Responses to Comments for the Draft Final Site Inspection (SI) QAPP, Biak Traning Center Brett Hall, Powell Butte, OR							
Response Code: A = Agree with comment D = Disagree with comment C = Comment requires clarification							
Comment Number	**Commenter**	**Page(s)**	**Section**	**Line(s)**	**Comment**	**Response Code**	**Response**
TECHNICAL COMMENTS							
1	Hafley			227	Ann Farris can remain DEQ POC, but D. Hafley is interim POC and completing review of document.	A	Acknowledged. All communications will be directed to D. Hafley, cc'ing A. Leidel and A. Farris. No change to text.
2	Hafley			347	Please identify the approximate number of individuals using the well. Also, whether the on-site well has been tested for PFAS.	A	The population at Biak Brett Hall is approximately 12 people. Facility population information will not be incorporated into the QAPP. The facility drinking water well was sampled and analyzed for PFAS in 2017 and 2020. Sample results summaries have been added to WS#10. Refer to Comment Number 12 for additional information.
3	Hafley			359	If know, please indicate the type of foams used (e.g., C8 vs C6, or both)	A	The training events were conducted by agencies/entities other than ORARNG and were not observed by ORARNG. Information regarding the type and amount of AFFF potentially released during the annual training events is not available. Refer to the Preliminary Assessment Report Biak Training Center Brett Hall, Oregon December 2019 (AECOM) for additional information. No change to text.
4	Hafley			390	"Holocene" is mis-spelled.	A	Text will be corrected as requested.
5	Hafley			419	In this section, discuss whether any perching of groundwater is either known or suspected. Please discussion site hydrogeology and can be surmised from on-site well log, assuming that it is available. If it is not, identify the source of information including depth to groundwater.	A	Perched water is not known or expected but is possible in complex volcanic deposits. As stated in the text (Line 443-445), the anticipated depth to groundwater (370 below ground surface) is based on the boring log for the onsite drinking water well (1852 in Crook County). The well log is available, as referenced, at the Oregon Water Resources Department website. As stated in the Climate section (Line 494-495), the Redmond Airport (less than 3 miles away and at nearly the same elevation) receives less than 20 inches of precipitation per year (sum of rain and snow). Groundwater recharge is primarily in the hills east/southeast of the facility. The following text will be added: "Shallow or perched groundwater has not been documented at or in the vicinity of the facility but is possible in complex volcanic formations. Boring logs for nearby wells (within 2 miles of the facility) available at the OWRD website indicated first encountered groundwater ranges from approximately 230 feet bgs to over 480 feet bgs, but the geology is difficult to correlate between locations do to inconsistent lithologic characterization between drillers (OWRD, 2020)."

6	Hafley			441	The surmised groundwater flow direction is presumably based local topography. Please elucidate. This is important given the proposal of a single monitoring well located downgradient of known PFAS release areas, and the significant depth at which groundwater is expected to occur. It should also be noted that groundwater flow is complex/mixed volcanic deposits can be highly variable.	A	As stated in the text, groundwater flow direction is inferred based on regional data and generalized. Regional flow direction is "based on hydraulic-head measurements in deep wells and on the mapped elevations of major springs and gaining stream reaches,..." Refer to the referenced USGS document for additional information. Although regional groundwater flow does not consider shallow or perched groundwater or localized flow variability within the aquifer resulting from preferential pathways, the documented regional groundwater flow and assumptions based on surface topography represent the extent of available groundwater flow information for the facility. No change to text.
7	Hafley			534	See comment #6 about surmised groundwater flow direction.	A	Refer to Response 6. Although preferential pathways directing infiltration from the facility may result in nearby private wells not being downgradient from the Areas of Interest (AOIs), it is conservative to assume the regional flow is accurate and the AOIs are upgradient from the residential wells. No change to text.
8	Hafley			538	Also 554. Information on PFAS type, amount, etc. is generally absent. Please provide more information if possible.	A	Refer to Response 3. No change to text.
9	Hafley			717	The schedule needs to be updated as it currently shows field work to have been completed in September 2021. Also, asterisk(s) are present but not explained in Notes.	A	Text will be updated as requested.
10	Hafley			907	Please identify the thickness of the soil horizons that will be sampled (6"?). DEQ recommends collecting samples from the full length of individual cores, augers, etc. (composite of, say, 0-2' rather than 0-6") to increase the likelihood of detecting contamination.	A	A composite of the 2 foot interval will be collected. No change to text.
11[a]	Hafley			971	In the QAPP, assessment of potential groundwater impacts is based on a single well, downgradient from AFFF use areas in the surmised groundwater flow direction.	A	The goal of the SI is to confirm presence/absence of PFOS, PFOA, PFBS and PFAS at the facility. PFAS in soil can trigger the RI phase. A second permanent groundwater monitoring well location is proposed for AOI 1. Additionally, water samples from the facility water well have been analyzed for PFAS in the past and will be re-sampled prior to the conducting the SI to confirm the well is a suitable source for drilling equipment decontamination water. As indicated in the QAPP (and Response Comment 6), groundwater flow direction is interpreted regional flow based on *Groundwater Hydrology of the Upper Deschutes Basin, Oregon* . Water-Resources Investigation Report 00-4162 (USGS, 2001).

11[b]	Hafley			971	DEQ has concerns about the uncertainty associated with this approach: we would would typically recommend a mininum of three wells, but acknowledges challenges including expected depth to groundwater. .	A	Due to the prevalence of potential preferential pathways and impermeable zones between the source area within the AOIs and the groundwater table, collecting a groundwater sample from directly beneath an AOI does not ensure confirming PFAS has reached the groundwater table. As DEQ acknowledged in Comment 6, groundwater flow in volcanic deposits is complex. Although installing three groundwater monitoring wells at the facility would provide facility-specific / local groundwater flow direction, interpreted flow direction is not likely to equal actual flow path within fractured bedrock, vesicular basalt, etc. (e.g., groundwater flow, interpreted from depth to groundwater measurements, could indicate flow due north, but the flow path could be along fractures at some angle relative to interpreted/general flow direction). Understanding specific flow pathways cannot be achieved with three wells at the site and is not a goal of the SI. However, a second groundwater monitoring well will be installed within AOI 1. Additionally, a groundwater (tap) sample will be collected the facility drinking water well. An attempt will be made to measure depth to groundwater in the facility water well if both proposed monitoring wells are screened within the same aquifer (approximately 370 feet below ground surface).
11[c]				971	More discussion of gradient would help support the sampling approach, including whether groundwater is expected to occur in an "interflow zone", fractured basalt, or granular media where common advective transport processes might be expected to occur.	A	Perched or shallow groundwater and interflow zones have not been confirmed at the facility or indicated in boring logs for nearby wells. Groundwater is anticipated at 370 feet bgs within conglomerate. Monitoring wells will be screened within first encountered groundwater. If a shallow water bearing zone is encountered while advancing a monitoring well boring, the boring will be converted into a monitoring well screened within the perched water table. Only first-encountered water will be sampled and the boring will not be advanced to the target depth of approximately 370 feet bgs. Soil samples will be collected from potential intermittent "interflow zones" (layers of non-competent material, fine to course grained material) if encountered below the bedrock surface while advancing borings at monitoring well locations. An attempt will be made to measure depth to groundwater in the facility water well if shallow / perched groundwater is not encountered at either proposed monitoring well location and both wells are screened withing the target groundwater zone. It should be noted that although groundwater elevation location can provide groundwater flow gradient at the facility, the interpreted flow direction would be a local generalization and will not account for preferential pathways (e.g., fractures, lava tubes, paleochannels, etc.) within the water bearing unit. Additionally, if shallow groundwater is encountered, groundwater depth in the facility water well will not be collected because groundwater will not be hydraulically connected to shallow groundwater zones.

11[d]				971	Please include and discuss the well log for the on-site supply well (vis-a-vis site hydrogeology) in support both the depth of the boring/coring, location, etc.	A	As indicated in WS#10, the on site well boring log is the primary line of evidence for depth to groundwater at the facility. The well log for the facility water well, available at OWRD website, encountered 4 feet of soil/fill and identified potentially non-competent rock as follows (all measurements in feet below ground surface [bgs]): 4 - 10: "lt brn congl" 138 - 141: "gray vesicular basalt" 153 - 167: "redish gray vesicular basalt" 185 - 193: "redish brn vesicular" 253 - 260: "gray vesicular basalt" 318 - 368: "redish gray vesicular" Groundwater was encountered at 370 feet bgs within a "red congl fine" ranging from 368 to 385 bgs.
11[e]				971	An alternative to the monitoring well approach would be multi-level groundwater sampling from a boring located closer/within the PFAS release area, including a determination of whether perched groundwater may be present.	A	Because perched groundwater has not been confirmed at the facility, the suggested alternative (multi-level groundwater sampling) will not be attempted. Should the facility proceed to the Remedial Investigation (RI) phase, the suggested method may be considered feasible after reviewing subsurface data obtained during this SI.
12	Hafley			1017	Please discuss whether previous sampling of the on-site well for PFAS has occurred, and any available sampling results. If not sampled to date, please sample. If previously sampled and non-detect, please identify date, analytical suite, method, and detection limits. Regarding, water elevation,all reasonable effort should be made to obtain water elevation data from the well.	A	After receiving from ORARNG laboratory analytical reports for Biak Training Center Brett Hall drinking water samples and permission to summarize the results, text has been added to WS#10 lines 467 - 486 follows: Drinking water from the water well at Biak Training Center Brett Hall were sampled and analyzed for selected PFAS, including PFOS, PFOA, and PFBS, in 2017 and 2020. Drinking water sample analytical results are summarized as follows: •June 2017 drinking water sample: The water well was sampled on 27 June 2017. The sample wase analyzed by EPA 537 Modified for 20 PFAS, included PFOS, PFOA, and PFBS. The analytical data was validated and indicates all 20 PFAS, including PFOS, PFOA, and PFBS, were not detected above limits of detection (LOD), which ranged from 0.985 ng/L to 14.8 ng/L. PFOS was not detected above 2.83 ng/L and both PFOA and PFBS were not detected above 1.88 ng/L. All LODs were below screening levels presented in the OSD memorandum “Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program,” September 15, 2021 (Assistant Secretary of Defense, 2021).

							•September 2020 drinking water sample: The water well was sampled on 23 September 2020. The sample was analyzed at a NELAP-approved laboratory by EPA 537. An unvalidated laboratory analytical report for one drinking water sample indicates the 14 reported PFAS, including PFOS, PFOA, and PFBS, were not detected above LODs ranging from 2.0 ng/L to 4.0 ng/L. PFOS, PFOA, and PFBS were not detected above 4.0 ng/L. All LODs were below screening levels presented in the OSD memorandum “Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program,” September 15, 2021 (Assistant Secretary of Defense, 2021).
13	Hafley			other	It is unclear whether sampling of the proposed monitoring well will be a single event, or multiple events will occur as commonly	D	Refer to "QAPP Worksheet #17: Sampling Design and Rationale" Table 17-1 for the number of samples planned for the Site Inspections. The objective of this SI effort is to identify whether there has been a release to the environment from the AOIs identified in the PA and determine the presence or absence of PFOA, PFOS, and PFBS at or above screening levels (SLs) at the facility. Resampling or periodic monitoring are note within the SI scope of work. No change to text.
EDITORIAL COMMENTS							
14	Hafley				Information presented in the QAPP, specifically related to the proposed monitoring well,and interpreparation of groundwater flow, constitutes the practice of geology in the State of Oregon. The document should be prepared or approved by a state-registered professional geologist.	A	Refer to "QAPP Worksheets #4, #7 & #8: Personnel Qualifications and Sign-off Sheet" and "QAPP Worksheet #6: Communication Pathways." As indicated, the QAPP Addendum was prepared by and reviewed by Oregon Registered Geologists. No change to text.
15	Hafley				There is insufficient information presented in the SI QAPP for DEQ to ascertain whether the permanent groundwater monitoring well approach is sound. Given that AFFF is known to have been released at two site AOCs, a higher standard of confidence seems warranted.	A	Due to the depth to groundwater at the collocated AOIs, limited precipitation in the area, and likeliness for preferential pathways (fractures, lava tubes, permeable interbeds/layers, etc.), complete understanding of the subsurface at the facility cannot be achieved during the SI. The goal of this SI is to confirm the presence or absence of PFAS. Although the AFFF releases are limited to small volumes, if PFAS will be confirmed in soil, the facility will likely advance to the RI phase where horizontal and vertical delineation would likely be goals. A second permanent groundwater well will be installed within AOI 1 to gather additional subsurface data and increase investigation design confidence. A groundwater (tap water) sample will be collected from the facility drinking water well (located less than 1,000 feet north of both AOIs) for PFAS analysis.