EAFB. As a note, the lack of gradient information for this area adds a significant uncertainty towards meeting the DQO of assessing groundwater impact (by collecting near-downgradient groundwater samples) at this site, especially since none of the proposed borings (shown on Figure 12) are located in the presumed downgradient direction of the suspected release area.	
	p. 1984 Boeing 720 CID. DTSC is unable to determine which OU this area is located and so is unable to independently assess groundwater flow directions or whether there are wells present in the area. Figure 13 shows groundwater flow direction to the west-southwest and northwest and references the PA as the source for this information, but the information is not provided in the PA. Please identify the OU, the proximity of this site to any existing EAFB groundwater study areas or IRP sites, and the basis for the estimated groundwater flow directions on Figure 13 so that DTSC can provide input on the proposed site investigation. **DTSC Response.** With so little available information of the site hydrogeology available, and the limited proposed investigation, DTSC wishes to remind the Air Force that the work scope for this site may be inadequate to meet the project DQOs.	p. Clarification. 1984 Boeing 720 CID is not in any of the OUs. No IRP Sites are known proximal to this SI Area. Agree. The source of the information for the groundwater flow direction is Figure 2.2-2 in the Operable Unit 1, GMSR for 2012 (AECOM 2015). This reference will be added to Figure 13 and included in Section 10.2.7 and Worksheet 13. **Air Force Response**. Clarification. The goal of the SI is to confirm the presence or absence of PFASs from Air Force-mediated AFFF releases at the SI areas. Therefore, the Air Force believes the project DQOs will be met by the proposed sample locations.
	q. Former Main Base Sewage Treatment Plant Evaporation Pond. Located in OU 2, near Site 29. Tables 17.1 and 18.2 and Figure 14 indicate that GW samples will be collected from wells 29-MW07, -MW09, and 110-MW01, all of which appear to be downgradient of the pond based on the groundwater flow direction shown on the figure. The figure references the PA for the flow direction, but this information is not in the PA. In contrast, Figure 3-1 in the 2008 Biennial Groundwater Monitoring Report for Site 29 shows groundwater flow direction to the southwest and west, which is contradictory to the direction shown on Figure 14. There does not appear to be any wells downgradient of the pond (and questions the need to sample the aforementioned wells), which likely will be a data gap	q. Agree. The groundwater flow direction on Figure 14 for the Former Main Base Sewage Treatment Plant Evaporation Pond, near Site 29, was changed to south-southwest as shown in Figure 3-1 in the 2008 Biennial Groundwater Monitoring Report for Site 29 (AECOM 2009). This reference was also added to Section 10.2.7 and Worksheet 13. However, if data from the gauging event indicate that local gradient shows that these wells are downgradient, then the wells will be sampled. These wells are still proposed for sampling, pending determination of current site-specific groundwater gradient

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	for the PFC characterization. **DTSC Response.** Understood. r. Former Nozzle Spray Test Area. Located in OU 1 southeast of Site 51. A review of the OU 1 2015 water level map confirms the groundwater flow direction shown on Figure 15. No monitoring wells are proposed to be sampled and there are no nearby downgradient wells, but wells 52-MW56 and 52-MW06 (although fairly distant downgradient-approximately 1,000 feet to the east) might serve as downgradient sample locations. DTSC recommends these wells be sampled. **DTSC Response.** Understood. DTSC reviewed Figure 15 and identified a fairly large dark area which implies substantial vegetation in the northern portion of the designated site. Assuming this is the case, the vegetation suggests an area of preferred ponding/infiltration. The closest boring, FNSTA-SB01 is located some distance south of this vegetated area. DTSC strongly recommends FNSTA-B01 be moved to this area. s. Refractometer Spray Test Area. Located in OU 2 south of Site 29. The PA is referenced as the basis for the groundwater flow direction shown on Figure 16, but this information is not provided in the PA. There are no monitoring wells in the area, but based on GW flow direction for Sites 29 (to the south) and Sites 5/14 (to the north), it is reasonable to assume flow direction is to the east-southeast as portrayed on Figure 15. No downgradient wells are available to be sampled and will therefore be a likely data gap for PFC characterization of this site. **DTSC Response.** DTSC recognizes the response, but the site identification appears based on no verifiable features and instead on the recollection of an individual. Since the borings are fairly close spaced (which DTSC is not contesting), we are putting a lot of faith that they are located specifically where the spill occurred. Definable downgradient groundwater sampling locations would provide added assurance that sampling has been performed in the correct location of the spill and better determine if groundwater has been impacted. This needs to be considered upon review of the SI sampling results.	direction **Air Force Response**. Comment acknowledged. r. Disagree. Well 52-MW56 is not screened across the water table and, therefore, not suitable for sampling for PFASs. Groundwater samples will be collected from the three soil borings. The goal of the SI is to confirm the presence or absence of PFASs from Air Force-mediated AFFF releases at the 23 SI areas. It is not in the scope of the SI to determine vertical and lateral extent. Therefore, well 52-MW06, approximately 1,000 feet downgradient to the east, will not be included in the sampling plan. **Air Force Response**. Clarification: Observations made during the March 2016 Site Visit confirmed that the vegetation apparent in the northern portion of the site is a large tree. Boring FNSTA-SB01 was plotted as close to the tree as practical to still provide safe access for the workers, drilling rig, and its appurtenances. No changes were made in response to this comment. s. Clarification. The PA states "The groundwater flow at Edwards AFB is generally toward Rogers Dry Lake", which is to the east-southeast as shown on Figure 15. Also, during the site visit, the fire department chief indicated that this location with areas selected for sampling will likely result in the detection of significant PFAS concentrations. **Air Force Response**. Clarification: Because the tests are required by Fire Department regulation to be both routine and systematic to calibrate and confirm the proper functionality of their equipment, a fixed location has been used for the Refractometer Spray Test Area. The features used to verify the location of the Refractometer Spray Test Area during the March 2016 Site Visit were sets of orange cones delineating the area, and painted markings on the asphalt pavement used

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	t. Muroc Golf Course. Located west of OU 1. DTSC does not have environmental information for this area of the base. Figure 17 shows (regional) groundwater flow to the east, but groundwater flow is more likely radially outward from the golf course. The Plan proposes sampling well 259-MW01, which we assume is the only well in the area. Considering the likelihood that GW flow is radially outward from the golf course, sampling groundwater from only the single well in the area will provide only limited information in assessing the presence of PFCs. u. Pad 7 Outfall and Stormwater Detention Pond. Located in OU 1, adjacent to Sites 11 and 19. Based on a review of the 2015 water level figure for OU 1, groundwater flow direction might be more directly to the east rather than towards the east-northeast as portrayed on Figure 18. The Plan proposes sampling wells 11-MW16, 19-MW06, 19-MW15, and 19-MW16, but wells 19-MW16 and 19-MW15 are likely upgradient of the site and DTSC questions why these wells were selected to be sampled. DTSC suggests sampling downgradient wells 19-MW14 and 19-T05, which are southeast and east, respectively, of Pad 7 and well 11-MW68, which is east of the Outfall (note that 11-MW68 is not shown on Figure 18). **DTSC Response.** Even if the Air Force's east-northeast flow direction is correct, wells 19-MW15 and 19-MW16 are not downgradient and are not good candidates for sampling to meet the project DQOs. On the other hand, 19-MW14 does appear downgradient based on the flow direction arrow on Figure 18 and should be sampled.	by the Fire Department to quantifiably measure the distance and pattern of the spray test. The cones and markings are unfortunately not visible on the aerial photograph used as the base for Figure 15. t. Clarification. Based on consensus during the 18 May 2016 scoping meeting, well 259-MW01 was added to the SI sampling plan based on influence from the golf course pond as evidenced by detected trihalomethanes concentrations detected in the pond water. Comment acknowledged regarding limited information being provided from single well. u. Disagree. Based on Plate 1 in the OU1 GMSR for 2012, groundwater flow direction near the Pad 7 Outfall and Stormwater Detention Pond is east-northeast (AECOM 2015). No change was made in response to this comment. **Air Force Response**. Clarification. The Air Force believes wells 19-MW15 and 19-MW16, while not downgradient, will provided valuable information on PFAS concentrations in groundwater and will be retained for sampling. Disagree. 19-MW14 is not proposed for sampling because it is not screened across the water table.
New General Comment 1	Justify why references are at numerous scattered locations in the QAPP rather than in one location like a normal document. This scattering makes it difficult and cumbersome to locate important reference information to support the workplan. An example is the difficulty in simply trying to figure out flow directions for the 377MG site as discussed in General Comment 8.o above.	**Air Force Response.** Agree. All references have been moved to a new section at the end of the document.

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New General Comment 2	Because of the significant uncertainty of the location of the former fire training area (FTA) at Site 14, and the very limited number of borings the Air Force is willing to drill at each site, DTSC questions whether the DQOs for this site will be met. Please see Mr. Skaug's Comments 19 and 26 for details regarding our questioning the location designated as the FTA for Site 14.	**Air Force Response**. See response to Mr. Skaug's Comments 19 and 26.

Specific Comments

Item	Section	Page	Line	Specific Comment	Response
1	Figure 1B			Please identify Building 151 on the figure.	Agree. Building 151 was identified on Figure 1B
2	Figure 2			In the Legend, please define the green and red-dashed circles shown on the figure.	Clarification: The red-dashed circles have been revised to solid purple line circles and defined on Figure 2. There are no green-dashed circles on this figure.
New S.C. 1	17.1.2.1, Second Paragraph			Text notes the collection of a composite sample from each soil horizon. Please make it clear the purpose of collecting these samples; are they for chemical analyses or physical parameters? Best to do this also for the samples described in the first paragraph of this section.	**Air Force Response**. Clarification: Composite samples will be analyzed for both physical parameters (grain size analysis) and chemical parameters (pH and TOC). The purpose of collecting these samples, specifically requested by the Air Force statement of work, is to facilitate fate and transport evaluation in the future at these SI Areas, not for specific use during this PFAS SI.
New S.C. 3	New Section 11.7			Sampling Rationale Bullets. The third bullet notes that samples collected in a soil area adjacent to a paved area will be biased towards areas most likely to receive runoff from the paved area. We assume a similar strategy is being employed for hanger areas and so recommend the second bullet contain language similar to the third bullet.	**Air Force Response**. Agree. This text was added to the second bullet.
New S.C. 4	New Section 14.1.2.			We recognize that the QAPP elsewhere notes continuous coring will be performed for soil borings, but please also add it to this section which discusses drilling methodology.	**Air Force Response**. Agree. Continuous coring sampling methodology was added to Section 17.4.1. The following sentence was added to Section 14.1.2..

Item	Section	Page	Line	Specific Comment	Response
New S.C. 5	New Section 17.4.1.1			The Air Force agreed to continuously core soil borings to accurately log lithology and select appropriate intervals for soil sample collection to meet DQOs. Continuous coring is an easy and commonly used procedure in drilling, especially when drilling hollow stem auger borings and does not slow down the operation. Please explain why "split-spoon" sampling was introduced into this section of the QAPP. We noted Section 14.1.3.1 specifies soil sample collection only using continuous coring methods as we expected.	**Air Force Response**. Agree. The reference to "split-spoon" sampling has been replaced with continuous coring methods in Section 17.4.1.

References:

AECOM Technical Services, Inc. (AECOM). 2015. Final AFCEC, IST, Edwards AFB, California, ERP, OU 1, Groundwater Monitoring and Sampling Report for 2012. February.

Tetra Tech, Inc. 2016. Draft. Basewide Groundwater Monitoring, Sampling and Analysis Plan – Volume III, Long-Term Monitoring Optimization Report, Operable Unit 4/9, Edwards Air Force Base, California. May.

Draft Final QAPP Addendum for Edwards AFB PFC Site Investigation

Document – Draft Final QAPP Addendum for Site Inspections of Aqueous Film Forming Foam Usage at Edwards AFB, Oneida Total Integrated Enterprises, August 2016
Reviewed By – Thomas Skaug
Organization – Department of Toxic Substances Control, Geological Services Unit
Date Review Completed – 6 October 2016
General Comments:

Item	General Comment	Response
1	The EPA Guidance on Systematic Planning Using the Data Quality Objectives Process (February, 2006), states that it is a tool "… for determining the type, quantity, and quality of data needed to reach defensible decisions or make credible estimates." Data quality is addressed by SOPs in Appendices A, B and C. However, the Draft Final UFP QAPP has no discussion or evaluation for determining the type(s) of data needed. More importantly, there is no discussion or evaluation for determining the quantity of data needed. A number of decisions affecting the quantity of data appear to be driven by budgetary considerations rather than data quality objectives. These include the decisions to: • investigate only locations where releases are known, but not the many sites where AFFF was used although with no specific documented releases; • limit soil sampling locations to 3 or fewer per site; • limit soil samples to 3 per boring; and • limit soil sample depths to a maximum of 25 feet, and in some cases, sample near rather than within release locations (presumably to avoid impact to infrastructure). These decisions all have a bearing on the confidence in the site characterization sufficiency. **GSU Response:** The second clarification addresses the first bullet point of the comment, indicating that the sites investigated as part of the SI effort are those the PA recommended for further evaluation. DTSC's Geological Services Unit provided comments on the PA that indicate additional sites warranted further evaluation. The comments also identified issues with the PA report that, if addressed, might have	Clarification: A discussion of the types of data needed was added to Worksheet 11, Section 11.5, Develop the Analytical Approach. Clarification: The incidents listed in the Preliminary Assessment (PA) were evaluated based on all available information. Sites investigated as part of the SI effort are those the PA recommended for further evaluation (under separate contract) and were based on the entire weight of evidence. The areas included in the Site Inspection (SI) are based on those areas identified in the PA and during March 2016 Site Visit and follow up scoping meeting discussions. **Air Force Response**. Comment acknowledged.

Item	General Comment	Response
	identified additional sites warranting further evaluation. The clarifications do not address the second, third or fourth bullet points, which appear to indicate that proposed sampling was driven by budgetary considerations instead of the quantity needed to adequately evaluate the sites. While limited additional information was added to Section 11.5, the QAPP still does not discuss the (above) noted limitations of the investigation. DTSC will not withhold concurrence with the QAPP based on this, but reminds the Air Force that these limitations likely will have a bearing on the sufficiency of the investigation to meet the DQOs.	

Specific Comments:

Item	Section	Page	Line	Specific Comment	Response
1	Worksheet #9	Pg 15 of 54	Item 8	The text references a groundwater sample to be collected from well N9-MW01. Worksheets 17.1 (Table 17.1) and 18.1 (Table 18.2) indicate the groundwater sample will be collected from well N1-MW01. The discrepancy should be resolved. **GSU Response:** Comment addressed.	Agree. Well N1-MW01 at Hangar Building 4826 was incorrectly labeled N9-MW01 This location was corrected during the 18 May 2016 follow up scoping meeting to the correct well ID, N1-MW01. **Air Force Response**. Comment acknowledged.
2	Worksheet #10.1			The Facility Profile incorrectly indicates Muroc Army Air Base was activated in 1972; it was activated in 1942. **GSU Response:** Comment addressed.	Agree. The text was revised. **Air Force Response**. Comment acknowledged.
3	Worksheet #10.2 §10.2.1			The text states that the objective "is to conduct SIs [site inspections] at various Air Force installations where PFCs may be found …" [emphasis added]. Proposed sampling is restricted to locations with documented releases and highest likelihood of finding PFCs. Sites with documented releases but lower probability of PFC detection (e.g. Hanger 151 and Fire Station 5) and sites that likely had AFFF releases, but the releases are not documented (e.g. Fire Station 4), are excluded. The text should be revised to clarify that the objective of the QAPP Addendum work is more restrictive than the overall contract objective. **GSU Response:** Regarding Hanger 151, the response ignores that the PA Report states "There was one reported release of AFFF … at the outdoor AFFF system. The PA text and Figure 4 indicate that the release location is in an area of soil (not within the low permeability ground cover, however extensive). The proposed soil sample location nearest to this documented release location is over 400 feet away. Regarding Fire Station # 5, Table 17.1 indicates potential pathways to soil. Also see DTSC GSU PA Report	Disagree with the premise of the argument - Hangar 151 is being studied as part of the Building 160 investigation. The two sites are co-located and surrounded by an extensive amount of low permeability ground cover. Fire Station # 5 is being investigated by sampling of co-located and downgradient monitoring wells. Areas identified during the Preliminary Assessment with no probable or documented release are typically not investigated during the SI process. **Air Force Response**. Disagree. The Air Force believes that the QAPP Addendum work is not more restrictive than the overall contract objective. The rationale for sample location selection for each SI Area is based on information from multiple lines of evidence, including the PA, the Site Visit, and follow-up discussions.

Item	Section	Page	Line	Specific Comment	Response
				comments 76, 78 and 99. Table 17.1 states that "runoff water" ponds and evaporates on the concrete and does not flow to unpaved areas. It is not credible that soil particles transported with runoff, settling dust, and released AFFF are not periodically cleaned from the concrete. The comment stands.	Hangar 151: Clarification. The "one reported release of AFFF and water on the east side of the hangar at the outdoor AFFF system" (CH2M Hill 2015) was discussed with the facility manager during the Site Visit in March 2016. He stated that the release was due to the AFFF Conveyance Line break. The Pipe Break Location is shown near proposed soil boring 160-SB01 on Figure 4. Fire Station #5: Clarification: Based on discussions with the facility manager, the amount of AFFF potentially release was minor. In addition, groundwater samples are being collected from 3 nearby wells, which will quantify PFASs present in groundwater beneath the SI Area.
4	Worksheet #10.2 §10.2.1 Sampling Rationale		4th bullet	The text states, "samples will be collected from boring location near the AFFF release points and downgradient areas." While sampling will occur at sites with documented releases, in some cases the documentation does not identify the exact release location and surface flow path(s). The text should be revised to clarify that boring locations will be near presumed and/or suspected release points and downgradient areas. **GSU Response:** Comment addressed.	Agree: The bullet was revised to read: "Soil and groundwater samples will be collected from boring locations near and downslope from the AFFF release areas identified in the PA and Site Visit." Note: Section 10.2.1 was moved to Worksheet 11, Develop the Plan for Obtaining Data (STEP 7). **Air Force Response**. Comment acknowledged.
5	Worksheet #10.2 §10.2.1 Sampling Rationale		6th bullet	The text states, "Collection of AFFF solutions from any release or application may have been transported to an on-site treatment facility for disposal. The text should be revised to clarify that the current and former Main Base sewage treatment plants are/were directly connected to known and suspected release sites by wastewater	Clarification: The sampling rationale for water treatment facilities was used to identify sampling locations during the Site Visit. These locations were discussed during the May 2016 scoping meetings. The following text will replace the 1st sentence

Item	Section	Page	Line	Specific Comment	Response
				drainage systems. **GSU Response:** For reference in future site activities, particularly environmental sampling related to the site wastewater system, DTSC recommends the text note that known and suspected release sites were connected to the system.	in 2nd paragraph under Sampling Guidelines (now Section 17.1.1): "The sample locations were selected following review of the PA Report and the Site Visit, and discussions during the scoping meetings within the framework of the general guidelines from the Final Work Plan for Site Inspections of Aqueous Film Forming Foam Usage at Multiple United States Air force Installations in EPA Regions 6 & 9 (Work Plan) (OTIE 2015), listed below." **Air Force Response**. Comment acknowledged.
6	Worksheet #10.2 §10.2.1 Environmental Media to be Sampled		1st bullet	The text indicates one soil sample will be collected at mid-depth between the surface and groundwater and one will be collected just above groundwater. However, statements in Worksheet #18 indicate that, at an undefined number of sites, the actual depths will be shallower. The third paragraph of Worksheet #18 indicates the soil sample borings will be limited to 25 feet and Table 18.1 indicates that groundwater depths range from 9 to 120 feet below ground surface. As such, at sites where groundwater is deeper than 25 feet, two of the three samples will not be at the depths indicated by this worksheet. Worksheet #18 should be revised to indicate sampling as described on this worksheet or this text should be revised to be consistent sampling depths indicated on Worksheet #18. **GSU Response:** Considering the mobility of AFFF in the environment and the long history of AFFF use at the site, the rational for limiting sampling to the upper 25 feet should be explained (see General Comment 1).	Agree. The description of soil sampling depths was clarified. No soil samples will be collected below 25 feet bgs. Section 10.2.1 was moved to Worksheet 11, Develop the Plan for Obtaining Data (STEP 7) and revised to read as follows: "• Soil samples will be collected at discrete intervals from each soil boring. OTIE will collect three (3) soil samples from the majority of borings. In borings with three soil samples, one surface soil sample and two subsurface soil samples will be collected in the top 25 feet or in the interval above the water table if groundwater is shallower than 25 feet bgs. • Surface soil samples will be collected from between 0 and 0.5 feet bgs. • Mid-depth soil samples will be collected approximately mid-way between the surface sample and the deep sample at a depth based on lithologic/permeability changes are observed by the Field Geologist. In the event that no lithologic/permeability

Item	Section	Page	Line	Specific Comment	Response
					changes are observed, the mid-depth sample will be collected at the mid-point between the surface soil sample and the deep subsurface soil sample. • A deep subsurface soil sample will be collected at 25 feet bgs if groundwater is deeper than 25 feet bgs. Otherwise, the deep sample will be collected directly above the water table." **Air Force Response**. Clarification. The purpose of the SI is to determine if PFASs exist at concentrations greater than Project Action Limits (PALs). Biased soil sampling of subsurface soils will be performed simply to confirm the presence (or absence) of PFASs above these PALs. The Air Force's experience at other bases sampled for PFAS is that PFAS concentrations in soil are generally highest in surface soils and decrease with depth.
7	Worksheet #10.2 §10.2.1, Environmental Media to be Sampled:		2nd bullet	The text should be revised to clarify that sampling will be conducted where ponded water or wetland areas are presumed to have received runoff from the investigation area/site. **GSU Response**: Comment addressed.	Agree. Text changed to "Sediment sampling locations were chosen where ponded water or wetland areas are presumed to have received runoff from the investigation area." Note: Section 10.2.1 was moved to Worksheet 11, Develop the Plan for Obtaining Data (STEP 7). **Air Force Response**. Comment acknowledged.
8	Worksheet #10.2 §10.2.1, Environmental Media to be		4th bullet	The text should be revised to clarify that wells proposed for sampling are not just near, but presumed to be in a down-gradient groundwater flow direction from the investigation area/site.	Agree. The 4th bullet was revised to read: "• Groundwater: Samples will be collected from temporary wells installed in soil borings and/or from existing groundwater wells presumed to be at or adjacent to the source or in a downgradient

Item	Section	Page	Line	Specific Comment	Response
	Sampled			**GSU Response:** Comment addressed, however, the proposed revised text indicates that groundwater samples will not be collected if it is not encountered within 25 feet of ground surface. The QAPP should therefore be revised to address how potential groundwater contamination will be addressed where this occurs.	groundwater flow direction from the source. If groundwater is not encountered in a boring, no temporary well will be installed and no grab groundwater sample will be collected from boring." Note: Section 10.2.1 was moved to Worksheet 11, Develop the Plan for Obtaining Data (STEP 7). **Air Force Response**. Clarification: The text is now in Worksheet 11, Develop the Plan for Obtaining Data (STEP 7) under Environmental Media to be Sampled. The text that the comment refers to discusses soil sampling. Groundwater sampling is discussed in the next first tier bullet down. For clarity, the following sentence was added to the groundwater bullet (the sixth bullet in that subsection). "Borings will be advanced to groundwater up to 100 ft bgs and temporary wells will be installed for groundwater sample collection."
9	Worksheet #10.2 §10.2.1, Environmental Media to be Sampled		5th bullet	The text states "… sampling points are as close as possible [emphasis added] to the presumed release locations." The text should be revised to clarify that, similar to sampling at hangers (see second bullet point under "Sampling Rationale"); sample points are as close as practicable, not as close as possible. For example, borings at the existing Fire Training Area and at Hanger 1624 are outside the structure even though primary release location is within the structure. **GSU Response:** Comment addressed.	Agree. The text was revised to state "Sampling locations are as close as practicable to the presumed release locations." This text was moved to the 1st paragraph of the Sampling Rationale section in Worksheet 11, STEP 7. Note: Section 10.2.1 was moved to Worksheet 11, Develop the Plan for Obtaining Data (STEP 7). **Air Force Response**. Comment acknowledged.

Item	Section	Page	Line	Specific Comment	Response
10	Worksheet #10.2 §10.2.1, Environmental Media to be Sampled:		7th bullet	The text indicates "… collection of grab samples from soil borings or [emphasis added] installation of temporary groundwater monitoring wells …". This is not consistent with Worksheet #17 which, under Temporary Well Installation and Groundwater Sampling, states, "OTIE will collect grab groundwater samples from [emphasis added] temporary wells and groundwater samples from existing monitoring wells …". Further, Appendix C does not include a Standard Operating Procedure for collecting a grab sample of groundwater from a soil boring, a temporary well, or a monitoring well. The text should be revised to indicate all groundwater samples will be from temporary or existing monitoring wells. **GSU Response:** Comment addressed.	Agree. The 7th bullet was revised to read: "• When groundwater is encountered, grab groundwater samples will be collected from temporary wells installed in soil borings." The revised groundwater sampling SOP, SOP OTIE008F-P includes a procedure for collection of grab groundwater samples. Note: Section 10.2.1 was moved to Worksheet 11, Develop the Plan for Obtaining Data (STEP 7). **Air Force Response**. Comment acknowledged.
11	Worksheet #10.2 §10.2.1, Environmental Media to be Sampled:		Last paragraph	The text indicates that a "representative composite sample of the entire area" will be collected for each depth sampled. Such samples should be considered representative of the area only if homogeneity between boring locations can be demonstrated based on detailed boring logs and distance between borings or other reasonable data. **GSU Response:** Comment addressed.	Agree. The following sentence was added in the last paragraph: "Such samples will be considered representative of the area when homogeneity between boring locations can be demonstrated based on detailed boring logs and distance between borings or other reasonable data." Note: Section 10.2.1 was moved to Worksheet 11, Develop the Plan for Obtaining Data (STEP 7). **Air Force Response**. Comment acknowledged.
12	Worksheet #10.2 §10.2.4		4th paragraph	The text should be revised to note that groundwater is present in alluvium below and near the lake bed and in fractured granitic bedrock elsewhere on the base, resulting in complex contaminant transport flow patterns.	Agree. The following text was added to the 4th paragraph of Section 10.2.4, Hydrogeologic Setting (renumbered Section 10.2.3) "Groundwater is present in alluvium below and near the lake bed and in fractured granitic bedrock elsewhere on the base, resulting in

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				GSU Response: Comment addressed.	complex contaminant transport flow patterns." **Air Force Response**. Comment acknowledged.
13	Worksheet #10.2 §10.2.6		second paragraph	The text states, "It is possible that these endangered species may be found …" [emphasis added]. The text should be revised to clarify that some of the endangered species are present. The Text should also identify steps that to be taken to ensure endangered species are not disturbed. **GSU Response:** Comment addressed.	Agree. The text in Section 10.2.6 (renumbered to Section 10.2.5) was revised to state: "Desert Tortoise and Mohave Ground Squirrel are present at Edwards AFB." Additionally, the procedures for Desert Tortoise encounters, provided by Environmental Management Office, have been listed in this section. **Air Force Response**. Comment acknowledged.
14	Worksheet #17, Sampling Design and Rationale			Worksheet #10.2 states, "The soil sample collected at the mid-depth of the boring should be taken at any lithologic/permeability changes if there are significant clay layers identified in any historic soil boring records near the site as these may act as an aquitard to surface water percolation." Most sites have existing monitoring wells and at least some are known to have had soil borings but this Worksheet does not include any discussion of lithologies identified in historical soil boring records. Table 17.1 should, for each site, state whether or not historical boring records indicate the presence of significant clay layers. Where such clay layers are present, the appropriate target sample depth should be identified. **GSU Response:** In order to allow sufficient time to adequate evaluate the historic information, DTSC recommend the revised text include the following: "Based on the review of historical logs, potential target intervals for sampling will be identified before field mobilization. Final determination for sampling intervals will be made in the field based on the results of these reviews and lithology identified in the field via	Agree. The following text was added as the second bullet in Section 11.3, Identify Information Inputs (STEP 3): • "Historical boring logs will be reviewed for each area where borings will be advanced, when available, by the Field Geologist to identify: o Lithologic/permeability changes (e.g. fine grained soils or sands with significant fines to select potential depths for mid-depth sample); o Depth to water; and o Depth to bedrock." The appropriate target sample depths will be determined during drilling. Therefore, Table 17.1 not changed in response to this comment. **Air Force Response**. Agree. The recommended text was added to Worksheet 11, Section 11.3.

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				continuous coring the borings."	
15	Worksheet #17 Sampling Design and Rationale,		1st paragraph	The text states, "… sample locations will target areas with the potential for the highest concentrations of PFCs." For some sites, boring locations are positioned away from the potential highest concentration locations as, presumably to avoid impacting existing infrastructure (e.g. no sampling within Building 1624 even though it was constructed directly on a significant release location and no sampling within the Site 14 FTA (fire training area) structure even though the majority of released AFFF was likely within that area prior to building the structure) or due to other restrictions (e.g. restricted access at 1970 Aero Spacelines site.). The text should be revised to clarify boring location limitations. **GSU Response:** Comment addressed.	Agree. The text in Worksheet 17 was revised to clarify boring location limitations as follows: "…sample locations will target areas with the potential for the highest concentrations of PFASs, with some exceptions. For some areas, boring locations are positioned away from the potential highest concentration locations to avoid impacting existing infrastructure (e.g. Hangar Buildings 1600, 1624, etc., Site 14 Current FTA structure to avoid puncturing the existing liner) or due to other restrictions (e.g. restricted access at 1970 Aero Spacelines 377MGT area due to proximity to an active runway; difficult access at Former Firs Station (Building 1850)) Detailed descriptions are in Table 17.1." **Air Force Response**. Comment acknowledged.
16	Worksheet #17, Sampling Design and Rationale		5th paragraph	The fifth paragraph indicates that sampling design and rationale details will be presented in the "Installation specific WP Addendums." Details of EAFB sampling design and rationale are presented in this worksheet. This text appears to be from a QAPP addressing multiple installations and should be removed or clarified. **GSU Response:** Comment addressed.	Agree. The sentence was removed. **Air Force Response**. Comment acknowledged.
17	Worksheet #17			Hollow Stem Auger Drilling: The information in the first sentence, at least in California, is questionable and likely untrue. Further, the sentence does not seem relevant. The sentence should be deleted. GSU Response: Comment addressed.	Agree. The first, second, and third sentences were revised and combined to read: "Hollow stem auger (HSA) drilling may be used for drilling to depths of 150 feet in unconsolidated environments." **Air Force Response**. Comment acknowledged.

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18	Worksheet #17		Table 17.1	For each investigation area listed, the Proposed Investigation Approach column begins with "Drilling with Soil and Grab Groundwater Sampling." However, the table does not list any grab groundwater samples from temporary wells for any site. The proposed sampling should be specified (perhaps with a footnote indicating that grab samples from temporary wells are planned for all borings that encounter groundwater). **GSU Response:** Comment addressed.	Agree: The following footnote was added to Table 17.1: "Grab groundwater samples will be collected from all borings unless specifically stated otherwise in this table." **Air Force Response**. Comment acknowledged.
19	Worksheet #17		Table 17.1	For ERP Site 14, the Proposed Investigation Approach indicates, "One soil boring (14-SB01) located in the center of the former circular bermed area of the Former FTA." The Former FTA location was revised per the May 18 scoping meeting (see Worksheet #9). At that meeting, it was agreed 14-SB01 should be moved "to a location slightly east of the Former FTA" (see comment on Figure 2). The text should be revised accordingly. **GSU Response:** A figure in the cited 2001 report uses the same base map as the ROD but it is unclear why this is considered definitive as to the Former FTA location. DTSC notes that an engineered drawing (Sheet C-1) in the Remedial Action Plan and Conceptual Documents (Engineering –Science, 1986) shows the Former FTA on flat ground well east of the drainage channel. This flat ground location is more logical for an area bermed to contain liquids than the sloping ground show in Earth Tech 2001, the ROD, or the SA. Further, Sheet C-1 shows soil boring location S-3 adjacent to the western edge of the Former FTA, not at the center as shown in the other documents. Site investigation should address this more likely release site. Also see Item 26.	Clarification: The following description of discussion on 18 May 2016 was added to the text in Worksheet 9: "The location of the Former FTA was verified to be west of the site boundary based on the a positive correlation between the ROD (Air Force 2009) and the Information Technical Information Report for Site 14 Bioventing System (Earth Tech, Inc. 2001). The group agreed that a soil boring should be placed in the center of the Former FTA. They further agreed that 14-SB01 could be moved to this location." **Air Force Response**. Disagree: Figure C-1 from the Remedial Action Plan and Conceptual Documents ([Engineering–Science, 1986], (attached for reference) was reviewed and compared with the more recent figures from the Remedial Investigation (RI)/ Feasibility Study (FS) Informal Technical Information Report (ITIR) (Earth Tech, Inc. 2001), RI/FS Report(Earth Tech, Inc. 2000), and the ROD (Air Force 2009). During the RI, the Air Force identified and investigated the soil and groundwater in the location of the former FTA. The location of the Former FTA is documented

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					on the three following figures (attached for your reference): • Remedial Investigation (RI)/ Feasibility Study (FS) Figure 3.2-2 (Earth Tech, Inc. 2000), • South Base (OU2) ROD Figure 2.6-5 (Air Force 2009), and • RI/FS Informal Technical Information Report (ITIR) Figure 1-2 (Earth Tech, Inc. 2001). While multiple differences can be identified between the design drawing C-1 and those included in the RI, ITIR, and ROD documents, between the age of Figure C-1, its lack of definitive features, and indefinite scale, the Air Force does not believe that Figure C-1 from the Remedial Action Plan and Conceptual Documents (Engineering –Science, 1986) provides sufficient conclusive evidence of the location of the Former FTA to dispute the rigorous stakeholder input, review and comment of the RI, ITIR and ROD to warrant moving its location for the SI activities.
20	Worksheet #18 Sampling Locations and Methods			Table 18.1 indicates groundwater depths up to 120 feet below ground surface and the third paragraph states, "Each boring will be advanced to static groundwater depth plus 8 feet …". This indicates that, after soil sampling is complete, borings will be advanced for groundwater sampling up to 128 feet below ground surface. However, Worksheet #11, Section 11.4, of the Program QAPP (OTIE, 2015) indicates the sampling boundary for groundwater is generally to a maximum 100 feet below ground surface. The text should be	Disagree. The text in Worksheet 18 was revised simply read: "Sample locations and methods are listed in Table 18.1 below." Because nearby wells will be sampled, there will be no data gap resulting from not collecting samples at areas with deeper groundwater.

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				revised to clarify whether borings advanced to install temporary wells for groundwater sampling will be limited to a maximum of 100 feet or will be deepened as necessary for well installation. If borings will be limited to 100 feet, the QAPP should also be revised to clarify how the data gap resulting from not collecting samples at sites with deeper groundwater will be addressed. **GSU Response:** The response indicates that groundwater will be sampled from wells at sites where groundwater is deeper than the 100-foot "boundary condition". Note that for some sites DTSC has noted that monitoring wells are unavailable to meet project DQOs (groundwater sampling at or downgradient of and close to source areas). The QAPP should note if these two conditions (depth to water is too deep for groundwater sampling in a boring and the lack of wells available to meet the project DQOs) are present for a given site.	**Air Force Response**. Clarification. SI Areas where groundwater sampling is warranted have either soil borings with proposed grab groundwater sampling or existing monitoring wells proposed for sampling. The QAPP was not changed in response to this comment.
21	Appendix C SOP OTIE005A §2.1			Indicates the use of a pump during sampling. The paragraph above the introduction notes that materials containing Teflon® should not be used but does not note that equipment, such as sampling pumps, might contain Teflon® parts. The SOP should be revised to prohibit use of equipment containing Teflon® and to identify specific equipment to be used that might contain Teflon® parts. **GSU Response:** Comment addressed.	Agree: The SOPs were revised to specifically prohibit equipment containing Teflon and other materials associate with PFASs. **Air Force Response**. Comment acknowledged.
22	Appendix C SOP OTIE006D §3.0			Indicates the potential use of a pump and/or bailer during sampling. The text should note that bailers and pumps will not contain Teflon® components. Item 10 in Section 4.5 indicates possible use of Tyvek but Department of the Navy (DON) Interim Guidance (DON, 2015) prohibits wearing Tyvek when sampling for PFCs. A statement discussing prohibited materials and equipment should be added before Section 1.0 (similar to SOP OTIE006B) for	Agree. All SOPs were revised to prohibit the use of Teflon, Tyvek, and other times that could be a source of PFAS cross-contamination.

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				this and all other SOPs that do not currently have such a statement. The prohibition of Tyvek use should be specifically included in that statement and all mention of Tyvek use should be deleted from the body of all SOPs and any attachments (i.e. SOP No. OTIE008F Attachment 1). **GSU Response:** Comment addressed.	**Air Force Response**. Comment acknowledged.
23	Appendix C SOP OTIE008E §4.2		Item 4	Text includes the parenthetical comment "See Section 4.2.1 for more information." However, there is no section 4.2.1 in this SOP. The SOP should be revised to indicate the actual location of the additional information. In addition, the SOP should note that the electronic tape should not be made with Teflon® or other components that might contain fluorinated materials. **GSU Response:** Comment addressed.	Agree. The SOP reference to Section 4.2.1 was deleted. See response to Specific Comment 22. **Air Force Response**. Comment acknowledged.
24	Appendix C SOP OTIE008F			The paragraph before Section 1.0 states, "Specific items related to direct push technologies are discussed below." Replace "direct push" with "monitoring well sampling." **GSU Response:** Comment addressed.	Agree. The SOP was revised and renamed OTIE008F-P. References to "direct push" were removed. **Air Force Response**. Comment acknowledged.
25	Appendix C SOP OTIE008F			This SOP is for monitoring well sampling but Section 3.0 states, "The following is a list of equipment recommended for hand auger boring." The sentence should be deleted. **GSU Response:** Comment addressed.	Agree. The SOP was revised. **Air Force Response**. Comment acknowledged.
26	Appendix F Figure 2:			Locations of the current and former FTAs are now shown about 400 feet apart, about twice the distance previously shown. Based on the distance between these sites, and on the uncertainty regarding the actual Former FTA location, these sites should be evaluated separately and additional sample locations collected for the Former FTA. **GSU Response:** Similarity of release mechanisms and occurrence of release sites within the same administrative	Disagree. The two areas are being evaluated together because they have the similar release mechanism and both are associated with Site 14. The goal is to confirm the presence or absence of PFASs from Air Force-mediated AFFF releases in these areas. Disagree. Based on comments from regulators during the scoping meeting during May 2016

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				area is irrelevant to determining the number and locations of borings necessary for adequate characterization (e.g. see Hangers 1874 and 1881, which also have similar release mechanisms and occur in the same administrative area). See Item 19 regarding location of the Former FTA. Further note that, as the ROD does not address soil or groundwater remediation associated with the Former FTA, there is no reason to believe its preparation included significant attention to its location. Given the distance between the existing and former FTAs, they should each have an adequate number of borings to determine the location of residual contamination. Given the uncertainty regarding the actual location, more borings are warranted for the former FTA than for a site where the release location is known. The comment stands.	and a review of the location presented in the ROD (Air Force 2009), the location of the former FTA was revised to match the location presented in the ROD. The location from the ROD is believed to be the correct location based on the extensive review the ROD underwent and review of the Bioventing System Informal Technical Information Report (ITIR) (Earth Tech, Inc. 2001). It is believed that the location originally acquired from GIS files was in error. **Air Force Response**. See response to specific comment 19 above. Disagree. Both the FTAs (former and current) are located inside the Site 14 site boundary, and if PFASs are detected in the groundwater, they will be co-located within the Sites 5/14 groundwater contaminant plume. Therefore, the Air Force will not create a new SI Area. No additional borings will be added since the AFFF release locations (the current and former fire training areas) are known and documented in the ROD.
27	Appendix F Figure 2			The Former FTA location has been revised per May 18 scoping meeting (see Worksheet #9). At that meeting, it was agreed 14-SB01 should be moved "to a location slightly east of the Former FTA." 14-SB01 is shown at the center of the Former FTA, only about 35 feet from the center of the drainage channel. Topography should be considered to determine the likelihood that the former FTA extended onto the area of the adjacent drainage channel (as shown on this figure) and whether or not surface flow in the area between the fence line and the channel would be toward the channel. These factors	See response to Specific Comment 19. **Air Force Response**. See response to Comments 19 and 26.

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				should be considered in evaluating whether a location further east is more likely to be near the center of the actual Former FTA location or otherwise preferable to the location shown. **GSU Response:** See Items 19 and 26.	
28	Appendix F Figure 2			Groundwater sample location 5/14-MW166 was added based on the revised Former FTA location. However, it is cross-gradient from the revised location. Based on the southeast flow direction, well 14-MW05 appears to be a more appropriate location downgradient of the currently interpreted location of the Former FTA. **GSU Response:** See Item 19 regarding location of the Former FTA. Given the potential that groundwater contamination (if present) might be missed at well 5/14-MW166 due to its cross gradient location, particularly if the actual Former FTA was further east, it is not acceptable as the sole source of groundwater data for this site. The comment stands. Unless the Former FTA location can be determined with greater confidence, multiple groundwater sample locations are warranted.	Disagree: Sample location 5/14-MW166 was selected because it is closer to the Former FTA and most likely to have received AFFF via overspray and infiltration. **Air Force Response**. See response to specific comments 19 and 26.
29	Appendix F Figure 2			The legend includes a symbol for "Proposed GW Sampling and/or Gauging Locations." That symbol is used at seven well locations on the figure, including the two wells proposed for sampling, indicating five locations proposed for groundwater gauging. However, Table 17.1 lists only well 14-MW04 and unspecified others as locations where groundwater elevation "may be gauged." The table should list the specific wells proposed for gauging. It would be useful to show separate symbols for wells planned for sampling and wells proposed for measuring groundwater elevation. This comment applies to Table 17.1 and figures for groundwater elevation gauging	Agree: The well symbols on the figures were changed to differentiate between wells that will be sampled and wells that will be gauged only. In addition, Table 17.2, added to Worksheet 17, summarizes this information.

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				locations at all sites. **GSU Response:** Comment addressed.	**Air Force Response**. Comment acknowledged.
30	Appendix F Figure 8			Locations of proposed borings 4840-SB01 and 4840-SB02 appear based on an assumption that water might be present in the evaporation pond. If dry and accessible, the borings should be moved easterly to the low point in the pond where total infiltration would be greatest. **GSU Response:** Lacking specific necessary information (flow rates/volumes, pond bottom infiltration rates, range or typical extent of ponding per release) it cannot be determined whether infiltration would be greatest at the outfall pipes or at the pond low point. In order to provide adequate characterization, a third soil sample boring should be added at the low point of the pond.	Disagree. The selection for the locations of borings 4840-SB01 and 4840-SB02 was based on their proximity to each of two drainage outfall discharge points from stormwater lines where water is conveyed from Hangar 4840 to the unlined evaporation ponds. **Air Force Response**. Agree. A sediment sample was added at the low point of the pond east of Building 4840. The change will be made throughout the QAPP and on Figure 8.

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