DEPARTMENT OF THE NAVY
COMMANDER
NAVY REGION HAWAII
850 TICONDEROGA ST STE 110
JBPHH, HAWAII 96860-5101

5750
Ser N4/0673
December 4, 2018

CERTIFIED NO: 7016 0910 0001 0891 9943

Mr. Omer Shalev
U.S. Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, CA 94105

CERTIFIED NO: 7016 0910 0001 0891 9950

Ms. Roxanne Kwan
State of Hawaii Department of Health
Solid and Hazardous Waste Branch
2827 Waimano Home Road, #100
Pearl City, HI 96782

Dear Mr. Shalev and Ms. Kwan:

SUBJECT: ADMINISTRATIVE ORDER ON CONSENT STATEMENT OF WORK SECTION 6 AND SECTION 7 GROUNDWATER FLOW MODEL PROGRESS REPORT 06 FOR REGULATORY AGENCY REVIEW, RED HILL BULK FUEL STORAGE FACILITY (RED HILL), JOINT BASE PEARL HARBOR-HICKAM, OAHU, HAWAII

The Groundwater Flow Model Progress Report 06 for Red Hill pursuant to the Administrative Order on Consent (AOC) Statement of Work (SOW) Section 6, Investigation and Remediation of Releases, and Section 7, Groundwater Protection and Evaluation is enclosed.

This progress report is the sixth of a series of groundwater flow modeling progress reports that describe the technical status of the groundwater flow modeling effort being conducted for the investigation and remediation of releases, and protection and evaluation of groundwater at Red Hill in accordance with the AOC and the January 4, 2017 AOC SOW Section 6 and Section 7 Work Plan/Scope of Work.

We respectfully request that you review the Groundwater Flow Model Progress Report 06 and forward any comments as soon as possible to maintain the expedited timeline.

5750
Ser N4/0673
December 4, 2018

If you have any questions, please contact Aaron Y. Poentis of our Regional Environmental Department at (808) 471-3858, or at aaron.poentis@navy.mil.

Sincerely,

M. R. DELAO
Captain, CEC, U.S. Navy
Regional Engineer
By direction of the
Commander

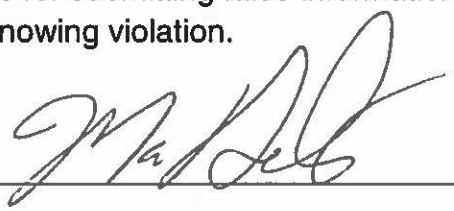
Enclosure: 1. Groundwater Flow Model Progress Report 06, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, Joint Base Pearl Harbor-Hickam, Oahu, Hawaii, December 4, 2018

Red Hill Administrative Order on Consent,
Groundwater Flow Model Progress Report 06 Deliverable

Section 6.2 Investigation and Remediation of Releases Scope of Work
Section 7.1.2 Groundwater Flow Model Report Scope of Work
Section 7.2.2 Contaminant Fate and Transport Model Report Scope of Work
Section 7.3.2 Groundwater Monitoring Well Network Scope of Work

In accordance with the Red Hill Administrative Order on Consent, paragraph 9, DOCUMENT CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to be the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fines and imprisonment for knowing violation.

Signature: 

CAPT Marc R. Delao, CEC, USN
Regional Engineer, Navy Region Hawaii

Date: 04 DEC 2018

Groundwater Flow Model Progress Report 06, Red Hill Bulk Fuel Storage Facility

JOINT BASE PEARL HARBOR-HICKAM, O‘AHU, HAWAI‘I

Administrative Order on Consent in the Matter of Red Hill Bulk Fuel Storage Facility, EPA Docket Number RCRA 7003-R9-2015-01 and DOH Docket Number 15-UST-EA-01, Attachment A, Statement of Work Section 6.2, Section 7.1.2, Section 7.2.2, and Section 7.3.2

December 4, 2018
Revision 00

Comprehensive Long-Term Environmental Action Navy
Contract Number N62742-17-D-1800, CTO18F0126

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Groundwater Flow Model Progress Report 06, Red Hill Bulk Fuel Storage Facility

JOINT BASE PEARL HARBOR-HICKAM, O‘AHU, HAWAI‘I

Administrative Order on Consent in the Matter of Red Hill Bulk Fuel Storage Facility, EPA Docket Number RCRA 7003-R9-2015-01 and DOH Docket Number 15-UST-EA-01, Attachment A, Statement of Work Section 6.2, Section 7.1.2, Section 7.2.2, and Section 7.3.2

December 4, 2018
Revision 00

Prepared for:

Defense Logistics Agency Energy
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Prepared by:

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1001 Bishop Street, Suite 1600
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Prepared under:

Comprehensive Long-Term Environmental Action Navy
Contract Number N62742-17-D-1800, CTO18F0126

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CONTENTS

FIGURE

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ACRONYMS AND ABBREVIATIONS

AOC	Administrative Order on Consent
bgs	below ground surface
BWS	Board of Water Supply, City and County of Honolulu
CF&T	contaminant fate and transport
CSM	conceptual site model
CWRM	Commission on Water Resource Management
DLNR	Department of Land and Natural Resources, State of Hawai‘i
DOH	Department of Health, State of Hawai‘i
DON; Navy	Department of the Navy, United States
EPA	Environmental Protection Agency, United States
GHB	general head boundary
GPEC	Groundwater Protection and Evaluation Considerations
GWFM	Groundwater Flow Model
GWFMWG	Groundwater Flow Model Working Group
IRR	Investigation and Remediation of Releases
LNAPL	light non-aqueous-phase liquid
MWIWP	Monitoring Well Installation Work Plan
SME	Subject Matter Expert
SOW	scope of work
TFN	transfer function-noise
U.S.	United States
UH	University of Hawai‘i
WP	work plan

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1. Introduction

This *Groundwater Flow Model Progress Report 06* is the sixth in a series of modeling progress reports that describe the technical status of the groundwater flow modeling effort being conducted for the Investigation and Remediation of Petroleum Product Releases and Groundwater Protection and Evaluation project at the Red Hill Bulk Fuel Storage Facility ("Facility"), Joint Base Pearl Harbor-Hickam, O'ahu, Hawai'i. The progress report is a component of the overall project reporting as specified in the project work plan (WP)/scope of work (SOW) (DON 2017a). The WP/SOW presents the process, tasks, and deliverables that address the goals and requirements of Statement of Work Sections 6 and 7 of the *Administrative Order on Consent* (AOC) *In the Matter of Red Hill Bulk Fuel Storage Facility, EPA Docket No: RCRA 7003-R9-2015-01; DOH Docket No: 15-UST-EA-01* (EPA Region 9 and DOH 2015). Submittal of groundwater flow model progress reports at a minimum of every 4 months is stipulated in AOC Statement of Work Section 7.1.2.

The objective of the AOC is to take steps to ensure that the drinking water resources in the vicinity of the Facility are protected and to ensure that the Facility is operated and maintained in an environmentally protective manner. Work to support Section 6 of the AOC Statement of Work is being conducted in response to the January 2014 release from Tank 5, and to evaluate potential remediation methods for the January 2014 Tank 5 release as well as any potential future releases. Work to support Section 7 of the AOC Statement of Work is being conducted to monitor and characterize the flow of groundwater around the Facility and includes groundwater modeling. The collective work conducted under Section 7 of the AOC Statement of Work will be used to inform changes to the current Groundwater Protection Plan (DON 2014).

Reporting Period 06 covered in this report represents progress for the sixth 4-month period (August 4–December 4, 2018) following conditional approval of the project WP/SOW by the Regulatory Agencies, which was received by the United States (U.S.) Department of the Navy (DON; Navy) on December 5, 2016 (EPA Region 9 and DOH 2016). *Groundwater Flow Model Progress Reports 01, 02, 03, 04,* and *05* (DON 2017b, 2017c, 2017e, 2018c, 2018f) were submitted on April 5, August 4, December 3, 2017; and April 5 and August 3, 2018, respectively.

2. Work Completed This Period

2.1 CURRENT STATUS

Groundwater Flow Model Working Group (GWFMWG) *Meeting #13, August 16, 2018:* The GWFMWG met once during this reporting period, on August 16. The GWFMWG is composed of representatives from the Navy, U.S. Geological Survey, U.S. Environmental Protection Agency (EPA), State of Hawai'i Department of Health (DOH), State of Hawai'i Department of Land and Natural Resources (DLNR) Commission on Water Resource Management (CWRM), City and County of Honolulu Board of Water Supply (BWS), and the University of Hawai'i (UH). The working group was formed to coordinate the Navy's development of accurate and reliable groundwater flow and contaminant fate and transport (CF&T) models, and to solicit technical feedback from stakeholders during the model development process. Each meeting includes a review of the modeling objectives and responses to previous meeting action items.

The following main topics were covered in the August 16 GWFMWG meeting:

- Regulatory Agencies' technical feedback on the Navy's Interim Groundwater Flow Model (DON 2018e)
- Additional considerations on the Interim Groundwater Flow Model

- Moving forward on the 2018 Groundwater Flow Model
- Synoptic water level study
- The Navy's current and future field activities

AOC Parties and Subject Matter Experts (SMEs) Meeting, August 14–15, 2018: The Navy provided the Regulatory Agencies and their SMEs with the current modeling files on July 27. In the August meeting, the Regulatory Agencies reported minimal differences between the Navy's model-generated output, and their own model-generated output using the provided files. Also at those meetings, the Regulatory Agencies presented initial comments on the July-published *Conceptual Site Model* (CSM) (DON 2018d) and *Groundwater Protection and Evaluation Considerations* (GPEC) (DON 2018e) reports; the latter report included the Interim Groundwater Flow Model report as an appendix. The comments included:

1. Using geostatistics applied to barrel log data and strike-and-dip field measurements produced basalt strike and dip results differing from those reported by the Navy. The Navy and geology SMEs subsequently met to work toward agreement on the range of strikes and dips, and on best estimates.
2. The need to be conservative in projecting the depth and extent of saprolite in the valleys based on seismic data from the seismic profiling survey (DON 2018b).
3. The need to incorporate the presence of tuffs and low-conductivity sediments into the model. It was observed that the presence of a cap (e.g., the Salt Lake tuffs) makai of groundwater flow could restrict groundwater discharge to the ocean and could cause groundwater to flow mauka.
4. The need to account for preferential pathways, including clinker layers and lava tubes, in the transport model.
5. The question of what conditions would be needed to properly represent tunnel inflow, which did not appear to be included in the model and would help with corroborating it.
6. Adjusting the CSM relative to the first five comments may provide a better calibration of the model to fit observed heads and gradients, noting the continued systematic difference between observed and modeled conditions.
7. The usefulness of soil vapor data as an important tool for early detection and for understanding future releases.
8. Understanding the distribution of light non-aqueous-phase liquid (LNAPL) in the subsurface is important for understanding the fate and transport of LNAPL. The use of temperature data to constrain LNAPL distribution was discussed. Developing a dynamic model for LNAPL can be useful in providing LNAPL transport rates and thus further informing possible containment options; currently, only groundwater flow and groundwater chemical fate and transport are being modeled.
9. The need to qualify some groundwater chemistry data, an inability to demonstrate a coherent flow path using the available geochemistry data, and the lack of a discussion of reactive transport that the investigation WP/SOW (DON 2017a) indicated would be provided.
10. The need for a better understanding of groundwater coastal/submarine discharge for incorporation into the CSM and flow model.

Two primary AOC Sections 6 and 7 deliverables, the *Investigation and Remediation of Releases* (IRR) *Report* and the *Groundwater Flow Model* (GWFM) *Report*, were originally scheduled in accordance with the AOC for delivery on December 5, 2018. Following the August 14, 2018 AOC Parties meeting, the Navy requested a revised schedule for both deliverables' due dates to fully address the comments conveyed by the Regulatory Agencies on the CSM and GPEC reports. The Regulatory Agencies approved the extension request in an October 29, 2018 letter (EPA Region 9 and DOH 2018). In the approval letter, the Regulatory Agencies further detailed their 10 key concerns with the interim CSM, the interim groundwater flow model, and the interim work related to fate and transport as follows:

- Concerns with the Interim CSM:
    1. Predominant strike and dip of basalt in the geologic model
    2. Saprolite extent in the interim model vs. depths inferred by seismic profiling
    3. Preferential pathways
- Concerns with the Interim Groundwater Flow Model:
    4. Representation of caprock, tuffs, and sediments
    5. Drinking water shaft inflows
    6. Calibration to groundwater heads and gradients
    7. Coastal marine boundary and discharge
- Concerns with interim work related to Fate and Transport:
    8. LNAPL fate and transport
    9. Groundwater data
    10. LNAPL and dissolved-phase distribution

The Regulatory Agencies also provided a recommended schedule, and requested the Navy to provide a response to their letter with a proposed schedule over the course of the 10-month extension (to October 5, 2019). The Navy provided the requested response and proposed schedule on November 14, 2018. A meeting was held via webinar with the AOC Parties on November 15, 2018 to coordinate this revised schedule.

AOC Parties Coordination Meeting, November 15, 2018: The Navy provided the Regulatory Agencies with feedback on AOC Parties' comments on the CSM (DON 2018d) and GPEC (DON 2018e) reports. The Navy and Navy contractors reiterated the importance of SME meetings and Regulator feedback to help better understand different perspectives and approaches so as to better address these issues as part of the deliverables. The Navy acknowledged the comments and is working to apply several of the recommendations provided by the SMEs. The Navy reinforced that correct representation of the site geologic conditions is critical for the development of credible flow and transport models. Effectively updating the geology into the flow model is a large effort with significant implications on the deliverable timeline.

The Navy discussed the steps required to address the "Top 10 Comments" for input into the IRR and GWFM Reports. The first step requires revising the geologic CSM, which is the cornerstone for making decisions and numerical modeling. Changes to the geologic CSM have significant impacts with respect to modeling, which in turn impacts the evaluation of remedial alternatives in the IRR Report.

The following action items were identified during the meeting:

- Regarding technical working group meetings:
  - Need to take minutes during working group meetings to record AOC Parties' agreements during the meeting.
  - Share materials/information ahead in advance of the technical meetings so that all attendees can prepare and have more productive meetings.
  - Explore other avenues to document agreement between parties on a topic-by-topic basis, as some topics are suited to documentation by letter/minutes, but other topics may be through data sharing.
  - Provide meeting minutes with agreements noted to all parties for review to ensure that all are moving in the same direction.
- Regarding the EPA/DOH letter dated October 29, 2018:
  - The Navy will provide feedback/consensus/concurrence/disagreement on the four topics presented in the EPA/DOH letter.
  - For the topics that the Navy has disagreement on, provide a plan for achieving agreement from all AOC Parties.
  - The Navy will provide a list of which of the Top 10 Comments have been incorporated into the work.
  - For the July 2019 presentation of draft deliverables, the Navy will present the Regulatory Agencies with a summary of the changes made to the draft deliverables for review.

The AOC Parties also discussed that the presentation planned for November 16, 2018 should incorporate discussion throughout, rather than questions and discussion at the end of the presentation.

AOC Parties and SMEs Meeting, November 16, 2018: A webinar was held to discuss key geology and modeling issues from the Top 10 Comments provided by the Regulatory Agencies in the August 14, 2018 meeting. The intent of this meeting was to reach consensus on select items to allow groundwater flow modeling to proceed. The following topics were presented and discussed:

- Detailed comments on geology:
  - *Comment #1:* Predominant strike and dip of basalt in the geologic model
  - *Comment #2:* Saprolite extent in the interim model vs. depths inferred by seismic profiling
  - *Comment #3:* Preferential pathways
  - *Comment #4:* Representation of caprock, tuffs, and sediments
- Detailed response to groundwater modeling comments:
  - *Comment #3:* Preferential pathways
  - *Comment #5:* Drinking water shaft inflows
  - *Comment #7:* Coastal marine boundary and discharge

Several agreements were reached, and several action items were identified during the meeting. These are summarized below.

The SMEs generally agreed with the predominant orientations of basalt. However, the following were agreed to in order to enable model grid construction as quickly as possible: The Navy will add X and Y coordinates for measured basalt strikes and dips and provide them to the SMEs. It was agreed that the Navy would project the two principal dip azimuths and magnitudes onto digital elevation models, and then SMEs from the Navy and DOH would meet in the Red Hill area in late November 2018 to determine if these qualitatively agree with observed outcrops.

It was agreed that the Navy will evaluate two configurations of the saprolite/basalt contacts with the groundwater flow model, and will evaluate sensitivity. The two configurations are based on interpreted contacts at -5 and -55 feet mean sea level in the Hālawa Deep Monitoring Well (HDMW2253-03), with a projected slope of 3 degrees upgradient and downgradient. Until new data related to the actual configuration of the saprolite contact are obtained, the Navy will use the more conservative configuration, based on the sensitivity analyses, for groundwater flow modeling.

There was agreement from the SMEs on the Navy's presentation on orientation of preferential pathways (e.g., lava tubes) as it relates to the groundwater flow and solute transport. LNAPL modeling remains to be resolved. DOH reiterated that preferential pathways between the Red Hill tanks and Red Hill Shaft are of particular interest to the AOC Parties.

The Navy will provide geologic three-dimensional visualization software files (.efb format) to Regulatory SMEs. The Navy also agreed to send a list of references consulted for interpretation of Honolulu volcanic series and caprock within the model domain. DOH agreed to contact the Honolulu Authority for Rapid Transit to obtain geotechnical boring logs that cannot be released directly by the Navy. DOH/UH SMEs will review tuff and caprock data and determine if they concur with the Navy's depictions within the model so that model construction can commence.

There was agreement on the Navy's proposed approach to modeling to better comport with Red Hill Shaft water development tunnel inflows reported at the time of construction. It was agreed that there may be a head dependency to the flows, and that this could be tested in upcoming flow modeling.

The Navy will provide the recent geochemical/isotopic data requested by the UH SME.

Following this was a discussion of future AOC and GWFMWG meetings (in December 2018 and January and February 2019), and informal smaller group calls/email/webinars to quickly reach resolution on these matters. Navy and DOH SMEs will have follow-up discussions on Comment #1 to reach quick resolution so that the model grids can be constructed. The EPA said it would be difficult to commit to meetings in January 2019 because of a possible Federal government shutdown in December 2018. The EPA also said that some matters may be more easily and efficiently addressed via email. The Navy will provide AOC SMEs with files that have been prepared for the transfer function-noise (TFN) analysis with necessary redactions.

2.1.1 Technical Progress

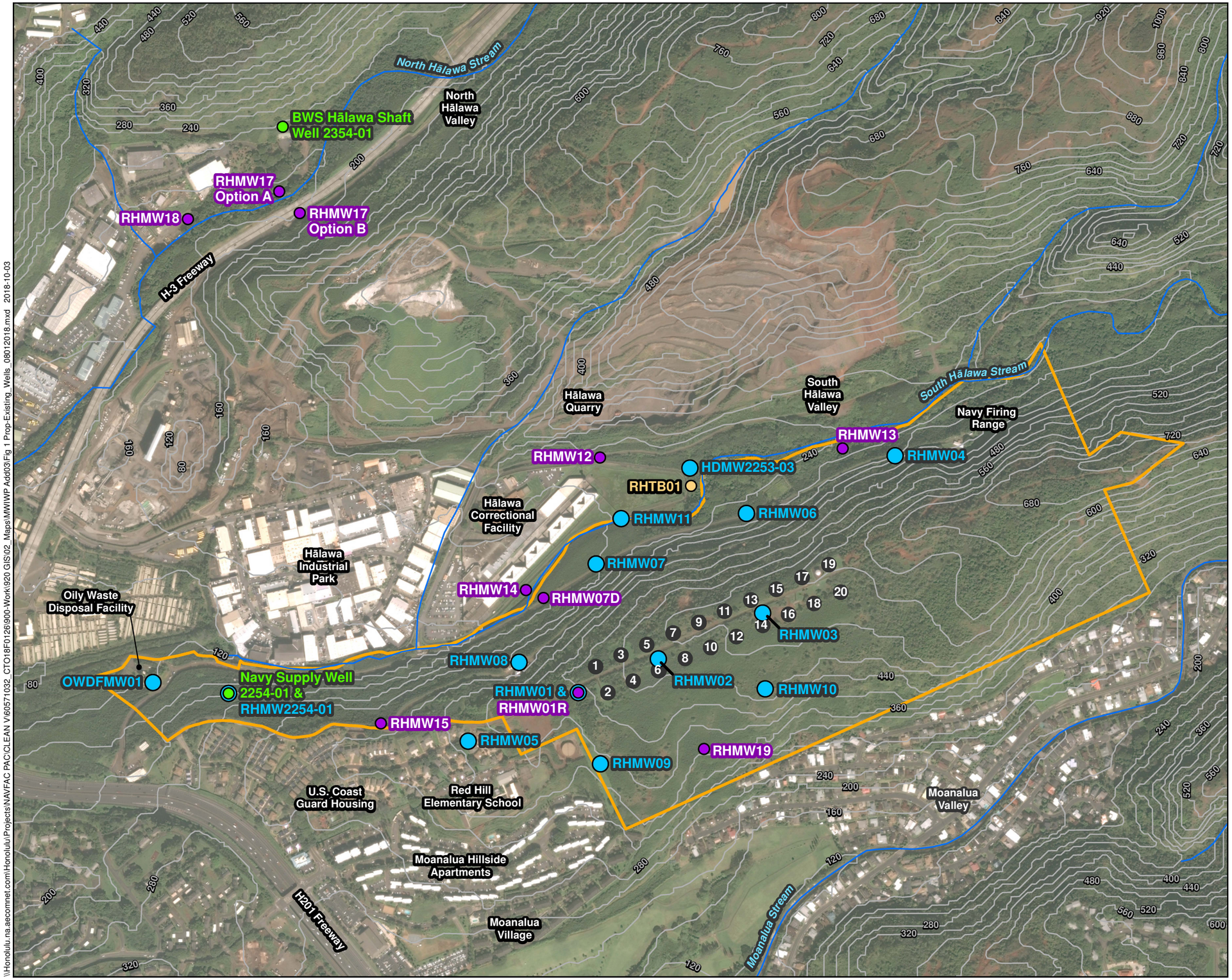
During this reporting period, the Navy continued refining and using the interim groundwater flow model. Preparation of the GWFM Report for publication in December 2018, concurrent with publication of the IRR Report, continued until the Navy's extension request was approved on October 29, 2018, as described in Section 2.1.

Some of the comments from DOH and EPA from the August 14 and 15 meetings were addressed by conducting additional simulations with the Interim Groundwater Flow Model. These additional models are listed below:

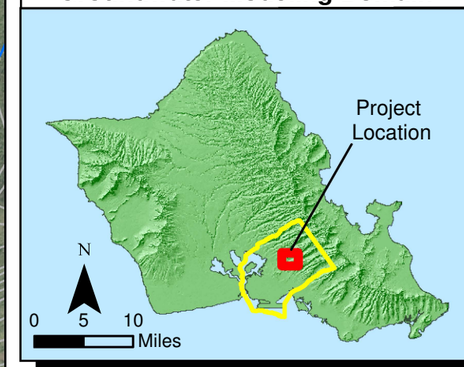
Model Number	Parameter
Model #11	Incorporates a high horizontal hydraulic conductivity value for basalt
Model #44	Anisotropy strike direction
Model #45	Lower general head boundary (GHB) conductance in Pearl Harbor
Model #46	Lower offshore GHB conductance outside of Pearl Harbor
Model #47	Tunnel inflows at Red Hill Shaft
Model #48	Extend saprolite in southwest direction
Model #49	Homogeneous model of 2017/2018 synoptic water level study
Model #50	Heterogeneous model of 2017/2018 synoptic water level study

Other activities conducted during this reporting period relevant to groundwater flow modeling include:

- Began preparations and commenced drilling and installation of the first of several additional CWRM-permitted multilevel wells (Figure 1). Field work included:
  - Drilling of RHMW14 at Hālawa Correctional Facility began in late October 2018. Due to the number of boulders encountered during air knifing, a bucket auger was required to advance through the boulders. Drilling was suspended in late November 2018 at 21.5 feet below ground surface (bgs) due to petroleum odors encountered below 12 feet bgs. The landowner officially notified DOH on November 28, 2018. Soil samples were collected and sent for analysis, and the hole was backfilled to ground surface with bentonite chips and sand.
- Received residual saturation and other petrographic data for core and fluid samples from Core Laboratories dated October 31, 2018.
- Continued review and evaluation of 2017/2018 synoptic water level study including a TFN Analysis.
- Downloaded and reviewed data from Zones 2 through 8 in RHMW11.
- Performed Red Hill Fourth Quarter 2018 groundwater monitoring and sampling in late October and early November. This included sampling Zone 5 in RHMW11.
- Used geostatistics (e.g., rose diagrams, Gaussian mixing models) applied to barrel log data and strike-and-dip field measurements. The Navy collected additional field measurements in September and October 2018 on the Moanalua Valley side of Red Hill. These results were presented to the AOC Parties on November 16, 2018.
- Met with DOH SME in the Red Hill area on November 28, 2018 to go over digital elevation model agreement with observed outcrops. DOH was accepting of the dip azimuth of 213.6 degrees, dip magnitude of 2.9 degrees, but still questions the 184.6 degree orientation. Took excursion up Tripler Ridge to look at rock outcrops on the Moanalua Valley side of Red Hill, where the Navy had collected some of the apparent dip data in October 2018. Two outcrops were observed; the DOH SME took measurements on these using a level transit, which was same procedure used when DOH surveyed the outcrop in July 2018 that resulted in an apparent dip direction of 217 degrees, 2.9 degree dip magnitude.
- Conducted double-ring infiltrometer testing the week of October 15, 2018 at three locations atop Red Hill, and received the report from Geolabs, Inc. on November 6, 2018.



Groundwater Modeling Domain



Legend

- Proposed Test Boring
- Proposed Monitoring Well
- Existing Monitoring Well
- Existing Water Supply Well
- Red Hill Fuel Storage Tank
- Stream
- Topographic Contour (feet mean sea level)
- Red Hill Facility Boundary
- Groundwater Model Area

Notes

1. Map projection: NAD 1983 UTM Zone 4N
2. Base Map: DigitalGlobe, Inc. (DG) and NRCS. Publication_Date: 2015
3. Coordinates: NAD 1983 UTM Zone 4N

N

0 500 1,000 2,000 Feet

Figure 1
Proposed and Existing Monitoring Well and Test Boring Locations
Groundwater Flow Model Progress Report 06
Red Hill Bulk Fuel Storage Facility
JBPHH, O'ahu, Hawai'i

\\Honolulu.na.aecomnet.com\Honolulu\Projects\NAVFAC PAC\CLEAN V\60571032_CTO18F01126\900-Work\920 GIS\02_Maps\MW\WP Add03\Fig 1 Prop-Existing_Wells_08012018.mxd 2018-10-03

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2.1.2 Technical Issues

No other technical issues were identified during this reporting period.

2.2 SUBMITTAL OF MODELING DELIVERABLES

Relevant deliverables submitted during this reporting period include:

- *Final Second Quarter 2018 - Quarterly Groundwater Monitoring Report, Red Hill Bulk Fuel Storage Facility, Joint Base Pearl Harbor-Hickam, O'ahu, Hawai'i* (DON 2018g)
- *Final Third Quarter 2018 - Quarterly Groundwater Monitoring Report, Red Hill Bulk Fuel Storage Facility, Joint Base Pearl Harbor-Hickam, O'ahu, Hawai'i* (DON 2018a)

The *Monitoring Well Installation Work Plan* (MWIWP) *Addendum 03* was prepared and submitted for internal Navy review on October 30, 2018, prior to submittal to the Regulatory Agencies. MWIWP Addendum 03 supersedes Addendum 02 (DON 2017d) with revised well locations and updated installation procedures for nine wells and one test borehole. Proposed well and borehole locations are shown on Figure 1.

3. Anticipated Work for Next Reporting Period

Anticipated work for Reporting Period 07 (December 5, 2018–April 3, 2019) includes:

- AOC Parties and/or GWFMWG meetings approximately monthly.
- Updating the CSM report.
- Updating the groundwater flow model addressing Regulatory Agency concerns.
- Review and evaluation of monitoring data from Hālawa Correctional Facility including data from monitoring wells UMW-1 and RHMW11 Zone 5.
- Conducting the First and Second Quarter 2019 Red Hill groundwater monitoring events in January and March 2019, respectively.
- Continue drilling and installation of CWRM-permitted multilevel wells RHMW12, RHMW13, and RHMW14, and test borehole RHTB01.
- Resume drilling at RHMW15.

Anticipated deliverables due during upcoming Reporting Period 07 (December 5, 2018–April 3, 2019) include:

- *Draft* and *Final Fourth Quarter 2018 - Quarterly Groundwater Monitoring Report*
- *Draft First Quarter 2019 - Quarterly Groundwater Monitoring Report*

4. References

Department of the Navy (DON). 2014. *Interim Update, Red Hill Bulk Fuel Storage Facility Final Groundwater Protection Plan, Pearl Harbor, Hawaii. (January 2008)*. Pearl Harbor, HI: Naval Facilities Engineering Command, Pacific. August.

———. 2017a. *Work Plan / Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, Joint Base Pearl*

Harbor-Hickam, O'ahu, Hawai'i; January 4, 2017, Revision 02. Prepared by AECOM Technical Services, Inc., Honolulu, HI. Prepared for Defense Logistics Agency Energy, Fort Belvoir, VA, under Naval Facilities Engineering Command, Hawaii, JBPHH HI.

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———. 2017e. *Groundwater Flow Model Progress Report 03, Red Hill Bulk Fuel Storage Facility, Joint Base Pearl Harbor-Hickam, O'ahu, Hawai'i; December 3, 2017, Revision 00*. Prepared by AECOM Technical Services, Inc., Honolulu, HI. Prepared for Defense Logistics Agency Energy, Fort Belvoir, VA, under Naval Facilities Engineering Command, Hawaii, JBPHH HI.

———. 2018a. *Final Third Quarter 2018 - Quarterly Groundwater Monitoring Report, Red Hill Bulk Fuel Storage Facility, Joint Base Pearl Harbor-Hickam, O'ahu, Hawai'i*. Prepared by AECOM Technical Services, Inc. JBPHH HI: Naval Facilities Engineering Command, Hawaii. November.

———. 2018b. *Seismic Profiling to Map Hydrostratigraphy in the Red Hill Area, Red Hill Bulk Fuel Storage Facility, Joint Base Pearl Harbor-Hickam, O'ahu, Hawai'i; March 30, 2018, Revision 00*. Prepared by Lee Liberty and James St. Claire, Boise State University, Boise, ID, for AECOM Technical Services, Inc., Honolulu, HI. Boise State University Technical Report BSU CGISS 18-01. Prepared for Defense Logistics Agency Energy, Fort Belvoir, VA, under Naval Facilities Engineering Command, Hawaii, JBPHH HI.

———. 2018c. *Groundwater Flow Model Progress Report 04, Red Hill Bulk Fuel Storage Facility, Joint Base Pearl Harbor-Hickam, O'ahu, Hawai'i; April 5, 2018, Revision 00*. Prepared by AECOM Technical Services, Inc., Honolulu, HI. Prepared for Defense Logistics Agency Energy, Fort Belvoir, VA, under Naval Facilities Engineering Command, Hawaii, JBPHH HI.

———. 2018d. *Conceptual Site Model, Red Hill Bulk Fuel Storage Facility, Joint Base Pearl Harbor-Hickam, O'ahu, Hawai'i; July 27, 2018, Revision 00*. Prepared by AECOM Technical Services, Inc., Honolulu, HI. Prepared for Defense Logistics Agency Energy, Fort Belvoir, VA, under Naval Facilities Engineering Command, Hawaii, JBPHH HI.

———. 2018e. *Groundwater Protection and Evaluation Considerations for the Red Hill Bulk Fuel Storage Facility, Joint Base Pearl Harbor-Hickam, O'ahu, Hawai'i; July 27, 2018, Revision 00*. Prepared by AECOM Technical Services, Inc., Honolulu, HI. Prepared for Defense Logistics

Agency Energy, Fort Belvoir, VA, under Naval Facilities Engineering Command, Hawaii, JBPHH HI.

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