KIRTLAND AIR FORCE BASE
ALBUQUERQUE, NEW MEXICO

OPERATIONS AND MAINTENANCE PLAN
GROUNDWATER TREATMENT SYSTEM
BULK FUELS FACILITY
SOLID WASTE MANAGEMENT UNITS ST-106/SS-111
REVISION ~~R3~~R4

~~APRIL 2020~~MARCH 2021

377 MSG/CEI
2050 Wyoming Boulevard Southeast
Kirtland Air Force Base, New Mexico 87117-5270

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~~**April 2020**~~**March 2021**

Revision ~~R3~~R4

Prepared for
Kirtland Air Force Base
2050 Wyoming Boulevard SE
Kirtland Air Force Base, New Mexico 87117-5270

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14. ABSTRACT

This Operations and Maintenance (O&M) Plan for the groundwater treatment system (GWTS) was prepared for the Kirtland Air Force Base Bulk Fuels Facility (BFF), Solid Waste Management Units ST-106/SS-111 located in Albuquerque, New Mexico. This Plan was prepared in accordance with all applicable federal, state, and local laws and regulations, including the New Mexico Hazardous Waste Act (and regulations) and the New Mexico Water Quality Act (and regulations). The GWTS has been installed as an interim measure to collapse and contain the ethylene dibromide groundwater plume from the BFF site in order to protect Albuquerque, Kirtland Air Force Base, and the Raymond G. Murphy Veterans Affairs Medical Center drinking water supply wells. The GWTS currently includes groundwater extraction wells and groundwater treatment using granular activated carbon ~~carbonGAC~~ adsorption. Treated groundwater is utilized for irrigation or injected into the aquifer under an approved underground injection control discharge permit. This O&M Plan is intended to assist personnel in successfully operating the GWTS and serves as a resource for equipment information, operational procedures, inspections and maintenance, repairs, recordkeeping, and waste management.

15. SUBJECT TERMS
Bulk Fuels Facility, Solid Waste Management Units ST-106/SS-111, interim measures, RCRA, groundwater sampling, groundwater treatment system operation, granular activated carbon, ethylene dibromide, underground injection control.

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DAVID S. MILLER, Colonel, U.S. Air Force
Commander, 377th Air Base Wing

Date

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KIRTLAND AIR FORCE BASE
377th Air Base Wing Public Affairs

Date

PREFACE

This Operations and Maintenance Plan for the groundwater treatment system (GWTS) was prepared for the U.S. Army Corps of Engineers. It pertains to the Kirtland Air Force Base Bulk Fuels Facility, Solid Waste Management Units ST-106/SS-111 located in Albuquerque, New Mexico. This Plan was prepared in accordance with all applicable federal, state, and local laws and regulations, including the New Mexico Hazardous Waste Act and the New Mexico Water Quality Act (New Mexico Statutes Annotated 1978), the New Mexico Hazardous Waste Management Regulations, and the Water Quality Control Commission Regulations.

This Operations and Maintenance Plan for the GWTS contains the necessary information to conduct operations at the GWTS.

REVISION TRACKING

Date	Revision	Section Changed	Description of Changes
8/2016	0	Baseline document	None.
9/2017	1	Front Matter	Added notice and revised preface.
		Executive Summary	Revised permit and agreement citations.
		Section 1 – Introduction	Revised all subsections to include KAFB-106239, operational changes, and permit requirements (DP-1839).
		Section 2 – Operation of the Groundwater Treatment System	Revised all subsections to reflect changes in system programming; added pending installation items and system utilities information.
		Section 3 – Inspection and Preventative Maintenance	Added subsections for additional maintenance activities including pending installation items.
		Section 4 – System Troubleshooting	Added this section to document nonstandard operational procedures.
		Section 5 – Process Monitoring	Revised all subsections to provide more accurate description of process monitoring activities.
		Section 6 – Recordkeeping	Revised all subsections to provide compliance with DP-1839.
		Section 7 – Waste Management	Revised text and added subsections for additional waste streams identified and created with pending installation items.
		References	Revised references.
		Figures	Removed Figure 1-1 extent of ethylene dibromide plume as updated plume maps are provided in quarter monitoring reports, Figure 1-2 Site Map was revised to include new proposed conveyance line-.
		Tables	Added the following tables: 1-1 Applicable Permits 1-2 Permit Terms and Conditions, Operations and Maintenance Plan Cross References 2-2 Permitted Extraction Well Flow Rates 2-3 Standard Operational Set Points 3-1 Groundwater Treatment System Routine Maintenance Schedule 3-2 Specific Consumable Product Codes, Suppliers, and Recommended On-Hand Inventory 3-3 Consumable Supply Inventory 3-4 Large Item Inventory 5-1 Influent Criteria 6-1 Reports and Recipients.

REVISION TRACKING

Date	Revision	Section Changed	Description of Changes
9/2017	1	Appendix A – Permits and Agreements	Revised to contain copies of regulatory approvals and permits as well as access agreements instead of a description of those items.
		Appendix B – Health and Safety	Added the following to the list of hazards: Hearing damage hazards Pinch points (lift gates, vault lids) Hand tool use Respiratory hazards (granular activated carbon fines).
		Appendix C – Organization and Responsibilities	Updated organization structure.
		Appendix D – Description of Groundwater Treatment System Equipment and Facilities	Revised to reflect equipment adjustments, added pending installation equipment descriptions, and references.
		Appendix E – Description of Groundwater Treatment System Equipment/Instrument Location Pictures	Revised to reflect equipment adjustments.
		Appendix F – Process Control Description	Revised to reflect equipment adjustments, programming changes, and added pending installation equipment control descriptions.
		Appendix G – Human Machine Interface Screens	Revised to reflect programming changes.
		Appendix H – Design Calculations for ~~Carbon~~GAC Vessel Media Beds	Added manufacturer modeled granular activated ~~carbon~~GAC usage rates at two theoretical higher influent concentrations.
		Appendix I – Groundwater Treatment System Operations Log Sheets and Record Forms	Revised to reflect Train 2 expansion and new equipment.
		Appendix J – Manufacturers' Literature	Revised by adding in the Train 2 expansion equipment literature.
		Appendix K – Contingency Plan	Revised to maintain compliance with DP-1839, access agreements, update emergency response table, and added references.
		Appendix L – Sampling and Analysis Plan	Revised for compliance with DP-1839 and provide more detailed description of driving factors as well as monitoring locations and added references.
		Appendix N – User Operational Adjustments Documentation	Added to provide documentation of changes made to the system that deviate from as-built drawings or operational set points.
		Appendix O – Well Construction Diagrams and Borehole Logs	Added to provide extraction and injection well information readily to operators.
9/2017	1	Appendix P – Example Reports	Added to provide examples of report structures and ensure compliance with relevant permits.
		Appendix Q – Technical Memorandum	Added to provide approved technical memoranda that are applicable to the groundwater treatment system.

REVISION TRACKING

Date	Revision	Section Changed	Description of Changes
5/2018	2	Front Matter	Added revision tracking table.
		Section 1 – Introduction	Revised to include newly installed equipment.
		Section 2 – Operation of the Groundwater Treatment System	Revised to include newly installed Treatment Train 2 equipment and equipment pending installation.
		Section 3 – Inspection and Preventative Maintenance	Revised to include newly installed equipment maintenance and maintenance for equipment pending installation; added flowmeter verification testing Subsection 3.17.
		Section 4 – System Troubleshooting	Added Subsections 4.3 KAFB-7 Hydraulic Pump Overload Reset and 4.4 KAFB-106233 and KAFB-106234 Start Order.
		Section 5 – Process Monitoring	Minor text revisions.
		Section 6 – Recordkeeping	Minor text revisions.
		Section 7 – Waste Management	Added Kirtland Air Force Base Hazardous Materials Group management information.
		Figures	Revised Figure 1-1 to show KAFB-106239 conveyance line as installed.
		Tables	Revised the following tables: Added clarification to Table 2-2 Revised Table 2-3 to reflect required operational and programing changes Added skimming to Table 3-1 Added sand filter consumables to Table 3-2 Added tools to Table 3-3.
		Appendix A – Permits and Agreements	No revisions.
		Appendix B – Health and Safety	Added the following hazards: Exposure to oxidants (sodium hypochlorite) Respiratory hazards (sand filter media [IMA-65 or DMI-65]).
		Appendix D – Description of Groundwater Treatment System Equipment and Facilities	Revised text to properly refer to newly installed equipment as installed rather than pending installation.
		Appendix E – Description of Groundwater Treatment System Equipment/Instrument Location Pictures	Added photographs of newly installed equipment including sand filters, clarifier, KAFB-196239 wellhead and control panel.
		Appendix F – Process Control Description	Revised the control description to reflect programming changes.
		Appendix G – Human Machine Interface Screens	Revised the screens to reflect programming changes.
		Appendix I – Groundwater Treatment System Operations Log Sheets and Record Forms	Revised forms to reflect equipment additions.
		Appendix J – Manufacturers' Literature	Added construction as-builts, basis of design (includes manufacturers' literature) for sand filters, and manufacturers' literature for equipment associated with KAFB-106239.

REVISION TRACKING

Date	Revision	Section Changed	Description of Changes
5/2018	2	Appendix L – Sampling and Analysis Plan	Clarified requirements that result in extraction well sampling; revised to ensure compliance with DP-1839.
		Appendix O – Well Construction Diagrams and Borehole Logs	Updated KAFB-106239 construction diagram.
		Appendix P – Example Reports	Revised to most recent report examples.
		Appendix R – Approved Standard Operating Procedures	New appendix added to provide approved standard operating procedures that are applicable to the groundwater treatment system.
6/2019	3	Front matter	Updated name of responsible person. Removed Notice page.
		Section 1 – Introduction	Added sodium hypochlorite generator to list of GWTS expansion items, and added bulletin board to Health and Safety section.
		Section 2 – Operation of the Groundwater Treatment System	Added special GAC sampling procedure reference, KAFB-7 V-smart valve updates, and minor text edits.
		Section 3 – Inspection and Preventative Maintenance	Added details on sodium hypochlorite generator and associated shutdown procedure, and added reference for TIGG GAC change-out procedure.
		Section 4 – System Troubleshooting	Added preface to KAFB-7 V-smart valve section indicating its absence in the system.
		Section 5 – Process Monitoring	Revised for new water level transmitters in extraction wells and injection well.
		Section 8 – References	Revised references.
		Figures	Updated Figure 1-1 for updated EDB plume.
		Tables	Revised the following tables: Included set points on Table 2-1 Updated set point ranges on Table 2-3 Updated Table 3-1 for regular disinfection Added food grade salt for brine tank to Table 3-2 Updated Table 3-3 Added emergency conveyance line material and water trailer to Table 3-4.
		Appendix A – Permits and Agreements	Added three NMED approval letters.
		Appendix C – Organization and Responsibilities	Revised for staffing changes, general edits.
		Appendix D – Description of Groundwater Treatment System Equipment and Facilities	Added details on sodium hypochlorite generator, removed KAFB-7 V-smart valve descriptions, and added documents for water trailer as attachments; updated extraction well pump depths; updated for new SCADA system and clarifier drain line.
		Appendix E – Description of Groundwater Treatment System Equipment/Instrument Location Pictures	Updated for sodium hypochlorite generator, and associated equipment; updated for basket strainers, SCADA computer, bypasses, and clarifier drain line.
		Appendix F – Process Control Description	Added sodium hypochlorite generator controls and interlocks, and removed KAFB-7 V-smart control valve descriptions; updated language for SCADA.
		Appendix G – Supervisory Control and Data Acquisition and Human Machine Interface Screens	Included SCADA screenshots.
		Appendix I – Groundwater Treatment System Operations Log Sheets and Record Forms	Updated field forms.
		Appendix J – Manufacturers' Literature	Added sodium hypochlorite generator documentation, the TIGG GAC change-out procedure as an

REVISION TRACKING

Date	Revision	Section Changed	Description of Changes
			attachment, the new basket strainers, and a procedure for emergency conveyance line repairs.
		Appendix L – Sampling and Analysis Plan	Added GAC special sampling flow chart as attachment, and reference within appendix text; extraction well annual sampling data change. Added Table L-6 Field Measurement Frequency.
		Appendix O – Well Construction Diagrams and Borehole Logs	Updated KAFB-7 well construction diagram; updated KAFB-106228, KAFB-106234, and KAFB-106239 construction diagrams. Added conceptual design schematics for new UIC wells.
		Appendix P – Example Reports	Updated reports and recipients list.
		Appendix R – Approved Standard Operating Procedures	Updated for new revision 1 of Standard Operating Procedure for Cleaning and Disinfection of the Groundwater Treatment System Remediation Wells and Groundwater Monitoring Wells-.
3/2020	3	Appendices	Removed Appendices B, K, and R as directed-.
3/2021	4	Section 1	Added changeover valve upgrade and KAFB-106IN2 to list of GWTS expansion items.
		Section 2	Added sentence regarding wireless cameras used to view GWTS when personnel are not onsite and discussion of uninterruptible power supply checks.
		Section 2.6	Edited instructions for operating the automated changeover valves. Added information regarding KAFB-7 wellhead equipment. Added information regarding KAFB-106IN2 Baski flow control valve.
		Section 2.11	Added provision for inspecting the system uninterrupted power supplies.
		Section 3.5	Edited instructions for operating the automated changeover valves.
		Section 4.3	Removed Section 4.3 as the V-Smart control valve is no longer installed on the system.
		General	Added discussion of KAFB-106IN2 and NPDES outfall.
		Appendix A	Notice of Disapproval and Response to comments have been added to Appendix A-1. Added Revision Tracking/Red-Line Documents to Appendix A-2. Moved permits to Appendix A-3.
		Appendix B	Modified to only include USAF, USACE, and EA.
		Appendix C	Added details for the automated changeover valves and KAFB-106IN2.
		Appendix D	Updated the piping and instrumentation diagram ~~P&ID~~ and added construction drawings for the changeover valves and KAFB-106IN2.
		Appendix E	Added instructions for operating the automated changeover valves as wells as details regarding KAFB-106IN2.
		Appendix G	Removed as requested.
		Appendix H	Added material cutsheets for automated changeover valves and KAFB-106IN2 including O&M M~~m~~anual for the Baski ~~V~~valve.~~-~~
		Appendix I	Addedinformation regarding the NPDES outfall.
		Appendix L	Added well completion diagram for KAFB-106IN2.
		Appendix O	Removed as requested.
		Response to comments from NMED on Disapproval on the O&M Revision R3	See response to comments spreadsheet for details of requested edits (provided in Appendix A-1).

CONTENTS

Section **Page**

APPENDICES

FIGURES

TABLES

ACRONYMS AND ABBREVIATIONS

µg/L	microgram(s) per liter
AFB	Air Force Base
AWWA	American Water Works Association
Baski	Baski, Inc.
BFF	Bulk Fuels Facility
CFR	Code of Federal Regulations
DP	discharge permit
EDB	ethylene dibromide
EPA	U.S. Environmental Protection Agency
FCV	~~F~~flow control valve
ft	foot/feet
GAC	granular activated carbon
GCMP	Golf Course main pond
gpm	gallon(s) per minute
GWQB	Groundwater Quality Bureau
GWTS	groundwater treatment system
HDPE	high density polyethylene
HWB	Hazardous Waste Bureau
IM	interim measure
IMOA	Interim Measure Operational Area
mg/L	milligram(s) per liter
NMED	New Mexico Environment Department
No.	Number
NPDES	National Pollutant Discharge Elimination System
O&M	operations and maintenance
PLC	programmable logic controller
psi	pound(s) per square inch
psig	pound(s) per square inch gauge
RCRA	Resource Conservation and Recovery Act
SCADA	supervisory control and data acquisition
SE	Southeast
SWMU	Solid Waste Management Unit

UIC	underground injection control
UPS	uninterruptible power supply
VFD	variable frequency drive
WCH	well control house

EXECUTIVE SUMMARY

This Operations and Maintenance (O&M) Plan for the groundwater treatment system (GWTS) was prepared for the Bulk Fuels Facility (BFF), Solid Waste Management Units (SWMUs) ST-106/SS-111 located at Kirtland Air Force Base (AFB), New Mexico.

~~New Mexico Environment Department,This O&M Plan revision addresses the comments received from the NMED. A response to comments is provided in Appendix A.~~

~~The GWTS was installed as part of the ongoing interim measures for groundwater remediation at SWMUs ST-106/SS-111 pursuant to the Resource Conservation and Recovery Act Hazardous Waste Treatment Facility Operating Permit Number NM9570024423 (New Mexico Environment Department, 2010). This Plan was prepared in accordance with all applicable federal, state, and local laws and regulations.~~

The GWTS has been installed as an interim measure to collapse and contain the ethylene dibromide groundwater plume from the BFF site~~,~~ in order to protect Albuquerque Bernalillo County Water Utility Authority, Kirtland AFB, and the Raymond G. Murphy Veterans Affairs Medical Center drinking water supply wells. ~~-~~The GWTS currently includes groundwater extraction wells and groundwater treatment using granular activated carbon~~carbon~~ adsorption. ~~-~~Treated groundwater is utilized for irrigation or injected into the aquifer. ~~-~~This O&M Plan is intended to assist personnel in successfully operating the GWTS and serves as a resource for equipment information, operational procedures, inspection and maintenance, troubleshooting and repairs, recordkeeping, and waste management.

~~-~~A Notice of Disapproval ~~(NOD)~~ of the O&~~peration and~~ Maintenance Plan GW~~roundwater~~ Treatment ~~System, Bulk Fuels Facility Solid Waste Management Usnits~~ ST-106 and SS-111 Revision R3 (New Mexico Environment Department, 2020) was received on December 17, 2020. This O&M Plan revision addresses the comments received from the NMED. A response to comments is provided in Appendix A-1.

1. INTRODUCTION

This Operations and Maintenance (O&M) Plan is intended to assist personnel in successfully operating the groundwater treatment system (GWTS) to treat and collapse the ethylene dibromide (EDB) groundwater plume from the Kirtland Air Force Base (AFB) Bulk Fuels Facility (BFF) site. A Notice of Disapproval ~~(NOD)~~ of the O&~~peration and M~~Maintenance Plan GW~~roundwater Treatment System~~, Bulk ~~Fuels F~~acility Solid Waste Management Units (SWMUs) ST-106 and SS-~~-~~111 Revision R3 (New Mexico Environment Department [NMED] 2020) was received on December 17, 2020. This O&M Plan revision addresses the comments received from ~~the~~ NMED. The letter from NMED and a response to their comments is provided in Appendix A-1. Revision tracking/red-line version of this document, detailing O&M updates and requested changes, is provided in Appendix A-2. This Plan serves as a resource for the following:

- Equipment information (one-stop for manufacturer-supplied catalog cuts and O&M manuals)
- Operational procedures
- Inspection~~s~~ and maintenance
- Troubleshooting
- Repairs
- Recordkeeping
- Waste management.

This O&M Plan contains the following appendices to support the above items:

- Appendix A – Regulatory Correspondence, Revision Tracking, and Permits ~~and Agreements~~
- Appendix B – Organization and Responsibilities
- Appendix C – Description of GWTS Equipment and Facilities
- Appendix D – Process Drawings and GWTS Equipment/Instrument Location Pictures
- Appendix E – Process Control Description
- Appendix F – Supervisory Control and Data Acquisition (SCADA) and Human Machine Interface Screens
- ~~Appendix G – Design Calculations for Granular Activated Carbon (Carbon) Vessel Media Beds~~
- ~~Appendix H~~Appendix G – GWTS Operations Log Sheets and Record Forms
- ~~Appendix I~~Appendix H – Manufacturers' Literature
- ~~Appendix J~~Appendix I – Sampling and Analysis Plan
- ~~Appendix K~~Appendix J – Waste Characterization Documentation
- ~~Appendix L~~Appendix K – User Operational Adjustments Documentation
- ~~Appendix M~~Appendix L – Well Construction Diagrams and Borehole Logs

- ~~Appendix N~~Appendix M – Example Reports.
- ~~Appendix O – Technical Memorandum.~~

A copy of the most recent version of this Plan is kept onsite at the GWTS at all times.

1.1 Site Description

~~Kirtland AFB is located in Bernalillo County in central New Mexico, southeast of the City of Albuquerque and adjacent to the Albuquerque International Sunport. The BFF is located in the northwestern portion of Kirtland AFB and is the source for the Solid Waste Management Units (SWMUs) ST-106/SS-111. The overall layout of the extraction wells, conveyance lines, GWTS, the Tijeras Arroyo Golf Course main pond (GCMP), injection well KAFB-7, and proposed Underground Injection Control (UIC) well KAFB-106IN2 are shown on Figure 1-1.~~
Kirtland AFB is located in Bernalillo County in central New Mexico, southeast (SE) of and adjacent to the City of Albuquerque and the Albuquerque International Sunport (Figure 1-1). The approximate area of the Base is 52,287 acres. The BFF site, comprised of SWMUs ST-106/SS-111, is located within the installation boundary in the northwestern portion of Kirtland AFB. The BFF site is the location of jet fuel releases that occurred over an unknown period of time at Kirtland AFB. The releases originated from fuel delivery infrastructure at the BFF~~,~~ and were identified by Kirtland AFB personnel in November 1999.

In 2015, pursuant to the Resource Conservation and Recovery Act Hazardous Waste Treatment Facility Operating Permit Number NM9570024423 (New Mexico Environment Department, 2010), an interim measure (IM) was implemented to collapse and hydraulically control the EDB plume north of Ridgecrest Drive SE. The current groundwater IM consists of a network of four groundwater extraction wells located within the Interim Measures Operational Area (IMOA) in the distal portion of the dissolved-phase EDB plume, conveyance lines, GWTS, the Tijeras Arroyo Golf Course main pond (GCMP), underground injection control (UIC) wells KAFB-7 and KAFB-106IN2, and a National Pollutant Discharge Elimination System (NPDES) outflow to Tijeras Arroyo. -A site map is presented in Figure 1-1.

1.2 Overall System Description

The system currently includes four extraction wells located north of Kirtland AFB (Figure 1-1). Contaminated groundwater from the extraction wells is pumped to the GWTS through double-walled, high density polyethylene (HDPE) pipe equipped with leak detection. Off-Base, the influent piping is installed below ground along rights-of-way and alleys and on-Base in existing utility corridors. The conveyance line from extraction well KAFB-106239 is connected below grade with a Y-junction to the conveyance line for extraction well KAFB-106228 that runs directly to the GWTS. The conveyance lines from wells KAFB-106233 and KAFB-106234 run to a well control house (WCH) located on-Base. The combined flow from KAFB-106233 and KAFB-106234 is conveyed from the WCH through a single conveyance line to the GWTS. Construction diagrams and borehole logs for extraction wells are provided in ~~Appendix M~~Appendix L.

The GWTS treatment plant is located on Ridgecrest Drive SE~~outheast~~ on Kirtland AFB in the former Zia Park housing neighborhood. The building has three entrances, which are all locked to prevent unauthorized access. The system is designed to treat up to 800 gallons per minute (gpm) of non-hazardous, contaminated groundwater; each of two treatment trains can treat up to 400 gpm. Each treatment train is comprised of the following (Appendix D):

- Pre-treatment influent equalization tank (6,000-gallon capacity)
- Pre-treatment free chlorine analyzer and dosing station
- Two pre-treatment influent pumps (400-gpm combined flow capacity)
- Two pre-treatment sand filters (477-gpm combined flow capacity)
- Two pre-treatment bag filter units (six bag filters per unit)
- Two granular activated carbon (~~carbongranular activated carbon (~~GAC)~~)~~ vessels (20,000 pounds of ~~carbon~~GAC per vessel)
- One treated water storage tank (6,000-gallon capacity)
- One treated effluent pump (400-gpm flow capacity)
- Two post-treatment bag filter units for treated water (six bag filters per unit).

~~Multiple improvements have been performed to the GWTS in accordance with the approved work plan (Kirtland AFB, 2017). These improvements did not result in changes to effluent concentrations of remedial goals. TThe GWTS was expanded with a second treatment train in 2017. In 2018, pretreatment sand filters were installed to sequester any excess dissolved iron or manganese and suspended solids, including biological material entering the system.~~the and in Appendices I and O ~~Extraction well KAFB-106239 was connected to the GWTS in 2018 via double-walled HDPE, well extraction equipment, and wellhead instrumentation for flow control and communication. In addition, significant upgrades were made to monitoring devices and transmitters (flow, pressure, etc.) as well as the programmable logic controller (PLC) and the SCADA system. The SCADA system replaced the human machine interface system in 2019. A sodium hypochlorite generator system was installed in 2018 to facilitate pretreatment sodium hypochlorite injection, and to negate the need for the Operator to handle high concentrations of sodium hypochlorite. Basket strainers replaced the influent Y-strainers in 2019, which increases the ease of cleaning the screens and negates the need to shut down either or both trains. Additionally, in 2019, bypass lines were installed around the sand filters and the influent tree, and a drain line was installed at the clarifier to prevent high leveling the clarifier and negate the need to manually pump the clarifier. In 2020, check valves were installed on the effluent lines of Trains 1 and 2.~~
~~2~~

The treated groundwater is transported via a single-walled HDPE pipe to a junction with an existing pipeline that connects well KAFB-7 to the GCMP. Treated water can also be diverted to UIC well KAFB-~~-~~106IN2 ~~(once it is in operation)~~ from the main effluent conveyance line via piping to the well.

During the summer months, the treated water is predominantly used to irrigate the golf course. During the winter months, when the demand for irrigation water is reduced, the excess treated water is injected into the aquifer through KAFB-7 and KAFB-106IN2 in accordance with an UIC Discharge Permit (DP)-1839 (Appendix A-~~1~~3; [NMED~~]~~, 2017]). A schematic of the injection equipment ~~in~~ for UIC wells KAFB-7 and ~~conceptual schematics of~~ KAFB-106IN2 is~~are~~ provided in ~~Appendix M~~Appendix L.

Additionally, treated effluent water can be discharged to the NPDES outfall in accordance with the NPDES Permit Number (No.) NM0031216 (Appendix A-3)~~;~~ (~~[~~U.S. Environmental Protection Agency [EPA, 2019]). The NPDES outfall is considered a non-continuous DP~~discharge permit~~ and will ONLY BE USED in instances where other discharge locations (GCMP~~golf course main pond~~, KAFB-~~-~~7, and KAFB-106IN2) are not available for use.

1.3 Discharge Requirements

The GWTS supports a groundwater treatment IM~~interim measure~~ that is being implemented pursuant to the Resource Conservation and Recovery Act (RCRA) corrective action provisions in Part 6 of Kirtland AFB's Hazardous Waste Treatment Facility Operating Permit (Permit ~~Number [~~No.~~]~~ NM9570024423 [RCRA Permit]). Applicable state permits pertaining to GWTS effluent discharge are provided in Appendix A-3. Treated groundwater is either injected into the aquifer in accordance with DP-1839 or discharged to the GCMP in accordance with the April 4, 2016 letter from the NMED Hazardous Waste Bureau (NMED, 2016) (Table 1-1). ~~-~~All requirements from the associated applicable permits are strictly adhered to, such as discharge time limits or flow rates to any specific location. Table 1-2 provides each relevant permit term and condition and where each of the applicable items is addressed in this O&M Plan.

The GWTS has been designed to treat groundwater to meet the New Mexico Water Quality Control Commission water quality standards (20.6.2.3103 and 20.6.2.4103 New Mexico Administrative Code) and the drinking water maximum contaminant levels adopted by ~~the U.S. Environmental Protection Agency~~ EPA under the Federal Safe Drinking Water Act (42 U.S. Code §§ 300f to 300j-26). ~~-~~GWTS effluent must comply with ~~any~~ applicable permit or regulatory requirements including DP-1839 and NPDES Permit No. NM00131216. As stated in DP-1839, "The NMED"~~'~~s Hazardous Waste Bureau (HWB) and Groundwater Quality Bureau (GWQB) both provide regulatory oversight at the BFF project site. The HWB regulates the evaluation and remediation of the KAFB BFF dissolved-phase plume and the associated groundwater treatment system (GWTS). The GWQB regulates the procedures that ensure treated groundwater discharged from the GWTS to UIC well(s) meet Discharge Permit requirements." These discharge requirements, in accordance with DP-1839~~8~~ Table 2, are presented in Table 1-3. Additional discharge criteria are specified when discharging to the NPDES outfall. However, the additional criteria (Table 1-3) is only required when discharge to the NPDES outfall is occurring (~~[~~NPDES Permit No. NM0031216, Part I. Section A [~~(~~1~~])~~)~~]~~.

The Sampling and Analysis Plan (~~Appendix J~~Appendix I) contains the necessary reporting requirements, while ~~Appendix C within the DP-1839 permit provides corrective actions to be enacted in the event of an exceedance of the discharge criteria.~~the discharge limits, as stated in DP-1839 and the NPDES permit, are provided in Table 1-3. In the event that the GWTS effluent exceeds the discharge criteria listed in Table 1-3, the system will shut down until modifications can be implemented. The contingency plan (Appendix C of DP-1839) as well as any actions that can be taken to correct the problem and achieve the required effluent concentrations will be performed immediately. Notification to ~~the~~ NMED will be provided within 24 hours of a system shut-down. Additional information regarding discharge criteria exceedance is provided in Appendix I, Section ~~J~~I.10.2. Operation of the GWTS will resume after appropriate modifications have been performed and the ability of the treatment system to meet discharge criteria will be verified by daily and then weekly sampling.

1.4 Health and Safety

The foremost priority in operating the GWTS is to ensure the health and safety of the GWTS control operators (Operators), visitors, and nearby residents. Activities follow health and safety guidelines of a U.S. Air Force or U.S. Army Corps of Engineers-approved safety plan or other approved safety document. Safety information pertinent to the GWTS O&M is provided in the Kirtland AFB Accident Prevention Plan (~~APP [~~Kirtland AFB, 2020a~~]~~). A hard copy of the Accident Prevention Plan ~~PP~~ is always kept within the GWTS. Emergency contact information placards are placed on all doors of the GWTS and WCH, and on a bulletin board installed within the GWTS. Copies of ~~the Contingency Plan and its map of~~ evacuation routes and mustering area are ~~attached~~ posted to the inside surface of all doors of the GWTS.

1.5 Organization and Responsibilities

The organization chart and roles and responsibilities for the operation of the GWTS are provided in Appendix B.

2. OPERATION OF THE GROUNDWATER TREATMENT SYSTEM

Descriptions of the GWTS equipment and facilities are provided in Appendix C. A flow diagram and piping and instrumentation diagrams for the GWTS are provided in Appendix D. The GWTS is highly automated. The GWTS control system is programmed to automatically perform normal plant operations and to safely shut down the system under fault conditions. The programmable logic controller (PLC) notifies the Operators of fault conditions and shutdowns via email and text notifications. In addition, wireless cameras are placed throughout the GWTS that provide a general view of the plant. The cameras can be accessed via mobile application to view the plant at times when the operator is not present. A summary of main alarms is provided in Table 2-1.

This section is intended to provide only an overview of system operation. Appendix E provides a more detailed account of the function of all instruments and control elements in the system and the actions of all interlocks and shutdowns. Screen capture printouts of the SCADA screens are provided in Appendix F. The PLC and SCADA are installed in the treatment plant's main control panel (CP-100).

2.1 Groundwater Treatment System Operational Approach

The GWTS consists of four groundwater extraction wells and two identical treatment trains. Groundwater pumped from the extraction wells is collected into the GWTS influent tanks (TK-110 and TK-210); note that extraction wells can be routed to either treatment train during operation using system influent manifold valves. The GWTS influent pumps (P-112 A/B and P-212 A/B) transfer the water from the influent tank through the pre-treatment sand filters (SF-101 and SF-102), bag filters (F-112 A/B and F-212 A/B), GAC beds (V-114 A/B and V-214 A/B), and into the treated water tanks (TK-116 and TK-216). The treated effluent pumps (P-118 and P-218) transfer the water through the post-treatment bag filters (F-118 A/B and F-218 A/B) and the effluent conveyance line to either the GCMP, KAFB-7, KAFB-106IN2, or a future UIC well.

As the aquifer responds to extraction well operation, adjustments to the extraction well operation are made to ensure plume containment and collapse. Plume containment and collapse are evaluated in the Kirtland AFB BFF Quarterly Reports and recommendations for changes in extraction well operation are provided therein to comply with DP-1839 Table 1-2; Condition No. 22. Both NMED agencies will be notified of any planned long-term adjustments that would result in a change in influent concentration, volume to be discharged, or location of discharge. Per DP-1839 Condition No. 34, NMED approval will be obtained prior to implementation. Temporary adjustments associated with an emergency, GWTS O&M, or system testing may occur, and NMED is notified of these changes during the following Quarterly Report in accordance with DP-1839 Conditions Nos. 22 and 35.

The control mode for the feed rate to the GAC vessels depends on the amount of groundwater produced by the extraction wells. The minimum recommended groundwater flow rate into the carbon vessels is 120 gpm, which provides uniform flow distribution through the carbon bed. The feed rate to the carbon beds is controlled by a preset influent flow rate set by the Operator. The combined flow rate through the influent skids of both treatment trains is set to exceed the incoming flow rate produced by the extraction wells to ensure that the extraction wells remain online constantly during operation. The PLC controls the level in the tanks by cycling the pumps immediately downstream of the tank off or on when a preset tank level is reached.

If only one extraction well is online, groundwater flow to the GWTS may be below 120 gpm. In this case, one treatment train can be placed in operation at an operator specified flow rate and the PLC cycles the

influent pumps on and off to maintain adequate flow through the carbon bed. The effluent flow rate is set by the Operator to exceed the influent pumping rate to ensure that the effluent tank does not overfill. The effluent train discharge pressure is controlled by an electronically actuated valve that provides backpressure on the effluent pumps to limit cavitation.

2.2 Groundwater Well Pumps and Flow Control

Under normal conditions, well pumps are typically started by activating either train control switch with the well pumps placed in sequence mode on the SCADA. Well pumps cannot start and, if running, shut down under the following conditions:

- Switched on the SCADA to the Off position
- Low water level in the well
- Low current draw by the pump (for P-101 only, indicating run-dry condition)
- Leak detection in any vault or conveyance line associated with that well
- High-high water level in the GWTS influent tank or clarifier
- High-high water level in either GWTS building sumps
- Loss of power at the GWTS or wellhead
- Leak detection in the WCH (for KAFB-106233 and KAFB-106234).

Manual on/off switches for the well pumps are available in the SCADA and in the electrical shed at well KAFB-106228, the control panel at KAFB-106239, and at the WCH for KAFB-106233 and KAFB-106234. These local switches may be used for maintenance and troubleshooting pump problems but shall not be used during unmanned operation as they override PLC interlocks. Each extraction well has a maximum flow rate that can be extracted from the well, as permitted by the New Mexico Office of the State Engineer (Table 2-2). Extraction wells are equipped with totalizing, magnetic flowmeters and have been constructed to maximize water conservation to the maximum extent practical. Extraction wells cannot be operated in the event that a malfunction is detected with the totalizing flowmeter until the flowmeter is repaired or replaced.

2.3 Influent Tank, Pumps, and Pretreatment Sand Filters

The GWTS influent pumps, level in the GWTS influent tanks, and differential pressure across the pre-treatment bag filters are controlled and monitored by the PLC. The only Operator actions required during normal operations are to set the influent pump flow rates for the influent pump skids, put the control of the influent pumps into sequence using the SCADA, and change bag filters when the differential pressure across the pretreatment bag filters exceeds the differential pressure threshold (~~10 15~~ 4 pounds per square inch [psi]). Pump sequence number determines which pump (A or B) is active during times when only a single influent pump is required to provide the preset system flow rate (<200 gpm per train). If the pump first in the sequence fails, the pump second in the sequence activates and continues processing water. In the event that one influent pump cannot satisfy the preset system flow rate (>200 gpm per train), the second pump is placed into the same sequence number as the operating pump; this activates the second pump and balances the flow load between the two pumps. Manual on/off switches for the GWTS influent pumps are provided in the SCADA and on the variable frequency drive (VFD) panels to the pumps to aid with maintenance and troubleshooting but cannot be used during unmanned operation as they override PLC interlocks. The GWTS influent pumps are interlocked to shut down under the following conditions:

- Switched to the Off position on the SCADA
- Switched both pumps on the SCADA to the zero sequence

- High-high water level in treated water storage tank or clarifier
- High-high water level in GWTS building sumps
- Low-low water level in GWTS influent tank
- High pump-outlet pressure
- High inlet pressure to the ~~carbon~~GAC vessels.

Pre-treatment sand filters are installed on each train between the influent pumps and the pre-treatment bag filters. In standard operation-, the sand filters ~~to~~ remove excess dissolved iron and manganese as well as capture any suspended solids, including biological material, entering the system. The sand filters can be bypassed by the isolation of butterfly valves at the inlets and outlets of the sand filters and by opening the butterfly valve at the bypass line.– The sand filters remove excess dissolved metals by advanced oxidation processes that occur on the surface of catalytic media that causes the precipitation of metal oxides. The sand filters are equipped with a specialized sand (IMA-65 [American equivalent to DMI-65]) that, with the addition of sodium hypochlorite, oxidizes influent iron and manganese concentrations. The sand/sodium hypochlorite reaction causes the iron and manganese concentrations to precipitate out and become sequestered in the sand filter. The precipitates are then backwashed into the clarifier where they settle out. No additional water treatment system is combined with the sand filters. -Further description of these advanced oxidation processes is provided in ~~Appendicesx I and O~~Appendix I.

~~The metal oxides are then captured by the filter and removed from the system via backwashing.~~
Backwashing is manually activated by the Operator or occurs when differential pressure across a sand filter unit exceeds 10 psi from the clean operating differential pressure. Once activated, the sand filter controller actuates the appropriate valves to backwash the system for 4 minutes per sand filter vessel (two vessels per train). The system issues an alarm through the SCADA that backwash is occurring, and backwash water is transferred and stored in a clarifier located on top of the truck sump outside of the GWTS. The clarifier is equipped with a high-water level switch that alerts Operators that the clarifier is nearing capacity and results in a system-wide ~~shutdown~~shut down. Water is automatically drained from the clarifier to the internal sump through a drain line that runs through the southern wall of the GWTS building to the western edge of the internal sump. A bag filter is installed at the outfall of the drain line to capture any remaining biofouling or sediments. If necessary, water can be manually transferred from the clarifier to the internal sump by the Operator. Hoses for manually transferring water from the clarifier to the internal sump are stored in the GWTS building.

Dosing pumps are installed upstream of the influent tanks, on the influent pipe tree, and dose the influent water with sodium hypochlorite, an oxidant and disinfectant solution. The dosing pumps can be manually calibrated by the Operator to yield an influent concentration of free chlorine between 0.1 and 0.3 milligrams per liter (mg/L) or utilize a 4- to 20-milliamp signal from free chlorine analyzers installed immediately downstream of the influent equalization tanks to reach the same range. The dosage is calibrated by adjusting the injection rate of the dosing pumps and monitoring the free chlorine concentration read by the chlorine analyzers, readjusting until the free chlorine concentration is read at the correct range. Post-sand filter free chlorine concentration is monitored with a handheld analyzer as needed. The sodium hypochlorite maintains the function of the sand filters and disinfects the sand filter media and water, which minimizes the need to skim or backwash the ~~granular activated carbon (~~GAC~~)~~ vessels due to the formation of biofouling. The dosing pumps are controlled by the primary system PLC and are only in operation during times that the extraction wells are in operation; this means ~~that~~ the dosing pumps respond to shutdowns incurred by the fault conditions that halt the extraction wells. The dosing pumps are designed to deliver between 9 milliliters and 9 liters of sodium hypochlorite solution per hour and can be adjusted manually depending upon extraction well operation or utilizing a 4- to 20-milliamp signal from the free chlorine analyzers. The dosing pump reservoir is designed to hold 90 gallons of

solution. The reservoir's solution level is checked by a level-switch within the tank and is maintained by the self-contained PLC within the sodium hypochlorite generator.

The sodium hypochlorite generator supplies the dosing pumps with a stock solution of sodium hypochlorite solution. The sodium hypochlorite generator is comprised of a brine tank, water softener, electrode panel, and oxidant tank. The brine tank holds food grade salt and water supplied from the softened Base water supply. The brine is then pumped into the electrode panel where it is converted into dilute sodium hypochlorite solution. That solution is then stored in the oxidant tank until it is fed into the dosing pump tanks. A vent has been installed on the oxidant tank to relieve excess pressure and gas byproducts produced during sodium hypochlorite generation.

Free chlorine levels in the influent water are monitored by chlorine analyzers installed downstream of the influent tanks. The dosing pumps are manually adjusted by the Operator to maintain a free chlorine concentration between 0.1 and 0.3 mg/L. Field chlorine testing is performed using the reagent pillow pouch method. A testing container is filled to the specified line and a pouch of reagent is added to the container. The container is then mixed, allowed to sit for a specified amount of time, and then visibly compared to a color array to determine the free chlorine concentration. Field chlorine tests are performed upstream and downstream of the sand filters to ensure the accuracy of the chlorine analyzers and prevent excessive free chlorine transfer to the GAC vessels.

The pre-treatment bag filters on the GWTS influent pump skid remove any remaining suspended solids that may pass through the sand filter. Bag filters are equipped with differential pressure transmitters (both pre-treatment and post-treatment bag filters are equipped with 10-micron bag filters). If pressure drop across the filters increases to ~~10-15~~4 psi, the filters need to be changed. If the differential pressure exceeds 4 psi, the system sends an alarm to the Operator indicating that the bag filters need to be changed ~~soon~~ (bag filters will be changed within 48 hours of receiving the alarm). If plugging occurs in the bag filters or a valve in the outlet piping is inadvertently shut, a deadhead situation could occur at the pump. To prevent a no-flow (deadhead) condition, a high-pressure switch is installed immediately downstream of the pump discharge. The switch shuts down the pump and alerts the Operator of the fault. High pressure set points are detailed in Appendix E.

2.4 ~~Carbon~~Granular Activated Carbon~~AC~~ Vessels

The only automatic control for each set of GAC vessels is a high-pressure switch on the inlet to the system. High inlet pressure to the GAC vessels causes a shutdown of the associated GWTS influent pumps. In order to prevent air from building up in the inlet piping and to prevent siphoning of water from the GAC vessels, there are air/vacuum relief valves on the inlet and outlet piping into the vessel valve manifold. A pressure relief valve and manual air vent valve are installed on the top of each GAC vessel. During initial startup and once each week, the Operator partially opens the manual vent valve to remove any air that may have accumulated in the GAC vessel (Train 2 only). In order to monitor pressure drop across the two ~~carbon~~GAC beds, each GAC vessel is fitted with a local pressure gauge on its outlet nozzle and on the inlet branch of the valve manifold. At a feed rate of 400 gpm, the pressure drop through each ~~carbon~~GAC bed should be less than 2 pounds per square inch gauge (psig), and the total system pressure drop should be less than 5 psig. The ~~carbon~~GAC beds are inspected to determine if skimming or backwashing is required when the pressure drop increases to 10 psig above ambient operating differential pressure.

Each of the ~~carbon~~GAC vessels is sized to provide 12 minutes of empty bed contact time at 400 gpm. With this extended contact time, the lead ~~carbon~~GAC bed can lower an EDB concentration in 400 gpm of groundwater from 2 micrograms per liter (µg/L) (the concentration used for the GAC design) to below the discharge limit. ~~the first quarter ()second quarter ()third quarter ()ere~~

~~percentuss.~~
~~ew exico Water Quality Control Commissionloading calculations performed by TIGG t~~

~~Higher concentrations of EDB or the presence of additional volatile organic compounds at a contact time of 12 minutes or longer will still result in full sequestration of those compounds onto the carbon. That is, the additional volatile organic compounds are treated to applicable standards as long as the concentration(s) and loading are consistent with the Technical Memorandum Establishing the Basis of Design Maximum Concentration Limits for the Kirtland BFF GWTS (Appendix O). The treatment of higher concentrations does, however, decrease bed life.~~

The lag GAC vessel provides a backup in the event of breakthrough of the lead vessel. When ~~water~~ any regulated constituent is detected leaving the lead GAC vessel ~~contains EDB~~at a concentration~~s~~ of 90 percent of the effluent limit, that GAC vessel undergoes GAC change-out and the lag ~~carbon~~GAC vessel is placed into the lead position. However, a GAC change-out may be performed at lower effluent concentrations if deemed appropriate for efficient system operation. Valve alignment figures for the ~~carbon~~GAC beds are provided in Appendix D. These figures show valve alignment for operation of the ~~carbon~~ GAC beds in lead-lag, backwash, and ~~carbon~~GAC change-out configurations. If water leaving the lead GAC vessel contains ~~EDB~~ a regulated concentration~~s~~ of *less* than 90 percent of the effluent limit, then a special sampling procedure will be followed month to month to keep track of where vertically in the lag GAC vessel the breakthrough is reaching. This sampling procedure can be found in ~~Appendix J~~Appendix I.

~~,~~The GWTS GAC vessels were designed to treat low level contamination within the IMOA. Concentrations of benzene, toluene, ethylbenzene, and total xylenes have not been detected within the IMOA since the fourth quarter of ~~Q4~~ 2016, while the EDB plume has been decreasing since the second quarter of ~~Q2~~ 2016 as shown in Figure 2-1. Current system influent concentrations are below the original design criteria, indicating that the original design criteria are still valid under current operational conditions (Table 2-3). In the event that an increase in influent concentrations is observed or an additional extraction well is added in an area containing higher concentrations, the GAC design criteria will be adjusted, and new GAC bed life will be determined.

2.5 Treated Water Tank and Pump

The effluent pumps and level in the treated water tanks are controlled and monitored by the PLC. The only Operator actions required during normal operations are to set the effluent pumps to their appropriate flow rate, put the controls of the effluent pumps into sequence using the SCADA, and change bag filters when the differential pressure across the post-treatment bag filters exceeds the differential pressure threshold (~~10~~ ~~15~~4 psi). Manual on/off switches for the treated water pumps in the SCADA and on the motor starter panel are provided for maintenance and troubleshooting but cannot be used during unmanned operation as they override PLC interlocks. The treated effluent pumps are interlocked to shut down under the following conditions:

- Switched to the Off position on the SCADA
- High-high level in the GCMP or the injection well
- High-high level in GWTS building sumps or clarifier
- Low-low level in treated water storage tank
- High pump-outlet pressure
- High pressure at the injection well or in the discharge line.

The post-treatment bag filters on the treated effluent pump skids do not have automatic controls but are equipped with local differential pressure gauges. If pressure drop across the filters increases to ~~10-15~~4 psi (differential pressure), the filters ~~need to~~will be changed within 48~~-~~ hours.

On the treated effluent line, between the post-treatment bag filters and the underground effluent pipeline leaving the building, there are two actuated valves that are used to deliver water to the truck bay to wet newly delivered GAC as part of the GAC change-out process and to provide backpressure on the effluent pumps. The valves are controlled by the PLC and can operated by utilizing an access code and keypad located on the exterior of the building in the truck bay. A timer on this switch returns the valves to their normal position after 30 minutes of being activated. The valves can also be set to their normal position by inputting the access code prior to the 30-minute cutoff. The main line valve's normal position is variable and is adjusted by the PLC in response to the pressure reading from the pressure transmitter located just upstream of the valve. The PLC is currently set to maintain 20 psi of back pressure on the effluent pumps to mitigate cavitation at the pump impellers.

2.6 Operation and Maintenance of Discharge Locations

Currently, the GCMP, ~~and~~ KAFB-7, KAFB-106IN2, and the NPDES outfall are the only ~~two~~ approved discharge locations for treated effluent. Other UIC wells~~, including currently proposed KAFB-106IN2,~~ may be added to supplement discharge options in the future. As future UIC well(s) are brought on-line, all O&M forms, tables, monitoring, and reporting requirements associated with UIC wells will be updated. The GCMP consists of a lined pond that stores water for irrigation of the golf course. The liner extends up the sides of the pond and the water level in the pond cannot ~~not~~ exceed the high-level set point of ~~4~~5.5 feet (ft) with respect to the GCMP pump house transducer. The ~~5~~4.5-f~~oo~~t-level set point provides an adequate safety factor to ensure that the pond is not overfilled. The pond also has a stadia rod in place near the intake of the GCMP pump house and the stadia rod level of 3.5 f~~ee~~t corresponds to a transducer reading of ~~5~~4.5 f~~ee~~t. Currently, if the pond level exceeds ~~5~~4.5 f~~ee~~t with respect to the transducer while the GCMP is selected as the discharge location, the system sends an alarm email and shuts down the effluent pumps at the GWTS. If this condition occurs, the effluent flow is redirected to KAFB-7, KAFB-106IN2, or a future UIC. ~~At this time, the redirection of flow requires a manual valve switch by the Operator.~~ Redirection of flow is performed by shutting down the GWTS and selecting a new discharge location on the SCADA. The automated changeover valves will adjust to direct water to the selected location.

Maintenance of the five golf course ponds includes performing semiannual inspections (spring and fall). Any new vegetative growth around the ponds (5 f~~ee~~t from edge of pond) and any new growth within the ponds will be removed using large rakes or a floating cutter for cattails. Evaluation for the need of a chipper for new growth removal will be made. If, during these inspections, evidence of leaks in the liner is observed, or if alerted to such evidence by golf course personnel, minor repairs will be implemented to restore liner integrity.

KAFB-7 ~~(and proposed UIC well~~and KAFB-106IN2~~),~~ ~~is a~~are ~~gravity fed~~ permitted UIC well~~s~~ that ~~is~~ are equipped with ~~a~~ dedicated flowmeter~~s~~ and water level transducer~~s~~ to ensure that the well~~s~~ will not be overfilled (Table 1-2; DP-1839 Condition No. 14). The flowmeter~~s~~ ~~is~~ are inspected and calibrated as scheduled per the manufacturer's recommendations. In addition, each UIC well is also equipped with wellhead control valves, pressure transmitters, and a wellhead control panel that communicates with the GWTS PLC via radio transmission. After the KAFB-7 downhole control valve (V-smart valve) was determined to be malfunctioning due to a hydraulic line failure, the control valve and all components associated with the valve were removed and replaced with an above ground wellhead flow control valve. The replacement wellhead flow control valve and control equipment were installed by APTIM in 2020 (Kirtland AFB, 2020b). A well head diagram detailing wellhead equipment is provided in Appendix D~~A replacement flow control valve may be installed in a future phase of work (ORCOM, 2019)~~.

KAFB-106IN2 is equipped with a Baski, Inc. (Baski) downhole flow control valve (Baski FCV). The Baski FCV uses an inflatable rubber element, in association with compressed nitrogen, to control flow into the well. This flow control method reduces air intake into the injection well, thus decreasing the need for injection well rehabilitation. The Baski FCV is equipped with a control panel that communicates with the GWTS PLC to adjust the wellhead flowrate to match the current GWTS effluent flowrate. In addition, the control panel monitors the nitrogen supply and will notify the operator when the nitrogen level is getting low. The O&M manual for the Baski FCV is provided in Appendix H.

-The PLC monitors the water level, effluent line pressure at the control valve in KAFB-7 ~~(or proposed UIC KAFB-106IN2)~~or KAFB-106IN2, and effluent line pressure just downstream of the control valve at the GWTS. The system is set to alarm if the water level rises above a certain threshold (380 -ft below ground surface for KAFB-7 and not yet determined for KAFB-106IN2)~~exceeds that associated with the top of the louvered screen of the well~~ or if the pressure downstream of the GWTS control valve exceeds 45 -psi. Any of these conditions cause a shutdown of the GWTS effluent pumps and send an alarm to Operators indicating that the UIC well has experienced a fault condition. Operators then ~~manually~~ divert flow to the GCMP, if there is adequate capacity, and inspect UIC wells for malfunctions. Discharge to UIC wells is not to exceed 1,440,000 gallons per day (1,000 gpm continuous flow) and records are maintained of all volumes injected into this well for reporting to the New Mexico Office of the State Engineer (Table 1-2; DP-1839 Condition No. 9).

Treated effluent water can be discharged to the NPDES outfall in accordance with the NPDES Permit No. NM0031216 (EPA, 2019). The NPDES outfall is considered a non-continuous discharge permit and will ONLY BE USED in instances where primary discharge locations (GCMP, KAFB-7, and KAFB-106IN2) are not available for use. O&M~~peration and maintenance~~ requirements for the NPDES outfall consist of proper operation and maintenance of the existing treatment system equipment, instrumentation to minimize infrastructure failures at the primary discharge locations. This O&M~~operation and maintenance~~ will be performed to prevent and/or minimize the number of discharge events to Tijeras Arroyo as specified in NPDES Permit Part II A. Discharge to the NPDES outfall is performed by manually opening the outfall gate valve and setting the SCADA programing to discharge water to the GCMP. Elevation head will force the water to discharge through the NPDES outfall.

2.7 Groundwater Treatment System Building Containment Sumps

A sump is installed in the GWTS building floor slab as part of the building's secondary containment system. This sump collects any spilled, leaked, or washdown water produced within the GWTS building, and any water that contains fines or particulates is first filtered through a 10-micron bag filter. The sump water is then pumped by a submersible centrifugal sump pump (P-111) into the Train 1 GWTS influent tank (TK-110) ensuring all water collected undergoes treatment. This pump is controlled by a float switch. The float switch can be overridden to pump water out of the sump if entry to the sump is required. A high-high level switch shuts down the GWTS if the water level in the sump becomes too high. A truck sump is located outside of the building in the truck bay; this sump is also equipped with a high-high level switch that shuts down the GWTS if the water level in this sump becomes too high. In order to pump water out of the truck sump, the grating of the sump must be removed to allow temporary installation of a sump pump into the sump. The water pumped by the temporary sump pump is then discharged to the GWTS building sump.

2.8 Startup Sequence

Prior to startup, ensure that all set points are set to appropriate values. Table 2-~~3~~ 4 provides a list of standard operational set points. Prerequisites for normal startup of the GWTS include the following:

- Perform the valve lineup for normal operation as shown on the piping and instrumentation diagrams for the GWTS (Appendix D).
- Confirm that no maintenance activities are occurring at the extraction wells, the golf course, or UIC wells.
- Confirm there is communication (telemetry) between the WCH, GCMP, UIC wells, and the GWTS.
- Place local disconnects for pumps in the closed position.
- Place local switches for the well pumps, GWTS influent pumps, and treated water pump in the SEQ or AUTO position.
- Confirm that manual valves on the UIC well pipelines and SCADA distribution switch are set to send the treated water to the desired destination (GCMP or a UIC well).

The SCADA has color codes for quick reference to let the Operator know the status of system equipment.

The color codes are as follows:

- Blue = Standby and ready.
- Green = In operation using automated sequence.
- Yellow = Uncommanded and running, manual control assumed.
- Red = Fault or alarm condition exists.

At the SCADA, perform the following checks and setup steps:

- Verify there are no pumps or treatment trains in alarm on the Overview screen (any item in red may require to be reset) and on the train control screen.

- Verify that all required pumps and wells are indicating that they are in REMOTE AUTO mode on the SCADA screen.

- Verify on the alarm page that there are no active alarms (active alarms are highlighted in red). Clear or acknowledge any alarms or correct any false alarm conditions.

- Verify that all of the proportional-integral-derivative blocks for the active Wells/Pump Skids are in AUTO (this can be verified by viewing the proportional-integral-derivative block is green).

- Verify on the train control screen that the pumps for the system are in SEQ mode and that they have a sequence number (O = Off, 1 = Lead, 2 = Lag).

- Verify where the water is to be discharged to on the distribution screen. When the golf course or a UIC well is selected, a pop up appears reminding the Operator to verify that the correct valves are opened in the field.

- Verify all tank level transmitters are operational and that the water levels are acceptable to run the system. If the tank levels are not at acceptable levels to be in automated control, run the pumps manually to adjust water within the system to allow for automated control.

- Verify that all of the tank level float (LSH/LSL) devices are green on the overview and tank screens. If any of these devices are red, correct the alarm condition before proceeding.

- Set flow rates for the groundwater extraction wells to the values specified by the GWTS Project Manager. This may require that the system be in operation and for staff to be at the wellhead for wells that require manual valve closing to control flow rate. The flow rate from extraction wells equipped with VFDs can be manipulated using the SCADA.

To initiate system start, complete the following steps:

- On the train control screen, set each treatment train's influent flow set point to a flow rate exceeding 360 gpm but less than 400 gpm. Running the influent pumps above 360 gpm ensures that enough flow is supplied to maintain the minimum 120 gpm of flow to the GAC vessels as well as 239 gpm in the event that the sand filters require backwashing. This O&M Plan recommends exceeding the extraction flow rate entering the train's influent tank by at least 5 gpm to ensure that the system properly compensates for slight variations in flowmeter readings. Then set the effluent flow set point(s) to at least 5 gpm greater than the influent skid flow rates for the same reason as the previously mentioned offset. This O&M Plan also recommends that the influent tanks remain isolated during normal operations to minimize the risk of preferential draining of either influent tank.

- Select the "ON" button for the trains intended for operation. The system starts the extraction wells in the sequence previously selected. After the system has verified that the extraction wells are operating, the influent train and effluent train skid pumps start up and run at the set point selected in previous setup (tanks first have to reach their high set point before starting).

- At any time during water processing, a train can be turned on or off and taken out of the AUTO sequence. It is the responsibility of the Operator to change the required flow set point on the trains to offset the incoming flow.

- Confirm proper operation of all equipment.

2.9 Normal Shut Down Procedure

When it is necessary to shut the entire system down, perform the following:

- On the train control screen, select the off button for both trains. If the extraction well pumps are expected to be shut down for more than 24 hours, put the manual switches in the WCH, the electrical rack at KAFB-106239, and the electrical shed at KAFB-106228 into the Off position. Open the electrical disconnects at those locations and lock them open.

- Confirm that the PLC shuts down the GWTS influent pump and treated effluent pump.

- If the system is going to be down for more than 24 hours, put the local switches on the motor starter panel for the GWTS influent pumps and the treated water pump into the Off position. Additionally, notify Kirtland AFB and NMED point(s) of contact.

- Manual valves on the process piping, tanks, and GAC vessels can be closed by turning the valve handle until the valve indicator signals that the valve is closed. However, the manual valves do not need to be closed during shut down unless a repair is being made on the process piping, tanks, and GAC vessels. The system is equipped with multiple check valves that prevent the backflow of water as well as multiple vacuum break points that would prevent drainage into or from the holding tanks during standard shut downs.

2.10 Emergency Shutdown Procedure

In case of fire, leak, or other emergency condition, any person can activate one of the local emergency shutdown buttons (one located inside the building on the east wall between the eastern entry and overhead door, and one located on the exterior of the building next to the keypad west of the southwestern-most entry), or on the train control screen select the off button for both trains, and notify the GWTS Project Manager, who notifies the appropriate Kirtland AFB contacts and regulatory agencies as described in the GWTS-specific Contingency Plan (found within the GWTS), immediately.

In the event of a spill, leak, or unplanned release to the environment associated with the treated effluent from the GWTS or the treated effluent conveyance system, Kirtland AFB will follow the release reporting requirements in 20.6.2.1203(A) New Mexico Administrative Code. These requirements are fundamentally equivalent to the Twenty-Four Hour and Subsequent Reporting requirements in Part 1.27 of the RCRA Permit. The NMED Hazardous Waste Bureau will be copied on all notifications and any subsequent reports.

If a power outage occurs, the system shuts down. The Operator is notified of the shutdown condition. Upon power returning, the system automatically restarts in standby and ready mode. Once in this mode, the system can be restarted as described in Section 2.7. Further information regarding the control of the system is detailed ~~explained~~ in Appendix E.

2.11 System Utilities

Only extraction well KAFB-106228 operates using off-Base power. It is the GWTS operating Contractor's (Contractor) responsibility to set up or take ownership of the Public Service Company of New Mexico account associated with powering extraction well KAFB-106228. Extraction wells KAFB-106233, KAFB-106234, and KAFB-106239; WCH; GWTS; UIC wells; and GCMP are all powered using on-Base utilities.

All PLCs, SCADA, and control panel power receptacles (telemetry and modem) are equipped with uninterruptable power supplies (UPS) that keep the attached items online for a short period following a loss of power at the GWTS. This ensures that all equipment responds properly in the event of a loss of power anywhere in the system. The status lights of the battery backup for the main control panel is inspected daily to ensure proper operation in the event of a power loss. In addition, the battery backup for each UPS is tested monthly. Testing is performed by temporarily shutting each system with a UPS off to see if the UPS maintains power to the system. These batteries should be replaced when the service light indicates when the battery is no longer operational, or every 2-3 years.

The GWTS is supplied with non-potable water from the on-Base community water system. This non-potable water is supplied at a pressure of 100 psi and can be used for various O&M activities.

Remote communications to the GWTS are transmitted using a cellular modem. It is the Contractor's responsibility to set up or take ownership of the cellular data account associated with the GWTS. Currently, the GWTS utilizes a 5-gigabyte per month cellular data plan provided by AT&T, Inc. Additionally, the Contractor needs to support alarm email distribution from the GWTS PLC. Email distribution may require the use of a third-party email hosting service if hosting cannot be supplied by the Contractor's own email hosting service.

To ensure that off-Base conveyance lines are secure, the conveyance lines are registered under Kirtland AFB as a line-owner with New Mexico 811. Kirtland AFB is responsible for off- and on-Base line locates. Off-Base line locates may be the Contractor's responsibility depending on the terms of the contract. On-Base conveyance lines are secured as Kirtland AFB issues permits after performing line locates on-Base for all excavation projects. Additionally, the influent lines are marked with monuments at a maximum of 400-f~~oo~~t intervals. In the event of a conveyance line breach, the Contractor is required to perform emergency response to minimize the release of any contaminated water. This O&M Plan recommends that the Contractor have a subcontractor or an internal department ready to perform emergency response in the event of a conveyance line breach. Off-Base owners of property containing an influent line are notified in accordance with executed access agreements ~~provided in Appendix A-2~~ and summarized in the Contingency Plan (found within the GWTS) Section ~~K.~~6 in the event of a breach.

3. INSPECTION AND PREVENTATIVE MAINTENANCE

This section presents instructions for routine inspection and normal equipment servicing and lubrication. The purpose of preventative maintenance is to ensure steady operation and to extend the life of equipment. The following text summarizes inspection and preventative maintenance frequencies and actions. Pertinent vendor or manufacturer information and manuals are provided in ~~Appendix I~~Appendix H. Appendix B provides an organization chart and roles and responsibilities for system operation.

In the event that an Operator-initiated system shutdown is needed for routine maintenance, non-routine maintenance, or any other nonemergency reason, the GWTS Project Manager must be contacted, and they will notify the designated Kirtland AFB points of contact. The NMED point(s) of contact is notified for any shutdowns of longer than 24 hours by U.S. Air Force personnel.

For all maintenance activities, the Operator always reviews the appropriate U.S. Air Force, U.S. Army Corps of Engineers, or other approved health and safety documents that are available onsite, and follows the requirements for additional personal protective equipment, equipment lock-out/tag-out, confined space entry, fall protection equipment, etc. Additional safety documentation for maintenance operations can be developed on an as-needed basis and be on file in the GWTS building. These requirements are always considered prior to initiating the task. The Operators perform maintenance tasks that do not require factory-authorized service on a routine basis. If factory-authorized service is required, it is pre-scheduled to ensure minimal disruption of the plant operating schedule. Records of all maintenance events will be documented in the quarterly report as specified in DP-1839 Condition No. 22. Records will be provided within the sections: ~~;~~ GW~~roundwater T~~reatment ~~System~~ Operation and Performance, GW~~roundwater T~~reatment ~~System~~ Maintenance and Expansion Activities, and Non-Routine Maintenance Activities.

3.1 Scheduled Inspection and Routine Maintenance Activities

Table 3-1 provides a comprehensive list of routine maintenance activities. Inspection and preventative maintenance forms are provided in ~~Appendix H~~Appendix G. In general, the overall system does not have extensive preventative maintenance requirements. Most equipment requires inspection with periodic cleaning and repair as needed. The only recurring routine preventative maintenance operations are to change the oil in the influent and effluent pumps, grease pump bearings, and change the air filter on the air conditioner for the control room every 3 months. Requirements for calibration and inspection of flowmeters that measure groundwater feed and discharge flow rates are covered later in this section and inspection forms are provided in ~~Appendix H~~Appendix G.

3.2 Influent and Effluent Pump Monitors

All influent and effluent pumps in the GWTS are equipped with i-ALERT® Condition Monitors. These devices record pump operational metrics (i.e., vibration, temperature, and run-time) and can provide early detection of pump failures and metric trending. Treatment Train 2 and the effluent pump for Train 1 are equipped with i-ALERT® devices that can be connected to using a Bluetooth-enabled device with the i-ALERT® application. The Train 1 influent pumps are outfitted with i-ALERT® devices currently incapable of Bluetooth communication and only utilize light indictors to alert Operators to possible pump concerns. All i-ALERT® light indicators are inspected weekly.

3.3 Bag Filter Change-Out

Bag filters require replacement when the differential pressure across the bag filters exceeds the differential pressure threshold (4 psi)~~as needed to correct a pressure drop across the pre- and post-treatment bag filters~~. Replacement will be performed within 48~~-~~ hours of the 4-psi threshold exceedance. Two bag filter housings are located on each skid with six 10-micron bag filters in each housing; this allows for continuous operation of the plant during bag filter change-out. Once the Operator has deemed that a change-out is required, the system remains on and the Operator isolates the filter housing needing change-out. The filters are replaced and the offline filter housing is reinstated into the treatment train. In the event that both bag filter housings on one skid require change-out, flow can be diverted to the other train (if less than 400 gpm) in order to avoid a system shutdown. If the flow is greater than 400 gpm on a single train, the entire system is shut down to avoid unnecessary strain on the system.

To change the filters, all flow is directed to the filter vessel not requiring maintenance (close valves leading to the vessel requiring change-out). The air vent and drain valves are opened to drain water from the top half of the filter housing. After the head bolts are loosened and disengaged, the davit jack is used to raise the filter lid and swing it out of the way. The filter bags can then be replaced. The O-ring on the top of the filter vessel is then inspected to see if it requires replacement and is aligned properly. The lid is then swung back into place and the head bolts are tightened. Head bolts on opposite sides of the lid will be alternately tightened. Do not overtighten the bolts and inspect the filter for leaks upon restart. The flow is then reinstated to the filter vessel with new bags and the procedure can be repeated for the second filter vessel if necessary. After replacement, the old filter bags are disposed of as described in Section 6 and characterization information is provided in ~~Appendix K~~Appendix J.

3.4 Basket Strainer and Y-Strainer Cleaning

Eaton Duplex Model 50 Basket Strainers are present between the influent tanks and their respective pump skids. The strainers require cleaning and maintenance on an as needed basis. If the influent tanks are not effectively equalizing, the most likely culprit is that one or both basket strainers between the two tanks has become clogged with fine sediment pumped from the extraction wells. Another indication that the basket strainer may need to be cleaned is when cavitation is heard at the pump impeller housing. The basket strainers can be cleaned while in operation and do not require a system or train shutdown. In order to clean the strainer, rotate the plug lift handle counter-clockwise to release the diverter plug, switch the diverter handle from one side to the other to divert water into the clean basket, and rotate the plug lift handle clockwise to set the diverter in place. Loosen the yoke screw of the clogged basket's housing until the cover can be lifted. The basket can then be removed, brushed, and rinsed to remove any collected debris. Once cleaned, the screen is reinserted, cover replaced, and yoke screw retightened. Documentation for the Eaton Duplex Model 50 Basket Strainers is provided in ~~Appendix I~~Appendix H.

Y-strainers are present between the effluent tanks and their respective pump skids. The strainers require cleaning and maintenance on an as needed basis. The Y-strainer may need to be cleaned when cavitation is heard at the pump impeller housing. In order to clean the strainer, lock-out the appropriate pump skid so that the pumps cannot be remotely started while the butterfly valves are closed. The line is then isolated by closing all incoming butterfly valves and then drained, and the Y-strainer blind flange is removed. The Y-strainer screen can then be removed, brushed, and rinsed to remove any collected debris. Once cleaned, the screen is reinserted, blind flange replaced, drain valves closed, butterfly valves reopened, and pump skid reinstated into operation.

This O&M Plan suggests that the influent basket strainers are inspected and cleaned weekly and the effluent Y-strainers are inspected and cleaned biannually.

3.5 Discharge Changeover

~~Currently, t~~The treated effluent can be discharged to either the GCMP, ~~a~~ UIC wells KAFB-7 and KAFB-106IN2, or the NPDES outfall~~(final completion anticipated by the end of February 2021)~~. The entire system ~~is~~ must be shut down (Section 2.9) prior to performing a discharge change~~-~~over. Once the system is offline, ~~change~~ the discharge location can be changed as indicated on the SCADA ~~on the~~ Distribution screen. ~~This causes the SCADA to display a reminder window regarding valve positioning.~~Upon confirming the discharge location on the SCADA, the automated changeover valves will adjust to direct effluent water to the chosen location. The existing manual changeover valves remain in place on the effluent line and are locked in the open position. In the event that the automated valves fail, the discharge location can be controlled with the use of the manual valves.~~ Commute to the effluent changeover location shown on Figure 1-1 and close the valve where the system was previously discharging and open the valve leading to the new discharge location. It takes approximately **38.5 turns** of each post indicator to completely close or open the resilient wedge gate valve.~~ After ~~the valves have been switched~~a change in the discharge location is performed, both treatment train effluent totalizers~~,~~ and the shutdown time are recorded, and the system is reinstated into operation (Section 2.8). Upon changing the discharge location from a UIC well, the wellhead flow totalizer is also recorded.~~, proceed to a UIC well and record the totalizer reading at the well head. Return to the GWTS building, record both treatment train effluent totalizers, shutdown time, and reinstate the system into operation (Section 2.8).~~

3.6 Granular Activated Carbon~~Carbon~~GAC~~GAC~~ Backwashing, Skimming, and Change-Out

Before initial startup and following each ~~carbon~~GAC change-out (prior to re-start), the ~~carbon~~GAC beds must be backwashed. In order to perform the backwashing process, refer to the manufacturer O&M Manuals located in ~~Appendix I~~Appendix H and valve alignment figures in Appendix D. Backwashing the TIGG ~~carbon~~GAC beds requires at least 700 gpm of clean water, which can be provided from the fire hydrant near the GWTS building. The fire hydrant is connected to the Kirtland AFB potable water system. Backwashing the Calgon ~~carbon~~GAC beds requires at least 150 gpm of clean water, which can be provided from the TIGG treatment train, if the TIGG treatment train is processing water. Note that backwashing either train requires a temporary 21,000-gallon tank be available directly to the south of the GWTS building to store any produced backwash water. The 21,000-gallon tank allows for the settling out of fines produced during the backwash process. Sand filters pretreat the water for dissolved iron and manganese and suspended solids, including biological solids, which should mitigate scaling, biofouling, and plugging of the ~~carbon~~GAC beds. In the unlikely event that scale and fouling cause the pressure differential across the GAC vessels to exceed 10 psi before a change-out is required, either backwashing or, if the pressure loss is associated with the upper most layer of the GAC within the vessel, skimming the upper few inches of GAC removes limited scaling and fouling.

If a pressure drop of 10 psi or greater is primarily associated with the lead GAC vessel, vacuum skimming the top several inches of the lead ~~carbon~~GAC bed is a viable remedy instead of backwashing. Before skimming operations commence, lift equipment (e.g., scaffolding, scissor lift) is set up to access the top of the tank needing skimming of the GAC surface. Skimming requires that the system be shut down (Section 2.9) and the lead GAC vessel be drained so that the water level is below the bed surface. The vessel is then opened and the top several inches of the GAC are visually inspected. A sample can be collected by affixing a clear bailer, with its bottom removed to a pole and pressing the open end of the bailer into the top several inches of the GAC. The sample is then removed to determine the depth of the fouling and extent of the skimming required. The top layer of the GAC is then vacuumed until only non-fouled GAC is visible from the vessel entrance. GAC skimmed from the lead GAC vessel must be

containerized and removed as solid waste. Skimming is often much more cost effective than performing a full GAC change-out and produces minimal investigation-derived waste compared to backwashing.

If skimming does not alleviate the pressure drop through the GAC vessel, the GAC vessel will be backwashed in accordance with the manufacturer's recommendation (Appendix H). Note that backwashing either train requires a temporary 21,000-gallon tank be available directly to the south of the GWTS building to store any produced backwash water. The backwashing procedure is also discussed in Section- 7.4.

GAC needs to be changed out once breakthrough by the contaminants (defined in Section 2.4) occurs in the lead GAC vessel. In order to perform the GAC change-out process, refer to the manufacturer O&M Manuals provided in ~~Appendix I~~Appendix H. A procedure for the GAC change-out for the ~~carbon~~GAC vessels can be found in ~~Appendix I~~Appendix H. In addition, the Operator performs a visual inspection of the vessel's interior when the vessel is empty to determine if there is any plugging or damage of the inlets, distribution manifold, or feed and drain lines. Clean water from the plant hose connections can be pushed into the vessel to aid with visual inspections of all internal components. Only preconditioned GAC media are used to refill the GAC vessels during a change-out as this eliminates the need to store and dispose of conditioning reagents. When scheduling for the 7-day/4-week sampling required after a GAC change-out (as described in ~~Appendix I~~Appendix H), allow 2 full days between when the GAC is changed out and the first day of daily sampling as the slurry will need to sit for 24 hours before the backwashing process.

3.7 Dosing Pump, Chlorine Analyzer, and Sodium Hypochlorite Generator Maintenance

The pre-treatment dosing pumps that supply sodium hypochlorite solution to the influent water are sourced from a reservoir that holds approximately 90 gallons of generated solution. The usage of solution is dependent upon influent flow rates as well as sodium hypochlorite concentration in the dosing solution. Dosing rates must be adjusted to result in a concentration of sodium hypochlorite concentration upstream of the sand filters of 0.1-0.3 mg/L free chlorine. The free chlorine concentrations upstream and downstream of the sand filters should be measured and recorded at least once a month to ensure that the dosing pumps are supplying adequate volumes of oxidant and the sand filters are catalyzing oxidant to precipitate dissolved metals.

The pipe conveying water from the influent tanks to the influent skids is equipped with two free chlorine analyzers. The analyzers require weekly inspection and monthly replenishment of reagents in order to function properly.

The pre-treatment dosing pumps are supplied with a constant stream of freshly produced sodium hypochlorite solution created by the sodium hypochlorite generator. The generator requires weekly inspection and addition of food grade salt to the brine tank to provide a constant stream of sodium hypochlorite solution into the oxidant reservoir.

The Operator should refer to the manufacturer's recommendations in order to perform any additional maintenance on any of the dosing pumps, chlorine analyzers, or sodium hypochlorite generator. In the event that the sodium hypochlorite generator is off-line for more than 2 weeks, liquid sodium hypochlorite (bleach) will be provided in a batch process to be used with the dosing pumps.

~~If the sodium hypochlorite generator is off-line for more than 2 weeks, the following procedure should be initiated:~~

- ~~Place the MIOX sodium hypochlorite generator on standby by pressing STOP on the generator's SCADA screen. DO NOT turn off the generator. Doing this will reset the PLC settings to factory defaults.~~

- ~~Remove all salt from the brine tank and containerize for waste disposal.~~

- ~~Drain the tank of all brine solution and containerize for waste disposal. To drain the tank correctly, isolate the tank's drain by closing both valves on the outlet pipe. Attach a hose to the drain tee, open the first valve (immediately after the outlet of the tank), and let the brine solution drain through the hose and into an appropriate bucket or drum.~~

- ~~Thoroughly rinse the brine tank and its filter pack with softened water through the internal spray ring at least twice. Drain the rinsate and containerize for waste disposal. Remove the drain hose from the drain tee and reopen the second valve on the outlet pipe. Both valves on the outlet pipe should now be open.~~

- ~~Refill the brine tank with softened water. This will be used to rinse the electrolytic cell.~~

- ~~Detach the outlet tube of the solenoid brine pump from the rest of the system. The brine pump is located in the bottom cabinet of the sodium hypochlorite generator. Prime the brine pump with the prime bulb (located on the outside of the generator to the left), then manually run the pump until the majority of the air is removed from the brine line. To manually run the pump, press the green button below the SCADA screen, and press DIAGNOSTICS. Within the Diagnostics page, change the voltage of the brine pump to 2 volts (no greater than 3 volts is recommended), and press the solenoid brine pump button at the top of the screen. The pump will run for approximately 10 minutes before needing to be turned on again. As the pump runs, air bubbles and leftover brine solution will drain from the detached outlet tube. This should be containerized for waste disposal.~~

- ~~When little to no air bubbles remain in the brine line, turn the brine pump off and reattach the outlet line to its original placement. Turn the brine pump back on as before, and let it run for 40 minutes to rinse the electrolytic cell free of all brine solution. The rinsate from this process will be discharged to the sodium hypochlorite storage tank (reservoir), which stands on a secondary containment pallet and does not need to be moved or stored elsewhere and can be held for future use.~~

- ~~Once the electrolytic cell is thoroughly rinsed, turn off the brine pump, and drain the cell of all liquid by opening the small blue valve below the cell. Collect these liquids and containerize for waste disposal (nonhazardous solid waste). A pipe union above the electrolytic cell can be opened to facilitate the draining process. After all liquid within the cell has been drained, close the blue valve and reattach the pipe union.~~

- ~~Drain the brine tank of any remaining softened water, following similar valve and drain tee procedures as before.~~

- ~~Isolate the water softeners from the source water by closing its inlet valve.~~

- ~~Keep the generator online, even throughout its shutdown period, as turning it off will reset the PLC settings to factory default.~~

3.8 Sand Filter Maintenance

The pre-treatment sand filters require occasional backwashing and infrequent replacement of filter media. Backwashing is required when differential pressure across a sand filter unit exceeds 10 psi from the clean operating differential pressure. The Operator first adjusts the backwash throttling valve (red handled valve located above the sand filter vessels on the backwash line) to provide 239 gpm throughput in the backwash line during a backwash cycle. The throttling valve must be manually adjusted at each different flow condition; thus, this O&M Plan recommends that flow conditions do not be frequently modified by the Operator. Once the flow requirement is met, the system can be set to automatically initialize the sand filter into backwash mode once a certain differential pressure is reached across the sand filters. The PLC is programmed to lock in the influent pump VFD frequency when a backwash cycle (alarm) is received from the sand filter control unit. The VFD maintains the locked frequency until one of following three conditions occurs:

- The backwash cycle is completed (the VFD frequency remains locked for approximately 30 seconds following completion of the cycle).
- The low-level set point in the influent tank is reached (deactivating the influent pumps).
- Any alarm condition resulting in influent pump shutdown is received.

This O&M Plan recommends that the automatic backwashing differential pressure be set to no more than 10 psi above the clean operating differential pressure as differential pressures exceeding 10 psi, above background, results in significantly higher flow rates through the first sand filter vessel backwashed during backwash of the second vessel. Additionally, these conditions can result in flow rates that exceed design flow rates of the GAC vessels. Backwashing each vessel takes approximately 4 minutes to perform (8 minutes per skid). Backwash can only be performed on one sand filter housing per skid at a time as the second filter vessel supplies pretreated water to perform the backwashing of the first unit. Backwash water is transferred to the backwash clarifier located above the external truck sump.

Each sand filter vessel is loaded with the manufacturer's recommended amount of crushed gravel, garnet, and IMA-65 (or DMI-65) media. In the event that the removal efficiency of the sand filter begins to diminish, then media change-out may be required. The media manufacturer recommends that media be changed out regardless of a loss in removal efficiency following between 5 and 10 years of operation due to media degradation by particle contact and mechanical abrasion. Emptying and reloading of sand filter vessels is performed by following the manufacturer's instructions provided in ~~Appendix I~~Appendix H.

3.9 Clarifier Maintenance

The sand filter clarifier is designed to hold 8,000 gallons of backwash water (approximately 8 backwash cycles) and is automatically drained in order to provide space for additional backwashing. A drain line runs from the clarifier's last chamber, through the southern wall of the GWTS building, and to the western section of the internal sump. Flow through the drain line can be adjusted with the inline ball valve. Inline filtration of the draining water is recommended to collect fines that may not have settled out; for this purpose, a bag filter can be tied to the outlet of the drain line and should be replaced every three to four backwash cycles, or as needed.

If manual removal of clarifier water is necessary, the Operator first ensures that the clarifier has been allowed adequate time to settle out any fines backwashed from the sand filters. Once settling has occurred, the Operator sets up appropriate pumps and hoses to transfer clarified water to the GWTS internal sump for re-treatment through the system. Inline filtration of the clarified water is recommended in the event that some backwash fines may not have settled out. The clarified water is then discharged and, following this discharge, the clarifier is returned to its normal operating state and all equipment used is stored in the GWTS building.

3.10 Effluent Line Integrity Testing

The effluent line running between the GWTS and a UIC well requires integrity testing in accordance with DP-1839 (Table 1-2; Condition No. 15). ~~The line must be tested in year one of~~ DP-1839 requires that effluent line testing be performed ~~approval (by April 28, 2018) and~~ in year five of the approval before a renewal application is submitted (April 2022). Result of the effluent line integrity test will be provided in the appropriate quarterly report.

~~Effluent line integrity testing is performed by hydrostatic leak testing the line..However, t.~~

3.11 Well Pump Pulling

The extraction well pumps are designed for little to no maintenance when properly installed and monitored. Removal of the extraction well pumps for inspection or cleaning ~~on a regular basis is not cost effective and should~~ is only ~~be~~ considered in the event of a catastrophic failure or decrease in pump performance such as a decrease in flow rate, or an unexplained increase in amperage draw. Pump performance is monitored by observing the well flowrates presented on the SCADA. Verification of these flowrates is performed by monthly manual readings collected from the well head. Pump amperage draw is also monitored when a decrease in flow rate is observed and verified. ~~Extraction well pumps are pulled for inspection and maintenance only after a minimum of 10 years in the absence of documented performance issues.~~

Prior to pulling any pump, ensure that the appropriate permits (barricade, etc.) have been obtained. Access to the well is made through the vault doors or manhole directly above the well head. Disconnection of electrical and control wiring must be performed by a licensed electrician. After disconnection at the wellhead from piping/equipment in the vault, the well casing, gauge lines, and pump columns are disinfected with a solution of potable water and WEL-CHLOR (calcium hypochlorite) or equivalent. ~~and should be done as described~~The formula to calculate the concentration of calcium

hypochlorite can be found in Section 3.12.1. The solution is mixed at the surface and introduced through the top of the casing, gauge lines, and pump discharge piping. ~~An example mix of solution could consist of 1 pound of 65 percent dry granular, calcium hypochlorite and 500 gallons of clear water mixed until the chlorine is completely dissolved. After completely dissolving, this solution is poured into the casing, gauge lines, and pump column. This example is sufficient to initially produce a chlorine concentration of approximately 50 mg/L throughout the entire water colu~~A field chlorine test kit (Hach DR 900 Handheld Colorimeter, or equivalent) is utilized to monitor free chlorine concentrations. All field meters are calibrated in accordance with manufacturer's recommended procedures.

Following disinfection, all existing downhole piping (approximately 520 f~~ee~~t of 3-inch galvanized steel drop pipe), the submersible pump, and all associated wiring are removed. The pump is inspected for damage and replaced with a new pump, if required. Both 1.25-inch sounding tubes (for transducer and manual water level) are also removed. All pipes are stacked on a pipe trailer prior to storage, in order of retrieval, for subsequent inspection for corrosion and/or damage. All damaged materials are replaced prior to redeployment. Trailers with well equipment are stored and covered at the appropriate yard until needed for reinstallation. All pipe and wiring removed can be reinstalled at the completion of any work being performed so care is taken during handling and storage. Photographs are taken of all corrosion or damage on pipe, pumps, or other downhole materials for documentation purposes and identification of any replacement requirements.

An optional well inspection can be performed with a downhole video camera after the pump and piping equipment are removed and suspended solids have settled back into the well, if required. MUD-NOX (mud deflocculant/detergent) or equivalent may be added to the well to decrease solids suspension prior to the camera survey. Residual chlorine is measured downhole prior to deployment of the camera to ensure camera integrity. This camera survey can be used to evaluate the nature and extent of screen fouling, screen integrity, or other down well characteristic.

Prior to the reinstallation of pumps and downhole equipment into a well (disinfection, redevelopment, etc.), cathodic protection is also added to the pump, if not already installed, prior to redeployment. Cathodic protection ~~can potentially~~ consists of adding three 18-f~~oo~~t lengths of magnesium strips strapped to the stainless ~~-~~steel drop pipe above the submersible pump. These ~~example~~ strips are 3/8-inch thick by 0.75-inch wide and ~~can~~ covered with a poly mesh sleeve ~~-~~ and secured via stainless steel straps. ~~Other cathodic protection options may be considered.~~

Prior to reinstallation of the downhole equipment, the original or new drop pipe, submersible pump, transducer, drop tubes, and wiring are disinfected aboveground following standard practices (i.e., American Water Works Association [AWWA] Standard for Disinfection of Wells (AWWA, 2003). After the pump is installed, the gauge lines and pump column are disinfected as previously described. The wellhead is then reconnected to the conveyance line within the vault, restoring the system to the original configuration. The system is then tested for operational readiness to ensure proper pump operation, valve and meter operation, and verification and that there are no leaks or physical or electrical problems with the system.

3.12 Well and Conveyance Line Disinfection

Well and conveyance line disinfection is described in the following sections. Records of all maintenance events will be provided in the quarterly report as specified in DP-1839 Condition No. 22. Records will be provided within the sections: ~~;~~ GW~~roundwater T~~reatment System Operation and Performance, GW~~roundwater T~~reatment System Maintenance and Expansion Activities, and Non-Routine Maintenance Activities. Disinfection is performed in accordance with the Conditional Approval letter for Standard

Operation Procedure of Disinfection of the Groundwater Treatment System Remediation Wells and Groundwater Monitoring Wells; dated August 6, 2018 (Appendix A-3.

3.12.1 Well Disinfection

Extraction and monitoring wells may occasionally require disinfection to improve pumping and monitoring performance. Well disinfection is performed by adding a disinfectant solution directly to the well at the wellhead. The disinfectant solution is produced by mixing WEL-CHLOR and potable water at a concentration sufficient to provide adequate free chlorine- through the entire water column. Calculations for determining well volume and the amount of disinfectant are provided below:

Non-submerged well screen:

$$V_{well} = 7.48\frac{gal}{ft^3}\left[\pi\left(\frac{d_b}{2}\right)^2 (B - H)\right]$$

$V_{well} = static\ water\ volume\ (gal)$
$d_b = borehole\ diameter\ (ft)$
$H = water\ level\ (ft\ bgs)$
$B = total\ depth\ (ft\ bgs)$

Submerged well screen:

$$V_{well} = 7.48\frac{gal}{ft^3}\left[\pi\left(\frac{d_b}{2}\right)^2 (B - T)\right] + 7.48\frac{gal}{ft^3}\left[\pi\left(\frac{d_c}{2}\right)^2 (T - H)\right]$$

$V_{well} = static\ water\ volume\ (gal)$
$d_b = borehole\ diameter\ (ft)$
$d_c = casing\ diameter\ (ft)$
$H = water\ level\ (ft\ bgs)$
$B = total\ depth\ (ft\ bgs)$
$T = top\ of\ screen\ (ft\ bgs)$

Disinfectant:

$$V_T = V_{well} + (V_{cont})(2)$$

$V_T = total\ volume\ that\ will\ dilute\ sodium\ hypochlorite\ (gal)$
$V_{well} = volume\ of\ well\ to\ be\ disinfected\ (gal, see\ Section\ 3.2.1)$
V_{cont} = volume of container to hold solution (gal, 250 gal recommended).

$$M_{WClP} = 0.05\ (\frac{\text{oz}}{\text{gal}})(V_T)$$

M_{MClP} = mass of Wel-Chlor *Plus* to add to the stock solution (ounces [oz])
V_T = total volume that will dilute Wel-Chlor *Plus* (gal)

Mixing should be performed in according with the manufacturer recomendations

Injection of disinfectants into the extraction and monitoring wells may possibly oxidize contaminants in the immediate vicinity of the wells. However, after disinfectant has been allowed to occupy the well for a

given amount of time, water is removed from the well until the disinfectant is no longer observed in the purge water. The purge water will be monitored throughout the purging process using a reagent pillow pouch field testing kit. For any well disinfection, free chlorine concentrations after purging are targeted to less than 2 mg/L which is 50 percent of the National Primary Drinking Water Regulations 40 Code of Federal Regulations 141.54 Maximum residual disinfectant level goals for disinfectants (U.S. Environmental Protection Agency, 1998). In addition, analytical samples are collected from the well pre- and post-disinfection to determine if the groundwater has returned to pre-disinfection conditions.

3.12.2

3.12.33.12.2 Conveyance Line Disinfection

In order to perform conveyance line disinfection, the conveyance lines need to receive a dose of chlorine fed at a constant rate. An example target concentration of free chlorine throughout the conveyance line is 25 mg/L. To ensure that the appropriate concentration of free chlorine is provided, the chlorine concentration is measured at regular intervals in accordance with standard practices (i.e., AWWA Manual M12 procedures [AWWA, 1975]). Chlorine application is typically supplied through a temporary connection to the conveyance line and does not cease until the entire conveyance line is filled with chlorinated water. The chlorinated water is retained in the line to provide the appropriate amount of contact time (e.g., 24 hours). After, the chlorinated water is pumped from the line to a storage container(s) or the GWTS depending on water characterization.

3.13 Well Shocking

If iron-related and sulphate-reducing bacteria are suspected culprits of well biofouling or calcareous materials are observed on the well screen, well shocking may be used in addition to the above disinfection treatment. Shocking can be performed with a hydroxyacetic acid blend product Cotey Chemical Corporation BIOCLEAN or equivalent. Shocking can only be performed once all residual treatment chemicals have been removed from the well. The disinfectant solution is mechanically agitated into the well and gravel pack using a jetting or swabbing tool. An example treatment schedule is to perform agitation every 2-4 hours (during daylight hours) for a 24- to 36-hour period. The solution is worked across the entire length of the water column to ensure proper mixing and distribution through the well and gravel pack.

The well screen interval is then jetted or swabbed a final time before pumping fluids out of the well. Shock treatment fluids pumped from the well can be stored in temporary storage containers provided onsite. Pumping continues until all shock treatment fluids have been removed or a preset volume has been reached. All stored shock treatment liquids are sampled for waste characterization and held pending analytical results and final waste disposition. Records of all maintenance events will be provided in the quarterly report as specified in DP-1839 Condition No. 22. Records will be provided within the sections:; GWroundwater Treatment System Operation and Performance, GWroundwater Treatment System Maintenance and Expansion Activities, and Non-Routine Maintenance Activities. Methods and materials used for well shocking will be in accordance with the Conditional Approval letter for the Bulk Fuels Facility Expansion of the Dissolved-Phase Plume Groundwater Treatment System Design, Revision 2; dated May 31, 2017 (Appendix A-3).

3.14 Well Cleaning and Redevelopment

Well cleaning and redevelopment is performed by a licensed driller and all mechanical cleaning activities will be performed using a drilling rig or pulling unit. Once the well pump has been removed, physical or chemical cleaning/redevelopment processes, or a combination of these two processes, can be used to

address well performance problems. General descriptions of these processes are provided below. Records of all maintenance events will be provided in the quarterly report as specified in DP-1839 Condition No. 22. Records will be provided within the sections: ~~;~~ GWTS Operation and Performance, GWTS Maintenance and Expansion Activities, and Non-Routine Maintenance Activities. Methods and materials used for well cleaning and redevelopment will be in accordance with the Conditional Approval letter for the Bulk Fuels Facility Expansion of the Dissolved-Phase Plume Groundwater Treatment System Design, Revision 2; dated May 31, 2017 (Appendix A-3).

3.14.1 Physical Cleaning

Mechanical cleaning may be performed to remove any physical buildup such as iron or calcium deposits on the well screens. In addition, biologic films present on well casing and screen surfaces are physically removed during the initial mechanical cleaning. The mechanical cleaning process consists of a combination of swabbing, bailing, surging, pumping, and jetting. All mechanical cleaning is performed using a drilling rig or pulling unit equipped with a wireline and mechanical winch. All water generated from this cleaning needs to be temporarily containerized until it is sampled and analyzed for appropriate waste disposition. ~~–~~ Note that the process presented below is for general guidance and may be modified based on actual field observations.

- The redevelopment work may include the use of a mud deflocculant/detergent such as Cotey Chemical Corporation MUD-NOX or equivalent. Mud deflocculant/detergent is mixed with water at the surface and subsequently injected into the well in an attempt to disperse any remaining drilling mud that may remain in the gravel pack since well installation. The solution is mechanically worked into the gravel pack using a surge block in order to maximize effective distribution in the annular space.

- A ~~bailer~~ decontaminated stainless steel bailer with a toggle valve or equivalent is lowered into the well and used to gently surge the screen interval to remove any accumulated sand, silt, and debris accumulated in the well bore. When the bailer is brought to the surface, an Imhoff cone or equivalent is used to collect water from the bailer to evaluate the amount of silt and sediment in the water. This process is repeated after each cycle of surging and jetting.

- Following bailing, a surge block is used to surge the screened interval. The screen is surged at set intervals with strokes repeated for a set time period per interval (e.g., 5-f~~oo~~t intervals for 5 minutes per interval). Following the surging cycle, the well bore is bailed again to remove any accumulated sand and silt. Bailing is repeated until the discharged water has reached a set sediment volume per volume of water (e.g., less than 2 milliliters of sediment per 1 liter of water) measured using an Imhoff cone or equivalent.

- Following the surging cycle, a temporary pump is installed in the well and used to remove silt loosened during surging and settle the filter pack. Pumping follows a predetermined schedule. An example pumping schedule is lowering the pump across the saturated screen in 10-f~~oo~~t sections (10 -positions in 100-f~~oo~~t screen), pumping each area for approximately 5 minutes at 100 gpm. While pumping, temperature, pH, specific conductivity, and turbidity are monitored.

- Following pumping, a jet is installed in the well screen interval to jet increments of the screened interval. The jetting device is capable of injecting water at a predetermined flow rate applicable for the well screen and filter pack. A pump attached to the jet is used to pump at a rate slightly higher rate than the injection rate used for jetting. Each increment will be jetted for a set amount

of time (e.g., 5-f~~oo~~t increment jetted for 5 minutes). Water used in jetting is clean potable water or it may be recirculated water from the well if allowed to settle to remove fines and keep from reintroducing solids to the screen before being reinjected. The proposed potable water source is identified during the readiness review meeting.

All water generated during the mechanical well development process is containerized onsite ~~in temporary storage~~ until characterized and determination of final disposition.

3.14.2 Chemical Cleaning

Acid treatments may be used to remove and weaken existing biologic colonies and remove biologically-induced iron deposits and chemical crusts. Well acidification is performed using commercially available acid with inhibitors to minimize corrosive effects on metal components of the well (e.g., sulfamic acid, Dry Acid Special®). Ensure that, if using chemical cleaning with any other chemical disinfection or other treatment, there are no adverse reactions between chemical additions or mitigate the possibility that an adverse reaction could occur.

Introduction of the acid solution into the well water column is performed using a tremie pipe or jetting tool. The solution remains in the well for a preset contact time with preset agitation intervals (e.g., 24-36 hours of contact time, agitated every 2-4 hours) with a bailer or surge block during daylight hours. Chemical additives are to be used per manufacturer recommendations for mixing, installation, retention time, pH monitoring, removal, and safety.

After the acid treatment is completed, a preset volume is mechanically bailed or pumped from the well and placed into a lined roll-off or equivalent. Acidic water is recovered after completion of each acid treatment; therefore, initial and periodic pH readings of the purged water are measured during removal to determine if purging has been adequately completed. For any acid treatment, pH values after purging are targeted to be similar to the pre-treatment pH (e.g., within 1.0 pH units).

Acidifying chemicals are selected that result in the production of minimal hazardous waste. If characteristic hazardous waste is produced, the waste is managed as described in the Contractor's Work Plan. All acid treatment waste solutions may be ~~stored~~ placed in lined 20-yard roll-off bins pending sampling, waste characterization, and ~~disposal~~processing.

3.15 Well Step-Testing

A step-test may be performed to evaluate well yield or the effectiveness of the well rehabilitation on the well screens and filter pack to improve well yield. Following pump removal and any other optional activities, a rest period is allowed for aquifer recovery to steady state conditions (e.g., 12 hours).

An initial static water level measurement is taken prior to pump removal to reference as the baseline static water level. Prior to the start of a step-test, the water level is measured and compared to the baseline level to see that static water level conditions have been obtained within a reasonable amount of error (e.g., ± 0.5 f~~ee~~t). Since a step-test is a single well test to record drawdown levels at various steady-state pumping rates, the initial static level in the well is not critical for hydraulic analyses. Other extraction wells do not need to be shut down during the testing, as the impact from other extraction wells is relatively insignificant compared to the drawdown measured during the step-test and the sensitivity of the step-test analysis.

A temporary submersible pump/piping is installed into the well capable of producing the highest step flow rate under an expected total dynamic head. An inline flowmeter is necessary to monitor pumping rate. A pipe connection from the pump drop pipe to the existing conveyance line pipe in the vault may need to be fabricated for the step-test. Appropriate connector flanges, piping, and gaskets are to be provided to connect the temporary pump to the existing conveyance line. Disassembly and removal of vault instrumentation, equipment, and associated piping may be necessary to access the desired conveyance line hook-up point.

Once all physical and electrical connections are made and initial pump operational tests are complete, a water level probe(s) is installed within the sounding tube to record water level readings throughout the test. The step-test follows a pumping schedule without interruption based on field observations and equipment constraints.

Below is an example pumping schedule:

- 100 gpm for 60 minutes
- 150 gpm for 60 minutes
- 200 gpm for 60 minutes
- 250 gpm for 60 minutes.

Records of the time, pump flow rate, water levels in the well, and time for each step are recorded. Water level readings are to be taken at set intervals. An example of reading intervals is 1 reading per minute for the first 5 minutes and every 5-minute intervals thereafter for each step. The test water is pumped directly to the GWTS for treatment. At the completion of the test, all temporary piping, pump, and associated equipment are removed from the well and the original equipment can be installed provided there are no additional work requirements for the well.

3.16 Alarm Testing

Operators perform alarm testing ~~at least annually~~ semi-annually to ensure that:~~–~~ (1) alarm equipment has not failed; and (2) during an alarm condition, the system responds properly to the alarm. Alarm testing occurs on equipment affected by programming changes that may affect alarm equipment or response. Alarm testing typically consists of manually faulting or simulating fault conditions in order to have the system exhibit a fault alarm and response. Manual faulting is recommended on alarm equipment that is accessible and can be easily faulted (leak detectors). Leak detectors are tested by completing their circuit either using water, voltage meter, or conductors, but using water from the well(s) associated with the leak detector is recommended as this most closely resembles real-world conditions in the case of a leak. Certain equipment can be manually tested to see if they alarm; however, manual testing cannot be performed during normal operations (high pressure switches and tank level sensors). High pressure switches can be tested by isolating the location of the pressure switch and pressuring the line with potable water. The Operator ensures there is a gauge on the isolated line to test the switch pressure set point at the same time. Tank level sensors can be tested by manually operating the extraction well, influent, and effluent pumps to bring the tank levels above or below the level needed to cause the alarm condition.

Items that are inaccessible, difficult to fault under normal operating conditions (tank level sensors, high pressure switches), or could pose risk to equipment or personnel (skid power loss, extraction well alarms) can be tested for system response by simulating an alarm condition either through the software or by tripping breakers in the PLC panel. While simulation does not test the alarm equipment for function, conditions that typically cause these types of alarms result in shutdown of the affected system regardless

of PLC shutdown commands, except for the tank level sensors and high pressure switches (which can be tested manually for equipment function as described in the previous paragraph).

3.17 Flowmeter Verification Testing

Operators perform flowmeter verification testing at least annually to ensure that extraction well, influent, and effluent flowmeters are providing accurate flow information and totalized volumes. Flowmeter verification testing is typically performed by the following steps:

- Isolate the influent tanks.
- Shut down a treatment train and its respective extraction wells ~~(KAFB-106233 and KAFB-106234 for Train 1 during standard operation; KAFB-106228 and KAFB-106239 for Train 2 during standard operation)~~.
- Operate well pumps individually for the shutdown train using the "ON" mode on the SCADA for approximately 5-10 minutes each (as tank capacity allows), noting the following three items once flow has reach its maximum: ~~–~~ (1) the start and end times of operation, (2) average flow rate of the flowmeter (taken from the flowmeter directly), and (3) initial and final tank levels on the flowmeter verification form (~~Appendix H~~Appendix G).
- The average flow rate from the flowmeter is then compared to the tank volume change (calculated from the tank level change) divided by the change in time. If the flowmeter average flow varies by more than 5 percent from the tank calculated flow rate, the tested flowmeter requires recalibration. Recalibration is performed in accordance with manufacturer's specifications provided in ~~Appendix I~~Appendix H. Any recalibrated flowmeter is retested following recalibration. In the event that the recalibrated flowmeter fails to produce less than 5 percent error using the method described above, the flowmeter is replaced, and the replacement flowmeter tested.
- This process is then repeated for each flowmeter throughout the train. Note that effluent pumps use the loss of water from the effluent tanks in order to calculate the change in level and influent flowmeters can be tested using either change in influent or effluent tank level. Once all testing on a train has been completed, the other train then undergoes the same testing procedure until all of the flowmeters of the GWTS have been tested and verified.

3.18 Maintenance Logs

The Operators maintain logs that document and record all routine and non-routine maintenance activities. Forms used for recording general inspection, calibration of instruments, maintenance, and repair of equipment are provided in ~~Appendix H~~Appendix G. An example log sheet for lock-out/tag-out activities that may be required for equipment maintenance and repair activities is provided in ~~Appendix H~~Appendix G. Additionally, any records for repair of equipment (service invoices, spare parts orders and invoices, and service reports) are retained in an equipment file for individual pieces of equipment. Separate forms for maintenance and calibration of flowmeters are provided in ~~Appendix H~~Appendix G. The Contractor maintains hard copies of these records onsite in the GWTS building control room or the Contractor's office. If hard copies of records are kept offsite, electronic copies of the maintenance records are available to the Operator at the GWTS.

3.19 Non-Routine Maintenance and System Adjustments

Certain non-routine maintenance activities are uncommon. In the case that these activities occur, generalized procedures can be referenced here.

3.19.1 Emergency Conveyance Line Repairs

If the influent conveyance line is damaged, a current contract in place holds that the subcontractor will follow a general guideline, which is summarized below.

In the case that a damaged line results in water loss, NMED will be verbally notified as soon as possible after learning of the release, but no more than 24 hours thereafter.

The subcontractor will locate the damaged section of GWTS conveyance line and excavate the dirt to expose the damaged line. If the extraction well(s) associated with the damaged line have not already been automatically shut down due to a conveyance line leak detect, the well(s) in question will be shut down manually following immediate identification of the well(s). The subcontractor will make temporary emergency repairs to prevent further water loss and will remove any standing water and containerize for pending disposal/processing. Contaminated soil will also be containerized for pending disposal. Site security and safety will be maintained, and proper documentation of the incident will be completed. The subcontractor will then provide the necessary plans, drawings, and other documentation to properly repair the damaged conveyance line. Once repairs are completed, the newly repaired line and its alarms will be tested. The excavation will be backfilled and compacted; roadways, sidewalks, or landscapes will be reconstructed; and any remaining waste will be removed and held offsite. A full detailed list of the procedure is provided in ~~Appendix I~~Appendix H.

An emergency replacement double-wall conveyance line for all four extraction wells (KAFB-106228, KAFB-106233, KAFB-106234, and KAFB-106239) and for combined lines (KAFB-106233/234 and KAFB-106228/239) is stored in the GWTS yard (Table 3-2). Note that the conveyance line material for KAFB-106228 is separate from the other extraction wells and must only be used with KAFB-106228.

The treated effluent meets all applicable standards as specified in Table 1-3. In the event that the effluent line is damaged, the system will be shut down and the leak will be contained. The subcontractor will make temporary emergency repairs to prevent further water loss. The extent of the spill will be marked with temporary flagging to identify the spill area should sampling be required. Spill notification will be made to NMED GWQB and HWB, in accordance with DP-1839 Condition No. 27. Upon repair of the piping, effluent line integrity testing will be performed prior to continued operation.

3.19.2 Single Train Diversion

If a train (Train 1 or 2) is damaged, undergoing servicing, or is otherwise unable to operate under normal conditions, the influent water for that train can be diverted into the other train to continue to pump a maximum number of extraction wells as possible through the GWTS. It should be noted that ~~E~~extraction wells can be routed to either treatment train during operation using ~~the influent tree~~system ~~valving~~influent manifold valves.~~,~~ ~~h~~However, during standard operation ~~t~~Train 1 operates with extraction wells KAFB-106233 and KAFB-106234 ~~while~~and ~~t~~Train 2 operates with e~~E~~xtraction wells KAFB-106228 and KAFB-106239.

To divert influent water for one train into the other, shut down the GWTS and ensure all four extraction wells are offline. Place the inoperable train's influent pump skid VFDs into manual to prevent accidental

pump operation. At the influent tree, isolate the influent from the operable train by closing the train's valve above the bypass. If only the wells from one train will be pumped into the other train (e.g., pumping KAFB-106228 and KAFB-106239 through Train 1, or pumping KAFB-106233 and KAFB-106234 through Train 2), isolate the wells not to be pumped through by closing the respective train's valve *below* the influent tree bypass. Lastly, open the butterfly valve at the influent tree bypass to combine the flows from the influent of both trains. Ensure that the valves are in their correct opened or closed positions. Restart only the operable train and extraction wells and adjust the throughput gallons per minute, as necessary.

3.20 Groundwater Treatment System Consumables and Small Parts Information

The GWTS contains materials and supplies needed for occasional O&M activities. Table 3-2 provides a list of large items, such as replacement pumps. A recommended inventory of on-hand specific consumable supplies, recommended supplier, and part numbers is provided in Table 3-3. A list of tools and small parts that are present in the GWTS to perform various O&M activities is provided in Table 3-4. Several items that are required for GWTS operations need to be provided by the Contractor. Tables 3-2 through 3-4 denote items that are transferable between Contractors and non-transferable items that are the responsibility of the Contractor to purchase.

4. SYSTEM TROUBLESHOOTING

Occasionally, during day-to-day GWTS operations, certain system-specific issues may occur. This troubleshooting section exists to remedy such issues. User operational adjustments are provided in ~~Appendix L~~Appendix K.

4.1 Influent Valve Set Points

During times when wells are offline, the valves on the influent tree may require adjustment to keep from preferentially filling one influent tank over the other, especially when the influent tanks are not open to equalization or equalization is hampered (as described below). This can cause operational issues and downtime as the tanks may activate a high- or low-level switch. For instance, when operating wells KAFB-106228, KAFB-106233, and KAFB-106234, the valve on the influent tree associated with KAFB-106228 is closed to approximately 60 percent to obtain similar flow rates to the influent tanks. Set points have been marked on the influent valve indicators; however, it is important that the Operator be aware of the need to adjust these valves in order to maintain consistent flow. Fine tuning of the valves may be required when the system is operating under a different influent flow condition.

4.2 Influent Tank Equalization

The influent tanks are connected by a 6-inch pipe that contains two basket strainers and feeds to both influent skids. Over time, the levels in the influent tanks may begin to deviate as there is a loss of equalization, preferentially pulling water from one tank with both skids. This can cause operational issues and downtime as the tanks may activate a high- or low-level switch. In this instance, the basket strainers are cleaned and inspected.

~~4.3 Underground Injection Control~~UIC Hydraulic Pump Overload Reset

~~The V-smart valve located at KAFB-7 was removed after a hydraulic line failed (ORCOM, 2019).~~

~~Due to power fluctuations associated with on-Base utilities at a UIC, an automated flow control valve located at a UIC well may become to be unresponsive to SCADA/PLC controls. In the event that the smart valve becomes unresponsive, power loss to the hydraulic pump that actuates the valve has likely been interrupted. The first troubleshooting step to determine a loss of power to the hydraulic pump is to ensure that a power outage is not occurring at the UIC. This is accomplished by opening the control panel and seeing if the uninterruptable power supply lights are illuminated. If none of the uninterruptable power supply lights are illuminated, then an outage has likely occurred. Base utilities need to be contacted to resolve the outage. If the uninterruptable power supply lights indicate that power is being supplied to the UIC well equipment, but the hydraulic pump lights are not illuminated, the hydraulic pump needs to have its overload protector reset. The overload protector is reset by first opening the hydraulic pump cabinet. Next the Operator disconnects power to the cabinet. The Operator then removes the cover over the overload switch and presses the reset button. Once reset, the cover is returned and the unit is reenergized.~~

~~4.4~~4.3 KAFB-106233 and KAFB-106234 Start Order

Occasionally, when KAFB-106233 is offline and KAFB-106234 is started, KAFB-106233 initializes and then fails. The easiest way to correct this is by setting KAFB-106233 before KAFB-106234 in the startup sequence. If KAFB-106233 is not intended to operate at the same time as KAFB-106234, then KAFB-106233 should be deenergized prior to startup of KAFB-106234. In the event that KAFB-106233 needs to be initialized following KAFB-106234, then the system should undergo a standard startup; and,

following failure of KAFB-106233, the alarm condition can be reset by manually opening the remotely actuated valve, resetting the alarm on the SCADA, running KAFB-106233 locally, and then returning KAFB-106233 to the auto mode on the motor starter. KAFB-106233 must now be restarted using the "on" button on the SCADA. Once in operation, press the "auto" button to return the well into PLC controlled operation.

5. PROCESS MONITORING

This section provides an overview of the monitored operating parameters and sampling used to determine the performance of the ~~carbon~~GAC treatment system and quality of treated water discharged to the GCMP or a UIC well. The full requirements for sampling and analysis are covered in the Sampling and Analysis Plan (~~Appendix J~~Appendix I). The results of the process monitoring sampling are used to evaluate performance of the ~~carbon~~GAC beds and determine if the online beds require ~~carbon~~GAC change-out. The analytical results are reviewed to confirm that the contaminant concentrations meet the discharge criteria provided in ~~Appendix J~~Appendix I.

Analytical results will be reported in routine monitoring reports (e.g., Quarterly Monitoring Report) to NMED as required in any approved permit. Each reporting event consists of a Data Quality Summary Report and laboratory data packages. For details on sampling and analysis procedures, refer to the Sampling and Analysis Plan (~~Appendix J~~Appendix I). The Sampling and Analysis Plan includes laboratory testing requirements and the achievable laboratory limits.

Operational parameters for the treatment system are monitored by the SCADA. The SCADA records the output of automated flow and level instruments communicating with the PLC. The SCADA also records alarms and operating time totals for the influent pumps. These data are downloaded monthly and stored electronically by the Contractor for use in generating any system-related reports. System shutdowns are recorded on the shutdown logs provided in ~~Appendix H~~Appendix G.

5.1 Extraction Wells

The water level in the well casing, pump status, wellhead pressure, and groundwater flow rate at the extraction wells is monitored and recorded by the SCADA as part of normal process monitoring. Filter pack level at all extraction wells is monitored and recorded, at a minimum, annually. Laboratory analysis samples are collected in accordance with the Sampling and Analysis Plan (~~Appendix J~~Appendix I). In addition to the information collected by the SCADA, the Operators record the readings of the local instruments in the well vaults for KAFB-106228 and KAFB-106239 as well as in the WCH for wells KAFB-106233 and KAFB-106234. These include any manual gauges located at the wellheads, WCH, and conveyance line vaults. These readings are recorded at least once per month using the forms provided in ~~Appendix H~~Appendix G.

Water level transmitters were installed in KAFB-106233, KAFB-106234, and KAFB-106239 to replace the transducers. Water level data from the new transmitters are automatically recorded by the GWTS SCADA.

5.2 Treatment System

As noted above, GWTS operational parameters are recorded by the SCADA. These parameters include the following:

- Extraction well flow rates
- Extraction well head pressures
- Extraction well water levels
- Influent skid flow rates
- Effluent skid flow rates
- Total system flow rate
- Upstream distribution pressure

UIC well flow rates

- UIC wellhead pressures
- UIC well water levels
- GCMP level.

In addition to the SCADA data, the Operators record the readings of the differential pressure gauges on all four of the influent bag filter housings (PDI-112 A/B and PDI-116 A/B) and record the inlet and outlet pressure gauge readings on all ~~carbon~~GAC beds and pump skids (PI-3104 A/B and PI-3105). The Operator also records the totalizer readings from all flowmeters. These readings are recorded on the forms provided in ~~Appendix H~~Appendix G. All data from the GWTS, including run data gathered from the wells, WCH, vaults, and treatment plant operation logs, maintenance, and regular inspections, are reviewed quarterly by project engineering personnel and provided in the quarterly reports. This review identifies trending details of the performance of wells, pumps, and treatment equipment.

The Operators must specifically collect the following information relevant to KAFB-7, KAFB-106IN2 and any additional UIC wells installed in the future in accordance with DP-1839 Condition No. 21 (~~Table~~ Table 1~~-~~-2):

- Monthly average, maximum, and minimum values for flow rate and volume of treated effluent transferred to each UIC well
- The totalized monthly volume of treated effluent transferred to all UIC wells
- Monthly average, maximum, and minimum head values of injection water for each UIC well.

A transmitter is installed in ~~a~~ each UIC well to monitor water level and ensure that the well is not overfilled during injection. The transmitter replaced the previous transducer. The PLC is programmed to shut down the well if the water level in the well exceeds the high-level set point. Water level data from the transmitter are automatically recorded by the GWTS SCADA.

5.3 Influent and Effluent Monitoring

Influent water to be processed by the GWTS must meet certain standards prior to processing to mitigate the potential release of partially treated water to select discharge locations. Influent water concentrations have been established for water that reaches the lead GAC vessel; these concentrations are presented in Table 5-1~~ and are based upon manufacturer models provided in Appendix G~~.
GWTS effluent must comply with any approved federal, state, or local permits (DP-1839 and NPDES). Effluent discharged from the GWTS must not exceed the discharge criteria identified in ~~Appendix J~~Appendix I. Extraction well, influent, post-lead GAC vessel, and effluent sampling locations are described below.

Extraction Wells—Samples are collected from a sample port located at the wellhead and/or the WCH just downstream of the flowmeter. All of the extraction wells are capable of being sampled individually.

Samples are obtained at six locations throughout the plant. Each train can be sampled at each location individually.

Influent—Samples are collected at the combined outlet of the influent pumps, but prior to the pre-treatment bag filters on the influent pump skids.

Post-Lead GAC Vessel—Samples are collected at the outlet of the lead ~~carbon~~GAC vessels. Each train can be sampled individually.

Effluent—Samples are collected at the outlet of the effluent pump, but prior to the post-treatment bag filters on the effluent pump skids.

Extraction well and GWTS sampling schedules and analytes are described in ~~Appendix J~~Appendix I.

6. RECORDKEEPING

Records of the GWTS O&M and monitoring are maintained for use by operating personnel, management, and appropriate regulatory agencies. The proper collection and archiving of information are essential as the GWTS is intended for multiple years of operation. These records are used to establish a baseline and performance history of the GWTS. Records may be used for the following reasons:

- Evaluate plant performance
- Assist in troubleshooting operational problems at the GWTS
- Ensure the preventative maintenance schedule is performed
- Provide information for reports to regulatory agencies
- Comply with relevant permits and regulations.

Records are maintained by the Contractor onsite in the GWTS building control room or in the Contractor's office. Operators have access to electronic copies of the records if the hard copies are maintained in the Contractor's office. Records include hard copies of the O&M log sheets included in ~~Appendix H~~Appendix G and computerized operating records. Copies of reports are available to Operators electronically and at the Contractor's office. Waste characterization, generation, and waste records are maintained by the Contractor in accordance with the RCRA Permit.

6.1 Reporting

The Contractor submits weekly performance updates, monthly New Mexico Office of the State Engineer extraction/injection volumes, monthly Kirtland AFB Civil Engineering updates, and quarterly and annual performance reports, as required. Table 6-1 provides a list of reports, report contents, regulatory permits and/or documents requiring the reporting, and entities to which these reports need to be submitted. Examples of weekly and monthly reports are provided in ~~Appendix N~~Appendix M. Note that weekly reports are internal reports only (between the Contractor, USACE, and Kirtland AFB), and are used as an operational tool to evaluate and track operation and performance of the GWTS. All quarterly and annual reports are submitted to Kirtland AFB for review, approval, and submittal to NMED and can be found on the most recent project website (hosted and updated by Kirtland AFB or Contractor support). The quarterly and annual reports must include the items listed in Table ~~5~~6-1 as well as the following:

- Monthly average, minimum, and maximum flow rate values collected throughout the system
- Total monthly/quarterly/annual treatment volumes
- Monthly volumes distributed to each discharge location
- Total monthly volumes extracted from extraction well(s)
- Monthly average, minimum, and maximum head values from extraction well(s)
- Percent system runtime per quarter/annum
- Average operational groundwater extraction rates for individual wells per quarter/annum
- Average specific capacities for individual extraction wells per quarter/annum

- Analytical metrics including system sampling forms, analytical results, with laboratory and data quality reports, and estimated EDB removal per quarter/annum

- Summary of routine and non-routine equipment maintenance activities, repairs, and modifications if performed, including but not limited to the following:

  — Bag filter change-outs
  — GAC change-outs
  — Mechanical integrity evaluations
  — Well rehabilitation
  — Malfunction, repair, or replacement of a flowmeter
  — Operational changes with the potential to affect discharge quality

- Status of off-Base conveyance line security and administrative controls per quarter/annum

- Summary of shutdown and alarm events, including O&M issues that contributed to significant downtime for the GWTS.

The quarterly and annual performance reports of the GWTS are incorporated into the Quarterly Reports, which are submitted at the following frequency:

- Report inclusive of January 1 through March 31 is due June 30 of the same year
- Report inclusive of April 1 through June 30 is due September 30 of the same year
- Report inclusive of July 1 through September 30 is due December 31 of the same year
- Report inclusive of October 1 through December 31 is due March 31 of the next year.

The Operator makes any required notifications to the GWTS Project Manager, who then notifies Kirtland AFB, who must then make any required regulatory notifications to NMED. Specific to the discharge requirements, the Contractor provides validated monitoring data in the Quarterly Reports to NMED.

The entire system performance is evaluated by a qualified engineer and/or hydrologist, at a minimum, annually. Well performance parameters (flow rates, drawdown, changes in water chemistry, as well as performance of the ~~carbon~~GAC beds and mechanical/electrical systems) are evaluated quarterly. Trending data are incorporated from sampling, run logs, maintenance activities, and Operator feedback. The evaluations are included in the appropriate report and provide direction for further maintenance or optimization of the system and its components.

6.2 Equipment Warranties

Manufacturer's warranties for GWTS equipment are included with the manufacturers' information in ~~Appendix I~~Appendix H. The Contractor monitors system performance and identifies the need for additional spare parts based on assessing the likelihood of component failures and consequences. Spare parts and consumables are addressed in Section 3.15. Subcontractors for construction and installation of GWTS components provide guarantees that all work and services performed are in accordance with accepted standards and practices. These subcontractors also guarantee that all equipment and materials are furnished against defects in construction and/or workmanship for a period of 1 year following completion of its work and acceptance.

7. WASTE MANAGEMENT

Onsite waste management is performed by the Operator or other designated waste management person. Bag filters, water from monitoring wells, backwash water, depleted GAC, and pH adjustment solutions are the primary waste items requiring management at the GWTS facility. All waste requiring specialized disposal is disposed of in accordance with applicable permits.

7.1 Bag Filters

Spent bag filters are produced after any bag filter change-out occurs. The bag filters are dried prior to disposal and disposed of as non-hazardous solid waste; supporting documentation for this disposal decision is provided in ~~Appendix K~~Appendix J.

7.2 Monitoring Well and Maintenance Activity Water

All groundwater generated during well installation, development, or routine groundwater monitoring events and all well maintenance activities are 100 percent captured and contained during generation. The following categories of water are discussed in the paragraphs below:

- **Non-hazardous water** generated from:
  - Water from wells for which the sampling data for two consecutive preceding sampling events document no contaminants are present at concentrations that meet the definition of characteristic hazardous waste (40 Code of Federal Regulations [CFR] Part 261).
- **Hazardous/potentially hazardous water** generated from:
  - Water from wells for which any data from two consecutive preceding sampling events document contamination is present at concentrations that exceed the characteristic hazardous waste toxicity criteria (40 CFR Part 261.24) that have not been characterized.
  - Water from wells for which historical data show water quality fluctuating between non-hazardous and hazardous classification over the past four quarters that have not been characterized.
  - Water that had concentrations relatively close to the regulatory standard in 40 CFR part 261.24 (e.g., water that exhibited benzene above 0.4 mg/L in at least one of the previous two events that has not been characterized).
  - Decontamination water from equipment cleaning across all hazardous or potentially hazardous well activities that has not been characterized.
- **Water of unknown quality** generated from installation, development, decontamination, sampling, maintenance, or other activities for which data are not available for two sampling events and that has not been characterized.

7.2.1 Non-Hazardous Water

Based on the previous sampling data as described above, non-hazardous water generated from well sampling activities do not require segregation either at the point of generation or while ~~in storage~~ contained at the GWTS. Water generated at these wells is discharged to the GWTS in-floor sump if they meet the investigation-derived waste requirements provided in ~~Appendix P and summarized in~~ Table 5~~6~~-1. Water that does not meet the requirements ~~outlined in Appendix P~~ is disposed of at an offsite location. Water discharged to the GWTS in-floor sump is pumped from the sump to the Train 1 influent tank for treatment through the system. The quantity of water generated from each well and the total quantity of water transferred to the GWTS in~~-~~-floor sump is recorded. A minimal quantity of fines is anticipated to be present in this water and pre-filtering before batching into the GWTS is not anticipated. ~~At the discretion of the Operator,~~ Unfiltered water ~~may~~ will be run through a ~~50-,~~ 10~~-, or 1-~~micron bag filter as a pretreatment step to remove any sediments.

If, for any reason, the GWTS cannot accept water as it is generated (e.g., shut down for maintenance, improper flow condition, etc.), the water is temporarily stored in the investigation-derived waste area on pallets and properly labeled until it can be discharged to the GWTS in-floor sump.

7.2.2 Hazardous/Potentially Hazardous Water

Based on the previous quarterly sampling event as described above, characteristically hazardous water generated from well sampling activities is kept segregated by point of origin both during transport and ~~in storage~~while pending disposal. Upon generation, the water is placed in dedicated drums and transported to the less than 90-day accumulation area where the drums are labeled and ~~stored~~ held pending receipt of laboratory analytical results. This water is profiled for disposal based on the analytical data from the sample collected from the generating well. If the water is determined to be non-hazardous following characterization and meets the criteria identified in ~~Appendix O,~~Table 5-1 then that water is processed as described in the above section. Water generated from uncharacterized sources is treated the same way as the hazardous water until proven that the water is non-hazardous. The quantity of water generated from each well or activity is recorded.

Drums containing hazardous purge water are labeled with standard “Hazardous Waste” labels with RCRA waste code identified on the label and a separate label with the identifying hazard(s) of the waste. For the BFF hazardous purge water, the RCRA code is D018 and the hazard identification is “Toxic.”~~-~~ Updated labeling requirements are found in 40 CFR 262.17(a)(5)~~,~~ which were promulgated by EPA under the Generator Improvement Rule in May 2017 and adopted by NMED in ~~December,~~December 2018 (20.4.3 New Mexico Administrative Code).

Drums that contain potentially hazardous purge water are labeled with “This Container ON HOLD Pending Analysis.”~~-~~ Upon receipt of analytical data, the drum is either relabeled as hazardous or non-hazardous as dictated by the analytical results. Once classified as non-hazardous purge water, the drum is moved out of the <90-day accumulation area to the BFF non-hazardous investigation-derived waste yard.

7.2.3 Water of Unknown Quality

Water of unknown quality associated with installation, development, maintenance, or other activities is initially placed in portable tanks located at the wellhead where it is produced. Any fines are allowed to settle before the water is transported, on a daily basis, using vacuum trucks from the wellhead to a centralized storage area where it is pumped into storage tanks. The quantity of water generated~~,~~ and the total quantity of water transferred into any storage tanks is recorded. Upon conclusion of an activity, or

when a storage tank reaches capacity, one water sample is collected from the tank; proper disposal/processing takes place upon receipt of the analytical results. Upon receipt of the analytical results confirming that the water is non-hazardous and conforms to the requirements identified in ~~Appendix O~~Table 5-1, the water is processed as described in Section 6.2. If the water is hazardous based on toxicity characteristics or does not conform to the requirements identified in ~~Appendix K~~Appendix J or Table 5-1, the water is disposed of offsite in accordance with appropriate regulations.

7.3 Pre-Treatment pH Adjustment ~~and Disinfection~~

A pH adjustment will be performed for any IDW water associated with well cleaning and redevelopment events that require chemical clean with acid treatments. The pH will be adjusted with soda ash, or other appropriate basic materials, until a pH of 7 is obtained. Once adjusted, the water can be processed as described in the investigation-derived waste processing requirements provided in Section 7.2. Any basic material used for the pH adjustment will be ~~Sodium hypochlorite solution (8.25 percent) is used for two pre-treatment processes: (1) injection as an oxidant, disinfectant upstream of the pre-treatment sand filters; and (2) to adjust the pH, disinfect investigation-derived waste monitoring network purge water prior to disposal. The sodium hypochlorite solution is stored in the GWTS building on secondary containment pallets. The GWTS is registered with the Kirtland AFB Hazardous Materials Group as Shop Number 1706A. Any hazardous materials, such as sodium hypochlorite solution or calibration gas for instruments, must be~~ tracked and tagged with a Hazardous Waste Group label, use recorded, and storage capacities must not exceed the prescribed limits outlined in Kirtland AFB Hazardous Materials Group's Shop No. ~~umber~~ 1706A database. ~~Monthly reports are provided to the Kirtland AFB Hazardous Materials Group documenting chemical usage and restocking orders that occurred during the month.~~Materials will be used on an as needed basis and will not be stored within the GWTS.

~~7.3.1 Sand Filter Pre-Treatment~~

~~Following installation of the pre-treatment sand filters, dosing pumps were installed to inject commercially available sodium hypochlorite solution into the influent water. The sodium hypochlorite solution container is emptied directly into the dosing pump hopper. No sodium hypochlorite waste is expected from this process.~~

~~7.3.2 Investigation-Derived Waste Purge Water~~

~~Some monitoring network purge water may contain below neutral pH that requires adjustment or biological materials that need to be removed. A pH adjustment can be performed on water less than neutral to neutral conditions by adding commercially available sodium hypochlorite solution to the water. Additionally, sodium hypochlorite can be used as a disinfectant on waters with the potential to introduce high quantities of unwanted organisms into the system. When performing a pH adjustment or disinfection with sodium hypochlorite solution, ensure that the pH of the water being adjusted is continuously monitored. Once adjusted, the water can be disposed of per the investigation-derived waste processing requirements provided in Section 7.2. No sodium hypochlorite waste is expected from this process.~~

7.4 Backwash Water

Backwash water from GWTS components (GAC vessels, ~~tanks~~sand filters, etc.) is created when the components require backwashing due to differential pressure increases or during change-out of the GAC.

Backwash water originating from the sand filters is transferred to the clarifier and then to the internal sump where it is processed through the Train 1 influent tank. During processing, the backwash water is

pre-treated with sodium hypochlorite and processed through the sand filters and bag filters. This pre-treatment process removes biological materials and eliminates any remaining microbes within the backwash water.

Backwash water originating from GAC change-out or backwash events is containerized in a 21,000-gallon onsite storage tank. The backwash water is given sufficient time for suspended solids to settle, and then is filtered prior to processing through the GWTS. The backwash water is processed through the GWTS influent tanks where it is pre-treated with sodium hypochlorite and processed back through the sand filters and bag filters. This pre-treatment process removes biological materials and eliminates any remaining microbes within the backwash water. Backwash water is characterized prior to ~~disposal~~ processing through the GWTS. ~~Backwash water likely requires settling of fines and pre-filtration before being discharged to the GWTS.~~ In the event that the backwash water cannot be filtered effectively, the backwash water is disposed of offsite in accordance with appropriate regulations. ~~Backwash water sampling requirements are described in the Sampling and Analysis Plan (Appendix J).~~

While not expected, it is possible to experience desorption of contaminants during backwashing of the GAC vessels. If the presence of desorbed contaminants is detected within the backwash water, it will be processed through the GWTS influent. In the event that the backwash water cannot be processed through the GWTS for either of the above reasons, the backwash water is disposed of offsite in accordance with appropriate regulations. Backwash water sampling requirements are described in the Sampling and Analysis Plan (~~Appendix J~~Appendix I, Section ~~J~~I.2.3).

7.5 Depleted Granular Activated Carbon

Eventual depletion of the ability of the GAC to remove contaminants of concern will require removal of the depleted GAC from their associated vessels. Depleted GAC is removed from the GAC vessels and regenerated offsite by a third party for ~~reuse~~ recycling ~~in accordance with appropriate permits and regulations~~. The ~~R~~regeneration process involves thermal regeneration through a rotary kiln~~s~~ at temperatures up to 1,450 degrees Fahrenheit~~°F~~. A certificate of regeneration will be provided to Kirtland AFB, by the third party, upon completion of the GAC regeneration.

7.6 Used Pump Oil

Used pump oil and oil-contaminated materials including gloves, paper towels, or plastic bags are ~~stored~~ kept in labeled, lined 5-gallon buckets placed on polyethylene pallets with secondary containment in the GWTS building's southwest corner. Once the containers are near to being full, the oil and materials are recycled or disposed of, in accordance with approved Base requirements.

8. REFERENCES

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NMED. 2016. Correspondence from Trais Kliphuis, Director, Water Protection Division to Mr. Wayne L. Bitner, Chief, Environmental Restoration, Kirtland Air Force Base, New Mexico, regarding DP-1770 Modification Application and Termination. April 4.

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NMED. 2017b. Bulk Fuels Facility Expansion of the Dissolved-Phase Plume Groundwater Treatment System Design, Revision 2, Solid Waste Management Units S—106/SS-111, Kirtland Air Force Base, Bernalillo County, New Mexico, by the New Mexico Environment Department Groundwater Quality Bureau. May.

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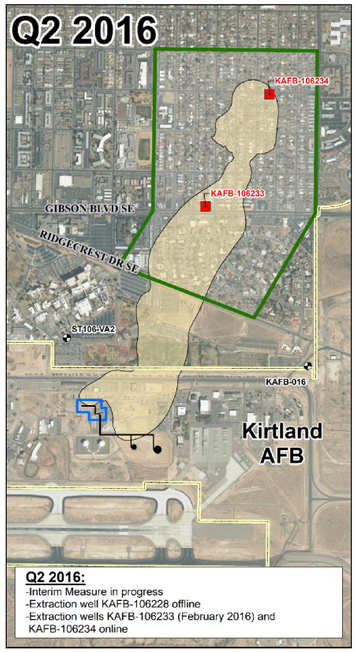
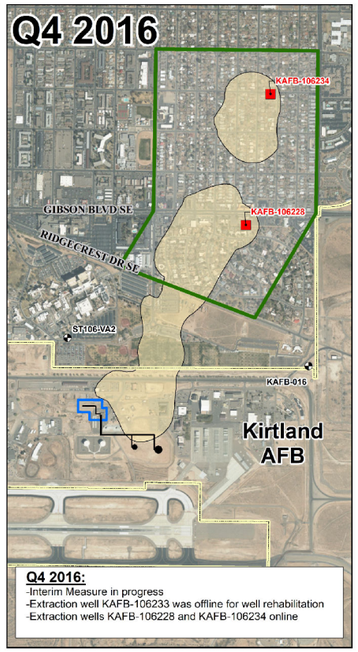
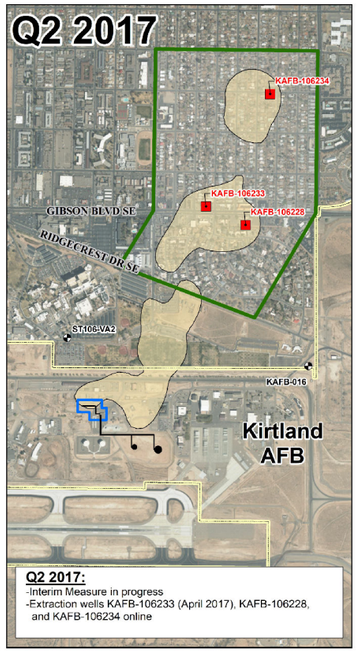
NMED. 2020. Disapproval of Operations and Maintenance Plan Groundwater Treatment System, Bulk Fuels Facility Solid Waste Management Units ST-106 and SS-111 Revision R3, Kirtland Air Force Base, New Mexico, by the New Mexico Environment Department Hazardous Waste Bureau. December.

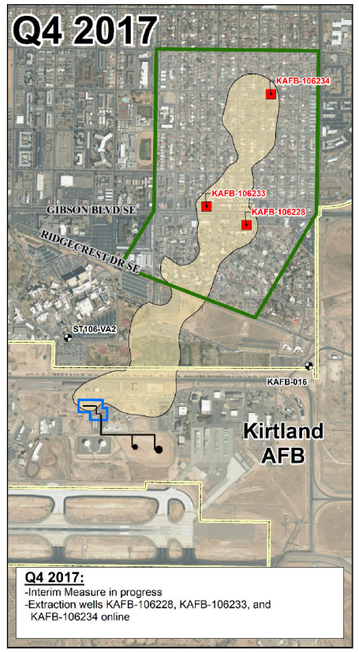
~~ORCOM. 2019. KAFB-7 Injection System Repair and Improvement, Bulk Fuels Facility Report, Kirtland Air Force Base, New Mexico. May.~~

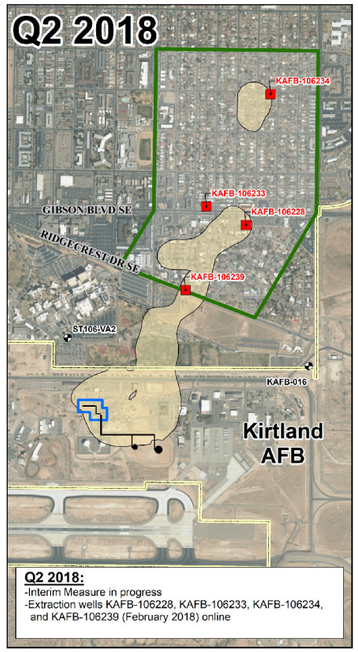
FIGURES

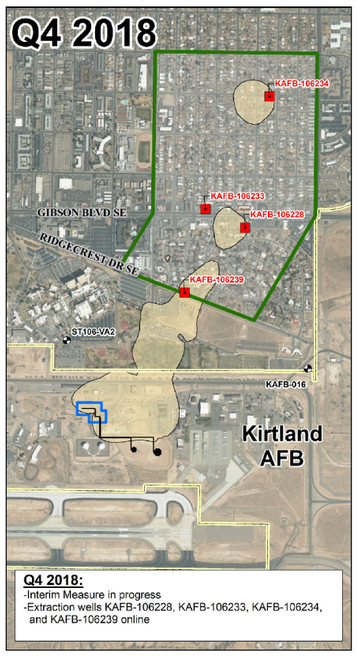


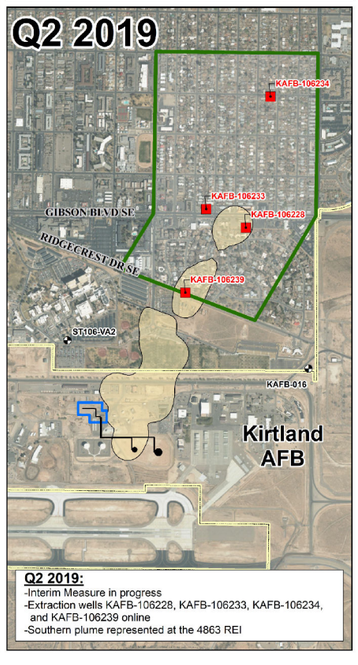


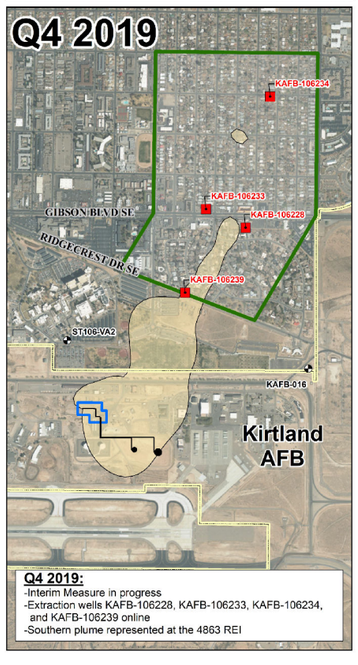


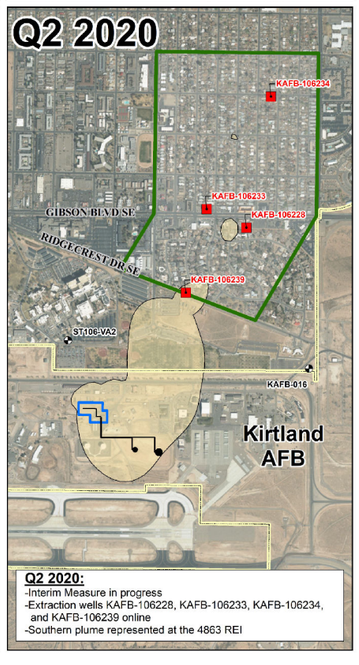










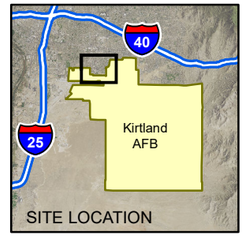


General Notes:
-Aerial imagery provided by ESRI Online service
-EDB plume models generated with C-Tech MVS Premier Version 9.94

Acronym(s):
AFB = Air Force Base
EDB = ethylene dibromide
EPA MCL = Environmental Protection Agency maximum contaminant level
REI = reference elevation interval in feet
SWMU = solid waste management unit
WUA = Water Utility Authority
µg/L = microgram(s) per liter
Q2 = quarter 2
Q4 = quarter 4

Legend

- Drinking Water Supply Well
- Kirtland AFB Extraction Well
- Kirtland AFB Installation Boundary
- Former Fuel Transfer Lines
- Former Aboveground Storage Tank
- Bulk Fuels Facility (SWMU ST-106/SS-111)
- Interim Measure Operational Area for Dissolved-Phase EDB
- Dissolved-Phase EDB ≥ 0.05 µg/L (EPA MCL) in REI 4857



N

0 1,250 2,500 5,000

Feet

Reference Scale: 1:30,000

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

OPERATIONS AND MAINTENANCE PLAN
REVISION 4
GROUNDWATER TREATMENT SYSTEM
SOLID WASTE MANAGEMENT UNIT ST-106/SS-111
KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE 2-1

PROGRESS ON DISSOLVED-PHASE EDB COLLAPSE IN TARGET CAPTURE ZONE

P:\Projects\Kirtland\Figures\BFF Workplan\WP-R4\2-1_WP_R4_Progress on EDB Collapse_Q216-Q220.mxd 1/10/2021 EA ecarpio

TABLES

Table 1-1
Applicable Permits

Permit	Issuing Agency	Date Issued	Date Expires	Permitted Activities
New Mexico Environment Department Permits				
Discharge Permit, DP-1839	Ground Water Quality Bureau New Mexico Environment Department 1190 South St. Francis Drive Santa Fe, NM 87502-5469	28 April 2017	28 April 2022	Discharge Permit for treated effluent maximum discharge of 1,000 gallons per minute to maximum of five underground injection control wells
Hazardous Waste Treatment Facility Operating Permit U.S. Environmental Protection Agency Identification Number NM9570024423	Hazardous Waste Bureau New Mexico Environment Department 2905 Rodeo Park Drive E, Building 1, Santa Fe, NM 87505	July 2010	Permit is administratively extended	The Bulk Fuels Facility corrective action, including the design and operation of the groundwater treatment system, is being implemented pursuant to the Resource Conservation and Recovery Act corrective action provisions in Part 6 of the Resource Conservation and Recovery Act Permit
State of New Mexico Office of the State Engineer Permits				
RG-1587	State of New Mexico Office of the State Engineer District I 5550 San Antonio NE Albuquerque, NM 87109	10 December 2015	1 December 2025	Allows for the injection of 1239 gpm (2,000 acre-feet per annum) into injection well KAFB-7
RG-1579 POD 292	State of New Mexico Office of the State Engineer District I 5550 San Antonio NE Albuquerque, NM 87109	17 June 2015	15 June 2025	Allows for the extraction of 250 gpm (403 acre-feet per annum) from extraction well KAFB-106228
RG-1579 POD 309	State of New Mexico Office of the State Engineer District I 5550 San Antonio NE Albuquerque, NM 87109	29 October 2015	1 November 2025	Allows for the extraction of 200 gpm (323 acre-feet per annum) from extraction well KAFB-106233
RG-1579 POD 310	State of New Mexico Office of the State Engineer District I 5550 San Antonio NE Albuquerque, NM 87109	29 October 2015	1 November 2025	Allows for the extraction of 200 gpm (323 acre-feet per annum) from extraction well KAFB-106234
RG-1579 POD 319	State of New Mexico Office of the State Engineer District I 5550 San Antonio NE Albuquerque, NM 87109	7 December 2016	1 December 2025	Allows for the extraction of 200 gpm (323 acre-feet per annum) from extraction well KAFB-106239

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Right of Entry Agreements				
Christ United Methodist Church License to Kirtland Air Force Base	Christ United Methodist Church 6200 Gibson Boulevard SE, Albuquerque, NM 87108	8 January 2020	7 January 2025	Allows for the entry and performance of tasks in an around extraction well KAFB-106228
License Agreement Between the City of Albuquerque and Kirtland Air Force Base	Chief Administrative Officer, City of Albuquerque City-County Government Center, #1 Civic Plaza P.O. Box 1293 Albuquerque, NM 87103	21 September 2016	20 September 2026	Allows for the entry and performance of tasks in an around extraction wells KAFB-106233, KAFB-106234, and KAFB-106239 as well as off-Base conveyance lines and various monitoring wells
New Mexico Veterans Administration Health Care System Permit	New Mexico VA Health Care System 1501 San Pedro SE Albuquerque, NM 87108	28 January 2016	27 January 2021 (Renewal currently in process with agreement to allow access until new agreement is in place)	Allows for the entry and performance of tasks in an around extraction well KAFB-106239 and various monitoring wells
Gibson Medical Center License to Kirtland Air Force Base	Gibson Medical Center 5400 Gibson Boulevard SE Albuquerque, NM 87108	15 July 2016	14 July 2021	Allows for the entry and performance of tasks in an around monitoring wells

gpm = gallon(s) per minute.
KAFB = Kirtland Air Force Base.
Copies of all permits are provided in Appendix A.

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RG-1579 POD 310	State of New Mexico Office of the State Engineer District I 5550 San Antonio NE Albuquerque, NM 87109	29 October 2015	1 November 2025	Allows for the extraction of 200 gpm (323 acre-feet per annum) from extraction well KAFB-106234
RG-1579 POD 319	State of New Mexico Office of the State Engineer District I 5550 San Antonio NE Albuquerque, NM 87109	7 December 2016	1 December 2025	Allows for the extraction of 200 gpm (323 acre-feet per annum) from extraction well KAFB-106239

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License Agreement Between the City of Albuquerque and Kirtland Air Force Base	Chief Administrative Officer, City of Albuquerque City-County Government Center, #1 Civic Plaza P.O. Box 1293 Albuquerque, NM 87103	21 September 2016	20 September 2026	Allows for the entry and performance of tasks in an around extraction wells KAFB-106233, KAFB-106234, and KAFB-106239 as well as off-Base conveyance lines and various monitoring wells
New Mexico Veterans Administration Health Care System Permit	New Mexico VA Health Care System 1501 San Pedro SE Albuquerque, NM 87108	28 January 2016	27 January 2021 (Renewal currently in process with agreement to allow access until new agreement is in place)	Allows for the entry and performance of tasks in an around extraction well KAFB-106239 and various monitoring wells
Gibson Medical Center License to Kirtland Air Force Base	Gibson Medical Center 5400 Gibson Boulevard SE Albuquerque, NM 87108	15 July 2016	14 July 2021	Allows for the entry and performance of tasks in an around monitoring wells

gpm = gallon(s) per minute.
KAFB = Kirtland Air Force Base.
Copies of all permits are provided in Appendix A.

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
	Discharge Permit, DP-1839	
	A. Operational Plan	
1	The Permittee shall implement the following operational plan to ensure compliance with Title 20, Chapter 6, Parts 2 and 4 NMAC. [20.6.2.3109.C NMAC]	Section 1.3 - Discharge Requirements
2	The Permittee shall operate in a manner such that standards and requirements of Sections 20.6.2.3101 and 20.6.2.3103 NMAC are not violated. [20.6.2.3101 NMAC,20.6.2.3103 NMAC, 20.6.2.3109(C) NMAC]	Section 1.3 - Discharge Requirements
3	The Permittee shall ensure that the most recent versions of all Work Plans associated with the GWTS, the effluent conveyance pipeline, and the UIC well(s) are consistent with the requirements of this Discharge Permit. [20.6.2.3101 NMAC,20.6.2.3103 NMAC, 20.6.2.3109(C) NMAC]	NA
4	The Permittee shall ensure all discharges associated with this Discharge Permit are located within the Designated UIC Area within Section 01 of T9N R3E; Sections 05, 06, 07, 08, and 09 of T9N R4E; and Section 31 of T10N R4E (see Appendix B). [20.6.2.3101 NMAC, 20.6.2.3103 NMAC, 20.6.2.3109(C) NMAC]	Appendix C - System Description
5	The Permittee shall ensure that proposed UIC well locations (see Appendix B) and associated discharges are consistent with the most recent approved Stage 2 Abatement Plan for SWMU ST-105. [20.6.2.3101 NMAC, 20.6.2.3103 NMAC, 20.6.2.3109(C) NMAC]	NA
6	The Permittee shall ensure that discharged groundwater effluent is less than or equal to the effluent standards for all constituents referenced in 20.6.2.3103 NMAC. The term "effluent standard" is used in this Discharge Permit to refer to the New Mexico Water Quality Control Commission (NMWQCC) groundwater standard or the federal U.S. Environmental Protection Agency (EPA) maximum contaminant level (MCL); whichever is more stringent. [20.6.2.3109(C) NMAC, 20.7.10.100 NMAC]	Appendix I - Sampling and Analysis Plan
7	The Permittee shall ensure that GWTS influent chemistry is consistent with the design basis of the GWTS. [20.6.2.3109(C) NMAC, 20.7.10.100 NMAC]	Section 5.3 - Influent and Effluent Monitoring
8	The Permittee is authorized to install and operate not more than five UIC wells. Authorized UIC wells are listed in Table 1. [20.6.2.3109(C) NMAC, 20.7.10.100 NMAC]	Section 2.6 - Operation and Maintenance of Discharge Locations, Table 2-2 - Permitted Extraction Rates
9	The Permittee shall ensure that the total discharge from the facility via UIC wells does not exceed 1,440,000 gpd. [20.6.2.3109(C) NMAC, 20.7.10.100 NMAC]	Section 2.6 - Operation and Maintenance of Discharge Locations, Table 2-2 - Permitted Extraction Rates
10	Prior to the installation of a new UIC well, the Permittee shall submit a Work Plan for NMED approval that satisfies the requirements of this Discharge Permit and the corrective action provisions at Part 6 of the RCRA Permit. This Work Plan shall, at a minimum, include the following information unless the Permittee can demonstrate to NMED that an item is not applicable or appropriate under the proposed activity or if an item has been provided separately under another submission: a. A statement of purpose and need for the additional UIC well(s); b. A list of groundwater monitoring wells which may be added to the monitoring program to effectively monitor performance of the new UIC well(s); c. A map showing the location of the proposed UIC well(s) and the location of all associated monitoring well(s); d. The geographic coordinates of the location of the UIC well(s) including township/range and section; e. A map showing the location of the nearest production well; f. A proposal of how the structural integrity of the treated effluent conveyance system between the GWTS and the new well will be demonstrated; g. Existing data showing the depth to water and general groundwater quality at the proposed new UIC well discharge location; h. A detailed description of groundwater flow modeling (numeric or analytical) predicting the effect of injection on the groundwater flow direction at the discharge location; i. A detailed description of geochemical modeling (numeric or analytical) evaluating the interaction between the treated effluent and receiving groundwater. Prior to any such geochemical modeling the treated effluent and receiving groundwater shall be tested for the analytes listed in Table 5 unless the Permittee can demonstrate that testing for a particular analyte is unnecessary; j. A detailed description of the impact that the proposed injection will have on any known groundwater contaminant plumes, e.g., the nitrate plume(s) addressed in the Site ST-105 Stage 2 Abatement Plan for Nitrate Contaminated Water; k. Maximum estimated monthly discharge volume to the UIC well(s); l. Project schedule, including the date the discharge is to commence and the anticipated duration; and m. Necessary changes to this Discharge Permit's language should the proposal be approved, e.g., the listing of authorized injection wells and associated monitoring wells in Table 1. These Work Plans shall be submitted for NMED approval at least 90 days prior to the scheduled installation of any UIC well. Proposed changes to this Discharge Permit constituting a "permit modification" as defined at 20.6.2.7.P NMAC shall not be submitted as a Work Plan, but shall instead be submitted as a discharge permit modification request as specified at 20.6.2.3109.G NMAC. A proposal to locate a discharge at a location outside the areas specified in Permit Condition #4 shall be considered a permit modification. A proposal to locate a UIC well at a location within the Designated UIC Area shall not be considered a permit modification unless the discharge quality or quantity is modified from that permitted herein. The Permittee shall post the approved Work Plan to the appropriate web site, i.e., KAFB/Environment/Kirtland AFB Fuel Plume Project Documents. [20.6.2.7(P) NMAC, 20.6.2.3107(A) NMAC, 20.6.2.3109(G) NMAC, 20.6.2.5003 NMAC]	NA

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
11	Prior to discharging to a newly installed UIC well, the Permittee shall submit written notification to NMED stating the date that the discharge is to commence. [20.6.2.3107(A) NMAC]	Appendix A - Regulatory Requirements
12	The Permittee shall ensure that the GWTS is secured to control access by the general public. [20.6.2.3109(B) and (C) NMAC, NMSA 1978, §74-6-5(D)]	Section 1.2 - Overall System Description
13	The Permittee shall maintain signs in English and Spanish (unless otherwise prohibited by KAFB policy) at appropriate locations indicating that the GWTS effluent is non-potable. Signs shall be posted at the UIC wellheads, at the GWTS, and any associated UIC well related infrastructure. [20.6.2.3109(B) and (C) NMAC, NMSA 1978, § 74-6-S(D)]	NA
14	The Permittee shall ensure that the UIC well(s) include monitoring devices, i.e., water level and pressure head transducers, to prevent overfilling of the well. The Permittee shall measure the volume of treated effluent discharged to each UIC well and maintain a record of these volumes. [20.6.2.3107 and 20.6.2.3109(C)(3)(c)(i) NMAC]	Section 2.6 - Operation and Maintenance of Discharge Locations
15	The Permittee shall ensure the treated effluent conveyance system, i.e., piping, between the GWTS and the UIC well(s) does not leak and shall report any such leakage to the NMED GWQB in accordance with 20.6.2.1203(A) NMAC and copy the NMED HWB. Within one year of the effective date of this Discharge Permit, the Permittee shall demonstrate the structural integrity of the treated effluent conveyance system between the GWTS and KAFB-7. Prior to testing, the Permittee shall propose for NMED approval the test method to be used. The results of the mechanical integrity testing shall be submitted to NMED within 60 days of test completion. The Permittee shall integrity test the treated effluent conveyance system between GWTS and the UIC well(s) prior to submitting a permit renewal application. [20.6.2.3106(C) NMAC, 20.6.2.3107(A) NMAC]	Section 3.10 - Effluent Line Integrity Testing
16	Prior to an initial discharge from the GWTS of treated effluent associated with a new extraction well, the Permittee shall submit documentation to NMED demonstrating that the treated effluent is at or below the effluent standards specified for the contaminants of concern listed in Table 2. [20.6.2.1202(A) and (C) NMAC, 20.6.2.3109(C) NMAC, NMSA 1978, §§ 61-23-1 through 61-23-32]	Appendix I - Sampling and Analysis Plan
B. Monitoring, Reporting, and Other Requirements		
17	The Permittee shall conduct the monitoring, operations, and reporting listed below. Unless otherwise specified, all periodic monitoring results or general information obtained shall be reported in the forthcoming quarterly report. [20.6.2.3107 NMAC]	Section 6.1 - Reporting
18	Unless otherwise approved by NMED, the Permittee shall conduct sampling in accordance with standard industry practice. Sampling in accordance with the most current version of the GWTS Sampling and Analysis Plan (Appendix L of the O&M Plan), which includes sampling locations, procedures, field measurements, quality control samples, handling and custody, analytical methods, quality control, analytical validation, and reporting requirements, satisfies this Condition. [20.6.2.3107(B) NMAC]	Appendix I - Sampling and Analysis Plan
19	The Permittee shall submit quarterly and annual reports to NMED pursuant to the most recent NMED HWB approved Work Plans. The Permittee shall identify the portions of these reports pertaining to this Discharge Permit with a table in the reports that identifies those portions. Quarterly reports shall be submitted as specified below unless otherwise authorized by NMED: • January 1st through March 31st - due by June 30th • April 1st through June 30th_ due by September 30th • July 1st through September 30th_ due by December 31st • October 1st through December 31st - due by March 31st Annual reporting requirements for the previous year, i.e., January 1st through December 31st, shall be reported in the March 31st quarterly report. [20.6.2.3107(A) NMAC]	Section 6.1 - Reporting
20	The Permittee shall monitor the concentration of all contaminants of concern listed on Table 2 in GWTS treated effluent. Associated sampling and analysis shall be performed monthly at a minimum. When groundwater from a new extraction well is first introduced to the GWTS, contaminant of concern monitoring of the GWTS treated effluent shall occur daily for the first week of treatment, weekly for the first month of treatment, and monthly thereafter. If alterations to, or conditions at, the GWTS result in a potential impact to effluent quality, the Permittee will repeat this sampling sequence as directed by NMED. A representative sample of GWTS influent and effluent shall be analyzed annually for the constituents identified in Table 3. A representative sample of GWTS influent and effluent shall be analyzed every five years for the constituents identified in Table 4. The first analysis of the five-year constituent list shall occur in July 2017. Any newly identified constituents detected during the five-years sampling events will be added to the annual sampling constituent list in Table 3. All analysis of GWTS influent and effluent shall utilize analytical methods with detection limits that are sufficiently low to allow comparison to the standards included in the above referenced state and federal regulations. All sampling, analysis, and reporting shall comply with the most recent approved Work Plans. [20.6.2.3107(A) NMAC and 20.6.2.3107(B) NMAC]	Appendix I - Sampling and Analysis Plan

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
21	The Permittee shall report the volume of treated GWTS effluent discharged to each UIC well each quarter. This report shall include the following: a. Monthly average, maximum, and minimum values for flow rate and volume of treated effluent transferred to each UIC well; b. The totalized monthly volume of treated effluent transferred to all UIC wells; and c. Monthly average, maximum, and minimum head values of injection water for each UIC well. The Permittee shall monitor the GWTS effluent volume utilizing an effluent flow meter installed on the effluent pump skid after the GAC units. Each UIC well shall have a dedicated flow meter. Flow meters shall be inspected and calibrated in accordance with the associated manufacturer's recommendations. [20.6.2.3107 NMAC]	Section 2.6 - Operation and Maintenance Discharge Locations, Section 6.1 - Reporting

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
22	The Permittee shall include the following results and general information in quarterly reports to NMED: a. Any mechanical integrity conducted on either the GWTS or a UIC well; b. Any replacement of GAC media and the associated data that initiated the decision to replace the media; c. Any UIC well rehabilitation conducted; d. Any malfunction, repair, or replacement of a flow meter; and e. Any additional operational changes with the potential to affect the discharge. [20.6.2.3107 NMAC]	Section 6.1 - Reporting
23	The Permittee shall monitor the groundwater wells in the vicinity of KAFB-7 and in the vicinity of any newly installed UIC well(s) to determine any change to aquifer chemistry that may be the result of injection. This monitoring shall be performed annually, shall conform to the procedures of the most current approved Work Plan, and shall measure the contaminants of concern listed in Table 2. This chemistry will be reported in the Annual Report for BFF. ST-105 Annual Report includes elevation contour mapping and analytical parameters identified in the Stage 2 Abatement Plan. The Permittee shall develop a groundwater elevation contour map depicting the groundwater flow direction in the vicinity of each UIC well and report it in the ST-105 Annual Report. If the chemical quality of the treated groundwater being injected changes over time, NMED may require the Permittee to repeat geochemical modeling (numeric or analytical) to predict the interaction between the treated effluent and receiving groundwater. [20.6.2.3107 NMAC]	Appendix I - Sampling and Analysis Plan
24	The Permittee shall post all reports required by this Discharge Permit on KAFB's most current web site (e.g., https://kirtlandafb.tlisolutions.com/main.aspx.) [20.6.2.3107(A) NMAC]	Section 6.1 - Reporting
	C. Contingency Plan	
25	If the automated monitoring system records a system alarm indicating a threat condition to a UIC well, and that threat condition is confirmed, at a minimum the affected UIC well will be taken off-line. If the alarm condition is confirmed during the response investigation, the UIC well(s) will be taken off-line and the discharge to the UIC well(s) will not be resumed until the problem is identified and corrected. [20.6.2.3107(A) NMAC]	Appendix C - Description of GWTS Equipment and Facilities
26	In accordance with this Discharge Permit, if the discharge to a UIC well exceeds effluent standards, the Permittee shall enact the Contingency Plan (Appendix C). The Permittee may be required to remediate water pollution in accordance with the corrective action provisions in Part 6 of the RCRA Permit except as provided in 20.6.2.4105(B) NMAC. [20.6.2.3107(A) NMAC, 20.6.2.3109(E) NMAC, 20.6.2.4105(A)(2) and (3) NMAC]	Section 1.3 - Discharge Requirements
27	In the event that a release or a spill occurs that is not authorized under this Discharge Permit, the Permittee shall notify the NMED GWQB in accordance with 20.6.2.1203(A) NMAC, shall include any additional reporting requirements specified at RCRA Permit Section 1.27, and shall copy the NMED HWB. The Permittee shall also take measures to mitigate damage from the unauthorized discharge and initiate corrective actions specified in the Contingency Plan (Appendix C). The Permittee may be required to remediate water pollution in accordance with the corrective action provisions in Part 6 of the RCRA Permit except as provided in 20.6.2.4105(B) NMAC. Nothing in this condition shall be construed as relieving the Permittee of the obligation to comply with all requirements of Section 20.6.2.1203 NMAC. [20.6.2.1203 NMAC, 20.6.2.4105(A)(2) and (3) NMAC]	Section 3.19.1 Emergency Conveyance Line Repairs
28	In the event that information indicates that a UIC well referenced at Table 1 is not constructed in a manner consistent with its intended use or is not completed in a manner that is protective of groundwater quality, the Permittee shall submit a Work Plan to the NMED with a proposal for well rehabilitation, abandonment only, or abandonment and replacement. This Work Plan shall include a project schedule and shall be submitted for NMED approval within 120 days following confirmation of the above referenced problems. The Permittee may propose an alternate use for the well. The UIC well requiring replacement shall be properly plugged and abandoned in accordance with Part 6.5.17.10.9 of the RCRA permit. [20.6.2.3107(A) NMAC, 20.6.2.5005 NMAC]	NA
29	In the event that NMED or the Permittee identifies any failures of the Application or this Discharge Permit not specifically noted herein, NMED may require the Permittee to submit a corrective action plan and a schedule for completion of corrective actions to address the failures. Additionally, NMED may require a modification to this Discharge Permit to achieve compliance with 20.6.2 NMAC. [20.6.2.3107(A) NMAC, 20.6.2.3109(E) NMAC]	NA

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
	D. Closure Plan	
30	Upon permanent cessation of discharge to a UIC well(s), the Permittee shall perform the following closure measures upon NMED approval, unless UIC well(s) and/or conveyance pipelines are needed for another use: a) Cap, plug, or remove all conveyance pipelines to prevent the discharge of GWTS treated effluent to all UIC well(s); b) Abandon UIC well(s) in accordance with Part 6.5.17.10.9 of the RCRA permit, which reference OSE regulation 19.27.4.30 and 31 NMAC and associated well abandonment guidance; and c) Appropriately dispose of any wastes associated with UIC well plugging and abandonment. The Permittee may, instead of abandoning a UIC well, propose an alternate use for the well. Upon cessation of the closure measures, the Permittee shall perform the following post-closure measures: a) Continue monitoring contaminants of concern in groundwater for at least 2 years, or as appropriate and in concurrence with NMED; and b) Enact the release notification requirements of the Contingency Plan if groundwater standards are exceeded. The Permittee may be required to remediate water pollution in accordance with the corrective action provisions in Part 6 of the RCRA Permit except as provided in 20.6.2.4105(B) NMAC. When all post-closure requirements have been met, the Permittee may request to terminate the Discharge Permit. [20.6.2.3107 (A) 11 NMAC]	NA
	E. General Terms and Conditions	
31	The Permittee shall maintain a written record of the following information: a) Information and data used to complete the Application for this Discharge Permit; b) Records of any releases or spills not authorized under this Discharge Permit and reports submitted pursuant to 20.6.2.1203 NMAC; c) Records of the operation, maintenance, and repair of all facilities/equipment used to treat, store, or inject the treated groundwater; d) Facility record drawings (plans and specifications) showing the actual construction of the facility and that the construction complies with all applicable statutes, regulations, and codes including applicable Department of Defense Engineering Standards; e) Copies of quarterly reports completed and/or submitted to NMED pursuant to this Discharge Permit; t) The volume of treated water discharged pursuant to this Discharge Permit; g) Groundwater quality and injected water quality data collected pursuant to this Discharge Permit; h) Copies of construction records and well logs for all groundwater monitoring wells required to be sampled pursuant to this Discharge Permit; i) Records of the maintenance, repair, replacement, or calibration of any monitoring equipment or flow measurement devices required by this Discharge Permit; and j) Data and information related to field measurements, sampling, and analysis conducted pursuant to this Discharge Permit. The following information shall be recorded and made available to NMED upon request: i) The dates, location, and times of sampling or field measurements; ii) The sample analysis date of each sample; iii) The name and address of the laboratory, and the name of the signatory authority for the laboratory analysis; iv) The analytical technique or method used to analyze each sample or collect each field measurement; v) The results of each analysis or field measurement; vi) The results of any split, spiked, duplicate or repeat sample; and vii) A copy of the laboratory analysis chain-of-custody as well as a description of the quality assurance and quality control procedures used. The written record shall be maintained by the Permittee so that it is accessible within a reasonable time period during or following a facility inspection by NMED through the post-closure period and shall be made available to NMED upon request. [20.6.2.3107(A) and (C) NMAC]	Section 6 - Recordkeeping
32	The Permittee shall allow NMED representatives to inspect the facility and its operations, which are subject to this Discharge Permit and the NMWQCC regulations. NMED representatives may, upon presentation of proper credentials, enter at reasonable times upon or through any premises in which a water contaminant source is located or in which any records are located regarding this discharge permit or related discharges required to be maintained by regulations of the federal government or the NMWQCC. The Permittee shall allow NMED representatives to have access to any copy of the records, and to perform assessments, sampling, or monitoring during an inspection for the purpose of evaluating compliance with this Discharge Permit and the NMWQCC regulations. Nothing in this Discharge Permit shall be construed as limiting in any way the inspection and entry authority of NMED under the WQA, the NMWQCC Regulations, or any other local, state, or federal regulations. [20.6.2.3107(D) NMAC, NMSA 1978, §§ 74-6-9(B) and 74-6-9(E)]	NA
33	The Permittee shall, upon NMED's request, allow for NMED's duplication of records required by this Discharge Permit and/or furnish to NMED electronic copies of such records. [20.6.2.3107(D) NMAC]	NA
34	In the event the Permittee proposes a change to the facility or the facility's discharge that would result in a change in the volume discharged; the location of the discharge; or in the amount or character of water contaminants received, treated, or discharged by the facility that differs from the terms and conditions in this Discharge Permit, the Permittee shall notify NMED prior to implementing such changes. The Permittee shall obtain approval (which may require modification of this Discharge Permit) by NMED prior to implementing such changes. [20.6.2.7(P) NMAC, 20.6.2.3107(C) NMAC, 20.6.2.3109(E) and (G) NMAC]	Table 6-1 - List of Reports and Recipients

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
35	In the event the Permittee proposes to construct or change an existing system such that the quantity or quality of the discharge will change substantially from that authorized by this Discharge Permit, the Permittee shall submit construction plans and specifications to NMED for the proposed system or process unit prior to the commencement of construction. In the event the Permittee implements changes to an existing system authorized by this Discharge Permit which will result in only a minor effect on the quality of the discharge, the Permittee shall report such changes (including the submission of record drawings, where applicable) in the next quarterly report to NMED. [20.6.2.1202(A) and (C) NMAC, NMSA 1978, §§ 61-23-1 through 61-23-32]	NA
36	Any violation of the requirements and conditions of this Discharge Permit, including any failure to allow properly credentialed NMED staff to enter and inspect records or facilities, or any refusal or failure to provide NMED with records or information required to be maintained by this Discharge Permit or related regulation may subject the Permittee to a civil enforcement action. Pursuant to WQA 74-6-1 O(A) and (B), such action may include a compliance order requiring compliance immediately or in a specified time, assessing a civil penalty, modifying or terminating the Discharge Permit, or any combination of the foregoing; or an action in district court seeking injunctive relief, civil penalties, or both. Pursuant to WQA 74-6-lO(C) and 74-6-10.1, civil penalties of up to $15,000 per day of noncompliance may be assessed for each violation of the WQA 74-6-5, the NMWQCC Regulations, or this Discharge Permit, and civil penalties of up to $10,000 per day of noncompliance may be assessed for each violation of any other provision of the WQA, or any regulation, standard, or order adopted pursuant to such other provision. In any action to enforce this Discharge Permit, the Permittee waives any objection to the admissibility as evidence of any data generated pursuant to this Discharge Permit. [20.6.2.1220 NMAC, NMSA 1978, §§ 74-6-10 and 74-6-10.1]	NA
37	No person shall: 1) make any false material statement, representation, certification, or omission of material fact in an application, record, report, plan, or other document filed, submitted, or required to be maintained under the WQA; 2) falsify, tamper with, or render inaccurate any monitoring device, method, or record required to be maintained under the WQA; or 3) fail to monitor, sample, or report as required by a permit issued pursuant to a state or federal law or regulation. Any person who knowingly violates or knowingly causes or allows another person to violate the requirements of this condition is guilty of a fourth degree felony and shall be sentenced in accordance with the provisions of NMSA 1978, § 31-18-15. Any person who is convicted of a second or subsequent violation of the requirements of this condition is guilty of a third degree felony and shall be sentenced in accordance with the provisions of NMSA 1978, § 31-18-15. Any person who knowingly violates the requirements of this condition or knowingly causes another person to violate the requirements of this condition and thereby causes a substantial adverse environmental impact is guilty of a third degree felony and shall be sentenced in accordance with the provisions of NMSA 1978, § 31-18-15. Any person who knowingly violates the requirements of this condition and knows at the time of the violation that he is creating a substantial danger of death or serious bodily injury to any other person is guilty of a second degree felony and shall be sentenced in accordance with the provisions of NMSA 1978, § 31-18-15. [20.6.2.1220 NMAC, NMSA 1978, §§ 74-6-10.2(A) through 74-6-10.2.F]	NA
38	Nothing in this Discharge Permit shall be construed in any way as relieving the Permittee of the obligation to comply with all applicable federal, state, and local laws, regulations, permits, or orders. [NMSA 1978, § 74-6-5.L]	NA
39	The Permittee may file a petition for review before the NMWQCC on this Discharge Permit. Such petition shall be in writing to the NMWQCC within 30 days of the receipt of postal notice of this Discharge Permit and shall include a statement of the issues to be raised and the relief sought. Unless a timely petition for review is made, the decision of NMED shall be final and not subject to judicial review. [20.6.2.3112 NMAC, NMSA 1978, § 74-6-5.O]	NA
40	Prior to the transfer of any ownership, control, or possession of this facility or any portion thereof, the Permittee shall: 1) notify the proposed transferee in writing of the existence of this Discharge Permit; 2) include a copy of this Discharge Permit with the notice; and 3) Deliver or send by certified mail to NMED a copy of the notification and proof that such notification has been received by the proposed transferee. Until both ownership and possession of the facility have been transferred to the transferee, the Permittee shall continue to be responsible for any discharge from the facility. [20.6.2.3111 NMAC]	NA
41	Payment of permit fees is due at the time of Discharge Permit approval. Permit fees shall be paid in a single payment or shall be paid in equal installments on a yearly basis over the term of the Discharge Permit. Single payments shall be remitted to NMED no later than 30 days after the Discharge Permit effective date. Initial installment payments shall be remitted to NMED no later than 30 days after the Discharge Permit effective date; subsequent installment payments shall be remitted to NMED no later than the anniversary of the Discharge Permit effective date. Permit fees are associated with issuance of this Discharge Permit. Nothing in this Discharge Permit shall be construed as relieving the Permittee of the obligation to pay all permit fees assessed by NMED. A Permittee that ceases discharging or does not commence discharging from the facility during the term of the Discharge Permit shall pay all permit fees assessed by NMED. An approved discharge permit shall be suspended or terminated if the facility fails to remit an installment payment by its due date. [20.6.2.3114(F) NMAC, NMSA 1978, § 74-6-5(K)]	NA

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
	RG-1587 (KAFB-7)	
1	This application is approved as follows: Permittee: Kirtland Air Force Base Permit No: RG-1587 Application File Date: September 17, 2015 Notice for Publication Issued: October 13, 2015 Affidavit of Publication Filed: November 4, 2015, The Albuquerque Journal published on October 16, 23, and 30, 2015 Priority: March 1, 1949 Source: Groundwater Point of Diversion: RG-1587: Located at a point where X=1,544,731.13 feet and Y=1,470,756.22 feet, NMSPCS, Central Zone, NAD83, on land owned by the Kirtland Air Force Base, Bernalillo County, New Mexico. Purpose of Use: Extraction/Production, Injection, and Irrigation Place of Use: NE1/4 NE1/4, Section 1, Township 10 North, Range 3 East, NMPM, Bernalillo County, New Mexico, and under permits RG-1579 through RG-1589 the applicant will discharge treated groundwater into the Tijeras Arroyo Golf Course main pond, infiltration galleries located adjacent to the golf course, and injection wells on land owned by the Kirtland Air Force Base.	NA
2	The total diversion of water from well RG-1587 under this permit shall not exceed 4,500 acre-feet per annum.	NA
3	The total injection of water from well RG-1587 under this permit shall not exceed 2,000 acre-feet per annum.	Table 2-2 - Permitted Extraction Rates
4	Well RG-1587 shall be equipped with a totalizing meter of a type, at location(s) approved by, and installed in a manner acceptable to the State Engineer. Records of the amount of water pumped and injected shall be submitted, in writing, to the District 1 Office of the State Engineer on or before the 10th day of January, April, July and October of each year. No water shall be diverted from any well unless equipped with a functional totalizing meter. The Permittee shall provide in writing the make, model, serial number, date of installation, initial reading, units, and dates of recalibration of each meter and any replacement meter.	Section 2.6 - Operation and Maintenance of Discharge Locations, Section 6.1 - Reporting
5	The Permittee shall utilize the highest and best technology to ensure conservation of water to the maximum extent practical.	Section 2.6 - Operation and Maintenance of Discharge Locations
6	This Permit will expire on December 1, 2025.	Table 1-1
	RG-1579 POD 292 (KAFB-106228)	
1	This application is approved as follows: Permittee: Kirtland Air Force Base Permit Number: RG-1579 POD 292 Application File Date: November 13, 2014 Notice for Publication: February 10, 2015 Affidavit of Publication: May 1, 2015 from the Albuquerque Journal Priority: March 1, 1949 Source: Groundwater Points of Diversion: RG-1581 POD 292, located at a point where X=1,543,677 feet and Y=1,476,476 feet, NMSPCS, Central Zone, NAD 83, within the NE 1/4 NE 1/4 of Section 36, Township 10 North, Range 3 East, NMPM, Bernalillo County New Mexico. Purpose of Use: Pollution control and recovery, specifically extraction of groundwater for remediation Place of Use: Land within Kirtland Air Force Base, and land within Section 36, Township 10 North, Range 3 East, NMPM, Bernalillo County, New Mexico. Amount of Water: 403 acre-feet per annum	NA
2	The total diversion of groundwater from well RG-1579 POD 292 shall be limited to 403 acre-feet per annum, measured at the well, a portion of the 6,398 acre-feet per annum, which includes the water right of 4,500 acre-feet per annum from well Numbers RG-1581 through RG-1589 (Kirtland East), and 1,898 acre-feet per annum from Numbers RG-1579, RG-1580 and RG-1579 and RG-1580 Combined-S (Kirtland West).	Table 2-2 - Permitted Extraction Rates
3	The total amount of water pumped from well RG-1579 POD 292 shall be measured by a totalizing meter of a type, at a location, and installed in a manner acceptable to the State Engineer. The Permittee shall provide the make, model, serial number, initial reading, units, multiplier, data of installation, and dates of recalibration to the State Engineer prior to any diversion of water under this permit.	Section 2.2 - Groundwater Well Pumps and Flow Control, Section 6.1 - Reporting
4	Records of the quantity of water diverted from well RG-1579 POD 292 shall be submitted to the District 1 Office via mail, e-mail, or facsimile on or before the 10th day of the months of January, April, July, and October for the preceding 3 calendar months, i.e., quarterly.	Table 6.1 - List of Reports and Recipients
5	None	NA
6	The Permittee shall utilize the highest and best technology available to assure conservation of water to the maximum extent practical.	Section 2.2 - Groundwater Well Pumps and Flow Control
7	This permit shall automatically expire on June 15, 2025 or upon completion of the intended purpose of use. If the intended purpose of use is completed prior to June 15, 2025, the permittee shall notify the State Engineer by certified letter.	Table 1-1 - Applicable Permits
8	Proof of Completion of Well shall be filed on or before June 15, 2017.	NA

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
	RG-1579 POD 309 (KAFB-106233) and POD 310 (KAFB-106234)	
1	This application is approved as follows: Permittee: Kirtland Air Force Base Permit No: RG-1579 POD 309 and POD 310 Application File Date: July 10, 2015 Notice for Publication Issued: August 25, 2015 Affidavit of Publication Filed: September 14, 2015, The Albuquerque Journal published on August 28, September 5, and September 11, 2015 Priority: March 1 , 1949 Source: Groundwater Point of Diversion: RG-1579 POD 309: Located at a point where X=1,543,061 feet and Y=1,476,824 feet, NMSPCS, Central Zone, NAD 83, on land owned by the City of Albuquerque, Bernalillo County, New Mexico. RG-1579 POD 310: Located at a point where X=1,544,083 feet and Y=1,478,577 feet, NMSPCS, Central Zone, NAO 83, on land owned by the City of Albuquerque, Bernalillo County, New Mexico. Purpose of Use: Pollution Control and Recovery, and Irrigation Place of Use: SE 1/4 SE 1/4, Section 25, Township 10 North, Range 3 East, NMPM, Bernalillo County, New Mexico, and under permits RG-1579 through RG-1589 the applicant will discharge treated groundwater into the Tijeras Arroyo Golf Course main pond, infiltration galleries located adjacent to the golf course, and injection wells on land owned by the Kirtland Air Force Base.	NA
2	The total diversion of water from wells RG-1579 POD309 and RG-1579 POD310 under this permit shall not exceed 636 acre-feet per annum.	Table 2-2 - Permitted Extraction Rate
3	Wells RG-1579 POD309 and RG-1579 POD310 shall be equipped with a totalizing meter of a type, at location(s) approved by, and installed in a manner acceptable to the State Engineer. Records of the amount of water pumped shall be submitted, in writing, to the District 1 Office of the State Engineer on or before the 10th day of January, April, July and October of each year. No water shall be diverted from any well unless equipped with a functional totalizing meter. The Permittee shall provide in writing the make, model, serial number, date of installation, initial reading, units, and dates of recalibration of each meter and any replacement meter.	Section 2.2 - Groundwater Well Pumps and Flow Control, Section 6.1 - Reporting
4	The Permittee shall utilize the highest and best technology to ensure conservation of water to the maximum extent practical.	Section 2.2 - Groundwater Well Pumps and Flow Control
5	This Permit will expire on November 1, 2025.	Table 1-1 - Applicable Permits

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
	RG-1579 POD 319 (KAFB-106239)	
1	This application is approved as follows: Permittee: Kirtland Air Force Base Permit No: RG-1579 POD319 Application File Date: August 25, 2016 Notice for Publication Issued: September 14, 2016 Affidavit of Publication Filed: October 6, 2016, The Albuquerque Journal published on September 18, 25, and October 2, 2016 Priority: March 1, 1949 through March 6, 1956 Source: Groundwater Point of Diversion: RG-1579 POD319: (KAFB-106239) Located at a point where X=1,542,707.9 feet and Y=1,475,412 feet, NAD 83, SPCS, Central Zone, on land owned by the City of Albuquerque, Bernalillo County, New Mexico. Purpose of Use: Pollution Control and Recovery Place of Use: SE 1/4 SE 1/4,, Section 25, Township 10 North, Range 3 East, NMPM, Bernalillo County, New Mexico, and under permits RG-1579 through RG-1589 the applicant will discharge treated groundwater into the Tijeras Arroyo Golf Course main pond, infiltration galleries located adjacent to the golf course, and injection well, RG-1587, on land owned by Kirtland Air Force Base.	NA
2	The total diversion of water from well RG-1579 POD319 under this permit shall not exceed 323 acre-feet per annum consumptive use.	Table 2-2 - Permitted Extraction Rate
3	The new well shall be drilled by a well driller licensed in the State of New Mexico, and a well record for new well RG-1579 POD319 shall be filed with the Office of the State Engineer within twenty (20) days of drilling the well.	NA
4	Well RG-1579 POD319 shall be equipped with a totalizing meter of a type, at location(s) approved by, and installed in a manner acceptable to the State Engineer. Records of the amount of water pumped shall be submitted, in writing, to the District 1 Office of the State Engineer on or before the 10th day of each month. No water shall be diverted from any well unless equipped with a functional totalizing meter. The permittee shall provide in writing the make, model, serial number, date of installation, initial reading, units, and dates of recalibration of each meter and any replacement meter.	Section 2.2 - Groundwater Well Pumps and Flow Control, Section 6.1 - Reporting
5	The Permittee shall utilize the highest and best technology to ensure conservation of water to the maximum extent practical.	Section 2.2 - Groundwater Well Pumps and Flow Control
6	This permit will expire on December 1, 2025.	Table 1-1 - Applicable Permits
7	The State Engineer retains jurisdiction over this permit.	NA
8	Pursuant to Section 72-8-1 NMSA, the permittee shall allow the state engineer and his representative's entry upon private property for the performance of their respective duties, including access to the wells for meter readings and water level measurements.	NA
	~~**Christ United Methodist Church License to Kirtland Air Force Base**~~	
~~1~~	~~The LICENSOR hereby grants unto the LICENSEE a no-rent license to enter upon the LICENSOR's real property located at 6200 Gibson Boulevard, S.E., Albuquerque, Bernalillo County, New Mexico, which real property is also known as: Tract C, as shown on the Replat of Tracts B, C, D and E, Siesta Hills No. 2, recorded November 25, 1980 in Book B18, Page 84, records of Bernalillo County, New Mexico, as more specifically identified on the general location map, attached hereto and incorporated herein as Attachment A, for the express purpose of: 1) constructing, drilling, installing, operating, maintaining and removing one (1) bulk fuels facility (BFF) interim fuel remediation extraction well, extraction well pipeline and associated electrical power lines, pole, transformer and junction boxes; 2) depending upon the depth of the ethylene-di-bromide plume, constructing, drilling, installing, operating, maintaining and removing no more than two (2) BFF regional deep monitoring wells; and 3) parking well drilling and construction equipment, to include a fork lift, water truck, other miscellaneous work pickups, hopper, lined waste roll-off bin and daily construction supplies, to include well casing; and 4) collecting ground water monitoring samples from the regional deep monitoring well and extracting and pumping ethylene-dibromide contaminated groundwater through the extraction well pipeline to Kirtland AFB for treatment during the term of the Kirtland AFB BFF fuel release remediation; in that area of the LICENSOR's west parking lot located immediately adjacent to the city alley right-of-way at the south boundary of the parking lot, as shown on the aerial photograph attached hereto and incorporated herein as Attachment B.~~	~~NA~~
~~2~~	~~The term of this license is five (5) years, beginning on January 8, 2020 and ending January7, 2025.~~	~~Table 1-1 - Applicable Permits, Appendix A - Regulatory Correspondence, Revision Tracking, and Permits~~

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
3	The LICENSEE, its officers, employees, agents, representatives, contractors, and assigns, shall use the area described above, and as shown in Attachments A and B, for the purposes described above and not for any other purpose without first obtaining the written consent of the LICENSOR. The LICENSEE, its officers, employees, agents, representatives, contractors, and assigns shall comply with the following additional LICENSOR use restrictions: 3.1. LICENSEE shall conduct no activities on LICENSOR's property on any Saturday or Sunday during the term of this License; 3.2. LICENSEE shall remove the basketball board standard from the west parking lot and reinstall it at a location on the parcel to be specified by the LICENSOR; 3.3. LICENSEE shall provide for city waste disposal truck access to the LICENSOR's trash dumpster located at the SE corner of the west parking lot to facilitate waste collection and disposal; 3.4 LICENSEE shall provide access to the west door of the Church through the west parking lot for Food Band truck deliveries on the first Tuesday of each month; 3.5. LICENSEE shall provide access to the west door of the Church through the west parking lot to LICENSOR's contractor(s) for the construction and installation of an ADA compliant wheelchair ramp; and 3.6. LICENSEE shall provide day and night access to the west door through the west parking lot for groups, including church members, using church facilities.	NA
4	All tools, equipment, and other property (the "Personal Property") taken upon or placed upon the LICENSOR's land by the LICENSEE shall remain the property of the LICENSEE and shall be removed within seven (7) days after the installation of the extraction and/or ground water monitoring wells or the expiration or revocation of this License. In the event that the LICENSEE fails to timely remove the Personal Property the LICENSOR may, at the LICENSOR's election, remove and have stored the Personal Property at the LICENSEE's expense or may elect to retain the Personal Property as LICENSOR's property.	NA
5	Liability and Insurance. 5.1 Liability 5.1.1 As between the PARTIES, the LICENSEE, its agents, representatives, contractors and/or sub-contractors assume all risk of loss or damage to property and injury or death to persons, whether to its officers, employees, contractors of any tier, agents, invitees or others, by reason of or incident to LICENSEE's use of the licensed area, and its activities conducted under this LICENSE. The LICENSEE agrees to hold harmless the LICENSOR, and its officials, agents and employees from any claims, actions, suits or other proceedings arising from or out of the acts or omissions of the LICENSEE, its agents, representatives, contractors or sub-contractors or arising from the failure of the LICENSEE, its agents, representatives, contractors or sub-contractors to perform any act or duty required of the LICENSEE herein. To the extent provided by law, the LICENSEE's liability under this clause is subject to the availability of funds, as set forth in 31 USC § 1341 (Anti-Deficiency Act) and nothing contained in this License may be considered as implying Congress will at a later date appropriate funds sufficient to meet deficiencies. 5.1.2. The LICENSEE hereby undertakes a contractual obligation to repair all actual damages to LICENSOR's property and improvements caused by LICENSEE's operation(s). Upon completion of the repairs, LICENSEE shall repave the west parking lot ensuring said paving is on-grade with the LICENSEE installed well casings and/or vaults. In lieu of performing such repair, LICENSEE may, at its discretion, pay for said repairs and parking lot repaving. To the extent provided by law, the Licensee's liability under this clause is subject to the availability of funds, as set forth in 31 USC § 1341 (Anti-Deficiency Act) and nothing contained in this License may be considered as implying Congress will at a later date appropriate funds sufficient to meet deficiencies. The provisions of this clause are without prejudice to any rights the LICENSOR may have to make a claim for damages under applicable laws. 5.1.3. Claims for damages, personal injury or death arising from negligent or wrongful act of LICENSEE, its officers, employees, contractors of any tier, agents or invitees (but specifically excluding contractual claims arising under paragraph 6.1 .2 above) shall be subject to the provisions of the Federal Tort Claims Act (28 USC §§ 2671 et seq.). 5.2 Insurance Requirement. LICENSEE shall require its agents, representatives, contractors or sub-contractors to obtain insurance coverage for the specific protection and benefit of the LICENSOR, including but not necessarily limited to, the following coverage: 5 .2.1. Comprehensive General Liability Insurance. Comprehensive general liability insurance with liability limits in an initial amount not less than $1 ,000,000 aggregate limit of liability for bodily injury, including death, and property damage in any one occurrence. 5.2.2. Automobile Liability Insurance. An automobile liability policy with liability limits in amounts not less than $1 ,000,000 combined single limit of liability for bodily injury, including death, and property damage in any one occurrence. Said policy of insurance must include coverage for the use of all owned, non-owned, hired automobiles, vehicles and other equipment both on and off work and is in addition to the Comprehensive General Liability Coverage. 5.2.3. Proof of Insurance: During the term of this Agreement, not less than once each year, on or before 9 January 2015 and 9 January of each succeeding year, LICENSEE shall cause its primary contractor to provide to the LICENSOR without demand, or more frequently upon demand, proof of all required insurance coverage. Prior to expiration or exchange of any policy, LICENSEE shall cause its primary contractor to furnish the LICENSOR evidence satisfactory to the LICENSOR that the policy has been renewed or replaced or is no longer required by this Agreement. All policies required hereunder shall provide that the LICENSOR shall be given thirty (30) days prior written notice of cancellation, non-renewal or material alteration of coverage. Provisions that the insurance company shall "endeavor to give the LICENSOR notice" shall not be allowed.	NA
6	The LICENSEE shall be solely responsible for maintaining the premises upon which LICENSEE's equipment is being stored in a safe condition during the term of this License.	NA
7	The LICENSEE will use all reasonable means available to protect the environment and natural resources from damage arising from this License or activities incident to it, to include the removal and disposal of all municipal and hazardous waste generated at all well and infrastructure construction and operation sites in accordance with City of Albuquerque, State and Federal law. Where damage occurs, the Licensee shall be liable and shall restore the damaged resources to the condition existing prior to the implementation of the remediation and monitoring, as documented in the Request for Environmental Impact Analysis (AF Form 813), which is attached hereto and incorporated herein as Attachment C, and an Environmental Baseline Survey (EBS), which is attached hereto and incorporated herein as Attachment D. Upon revocation or termination of this License, with the exception of pre-existing conditions identified in Attachments C and D, the LICENSOR's land will be returned in the same environmental condition as received, but without the contamination conditions for which the LICENSEE is performing the remediation, which shall be documented in a final closeout EBS, a copy of which shall be provided to the LICENSOR.	NA

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
8	In connection with its use of or any other activity on the property, the LICENSEE, its officers, employees, agents, representatives, contractors, and assigns will at all times and in all respects comply with all federal, state and local laws, ordinances and regulations, relating to the protection of the environment, including but not limited to protection of surface water and groundwater; industrial hygiene; the use, handling and disposal of any hazardous or toxic substances; the Clean Air Act, 42 U.S.C. 7401 et seq. applicable state and air quality local laws, and policies and procedures of the City's Environmental Health Air Quality Division.	NA
9	The LICENSEE, its officers, employees, agents, representatives, contractors, and assigns shall comply with all other applicable federal, state and local laws, statutes, ordinances and regulations and will not discriminate illegally against any person.	NA
10	For purposes of giving formal written notice, the points of contact are as follows: LICENSOR: CHRIST UNITED METHODIST CHURCH Attn: Ms. Vicki Chronister 6200 Gibson Blvd., SE Albuquerque, NM 87108 LICENSEE: Installation Commander 2000 Wyoming Blvd, SE Kirtland AFB, NM 87117	NA
11	Claims. 11.1 Point of Contact. The Permittee point of contact for all damages, whether to real or personal property, will be submitted to: AFNWC/JA 2000 Wyoming Blvd., SE Building 20604, Room B-36 Kirtland AFB, NM 87117 (505) 846-4217 11.2 Claims Process: To file a claim for damage and/or injury due to LICENSEE"s operations, the claimant, or his/her authorized agent, must file a properly signed SF-95, Claim for Damage, Injury or Death, setting forth a sum certain for damage to or loss of property, personal injury or death, to the POC identified in 11.1 above, within two (2) years of the incident causing the damage or injury. The claim form is available at the website www.claims.jag.af.mil.	NA
12	This License contains the entire agreement of the parties. Changes to this License are not binding unless made in writing and signed by both parties.	NA
13	This License is governed by and construed and enforced in accordance with federal law and the laws of New Mexico.	NA
14	If any part of this License is held to be invalid or unenforceable, the remainder of this License will remain valid and enforceable if the remainder of the License is reasonably capable of completion.	NA
15	Index of Attachments Attachment A - Description of Licensed Premises Attachment B - Map Attachment C - AF-813 Attachment D - EBS	NA
License Agreement Between The City of Albuquerque and Kirtland Air Force Base		

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
1	Subject to the terms and conditions of this License, and as set forth in the Vadose Zone Investigation Work Plan Bulk Fuels Facility Spill, Solid Waste Management Units ST-106 and SS-111 - March 2011 and Groundwater Investigation Work Plan, Bulk Fuels Facility Spill, Solid Waste Management Units ST-106 and SS-111 - March 2011, which are attached hereto and incorporated herein as Attachments A and B, respectively, the final revised plans will be attached and incorporated herein upon approval and signature by New Mexico Environment Department (NMED), the LICENSOR grants to LICENSEE this License to: a. Construct, install, operate, maintain, modify, repair, replace, remove, and plug and abandon soil vapor and ground water monitoring wells for the collection of groundwater samples and conducting aquifer tests. Wells are identified as shallow (groundwater surface), intermediate (45-60 feet below groundwater surface) and deep (85-100 feet below groundwater surface). Existing and currently proposed monitoring wells subject to the terms of this permit are: b. Construct, install, operate, maintain, modify, repair, replace, remove, and plug and abandon groundwater extraction wells, and their associated pipeline and infrastructure, to include underground power lines, for the extraction and transport of influent (LNAPL, and/or its various constituents, to include ethylene-di-bromide (EDB)), to the Kirtland AFB groundwater treatment facility for treatment. Existing and currently proposed extraction wells and extraction well pipelines subject to the terms of this permit are: c. Respond to and conduct emergency response activities at all current and future monitoring and extraction well locations and extraction well pipeline locations identified herein. d. Construct, install, operate, maintain, modify, repair, replace, remove, and plug and abandon additional groundwater extraction wells, and their associated pipeline and infrastructure, to include underground power lines additional groundwater monitoring wells, influent extraction wells, and/or influent extraction pipelines required by NMED/HWB to complete the Bulk Fuels Facility fuel plume remediation. All such activity shall occur within the area of investigation described in Condition 1 herein and as more fully depicted in Attachment D herein, such construction and installation being subject to the terms and conditions herein, or as otherwise agreed to by the PARTIES by written agreement and submission of well permits and other drawings, plans and schematics as determined necessary by the City and the City manuals. e. Coordinate all LICENSOR well location deviation requests with the NMED/HWB. f. Construct, install, operate, maintain, modify, repair, replace, remove, plug and abandon a core drilling borehole, as more fully depicted in Attachment G herein, for the collection of a continuous core sample extending from a borehole depth of 350 feet to 500 feet below ground level. The final core depth will depend upon observed LNAPL concentrations. A second alternate core drilling borehole may be necessary, if the first borehole LNAPL is observed in the first core sample. Specific borehole latitude/longitude location coordinates will be provided upon determination of the final borehole location and engineering specifications will be submitted prior to drilling. If the location of boreholes is within the confines of Bullhead park, the borehole location, core drilling time of year and other logistic considerations must be discussed with Park personnel well in advance of any activity planned for the Park and written approval by the Parks and Recreation Director must be obtained. g. Conduct all remediation activities set forth in Clauses 1 (a) through 1 (f) herein on City property, including rights of ways, within the following general area within the municipal boundaries of the City of Albuquerque and City-owned property in the County of Bernalillo, excluding all City-owned parks except Bullhead Park, Phil Chacon Park and the Veterans Memorial: and as more fully identified in Attachments D and E attached hereto and incorporated herein. Final locations of each well described and shown in the attachments, any changes in location and any future wells determined to be necessary to the investigation and remediation of the fuel plume shall be approved by the LICENSOR, as follows: new or additional sampling wells determined to be necessary during the term of this license that are located within the license agreement area in city rights-of-way need prior approval of the City Environmental Health Department, Environmental Services Division. All wells and construction need to be addressed by amending this License and approval by the City of Albuquerque Chief Administrative Officer. Additionally, all wells must be processed through the Well Permit approval process prior to LICENSEE commencing construction. Final locations of all pipelines described and shown in the attachments, any changes in location and any future wells, extraction pipelines or other infrastructure determined to be necessary to the investigation and remediation of the fuel plume shall be approved by the LICENSOR prior to LICENSEE commencing construction.	NA

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
2	The LICENSEE shall use the area described in Clause 1 (g) herein and as shown in Attachments D and E for the purposes described in Clause 1 herein and not for any other purpose without first obtaining the written consent of the LICENSOR and shall adhere to the following use conditions: a. As to the underground extraction pipeline, LICENSEE shall: i. Obtain written preconstruction approval of the location of the pipeline, which written approval will be documented on the underground influent pipeline map attached hereto and incorporated herein as Attachment F; a. Future Underground Influent Extraction Pipeline Locations: Reserved. ii. Conduct all construction, installation, maintenance, operation modification, repair, replacement, removal and abandonment activities to minimize impacts to the LICENSOR's property and minimize construction related noise and dust; iii. Backfill the pipeline trench immediately and in such a manner as to retard soil subsidence; iv. Inspect and repair any subsequent subsidence occurring along the length of the pipeline; v. Coordinate with the City Engineering Department when initiating horizontal drilling under city streets, particularly Louisiana Avenue, for pipeline installation to minimize traffic flow interruptions and damage to the surface of any city street; vi. Repair immediately all damage to city streets and/or alleys along the entire length of the pipeline; vii. Provide an as-built schematic to the LICENSOR to eliminate potential damage to the influent extraction pipeline system during any LICENSOR maintenance and/or construction activities, or any other LICENSOR subsurface activities, which schematic shall be attached hereto and incorporated herein as part of Attachment K when construction is completed; b. Future As Builts Schematic and Cross Sections of Wells and Extraction Pipeline Reserved viii. Coordinate all extraction pipeline deviations with the LICENSOR; ix. Register the influent extraction pipeline with New Mexico One Call to eliminate inadvertent line ruptures or breaks during LICENSOR and/or third party digging or excavation activities; and x. Remove said influent extraction pipeline upon New Mexico Environment Department's approved closure of the LICENSEE's bulk fuel release remediation. c. As to the monitoring and extraction well locations, LICENSEE shall: i. Obtain a City of Albuquerque Well Permit for each well by making application to the Development and Building Services Division. One permit may be used for multiple wells, grouped by type of well, by installation priority, by cluster or by location; a. Future Well Permits: Reserved. ii. Ensure that the LICENSEE's Contractor complies with the terms of all issued well permits and coordinates field activities with the Development and Building Services Division; iii. Ensure that the LICENSEE's Contractor complies with permitting and traffic/safety control requirements of the City's Department of Municipal Development (DMD), including but not limited to obtaining an excavation and barricade permit at each cluster; iv. Ensure that the LICENSEE's Contractor complies with permitting and environmental Health protections requirements of the City of Albuquerque Environmental Health Department, including but not limited to air quality and noise remediation; v. Restore all well heads to pre-existing grades in compliance with City ordinances, codes and guidelines and according to the approved work plans; vi. Coordinate all well installations within City Parks with the City's Department of Parks and Recreation (Parks) to implement adequate safety control measures prior to and during well drilling and construction activities and to minimize disruption to activities and uses scheduled by Parks;	NA
	vii. Revegetate the soil surface immediately consistent with the landscaping specifications contained in the City's Standard Specifications for Public Works Construction, Section 1000 - Landscaping and coordinate all surface restoration with Parks to allow on-site pre-construction field inspections by Parks with the KAFB contractor and a post construction field inspection by Parks following the restoration activities; and viii. Ensure LICENSEE's Contractor contacts the Bullhead Park Superintendent and/or park personnel to coordinate all sampling at wells 106028, 106065 and 106066 within Bullhead Park prior to traversing the park with vehicles to conduct the sampling. ix. Coordinate all monitoring and sampling activity affecting the Cesar Chavez Community Center facility with the facility's site manager to implement adequate safety control measures prior to and during well monitoring and sampling activities to minimize disruption to activities and uses scheduled by Family and Community Services. x. Restore any surface disturbance created by monitoring and sampling activities at the Cesar Chavez Community Center to its pre-disturbance condition. xi. Repair or replace any curbing or other vehicular access facility infrastructure affected by monitoring and sampling activities at the Cesar Chavez Community Center to restore it to its pre-disturbance condition. d. Miscellaneous locations: all ingress, egress and miscellaneous sites disturbed by the LICENSEE during the construction, installation, maintenance, operation, repair and/or removal of wells and underground pipeline shall be returned to pre-construction condition or as mutually agreed by the Parties. e. Before commencing or resuming any construction and repairs in USS Bullhead Park and/or the Veterans Memorial, LICENSEE shall coordinate with the Director of Parks and Recreation Department to schedule LICENSEE's activities so as to not interfere with activities and uses scheduled by Parks. The decision of the Director of Parks and Recreation as to when LICENSEE's construction and repairs may occur shall be final. f. In addition to the foregoing, LICENSEE shall, during and after the installation of its remediation infrastructure, ensure that the City property continues to be usable for its intended uses reasonably to the same extent as before the installation of the remediation infrastructure.	NA
3	This License shall remain in effect for a period of ten (10) years beginning on the date of execution by the LICENSEE, with multiple options to renew in five-year increments thereafter, corresponding with, but not to exceed, the New Mexico Environment Department Hazardous Waste Bureau remediation timetable, as set forth in Attachments A through D incorporated above in Clause 1, unless revoked as provided herein, or extended by the mutual written consent of both parties.	Table 1-1

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
4	Either Party may revoke this License upon providing written notice to the other party thirty (30) days prior to such revocation.	NA
5	All tools, equipment, and other property (the "Personal Property") taken upon or placed upon the City's land by the LICENSEE shall remain the property of the LICENSEE and shall be removed within thirty (30) days after the expiration or revocation of this License. In the event that the LICENSEE fails to timely remove the Personal Property the LICENSOR may, at the LICENSOR's election, remove and have stored the Personal Property at the LICENSEE's expense or may elect to retain the Personal Property as LICENSOR's property.	NA
6	Damages. a. If any action of the LICENSEE's officers, employees, or authorized representatives including contractors and subcontractors) in the exercise of this license results in damage to the Property, or any other property of the LICENSOR or LCENSOR's tenants, including but not limited to water lines, sanitary and storm sewers, and other utilities and services, caused by LICENSEE's Operation(s), to include but not limited to damage caused by vibration during well and pipeline drilling and installation, the LICENSEE will either repair such damage or make an appropriate settlement with the LICENSOR. Upon completion, expiration or termination of this license, LICENSEE shall make all reasonable efforts to restore the Property to its original condition in accordance with section 9. The LICENSEE's liability under this clause may not exceed appropriations available for such payment and nothing contained in this license may be considered as implying that Congress will at a later date appropriate funds sufficient to meet deficiencies. The provisions of this paragraph are without prejudice to any rights the LICENSOR may have to make a claim under applicable laws for any other damages than provided herein. b. The LICENSEE shall respond to claims repair or pay for all actual damages done to City Property and improvements, or to the improvements of the City's tenants. All claims for damage to adjacent properties caused by LICENSEE's Operations, to include damage caused by vibration during well and pipeline drilling and installation, brought by third parties shall be subject to the claims process set forth in Condition 13 herein and as limited by the provisions of the Federal Tort Claims Act (28 USC §§ 2671 et seq.). To the extent provided by law, the LICENSEE's liability under this clause is subject to the availability of funds, as set forth in 31 USC § 1341 (Anti-Deficiency Act) and nothing contained in this License may be considered as implying Congress will at a later date appropriate funds sufficient to meet deficiencies. The provisions of this clause are without prejudice to any rights the LICENSOR or any third party may have to make a claim for damages under applicable laws.	NA
7	The LICENSEE shall be solely responsible for maintaining in a safe condition the premises upon which the LICENSEE's remediation operations, to include but not limited to construction of improvements, subsequent well monitoring events effluent pipeline transport from well sites to the LICENSEE groundwater treatment facility, are being conducted and the property of the LICENSOR or LICENSOR's tenants within the premises, including but not limited to water lines, sanitary and storm sewer and other utilities and services. To the extent provided by law, the LICENSEE's liability under this clause is subject to the availability of funds, as set forth in 31 USC § 1341 (Anti-Deficiency Act) and nothing contained in this License may be considered as implying Congress will at a later date appropriate funds sufficient to meet deficiencies. Nothing herein is intended to impair any right or immunity under the laws of the State of New Mexico.	NA

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
8	The hold harmless provisions contained herein shall not apply to any liability, claims, damages, losses or expenses, including reasonable attorney's fees, arising out of bodily injury to persons or damage to property caused by or resulting from, in whole or in part, the negligent act or omission of the City, or the agents or employees of the City. Furthermore, LICENSEE shall require its agents, representatives, contractors or sub-contractors to obtain insurance for the specific protection and benefit of the City, including but not necessarily limited to, the following coverage: a. Comprehensive General Liability Insurance. Comprehensive general liability insurance with liability limits in an initial amount not less than $1,000,000 aggregate limit of liability for bodily injury, including death, and property damage in any one occurrence. b. Automobile Liability Insurance. An automobile liability policy with liability limits in amounts not less than $1,000,000 combined single limit of liability for bodily injury, including death, and property damage in any one occurrence. Said policy of insurance must include coverage for the use of all owned, non-owned, hired automobiles, vehicles and other equipment both on and off work and is in addition to the Comprehensive General Liability Coverage. c. Workers' Compensation Insurance. Workers' Compensation Insurance for its employees in accordance with the provisions of the Workers' Compensation Act of the State of New Mexico. d. Owner's Protective Public Liability Insurance. During any period of construction or major renovation, an owner's protective public liability insurance policy with liability limits in an amount not less than $1,000,000 combined single limit of liability for bodily injury, including death and property damage in any one occurrence. e. Builder's Risk and Property insurance. During any period of construction or major renovation, until completion of the construction, builder's risk, vandalism and malicious mischief insurance for the value of the property. Alternatively, Contractor shall procure and maintain insurance against loss or damage to the Project by fire, lightning, vandalism, and malicious mischief with the uniform extended coverage endorsement limited only as may be provided in the standard form or extended coverage endorsement at the time in use by the State of New Mexico to provide for not less than 90% recovery of the market value of the buildings and other improvements. f. Increased Limits. The City may require the LICENSEE's Contractor to reasonably increase the maximum limits of any insurance required herein and LICENSEE's Contractor shall promptly comply. g. No Subrogation. LICENSEE's Contractor and its surety shall and hereby do waive any right of subrogation they may acquire against the City, its officers, agents and employees by reason of any -payment made on account of injury, including death, sustained by any employee of the insured arising out of performance of this Agreement. Neither the LICENSEE's Contractor nor its employees are considered to be employees of the City of Albuquerque for any purpose whatsoever. h. The LICENSEE's Contractor shall be and is an independent contractor at all times in the performance of this Agreement. Neither the LICENSEE's Contractor nor its employees are entitled to any benefits from the City under the provisions of the Worker's Compensation Act of the State of New Mexico, nor to any of the benefits granted to employees of the City under the provisions of the Merit System Ordinance or any other law or provision, as now enacted or hereafter amended. i. Proof of Insurance: During the term of this Agreement, not less than once each year, on or before May 31, LICENSEE's Contractor shall provide to the City without demand, or more frequently upon demand, proof of all required insurance coverage. Prior to expiration or exchange of any policy, LICENSEE's Contractor shall furnish the City evidence satisfactory to the City that the policy has been renewed or replaced or is no longer required by this Agreement. All policies required hereunder shall provide that the City shall be given thirty (30) days prior written notice of cancellation, non-renewal or material alteration of coverage. Provisions that the insurance company shall "endeavor to give the City notice" shall not be allowed. j. Application of Net Proceeds of Insurance. The Net Proceeds of builder's risk insurance and of fire and other hazard and casualty insurance, carried pursuant to the provisions of this Agreement hereof, shall be applied first to the payment of the interests of the City as it may be from time to time, and only after such payment, to the interests of Contractor and others, and otherwise as provided in this Agreement and the Net Proceeds of liability insurance carried pursuant to the provisions of this Agreement hereof shall be applied toward extinguishment or satisfaction of the liability with respect to which such insurance proceeds have been paid. k. Additional Provisions Respecting Insurance. All insurance required of Contractor pursuant to this Agreement shall be obtained by Contractor from and maintained in generally recognized responsible insurance authorized to do business in the State of New Mexico. All applicable policies evidencing such insurance shall name both the City and Contractor as named insured and the City shall be named as loss payee as to the City's Mortgage under the builder's risk and property insurance required by this Agreement.	NA
9	The LICENSEE will use all reasonable means available to protect the environment and natural resources from damage arising from this License or activities incident to it, to include the removal and disposal of all municipal and hazardous waste generated at all well and infrastructure construction and operation sites in accordance with City of Albuquerque, State and Federal law. Where damage occurs, the Licensee shall be liable and shall restore the damaged resources to the condition existing prior to the implementation of the remediation and monitoring, as documented in the Request for Environmental Impact Analysis (AF Form 813), which is attached hereto and made a part of this License as Attachment H, and two Environmental Baseline Survey (EBS), which are to be attached hereto and made a part of this License as Attachments I and J when completed. Upon revocation or termination of this License, with the exception of pre-existing conditions identified in Attachments H, I and J herein, the LICENSOR's land will be returned in the same environmental condition as received but without the contamination conditions for which the LICENSEE is performing the remediation. a. Final EBS Reserved	NA
10	In connection with its use of or any other activity at the Location, the LICENSEE, its officers, employees, agents, representatives, contractors, and assigns will at all times and in all respects comply with all federal, state and local laws, ordinances and regulations, relating to the protection of the environment, including but not limited to protection of surface water and groundwater; industrial hygiene; the use, handling and disposal of any hazardous or toxic substances; the Clean Air Act, 42 U.S.C. 7401 et seq. applicable state and air quality local laws, and policies and procedures of the City's Environmental Health Air Quality Division.	NA
11	The LICENSEE and its agents, representatives, contractors or sub-contractors shall comply with all other applicable federal, state and local laws, statutes, ordinances and regulations and will not discriminate illegally against any person.	NA

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
12	For purposes of giving formal written notice, the points of contact are as follows: For the City: Chief Administrative Officer, City of Albuquerque City-County Government Center, #1 Civic Plaza P.O. Box 1293 Albuquerque, NM 87103 For Kirtland: Installation Commander 2000 Wyoming Blvd, SE Kirtland AFB, NM 87117	NA
13	Claims. a. Point of Contact. The LICENSEE's point of contact for all damages, whether to real or personal property, will be submitted to: 377 ABW/JA Attention: Claims Division 2000 Wyoming Blvd., SE Building 20604, Room B-36 Kirtland AFB, NM 87117-5000 (505) 846-4217 http://www.claims.jag.af.mil b. Claims Process. As set forth in License #LIC/I-KI-11-0001 Condition 6, Damages, a claim for damage and/or injury due to LICENSEE's operations, a claimant, or his/her authorized agent, must file a properly signed SF-95, Claim for Damage, Injury, or Death, setting forth a sum certain for damage to or loss of property, personal injury or death, to the point of contact identified in Condition 7(a) above. The claim form is available at the website provided herein in Condition 7(a) above. To the extent provided by law, the LICENSEE's liability under this Condition 13 is subject to the availability of funds, as set forth in 31 USC§ 1341 (Anti-Deficiency Act) and nothing contained in this License may be considered as implying Congress will at a later date appropriate funds sufficient to meet deficiencies. The provisions of this Condition 13 are without prejudice to any rights the LICENSOR or any third party may have to make a claim for damages under applicable laws.	NA
14	Index of Attachments referred to in License, copies of which are on file with LICENSOR Attachment A - Vadose Zone Investigation Work Plan - Bulk Fuels Facility Spill, Solid Waste Management Units ST-106 and SS-111 - March 2011 Attachment B - Groundwater Investigation Work Plan, Bulk Fuels Facility Spill, Solid Waste Management Units ST-106 and SS-111 - March 2011 Attachment C - Well Permits for wells identified under clauses 1 (a) and 1 (b) on file with LICENSOR'S City Engineer Attachment D - General Location Map of License Area Attachment E - Off Installation Well Location Map 2015 Attachment F - City of Albuquerque Well Locations with LNAPL Containment System Attachment G - Coring Borehole location map Attachment H - Requests for Environmental Impact Analysis (AF Form 813) dated 2/17/09 and 3/18/10 (Attachments H-1 and H-2, respectively) Attachment I - Initial Environmental Baseline Survey (EBS) dated 2/22/11, 3/2/10, 3/3/10, and 2/4/09 (Attachments 1-1, 1-2, 1-3, and 1-4, respectively) Attachment J - Final Environmental Baseline Survey February 2012 Attachment K - As built schematics and cross sections of wells and extraction pipeline (to be attached and incorporated herein when completed)	NA
15	This License contains the entire agreement of the parties. Changes to this License are not binding unless made in writing and signed by both parties.	NA
16	This License is governed by and construed and enforced in accordance with federal law and the laws of New Mexico.	NA
17	If any part of this License is held to be invalid or unenforceable, the remainder of this License will remain valid and enforceable if the remainder of the License is reasonably capable of completion.	NA

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
	New Mexico Veterans Administration Health Care System Permit	
1	PURPOSE: This Permit outlines the grant of right of entry and agreement between the New Mexico VA Health Care System (NMVAHCS) and Kirtland Air Force Base (KAFB) for disclosure of results of environmental services on NMVAHCS property . NMVAHCS has granted permission for KAFB to use a con tractor to conduct environmental services and remediation on NMVAHCS property. The contractor selected by KAFB to conduct environmental services and remediation is CH2MHill . KAFB agrees to allow NMVAHCS direct access to any information and outcomes regarding environmental services and remediation performed on NMVAHCS property by CH2MHill .	NA
2	BACKGROUND: In 2001, KAFB completed delineation of contaminated soil and groundwater discovered in 1999 as part of the Stage 1 Abatement Plan. In February 2007, KAFB discovered fuel product on the groundwater at another location near the Bulk Fuels Facility, which is being investigated as part of a Modification to the Stage 2 Abatement Plan. KAFB has delineated the contaminated areas on its property in the first and second stages of their abatement plan . The proposed next step in the Stage 2 Abatement Plan Modification is to investigate the land both within and outside of the KAFB boundaries, to determine if, and to what extent the fuel product has migrated outside of KAFB boundaries. Subsequent to the investigation, KAFB may be required to install remediation systems to remove the fuel product. As part of these efforts, KAFB has retained the services of an environmental contractor, CH2MHill, to perform environmental services on land both inside and outside of the KAFB boundary. The land proposed to be tested includes an 11 .5 acre plot of land on VA property or other areas identified and agreed upon that are owned by NMVAHCS. KAFB is required by the New Mexico Environment Department to define the extent of the fuel product on and off of KAFB. KAFB may therefore be required to install groundwater monitor wells on other VA property, specifically within the parking lots south and east of the VA Hospital to complete the investigation. This has been presented to the VA Engineering Staff in previous meetings. These 11 .5 acres of VA owned land are currently vacant, but the NMVAHCS has future plans to develop this land under the Federal Enhanced Use Lease (EUL) authority. The NMVAHCS needs assurance that any environmental contamination on its 11 .5 acre property has been addressed, and will be remediated before proceeding further with its EUL project plans. Thus, the NMVAHCS has granted permission to KAFB to conduct environmental services on the property proposed for use in the EUL or other areas identified and agreed upon that are owned by NMVAHCS. This testing is projected to include the drilling and testing of monitoring wells, in order to explore the quality of the groundwater beneath the 11 .5 acre parcel, to determine whether the leaked fuel product has migrated to affect the 11 .5 acre parcel or other VA property. The NMVAHCS needs to have unrestricted access to any and all results of the testing, conducted by CH2MHill, on its 11 .5 acre parcel of land and on all other VA property.	NA
3	RESPONSIBILITIES: a. Kirtland Air Force Base: 1) Allows NMVAHCS full, unrestricted access to any and all results of environmental services performed on NMVAHCS (VA) property. 2) Coordinates communication between NMVAHCS and KAFB to ensure that NMVAHCS is provided full access to all environmental services results derived from activities on NMVAHCS property. 3) Agrees to provide a written copy of any final environmental assessment reports produced by CH2MHill, once all testing on NMVAHCS property is complete. 4) Agrees to maintain open communication with the Engineering Staff of the NMVAHCS regarding environmental services performed on NMVAHCS property, and promptly informs them of any proposed changes to the initial testing protocols and schedules. b. New Mexico VA Health Care System: 1) Grants KAFB or its contractor/subcontractor permission to conduct environmental services on NMVAHCS property, to include drilling monitoring wells on NMVAHCS property to determine the quality of the groundwater at the well sites located on NMVAHCS property. 2) Grants KAFB or its contractor/subcontractor permission to temporarily install and use remediation equipment such as soil vapor extraction systems currently installed on KAFB, to remove any leaked fuel product. When remediation equipment is used by KAFB or its subcontractor, KAFB agrees to adhere to the following: a. Remediation equipment will be secured using a secured chain-link fencing system. b. Remediation equipment located in residential areas will be soundproofed. c. KAFB will be responsible for and will address issues of physical equipment security, public safety and public perception at the time the remediation equipment is deployed. d. KAFB will be responsible for meeting any and all applicable air emission standards for the remediation equipment. e. KAFB agrees to comply with any and all applicable city, state or federal laws and regulations regarding EPA permitting. f. All tools, equipment, and other property taken upon, placed upon, or installed on VA property by KAFB, or its contractor/subcontractor, excluding the installed monitoring wells, shall remain the property of KAFB, or its contractor/subcontractor, and may be removed by KAFB, or its contractor/subcontractor, at any time within a reasonable period after the expiration of this right-of-entry. g. Monitoring wells drilled and installed on VA property will remain in place until groundwater remediation activities are completed consistent with the terms of Paragraph 6, Terms of Agreement, contained herein, at which time NMVAHCS will determine which monitoring wells will be removed and/or abandoned in place. All monitoring well removal and/or abandonment activities will comply with the provisions of Title 19, Chapter 27 and Title 20, Chapter 6 of the New Mexico Administrative Code (NMAC).	NA

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
3	3) Grants KAFB permission to erect a temporary equipment staging area on VA property in an area within the 11 .5 acre plot of land, not to exceed 50 feet by 100 feet for the purpose of housing supplies needed for the environmental services effort. When a temporary equipment staging area has been established by KAFB, KAFB agrees to adhere to the following: a. The temporary storage area located on VA property within the 11 .5 acre plot of land will be secured using a secured chain-link fencing system. b. KAFB will be responsible for and will address issues of physical equipment security, public safety and public perception at the time the remediation equipment is deployed. c. KAFB agrees to maintain oversight of and responsibility for all items placed in the designated temporary storage area. d. KAFB will be responsible for and will address issues of physical equipment security, public safety and public perception at the time the temporary storage area is deployed. e. All tools, equipment, and other property taken upon the land and housed or placed on VA property within the temporary equipment staging area by KAFB, or its contractor/subcontractor, shall remain the property of KAFB, or its contractor/subcontractor, and may be removed by KAFB, or its contractor/subcontractor, at any time within a reasonable period after the expiration of this right-of-entry. 4) Receives copies of all environmental services performed by CH2MHill, reviews them, and promptly provides comment back to KAFB regarding any concerns, questions, or issues involving the environmental services so that if changes need to be made to the environmental services schedule and/or protocols, this information can be communicated to KAFB and CH2MHill. 5) Maintains open communication with the KAFB Natural Resource Management Restoration Section concerning the environmental services on NMVAHCS property. 6) Informs KAFB of any access and/or scheduling issues with the environmental services performed by CH2MHill. 7) Grants KAFB, via VA Form 10-6215, "Permit for Use of Real Property by Federal Agency," a five (5) year "Right of Entry" for the installation of and collection of data from groundwater monitoring wells designed to both delineate and remediate any leaked groundwater fuel product.	NA
4	PROCEDURES: Standard procedures and timelines for receiving regular updates on the progress of environmental services, as well as periodic written reports and the final written report produced by CH2MHill will be developed and adhered to.	NA
5	PAYMENT I REIMBURSEMENT: No payment or reimbursement will be made or exchanged between NMVAHCS and KAFB for environmental services conducted, or copies of testing results shared between the two organizations in accordance with this Permit.	NA
6	TERMS OF AGREEMENT: This five (5) year agreement may be modified or revised by written amendment, provided such revision or modification is mutually agreed upon and signed by the authorized representative of Kirtland Air Force Base and the New Mexico VA Health Care System. This agreement will remain in effect during the period stated unless terminated at the request of either party after thirty (30) days notice in writing. The parties involved shall review this agreement annually. No later than twelve (12) months prior to the expiration of this Permit, NMVAHCS and KAFB officials will review the status of groundwater monitoring and remediation efforts and determine whether the Permit and Right of Entry shall both expire or be renewed for an additional term not to exceed five (5) years.	NA
7	PROTECTION OF RESOURCES a. GRANTEE will use all reasonable means available to protect the environment and natural resources from damage arising from this Right of Entry or activities incident to it. Where damage nonetheless occurs, GRANTEE shall be liable to restore the damaged resources. Upon termination of this Right of Entry, the land shall be returned to GRANTOR in the same environmental condition as received, as documented in the Request for Environmental Impact Analysis (AF Form 813) and Environmental Baseline Survey (EBS) Waiver for Right of Entry attached hereto and made a part hereof as Exhibit Band C respectively. - b. To the extent provided by law and subject to the availability of funds, KAFB agrees to use its appropriations and resources, as required, to repair damages to said parcel and pay any awards, claims, settlements or judgments rising out of its use of said parcel, or routes of ingress or egress therefrom, including reimbursement of the Judgment Fund, 31 USC§ 1304; provided however, that NMVAHCS or another agency of the Government may, as a matter of its internal policy, assume responsibility for certain claims of that agency's personnel while assigned or detailed to the KAFB, or otherwise present on the said parcel.	NA
8	EFFECTIVE DATE: This agreement is effective for the period 09/12/2008 through 08/31 /2013.	NA
New Mexico Veterans Administration Health Care System Permit Amendment No. 2		
1	The Permit shall be amended to extend the permit term for a five (5) year term beginning on 28 January 2016 and ending on 27 January 2021.	Table 1-1 - Applicable Permits
2	All Permit references to "PERMITTEE's contractor" shall refer to any of the PERMITTEE's contractors/subcontractors conducting environmental services for the KAFB bulk fuels release investigation and remediation.	NA
3	Permit§ 8(8), Effective Date, shall be amended to read as follows: "This Agreement is effective for the period 28 January 2016 through 27 January 2021."	NA
4	All other terms and conditions of the NMVAHCS Permit shall be and remain the same.	NA
Gibson Medical Center License to Kirtland Air Force Base		

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
1	The LICENSOR hereby grants unto the LICENSEE a license to enter upon the LICENSOR's real property located at 5400 Gibson Blvd SE, Albuquerque, Bernalillo County, New Mexico, which real property is also known as: SWIFT ADDITION, LOT 1,BERNALILLO COUNTY & LOVELACE HOSPITAL, LOT A 1 A, BERNALILLO COUNTY and more specifically identified on the attached general location map, which is attached hereto and incorporated herein as Attachment A, for the express purpose of: constructing, installing, operating, maintaining, modifying, repairing, replacing and/or removing soil vapor and ground water monitoring wells for the collection of soil and groundwater samples; and collecting quarterly well samples as more fully identified in Attachments Band C, attached hereto and incorporated herein.	NA
2	The LICENSEE shall use the area described above and as shown in Attachments A and B, for the purposes described above and not for any other purpose without first obtaining the written consent of the LICENSOR and shall adhere to the following use conditions: a. LICENSEE shall obtain a City of Albuquerque Well Permit for each well by making application to the Development and Building Services Division. One permit may be used for multiple wells grouped by type of well, by installation priority, by cluster or by location. b. Ensure that the LICENSEE's Contractor complies with the terms of the well permit Division. c. Ensure that the LICENSEE's Contractor complies with permitting and environmental health protections requirements of the city of Albuquerque Environmental Health Department, including but not limited to air quality and noise remediation; d. Restore all well heads to pre-existing grades and restore any surface disturbance created by the well installation process; e. At each successive License renewal, or upon request. provide the LICENSOR a well status update as set forth in the annual monitoring reports submitted to the New Mexico Environment Department Hazardous Waste Bureau f. Provide the LICENSOR a 48 hour notice, as set forth in Condition 11 herein before the Contractor enters the property to conduct sampling.	NA

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
3	This License shall remain in effect for a period of five (5) years beginning on the date of execution by the PARTIES, with multiple options to renew thereafter, corresponding with, but not to exceed, the New Mexico Environment Department Hazardous Waste Bureau (NMED-HWB) remediation timetable, which timetable will be attached and incorporated herein as Attachment D when approved by the NMED-HWB, unless revoked as provided herein, or extended by the mutual written consent of both parties.	Table 1-1 - Applicable Permits
4	Either Party may revoke this License upon providing written notice to the other party thirty (30) days prior to such revocation.	NA
5	All tools, equipment, and other property (the "Personal Property") taken upon or placed upon the LICENSOR's land by the LICENSEE shall remain the property of the LICENSEE and shall be removed within thirty (30) days after the expiration or revocation of this License. In the event that the LICENSEE fails to timely remove the Personal Property the LICENSOR may, at the LICENSOR's election, remove and have stored the Personal Property at the LICENSEE's expense or may elect to retain the Personal Property as LICENSOR's property.	NA
6	Damages and Indemnity. The LICENSEE shall repair or pay for all actual damages done to LICENSOR's property and improvements caused by LICENSEE's operation(s), to include damage caused by vibration during well drilling and installation. All claims for damage to LICENSOR's property and improvements shall be subject to the provisions of the Federal Tort Claims Act (28 USC§§ 2671 et seq.). To the extent provided by law, the Licensee's liability under this clause is subject to the availability of funds, as set forth in 31 USC§ 1341 (Anti-Deficiency Act) and nothing contained in this License may be considered as implying Congress will at a later date appropriate funds sufficient to meet deficiencies. The provisions of this clause are without prejudice to any rights the LICENSOR may have to make a claim for damages under applicable laws.	NA
7	The LICENSEE shall be solely responsible for maintaining the premises upon which the Improvements are being constructed in a safe condition during construction and subsequent well monitoring events.	NA
8	The Licensee will use all reasonable means available to protect the environment and natural resources from damage arising from this License or activities incident to it, to include the removal and disposal of all municipal and hazardous waste generated at all well and infrastructure construction and operation sites in accordance with City of Albuquerque, State and Federal law. Where damage occurs, the Licensee shall be liable and shall restore the damaged resources to the condition existing prior to the implementation of the remediation and monitoring, as documented in the Request for Environmental Impact Analysis (AF Form 813), which is attached hereto and incorporated herein as Attachment E, and two Environmental Baseline Surveys (EBS), which are attached hereto and incorporated herein as Attachments F and G. Upon revocation or termination of this License, with the exception of pre-existing conditions identified in Attachments E, F and G, the LICENSOR's land will be returned in the same environmental condition as received but without the contamination conditions for which the LICENSEE is performing the remediation.	NA
9	In connection with its use of or any other activity on the property, the LICENSEE, its officers, employees, agents, representatives, contractors, and assigns will at all times and in all respects comply with all federal, state and local laws, ordinances and regulations, relating to the protection of the environment, including but not limited to protection of surface water and groundwater; industrial hygiene; the use, handling and disposal of any hazardous or toxic substances; the Clean Air Act, 42 U.S.C. 7401 et seq. applicable state and air quality local laws, and policies and procedures of the City's Environmental Health Air Quality Division.	NA
10	The LICENSEE and its contractors shall comply with all other applicable federal, state and local laws, statutes, ordinances and regulations and will not discriminate illegally against any person.	NA
11	For purposes of giving formal written notice, the points of contact are as follows: LICENSOR: GIBSON MEDICAL CENTER 2009 EUBANK NE Albuquerque, NM 87112 LICENSEE: Installation Commander 2000 Wyoming Blvd, SE Kirtland AFB, NM 8711 7	NA
12	Claims. a. Point of Contact. The Permittee point of contact for all damages, whether to real or personal property, will be submitted to: 377 ABW/JA Attention: Claims Division 2000 Wyoming Blvd., SE Kirtland AFB, NM 87117-5000 (505) 846-4217 http://www.kirtland.af.mil/Organizations/StaffJudge/index.htm b. Claims Process: To file a claim for damage and/or injury due to Permittee's operations, the claimant, or his/her authorized agent, must file a properly signed SF-9S, Claim for Damage, Injury or Death, setting forth a sum certain for damage to or loss of property, personal injury or death, to the POC identified in Condition 13(a) above, within two (2) years of the incident causing the damage or injury. The claim form is available at the website provided herein in paragraph a.	NA
13	This License contains the entire agreement of the parties. Changes to this License are not binding unless made in writing and signed by both parties.	NA
14	This License is governed by and construed and enforced in accordance with federal law and the laws of New Mexico.	NA
15	If any part of this License is held to be invalid or unenforceable, the remainder of this License will remain valid and enforceable if the remainder of the License is reasonably capable of completion.	NA

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
~~16~~	~~Index of Attachments~~ ~~Attachment A- General Location Map~~ ~~Attachment B-Well Permits as Developed~~ ~~Attachment C -Sampling Schedule~~ ~~Attachment D -NMED-HWB Remediation Plan and Timetable~~ ~~Attachment E-Request for Environmental Impact Analysis (AF Form 813)~~ ~~Attachment F -Initial Environmental Baseline Survey (EBS)~~ ~~Attachment G-Final EBS~~	~~NA~~

$ = dollar(s)
AF = Air Force
AFB = Air Force Base
BFF = Bulk Fuels Facility
EBS = environmental baseline survey
EDB = ethylene dibromide
EPA = U.S. Environmental Protection Agency
EUL = enhanced use lease
GAC = granular activated carbon
gpd = gallon per day
GWQB = Groundwater Quality Bureau
GWTS = groundwater treatment system
HWB = Hazardous Waste Bureau
KAFB = Kirtland Air Force Base
LNAPL = light non-aqueous phase liquid
MCL = maximum contaminant level
NA = not applicable
NM = New Mexico
NMAC = New Mexico Administrative Code
NMED = New Mexico Environment Department
NMPM = New Mexico Principal Meridian
NMSA = New Mexico Statutes Annotated
NMSPCS = New Mexico State Place Coordinate System
NMVAHCS = New Mexico Veterans Administration Health Care System
NMWQCC = New Mexico Water Quality Control Commission
O&M = operations and maintenance
OSE = Office of the State Engineer
~~POC =point of contact~~
POD = point of diversion
RCRA = Resource Conservation and Recovery Act
SWMU = solid waste management unit
UIC = underground injection control
~~USC = United States Code~~
~~VA = Veterans Administration~~
WQA = Water Quality Act

Table 1-3
GWTS Effluent UIC Well Discharge Limits

Constituents	Effluent Standard
Ethylene Dibromide[1]	0.05 µg/L
Benzene[1]	5.0 µg/L
Ethylbenzene[1]	700 µg/L
Toluene[1]	750 µg/L
Total Xylenes[1]	620 µg/L
Iron[1]	1,000 µg/L
Manganese[1]	200 µg/L
pH[2,3]	6 (minimum) to 9 (maximum)
Total residual chlorine[2,3]	NA mg/L - 11 µg/L
Total suspended solids[2,3]	21 mg/L - 33 mg/L
Biochemical oxygen demand[2,3]	26 mg/L - 48 mg/L
Oil and grease[2,3]	8 mg/L - 15 mg/L

[1] UIC discharge limits are in accordance with Table 2 of DP-1839.

[2] NPDES discharge limits are in accordance with NPDES Permit Number NM0031216 Part I Section A(1).

[3] Only applicable during times of discharge to the NPDES outfall.

GWTS = groundwater treatment system
NPDES = National Pollutant Discharge Elimination System
UIC = underground injection control
µg/L = micrograms per liter
mg/L = milligrams per liter

Table 2-1
Alarm Conditions, Interlocks, and System Responses

Alarm Condition	Interlock	System Response
Leak detected in an extraction well vault or well control house	Disables extraction pumps associated with the affected vault	Email and shutdown of the affected equipment
Leak detected in a double walled pipe	Disables all extraction pumps	Email and shutdown of the affected equipment
High water level in groundwater treatment system building sump or truck bay sump	Disables all extraction pumps and all skid pumps	Email and immediate Full system shutdown
Water level too high in influent tank	Disables all extraction pumps	Email and eventual Full system shutdown
Water level too low in influent tank or too high in effluent tank	Disables influent skid pumps	Email and eventual Full system shutdown
Water level too high in effluent tank	Disables effluent skid pump	Email and eventual Full system shutdown
Water level too low in effluent tank	Disables effluent skid pump	Email and eventual Full system shutdown
Influent skid or granular activated carbon pressure exceeds set point	Disables influent skid pumps	Email and eventual Full system shutdown
Effluent skid pressure exceeds set point	Disables effluent skid pump	Email and eventual Full system shutdown
Main panel AC power failure	Disables all skid pump and extraction wells	Email and eventual Full system shutdown
Intrusion alert, low temperature detected, or high influent bag filter differential pressure	None	Email
Smoke detected in groundwater treatment system	None	Email and notifies Kirtland Air Force Base Fire Department
High water level or high pressure in well KAFB-7	Disables effluent skid pump	Email and eventual Full system shutdown
High water level or high pressure in well KAFB-106IN2	Disables effluent skid pump	Email and eventual Full system shutdown
High water level in Golf Course Main Pond	Disables effluent skid pump	Email and eventual Full system shutdown
Activation of emergency stop	Disables all extraction pumps and all skid pumps	Email and immediate Full system shutdown
High water level in sand filter clarifier	Entire system shutdown	Email and immediate Full system shutdown

Table 2-2
Permitted Extraction Well Flow Rates

Well ID	Permit No.	Extraction/Injection Flow Rate Not to Exceed (gpm, continuous for 24 hours)	Total Extracted Volume Not to Exceed (gallons, continuous for 24 hours)
KAFB-106228	RG-1579 POD 292	250	360,000
KAFB-106233	RG-1579 POD 309	197	283,680
KAFB-106234	RG-1579 POD 310	197	283,680
KAFB-106239	RG-1579 POD 319	200	288,000
KAFB-7	DP-1839	1000 (injection)	1,440,000
KAFB-106IN2	DP-1839	1000 (injection)	1,440,000
NPDES outfall	NM0031216	800 (discharge)	1,152,000

ID = identification
gpm = gallon per minute
No. = number

Table 2-3
GAC Loading Criteria

Contaminant	Maximum Influent Concentrations Reaching the Lead GAC Vessel	GAC Design Concentrations	Current Influent Concentrations
1,2-Dibromoethane	250	2	<0.019
Benzene	197	<0.5	<0.5
Ethylbenzene	197	<0.5	<0.8
Toluene	200	<0.5	<0.5
Xylenes, Total	1,000	<1.5	<3.0

All concentrations are reported in micrograms per liter
Maximum incluent concentrations reaching the lead GAC vessel are discussed in the Technical Memorandum Establishing the Basis of Design Maximum Concentration Limits for the Kirtland BFF GWTS
GAC design concentrations are presented in Appendix G of this Operations and Maintenance Plan
Current influent concentrations are from December 2020

Table 2-4
Standard Operational Set Points

PID Set Points			
Item		**Set Point**	**Units**
Groundwater Influent Pump 112	Flow Rate	Varies	gpm
	KP	1.5	--
	KI	0.05	--
	KD	0	--
Groundwater Influent Pump 212	Flow Rate	Varies	gpm
	KP	1.5	--
	KI	0.05	--
	KD	0	--
Treated water Effluent Pump 118	Flow Rate	Varies	gpm
	KP	1.25	--
	KI	0.09	--
	KD	0	--
Treated water Effluent Pump 218	Flow Rate	Varies	gpm
	KP	1.25	--
	KI	0.09	--
	KD	0	--
System Distribution Pressure Control	Pressure	20	psi
	KP	2	--
	KI	0.02	--
	KD	0	--
KAFB-7 Injection Pressure	Pressure	15	psi
	KP	1.5	--
	KI	0.2	--
	KD	0.02	--
Train Control Set Points			
Item		**Set Point**	**Units**
Extraction Well Drawdown		1.0 - 5.0	ft
Influent Bag Filter High Differential Pressure		4	psid
Downstream Distribution High Pressure		45	psid
KAFB-7 High Level		200	ft
Golf Course High Level		5.3 - 5.7	ft
Groundwater Influent Pumps - Level Stop		3.5 - 4.5	ft
Groundwater Influent Pumps - Level Start		7.0 - 8.0	ft
Treated water Effluent Pumps - Level Stop		3.5 - 4.5	ft
Treated water Effluent Pumps - Level Start		7.0 - 8.0	ft
Manual Alarm Set Points			
Item		**Set Point**	**Units**
Influent Skid High Pressure Switches		40	psi
Carbon Absorber High Pressure Switches		40	psi
Effluent Skid High Pressure Switches		50	psi
Tank High Level Switches		11	ft
Tank Low Level Switches		2	ft

gpm = gallon per minute
ft = foot/feet
KD = derivative gain
KI = integral gain
KP = proportional gain
PID = proportional–integral–derivative
psi = pound per square inch
psid = pound per square inch differential

Table 3-1
Groundwater Treatment System Routine Maintenance Schedule

	Frequency			
Maintenance Activity	**Daily**	**Weekly**	**Monthly**	**As Needed**
Recording and inspecting influent, GAC vessel, and effluent skid pressure, flow rate, and totalizer readings from their respective gauges and the human machine	X			
Recording extraction well pressure, flow rate, and totalizer readings from the human machine interface	X			
Recording extraction well pressure, flow rate, and totalizer readings from the gauges at the well vaults		X		
Inspecting well control house and recording well control house pressure, flow rate, and totalizer readings		X		
Recording totalizer reading at KAFB-7		X		
Running and inspecting the GWTS air compressor		X		
Inspecting extraction well, conveyance line, and air release valve vaults			X	
Inspecting wellhead and associated equipment of injection well KAFB-7			X	
Inspecting and performing maintenance of flowmeters throughout the system			X	
Inspecting and performing maintenance on actuating valves throughout the system			X	
Performing confined space entries			X	
Gauging extraction well filter pack			X	
Inspecting and cleaning the GWTS Y-strainer				X
Logging lockout-tagout entries				X
Logging system shutdowns				X
Emptying storm water runoff flooded vaults				X
Performing air compressor maintenance				X
Cleaning GWTS sumps				X
Draining air release valve containment vessels				X
Grounds keeping including vegetation control				X
Semiannual inspections and maintenance of Tijeras Arroyo Gold Course ponds				X[a]
Performing flow meter calibration				X[b]
Greasing pump bearings				X[c]
Changing process pump oil				X[c]
Changing air filter on control room air conditioner				X[c]
Changing bag filters				X[d]
Changing out GAC				X[d]
Disinfection of extraction wells and conveyance lines				X[e]
Testing of alarms and interlocks				X[f]
Cleaning coils and replacing air filter for the Well Control House air conditioner				X[g]
GAC Skimming of the lead GAC vessel				X[h]

Table 3-1
Groundwater Treatment System Routine Maintenance Schedule

[a] Inspections are performed semi-annually while maintenance is performed as needed.
[b] Flowmeters are calibrated at a minimum of once per year, but may be calibrated more often as needed.
[c] Changing of process pump oil, greasing pump bearings, and replacing the air filter in the air conditioning unit are
[d] Bag filters are scheduled for change out when the pressure differential across a bag filter vessel exceeds 15 psi
[e] Disinfection of extraction wells and conveyance lines occurs semiannually or more often as needed.
[f] Testing of alarms and interlocks occurs annually or more often as needed.
[g] Cleaning of the coil and replacing of the air filter are scheduled as quarterly activities, but frequency may be
[h] GAC skimming is performed when the differential pressure in the lead GAC vessel has increased from the
GAC = granular activated carbon
GWTS = groundwater treatment system
KAFB = Kirtland Air Force Base
psi = pound per square inch

Table 5-1
Influent Criteria

Parameter	Contaminant	Analysis	Discharge Criteria[1]	Maximum Influent Concentrations Reaching the Lead Granular Activated Carbon Vessel	Maximum Single Extraction Well Concentrations[2]	Small Volume IDW Concentrations at Minimum Flow Conditions[3]	Small Volume IDW Concentrations at Maximum Flow Conditions[4]	Large Volume IDW Concentrations at Minimum Flow Conditions[5]	Large Volume IDW Concentrations at Maximum Flow Conditions[6]
Ethylene Dibromide	1,2-Dibromoethane	EPA Method SW8011	0.05	20	41	1,100	1,250	88	225
Volatile Organic Compounds	Benzene	EPA Method SW8260C	5.0	450	405	499	499	499	499
	Ethylbenzene	EPA Method SW8260C	750	102	210	5,500	6,000	450	1,150
	Toluene	EPA Method SW8260C	700	212	436	12,000	13,250	935	2,400
	Xylenes, Total	EPA Method SW8260C	620	110	226	5,750	6,500	485	1,225
Dissolved Metals	Iron	EPA Method SW6010C	1000	1,000	20,571 (2,057)	570,000 (57,000)	625,000 (62,500)	44,250 (4,425)	112,500 (11,250)
	Manganese	EPA Method SW6010C	200	200	20,571 (411)	570,000 (11,000)	625,000 (12,000)	44,250 (880)	112,500 (2,250)
Field Parameters	Temperature (°C)	NA	NA	NS	NS	NS	NS	NS	NS
	Spec Cond (µS/cm)	NA	NA	NS	NS	NS	NS	NS	NS
	pH (S.U.)[7]	NA	NA	7 - 8	NS	NS	NS	NS	NS
	ORP (mV)	NA	NA	NS	NS	NS	NS	NS	NS
	DO (mg/L)[7]	NA	NA	4.5 - 8.6	NS	NS	NS	NS	NS

Maximum influent concentrations reaching the lead GAC vessel are discussed in the Technical Memorandum Establishing the Basis of Design Maximum Concentration Limits for the Kirtland BFF GWTS

Simple continuous mixing calculations and AQUASIM model descriptions are further described in the Technical Memorandum Establishing the Basis of Design Maximum Concentration Limits for the Kirtland BFF GWTS

Field parameter criteria is established from the historical maximum and minimum readings obtained during monthly sampling. These criteria are used as a guideline, if reading are observed outside of the of the specified range a system assessment will be performed. The parameters are collected as specified in Appendix I for monitoring purposes.

Values in parentheses indicate values calculated assuming the sand filters are not installed or otherwise offline.

[1] Discharge criteria is in accordance with DP-1839 Table 2.

[2] Maximum concentrations of water produced from a single well were calculated assuming a maximum well flow rate of 175 gpm, maximum system flow rate of 400 gpm, installation of the sand filters, and using a simple continuous mixing calculation.

[3] Maximum concentrations of 55 gallons of IDW water that can be discharged to the GWTS sump, which were calculated assuming a minimum system flow rate of 120 gpm, installation of the sand filters, and using the AQUASIM model.

[4] Maximum concentrations of 55 gallons of IDW water that can be discharged to the GWTS sump, which were calculated assuming a maximum system flow rate of 365 gpm, installation of the sand filters, and using the AQUASIM model.

[5.] Maximum concentrations of 21,000 gallons of IDW water that can be discharged to the GWTS sump, which were calculated assuming a minimum system flow rate of 120 gpm, installation of the sand filters, and using the AQUASIM model.

[6] Maximum concentrations of 21,000 gallons of IDW water that can be discharged to the GWTS sump, which were calculated assuming a maximum system flow rate of 365 gpm, installation of the sand filters, and using the AQUASIM model6

[7] Operational parameter not required by discharge permit.

°C = degree Celsius
µg/L = microgram(s) per liter
µS/cm = microsiemen(s) per centimeter
DO = dissolved oxygen
gpm = gallon per minute
GWTS = groundwater treatment system
IDW = investigation-derived waste
mg/L = milligram per liter
mV = millivolt
NS = not specified
ORP = oxidation reduction potential
Spec Cond = specific conductivity
S.U. = standard unit

Table 6-1
Reports and Recipients

Report Title	Regulatory Permit/Document Requiring	Report Contents	Responsible Party	Recipients	Transmission Method
Greater than 24-Hour Shutdown Notification	Operations and Maintenance Plan	- Notification of greater than 24-hour shutdown -Notification will be provided within 24-hours	Operator	AFCEC and USACE	Email
			AFCEC	NMED GWQB and NMED HWB	Email
Notification of Change resulting in change in volume of discharge, location of discharge, or amount or character of contaminants received, treated, or discharged outside of DP-1839 scope	DP-1839 issued by NMED GWQB, Condition 22.e	- Notification of change in volume of discharge, location of discharge, or amount or character of contaminants received, treated, or discharged outside of DP-1839 scope -Notification will be provided within 24-hours	Operator	AFCEC and USACE	Email
			AFCEC	NMED GWQB and NMED HWB	Email
Kirtland BFF - Weekly Update-W/E mm/dd/yy	USACE Contract Requirement	- Site Monitoring Status - Weekly GWTS Operational Values - Current Discharge Location - Recent Effluent Analytical Results - Weekly Maintenance Information	Operator	Kirtland Air Force Base Civil Engineering Group AFCEC/USACE	Email
Kirtland BFF - GWTS Monthly Water Summary - month year	Kirtland Air Force Base Water Use/conservation Internal Reporting	- Table containing monthly total extracted and discharged by Discharge Location	Operator	Kirtland Air Force Base Civil Engineering Group AFCEC/USACE	Email
Kirtland BFF - NMOSE Monthly Reporting for GWTS - month year	Kirtland Air Force Base NMOSE Quarterly Reporting for all NMOSE Permits	- Table containing monthly extraction totals per well and injection volume	Operator	Kirtland Air Force Base Civil Engineering Group AFCEC/USACE	Email
			Kirtland Air Force Base Civil Engineering Group	NMOSE	Email

Table 6-1
Reports and Recipients

Report Title	Regulatory Permit/Document Requiring	Report Contents	Responsible Party	Recipients	Transmission Method
Kirtland BFF Quarterly/Annual Report	DP-1839 issued by NMED GWQB	- Summarize ongoing site monitoring and interim measure activities (Condition 17) - Any mechanical integrity testing conducted on either the GWTS or a UIC well (Condition 22.a) - Any replacement of granular activated carbon media and the associated data that initiated the decision to replace the media (Condition 22.b) - Any UIC well rehabilitation conducted (Condition 22.c) - Any malfunction, repair, or replacement of a flow meter (Condition 22.d) - Any additional operational changes with the potential to affect the discharge (Condition 22.e) - Monthly average, maximum, and minimum values for flow rate and volume of treated effluent transferred to each UIC well (Condition 21.a) - The totalized monthly volume of treated effluent transferred to all UIC wells (Condition 21.b) - Monthly average, maximum, and minimum head values of injection water for each UIC well (Condition 21.c)	Operator	AFCEC/USACE	Electronic Deliverable
			AFCEC	NMED GWQB and NMED HWB	Hardcopy and Electronic Deliverable (provided by Operator)
	HWTF Interim Measure Resource Conservation and Recovery Act Permit Section 6.2.4.4 Periodic Monitoring Reports Approved Work Plans USACE Contract Requirements	- A description of the work completed and an estimate of the percentage of total planned work completed - Summaries of all findings, including summaries of laboratory data - Summaries of all problems or potential problems encountered during the reporting period and actions taken to rectify problems - Planned work for the next reporting period - Summaries of contacts pertaining to corrective action with representatives of the local community, public interest groups, or State government during the reporting period - Changes in key project personnel during the reporting period - Summaries of any variances from approved investigation or remediation work plans - Brief summaries of any periodic monitoring reports prepared in accordance with the requirements in Permit Section 6.2.4.4.	Operator	AFCEC/USACE	Electronic Deliverable
			AFCEC	NMED HWB	Hardcopy and Electronic Deliverable (provided by Operator)

AFCEC = Air Force Civil Engineer Center
BFF = Bulk Fuels Facility
DP = discharge permit
GWQB = Groundwater Quality Bureau
GWTS = groundwater treatment system
HWB = Hazardous Waste Bureau
HWTF = Hazardous Waste Treatment Facility
NMED = New Mexico Environment Department
NMOSE = New Mexico Office of the State Engineer
UIC = underground injection control
USACE = U.S. Army Corps of Engineers