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Flint Hills Resources Alaska, LLC

LONG-TERM MONITORING PLAN – 2015 UPDATE

North Pole Terminal
North Pole, Alaska
DEC File Number: 100.38.090

December 14, 2015

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ACRONYMS AND ABBREVIATIONS

ADEC	Alaska Department of Environmental Conservation
Arcadis	Arcadis U.S., Inc.
COC	constituent of concern
CSM	conceptual site model
FHRA	Flint Hills Resources Alaska, LLC
LNAPL	light nonaqueous phase liquid
LTM	Long-Term Monitoring
NPT	North Pole Terminal
NSZD	natural source zone depletion
OCP	Final Onsite Cleanup Plan
OMM	Operations Maintenance and Monitoring
RSAP	Onsite Revised Sampling and Analysis Plan
site	Flint Hills Resources Alaska, LLC North Pole Terminal, located on H and H Lane in North Pole, Alaska
SMP	Onsite Soil Management Plan
VPT	vertical profiling transect
µg/L	micrograms per liter

1 INTRODUCTION

On behalf of Flint Hills Resources Alaska, LLC (FHRA), Arcadis U.S., Inc. (Arcadis) prepared this Long-Term Monitoring (LTM) Plan – 2015 Update, as part of the Final Onsite Cleanup Plan (OCP), for the FHRA North Pole Terminal (NPT), located on H and H Lane in North Pole, Alaska (site). This LTM Plan – 2015 Update includes the following items:

- Groundwater sampling program objectives and schedule.
- Groundwater sampling and analysis plan including all constituents of concern (COCs) and the appropriate frequencies based on concentration.
- Description and maps showing the alternative point of compliance monitoring wells along with major site features.
- List and figures of all monitoring wells to be included in LTM including alternative point of compliance wells and selected upgradient and downgradient wells for trend analysis.
- The framework to determine future modifications to monitoring network and/or frequency.
- Onsite Soil Management Plan (SMP).

Groundwater COCs for the site were identified by comparing detected concentrations with Alaska Department of Environmental Conservation (ADEC) cleanup levels presented in 18 AAC 75.345 Table C. Sulfolane is currently under ADEC review to determine a sulfolane cleanup number for the site.

This LTM Plan – 2015 Update adopts and references information, work, and analysis described in more detail in the Onsite Revised Sampling and Analysis Plan (RSAP; Arcadis 2015).

2 GROUNDWATER SAMPLING PROGRAM OBJECTIVES

As of August 2014, 306 monitoring wells were present onsite at the NPT site. As of this 2015 update, there are 308 monitoring wells. Periodic monitoring of many of these wells has been ongoing since 1987. The groundwater concentration data have been integral in developing a conceptual site model (CSM) and documenting current site groundwater conditions. This LTM Plan – 2015 Update is intended for use in conjunction with onsite remedial activities, as documented in the OCP (Arcadis 2014). The objectives of the scope of monitoring summarized in this LTM Plan – 2015 Update are to:

- Monitor the nature and extent of COCs onsite.
- Evaluate the potential exposure to COCs.
- Evaluate groundwater remediation system effectiveness.
- Monitor residual sulfolane concentrations between the groundwater recovery system and the property boundary.
- Evaluate contaminant trends.

3 GROUNDWATER SAMPLING FREQUENCY AND SCHEDULE

The most recent revision of the RSAP was included as Appendix A to the Fourth Quarter 2014 Groundwater Monitoring Report (Arcadis 2015). This plan adopts and references information, work, and analysis described in more detail in the RSAP. The groundwater monitoring schedules and frequencies outlined in this LTM Plan – 2015 Update supersede those of the RSAP for work beyond fourth quarter 2014; however procedures for conducting the activities included in this plan, such as groundwater level gauging and monitoring well purging, remain the same as outlined in the RSAP. Additionally, groundwater monitoring schedules and frequencies outlined in this LTM Plan – 2015 Update supersede the LTM Plan submitted in October 2014. The groundwater elevation monitoring network is summarized in Table 3-1 and shown on Figures 3-1 through 3-4. The revised sampling schedule to begin in first quarter 2016 is summarized in Tables 3-2, 3-3, 3-4, 3-5, and 3-6 and is shown on Figures 3-5 through 3-12. The following annual schedule is proposed for monitoring based on the assigned monitoring frequencies:

Frequency	Monitoring Schedule
Monthly	Monthly
Quarterly	Quarterly
Semiannual	First and third quarters
Annual	Third quarter

Semi-annual light nonaqueous phase liquid (LNAPL) monitoring will target the water table minima (typically in March and late October). Groundwater levels will be recorded during LNAPL monitoring events and compared to seasonal water levels in the monitoring reports. A representative graph of groundwater table elevation from a nearby well with a pressure transducer will be provided to show relative water level, if available. Semiannual groundwater monitoring will be completed in the first and third quarters. Annual monitoring will be completed in the third quarter to allow the greatest chance for thawed conditions and to minimize cold weather limitations.

Due to the extreme seasonal cold occasionally preventing field work in the winter months, field staff may not be able to complete the scope of work. If the scope of work identified for the first quarter cannot be complete in the quarter, it will continue into the second quarter.

4 ALTERNATIVE POINTS OF COMPLIANCE AND MONITORING NETWORKS

Alternative Points of Compliance will be established to monitor the effectiveness of the groundwater remediation system and to document that applicable cleanup levels or performance standards (as defined in the OCP) are being achieved. The alternative point of compliance wells are:

- Vertical profiling (VPT) wells (MW-301 through MW-306 well clusters)
- Monitoring well MW-141-20.

Numerous monitoring wells were retained for LTM and the monitoring networks are summarized in Tables 3-1 through 3-5 and shown on Figures 3-1 through 3-11. Groundwater elevation measurements are collected periodically to evaluate hydraulic capture of the Groundwater Recovery and Treatment System as described in the Operations Maintenance and Monitoring (OMM) Plan – 2015 Update (Barr 2015).

The monitoring well networks were selected through the methods presented in Section 5.

5 FRAMEWORK FOR DETERMINING MONITORING WELL NETWORKS AND MODIFICATIONS

The following frameworks were used to determine the appropriate monitoring frequencies for individual wells within the monitoring networks. These methods were used to establish the monitoring frequency presented in this LTM Plan – 2015 Update and are anticipated to be used to guide future adjustments of the monitoring network. Monitoring frequencies from the OMM Plan – 2015 Update (Barr 2015) are included below.

5.1 Groundwater Elevation Monitoring

The groundwater elevation monitoring well network was evaluated and reduced to a semiannual monitoring frequency. Historical gauging data indicate that the overall groundwater gradient and flow direction are generally consistent. The network for semi-annual gauging was selected based on key well locations and to minimize redundancy. The monitoring well network is summarized in Table 3-1.

5.2 Light Nonaqueous Phase Liquid

The LNAPL criteria and corresponding monitoring frequency are summarized in Table 5-1. Because LNAPL is largely limited to the developed portion of the site there are numerous groundwater monitoring wells located between the LNAPL footprint and the VPT. Therefore, the groundwater recovery system and the known extent of LNAPL impacts are used as reference points for identifying the monitoring frequencies. Monitoring wells without LNAPL present are assigned a decreasing monitoring frequency with increasing distance downgradient of the groundwater recovery system. For example, wells further downgradient of the groundwater recovery system will be monitored less frequently than those proximate to the system.

Table 5-1. LNAPL Migration and Thickness Monitoring Criteria

Category	Monitoring Frequency
Active groundwater recovery wells in the LNAPL impacted area	Monthly
Wells located immediately downgradient of GAC East without LNAPL present	Quarterly
Wells where LNAPL recovery was conducted within the last year	Quarterly
Wells with LNAPL present, but recovery was not possible within the last year[1]	Semiannual[3]
Wells located further downgradient of GAC East (no LNAPL present)[2]	Semiannual[3]
Wells located upgradient/cross-gradient of GAC East (no LNAPL present)	Annual[3]

Notes:
[1]An exception to the above monitoring frequency is monitoring well MW-334-15, which will continue to be monitored on a monthly schedule.
[2]Wells located more than 300 feet away from the nearest active recovery well (e.g. S-9 and MW-139-25).
[3]Semiannual and annual LNAPL monitoring will be performed at hydrogeologic minima.

5.3 Sulfolane

The monitoring frequency framework for wells in the sulfolane monitoring network is specified in Table 5-2. The hydraulic capture performance standard of 15 micrograms per liter (µg/L) sulfolane is established as the primary driver for determining sulfolane monitoring frequency for selected onsite monitoring wells. The sulfolane performance standard for the site is under ADEC review[1]. Once a sulfolane performance standard is established by ADEC, the monitoring frequency will be evaluated.

Phase 8 monitoring wells installed in 2013, which did not have four quarters of data prior to the submittal of the 2014 LTM Plan, were evaluated and incorporated into the monitoring schedule using the established evaluation criteria. The current frequency is shown in Table 3-4.

[1] An appeal is pending regarding a requested revision of the performance standard. Issues regarding the appropriate cleanup levels for sulfolane are also pending in litigation.

Table 5-2. Sulfolane Monitoring Criteria

Category[1]	Monitoring Frequency
Selected[2] wells with concentrations greater than 15 µg/L or the sulfolane performance standard for the site, whichever is higher	Quarterly
Selected wells with detectable concentrations below 15 µg/L or the sulfolane performance standard for the site, whichever is higher[2]	Semiannual
Selected wells with concentrations below the detection limit for two sequential samples	Annual
Groundwater remediation system performance monitoring network	Quarterly or semiannual as assigned in the OMM plan.

Notes:
[1] Data from the last 2 years (since third quarter 2012) were considered for establishing the LTM well network frequency.
[2]Wells which have not historically been included in the groundwater monitoring program were not selected for ongoing long-term monitoring. Generally these wells have either had consistent non-detectable concentrations, or other monitoring wells sampled under the LTM program are located in close proximity.

5.4 Other Constituents of Concern

Other COCs in groundwater are set out in the OCP. Table 5-3 summarizes the monitoring frequency framework for these other COCs. The criteria are based on benzene, which is consistent with past monitoring decisions at the NPT.

Table 5-3. Other Constituents of Concern Monitoring Criteria (based on concentration data)

Category	Monitoring Frequency[1]
North property boundary water table wells	Every 5 years[2]
VPT wells with screens less than 30 feet below ground surface[3]	Biennial (every 2 years)[2]
Wells with benzene concentrations less than 50 µg/L	Annual
Wells with benzene concentrations greater than 50 µg/L	Semiannual
Groundwater remediation system performance monitoring network	Semiannual or annual as assigned in the OMM plan.

Notes:
[1]Data from the last 2 years (since third quarter 2012) were considered for establishing the LTM well network frequency.
[2]Wells not previously sampled for other COCs will be sampled for a minimum of two consecutive events before establishing a frequency less often than annual.
[3]Only intervals within 30 feet of the ground surface will be sampled at the VPT.

Sample locations and frequency based on the above rationale are listed in Tables 3-1 through 3-5 of this LTM Plan – 2015 Update.

5.5 Natural Source Zone Depletion

An evaluation of the potential efficacy of natural source zone depletion (NSZD) in the saturated zone will be conducted following protocols outlined in the Technology Overview for Evaluating Natural Source Zone Depletion at Sites with LNAPL (ITRC 2009). NSZD rates will be calculated using a mass balance approach. LNAPL attenuation through dissolution and biodegradation will be quantified by assessing groundwater quality upgradient, downgradient and within the LNAPL plume. A summation of the mass flux of electron acceptors into and out of the plume combined with mass flux of dissolved phase petroleum constituents out of the plume will be used to quantify dissolved phase NSZD rates (ITRC 2009).

Twelve monitoring wells will be sampled for the NSZD parameters on an annual basis during the third quarter to evaluate the potential for NSZD to occur at the site. Sample locations will include two upgradient wells (MW-105A-25 and MW-196-15), four downgradient wells (MW-101A-25, MW-142-20, MW-145-20 and MW-369-16) and six LNAPL source zone wells (MW-116-15, MW-125-25, MW-130-25, MW-180A-15, MW-321-15 and MW-336-20). If LNAPL is present at the time of sampling in any of the NSZD monitoring wells, LNAPL will be removed, and a sample will be collected at least two feet beneath the piezometric surface so that LNAPL will not be present in the groundwater sample according to the procedures described in the Onsite RSAP. NSZD groundwater samples will be collected in accordance with the Onsite RSAP. Data will be evaluated and presented in the semiannual onsite groundwater monitoring report.

For quantifying dissolution and biodegradation in the saturated zone, the required data include:

- Hydraulic parameters such as hydraulic gradient and groundwater flow direction: These parameters will be estimated based on routine gauging data collected at the site.
- Horizontal and vertical dimensions of the LNAPL source zone: The LNAPL source zone dimensions will be determined based on GRO and DRO concentrations in groundwater within, upgradient and downgradient of the source zone.
- Presence of dissolved electron acceptors (e.g., oxygen and sulfate) and reaction products (e.g., ferrous iron, manganese (II) and methane) in groundwater within, upgradient and downgradient of the source zone. This can be accomplished by collecting groundwater samples and analyzing for these parameters by appropriate analytical methods. Nitrate monitoring is not included as an NSZD monitoring parameter as it has been consistently nondetect at the site.

Monitoring wells and analytical parameters for NSZD monitoring are summarized in Table 3-6. Monitoring well locations are shown on Figure 3-12.

5.6 Trend Analysis and Evaluation of the Sampling Program

Statistical concentration trends will continue to be evaluated at the site as appropriate. Historical concentration data along with changes in statistical trends (magnitude and rate of change) will be taken into account while evaluating modifications to sulfolane or other COC monitoring networks and frequency.

Sulfolane concentration trends will be compared to concentrations of 15 µg/L for sulfolane (or the sulfolane current performance standard[2] initially established for the site) and 50 µg/L benzene for other COCs as discussed above. If a well concentration trend changes, the sampling frequency may be revised based on a well by well analysis. Prior to any adjustment, a pre-scoping meeting will be held if FHRA deems it necessary. Upon request by FHRA to modify evaluation frequency, ADEC will act upon the request within 30 days provided the submittal is complete.

Monitoring schedule and frequency will be reevaluated on an annual basis and results of the evaluations will be provided annually in the groundwater monitoring reports or more frequently, if appropriate. An updated LTM Plan will be submitted annually. Based on current data, the evaluation of groundwater concentration trends, and groundwater modeling conducted for the site, onsite sulfolane concentrations in groundwater are generally decreasing. Adjustments to the LTM Plan are summarized in Attachment 1.

6 SOIL MANAGEMENT

NPT workers, contractors, and other third parties performing ground-disturbing activities within the site boundary will properly manage soil potentially contaminated with COCs (or “impacted soil”). An SMP has been prepared to provide guidance for potential ground-disturbing activities to protect workers from exposure to impacted soil associated with former site operations and is included as Attachment 2.

7 DOCUMENTATION OF CHANGES TO LONG-TERM MONITORING PLAN

Modifications to the monitoring network and schedule will be documented in the LTM Plan, which will be updated as necessary and submitted as a stand-alone document at least annually. The RSAP was updated with the Fourth Quarter 2014 Onsite Groundwater Monitoring Report. The RSAP only describes sampling methodologies and procedures; groundwater monitoring networks and schedules will be retained and updated in the LTM Plan.

8 LONG-TERM MONITORING PLAN IMPLEMENTATION AND REPORTING SCHEDULE

FHRA plans to implement the updated LTM Plan during first quarter 2016. Monitoring results will continue to be reported in semiannual groundwater monitoring reports on or before July 31 and January 31 of each year.

[2] This standard is subject to revision based on litigation and administrative appeals.

9 REFERENCES

Arcadis U.S., Inc. 2015. Onsite Revised Sampling and Analysis Plan. January 30, 2015.

Barr Engineering Company. 2015. Operations, Maintenance and Monitoring Plan – Groundwater Remediation System – 2015 Update. December 2015.

Interstate Technology & Regulatory Council. 2009. Technology Overview for Evaluating Natural Source Zone Depletion at Sites with LNAPL. Washington, D.C.: Interstate Technology & Regulatory Council, LNAPLs Team. April.

TABLES

Table 3-1
Groundwater Elevation Monitoring Well Network

Long-Term Monitoring Plan
Flint Hills Resources Alaska, LLC
North Pole Terminal, North Pole, Alaska

Well	Previous Frequency	Revised Frequency	Zone	Comments
MW-101-60	Quarterly	Semi-annual	10-55	
MW-102-70	Quarterly	Semi-annual	55-90	
MW-104-65	Quarterly	Semi-annual	10-55	
MW-105-65	Quarterly	Semi-annual	10-55	
MW-105A-25	Quarterly	Semi-annual	Water Table	
MW-106-25	Quarterly	Semi-annual	Water Table	
MW-109-15	Quarterly	Semi-annual	Water Table	
MW-110-20	Quarterly	Semi-annual	Water Table	
MW-110-65	Quarterly	Semi-annual	10-55	added 3/11/14
MW-113-15	Quarterly	Semi-annual	Water Table	
MW-125-25	Quarterly	Semi-annual	Water Table	
MW-129-40	Quarterly	Semi-annual	10-55	
MW-130-25	Quarterly	Semi-annual	Water Table	
MW-133-20	Quarterly	Semi-annual	Water Table	
MW-135-20	Quarterly	Semi-annual	Water Table	
MW-140-25	Quarterly	Semi-annual	Water Table	
MW-141-20	Quarterly	Semi-annual	Water Table	
MW-144A-25	Quarterly	Semi-annual	Water Table	
MW-144BR-90	Quarterly	Semi-annual	55-90	
MW-145-20	Quarterly	Semi-annual	Water Table	
MW-148A-15	Quarterly	Semi-annual	Water Table	
MW-148C-55	Quarterly	Semi-annual	10-55	
MW-148-80	Quarterly	Semi-annual	55-90	added 6/30/15
MW-148-100	Quarterly	Semi-annual	90-160	added 6/30/15
MW-148D-150	Quarterly	Semi-annual	90-160	
MW-149A-15	Quarterly	Semi-annual	Water Table	
MW-154A-75	Quarterly	Semi-annual	55-90	
MW-173A-15	Quarterly	Semi-annual	Water Table	
MW-173B-150	Quarterly	Semi-annual	90-160	
MW-174-15	Quarterly	Semi-annual	Water Table	added 3/11/14
MW-174A-50	Quarterly	Semi-annual	10-55	
MW-174B-90	Quarterly	Semi-annual	55-90	
MW-175-90	Quarterly	Semi-annual	55-90	
MW-176A-15	Quarterly	Semi-annual	Water Table	added 3/11/14
MW-176B-50	Quarterly	Semi-annual	10-55	
MW-176C-90	Quarterly	Semi-annual	55-90	
MW-180B-50	Quarterly	Semi-annual	10-55	
MW-180C-90	Quarterly	Semi-annual	55-90	
MW-186A-15	Quarterly	Semi-annual	Water Table	
MW-186B-60	Quarterly	Semi-annual	10-55	
MW-186D-135	Quarterly	Semi-annual	90-160	
MW-186E-75	Quarterly	Semi-annual	55-90	
MW-192A-15	Quarterly	Semi-annual	Water Table	
MW-192B-55	Quarterly	Semi-annual	10-55	
MW-195A-15	Quarterly	Semi-annual	Water Table	
MW-195B-150	Quarterly	Semi-annual	90-160	
MW-197A-65	Quarterly	Semi-annual	10-55	

Table 3-1
Groundwater Elevation Monitoring Well Network

Long-Term Monitoring Plan
Flint Hills Resources Alaska, LLC
North Pole Terminal, North Pole, Alaska

Well	Previous Frequency	Revised Frequency	Zone	Comments
MW-198-150	Quarterly	Semi-annual	90-160	
MW-199-150	Quarterly	Semi-annual	90-160	
MW-300-150	Quarterly	Semi-annual	90-160	
MW-301-60	Quarterly	Semi-annual	10-55	
MW-301-70	Quarterly	Semi-annual	55-90	
MW-301-CMT-10	Quarterly	Semi-annual	Water Table	
MW-302-CMT-50	Quarterly	Semi-annual	10-55	
MW-303-80	Quarterly	Semi-annual	55-90	
MW-303-130	Quarterly	Semi-annual	90-160	
MW-303-CMT-59	Quarterly	Semi-annual	10-55	
MW-304-80	Quarterly	Semi-annual	55-90	
MW-304-125	Quarterly	Semi-annual	90-160	
MW-304-CMT-10	Quarterly	Semi-annual	Water Table	
MW-304-CMT-60	Quarterly	Semi-annual	10-55	
MW-306-80	Quarterly	Semi-annual	55-90	
MW-306-150	Quarterly	Semi-annual	90-160	
MW-306-CMT-60	Quarterly	Semi-annual	10-55	
MW-307-150	Quarterly	Semi-annual	90-160	
MW-309-15	Quarterly	Semi-annual	Water Table	
MW-309-66	Quarterly	Semi-annual	10-55	
MW-310-15	Quarterly	Semi-annual	Water Table	
MW-310-65	Quarterly	Semi-annual	10-55	
MW-310-110	Quarterly	Semi-annual	90-160	
MW-321-15	Quarterly	Semi-annual	Water Table	
MW-330-20	Quarterly	Semi-annual	Water Table	added 3/11/14
MW-330-65	Quarterly	Semi-annual	10-55	
MW-334-15	Quarterly	Semi-annual	Water Table	added 3/11/14
MW-334-85	Quarterly	Semi-annual	55-90	added 3/11/14
MW-336-20	Quarterly	Semi-annual	Water Table	added 3/11/14
MW-336-55	Quarterly	Semi-annual	10-55	added 3/11/14
MW-355-55	Quarterly	Semi-annual	10-55	
MW-358-20	Quarterly	Semi-annual	Water Table	added 3/11/14
MW-358-40	Quarterly	Semi-annual	10-55	added 3/11/14
MW-358-60	Quarterly	Semi-annual	10-55	added 3/11/14
MW-358-150	Quarterly	Semi-annual	90-160	added 3/11/14
MW-359-15	Quarterly	Semi-annual	Water Table	added 3/11/14
MW-359-60	Quarterly	Semi-annual	10-55	added 3/11/14
MW-359-80	Quarterly	Semi-annual	55-90	added 3/11/14
MW-360-15	Quarterly	Semi-annual	Water Table	added 3/11/14
MW-360-50	Quarterly	Semi-annual	10-55	added 3/11/14
MW-360-80	Quarterly	Semi-annual	55-90	added 3/11/14
MW-360-150	Quarterly	Semi-annual	90-160	added 3/11/14
MW-361-15	Quarterly	Semi-annual	Water Table	added 3/11/14
MW-362-15	Quarterly	Semi-annual	Water Table	added 3/11/14
MW-362-50	Quarterly	Semi-annual	10-55	added 3/11/14
MW-362-80	Quarterly	Semi-annual	55-90	added 3/11/14
MW-362-150	Quarterly	Semi-annual	90-160	added 3/11/14

Table 3-1
Groundwater Elevation Monitoring Well Network

Long-Term Monitoring Plan
Flint Hills Resources Alaska, LLC
North Pole Terminal, North Pole, Alaska

Well	Previous Frequency	Revised Frequency	Zone	Comments
MW-363-15	Quarterly	Semi-annual	Water Table	added 3/11/14
MW-364-15	Quarterly	Semi-annual	Water Table	added 3/11/14
MW-364-65	Quarterly	Semi-annual	10-55	added 3/11/14
MW-364-90	Quarterly	Semi-annual	55-90	added 3/11/14
MW-364-150	Quarterly	Semi-annual	90-160	added 3/11/14
MW-365-15	Quarterly	Semi-annual	Water Table	added 3/11/14
North Gravel Pit	Quarterly	Semi-annual	Gravel Pit	
O-14	Quarterly	Semi-annual	Water Table	
South Gravel Pit	Quarterly	Semi-annual	Gravel PIt	
MW-372-15		Semi-annual	Water Table	added 10/20/15
MW-373-15		Semi-annual	Water Table	added 10/20/15

Table 3-2
LNAPL Migration Monitoring Well Network

Long-Term Monitoring Plan
Flint Hills Resources Alaska, LLC
North Pole Terminal, North Pole, Alaska

Well	Previous Frequency	Revised Frequency	Rationale	Notes
MW-139-25	Semi-annual	Semi-annual	Monitor NW LNAPL boundary	
MW-142-20	Annual	Annual	Monitor LNAPL boundary	
MW-178A-15	Annual	Annual	Monitor LNAPL boundary	
MW-180A-15	Annual	Annual	Monitor LNAPL boundary	
O-12	Quarterly	Quarterly	Monitor LNAPL boundary	
O-16	Annual	Annual	Monitor LNAPL boundary	
O-17	Annual	Annual	Monitor LNAPL boundary	
O-20	Annual	Annual	Monitor LNAPL boundary	
O-23	Annual	Annual	Monitor LNAPL boundary	
O-24	Quarterly	Quarterly	Monitor LNAPL boundary	
O-25	Quarterly	Quarterly	Monitor LNAPL boundary	
O-26	Quarterly	Quarterly	Monitor LNAPL boundary	
O-29	Annual	Annual	Monitor LNAPL boundary	
O-3	Quarterly	Quarterly	Monitor LNAPL boundary	
O-4	Quarterly	Quarterly	Monitor LNAPL boundary	
O-5	Semi-annual	Semi-annual	Monitor LNAPL boundary	
O-8	Annual	Annual	Monitor LNAPL boundary	
R-42	Monthly	Monthly	Monitor LNAPL boundary	Active recovery well.
R-43	Monthly	Monthly	Monitor LNAPL boundary	Active recovery well.
R-46	Monthly	Monthly	Monitor LNAPL boundary	Active recovery well.

Acronyms and Abbreviations:
LNAPL = light nonaqueous phase liquids
NW = northwest

Table 3-3
LNAPL Thickness Monitoring Well Nework

Long-Term Monitoring Plan
Flint Hills Resources Alaska, LLC
North Pole Terminal, North Pole, Alaska

Well	Previous Frequency	Revised Frequency	Rationale	Notes
MW -115-15	Semi-annual	Semi-annual	Monitor fluctuation in LNAPL thickness	added 10/24/14
MW-135-20	Semi-annual	Semi-annual	Monitor fluctuation in LNAPL thickness	
MW-138-20	Quarterly	Quarterly	Monitor fluctuation in LNAPL thickness	skimmer pump used when applicable
MW-176A-15	Quarterly	Quarterly	Monitor fluctuation in LNAPL thickness	
MW-186A-15	Semi-annual	Semi-annual	Monitor fluctuation in LNAPL thickness	
MW-334-15	Monthly	Monthly	Monitor fluctuation in LNAPL thickness	
MW-336-15	Semi-annual	Semi-annual	Monitor fluctuation in LNAPL thickness	
MW-348-15	Semi-annual	Semi-annual	Monitor fluctuation in LNAPL thickness	
MW-354-15	Semi-annual	Semi-annual	Monitor fluctuation in LNAPL thickness	
MW-366-15	Quarterly	Quarterly	Monitor fluctuation in LNAPL thickness	
O-2	Semi-annual	Semi-annual	Monitor fluctuation in LNAPL thickness	
O-9	Quarterly	Semi-annual	Monitor fluctuation in LNAPL thickness	
O-10	Quarterly	Semi-annual	Monitor fluctuation in LNAPL thickness	
O-11	Quarterly	Quarterly	Monitor fluctuation in LNAPL thickness	
O-13	Quarterly	Quarterly	Monitor fluctuation in LNAPL thickness	
O-19	Quarterly	Quarterly	Monitor fluctuation in LNAPL thickness	
O-21	Semi-annual	Quarterly	Monitor fluctuation in LNAPL thickness	change to quarterly on 4/22/2015
O-27	Semi-annual	Semi-annual	Monitor fluctuation in LNAPL thickness	
O-31	Quarterly	Quarterly	Monitor fluctuation in LNAPL thickness	installed in 2013
O-32	Semi-annual	Semi-annual	Monitor fluctuation in LNAPL thickness	installed in 2013
O-33	Quarterly	Quarterly	Monitor fluctuation in LNAPL thickness	installed in 2013
O-34	Quarterly	Quarterly	Monitor fluctuation in LNAPL thickness	installed in 2013
O-35	Semi-annual	Semi-annual	Monitor fluctuation in LNAPL thickness	installed in 2013
O-36	Semi-annual	Semi-annual	Monitor fluctuation in LNAPL thickness	installed in 2013
O-37	Semi-annual	Semi-annual	Monitor fluctuation in LNAPL thickness	installed in 2013
O-38	Quarterly	Quarterly	Monitor fluctuation in LNAPL thickness	installed in 2013
R-14A	Semi-annual	Semi-annual	Monitor fluctuation in LNAPL thickness	
R-18	Quarterly	Quarterly	Monitor fluctuation in LNAPL thickness	
R-20R	Quarterly	Quarterly	Monitor fluctuation in LNAPL thickness	
R-21	Monthly	Monthly	Monitor fluctuation in LNAPL thickness	active recovery well
R-32	Quarterly	Quarterly	Monitor fluctuation in LNAPL thickness	
R-32R	Quarterly	Quarterly	Monitor fluctuation in LNAPL thickness	replaced well R-32
R-33	Semi-annual	Semi-annual	Monitor fluctuation in LNAPL thickness	
R-34	Quarterly	Quarterly	Monitor fluctuation in LNAPL thickness	
R-35R	Monthly	Monthly	Monitor fluctuation in LNAPL thickness	active recovery well
R-39	Semi-annual	Semi-annual	Monitor fluctuation in LNAPL thickness	
R-40	Quarterly	Monthly	Monitor fluctuation in LNAPL thickness	
R-44	Monthly	Monthly	Monitor fluctuation in LNAPL thickness	active recovery well
R-45	Monthly	Monthly	Monitor fluctuation in LNAPL thickness	active recovery well
S-21	Quarterly	Semi-annual	Monitor fluctuation in LNAPL thickness	
S-22	Quarterly	Quarterly	Monitor fluctuation in LNAPL thickness	
S-32	Semi-annual	Semi-annual	Monitor fluctuation in LNAPL thickness	
S-39	Semi-annual	Quarterly	Monitor fluctuation in LNAPL thickness	change to quarterly on 4/22/2015
S-44	Quarterly	Quarterly	Monitor fluctuation in LNAPL thickness	
S-50	Quarterly	Quarterly	Monitor fluctuation in LNAPL thickness	
S-51	Quarterly	Quarterly	Monitor fluctuation in LNAPL thickness	

Acronyms and Abbreviations:
LNAPL = light nonaqueous phase liquids

Table 3-4
Sulfolane Monitoring Well Network - Onsite

Long-Term Monitoring Plan
Flint Hills Resources Alaska, LLC
North Pole Terminal, North Pole, Alaska

Well	Previous Frequency	Revised Frequency	Category
MW-101A-25	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-101-60	Quarterly	Annual	ND for two events
MW-105A-25	Annual	Annual	ND for two events
MW-105-65	Annual	Annual	ND for two events
MW-106-25	Semi-annual	Annual	ND for two events
MW-109-15	Annual	Annual	ND for two events
MW-110-20	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-110-65	Quarterly	Annual	ND for two events
MW-113-15	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-115-15	Semi-annual	Semi-annual	Sulfolane <15 µg/L
MW-116-15	Semi-annual	Quarterly	Sulfolane >15 µg/L
MW-125-25	Quarterly	Semi-annual	Groundwater Remediation System Performance
MW-127-25	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-129-40	Quarterly	Semi-annual	Groundwater Remediation System Performance
MW-130-25	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-131-25	Quarterly	Annual	ND for two events
MW-132-20	Annual	Annual	ND for two events
MW-133-20	Annual	Annual	ND for two events
MW-134-20	Annual	Semi-annual	Sulfolane <15 µg/L
MW-135-20	Semi-annual	Semi-annual	Sulfolane <15 µg/L
MW-138-20	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-139-25	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-141-20	Semi-annual	Annual	ND for two events
MW-142-20	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-142-65	Semi-annual	Semi-annual	Sulfolane <15 µg/L
MW-142-150	Annual	Annual	ND for two events
MW-143-20	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-144A-25	Annual	Annual	ND for two events
MW-144BR-90	Annual	Annual	ND for two events
MW-145-20	Quarterly	Semi-annual	Groundwater Remediation System Performance
MW-147B-25	Annual	Annual	ND for two events
MW-148A-15	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-148B-30	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-148C-55	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-148-80	Semi-annual	Semi-annual	Sulfolane <15 µg/L
MW-148-100	Annual	Annual	ND for two events
MW-148D-150	Annual	Annual	ND for two events
MW-149A-15	Annual	Annual	ND for two events
MW-149B-20	Annual	Annual	ND for two events
MW-154A-75	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-154B-95	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-173A-15	Annual	Annual	ND for two events
MW-173B-150	Annual	Annual	ND for two events
MW-174-15	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-174A-50	Semi-annual	Semi-annual	Sulfolane <15 µg/L
MW-174B-90	Annual	Annual	ND for two events
MW-175-90	Quarterly	Semi-annual	Groundwater Remediation System Performance
MW-176A-15	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-176B-50	Semi-annual	Annual	ND for two events
MW-176C-90	Annual	Annual	ND for two events
MW-177-90	Annual	Annual	ND for two events
MW-178A-15	Quarterly	Semi-annual	Sulfolane <15 µg/L

Table 3-4
Sulfolane Monitoring Well Network - Onsite

Long-Term Monitoring Plan
Flint Hills Resources Alaska, LLC
North Pole Terminal, North Pole, Alaska

Well	Previous Frequency	Revised Frequency	Category
MW-178B-50	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-178C-90	Annual	Annual	ND for two events
MW-179A-15	Semi-annual	Semi-annual	Sulfolane <15 µg/L
MW-179B-50	Semi-annual	Semi-annual	Sulfolane <15 µg/L
MW-179C-90	Annual	Annual	ND for two events
MW-180A-15	Annual	Annual	ND for two events
MW-180B-50	Annual	Annual	ND for two events
MW-180C-90	Annual	Annual	ND for two events
MW-186A-15	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-186B-60	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-186C-100	Annual	Annual	ND for two events
MW-186E-75	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-192A-15	Annual	Annual	ND for two events
MW-192B-55	Annual	Annual	ND for two events
MW-195A-15	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-196-15	Annual	Annual	ND for two events
MW-197A-65	Annual	Annual	ND for two events
MW-199-150	Quarterly	Semi-annual	Groundwater Remediation System Performance
MW-301-CMT-10	Annual	Annual	ND for two events
MW-301-CMT-20	Annual	Annual	ND for two events
MW-301-CMT-30	Annual	Annual	ND for two events
MW-301-CMT-40	Annual	Annual	ND for two events
MW-301-CMT-50	Semi-annual	Annual	ND for two events
MW-301-60	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-301-70	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-302-CMT-10	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-302-CMT-20	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-302-CMT-30	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-302-CMT-40	Quarterly	Annual	ND for two events
MW-302-CMT-50	Quarterly	Annual	ND for two events
MW-302-70	Quarterly	Annual	ND for two events
MW-302-80	Quarterly	Annual	ND for two events
MW-302-95	Annual	Annual	ND for two events
MW-302-110	Annual	Annual	ND for two events
MW-303-CMT-9	Quarterly	Annual	ND for two events
MW-303-CMT-19	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-303-CMT-29	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-303-CMT-39	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-303-CMT-49	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-303-CMT-59	Semi-annual	Annual	ND for two events
MW-303-70	Semi-annual	Annual	ND for two events
MW-303-80	Semi-annual	Annual	ND for two events
MW-303-95	Annual	Annual	ND for two events
MW-303-130	Annual	Annual	ND for two events
MW-304-CMT-10	Quarterly	Quarterly	Frequently dry/frozen
MW-304-15	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-304-CMT-20	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-304-CMT-30	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-304-CMT-40	Quarterly	Annual	ND for two events
MW-304-CMT-50	Quarterly	Annual	ND for two events
MW-304-CMT-60	Semi-annual	Annual	ND for two events
MW-304-70	Semi-annual	Annual	ND for two events

Table 3-4
Sulfolane Monitoring Well Network - Onsite

Long-Term Monitoring Plan
Flint Hills Resources Alaska, LLC
North Pole Terminal, North Pole, Alaska

Well	Previous Frequency	Revised Frequency	Category
MW-304-80	Semi-annual	Annual	ND for two events
MW-304-96	Semi-annual	Annual	ND for two events
MW-304-125	Annual	Annual	ND for two events
MW-304-150	Annual	Annual	ND for two events
MW-305-CMT-8	Quarterly	Annual	Frequently dry
MW-305-CMT-18	Quarterly	Annual	ND for two events
MW-305-CMT-28	Semi-annual	Annual	ND for two events
MW-305-CMT-38	Annual	Annual	ND for two events
MW-305-CMT-48	Annual	Annual	ND for two events
MW-305-CMT-58	Annual	Annual	ND for two events
MW-305-70	Annual	Annual	ND for two events
MW-305-80	Annual	Annual	ND for two events
MW-305-100	Annual	Annual	ND for two events
MW-306-CMT-10	Annual	Annual	ND for two events
MW-306-15	Annual	Annual	ND for two events
MW-306-CMT-20	Annual	Annual	ND for two events
MW-306-CMT-30	Annual	Annual	ND for two events
MW-306-CMT-40	Annual	Annual	ND for two events
MW-306-CMT-50	Annual	Annual	ND for two events
MW-306-CMT-60	Annual	Annual	ND for two events
MW-306-70	Annual	Annual	ND for two events
MW-306-80	Annual	Annual	ND for two events
MW-306-100	Annual	Annual	ND for two events
MW-306-150	Annual	Annual	ND for two events
MW-309-15	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-309-66	Quarterly	Semi-annual	Groundwater Remediation System Performance
MW-310-15	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-310-65	Annual	Annual	ND for two events
MW-310-110	Annual	Annual	ND for two events
MW-321-15	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-321-65	Annual	Annual	ND for two events
MW-330-20	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-330-65	Annual	Annual	ND for two events
MW-334-15	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-334-65	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-334-85	Annual	Annual	ND for two events
MW-336-15	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-336-20	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-336-35	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-336-55	Semi-annual	Semi-annual	Sulfolane <15 µg/L
MW-337-20	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-344-15	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-344-55	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-344-75	Quarterly	Semi-annual	Groundwater Remediation System Performance
MW-345-15	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-345-55	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-345-75	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-348-15	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-348-65	Semi-annual	Semi-annual	Sulfolane <15 µg/L
MW-351-15	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-351-55	Quarterly	Semi-annual	Groundwater Remediation System Performance
MW-351-75	Quarterly	Semi-annual	Groundwater Remediation System Performance

Table 3-4
Sulfolane Monitoring Well Network - Onsite

Long-Term Monitoring Plan
Flint Hills Resources Alaska, LLC
North Pole Terminal, North Pole, Alaska

Well	Previous Frequency	Revised Frequency	Category
MW-351-150	Quarterly	Semi-annual	Groundwater Remediation System Performance
MW-354-15	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-354-35	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-354-65	Annual	Semi-annual	Sulfolane <15 µg/L
MW-355-15	Semi-annual	Quarterly	Sulfolane >15 µg/L
MW-355-55	Annual	Semi-annual	Groundwater Remediation System Performance
MW-358-15	Semi-annual	Annual	ND for two events
MW-358-20	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-358-40	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-358-60	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-358-150	Annual	Annual	ND for two events
MW-359-15	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-359-35	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-359-60	Semi-annual	Semi-annual	Sulfolane <15 µg/L
MW-359-80	Semi-annual	Annual	ND for two events
MW-359-150	Annual	Annual	ND for two events
MW-360-15	Annual	Semi-annual	Sulfolane <15 µg/L
MW-360-35	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-360-50	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-360-80	Annual	Semi-annual	Sulfolane <15 µg/L
MW-360-150	Annual	Annual	ND for two events
MW-361-15	Annual	Quarterly	Sulfolane >15 µg/L
MW-362-15	Annual	Annual	ND for two events
MW-362-25	Annual	Annual	ND for two events
MW-362-35	Annual	Annual	ND for two events
MW-362-50	Annual	Annual	ND for two events
MW-362-80	Semi-annual	Semi-annual	Sulfolane <15 µg/L
MW-362-150	Annual	Annual	ND for two events
MW-363-15	Annual	Annual	ND for two events
MW-364-15	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-364-30	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-364-65	Semi-annual	Semi-annual	Sulfolane <15 µg/L
MW-364-90	Semi-annual	Semi-annual	Sulfolane <15 µg/L
MW-364-150	Annual	Annual	ND for two events
MW-365-15	Annual	Annual	ND for two events
MW-366-15	Semi-annual	Semi-annual	Sulfolane <15 µg/L
MW-367-15	Annual	Annual	ND for two events
MW-368-15	Annual	Annual	ND for two events
MW-369-16	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-369-55	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-369-75	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-370-15	Quarterly	Semi-annual	Groundwater Remediation System Performance
MW-370-55	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-370-75	Quarterly	Semi-annual	Groundwater Remediation System Performance
MW-371-15	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-371-55	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-371-75	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-371-125	Quarterly	Semi-annual	Groundwater Remediation System Performance
O-1	Quarterly	Quarterly	Sulfolane >15 µg/L
O-2	Quarterly	Quarterly	Groundwater Remediation System Performance
O-3	Quarterly	Semi-annual	Groundwater Remediation System Performance
O-4	Quarterly	Quarterly	Groundwater Remediation System Performance

Table 3-4
Sulfolane Monitoring Well Network - Onsite

Long-Term Monitoring Plan
Flint Hills Resources Alaska, LLC
North Pole Terminal, North Pole, Alaska

Well	Previous Frequency	Revised Frequency	Category
O-5	Quarterly	Quarterly	Groundwater Remediation System Performance
O-5-65	Quarterly	Quarterly	Groundwater Remediation System Performance
O-6	Quarterly	Quarterly	Groundwater Remediation System Performance
O-12	Quarterly	Quarterly	Groundwater Remediation System Performance
O-12-65	Quarterly	Semi-annual	Groundwater Remediation System Performance
O-14	Annual	Semi-annual	Sulfolane <15 µg/L
O-19	Quarterly	Quarterly	Groundwater Remediation System Performance
O-19-55	Quarterly	Quarterly	Groundwater Remediation System Performance
O-19-90	Quarterly	Semi-annual	Groundwater Remediation System Performance
O-20	Quarterly	Quarterly	Sulfolane >15 µg/L
O-24	Quarterly	Quarterly	Groundwater Remediation System Performance
O-24-65	Quarterly	Semi-annual	Groundwater Remediation System Performance
O-26	Quarterly	Quarterly	Groundwater Remediation System Performance
O-26-65	Quarterly	Semi-annual	Groundwater Remediation System Performance
O-27	Quarterly	Quarterly	Sulfolane >15 µg/L
O-27-65	Semi-annual	Semi-annual	Sulfolane <15 µg/L
O-27-150	Quarterly	Annual	ND for two events
O-31	Quarterly	Semi-annual	Sulfolane <15 µg/L
O-32	Quarterly	Quarterly	Sulfolane >15 µg/L
O-33	Quarterly	Quarterly	Sulfolane >15 µg/L
O-34	Quarterly	Quarterly	Sulfolane >15 µg/L
O-35	Semi-annual	Annual	ND for two events
O-36	Annual	Annual	ND for two events
O-37	Semi-annual	Semi-annual	Sulfolane <15 µg/L
O-38	Quarterly	Annual	ND for two events
R-21	Monthly	Monthly	Remediation System Well
R-32R	Quarterly	Quarterly	Sulfolane >15 µg/L
R-35R	Monthly	Monthly	Remediation System Well
R-40	--	Monthly	Remediation System Well
R-42	Monthly	Monthly	Remediation System Well
R-43	Monthly	Monthly	Remediation System Well
R-44	Monthly	Monthly	Remediation System Well
R-45	Monthly	Monthly	Remediation System Well
R-46	Monthly	Monthly	Remediation System Well
R-47	Monthly	Monthly	Remediation System Well
R-48	Monthly	Monthly	Remediation System Well
S-21	Semi-annual	Semi-annual	Sulfolane <15 µg/L
S-39	Quarterly	Semi-annual	Sulfolane <15 µg/L
S-41R	Quarterly	Quarterly	Sulfolane >15 µg/L
S-43	Quarterly	Quarterly	Groundwater Remediation System Performance
S-50	Semi-annual	Quarterly	Sulfolane >15 µg/L
S-51	Quarterly	Quarterly	Groundwater Remediation System Performance
GAC East Combined Influent	--	Monthly	Groundwater Remediation System Performance
GAC West Combined Influent	--	Monthly	Groundwater Remediation System Performance
MW-372-15		Quarterly	Installed in Q42015
MW-373-15		Quarterly	Installed in Q42015

General Notes:
Semi-annual wells will be sampled during the first and third quarters of the year.
Annual wells will be sampled during the third quarter of the year.

Table 3-4
Sulfolane Monitoring Well Network - Onsite

Long-Term Monitoring Plan
Flint Hills Resources Alaska, LLC
North Pole Terminal, North Pole, Alaska

Well	Previous Frequency	Revised Frequency	Category

Acronyms and Abbreviations:
µg/L = milligrams per liter
ND = not detected

Table 3-5
Other Constituents of Concern (BTEX, GRO and DRO) Monitoring Well Network

Long-Term Monitoring Plan
Flint Hills Resources Alaska, LLC
North Pole Terminal, North Pole, Alaska

Well	Previous Frequency	Revised Frequency	Category
MW-101A-25	Annual	Annual	Benzene <50 µg/L
MW-105A-25	Annual	Annual	Benzene <50 µg/L
MW-106-25	Annual	Semi-annual	Groundwater Remediation System Performance
MW-109-15	Annual	Annual	Benzene <50 µg/L
MW-110-20	Semi-annual	Annual	Benzene <50 µg/L
MW-113-15	Semi-annual	Semi-annual	Groundwater Remediation System Performance
MW-115-15	Semi-annual	Semi-annual	Benzene >50 µg/L
MW-116-15	Semi-annual	Semi-annual	Benzene >50 µg/L
MW-124-25	Annual	Annual	Benzene <50 µg/L
MW-125-25	Semi-annual	Semi-annual	Groundwater Remediation System Performance
MW-126-25	Annual	Annual	Benzene <50 µg/L
MW-127-25	Semi-annual	Annual	Groundwater Remediation System Performance
MW-129-40	Semi-annual	Annual	Groundwater Remediation System Performance
MW-130-25	Semi-annual	Semi-annual	Groundwater Remediation System Performance
MW-131-25	Annual	Annual	Benzene <50 µg/L
MW-132-20	Annual	Annual	Benzene <50 µg/L
MW-133-20	Annual	Annual	Benzene <50 µg/L
MW-134-20	Annual	Annual	Benzene <50 µg/L
MW-135-20	Semi-annual	Semi-annual	Benzene >50 µg/L
MW-136-20	Semi-annual	Semi-annual	Benzene >50 µg/L
MW-137-20	Semi-annual	Annual	Benzene <50 µg/L
MW-138-20	Semi-annual	Semi-annual	Benzene >50 µg/L
MW-139-25	Semi-annual	Semi-annual	Groundwater Remediation System Performance
MW-140-25	Annual	Annual	Benzene <50 µg/L
MW-141-20	Annual	Semi-annual	Groundwater Remediation System Performance
MW-142-20	Semi-annual	Annual	Groundwater Remediation System Performance
MW-143-20	Annual	Annual	Benzene <50 µg/L
MW-144A-25	Annual	Annual	Benzene <50 µg/L
MW-145-20	Semi-annual	Annual	Groundwater Remediation System Performance
MW-148A-15	Every 5 years	Every 5 years	North Property Boundary
MW-149A-15	Every 5 years	Every 5 years	North Property Boundary
MW-176A-15	Semi-annual	Semi-annual	Benzene >50 µg/L
MW-179A-15	Annual	Annual	Benzene <50 µg/L
MW-180A-15	Annual	Annual	Benzene <50 µg/L
MW-186A-15	Semi-annual	Semi-annual	Groundwater Remediation System Performance
MW-192A-15	Annual	Annual	Benzene <50 µg/L
MW-196-15	Annual	Annual	Benzene <50 µg/L
MW-301-CMT-10	Biennial	Biennial	Vertical Profiling Transect
MW-301-CMT-20	Biennial	Biennial	Vertical Profiling Transect
MW-302-CMT-10	Biennial	Biennial	Vertical Profiling Transect
MW-302-CMT-20	Biennial	Biennial	Vertical Profiling Transect
MW-303-CMT-9	Biennial	Biennial	Vertical Profiling Transect
MW-303-CMT-19	Biennial	Biennial	Vertical Profiling Transect
MW-304-CMT-10	Biennial	Biennial	Vertical Profiling Transect
MW-304-15	Biennial	Biennial	Vertical Profiling Transect
MW-304-CMT-20	Biennial	Biennial	Vertical Profiling Transect
MW-305-CMT-8	Biennial	Biennial	Vertical Profiling Transect
MW-309-15	Semi-annual	Annual	Groundwater Remediation System Performance
MW-321-15	Annual	Semi-annual	Benzene >50 µg/L
MW-334-15	Semi-annual	Semi-annual	Groundwater Remediation System Performance
MW-336-15	Semi-annual	Semi-annual	Benzene >50 µg/L
MW-336-20	Semi-annual	Semi-annual	Benzene >50 µg/L
MW-336-35	Semi-annual	Annual	Benzene <50 µg/L
MW-336-55	Semi-annual	Annual	Benzene <50 µg/L
MW-337-20	Semi-annual	Semi-annual	Benzene >50 µg/L

Table 3-5
Other Constituents of Concern (BTEX, GRO and DRO) Monitoring Well Network

Long-Term Monitoring Plan
Flint Hills Resources Alaska, LLC
North Pole Terminal, North Pole, Alaska

Well	Previous Frequency	Revised Frequency	Category
MW-344-15	Semi-annual	Annual	Groundwater Remediation System Performance
MW-344-55	Semi-annual	Semi-annual	Groundwater Remediation System Performance
MW-345-15	Semi-annual	Annual	Groundwater Remediation System Performance
MW-345-55	Semi-annual	Annual	Groundwater Remediation System Performance
MW-351-15	Semi-annual	Annual	Groundwater Remediation System Performance
MW-351-55	Semi-annual	Annual	Groundwater Remediation System Performance
MW-358-15	Every 5 years	Every 5 years	North Property Boundary
MW-358-20	Every 5 years	Every 5 years	North Property Boundary
MW-359-15	Every 5 years	Every 5 years	North Property Boundary
MW-360-15	Every 5 years	Every 5 years	North Property Boundary
MW-362-15	---	Every 5 years	North Property Boundary
MW-363-15	Every 5 years	Every 5 years	North Property Boundary
MW-364-15	Every 5 years	Every 5 years	North Property Boundary
MW-369-16	Semi-annual	Annual	Groundwater Remediation System Performance
MW-370-15	Semi-annual	Annual	Groundwater Remediation System Performance
MW-371-15	Semi-annual	Annual	Groundwater Remediation System Performance
O-2	Semi-annual	Semi-annual	Groundwater Remediation System Performance
O-3	Semi-annual	Semi-annual	Groundwater Remediation System Performance
O-4	Semi-annual	Semi-annual	Groundwater Remediation System Performance
O-5	Semi-annual	Semi-annual	Groundwater Remediation System Performance
O-6	Semi-annual	Annual	Groundwater Remediation System Performance
O-12	Semi-annual	Semi-annual	Groundwater Remediation System Performance
O-14	Annual	Annual	Benzene <50 µg/L
O-16	Annual	Annual	Benzene <50 µg/L
O-17	Annual	Annual	Benzene <50 µg/L
O-18	Annual	Annual	Benzene <50 µg/L
O-19	Semi-annual	Semi-annual	Groundwater Remediation System Performance
O-19-55	Semi-annual	Annual	Groundwater Remediation System Performance
O-24	Semi-annual	Semi-annual	Groundwater Remediation System Performance
O-26	Semi-annual	Annual	Groundwater Remediation System Performance
R-21	Monthly	Monthly	Groundwater Remediation System Performance
R-40	Monthly	Monthly	Groundwater Remediation System Performance
R-35R	Monthly	Monthly	Groundwater Remediation System Performance
R-42	Monthly	Monthly	Groundwater Remediation System Performance
R-43	Monthly	Monthly	Groundwater Remediation System Performance
R-44	Monthly	Monthly	Groundwater Remediation System Performance
R-45	Monthly	Monthly	Groundwater Remediation System Performance
R-46	Monthly	Monthly	Groundwater Remediation System Performance
R-47	Monthly	Monthly	Groundwater Remediation System Performance
R-48	Monthly	Monthly	Groundwater Remediation System Performance
S-9	Annual	Annual	Benzene <50 µg/L
S-43	Semi-annual	Semi-annual	Groundwater Remediation System Performance
S-44	Semi-annual	Semi-annual	Benzene >50 µg/L
S-50	Semi-annual	Semi-annual	Benzene >50 µg/L
S-51	Semi-annual	Semi-annual	Groundwater Remediation System Performance

Acronyms and Abbreviations:
µg/L = milligrams per liter
BTEX = benzene, toluene, ethylbenzene, and total xylenes
GRO = gasoline range organics
DRO = diesel range organics

Table 3-6

Natural Source Zone Depletion Monitoring Network
Long-Term Monitoring Plan
Flint Hills Resources Alaska, LLC
North Pole Terminal, North Pole, Alaska

Location	Well ID	TPH - GRO	TPH - DRO	E- acceptors		Biodegradation Products		
				Oxygen	Sulfate	Ferrous Iron	Manganese (II)	Methane
Upgradient	MW-105A-25	X	X	X	X	X	X	X
Upgradient	MW-196-15	X	X	X	X	X	X	X
Downgradient	MW-145-20	X	X	X	X	X	X	X
Downgradient	MW-369-16	X	X	X	X	X	X	X
Downgradient	MW-142-20	X	X	X	X	X	X	X
Downgradient	MW-101A-25	X	X	X	X	X	X	X
Source Zone	MW-116-15	X	X	X	X	X	X	X
Source Zone	MW-125-25	X	X	X	X	X	X	X
Source Zone	MW-130-25	X	X	X	X	X	X	X
Source Zone	MW-180A-15	X	X	X	X	X	X	X
Source Zone	MW-321-15	X	X	X	X	X	X	X
Source Zone	MW-336-20	X	X	X	X	X	X	X

General Notes:
1. NSZD monitoring will be conducted annually during the third quarter monitoring program

Acronyms and Abbreviations:
TPH = total petroleum hydrocarbons
GRO = gasoline range organics
DRO = diesel range organics

FIGURES

MW-148A-15
MW-364-15
MW-149A-15
MW-363-15
MW-360-15
MW-359-15
MW-358-20
MW-304-CMT-10
MW-140-25
MW-362-15
MW-141-20
MW-301-CMT-10
MW-144A-25
MW-173A-15
MW-145-20
MW-309-15
MW-334-15
MW-125-25
MW-113-15
MW-186A-15
MW-135-20
North Gravel Pit
MW-310-15
MW-130-25
MW-133-20
MW-174-15
MW-321-15
MW-372-15
MW-330-20
MW-195A-15
MW-176A-15
MW-106-25
MW-110-20
O-14
MW-373-15
South Gravel Pit
MW-109-15
MW-336-20
MW-361-15
MW-365-15
MW-192A-15
MW-105A-25

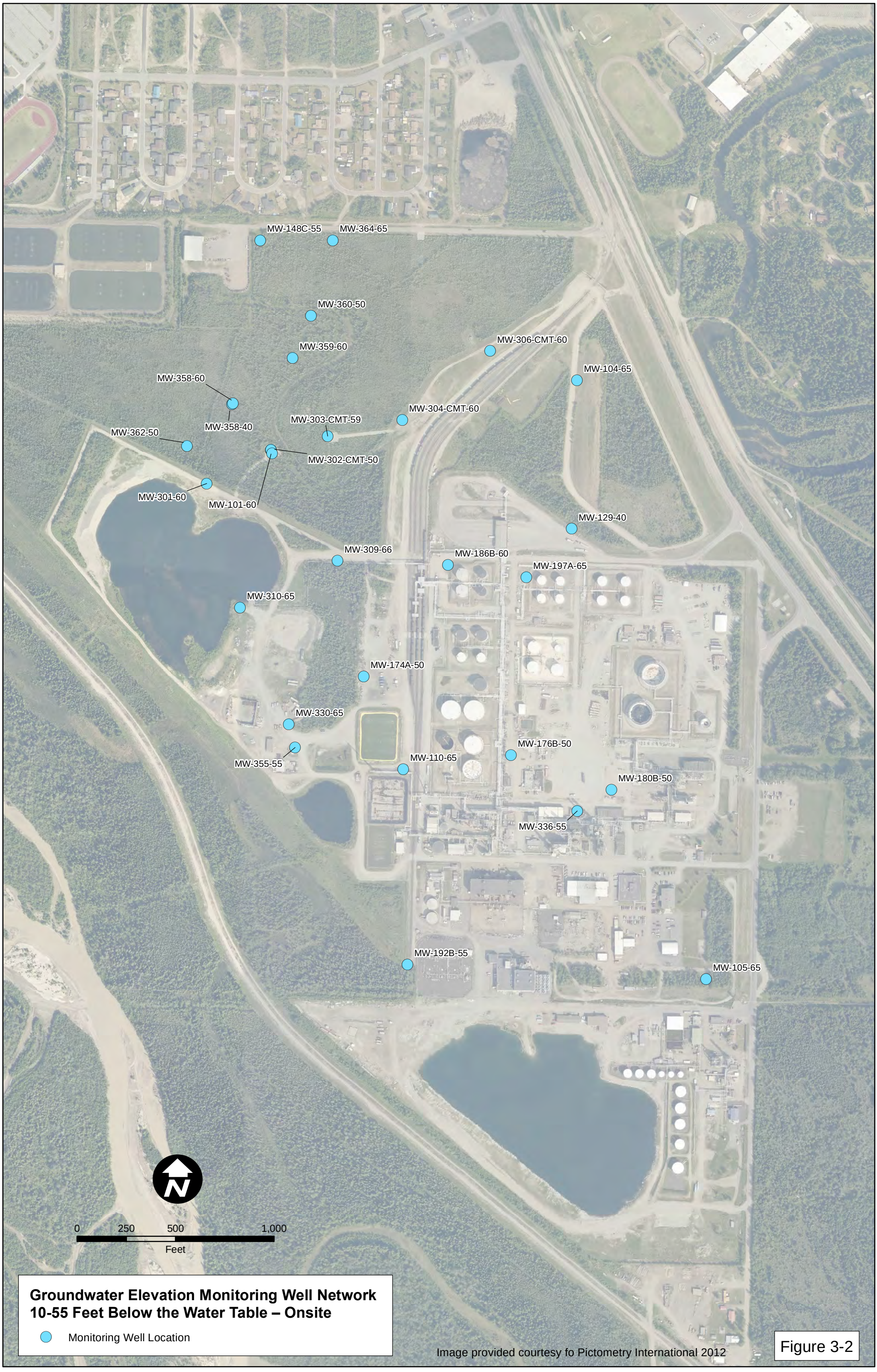
0 250 500 1,000
Feet

Groundwater Elevation Monitoring Well Network
Water Table – Onsite

Monitoring Well Location

Image provided courtesy fo Pictometry International 2012

Figure 3-1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MW-364-65
MW-360-50
MW-359-60
MW-306-CMT-60
MW-104-65
MW-358-60
MW-358-40
MW-304-CMT-60
MW-303-CMT-59
MW-362-50
MW-302-CMT-50
MW-301-60
MW-101-60
MW-129-40
MW-309-66
MW-186B-60
MW-197A-65
MW-310-65
MW-174A-50
MW-330-65
MW-355-55
MW-110-65
MW-176B-50
MW-180B-50
MW-336-55
MW-192B-55
MW-105-65
N
0
250
500
1,000
Feet
Groundwater Elevation Monitoring Well Network
10-55 Feet Below the Water Table – Onsite
Monitoring Well Location
Image provided courtesy fo Pictometry International 2012
Figure 3-2


MW-148-80
MW-364-90
MW-360-80
MW-359-80
MW-306-80
MW-102-70
MW-304-80
MW-303-80
MW-362-80
MW-301-70
MW-154A-75
MW-144BR-90
MW-334-85
MW-186E-75
MW-175-90
MW-174B-90
MW-176C-90
MW-180C-90
N
0
250
500
1,000
Feet
Groundwater Elevation Monitoring Well Network
55-90 Feet Below the Water Table – Onsite
Monitoring Well Location
Image provided courtesy of Pictometry International 2012

Figure 3-3


MW-148D-150
MW-364-150
MW-148-100
MW-360-150
MW-306-150
MW-358-150
MW-304-125
MW-303-130
MW-362-150
MW-173B-150
MW-186D-135
MW-307-150
MW-199-150
MW-310-110
MW-195B-150
MW-300-150
MW-198-150
0
250
500
1,000
Feet
Groundwater Elevation Monitoring Well Network
90-160 Feet Below the Water Table – Onsite
Monitoring Well Location
Image provided courtesy of Pictometry International 2012
Figure 3-4

MW-142-20
MW-139-25
O-25
O-26
O-12
O-24
O-4
O-23
O-3
R-43
R-46
R-42
O-5
O-29
O-17
MW-178A-15
O-8
O-20
MW-180A-15
O-16
N
0
250
500
Feet

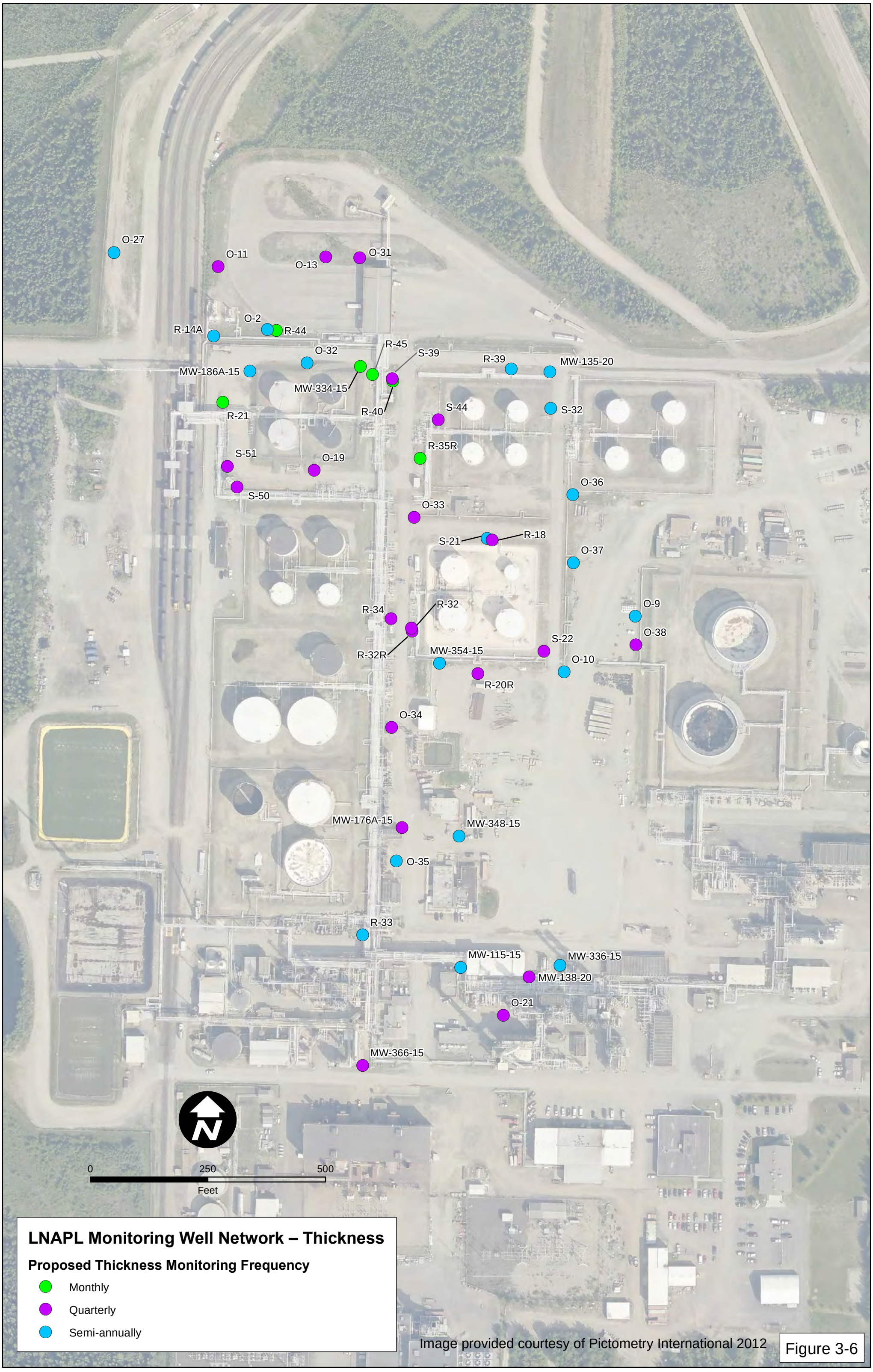
LNAPL Monitoring Well Network - Migration

Proposed Migration Monitoring Frequency

- Monthly
- Quarterly
- Semi-annually
- Annually

Image provided courtesy fo Pictometry International 2012

Figure 3-5


O-27
O-11
O-13
O-31
O-2
R-14A
R-44
R-45
S-39
O-32
R-39
MW-135-20
MW-186A-15
MW-334-15
R-21
R-40
S-44
S-32
R-35R
S-51
O-19
S-50
O-36
O-33
S-21
R-18
O-37
R-34
R-32
O-9
O-38
R-32R
MW-354-15
S-22
O-10
R-20R
O-34
MW-176A-15
MW-348-15
O-35
R-33
MW-115-15
MW-336-15
MW-138-20
O-21
MW-366-15
N
0
250
500
Feet
LNAPL Monitoring Well Network – Thickness
Proposed Thickness Monitoring Frequency
Monthly
Quarterly
Semi-annually
Image provided courtesy of Pictometry International 2012
Figure 3-6

MW-148A-15
MW-364-15
MW-149A-15
MW-149B-20
MW-363-15
MW-360-15
MW-306-CMT-10
MW-306-15
MW-306-CMT-20
MW-359-15
MW-305-CMT-8
MW-305-CMT-18
MW-358-15
MW-358-20
MW-303-CMT-9
MW-303-CMT-19
MW-304-CMT-10
MW-304-15
MW-304-CMT-20
MW-141-20
MW-143-20
MW-302-CMT-10
MW-302-CMT-20
MW-142-20
MW-173A-15
MW-362-15
MW-301-CMT-10
MW-301-CMT-20
O-26
MW-371-15
O-27
O-12
O-31
O-24
MW-351-15
MW-145-20
O-4
MW-345-15
R-44
MW-334-15
O-3
S-39
MW-370-15
MW-309-15
R-42
O-2
R-40
MW-135-20
MW-344-15
R-43
O-32
R-46
MW-310-15
R-21
MW-186A-15
MW-113-15
O-5
R-45
S-51
S-43
MW-369-16
O-6
S-50
O-19
R-35R
O-36
O-33
O-37
MW-133-20
S-21
MW-174-15
MW-132-20
R-32R
O-38
MW-354-15
MW-321-15
MW-330-20
O-34
MW-178A-15
MW-372-15
MW-355-15
MW-195A-15
MW-348-15
MW-179A-15
MW-134-20
MW-110-20
MW-176A-15
O-14
MW-373-15
S-41R
O-35
O-1
O-20
MW-109-15
MW-180A-15
MW-336-15
MW-115-15
MW-336-20
MW-138-20
MW-337-20
MW-116-15
MW-361-15
MW-365-15
MW-366-15
MW-367-15
MW-368-15
MW-196-15
MW-192A-15

0 250 500 1,000
Feet

Sulfolane Monitoring Well Network
Water Table – Onsite

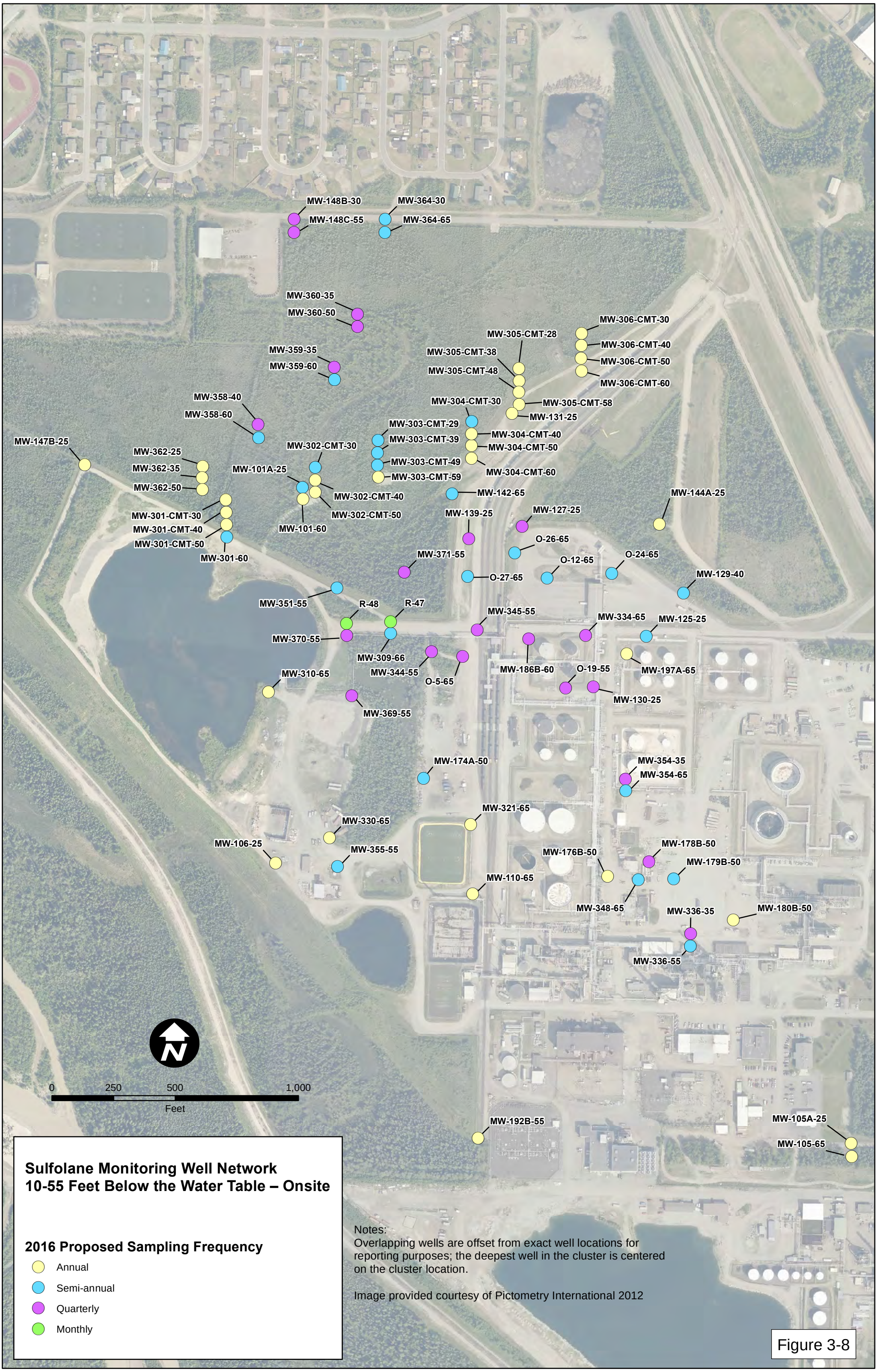
2016 Proposed Sampling Frequency

- Annual
- Semi-annual
- Quarterly
- Monthly

Notes:
Overlapping wells are offset from exact well locations for reporting purposes; the deepest well in the cluster is centered on the cluster location.

Image provided courtesy of Pictometry International 2012

Figure 3-7



Sulfolane Monitoring Well Network
10-55 Feet Below the Water Table – Onsite

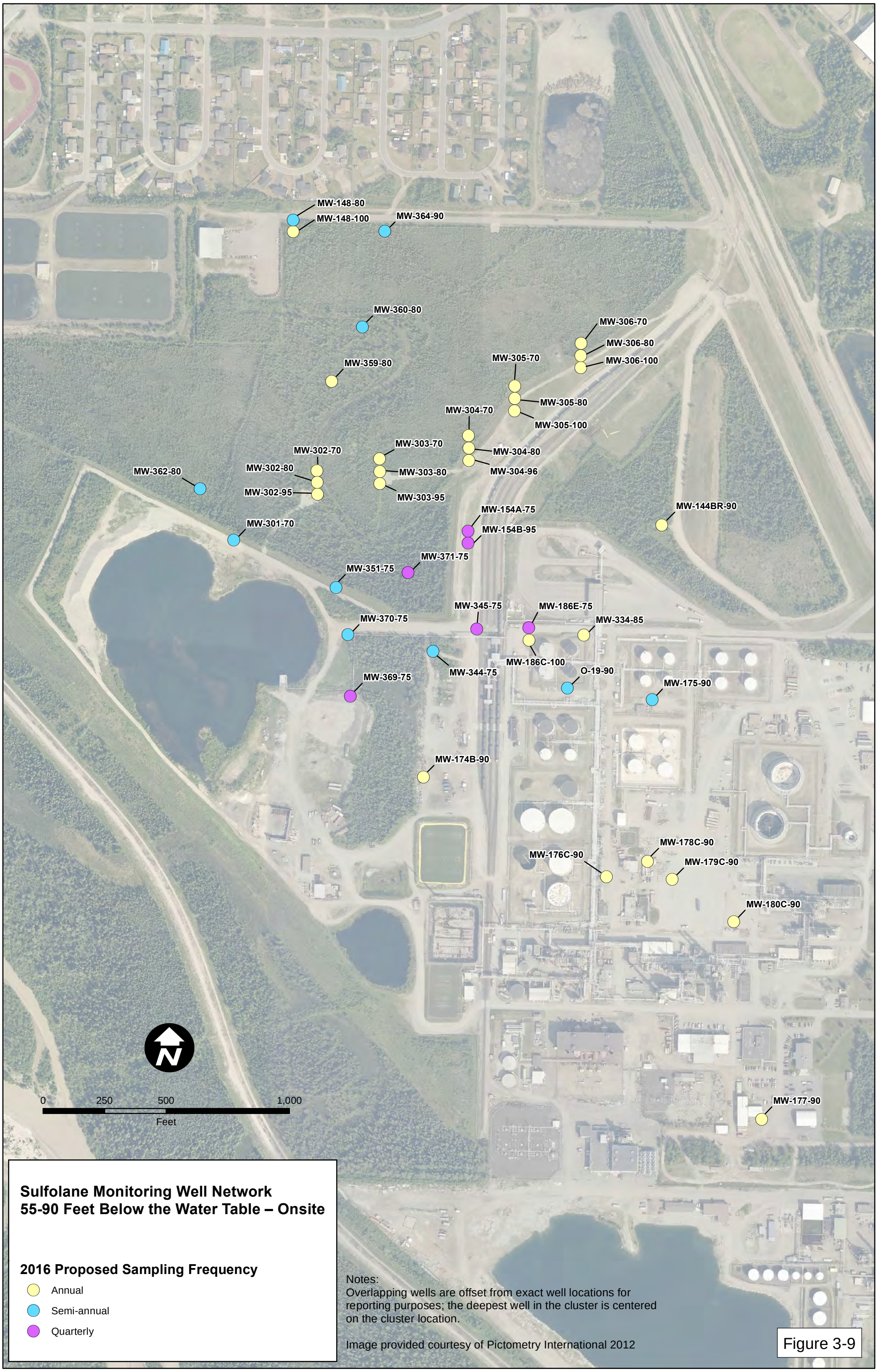
2016 Proposed Sampling Frequency

- Annual
- Semi-annual
- Quarterly
- Monthly

Notes:
Overlapping wells are offset from exact well locations for reporting purposes; the deepest well in the cluster is centered on the cluster location.

Image provided courtesy of Pictometry International 2012

Figure 3-8


MW-148-80
MW-148-100
MW-364-90
MW-360-80
MW-359-80
MW-306-70
MW-306-80
MW-306-100
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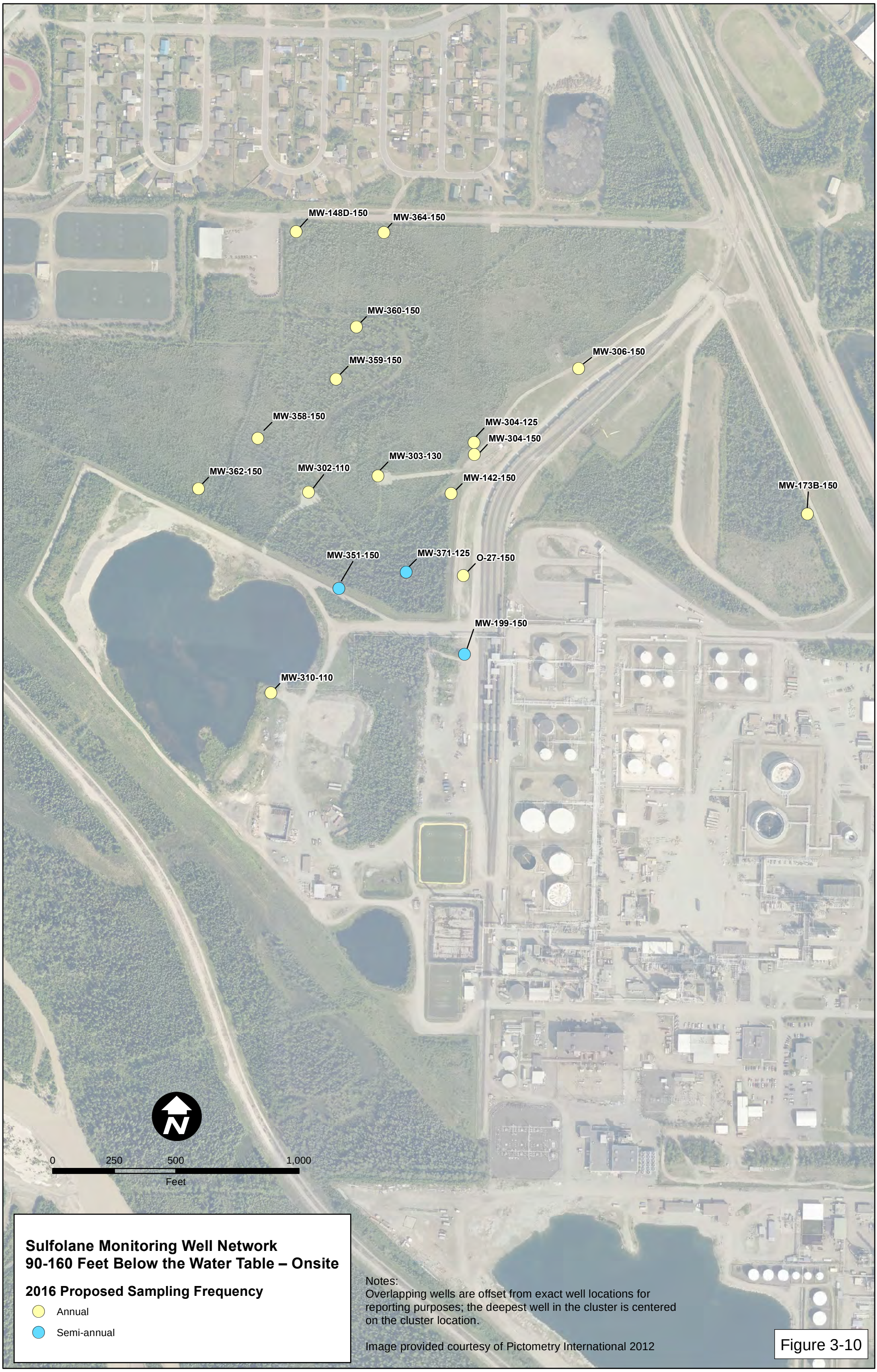
MW-303-80
MW-303-95
MW-302-70
MW-302-80
MW-302-95
MW-362-80
MW-301-70
MW-154A-75
MW-154B-95
MW-144BR-90
MW-371-75
MW-351-75
MW-345-75
MW-186E-75
MW-334-85
MW-370-75
MW-344-75
MW-186C-100
O-19-90
MW-175-90
MW-369-75
MW-174B-90
MW-178C-90
MW-176C-90
MW-179C-90
MW-180C-90
MW-177-90
0
250
500
1,000
Feet
Sulfolane Monitoring Well Network
55-90 Feet Below the Water Table – Onsite
2016 Proposed Sampling Frequency
Annual
Semi-annual
Quarterly
Notes:
Overlapping wells are offset from exact well locations for reporting purposes; the deepest well in the cluster is centered on the cluster location.
Image provided courtesy of Pictometry International 2012
Figure 3-9


MW-148D-150
MW-364-150
MW-360-150
MW-359-150
MW-306-150
MW-358-150
MW-304-125
MW-304-150
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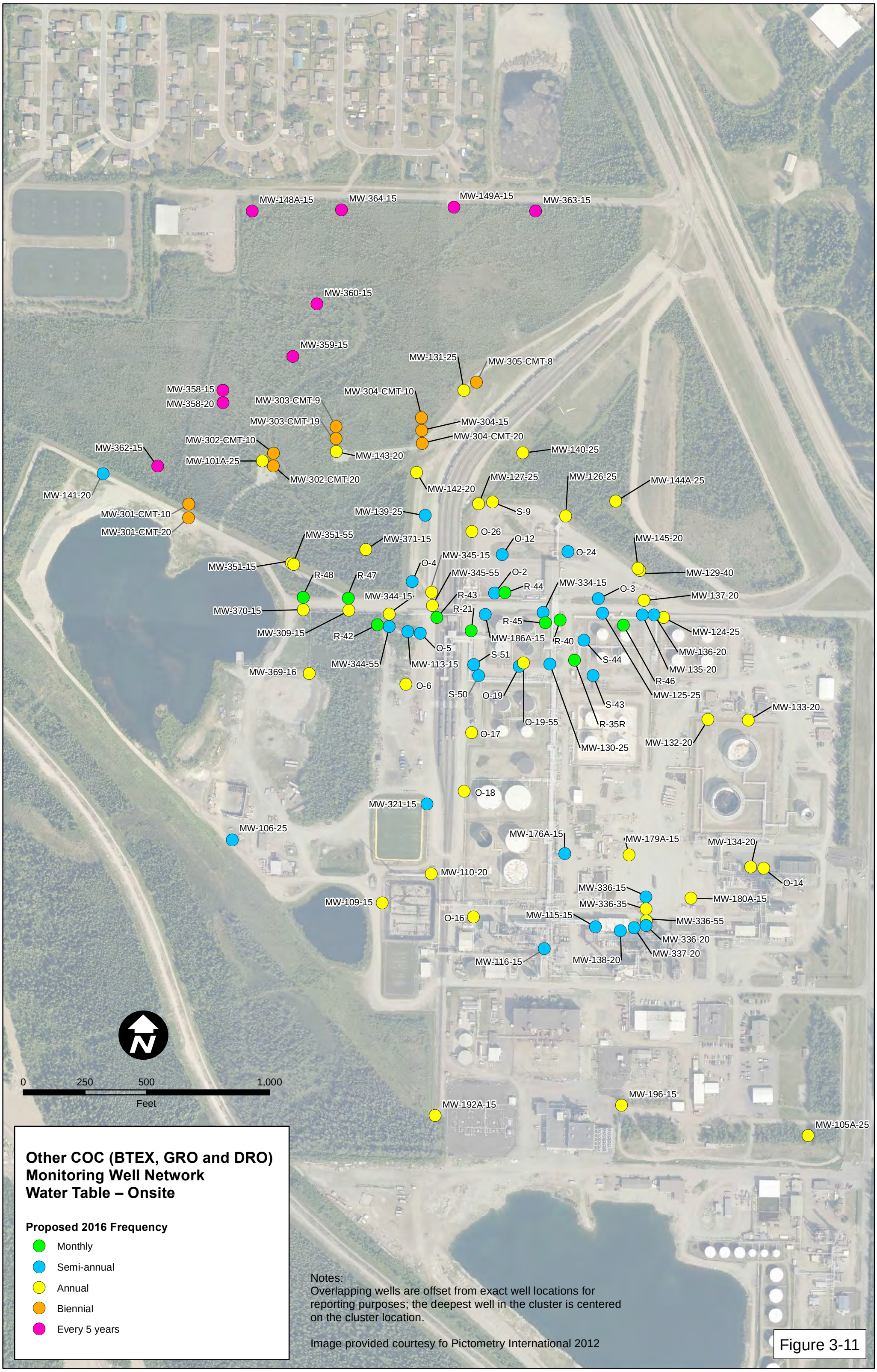
MW-362-150
MW-302-110
MW-142-150
MW-173B-150
MW-351-150
MW-371-125
O-27-150
MW-199-150
MW-310-110
0
250
500
1,000
Feet
Sulfolane Monitoring Well Network
90-160 Feet Below the Water Table – Onsite
2016 Proposed Sampling Frequency
Annual
Semi-annual
Notes:
Overlapping wells are offset from exact well locations for reporting purposes; the deepest well in the cluster is centered on the cluster location.
Image provided courtesy of Pictometry International 2012
Figure 3-10



Other COC (BTEX, GRO and DRO) Monitoring Well Network Water Table – Onsite

Proposed 2016 Frequency

- Monthly
- Semi-annual
- Annual
- Biennial
- Every 5 years

Notes:
Overlapping wells are offset from exact well locations for reporting purposes; the deepest well in the cluster is centered on the cluster location.

Image provided courtesy fo Pictometry International 2012

Figure 3-11


MW-101A-25
MW-142-20
MW-145-20
MW-125-25
MW-130-25
MW-369-16
MW-321-15
MW-180A-15
MW-336-20
MW-116-15
MW-196-15
MW-105A-25
0
250
500
1,000
Feet
Natural Source Zone Depletion Locations
Annual Sampling Frequency
Image provided courtesy fo Pictometry International 2012
Figure 3-12

ATTACHMENT A

Summary of Revisions to the LTM Plan

Attachment 1
Summary of Revisions to the Long-Term Monitoring Plan
Flint Hills Resources Alaska, LLC
North Pole Terminal, North Pole, Alaska

Date of Revisions to the LTM Plan	Sections Updated	Reason for Changes
October 2014	Table 3-3	Added well MW-115-15 to LNAPL Thickness Monitoring Network because LNAPL was observed.
April 2015	Table 3-4	Updated the frequency of groundwater monitoring based on criteria in Table 5-2
July 2015	Table 3-4	Updated the frequency of groundwater monitoring based on criteria in Table 5-2
June 2015	Table 3-4	Added remediation system wells to Sulfolane Monitoring Network. Increase frequency of MW-355-15 and S-50 from semi-annual to quarterly based on detections above 15 µg/L.
October 2015	Table 3-4	Updated the frequency of groundwater monitoring based on criteria in Table 5-2
December 2015	entire text	Updated "North Pole Refinery" to "North Pole Terminal"
December 2015	Section 5.1, Table 3-1, Figures 3-1 through 3-4	Revised groundwater elevation monitoring network frequency to semi-annual and made revisions based on redundancy.
December 2015	Tables 3-2 and 3-3, Figures 3-5 and 3-6	Revised LNAPL thickness and migration networks based on redundancy.
December 2015	Section 5.2, Table 3-4, Figures 3-7 through 3-10	Revised the frequency of the following based on criteria in Table 5-2: Sulfolane monitoring network Performance monitoring wells with no detections Phase 8 wells VPT wells below 40 feet bgs Revised network based on redundancy; dropped selected wells outside the lateral or vertical extent of the plume.
December 2015	Table 3-5, Figure 3-11	Revised the frequency of other COCs based on criteria in Table 5-3.
December 2015	Section 5.4	Revised text to clarify when network frequency changes would be made.
December 2015	Section 5.5, Table 3-6, Figure 3-12	Added Section 5.5, Table 3-6 and Figure 3-13 summarizing natural source zone depletion monitoring.

Notes:
LTM Plan = Long-Term Monitoring Plan
LNAPL = light nonaqueous phase liquid
VPT = vertical profile transect
COC = constituents of concern

ATTACHMENT B

Soil Management Plan

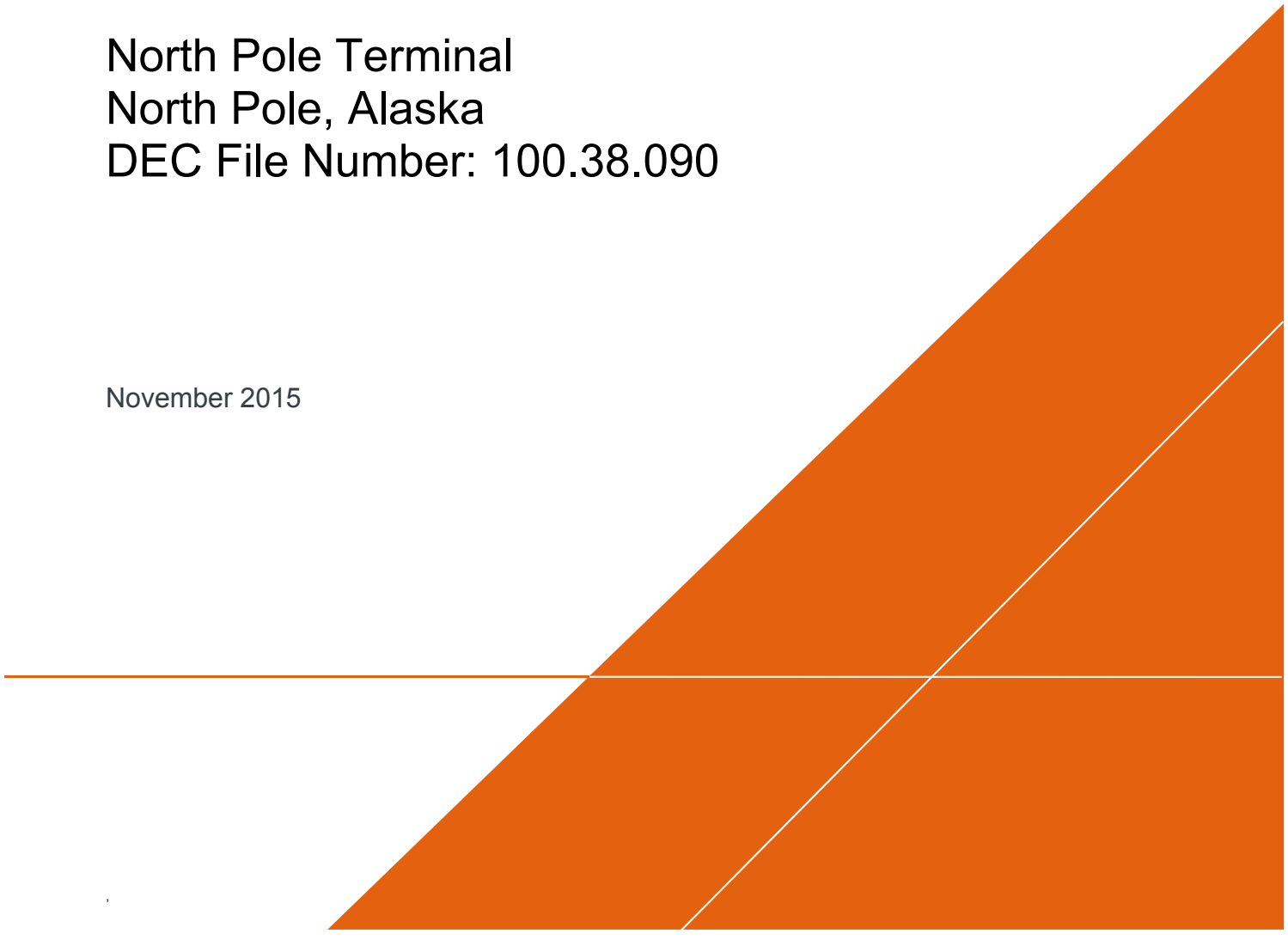
ARCADIS Design & Consultancy for natural and built assets

Flint Hills Resources Alaska, LLC

ONSITE SOIL MANAGEMENT PLAN

North Pole Terminal
North Pole, Alaska
DEC File Number: 100.38.090

November 2015



ONSITE SOIL MANAGEMENT PLAN

North Pole Terminal

North Pole, Alaska

Gina Withy
Project Engineer

Rebecca Andresen
Technical Expert

Prepared for:

Flint Hills Resources Alaska, LLC

Prepared by:

Arcadis U.S., Inc.
630 Plaza Drive
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Colorado 80129
Tel 720 344 3500
Fax 720 344 3535

Our Ref.:

B0081981.0072.0001

Date:

November 2015

CONTENTS

TABLE

ATTACHMENT

1 INTRODUCTION

On behalf of Flint Hills Resources Alaska, LLC (FHRA), Arcadis U.S., Inc. (Arcadis) prepared this Onsite Soil Management Plan (Onsite SMP) for the FHRA North Pole Terminal (NPT), an idled petroleum refinery located on H and H Lane in North Pole, Alaska (site). Future land use of the property will remain consistent with an industrial manufacturing setting given its significant infrastructure and capabilities. The purpose of this Onsite SMP is to provide guidance for potential ground-disturbing activities to protect workers from exposure to impacted soil associated with former site operations. This Onsite SMP applies to ground-disturbing activities by the Property Owner and operators, on-site contractors, and future Property Owners and operators, and should be used in conjunction with existing NPT health and safety policies for excavation.

To supplement this Onsite SMP, project-specific soil plans may be developed to identify responsibilities and procedures for onsite soil management based on the scope and extent of a specific project. This Onsite SMP provides general guidance on the roles and responsibilities for emergency, routine maintenance, or short lead-time ground-disturbing activities.

2 BACKGROUND

The 240-acre site is located inside the city limits of North Pole, Alaska (the city). The city is located approximately 13 miles southeast of Fairbanks, Alaska, within the Fairbanks North Star Borough. The physical setting for the site is described in the Onsite Site Characterization Report – 2013 Addendum (Arcadis 2013b).

2.1 Site Characterization Background

A series of site characterization reports collectively present an extensive body of information that has been gathered to ascertain the physical characteristics of the site, define the sources of contamination, and determine the nature and extent of contamination present at the site. These reports are listed below:

- Site Characterization Report – Through 2011 (Barr Engineering Company 2012)
- Site Characterization Report – 2012 Addendum (Arcadis 2013a)
- Onsite Site Characterization Report – 2013 Addendum (Arcadis 2013b)

For this Onsite SMP, the term “onsite” is the area that is located within the property boundary of the FHRA NPT. This Onsite SMP only applies to excavations that occur more than 12 inches below the soil surface, although all contaminated soil must be properly managed per Alaska Department of Environmental Conservation (ADEC) regulations.

2.2 Constituents of Concern

Extensive sampling of soil was completed for numerous constituents of potential concern (COPCs) to develop a list of constituents of concern (COCs) for the site. COCs were identified based on a comparison of site maximum concentrations to Method 2 cleanup levels for soil (Table B1 and B2of 18 AAC 75.341(c)) for those constituents listed in Table 2-1.

Perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) are considered COPCs for the site, but have not been designated as COCs. Like sulfolane, PFOS and PFOA are not regulated under the above-cited sections of the Alaska regulations; however, they are considered potential contaminants to be considered in future soil excavation plans, as appropriate.

Table 2-1. Constituents of Concern in Soil

Soil COC	Maximum Concentration (mg/kg)	Soil Cleanup Level[1] (mg/kg)
1,2,4-Trimethylbenzene	205	23
1,3,5-Trimethylbenzene	81.1	23
1,2,3 Trichloropropane	0.374	0.00053
Benzene	438	0.025
Ethylbenzene	392	6.9
Methylene chloride	0.188	0.016
n-Butylbenzene	107	15
sec-Butylbenzene	25.3	12
n-Propylbenzene	72.7	15
Toluene	1,330	6.5
Xylenes	2,510	63
1-Methylnaphthalene	88.5	6.2
2-Methylnaphthalene	240	6.1
Naphthalene	125	20
Sulfolane	1,620	TBD
Gasoline range organics	7,730	300
Diesel range organics	32,000	250

Notes:

1 Soil cleanup level set at the minimum value of the direct contact, outdoor inhalation and migration to groundwater value in 18 AAC 75 Table B1 and B2 for the under 40-inch zone.

mg/kg = milligrams per kilogram

TBD = to be determined

3 COMPLIANCE WITH SOIL MANAGEMENT REQUIREMENTS

NPT workers, contractors, and other third parties performing ground-disturbing activities within the site boundary will properly manage soil potentially contaminated with COCs (or "impacted soil"). Ground-disturbing activities include any man-made cut, boring, cavity, trench or depression in an earth surface, formed by earth removal. FHRA considers any dig of 12 inches or more an Excavation.

This Onsite SMP will be used in conjunction with existing NPT policies for Excavation activities. Soil management requirements for contaminated soils are defined below. Excavated soil will be properly characterized. Soil will be properly managed, transported, and disposed of in accordance with all state, federal and international laws and regulations.

3.1 Contaminated Soils Management Requirements

The area of the facility where soil may be found that is contaminated is identified in Attachment A. Pursuant to the FHRA Excavation Procedure, any excavation for the purpose of remediation that will take place will be subject to an excavation permit and will be supervised by the qualified person assigned to the excavation project.

For excavation that involves repair and replacement of existing infrastructure, excavated contaminated soil appropriate for use as fill material will be placed back in the excavation where it originated. For new construction or demolition activities, excavated contaminated soil may be used as backfill with prior ADEC approval. Obviously contaminated soils containing saturated levels of hydrocarbons or other COC will not be replaced unless a suitable replacement is not available and an unacceptable safety condition would result.

Basic requirements for handling contaminated soils excavated from the subsurface are as follows:

- Notify FHRA personnel and obtain an Excavation Permit pursuant to FHRA's procedures prior to any excavation.
- Do not transfer, remove, or otherwise move contaminated soils from a contaminated area to a non-contaminated area, or from one contaminated area to another contaminated area without properly emplacing engineering controls to mitigate potentially spreading contamination. Directions will be provided by FHRA regarding the handling, management, and transport of any excess contaminated soils that will not be returned to the excavation for re-use.
- Avoid mixing contaminated and uncontaminated soils during excavation or repeated handling to minimize potential waste generation.
- Excavation equipment that comes in contact with contaminated soils must be properly decontaminated before transport offsite or to an uncontaminated area of the property.

If new areas of contamination are discovered while excavation is occurring in areas previously believed to be uncontaminated, it will be necessary to halt work in these areas. Under these circumstances, excavation activities will stop to ensure appropriate FHRA personnel and ADEC have been notified that actual or potential contaminated soils have been encountered. This work delay will allow FHRA to ensure that the appropriate health and safety and soil management procedures are in place before continuing.

4 HEALTH AND SAFETY PLAN

A site-specific Health and Safety Policy (HSP-06, Alaska Excavation Procedure) has been and will continue to be used to protect the health and safety of subsurface workers when subsurface work is conducted at the site. The HSP conforms to the requirements established under 29 Code of Federal Regulations (CFR) 1910.120, including the use of appropriately trained workers, monitoring and identification of contaminated media, site health and safety officer's authorities and responsibilities, and health and safety meetings for applicable site personnel.

The Excavation Procedure requires anyone involved with subsurface work to use a minimum level of personal protective equipment (PPE) (e.g., protective clothing, work-appropriate gloves and boots, etc.) to protect against the COCs identified at the site. HSP-06 defines appropriate air monitoring protocols, PPE requirements, and worker decontamination.

Hazards associated with the site and the content of the Excavation Procedure are communicated to site workers prior to commencing Excavation work and during daily tailgate safety meetings. Site-specific hazards, changes in site conditions, safe work practices, PPE requirements, emergency procedures, and notification protocols will be discussed with the site workers as part of the Safe Work Permitting process.

The map included in Attachment A is also included in the Excavation Procedure and identifies areas containing COCs. In order to excavate in the areas identified on the map, employees, contractors and other third parties must obtain an Excavation Permit from trained FHRA employee. That employee's training will include identification of areas located within the map so that persons undertaking the excavation can undertake appropriate precautions.

The primary hazard relevant to this Onsite SMP is soil impacted by COCs identified in Table 2-1. The majority of the COCs are related to petroleum hydrocarbons. As the site operations directly involve the handling and storage of petroleum hydrocarbons, the site is very familiar and experienced with the health and safety requirements necessary to ensure workers are properly protected. The primary routes of exposure include inhalation of volatilized constituents in trench air. However, direct contact with soil impacted by other constituents associated with historical operations, including sulfolane, is also considered. Excavation work conducted at the NPT in areas of impacted soil, or areas with soil suspected to be impacted, requires the issuance of a Safe Work Permit prior to commencing work. This includes, but is not limited to, permission by operations personnel to work in an area, a discussion of potential hazards and associated risk mitigation activities, completion of an Excavation checklist, and designation of only authorized workers to be performing work within the work area.

Appropriate worker hygiene is required so that individuals will not inadvertently ingest or inhale impacted soil particles adhering to gloves or clothing, or ingest impacted groundwater. Work within the Excavation areas containing impacted soil is anticipated to require modified Level D PPE for workers who could potentially come into contact with impacted soil and/or groundwater. Modified Level D PPE includes: steel-toed boots, hard hat, and protective eyewear. Chemical-resistant gloves and/or respirators, as well as decontamination requirements, would be required if hazards are identified by the Excavation Competent Person or as part of the Safe Work Permitting Process.

5 WORKER HEALTH AND SAFETY TRAINING

The Alaska Occupational Safety and Health Program generally follows federal Occupational Safety and Health Administration (OSHA) requirements. According to OSHA 29 CFR 1910.120(e), workers and field supervisors that are engaged in hazardous substance removal as part of cleanup operations are required to have received either 24- or 40-hour Hazardous Waste Operations and Emergency Response training from a qualified vendor.

6 SOIL MANAGEMENT PLAN AMENDMENTS

This Onsite SMP may be amended and approved by the Property Owner as necessary to address changes in ownership, NPT operations, regulatory changes, or other requirements. A project-specific soil management plan may be prepared based on the proposed scope of future work.

7 REFERENCES

Arcadis U.S., Inc. 2013a. Site Characterization Report – 2012 Addendum. January 25, 2013.

Arcadis U.S., Inc. 2013b. Onsite Site Characterization Report – 2013 Addendum. December 20, 2013.

Barr Engineering Company. 2012. Site Characterization Report – Through 2011. December 2012.

ATTACHMENT A

Map of Potential Contamination

Legend

- Soil potentially contaminated with BTEX or Sulfolane
- FHRA Property Boundary

0 600 1,200

SCALE IN FEET

FLINT HILLS RESOURCES ALASKA, LLC
NORTH POLE TERMINAL, NORTH POLE, ALASKA

ONSITE SOIL MANAGEMENT PLAN

MAP OF POTENTIALLY CONTAMINATED SOIL

ARCADIS

Appendix **A**

CITY: SAN FRANCISCO DIV/GROUP: ENV/IM DB: BGRIFFITH LD: PIC: PM: TM: TR:
PROJECT: (PROJECT #)
PATH: W:\GIS\PROJECTS_ENV\FHR_AK\NorthPoleRefinery\Misc_Figures\AppendixA PotentiallyContaminatedSoil.mxd 10/15/2014 3:49:36 PM

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