DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 377TH AIR BASE WING (AFMC)

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AUG 0 1 2014

Mr. Tom Blaine, Manager
Environmental Health Division Director
Environmental Health Division
New Mexico Environment Department (NMED)
1190 St. Francis Drive
Santa Fe, New Mexico 87502

Dear Mr. Blaine

Attached please find the *Kirtland Air Force Base Bulk Fuels Facility – Groundwater Extraction Pilot Implementation and Additional Characterization Work Plan* dated August 1, 2014, for sites ST-106 and SS-111. This submittal fulfills NMED's July 10, 2014 letter requirement for a work plan (WP) and is based on technical discussions held on July 23, 2014. The WP outlines activities needed to complete a pilot test designed to demonstrate the effectiveness of groundwater extraction technology for extraction and treatment of the dissolved-phase ethylene dibromide (EDB). Furthermore, the WP describes a proposal to install additional wells to enhance EDB plume characterization.

Please contact Mr. L. Wayne Bitner at (505) 853-3484 or at ludie.bitner@us.af.mil or Ms. Victoria R. Branson at (505) 846-6362 or at victoria.branson@us.af.mil if you have questions.

Sincerely

TOM D. MILLER, Colonel, USAF
Commander

Attachment:
Groundwater Extraction Pilot Implementation and Additional Characterization Work Plan, August 1, 2014

cc:
NMED-HWB (Kieling, Cobrain, Moats, McDonald, Brandwein) w/attch
NMED (McQuillan, Longmire), w/attchNMED-PSTB (Reuter) w/attch
NMED-GWQB (Schoeppner) w/attch
NMED-OGC (Kendall) w/attch

EPA Region 6 (King) w/attch
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August 1, 2014

Subject: **Kirtland Air Force Base Bulk Fuel Facility – Groundwater Extraction Pilot Implementation and Additional Plume Characterization Work Plan – Revision 1**

This Kirtland Air Force Base (AFB) Bulk Fuel Facility (BFF) Groundwater Extraction Pilot Implementation and Additional Plume Characterization Work Plan has been prepared by CB&I Federal Services LLC for the U.S. Army Corps of Engineers (USACE), Albuquerque District, under Contract No. W912DY-10-D-0014. This letter work plan is based on the technical discussions held between the Air Force Civil Engineer Center, USACE, the New Mexico Environment Department, Kirtland AFB personnel, and their contractor on July 23, 2014, and outlines the activities needed to complete a pilot test designed to demonstrate the effectiveness of groundwater extraction technology for the extraction and treatment of dissolved-phase ethylene dibromide (EDB). The plan also describes the location and installation of additional groundwater monitoring wells to further characterize the horizontal and vertical extent of the dissolved-phase EDB plume defined by the 0.05 microgram (µg/L) maximum contaminant level (MCL). Based on the technical discussions, the location of the proposed extraction well has been revised from the originally-proposed use of well KAFB-106157 to a new location described below to capture higher downgradient concentrations of EDB; well KAFB-106157 is not currently being considered as part of this Interim Measure.

Components of the project include the following:

- Installation of a new groundwater monitoring well near the existing well cluster consisting of wells Kirtland Air Force Base (KAFB)-106035, KAFB-106036, and KAFB-106037. The new well will be screened from approximately 85 to 100 feet below the water table (designated as KAFB-106212) to delineate the vertical extent of the dissolved-phase EDB plume as defined by the 0.05 µg/L MCL. Three bi-weekly sampling events (i.e., 0, 2, and 4 weeks) will be conducted to collect groundwater samples in triplicate, and the average EDB concentration among all nine samples will be used to make this determination.

  – If the EDB average concentration is below the MCL, the vertical extent of the EDB plume is defined, and the design and installation of the groundwater extraction well, designated as KAFB-106228, will start.

  – If the EDB average concentration is at or above the MCL, another deeper well will be installed and sampled as described above. This process will continue until the vertical extent of the EDB plume at the monitoring well location is delineated. The extraction well will not be installed until the vertical extent of EDB is defined.

- A new extraction well (KAFB-106228) will be installed near existing cluster wells KAFB-106035, KAFB-106036, KAFB-106037, and new well KAFB-106212. The design of the extraction well will be based on the vertical delineation of EDB in groundwater (following the steps described above).

- Installation of conveyance piping from the extraction well and a groundwater treatment (GWT) system along with an infiltration gallery to dispose of treated water on Kirtland AFB property.

- Installation of 15 additional groundwater monitoring wells will occur to fully delineate the horizontal and vertical extent of the EDB plume.

This pilot test is being conducted in response to direction by the New Mexico Environment Department (NMED) as described in the letter received July 10, 2014 (NMED, 2014) and follow on discussions held on July 23, 2014. Additional details on the project components follow.

Installation and Sampling of Groundwater Monitoring Well KAFB-106212 to Delineate Vertical Extent of Dissolved-Phase EDB

In order to fully characterize the vertical extent of the EDB plume in the area of monitoring wells KAFB-106035, KAFB-106036, and KAFB-106037, an additional monitoring well, designated as KAFB-106212, will be drilled using Air Rotary Casing Hammer (ARCH) drilling and installed with a screened interval extending from 85 to 100 feet below the water table (Figure 1). In order to avoid placing the screen in an area of low permeability, the screened interval may be adjusted up or down up to 15 feet to the nearest coarser grained layer. The NMED will be notified if an adjustment greater than +/- 15 feet is required. This well will be installed and developed in accordance with the NMED-approved Groundwater Investigation Work Plan (USACE, 2011). Continuous core samples will be taken during drilling of KAFB-106212 from 10 feet above the water table (as determined from the water level in the closest existing monitoring wells) to the total depth of the borehole and will be logged for lithology and selectively submitted for particle-size analysis, permeability, hydraulic conductivity, effective porosity, and mass of solid organic carbon. Borehole geophysics, consisting of induction, neutron, and gamma logging, will be conducted at KAFB-106212 as well.

Once KAFB-106212 is developed and allowed to sit for 10 days, the waiting time required under the Resource Conservation and Recovery Act permit, groundwater samples will be collected in triplicate during three separate sampling events (i.e., 0, 2, and 4 weeks). The triplicate samples collected at each sampling event will be shipped to Empirical Laboratories, LLC in Nashville, Tennessee (a U.S. Department of Defense Environmental Laboratory Accreditation Program certified laboratory). Samples will be analyzed for field parameters, EDB detection/quantification using U.S. Environmental Protection Agency Method SW-846 8011, volatile organic compounds (VOCs), target analyte list (TAL) metals, anions, and cations. An expedited turn-around-time will be requested for all samples.

The need for extending the vertical delineation effort to a deeper well will be based on the decision logic illustrated in Figure 2. If the average EDB concentration of the nine samples is at or above the 0.05µg/L MCL, an additional monitoring well will be installed with a deeper screened interval, and the sampling process will be repeated. This decision process will be repeated until the vertical extent of the plume is defined in the vicinity of the new monitoring well, which is near the cluster monitoring wells KAFB-106035, KAFB-106036, and KAFB-106037.

Installation of Extraction Well KAFB-106228

If the average result of the samples show that the EDB concentration in monitoring well KAFB-106212 is below the 0.05 µg/L MCL, then an extraction well, designated as KAFB-106228, will be designed based on the aquifer properties determined in well KAFB-106212 and using a groundwater flow model. Upon NMED approval of the design, the extraction well will be installed. The drilling method used at the KAFB-106228 location will be determined as part of the final well design. (Note: A detailed engineering design of the pilot-system components will be submitted under separate cover.)

Extraction well KAFB-106228 will be screened to extract water from the shallow, intermediate and deep zones of the aquifer. The well will be designed based on model results and other previously obtained data to capture the maximum radius of influence and have 80 to 90 percent efficiency. Due to the depth of the

well the extraction pump will be a multi-stage centrifugal pump designed for the optimal pumping rate determined during the modeling phase. Final design specifications will be determined based on the results of the groundwater flow model. The extraction pump placed in the well will be powered and controlled from the treatment system. A vault will be installed at the wellhead to house piping and electrical cables. The vault will be locked and will have intrusion alarms to shut down power to the pump if the vault is opened.

Extracted Groundwater Conveyance and Treatment System Specifications

Groundwater from extraction well KAFB-106228 (Figure 1) will be pumped through a double-walled high-density polyethylene pipeline to a groundwater treatment system located just east of Louisiana Boulevard on Kirtland AFB property. Groundwater will be treated to remove EDB and any other organics to below MCLs prior to discharge to an infiltration gallery, where the water will percolate into the vadose zone soil. The exact location of the infiltration gallery will be determined at a later date.

Groundwater monitoring wells KAFB-106035, 106036, and 106037 (Figure 1) are screened in the shallow, intermediate, and deep zones of the aquifer, respectively. Analytical results from these wells during First Quarter calendar year 2014 (USACE, 2014) exceeded the 0.05 µg/L EDB MCL. No other organic contaminants have been detected in these wells, and all metals and other general chemistry parameters are at background levels.

Groundwater from the extraction well will be pumped through approximately 2,000 linear feet of pipeline to the treatment system. The pipeline will be buried in a trench in the unpaved alley that runs between Gibson Boulevard and Mitchel Road. The pipeline will then cross Louisiana Boulevard and will discharge the extracted water into an equalization tank prior to pumping into the GWT system to be located on Kirtland AFB property.

The conveyance pipe will be double walled high-density polyethylene with an 8-inch-diameter inner pipe and a 12-inch-diameter outer pipe. Leak-detection monitoring will be installed on the double walled pipe system. The pipeline will be leak-tested before it is put into service and will be tested on a regular basis with frequency to be defined during the system design. The power supply and control cable for the extraction pump as well as the intrusion alarm cable will be run in the same trench as the groundwater pipeline. The power supply cable will carry 480 volts and will be a heavy-duty armored cable. After the pipeline is installed, the alley will be paved to discourage access to the pipeline.

The GWT system will be installed in a small modular building that can be upgraded based on changes to the system design. The building will be located just east of the Kirtland AFB property fence line. The treatment system will include the following:

- A 6,000-gallon equalization tank will receive the groundwater from the conveyance pipe and will be provide the surge capacity needed to maintain a consistent groundwater feed rate to the carbon contact vessels.

- The equalization tank pump will be a standard centrifugal pump rated for 100 gallons per minute and will feed the carbon contact vessels.

- A set of bag filters will be placed between the equalization tank pump and the carbon contact vessels to remove suspended solids.

- Two carbon contact vessels, each containing 20,000 pounds of virgin coconut shell granular-activated carbon (GAC) will be used to remove EDB as the extracted water flows through the GAC bed.

- A 4,000-gallon post-treatment equalization tank will be used to provide surge capacity for the pumps that discharge into the infiltration gallery.

- A treated-water discharge pump will be used to feed the infiltration gallery.

- A second set of bag filters will be placed between the treated water discharge pump and the infiltration gallery to remove carbon fines from the carbon vessels.

- A control system and operator interface panel will allow control of the GWT system and the extraction well pump.

Treatment with GAC is a proven technology for removal of EDB from drinking water and is used both at centralized water-treatment systems and for point-of-use or home filtration systems. The GAC treatment system will be a typical lead-lag system where the groundwater will flow through two contact vessels plumbed in series. The lead contact vessel removes all of the EDB, and the lag or second contact vessel is a backup unit in case of breakthrough. The key design requirement for the GWT system is to achieve the 0.05 µg/L EDB MCL. At a 100–gallons-per-minute flow rate, each contact vessel will provide 54 minutes of "empty bed contact time." The typical design practice for removal of low levels of organics from groundwater is to provide 10 to 15 minutes of contact time to achieve 95% removal. The designed contact time of 54 minutes is expected to produce treated water with EDB concentrations below the detection limit. GAC change-out is expected to be necessary once or twice per year to account for fouling due to dirt or mineral deposits. Poor flow distribution through the GAC bed due to plugging or fouling of the GAC could result in early EDB breakthrough from the lead contact vessel. Timely GAC change-out is the best practice for minimizing potential flow-distribution problems.

The contact vessels will be 10-foot-diameter American Society of Mechanical Engineers code tanks and will have a 35-millimeter vinyl ester epoxy lining. Each contact vessel will be fitted with stainless steel inlet and outlet distributors designed to provide uniform flow through the GAC beds. The two contact vessels will be fitted with an 8-valve manifold that allows either tank to be used as the lead or lag vessel. When EDB is detected in the outlet of the lead vessel, the valve positions will be switched to take the lead vessel out of service, and the GAC in the vessel taken off line will be replaced. Once the GAC is replaced, the vessel will be put back in service in the lag position. Additional treatment components may be added to accommodate system expansion.

Influent, in-process, and effluent samples will be collected to monitor EDB concentrations. A detailed sampling and analysis plan will be developed in coordination with the NMED Hazardous Waste Bureau and Groundwater Quality Bureau. Sampling will be conducted on a more frequent basis at initial start-up, and then reduced to regular baseline sampling after the system has been in operation for a specified amount of time.

Once the extracted water has been treated on Kirtland AFB property, the treated water will be pumped to an infiltration gallery and/or basin also located on Kirtland AFB property. The infiltration gallery will be designed to provide sufficient surface area for the treated groundwater to percolate into the vadose zone soil. The infiltration gallery will be installed deep enough to be below any surficial clays or silts that would impede percolation. The exact system design and location of the infiltration gallery/basin is yet to be determined but will be targeted for infiltration into the perched aquifer. Additionally, a water tap will be installed to provide access for Kirtland AFB water tankers to collect treated water for dust suppression on base property.

Installation of 15 Additional Groundwater Monitoring Wells

In addition to monitoring well KAFB-106212 and extraction well KAFB-106228, 15 new groundwater monitoring wells will be drilled using ARCH drilling and installed to further delineate the horizontal and vertical extent of the EDB plume. To satisfy priority data gaps regarding the EDB horizontal and vertical plume characterization, priority data gaps were discussed, and 15 new groundwater monitoring wells were determined to be critical. To maximize well installation efficiency, multiple drill rigs will be utilized simultaneously. Figure 1 illustrates the proposed locations of the additional wells, designated as KAFB-106213 through KAFB-106227.

The 15 monitoring wells will be installed in five clusters of three wells, one screened in each of the shallow, intermediate, and deep aquifer zones. The wells will be installed in accordance with the approved Groundwater Investigation Work Plan (USACE, 2011) and subsequent correspondence between NMED and Kirtland AFB pertaining to groundwater well installation. Shallow and intermediate wells will be installed in accordance with the April 13, 2012 NMED direction; shallow wells will be installed with 30 feet of screen with no more than 15 feet below the water table, and intermediate wells will be installed with 15-foot screens, the top of which will be 15 feet below the water table (NMED, 2012). The screen intervals for the deep wells in each cluster will be determined once the vertical extent of EDB is known at proposed well KAFB-106212. Three of the 15 new wells, designed as KAFB-106213, KAFB-106214, and KAFB-106215, will be installed within 300 feet of extraction well KAFB-106228 to allow more effective monitoring of the aquifer response to pumping at extraction well KAFB-106228 (see Figure 1).

Continuous core samples will be taken during drilling of each of the deep wells at each cluster from 10 feet above the water table to the total depth of the borehole and will be logged for lithology and selectively submitted for particle-size analysis, permeability, hydraulic conductivity, effective porosity, and mass of solid organic carbon. Borehole geophysics, consisting of induction, neutron, and gamma logging, will also be conducted at each deep well. Development and sampling of these groundwater monitoring wells will follow procedures outlined in the NMED approved Groundwater Investigation Work Plan (USACE, 2011).

Permitting

A permit application to change an existing water right (wr-06) is required from the Office of the State Engineer (OSE) to begin pumping and treatment at KAFB-106228. This permit is submitted directly to the OSE for review. Following an initial 14-day filing period, the OSE will issue a legal notice that is run in the Albuquerque Journal 1 day a week for 3 consecutive weeks. A 10-day protest period begins after the last day of public notice has been completed. If no protest is filed during the protest period, there will be an estimated additional 6 weeks of review after which the OSE will issue a technical memorandum and the permit. If a protest is filed during the 10-day protest period, the hearing process will begin, which could take additional months or years to resolve before the permit is issued. KAFB is currently drafting this permit application and is in communication with the OSE to ensure all details are captured. Additional permits will be required depending on the final disposition of the extracted and treated water.

Additional Right of Entry permits and OSE permits to Drill a Well with No Consumptive Use of Water (wr-07) will be obtained as needed.

A discharge permit with the NMED Groundwater Quality Bureau is also required for the discharge of treated water into the infiltration gallery. This permit includes the final treatment system design, treatment standards, sampling and analysis plan, and operations and maintenance. The discharge permit includes a public comment period and can take as few as 4 months for approval, depending on the comments and requests received.

Additional Plans and Reporting

Following the installation and sampling of monitoring well KAFB-106212, a detailed engineering design of the extraction well pilot-system components will be submitted under separate cover. This detailed design plan will include a full engineering design of the extraction well, the conveyance piping, the pump-and-treat system, the sampling and analysis plan for the treatment system, and the location and design of the infiltration gallery. Additionally, a summary of the installation of data-gap monitoring wells and their respective data collected will be submitted under separate cover prior to the detailed engineering design of the pilot-system components.

References

NMED. 2014. July 10, 2012 correspondence from Mr. Tom Blaine, Director, NMED-EHD, to Colonel Tom Miller, Base Commander, 377 ABW/CC, Kirtland AFB, NM, and Mr. John Pike, Director, Environmental Management Section, 377 MSG/CEANR, Kirtland AFB, NM, re: Interim treatment Of Dissolved Phase, Bulk Fuels Facility Spill, Solid Waste Management Units ST-106 and SS-111, Kirtland Air Force Base, New Mexico, April 2012, EPA ID# NM9570024423, HWB-KAFB-14-MISC.

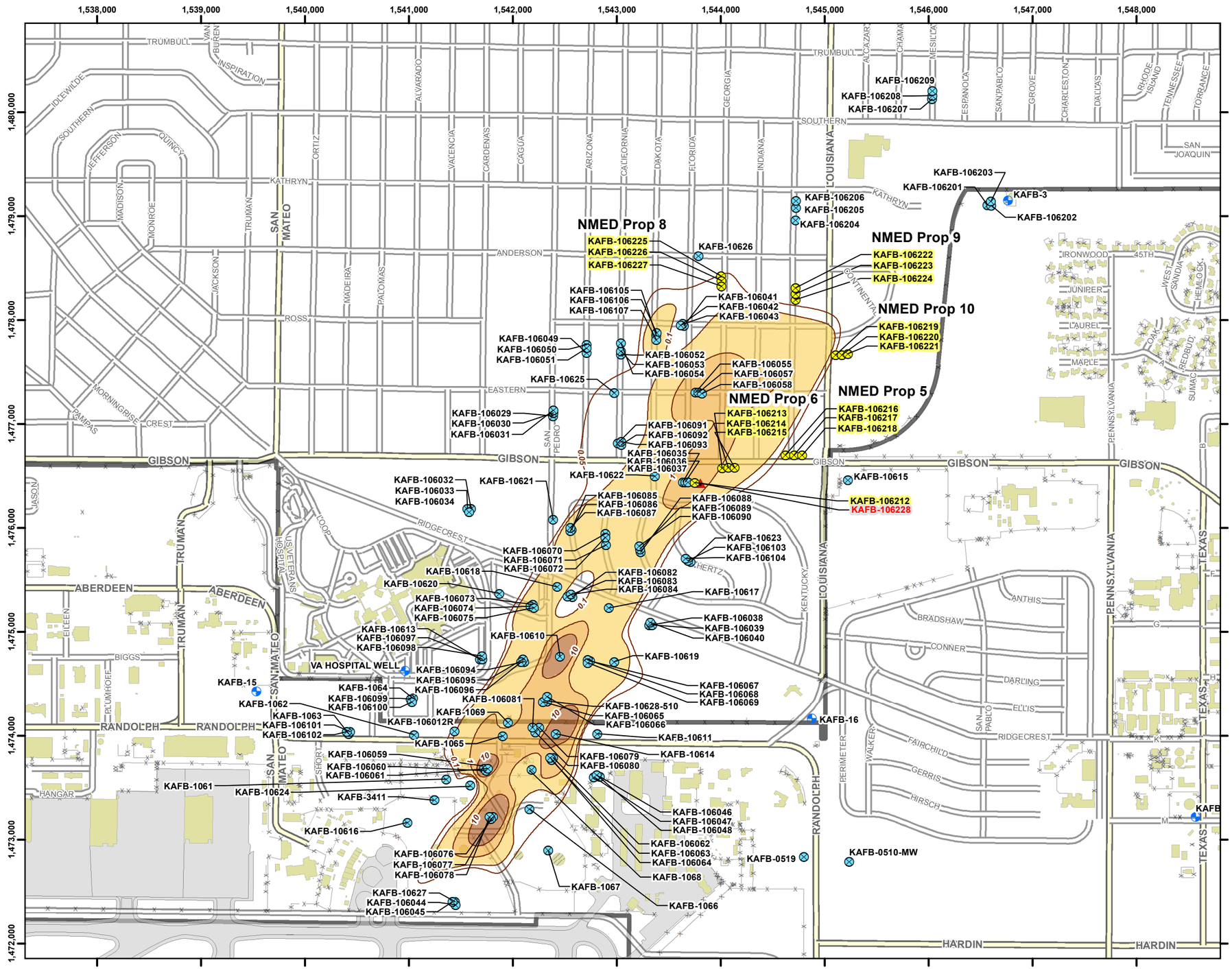
NMED. 2012. April 13, 2012 correspondence from Mr. John E. Kieling, Chief, NMED-HWB, to Colonel John Kubinec, Base Commander, 377 ABW/CC, Kirtland AFB, NM, and Mr. John Pike, Director, Environmental Management Section, 377 MSG/CEANR, Kirtland AFB, NM, re: Requirement for Characterization Plan Conditional Approval: Additional Groundwater Monitoring Wells (GWM), Addendum to Groundwater Investigation Work Plan (GIWP) March 2011, Bulk Fuels Facility Spill, Solid Waste Management Units ST-106 and SS-111, Kirtland Air Force Base, New Mexico, April 2012, EPA ID# NM9570024423, HWB-KAFB-10-019.

USACE. 2014. *Quarterly Pre-Remedy Monitoring and Site Investigation Report, January – March 2014, Bulk Fuels Facility Spill, Solid Waste Management Units ST-106 and SS-111.* Prepared by CB&I Federal Services LLC for the USACE Albuquerque District under USACE Contract No. W912DY-10-D-0014, Delivery Order 0002. June.

USACE, 2012. *Additional Groundwater Monitoring Wells Addendum to Groundwater Investigation Work Plan, March 2011, Bulk Fuels Facility (BFF) Spill, Solid Waste Management Units ST-106 and SS-111, Kirtland Air Force Base, Albuquerque, New Mexico.* Prepared by Shaw Environmental & Infrastructure, Inc. for the USACE Albuquerque District under USACE Contract No. W912DY-10-D-0014, Delivery Order 0002. March.

USACE. 2011. *Groundwater Investigation Work Plan, Bulk Fuels Facility (BFF) Spill, Solid Waste Management Units ST-106 and SS-111, Kirtland Air Force Base, Albuquerque, New Mexico.* Prepared by Shaw Environmental & Infrastructure, Inc. for the USACE Albuquerque District under USACE Contract No. W912DY-10-D-0014, Delivery Order 0002. March.

FIGURES



Legend

- Proposed Monitor Well
- Proposed Extraction Well Location
- Monitor Well
- Water Supply Well
- EDB Concentration Contour (ug/L)

EDB Concentration (ug/L)

Contours less than 0.05 ug/L are not shown

- 0.1 - 1
- 1 - 10
- 10 - 70

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

N

Revision Date: 07/25/14

0 500 1,000 2,000

Feet

1 inch = 1,000 feet

Projection : NAD83 State Plane New Mexico Central FIPS3002 Feet

PUMP AND TREAT WORKPLAN
BULK FUELS FACILITY
KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE 1

PROPOSED WELL LOCATIONS

H:\Kirtland_AFB\GIS_Documents\Project_Maps\Misc_Maps\KAFB_001_NMED_proposed_gw_locs.mxd 07/25/14

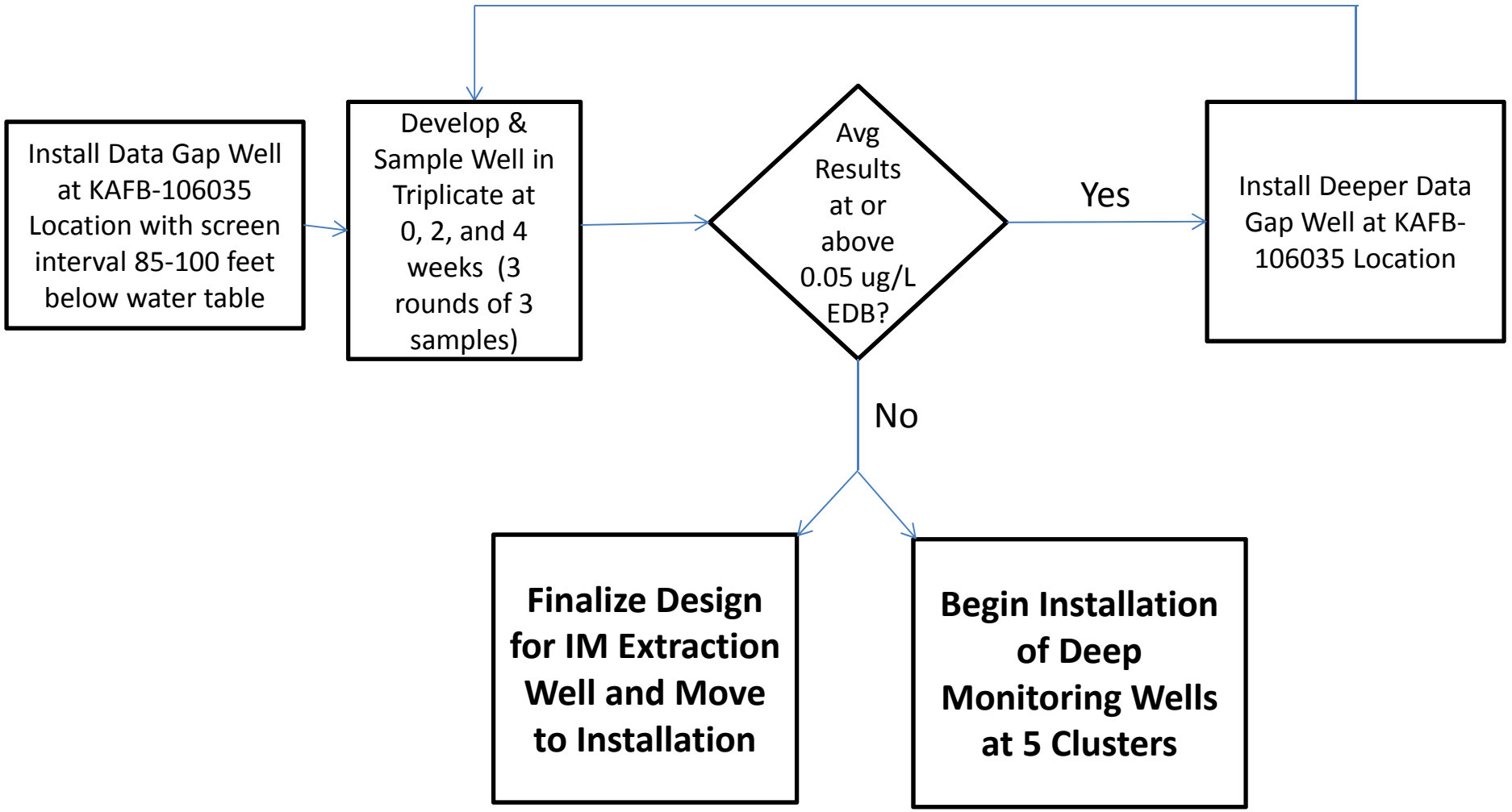


Figure 2. EDB Plume Conceptual Plan Well Installation Decision Tree

40 CFR 270.11
DOCUMENT CERTIFICATION
AUGUST 2014

AUG 0 1 2014

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to 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 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 violations.

TOM D. MILLER, Colonel, USAF
Commander, 377th Air Base Wing

This document has been approved for public release.

KIRTLAND AIR FORCE BASE
377th Air Base Wing Public Affairs