CHAPTER 5

Wastewater discharged to land surfaces and infiltration basins (percolation ponds) at the Idaho National Laboratory (INL) Site is regulated by the state of Idaho groundwater quality and recycled water rules and requires a reuse permit. Liquid effluents and surface water runoff were monitored in 2023 by the INL contractor and the Idaho Cleanup Project (ICP) contractor for compliance with permit requirements and applicable Department of Energy (DOE) orders established to protect human health and the environment.

During 2023, permitted reuse facilities included the Advanced Test Reactor (ATR) Complex Cold Waste Ponds (CWP), Idaho Nuclear Technology and Engineering Center (INTEC) New Percolation Ponds and Sewage Treatment Plant (STP), and the Materials and Fuels Complex (MFC) Industrial Waste Pond (IWP). Liquid effluent and groundwater at these facilities were sampled for parameters required by their facility-specific permits. No permit limits were exceeded in 2023.

Additional liquid effluent and groundwater surveillance monitoring was also performed in 2023 at the ATR Complex, INTEC, and MFC to comply with the DOE environmental protection objectives. All parameters were below applicable health-based standards in 2023.

Surface water that runs off the Subsurface Disposal Area (SDA) at the Radioactive Waste Management Complex (RWMC) during periods of rapid snowmelt or heavy precipitation was sampled and analyzed for radionuclides. Additionally, water sheet flowed across asphalt surfaces and infiltrated around/under door seals at Waste Management Facility-636 at the Advanced Mixed Waste Treatment Project (AMWTP) and collected in catch tanks. Specific human-made gamma-emitting radionuclides were not detected. Detected concentrations of americium-241 (^{241}Am), plutonium-239/240 ($^{239/240}$Pu), and uranium isotopes did not exceed DOE Derived Concentration Standards (DCS).

5. ENVIRONMENTAL MONITORING PROGRAMS – LIQUID EFFLUENTS MONITORING

Some INL Site operations retain wastewater in lined, total containment evaporative ponds constructed to eliminate liquid effluent discharges to the environment. Other INL Site operations discharge liquid effluents to unlined infiltration basins or ponds that may potentially contain nonhazardous levels of radioactive, or nonradioactive, contaminants. Effluent discharges are subject to specified discharge limits, permit limits, or maximum contaminant levels (MCLs). INL Site contractor personnel conduct liquid effluent monitoring through liquid effluent and surface water runoff sampling and surveillance programs to ensure compliance with applicable permits, limits, and MCLs. These programs also sample groundwater related to liquid effluent.

Table 5-1 presents the requirements for liquid effluent monitoring and surveillance performed at the INL Site. Maps and a comprehensive discussion of environmental monitoring, including liquid effluent monitoring and surveillance programs performed by various organizations within and around the INL Site, can be found in the “INL Environmental Monitoring Plan” (DOE-ID 2021). To improve the readability of this chapter, data tables are only included when monitoring results exceed specified discharge limits, permit limits, or MCLs. Data tables for other monitoring results are provided in Appendix A.

Table 5-1. Liquid effluent monitoring and surveillance at the INL Site.

AREA/FACILITY	MONITORING REQUIREMENTS		
	IDAHO REUSE PERMIT[a]	DOE O 458.1[b] LIQUID EFFLUENT MONITORING	DOE O 435.1[c] SURFACE RUNOFF SURVEILLANCE
INL CONTRACTOR			
ATR[d] Complex Cold Waste Ponds	•	•	
MFC[d] Industrial Waste Pond	•	•	
ICP CONTRACTOR			
INTEC[d] New Percolation Ponds and Sewage Treatment Plant	•	•	
RWMC[d] SDA[d] surface water runoff		•	•

a. Required by permits issued according to the Idaho Department of Environmental Quality Rules, IDAPA 58.01.17, "Recycled Water Rules." This includes wastewater effluent monitoring and related groundwater monitoring.

b. Paragraph 4(g) of DOE Order 458.1, "Radiation Protection of the Public and the Environment," establishes specific requirements related to control and management of radionuclides from DOE activities in liquid discharges. Radiological liquid effluent monitoring recommendations in DOE Handbook Environmental Radiological Effluent Monitoring and Environmental Surveillance (DOE-HDBK-1216-2015) (DOE 2015) are followed to ensure quality. DOE Standard DOE-STD-1196-2022, "Derived Concentration Technical Standard," (DOE 2022) supports the implementation of DOE O 458.1 and provides DCSs as reference values to control effluent releases from DOE facilities.

c. The objective of DOE O 435.1, "Radioactive Waste Management," is to ensure that all DOE radioactive waste is managed in a manner that is protective of worker and public health and safety and the environment. This order requires that radioactive waste management facilities, operations, and activities meet the environmental monitoring requirements of DOE O 458.1. DOE Handbook DOE-HDBK-1216-2015 suggests that potential impacts of stormwater runoff as a pathway to humans or biota should be evaluated.

d. Advanced Test Reactor (ATR), Materials and Fuels Complex (MFC), Idaho Nuclear Technology and Engineering Center (INTEC), and Radioactive Waste Management Complex (RWMC), Subsurface Disposal Area (SDA).

5.1 Liquid Effluent and Related Groundwater Compliance Monitoring

Discharge of liquid effluent to the land surface for treatment or disposal is known as "reuse" in the state of Idaho and is regulated by the Recycled Water Rules (IDAPA 58.01.17), Wastewater Rules (IDAPA 58.01.16), and Ground Water Quality Rule (IDAPA 58.01.11) promulgated according to the Idaho Administrative Procedures Act. The Idaho Department of Environmental Quality (DEQ) issues reuse permits for operation of the reuse systems. Reuse permits may require monitoring of nonradioactive constituents in the effluent and groundwater in accordance with the monitoring requirements specified within each permit. Some facilities may have specified radiological constituents monitored for surveillance purposes to comply with DOE orders (but are not required by regulations). The reuse permits may specify annual discharge volumes, application rates, and effluent quality limits. Annual reports (ICP 2024a and 2024b; INL 2024a, 2024b, 2024c, and 2024d) were prepared and submitted to the Idaho DEQ.

During 2023, the INL Site contractors monitored, as required by the permits, the following reuse facilities shown in Table 5-2:

- ATR Complex Cold Waste Ponds (Section 5.1.1)
- INTEC New Percolation Ponds and STP (Section 5.1.2)
- MFC Industrial Waste Pond (Section 5.1.3).

Table 5-2. 2023 status of reuse permits.

FACILITY	PERMIT STATUS AT END OF 2023	PERMIT EXPIRATION DATE	EXPLANATION
ATR Complex Cold Waste Ponds	Active	October 29, 2029	Idaho DEQ issued Reuse Permit I-161-03 on October 30, 2019 (DEQ 2019), with Modifications issued May 23, 2022 (DEQ 2022a); and October 24, 2023 (DEQ 2023a).
INTEC New Percolation Ponds	Active	June 25, 2034	Idaho DEQ issued Permit M-130-07 on June 25, 2024 (DEQ 2024).
MFC Industrial Waste Pond	Active	January 25, 2027	Idaho DEQ issued Reuse Permit I-160-02 on January 26, 2017, with modifications issued March 7, 2017; May 8, 2019; May 21, 2020 (DEQ 2020); May 23, 2022 (DEQ 2022b); and October 24, 2023 (DEQ 2023b).

Additional effluent constituents are monitored at these facilities to comply with environmental protection objectives of DOE O 458.1 and are discussed in Section 5.2. Surface water monitoring at the RWMC is presented in Section 5.3.

5.1.1 Advanced Test Reactor Complex Cold Waste Ponds

Description. The Cold Waste Ponds (CWP) are located approximately 137 m (450 ft) from the southeast corner of the ATR Complex compound and approximately 1.2 km (0.75 mi) northwest of the Big Lost River channel, as shown in Figure 5-1. The CWP was excavated in 1982 and consists of two unlined cells, each with dimensions of 55 × 131 m (180 × 430 ft) across the top of the berms and with a depth of 3 m (10 ft). Total surface area for the two cells at the top of the berms is approximately 1.44 ha (3.55 acres). Maximum capacity is approximately 38.69 ML (10.22 MG).

The CWP function as percolation basins for the infiltration of nonhazardous industrial liquid effluent consisting primarily of noncontact cooling tower blowdown, once-through cooling water for air conditioning units, coolant water from air compressors, and wastewater from secondary system drains and other nonradioactive drains throughout the ATR Complex. Chemicals used in the cooling tower and other effluent streams discharged to the CWP include commercial biocides and corrosion inhibitors. The cold waste effluent reports through collection piping to a monitoring location where flow rates to the CWP are measured using a v-notch weir and effluent samples are collected using an automated composite sampler.

Effluent Monitoring Results for the Reuse Permit. Reuse Permit I-161-03 Modifications 1 and 2 require monthly sampling of the effluent to the CWP (DEQ 2022a; DEQ 2023a). The 2023 permit reporting year monitoring results are presented in the 2023 annual reuse report (INL 2024c) and the 2023 calendar year monitoring results are summarized in Table A-1 in Appendix A. The total dissolved solids concentrations ranged from 192 mg/L to 1,200 mg/L. Sulfate ranged from 20.9 mg/L to 667 mg/L. Concentrations of sulfate and total dissolved solids are higher during reactor operation because of the evaporative concentration of the corrosion inhibitors and biocides added to the reactor cooling water. Due to the composition and characteristics of the effluent, the reuse permit does not require pre-treatment or specify maximum constituent loading limits or concentration limits for the cold waste effluent discharged to the CWP. The 2023 constituent concentrations continue to remain consistent with historical results.

The permit specifies the maximum annual and five-year moving average hydraulic loading rate limits of 300 MG/yr and 375 MG/yr, respectively, based on the annual reporting year of the permits. As shown in Table A-2, the 2023 annual reporting year flow of 215.60 MG did not exceed either of these hydraulic loading limits.

Groundwater Monitoring Results for the Reuse Permit. The permit requires groundwater monitoring twice annually in April/May and September/October, at seven groundwater wells (see Figure 5-1), to measure potential impacts from the CWP. In 2023, none of the constituents exceeded their respective primary or secondary constituent standards. The constituents are presented in Table A-3a and Table A-3b. Nitrate + nitrite as nitrogen continues to show a minor increasing trend in both the upgradient and downgradient wells but remain well below the primary constituent standard. Sulfate and total dissolved solids continue to gradually trend downward. The metals concentrations continue to remain at low levels and are consistent with historical ranges.

5.1.2 Idaho Nuclear Technology and Engineering Center New Percolation Ponds and Sewage Treatment Plant

Description. The INTEC New Percolation Ponds are composed of two rapid infiltration ponds excavated into the surficial alluvium and surrounded by bermed alluvial material, as observed in Figure 5-2. The rapid infiltration system uses the soil ecosystem to treat wastewater. Each pond is 93 m × 93 m (305 ft × 305 ft) at the top of the berm and is approximately 3 m (10 ft) deep. Each pond is designed to accommodate a continuous wastewater discharge rate of 11.36 ML (3 MG) per day.

The INTEC New Percolation Ponds receive discharge of only industrial and municipal wastewater. Industrial wastewater (i.e., service waste) from INTEC operations consists of steam condensates, noncontact cooling water, water treatment effluent, boiler blowdown wastewater, stormwater, and small volumes of other nonhazardous/nonradiological liquids. Municipal wastewater (i.e., sanitary waste) is treated at the INTEC STP.

The STP is located east of INTEC, outside the INTEC security fence, and treats and disposes of sewage, septage, and other nonhazardous industrial wastewater at INTEC. The sanitary waste is treated by natural biological and physical processes (e.g., digestion, oxidation, photosynthesis, respiration, aeration, evaporation) in four lagoons. After treatment in the lagoons, the effluent is combined with the service waste and discharged to the INTEC New Percolation Ponds.

The INTEC New Percolation Ponds were permitted by Idaho DEQ to operate as a reuse facility under Reuse Permit M-130-06 (DEQ 2017).

Wastewater Monitoring Results for the Reuse Permit. Monthly samples were collected from CPP-769 (influent to STP), CPP-773 (effluent from STP), and CPP-797 (effluent to the INTEC New Percolation Ponds), as shown in Figure 5-3. As required by the permit, all samples are collected as 24-hour composites, except pH, fecal coliform, and total coliform, which are collected as grab samples. The permit specifies the constituents that must be monitored at each location. The permit does not specify any wastewater discharge limits at these three locations. The 2023 reporting year monitoring results for CPP-769, CPP-773, and CPP-797 are provided in the 2023 Wastewater Reuse Report (ICP 2024a), and the 2023 calendar year monitoring results are summarized in Tables A-4, A-5, and A-6 (in Appendix A).

The permit specifies maximum daily and yearly hydraulic loading rates for the INTEC New Percolation Ponds. As shown in Table A-7, the maximum daily flow and yearly total flow to the INTEC New Percolation Ponds were below the permit limits in 2023.

Groundwater Monitoring Results for the Reuse Permit. To measure the potential impact on groundwater from wastewater discharges to the INTEC New Percolation Ponds, the permit requires that groundwater samples are collected from six monitoring wells, as shown in Figure 5-2.

The permit requires that groundwater samples are collected semiannually during April/May and September/October and lists which constituents must be analyzed. Contaminant concentrations in the monitoring wells are limited by primary constituent standards and secondary constituent standards specified in IDAPA 58.01.11, “Ground Water Quality Rules.”

Table A-8 shows the 2023 water table elevations and depth-to-water table, determined prior to purging and sampling, and the analytical results for all constituents specified by the permit for the aquifer wells. Table A-9 presents similar information for the perched water wells.

Tables A-8 and A-9 show all permit-required constituents associated with the aquifer monitoring wells were below their respective primary constituent standards and secondary constituent standards in 2023.

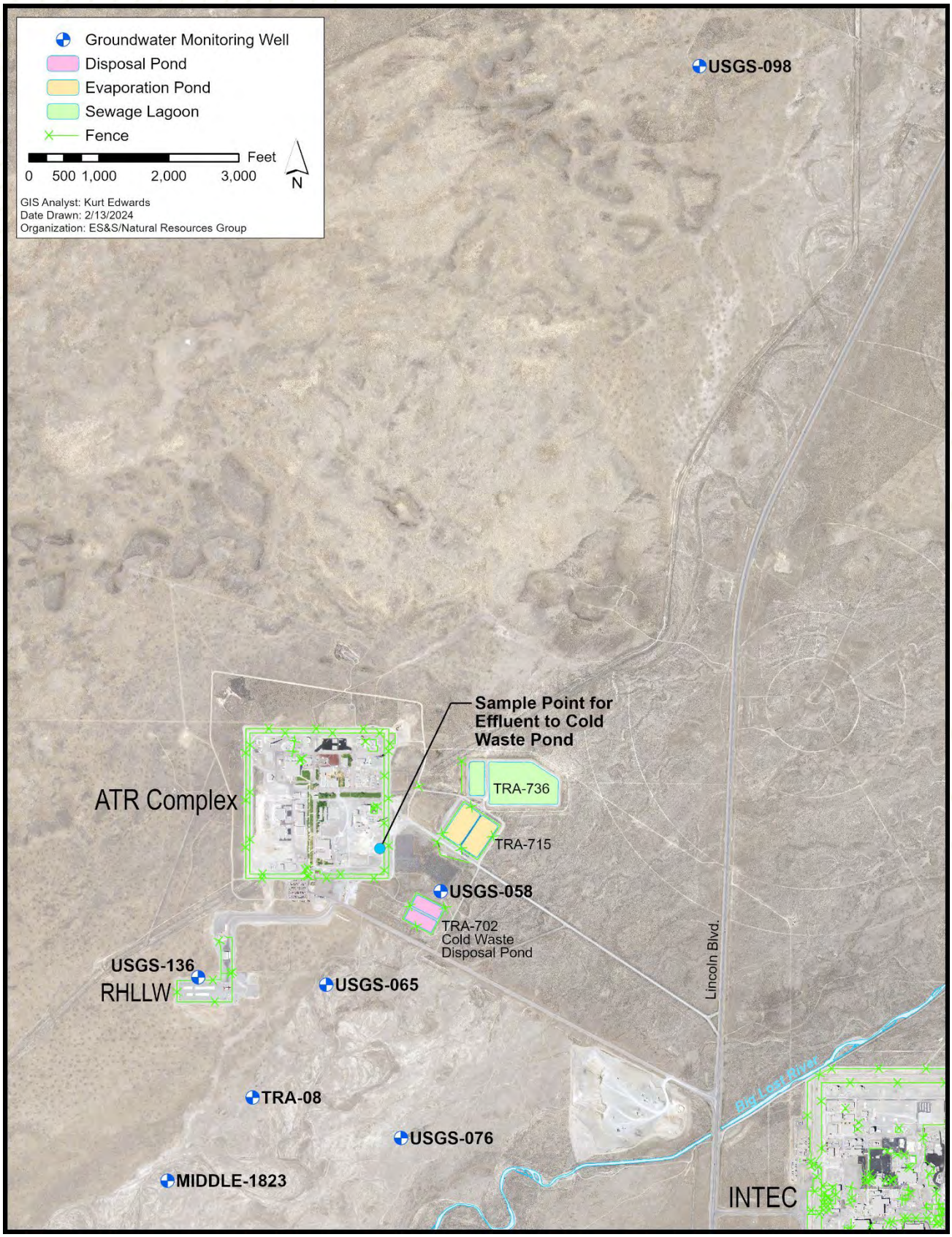

Figure 5-1. Permit monitoring locations for the ATR Complex Cold Waste Pond.

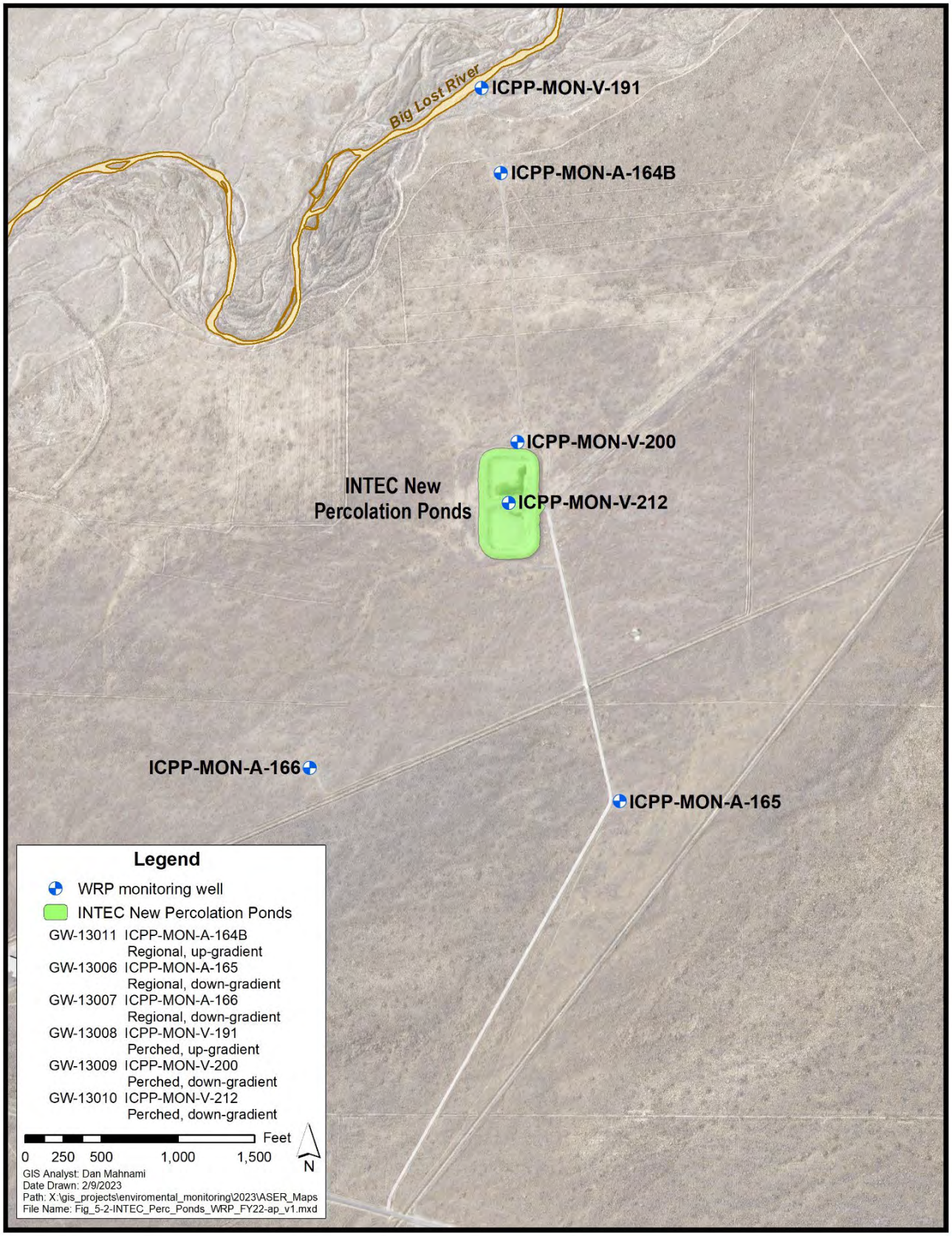

Figure 5-2. Reuse permit groundwater monitoring locations for INTEC New Percolation Ponds.

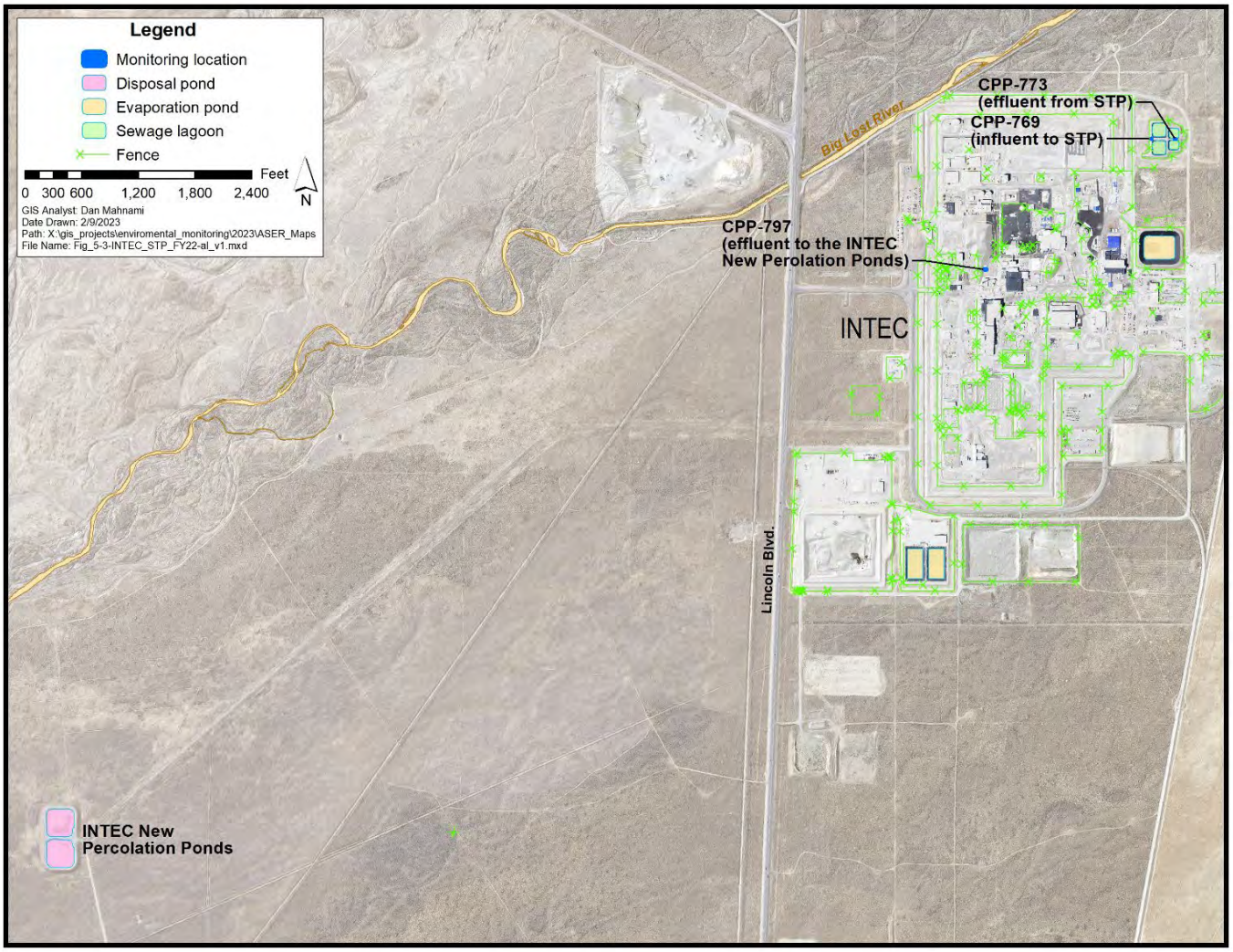

Figure 5-3. INTEC wastewater monitoring for reuse permit.

5.1.3 Materials and Fuels Complex Industrial Waste Pond

Description. The MFC Industrial Waste Pond (IWP) is an unlined basin that was first excavated in 1959 and has a design capacity of 1,078.84 ML (285 MG) at a maximum water depth of 3.96 m (13 ft) as identified in Figure 5-4. The industrial wastewater system that discharges to the IWP, referred to as the Industrial Wastewater Collection System (IWCS), consists of a combination of pipelines/branches, lift stations, flow meter, composite sampler, and associated components. Wastewater discharged to the IWCS consists of primarily noncontact cooling water, cooling tower drains, and air wash flows. Small volumes of MFC-768 Powerplant cooling water system blowdown, intermittent reverse osmosis blowdown, and floor drain and laboratory sink discharges are also sent to the IWCS. On occasion, with pre-approval, industrial wastewater from MFC facility process holdup tanks discharge to the pipeline. The IWP functions as a percolation basin for the infiltration of the nonhazardous industrial effluent, which is discharged to the pond via the IWCS.

The IWCS has two distinct sections: the IWCS Primary Line (PL) and IWCS Southwestern Branch Line (SBL). The IWCS PL begins near MFC-774, travels north to and beyond a lift station, then turns and travels west to the monitoring station, and eventually discharges to the pond. This section is referred to as the PL because it is the pipeline that collects wastewater from all sources, and on which the flow meter and composite sampler are located. The section referred to as the SBL collects wastewater from sources inside MFC-768 and discharges the wastewater to an underground pipe running northwest and then north into a lift station. This lift station pumps wastewater to the north and then northeast where it discharges into the PL upstream of the flow meter and composite sampler.

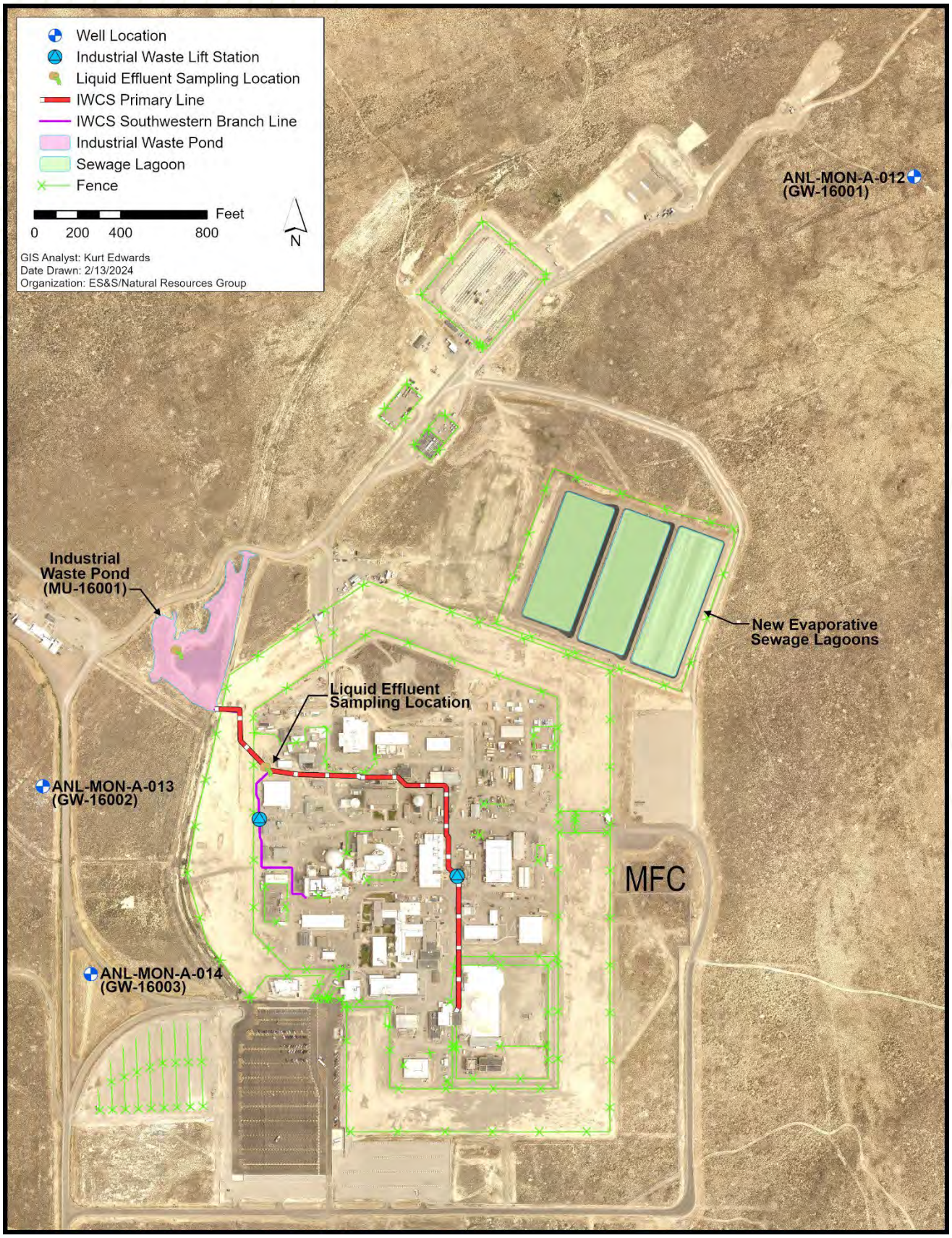

Figure 5-4. Wastewater and groundwater sampling locations at MFC.

Wastewater Monitoring Results for the Reuse Permit. Reuse Permit I-160-02 Modifications 4 and 5 require monthly sampling of effluent discharging from the IWCS into the IWP (DEQ 2022b, DEQ 2023b). The 2023 permit reporting year monitoring results are presented in the 2023 annual reuse report (INL 2024d), and the calendar year results are summarized in Table A-10. Based on the composition of the industrial effluent, the reuse permit does not require pre-treatment or specify maximum constituent loading limits or concentration limits. In 2023, concentrations of iron and manganese continued to be at or near the minimum detection levels of the laboratory instruments. Total dissolved solids ranged from 208 mg/L to 283 mg/L. The 2023 constituent concentrations continue to be within historical ranges.

The permit specifies an annual reporting year hydraulic loading limit of 17 MG/yr. As shown in Table A-11, the 2023 reporting year flow of 9.435 MG/yr was well below the permit limit.

Groundwater Monitoring Results for the Reuse Permit. The reuse permit requires groundwater monitoring twice per year, in April/May and September/October, at one upgradient well and two downgradient wells, as observed in Figure 5-4, to measure potential impacts from the pond. The analytical results are summarized in Table A-12. In 2023, none of the constituents exceeded their respective primary or secondary constituent standards, and the analyte concentrations in the downgradient wells remained consistent with the background levels in the upgradient well.

5.2 Liquid Effluent Surveillance Monitoring

The following sections discuss the results of liquid effluent surveillance monitoring performed at each wastewater reuse permitted facility.

5.2.1 Advanced Test Reactor Complex

The effluent to the CWP receives a combination of process water from various ATR Complex facilities. The CWP effluent is analyzed monthly for gross alpha, gross beta, gamma spectrometry, and tritium. Table A-13 lists wastewater effluent surveillance monitoring results for those constituents with at least one detected result. In 2023, gross alpha, gross beta, and radium-228 were the only constituents detected in the CWP effluent. Radium-228 was detected once at 0.755 (± 0.165) pCi/L and was well below the DOE DCS for ingested water of 73 pCi/L (DOE 2022).

Additionally, seven groundwater monitoring wells are sampled twice per year for radiological surveillance. The groundwater radionuclide surveillance monitoring results are summarized in Table A-14. All detected constituents, including tritium, gross alpha, and gross beta, were well below the Idaho groundwater primary constituent standards, IDAPA 58.01.11. Gross alpha and gross beta remain within historical ranges. Tritium continues to trend downward in the monitoring wells that have positive detections.

5.2.2 Idaho Nuclear Technology and Engineering Center

In addition to the permit-required monitoring summarized in Section 5.1.3, surveillance monitoring was conducted at CPP-797 (effluent to the INTEC New Percolation Ponds), and groundwater monitoring was conducted at the INTEC New Percolation Ponds. Table A-15 summarizes the results of radiological monitoring at CPP-797, while Table A-16 summarizes the results of radiological monitoring at groundwater Wells ICPP-MON-A-165, ICPP-MON-A-166, ICPP-MON-V-200, and ICPP-MON-V-212.

Twenty-four-hour flow proportional samples were collected from the CPP-797 wastewater effluent and composited daily into a monthly sample. Each collected monthly composite sample was analyzed for specific gamma-emitting radionuclides, gross alpha, gross beta, and total strontium activity. As shown in Table A-15, no total strontium activity was detected in any of the samples collected at CPP-797 in 2023. Gross alpha was detected in four samples, while gross beta was detected in all 12 samples collected in 2023.

Groundwater samples were collected from aquifer Wells ICPP-MON-A-165 and ICPP-MON-A-166 and perched water Wells ICPP-MON-V-200 and ICPP-MON-V-212 in May 2023 and September 2023 and were analyzed for gross alpha and gross beta. As shown in Table A-16, gross alpha was detected in three of the four monitoring wells in September 2023. Gross beta was detected in three of the four wells in May 2023 and all of the monitoring wells in September 2023. All detected constituents, including strontium-90 (^{90}Sr), tritium, gross alpha, and gross beta, were below the Idaho groundwater primary constituent standards, IDAPA 58.01.11.

5.2.3 Materials and Fuels Complex

The IWP is sampled three times per year and analyzed for gross alpha, gross beta, gamma spectrometry, and tritium, as shown in Figure 5-4. Annual samples are also collected and analyzed for select isotopes of americium, strontium, plutonium, and uranium. As summarized in Table A-17, the gross alpha, gross beta, and uranium isotopes that were detected in 2023 are all well below applicable DCS (DOE 2022) and remain within historical ranges.

Additionally, three ground water monitoring wells are sampled twice per year and analyzed for gross alpha, gross beta, alpha spectrometry, gamma spectrometry, and tritium. The 2023 groundwater surveillance monitoring results are summarized in Table A-18. Overall, the detected results were below the Idaho groundwater primary constituent standards, IDAPA 58.01.11, remain within historical ranges, and show no discernible impact from activities at MFC.

5.3 Surface Water Runoff Surveillance Water Sampling

Radionuclides could be transported outside the RWMC boundaries via surface water runoff. Surface water runs off the SDA only during periods of rapid snowmelt or heavy precipitation. At these times, water may be pumped out of the SDA retention basin into a drainage canal, which directs the flow outside RWMC. The canal also carries runoff from outside RWMC that has been diverted around the SDA.

Additionally, water sheet flows across asphalt surfaces and infiltrates around/under door seals at Waste Management Facility (WMF)-636 at AMWTP. The resulting surface water inflow accumulates in the WMF-636 Fire Water Catch Tanks (Tanks A, B, C, and D). If the level of surface water in the Fire Water Catch Tanks reaches a predetermined level, the water is pumped into aboveground holding tanks, where it can be sampled, prior to discharge into the drainage canal surrounding the SDA.

In compliance with DOE O 435.1, the ICP contractor collects surface water runoff samples at the RWMC SDA from the location shown in Figure 5-5. The WMF-636 Fire Water Catch Tanks are also shown in Figure 5-5. Surface water is collected to determine whether radionuclide concentrations exceed administrative control levels or if concentrations have increased significantly, as compared to historical data. A field blank is also collected for comparison. Samples from the WMF-636 Fire Water Catch Tanks were not collected during 2023 as periodic measurements of tank levels did not indicate pumping to be necessary.

One sample was collected from the SDA Lift Station in 2023. This sample was analyzed for a suite of radionuclides that includes ^{241}Am and ^{90}Sr, as well as plutonium and uranium isotopes. There were positive detections (three sigma [3σ]) of ^{241}Am, plutonium-238 (^{238}Pu), $^{239/240}$Pu, and ^{90}Sr in the samples taken in 2023. The maximum concentration detected for ^{241}Am was 2.35 (± 0.16) pCi/L, which is well below the 740 pCi/L DCS for ^{241}Am. The maximum concentration detected for ^{238}pu was 0.04 (± 0.01) pCi/L, which is well below the 430 pCi/L DCS. The maximum concentration detected for $^{239/240}$Pu was 0.32 (± 0.03) pCi/L, which is well below the applicable DCS (400 pCi/L). Finally, the maximum concentration detected for ^{90}Sr was 0.38 (± 0.17) pCi/L, which is also well below the applicable DCS (1,700 pCi/L). In addition to these nuclides, uranium isotopes were detected at levels consistent with historical results, which are below any applicable DCS.

Table 5-3 summarizes the specific alpha and beta results of human-made radionuclides. No human-made gamma-emitting radionuclides were detected. ICP temporarily ceased sample collection since the teardown of the Accelerated Retrieval Project (ARP) V facility removed electrical facilities to the SDA Lift Station. The ICP contractor is revising the process for sample collection and updating their sampling procedure to allow continued sampling at the SDA Lift Station considering the changes resulting from closure activities.

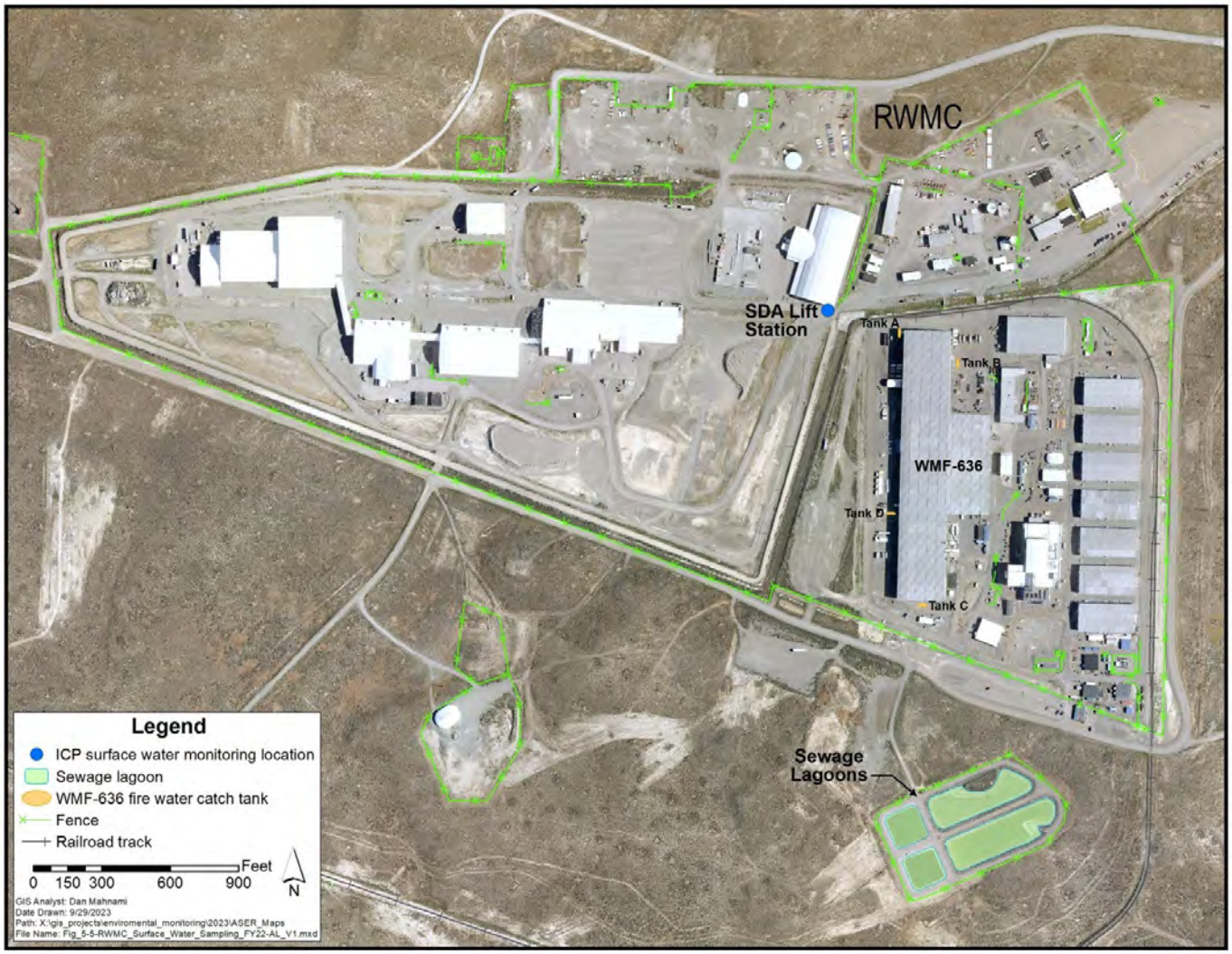

Figure 5-5. Surface water sampling location at the RWMC SDA.

Table 5-3. Radionuclides detected in surface water runoff at the RWMC SDA (2023).

LOCATION	PARAMETER	MAXIMUM CONCENTRATION[a] (pCi/L)	% DCS[b]
SDA Lift Station	Americium-241	2.36 ± 0.10	0.13
	Plutonium-238	0.04 ± 0.01	0.01
	Plutonium-239/240	0.32 ± 0.03	0.04
	Strontium-90	0.38 ± 0.17	0.04
	Uranium-234	0.53 ± 0.04	0.04
	Uranium-235	0.04 ± 0.01	0.00
	Uranium-238	0.44 ± 0.03	0.03

a. Result ±1s. Results shown are greater than 3σ.
b. See DOE-STD-1196-2021, Table A-6 (DOE 2022).

5.4 References

DEQ, 2019, "Idaho National Laboratory (INL) Advanced Test Reactor (ATR) Complex Cold Waste Ponds – Reuse Permit I-161-03," PER-132, October 2019, Idaho Department of Environmental Quality, Boise, ID.

DEQ, 2020, "Idaho National Laboratory (INL) Materials and Fuels Complex (MFC) Industrial Waste Pond (IWP), Reuse Permit No. I-160-02, Modification 3," PER-138, Sept. 2020, Idaho Department of Environmental Quality, Boise, ID.

DEQ, 2022a, "Idaho National Laboratory (INL) Advanced Test Reactor (ATR) Complex Cold Waste Ponds – Reuse Permit I-161-03, Modification 1" PER-132, May 2022, Idaho Department of Environmental Quality, Boise, ID.

DEQ, 2022b, "Idaho National Laboratory (INL) Materials and Fuels Complex (MFC) Industrial Waste Pond (IWP), Reuse Permit No. I-160-02, Modification 4," PER-138, May 2022, Idaho Department of Environmental Quality, Boise, ID.

DEQ, 2023a, "Idaho National Laboratory (INL) Advanced Test Reactor (ATR) Complex Cold Waste Ponds – Reuse Permit I-161-03, Modification 2" PER-132, October 2023, Idaho Department of Environmental Quality, Boise, ID.

DEQ, 2023b, "Idaho National Laboratory (INL) Materials and Fuels Complex (MFC) Industrial Waste Pond (IWP), Reuse Permit No. I-160-02, Modification 5," PER-138, October 2023, Idaho Department of Environmental Quality, Boise, ID.

DEQ, 2024, "Idaho National Laboratory, Idaho Nuclear Technology and Engineering Center New Percolation Ponds," Reuse Permit M-130-07, ICP PER-143, June 2024, Idaho Department of Environmental Quality, Idaho Falls, ID.

DOE, 2015, "DOE Handbook—Environmental Radiological Effluent Monitoring and Environmental Surveillance," DOE-HDBK-1216-2015, U.S. Department of Energy, Washington, D.C.

DOE, 2022, "Derived Concentration Technical Standard," DOE-STD-1196-2022, U.S. Department of Energy, Washington, D.C.

DOE O 435.1, 2001, "Radioactive Waste Management," Change 2, U.S. Department of Energy, Washington, D.C., https://directives.dev.doxcelerate.com/directives-documents/400-series/0435.1-BOrder-chg2-AdminChg/@@images/file.

DOE O 458.1, 2020, "Radiation Protection of the Public and the Environment," Administrative Change 4, U.S. Department of Energy, Washington, D.C., https://www.directives.doe.gov/directives-documents/400-series/0458.1-BOrder-chg4-ltdchg/@@images/file.

DOE-ID, 2021, "Idaho National Laboratory Site Environmental Monitoring Plan," DOE/ID-11088, Rev. 5, October 2021, U.S. Department of Energy Idaho Operations Office, Idaho Falls, ID.

ICP, 2024a, "2023 Wastewater Reuse Site Performance Report for the Idaho Nuclear Technology and Engineering Center New Percolation Ponds (M-130-06)," RPT-2120, Idaho Cleanup Project, Idaho Falls, ID.

ICP, 2024b, "2023 Radiological Monitoring Results Associated with the Idaho Nuclear Technology and Engineering Center New Percolation Ponds," RPT-2124, Idaho Cleanup Project, Idaho Falls, ID.

IDAPA 58.01.11, "Ground Water Quality Rule," Idaho Administrative Procedures Act, Idaho Department of Environmental Quality, Boise, ID, https://adminrules.idaho.gov/rules/current/58/580111.pdf.

IDAPA 58.01.16, "Wastewater Rules," Idaho Administrative Procedures Act, Idaho Department of Environmental Quality, Boise, ID, https://adminrules.idaho.gov/rules/current/58/580116.pdf.

IDAPA 58.01.17, "Recycled Water Rules," Idaho Administrative Procedures Act, Idaho Department of Environmental Quality, Boise, ID, https://adminrules.idaho.gov/rules/current/58/580117.pdf.

INL, 2024a, "2023 Groundwater Radiological Monitoring Results Associated with the Advanced Test Reactor Complex Cold Waste Ponds," INL/RPT-24-76099, Idaho National Laboratory, Idaho Falls, ID.

INL, 2024b, "2023 Groundwater Radiological Monitoring Results Associated with the Materials and Fuels Complex Industrial Waste Pond," INL/RPT-24-76100, Idaho National Laboratory, Idaho Falls, ID.

INL, 2024c, "2023 Annual Reuse Report for the Idaho National Laboratory Site's Advanced Test Reactor Complex Cold Waste Ponds," INL/RPT-24-76101, Idaho National Laboratory, Idaho Falls, ID.

INL, 2024d, "2023 Annual Industrial Wastewater Reuse Report for the Idaho National Laboratory Site's Materials and Fuels Complex Industrial Waste Pond," INL/RPT-24-76102, Idaho National Laboratory, Idaho Falls, ID.