



**STATEMENT OF BASIS
KENNEDY ATHLETIC RECREATION AND SOCIAL PARK I,
SWMU 084
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
KENNEDY SPACE CENTER**



PURPOSE OF STATEMENT OF BASIS

This Statement of Basis (SB) has been developed to inform and give the public an opportunity to comment on the proposed corrective action to address contamination at the Kennedy Athletic Recreation and Social (KARS) Park I⁽¹⁾. A Kennedy Space Center (KSC) Remediation Team consisting of National Aeronautics and Space Administration (NASA) and Florida Department of Environmental Protection (FDEP) personnel has determined that the proposed corrective action is cost effective and protective of human health and the environment. However, before implementing the proposed action, the KSC Remediation Team would like to provide the public an opportunity to comment on the proposed corrective action. At any time during the public comment period, the public may comment as explained in the “How Do You Participate” section of this SB. After the end of the public comment period, the KSC Remediation Team will review all comments and issues raised in the comments and determine if there is a need to modify the proposed corrective action prior to implementation.

WHY IS A REMEDY NEEDED?

The results of the Resource Conservation and Recovery Act (RCRA) Facility Investigation

(RFI) and Corrective Measures Study (CMS) at KARS Park I indicated that 1,1'-biphenyl in Location of Concern (LOC) 2 groundwater, arsenic in LOC 7 groundwater, and lead in LOC 9 groundwater are present at concentrations that may be potentially harmful to human health if this water was used for human consumption now or in the future.

HOW DO YOU PARTICIPATE?

The KSC Remediation Team is soliciting public review and comment on this SB before implementing the proposed corrective action. The final corrective action for KARS Park I will eventually be incorporated into the RCRA Permit for KSC.

The public comment period for this SB and proposed corrective action will begin on the date of

<p>The Cleanup Remedy</p> <p>The proposed corrective action for KARS Park I groundwater includes the following components:</p> <ul style="list-style-type: none"> • LOC 2 & 7: NFA with Controls under FDEP Risk Management Option (RMO) Level II • LOC 2: One year of quarterly monitoring • LOC 7: Two years of semi-annual monitoring • LOC 9: NFA with Controls under RMO Level III, annual monitoring for four years • LOC 2, 7 & 9: Implementation of institutional controls to prohibit the use of groundwater as a potable water supply

¹ In accordance with RCRA §7004(b), this Statement of Basis summarizes the proposed corrective action for the NASA KARS Park I site. For detailed information on the site, consult the KARS Park I administrative file, which is available for review by contacting the KSC Environmental Program Office at (321) 867-8411.

publication of notice of availability of the SB in major local newspapers of general circulation and will end 45 days thereafter. If requested during the comment period, the KSC Remediation Team will hold a public meeting to respond to any oral comments or questions regarding the proposed corrective action. To request a hearing or provide comments, contact the following person in writing within the 45-day comment period:

Mr. John R. Armstrong, P.G.
 FDEP-Bureau of Waste Cleanup
 Federal Facilities Section
 Bob Martinez Center Mail Station 4535
 2600 Blair Stone Road
 Tallahassee, Florida 32399-2400
 Email: John.Armstrong@dep.state.fl.us
 Telephone: (850) 245-8981

The RCRA Permit, SB, and associated administrative file, including the RFI, CMS, and Interim Measures (IM) Reports, will be available to the public for viewing and copying at:

NASA Document Library
 Merritt Island Public Library
 1195 N. Courtenay Parkway
 Merritt Island, FL 32953
 Telephone: (321) 455-1369

To request further information, please contact one of the following people:

Mr. Harold Williams
 Remediation Program Manager
 Environmental Program Office
 Mail Code: TA-B1B
 Kennedy Space Center, FL 32899
 E-mail: Harold.G.Williams@nasa.gov
 Telephone: (321) 867-8411

Mr. John R. Armstrong, P.G.
 FDEP-Bureau of Waste Cleanup
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 2600 Blair Stone Road
 Tallahassee, Florida 32399-2400

FACILITY DESCRIPTION

NASA established KSC as the primary launch site for the space program, and associated operations have involved the use of toxic and hazardous materials. Under RCRA Permit No. 26028/HO/001 issued by the FDEP on September 30, 2002, KSC was required to investigate the nature and extent of contamination at Solid Waste Management Unit (SWMU) 084, KARS Park I, and to develop and implement corrective measures to address contaminated media that may adversely impact human health and the environment at the SWMU.

SITE DESCRIPTION AND HISTORY

KARS Park I is a recreational facility for current and past NASA personnel that is located on Merritt Island, between the Indian and Banana Rivers, in Brevard County, Florida. Figure 1 shows that KARS Park I is located east of State Route 3 along the western shore of the Banana River and approximately 5 miles south of the KSC Industrial Area.

The KARS Park I site is fenced and encompasses approximately 135 acres as shown on Figure 2. Eleven LOCs were identified at KARS Park I. Improper use, storage, and disposal of materials used for maintenance of the park resulted in contaminated media at many of the LOCs. The remaining LOCs were used for shooting

ranges, which resulted in the deposition of lead shot and target debris through out the LOCs. Based on the results of the KARS Park I RFI (TtNUS, 2005), a CMS was recommended for LOCs 2, 7, 9, and 11. Investigations conducted subsequent to the RFI included the CMS Data Gap Investigation (LOCs 2, 7, and 9), Treatability Study (LOC 9B soil), and Pilot-Scale Study (LOC 9B soil). Several IMs were also conducted to address contaminated soil/sediment (source removal) before and after completion of the RFI and CMS. The following is a summary of the investigations, studies, and IMs conducted for KARS Park I:

- 2003: The results of the initial characterization efforts for the 11 LOCs at KARS Park I were documented in the Confirmatory Sampling Report. An IM was conducted for LOC 10 to address contaminated soil, and no further sampling was conducted at this LOC.
- 2005: Phase 1 IM was completed to address polynuclear aromatic hydrocarbon (PAH)-contaminated soil associated with fragmented skeet targets at LOCs 2 and 9, arsenic- and chromium-contaminated soil associated with the burn pit at LOC 7, and total recoverable petroleum hydrocarbon (TRPH)-contaminated soil at LOCs 2, 4, and 5. A total of 1,494 cubic yards (yd³) of contaminated soil from LOC 2 were excavated and properly disposed. At LOCs 4 and 5, 49 yd³ of TRPH-contaminated soil were excavated and disposed. A total of 538 yd³ of arsenic- and chromium contaminated soil were excavated from LOC 7 and disposed. At LOC 9A (Areas 1, 3, and 4), a total of

21,460 yd³ of PAH-contaminated soil were excavated and disposed.

- 2005: An RFI was conducted to determine the nature and extent of contamination in soil, groundwater, surface water, and sediment. Eleven phases of investigation were performed to complete the RFI. The results of the investigations were used to conduct human health risk assessments (HHRAs) and ecological risk assessments (ERAs) to determine the contaminated media that pose potential risks to human and ecological receptors. The RFI recommended NFA for soil at LOCs 1 through 8, groundwater at LOCs 1, 3, 4, 5, 6, 8 and 11, and surface water throughout KARS Park I. The HHRA identified 1,1'-biphenyl in LOC 2 groundwater, arsenic in LOC 7 groundwater, and lead in LOC 9 groundwater as the chemicals of concern (COCs) posing potentially unacceptable risks if the groundwater was used as a potable water source. The results of the HHRA and ERA showed that concentrations of benzo(a)pyrene equivalents (BaPEqs), antimony, arsenic, copper, lead, and zinc in soil at LOC 9B, lead in soil at LOC 11, and lead in sediment in the drainage channels pose potential unacceptable risks to human and ecological receptors. The RFI recommended that a CMS be conducted for groundwater at LOCs 2, 7, and 9 and soil/sediment at LOCs 9B and 11 to develop appropriate strategies to address the contaminated media.
- 2006: A Data Gap Investigation was conducted at LOCs 2, 7, and 9 to address

gaps in the RFI data set to facilitate development of the CMS. A Treatability Study was conducted to evaluate the ability of stabilization reagents to fixate lead in LOC 9B soil to render it nonhazardous. The Treatability Study recommended use of a phosphate-based additive (MAECTITE®) to treat the lead-contaminated soil. A Pilot-Scale Study was conducted to field test the treatment process. Approximately 2,600 yd³ of soil were successfully treated using the reagent to reduce Toxicity Characteristic Leaching Procedure (TCLP) lead concentrations to the Universal Treatment Standard for lead (0.75 mg/L). The treated soil and 2,000 yd³ of untreated contaminated soil were excavated and properly disposed off site during Pilot-Scale Study.

- 2007: A CMS was prepared to identify and evaluate potential technologies to efficiently and cost effectively mitigate unacceptable human health and environmental risks posed by contaminants in soil/sediment (LOCs 9 and 11) and groundwater (LOCs 2, 7, and 9) at KARS Park I.
- 2007: Phase 2 IM was completed to address a portion of soil/sediment at LOCs 9B and 11 contaminated with lead, BaPEqs, antimony, arsenic, copper, and zinc. The Phase 2 IM included treatment of 4,440 yd³ of lead-contaminated soil to the Universal Treatment Standard using MAECTITE®, excavation and disposal of 4,440 yd³ of treated soil, excavation and disposal of 15,594 yd³ of untreated contaminated soil, and restoration of all disturbed areas.

- 2008: Phase 3 IM was conducted to remediate the contaminated soil/sediment at LOCs 9B and 11 that was not addressed during the Phase 2 IM. A total of 8,312 yd³ of lead-contaminated soil were treated during the Phase 3 IM utilizing a MAECTITE®. Following treatment and verification sampling, the soil was properly disposed off site. In addition, approximately 17,085 yd³ of untreated contaminated soil were excavated and disposed off site. Because the Phase 3 IM required the disturbance of 1.88 acres of wetlands, this area was restored in accordance with the Mitigation Plan submitted as part of the Joint Application for Individual Environmental Resource Permit and approved by the St. Johns River Water Management District.

SUMMARY OF SITE RISK

As part of the RFI, HHRAs and ERAs were completed for LOC-specific media in accordance with KSC's Remediation Team Risk Assessment Decision Process Document (DPD). Several EPA documents were also used as guidance during preparation of the ERA. The screening-level ERA performed for the LOCs consisted of Steps 1 and 2 of EPA's 8-step ERA process. Following Step 2, quantitative and qualitative screening refinements were completed for chemicals that were identified in Step 2 as ecological chemicals of potential concern (COPCs).

The HHRAs and ERAs completed during the RFI for LOCs 9B and 11 indicated that soil and sediment posed potential unacceptable risks to residential and ecological receptors.

FDEP’s target risk levels (i.e., carcinogenic risks greater than 1×10^{-6} and non-carcinogenic risks greater than 1) were used to determine unacceptable human health risks. Hazard quotients (HQs), the ratio of chemical concentration to ecological screening value (ESV), were used to identify unacceptable ecological risks. The major contributors to the risks were BaPEqs, antimony, arsenic, copper, lead, and zinc. IMs were subsequently conducted, and all contaminated soil/sediment with COC concentrations greater than their FDEP Residential Soil Cleanup Target Levels (SCTLs) were remediated. Based on a prior agreement with FDEP, remediation to these concentrations was also deemed protective of ecological receptors. As a result of the IMs, the soil and sediment at LOCs 9B and 11 no longer pose unacceptable risks to human or ecological receptors.

Preliminary risk evaluations performed for groundwater during the RFI showed potential unacceptable risks to residential receptors for groundwater at LOCs 2, 7, and 9. 1,1'-Biphenyl was detected in LOC 2 groundwater at a concentration that exceeded the FDEP Groundwater Cleanup Target Level (GCTL) of 0.5 µg/L. The HHRA showed that when the maximum 1,1'-biphenyl concentration was compared to the health-based standard (350 µg/L), the resulting non-carcinogenic risk, expressed as a hazard index (HI) was 0.01, which is significantly less than the FDEP’s target HI of 1. However, based on further discussions with the FDEP and KSC Remediation Team, it was decided that 1,1'-biphenyl would be retained as a groundwater COC at LOC 2 because of the exceedance of the GCTL. The HHRA determined that the lifetime excess cancer risk and HI associated

with exposure to arsenic in LOC 7 groundwater were 9×10^{-3} and 97, respectively. Both the carcinogenic and non-carcinogenic risks exceed FDEP’s target levels; therefore, arsenic was retained as a COC for LOC 7 groundwater. Human health risk estimates were not calculated for lead in LOC 9 groundwater; lead was identified as a groundwater COC by comparing the maximum lead concentration to FDEP’s GCTL (15 µg/L).

WHAT ARE THE REMEDY OBJECTIVES AND LEVELS?

The corrective action objectives for groundwater are to prevent exposure of human receptors to contaminated groundwater with concentrations of COCs greater than their FDEP GCTLs, to minimize migration of groundwater COCs that could adversely impact off-site receptors and surface water, and to restore contaminated groundwater quality to FDEP GCTLs and/or KSC background concentrations. Table 1 lists the COCs present in groundwater at LOCs 2, 7, and 9. The ranges of detections and cleanup levels for the COCs are also summarized in Table 1.

Table 1

Site-Related Groundwater COC	Range of Concentrations ⁽¹⁾ (µg/L)	Groundwater Cleanup Level (µg/L)
1,1'-Biphenyl	0.73 - 1.3	0.5 ⁽²⁾
Arsenic	2.8 U - 218	30 ⁽³⁾
Lead	1.7 U - 32.5	15 ⁽²⁾

µg/L = Micrograms per liter.

¹ KARS Park I CMS Report (NASA, 2007).

² FDEP GCTL, Chapter 62-777, Florida Administrative Code (F.A.C.) (FDEP, 2005).

³ Kennedy Space Center background value, which equals two times the mean sampled background concentration.

REMEDIAL ALTERNATIVES FOR KARS PARK I

Corrective measures alternatives are different combinations of plans or technologies that can be used to address the potential risks posed to human health and the environment by exposure to contaminated media. The following alternatives were considered for groundwater at LOCs 2, 7, and 9 at KARS Park I:

LOC 2

- NFA with Controls – RMO Level IID
- Monitored Natural Attenuation and Controls

LOC 7

- NFA with Controls – RMO Level IID
- Monitored Natural Attenuation and Controls
- In-Situ Treatment (Chemical Oxidation and Precipitation), Monitoring, and Controls
- Extraction, Ex-Situ Treatment (Oxidative Filtration), Surface Water Discharge, Monitoring, and Controls

LOC 9

- NFA with Controls – RMO Level IIIA
- Monitored Natural Attenuation and Controls
- In-Situ Treatment (Chemical Precipitation), Monitoring, and Controls

Detailed information for each alternative was presented in the CMS. For each LOC, the alternatives were screened and a comparative

analysis was performed to determine the alternative that best meets the corrective action objectives.

EVALUATION OF REMEDIES

The corrective measures alternatives were evaluated to determine if they will comply with EPA's four threshold criteria and five balancing criteria for corrective measures. The following are the four threshold criteria considered for the corrective measures:

- Overall protection of human health and the environment
- Attainment of media cleanup standards
- Control of the sources of releases
- Compliance with standards for management of wastes

The following are the five balancing criteria considered for the corrective measures:

- Long-term reliability and effectiveness
- Short-term effectiveness
- Reduction in the toxicity, mobility, and volume of wastes
- Implementability
- Cost

Based on the detailed evaluation performed for the CMS Report, NFA with Controls under FDEP RMO Levels IID for LOCs 2 and 7 and IIIA for LOC 9 meets each of the threshold criteria and was determined by the KSC Remediation Team to be the best overall approach for groundwater at LOCs 2, 7, and 9 considering the balancing criteria.

PROPOSED REMEDY

The final corrective measure for KARS Park I soil/sediment is NFA. All soil and sediment identified as posing potential risks to human health or the environment were addressed through IMs.

The proposed corrective action for groundwater KARS Park I LOCs 2, 7, and 9 includes the following:

- LOC 2 groundwater – NFA with Controls under FDEP RMO Level II. Quarterly monitoring will be performed for 1 year at one existing well for 1,1'-biphenyl (see Figure 3). A LUCIP for groundwater will be prepared and implemented, and yearly inspections/reviews will be performed to confirm continued implementation of controls. A site review will be completed at the end of the first year of monitoring to confirm that the site meets NFA RMO Level IID conditions.
- LOC 7 groundwater – NFA with Controls under FDEP RMO Level II. Semi-annual monitoring will be performed for 2 years at four wells for arsenic (see Figure 4). A LUCIP for groundwater will be prepared and implemented, and yearly inspections/reviews will be performed to confirm continued implementation of controls. A site review will be completed at the end

of the second year of monitoring to confirm that the site meets NFA RMO Level IID conditions.

- LOC 9 groundwater – NFA with Controls under FDEP RMO Level III (see Figure 5). Annual monitoring will be performed for 4 years at 10 wells for lead. A LUCIP for groundwater will be prepared and implemented, and yearly inspections/reviews will be performed to confirm continued implementation of controls. A site review will be completed at the end of the fourth year of monitoring to confirm that the site meets NFA RMO Level IIIA conditions.

Institutional controls will be implemented to limit the use of groundwater as a drinking water source for LOCs 2, 7, and 9 to avoid exposure of hypothetical future residents to contaminated groundwater. NASA, EPA, and FDEP have entered into a Memorandum of Agreement (MOA) that outlines how institutional controls will be managed at NASA⁽²⁾. The MOA requires periodic inspections, condition certification, and agency notification. The areas of LOCs 2, 7, and 9 that would have institutional controls under the proposed corrective action are shown on Figures 3, 4, and 5, respectively.

² By separate Memorandum of Agreement (MOA) effective February 23, 2001, with the EPA and FDEP, KSC, on behalf of NASA, agreed to implement Center-wide certain periodic site inspections, condition certification, and agency notification procedures designed to ensure the maintenance by Center personnel of any site-specific LUCs deemed necessary for future protection of human health and the environment. A fundamental premise underlying execution of that agreement was that through the Center's substantial good-faith compliance with the procedures called for herein, reasonable assurances would be provided to EPA and FDEP as to the permanency of those remedies that included the use of specific LUCs.

Although the terms and conditions of the MOA are not specifically incorporated or made enforceable herein by reference, it is understood and agreed by NASA KSC, EPA, and FDEP that the contemplated permanence of the remedy reflected herein shall be dependent upon the Center's substantial good-faith compliance with the specific LUC maintenance commitments reflected herein. Should such compliance not occur or should the MOA be terminated, it is understood that the protectiveness of the remedy concurred in may be reconsidered and that additional measures may need to be taken to adequately ensure necessary future protection of human health and the environment.

WHAT IMPACTS WOULD THE REMEDY HAVE ON THE LOCAL COMMUNITY?

There would be no impacts to the local community because groundwater is not used for drinking or other potable purposes at KARS Park I. The alternatives proposed include administrative actions to limit the use of groundwater until the cleanup levels have been reached. Groundwater monitoring would be used to confirm that the contaminant plumes are stable and that no contaminant concentrations greater than GCTLs are migrating beyond the boundaries of the LOCs. Institutional controls would also prevent exposure to contaminants prior to cleanup levels being achieved by prohibiting use of groundwater for drinking or other purposes.

WHY DOES THE KSC REMEDIATION TEAM RECOMMEND THIS REMEDY?

The KSC Remediation Team recommends the proposed corrective actions because they are cost-effective means to remediate/control the contaminated groundwater in a reasonable amount of time. The institutional controls will prevent exposure to contaminants prior to the cleanup levels being achieved. The proposed actions meet the four threshold criteria for corrective measures, and after considering the five balancing criteria, were determined to be the best overall approaches to remediate the groundwater at LOCs 2, 7, and 9.

NEXT STEPS

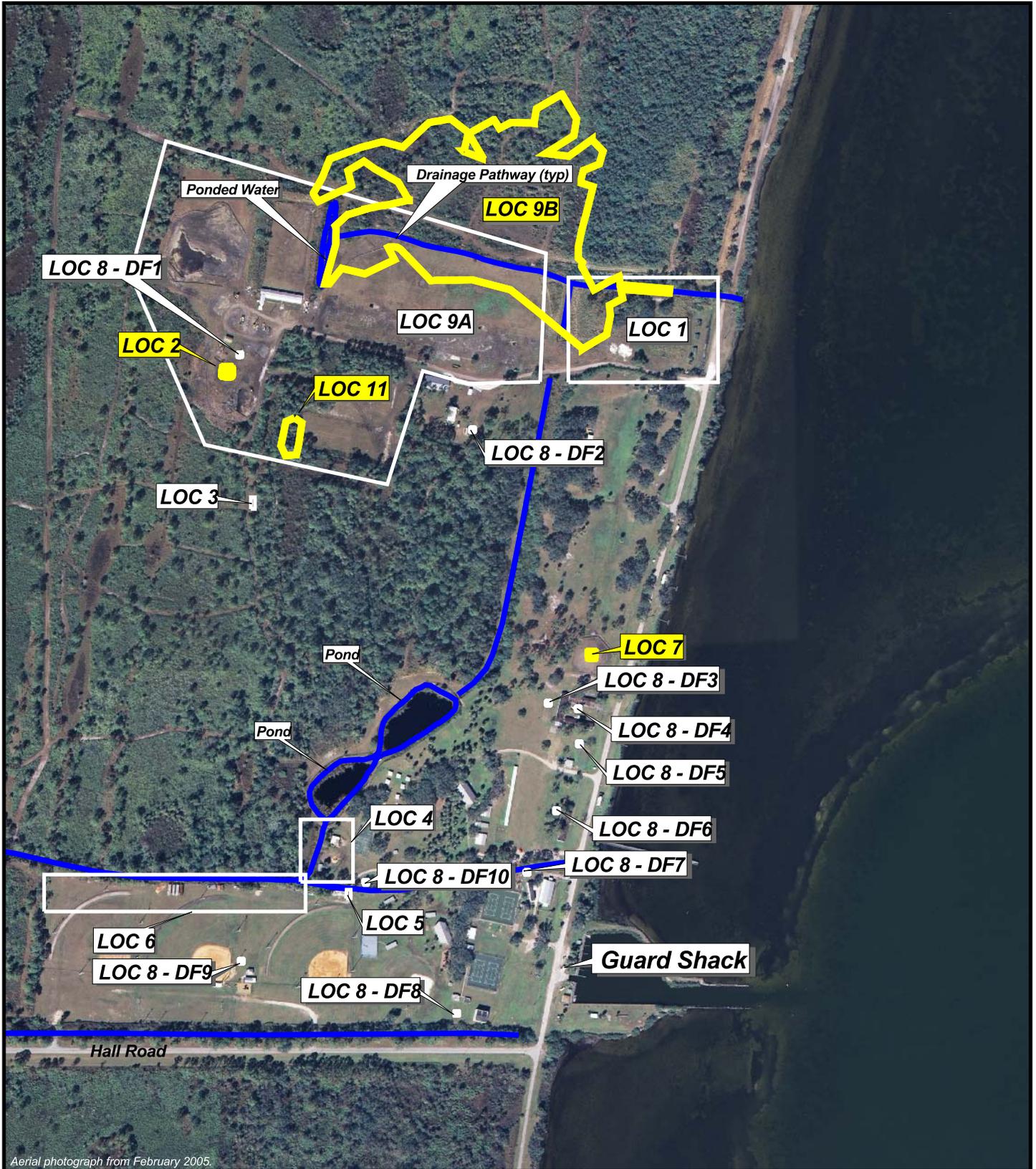
The KSC Remediation Team will review all comments on this SB to determine if the proposed corrective action needs modification prior to implementation and prior to incorporating the proposed corrective action into KSC's RCRA permit. If the proposed corrective action is determined to be appropriate for implementation, then corrective measures will be implemented, including groundwater monitoring and development of a LUCIP to implement the institutional controls at this site.

FIGURE 1 FACILITY LOCATION MAP
KARS PARK I, KENNEDY SPACE CENTER, FLORIDA



Aerial photograph from February 2005.

FIGURE 2 LOCATIONS OF CONCERN MAP
 KARS PARK I, KENNEDY SPACE CENTER, FLORIDA



Legend: — CMS Locations of Concern (LOC), RFI No Further Action LOCs shown in white
 — Drainage Pathways or Surface Water Bodies



500 0 500 Feet

FIGURE 3 LOC 2 SITE MAP
KARS PARK I, KENNEDY SPACE CENTER, FLORIDA



Aerial photograph from February 2005.

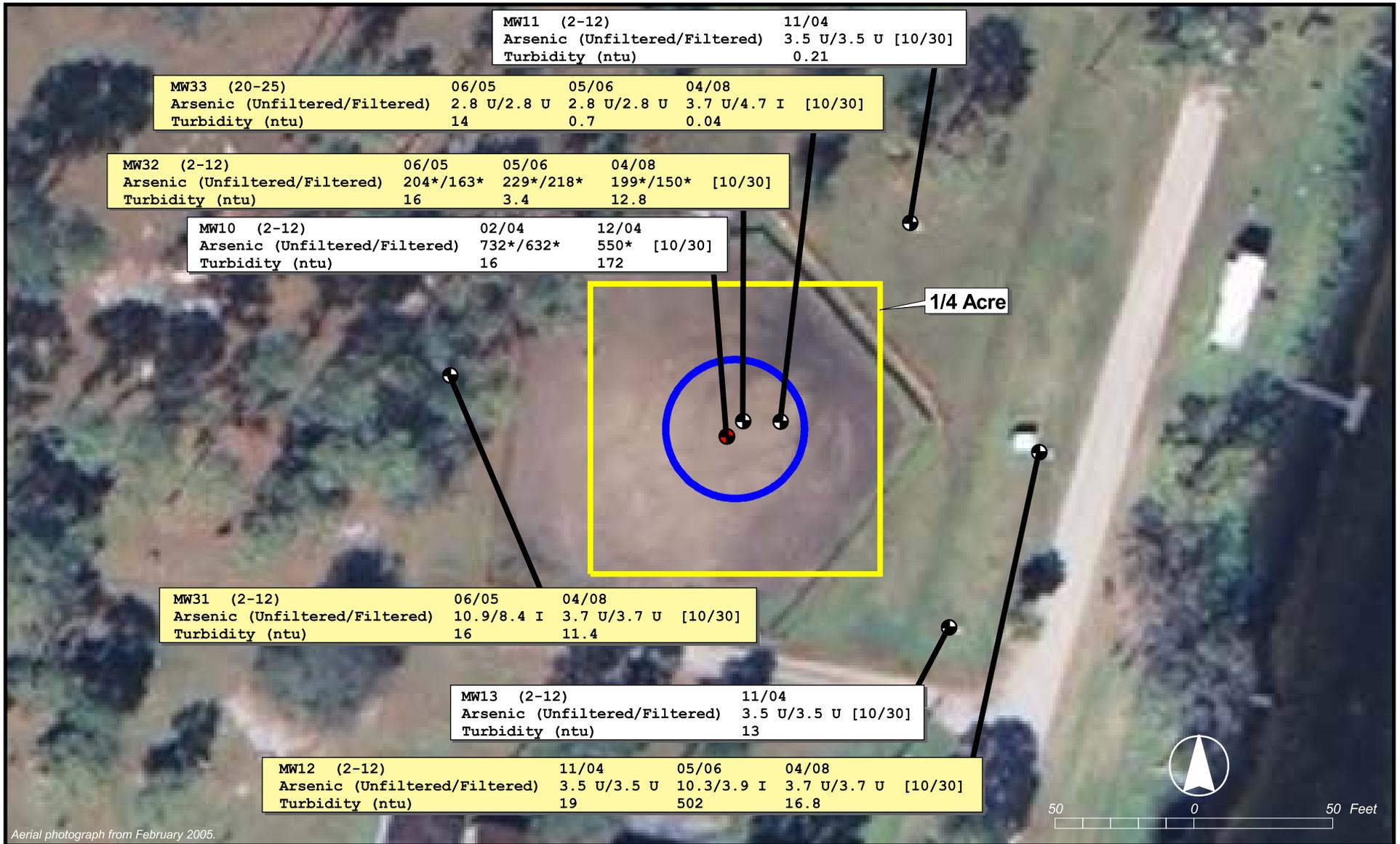
Legend:

- Monitoring Well (Shaded tag indicates well included in long-term monitoring plan)
- 1,1-Biphenyl Plume (GCTL 0.5 ug/L)
- Area covered by Statement of Basis and groundwater use control areas

Sample ID	Screen Interval in feet bgs	Sample Date	GCTL	Detected concentration (ug/L)
MW07 (2-12)		02/04		
1-Methlynaphthlene		23.4	[28]	

*** indicates above GCTLs
Contaminant

FIGURE 4 LOC 7 SITE MAP
KARS PARK I, KENNEDY SPACE CENTER, FLORIDA

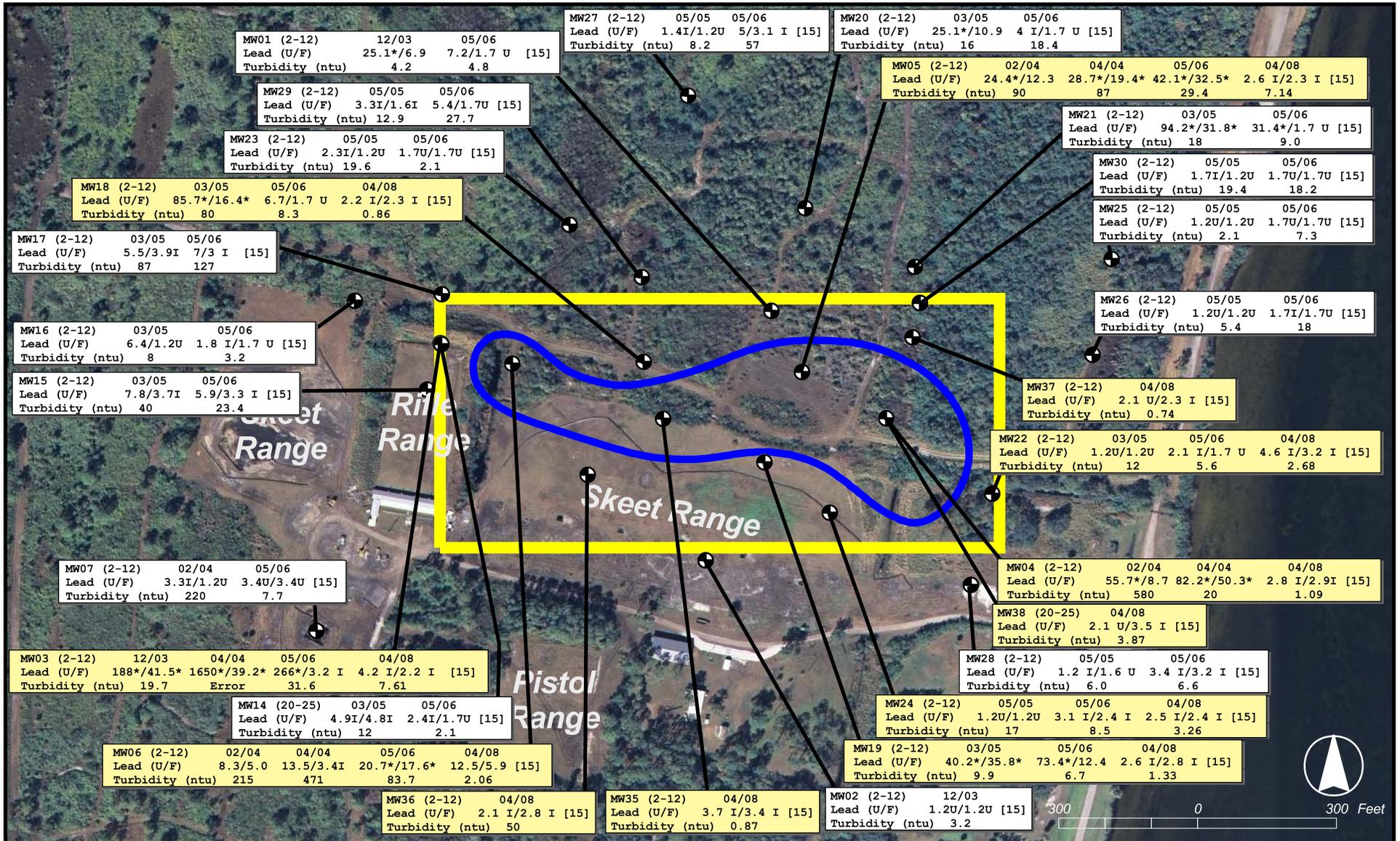


Legend: ● Monitoring Well (Shaded tag indicates well included in long-term monitoring plan, red symbol indicates well has been abandoned)
 ■ Arsenic Plume (Background 30 ug/L)
 ■ Area covered by Statement of Basis and groundwater use control areas

Sample ID
 Screen Interval in feet bgs
 Sample Date
 GCTL/Background
 Detected concentration (ug/L),
 *** indicates above Background
 Contaminant

MW31 (2-12) 06/05
 Arsenic (Unfiltered/Filtered) 10.9/8.4 I [10/30]
 Turbidity 16

FIGURE 5 LOC 9 SITE MAP
KARS PARK I, KENNEDY SPACE CENTER, FLORIDA



Legend: ● Monitoring Well (Shaded tag indicates well included in long-term monitoring plan)
 — Dissolved Lead Plume based on May 2006 results (GCTL 15 ug/L)
 — Area covered by Statement of Basis and groundwater use control areas

Sample ID
 Screen Interval in feet bgs
 Sample Date
 GCTL/Background
 Detected concentration (ug/L),
 "*" indicates above Background
 Contaminant