

**2018 Inspection and Annual
Site Status Report for the
Site A/Plot M, Illinois,
Decommissioned Reactor Site**

August 2018



U.S. DEPARTMENT OF
ENERGY

Legacy
Management

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Appendix

Appendix A Site Drawing

Abbreviations

^3H	tritium
^{90}Sr	strontium-90
ANL	Argonne National Laboratory
DOE	U.S. Department of Energy
GEMS	Geospatial Environmental Mapping System
IEMA	Illinois Emergency Management Agency
LM	Office of Legacy Management
LTSP	Long-Term Surveillance Plan
pCi/L	picocuries per liter
PL	photograph location

Executive Summary

The Site A/Plot M, Illinois, Decommissioned Reactor Site was inspected on May 1, 2018. The site, located in a Cook County forest preserve that is open to the public, was found to be in good condition. Erosion on top of the grass-covered mound at Plot M (resulting from pedestrian and bicycle traffic across the mound) continues to be a concern and is being managed appropriately by Argonne National Laboratory (ANL). This traffic over Plot M appears to be less this year now that new trails are open around Plot M. Landscaping timbers installed along the footpath north of Plot M appear to be effective in helping to baffle precipitation runoff down the trail. Cracks are present in the Site A monument marker stone. The cracks will widen over time and eventually split and permanently damage the historic marker. No cause for a follow-up inspection was identified.

The 17 groundwater monitoring wells at the site were secure and in good condition. Preliminary environmental monitoring results for 2017 are provided in a draft report titled *Surveillance of Site A and Plot M, Report for 2017*, prepared by ANL. The report also contains results of an independent analysis conducted by the Illinois Emergency Management Agency on some of the samples collected by ANL in 2017. Those results indicate the radioactivity remaining at Site A/Plot M does not pose a risk to the health or safety of the public visiting the site, using the picnic areas, or living in the vicinity. However, tritium activities in monitoring well BH6 continue to rise. ANL continues to monitor the situation.

A new Cook County forest preserve campsite opened in 2015 at Bull Frog Lake, which is east of Plot M. Hiking and biking trails connect the Bull Frog Lake area with the Site A/Plot M area. There were no indications that the increased traffic to Site A/Plot M by forest preserve visitors in 2017 was impacting the integrity of the sites.

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1.0 Introduction

This report presents the findings of the 2018 annual inspection of the Site A/Plot M, Illinois, Decommissioned Reactor Site at the Palos Forest Preserve in Cook County, Illinois, and summarizes preliminary environmental monitoring results reported by the Argonne National Laboratory (ANL) for 2017. Features and photograph locations (PLs) discussed in this report are shown in Appendix A.

Navarro Research and Engineering, Inc. (Navarro), the U.S. Department of Energy (DOE) Legacy Management Support contractor, conducted the site inspection on May 1, 2018. This DOE Office of Legacy Management (LM) site, located in a Cook County forest preserve that is open to the public, was found to be in good condition. The following points describe the site.

1. Site A is approximately 19 acres in size. It contains two buried nuclear reactor shells and buried debris from the various support buildings associated with the reactors and other laboratory operations at Site A. Operations at Site A commenced in 1943, and decommissioning was complete by 1956. The only structures visible are the stone monument marking the site, occasional concrete flatwork and fence post collars, a section of the original chain-link fence, and monitoring wells. The site surface, which had been cleared and used as a golf course before World War II, is returning to hardwood forest. Groundwater in the glacial drift beneath Site A was monitored one time in 2017 for tritium (also called hydrogen-3) (^3H) and strontium-90 (^{90}Sr) at monitoring wells BH55 and BH56.
2. Plot M is less than 1 acre in size and contains a series of trenches that were used to bury radioactive wastes. A granite monument and six corner markers are on the site, which consists of a mounded earth cover, planted in grass, over an inverted concrete box. The concrete box was constructed in 1956 to reduce infiltration and lateral movement of soluble contaminants. Groundwater in the glacial drift beneath Plot M was monitored quarterly in 2017 for ^3H and one time for ^{90}Sr at nine monitoring wells (BH2, BH3, BH4, BH6, BH9, BH10, BH11, BH26, and BH35). Groundwater in the dolomite bedrock wells north of Plot M was monitored once in 2017 for ^3H at six monitoring wells (DH3, DH4, DH11, DH12, DH14, and DH15). Tritium contamination in groundwater beneath Plot M is thought to result from a single period of release before the concrete containment box was installed.
3. LM contracts directly with ANL for all environmental sampling, analysis, and reporting. Environmental monitoring reports are issued annually by ANL.
4. In 2003 and 2004, LM contractor staff worked with representatives of the DOE Chicago Operations Office, ANL, and Illinois Emergency Management Agency (IEMA) to evaluate groundwater and surface water conditions and the current monitoring program. The evaluation demonstrated that contaminant levels were diminishing and the lateral and vertical extent of contamination had not increased. The monitoring program was revised, as described in the *Environmental Monitoring Program at Site A and Plot M, Palos Forest Preserve, Cook County, Illinois* (GJO-2004-558-TAC, February 2004).

5. In 2005, LM incorporated monitoring data from the ANL database into its Geospatial Environmental Mapping System (GEMS) database. The GEMS database monitoring data for the site can be accessed at the LM public website at <https://www.lm.doe.gov/land/sites/il/sitea/sitea.htm>.
6. In 2011, LM performed a review of groundwater monitoring results. The report concluded that:
 - Quarterly monitoring for ^3H should continue at all nine glacial drift monitoring wells and all surface water locations at Plot M.
 - The Long-Term Surveillance Plan (LTSP) objective could be met with all other monitoring being performed on an annual schedule.
7. In 2014, a supplemental assessment was made of the groundwater and surface water monitoring activities at Site A/Plot M. The supplemental assessment identified eight groundwater monitoring wells that could be plugged and abandoned without jeopardizing LTSP objectives.

In 2015, the monitoring schedule proposed in the 2011 groundwater review was implemented, and the eight groundwater monitoring wells identified in the 2014 supplemental assessment (BH41, BH51, BH52, BH54, DH9, DH10, DH13, and DH17) were plugged and abandoned.

2.0 Inspection Results

Navarro conducted the site inspection. The LM site manager, four employees from ANL, and three employees from IEMA accompanied the inspection.

IEMA does not have regulatory authority over DOE at Site A/Plot M, but IEMA personnel are informed of and consulted with on long-term surveillance and maintenance activities that DOE conducts at the site.

The inspection was conducted in accordance with the *Long-Term Surveillance and Maintenance Plan, Site A and Plot M, Palos Forest Preserve, Cook County, Illinois* (LMS/SAM/S01063, January 2015). The purposes of the inspection were to look for evidence that the integrity of the disposal site is not threatened, evaluate the condition of the monuments, determine whether maintenance is needed, and examine the condition of the DOE monitoring wells.

Inspectors met at the Red Gate Woods parking area and reviewed the Plan of the Day and Job Safety Analysis. Inspectors noted that the drinking water wells at the Red Gate Woods picnic area still have no pump handles (PL-1). The handles were removed from the pumps years ago to prevent the use of the wells because of fecal coliform in the water. The fecal coliform originated from a nearby permanent restroom facility, which was removed.

2.1 Site A

Inspectors were able to drive to Site A during this year's inspection. Site A was found to be in good condition. Stress cracks in the historic Site A monument appear to be getting larger over time (PL-2 and PL-3). It is anticipated that these cracks will continue to widen and eventually split and permanently damage the historic marker.

Two monitoring wells remain at Site A: BH55 (PL-4) and BH56 (PL-5). Both monitoring wells were secured with locks and identified with a well number on the outer casing. ANL personnel visited the wells once in 2017 for sampling to ensure well security and perform any required maintenance.

Vegetation growth along the lower portion of the access road to Site A (near the Archer Avenue turnoff) is an ongoing challenge, but ANL is doing a good job of working with the Palos Forest Preserve District to maintain control of the encroaching vegetation. It is recommended that ANL continue to work with the forest preserve district to keep the road clear of vegetation.

2.2 Plot M

The Plot M historic site marker was unchanged from last year's inspection. It was in good condition, with the exception of some minor vandalism that occurred several years ago (i.e., some words on the marker are chiseled off) (PL-6). All Plot M corner markers were located and found to be in good condition.

A new Cook County forest preserve campsite opened in 2015 at Bull Frog Lake, which is east of Plot M. Hiking and biking trails connect the Bull Frog Lake area with the Site A/Plot M area. Erosion on top of the grass-covered mound at Plot M continues to be a concern. The erosion is caused by pedestrian and bicycle traffic, but this traffic over Plot M appears to be less this year now that new trails are open around Plot M. ANL conducts annual maintenance reviews of the grass-covered mound and periodically adds topsoil to erosion ruts as needed to keep them from expanding. No additional repairs are needed at this time. A footpath on the north side of the mound was affected by water runoff and erosion. Landscaping timbers installed along the path appear to be effective in baffling surface water flow from precipitation down the path (PL-7 and PL-8).

All groundwater monitoring wells at Plot M and north of Plot M were found to be secured with locks and identified with a well number on the outer casing. ANL personnel are keeping the wells secure.

3.0 Monitoring Results

ANL collects water samples in accordance with the *Environmental Monitoring Program at Site A and Plot M, Palos Forest Preserve, Cook County, Illinois*. All samples are analyzed for ^3H . Samples from monitoring locations near historical occurrences of ^{90}Sr are analyzed for that radionuclide. Preliminary monitoring results for 2017 are compiled in the *Surveillance of Site A and Plot M, Report for 2017*, which will be available on the LM public website once it has been issued as final. Preliminary monitoring results for 2017 are summarized below.

3.1 Surface Water

Surface water is sampled quarterly at four locations near Plot M: locations 0001, 0006, 0007, and 0008. All four locations were reported dry in the first, third, and fourth quarters of 2017, and location 0006 was reported dry for the entire year. Samples were collected from locations 0001, 0007, and 0008 during the second quarter.

As shown in Detail A in the map in Appendix A, three of the sampling locations (0001, 0006, and 0007) sample an intermittent stream that runs along the east side of Plot M. Location 0008 monitors a separate intermittent stream that flows from the northwest corner of plot M. The two streams join north of Plot M.

For the intermittent stream that runs along the east side of Plot M, sample location 0001 is upgradient of Plot M, and sample locations 0006 and 0007 are downgradient of Plot M. In 2017, ³H activities did not exceed the State of Illinois drinking water standard of 20,000 picocuries per liter (pCi/L) at any sampled location in this intermittent stream (Figure 1). The highest ³H activity measured in 2017 in this intermittent stream was 5500 pCi/L at location 0007.

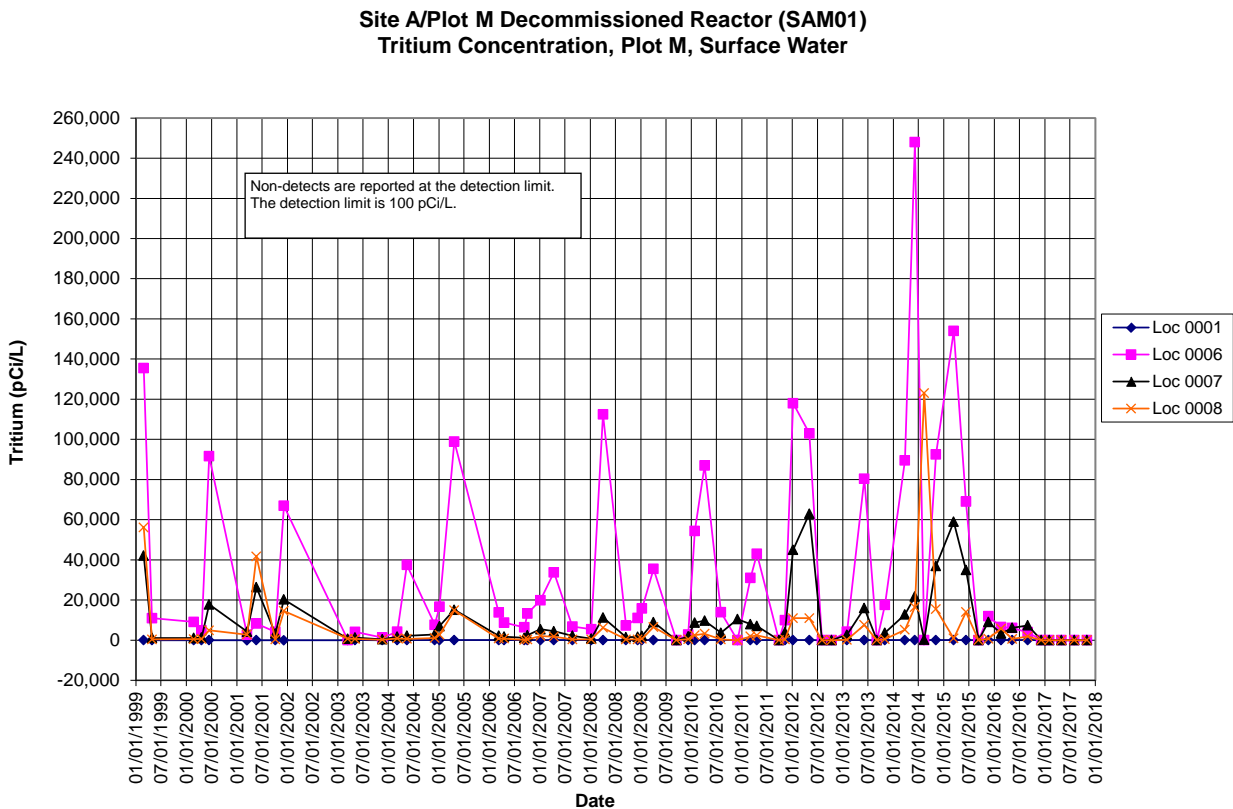


Figure 1. Tritium Activities in Surface Water at Plot M, Cook County, Illinois

The tritium concentration measure in 2017 in the intermittent stream flowing from the northwest corner of Plot M (at location 0008) was 800 pCi/L.

Historically, sampling location 0006 was identified by ANL as a seep. In 2017, ANL reclassified this location as a surface water location. No flow was observed at this sampling location in 2017.

Annual surface water samples collected from five area ponds in 2017 (NW pond, SE pond, Bull Frog Lake, Horse Collar Slough, and Tomahawk Slough) were all less than the ^3H detection limit of 100 pCi/L.

3.2 Groundwater—Glacial Drift

In 2017, ^3H was detected in the groundwater at Site A at both monitoring well locations that are completed in the glacial drift. No measured activities exceeded the standard of 20,000 pCi/L. Activities ranged from 930 to 1170 pCi/L (Figure 2).

In 2017, ^{90}Sr was detected in the groundwater at Site A at both monitoring well locations completed in the glacial drift. Activities ranged from 0.68 to 1.2 pCi/L, but none exceeded the State of Illinois standard of 8 pCi/L (Figure 3).

In 2017, ^3H was detected in the groundwater beneath Plot M in eight of the nine monitoring wells completed in the glacial drift. Monitoring Well BH9 was dry in 2017. Tritium activities ranged from 700 to 1,040,000 pCi/L (Figure 4).

As reported in the draft version of the *Surveillance of Site A and Plot M, Report for 2017*, the highest ^3H activity reported for monitoring well BH35 in 2017 was 707,000 pCi/L. This activity is within the historical range for the well. The historical maximum tritium activity (1,360,000 pCi/L) was measured in 2000; activities decreased to a low of approximately 61,250 pCi/L in 2003. Since 2003, activities have been increasing again and are now approximately one-half of their historical range. During the 2016 inspection, ANL personnel reported that the 2-inch diameter casing in monitoring well BH35 was cracked near the surface of the well. DOE requested that ANL plan to install a replacement well for BH35 in the next year or so to see if the damaged casing might be the cause for the increasing concentrations. Further analysis of the situation resulted in a decision not to replace this well.

According to ANL, besides the near-surface crack in the 2-inch casing noted during the 2016 inspection, the original 2-inch diameter PVC casing in well BH35 was bent, making the well hard to sample. Around 2001, a 1-inch diameter PVC well was installed inside the original 2-inch diameter well. Samples since then have been collected from the 1-inch diameter well. Given that monitoring results from the 1-inch diameter well are within the historical background range of concentrations previously measured at the 2-inch well, it does not appear that the surface crack in the 2-inch casing is impacting sampling results from the 1-inch well. It has therefore been decided to table the idea for a replacement well. A replacement well will be considered again if concentrations measured in the 1-inch diameter well ever exceed the historical range of the 2-inch well.

**Site A/Plot M Decommissioned Reactor (SAM01)
Tritium Concentration, Site A, Glacial Drift**

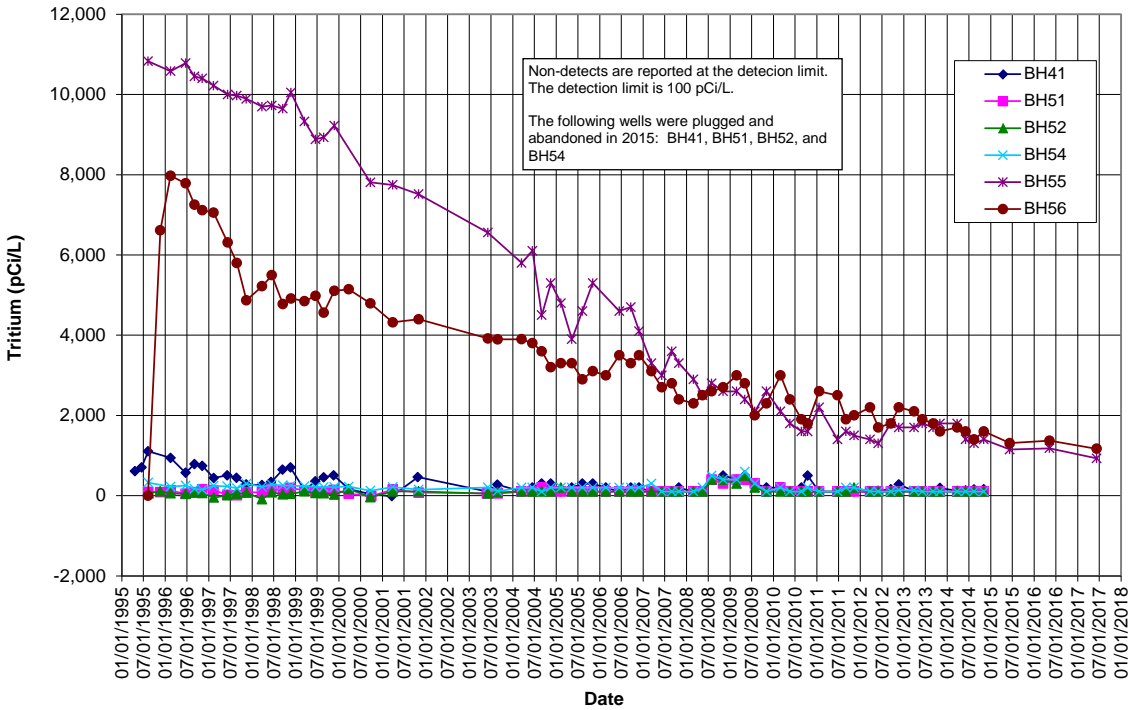


Figure 2. Tritium Activities in Groundwater in the Glacial Drift at Site A, Cook County, Illinois

**Site A/Plot M Decommissioned Reactor (SAM01)
Strontium-90 Concentration, Site A, Glacial Drift**

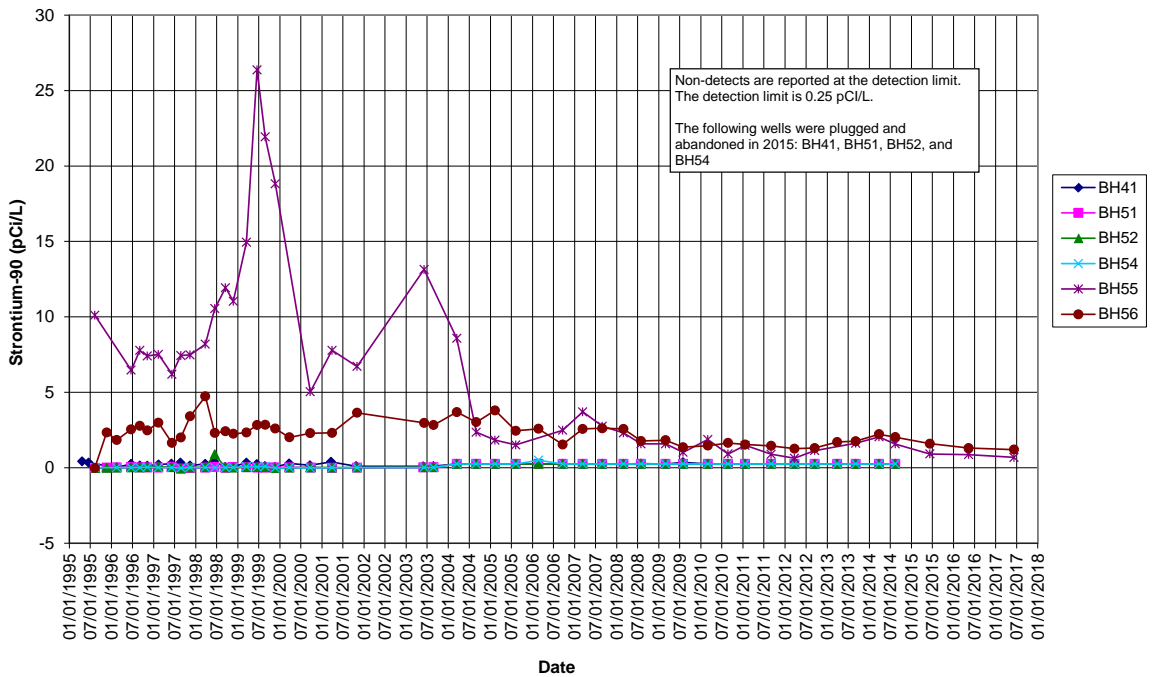


Figure 3. Strontium-90 Activities in Groundwater in the Glacial Drift at Site A, Cook County, Illinois

**Site A/Plot M Decommissioned Reactor (SAM01)
Tritium Concentration, Plot M, Glacial Drift**

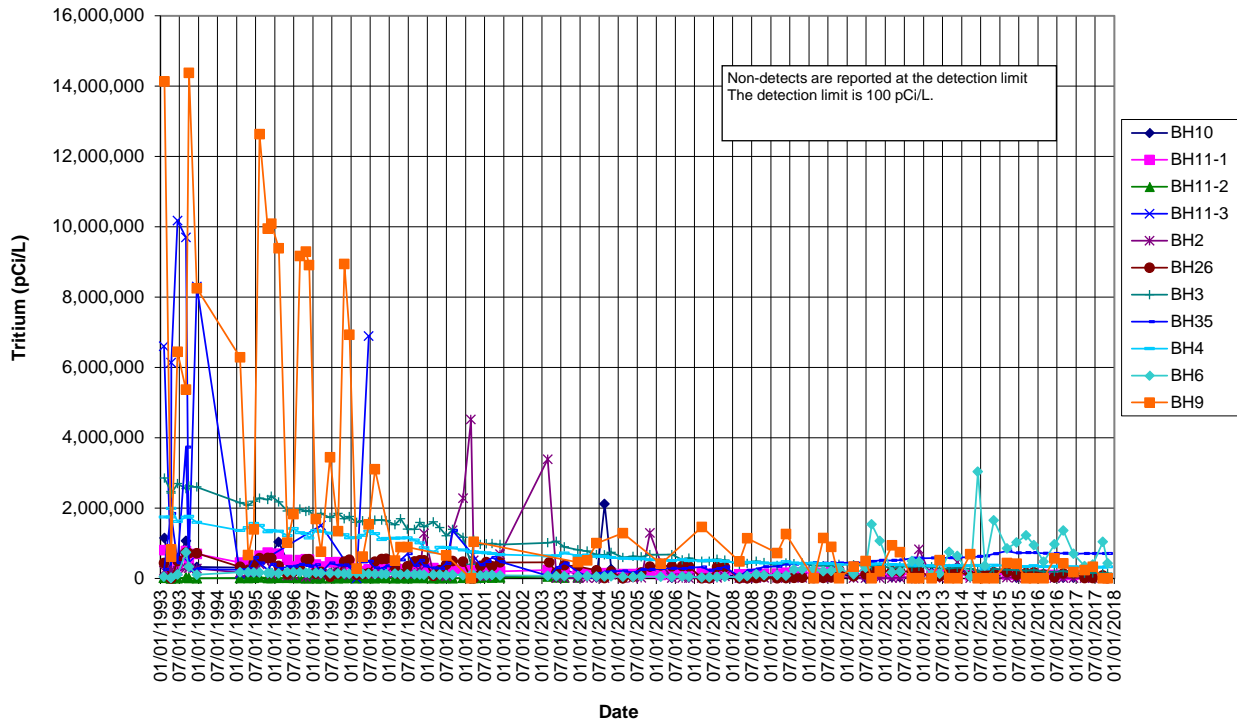


Figure 4. Tritium Activities in Groundwater in the Glacial Drift at Plot M, Cook County, Illinois

As reported in the draft version of the *Surveillance of Site A and Plot M, Report for 2017*, ^3H activities and water levels in monitoring well BH6 began to increase and fluctuate erratically in 2009 (Figure 5). The increase and erratic fluctuation of ^3H activities after 2009 are being attributed to changing groundwater elevations. The situation will continue to be monitored. If ^3H concentrations continue to increase, DOE has requested that ANL investigate further.

In 2017, ^{90}Sr was detected in the groundwater at Plot M at four of the nine groundwater monitoring wells. Monitoring well BH35 could not be sampled in 2017 due to low water volume in the well at the time of sampling. Activities ranged from nondetect (less than 0.25 pCi/L) to 2.80 pCi/L, but none exceeded the State of Illinois standard of 8 pCi/L.

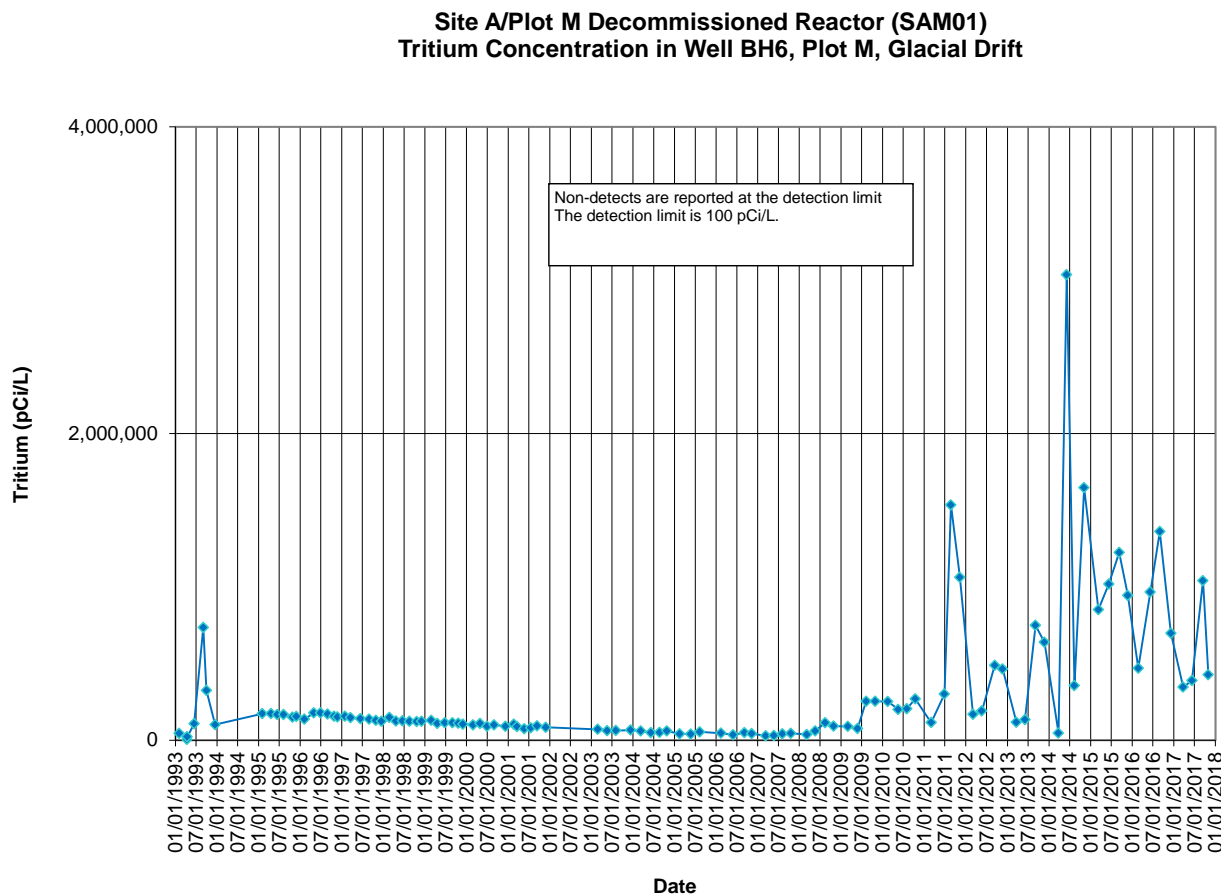


Figure 5. Tritium Activities in Groundwater in Well BH6 in the Glacial Drift at Plot M, Cook County, Illinois

3.3 Groundwater—Dolomite Bedrock

In 2017, ^3H was detected in the groundwater at the Red Gate Woods picnic area wells. Tritium activities for the two picnic area wells in 2017 ranged from 700 to 1290 pCi/L (Figure 6). No activities measured in 2017 exceeded the State of Illinois standard of 20,000 pCi/L.

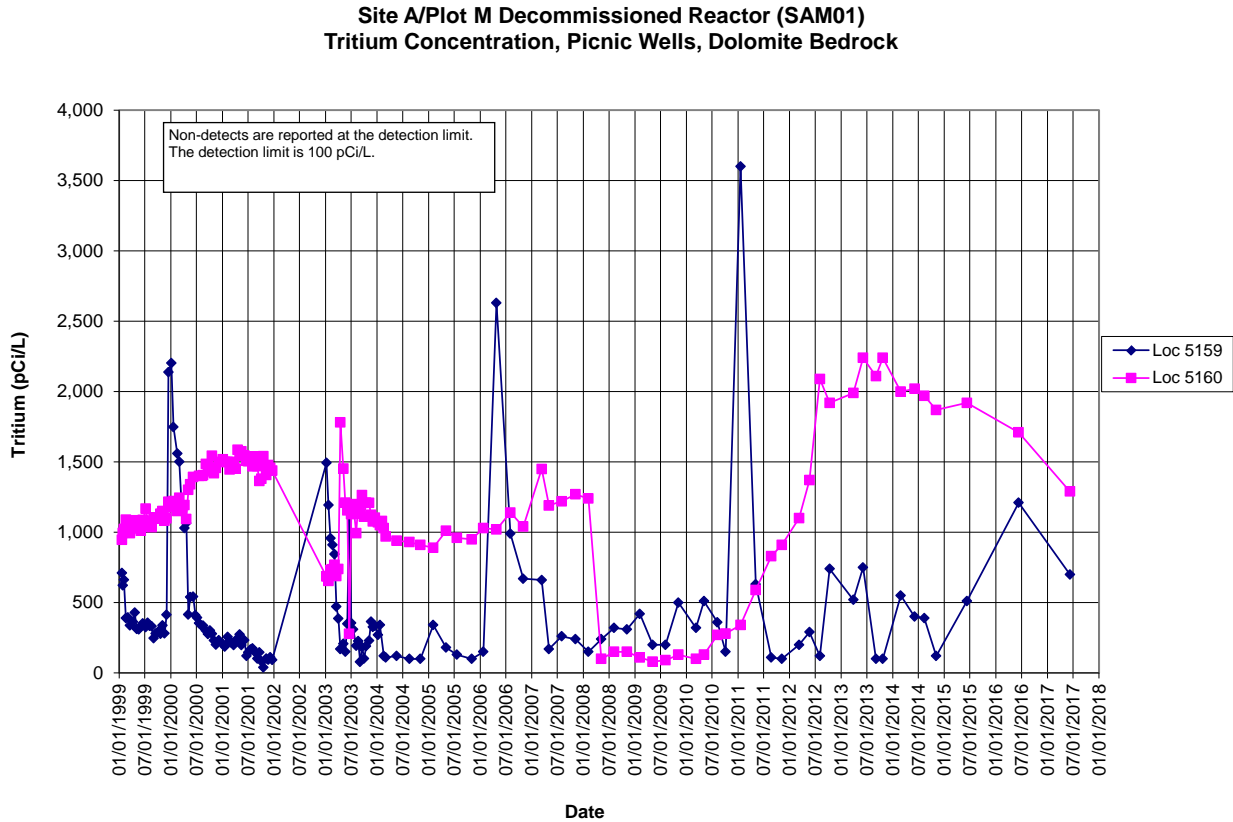


Figure 6. Tritium Activities in Groundwater in the Picnic Area Wells, Site A/Plot M, Cook County, Illinois

In 2017, ^3H was detected in the groundwater at all six monitoring wells completed in the dolomite bedrock north of Plot M. Activities ranged from 540 to 2510 pCi/L (Figure 7). Tritium is no longer sampled for in the dolomite bedrock beneath Site A. Monitoring stopped in 2004 after approximately 30 years of sampling failed to detect this isotope.

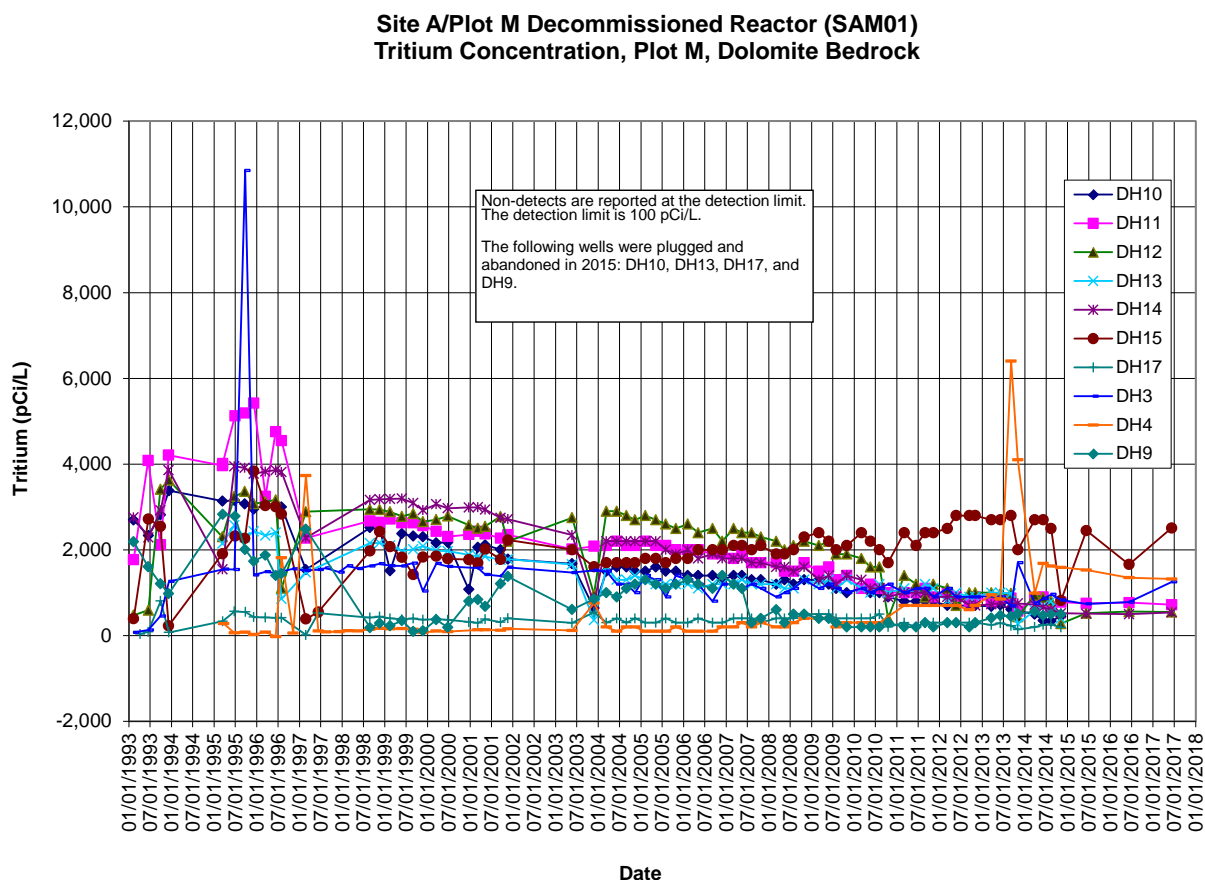


Figure 7. Tritium Activities in Groundwater in the Dolomite Bedrock, Site A/Plot M, Cook County, Illinois

3.4 Risk Assessment

As reported by ANL, all exposure pathways to contaminated groundwater are incomplete (handles have been removed from the picnic wells because of fecal coliform contamination, and the groundwater beneath Site A/Plot M is not used for any purpose). The seep and stream flow in the spring does not pose a risk to human health or the environment because of low volume and intermittent flow (see the risk assessment summary in *Evaluation and Recommendation for Environmental Monitoring at Site A and Plot M, Palos Forest Preserve, Cook County, Illinois*, United States Department of Energy (DOE), GJO-2003-462-TAC, August 2003).

3.5 IEMA Independent Analysis of ANL Water Samples

In 2017, IEMA performed an independent analysis of water samples collected at the Palos Forest Preserve. Results can be found in *Surveillance of Site A and Plot M, Report for 2017*, which will be made available to the public on the LM website once it is finalized.

4.0 Actions

1. Vegetation growth along the lower portion of the access road to Site A (near the Archer Avenue turnoff) is an ongoing challenge. ANL is working effectively with the Palos Forest Preserve District to maintain control of the encroaching vegetation.

Action: ANL will continue to work with the forest preserve to keep the road clear of encroaching vegetation.

2. Although improved this year, erosion on top of the grass-covered mound at Plot M continues to be a problem.

Action: ANL will continue to routinely inspect the grass-covered mound and periodically repair ruts by filling them in with clean dirt and reseeding.

3. Tritium activities and water levels in monitoring well BH6 have been fluctuating erratically since 2009.

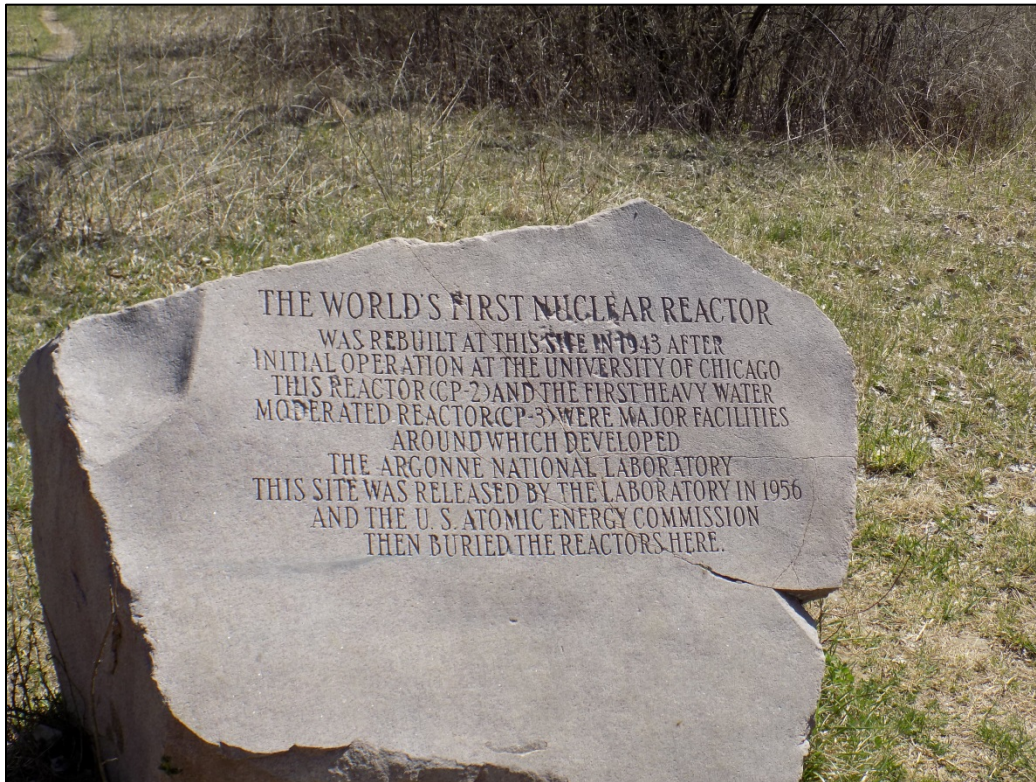
Action: ANL will continue to monitor well BH6.

5.0 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	45	Handle Removed from Picnic Area Well 5160 in Red Gate Woods Area
PL-2	90	Cracks on Front of Site A Marker
PL-3	270	Cracks on Back of Site A Marker
PL-4	90	Monitoring Well BH55 at Site A
PL-5	90	Monitoring Well BH56 at Site A
PL-6	360	Looking North at the Plot M Site Marker
PL-7	360	Looking North down Path with New Timbers Installed to Reduce Erosion
PL-8	180	Looking South at Erosion-Control Timbers Installed in Footpath Leading to Plot M



PL-1. Handle Removed from Picnic Area Well 5160 in Red Gate Woods Area



PL-2. Cracks on Front of Site A Marker



PL-3. Cracks on Back of Site A Marker



PL-4. Monitoring Well BH55 at Site A



PL-5. Monitoring Well BH56 at Site A



PL-6. Looking North at the Plot M Site Marker



PL-7. Looking North down Path with New Timbers Installed to Reduce Erosion



PL-8. Looking South at Erosion-Control Timbers Installed in Footpath Leading to Plot M

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Appendix A

Site Drawing

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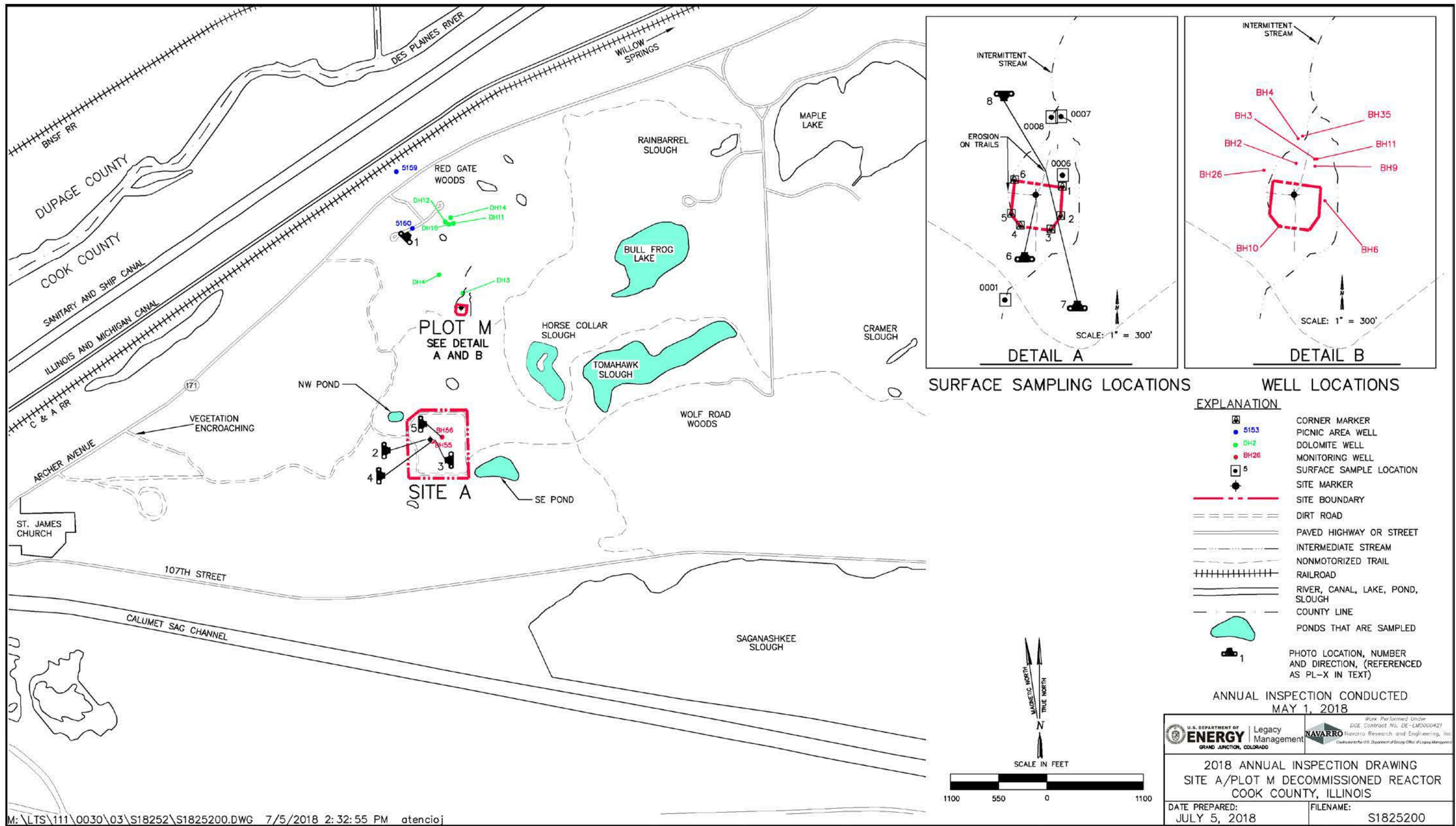


Figure A-1. 2018 Annual Inspection Drawing Site A/Plot M Decommissioned Reactor, Cook County, Illinois

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