



**US Army Corps
of Engineers®**

Buffalo District

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**NIAGARA FALLS STORAGE SITE
Formerly Utilized Sites Remedial Action Program**

**2019
ENVIRONMENTAL SURVEILLANCE
TECHNICAL MEMORANDUM**

**PREPARED BY:
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Acronyms and Abbreviations

AEC	Atomic Energy Commission
ASTM	American Society for Testing and Materials
CAP88-PC	Clean Air Act Assessment Package – 1988 (U.S. EPA)
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CF	confidence factor
CFR	Code of Federal Regulations
COV	coefficient of variation
DOD	Department of Defense
DOE	United States Department of Energy
DOH	Department of Health
EPA	United States Environmental Protection Agency
ESP	environmental surveillance program
FUSRAP	Formerly Utilized Sites Remedial Action Program
IWCS	Interim Waste Containment Structure
KAPL	Knolls Atomic Power Laboratory
LOOW	Lake Ontario Ordnance Works
MCL	maximum contaminant level
MDA	minimum detectable activity
MED	Manhattan Engineer District
MEI	maximally exposed off-site individual
m	meters
m ³	cubic meter(s)
µg/g	micrograms per gram
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
NCRP	National Council on Radiation Protection and Measurements
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NFSS	Niagara Falls Storage Site
NTUs	nephelometric turbidity units
NRC	Nuclear Regulatory Commission
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
OSLD	optically stimulated luminescence dosimeter
PAH	polycyclic aromatic hydrocarbon
PCE	tetrachloroethene
pCi/g	picocuries per gram
pCi/L	picocuries per liter
Ra	radium
RCRA	Resource Conservation and Recovery Act
RSL	regional screening level
SCO	soil cleanup objective
SDWA	Safe Drinking Water Act
TDS	total dissolved solids
TED	total effective dose
U	lab qualifier–nondetect
U ₃ O ₈	triuranium octoxide
USACE	United States Army Corps of Engineers
VOC	volatile organic compound

Units of Measurement and Conversion Factors–Radioactivity

Parameter	Conventional Units	SI Units	Conversion Factor
Dose	millirem (mrem)	millisievert (mSv)	1 mrem = 0.01 mSv
Activity	picocurie (pCi)	becquerel (Bq)	1 pCi = 0.037 Bq

Units of Measurement and Conversion Factors–Mass, Length, Area, and Volume

Parameter	SI Units	English Units	Conversion Factor
Mass	gram (g)	ounce (oz)	1 g = 0.035 oz
	kilogram (kg)	pound (lb)	1 kg = 2.2046 lb
Length	centimeter (cm)	inch (in)	1 cm = 0.394 in
	meter (m)	foot (ft)	1 m = 3.281 ft
	kilometer (km)	mile (mi)	1 km = 0.621 mi
Area	hectare (ha)	acre	1 ha = 2.47 acres
Volume	milliliter (mL)	fluid ounce (fl. oz)	1 mL = 0.0338 fl. oz
	liter (L)	gallon (gal)	1 L = 0.264 gal
	cubic meter (m ³)	cubic yard (yd ³)	1 m ³ = 1.307 yd ³

EXECUTIVE SUMMARY

Purpose: This technical memorandum documents the scientific methods, criteria, data, and findings of the Environmental Surveillance Program (ESP) at the Niagara Falls Storage Site (NFSS). The U.S. Army Corps of Engineers Buffalo District is executing this program in support of its mission under the Formerly Utilized Sites Remedial Action Program (FUSRAP) to protect human health and the environment at the NFSS. The Buffalo District publishes this technical memorandum annually and posts it to the Corps website in the "Environmental Monitoring" section:

<https://www.lrb.usace.army.mil/Missions/HTRW/FUSRAP/Niagara-Falls-Storage-Site/>.

Site Description and Background: The NFSS is located at 1397 Pletcher Road in the Town of Lewiston, New York, 19 miles (30.6 km) north of Buffalo, New York. The NFSS is federally owned property that covers an area of 191 acres. The NFSS was originally part of a World War II explosives plant called the Lake Ontario Ordnance Works (LOOW), which was approximately 7,500 acres in size. Between 1944 and 1954, the Manhattan Engineer District (MED) and the Atomic Energy Commission (AEC) (a predecessor to the U.S. Department of Energy [DOE]) brought radioactive wastes and residues to a small portion of the LOOW. Throughout the 1970s, the AEC gradually consolidated its operations and sold excess property to the public. In the 1980s, the DOE constructed a ten-acre Interim Waste Containment Structure (IWCS) on the NFSS to contain the radioactive wastes and residues.

In October 1997, Congress transferred management of FUSRAP (which had been initiated in 1974) from the DOE to the Corps of Engineers. In addition to investigating and remediating site contaminants at the NFSS, the Corps of Engineers is responsible for maintaining the site and conducting the ESP. The environmental surveillance activities the DOE initiated in 1979 have continuously been reviewed and updated; today the Corps of Engineers Buffalo District ensures that wastes buried within the IWCS and contaminated on-site soil and groundwater do not pose a risk to human health and the environment. The program includes monitoring air, water, and sediments for radiological and chemical parameters.

In December 2007 and April 2011, the Corps of Engineers completed the *Remedial Investigation Report for the NFSS* and *NFSS Remedial Investigation Report Addendum*, respectively (USACE 2007, USACE 2011). These reports defined the nature and extent of contaminants on the NFSS and assessed their potential long-term risks. Based on findings from these investigations and public input, the Corps of Engineers further enhanced the ESP.

Between 2012 and 2014, the Corps of Engineers investigated further to locate the source of elevated uranium in groundwater south and east of the IWCS. As part of these investigations, the Corps of Engineers worked to prevent possible off-site migration of contaminants through site utilities. The work included installing monitoring wells, collecting and analyzing soil and groundwater samples, sealing manholes and pipelines near the property boundary, excavating investigative trenches, and completing a geophysical survey. The Corps of Engineers presented results of these investigations in reports issued in August 2013 (U.S. Army Corps of Engineers [USACE], 2013a) and February 2015 (USACE 2015a).

In 2013, the Corps of Engineers implemented the following modifications to the ESP:

- The number of wells monitored semiannually increased from 39 to 54 (to include several wells installed in 2012); the analytical parameters were refined to include total uranium, radium-226, and volatile organic compounds (for a limited number of wells)
- The number of surface water and sediment locations sampled semiannually decreased from 11 to 9; the analytical parameters were refined to include total uranium, radium-226, polycyclic aromatic hydrocarbons, and metals.

In 2014, the Corps of Engineers added well MW943 to the ESP, increasing the total number of wells monitored semiannually to 55. Well MW943 monitors the upper water-bearing zone south of the IWCS.

In late 2018, the Corps of Engineers replaced nine ESP monitoring that were in disrepair. Wells replaced include A50, A55, BH49, BH49A, MW953, OW13B, OW15B, OW17B, and OW18B. The new wells are identified as the former name followed by an “R” for replacement (e.g., A50R, A55R, BH49R, BH49AR, etc.)

The Corps of Engineers made no changes to the air monitoring schedule and continues to measure radon-222 flux on the IWCS cap annually and radon-222 concentrations and gamma emissions at the IWCS perimeter and NFSS property boundary semiannually.

To evaluate environmental surveillance data, the Corps of Engineers uses the criteria, standards, and guidelines of the DOE, U.S. Environmental Protection Agency (EPA), Nuclear Regulatory Commission (NRC), and New York State Department of Environmental Conservation (NYSDEC) for comparison purposes.

Additional information about the site and the ESP is available on the Corps of Engineers Buffalo District website: <https://www.lrb.usace.army.mil/Missions/HTRW/FUSRAP/Niagara-Falls-Storage-Site/>.

Key Findings: The 2019 environmental surveillance analytical results confirm that site controls are fully protective of human health and the environment.

With the exception of radon flux data, the results of the 2019 surveillance program are consistent with previous years and show:

- Site radon-222 concentrations are below the DOE off-site limit of 3.0 picocuries/liter (pCi/L).
- The calculated dose to a receptor due to airborne particulates is below the EPA guideline of 10 millirem/year (excluding radon); the cumulative dose, which is calculated by adding the maximum external gamma dose to the maximum airborne particulate dose, is significantly less than the DOE limit of 100 millirem/year.
- Surface water samples collected in 2019 exhibited trace levels of polycyclic aromatic hydrocarbons; several metals were detected and the results were comparable to previous years.
- Several metals were detected in all sediment samples and several polycyclic aromatic hydrocarbons were detected predominantly in upstream sediment samples; 2019 results were generally comparable to past results.
- Tetrachloroethene was detected in a groundwater monitoring well in the former acidification area.

The calculated annual average radon flux across the IWCS remained below 20 picocuries per meter squared per second (pCi/m²/s), the standard specified in 40 CFR Part 61, Subpart Q despite an elevated result from canister location 65, approximately 50 feet from canister 62 that produced an elevated measurement in 2018. To investigate, the Corps of Engineers performed a limited gamma walkover survey and found elevated radioactivity around the area of canister locations 62 and 65. The area of concern identified by the flux and gamma walkover survey data is located above the eastern wall of Building 411 that contains radioactive residues in the IWCS. The Corps of Engineers has evaluated strategies to fix the problem and decided to proceed with an iterative approach. First, several inches of topsoil and grass seed will be added in late spring 2020 to the areas where elevated readings and distressed grass were identified, around canister locations 62 and 65. The Corps of Engineers believes that enhancing the grass cover will restore optimal moisture to the underlying clay layer that may have developed desiccation cracks. Once the cover is replaced, radon flux measurements will determine whether this approach has been successful.

If radon flux levels are not reduced, the Corps of Engineers will explore ways to repair the underlying clay blanket.

Based on regulatory compliance data collected in 2019, the Corps of Engineers has demonstrated that the site is compliant with regulatory criteria and remains protective of human health and the environment. The average radon flux across the IWCS measured during the annual monitoring event performed in July 2019 remained below 20 pCi/m²/s, the standard specified in 40 CFR Part 61, Subpart Q, and radon-222 concentrations measured at the site boundary were well below 3 pCi/L, the limit for annual average radon-222 concentrations, not including background.

Total uranium concentrations in surface water across the Central Drainage Ditch were fairly stable with no evidence of a statistically increasing or decreasing trend. The most downgradient location in the Central Drainage Ditch, SWSD011, shows evidence of “probably increasing” trend. Both locations sampled along the West Drainage Ditch, WDD2 and WDD3, exhibit “increasing” trends. However, total uranium concentrations in 2019 at all three locations remain low: 7.81 µg/L and 9.65 µg/L at SWSD011; 2.24 µg/L and 3.8 µg/L at WDD2; and, 2.29 µg/L and 4.40 µg/L at WDD3. For comparison, the site-specific background total uranium concentration in surface water developed for use in the remedial investigation was 12.5 µg/L (USACE 2007).

Trend analysis shows uranium-238 concentrations in sediment increasing in a downgradient path along the Central Drainage Ditch. However, the highest concentration of uranium-238 detected at any location in 2019 was 3.06 pCi/g (SWSD010), which is less than the site-specific background concentration of 3.08 pCi/g reported in the remedial investigation (USACE 2007).

The maximum concentration of radium-226 in sediment detected in the Central Drainage Ditch in 2019 was 2.26 pCi/g at location SWSD025. For comparison, the site-specific background concentration developed for the remedial investigation was 2.43 pCi/g (USACE 2007). Radium-226 is known to be readily adsorbed to clays and mineral oxides present in sediment, especially near neutral and alkaline pH conditions, so it is usually not a mobile constituent in the environment. Therefore, radium-226 would not be expected to migrate significantly from the area where it is released or generated. Radium-226 concentrations in surface water continue to be predominantly nondetect or less than the laboratory detection limit.

The 2019 groundwater analytical data showed that total uranium concentrations in 25 groundwater monitoring wells exceeded the uranium drinking water criterion (30 µg/L). The most elevated total uranium concentrations continue to be detected in wells installed in late 2012 east and south of the IWCS as part of the Balance of Plant field investigation. The Corps of Engineers believes the source of uranium in wells east of the IWCS is residual soil contamination from former operations in this area, which included a railroad bed, storage piles, and a decontamination pad used during construction of the IWCS. In addition, residual contamination in the sanitary sewer near Manhole 6, which has been removed and the sewer line plugged, may have contributed to groundwater contamination in this area. The Corps of Engineers believes the former storage piles and residual contamination from former Building 409 are the source of the uranium in wells south of the IWCS (USACE 2015a). The uranium contamination in groundwater south of the IWCS, and in other site areas, was produced when the historical residue piles and storage areas leached uranium into the underlying low-permeability soils. Subsequent remediation removed the residue sources and some contaminated soils, whereas the underlying groundwater retained the dissolved uranium impacts.

Trend analysis shows increasing or “probably increasing” trends in 10 of 57 wells evaluated. Among the 10 wells, only two wells, OW04A and BH49AR, are located proximate to the IWCS. The cause of these

increasing uranium concentrations is likely legacy sources since there is no apparent trend pattern of increasing uranium concentrations when considering either their respective paired wells (OW04B and BH49R) or nearby wells.

It is noted that uranium concentrations normally increase during wet-season periods (winter through spring) and decline during dry-season periods (late spring through fall), which is evident to varying degrees in many upper water-bearing zone wells. This variation is due to a combination of residual low-concentration soil impacts (especially south of the IWCS) and changes in uranium solubility during seasonal soil saturation (or groundwater recharge) that increases the oxygen content in the subsurface. The seasonal oxygenation of groundwater increases the uranium solubility of pre-existing contamination, and thus increases concentrations in spring-time samples. Water levels decline throughout the summer and fall due to evapotranspiration of rainfall, which increases groundwater temperatures and reduces the oxygen content in groundwater. Iron-reducing bacteria samples also increase during this period. This geochemical mechanism lowers uranium solubility, promotes uranium adsorption to soil minerals, and lowers groundwater concentrations in fall samples. This geochemical process repeats annually, as seen in the spring and fall sampling data. This trend may be less evident or absent in wells with larger sand lenses, but is commonly evident in upper water-bearing zone wells.

1.0 INTRODUCTION

The U.S. Army Corps of Engineers is addressing the Niagara Falls Storage Site (NFSS) as part of the Formerly Utilized Sites Remedial Action Program (FUSRAP); this effort is subject to the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, and the National Oil and Hazardous Substances Pollution Contingency Plan. The site is located in the Town of Lewiston, New York, north of Buffalo (Figure 1).

The Corps of Engineers Buffalo District conducts the NFSS Environmental Surveillance Program (ESP); it performs site operations, maintenance, and monitoring to ensure protection of human health and the environment. These activities are ongoing across the site, including at Interim Waste Containment Structure (IWCS). The IWCS contains radiologically contaminated materials from cleanup actions the U.S. Department of Energy (DOE) conducted more than 20 years ago. The ESP is the focus of this report.

1.1 Brief History of the Niagara Falls Storage Site

The NFSS represents a portion of the former Lake Ontario Ordnance Works (LOOW). Portions of the LOOW were used by the Corps of Engineers Manhattan Engineer District (MED) and U.S. Atomic Energy Commission (AEC) to store radioactive residues and other materials beginning in 1944. Nearly all the radioactive residues in the IWCS originated from uranium (U) processing activities conducted for MED and AEC at two locations: the Linde Air Products facility in Tonawanda, New York, and the Mallinckrodt Chemical Works refinery in St. Louis, Missouri. Other residues were generated from past processing activities at the Middlesex Sampling Plant in New Jersey.

The first materials sent to NFSS for storage were low-grade radioactive residues from processing pitchblende ore at the Linde Air Products facility. These residues came about as a result of processing ores with different uranium (U_3O_8) contents; they are categorized as follows:

- R-10 residues: from processing ore with 3.5 percent U_3O_8
- L-30 residues: from processing ore with 10 percent U_3O_8
- L-50 residues: from processing ore with 7 percent U_3O_8
- F-32 residues: from processing ore (unknown percent U_3O_8)

Beginning in 1949, highly radioactive residues from uranium processing at the Mallinckrodt Chemical Works—referred to as the K-65 residues—were shipped to NFSS in 208-liter (L) (55-gallon [gal]) drums for storage. The residues were generated from uranium ore containing 35 to 65 percent U_3O_8 . Between 1950 and 1952, the K-65 residues were transferred from the 208-L (55-gal) drums to a large concrete tower on site, referred to as Building 434. The residues remained there until the DOE transferred them to the IWCS in the 1980s.

The K-65 residues represent the main hazard in the IWCS. Uncontained, the high levels of radium-226 (Ra-226) in these residues would emit substantial external gamma radiation and release radon-222 (Rn-222) gas to air. Without controls, the doses from external gamma irradiation and inhalation of Rn-222 progeny could harm anyone nearby.

In addition to these residues, radioactive wastes from a number of other federal government programs were sent to NFSS decades ago for storage or disposal. These included radioactive wastes from the Knolls Atomic Power Laboratory (KAPL) and the University of Rochester. The KAPL processing wastes contained some residual plutonium and fission product radioactivity (cesium-137 and strontium-90).

These materials were transferred to the Oak Ridge Burial Grounds during the late 1950s; most of the buildings where they were stored were later destroyed (EA 1998).

Based on an investigation of the former storage areas, the DOE concluded that all suspect areas had been remediated for unrestricted use, and that “although minor KAPL residuals remain, particularly cesium-137, they are less than a risk-based screening benchmark. Therefore, they do not pose an unacceptable risk and do not require further remediation” (DOE 2012).

From 1981 to 1991, the DOE performed a number of cleanup activities at the site and nearby areas known as vicinity properties. The DOE placed the radioactive materials generated by these activities in an engineered structure on the west side of the NFSS property, the IWCS (Figure 2).

Within the IWCS, the DOE placed the more highly contaminated residues (K-65, L-30, L-50, and F-32) in existing concrete structures that had been part of the freshwater treatment plant for the LOOW during the 1940s. It placed L-50 residues in Buildings 413 and 414, cylindrical structures made of reinforced concrete. They had been used as clarifier tanks at the treatment plant. The DOE placed the remaining residues in several bays of Building 411, which was also made of reinforced concrete. It had originally been designed to securely hold liquids.

The DOE placed contaminated soil and debris from its cleanup of the site and vicinity properties together with the R-10 residues within the IWCS and then compacted them to increase stability. Soils contaminated by the K-65 residues during interim storage, referred to as tower soils, were placed in the north end of Building 411. The DOE addressed the R-10 residues in the same manner as contaminated soil due to their similar radionuclide concentrations. It put additional contaminated soil and debris in the remaining areas of the IWCS so as to ensure the stability of the structure.

The IWCS was constructed by installing a clay dike and cutoff wall around the areas containing all the consolidated wastes. The wall was tied into the underlying clay formation. A multi-layered cap was placed over the contents after the cleanup actions were completed. These DOE actions are described in further detail in the remedial investigation report (U.S. Army Corps of Engineers [USACE] 2007) and the references cited therein.

In September 1986, the DOE issued a record of decision under the National Environmental Policy Act to store the consolidated residues and other contaminated materials in the IWCS. The record of decision identified the IWCS as an acceptable long-term management solution for the residues once the existing interim cap was replaced with a long-term, multi-layered, engineered cap. The design service life of the clay dike and cutoff walls surrounding the IWCS and the natural glaciolacustrine clay beneath the IWCS is 200 to 1,000 years (Bechtel National, Inc. [BNI] 1986); the design service life of the interim IWCS cap is 25 to 50 years (BNI 1986).

In October 1997, Congress transferred overall responsibility for implementing FUSRAP from DOE to the Corps of Engineers and directed that FUSRAP remediation be done according to CERCLA. With this transfer, the Corps of Engineers assumed responsibility for the remedial action process at NFSS.

Since that time, the Corps of Engineers completed a number of studies of the NFSS, including the *Remedial Investigation Report for the NFSS* (USACE 2007), *NFSS Remedial Investigation Report Addendum* (USACE 2011), *Feasibility Study Report for the IWCS at the NFSS* (USACE 2015b), *Proposed Plan IWCS Operable Unit* (USACE 2015c), and the *Feasibility Study Balance of Plant and Groundwater Operable Units* (USACE 2019). The *Record of Decision for the Interim Waste Containment Structure* signed in March 2019 selected remedial Alternative 4, complete removal and off-site disposal of all waste in the IWCS (USACE 2017).

1.2 Overview of Environmental Surveillance Program

The DOE initiated the ESP at the NFSS in 1979 before the construction of the IWCS, monitoring air, water, and external gamma radiation (and later streambed sediments) to ensure human health and environmental protection from radioactive residues and wastes later buried in the IWCS. In 1997, when responsibility for FUSRAP transferred to the Corps of Engineers, the Corps of Engineers Buffalo District continued to follow the DOE ESP, with some revisions over the years. The Corps of Engineers reports its findings annually in the form of this technical memorandum, which is posted to the NFSS website at <https://www.lrb.usace.army.mil/Missions/HTRW/FUSRAP/Niagara-Falls-Storage-Site/>.

The surveillance program is designed to achieve the following objectives:

- Ensure protection of human health and the environment
- Verify compliance with environmental regulatory standards
- Verify the IWCS is performing as designed

To meet these objectives, the Corps of Engineers monitors environmental media and regularly reassesses the adequacy of the program. If warranted, the Corps of Engineers makes necessary adjustments to the program. It has made several modifications to the surveillance program over time. These changes are identified on Table 1. Tables 2 and 3 show the ESP sampling schedule for groundwater and surface water/sediment, respectively. Sample locations and analytical parameters and methods are detailed in Section 2.0.

In addition to collecting and analyzing environmental samples, the ESP calculates the dose to off-site receptors from airborne emissions of site soils. To do this, the Corps of Engineers uses annual weather data collected at the Niagara Falls International Airport by the National Weather Service. The dose to off-site receptors based on gamma radiation measurements is also calculated and added to the airborne emissions dose to determine the cumulative dose to the public from the NFSS.

1.3 Regional Hydrogeology

1.3.1 Groundwater

The NFSS and surrounding vicinity are underlain by two water-bearing zones within 50 feet of the ground surface; these are separated by an aquitard, or confining unit. The two water-bearing zones, the upper water-bearing zone and the lower water-bearing zone, are detailed below.

The upper water-bearing zone is present in the surficial Brown Clay Unit. This is situated above the Gray Clay Unit (Figure 3). The Brown Clay Unit consists of a clayey silt and silty clay groundmass. It has occasional sand and gravel lenses. Coarse-grained deposits appear in places along the undulating contact between the Brown Clay Unit and the Gray Clay Unit.

The Corps of Engineers conducted a geostatistical analysis of these coarse-grained lenses to assess their continuity or whether they act as preferential migration pathways for contamination. Lithologic information from boring logs was spatially analyzed using semivariogram calculations and models.

The results suggest the sand lenses in the upper water-bearing zone are intermittent and vertically and horizontally discontinuous, vary considerably in thickness, color, texture, extent, and saturation, and are

not horizontally continuous over distances greater than 4.57 to 6.1 meters (15 to 20 feet) and vertical distances of 1.22 to 1.83 meters (4 to 6 feet). As a result, the occurrence of groundwater varies across the site (i.e., proximate wells may have noticeably different water levels depending on the presence or absence of sand lenses). Regional groundwater flow in the upper water-bearing zone is to the northwest towards Lake Ontario.

Underlying the Brown Clay Unit is the Gray Clay Unit, which consists of glacio-lacustrine clay and acts as an aquitard that separates the upper water-bearing zone from the lower water-bearing zone and minimizes transport between the two zones (Figure 3). For purposes of classification, wells that terminate in the Gray Clay Unit are considered representative of the upper water-bearing zone.

The lower water-bearing zone consists of unconsolidated glacial sediments, most notably the Alluvial Sand and Gravel that overlie the upper, fractured portion of the Queenston Formation (Figure 3). It extends from the bottom of the Gray Clay Unit to the bottom of the weathered zone of the Queenston Formation. A regional groundwater divide (the Lockport Escarpment) is approximately two miles south of the NFSS. Regional groundwater flow north of the divide is toward the northwest, whereas groundwater flow south of the divide is toward the southwest.

The entire lower zone varies from 3.05 to 11.73 meters (10 feet to 38.5 feet) in thickness; it consists of the stratified sands and gravels of the Alluvial Sand and Gravel Unit, the dense silt and sands of the Red Silt Unit, and the weathered and fractured upper portions of the Queenston Formation in the upper 3.05 meters (10 feet) of the bedrock. The lower water-bearing zone has higher permeability and more lateral continuity than the upper water-bearing zone. The lower water-bearing zone generally shows a westerly to northwesterly flow.

1.3.2 Surface Water Drainage

Before site development, surface drainage from the NFSS entered Four Mile, Six Mile, and Twelve Mile Creeks. All of these flow northward to Lake Ontario. During the 1940s, drainage modifications routed surface water to a series of linear ditches that eventually coalesce into the Central Drainage Ditch. The Central Drainage Ditch enters into Four Mile Creek approximately 3 miles northwest of the NFSS. The vegetation that grows in the on-site ditches during the summer months dewater the ditches via evapotranspiration between rainfall events.

Groundwater elevations in wells near the ditches are notably lower throughout the summer and early fall; this is due to higher localized evapotranspiration. In other words, wetland vegetation in and along the ditches creates a significant moisture deficit in the surrounding soils. Low baseflow conditions in the site ditches between rainfall events also indicate that groundwater in the clayey soils does not significantly discharge into the ditches (i.e., surface drainage is the main contributor to flow).

2.0 SAMPLE COLLECTION AND ANALYSIS

2.1 Sampling Locations and Rationale

The purpose of the ESP is to ensure the protection of human health and the environment by monitoring the IWCS and other site media for release of hazardous constituents.

To monitor the integrity of the IWCS, the Corps of Engineers collects:

- Annual radon-222 flux data via 180 radon flux canisters placed on the IWCS protective cap at discrete grid intersections and at three off-site (background) locations, as shown on Figure 4.
- Semiannual groundwater samples from 44 monitoring wells, 13 wells screened in the lower water-bearing zone and 31 wells screened in the upper water-bearing zone, near the IWCS (two wells are sampled on a quarterly basis), as shown on Figure 5.
- Semiannual radon and external gamma radiation samples by placing Radtrak2® detectors and optically stimulated luminescence dosimeters (OSLDs), respectively, at seven locations around the perimeter of the IWCS, as shown on Figure 6.
- Semiannual surface water and sediment sampling from a total of nine locations shown on Figure 7 along the West Drainage Ditch, Central Drainage Ditch, and east (upstream) of the Central Drainage Ditch (one location is sampled on a quarterly basis).
 - SWSD009, SWSD021, and SWSD023 were selected as “upstream” locations because they are located at the site boundary where surface water flows onto NFSS from off site.
 - SWSD010, SWSD011, SWSD022, and SWSD025 are situated along the Central Drainage Ditch.
 - WDD2 and WDD3 are located along the West Drainage Ditch.

In addition, the Corps of Engineers collects:

- Semiannual groundwater samples from 11 monitoring wells, one well screened in the lower water-bearing zone and ten wells screened in the upper water-bearing zone, as shown on Figure 5 (note that well MW922 is sampled only if well MW921 is dry).
- Semiannual radon and external gamma radiation samples by placing Radtrak2® detectors and OSLDs, respectively, at 16 locations within and around the perimeter of the site and at three off-site (background) locations, as shown on Figure 6.
- Quarterly water level measurements in over 100 monitoring wells throughout the site to monitor the groundwater flow directions in the upper and lower water-bearing zones.

2.2 Sampling Parameters and Laboratory Analytical Methods

Environmental surveillance monitoring of air, water, and sediment includes the following analytes:

- The IWCS cap and off-site locations are monitored for radon-222 flux.
- The perimeter of the IWCS and the NFSS and off-site locations are monitored for radon concentrations and gamma emissions.
- Sediment is monitored for total uranium and radium-226, as well as metals and polycyclic aromatic hydrocarbons (PAHs) (to evaluate potential impacts from off-site sources such as Modern Landfill).
- Surface water is monitored for total uranium, radium-226, metals, and PAHs; field measurements are recorded for dissolved oxygen, turbidity, pH, temperature, specific conductivity, and oxidation-reduction potential.

- Groundwater is monitored for total uranium, radium-226, volatile organic compounds (VOCs) (limited to five wells), anions, and water quality parameters; field measurements are recorded for dissolved oxygen, turbidity, pH, temperature, specific conductivity, and oxidation-reduction potential.

The Corps of Engineers uses standard analytical methods approved and published by EPA and the American Society for Testing and Materials (ASTM) for chemical (i.e., all nonradiological) analyses. The laboratories conducting the radiological analyses adhere to EPA, National Urban Security Technology (formerly the Environmental Measurements Laboratory) and ASTM standard methods. Radiological and chemical laboratories are accredited through the Department of Defense (DOD) Environmental Laboratory Accredited Program. That accreditation is based on conformance to the DOD Quality Systems Manual for Environmental Laboratories. The laboratory analytical methods associated with sediment, surface water, and groundwater monitoring are presented in the following table:

Parameter	Analytical Method		
	Groundwater	Surface Water	Sediment
Volatile Organic Compounds	SW 846 8260 (select wells only)	---	---
Polycyclic Aromatic Hydrocarbons	---	SW 846 8270	SW 846 8270
Metals	---	SW 846 6010/6020/7470	SW 846 6010/7470
Total Uranium	ASTM D5174.97, Trace Uranium by Pulsed Laser Phosphorimetry	ASTM D5174.97 Trace Uranium by Pulsed Laser Phosphorimetry	HASL-300m, Iso-uranium
Radium-226	EPA 903.1	EPA 903.1	EPA 901.1m
Anions •Chloride •Fluoride •Nitrate/Nitrite •Ortho-phosphate •Sulfate	EPA 300.0 ¹	---	---
Water Quality •Alkalinity •Total Dissolved Solids	SM-2320B SM-2540C	---	---

¹ Ortho-phosphate is tested as phosphorus using method A4500-P-F (4500-P Standard Method)

--- Indicates that media is not analyzed for that parameter(s)

2.3 Sample Collection Techniques

All environmental surveillance activities at the NFSS are conducted in accordance with DOD Environmental Field Sampling Handbook (DOD 2013) and the Uniform Federal Policy for Quality

Assurance Project Plans (UFP-QAPP). The UFP-QAPP provides procedures and guidance on implementing the national consensus standard (ANSI/ASQ E-4, *Quality Systems for Environmental Data and Technology Programs*) for the collection and use of environmental data at federal facilities.

2.3.1 Groundwater and Surface Water

The Corps of Engineers collects groundwater samples using low-flow sampling techniques in accordance with EPA's Ground Water Issue Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures (EPA/540/S-95/504). Existing polyethylene tubing is used for each well during each sampling event and is replaced when necessary. The Corps of Engineers also measures groundwater levels and uses sample collection techniques in accordance with Engineering Manual 1110-2-1421, *Groundwater Hydrology* (USACE 1999).

The Corps of Engineers collects surface water samples by using a peristaltic pump. This type of pump is needed because of the shallowness of the designated ditch locations. New polyethylene tubing is carefully placed below the water line to minimize disturbance of organic materials and sediments in the ditch.

If turbidity measurements for any groundwater or surface water sample exceed 50 nephelometric turbidity units (NTUs), the Corps of Engineers field filters the sample via a disposable 0.45 micron in-line filter to remove solids and reduce the turbidity readings to below the 50 NTU threshold. Both the filtered and unfiltered samples are sent to the laboratory for analysis.

2.3.2 Sediment

The Corps of Engineers collects sediment using a stainless steel posthole digger. This digger works well in areas where there are excess fibrous materials and roots from phragmites. A sample consists of several grab samples (5 to 10 centimeters [2 to 4 inches] in depth) near the center of the ditch below the water line. The cores are placed in a stainless steel pan and are composited into sample containers.

2.3.3 Radon Flux

The Corps of Engineers measures radon flux at the NFSS once a year between early to late summer. An effective means of trapping radon gas is activated charcoal. Metal canisters filled with activated charcoal and filter pads are placed on the ground in the morning and collected 24 hours later.

The activated charcoal in the canister adsorbs the radon gas emanating from the surface over which the canister is placed. The charcoal holds the radon, which subsequently decays until equilibrium between radon and its short-lived daughters is established (a minimum of 3 hours). The radon flux is calculated in the laboratory through gamma spectroscopy using the area of canister exposed to the radon flux and the time that exposure took place.

2.3.4 Radon Gas

The Corps of Engineers monitors radon gas concentrations using Radonova Radtrak2® detectors placed around the IWCS and the NFSS. The Radtrak2® detectors are placed on the fence at breathing height (1.7 meters [5.6 feet] above the ground) and replaced every six months. The Radtrak2® detector consists of a small piece of film inside an anti-static plastic container. Radon diffuses through a plastic cover in the container; alpha particles from radon and its decay products strike the film and produce alpha tracks. At the end of the deployment, the detectors are returned to a laboratory for analysis, i.e., the alpha tracks are chemically etched and counted using computer-assisted image analysis equipment. The number of

alpha tracks along with the deployment duration provides the basis for converting calculated radon exposure to the average air concentration.

2.3.5 Gamma Emissions

External gamma radiation is monitored at the NFSS by Landauer optically stimulated luminescent dosimeters (OSLDs) placed around the IWCS and the NFSS at the same locations as the Radtrak2® detectors, at a height of 0.91 meters (3 feet) above the ground. Two OSLDs are placed at each location for quality control. The OSLDs are also replaced every six months.

Optically-stimulated luminescence technology is the newest advancement in passive radiation protection dosimetry; it improves on the best features of traditional film and thermo-luminescent dosimeter (TLD) technologies. The specific OSLDs used at NFSS consist of specially formulated aluminum oxide crystalline detector material; this is configured into a thin strip sandwiched within a multi-element filter pack. The filter pack is heat sealed with a laminated, light-tight paper wrapper, creating an integrated, self-contained packet that is radio-frequency sealed inside a tamper-proof plastic blister pack to eliminate possible mishandling, light leaking, or lost detection elements.

Radiation exposure is measured at the laboratory by stimulating the aluminum oxide crystalline detector material with selected frequencies of laser light; this causes it to luminesce in proportion to the amount of radiation exposure.

3.0 REGULATORY GUIDELINES

The criteria in federal statutes and federal and state regulations and guidelines relevant to activities at NFSS are compared to ESP analytical data. However, the standards and criteria provided herein are for comparative purposes only; applicable or relevant and appropriate requirements and media-specific cleanup goals will be evaluated independently and presented in future CERCLA decision documents that will be available for public comment. Details are provided in the following sections.

3.1 Dose to the Public

The annual public dose limit from sources of radiation (excluding radon) is 100 millirem (mrem) above background. This standard is used by the U.S. Army, the DOE, and the Nuclear Regulatory Commission (NRC). This limit is stated in Army Pamphlet 385-24 entitled *The Army Radiation Safety Program*, DOE Order 458.1 entitled *Radiation Protection of the Public and the Environment* (DOE 2011), and NRC 10 CFR Part 20 entitled *Standards for Protection Against Radiation*.

Doses from sampled media and external gamma can be combined and compared to the public annual dose limit of 100 mrem. For purposes of this document, the maximum off-site dose to a receptor is calculated from the total of the external gamma dose and the internal dose from airborne materials.

3.2 Radioactive Constituents in Air

3.2.1 U.S. Department of Energy Order 458.1

The DOE limits for radon concentrations in air from operations at DOE-owned and -operated facilities are presented in DOE Order 458.1. Based on the radioactive constituents in the wastes contained in the IWCS, it's unlikely that radon-220 would be emitted from the IWCS. This is because the radon-220 half-life is approximately 55.6 seconds; this isotope would decay before it permeated the IWCS cap. It is possible, however, that radon-222 with a half-life of 3.8 days could be emitted. The DOE limit for an annual average radon-222 concentration at the site boundary, not including background, is 3.0 picocuries/liter (pCi/L). To provide a conservative basis for comparison, on-site radon concentrations are evaluated against the site boundary limit of 3.0 pCi/L.

3.2.2 U.S. Environmental Protection Agency Clean Air Act

The EPA guidance action level for radon concentrations in indoor air (homes and buildings) is 4.0 pCi/L. Although this limit is specific to indoor air, it is a conservative basis for comparing the outdoor air results of the environmental surveillance. To compare further, the average radon level in U.S. homes is about 1.25 pCi/L, and the average outdoor value is 0.4 pCi/L (National Council on Radiation Protection and Measurements [NCRP] 2009).

Section 112 of the Clean Air Act authorized the EPA to promulgate the National Emission Standards for Hazardous Air Pollutants (NESHAPs), which are provided in 40 Code of Federal Regulations (CFR) Part 61. The 40 CFR Part 61, Subparts H and Q, apply to the NFSS; they are summarized below:

- 40 CFR 61.92, Subpart H, National Emission Standards for Emissions of Radionuclides Other Than Radon from DOE Facilities: emissions of radionuclides to the ambient air from DOE facilities shall not exceed amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem.
- 40 CFR 61.192, Subpart Q, National Emission Standards for Radon Emissions from DOE Facilities: no source at a DOE facility shall emit into the air more than 20 picocuries per square

meter per second ($\text{pCi}/(\text{meter}^2\text{-sec})$) ($1.9 \text{ pCi}/(\text{feet}^2\text{-sec})$) of radon-222 as an average for the entire source.

At the NFSS, the Corps of Engineers complies with 40 CFR 61.92, Subpart H, by running the EPA-approved CAP88-PC air dispersion model with site-specific input values, such as average radionuclide concentrations in soil and average annual wind speed data. Compliance with 40 CFR 61.192, Subpart Q, is verified by annual monitoring of the IWCS cap for radon-222 flux.

3.3 Radioactive and Chemical Constituents in Groundwater

3.3.1 General Groundwater Quality

Shallow groundwater resources at the NFSS demonstrate uniformly poor groundwater quality and availability in the region. Regional studies and studies conducted near the site (La Sala, 1968, Wehran 1977, and Acres American 1981) conclude that local groundwater quality is poor because of high mineralization. Additionally, local studies indicate that the low permeability of the upper water-bearing zone doesn't provide sustainable production quantities to standard wells for water supply use (Wehran 1977 and Acres American, 1981). On-site permeability testing at the NFSS confirms the low permeability.

In 1988, the DOE conducted a well survey; it found eight wells within three miles (4.8 km) of the site. They are used mainly for irrigation; none are drinking water wells (DOE 1994).

In 2007, the Niagara County Department of Health (DOH) updated its well inventory to include nine potable wells (two were a sole source for drinking water), eight nonpotable wells, 20 abandoned wells, and 77 idle wells within the survey area. Based on the DOE report and the recent Niagara County DOH inventory, groundwater isn't the main source of drinking water; however, the New York State Department of Environmental Conservation (NYSDEC) Class GA groundwater standards are conservatively used to compare to ESP groundwater analytical results. Groundwater at the NFSS and surrounding area, in both the upper and lower water-bearing zones, consistently (and naturally) exceeds sodium and sulfate Class GA standards; it exhibits over 1,000 milligrams/liter (mg/L) total dissolved solids and commonly over 250 mg/L of chloride. By definition, these levels indicate that the natural condition of groundwater in the NFSS area is saline and qualifies for the GSA groundwater classification (Title 6 New York Codes, Rules and Regulations (6 NYCRR) Part 701.16).

3.3.2 Federal Safe Drinking Water Act for Chemicals and Radionuclides

The Safe Drinking Water Act (SDWA) is the primary federal law that applies to operating a public water system and developing drinking water quality standards [*EPA Drinking Water Regulations and Health Advisories* (EPA 1996)]. The regulations in 40 CFR Part 141 (National Primary Drinking Water Regulations) set maximum permissible levels, known as maximum contaminant levels (MCLs), for organic, inorganic, radionuclide (including uranium and combined radium), and microbial contaminants in drinking water.

The established (promulgated) MCL for combined concentrations of radium-226 and radium-228 is 5 pCi/L. The MCL for total uranium is 30 micrograms per liter ($\mu\text{g/L}$).

3.3.3 New York State Department of Environmental Conservation Groundwater Criteria for Chemicals and Radionuclides

Aside from adopting the federal SDWA standards, the NYSDEC has promulgated its own standards; they are presented in 6 NYCRR Part 703.5, “Water Quality Standards for Taste-, Color- and Odor-producing, Toxic and Other Deleterious Substances” (NYSDEC 1998). The New York State (NYS) limit for radium-226 in groundwater is 3 pCi/L.

Also, the New York State DOH, per 10 NYCRR Part 5, Subpart 5-1, established an MCL of 30 µg/L for uranium in drinking water that applies to community water systems but doesn’t apply to groundwater at the site. Since this limit is identical to the federal criteria, the analytical results discussed in Section 4.0 only reference NYS criteria.

3.4 Radioactive and Chemical Constituents in Sediment

The 2007 NFSS remedial investigation report evaluated sediment analytical data and considered a weight-of-evidence approach to conclude no further actions were needed to protect ecological resources from exposure to site sediment. (No human health impacts were identified either.) Therefore, data collected as part of the ESP will not be compared to regulatory criteria but will be subjected to statistical trend analysis (radionuclides only), e.g., Mann-Kendall test, to ensure that the IWCS is performing as designed.

3.5 Radioactive and Chemical Constituents in Surface Water

The 2007 NFSS remedial investigation report evaluated surface water analytical data and considered a weight-of-evidence approach to conclude no further actions were needed to protect ecological resources from exposure to site surface water. (No human health impacts were identified either.) Therefore, data collected as part of the ESP will not be compared to regulatory criteria but will be subjected to statistical trend analysis (radionuclides only), e.g., Mann-Kendall test, to ensure that the IWCS is performing as designed.

4.0 ANALYTICAL DATA AND INTERPRETATION OF RESULTS

This section presents the 2019 ESP analytical results for groundwater, surface water, sediment, airborne particulate, radon, and gamma radiation. It's important to note that results for radioactive constituents may be expressed as negative numbers. Negative numbers can occur when the average background activity of the laboratory counting instrument exceeds the measured sample activity; background activity is subtracted from the measured sample activity to calculate the result. Also, when results fall below the laboratory's minimum detectable activity (MDA), they are interpreted as having unknown values between zero and the MDA; these are referred to herein as nondetects.

4.1 Air

To establish the annual dose to the public from radiological sources in air, the Corps of Engineers determines doses at specific off-site receptors by combining (1) the calculated external gamma radiation doses based on gamma radiation dose measurements taken at the NFSS perimeter and (2) modeled doses from airborne particulate releases using soil data from the remedial investigation and later field investigations and annual average wind speed.

4.1.1 External Gamma Radiation

OSLDs measure gamma radiation doses at the NFSS but these measurements also include natural sources of background radiation, such as cosmic radiation and terrestrial radiation.¹ To measure background gamma radiation near the NFSS, OSLDs are placed at several locations in the vicinity of the NFSS including Lewiston Porter High School, Balmer Road, and the Lewiston Water Pollution Control Center. At the NFSS, the OSLDs are placed along the property boundary and perimeter of the IWCS (Figure 6). Two OSLDs are placed at each monitoring location as a quality control check and to provide data if an OSLD is lost or a result is rejected. The OSLDs are replaced semi-annually.

Following receipt of the laboratory analytical data, the Corps of Engineers calculates a time-weighted or normalized annual dose that accounts for exposure periods having different integration times (a different number of measurement days). The 2019 results, including both corrected for transit and background, are presented in Table 4. The net dose rate at each OSLD location is used to calculate the annual gamma radiation dose at each of the four property boundaries or perimeter fences, as shown in the table below (background rates are shown for comparison).

Direction	OSLD Locations	Calculated Average Net Dose Rate (mrem/year) ^a
Eastern Perimeter (closest to worker receptor)	45, 50, 55, 65	6.0
Western Perimeter (closest to residential receptor)	8, 10, 11, 13, 15, 29, 36	3.8
Northern Perimeter	1, 11, 12, 60, 65, 122	1.2
Southern Perimeter	7, 28, 29, 45	6.7

^a Net dose rates (corrected for background) for each perimeter are summed and divided by the total number of observations (e.g., 14 for the western perimeter)

¹ In the United States, the annual average per capita cosmic and terrestrial radiation doses are 34 millirem per year and 22 millirem per year, respectively (NCRP Report 160)

As indicated in the table above, the calculated average net dose rates at the NFSS perimeter fences ranged from 1.2 to 6.7 mrem/year, which are below the allowable public dose limit of 100 mrem/year above background (see Section 3.1). The average net dose rates at the NFSS perimeter fences used to calculate the hypothetical dose to the nearest worker and residential receptors consider both exposure time and distance. For example, the dose received by a hypothetical industrial worker standing at the eastern perimeter fence over the period of one year is 1.38 mrem/year. Calculation details are as follows:

- The worker stands at the fence for 2,000 hours (8 hours per day, 5 days a week, 50 weeks per year); note that distance is ignored here although the worker would not be at the fence all the time
- 2,000 hours out of a possible 8,760 hours in a year (24 hours in a day, 365 days in a year) represents a fraction of 0.23 (2,000/8,760 hours)
- An industrial worker standing at the eastern perimeter fence where the calculated net dose is 6.0 mrem/year receives a dose of 1.38 mrem/year (6.0 mrem/year multiplied by 0.23)

Trend graphs depicting external gamma dose rates at the NFSS and IWCS perimeters from 1998 thru 2019 are presented on Figures 8 and 9, respectively.

4.1.2 Airborne Particulate Dose

To determine the dose from airborne particulates potentially released from NFSS during 2019, the Corps of Engineers calculates airborne particulate release rates using site soil data (from the remedial investigation initiated in 1999 through field investigations conducted in 2014) and weather data collected at the Niagara Falls International Airport in 2019.

Contributions from radon gas, which is not a particulate, are not considered in this calculation. The total airborne particulate release rate is input into the EPA's CAP88-PC (Version 4.0) computer model to calculate:

- Doses from airborne particulates to individuals of several population age groups in the nearest residence, school, farm, and commercial/industrial facility, as measured from a central location on site. Doses are then corrected for occupancy at an assumed rate, and the individual receiving the higher of these calculated doses is identified as the maximally exposed off-site individual (MEI) for airborne particulate dose.
- Airborne particulate collective dose to the population within 50 miles (80 km) of the site using population data for the United States and Canada from Landscan 2013 Global Population Data from Oak Ridge National Laboratory (Figure 10).

The first calculation indicates that the annual airborne particulate dose to the MEI, an infant resident, 914 meters (2,999 feet) south-southwest of the site, in 2019, was 0.00018 mrem. Consistent with results from previous years, this value is well below the 10 mrem per year standard, individual dose, specified in 40 CFR, Part 61.92, Subpart H.

The second calculation indicates that the annual airborne particulate collective dose to the population within 80 km (50 miles) of the site in 2019 was 0.000394 person-rem. This compares to an annual background dose to the same population of 5,425,000 person-rem. Details of the calculations, including methodology, are presented in the Corps of Engineers' *FUSRAP CY2019 NESHAP Annual Report for Niagara Falls Storage Site (NFSS)*, Lewiston, New York (USACE 2020).

4.1.3 Calculated Cumulative Dose

As a conservative measure, the cumulative dose to the MEI, which is calculated by adding the maximum airborne particulate dose to the maximum external gamma dose, is compared to the 100 mrem per year dose limit (excluding radon). The maximum external dose is conservatively estimated to be the dose at the southern perimeter fence (i.e., a resident is assumed to stand at the fence 24 hours a day for 365 days). Based on 2019 data, the cumulative annual dose is 6.7 mrem (0.00018 mrem + 6.7 mrem), which is significantly less than the DOE limit of 100 mrem per year² (excluding radon) and the U.S. average per capita background dose of approximately 620 mrem per year (NCRP 2009).

4.1.4 Radon Gas

Radon monitoring at NFSS is performed at a height that represents the human breathing zone (1.7 meters or 5.6 feet above ground level). Radon concentration diminishes significantly as distance from the ground increases and mixing with ambient air takes place.

Based on the radioactive constituents in the wastes contained in the IWCS, it's unlikely that the IWCS would emit radon-220; however, it's possible that it would emit radon-222. The Corps of Engineers uses Radtrak2® detectors to conduct air surveillance to determine the concentration of radon gas at NFSS. These Radtrak2® detectors measure alpha particle emissions from radon-222 and collect passive, integrated data throughout the period of exposure. Because radon-220 isn't a contaminant of concern at NFSS (due to the relatively low concentrations of radium-228 and the short half-life of radon-220), all concentrations are assumed to be radon-222.

Typically, the Corps of Engineers monitors for radon gas semi-annually; however, due to elevated radon flux measurements recorded in September 2019, which is explained in more detail in section 4.1.5, Radtrak2® detectors deployed in July were replaced in October to ensure that there was no increase in radon gas concentrations along the site perimeter. The corresponding surveillance locations are shown on Figure 6.

The results, presented in Table 5, indicate that there was no increase in radon gas at the site perimeter during any of the three monitoring periods in 2019. Consistent with results from previous years, all site radon-222 results from the 2019 ESP were well below the DOE off-site limit of 3.0 pCi/L above background. Results presented are without background subtracted and ranged from nondetect (less than 0.4 pCi/L) to 0.6 pCi/L. The results from the background locations ranged from nondetect (less than 0.4 pCi/L) to 0.5 pCi/L. Including nondetects, the site and background averages are both 0.4 pCi/L, which is equal to the average outdoor value of 0.4 pCi/L (EPA 1993).

4.1.5 Radon-222 Flux

Measurement of radon-222 flux provides an indication of the rate of radon-222 emission from a surface. Radon-222 flux is measured with activated charcoal canisters placed on a grid spaced 15 meters (49.2 feet) on center across the surface of the IWCS for a 24-hour exposure period. Sample locations are shown on Figure 4.

The initial 2019 radon flux event took place on July 8 and 9. Measured results from this event, presented on Table 6A, ranged from nondetect to 23.0501 pCi/m²/s, with an average result (of detects and

² The U.S. per capita dose from background radiation has been increased to 620 mrem/person due mainly to increased use of nuclear medical imaging.

nondetects) of 0.2109 pCi/m²/s. Average background flux rate was 0.05148 pCi/m²/s. These results were similar to previous years at most locations, however, the flux result at sample location 65 (23.0501 pCi/m²/s) was higher than past results. Despite being elevated compared to past results, the average of all the data remained below 20 pCi/m²/s, the standard specified in 40 CFR Part 61, Subpart Q.

As part of an investigation to identify the source of the elevated measurement at location 65, the Corps of Engineers requested that the laboratory confirm that the canisters deployed at locations 62 (elevated in 2018) and 65 (elevated in 2019) were not contaminated prior to their use. It is noted that the canisters used by the Corps of Engineers are re-used annually after they are decontaminated by the laboratory. The laboratory tested the canisters and reported their findings of no contamination on September 4, 2019.

On September 6 and October 18, 2019, using 2-inch x 2-inch NaI paired with a geographic positioning unit, the Corps of Engineers performed gamma walkover surveys (GWS) on top of the IWCS in the area where canisters 62 and 65 are located. Located below this area within the IWCS is the eastern wall of Building 411 where the radioactive residues are contained. The GWS identified small localized areas of elevated surface count rates indicative of deposited short-lived radon progeny (e.g., lead-214 and bismuth-214) (Figure 4A). Patches of brown and stressed grass were observed during the GWS in the areas surveyed.

Between October 9 and October 24, 2019, the Corps of Engineers performed additional radon flux sampling at the locations identified in the GWS's as shown on Figure 4A. A total of 15 locations were monitored, including canister locations 47, 62, and 65 and 12 bias locations (B1 through B12) identified during the GWS. Four of the 15 locations were monitored twice. As shown in Table 6B, radon flux at these locations ranged from 0.68 pCi/m²/s at B6 to 243.07 pCi/m²/s at B7. The data demonstrates that isolated areas of the IWCS cover are not effectively mitigating the release of radon-222.

The Corps of Engineers has evaluated strategies to fix the problem and decided to proceed with an iterative approach. First, several inches of topsoil and grass seed will be added in late spring 2020 to the areas where elevated readings and distressed grass were identified, around canister locations 62 and 65 (Figure 4A). The Corps of Engineers believes that enhancing the grass cover will restore optimal moisture to the underlying clay layer that may have developed desiccation cracks or become otherwise more susceptible to gas transport. Once the cover is replaced, radon flux measurements will determine whether this approach has been successful. If radon flux levels are not reduced, the Corps of Engineers will explore ways to repair the underlying clay blanket.

4.2 Surface Water

In 2019, all surface water samples were collected semiannually (2nd and 4th quarters) from nine designated locations. Location SWSD025 is also sampled during 1st and 3rd quarters. For five years (2013 through 2018), location SWSD025 was sampled by an auto-sampler during significant rain events. In late 2018, the auto-sampler experienced mechanical failure and the decision was made to discontinue rain event sampling because the rain event data reflect the same range as quarterly data, neither of which show increasing trends in contaminant concentrations. It is suspected that the rain event data reflect first-flush storm flows that dilute any standing water or groundwater seepage in the Central Drainage Ditch that accumulates between storm flows. Sample locations are presented in Figure 7.

A summary of the surface water sample collection effort is as follows:

- 2nd quarter samples were collected on May 23 and 29, 2019
- 4th quarter samples were collected on October 21 through 23, 2019

- 1st and 3rd quarter samples were also collected from SWSD025 on March 12 and August 28, 2019, respectively
- Analytical parameters included radium-226, total uranium, PAHs, and metals

All surface water samples are measured for turbidity prior to submission to the laboratory for analysis. If turbidity measurements are greater than 50 NTUs, the sample is field filtered, and both the filtered and unfiltered samples are submitted to the laboratory for analysis (applies to radionuclides and metals only). Otherwise, only an unfiltered sample is collected and analyzed.

Details of the findings are presented in the following sections.

4.2.1 Surface Water Field Measurements

Before sampling, the Corps of Engineers measures field parameters at each surface water sampling location using a calibrated water quality meter. Field parameters include temperature, pH, specific conductance, oxidation-reduction potential, turbidity, and dissolved oxygen. The results are summarized on Table 7.

4.2.2 Surface Water Radiological Findings

In general, the 2019 analytical results for radionuclides in surface water, which are presented on Table 8, were comparable to past results. Details are presented in the following sections.

Radium-226

Radium-226 was not detected in 18 of 24 surface water samples, which included two filtered samples. Among the six detections, the concentrations ranged between 0.24 pCi/L (SWSD009) to 2.39 pCi/L, both at SWSD009, and were within the range of historical results.

Radium-226 concentrations in surface water are not subjected to trend analysis (e.g., Mann-Kendall) because reported results are predominantly less than the laboratory detection limit, precluding the accurate assessment of trends. The test loses significant statistical power if most of the data are censored (below detection limits).

Total Uranium

Uranium was detected in all 23 surface water samples collected in 2019, which included two filtered samples. Concentrations ranged from 2.24 µg/L at WWD2 to 12.1 µg/L at SWSD025.

Total uranium concentrations detected in surface water over the course of the Corps of Engineers' ESP (1997 through 2019) are evaluated by the Mann-Kendall test to identify the presence of a statistically significant trend using *GSI Mann-Kendall Toolkit* software (GSI Environmental 2012). The Mann-Kendall test, described in the Corps of Engineers' Manual *Environmental Quality—Environmental Statistics* (USACE 2013b), is an accepted method for identifying the presence of a significant trend in surface water.

The *GSI Mann-Kendall Toolkit* limits the amount of data considered per monitoring location to 40 data points, so if the amount of data exceeds 40, the most recent results are evaluated. In addition, although the *GSI Mann-Kendall Toolkit* evaluates a data set with as few as four data points, sample sizes of 10 or less are marginal for definitively determining a trend because the test's statistical power increases as the

amount of data evaluated increases.

The *GSI Mann-Kendall Toolkit* software employs the following statistical metrics to define the concentration trend at each monitoring location:

- **The ‘S’ Statistic:** Indicates whether concentration trend vs. time is generally decreasing (negative *S* value) or increasing (positive *S* value).
- **The Confidence Factor (CF):** The CF value modifies the *S* Statistic calculation to indicate the degree of confidence in the trend result, as in ‘Decreasing’ vs. ‘Probably Decreasing’ or ‘Increasing’ vs. ‘Probably Increasing.’ Additionally, if the confidence factor is quite low, due either to considerable variability in concentrations vs. time or little change in concentrations vs. time, the CF is used to apply a preliminary ‘No Trend’ classification, pending consideration of the coefficient of variation (COV).
- **The Coefficient of Variation:** The COV is used to distinguish between a ‘No Trend’ result (significant scatter in concentration trend vs. time) and a ‘Stable’ result (limited variability in concentration vs. time) for datasets with no significant increasing or decreasing trend (e.g. low CF).

By using the metrics described above, the concentration trend is matched to one of six categories: Increasing, Decreasing, Probably Increasing, Probably Decreasing, Stable, or No Trend. The following table presents the logic used by *GSI Mann-Kendall Toolkit*.

Statistical Metrics Used in GSI Mann-Kendall Toolkit		
S Statistic	Confidence In Trend	Trend
$S > 0$	$CF > 95\%$	Increasing
$S > 0$	$95\% \geq CF \geq 90\%$	Probably Increasing
$S > 0$	$CF < 90\%$	No Trend
$S \leq 0$	$CF < 90\%$ and $COV \geq 1$	No Trend
$S \leq 0$	$CF < 90\%$ and $COV < 1$	Stable
$S < 0$	$95\% \geq CF \geq 90\%$	Probably Decreasing
$S < 0$	$CF > 95\%$	Decreasing

Source: Aziz et al. (2003).

The results of the trend evaluation (spring and fall data from 1997 to 2019) of total uranium in surface water are presented in Attachment B-1 and summarized in the table below.

Mann-Kendall Trend Results for Total Uranium in Surface Water			
SAMPLE ID	SAMPLE SIZE	RESULTING TREND	LOCATION ALONG DITCH
Central Drainage Ditch			
SWSD009	35	No Trend	Upgradient
SWSD021	34	Probably Decreasing	Upgradient
SWSD023	16	No trend	Upgradient
SWSD010	37	Stable	Midgradient 1
SWSD022	36	No trend	Midgradient 2
SWSD025 ¹	37	Stable	Midgradient 3
SWSD011	36	Probably Increasing	Downgradient
West Drainage Ditch			
WDD2	16	Increasing	Upgradient
WDD3	16	Increasing	Downgradient

¹Only the results from the scheduled sampling events (i.e., not the rain events) are included in the trend analysis (due to the sample set exceeding the maximum allowable 40 data points when all data is considered).

The results indicate fairly stable total uranium concentrations in surface water across the Central Drainage Ditch with no evidence of a statistically increasing or decreasing trend. The most downgradient location in the Central Drainage Ditch, SWSD011, shows evidence of “probably increasing” trend. Both locations sampled along the West Drainage Ditch, WDD2 and WDD3, exhibit “increasing” trends. However, total uranium concentrations in 2019 at all three locations remain low: 7.81 µg/L and 9.65 µg/L at SWSD011; 2.24 µg/L and 3.8 µg/L at WDD2; and, 2.29 µg/L and 4.00 µg/L at WDD3. For comparison, the site-specific background total uranium concentration in surface water developed for use in the remedial investigation was 12.5 µg/L (USACE 2007).

4.2.3 Surface Water Chemical Findings

The 2019 analytical results for PAHs and metals in surface water are presented in Attachment A as Tables A-1 and A-2, respectively. Trace levels of PAHs were detected, predominantly at upgradient locations. Several metals also were detected in surface water samples. The results were comparable to previous years.

4.3 Sediment

In accordance with the 2019 analytical schedule, the Corps of Engineers collected sediment samples from eight locations in the 2nd and 4th quarters (i.e., semiannually) and one location (SWSD025) in all four quarters (i.e., quarterly). Sampling locations are presented on Figure 7.

A summary of the sediment sample collection effort for 2019 is as follows:

- 2nd quarter samples were collected on May 24, 29, and 30, 2019
- 4th quarter samples were collected on October 22 and 23, 2019
- Location SWSD025 was also sampled on March 13 and August 28, 2019 (1st and 3rd quarters)
- Analytical parameters include radionuclides (radium-226, uranium-234, uranium-235, and uranium-238), metals, and PAHs

Details of the findings are presented in the following sections.

4.3.1 Sediment Radiological Findings

The 2019 analytical results for radionuclides in sediment are presented on Table 9.

Radium-226

The 2019 analytical results for the 19 sediment samples (including one field duplicate sample) analyzed for radium-226 ranged from 0.82 pCi/g (WDD2) to 3.08 (WDD3). These results are similar to historical data, as shown on the graph on Figure 11, which presents radium-226 concentrations in sediment between 1997 and 2019.

Trend analysis of radium-226 in sediment using the *GSI Mann-Kendall Toolkit* shows evidence of an increasing trend at sample locations SWSD010, SWSD023, and SWSD025, a probably increasing trend at locations SWSD009, SWSD011, and WDD2, a stable trend at WDD3, and no trend at locations SWSD021 and SWSD022. Results are summarized below and presented in Attachment B-2.

Mann-Kendall Trend Results¹ for Radium-226 in Sediment

SAMPLE ID	SAMPLE SIZE	RESULTING TREND	LOCATION ALONG DITCH
Central Drainage Ditch			
SWSD009	18	Probably Increasing	Upgradient
SWSD021	18	No trend	Upgradient
SWSD023	16	Increasing	Upgradient
SWSD010	18	Increasing	Midgradient 1
SWSD022	18	No trend	Midgradient 2
SWSD025	34	Increasing	Midgradient 3
SWSD011	15	Probably Increasing	Downgradient
West Drainage Ditch			
WDD2	18	Probably Increasing	Upgradient
WDD3	18	Stable	Downgradient

¹Trend evaluation was performed on samples analyzed by gamma spectroscopy (EPA Method 901.1)

It is noted that the predominant source of flow in the Central Drainage Ditch is runoff from Modern's property located east and south of the NFSS; overland flow across the NFSS during storm events is a minor contributor. Stormwater from Modern's landfill is collected in a retention pond (observable on Figure 7) that discharges onto NFSS property via South 31 Ditch at sample location SWSD009. Surface water runoff from Modern's property to the south that is used primarily as parking and storage discharges onto NFSS property via the Central Drainage Ditch at sample locations SWSD021 and SWSD023.

Radium-226 is known to be readily adsorbed to clays and mineral oxides present in sediment, especially near neutral and alkaline pH conditions, so it is usually not a mobile constituent in the environment. Therefore, radium-226 would not be expected to migrate significantly from the area where it is released or generated, and its presence in Central Drainage Ditch sediment likely originated from legacy impacts, adjacent upgradient sources, and/or overland flow. As previously noted, radium-226 concentrations in surface water continue to be predominantly nondetect or less than the laboratory detection limit. The maximum concentration of radium-226 in sediment detected in the Central Drainage Ditch in 2019 was 2.26 pCi/g at location SWSD025. For comparison, the site-specific background concentration developed for the remedial investigation was 2.43 pCi/g (USACE 2007).

Uranium

The 2019 analytical results for uranium isotopes uranium-234, uranium-235 and uranium-238 in sediment showed detections in all but one of the samples collected. Among the detections, the isotopic activity levels ranged from 0.035 pCi/g to 3.62 pCi/g. The isotopic uranium data are similar to historical data. A graphical representation of the analytical data is shown on Figure 12.

Mann-Kendall trend analysis for uranium-238 (used as a surrogate for total uranium) shows evidence of decreasing trends at sample locations SWSD009 and SWSD021; increasing trends at SWSD010, SWSD011, and SWSD025; probably increasing trend at SWSD022; and stable or no trend at SWSD023, WDD2, and WDD3. Based on this data, it appears that uranium concentrations in sediment are increasing in a downgradient path along the Central Drainage Ditch. The highest concentration of uranium-238 detected at any location in 2019 was 3.06 pCi/g (SWSD010), which is slightly less than the site-specific background concentration of 3.08 pCi/g developed for use in the remedial investigation (USACE 2007). Mann-Kendall trend results are summarized below and presented in Attachment B-3.

Mann-Kendall Trend Results¹ for Uranium-238 in Sediment

SAMPLE ID	SAMPLE SIZE	RESULTING TREND	LOCATION ALONG DITCH
Central Drainage Ditch			
SWSD009	33	Decreasing	Upgradient
SWSD021	33	Decreasing	Upgradient
SWSD023	24	Stable	Upgradient
SWSD010	34	Increasing	Midgradient 1
SWSD022	33	Probably Increasing	Midgradient 2
SWSD025	37	Increasing	Midgradient 3
SWSD011	33	Increasing	Downgradient
West Drainage Ditch			
WDD2	24	No trend	Upgradient
WDD3	24	No trend	Downgradient

¹Tests were performed using the *GSI Mann-Kendall Toolkit*

4.3.2 Sediment Chemical Findings

The 2019 analytical results for metals and PAHs in sediment are presented in Attachment A as Tables A-3 and A-4, respectively. Several metals were detected in all sediment samples and several polycyclic aromatic hydrocarbons were detected predominantly at upstream sample locations. The 2019 data were generally comparable to past results.

4.4 Groundwater

There are 55 monitoring wells in the groundwater monitoring program; they are sampled semiannually. Two of these wells, OW04A and OW04B, are also sampled quarterly. Occasionally, additional or replacement wells are sampled when the program wells are dry or will not yield acceptable sample quantity. Well locations are presented on Figure 5. Water levels are measured on a quarterly basis in over 100 wells.

In late 2018, nine monitoring wells that are sampled regularly as part of the ESP were replaced due to damaged components. They include BH49, BH49A, A50, A55, OW13B, OW15B, OW17B, OW18B, and MW953. The new wells were installed at the same locations and at the same depths and are identified as BH49R, BH49AR, A50R, A55R, OW13BR, OW15BR, OW17BR, OW18BR, and MW953R.

Highlights of the groundwater sample collection effort in 2019 are as follows:

- The semiannual sampling took place between May 23 and June 6 (2nd quarter) and October 24 and October 30 (4th quarter); wells OW04A and OW04B were also sampled on March 12 and August 28, 2019.
- 15 groundwater samples were filtered for total U.
- Water level measurements were recorded from over 100 wells.
- Groundwater samples were analyzed for radium-226, total uranium, VOCs (five wells only), and water quality parameters (such as alkalinity and total dissolved solids).

For comparative purposes, the NYSDEC Class GA (groundwater, which is considered potable) water

quality standards (hereafter referred to as NYSDEC drinking water standards) were used. It is noted that groundwater at the NFSS is not a source of drinking water and is naturally a Class GSA saline water.

Details of the findings are presented in the following sections.

4.4.1 Groundwater Level Measurements

In 2019, the Corps of Engineers measured groundwater levels in 104 wells using an electronic depth-to-water meter. Potentiometric data were recorded from 68 wells in the upper water-bearing zone and 36 wells in the lower water-bearing zone. Water level measurements are presented on Table 10. Figures 13 through 16 show the seasonal high and low groundwater elevations in the upper and lower units.

The upper water-bearing zone exists in a fine-grained glacial till that was derived from ice advancement through a pro-glacial lake, where beach ridges were modified into discontinuous sand lenses within the clayey ground mass. The clayey sediments exhibit capillary characteristics that cause non-uniform saturation and desaturation of the upper water-bearing zone during seasonal periods. This variability (texture and saturation) can produce groundwater levels that vary between proximal wells. Groundwater levels imply general groundwater elevations and regional to local flow directions that vary slightly from seasonal high- and low-water conditions in each water-bearing zone. Figures 13 through 16 exemplify the spatial and temporal variability of groundwater levels.

The screened intervals for wells completed in the upper water-bearing zone range from 0.92 to 8.4 meters (3.02 to 27.6 feet) below ground surface; the screened intervals for wells completed in the lower water-bearing zone range from 6.8 to 31.9 meters (22.4 to 104.5 feet) below ground surface.

In the upper water-bearing zone, the depth to water ranged from 0.53 to 6.36 meters (1.73 to 20.85 feet) below ground surface during 2019. The quarterly water level fluctuations in the upper water-bearing zone averaged 0.53 meters (1.75 feet) and showed low and high elevations on August 26, 2019, and May 23, 2019, respectively.

In the lower groundwater system, the depth to water ranged from 0.37 to 3.91 meters (3.34 to 11.34 feet) below ground surface during 2019. Quarterly water level fluctuations in the lower groundwater system averaged 0.30 meters (0.97 feet) and showed low and high elevations also on March 12, 2019, and May 23, 2019, respectively. The lower groundwater system exhibits artesian conditions due to the overlying clay aquitard that confines the zone.

The high-water elevations in the upper system ranged from 94.77 to 97.29 meters (310.90 to 319.12 feet) above mean sea level, whereas the low-water condition ranged from 92.54 to 97.06 meters (303.53 to 318.35 feet). The high-water elevation in the lower system ranged from 94.94 to 96.54 meters (311.41 to 316.64 feet) above mean sea level, whereas the low-water condition ranged from 94.34 to 96.97 meters (309.44 to 318.06 feet).

Water level data indicate that the upper water-bearing zone responds more rapidly to the recharge and discharge seasons (wet and dry periods) than the lower confined groundwater system due to the intervening glacio-lacustrine clay aquitard. The two water-bearing zones demonstrate hydraulic separation through independent water level responses seen in the data (i.e., the range and timing of fluctuations). The high-stress (dry) summer conditions normally lower water levels throughout the upper water-bearing zone, whereas the lower water-bearing zone is much less reactive to seasonal variations due to the aquitard. Upper zone water levels collected during 2019 reflect normal seasonal patterns of a wet spring and dry summer through fall. The lower zone exhibited a continuation of late-2018 low-water levels that rebounded in May 2019 and then minimally varied in fluctuation (averaging 0.30 meters or 0.97 feet).

Vertical gradients calculated using water levels obtained from monitoring well pairs indicate vertical groundwater flow from the upper zone to the lower zone (or downward) is most significant during the midwinter and spring, when evapotranspiration is less robust. Vertical gradients show more upward pressure due to water-level declines in the upper water-bearing zone from midsummer to late fall, when evapotranspiration is robust. This seasonal saturation of the soils and vertical flow variation mitigates the potential transport of contaminants from the upper zone into the lower zone.

4.4.2 Groundwater Field Parameters

Before sampling, the Corps of Engineers measures field parameters at each well using a calibrated water quality meter. Field parameters include temperature, pH, specific conductance, oxidation-reduction potential, turbidity, and dissolved oxygen. The results are summarized on Table 11.

4.4.3 Groundwater Quality Parameters

At the NFSS, water quality in the upper water-bearing zone is indicative of low recharge to a hydraulically slow flow system; this produces poor-quality (near-saline) groundwater with high total dissolved solids and calcium/magnesium sulfates. Water quality in the lower water-bearing zone is poor due to high total dissolved solids. It's likely that the lower groundwater system receives recharge along the base of the Niagara Escarpment, situated approximately 3.2 kilometers (2 miles) south of the site (DOE 1994) and, to a lesser extent, via downward flow from the upper unit. Table 12 presents water quality parameter data for 2019.

Analytical results for sulfate and total dissolved solids were consistently above the NYS Class GA groundwater quality standards, while total alkalinity, chloride, and bromide exceeded NYS standards in a limited number of samples.

Sampling of wells during the remedial investigation confirms that groundwater in the area is naturally saline and of poor quality because of high mineralization (see La Sala 1968; Wehran 1977; Acres American 1981). Groundwater at the NFSS is not used as a public drinking water supply; it is definable as a Class GSA water, although the comparison to the drinking water standards continues to be used as a conservative basis for evaluating the results of groundwater analysis.

4.4.4 Groundwater Radiological Findings

The 2019 analytical results for radium-226 and total uranium in groundwater are presented on Table 13 and discussed in detail below.

Radium-226

Radium-226 was not detected in 99 of the 116 samples (includes two filtered and two field duplicate samples) collected in 2019. Among the 17 detections, radium-226 concentrations were below the NYS drinking water standard of 3 pCi/L and ranged from 0.22 pCi/L to 1.93 pCi/L. The highest activity level was detected in well OW15B, which is screened in the upper water-bearing zone and is situated west of the IWCS.

The range of radium-226 concentrations differentiated by upper and lower water-bearing zones over the last two years is presented in the following table:

**Radium-226 Findings
2018 and 2019**

Groundwater Zone Monitored	Concentration Range	
	2018	2019
Upper water-bearing zone	Nondetect— 0.983 pCi/L	Nondetect— 1.93 pCi/L
Lower water-bearing zone	Nondetect— 0.859 pCi/L	Nondetect— 1.75 pCi/L

Total Uranium

The 2019 groundwater analytical data showed that total uranium concentrations in 25 groundwater monitoring wells exceeded the uranium drinking water criterion (30 µg/L). The most elevated total uranium concentrations continue to be detected in wells installed in late 2012 east and south of the IWCS as part of the Balance of Plant field investigation. The two wells with the highest total uranium concentrations in 2019 are MW957 (3,487 µg/L) and MW951 (3,097 µg/L), both located south of the IWCS. Among the wells installed in 2012, well MW953 typically exhibits the highest total uranium concentrations; however, well MW953 was replaced just prior to the 2019 sampling event (and is now labeled MW953R) due to a heaved well pad. Total uranium concentrations in well MW953R in 2019 were 376 µg/L and 277 µg/L, an order of magnitude lower than historical concentrations. The table below presents a comparison of range of total uranium concentrations detected in groundwater in 2018 and 2019.

**Total Uranium Findings
2018 and 2019**

Groundwater Zone Monitored	Concentration Range	
	2018	2019
Upper water-bearing zone	4.83 – 8,927 µg/L	5.25 – 3,487 µg/L
Lower water-bearing zone	0.178 – 10.9 µg/L	0.094 – 11.4 µg/L

The Corps of Engineers believes the source of uranium in wells east of and across the Central Drainage Ditch from the IWCS is residual soil contamination from former operations in this area; these included a railroad bed, storage piles, and a decontamination pad used during construction of the IWCS. In addition, residual contamination in the sanitary sewer near Manhole 6, which was removed in 2013 as part of the field investigation, may have contributed to groundwater contamination in this area. The Corps of Engineers believes the source of the uranium in wells south of the IWCS is the former storage piles and possibly residual contamination in and around former Building 409. The uranium contamination in these areas, and in other site areas, was produced when the historical residue piles and storage areas leached uranium into the underlying low-permeability soils. Subsequent remediation removed the residue sources and some contaminated soils, whereas the underlying groundwater retained the dissolved uranium impacts. Historical aerial photographs show land scarring in the OW11B area during the time of DOE remediation activities. Also, video footage taken during IWCS construction shows extensive activities, such as equipment decontamination (on and around the decontamination pad) and materials unloading, storage, and loading occurred in this area. The uranium impacts detected in the groundwater collected from recent investigative excavations in the vicinity of OW11B might be associated with those former remediation activities. In addition to advancing five investigative excavations along the sanitary sewer line between South Ditch 31 and the former decontamination pad, 35 delineation soil borings were

advanced in the OW11B area in 2013. The fact that none of these investigation activities identified a source term in this area indicates that the source term, if previously present, had been removed and the current groundwater contamination is the result of the historical movement of residue material in this area.

As previously reported, declining to dynamic steady-state (i.e., annually fluctuating about a mean) uranium trends in the majority of wells surrounding the IWCS indicate attenuating legacy sources (i.e., surface stored wastes) that impacted soil and groundwater before and during IWCS construction. Analysis of trends for total uranium in groundwater is discussed in more detail in Section 4.4.6.

4.4.5 Groundwater Chemical Findings

Analysis of VOCs in groundwater is limited to the former Acidification Area in the north-central portion of the site and is monitored by wells 411A, MW934, MW947, MW948, and MW949. All of these wells monitor the upper water-bearing zone except well MW949, which monitors the lower water-bearing zone. These wells were selected to monitor potential migration of the chlorinated solvent plume (i.e., tetrachloroethylene [PCE] and its degradation products). Although not part of the ESP, well MW422 was sampled in the fall as a substitute for well MW947, which had an insufficient volume of water to sample.

Results from the 2019 analysis showed PCE in well MW934 at a concentration of 6 µg/L, which is slightly greater than the state drinking water standard of 5 µg/L. PCE was not detected in well MW948, which is nearby and downgradient of well MW934. Several wells also exhibited VOCs that are typical laboratory contaminants (e.g., acetone and chloroform). The analytical results are presented in Table 14.

4.4.6 Groundwater Trend Analysis

Total uranium concentrations in monitoring wells over the course of the Corps of Engineers' ESP (1997 through 2019) are evaluated by the Mann-Kendall test to identify the presence of a statistically significant trend using *GSI Mann-Kendall Toolkit* software (GSI Environmental 2012). It is noted that the sample sizes for some of the wells are 10 or less, which are marginal for definitively determining a trend. The test's statistical power is limited by the sample size of data collected from the wells but as additional data is collected through the surveillance program, the statistical power of the test increases. In addition, the maximum number of data points per monitoring location considered by the *GSI Mann-Kendall Toolkit* is set at 40, so if the amount of data exceeds 40, the most recent results are evaluated.

The results of the trend evaluation indicated no increasing or decreasing trends (i.e., stable or no trend) in total uranium concentrations in 33 of 57 wells analyzed. Decreasing or "Probably Decreasing" trends in total uranium concentrations were identified in 14 wells. Increasing or "Probably Increasing" trends were identified in 10 wells: OW12B, BH49AR, 505, OW04A, OW011A, MW423, MW934, MW954, MW955, and MW958. The results are presented in Attachment B-4 and summarized in the table below.

Mann-Kendall Trend Results for Total Uranium in Groundwater

Well	Sample Size (n)	Resulting Trend
OW03B	20	Stable
OW04B	44	Decreasing
OW05B	20	No trend
OW06B	37	Decreasing
OW07B	25	Stable
OW11B	32	Stable
OW12B	18	Increasing¹

Well	Sample Size (n)	Resulting Trend
OW13BR	29	Decreasing
OW15BR	35	Stable
OW17BR	35	Decreasing
OW18BR	25	Decreasing
BH49R	18	No trend
BH49AR	24	Probably Increasing²
A42	35	Decreasing
A43	15	No trend
A45	37	Decreasing
A50R	36	Stable
A55R	18	No trend
505	23	Increasing³
302A	34	Decreasing
411A	21	Stable
808A	7	No trend
OW03A	20	Stable
OW04A	41	Increasing⁴
OW05A	21	Stable
OW06A	21	Stable
OW07A	21	Stable
OW11A	20	Probably Increasing⁵
OW12A	19	Decreasing
OW13A	21	Stable
OW15A	19	Probably Decreasing
OW17A	20	Stable
MW423	9	Probably Increasing⁶
MW862	21	No Trend
MW863	21	Decreasing
MW921	13	Stable
MW922	10	No trend
MW934	20	Increasing⁷
MW935	20	Decreasing
MW938	15	Stable
MW943	12	No Trend
MW944	10	Stable
MW945	11	Stable
MW946	11	No trend
MW948	14	Stable
MW949	15	No trend
MW950	16	No trend
MW951	16	Probably Decreasing
MW952	14	Decreasing
MW953R	15	Stable
MW954	14	Probably Increasing⁸
MW955	15	Increasing⁹
MW956	15	No trend
MW957	15	No trend
MW958	15	Increasing¹⁰
MW959	15	No trend

Well	Sample Size (n)	Resulting Trend
MW960	15	No trend

¹ Total uranium concentrations in OW12B ranged from 17.9 µg/L to 64.2 µg/L.

² Total uranium concentrations in BH49AR ranged from 11 µg/L to 23.5 µg/L.

³ Total uranium concentrations in 505 ranged from 21.5 µg/L to 55.5 µg/L.

⁴ Total uranium concentrations in OW04A ranged from 1.32 µg/L to 5.27 µg/L.

⁵ Total uranium concentrations in OW011A ranged from 1.21 µg/L to 4.14 µg/L.

⁶ Total uranium concentrations in MW423 ranged from 10.2 µg/L to 37.8 µg/L.

⁷ Total uranium concentrations in MW934 ranged from 19.6 µg/L to 41.1 µg/L.

⁸ Total uranium concentrations in MW954 ranged from 218 µg/L to 724 µg/L.

⁹ Total uranium concentrations in MW955 ranged from 20.3 µg/L to 42.3 µg/L.

¹⁰ Total uranium concentrations in MW958 ranged from 32.2 µg/L to 379 µg/L.

Among the wells exhibiting an increasing or probably increasing trend, only wells OW04A and BH49AR are located proximate and downgradient of the IWCS. Well OW04A is screened in the lower-water bearing zone and well BH49AR is screened in the upper-water bearing zone. Between 2010 and 2019, total uranium concentrations in well BH49AR ranged from 11 µg/L to 23.5 µg/L, with concentrations in the fall of 2019 of 18.4 µg/L (a spring 2019 sample was not collected). Between 2008 and 2019, total uranium concentrations in well OW04A ranged from 1.32 µg/L to 5.27 µg/L, with concentrations in 2019 of 3.19 µg/L, 2.28 µg/L, 2.03 µg/L, and 2.40 µg/L. The cause of these increasing uranium concentrations is likely legacy sources since there is no apparent pattern of increasing uranium concentrations in the area surrounding wells OW04A and BH49AR. For example, well OW04B, the companion well to OW04A that is screened in the upper-water bearing zone, exhibits a decreasing trend. The companion well to BH49AR, well BH49R that is screened in the lower-water bearing zone, exhibits no trend. An adjacent well pair, wells OW03A and OW03B, both exhibit a stable trend.

Uranium concentrations in most upper water-bearing zone wells increase during wet-season periods (winter through spring) and decline during dry-season periods (late spring through fall). This variation is derived from residual low-concentration soil impacts (especially south of the IWCS) and changes in uranium solubility during the wet season, when soil saturation (or groundwater recharge) increases the oxygen content in the subsurface. The seasonal oxygenation of groundwater increases the uranium solubility of pre-existing contamination (soil and pore-water residuals) that increases concentrations in spring-time samples. Water levels decline throughout the summer and fall due to evapotranspiration of rainfall, which increases groundwater temperatures and reduces the oxygen content in groundwater. Iron-reducing bacteria appears to increase during this period, which further reduces oxygen in the soils and groundwater. This seasonal geochemical response promotes uranium adsorption to soil minerals that lowers groundwater concentrations in fall samples. The geochemical cycle of uranium solubility repeats annually in most wells, as seen in the spring and fall sampling data. The seasonal trend may be less evident or slightly opposite in wells with larger sand lenses that produce a delayed or dampened geochemical response in the wells.

Trend analysis for radium-226 concentrations (pCi/L) in groundwater was not performed because concentrations over the course of the Corps of Engineers ESP (1997 through 2019) are predominantly less than the laboratory detection limit, precluding the accurate assessment of trends. The test loses significant statistical power if most of the data are censored.

5.0 CONCLUSION

The objective of the ESP is to monitor the air, groundwater, surface water, and sediment for the release of contaminants to ensure the protection of human health and the environment. To achieve this objective, the Corps of Engineers:

- Measures radon gas concentrations at several locations around the property boundary and radon flux on top of the IWCS
- Calculates the annual cumulative dose to the nearest receptor from NFSS sources based on (1) measured total external gamma radiation and (2) modeled airborne particulate dose using remedial investigation soil data and annual meteorological data
- Analyzes surface water and sediment samples for radionuclides (as well as metals and PAHs to monitor potential impact from off-site sources such as Modern Landfill)
- Analyzes groundwater samples for radionuclides and VOCs in a limited area of the site

The results of the 2019 radon flux monitoring showed an elevated flux measurement at canister location 65. Canister 65 is situated approximately 50 feet from Canister 62 that exhibited an elevated flux measurement in 2018. To investigate, the Corps of Engineers performed a GWS on top of the IWCS in the area of canister locations 62 and 65. The GWS identified small localized areas of elevated radioactivity. The area of concern identified by elevated flux and GWS data is located above the eastern wall of Building 411 that contains radioactive residues in the IWCS. The Corps of Engineers has evaluated strategies to fix the problem and decided to proceed with an iterative approach. First, several inches of topsoil and grass seed will be added in late spring 2020 to the areas where elevated readings and distressed grass were identified, around canister locations 62 and 65. The Corps of Engineers believes that enhancing the grass cover will restore optimal moisture to the underlying clay layer that may have developed desiccation cracks. Once the cover is replaced, radon flux measurements will determine whether this approach has been successful. If radon flux levels are not reduced, the Corps of Engineers will explore ways to repair the underlying clay blanket.

Based on the regulatory compliance data collected in 2019, the Corps of Engineers has demonstrated that the site is compliant with regulatory criteria and remains protective of human health and the environment. The average radon flux across the IWCS measured during the annual monitoring event performed in July 2019 remained below 20 pCi/m²/s, the standard specified in 40 CFR Part 61, Subpart Q, and radon-222 concentrations measured at the site boundary were well below 3.0 pCi/L the DOE limit for annual average radon-222 concentrations, not including background.

A summary of the 2019 trend evaluations for total uranium in surface water and uranium-238 and radium-226 in sediment are presented in the following table:

LOCATION		SURFACE WATER ¹	SEDIMENT	
		Total uranium	Uranium-238	Radium-226 ³
Central Drainage Ditch				
SWSD009	Upgradient	No trend	Decreasing	Probably Increasing
SWSD021	Upgradient	Probably Decreasing	Decreasing	No trend
SWSD023	Upgradient	No trend	Stable	Increasing
SWSD010	Midstream	Stable	Increasing	Increasing
SWSD022	Midstream	No trend	Probably Increasing	No trend
SWSD025	Midstream	Stable	Increasing	Increasing
SWSD011 ²	Downgradient	Probably Increasing	Increasing	Probably Increasing
West Drainage Ditch				
WDD2	Upgradient	Increasing	No trend	Probably Increasing
WDD3	Downgradient	Increasing	No trend	Stable

¹ Radium-226 concentrations in surface water are not evaluated for trending because concentrations are either nondetect or predominantly less than the laboratory detection limit, precluding the accurate assessment of trends.

² SWSD011 is the most downgradient sampling location on the Central Drainage Ditch and the point at which surface water flows off-site.

³ Trending tests were performed on samples analyzed by gamma spectroscopy (EPA Method 901.1)

Three (SWSD011, WDD2, and WDD3) of the nine surface water sample locations show evidence of an increasing or probably increasing trend for total uranium. Similar to the previous year, total uranium concentrations at these locations remain low: 2.24 µg/L and 3.80 µg/L at WDD2; 2.29 µg/L and 4.4 µg/L at WDD3; and, 7.81 µg/L and 9.65 µg/L at SWSD011. For comparison, the site-specific background total uranium concentration in surface water developed during the remedial investigation was 12.5 µg/L (USACE 2007).

The trend analysis shows uranium-238 concentrations in sediment increasing in a downgradient path along the Central Drainage Ditch. However, the highest concentration of uranium-238 detected at any location in 2019 was 3.06 pCi/g (SWSD010), which is less than the site-specific background concentration of 3.08 pCi/g reported in the remedial investigation (USACE 2007).

The maximum concentration of radium-226 in sediment detected in the Central Drainage Ditch in 2019 was 2.26 pCi/g at location SWSD025. For comparison, the site-specific background concentration developed for the remedial investigation was 2.43 pCi/g (USACE 2007). Radium-226 is known to be readily adsorbed to clays and mineral oxides present in sediment, especially near neutral and alkaline pH conditions, so it is usually not a mobile constituent in the environment. Therefore, radium-226 would not be expected to migrate significantly from the area where it is released or generated. Radium-226 concentrations in surface water continue to be predominantly nondetect or less than the laboratory detection limit.

The 2019 groundwater analytical data showed that total uranium concentrations in 25 groundwater monitoring wells exceeded the uranium drinking water criterion (30 µg/L). The most elevated total uranium concentrations continue to be detected in wells installed in late 2012 east and south of the IWCS as part of the Balance of Plant field investigation. The Corps of Engineers believes the source of uranium in wells east of the IWCS is residual soil contamination from former operations in this area, which included a

railroad bed, storage piles, and a decontamination pad used during construction of the IWCS. In addition, residual contamination in the sanitary sewer near Manhole 6, which has been removed and the sewer line plugged, may have contributed to groundwater contamination in this area. The Corps of Engineers believes the former storage piles and residual contamination from former Building 409 are the source of the uranium in wells south of the IWCS (USACE 2015a). The uranium contamination in groundwater south of the IWCS, and in other site areas, was produced when the historical residue piles and storage areas leached uranium into the underlying low-permeability soils. Subsequent remediation removed the residue sources and some contaminated soils, whereas the underlying groundwater retained the dissolved uranium impacts.

Trend analysis shows increasing or “probably increasing” trends in 10 of 57 wells evaluated. Among the 10 wells, only two wells, OW04A and BH49AR, are located proximate to the IWCS. The cause of these increasing uranium concentrations is likely legacy sources since there is no apparent trend pattern of increasing uranium concentrations when considering either their respective paired wells (OW04B and BH49R) or nearby wells.

It is noted that uranium concentrations normally increase during wet-season periods (winter through spring) and decline during dry-season periods (late spring through fall), which is evident to varying degrees in many upper water-bearing zone wells. This variation is due to a combination of residual low-concentration soil impacts (especially south of the IWCS) and changes in uranium solubility during seasonal soil saturation (or groundwater recharge) that increases the oxygen content in the subsurface. The seasonal oxygenation of groundwater increases the uranium solubility of pre-existing contamination, and thus increases concentrations in spring-time samples. Water levels decline throughout the summer and fall due to evapotranspiration of rainfall, which increases groundwater temperatures and reduces the oxygen content in groundwater. Iron-reducing bacteria samples also increase during this period. This geochemical mechanism lowers uranium solubility, promotes uranium adsorption to soil minerals, and lowers groundwater concentrations in fall samples. This geochemical process repeats annually, as seen in the spring and fall sampling data. This trend may be less evident or absent in wells with larger sand lenses, but is commonly evident in upper water-bearing zone wells.

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TABLES

Acronyms and Abbreviations (in Tables)

BKGD	background
CY	calendar year
DO	dissolved oxygen
DOE	Department of Energy
°F	degrees Fahrenheit.
IWCS	Interim Waste Containment Structure
J	data estimated
LWBZ	lower water bearing zone
MDA	method detection activity
MDL	method detection limit
MCL	maximum contaminant level
MG/KG	milligrams per kilogram
MG/L	milligrams per liter
mrem	millirem
mrem/yr	millirem per year
mS/cm	milliSiemens per centimeter
mV	millivolts
NA	not applicable
NFSS	Niagara Falls Storage Site
NTU	nephelometric turbidity units
NYCRR	New York Codes, Rules, and Regulations
NYS	New York State
NYSDOH	New York State Department of Health
ORP	oxidation-reduction potential
OSL	optically stimulated luminescence
OSLD	optically stimulated luminescence dosimeter
PCI	picocurie
PCI/G	picocuries per gram
PCI/L	picocuries per liter
pCi/L	picocuries per liter
pCi/m ² /s	picocuries per meters-squared per second
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
R	data rejected
RI	remedial investigation
RSL	regional screening level
SDWA	Safe Drinking Water Act
Spec. Cond.	Specific conductance
TDS	total dissolved solids
TLD	thermo luminescent dosimeter
U	not detected
UG/L	microgram per liter
VOC	volatile organic compound

Table 1 Continued: Evolution of NFSS Environmental Surveillance Plan

Parameter	1997	2000	2003	2008	2009	2010	2013	2014
Surface water:	SWSD009, SWSD010, SWSD011, SWSD021, SWSD022 <u>Field Parameters:</u> Dissolved oxygen, redox potential, turbidity, temperature, specific conductivity, pH <u>Radionuclides:</u> total uranium radium-226, -228 thorium-230, -232	Same 5 locations <u>Field Parameters:</u> Same <u>Radionuclides:</u> Uranium-234, -235, -238 radium-226, -228 thorium-230, -232	Same 5 locations <u>Field Parameters:</u> Same <u>Radionuclides:</u> Same	Same 5 locations plus 5 additional locations: SWSD023, SWSD024, WDD1, WDD2, WDD3. <u>Field Parameters:</u> Same <u>Radionuclides:</u> Uranium-234, -235, -238, radium-226, -228 thorium-228 (new), -230, -232 <u>Metals:</u> TAL metals, lithium, boron <u>Organics:</u> PCBs, pesticides, VOCs, PAHs	Same 10 locations <u>Field Parameters:</u> Same <u>Radionuclides:</u> Same <u>Metals:</u> Same <u>Organics:</u> Same	Spring 2010 - Same 10 locations as 2009 Fall 2010: 11 locations (Added location SWSD025) <u>Field Parameters:</u> Same <u>Radionuclides:</u> Iso-uranium, Iso-thorium, Radium-226, -228 Strontium-90, Technetium-99, Cesium-137, Iso-plutonium, Tritium <u>Metals:</u> Same <u>Organics:</u> Same	9 locations (removed SWSD024 and WDD1) <u>Field Parameters:</u> Same <u>Radionuclides:</u> Total Uranium Radium-226 <u>Metals:</u> Same <u>Organics:</u> PAHs only	9 locations (removed SWSD024 and WDD1) <u>Field Parameters:</u> Same <u>Radionuclides:</u> Total Uranium Radium-226 <u>Metals:</u> Same <u>Organics:</u> PAHs only
Sediment:	SWSD011, SWSD021, SWSD010, SWSD022, SWSD009 <u>Radionuclides:</u> total uranium radium-226, -228 thorium-230, -232	Same 5 locations <u>Radionuclides:</u> Uranium-234, -235, -238 radium-226, -228 thorium-230, -232	Same 5 locations <u>Radionuclides:</u> Same	Same 5 locations plus 5 additional locations: WDD1, WDD2, WDD3, SWSD023, SWSD024 <u>Radionuclides:</u> Uranium-234, -235, -238 radium-226, -228 thorium-228 (new), -230, -232 <u>Metals:</u> TAL metals, lithium, boron <u>Organics:</u> PCBs, pesticides, VOCs, PAHs	Same 10 locations <u>Radionuclides:</u> Same <u>Metals:</u> Same <u>Organics:</u> Same	Spring 2010 - Same as 2009 Fall 2010: <u>Radionuclides:</u> Iso-uranium, Iso-thorium, Radium-226, -228 Strontium-90, Technetium-99, Cesium-137, Iso-plutonium, Tritium <u>Metals:</u> Same <u>Organics:</u> Same	9 locations (removed SWSD024 and WDD1) <u>Radionuclides:</u> Total Uranium Radium-226 <u>Metals:</u> Same <u>Organics:</u> PAHs only	9 locations (removed SWSD024 and WDD1) <u>Radionuclides:</u> Total Uranium Radium-226 <u>Metals:</u> Same <u>Organics:</u> PAHs only

Table 2
2019 ESP
Groundwater Sampling
Niagara Falls Storage Site

Well Location	UWBZ or LWBZ	Well	Purpose	*Laboratory Analytical Parameters						**Field Parameters
				Total Uranium	Radium -226	VOCs	Alkalinity	TDS	Anions	
A45		UWBZ	N (IWCS)	X	X		X	X	X	X
OW04A ¹		LWBZ	N (IWCS)	X	X		X	X	X	X
OW04B ¹		UWBZ	N (IWCS)	X	X		X	X	X	X
BH49AR		UWBZ	N (IWCS)	X	X		X	X	X	X
BH49R		LWBZ	N (IWCS)	X	X		X	X	X	X
OW05A		LWBZ	N (IWCS)	X	X		X	X	X	X
OW05B		UWBZ	N (IWCS)	X	X		X	X	X	X
A50R		UWBZ	E (IWCS)	X	X		X	X	X	X
MW862		UWBZ	E (IWCS)	X	X		X	X	X	X
MW863		LWBZ	E (IWCS)	X	X		X	X	X	X
OW11A		LWBZ	E (IWCS)	X	X		X	X	X	X
OW11B		UWBZ	E (IWCS)	X	X		X	X	X	X
OW12A		LWBZ	E (IWCS)	X	X		X	X	X	X
OW12B		UWBZ	E (IWCS)	X	X		X	X	X	X
OW06A		LWBZ	S (IWCS)	X	X		X	X	X	X
OW06B		UWBZ	S (IWCS)	X	X		X	X	X	X
OW13A		LWBZ	S (IWCS)	X	X		X	X	X	X
OW13BR		UWBZ	S (IWCS)	X	X		X	X	X	X
OW07A		LWBZ	S (IWCS)	X	X		X	X	X	X
OW07B		UWBZ	S (IWCS)	X	X		X	X	X	X
OW03A		LWBZ	W (IWCS)	X	X		X	X	X	X
OW03B		UWBZ	W (IWCS)	X	X		X	X	X	X
OW15A		LWBZ	W (IWCS)	X	X		X	X	X	X
OW15BR		UWBZ	W (IWCS)	X	X		X	X	X	X
A42		UWBZ	W (IWCS)	X	X		X	X	X	X
OW17A		LWBZ	W (IWCS)	X	X		X	X	X	X
OW17BR		UWBZ	W (IWCS)	X	X		X	X	X	X
OW18BR		UWBZ	W (IWCS)	X	X		X	X	X	X
A55R		LWBZ	W (IWCS)	X	X		X	X	X	X
A43		UWBZ	W (IWCS)	X	X		X	X	X	X
505		UWBZ	EU 1	X	X		X	X	X	X
MW934		UWBZ	EU 4	X	X	X	X	X	X	X
411A		UWBZ	EU 4	X	X	X	X	X	X	X
302A		UWBZ	EU 8	X	X		X	X	X	X
MW921 or MW922 ²		UWBZ	NW (off-site)	X	X		X	X	X	X
MW 935		UWBZ	NW (IWCS)	X	X		X	X	X	X
MW938		UWBZ	NW (IWCS)	X	X		X	X	X	X
MW-943		UWBZ	S (IWCS)	X	X		X	X	X	X
MW-944		UWBZ	EU 1	X	X		X	X	X	X
MW-945		UWBZ	EU 1	X	X		X	X	X	X
MW-946		UWBZ	EU 1	X	X		X	X	X	X
MW-947 ³		UWBZ	EU 4	X	X	X	X	X	X	X
MW-948		UWBZ	EU 4	X	X	X	X	X	X	X
MW-949		LWBZ	EU 4	X	X	X	X	X	X	X
MW-950		UWBZ	S (IWCS)	X	X		X	X	X	X
MW-951		UWBZ	S (IWCS)	X	X		X	X	X	X
MW-952		UWBZ	E (IWCS)	X	X		X	X	X	X
MW-953R		UWBZ	E (IWCS)	X	X		X	X	X	X
MW-954		UWBZ	E (IWCS)	X	X		X	X	X	X
MW-955		UWBZ	E (IWCS)	X	X		X	X	X	X
MW-956		UWBZ	S (IWCS)	X	X		X	X	X	X
MW-957		UWBZ	S (IWCS)	X	X		X	X	X	X
MW-958		UWBZ	S (IWCS)	X	X		X	X	X	X
MW-959		UWBZ	S (IWCS)	X	X		X	X	X	X
MW-960		UWBZ	S (IWCS)	X	X		X	X	X	X
Field Duplicate		-	-	X	X		X	X	X	X

***Laboratory Analytical Parameters**

VOC - Volatile Organic Compounds
TDS - Total Dissolved Solids
Anions: Chloride
Fluoride
Nitrate
Nitrite
Phosphate
Sulfate

****Field Parameters:**

pH
Temperature
Specific conductivity
Oxidation-Reduction Potential
Dissolved oxygen
Turbidity (If the turbidity reading for a sample is 50 NTUs or greater, the sample will be filtered in the field and both filtered and unfiltered samples at that location will be submitted to the lab for analysis.)

UWBZ - upper water bearing zone

LWBZ - lower water-bearing zone

indicates new well (Spring 2013)

indicates not sampled

¹ These wells are sampled quarterly

² MW921 or MW922 is sampled based on availability of water within these wells

³ MW422 or MW423 is substituted for MW947 when well MW947 is dry.

Table 3

2019 ESP
Surface Water and Sediment Sampling
Niagara Falls Storage Site

*Laboratory Analytical Parameters					**Field Parameters
Sample Location	Total Uranium	Radium-226	Metals	PAHs	
SWSD009	X	X	X	X	X
SWSD010	X	X	X	X	X
SWSD011	X	X	X	X	X
SWSD021	X	X	X	X	X
SWSD022	X	X	X	X	X
SWSD023	X	X	X	X	X
SWSD025 ¹	X	X	X	X	X
WDD2	X	X	X	X	X
WDD3	X	X	X	X	X
Field Duplicate	X	X	X	X	X

***Laboratory Analytical Parameters:**

PAH - Polyaromatic Hydrocarbons

¹ Sampled quarterly

****Field Parameters:**

pH

Temperature

Specific conductivity

Oxidation-Reduction Potential

Dissolved oxygen

Turbidity

(If the turbidity reading for a sample is 50 NTUs or greater, the sample will be filtered in the field and both filtered and unfiltered samples at that location will be submitted to the lab for analysis.)

Table 4
2019 External Gamma Radiation Dose Rates
Niagara Falls Storage Site

Monitoring Location	Monitoring Station	Gross ^a OSL Data (mrem/monitoring period) 12/30/2018-6/29/2019	Gross ^a OSL Data (mrem/monitoring period) 7/2/2019-1/2/2020	Normalized Gross OSL Data ^b (mrem/yr)	CY2019 Net ^d OLD Data (mrem/yr)
NFSS Perimeter	1	11.0	9.0	20.0	0.8
	1	9.0	12.0	21.0	1.8
	7	13.0	12.0	25.0	5.8
	7	11.0	12.0	23.0	3.8
	11	6.0	8.0	14.0	-5.2
	11	4.0	9.0	13.0	-6.2
	12	10.0	10.0	20.0	0.8
	12	9.0	11.0	20.0	0.8
	13	12.0	12.0	24.0	4.8
	13	14.0	13.0	27.0	7.8
	15	12.0	12.0	24.0	4.8
	15	12.0	14.0	26.0	6.8
	28	17.0	16.0	33.0	13.8
	28	15.0	15.0	30.0	10.8
	29	13.0	13.0	26.0	6.8
	29	11.0	17.0	28.0	8.8
	32*	11.0	12.0	23.0	3.8
	32*	12.0	10.0	22.0	2.8
	36	12.0	15.0	27.0	7.8
	36	14.0	15.0	29.0	9.8
	45	9.0	12.0	21.0	1.8
	45	11.0	10.0	21.0	1.8
	50	16.0	18.0	34.0	14.8
	50	17.0	16.0	33.0	13.8
	55	10.0	13.0	23.0	3.8
	55	9.0	13.0	22.0	2.8
	60	12.0	11.0	23.0	3.8
	60	12.0	12.0	24.0	4.8
	65	9.0	15.0	24.0	4.8
	65	9.0	14.0	23.0	3.8
	122	9.0	10.0	19.0	-0.2
	122	13.0	11.0	24.0	4.8
	123	11.0	15.0	26.0	6.8
	123	11.0	15.0	26.0	6.8
IWCS Perimeter	8	8.0	11.0	19.0	-0.2
	8	7.0	10.0	17.0	-2.2
	10	11.0	11.0	22.0	2.8
	10	11.0	15.0	26.0	6.8
	18	12.0	7.0	19.0	-0.2
	18	8.0	8.0	16.0	-3.2
	21	8.0	9.0	17.0	-2.2
	21	7.0	14.0	21.0	1.8
	23	8.0	11.0	19.0	-0.2
	23	9.0	11.0	20.0	0.8
	24	9.0	12.0	21.0	1.8
	24	9.0	13.0	22.0	2.8
	40	9.0	8.0	17.0	-2.2
	40	8.0	10.0	18.0	-1.2
Background ^c	105	6.0	7.0	13.0	
	105	6.0	7.0	13.0	
	116	11.0	9.0	20.0	
	116	9.0	11.0	20.0	
	120	11.0	13.0	24.0	
	120	12.0	13.0	25.0	
Average Background		9.2	10.0	19.2	

a Gross refers to total deployment exposure. Transit exposures are subtracted as the mean of the two USACE-assigned control

b Gross data for each period are normalized to a daily dose rate, averaged, and then normalized for the length of the year (365 days).

c Background Locations: 105-Lewiston-Porter School, 116-Balmer Road and 120-Lewiston Water Pollution Control Center

d Net data are corrected by subtracting the average normalized background value

* Location 32 is a duplicate sample for location 12.

OSL - Optically Stimulated Luminescence dosimeters

Table 5
2019 Radon Gas Concentrations^a

Monitoring Location ^b	Station	Average Daily Concentration (pCi/L) 1/03/19 - 07/01/19 ^c	Average Daily Concentration (pCi/L) 7/01/19 - 10/09/19 ^c	Average Daily Concentration (pCi/L) 10/09/19 - 1/02/20 ^c
NFSS Perimeter	1	< 0.4	< 0.4	< 0.4
	7	< 0.4	< 0.4	< 0.5
	11	< 0.4	< 0.4	< 0.4
	12	< 0.4	< 0.4	0.6 ± 0.2
	12 (dup ^d)	< 0.4	< 0.4	< 0.5
	13	< 0.4	< 0.4	< 0.5
	15	< 0.4	< 0.4	< 0.4
	28	< 0.4	< 0.4	< 0.4
	29	< 0.4	< 0.4	< 0.5
	36	< 0.4	0.4 ± 0.3	< 0.4
	45	< 0.4	< 0.4	< 0.5
	50	< 0.4	0.4 ± 0.3	< 0.4
	55	< 0.4	< 0.4	< 0.4
	60	< 0.4	< 0.4	< 0.4
	65	< 0.4	< 0.4	< 0.4
	122	< 0.4	0.5 ± 0.3	< 0.4
	123	< 0.4	< 0.4	< 0.5
IWCS Perimeter	8	< 0.4	0.5 ± 0.3	< 0.4
	10	< 0.4	< 0.4	0.6 ± 0.3
	18	< 0.4	< 0.4	< 0.4
	21	< 0.4	< 0.4	< 0.4
	23	< 0.4	< 0.4	< 0.4
	24	< 0.4	< 0.4	< 0.4
	40	< 0.4	< 0.4	< 0.5
Background	105	< 0.4	< 0.4	< 0.4
	116	< 0.4	< 0.4	0.5 ± 0.2
	120	< 0.4	< 0.4	< 0.4

a. Radon gas concentrations were measured with RadTrak2® detectors

These detectors measure the concentration of radon-222 in air.

b. Monitoring locations are shown on Figure 6.

c. Detectors were installed (start date) and removed (end date) on the dates listed.

d. A quality control duplicate is collected at the same time and location and is analyzed by the same method for evaluating precision in sampling and analysis.

Note: DOE off-site limit for radon-222 concentration is 3 pCi/L above background.

(<0.X) Indicates detection limit is reported. Actual result is less than this value.

1 pCi = 0.037 becquerel

Table 6a
2019 Radon Flux Monitoring Results^a
Niagara Falls Storage Site

NFSS Sample ID	Qualifier ^d	Radon-222 Flux				NFSS Sample ID	Qualifier ^d	Radon-222 Flux			
		(pCi/m ² /s)			MDA			(pCi/m ² /s)			MDA
1		0.0737	±	0.0126	0.0382	51		0.1104	±	0.0210	0.0289
2		0.0601	±	0.0118	0.0244	52		0.0469	±	0.0108	0.0362
3		0.0673	±	0.0120	0.0205	53		0.0809	±	0.0144	0.0407
4	U	0.0496	±	0.0329	0.1239	54	U	0.0970	±	0.0250	0.1015
5	U	0.0367	±	0.0110	0.0404	55		0.1749	±	0.0217	0.0408
6		0.1616	±	0.0195	0.0256	56		0.1077	±	0.0183	0.0527
7		0.0696	±	0.0118	0.0122	57		0.0600	±	0.0109	0.0122
8		0.1623	±	0.0282	0.0940	58		0.1382	±	0.0267	0.0839
9		0.1110	±	0.0157	0.0064	59		0.0881	±	0.0152	0.0295
10		0.1330	±	0.0176	0.0180	60		0.0822	±	0.0156	0.0624
10-DUP		0.1409	±	0.0180	0.0242	60-DUP		0.0926	±	0.0145	0.0258
11		0.1035	±	0.0160	0.0203	61		0.0851	±	0.0147	0.0356
12		0.2017	±	0.0309	0.0288	62 ^g		0.2249	±	0.0270	0.0434
13		0.1322	±	0.0165	0.0064	63		0.0903	±	0.0149	0.0414
14		0.1191	±	0.0168	0.0201	64		0.8252	±	0.0862	0.0959
15		0.1509	±	0.0254	0.0288	65 ^g		23.0501	±	1.9272	0.6387
16		0.1076	±	0.0142	0.0170	66		0.0890	±	0.0152	0.0184
17		0.0794	±	0.0158	0.0567	67	U	0.0369	±	0.0130	0.0470
18		0.1049	±	0.0140	0.0121	68	U	0.0310	±	0.0268	0.1159
19		0.1435	±	0.0287	0.0900	69		0.0738	±	0.0120	0.0531
20		0.0736	±	0.0117	0.0065	70		0.0882	±	0.0141	0.0183
20-DUP		0.0839	±	0.0113	0.0065	70-DUP		0.0701	±	0.0135	0.0414
21		0.0969	±	0.0133	0.0092	71		0.0779	±	0.0142	0.0207
22		0.1884	±	0.0233	0.0549	72		0.1198	±	0.0211	0.0282
23		0.0615	±	0.0110	0.0122	73		0.1149	±	0.0177	0.0468
24		0.1502	±	0.0264	0.0289	74		0.0683	±	0.0130	0.0445
25		0.0507	±	0.0123	0.0483	75		0.1371	±	0.0264	0.0295
26		0.0978	±	0.0160	0.0243	76	U	0.0329	±	0.0239	0.0614
27		0.1066	±	0.0185	0.0462	77		0.1268	±	0.0176	0.0247
28		0.1318	±	0.0266	0.0718	78		0.1142	±	0.0154	0.0124
29		0.0717	±	0.0125	0.0171	79		0.1958	±	0.0305	0.0295
30		0.1248	±	0.0185	0.0242	80	U	0.0366	±	0.0204	0.0657
30-DUP		0.1454	±	0.0221	0.0522	80-DUP		0.0560	±	0.0124	0.0469
31		0.1228	±	0.0164	0.0203	81		0.0461	±	0.0117	0.0365
32		0.1905	±	0.0283	0.0288	82	U	0.0283	±	0.0177	0.0525
33		0.0891	±	0.0131	0.0352	83		0.0534	±	0.0120	0.0409
34		0.0427	±	0.0105	0.0399	84		0.1164	±	0.0248	0.0296
35		0.1339	±	0.0245	0.0277	85	U	0.0322	±	0.0229	0.0659
36		0.0629	±	0.0131	0.0359	86		0.0694	±	0.0137	0.0446
37		0.0964	±	0.0166	0.0301	87		0.0513	±	0.0102	0.0123
38		0.0568	±	0.0126	0.0329	88		0.0826	±	0.0186	0.0295
39		0.0890	±	0.0184	0.0253	89		0.0703	±	0.0140	0.0410
40		0.0460	±	0.0099	0.0264	90		0.1698	±	0.0215	0.0249
40-DUP		0.0594	±	0.0123	0.0358	90-DUP		0.1611	±	0.0227	0.0448
41		0.1034	±	0.0158	0.0182	91		0.1086	±	0.0159	0.0209
42		0.0757	±	0.0137	0.0469	92		0.0889	±	0.0224	0.0295
43	U	0.0688	±	0.0203	0.0697	93		0.0514	±	0.0115	0.0094
44		0.0342	±	0.0088	0.0172	94		0.0848	±	0.0142	0.0331
45		0.0443	±	0.0098	0.0181	95	U	0.0708	±	0.0337	0.1207
46	U	0.0219	±	0.0079	0.0396	96	U	-0.0070	±	0.0065	0.0523
47	U	0.0437	±	0.0304	0.1097	97		0.0726	±	0.0126	0.0186
48		0.0533	±	0.0110	0.0362	98		0.1046	±	0.0172	0.0547
49		0.0483	±	0.0109	0.0348	99	U	0.0201	±	0.0268	0.1074
50		0.0673	±	0.0115	0.0205	100	U	0.0140	±	0.0089	0.0404
50-DUP		0.0686	±	0.0121	0.0205	100-DUP		0.0192	±	0.0138	0.0441

Table 6a (cont.)
2019 Radon Flux Monitoring Results^a
Niagara Falls Storage Site

NFSS Sample ID	Qualifier ^d	Radon-222 Flux			NFSS Sample ID	Qualifier ^d	Radon-222 Flux		
		(pCi/m ² /s)		MDA			(pCi/m ² /s)		MDA
101		0.0780	± 0.0169	0.0644	151		0.0417	± 0.0095	0.0138
102	U	0.0350	± 0.0127	0.0485	152		0.1544	± 0.0283	0.0287
103	U	0.0427	± 0.0123	0.0460	153	U	0.0428	± 0.0135	0.0492
104		0.1073	± 0.0257	0.0913	154		0.0404	± 0.0097	0.0138
105		0.1512	± 0.0230	0.0197	155		0.0703	± 0.0192	0.0328
106	U	0.0123	± 0.0171	0.0691	156		0.0516	± 0.0123	0.0194
107		0.0687	± 0.0134	0.0140	157		0.0695	± 0.0188	0.0551
108		0.2351	± 0.0393	0.0335	158		0.0343	± 0.0100	0.0230
109		0.0589	± 0.0215	0.0566	159	U	-0.0394	± 0.0528	0.1185
110		0.1630	± 0.0257	0.0281	160		0.0698	± 0.0233	0.0628
110-DUP		0.1333	± 0.0229	0.0526	160-DUP		0.0398	± 0.0134	0.0458
111		0.0407	± 0.0113	0.0380	161	U	0.0494	± 0.0145	0.0592
112		0.1269	± 0.0253	0.0321	162		0.0467	± 0.0107	0.0207
113	U	0.0421	± 0.0114	0.0631	163		0.0471	± 0.0123	0.0233
114		0.0605	± 0.0117	0.0139	164	U	0.0697	± 0.0279	0.1336
115		0.1086	± 0.0231	0.0291	165	U	0.0019	± 0.0103	0.0648
116		0.0595	± 0.0151	0.0414	166	U	0.0490	± 0.0129	0.0498
117	U	0.0342	± 0.0112	0.0404	167		0.0387	± 0.0106	0.0234
118	U	0.0516	± 0.0288	0.0871	168		0.2327	± 0.0390	0.0290
119	U	0.0451	± 0.0381	0.1113	169		0.0749	± 0.0163	0.0560
120		0.0576	± 0.0137	0.0393	170		0.1508	± 0.0243	0.0474
120-DUP		0.0414	± 0.0171	0.0760	170-DUP		0.1202	± 0.0219	0.0515
121		0.0820	± 0.0186	0.0510	171		0.0375	± 0.0103	0.0236
122		0.0732	± 0.0150	0.0278	172		0.1902	± 0.0341	0.0319
123	U	0.0058	± 0.0189	0.0636	173		0.1089	± 0.0199	0.0569
124	U	0.0547	± 0.0204	0.0674	174		0.0917	± 0.0169	0.0235
125		0.0675	± 0.0150	0.0322	175	U	0.0702	± 0.0281	0.1506
126		0.0467	± 0.0135	0.0400	176	U	0.0109	± 0.0208	0.0556
127	U	0.0434	± 0.0147	0.0489	177		0.0449	± 0.0129	0.0280
128	U	0.0428	± 0.0388	0.1493	178	U	-0.0068	± 0.0220	0.0488
129	U	0.0315	± 0.0127	0.0509	179	U	0.0000	± 0.0000	0.1309
130		0.0626	± 0.0141	0.0207	180	U	-0.0020	± 0.0096	0.0532
130-DUP		0.0598	± 0.0157	0.0520	180-DUP		0.0275	± 0.0150	0.0476
131		0.0523	± 0.0116	0.0235	181 ^c		0.0263	± 0.0092	0.0247
132		0.1014	± 0.0234	0.0290	182 ^c		0.0928	± 0.0215	0.0335
133		0.0752	± 0.0151	0.0378	183 ^c		0.0354	± 0.0092	0.0218
134		0.0896	± 0.0158	0.0140	Average background	0.05148 (pCi/m ² /s)			
135		0.1571	± 0.0337	0.0898					
136	U	0.0234	± 0.0176	0.0544		IWCS	Value	Units	
137		0.1018	± 0.0186	0.0464		Average ^e	0.2109	(pCi/m ² /s)	
138		0.0580	± 0.0127	0.0139		High ^f	0.8252	(pCi/m ² /s)	
139		0.1469	± 0.0326	0.0992		Low	-0.0394	(pCi/m ² /s)	
140	U	0.0149	± 0.0168	0.0523	NOTE: The EPA Standard for Radon-222 Flux is 20 pCi/m²/s. a. Radon-222 flux was performed on July 8-9, 2019 (24 hour b. Every 10th canister is counted twice as a quality control (QC) duplicate to evaluate analytical precision. c. Background: 181-Lewiston-Porter Central School 182-Lewiston Water Pollution Control Center 183-Balmer Rd. (CWM Secondary Gate) d. Data Qualifier: U - no analyte was detected (Non-Detect). J - indicates a estimated value when relative percent difference and Z-score > 1.96 between the primary finding and duplicate e. Average of all values (detects and Un-detects) f. Highest detectable finding.				
140-DUP		0.0100	± 0.0197	0.0630					
141	U	0.0279	± 0.0137	0.0767					
142		0.0537	± 0.0131	0.0468					
143	U	0.0377	± 0.0192	0.0510					
144	U	0.0768	± 0.0408	0.1695					
145	U	0.0189	± 0.0240	0.0523					
146	U	0.0298	± 0.0172	0.0772					
147		0.0777	± 0.0147	0.0139					
148		0.0954	± 0.0229	0.0289					
149	U	0.0482	± 0.0238	0.0627					
150		0.1044	± 0.0190	0.0277					
150-DUP		0.0985	± 0.0183	0.0478					

NOTE: The EPA Standard for Radon-222 Flux is 20 pCi/m²/sec

a. Radon-222 flux was performed on July 8-9, 2019 (24 hour exposure).

b. Every 10th canister is counted twice as a quality control (QC) duplicate to evaluate analytical precision.

c. Background:
181-Lewiston-Porter Central School
182-Lewiston Water Pollution Control Center
183-Balmer Rd. (CWM Secondary Gate)

d. Data Qualifier: U - no analyte was detected (Non-Detect).
J - indicates a estimated value when relative percent difference > 30% and Z-score > 1.96 between the primary finding and duplicate (-DUP).

e. Average of all values (detects and Un-detects)

f. Highest detectable finding.

g. This result represents the area of elevated flux which has been studied for its spatial and temporal variation and it's correct influence on the annual average flux calculation

Table 6b
2019 Heterogeneous Regional Radon Flux Monitoring Results^a
Niagara Falls Storage Site

NFSS Sample ID	Date	Qualifier ^d	Radon-222 Flux				NFSS Sample ID	Date	Qualifier ^d	Radon-222 Flux			
			(pCi/m ² /s)			MDA				(pCi/m ² /s)			MDA
47 ^g	10/11/2019		0.1177	±	0.0302	0.0207	B4	10/25/2019		83.7565	±	9.1729	0.9531
62	7/10/2019		0.2249	±	0.0270	0.0434	B5 ^b	10/22/2019		167.5266	±	49.1145	2.1485
62	10/11/2019		0.3781	±	0.0603	0.0207	B5	10/25/2019		11.0872	±	1.2035	0.3790
65	7/10/2019		23.0501	±	1.9272	0.6387	B5-DUP ^b	10/22/2019		168.7768	±	49.3911	2.1644
65	10/11/2019		0.1145	±	0.0294	0.0487	B6 ^b	10/22/2019		0.6798	±	0.2026	0.0327
B1	10/11/2019		1.2801	±	0.1565	0.0691	B7	10/25/2019		243.0714	±	28.1311	1.5976
B1-DUP	10/11/2019		1.3213	±	0.1633	0.0691	B7-DUP	10/25/2019		237.8208	±	24.8769	1.5994
B2	10/11/2019		66.8727	±	7.0762	1.2301	B8	10/25/2019		6.8274	±	0.7457	0.2916
B2	10/25/2019		41.0868	±	4.3460	0.4642	B9	10/25/2019		18.3382	±	2.3235	0.6677
B3	10/11/2019		23.2846	±	2.4593	0.2397	B10	10/25/2019		3.5635	±	0.4068	0.0458
B3	10/25/2019		72.9996	±	8.4318	1.4330	B11	10/25/2019		115.2764	±	12.2845	1.5597
B4	10/11/2019		64.8823	±	6.8642	1.0638	B12	10/25/2019		75.4845	±	8.7238	1.4556
							183 ^c	10/11/2019		0.1247	±	0.0312	0.0218

NOTE: This sub-region of the IWCS is approximately 225 m²

a. Radon-222 flux was performed over 24 hour exposure except where noted

b. Radon-222 flux was performed over 96 hour exposure

c. Background: 183-Balmer Rd. (CWM Secondary Gate)

d. Data Qualifier: U - no analyte was detected (Non-Detect).

J - indicates a estimated value when relative percent difference > 30%
and Z-score > 1.96 between the primary finding and duplicate (-DUP).

e. Average of all values (detects and Un-detects)

f. Highest detectable finding.

g. Measurement performed as reference; not included in region mean

Region	Value	Units
Average ^e	50.9892	(pCi/m ² /s)
High ^f	243.0714	(pCi/m ² /s)
Low	0.1145	(pCi/m ² /s)

Table 7
2019 Surface water Field Parameter Measurements
Niagara Falls Storage Site

SURFACE WATER

Surface Water	Date	Temperature (°F ^a)	pH	ORP ^f (mV ^g)	Spec. Cond. ^b (mS/cm ^c)	Turbidity (NTU ^h)	DO ^d (mg/L ^e)
SWSD025 ¹	03/12/2019	34.8	6.72	181	1.200	36.4	10.88
SWSD009	05/23/2019	71.5	7.51	115	1.760	11.0	5.45
SWSD010	05/29/2019	56.6	7.31	96	1.050	28.1	4.69
SWSD011	05/29/2019	56.5	7.53	210	0.833	16.2	8.32
SWSD021 ²	05/29/2019	58.1	7.39	91	0.752	76.5	5.46
SWSD022	05/29/2019	56.7	7.42	32	1.000	31.0	6.42
SWSD023	05/23/2019	62.6	7.06	0	1.490	3.0	3.45
SWSD025 ¹	05/29/2019	56.7	7.45	155	0.964	26.4	10.05
WDD2	05/23/2019	66.2	7.47	187	0.786	33.6	5.36
WDD3	05/23/2019	73.2	7.59	177	0.763	37.6	4.88
SWSD025 ¹	8/28/2019	70.3	7.36	54	1.230	2.6	3.37
SWSD009 ²	10/22/2019	58.6	7.52	141.0	1.39	83.2	7.60
SWSD010	10/23/2019	52.5	7.52	93.0	0.900	38.8	9.06
SWSD011	10/23/2019	54.6	7.68	168.0	0.810	8.9	9.36
SWSD021	10/23/2019	52.2	7.66	125.0	0.477	22.5	9.13
SWSD022	10/23/2019	51.9	7.57	157.0	0.911	12.0	9.75
SWSD023	10/22/2019	58.0	6.74	10.0	1.020	35.1	4.82
SWSD025 ¹	10/23/2019	51.8	7.64	134.0	0.887	10.5	9.79
WDD2	10/21/2019	55.7	7.46	109.0	0.934	15.0	6.65
WDD3	10/21/2019	56.1	6.90	176.0	0.930	5.0	6.60

a. °F - Degrees Fahrenheit.

b. Spec. Cond. - Specific conductance.

c. mS/cm - millisiemens/centimeter.

d. DO - Dissolved oxygen.

e. mg/L - milligrams per liter.

f. ORP - Oxidation-Reduction potential.

g. mV - milliVolts.

h. NTU - Nephelometric turbidity units.

NA - Not Applicable

*Parameter not taken/meter malfunction

¹ NYSDOH requested sampling location for quarterly sampling.

²Primary sample will have an accompanying filtered sample (-F).

TABLE 8
SURFACE WATER ANALYTICAL RESULTS - RADIONUCLIDES
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD009	SWSD009	SWSD009	SWSD010	SWSD010
Field Sample Identifier		SWSD009	SWSD009	SWSD009-D	SWSD010	SWSD010
Sample Matrix		Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
Depth Interval (ft)		-	-	-	-	-
Date of Sample		05/23/19	10/22/19	10/22/19	05/29/19	10/23/19
Parameter	Units			Field Duplicate		
RADIONUCLIDES						
RADIUM-226	PCI/L	0.24	2.39 J	0.44 UJ	0.11 U	0.4
TOTAL URANIUM	UG/L	8.05	5.96	5.3	10.2	3.73
RADIONUCLIDES (FILTERED)						
RADIUM-226	PCI/L	Not Analyzed	0.37 U	Not Analyzed	Not Analyzed	Not Analyzed
TOTAL URANIUM	UG/L	Not Analyzed	6.76	Not Analyzed	Not Analyzed	Not Analyzed

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE 8
SURFACE WATER ANALYTICAL RESULTS - RADIONUCLIDES
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD011	SWSD011	SWSD021	SWSD021	SWSD022
Field Sample Identifier		SWSD011	SWSD011	SWSD021	SWSD021	SWSD022
Sample Matrix		Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
Depth Interval (ft)		-	-	-	-	-
Date of Sample		05/29/19	10/23/19	05/29/19	10/23/19	05/29/19
Parameter	Units					
RADIONUCLIDES						
RADIUM-226	PCI/L	0.11 U	0.3 U	0.57	0.24 U	0.14 U
TOTAL URANIUM	UG/L	9.65	7.81	Not Analyzed	3.83	11.3
RADIONUCLIDES (FILTERED)						
RADIUM-226	PCI/L	Not Analyzed	Not Analyzed	0.17 U	Not Analyzed	Not Analyzed
TOTAL URANIUM	UG/L	Not Analyzed	Not Analyzed	12.1	Not Analyzed	Not Analyzed

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE 8
SURFACE WATER ANALYTICAL RESULTS - RADIONUCLIDES
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD022	SWSD023	SWSD023	SWSD025	SWSD025
Field Sample Identifier		SWSD022	SWSD023	SWSD023	SWSD025	SWSD025
Sample Matrix		Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
Depth Interval (ft)		-	-	-	-	-
Date of Sample		10/23/19	05/23/19	10/22/19	03/12/19	05/29/19
Parameter	Units					
RADIONUCLIDES						
RADIUM-226	PCI/L	0.57	0.07 U	0.38 U	0.03 U	0.23 U
TOTAL URANIUM	UG/L	6.88	6.68	3.15	12.1	10
RADIONUCLIDES (FILTERED)						
RADIUM-226	PCI/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
TOTAL URANIUM	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE 8
SURFACE WATER ANALYTICAL RESULTS - RADIONUCLIDES
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD025	SWSD025	WDD2	WDD2	WDD3
Field Sample Identifier		SWSD025	SWSD025	WDD2	WDD2	WDD3
Sample Matrix		Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
Depth Interval (ft)		-	-	-	-	-
Date of Sample		08/28/19	10/23/19	05/23/19	10/21/19	05/23/19
Parameter	Units					
RADIONUCLIDES						
RADIUM-226	PCI/L	0.41	0.32 U	0.02 U	0.4 U	0.09 U
TOTAL URANIUM	UG/L	5.06	7.74	3.8	2.24	4
RADIONUCLIDES (FILTERED)						
RADIUM-226	PCI/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
TOTAL URANIUM	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE 8
SURFACE WATER ANALYTICAL RESULTS - RADIONUCLIDES
NIAGARA FALLS STORAGE SITE

Location Identifier		WDD3	WDD3
Field Sample Identifier		WDD3-D	WDD3
Sample Matrix		Surface Water	Surface Water
Depth Interval (ft)		-	-
Date of Sample		05/23/19	10/21/19
Parameter	Units	Field Duplicate	
RADIONUCLIDES			
RADIUM-226	PCI/L	0.11 U	0.32 U
TOTAL URANIUM	UG/L	4.4	2.29
RADIONUCLIDES (FILTERED)			
RADIUM-226	PCI/L	Not Analyzed	Not Analyzed
TOTAL URANIUM	UG/L	Not Analyzed	Not Analyzed

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE 9
SEDIMENT ANALYTICAL RESULTS - RADIONUCLIDES
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD009	SWSD009	SWSD009	SWSD010	SWSD010
Field Sample Identifier		SWSD009	SWSD009	SWSD009-D	SWSD010	SWSD010
Sample Matrix		Sediment	Sediment	Sediment	Sediment	Sediment
Depth Interval (ft)		-	-	-	-	-
Date of Sample		05/24/19	10/22/19	10/22/19	05/29/19	10/23/19
Parameter	Units			Field Duplicate		
RADIONUCLIDES						
RADIUM-226	PCI/G	1.14	0.9 U	1.17	1.63	1.5
URANIUM-233/234	PCI/G	1.15	1.21	1.09	3.12	3.62
URANIUM-235	PCI/G	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
URANIUM-235/236	PCI/G	0.037	0.054	0.063	0.158	0.136
URANIUM-238	PCI/G	1.01	1.06	0.96	2.9	3.06

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE 9
SEDIMENT ANALYTICAL RESULTS - RADIONUCLIDES
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD011	SWSD011	SWSD021	SWSD021	SWSD022
Field Sample Identifier		SWSD011	SWSD011	SWSD021	SWSD021	SWSD022
Sample Matrix		Sediment	Sediment	Sediment	Sediment	Sediment
Depth Interval (ft)		-	-	-	-	-
Date of Sample		05/29/19	10/23/19	05/30/19	10/23/19	05/29/19
Parameter	Units					
RADIONUCLIDES						
RADIUM-226	PCI/G	1.45	2.07	1.6	1.05	1.58
URANIUM-233/234	PCI/G	2.17	2.38	1.08	1.19	1.7
URANIUM-235	PCI/G	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
URANIUM-235/236	PCI/G	0.094	0.119	0.046	0.094	0.074
URANIUM-238	PCI/G	2.07	2.09	1.07	1.12	1.66

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE 9
SEDIMENT ANALYTICAL RESULTS - RADIONUCLIDES
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD022	SWSD023	SWSD023	SWSD025	SWSD025
Field Sample Identifier		SWSD022	SWSD023	SWSD023	SWSD025	SWSD025
Sample Matrix		Sediment	Sediment	Sediment	Sediment	Sediment
Depth Interval (ft)		-	-	-	-	-
Date of Sample		10/23/19	05/24/19	10/22/19	03/13/19	05/29/19
Parameter	Units					
RADIONUCLIDES						
RADIUM-226	PCI/G	1.46	0.85	1.06	Not Analyzed	1.36
URANIUM-233/234	PCI/G	1.81	1.06	0.9	2.18	2.8
URANIUM-235	PCI/G	Not Analyzed	Not Analyzed	Not Analyzed	0.1 U	Not Analyzed
URANIUM-235/236	PCI/G	0.086	0.05	0.065	0.096	0.124
URANIUM-238	PCI/G	1.78	0.93	0.94	1.92	2.42

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE 9
SEDIMENT ANALYTICAL RESULTS - RADIONUCLIDES
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD025	SWSD025	SWSD025	WDD2	WDD2
Field Sample Identifier		SWSD025	SWSD025	SWSD025	WDD2	WDD2
Sample Matrix		Sediment	Sediment	Sediment	Sediment	Sediment
Depth Interval (ft)		-	-	-	-	-
Date of Sample		05/29/19	08/28/19	10/23/19	05/24/19	10/22/19
Parameter	Units	Field Duplicate				
RADIONUCLIDES						
RADIUM-226	PCI/G	1.85	2.25	2.26	0.82	1.33
URANIUM-233/234	PCI/G	2.24	3.48	2.59	0.73	1.9
URANIUM-235	PCI/G	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
URANIUM-235/236	PCI/G	0.127	0.102	0.109	0.035	0.052
URANIUM-238	PCI/G	2.07	2.73	2.41	0.68	1.44

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE 9
SEDIMENT ANALYTICAL RESULTS - RADIONUCLIDES
NIAGARA FALLS STORAGE SITE

Location Identifier		WDD3	WDD3
Field Sample Identifier		WDD3	WDD3
Sample Matrix		Sediment	Sediment
Depth Interval (ft)		-	-
Date of Sample		05/24/19	10/22/19
Parameter	Units		
RADIONUCLIDES			
RADIUM-226	PCI/G	1.46	3.08
URANIUM-233/234	PCI/G	0.93	2.28
URANIUM-235	PCI/G	Not Analyzed	Not Analyzed
URANIUM-235/236	PCI/G	0.039	0.101
URANIUM-238	PCI/G	0.93	1.94

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE 10
2019 WATER LEVEL MEASUREMENTS

Well No.	Reference Elevation (ft)	1st Quarter (03/12/19)		2nd Quarter (05/23/19)		3rd Quarter (08/26/19)		4th Quarter (10/21/19)	
		Depth to Water (ft)	Groundwater Elevation (ft)	Depth to Water (ft)	Groundwater Elevation (ft)	Depth to Water (ft)	Groundwater Elevation (ft)	Depth to Water (ft)	Groundwater Elevation (ft)
UPPER WATER BEARING ZONE WELLS									
505	317.80	5.69	312.11	3.09	314.71	14.25	303.55	15.35	302.45
201A	321.47	4.54	316.93	5.07	316.40	5.40	316.07	4.66	316.81
203A	321.87	4.24	317.63	4.73	317.14	4.97	316.90	4.56	317.31
213A	321.37	4.55	316.82	5.12	316.25	7.54	313.83	7.95	313.42
215A	320.26	3.32	316.94	4.32	315.94	12.21	308.05	9.99	310.27
302A	320.53	4.14	316.39	4.08	316.45	5.62	314.91	5.02	315.51
303A	321.83	4.22	317.61	4.56	317.27	6.38	315.45	5.89	315.94
404A	323.73	4.99	318.74	5.18	318.55	7.37	316.36	6.96	316.77
411A	322.05	4.40	317.65	4.22	317.83	5.99	316.06	4.59	317.46
415A	321.27	3.30	317.97	3.34	317.93	8.80	312.47	10.45	310.82
603A	320.57	2.50*		2.10	318.47	3.08	317.49	2.48	318.09
606A	321.49	2.80	318.69	3.15	318.34	3.68	317.81	3.40	318.09
808A	319.27	2.38	316.89	2.07	317.20	5.37	313.90	7.05	312.22
810A	318.44	5.10	313.34	4.76	313.68	14.91	303.53	15.48	302.96
816A	320.62	1.73	318.89	2.66	317.96	2.72	317.90	2.10	318.52
A42	319.70	7.10	312.60	5.20	314.50	5.09	314.61	5.45	314.25
A43	320.50	7.26	313.24	4.63	315.87	5.08	315.42	5.05	315.45
A45	321.70	9.07	312.63	8.22	313.48	8.88	312.82	8.27	313.43
A50	321.30	12.59**		10.40	310.90	10.94	310.36	10.69	310.61
B02W20S	322.00	2.73	319.27	2.88	319.12	3.65	318.35	3.47	318.53
BH49A	320.65	6.24	314.41	4.19	316.46	4.22	316.43	3.61	317.04
MW313	320.88	3.92	316.96	3.64	317.24	6.37	314.51	6.19	314.69
MW314	318.94	3.45	315.49	2.85	316.09	7.53	311.41	8.50	310.44
MW422	321.36	19.33	302.03	5.26	316.10	16.00	305.36	18.77	302.59
MW423	322.39	4.91	317.48	4.19	318.20	10.87	311.52	12.57	309.82
MW424	320.93	3.23	317.70	3.41	317.52	5.06	315.87	3.48	317.45
MW862	319.62	5.69	313.93	6.53	313.09	6.12	313.50	5.82	313.80
MW921	319.88	6.42	313.46	4.94	314.94	12.01	307.87	14.29	305.59
MW922	318.56	3.46	315.10	2.84	315.72	7.17	311.39	6.17	312.39
MW923	319.53	4.90	314.63	3.54	315.99	11.83	307.70	15.38	304.15
MW930	323.16	4.79	318.37	4.63	318.53	10.47	312.69	10.72	312.44
MW934	322.20	4.09	318.11	3.70	318.50	7.67	314.53	7.53	314.67
MW935	319.33	3.95	315.38	4.65	314.68	4.99	314.34	3.92	315.41
MW936	320.64	6.20	314.44	2.29	318.35	3.42	317.22	2.84	317.80
MW938	319.54	3.58	315.96	4.21	315.33	6.53	313.01	3.95	315.59
MW941	318.98	3.43	315.55	3.16	315.82	3.69	315.29	3.22	315.76
MW943	321.60	3.74	317.86	3.65	317.95	4.64	316.96	4.10	317.50
MW944	318.64	5.47	313.17	4.34	314.30	10.71	307.93	11.79	306.85
MW945	320.24	5.48	314.76	5.44	314.80	13.55	306.69	15.62	304.62
MW946	319.65	3.24	316.41	2.42	317.23	7.20	312.45	10.97	308.68
MW947	322.53	20.85	301.68	6.62	315.91	17.92	304.61	19.35	303.18
MW948	321.04	2.85*		2.77	318.27	5.95	315.09	6.56	314.48
MW950	322.03	4.66	317.37	4.18	317.85	5.60	316.43	4.61	317.42
MW951	320.84	5.04	315.80	4.85	315.99	5.75	315.09	5.23	315.61
MW952	320.16	5.30	314.86	4.81	315.35	5.11	315.05	4.40	315.76
MW953	319.94	5.84	314.10	6.34	313.60	5.43	314.51	4.80	315.14
MW954	319.85	5.51	314.34	4.39	315.46	5.02	314.83	3.76	316.09
MW955	320.09	21.74**		4.84	315.25	5.24	314.85	4.50	315.59
MW956	323.13	7.60	315.53	6.25	316.88	7.17	315.96	6.71	316.42
MW957	324.48	7.80	316.68	7.16	317.32	9.42	315.06	8.84	315.64
MW958	319.77	4.18	315.59	4.30	315.47	8.14	311.63	5.18	314.59
MW959	320.56	5.25	315.31	4.43	316.13	5.84	314.72	4.90	315.66
MW960	321.02	5.55	315.47	5.28	315.74	6.10	314.92	5.69	315.33
OW02B	321.55	5.71	315.84	3.40	318.15	3.67	317.88	8.87	312.68
OW03B	321.55	6.69	314.86	4.39	317.16	4.30	317.25	4.76	316.79
OW04B	320.17	4.78	315.39	3.78	316.39	4.56	315.61	3.62	316.55
OW05B	319.68	5.21	314.47	3.78	315.90	4.95	314.73	3.53	316.15
OW06B	322.28	4.93	317.35	5.08	317.20	5.55	316.73	5.28	317.00
OW07B	319.69	4.97	314.72	4.50	315.19	8.78	310.91	4.55	315.14
OW08B	318.97	4.42	314.55	4.40	314.57	5.39	313.58	3.96	315.01
OW09B	318.82	3.63	315.19	3.48	315.34	4.98	313.84	3.45	315.37
OW10B	320.13	3.44	316.69	3.07	317.06	4.25	315.88	3.18	316.95
OW11B	319.09	4.14	314.95	3.37	315.72	3.87	315.22	2.98	316.11
OW12B	319.09	5.44	313.65	4.87	314.22	7.08	312.01	6.20	312.89
OW13B	321.09	6.93	314.16	4.94	316.15	5.75	315.34	5.51	315.58
OW15B	320.12	5.58	314.54	3.91	316.21	5.45	314.67	4.38	315.74
OW17B	320.29	17.95	302.34	4.06	316.23	4.20	316.09	3.91	316.38
OW18B	320.76	14.10	306.66	5.78	314.98	5.86	314.90	8.58	312.18

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****Under Development**

Table 11
2019 Groundwater Field Parameter Measurements
Niagara Falls Storage Site

Well ID	Date	Temperature (°F ^a)	pH	ORP ^f (mV ^g)	Spec. Cond. ^b (mS/cm ^c)	Turbidity (NTU ^h)	DO ^d (mg/L ^e)	Volume Purged (Liters ⁱ)	Discharge milliter PM ^j
OW04A ¹	3/12/2019	50.0	8.43	168	1.16	0.0	6.98	5.4	180
OW04B ¹	3/12/2019	47.0	7.30	73	1.60	37.7	1.56	5.3	175
505	6/3/2019	51.8	6.93	-99	6.39	2.5	4.46	6.9	230
302A	5/28/2019	52.7	7.05	18	2.20	9.0	2.06	4.2	120
411A	5/30/2019	58.7	6.9	-53	3.07	3.5	0.61	3.8	125
A42	5/30/2019	72.7	6.62	13	1.50	3.8	0.49	3.3	110
A43	5/31/2019	72.70	6.62	14	1.51	4.1	0.50	3.8	125
A45	5/31/2019	72.8	7.02	81	1.62	0.0	0.76	3.8	125
A50R	5/31/2019	64.5	7.38	210	0.33	0.0	2.80	3.3	110
A55R	5/31/2019	59.8	8.08	159	3.33	1.6	1.05	3.8	125
BH49R	6/4/2019	56.5	7.38	120	1.77	4.8	3.77	4.7	155
BH49AR ³	6/6/2019	56.5	9.07	-171	1.77	0.0	1.05	-	-
MW862	6/3/2019	56.7	6.86	199	1.73	0.2	0.53	3.3	110
MW863	6/3/2019	60.6	7.90	189	1.89	0.0	1.57	3.6	120
MW921	6/3/2019	53.4	6.98	193	4.71	0.0	5.28	5.1	170
MW934	5/30/2019	55.6	6.91	145	4.14	19.1	0.80	4.8	160
MW935	5/28/2019	52.2	7.30	-78	1.28	12.6	3.09	4.5	150
MW938	5/28/2019	51.2	7.12	-52	2.36	3.4	1.71	4.4	145
MW943	6/3/2019	61.9	6.94	217	1.75	1.9	0.50	3.4	114
MW944	5/30/2019	57.2	6.60	180	1.31	0.0	2.42	4.8	160
MW945	5/30/2019	55.8	6.81	116	2.67	11.4	1.42	4.9	163
MW946	5/30/2019	56.2	6.99	51	6.80	0.0	4.27	3.9	130
MW947	5/30/2019	58.9	6.81	-47	1.78	7.5	0.69	4.2	140
MW948	5/30/2019	56.8	6.98	214	4.25	15.9	2.30	5.2	173
MW949	5/30/2019	60.3	7.82	-186	2.98	0.0	1.00	5.1	169
MW950	5/31/2019	57.8	7.11	168	3.15	11.0	0.79	4.4	147
MW951	6/3/2019	66.1	6.90	19	1.60	0.0	0.36	4.6	130
MW952	5/28/2019	55.6	7.44	249	0.99	48.9	3.66	4.9	163
MW953R	5/28/2019	53.3	7.31	276	1.80	0.0	3.62	4.9	163
MW954	5/28/2019	53.9	7.26	213	2.15	0.3	7.31	3.3	110
MW955	5/28/2019	52.3	7.09	218	1.77	1.4	7.17	5.0	167
MW956	5/31/2019	56.3	7.09	140	2.23	8.2	4.82	4.7	155
MW957	5/28/2019	56.6	6.83	239	1.87	95.5	3.34	7.3	183
MW958	5/28/2019	53.3	7.24	222	1.19	7.0	5.42	4.4	148
MW959	5/31/2019	59.3	7.21	147	1.74	22.6	1.60	5.9	168
MW960	5/31/2019	63.1	6.97	-12	1.41	4.8	0.81	5.0	151
OW03A	6/3/2019	56.7	7.74	127	1.89	8.3	5.30	3.8	125
OW03B	6/3/2019	61.7	7.40	194	1.68	0.0	0.69	3.8	125
OW04A	6/3/2019	54.8	8.52	185	1.18	0.0	0.87	3.9	130
OW04B	6/3/2019	52.6	7.14	-67	1.59	22.8	1.50	3.9	130
OW05A	5/30/2019	62.3	7.70	-76	1.31	88.8	0.59	4.8	160
OW05B	5/30/2019	65.3	7.24	-2	1.48	0.8	0.28	4.1	137
OW06A	6/3/2019	55.8	8.03	64	1.75	5.1	2.94	3.8	125
OW06B	6/3/2019	61.5	7.17	-97	1.59	0.0	0.39	3.8	125
OW07A	5/28/2019	54.5	7.79	103	2.02	1.6	1.62	6.1	152
OW07B	5/28/2019	54.6	7.25	240	1.85	1.4	2.36	4.9	163
OW11A	5/30/2019	56.2	8.03	-66	1.44	0.0	0.92	4.9	163
OW11B	5/30/2019	57.5	7.35	52	1.75	0.0	0.67	5.0	167
OW12A	5/31/2019	58.4	7.43	-90	1.77	4.2	0.42	5.5	166
OW12B	5/31/2019	59.3	7.94	182	0.99	0.2	1.36	5.1	169
OW13A	5/31/2019	57.3	7.39	-97	2.10	0.0	1.20	3.8	125
OW13BR	6/4/2019	57.7	7.23	208	1.71	1.5	1.20	4.7	157
OW15A	5/28/2019	55.3	7.58	-71	2.28	0.0	0.87	4.7	157
OW15BR	5/28/2019	57.7	7.36	181	1.70	2.5	8.43	4.3	143
OW17AR	5/29/2019	55.2	7.34	-101	2.40	0.0	1.16	4.8	160
OW17BR	5/29/2019	61.5	7.67	201	1.96	6.1	2.46	4.8	160
OW18B	5/30/2019	60.6	7.60	157	2.01	13.1	1.11	4.5	150
OW04A ¹	8/28/2019	64.6	7.88	-136	1.29	0.0	0.47	5.8	193
OW04B ¹	8/28/2019	67.8	7.03	-28	1.59	38.4	7.54	6.5	217

Table 11
2019 Groundwater Field Parameter Measurements
Niagara Falls Storage Site

Well ID	Date	Temperature (°F ^a)	pH	ORP ^f (mV ^g)	Spec. Cond. ^b (mS/cm ^c)	Turbidity (NTU ^h)	DO ^d (mg/L ^e)	Volume Purged (Liters ⁱ)	Discharge milliter PM ^j
505	10/28/2019	60.0	6.58	-116	8.00	0.0	0.56	3.0	100
302A	10/29/2019	61.5	6.90	-33	2.95	0.0	0.64	4.4	148
411A	10/28/2019	59.4	6.82	-86	2.92	1.7	0.99	6.4	142
A42	10/29/2019	60.5	6.78	-69	1.29	0.3	0.29	6.3	210
A43	10/29/2019	61.1	6.66	-68	0.69	1.5	0.68	3.8	125
A45	10/25/2019	58.6	7.16	-27	1.01	7.0	0.47	4.5	150
A50R	10/29/2019	66.0	6.98	-2	1.07	0.0	0.53	3.8	125
A55R	10/25/2019	55.6	7.35	178	3.02	4.7	1.62	4.3	143
BH49R	10/30/2019	56.1	10.39	-245	1.50	111.0	0.49	4.8	160
BH49AR	10/29/2019	61.2	7.29	1	1.79	5.4	0.60	4.2	140
MW862	10/25/2019	56.9	6.77	14	1.88	0.2	0.63	4.1	137
MW863	10/25/2019	56.0	7.43	-139	2.03	9.9	1.13	4.5	150
MW922	10/24/2019	58.5	6.64	59	5.24	8.9	2.36	3.5	117
MW934	10/28/2019	58.0	6.89	-47	4.22	1.4	1.84	5.4	181
MW935	10/25/2019	56.3	7.34	-209	1.59	1.9	2.86	3.9	129
MW938	10/25/2019	55.7	6.99	-106	2.76	1.0	0.56	4.4	147
MW943	10/25/2019	57.0	7.04	-36	2.29	56.4	1.25	5.2	172
MW944	10/24/2019	63.5	6.69	161	1.32	4.0	3.56	4.2	140
MW945 ²	10/24/2019	58.8	6.70	228	3.50	30.2	1.98	1	100
MW946 ²	10/28/2019	58.0	6.96	33	6.65	38.9	7.06	4.2	140
MW947 ^{2,5}	10/28/2019	56.7	6.60	44	2.66	3.5	0.96	2.4	120
MW422 ⁶	10/28/2019	56.3	6.51	-110	7.57	0.0	0.41	2.5	124
MW948	10/28/2019	58.5	6.97	221	4.49	0.8	4.36	4.7	155
MW949	10/28/2019	56.4	7.88	-220	3.23	8.2	0.41	4.6	153
MW950	10/25/2019	56.8	7.13	113	3.13	0.5	2.42	5.6	187
MW951	10/28/2019	62.7	6.84	-48	2.03	0.0	0.44	3.8	125
MW952	10/28/2019	62.5	7.47	88	0.55	47.3	3.86	4.9	163
MW953R	10/28/2019	65.4	7.40	59	1.66	0.0	0.80	4.6	152
MW954	10/24/2019	61.1	7.40	199	1.76	0.0	3.48	4.1	137
MW955	10/24/2019	60.1	7.14	190	1.83	37.6	2.38	6.0	200
MW956	10/24/2019	60.3	6.99	23	2.29	41.8	0.68	3.8	150
MW957	10/28/2019	63.1	6.82	210	1.95	0.0	3.89	3.3	111
MW958	10/28/2019	61.5	7.16	-45	1.37	0.0	1.92	3.3	110
MW959	10/25/2019	59.3	7.35	114	1.04	3.0	4.33	5.3	175
MW960	10/29/2019	62.1	6.97	17	1.43	5.2	1.68	4.3	143
OW03A	10/29/2019	55.6	7.10	-104	1.95	1.8	0.46	5.9	196
OW03B	10/29/2019	58.5	7.52	105	1.67	0.2	4.47	6.2	205
OW04A	10/25/2019	54.1	7.75	-151	1.30	0.7	0.78	5.8	192
OW04B	10/30/2019	58.2	6.79	6	1.59	31.1	1.44	7.9	262
OW05A	10/25/2019	54.8	7.55	-122	1.37	2.1	0.76	5.8	193
OW05B	10/29/2019	60.7	7.28	-193	1.58	29.7	2.58	5.3	176
OW06A	10/28/2019	60.4	7.42	-129	1.91	0.0	0.58	4.5	150
OW06B	10/25/2019	61.0	7.03	-125	1.68	17.1	0.80	3.9	130
OW07A	10/24/2019	57.6	7.72	-64	2.05	0.0	0.75	5.0	168
OW07B ⁷	10/24/2019	61.0	6.58	205	1.69	29.0	4.18	7.4	245
OW11A	10/29/2019	65.1	7.79	27	1.43	0.0	1.29	4.6	153
OW11B	10/28/2019	61.1	7.44	91	1.70	0.0	1.14	6.8	194
OW12A	10/24/2019	59.7	7.39	-123	1.70	0.0	0.44	5.5	182
OW12B	10/24/2019	59.2	7.06	-10	1.39	5.8	6.90	7.1	235
OW13A	10/24/2019	56.7	7.36	-127	2.10	2.3	0.49	5.8	192
OW13BR	10/28/2019	61.1	7.35	43	1.63	0.0	3.32	7.6	191
OW15A	10/25/2019	55.5	7.49	-120	2.29	3.0	0.75	6.6	188
OW15BR	10/28/2019	61.2	7.29	-1	1.77	0.0	0.84	7.1	177
OW17AR	10/24/2019	55.9	7.77	-135	2.21	1.0	0.51	6.6	165
OW17BR	10/24/2019	60.0	7.72	-31	1.36	0.3	2.28	4.8	160
OW18BR	10/24/2019	61.8	7.31	-106	2.16	0.1	0.73	4.3	142

- a. °F - Degrees Fahrenheit.
b. Spec. Cond. - Specific conductance.
c. mS/cm - millisiemens/centimeter.
d. DO - Dissolved oxygen.
e. mg/L - milligrams per liter.
f. ORP - Oxidation-Reduction potential.
g. mV - milliVolts.
h. NTU - Nephelometric turbidity units.
i. 1-Liter = 0.26 gallons
j. Milliter PM = milliter per minute
(1000ml = 1.0 liter) -averaged rate

NA - Not Applicable

*Parameter not taken/meter malfunction

¹ Quarterly sampling.

² Well purged dry and/or began to purge dry during sampling

³ Grab sample (-G)

⁴Substitute well for wells: 505, MW921, MW944 and MW945 ⁵Insufficient volume for sample

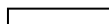
⁶Substitute well for well: MW947

⁷TDS, ALK and ANIONS -Resampled (10/28) due to lab error.

NOTE: Wells with an 'R' at the end (e.g., MW###R or OW###R) indicate well was replaced.

TABLE 12
GROUNDWATER ANALYTICAL RESULTS - WATER QUALITY PARAMETERS
NIAGARA FALLS STORAGE SITE

Location Identifier :			302A	302A	411A	411A	505
Field Sample Identifier :			302A	302A	411A	411A	505
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			05/28/19	10/29/19	05/30/19	10/28/19	06/03/19
Parameter	Units	Criteria ¹					
MISCELLANEOUS							
ALKALINITY, TOTAL	MG/L	500	334	419	709	820	867
BROMIDE	MG/L	2	0.56	0.48	0.18 J	0.3	3.6
CHLORIDE (AS CL)	MG/L	250	112	139	26.9	31.1	353
DISSOLVED SOLIDS, TOTAL	MG/L	1000	1,650	2,350	1,980	2,370	5,900
FLUORIDE	MG/L	1.5	0.3	0.28	0.38	0.42	0.02 U
NITROGEN, NITRATE (AS N)	MG/L	10	0.16 J	0.02 U	0.06 J	0.08 J	0.14 J
NITROGEN, NITRITE (AS N)	MG/L	1	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
PHOSPHORUS, TOTAL ORTHOPHOSPHATE (AS PO ₄)	MG/L	-	0.0029 U	0.011 J	0.0032 J	0.0097 J	0.0096 J
SULFATE	MG/L	250	1,230	1,480	965	1,150	4,460



Concentration Exceeds Criteria

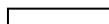
(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 12
GROUNDWATER ANALYTICAL RESULTS - WATER QUALITY PARAMETERS
NIAGARA FALLS STORAGE SITE

Location Identifier :			505	A42	A42	A43	A43
Field Sample Identifier :			505	A42	A42	A43	A43
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			10/28/19	05/30/19	10/29/19	05/30/19	10/29/19
Parameter	Units	Criteria ¹					
MISCELLANEOUS							
ALKALINITY, TOTAL	MG/L	500	1,180	377	405	526	596
BROMIDE	MG/L	2	4.1	0.34	0.32	0.56	0.52
CHLORIDE (AS CL)	MG/L	250	349	29	37	29.1	28.5
DISSOLVED SOLIDS, TOTAL	MG/L	1000	7,680	1,060	1,020	1,690	1,650
FLUORIDE	MG/L	1.5	0.52	0.16 J	0.1 J	0.24	0.22
NITROGEN, NITRATE (AS N)	MG/L	10	0.12 J	0.02 U	0.06 J	0.02 U	0.02 U
NITROGEN, NITRITE (AS N)	MG/L	1	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
PHOSPHORUS, TOTAL ORTHOPHOSPHATE (AS PO ₄)	MG/L	-	0.0029 U	0.0029 U	0.013 J	0.0029 U	0.0029 U
SULFATE	MG/L	250	4,130	341	387	763	734



Concentration Exceeds Criteria

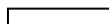
(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 12
GROUNDWATER ANALYTICAL RESULTS - WATER QUALITY PARAMETERS
NIAGARA FALLS STORAGE SITE

Location Identifier :			A45	A45	MW422	MW862	MW862
Field Sample Identifier :			A45	A45	MW422	MW862	MW862
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			05/31/19	10/25/19	10/28/19	06/03/19	10/25/19
Parameter	Units	Criteria ¹					
MISCELLANEOUS							
ALKALINITY, TOTAL	MG/L	500	415	459	1,160	650	635
BROMIDE	MG/L	2	0.2	0.34 J	1.1	0.54	0.56 J
CHLORIDE (AS CL)	MG/L	250	58.2	59.2	141	68.3	69.1
DISSOLVED SOLIDS, TOTAL	MG/L	1000	1,720	1,570	8,170	1,390	1,370
FLUORIDE	MG/L	1.5	0.12 J	0.1 J	0.76	0.2	0.18 J
NITROGEN, NITRATE (AS N)	MG/L	10	0.1 J	0.02 U	0.08 J	0.36	0.22
NITROGEN, NITRITE (AS N)	MG/L	1	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
PHOSPHORUS, TOTAL ORTHOPHOSPHATE (AS PO ₄)	MG/L	-	0.0029 U	0.0097 J	0.0029 U	0.0029 U	0.013 J
SULFATE	MG/L	250	712	719	4,600	401	368 J



Concentration Exceeds Criteria

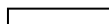
(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 12
GROUNDWATER ANALYTICAL RESULTS - WATER QUALITY PARAMETERS
NIAGARA FALLS STORAGE SITE

Location Identifier :			MW863	MW863	MW921	MW921	MW934
Field Sample Identifier :			MW863	MW863	MW921	MW921	MW934
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			06/03/19	10/25/19	06/03/19	10/24/19	05/30/19
Parameter	Units	Criteria ¹					
MISCELLANEOUS							
ALKALINITY, TOTAL	MG/L	500	227	Not Analyzed	789	819	695
BROMIDE	MG/L	2	0.46	0.5 J	3.1	2.7 J	0.68
CHLORIDE (AS CL)	MG/L	250	32.7	31.9	270	232	61.1
DISSOLVED SOLIDS, TOTAL	MG/L	1000	1,760	1,500	4,410	4,380	3,610
FLUORIDE	MG/L	1.5	0.16 J	0.18 J	0.1 J	0.02 U	0.2
NITROGEN, NITRATE (AS N)	MG/L	10	0.46	0.34	0.14 J	0.02 U	0.06 J
NITROGEN, NITRITE (AS N)	MG/L	1	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
PHOSPHORUS, TOTAL ORTHOPHOSPHATE (AS PO ₄)	MG/L	-	0.0029 U	0.011 J	0.0029 U	0.0048 J	0.0029 U
SULFATE	MG/L	250	957	907	2,740	2,340	2,000



Concentration Exceeds Criteria

(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 12
GROUNDWATER ANALYTICAL RESULTS - WATER QUALITY PARAMETERS
NIAGARA FALLS STORAGE SITE

Location Identifier :			MW934	MW935	MW935	MW938	MW938
Field Sample Identifier :			MW934	MW935	MW935	MW938	MW938
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			10/28/19	05/28/19	10/25/19	05/28/19	10/25/19
Parameter	Units	Criteria ¹					
MISCELLANEOUS							
ALKALINITY, TOTAL	MG/L	500	719	408	524	677	802
BROMIDE	MG/L	2	0.6	0.04 U	0.04 U	0.18 J	0.04 U
CHLORIDE (AS CL)	MG/L	250	57.6	4	6	13	14.4
DISSOLVED SOLIDS, TOTAL	MG/L	1000	3,730	744	932	1,720	1,740
FLUORIDE	MG/L	1.5	0.38	0.58	0.46	0.3	0.3
NITROGEN, NITRATE (AS N)	MG/L	10	0.34	1.1	0.38	0.08 J	0.16 J
NITROGEN, NITRITE (AS N)	MG/L	1	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
PHOSPHORUS, TOTAL ORTHOPHOSPHATE (AS PO ₄)	MG/L	-	0.0029 U	0.0029 U	0.053	0.0029 U	0.021 J
SULFATE	MG/L	250	3,100	186	284	726	860

Concentration Exceeds Criteria

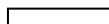
(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 12
GROUNDWATER ANALYTICAL RESULTS - WATER QUALITY PARAMETERS
NIAGARA FALLS STORAGE SITE

Location Identifier :			MW943	MW943	MW944	MW945	MW945
Field Sample Identifier :			MW943	MW943	MW944	MW945	MW945
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			06/03/19	10/25/19	05/30/19	05/30/19	10/24/19
Parameter	Units	Criteria ¹					
MISCELLANEOUS							
ALKALINITY, TOTAL	MG/L	500	400	424	497	493	606
BROMIDE	MG/L	2	0.26	0.38 J	0.16 J	1.7	1.7 J
CHLORIDE (AS CL)	MG/L	250	74.3	80.9	7.1	137	150
DISSOLVED SOLIDS, TOTAL	MG/L	1000	1,510	1,370	963	4,610 J	2,540
FLUORIDE	MG/L	1.5	0.34	0.4	0.14 J	0.22	0.18 J
NITROGEN, NITRATE (AS N)	MG/L	10	0.02 U	0.08 J	0.06 J	0.04 J	0.06 J
NITROGEN, NITRITE (AS N)	MG/L	1	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
PHOSPHORUS, TOTAL ORTHOPHOSPHATE (AS PO ₄)	MG/L	-	0.0029 U	0.011 J	0.008 J	0.0048 J	0.013 J
SULFATE	MG/L	250	599	558	206	953	1,970



Concentration Exceeds Criteria

(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 12
GROUNDWATER ANALYTICAL RESULTS - WATER QUALITY PARAMETERS
NIAGARA FALLS STORAGE SITE

Location Identifier :			MW946	MW946	MW947	MW948	MW948
Field Sample Identifier :			MW946	MW946-G	MW947	MW948	MW948
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			05/30/19	10/29/19	05/30/19	05/30/19	10/28/19
Parameter	Units	Criteria ¹					
MISCELLANEOUS							
ALKALINITY, TOTAL	MG/L	500	468	537	681	540	580
BROMIDE	MG/L	2	2.5	2.5	0.04 U	0.82	0.78
CHLORIDE (AS CL)	MG/L	250	534	330	20.4	88.6	84
DISSOLVED SOLIDS, TOTAL	MG/L	1000	6,180	6,750	1,200	4,260	3,990
FLUORIDE	MG/L	1.5	0.02 U	0.34	0.26	0.18 J	0.34
NITROGEN, NITRATE (AS N)	MG/L	10	0.66	0.32	0.22	0.04 J	0.18 J
NITROGEN, NITRITE (AS N)	MG/L	1	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
PHOSPHORUS, TOTAL ORTHOPHOSPHATE (AS PO ₄)	MG/L	-	0.016 J	0.0081 J	0.0029 U	0.0064 J	0.0081 J
SULFATE	MG/L	250	4,280	4,910	316	3,590	2,600



Concentration Exceeds Criteria

(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 12
GROUNDWATER ANALYTICAL RESULTS - WATER QUALITY PARAMETERS
NIAGARA FALLS STORAGE SITE

Location Identifier :			MW949	MW949	MW950	MW950	MW951
Field Sample Identifier :			MW949	MW949	MW950	MW950	MW951
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			05/30/19	10/28/19	05/31/19	10/25/19	06/03/19
Parameter	Units	Criteria ¹					
MISCELLANEOUS							
ALKALINITY, TOTAL	MG/L	500	126	136	518	530	505
BROMIDE	MG/L	2	0.92	0.82	0.52	0.5 J	0.2
CHLORIDE (AS CL)	MG/L	250	91.2	86.8	59.9	61.5	77.6
DISSOLVED SOLIDS, TOTAL	MG/L	1000	2,560	2,840	2,620	2,600	1,410
FLUORIDE	MG/L	1.5	0.12 J	0.14 J	0.24	0.3	0.26
NITROGEN, NITRATE (AS N)	MG/L	10	0.18 J	0.02 U	0.06 J	0.12 J	0.02 U
NITROGEN, NITRITE (AS N)	MG/L	1	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
PHOSPHORUS, TOTAL ORTHOPHOSPHATE (AS PO ₄)	MG/L	-	0.0029 U	0.0081 J	0.0032 J	0.0065 J	0.0029 U
SULFATE	MG/L	250	1,640	1,840	2,490	1,450	477



Concentration Exceeds Criteria

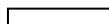
(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 12
GROUNDWATER ANALYTICAL RESULTS - WATER QUALITY PARAMETERS
NIAGARA FALLS STORAGE SITE

Location Identifier :			MW951	MW952	MW952	MW954	MW954
Field Sample Identifier :			MW951	MW952	MW952	MW954	MW954
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			10/28/19	05/28/19	10/28/19	05/28/19	10/24/19
Parameter	Units	Criteria ¹					
MISCELLANEOUS							
ALKALINITY, TOTAL	MG/L	500	567	249	178	335	376
BROMIDE	MG/L	2	0.2	0.04 J	0.04 U	0.06 J	0.04 UJ
CHLORIDE (AS CL)	MG/L	250	78.2	26.6	7.8	31.3	20.2
DISSOLVED SOLIDS, TOTAL	MG/L	1000	1,400	1,020	362 J	1,880	1,010
FLUORIDE	MG/L	1.5	0.26	0.36	0.26	0.34	0.56
NITROGEN, NITRATE (AS N)	MG/L	10	0.02 U	0.64	1.1	0.66	0.46
NITROGEN, NITRITE (AS N)	MG/L	1	0.02 U	0.02 U	0.02 J	0.02 U	0.02 U
PHOSPHORUS, TOTAL ORTHOPHOSPHATE (AS PO ₄)	MG/L	-	0.0029 U	0.0029 U	0.018 J	0.0029 U	0.011 J
SULFATE	MG/L	250	505	488	99.2	924	470



Concentration Exceeds Criteria

(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 12
GROUNDWATER ANALYTICAL RESULTS - WATER QUALITY PARAMETERS
NIAGARA FALLS STORAGE SITE

Location Identifier :			MW955	MW955	MW956	MW956	MW957
Field Sample Identifier :			MW955	MW955	MW956	MW956	MW957
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			05/28/19	10/24/19	05/31/19	10/24/19	05/28/19
Parameter	Units	Criteria ¹					
MISCELLANEOUS							
ALKALINITY, TOTAL	MG/L	500	363	425	499	Not Analyzed	614
BROMIDE	MG/L	2	0.18 J	0.16 J	0.42	0.38 J	0.24
CHLORIDE (AS CL)	MG/L	250	26.2	24.9	38.3	35.6	10.2
DISSOLVED SOLIDS, TOTAL	MG/L	1000	1,380	1,270	1,850	1,620	1,610
FLUORIDE	MG/L	1.5	0.28	0.3	0.24	0.26	0.48
NITROGEN, NITRATE (AS N)	MG/L	10	0.22 J	0.22	0.36	0.08 J	0.24 J
NITROGEN, NITRITE (AS N)	MG/L	1	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
PHOSPHORUS, TOTAL ORTHOPHOSPHATE (AS PO ₄)	MG/L	-	0.0029 U	0.0029 U	0.0029 U	0.0065 J	0.0029 U
SULFATE	MG/L	250	610	651	956	848	626



Concentration Exceeds Criteria

(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 12
GROUNDWATER ANALYTICAL RESULTS - WATER QUALITY PARAMETERS
NIAGARA FALLS STORAGE SITE

Location Identifier :			MW957	MW958	MW958	MW959	MW959
Field Sample Identifier :			MW957	MW958	MW958	MW959	MW959
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			10/28/19	05/28/19	10/28/19	05/31/19	10/25/19
Parameter	Units	Criteria ¹					
MISCELLANEOUS							
ALKALINITY, TOTAL	MG/L	500	626	432	533	447	411
BROMIDE	MG/L	2	0.2	0.08 J	0.12 J	0.2	0.18 J
CHLORIDE (AS CL)	MG/L	250	7.3	32.3	34.9	51.4	28.3
DISSOLVED SOLIDS, TOTAL	MG/L	1000	1,360	824	880	1,360	788
FLUORIDE	MG/L	1.5	0.5	0.36	0.3	0.44	0.46
NITROGEN, NITRATE (AS N)	MG/L	10	0.08 J	0.04 J	0.02 U	1.7	0.36
NITROGEN, NITRITE (AS N)	MG/L	1	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
PHOSPHORUS, TOTAL ORTHOPHOSPHATE (AS PO ₄)	MG/L	-	0.0032 J	0.0029 U	0.0048 J	0.0029 U	0.0097 J
SULFATE	MG/L	250	502	184	211	534	270



Concentration Exceeds Criteria

(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 12
GROUNDWATER ANALYTICAL RESULTS - WATER QUALITY PARAMETERS
NIAGARA FALLS STORAGE SITE

Location Identifier :			MW960	MW960	OW03A	OW03A	OW03B
Field Sample Identifier :			MW960	MW960	OW03A	OW03A	OW03B
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			05/31/19	10/29/19	06/03/19	10/29/19	06/03/19
Parameter	Units	Criteria ¹					
MISCELLANEOUS							
ALKALINITY, TOTAL	MG/L	500	505	519	475	485	478
BROMIDE	MG/L	2	0.04 U	0.08 J	0.32	0.38	0.22
CHLORIDE (AS CL)	MG/L	250	45.8	43.6	31.1	30.7	31.5
DISSOLVED SOLIDS, TOTAL	MG/L	1000	1,120	884	1,580	1,480	1,610
FLUORIDE	MG/L	1.5	0.28	0.24	0.18 J	0.22	0.24
NITROGEN, NITRATE (AS N)	MG/L	10	0.08 J	0.16 J	0.18 J	0.02 U	0.08 J
NITROGEN, NITRITE (AS N)	MG/L	1	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
PHOSPHORUS, TOTAL ORTHOPHOSPHATE (AS PO ₄)	MG/L	-	0.0029 U	0.018 J	0.0029 U	0.0097 J	0.0029 U
SULFATE	MG/L	250	279	250	702	772	172

Concentration Exceeds Criteria

(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 12
GROUNDWATER ANALYTICAL RESULTS - WATER QUALITY PARAMETERS
NIAGARA FALLS STORAGE SITE

Location Identifier :			OW03B	OW04A	OW04A	OW04A	OW04A
Field Sample Identifier :			OW03B	OW04A	OW04A	OW04A-D	OW04A
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			10/29/19	03/12/19	06/03/19	06/03/19	08/28/19
Parameter	Units	Criteria ¹				Field Duplicate	
MISCELLANEOUS							
ALKALINITY, TOTAL	MG/L	500	476	186	164	162	187
BROMIDE	MG/L	2	0.14 J	0.38 J	0.42	0.4	0.44
CHLORIDE (AS CL)	MG/L	250	34.2	30.3	31.4	31.9	33.2
DISSOLVED SOLIDS, TOTAL	MG/L	1000	1,210	1,010	943	964	991
FLUORIDE	MG/L	1.5	0.28	0.02 U	0.18 J	0.18 J	0.24
NITROGEN, NITRATE (AS N)	MG/L	10	0.22	0.28	0.22	0.26	0.1 J
NITROGEN, NITRITE (AS N)	MG/L	1	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
PHOSPHORUS, TOTAL ORTHOPHOSPHATE (AS PO ₄)	MG/L	-	0.011 J	0.0046 J	0.0029 U	0.0029 U	0.0032 J
SULFATE	MG/L	250	624	494	378	470	521

Concentration Exceeds Criteria

(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 12
GROUNDWATER ANALYTICAL RESULTS - WATER QUALITY PARAMETERS
NIAGARA FALLS STORAGE SITE

Location Identifier :			OW04A	OW04B	OW04B	OW04B	OW04B
Field Sample Identifier :			OW04A	OW04B	OW04B	OW04B	OW04B
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			10/25/19	03/12/19	06/03/19	08/28/19	10/30/19
Parameter	Units	Criteria ¹					
MISCELLANEOUS							
ALKALINITY, TOTAL	MG/L	500	Not Analyzed	357	332	384	348
BROMIDE	MG/L	2	0.46 J	0.04 UJ	0.04 U	0.1 U	0.14 J
CHLORIDE (AS CL)	MG/L	250	33.4	73.7	74.4	74.7	66.6
DISSOLVED SOLIDS, TOTAL	MG/L	1000	902	1,260	1,310	1,300	1,190
FLUORIDE	MG/L	1.5	0.2	0.26	0.36	0.45 J	0.4
NITROGEN, NITRATE (AS N)	MG/L	10	0.1 J	0.12 J	0.02 U	0.05 U	0.06 J
NITROGEN, NITRITE (AS N)	MG/L	1	0.02 U	0.08 J	0.02 U	0.05 U	0.02 U
PHOSPHORUS, TOTAL ORTHOPHOSPHATE (AS PO ₄)	MG/L	-	0.015 J	0.0046 J	0.0048 J	0.0029 U	0.0029 U
SULFATE	MG/L	250	516	531	560	524	536



Concentration Exceeds Criteria

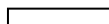
(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 12
GROUNDWATER ANALYTICAL RESULTS - WATER QUALITY PARAMETERS
NIAGARA FALLS STORAGE SITE

Location Identifier :			OW05A	OW05A	OW05B	OW05B	OW06A
Field Sample Identifier :			OW05A	OW05A	OW05B	OW05B	OW06A
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			05/30/19	10/25/19	05/30/19	10/29/19	06/03/19
Parameter	Units	Criteria ¹					
MISCELLANEOUS							
ALKALINITY, TOTAL	MG/L	500	266	Not Analyzed	398	400	262
BROMIDE	MG/L	2	0.5	0.52 J	0.04 U	0.1 J	0.44
CHLORIDE (AS CL)	MG/L	250	37.3	40	21.2	20.3	32.3
DISSOLVED SOLIDS, TOTAL	MG/L	1000	1,020	882	1,320	1,190	1,380
FLUORIDE	MG/L	1.5	0.26	0.24	0.22	0.24	0.16 J
NITROGEN, NITRATE (AS N)	MG/L	10	0.12 J	0.02 U	0.1 J	0.12 J	0.16 J
NITROGEN, NITRITE (AS N)	MG/L	1	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
PHOSPHORUS, TOTAL ORTHOPHOSPHATE (AS PO ₄)	MG/L	-	0.016 J	0.0097 J	0.0048 J	0.18	0.0029 U
SULFATE	MG/L	250	427	427	557	840	540



Concentration Exceeds Criteria

(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 12
GROUNDWATER ANALYTICAL RESULTS - WATER QUALITY PARAMETERS
NIAGARA FALLS STORAGE SITE

Location Identifier :			OW06A	OW06B	OW06B	OW07A	OW07A
Field Sample Identifier :			OW06A	OW06B	OW06B	OW07A	OW07A
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			10/28/19	06/03/19	10/25/19	05/28/19	10/24/19
Parameter	Units	Criteria ¹					
MISCELLANEOUS							
ALKALINITY, TOTAL	MG/L	500	332	500	510	155	Not Analyzed
BROMIDE	MG/L	2	0.4	0.26	0.36 J	0.62	0.58 J
CHLORIDE (AS CL)	MG/L	250	29.2	62.6	65.8	39.1	40.6
DISSOLVED SOLIDS, TOTAL	MG/L	1000	1,370	1,270	1,120	1,570	1,600
FLUORIDE	MG/L	1.5	0.22	0.24	0.22	0.16 J	0.22
NITROGEN, NITRATE (AS N)	MG/L	10	0.02 U	0.02 U	0.14 J	0.24 J	0.14 J
NITROGEN, NITRITE (AS N)	MG/L	1	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
PHOSPHORUS, TOTAL ORTHOPHOSPHATE (AS PO ₄)	MG/L	-	0.0065 J	0.0029 U	0.0065 J	0.0029 U	0.0048 J
SULFATE	MG/L	250	810	440	419	980	1,010



Concentration Exceeds Criteria

(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 12
GROUNDWATER ANALYTICAL RESULTS - WATER QUALITY PARAMETERS
NIAGARA FALLS STORAGE SITE

Location Identifier :			OW07B	OW07B	OW11A	OW11A	OW11A
Field Sample Identifier :			OW07B	OW07B-G	OW11A	OW11A	OW11A-D
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			05/28/19	10/28/19	05/30/19	10/29/19	10/29/19
Parameter	Units	Criteria ¹					Field Duplicate
MISCELLANEOUS							
ALKALINITY, TOTAL	MG/L	500	386	444	223	307	312
BROMIDE	MG/L	2	0.24	0.22	0.34	0.34	0.34
CHLORIDE (AS CL)	MG/L	250	27.8	22.4	28.5	26.7	26.2
DISSOLVED SOLIDS, TOTAL	MG/L	1000	1,510	1,580	1,090	1,070	1,090
FLUORIDE	MG/L	1.5	0.26	0.24	0.16 J	0.22	0.2
NITROGEN, NITRATE (AS N)	MG/L	10	0.2 J	0.08 J	0.06 J	0.06 J	0.02 UJ
NITROGEN, NITRITE (AS N)	MG/L	1	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
PHOSPHORUS, TOTAL ORTHOPHOSPHATE (AS PO ₄)	MG/L	-	0.0029 U	0.0097 J	0.0064 J	0.018 J	0.013 J
SULFATE	MG/L	250	1,000	758	564	600	627

Concentration Exceeds Criteria

(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 12
GROUNDWATER ANALYTICAL RESULTS - WATER QUALITY PARAMETERS
NIAGARA FALLS STORAGE SITE

Location Identifier :			OW11B	OW11B	OW12A	OW12A	OW12B
Field Sample Identifier :			OW11B	OW11B	OW12A	OW12A	OW12B
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			05/30/19	10/28/19	05/31/19	10/24/19	05/31/19
Parameter	Units	Criteria ¹					
MISCELLANEOUS							
ALKALINITY, TOTAL	MG/L	500	354	371	216	283	232
BROMIDE	MG/L	2	0.18 J	0.22	0.38	0.3 J	0.04 U
CHLORIDE (AS CL)	MG/L	250	36.8	35.8	27.3	25	4.7
DISSOLVED SOLIDS, TOTAL	MG/L	1000	1,450	1,410	1,470	1,310	834
FLUORIDE	MG/L	1.5	0.24	0.22	0.24	0.26	0.48
NITROGEN, NITRATE (AS N)	MG/L	10	0.02 U	0.1 J	0.08 J	0.44	23.6
NITROGEN, NITRITE (AS N)	MG/L	1	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
PHOSPHORUS, TOTAL ORTHOPHOSPHATE (AS PO ₄)	MG/L	-	0.0029 U	0.0029 U	0.0029 U	0.0029 U	0.0029 U
SULFATE	MG/L	250	729	680 J	807	776	275

Concentration Exceeds Criteria

(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 12
GROUNDWATER ANALYTICAL RESULTS - WATER QUALITY PARAMETERS
NIAGARA FALLS STORAGE SITE

Location Identifier :			OW12B	OW13A	OW13A	OW15A	OW15A
Field Sample Identifier :			OW12B	OW13A	OW13A	OW15A	OW15A
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			10/24/19	05/31/19	10/24/19	05/28/19	10/25/19
Parameter	Units	Criteria ¹					
MISCELLANEOUS							
ALKALINITY, TOTAL	MG/L	500	313	199	Not Analyzed	87	Not Analyzed
BROMIDE	MG/L	2	0.04 UJ	0.6	0.48 J	0.88	0.74 J
CHLORIDE (AS CL)	MG/L	250	4.5	42.8	40.8	72	69.4
DISSOLVED SOLIDS, TOTAL	MG/L	1000	708	1,770	1,650	1,790	1,740
FLUORIDE	MG/L	1.5	0.5	0.22	0.24	0.24	0.24
NITROGEN, NITRATE (AS N)	MG/L	10	6.8	0.02 U	0.02 U	0.22 J	0.02 U
NITROGEN, NITRITE (AS N)	MG/L	1	0.16 J	0.02 U	0.02 U	0.02 U	0.02 U
PHOSPHORUS, TOTAL ORTHOPHOSPHATE (AS PO ₄)	MG/L	-	0.029 J	0.0029 U	0.0029 U	0.0029 U	0.0029 U
SULFATE	MG/L	250	292	1,000	1,080	1,570	1,060



Concentration Exceeds Criteria

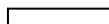
(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 12
GROUNDWATER ANALYTICAL RESULTS - WATER QUALITY PARAMETERS
NIAGARA FALLS STORAGE SITE

Location Identifier :			OW17A	OW17A
Field Sample Identifier :			OW17A	OW17A
Sample Type :			Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-
Date of Sample :			05/29/19	10/24/19
Parameter	Units	Criteria ¹		
MISCELLANEOUS				
ALKALINITY, TOTAL	MG/L	500	122	Not Analyzed
BROMIDE	MG/L	2	0.46	0.34 J
CHLORIDE (AS CL)	MG/L	250	37.5	32.6
DISSOLVED SOLIDS, TOTAL	MG/L	1000	1,940	1,790
FLUORIDE	MG/L	1.5	0.16 J	0.14 J
NITROGEN, NITRATE (AS N)	MG/L	10	0.16 J	0.24
NITROGEN, NITRITE (AS N)	MG/L	1	0.02 U	0.02 U
PHOSPHORUS, TOTAL ORTHOPHOSPHATE (AS PO ₄)	MG/L	-	0.019 J	0.0065 J
SULFATE	MG/L	250	1,230	1,110



Concentration Exceeds Criteria

(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 13
GROUNDWATER ANALYTICAL RESULTS - RADIONUCLIDES
NIAGARA FALLS STORAGE SITE

Location Identifier :			302A	302A	411A	411A	505
Field Sample Identifier :			302A	302A	411A	411A	505
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			05/28/19	10/29/19	05/30/19	10/28/19	06/03/19
Parameter	Units	Criteria ¹					
RADIONUCLIDES							
RADIUM-226	PCI/L	3	0.11 U	0.31 U	0.13 U	0.44 J	0.28 U
TOTAL URANIUM	UG/L	30	20.6	26.9	22.1	18.5	45.2
RADIONUCLIDES (FILTERED)							
RADIUM-226	PCI/L	3	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
TOTAL URANIUM	UG/L	30	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed

Concentration Exceeds Criteria

(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 13
GROUNDWATER ANALYTICAL RESULTS - RADIONUCLIDES
NIAGARA FALLS STORAGE SITE

Location Identifier :			505	A42	A42	A43	A43
Field Sample Identifier :			505	A42	A42	A43	A43
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			10/28/19	05/30/19	10/29/19	05/30/19	10/29/19
Parameter	Units	Criteria ¹					
RADIONUCLIDES							
RADIUM-226	PCI/L	3	Not Analyzed	0.3 U	0.48 U	0.2 U	0.22 U
TOTAL URANIUM	UG/L	30	43.8	34.7	40.4	40.9	43.7
RADIONUCLIDES (FILTERED)							
RADIUM-226	PCI/L	3	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
TOTAL URANIUM	UG/L	30	Not Analyzed	Not Analyzed	42.2	Not Analyzed	Not Analyzed

Concentration Exceeds Criteria

(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 13
GROUNDWATER ANALYTICAL RESULTS - RADIONUCLIDES
NIAGARA FALLS STORAGE SITE

Location Identifier :			A45	A45	MW422	MW862	MW862
Field Sample Identifier :			A45	A45	MW422	MW862	MW862
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			05/31/19	10/25/19	10/28/19	06/03/19	10/25/19
Parameter	Units	Criteria ¹					
RADIONUCLIDES							
RADIUM-226	PCI/L	3	0.24 U	0.42 U	0.57 J	0.29 U	0.29 U
TOTAL URANIUM	UG/L	30	34	28.1	115	23.4	23.3
RADIONUCLIDES (FILTERED)							
RADIUM-226	PCI/L	3	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
TOTAL URANIUM	UG/L	30	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed

Concentration Exceeds Criteria

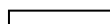
(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 13
GROUNDWATER ANALYTICAL RESULTS - RADIONUCLIDES
NIAGARA FALLS STORAGE SITE

Location Identifier :			MW863	MW863	MW921	MW921	MW934
Field Sample Identifier :			MW863	MW863	MW921	MW921	MW934
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			06/03/19	10/25/19	06/03/19	10/24/19	05/30/19
Parameter	Units	Criteria ¹					
RADIONUCLIDES							
RADIUM-226	PCI/L	3	-0.04 U	0.4	0.04 U	0.39 U	0.31
TOTAL URANIUM	UG/L	30	2.95	3.07	34.6	30.2	35.3
RADIONUCLIDES (FILTERED)							
RADIUM-226	PCI/L	3	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
TOTAL URANIUM	UG/L	30	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed



Concentration Exceeds Criteria

(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 13
GROUNDWATER ANALYTICAL RESULTS - RADIONUCLIDES
NIAGARA FALLS STORAGE SITE

Location Identifier :			MW934	MW935	MW935	MW938	MW938
Field Sample Identifier :			MW934	MW935	MW935	MW938	MW938
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			10/28/19	05/28/19	10/25/19	05/28/19	10/25/19
Parameter	Units	Criteria ¹					
RADIONUCLIDES							
RADIUM-226	PCI/L	3	0.29 U	Not Analyzed	0.37 U	-0.03 U	0.27 U
TOTAL URANIUM	UG/L	30	30.8	10.8	18.4	18.8	21.6
RADIONUCLIDES (FILTERED)							
RADIUM-226	PCI/L	3	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
TOTAL URANIUM	UG/L	30	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed

Concentration Exceeds Criteria

(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 13
GROUNDWATER ANALYTICAL RESULTS - RADIONUCLIDES
NIAGARA FALLS STORAGE SITE

Location Identifier :			MW943	MW943	MW944	MW944	MW945
Field Sample Identifier :			MW943	MW943	MW944	MW944	MW945
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			06/03/19	10/25/19	05/30/19	10/24/19	05/30/19
Parameter	Units	Criteria ¹					
RADIONUCLIDES							
RADIUM-226	PCI/L	3	0.13 U	0.19 U	0.1 U	0.24 U	0 U
TOTAL URANIUM	UG/L	30	20.7	22.1	5.25	8.27	11.2
RADIONUCLIDES (FILTERED)							
RADIUM-226	PCI/L	3	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
TOTAL URANIUM	UG/L	30	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed

Concentration Exceeds Criteria

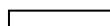
(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 13
GROUNDWATER ANALYTICAL RESULTS - RADIONUCLIDES
NIAGARA FALLS STORAGE SITE

Location Identifier :			MW945	MW946	MW946	MW947	MW948
Field Sample Identifier :			MW945	MW946	MW946	MW947	MW948
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			10/24/19	05/30/19	10/28/19	05/30/19	05/30/19
Parameter	Units	Criteria ¹					
RADIONUCLIDES							
RADIUM-226	PCI/L	3	0.24 U	0.05 U	0.44 U	0.31	0.22
TOTAL URANIUM	UG/L	30	9.71	40.7	29.9	12.4	31.7
RADIONUCLIDES (FILTERED)							
RADIUM-226	PCI/L	3	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
TOTAL URANIUM	UG/L	30	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed



Concentration Exceeds Criteria

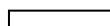
(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 13
GROUNDWATER ANALYTICAL RESULTS - RADIONUCLIDES
NIAGARA FALLS STORAGE SITE

Location Identifier :			MW948	MW949	MW949	MW950	MW950
Field Sample Identifier :			MW948	MW949	MW949	MW950	MW950
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			10/28/19	05/30/19	10/28/19	05/31/19	10/25/19
Parameter	Units	Criteria ¹					
RADIONUCLIDES							
RADIUM-226	PCI/L	3	0.5 U	0.07 U	0.44 J	0.1 U	0.22 U
TOTAL URANIUM	UG/L	30	33.4	1.08	0.721	31	30.6
RADIONUCLIDES (FILTERED)							
RADIUM-226	PCI/L	3	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
TOTAL URANIUM	UG/L	30	Not Analyzed	Not Analyzed	Not Analyzed	29.7	30.8



Concentration Exceeds Criteria

(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 13
GROUNDWATER ANALYTICAL RESULTS - RADIONUCLIDES
NIAGARA FALLS STORAGE SITE

Location Identifier :			MW951	MW951	MW952	MW952	MW954
Field Sample Identifier :			MW951	MW951	MW952	MW952	MW954
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			06/03/19	10/28/19	05/28/19	10/28/19	05/28/19
Parameter	Units	Criteria ¹					
RADIONUCLIDES							
RADIUM-226	PCI/L	3	0.05 U	0.31 U	0.23 U	0.24 U	0.13 U
TOTAL URANIUM	UG/L	30	2,791	3,052	230	128	532
RADIONUCLIDES (FILTERED)							
RADIUM-226	PCI/L	3	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
TOTAL URANIUM	UG/L	30	2,930	3,097	Not Analyzed	Not Analyzed	Not Analyzed

Concentration Exceeds Criteria

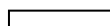
(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 13
GROUNDWATER ANALYTICAL RESULTS - RADIONUCLIDES
NIAGARA FALLS STORAGE SITE

Location Identifier :			MW954	MW955	MW955	MW956	MW956
Field Sample Identifier :			MW954	MW955	MW955	MW956	MW956
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			10/24/19	05/28/19	10/24/19	05/31/19	10/24/19
Parameter	Units	Criteria ¹					
RADIONUCLIDES							
RADIUM-226	PCI/L	3	0.38	0.12 U	0.25 U	0.14 U	0.33 U
TOTAL URANIUM	UG/L	30	720	34.7	39.6	65.8	59.8
RADIONUCLIDES (FILTERED)							
RADIUM-226	PCI/L	3	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
TOTAL URANIUM	UG/L	30	Not Analyzed	Not Analyzed	Not Analyzed	65.9	50.4



Concentration Exceeds Criteria

(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 13
GROUNDWATER ANALYTICAL RESULTS - RADIONUCLIDES
NIAGARA FALLS STORAGE SITE

Location Identifier :			MW957	MW957	MW958	MW958	MW959
Field Sample Identifier :			MW957	MW957	MW958	MW958	MW959
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			05/28/19	10/28/19	05/28/19	10/28/19	05/31/19
Parameter	Units	Criteria ¹					
RADIONUCLIDES							
RADIUM-226	PCI/L	3	0.07 U	0.23 U	0.08 U	0.29 J	0.32 U
TOTAL URANIUM	UG/L	30	3,290	3,234	379	298	161
RADIONUCLIDES (FILTERED)							
RADIUM-226	PCI/L	3	0.34 U	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
TOTAL URANIUM	UG/L	30	3,139	3,487	231	283	164

Concentration Exceeds Criteria

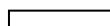
(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 13
GROUNDWATER ANALYTICAL RESULTS - RADIONUCLIDES
NIAGARA FALLS STORAGE SITE

Location Identifier :			MW959	MW960	MW960	OW03A	OW03A
Field Sample Identifier :			MW959	MW960	MW960	OW03A	OW03A
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			10/25/19	05/31/19	10/29/19	06/03/19	10/29/19
Parameter	Units	Criteria ¹					
RADIONUCLIDES							
RADIUM-226	PCI/L	3	0.21 U	0.39 U	0.31 U	0.54 U	0.21 U
TOTAL URANIUM	UG/L	30	94.3	16.1	1,232	10.5	11.4
RADIONUCLIDES (FILTERED)							
RADIUM-226	PCI/L	3	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
TOTAL URANIUM	UG/L	30	122	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed



Concentration Exceeds Criteria

(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 13
GROUNDWATER ANALYTICAL RESULTS - RADIONUCLIDES
NIAGARA FALLS STORAGE SITE

Location Identifier :			OW03B	OW03B	OW04A	OW04A	OW04A
Field Sample Identifier :			OW03B	OW03B	OW04A	OW04A	OW04A-D
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			06/03/19	10/29/19	03/12/19	06/03/19	06/03/19
Parameter	Units	Criteria ¹					Field Duplicate
RADIONUCLIDES							
RADIUM-226	PCI/L	3	0.22 U	0.25 U	0.05 U	0.15 U	-0.08 U
TOTAL URANIUM	UG/L	30	15.2	16.8	3.19	2.28	2.24
RADIONUCLIDES (FILTERED)							
RADIUM-226	PCI/L	3	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
TOTAL URANIUM	UG/L	30	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed

Concentration Exceeds Criteria

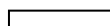
(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 13
GROUNDWATER ANALYTICAL RESULTS - RADIONUCLIDES
NIAGARA FALLS STORAGE SITE

Location Identifier :			OW04A	OW04A	OW04B	OW04B	OW04B
Field Sample Identifier :			OW04A	OW04A	OW04B	OW04B	OW04B
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			08/28/19	10/25/19	03/12/19	06/03/19	08/28/19
Parameter	Units	Criteria ¹					
RADIONUCLIDES							
RADIUM-226	PCI/L	3	0.19 U	0.16 U	0.07 U	0.08 U	0.15 U
TOTAL URANIUM	UG/L	30	2.03	2.4	34.3	37.9	30.8
RADIONUCLIDES (FILTERED)							
RADIUM-226	PCI/L	3	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
TOTAL URANIUM	UG/L	30	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed



Concentration Exceeds Criteria

(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 13
GROUNDWATER ANALYTICAL RESULTS - RADIONUCLIDES
NIAGARA FALLS STORAGE SITE

Location Identifier :			OW04B	OW05A	OW05A	OW05B	OW05B
Field Sample Identifier :			OW04B	OW05A	OW05A	OW05B	OW05B
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			10/30/19	05/30/19	10/25/19	05/30/19	10/29/19
Parameter	Units	Criteria ¹					
RADIONUCLIDES							
RADIUM-226	PCI/L	3	0.2 U	0.36 U	0.27 U	0.07 U	0.21 U
TOTAL URANIUM	UG/L	30	32.7	2.06	1.74	13.6	15.5
RADIONUCLIDES (FILTERED)							
RADIUM-226	PCI/L	3	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
TOTAL URANIUM	UG/L	30	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed

Concentration Exceeds Criteria

(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 13
GROUNDWATER ANALYTICAL RESULTS - RADIONUCLIDES
NIAGARA FALLS STORAGE SITE

Location Identifier :			OW06A	OW06A	OW06B	OW06B	OW07A
Field Sample Identifier :			OW06A	OW06A	OW06B	OW06B	OW07A
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			06/03/19	10/28/19	06/03/19	10/25/19	05/28/19
Parameter	Units	Criteria ¹					
RADIONUCLIDES							
RADIUM-226	PCI/L	3	0 U	0.23 U	0.17 U	0.34 U	0.17 U
TOTAL URANIUM	UG/L	30	1.89	1.42	16.8	16.4	1.58
RADIONUCLIDES (FILTERED)							
RADIUM-226	PCI/L	3	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
TOTAL URANIUM	UG/L	30	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed

 Concentration Exceeds Criteria

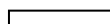
(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 13
GROUNDWATER ANALYTICAL RESULTS - RADIONUCLIDES
NIAGARA FALLS STORAGE SITE

Location Identifier :			OW07A	OW07B	OW07B	OW11A	OW11A
Field Sample Identifier :			OW07A	OW07B	OW07B	OW11A	OW11A
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			10/24/19	05/28/19	10/24/19	05/30/19	10/29/19
Parameter	Units	Criteria ¹					
RADIONUCLIDES							
RADIUM-226	PCI/L	3	0.23	0.05 U	0.3	0.12 U	0.31 U
TOTAL URANIUM	UG/L	30	1.67	18.3	20.5	4.14	1.9
RADIONUCLIDES (FILTERED)							
RADIUM-226	PCI/L	3	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
TOTAL URANIUM	UG/L	30	Not Analyzed	19	21.4	Not Analyzed	Not Analyzed



Concentration Exceeds Criteria

(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 13
GROUNDWATER ANALYTICAL RESULTS - RADIONUCLIDES
NIAGARA FALLS STORAGE SITE

Location Identifier :			OW11A	OW11B	OW11B	OW12A	OW12A
Field Sample Identifier :			OW11A-D	OW11B	OW11B	OW12A	OW12A
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			10/29/19	05/30/19	10/28/19	05/31/19	10/24/19
Parameter	Units	Criteria ¹	Field Duplicate				
RADIONUCLIDES							
RADIUM-226	PCI/L	3	0.44 U	-0.03 U	0.32 U	0.56	0.32 U
TOTAL URANIUM	UG/L	30	1.63	450	387	3.71	3.39
RADIONUCLIDES (FILTERED)							
RADIUM-226	PCI/L	3	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
TOTAL URANIUM	UG/L	30	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed

Concentration Exceeds Criteria

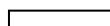
(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 13
GROUNDWATER ANALYTICAL RESULTS - RADIONUCLIDES
NIAGARA FALLS STORAGE SITE

Location Identifier :			OW12B	OW12B	OW13A	OW13A	OW15A
Field Sample Identifier :			OW12B	OW12B	OW13A	OW13A	OW15A
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			05/31/19	10/24/19	05/31/19	10/24/19	05/28/19
Parameter	Units	Criteria ¹					
RADIONUCLIDES							
RADIUM-226	PCI/L	3	-0.12 U	0.28 U	0.56	0.39 U	1.75
TOTAL URANIUM	UG/L	30	38.2	36.5	2.35	3.15	0.353
RADIONUCLIDES (FILTERED)							
RADIUM-226	PCI/L	3	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
TOTAL URANIUM	UG/L	30	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed



Concentration Exceeds Criteria

(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 13
GROUNDWATER ANALYTICAL RESULTS - RADIONUCLIDES
NIAGARA FALLS STORAGE SITE

Location Identifier :			OW15A	OW15B	OW17A	OW17A
Field Sample Identifier :			OW15A	OW15B	OW17A	OW17A
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-
Date of Sample :			10/25/19	05/28/19	05/29/19	10/24/19
Parameter	Units	Criteria ¹				
RADIONUCLIDES						
RADIUM-226	PCI/L	3	0.42	1.93	0.26 U	0.18 U
TOTAL URANIUM	UG/L	30	0.493	Not Analyzed	2.05	1.04 J
RADIONUCLIDES (FILTERED)						
RADIUM-226	PCI/L	3	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
TOTAL URANIUM	UG/L	30	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed

 Concentration Exceeds Criteria

(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 14
GROUNDWATER ANALYTICAL RESULTS - VOLATILES
NIAGARA FALLS STORAGE SITE

Location Identifier :			411A	411A	411A	MW422	MW934
Field Sample Identifier :			411A	411A	411A-D	MW422	MW934
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			05/30/19	10/28/19	10/28/19	10/28/19	05/30/19
Parameter	Units	Criteria ¹			Field Duplicate		
VOLATILE ORGANIC ANALYSES							
1,1,2,2-TETRACHLOROETHANE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
1,1,2-TRICHLOROETHANE	UG/L	1	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
1,1-DICHLOROETHANE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
1,1-DICHLOROETHENE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
1,2,3-TRICHLOROBENZENE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
1,2,4-TRICHLOROBENZENE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
1,2-DIBROMO-3-CHLOROPROPANE	UG/L	0.04	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	UG/L	0.006	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
1,2-DICHLOROBENZENE	UG/L	3	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
1,2-DICHLOROETHANE	UG/L	0.6	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
1,2-DICHLOROPROPANE	UG/L	1	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
1,3-DICHLOROBENZENE	UG/L	3	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
1,4-DICHLOROBENZENE	UG/L	3	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
2-HEXANONE	UG/L	50	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U
ACETONE	UG/L	50	1.6 U	4.1 J	3.3 J	1.6 U	4.4 J
BENZENE	UG/L	1	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
BROMOCHLOROMETHANE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
BROMODICHLOROMETHANE	UG/L	50	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U



Concentration Exceeds Criteria

(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 14
GROUNDWATER ANALYTICAL RESULTS - VOLATILES
NIAGARA FALLS STORAGE SITE

Location Identifier :			411A	411A	411A	MW422	MW934
Field Sample Identifier :			411A	411A	411A-D	MW422	MW934
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			05/30/19	10/28/19	10/28/19	10/28/19	05/30/19
Parameter	Units	Criteria ¹			Field Duplicate		
VOLATILE ORGANIC ANALYSES							
BROMOFORM	UG/L	50	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
BROMOMETHANE	UG/L	5	0.33 U	0.33 UJ	0.33 U	0.33 UJ	0.33 U
CARBON DISULFIDE	UG/L	60	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
CARBON TETRACHLORIDE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
CHLOROBENZENE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
CHLOROETHANE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
CHLOROFORM	UG/L	7	0.33 U	0.33 U	0.33 U	0.33 U	1.7
CHLOROMETHANE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
CIS-1,2-DICHLOROETHYLENE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
CIS-1,3-DICHLOROPROPENE	UG/L	0.4	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
CYCLOHEXANE	UG/L	-	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
DIBROMOCHLOROMETHANE	UG/L	50	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
DICHLORODIFLUOROMETHANE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
ETHYLBENZENE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
ISOPROPYLBENZENE (CUMENE)	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
M+P-XYLENE	UG/L	5	0.66 U	0.66 U	0.66 U	0.66 U	0.66 U
METHYL ACETATE	UG/L	-	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
METHYL ETHYL KETONE (2-BUTANONE)	UG/L	50	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	UG/L	-	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U

 Concentration Exceeds Criteria

(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 14
GROUNDWATER ANALYTICAL RESULTS - VOLATILES
NIAGARA FALLS STORAGE SITE

Location Identifier :			411A	411A	411A	MW422	MW934
Field Sample Identifier :			411A	411A	411A-D	MW422	MW934
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			05/30/19	10/28/19	10/28/19	10/28/19	05/30/19
Parameter	Units	Criteria ¹			Field Duplicate		
VOLATILE ORGANIC ANALYSES							
METHYLCYCLOHEXANE	UG/L	-	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
METHYLENE CHLORIDE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
O-XYLENE (1,2-DIMETHYLBENZENE)	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
STYRENE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
TERT-BUTYL METHYL ETHER	UG/L	10	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
TETRACHLOROETHYLENE(PCE)	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
TOLUENE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
TRANS-1,2-DICHLOROETHENE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
TRANS-1,3-DICHLOROPROPENE	UG/L	0.4	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
TRICHLOROETHANE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
TRICHLOROETHYLENE (TCE)	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
TRICHLOROFLUOROMETHANE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
VINYL CHLORIDE	UG/L	2	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
XYLENES, TOTAL	UG/L	-	1 U	1 U	1 U	1 U	1 U

 Concentration Exceeds Criteria

(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 14
GROUNDWATER ANALYTICAL RESULTS - VOLATILES
NIAGARA FALLS STORAGE SITE

Location Identifier :			MW934	MW947	MW948	MW948	MW948
Field Sample Identifier :			MW934-G	MW947	MW948	MW948	MW948
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			10/29/19	05/30/19	05/30/19	05/30/19	10/28/19
Parameter	Units	Criteria ¹			Field Duplicate		
VOLATILE ORGANIC ANALYSES							
1,1,2,2-TETRACHLOROETHANE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
1,1,2-TRICHLOROETHANE	UG/L	1	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
1,1-DICHLOROETHANE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
1,1-DICHLOROETHENE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
1,2,3-TRICHLOROBENZENE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
1,2,4-TRICHLOROBENZENE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
1,2-DIBROMO-3-CHLOROPROPANE	UG/L	0.04	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	UG/L	0.006	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
1,2-DICHLOROBENZENE	UG/L	3	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
1,2-DICHLOROETHANE	UG/L	0.6	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
1,2-DICHLOROPROPANE	UG/L	1	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
1,3-DICHLOROBENZENE	UG/L	3	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
1,4-DICHLOROBENZENE	UG/L	3	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
2-HEXANONE	UG/L	50	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U
ACETONE	UG/L	50	1.6 U	1.6 U	7.7	6	1.6 U
BENZENE	UG/L	1	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
BROMOCHLOROMETHANE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
BROMODICHLOROMETHANE	UG/L	50	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U

 Concentration Exceeds Criteria

(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 14
GROUNDWATER ANALYTICAL RESULTS - VOLATILES
NIAGARA FALLS STORAGE SITE

Location Identifier :			MW934	MW947	MW948	MW948	MW948
Field Sample Identifier :			MW934-G	MW947	MW948	MW948	MW948
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			10/29/19	05/30/19	05/30/19	05/30/19	10/28/19
Parameter	Units	Criteria ¹			Field Duplicate		
VOLATILE ORGANIC ANALYSES							
BROMOFORM	UG/L	50	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
BROMOMETHANE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
CARBON DISULFIDE	UG/L	60	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
CARBON TETRACHLORIDE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
CHLOROBENZENE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
CHLOROETHANE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
CHLOROFORM	UG/L	7	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
CHLOROMETHANE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
CIS-1,2-DICHLOROETHYLENE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
CIS-1,3-DICHLOROPROPENE	UG/L	0.4	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
CYCLOHEXANE	UG/L	-	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
DIBROMOCHLOROMETHANE	UG/L	50	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
DICHLORODIFLUOROMETHANE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
ETHYLBENZENE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
ISOPROPYLBENZENE (CUMENE)	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
M+P-XYLENE	UG/L	5	0.66 U	0.66 U	0.66 U	0.66 U	0.66 U
METHYL ACETATE	UG/L	-	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
METHYL ETHYL KETONE (2-BUTANONE)	UG/L	50	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	UG/L	-	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U

 Concentration Exceeds Criteria

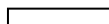
(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 14
GROUNDWATER ANALYTICAL RESULTS - VOLATILES
NIAGARA FALLS STORAGE SITE

Location Identifier :			MW934	MW947	MW948	MW948	MW948
Field Sample Identifier :			MW934-G	MW947	MW948	MW948	MW948
Sample Type :			Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-	-	-
Date of Sample :			10/29/19	05/30/19	05/30/19	05/30/19	10/28/19
Parameter	Units	Criteria ¹			Field Duplicate		
VOLATILE ORGANIC ANALYSES							
METHYLCYCLOHEXANE	UG/L	-	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
METHYLENE CHLORIDE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
O-XYLENE (1,2-DIMETHYLBENZENE)	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
STYRENE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
TERT-BUTYL METHYL ETHER	UG/L	10	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
TETRACHLOROETHYLENE(PCE)	UG/L	5	6	0.33 U	0.33 U	0.33 U	0.33 U
TOLUENE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
TRANS-1,2-DICHLOROETHENE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
TRANS-1,3-DICHLOROPROPENE	UG/L	0.4	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
TRICHLOROETHANE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
TRICHLOROETHYLENE (TCE)	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
TRICHLOROFLUOROMETHANE	UG/L	5	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
VINYL CHLORIDE	UG/L	2	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
XYLENES, TOTAL	UG/L	-	1 U	1 U	1 U	1 U	1 U



Concentration Exceeds Criteria

(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 14
GROUNDWATER ANALYTICAL RESULTS - VOLATILES
NIAGARA FALLS STORAGE SITE

Location Identifier :			MW949	MW949	MW949
Field Sample Identifier :			MW949	MW949	MW949
Sample Type :			Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-
Date of Sample :			05/30/19	05/30/19	10/28/19
Parameter	Units	Criteria ¹	Field Duplicate		
VOLATILE ORGANIC ANALYSES					
1,1,2,2-TETRACHLOROETHANE	UG/L	5	0.33 U	0.33 U	0.33 U
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	UG/L	5	0.33 U	0.33 U	0.33 U
1,1,2-TRICHLOROETHANE	UG/L	1	0.33 U	0.33 U	0.33 U
1,1-DICHLOROETHANE	UG/L	5	0.33 U	0.33 U	0.33 U
1,1-DICHLOROETHENE	UG/L	5	0.33 U	0.33 U	0.33 U
1,2,3-TRICHLOROBENZENE	UG/L	5	0.33 U	0.33 U	0.33 U
1,2,4-TRICHLOROBENZENE	UG/L	5	0.33 U	0.33 U	0.33 U
1,2-DIBROMO-3-CHLOROPROPANE	UG/L	0.04	1.6 U	1.6 U	1.6 U
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	UG/L	0.006	0.33 U	0.33 U	0.33 U
1,2-DICHLOROBENZENE	UG/L	3	0.33 U	0.33 U	0.33 U
1,2-DICHLOROETHANE	UG/L	0.6	0.33 U	0.33 U	0.33 U
1,2-DICHLOROPROPANE	UG/L	1	0.33 U	0.33 U	0.33 U
1,3-DICHLOROBENZENE	UG/L	3	0.33 U	0.33 U	0.33 U
1,4-DICHLOROBENZENE	UG/L	3	0.33 U	0.33 U	0.33 U
2-HEXANONE	UG/L	50	1.6 U	1.6 U	1.6 U
ACETONE	UG/L	50	4.6 J	4.4 J	4.3 J
BENZENE	UG/L	1	0.33 U	0.33 U	0.33 U
BROMOCHLOROMETHANE	UG/L	5	0.33 U	0.33 U	0.33 U
BROMODICHLOROMETHANE	UG/L	50	0.33 U	0.33 U	0.33 U



Concentration Exceeds Criteria

(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

TABLE 14
GROUNDWATER ANALYTICAL RESULTS - VOLATILES
NIAGARA FALLS STORAGE SITE

Location Identifier :			MW949	MW949	MW949
Field Sample Identifier :			MW949	MW949	MW949
Sample Type :			Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-
Date of Sample :			05/30/19	05/30/19	10/28/19
Parameter	Units	Criteria ¹	Field Duplicate		
VOLATILE ORGANIC ANALYSES					
BROMOFORM	UG/L	50	0.33 U	0.33 U	0.33 U
BROMOMETHANE	UG/L	5	0.33 U	0.33 U	0.33 UJ
CARBON DISULFIDE	UG/L	60	0.33 U	0.33 U	0.33 U
CARBON TETRACHLORIDE	UG/L	5	0.33 U	0.33 U	0.33 U
CHLOROBENZENE	UG/L	5	0.33 U	0.33 U	0.33 U
CHLOROETHANE	UG/L	5	0.33 U	0.33 U	0.33 U
CHLOROFORM	UG/L	7	0.33 U	0.33 U	0.33 U
CHLOROMETHANE	UG/L	5	0.33 U	0.33 U	0.33 U
CIS-1,2-DICHLOROETHYLENE	UG/L	5	0.33 U	0.33 U	0.33 U
CIS-1,3-DICHLOROPROPENE	UG/L	0.4	0.33 U	0.33 U	0.33 U
CYCLOHEXANE	UG/L	-	0.33 U	0.33 U	0.33 U
DIBROMOCHLOROMETHANE	UG/L	50	0.33 U	0.33 U	0.33 U
DICHLORODIFLUOROMETHANE	UG/L	5	0.33 U	0.33 U	0.33 U
ETHYLBENZENE	UG/L	5	0.33 U	0.33 U	0.33 U
ISOPROPYLBENZENE (CUMENE)	UG/L	5	0.33 U	0.33 U	0.33 U
M+P-XYLENE	UG/L	5	0.66 U	0.66 U	0.66 U
METHYL ACETATE	UG/L	-	0.33 U	0.33 U	0.33 U
METHYL ETHYL KETONE (2-BUTANONE)	UG/L	50	1.6 U	1.6 U	1.6 U
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	UG/L	-	1.6 U	1.6 U	1.6 U



Concentration Exceeds Criteria

(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

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NOTE: The detection limits shown are MDL.

TABLE 14
GROUNDWATER ANALYTICAL RESULTS - VOLATILES
NIAGARA FALLS STORAGE SITE

Location Identifier :			MW949	MW949	MW949
Field Sample Identifier :			MW949	MW949	MW949
Sample Type :			Groundwater	Groundwater	Groundwater
Sample Depth Interval (ft) :			-	-	-
Date of Sample :			05/30/19	05/30/19	10/28/19
Parameter	Units	Criteria ¹	Field Duplicate		
VOLATILE ORGANIC ANALYSES					
METHYLCYCLOHEXANE	UG/L	-	0.33 U	0.33 U	0.33 U
METHYLENE CHLORIDE	UG/L	5	0.33 U	0.33 U	0.33 U
O-XYLENE (1,2-DIMETHYLBENZENE)	UG/L	5	0.33 U	0.33 U	0.33 U
STYRENE	UG/L	5	0.33 U	0.33 U	0.33 U
TERT-BUTYL METHYL ETHER	UG/L	10	0.33 U	0.33 U	0.33 U
TETRACHLOROETHYLENE(PCE)	UG/L	5	0.33 U	0.33 U	0.33 U
TOLUENE	UG/L	5	0.33 U	0.33 U	0.33 U
TRANS-1,2-DICHLOROETHENE	UG/L	5	0.33 U	0.33 U	0.33 U
TRANS-1,3-DICHLOROPROPENE	UG/L	0.4	0.33 U	0.33 U	0.33 U
TRICHLOROETHANE	UG/L	5	0.33 U	0.33 U	0.33 U
TRICHLOROETHYLENE (TCE)	UG/L	5	0.33 U	0.33 U	0.33 U
TRICHLOROFLUOROMETHANE	UG/L	5	0.33 U	0.33 U	0.33 U
VINYL CHLORIDE	UG/L	2	0.33 U	0.33 U	0.33 U
XYLENES, TOTAL	UG/L	-	1 U	1 U	1 U



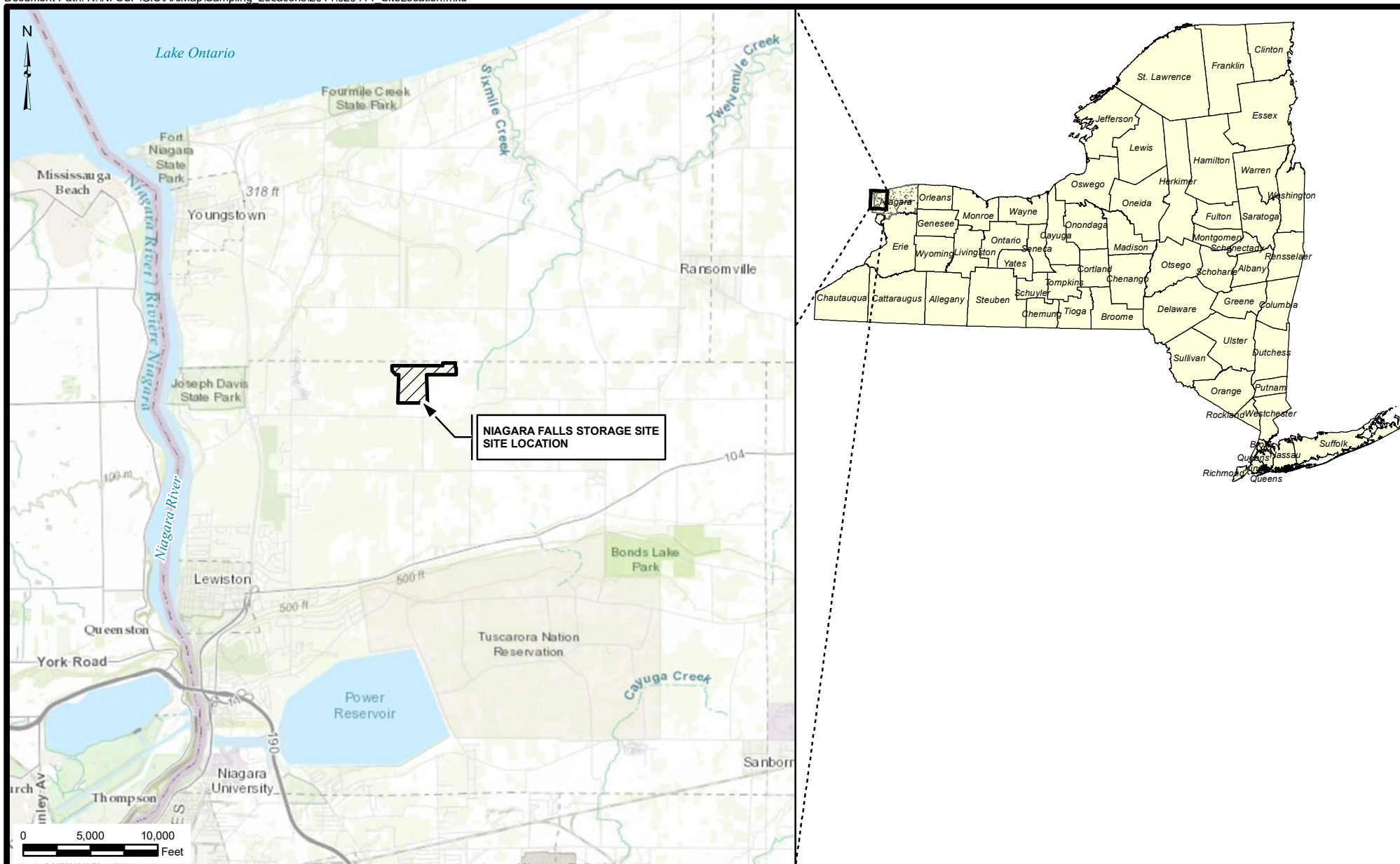
Concentration Exceeds Criteria

(1) - TOGS 1.1.1 (June 1998) for chemicals (VOCs, metals), Ra-226 and Ra-228 (5 pCi/l), Thorium (sum total of 15 pCi/l). 10 NYCRR Part 5, Subpart 5-1 (NYSDOH) for Arsenic, Total Uranium (30 ug/L or 27 pCi/L) beta emitters total dose not to exceed 4 mrem/yr (Sr-90, Tc-99, Cs-137, Pu-238, Pu-239/240, H-3).

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: The detection limits shown are MDL.

FIGURES



U.S. Army Corps
of Engineers
Buffalo District

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
BUFFALO, NY

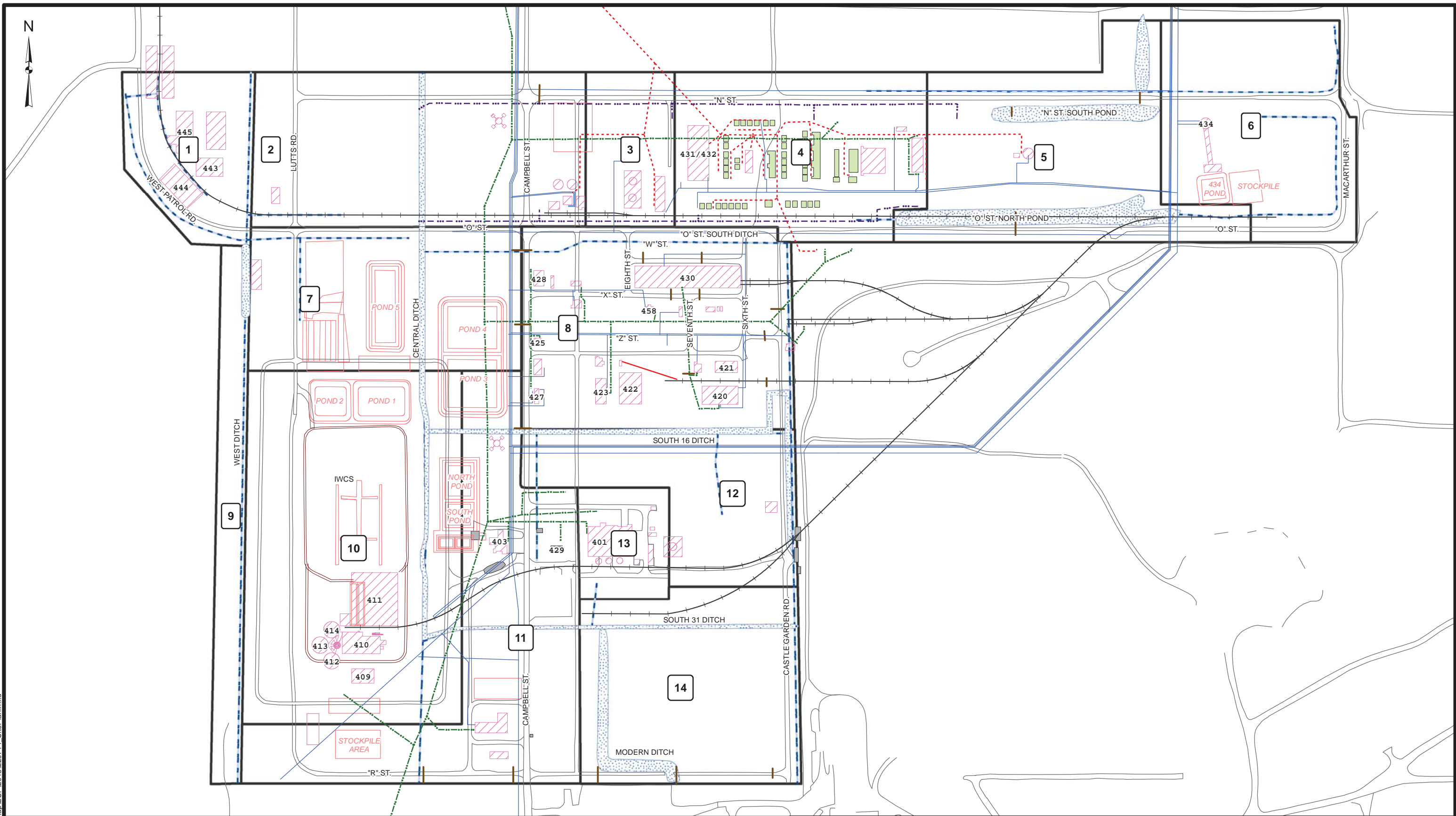
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NIAGARA FALLS STORAGE SITE
LEWISTON, NEW YORK

FIGURE 1

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Legend

Ephemeral Ditches

IWCS Cutoff Wall

Former Remedial Structures

EU Boundaries

Surface Water Features

NFSS Site Roads

Former Railroads

EU Boundaries

Structure (Active)

Structure (Abandoned Above Grade)

Former Structure

Acid Sewer

Water Line

Culvert

Fuel Line

Sanitary Sewer

Storm Sewer

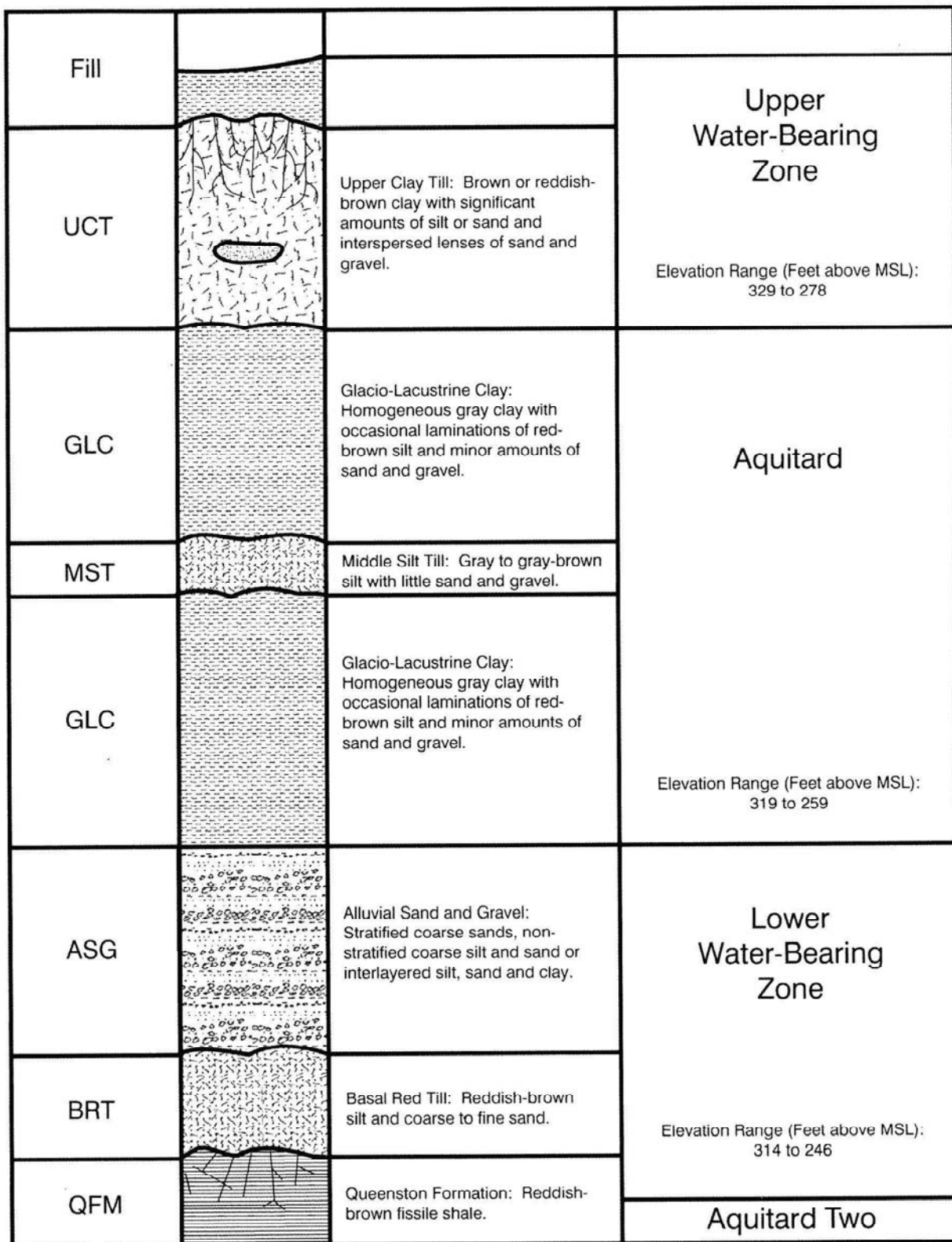
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
Buffalo District
BUFFALO, NY

SITE PLAN

NIAGARA FALLS STORAGE SITE
LEWISTON, NEW YORK

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Time Saved: 1:14:51 PM

FIGURE 2



U.S. Army Corps
of Engineers
Buffalo District

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CORPS OF ENGINEERS
BUFFALO, NY

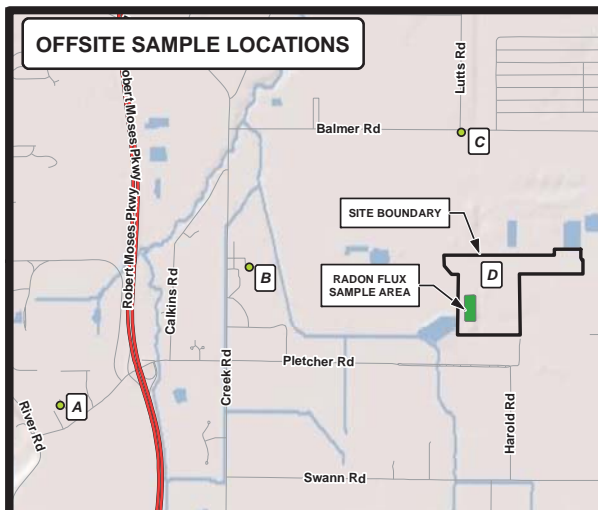
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NIAGARA FALLS STORAGE SITE
LEWISTON, NEW YORK

FIGURE 3

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Legend

- Radon Flux Location
- IVCS Cutoff Wall
- NFSS Site Boundary

A - Lewiston Water Pollution Control Center
B - Lewiston Porter School Campus
C - Balmer Road Location
D - Niagara Falls Storage Site

Locations A, B, and C are background locations for Radon Flux Sampling.



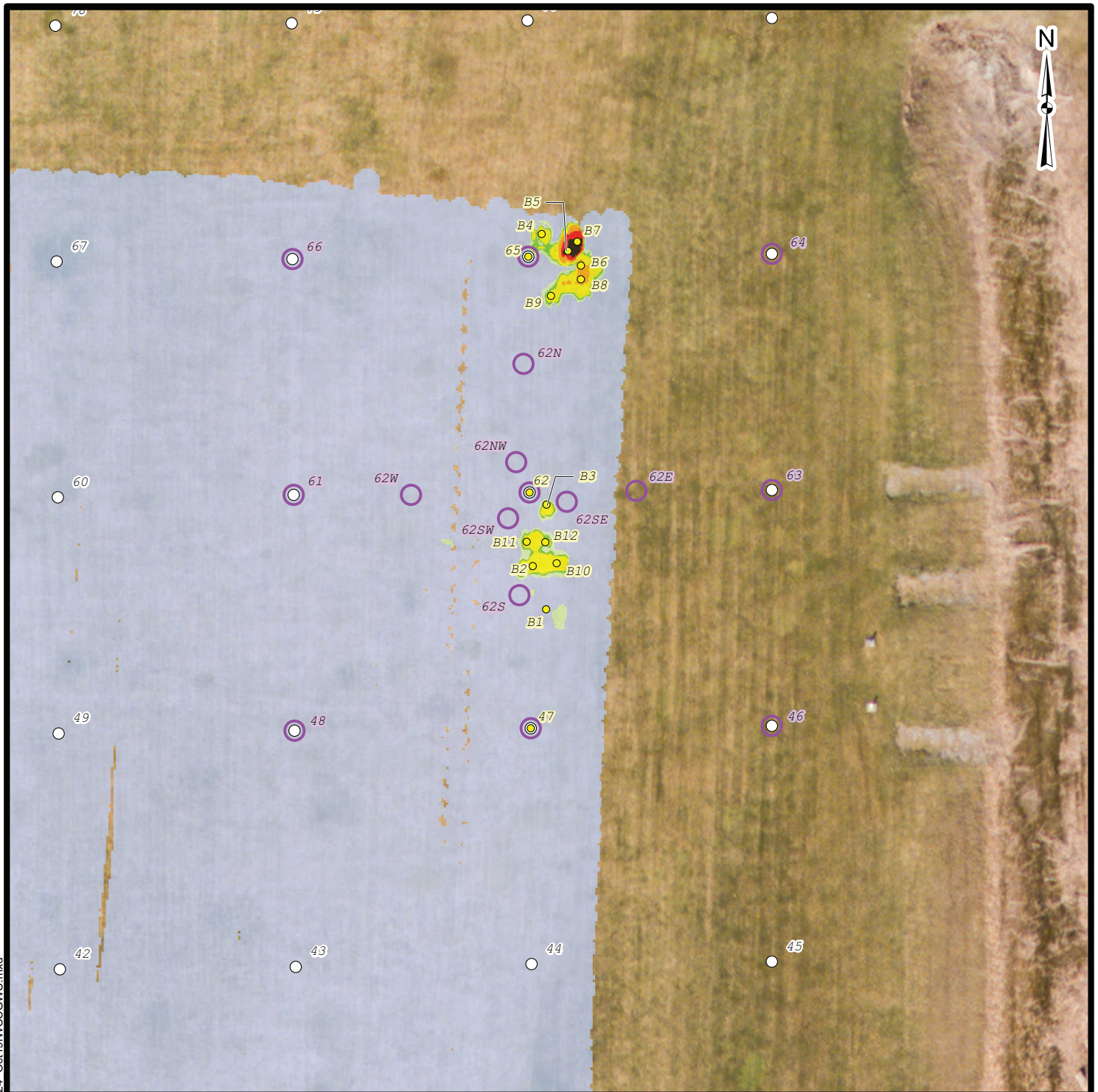
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
BUFFALO, NY

**LOCATIONS OF RADON FLUX MEASUREMENTS
ON THE IVCS**

**NIAGARA FALLS STORAGE SITE
LEWISTON, NEW YORK**

FIGURE 4

Name: 220714_ESPRadonFlux.mxd
Drawn By: H5TDESPM
Date Saved: 23 Jul 2014
Time Saved: 9:52:36 AM



Legend

- 2019 Additional/Resample Radon Flux Samples
- 2018 Additional/Resample Radon Flux Samples
- Radon Flux Location

Gamma Walkover Survey (Sept 20 & Oct 18, 2019)

- | | |
|--|--|
| < 13,000 CPM | 30,000 - 60,000 CPM |
| 13,000 - 16,000 CPM | 60,000 - 90,000 CPM |
| 16,000 - 18,000 CPM | > 90,000 CPM |
| 18,000 - 30,000 CPM | |

0 15 30 60
Feet



U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
BUFFALO, NY

LOCATIONS OF 2018 and 2019 ADDITIONAL AND RESAMPLED RADON FLUX LOCATIONS AND 2019 GAMMA WALKOVER SURVEY DATA

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NIAGARA FALLS STORAGE SITE
LEWISTON, NEW YORK

FIGURE 4A

Document Path: K:\NFSSP\GIS\AerialMap\Sampling Locations\2015\200415 ESPSampleWells Aerial.mxd



Legend

- Monitoring Well (Sampled Bi-Annually)
- Monitoring Well (Sampled Quarterly)
- Secondary Monitoring Well
- Tertiary Monitoring Well
- NFSS Site Boundary

Notes:
1) If MW921 is dry, MW922 shall be sampled.
2) If MW946 is dry, 808A shall be sampled.
3) If MW947 is dry, MW422 shall be sampled, but if both MW947 and MW422 are dry, MW423 shall be sampled.



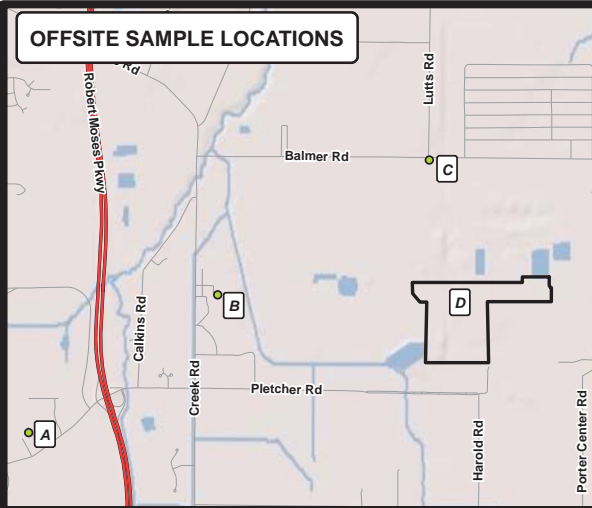
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
Buffalo District

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MONITORING WELL LOCATION MAP

NIAGARA FALLS STORAGE SITE
LEWISTON, NEW YORK

FIGURE 5



Legend

- OSLDs and RadTrack Detectors
- IWCS Cutoff Wall
- NFSS Site Boundary

A - Lewiston Water Pollution Control Center
 B - Lewiston Porter School Campus
 C - Balmer Road Location
 D - Niagara Falls Storage Site

Locations A, B, and C are background locations for OSLDs and RadTrack Detectors.



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 CORPS OF ENGINEERS
 BUFFALO, NY

LOCATION OF RADTRACK DETECTORS AND OPTICALLY STIMULATED LUMINESCENCE DOSIMETERS (OSLDs)

Name: 220714_ESPTLD.mxd
 Drawn By: H5TDESPM
 Date Saved: 23 Jul 2014
 Time Saved: 10:47:50 AM

**NIAGARA FALLS STORAGE SITE
 LEWISTON, NEW YORK**

FIGURE 6

Document Path: K:\NFSSP\GIS\ArcMap\Sampling Locations\130321_SWaterSed_Aerial.mxd




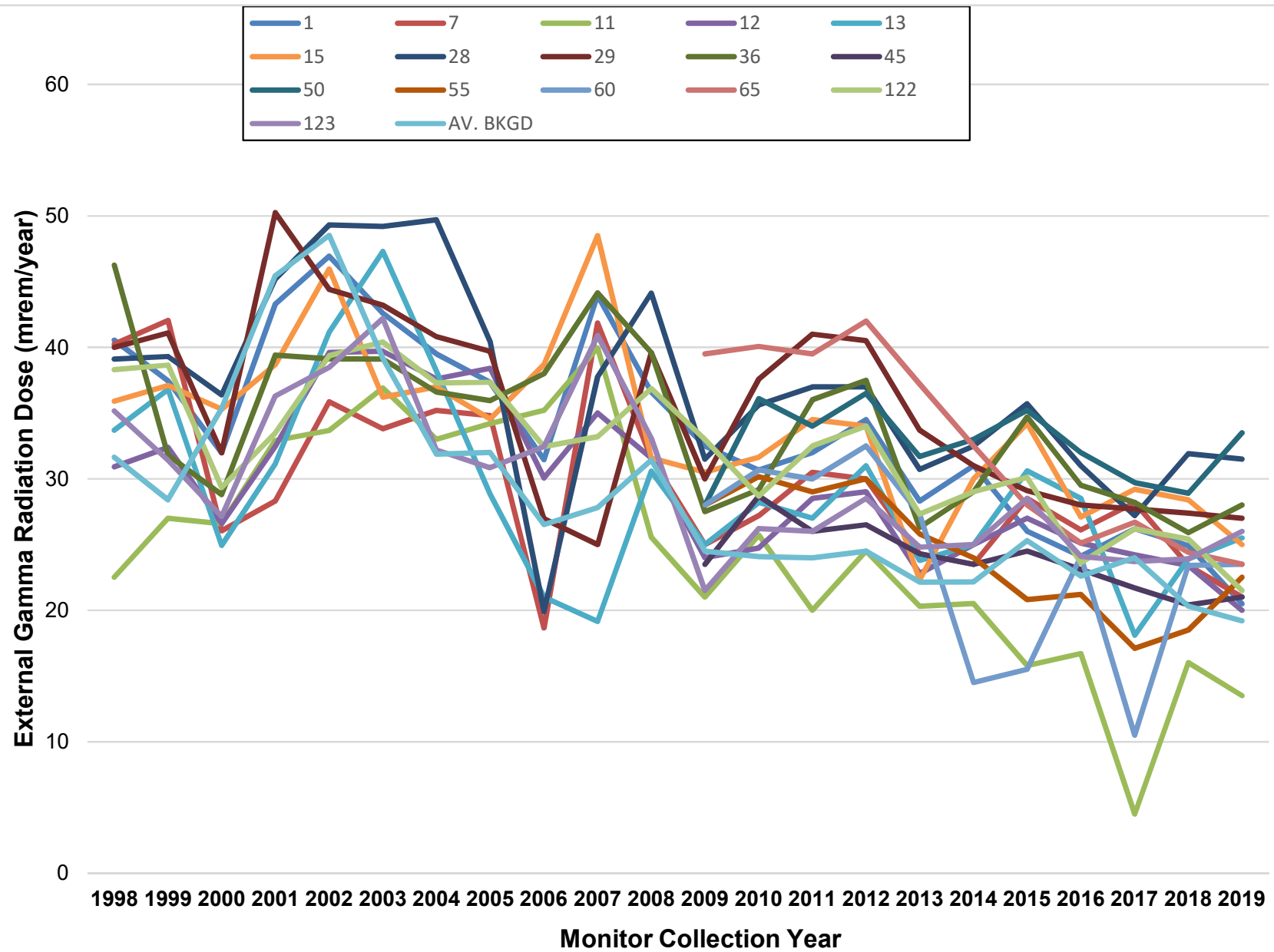
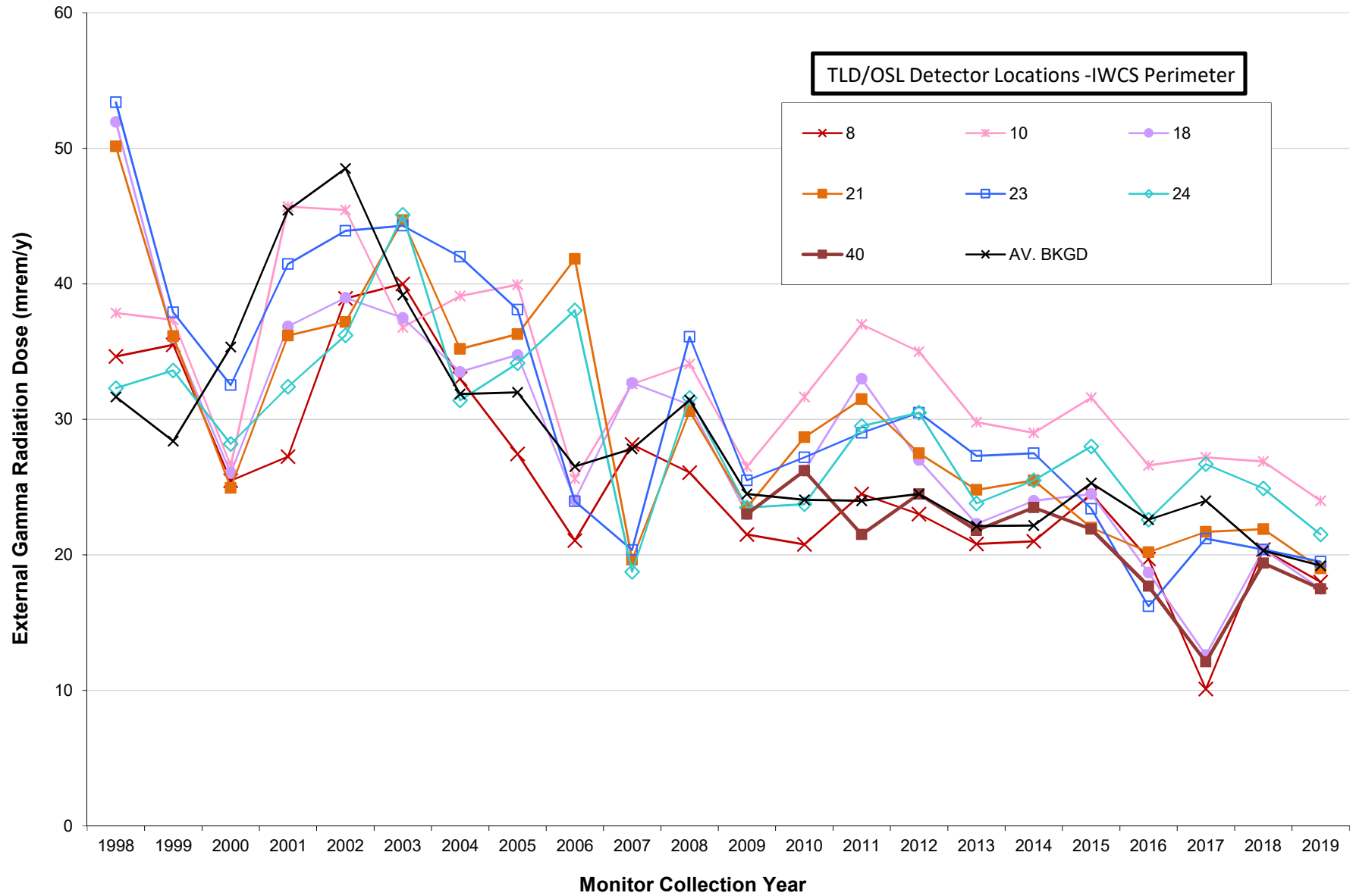
<p>Legend</p> <p>▲ Surface Water/Sediment Sample Location</p> <p>○ NFSS Site Boundary</p>	<p> U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS BUFFALO, NY</p> <p>Name: 130321_SWaterSed_Aerial.mxd Drawn By: H5TDESPM Date Saved: 30 Apr 2013 Time Saved: 12:26:07 PM</p>	<p>SURFACE WATER/SEDIMENT SAMPLING LOCATION MAP</p> <p>NIAGARA FALLS STORAGE SITE LEWISTON, NEW YORK</p> <p>FIGURE 7</p>	
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FIGURE 8
EXTERNAL GAMMA RADIATION DOSE RATES AT NFSS PERIMETER

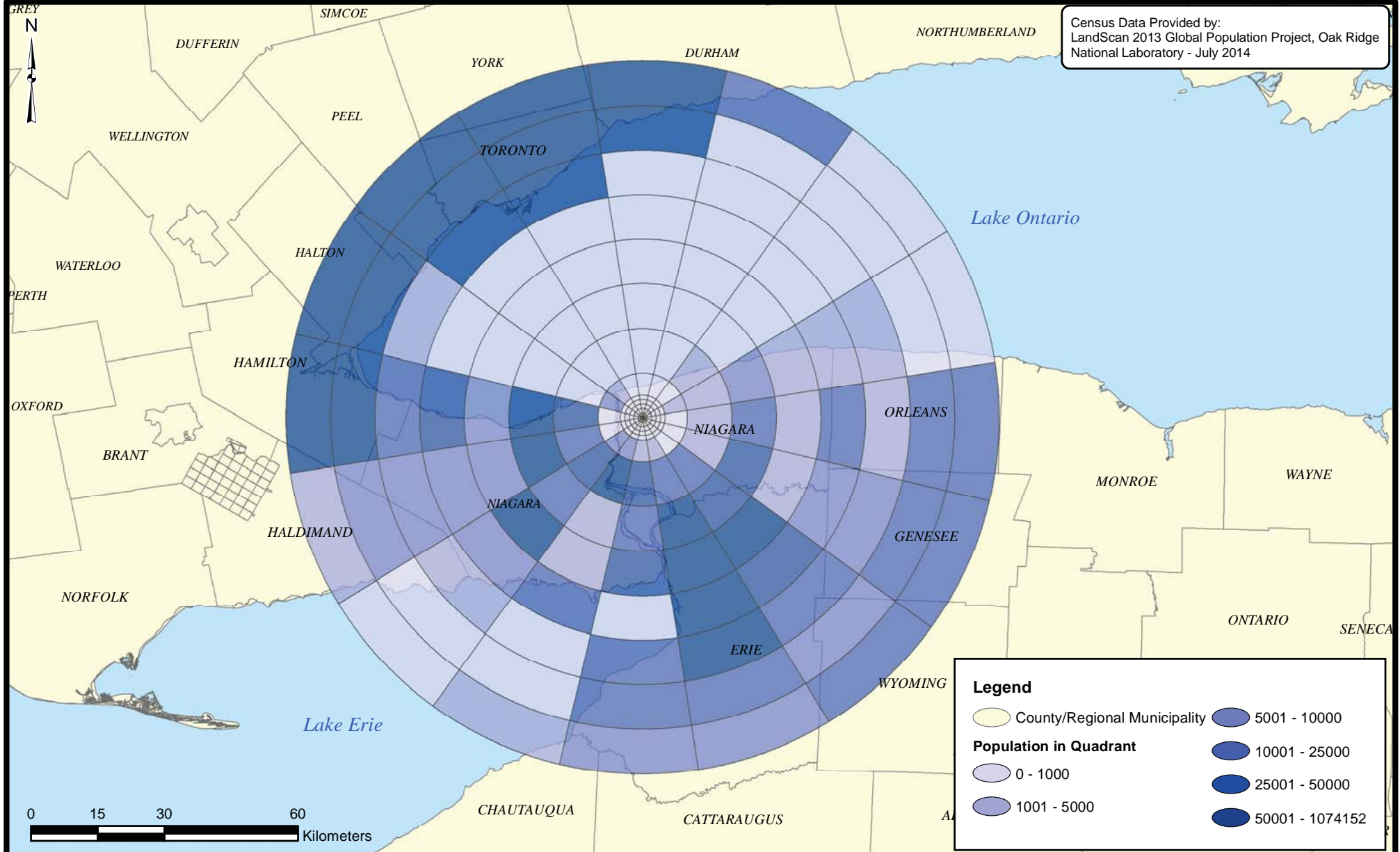


*USDOE limit for external gamma radiation is 100 mrem/year above background but the value for each detector location includes background. Select 2016 and 2017 OSL results may be biased low as a result of laboratory detection sensitivity.

FIGURE 9
EXTERNAL GAMMA RADIATION DOSE RATES AT IWCS PERIMETER



*The USDOE limit for external gamma radiation is 100 mrem/year above background but the value shown for each detector location includes background.
Select 2016 and 2017 OSL results may be biased low as a result of laboratory detection sensitivity.



U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
BUFFALO, NY

CENSUS DATA

Document Name: 180614_CensusData.mxd
Drawn By: H5TDESPM
Date Saved: 25 Jun 2015
Time Saved: 1:48:47 PM

NIAGARA FALLS STORAGE SITE
LEWISTON, NEW YORK

FIGURE 10

FIGURE 11
RADIUM-226 CONCENTRATIONS IN SEDIMENT
1997 - 2019

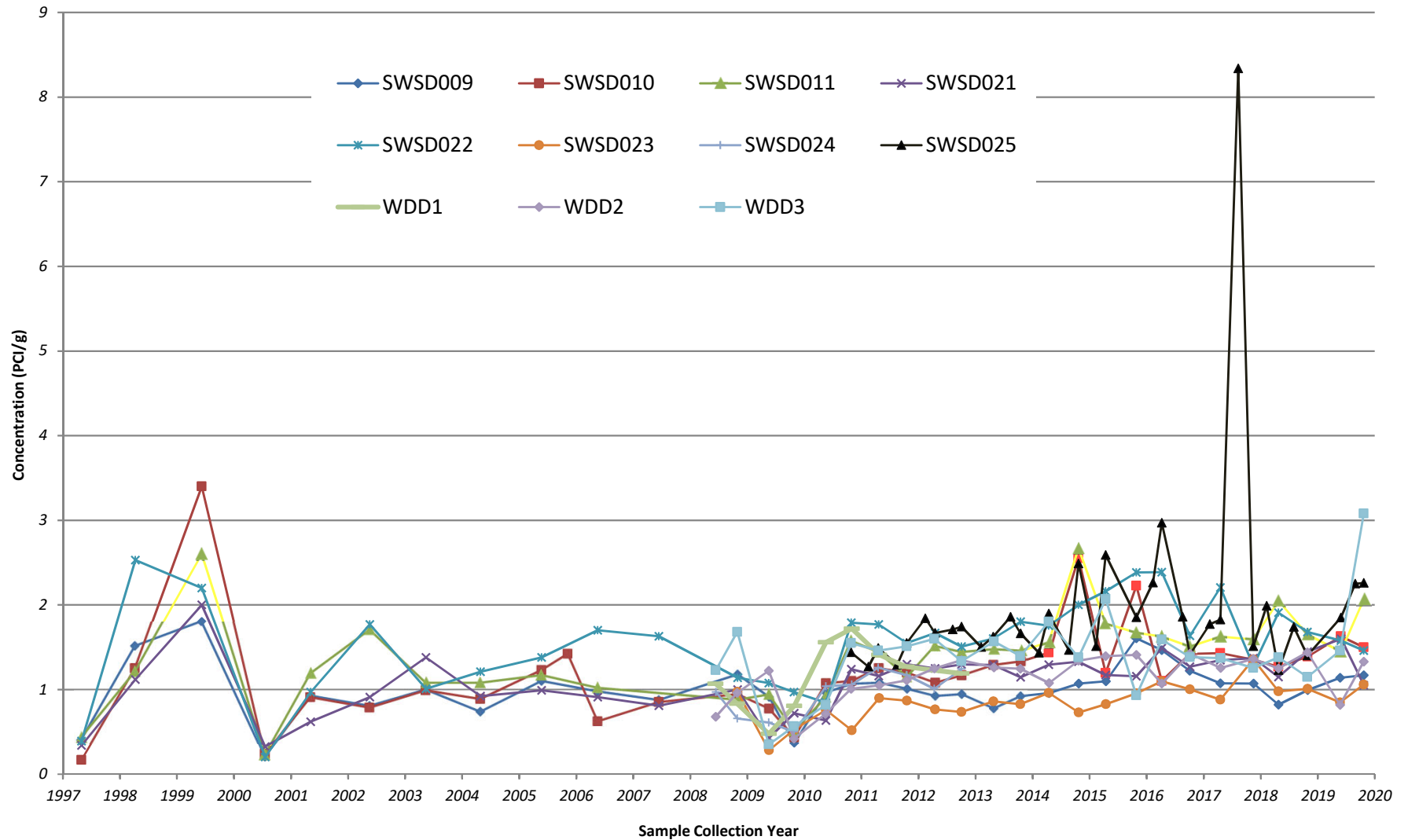
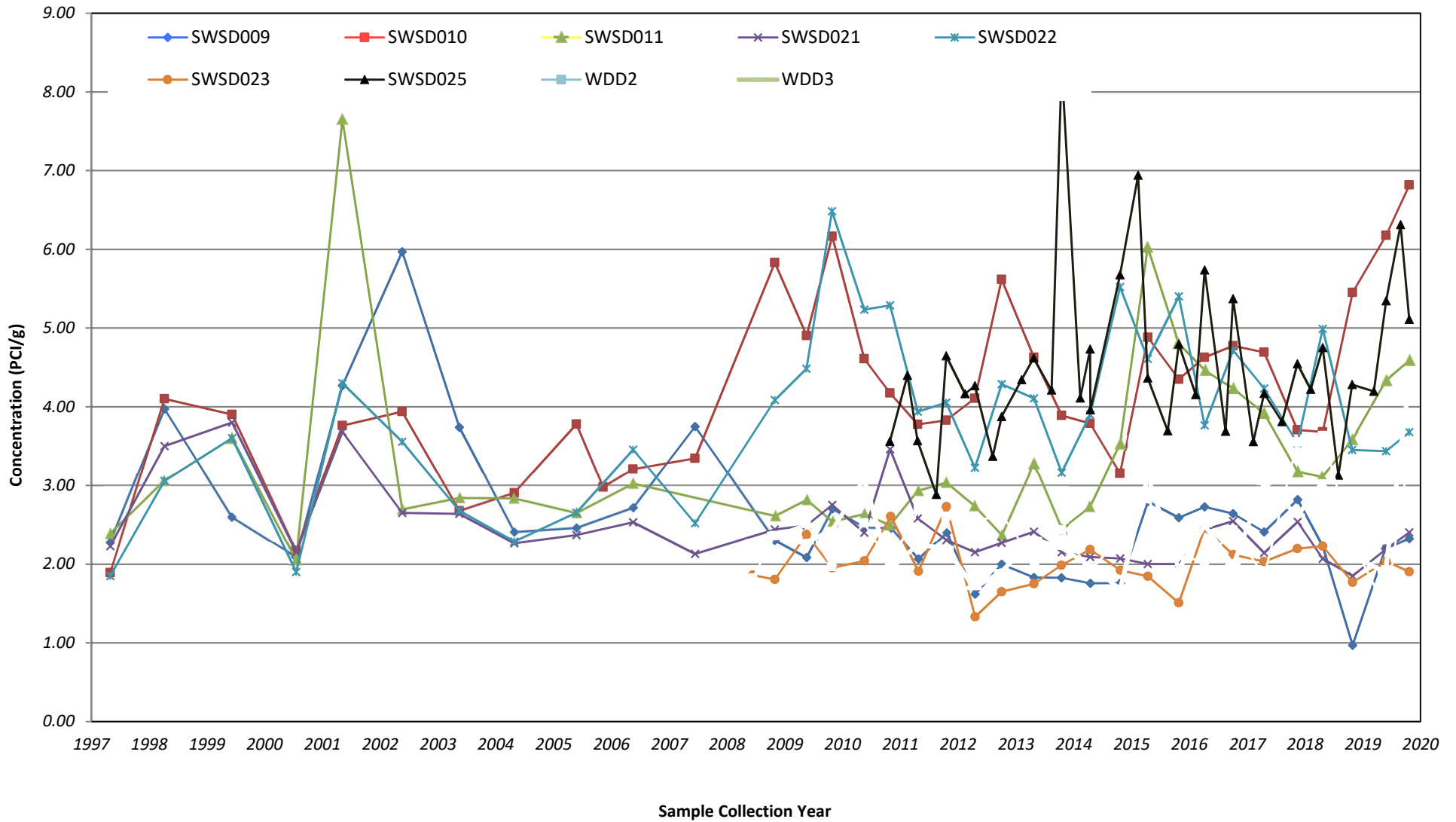


FIGURE 12
TOTAL URANIUM CONCENTRATIONS IN SEDIMENT
1997 - 2019

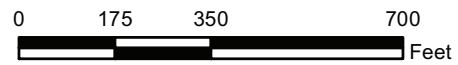



Document Path: D:\Projects\GIS\ArdMap\NFSS\ESP2019\200605_LWBZ_High.mxd



- Legend**
- Monitoring Well (Lower Water Bearing Zone)
 - Groundwater Flow Direction
 - NFSS Site Boundary

NOTES:
1) All elevations are represented in NGVD 88.



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Name: 200605_LWBZ_High.mxd
Drawn By: H5TDESPM
Date Saved: 08 Jun 2020
Time Saved: 11:37:56 AM

GROUNDWATER ELEVATION MEASUREMENTS FOR
THE LOWER WATER BEARING ZONE
(MAY 23, 2019 - SEASONAL HIGH)

NIAGARA FALLS STORAGE SITE
LEWISTON, NEW YORK

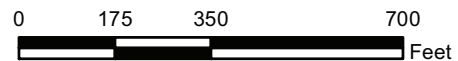
FIGURE 13


Document Path: D:\Projects\GIS\ArdMap\NFSS\ES\SP2019\200605_UWBZ_High.mxd



- Legend**
- Monitoring Well (Upper Water Bearing Zone)
 - Groundwater Flow Direction
 - NFSS Site Boundary

NOTES:
1) All elevations are represented in NGVD 88.



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BUFFALO, NY

Name: 200605_UWBZ_High.mxd
Drawn By: H5TDESPM
Date Saved: 08 Jun 2020
Time Saved: 10:07:14 AM

GROUNDWATER ELEVATION MEASUREMENTS FOR
THE UPPER WATER BEARING ZONE
(MAY 23, 2019 - SEASONAL HIGH)

NIAGARA FALLS STORAGE SITE
LEWISTON, NEW YORK

FIGURE 14



ATTACHMENT A
NON-RADIOLOGICAL ANALYTICAL DATA
FOR SURFACE WATER AND SEDIMENT

TABLE A-1
SURFACE WATER ANALYTICAL RESULTS - PAHs
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD009	SWSD009	SWSD009	SWSD010	SWSD010
Field Sample Identifier		SWSD009	SWSD009	SWSD009-D	SWSD010	SWSD010
Sample Matrix		Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
Depth Interval (ft)		-	-	-	-	-
Date of Sample		05/23/19	10/22/19	10/22/19	05/29/19	10/23/19
Parameter	Units			Field Duplicate		
SEMI-VOLATILE ORGANIC ANALYSES						
ACENAPHTHENE	UG/L	0.24 U	0.23 U	0.24 U	0.23 U	0.23 U
ACENAPHTHYLENE	UG/L	0.24 U	0.23 U	0.24 U	0.23 U	0.23 U
ANTHRACENE	UG/L	0.24 U	0.23 U	0.24 U	0.23 U	0.23 U
BENZO(A)ANTHRACENE	UG/L	0.24 U	0.23 U	0.24 U	0.23 U	0.23 U
BENZO(A)PYRENE	UG/L	0.24 U	0.23 U	0.24 U	0.23 U	0.23 U
BENZO(B)FLUORANTHENE	UG/L	0.24 U	0.23 U	0.24 U	0.23 U	0.23 U
BENZO(G,H,I)PERYLENE	UG/L	0.24 U	0.23 U	0.24 U	0.23 U	0.23 U
BENZO(K)FLUORANTHENE	UG/L	0.24 U	0.23 U	0.24 U	0.23 U	0.23 U
CHRYSENE	UG/L	0.24 U	0.23 U	0.24 U	0.23 U	0.23 U
DIBENZ(A,H)ANTHRACENE	UG/L	0.24 U	0.23 U	0.24 U	0.23 U	0.23 U
FLUORANTHENE	UG/L	0.24 U	0.23 U	0.24 U	0.23 U	0.23 U
FLUORENE	UG/L	0.24 U	0.23 U	0.24 U	0.23 U	0.23 U
INDENO(1,2,3-C,D)PYRENE	UG/L	0.24 U	0.23 U	0.24 U	0.23 U	0.23 U
NAPHTHALENE	UG/L	0.24 U	0.23 U	0.24 U	0.23 U	0.23 U
PHENANTHRENE	UG/L	0.24 U	0.23 U	0.24 U	0.23 U	0.23 U
PYRENE	UG/L	0.24 U	0.23 U	0.24 U	0.23 U	0.23 U

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE A-1
SURFACE WATER ANALYTICAL RESULTS - PAHs
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD011	SWSD011	SWSD021	SWSD021	SWSD022
Field Sample Identifier		SWSD011	SWSD011	SWSD021	SWSD021	SWSD022
Sample Matrix		Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
Depth Interval (ft)		-	-	-	-	-
Date of Sample		05/29/19	10/23/19	05/29/19	10/23/19	05/29/19
Parameter	Units					
SEMI-VOLATILE ORGANIC ANALYSES						
ACENAPHTHENE	UG/L	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U
ACENAPHTHYLENE	UG/L	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U
ANTHRACENE	UG/L	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U
BENZO(A)ANTHRACENE	UG/L	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U
BENZO(A)PYRENE	UG/L	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U
BENZO(B)FLUORANTHENE	UG/L	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U
BENZO(G,H,I)PERYLENE	UG/L	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U
BENZO(K)FLUORANTHENE	UG/L	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U
CHRYSENE	UG/L	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U
DIBENZ(A,H)ANTHRACENE	UG/L	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U
FLUORANTHENE	UG/L	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U
FLUORENE	UG/L	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U
INDENO(1,2,3-C,D)PYRENE	UG/L	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U
NAPHTHALENE	UG/L	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U
PHENANTHRENE	UG/L	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U
PYRENE	UG/L	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE A-1
SURFACE WATER ANALYTICAL RESULTS - PAHs
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD022	SWSD023	SWSD023	SWSD025	SWSD025
Field Sample Identifier		SWSD022	SWSD023	SWSD023	SWSD025	SWSD025
Sample Matrix		Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
Depth Interval (ft)		-	-	-	-	-
Date of Sample		10/23/19	05/23/19	10/22/19	03/12/19	05/29/19
Parameter	Units					
SEMI-VOLATILE ORGANIC ANALYSES						
ACENAPHTHENE	UG/L	0.23 U	0.23 U	0.23 U	0.012 U	0.23 U
ACENAPHTHYLENE	UG/L	0.23 U	0.23 U	0.23 U	0.012 U	0.23 U
ANTHRACENE	UG/L	0.23 U	0.23 U	0.23 U	0.005 U	0.23 U
BENZO(A)ANTHRACENE	UG/L	0.23 U	0.23 U	0.23 U	0.014 U	0.23 U
BENZO(A)PYRENE	UG/L	0.23 U	0.23 U	0.23 U	0.021 U	0.23 U
BENZO(B)FLUORANTHENE	UG/L	0.23 U	0.23 U	0.23 U	0.033 U	0.23 U
BENZO(G,H,I)PERYLENE	UG/L	0.23 U	0.23 U	0.23 U	0.024 U	0.23 U
BENZO(K)FLUORANTHENE	UG/L	0.23 U	0.23 U	0.23 U	0.029 U	0.23 U
CHRYSENE	UG/L	0.23 U	0.23 U	0.23 U	0.016 U	0.23 U
DIBENZ(A,H)ANTHRACENE	UG/L	0.23 U	0.23 U	0.23 U	0.021 U	0.23 U
FLUORANTHENE	UG/L	0.23 U	0.23 U	0.23 U	0.0093 U	0.23 U
FLUORENE	UG/L	0.23 U	0.23 U	0.23 U	0.013 U	0.23 U
INDENO(1,2,3-C,D)PYRENE	UG/L	0.23 U	0.23 U	0.23 U	0.026 U	0.23 U
NAPHTHALENE	UG/L	0.23 U	0.23 U	0.23 U	0.012 U	0.23 U
PHENANTHRENE	UG/L	0.23 U	0.23 U	0.23 U	0.009 U	0.23 U
PYRENE	UG/L	0.23 U	0.23 U	0.23 U	0.0093 U	0.23 U

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE A-1
SURFACE WATER ANALYTICAL RESULTS - PAHs
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD025	SWSD025	WDD2	WDD2	WDD3
Field Sample Identifier		SWSD025	SWSD025	WDD2	WDD2	WDD3
Sample Matrix		Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
Depth Interval (ft)		-	-	-	-	-
Date of Sample		08/28/19	10/23/19	05/23/19	10/21/19	05/23/19
Parameter	Units					
SEMI-VOLATILE ORGANIC ANALYSES						
ACENAPHTHENE	UG/L	0.23 U	0.23 U	0.23 U	0.23 U	0.23 UJ
ACENAPHTHYLENE	UG/L	0.23 U	0.23 U	0.23 U	0.23 U	0.23 UJ
ANTHRACENE	UG/L	0.23 U	0.23 U	0.23 U	0.23 U	0.23 UJ
BENZO(A)ANTHRACENE	UG/L	0.23 U	0.23 U	0.23 U	0.23 U	0.23 UJ
BENZO(A)PYRENE	UG/L	0.23 U	0.23 U	0.23 U	0.23 U	0.23 UJ
BENZO(B)FLUORANTHENE	UG/L	0.23 U	0.23 U	0.23 U	0.23 U	0.23 UJ
BENZO(G,H,I)PERYLENE	UG/L	0.23 U	0.23 U	0.23 U	0.23 U	0.23 UJ
BENZO(K)FLUORANTHENE	UG/L	0.23 U	0.23 U	0.23 U	0.23 U	0.23 UJ
CHRYSENE	UG/L	0.23 U	0.23 U	0.23 U	0.23 U	0.23 UJ
DIBENZ(A,H)ANTHRACENE	UG/L	0.23 U	0.23 U	0.23 U	0.23 U	0.23 UJ
FLUORANTHENE	UG/L	0.23 U	0.23 U	0.23 U	0.23 U	0.23 UJ
FLUORENE	UG/L	0.23 U	0.23 U	0.23 U	0.23 U	0.23 UJ
INDENO(1,2,3-C,D)PYRENE	UG/L	0.23 U	0.23 U	0.23 U	0.23 U	0.23 UJ
NAPHTHALENE	UG/L	0.23 U	0.23 U	0.23 U	0.23 U	0.23 UJ
PHENANTHRENE	UG/L	0.23 U	0.23 U	0.23 U	0.23 U	0.23 UJ
PYRENE	UG/L	0.23 U	0.23 U	0.23 U	0.23 U	0.23 UJ

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE A-1
SURFACE WATER ANALYTICAL RESULTS - PAHs
NIAGARA FALLS STORAGE SITE

Location Identifier		WDD3	WDD3
Field Sample Identifier		WDD3-D	WDD3
Sample Matrix		Surface Water	Surface Water
Depth Interval (ft)		-	-
Date of Sample		05/23/19	10/21/19
Parameter	Units	Field Duplicate	
SEMI-VOLATILE ORGANIC ANALYSES			
ACENAPHTHENE	UG/L	0.23 U	0.23 U
ACENAPHTHYLENE	UG/L	0.23 U	0.23 U
ANTHRACENE	UG/L	0.23 U	0.23 U
BENZO(A)ANTHRACENE	UG/L	0.23 U	0.23 U
BENZO(A)PYRENE	UG/L	0.23 U	0.23 U
BENZO(B)FLUORANTHENE	UG/L	0.23 U	0.23 U
BENZO(G,H,I)PERYLENE	UG/L	0.23 U	0.23 U
BENZO(K)FLUORANTHENE	UG/L	0.23 U	0.23 U
CHRYSENE	UG/L	0.23 U	0.23 U
DIBENZ(A,H)ANTHRACENE	UG/L	0.23 U	0.23 U
FLUORANTHENE	UG/L	0.23 U	0.23 U
FLUORENE	UG/L	0.23 U	0.23 U
INDENO(1,2,3-C,D)PYRENE	UG/L	0.23 U	0.23 U
NAPHTHALENE	UG/L	0.23 U	0.23 U
PHENANTHRENE	UG/L	0.23 U	0.23 U
PYRENE	UG/L	0.23 U	0.23 U

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE A-2
SURFACE WATER ANALYTICAL RESULTS - METALS
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD009	SWSD009	SWSD009	SWSD010	SWSD010
Field Sample Identifier		SWSD009	SWSD009	SWSD009-D	SWSD010	SWSD010
Sample Matrix		Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
Depth Interval (ft)		-	-	-	-	-
Date of Sample		05/23/19	10/22/19	10/22/19	05/29/19	10/23/19
Parameter	Units			Field Duplicate		
METALS						
ALUMINUM	UG/L	270	710 J	520 J	270	1,500
ANTIMONY	UG/L	4.2	3.5	3.1	1.6 J	3.2
ARSENIC	UG/L	2.7 J	2.9 J	2.4 J	1.7 J	1.7 J
BARIUM	UG/L	84 J	100	100	69 J	74
BERYLLIUM	UG/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
BORON	UG/L	410	510	510	400	350
CADMIUM	UG/L	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U
CALCIUM	UG/L	105,000	102,000	102,000	88,600	92,100
CHROMIUM, TOTAL	UG/L	2 J	3	2.6	8.5	7.3
COBALT	UG/L	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U
COPPER	UG/L	6.9	8.9	7.3	7.8	19
IRON	UG/L	750	1,300	1,100	650	2,900
LEAD	UG/L	1.6 J	4.9	3.8	1.2 J	24
LITHIUM	UG/L	48 J	44 J	43 J	36 U	36 U
MAGNESIUM	UG/L	44,500	32,200	32,300	31,600	23,500
MANGANESE	UG/L	180	200	200	190	120
MERCURY	UG/L	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U
MOLYBDENUM	UG/L	9.8	11	8.3	5.6	7.9
NICKEL	UG/L	5.1 J	6.8	6.5	4.6 J	5.9
POTASSIUM	UG/L	11,800	16,100	16,400	11,600	8,900
SELENIUM	UG/L	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE A-2
SURFACE WATER ANALYTICAL RESULTS - METALS
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD009	SWSD009	SWSD009	SWSD010	SWSD010
Field Sample Identifier		SWSD009	SWSD009	SWSD009-D	SWSD010	SWSD010
Sample Matrix		Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
Depth Interval (ft)		-	-	-	-	-
Date of Sample		05/23/19	10/22/19	10/22/19	05/29/19	10/23/19
Parameter	Units			Field Duplicate		
METALS						
SILVER	UG/L	0.74 U	0.74 U	0.74 U	0.74 U	0.74 U
SODIUM	UG/L	185,000	118,000	120,000	81,900	51,700
THALLIUM	UG/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
VANADIUM	UG/L	1.9 J	2.5	2.2	1.8 J	4.6
ZINC	UG/L	19 J	33	28	21 J	91
METALS (FILTERED)						
ALUMINUM	UG/L	Not Analyzed	620	Not Analyzed	Not Analyzed	Not Analyzed
ANTIMONY	UG/L	Not Analyzed	7.5	Not Analyzed	Not Analyzed	Not Analyzed
ARSENIC	UG/L	Not Analyzed	2.6 J	Not Analyzed	Not Analyzed	Not Analyzed
BARIUM	UG/L	Not Analyzed	77	Not Analyzed	Not Analyzed	Not Analyzed
BERYLLIUM	UG/L	Not Analyzed	0.37 U	Not Analyzed	Not Analyzed	Not Analyzed
BORON	UG/L	Not Analyzed	360	Not Analyzed	Not Analyzed	Not Analyzed
CADMIUM	UG/L	Not Analyzed	0.37 U	Not Analyzed	Not Analyzed	Not Analyzed
CALCIUM	UG/L	Not Analyzed	99,900	Not Analyzed	Not Analyzed	Not Analyzed
CHROMIUM, TOTAL	UG/L	Not Analyzed	2.7	Not Analyzed	Not Analyzed	Not Analyzed
COBALT	UG/L	Not Analyzed	1.9 U	Not Analyzed	Not Analyzed	Not Analyzed
COPPER	UG/L	Not Analyzed	21	Not Analyzed	Not Analyzed	Not Analyzed
IRON	UG/L	Not Analyzed	1,100	Not Analyzed	Not Analyzed	Not Analyzed
LEAD	UG/L	Not Analyzed	10	Not Analyzed	Not Analyzed	Not Analyzed
LITHIUM	UG/L	Not Analyzed	33 U	Not Analyzed	Not Analyzed	Not Analyzed
MAGNESIUM	UG/L	Not Analyzed	27,800	Not Analyzed	Not Analyzed	Not Analyzed

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE A-2
SURFACE WATER ANALYTICAL RESULTS - METALS
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD009	SWSD009	SWSD009	SWSD010	SWSD010
Field Sample Identifier		SWSD009	SWSD009	SWSD009-D	SWSD010	SWSD010
Sample Matrix		Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
Depth Interval (ft)		-	-	-	-	-
Date of Sample		05/23/19	10/22/19	10/22/19	05/29/19	10/23/19
Parameter	Units			Field Duplicate		
METALS (FILTERED)						
MANGANESE	UG/L	Not Analyzed	130	Not Analyzed	Not Analyzed	Not Analyzed
MERCURY	UG/L	Not Analyzed	0.03 U	Not Analyzed	Not Analyzed	Not Analyzed
MOLYBDENUM	UG/L	Not Analyzed	9.5	Not Analyzed	Not Analyzed	Not Analyzed
NICKEL	UG/L	Not Analyzed	6.7	Not Analyzed	Not Analyzed	Not Analyzed
POTASSIUM	UG/L	Not Analyzed	10,300	Not Analyzed	Not Analyzed	Not Analyzed
SELENIUM	UG/L	Not Analyzed	1.9 U	Not Analyzed	Not Analyzed	Not Analyzed
SILVER	UG/L	Not Analyzed	0.74 U	Not Analyzed	Not Analyzed	Not Analyzed
SODIUM	UG/L	Not Analyzed	108,000	Not Analyzed	Not Analyzed	Not Analyzed
THALLIUM	UG/L	Not Analyzed	0.37 U	Not Analyzed	Not Analyzed	Not Analyzed
VANADIUM	UG/L	Not Analyzed	3	Not Analyzed	Not Analyzed	Not Analyzed
ZINC	UG/L	Not Analyzed	66	Not Analyzed	Not Analyzed	Not Analyzed

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE A-2
SURFACE WATER ANALYTICAL RESULTS - METALS
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD011	SWSD011	SWSD021	SWSD021	SWSD022
Field Sample Identifier		SWSD011	SWSD011	SWSD021	SWSD021	SWSD022
Sample Matrix		Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
Depth Interval (ft)		-	-	-	-	-
Date of Sample		05/29/19	10/23/19	05/29/19	10/23/19	05/29/19
Parameter	Units					
METALS						
ALUMINUM	UG/L	160	770	950	2,100	280
ANTIMONY	UG/L	0.74 U	1.6 J	0.74 U	0.74 U	1.1 J
ARSENIC	UG/L	1.2 J	1.2 J	1.7 J	1.4 J	1.3 J
BARIUM	UG/L	62 J	71	70 J	56	63 J
BERYLLIUM	UG/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
BORON	UG/L	270	430	87 J	49 J	360
CADMIUM	UG/L	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U
CALCIUM	UG/L	97,800	91,500	92,100	51,100	92,600
CHROMIUM, TOTAL	UG/L	4.3	4.7	430	3.6	3.7
COBALT	UG/L	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U
COPPER	UG/L	4.4 J	6.7	3.7 J	8.8	6.1
IRON	UG/L	580	1,200	1,000	3,000	760
LEAD	UG/L	0.74 U	3	0.74 U	1.5 J	0.74 U
LITHIUM	UG/L	36 U	36 U	65 U	36 U	36 U
MAGNESIUM	UG/L	30,500	27,200	30,400	18,500	32,000
MANGANESE	UG/L	170	96	68	42	180
MERCURY	UG/L	0.16 U	0.16 U	Not Analyzed	0.16 U	0.16 U
MOLYBDENUM	UG/L	3.3	4.7	6.5	2.9	4.6
NICKEL	UG/L	2.6 J	3.8 J	2.6 J	3.7 J	3.5 J
POTASSIUM	UG/L	8,200	8,100	3,200	6,100	11,100
SELENIUM	UG/L	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE A-2
SURFACE WATER ANALYTICAL RESULTS - METALS
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD011	SWSD011	SWSD021	SWSD021	SWSD022
Field Sample Identifier		SWSD011	SWSD011	SWSD021	SWSD021	SWSD022
Sample Matrix		Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
Depth Interval (ft)		-	-	-	-	-
Date of Sample		05/29/19	10/23/19	05/29/19	10/23/19	05/29/19
Parameter	Units					
METALS						
SILVER	UG/L	0.74 U	0.74 U	0.74 U	0.74 U	0.74 U
SODIUM	UG/L	38,400	47,700	25,800	7,500	67,800
THALLIUM	UG/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
VANADIUM	UG/L	1.2 J	2.2	6.8	3.9	1.4 J
ZINC	UG/L	11 J	20	12 J	16	11 J
METALS (FILTERED)						
ALUMINUM	UG/L	Not Analyzed	Not Analyzed	580	Not Analyzed	Not Analyzed
ANTIMONY	UG/L	Not Analyzed	Not Analyzed	0.74 U	Not Analyzed	Not Analyzed
ARSENIC	UG/L	Not Analyzed	Not Analyzed	1.7 J	Not Analyzed	Not Analyzed
BARIUM	UG/L	Not Analyzed	Not Analyzed	61	Not Analyzed	Not Analyzed
BERYLLIUM	UG/L	Not Analyzed	Not Analyzed	0.37 U	Not Analyzed	Not Analyzed
BORON	UG/L	Not Analyzed	Not Analyzed	84 J	Not Analyzed	Not Analyzed
CADMIUM	UG/L	Not Analyzed	Not Analyzed	0.37 U	Not Analyzed	Not Analyzed
CALCIUM	UG/L	Not Analyzed	Not Analyzed	86,600	Not Analyzed	Not Analyzed
CHROMIUM, TOTAL	UG/L	Not Analyzed	Not Analyzed	400 J	Not Analyzed	Not Analyzed
COBALT	UG/L	Not Analyzed	Not Analyzed	1.9 U	Not Analyzed	Not Analyzed
COPPER	UG/L	Not Analyzed	Not Analyzed	3.4 J	Not Analyzed	Not Analyzed
IRON	UG/L	Not Analyzed	Not Analyzed	580	Not Analyzed	Not Analyzed
LEAD	UG/L	Not Analyzed	Not Analyzed	0.74 U	Not Analyzed	Not Analyzed
LITHIUM	UG/L	Not Analyzed	Not Analyzed	33 U	Not Analyzed	Not Analyzed
MAGNESIUM	UG/L	Not Analyzed	Not Analyzed	26,400	Not Analyzed	Not Analyzed

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE A-2
SURFACE WATER ANALYTICAL RESULTS - METALS
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD011	SWSD011	SWSD021	SWSD021	SWSD022
Field Sample Identifier		SWSD011	SWSD011	SWSD021	SWSD021	SWSD022
Sample Matrix		Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
Depth Interval (ft)		-	-	-	-	-
Date of Sample		05/29/19	10/23/19	05/29/19	10/23/19	05/29/19
Parameter	Units					
METALS (FILTERED)						
MANGANESE	UG/L	Not Analyzed	Not Analyzed	55	Not Analyzed	Not Analyzed
MERCURY	UG/L	Not Analyzed	Not Analyzed	0.03 U	Not Analyzed	Not Analyzed
MOLYBDENUM	UG/L	Not Analyzed	Not Analyzed	6.1	Not Analyzed	Not Analyzed
NICKEL	UG/L	Not Analyzed	Not Analyzed	2 J	Not Analyzed	Not Analyzed
POTASSIUM	UG/L	Not Analyzed	Not Analyzed	3,100	Not Analyzed	Not Analyzed
SELENIUM	UG/L	Not Analyzed	Not Analyzed	1.9 U	Not Analyzed	Not Analyzed
SILVER	UG/L	Not Analyzed	Not Analyzed	0.74 U	Not Analyzed	Not Analyzed
SODIUM	UG/L	Not Analyzed	Not Analyzed	24,200	Not Analyzed	Not Analyzed
THALLIUM	UG/L	Not Analyzed	Not Analyzed	0.37 U	Not Analyzed	Not Analyzed
VANADIUM	UG/L	Not Analyzed	Not Analyzed	1.2 J	Not Analyzed	Not Analyzed
ZINC	UG/L	Not Analyzed	Not Analyzed	6.6	Not Analyzed	Not Analyzed

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE A-2
SURFACE WATER ANALYTICAL RESULTS - METALS
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD022	SWSD023	SWSD023	SWSD025	SWSD025
Field Sample Identifier		SWSD022	SWSD023	SWSD023	SWSD025	SWSD025
Sample Matrix		Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
Depth Interval (ft)		-	-	-	-	-
Date of Sample		10/23/19	05/23/19	10/22/19	03/12/19	05/29/19
Parameter	Units					
METALS						
ALUMINUM	UG/L	770	130	90	310	220
ANTIMONY	UG/L	2.1 J	0.76 J	1.4 J	17	0.89 J
ARSENIC	UG/L	1.5 J	1.6 J	1.5 J	1 U	1 U
BARIUM	UG/L	73	63 J	58	54	65 J
BERYLLIUM	UG/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
BORON	UG/L	830	170	140	240	330
CADMIUM	UG/L	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U
CALCIUM	UG/L	85,400	140,000	110,000	70,400	100,000
CHROMIUM, TOTAL	UG/L	9.3	1.4 J	0.74 U	3.7	3.2
COBALT	UG/L	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U
COPPER	UG/L	6.9	12	3.9 J	5.1 J	5.5 J
IRON	UG/L	1,400	1,400	1,100	430	730
LEAD	UG/L	3.7	1.6 J	2.1 J	0.93 J	0.74 U
LITHIUM	UG/L	36 U	45 J	36 U	36 U	36 U
MAGNESIUM	UG/L	24,100	46,400	29,100	23,300	36,600
MANGANESE	UG/L	98	410	350	62	190
MERCURY	UG/L	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U
MOLYBDENUM	UG/L	5.3	8.1	6.8	8.8	4.2
NICKEL	UG/L	4.5 J	4.6 J	3.5 J	2.7 J	3.4 J
POTASSIUM	UG/L	9,800	13,000	4,900	5,300	10,600
SELENIUM	UG/L	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE A-2
SURFACE WATER ANALYTICAL RESULTS - METALS
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD022	SWSD023	SWSD023	SWSD025	SWSD025
Field Sample Identifier		SWSD022	SWSD023	SWSD023	SWSD025	SWSD025
Sample Matrix		Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
Depth Interval (ft)		-	-	-	-	-
Date of Sample		10/23/19	05/23/19	10/22/19	03/12/19	05/29/19
Parameter	Units					
METALS						
SILVER	UG/L	0.74 U	0.74 U	0.74 U	0.74 U	0.74 U
SODIUM	UG/L	61,100	122,000	66,400	91,000	65,300
THALLIUM	UG/L	0.3 U	0.3 U	0.3 U	2.3	0.3 U
VANADIUM	UG/L	2.1 J	1.4 J	0.74 U	1.4 J	1.2 J
ZINC	UG/L	20	28 J	31	11	13 J
METALS (FILTERED)						
ALUMINUM	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
ANTIMONY	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
ARSENIC	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
BARIUM	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
BERYLLIUM	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
BORON	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
CADMIUM	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
CALCIUM	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
CHROMIUM, TOTAL	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
COBALT	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
COPPER	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
IRON	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
LEAD	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
LITHIUM	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
MAGNESIUM	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE A-2
SURFACE WATER ANALYTICAL RESULTS - METALS
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD022	SWSD023	SWSD023	SWSD025	SWSD025
Field Sample Identifier		SWSD022	SWSD023	SWSD023	SWSD025	SWSD025
Sample Matrix		Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
Depth Interval (ft)		-	-	-	-	-
Date of Sample		10/23/19	05/23/19	10/22/19	03/12/19	05/29/19
Parameter	Units					
METALS (FILTERED)						
MANGANESE	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
MERCURY	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
MOLYBDENUM	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
NICKEL	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
POTASSIUM	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
SELENIUM	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
SILVER	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
SODIUM	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
THALLIUM	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
VANADIUM	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
ZINC	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE A-2
SURFACE WATER ANALYTICAL RESULTS - METALS
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD025	SWSD025	WDD2	WDD2	WDD3
Field Sample Identifier		SWSD025	SWSD025	WDD2	WDD2	WDD3
Sample Matrix		Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
Depth Interval (ft)		-	-	-	-	-
Date of Sample		08/28/19	10/23/19	05/23/19	10/21/19	05/23/19
Parameter	Units					
METALS						
ALUMINUM	UG/L	180	780	220	120	400
ANTIMONY	UG/L	0.86 J	1.7 J	0.74 U	0.74 U	0.74 U
ARSENIC	UG/L	2.3 J	1.3 J	1.8 J	1 U	2 J
BARIUM	UG/L	80	71	41 J	43	43 J
BERYLLIUM	UG/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
BORON	UG/L	610	530	99 J	130	100 J
CADMIUM	UG/L	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U
CALCIUM	UG/L	121,000	85,400	73,700	76,500	78,300
CHROMIUM, TOTAL	UG/L	1.9 J	6.9	1.5 J	0.74 U	1.7 J
COBALT	UG/L	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U
COPPER	UG/L	1.9 J	6.6	1.9 U	1.9 U	2.1 J
IRON	UG/L	840	1,400	780	470	1,000
LEAD	UG/L	0.74 U	3	0.74 U	0.74 U	0.74 U
LITHIUM	UG/L	36 U	36 U	36 U	36 U	36 U
MAGNESIUM	UG/L	37,900	24,400	28,900	30,400	29,600
MANGANESE	UG/L	1,500	99	470	280	340
MERCURY	UG/L	0.16 UJ	0.16 U	0.16 U	0.16 U	0.16 U
MOLYBDENUM	UG/L	3.9	4.6	3	1.5 J	3.2
NICKEL	UG/L	3.4 J	3.8 J	2.9 J	1.9 J	3.2 J
POTASSIUM	UG/L	5,900	8,800	6,900	6,300	7,300
SELENIUM	UG/L	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE A-2
SURFACE WATER ANALYTICAL RESULTS - METALS
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD025	SWSD025	WDD2	WDD2	WDD3
Field Sample Identifier		SWSD025	SWSD025	WDD2	WDD2	WDD3
Sample Matrix		Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
Depth Interval (ft)		-	-	-	-	-
Date of Sample		08/28/19	10/23/19	05/23/19	10/21/19	05/23/19
Parameter	Units					
METALS						
SILVER	UG/L	0.74 U	0.74 U	0.74 U	0.74 U	0.74 U
SODIUM	UG/L	75,900	51,700	51,500	56,400	48,900
THALLIUM	UG/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
VANADIUM	UG/L	1 J	2.3	1.3 J	0.74 U	1.9 J
ZINC	UG/L	6.6	24	12 J	4.5 J	13 J
METALS (FILTERED)						
ALUMINUM	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
ANTIMONY	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
ARSENIC	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
BARIUM	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
BERYLLIUM	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
BORON	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
CADMIUM	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
CALCIUM	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
CHROMIUM, TOTAL	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
COBALT	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
COPPER	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
IRON	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
LEAD	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
LITHIUM	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
MAGNESIUM	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE A-2
SURFACE WATER ANALYTICAL RESULTS - METALS
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD025	SWSD025	WDD2	WDD2	WDD3
Field Sample Identifier		SWSD025	SWSD025	WDD2	WDD2	WDD3
Sample Matrix		Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
Depth Interval (ft)		-	-	-	-	-
Date of Sample		08/28/19	10/23/19	05/23/19	10/21/19	05/23/19
Parameter	Units					
METALS (FILTERED)						
MANGANESE	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
MERCURY	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
MOLYBDENUM	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
NICKEL	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
POTASSIUM	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
SELENIUM	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
SILVER	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
SODIUM	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
THALLIUM	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
VANADIUM	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
ZINC	UG/L	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE A-2
SURFACE WATER ANALYTICAL RESULTS - METALS
NIAGARA FALLS STORAGE SITE

Location Identifier		WDD3	WDD3
Field Sample Identifier		WDD3-D	WDD3
Sample Matrix		Surface Water	Surface Water
Depth Interval (ft)		-	-
Date of Sample		05/23/19	10/21/19
Parameter	Units	Field Duplicate	
METALS			
ALUMINUM	UG/L	410	150
ANTIMONY	UG/L	0.74 U	0.74 U
ARSENIC	UG/L	2.1 J	1 U
BARIUM	UG/L	47	39
BERYLLIUM	UG/L	0.3 U	0.3 U
BORON	UG/L	98 J	130
CADMIUM	UG/L	0.37 U	0.37 U
CALCIUM	UG/L	81,900	77,000
CHROMIUM, TOTAL	UG/L	1.8 J	0.74 U
COBALT	UG/L	1.9 U	1.9 U
COPPER	UG/L	2.2 J	1.9 U
IRON	UG/L	890	470
LEAD	UG/L	0.74 U	0.74 U
LITHIUM	UG/L	36 U	36 U
MAGNESIUM	UG/L	30,000	30,400
MANGANESE	UG/L	360	140
MERCURY	UG/L	0.16 U	0.16 U
MOLYBDENUM	UG/L	2.7	1.5 J
NICKEL	UG/L	3.4 J	1.9 U
POTASSIUM	UG/L	7,100	6,500
SELENIUM	UG/L	1.9 U	1.9 U

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE A-2
SURFACE WATER ANALYTICAL RESULTS - METALS
NIAGARA FALLS STORAGE SITE

Location Identifier		WDD3	WDD3
Field Sample Identifier		WDD3-D	WDD3
Sample Matrix		Surface Water	Surface Water
Depth Interval (ft)		-	-
Date of Sample		05/23/19	10/21/19
Parameter	Units	Field Duplicate	
METALS			
SILVER	UG/L	0.74 U	0.74 U
SODIUM	UG/L	48,200	56,300
THALLIUM	UG/L	0.3 U	0.3 U
VANADIUM	UG/L	1.8 J	0.74 U
ZINC	UG/L	10 J	4.8 J
METALS (FILTERED)			
ALUMINUM	UG/L	Not Analyzed	Not Analyzed
ANTIMONY	UG/L	Not Analyzed	Not Analyzed
ARSENIC	UG/L	Not Analyzed	Not Analyzed
BARIUM	UG/L	Not Analyzed	Not Analyzed
BERYLLIUM	UG/L	Not Analyzed	Not Analyzed
BORON	UG/L	Not Analyzed	Not Analyzed
CADMIUM	UG/L	Not Analyzed	Not Analyzed
CALCIUM	UG/L	Not Analyzed	Not Analyzed
CHROMIUM, TOTAL	UG/L	Not Analyzed	Not Analyzed
COBALT	UG/L	Not Analyzed	Not Analyzed
COPPER	UG/L	Not Analyzed	Not Analyzed
IRON	UG/L	Not Analyzed	Not Analyzed
LEAD	UG/L	Not Analyzed	Not Analyzed
LITHIUM	UG/L	Not Analyzed	Not Analyzed
MAGNESIUM	UG/L	Not Analyzed	Not Analyzed

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE A-2
SURFACE WATER ANALYTICAL RESULTS - METALS
NIAGARA FALLS STORAGE SITE

Location Identifier		WDD3	WDD3
Field Sample Identifier		WDD3-D	WDD3
Sample Matrix		Surface Water	Surface Water
Depth Interval (ft)		-	-
Date of Sample		05/23/19	10/21/19
Parameter	Units	Field Duplicate	
METALS (FILTERED)			
MANGANESE	UG/L	Not Analyzed	Not Analyzed
MERCURY	UG/L	Not Analyzed	Not Analyzed
MOLYBDENUM	UG/L	Not Analyzed	Not Analyzed
NICKEL	UG/L	Not Analyzed	Not Analyzed
POTASSIUM	UG/L	Not Analyzed	Not Analyzed
SELENIUM	UG/L	Not Analyzed	Not Analyzed
SILVER	UG/L	Not Analyzed	Not Analyzed
SODIUM	UG/L	Not Analyzed	Not Analyzed
THALLIUM	UG/L	Not Analyzed	Not Analyzed
VANADIUM	UG/L	Not Analyzed	Not Analyzed
ZINC	UG/L	Not Analyzed	Not Analyzed

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE A-3
SEDIMENT ANALYTICAL RESULTS - METALS
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD009	SWSD009	SWSD009	SWSD010	SWSD010
Field Sample Identifier		SWSD009	SWSD009	SWSD009-D	SWSD010	SWSD010
Sample Matrix		Sediment	Sediment	Sediment	Sediment	Sediment
Depth Interval (ft)		-	-	-	-	-
Date of Sample		05/24/19	10/22/19	10/22/19	05/29/19	10/23/19
Parameter	Units			Field Duplicate		
METALS						
ALUMINUM	MG/KG	30,300	14,100	13,600	54,300	33,700
ANTIMONY	MG/KG	4.9	4.9	6.3	2.9 J	15.7
ARSENIC	MG/KG	11.9	14.5	13.7	13	32.3
BARIUM	MG/KG	166	113 J	114	228	216
BERYLLIUM	MG/KG	1.3 J	0.82 J	0.74 J	2.1 J	1.8 J
BORON	MG/KG	66.1	24.5	23.1	66.1	39.7 J
CADMIUM	MG/KG	1.1	2.6	2.1	0.41 U	0.69 U
CALCIUM	MG/KG	58,000	61,900	55,300	50,800	68,400
CHROMIUM, TOTAL	MG/KG	88.3	202 J	52.6 J	99.3	171
COBALT	MG/KG	13	10.2	10.9	18.1	25.4
COPPER	MG/KG	67.2	71.5	74.4	14.6	148
IRON	MG/KG	29,800	22,300	23,500	44,800	58,000
LEAD	MG/KG	60.4	53.2	59.2	31.3	103
LITHIUM	MG/KG	44.5	24.3	25.9	64.8	61.9
MAGNESIUM	MG/KG	15,300	12,900	12,900	19,700	23,900
MANGANESE	MG/KG	741	717	636	766	1,370
MERCURY	MG/KG	0.086 J	0.21 J	0.16 J	0.131 J	0.33 U
MOLYBDENUM	MG/KG	3.3 J	2.6 J	3 J	4.2 J	15.2
NICKEL	MG/KG	37.9	28.6	31	49.2	71.3
POTASSIUM	MG/KG	8,430	2,670	2,090	17,100	6,450
SELENIUM	MG/KG	2.9 U	3.6 J	3.6 J	4.1 U	10.1 J

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE A-3
SEDIMENT ANALYTICAL RESULTS - METALS
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD009	SWSD009	SWSD009	SWSD010	SWSD010
Field Sample Identifier		SWSD009	SWSD009	SWSD009-D	SWSD010	SWSD010
Sample Matrix		Sediment	Sediment	Sediment	Sediment	Sediment
Depth Interval (ft)		-	-	-	-	-
Date of Sample		05/24/19	10/22/19	10/22/19	05/29/19	10/23/19
Parameter	Units			Field Duplicate		
METALS						
SILVER	MG/KG	0.29 U	0.32 U	0.28 U	0.41 U	0.69 U
SODIUM	MG/KG	628	440	403	482	818
THALLIUM	MG/KG	1.7 U	1.9 U	1.7 U	2.5 U	4.2 U
VANADIUM	MG/KG	60.3	33 J	30.4	94.2	73.4
ZINC	MG/KG	443	341	364	226	681

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE A-3
SEDIMENT ANALYTICAL RESULTS - METALS
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD011	SWSD011	SWSD021	SWSD021	SWSD022
Field Sample Identifier		SWSD011	SWSD011	SWSD021	SWSD021	SWSD022
Sample Matrix		Sediment	Sediment	Sediment	Sediment	Sediment
Depth Interval (ft)		-	-	-	-	-
Date of Sample		05/29/19	10/23/19	05/30/19	10/23/19	05/29/19
Parameter	Units					
METALS						
ALUMINUM	MG/KG	29,500	21,200	44,300	11,800	45,500
ANTIMONY	MG/KG	2.6 J	5 J	1.4 U	4.4	4.1 J
ARSENIC	MG/KG	8.2	17	10.3	12.9	11.3
BARIUM	MG/KG	140	151 J	195	100 J	218
BERYLLIUM	MG/KG	1.2 J	1.2 U	1.8 J	0.63 U	1.8 J
BORON	MG/KG	40.4	23 J	47.1	14.2 J	58.6
CADMIUM	MG/KG	0.38 U	0.58 U	0.35 U	4.8	0.35 U
CALCIUM	MG/KG	28,900	34,900	41,400	85,700	24,600
CHROMIUM, TOTAL	MG/KG	62.7	67.2	111	23.9	87.5
COBALT	MG/KG	11.1	14.3	16.5	7.9	15.5
COPPER	MG/KG	22.7	48.1	2.6 J	68.8	33.8
IRON	MG/KG	26,700	35,900	41,000	20,200	37,400
LEAD	MG/KG	24.9	27.8	7.9	86.6	52.8
LITHIUM	MG/KG	34.7	35.8	54	19.6	53.2
MAGNESIUM	MG/KG	10,800	12,400	15,600	28,200	17,100
MANGANESE	MG/KG	847	1,480	686	557	498
MERCURY	MG/KG	0.099 J	0.24 U	0.101 J	0.13 U	0.041 J
MOLYBDENUM	MG/KG	2.5 J	2.3 U	1.4 U	4	3.3 J
NICKEL	MG/KG	29.7	38.2	42	26.3	43.3
POTASSIUM	MG/KG	9,230	4,380	13,300	2,680	13,900
SELENIUM	MG/KG	3.8 U	6.7 J	3.5 U	3.2 U	3.5 U

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE A-3
SEDIMENT ANALYTICAL RESULTS - METALS
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD011	SWSD011	SWSD021	SWSD021	SWSD022
Field Sample Identifier		SWSD011	SWSD011	SWSD021	SWSD021	SWSD022
Sample Matrix		Sediment	Sediment	Sediment	Sediment	Sediment
Depth Interval (ft)		-	-	-	-	-
Date of Sample		05/29/19	10/23/19	05/30/19	10/23/19	05/29/19
Parameter	Units					
METALS						
SILVER	MG/KG	0.38 U	0.58 U	0.35 U	0.32 U	0.35 U
SODIUM	MG/KG	261	392	291	304	399
THALLIUM	MG/KG	2.3 U	3.5 U	2.1 U	1.9 U	2.1 U
VANADIUM	MG/KG	54.9	43.1 J	76	34.8 J	78.1
ZINC	MG/KG	253	318	101	468	322

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE A-3
SEDIMENT ANALYTICAL RESULTS - METALS
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD022	SWSD023	SWSD023	SWSD025	SWSD025
Field Sample Identifier		SWSD022	SWSD023	SWSD023	SWSD025	SWSD025
Sample Matrix		Sediment	Sediment	Sediment	Sediment	Sediment
Depth Interval (ft)		-	-	-	-	-
Date of Sample		10/23/19	05/24/19	10/22/19	03/13/19	05/29/19
Parameter	Units					
METALS						
ALUMINUM	MG/KG	17,800	15,300	32,200	40,900	34,300
ANTIMONY	MG/KG	6.4	4.5	2.1 J	6.2 J	6 J
ARSENIC	MG/KG	17	9.7	26.7	8.2	14.1
BARIUM	MG/KG	159 J	102	184 J	211	174
BERYLLIUM	MG/KG	1.1 U	0.67 J	1.6 J	1.8 J	1.5 J
BORON	MG/KG	18.8 J	25.5	16 J	62.2	50.5
CADMIUM	MG/KG	0.53 U	2.5	0.37 U	0.8 J	0.67 U
CALCIUM	MG/KG	23,800	73,200	51,900	37,200	31,800
CHROMIUM, TOTAL	MG/KG	55.2	34.2	100	73.7	75.4
COBALT	MG/KG	11.8	16.5	19.7	15.9	14.4
COPPER	MG/KG	39.1	100	29.4	60.2	39.6
IRON	MG/KG	30,700	19,400	46,700	41,800	38,700
LEAD	MG/KG	25.5	106	6.2	28.6	39.5
LITHIUM	MG/KG	30.9 J	33.6	54.6	46	44.4
MAGNESIUM	MG/KG	10,600	28,600	16,100	14,400	15,000
MANGANESE	MG/KG	1,230	510	836	1,040	890
MERCURY	MG/KG	0.21 U	0.2 J	0.2 J	0.1 J	0.201 J
MOLYBDENUM	MG/KG	3.2 J	5.8	1.5 U	2.2 U	4.4 J
NICKEL	MG/KG	34.1	26.7	50.6	38.6	40
POTASSIUM	MG/KG	3,670	4,530	6,020	11,800	10,200
SELENIUM	MG/KG	6.2 J	2.9 U	6.8 J	5.5 U	6.7 U

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE A-3
SEDIMENT ANALYTICAL RESULTS - METALS
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD022	SWSD023	SWSD023	SWSD025	SWSD025
Field Sample Identifier		SWSD022	SWSD023	SWSD023	SWSD025	SWSD025
Sample Matrix		Sediment	Sediment	Sediment	Sediment	Sediment
Depth Interval (ft)		-	-	-	-	-
Date of Sample		10/23/19	05/24/19	10/22/19	03/13/19	05/29/19
Parameter	Units					
METALS						
SILVER	MG/KG	0.53 U	0.29 U	0.37 U	33	0.67 U
SODIUM	MG/KG	405	350	272	331	366
THALLIUM	MG/KG	3.2 U	1.7 U	2.8 J	4.6 J	4 U
VANADIUM	MG/KG	39.2 J	36.5	57 J	76.3	70.8
ZINC	MG/KG	221	868	121	287	343

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE A-3
SEDIMENT ANALYTICAL RESULTS - METALS
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD025	SWSD025	SWSD025	WDD2	WDD2
Field Sample Identifier		SWSD025	SWSD025	SWSD025	WDD2	WDD2
Sample Matrix		Sediment	Sediment	Sediment	Sediment	Sediment
Depth Interval (ft)		-	-	-	-	-
Date of Sample		05/29/19	08/28/19	10/23/19	05/24/19	10/22/19
Parameter	Units	Field Duplicate				
METALS						
ALUMINUM	MG/KG	40,500	21,700	23,900	11,200	11,800
ANTIMONY	MG/KG	5.9 J	10.5	6.4 J	1.2 J	2 J
ARSENIC	MG/KG	13.1	11.1	23.2	5.9	8.3
BARIUM	MG/KG	194	172	185 J	65.8	136
BERYLLIUM	MG/KG	1.6 J	1.2 J	1.3 J	0.47 J	0.91 U
BORON	MG/KG	57.5	24.2 J	19.6 J	12.1 J	9.1 U
CADMIUM	MG/KG	0.52 U	0.53 U	0.58 U	0.49 J	0.46 U
CALCIUM	MG/KG	29,000	34,200	44,400	59,900	37,800
CHROMIUM, TOTAL	MG/KG	78.4	66.1	72.7	17.8	18
COBALT	MG/KG	14.4	17.5	18.3	6.7	7.8
COPPER	MG/KG	29.9	73	69	17.2	18
IRON	MG/KG	37,900	39,000	45,300	18,600	21,200
LEAD	MG/KG	38.6	46.7	47.2	6.9	7
LITHIUM	MG/KG	44.7	41	46.3	27.6	23.6 J
MAGNESIUM	MG/KG	15,200	14,000	16,100	17,100	6,080
MANGANESE	MG/KG	794	1,160	1,280	1,040	2,470
MERCURY	MG/KG	0.065 J	0.25 U	0.21 U	0.0701 J	0.19 U
MOLYBDENUM	MG/KG	3.7 J	7.1	3.8 J	1.3 J	1.8 U
NICKEL	MG/KG	39.6	45.9	48.5	15.8	18.6
POTASSIUM	MG/KG	13,000	3,740	4,430	2,890	2,140
SELENIUM	MG/KG	5.2 U	5.3 U	7.2 J	2.3 U	4.6 U

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE A-3
SEDIMENT ANALYTICAL RESULTS - METALS
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD025	SWSD025	SWSD025	WDD2	WDD2
Field Sample Identifier		SWSD025	SWSD025	SWSD025	WDD2	WDD2
Sample Matrix		Sediment	Sediment	Sediment	Sediment	Sediment
Depth Interval (ft)		-	-	-	-	-
Date of Sample		05/29/19	08/28/19	10/23/19	05/24/19	10/22/19
Parameter	Units	Field Duplicate				
METALS						
SILVER	MG/KG	0.52 U	0.53 U	0.58 U	0.23 U	0.46 U
SODIUM	MG/KG	346	453	342	117	244
THALLIUM	MG/KG	3.1 U	3.2 U	3.5 U	1.4 U	2.7 U
VANADIUM	MG/KG	77.7	48.8	50.7 J	26.8	20.8
ZINC	MG/KG	358	376	361	83.3	158

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE A-3
SEDIMENT ANALYTICAL RESULTS - METALS
NIAGARA FALLS STORAGE SITE

Location Identifier		WDD3	WDD3
Field Sample Identifier		WDD3	WDD3
Sample Matrix		Sediment	Sediment
Depth Interval (ft)		-	-
Date of Sample		05/24/19	10/22/19
Parameter	Units		
METALS			
ALUMINUM	MG/KG	25,600	21,500
ANTIMONY	MG/KG	1.2 J	2 J
ARSENIC	MG/KG	5.9	18.5
BARIUM	MG/KG	140	234
BERYLLIUM	MG/KG	0.87 J	1.1 J
BORON	MG/KG	29.5	10.2 J
CADMIUM	MG/KG	0.24 U	0.83 J
CALCIUM	MG/KG	33,100	82,800
CHROMIUM, TOTAL	MG/KG	31.4	33.3
COBALT	MG/KG	9.8	17.8
COPPER	MG/KG	32	28.1
IRON	MG/KG	24,400	39,000
LEAD	MG/KG	7.8	6.4
LITHIUM	MG/KG	33.9	40
MAGNESIUM	MG/KG	9,820	19,200
MANGANESE	MG/KG	866	2,330
MERCURY	MG/KG	0.0781 J	0.14 U
MOLYBDENUM	MG/KG	0.97 U	2.2 J
NICKEL	MG/KG	22.3	38.9
POTASSIUM	MG/KG	7,770	3,820
SELENIUM	MG/KG	2.4 U	5.6 J

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE A-3
SEDIMENT ANALYTICAL RESULTS - METALS
NIAGARA FALLS STORAGE SITE

Location Identifier		WDD3	WDD3
Field Sample Identifier		WDD3	WDD3
Sample Matrix		Sediment	Sediment
Depth Interval (ft)		-	-
Date of Sample		05/24/19	10/22/19
Parameter	Units		
METALS			
SILVER	MG/KG	0.24 U	0.34 U
SODIUM	MG/KG	261	364
THALLIUM	MG/KG	5.1	2 U
VANADIUM	MG/KG	42.2	41.7
ZINC	MG/KG	115	131

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE A-4
SEDIMENT ANALYTICAL RESULTS - PAHs
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD009	SWSD009	SWSD009	SWSD010	SWSD010
Field Sample Identifier		SWSD009	SWSD009	SWSD009-D	SWSD010	SWSD010
Sample Matrix		Sediment	Sediment	Sediment	Sediment	Sediment
Depth Interval (ft)		-	-	-	-	-
Date of Sample		05/24/19	10/22/19	10/22/19	05/29/19	10/23/19
Parameter	Units			Field Duplicate		
SEMI-VOLATILE ORGANIC ANALYSES						
ACENAPHTHENE	UG/KG	32.6 U	31.8 U	28.9 UJ	45.4 U	81.2 U
ACENAPHTHYLENE	UG/KG	32.6 U	31.8 U	28.9 UJ	45.4 U	81.2 U
ANTHRACENE	UG/KG	47.7 J	38 J	36.9 J	45.4 U	81.2 U
BENZO(A)ANTHRACENE	UG/KG	212	126 J	138 J	45.4 U	114 J
BENZO(A)PYRENE	UG/KG	227	128 J	132 J	45.4 U	114 J
BENZO(B)FLUORANTHENE	UG/KG	319	130 J	142 J	45.4 U	129 J
BENZO(G,H,I)PERYLENE	UG/KG	188 J	93.1 J	98.3 J	45.4 U	108 J
BENZO(K)FLUORANTHENE	UG/KG	113 J	119 J	121 J	45.4 U	104 J
CHRYSENE	UG/KG	238	141 J	153 J	45.4 U	84.8 J
DIBENZ(A,H)ANTHRACENE	UG/KG	48.2 J	31.8 U	29.9 J	45.4 U	81.2 U
FLUORANTHENE	UG/KG	423	258	333 J	45.4 U	132 J
FLUORENE	UG/KG	36 J	31.8 U	28.9 UJ	45.4 U	81.2 U
INDENO(1,2,3-C,D)PYRENE	UG/KG	173 J	100 J	95.3 J	45.4 U	112 J
NAPHTHALENE	UG/KG	32.6 U	31.8 U	28.9 UJ	45.4 U	81.2 U
PHENANTHRENE	UG/KG	202	122 J	184 J	45.4 U	81.2 U
PYRENE	UG/KG	359	228	270 J	45.4 U	144 J

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE A-4
SEDIMENT ANALYTICAL RESULTS - PAHs
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD011	SWSD011	SWSD021	SWSD021	SWSD022
Field Sample Identifier		SWSD011	SWSD011	SWSD021	SWSD021	SWSD022
Sample Matrix		Sediment	Sediment	Sediment	Sediment	Sediment
Depth Interval (ft)		-	-	-	-	-
Date of Sample		05/29/19	10/23/19	05/30/19	10/23/19	05/29/19
Parameter	Units					
SEMI-VOLATILE ORGANIC ANALYSES						
ACENAPHTHENE	UG/KG	39.4 U	59.8 U	35.9 U	35.1 U	37.5 U
ACENAPHTHYLENE	UG/KG	39.4 U	59.8 U	35.9 U	35.1 U	37.5 U
ANTHRACENE	UG/KG	39.4 U	59.8 U	35.9 U	35.1 U	37.5 U
BENZO(A)ANTHRACENE	UG/KG	39.4 U	59.8 U	35.9 U	35.1 U	37.5 U
BENZO(A)PYRENE	UG/KG	39.4 U	59.8 U	35.9 U	35.1 U	37.5 U
BENZO(B)FLUORANTHENE	UG/KG	39.4 U	59.8 U	35.9 U	35.1 U	37.5 U
BENZO(G,H,I)PERYLENE	UG/KG	39.4 U	59.8 U	35.9 U	35.1 U	37.5 U
BENZO(K)FLUORANTHENE	UG/KG	39.4 U	59.8 U	35.9 U	35.1 U	37.5 U
CHRYSENE	UG/KG	39.4 U	59.8 U	35.9 U	35.1 U	37.5 U
DIBENZ(A,H)ANTHRACENE	UG/KG	39.4 U	59.8 U	35.9 U	35.1 U	37.5 U
FLUORANTHENE	UG/KG	39.4 U	59.8 U	35.9 U	35.1 U	37.5 U
FLUORENE	UG/KG	39.4 U	59.8 U	35.9 U	35.1 U	37.5 U
INDENO(1,2,3-C,D)PYRENE	UG/KG	39.4 U	59.8 U	35.9 U	35.1 U	37.5 U
NAPHTHALENE	UG/KG	39.4 U	59.8 U	35.9 U	35.1 U	37.5 U
PHENANTHRENE	UG/KG	39.4 U	59.8 U	35.9 U	35.1 U	37.5 U
PYRENE	UG/KG	39.4 U	59.8 U	35.9 U	35.1 U	37.5 U

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE A-4
SEDIMENT ANALYTICAL RESULTS - PAHs
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD022	SWSD023	SWSD023	SWSD025	SWSD025
Field Sample Identifier		SWSD022	SWSD023	SWSD023	SWSD025	SWSD025
Sample Matrix		Sediment	Sediment	Sediment	Sediment	Sediment
Depth Interval (ft)		-	-	-	-	-
Date of Sample		10/23/19	05/24/19	10/22/19	03/13/19	05/29/19
Parameter	Units					
SEMI-VOLATILE ORGANIC ANALYSES						
ACENAPHTHENE	UG/KG	53.9 UJ	40 J	39 U	0.91 J	72.6 U
ACENAPHTHYLENE	UG/KG	53.9 UJ	55.3 J	39.7 J	1.2 J	72.6 U
ANTHRACENE	UG/KG	53.9 UJ	113 J	81.8 J	2.3 J	72.6 U
BENZO(A)ANTHRACENE	UG/KG	53.9 UJ	451 J	279	13.7	72.6 U
BENZO(A)PYRENE	UG/KG	53.9 UJ	458 J	292	15.8	72.6 U
BENZO(B)FLUORANTHENE	UG/KG	53.9 UJ	724 J	358	23.7	72.6 U
BENZO(G,H,I)PERYLENE	UG/KG	53.9 UJ	557 J	314	14.4	72.6 U
BENZO(K)FLUORANTHENE	UG/KG	53.9 UJ	246 J	327	9.7 J	72.6 U
CHRYSENE	UG/KG	53.9 UJ	513 J	404	17.1	72.6 U
DIBENZ(A,H)ANTHRACENE	UG/KG	53.9 UJ	106 J	57.3 J	5.2 J	72.6 U
FLUORANTHENE	UG/KG	53.9 UJ	954 J	542	25	72.6 U
FLUORENE	UG/KG	53.9 UJ	68.8 J	39.6 J	1.5 J	72.6 U
INDENO(1,2,3-C,D)PYRENE	UG/KG	53.9 UJ	384 J	213 J	14.9	72.6 U
NAPHTHALENE	UG/KG	53.9 UJ	57 J	60.9 J	1.3 J	72.6 U
PHENANTHRENE	UG/KG	53.9 UJ	290 J	229 J	9.7 J	72.6 U
PYRENE	UG/KG	53.9 UJ	916 J	579	24	72.6 U

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE A-4
SEDIMENT ANALYTICAL RESULTS - PAHs
NIAGARA FALLS STORAGE SITE

Location Identifier		SWSD025	SWSD025	SWSD025	WDD2	WDD2
Field Sample Identifier		SWSD025	SWSD025	SWSD025	WDD2	WDD2
Sample Matrix		Sediment	Sediment	Sediment	Sediment	Sediment
Depth Interval (ft)		-	-	-	-	-
Date of Sample		05/29/19	08/28/19	10/23/19	05/24/19	10/22/19
Parameter	Units	Field Duplicate				
SEMI-VOLATILE ORGANIC ANALYSES						
ACENAPHTHENE	UG/KG	54.6 U	63.7 U	59.9 U	26.3 U	45.9 U
ACENAPHTHYLENE	UG/KG	54.6 U	63.7 U	59.9 U	26.3 U	45.9 U
ANTHRACENE	UG/KG	54.6 U	63.7 U	59.9 U	26.3 U	45.9 U
BENZO(A)ANTHRACENE	UG/KG	54.6 U	63.7 U	59.9 U	46.4 J	45.9 U
BENZO(A)PYRENE	UG/KG	54.6 U	63.7 U	59.9 U	40 J	45.9 U
BENZO(B)FLUORANTHENE	UG/KG	54.6 U	63.7 U	59.9 U	52.8 J	45.9 U
BENZO(G,H,I)PERYLENE	UG/KG	54.6 U	63.7 U	59.9 U	26.7 J	45.9 U
BENZO(K)FLUORANTHENE	UG/KG	54.6 U	63.7 U	59.9 U	26.3 U	45.9 U
CHRYSENE	UG/KG	54.6 U	63.7 U	59.9 U	27 J	45.9 U
DIBENZ(A,H)ANTHRACENE	UG/KG	54.6 U	63.7 U	59.9 U	26.3 U	45.9 U
FLUORANTHENE	UG/KG	54.6 U	63.7 U	59.9 U	45 J	45.9 U
FLUORENE	UG/KG	54.6 U	63.7 U	59.9 U	26.3 U	45.9 U
INDENO(1,2,3-C,D)PYRENE	UG/KG	54.6 U	63.7 U	59.9 U	26.3 U	45.9 U
NAPHTHALENE	UG/KG	54.6 U	63.7 U	59.9 U	26.3 U	45.9 U
PHENANTHRENE	UG/KG	54.6 U	63.7 U	59.9 U	26.3 U	45.9 U
PYRENE	UG/KG	54.6 U	63.7 U	59.9 U	50.3 J	45.9 U

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

TABLE A-4
SEDIMENT ANALYTICAL RESULTS - PAHs
NIAGARA FALLS STORAGE SITE

Location Identifier		WDD3	WDD3
Field Sample Identifier		WDD3	WDD3
Sample Matrix		Sediment	Sediment
Depth Interval (ft)		-	-
Date of Sample		05/24/19	10/22/19
Parameter	Units		
SEMI-VOLATILE ORGANIC ANALYSES			
ACENAPHTHENE	UG/KG	25.6 U	35.1 U
ACENAPHTHYLENE	UG/KG	25.6 U	35.1 U
ANTHRACENE	UG/KG	25.6 U	35.1 U
BENZO(A)ANTHRACENE	UG/KG	25.6 U	35.1 U
BENZO(A)PYRENE	UG/KG	25.6 U	35.1 U
BENZO(B)FLUORANTHENE	UG/KG	25.6 U	35.1 U
BENZO(G,H,I)PERYLENE	UG/KG	25.6 U	35.1 U
BENZO(K)FLUORANTHENE	UG/KG	25.6 U	35.1 U
CHRYSENE	UG/KG	25.6 U	35.1 U
DIBENZ(A,H)ANTHRACENE	UG/KG	25.6 U	35.1 U
FLUORANTHENE	UG/KG	25.6 U	35.1 U
FLUORENE	UG/KG	25.6 U	35.1 U
INDENO(1,2,3-C,D)PYRENE	UG/KG	25.6 U	35.1 U
NAPHTHALENE	UG/KG	25.6 U	35.1 U
PHENANTHRENE	UG/KG	25.6 U	35.1 U
PYRENE	UG/KG	25.6 U	35.1 U

The flags shown were assigned during chemistry validation.

U - Not detected above the reported quantitation limit.; R - The data is rejected.; J - The reported concentration is an estimated value.

NOTE: Detection limits shown are MDL.

ATTACHMENT B
MANN-KENDALL TEST RESULTS

ATTACHMENT B-1

TOTAL URANIUM IN SURFACE WATER

GSI MANN-KENDALL TOOLKIT

for Constituent Trend Analysis

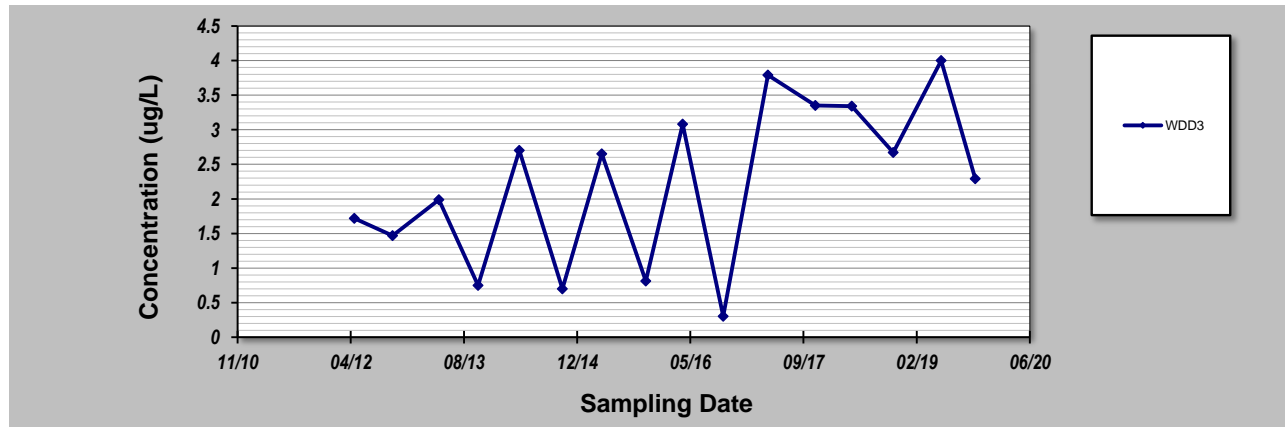
Evaluation Date: **23-May-19**
 Facility Name: **NFSS**
 Conducted By:

Job ID: **Surface Water**
 Constituent: **Total Uranium**
 Concentration Units: **ug/L**

Sampling Point ID: **WDD3**

Sampling Event	Sampling Date	TOTAL URANIUM CONCENTRATION (ug/L)					
1	Apr-12	1.72					
2	Oct-12	1.47					
3	Apr-13	1.99					
4	Oct-13	0.748					
5	Apr-14	2.7					
6	Oct-14	0.7					
7	Apr-15	2.65					
8	Oct-15	0.812					
9	Apr-16	3.08					
10	Oct-16	0.303					
11	Apr-17	3.79					
12	Nov-17	3.35					
13	Apr-18	3.34					
14	Oct-18	2.67					
15	May-19	4					
16	Oct-19	2.29					
17							
18							
19							
20							

Coefficient of Variation:	0.53						
Mann-Kendall Statistic (S):	40						
Confidence Factor:	96.1%						
Concentration Trend:	Increasing						



Notes:

- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
- Confidence in Trend = Confidence (in percent) that constituent concentration is increasing ($S > 0$) or decreasing ($S < 0$): $> 95\%$ = Increasing or Decreasing; $\geq 90\%$ = Probably Increasing or Probably Decreasing; $< 90\%$ and $S > 0$ = No Trend; $< 90\%$, $S \leq 0$, and $COV \geq 1$ = No Trend; $< 90\%$ and $COV < 1$ = Stable.
- Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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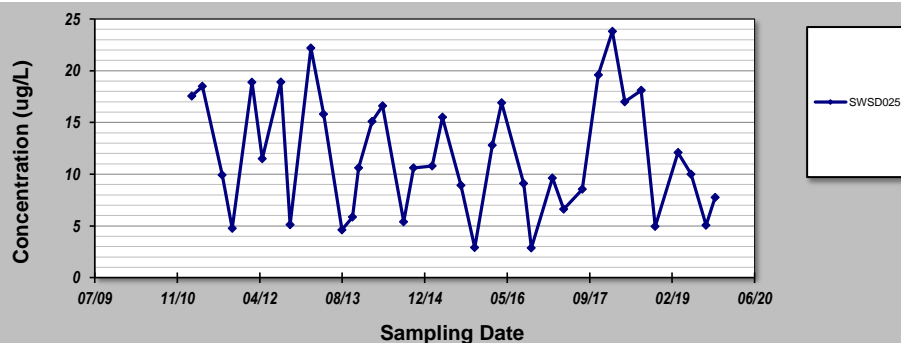
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GSI MANN-KENDALL TOOLKIT for Constituent Trend Analysis

Evaluation Date: 23-May-19	Job ID: Surface Water
Facility Name: NFSS	Constituent: Total Uranium
Conducted By: [REDACTED]	Concentration Units: ug/L

Sampling Point ID: **SWSD025**

Sampling Event	Sampling Date	TOTAL URANIUM CONCENTRATION (ug/L)
1	Feb-11	17.5527
2	Apr-11	18.5031
3	Aug-11	9.9198
4	Oct-11	4.752
5	Feb-12	18.8892
6	Apr-12	11.5
7	Aug-12	18.9
8	Oct-12	5.12
9	Feb-13	22.2
10	Apr-13	15.8
11	Aug-13	4.62
12	Oct-13	5.85
13	Nov-13	10.6
14	Feb-14	15.1
15	Apr-14	16.6
16	Aug-14	5.4
17	Oct-14	10.6
18	Feb-15	10.8
19	Apr-15	15.5
20	Aug-15	8.91
21	Oct-15	2.9
22	Feb-16	12.8
23	Apr-16	16.9
24	Aug-16	9.1
25	Oct-16	2.86
26	Feb-17	9.63
27	Apr-17	6.62
28	Aug-17	8.54
29	Nov-17	19.6
30	Feb-18	23.8
31	Apr-18	17
32	Aug-18	18.1
33	Oct-18	4.94
34	Mar-19	12.1
35	May-19	10
36	Aug-19	5.06
37	Oct-19	7.74
38		
39		
40		
Coefficient of Variation:	0.49	
Mann-Kendall Statistic (S):	-69	
Confidence Factor:	81.2%	
Concentration Trend:	Stable	



Notes:

- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
- Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
- Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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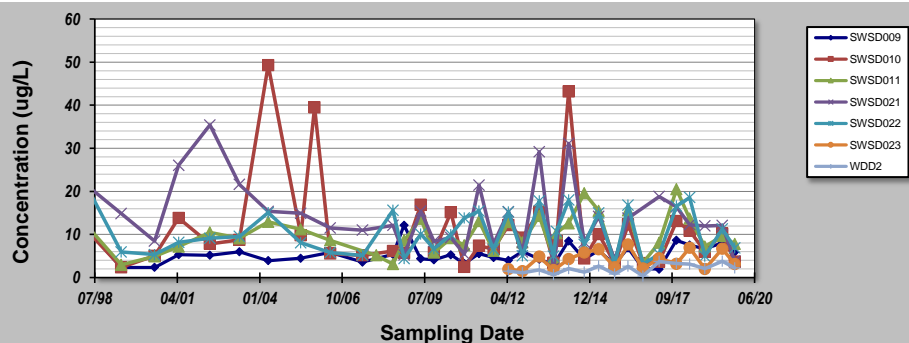
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GSI MANN-KENDALL TOOLKIT for Constituent Trend Analysis

Evaluation Date: 12-May-20	Job ID: Surface Water
Facility Name: NFSS	Constituent: Total Uranium
Conducted By: [REDACTED]	Concentration Units: ug/L

Sampling Point ID: SWSD009	SWSD010	SWSD011	SWSD021	SWSD022	SWSD023	WDD2
----------------------------	---------	---------	---------	---------	---------	------

Sampling Event	Sampling Date	TOTAL URANIUM CONCENTRATION (ug/L)						
1	Apr-97	2.77	5.45	8.04	10.5	7.47		
2	Apr-98	11.6127	11.1375	12.2364	21.5622	21.4434		
3	Jun-99	2.376	2.376	2.97	14.85	5.94		
4	Jul-00	2.36709	5.03118	4.93317	8.48232	5.32224		
5	May-01	5.3163	13.8402	7.1874	26.0469	8.1675		
6	May-02	5.1678	7.8408	10.5	35.4	9.12		
7	May-03	5.9994	8.7615	9.1179	21.6216	9.5337		
8	Apr-04	3.9204	49.302	12.9492	15.3549	15.0579		
9	May-05	4.4847	9.801	11.1969	14.9094	8.0784		
10	Nov-05		39.501					
11	May-06	5.8509	5.5836	8.6427	11.5236	5.8212		
12	Jun-07	3.5937	5.1678		11.0187	5.1678		
13	Nov-07			5.1678				
14	Jun-08	5.3757	6.1479	3.1482	12.1473	15.5925		
15	Oct-08	12.1176	5.7024	8.613	5.2866	4.4253		
16	May-09	4.38075	16.89633	13.65309	15.41727	10.09206		
17	Oct-09	4.11048	5.89545	5.80041	8.39619	6.70626		
18	May-10	5.28957	15.15294	9.16839	9.28125	9.97029		
19	Oct-10	3.267	2.47104	7.4844	5.4648	13.8402		
20	Apr-11	5.5539	7.3953	13.0977	21.4434	15.444		
21	Oct-11	4.6332	6.6231	6.2073	7.8111	6.5043		
22	Apr-12	3.97	12.2	12.9	15.3	15.2	1.99	1.5
23	Oct-12	6.04	9.3	8.15	5.94	5.04	1.51	1.14
24	Apr-13	4.25	15.3	14.3	29.2	17.8	4.86	1.81
25	Oct-13	2.92	3.47	4.64	2.11	4.95	1.75	0.681
26	Nov-13		8.55	10.3		10.7		
27	Apr-14	8.49	43.2	12.6	31.1	18	4.3	2.11
28	Oct-14	4.25	4.44	19.6	8.21	7.69	5.83	1.28
29	Apr-15	6.3	10.1	15.5	14.2	15	6.58	2.71
30	Oct-15	3.08	3.19	3.43	4.08	3.26	2.37	0.831
31	Apr-16	6.86	12.3	15.6	13.8	16.8	7.67	2.64
32	Oct-16	2.06	3.37	3.39	3.15	3.15	2.12	0.351
33	Apr-17	1.95	3.7	8.08	18.8	5.45	4.47	3.75
34	Nov-17	8.67	13.1	20.5	16.4	16.6	3.17	3.26
35	Apr-18	7.53	10.9	13.7	12.3	18.6	6.93	3.15
36	Oct-18	6.66	6.04	7.2	12	4.95	2	2.12
37	May-19	8.05	10.2	9.65	12.1	11.3	6.68	3.8
38	Oct-19	5.96	3.73	7.81	3.83	6.88	3.15	2.24
39								
40								
Coefficient of Variation:		0.46	0.99	0.46	0.57	0.51	0.52	0.52
Mann-Kendall Statistic (S):		88	-14	102	-99	23	28	46
Confidence Factor:		89.1%	56.7%	91.5%	92.6%	61.7%	88.6%	97.9%
Concentration Trend:		No Trend	Stable	Prob. Increasing	Prob. Decreasing	No Trend	No Trend	Increasing



Notes:

- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
- Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S=0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
- Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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ATTACHMENT B-2
RADIUM-226 IN SEDIMENT
(901.1 analysis only)

GSI MANN-KENDALL TOOLKIT

for Constituent Trend Analysis

Evaluation Date: **13-May-20**

Facility Name: **NFSS**

Conducted By: **[REDACTED]**

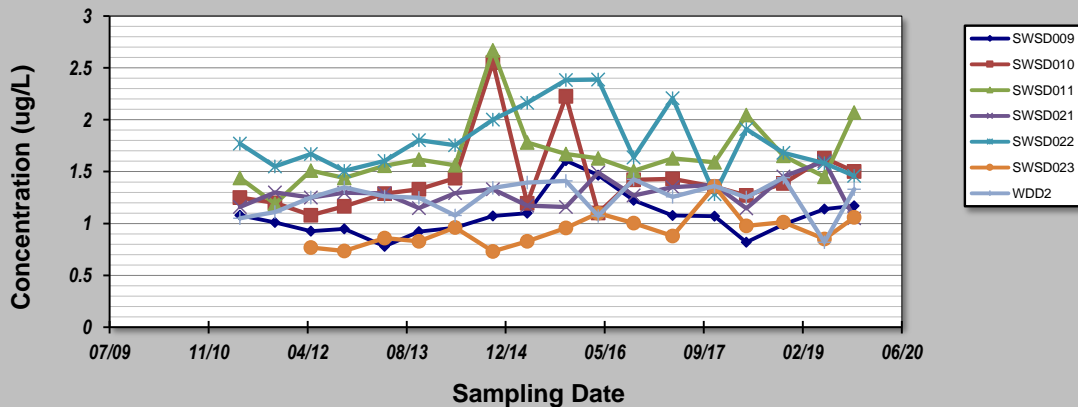
Job ID: **Sediment**

Constituent: **Radium-226**

Concentration Units: **ug/L**

Sampling Point ID: SWSD009 SWSD010 SWSD011 SWSD021 SWSD022 SWSD023 WDD2

Sampling Event	Sampling Date	RADIUM-226 CONCENTRATION (ug/L)						
1	Apr-11	1.08	1.25	1.44	1.16	1.77		1.05
2	Oct-11	1.01	1.2	1.19	1.3	1.55		1.11
3	Apr-12	0.926	1.08	1.51	1.25	1.67	0.767	1.25
4	Oct-12	0.948	1.166	1.44	1.296	1.508	0.735	1.348
5	Apr-13	0.78	1.287	1.557	1.29	1.604	0.86	1.262
6	Oct-13	0.922	1.329	1.617	1.147	1.803	0.828	1.247
7	Apr-14	0.958	1.436	1.561	1.293	1.754	0.961	1.077
8	Oct-14	1.073	2.552	2.669	1.33	2	0.731	1.343
9	Apr-15	1.099	1.195	1.782	1.172	2.162	0.828	1.395
10	Oct-15	1.606	2.226	1.671	1.158	2.384	0.957	1.411
11	Apr-16	1.466	1.102	1.627	1.489	2.388	1.099	1.072
12	Oct-16	1.223	1.422	1.508	1.27	1.636	1.003	1.425
13	Apr-17	1.076	1.43	1.627	1.349	2.207	0.88	1.256
14	Nov-17	1.071	1.354	1.59	1.372	1.281	1.358	1.362
15	Apr-18	0.82	1.271	2.046	1.146	1.909	0.977	1.251
16	Oct-18	0.99	1.385	1.653	1.452	1.681	1.012	1.442
17	May-19	1.14	1.63	1.45	1.6	1.58	0.85	0.82
18	Oct-19	1.17	1.5	2.07	1.05	1.46	1.06	1.33
19								
20								
Coefficient of Variation:		0.19	0.26	0.19	0.11	0.18	0.17	0.13
Mann-Kendall Statistic (S):		35	53	61	23	3	57	35
Confidence Factor:		90.0%	97.6%	98.9%	79.5%	53.0%	99.5%	90.0%
Concentration Trend:		Prob. Increasing	Increasing	Increasing	No Trend	No Trend	Increasing	Prob. Increasing



Notes:

- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
- Confidence in Trend = Confidence (in percent) that constituent concentration is increasing ($S > 0$) or decreasing ($S < 0$): $> 95\%$ = Increasing or Decreasing; $\geq 90\%$ = Probably Increasing or Probably Decreasing; $< 90\%$ and $S > 0$ = No Trend; $< 90\%$, $S \leq 0$, and $COV \geq 1$ = No Trend; $< 90\%$ and $COV < 1$ = Stable.
- Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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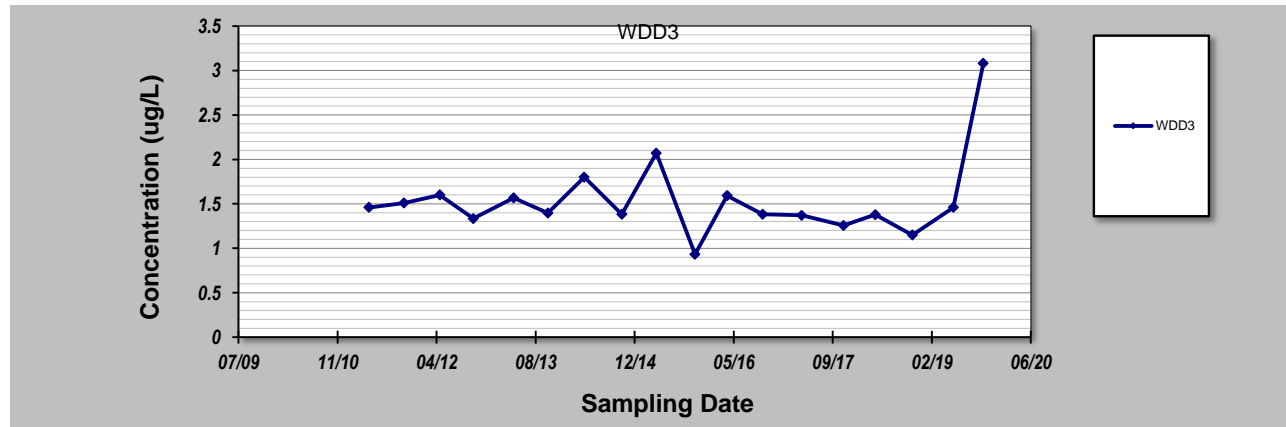
for Constituent Trend Analysis

Evaluation Date: **13-May-20**
 Facility Name: **NFSS**
 Conducted By:

Job ID: **Sediment**
 Constituent: **Radium-226**
 Concentration Units: **ug/L**

Sampling Point ID: **WDD3**

Sampling Event	Sampling Date	RADIUM-226 CONCENTRATION (ug/L)						
1	Apr-11	1.46						
2	Oct-11	1.51						
3	Apr-12	1.6						
4	Oct-12	1.335						
5	Apr-13	1.568						
6	Oct-13	1.396						
7	Apr-14	1.801						
8	Oct-14	1.382						
9	Apr-15	2.07						
10	Oct-15	0.933						
11	Apr-16	1.592						
12	Oct-16	1.383						
13	Apr-17	1.371						
14	Nov-17	1.256						
15	Apr-18	1.378						
16	Oct-18	1.149						
17	May-19	1.46						
18	Oct-19	3.08						
19								
20								
Coefficient of Variation:		0.30						
Mann-Kendall Statistic (S):		-20						
Confidence Factor:		76.2%						
Concentration Trend:		Stable						



Notes:

- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
- Confidence in Trend = Confidence (in percent) that constituent concentration is increasing ($S > 0$) or decreasing ($S < 0$): $> 95\%$ = Increasing or Decreasing; $\geq 90\%$ = Probably Increasing or Probably Decreasing; $< 90\%$ and $S > 0$ = No Trend; $< 90\%$, $S \leq 0$, and $COV \geq 1$ = No Trend; $< 90\%$ and $COV < 1$ = Stable.
- Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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GSI MANN-KENDALL TOOLKIT for Constituent Trend Analysis

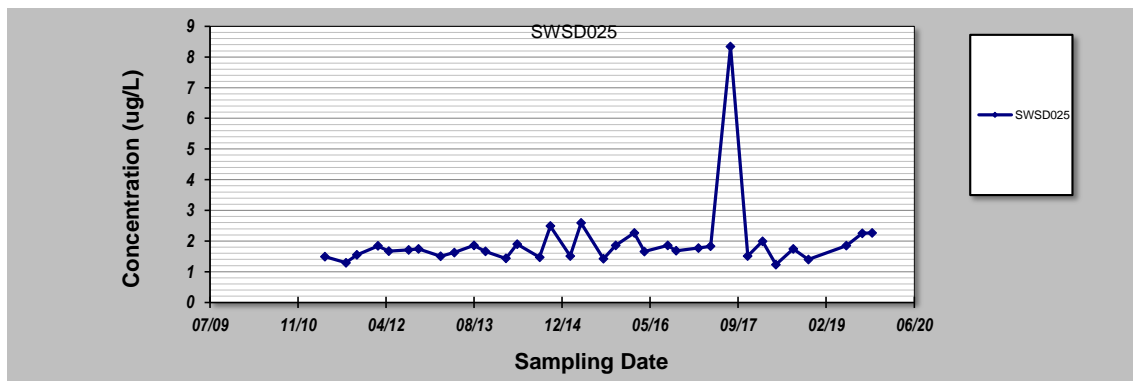
Evaluation Date: **13-May-20**
 Facility Name: **NFSS**
 Conducted By: **[REDACTED]**

Job ID: **Sediment**
 Constituent: **Radium-226**
 Concentration Units: **ug/L**

Sampling Point ID: **SWSD025**

Sampling Event	Sampling Date	RADIUM-226 CONCENTRATION (ug/L)						
1	Apr-11	1.49						
2	Aug-11	1.29						
3	Oct-11	1.55						
4	Feb-12	1.84						
5	Apr-12	1.67						
6	Aug-12	1.71						
7	Oct-12	1.743						
8	Feb-13	1.503						
9	Apr-13	1.624						
10	Aug-13	1.859						
11	Oct-13	1.663						
12	Feb-14	1.435						
13	Apr-14	1.897						
14	Aug-14	1.468						
15	Oct-14	2.488						
16	Feb-15	1.511						
17	Apr-15	2.591						
18	Aug-15	1.419						
19	Oct-15	1.854						
20	Feb-16	2.264						
21	Apr-16	1.658						
22	Aug-16	1.858						
23	Oct-16	1.685						
24	Feb-17	1.772						
25	Apr-17	1.826						
26	Aug-17	8.338						
27	Nov-17	1.51						
28	Feb-18	1.989						
29	Apr-18	1.231						
30	Aug-18	1.739						
31	Oct-18	1.397						
32	May-19	1.85						
33	Aug-19	2.25						
34	Oct-19	2.26						
35								

Coefficient of Variation:	0.60						
Mann-Kendall Statistic (S):	115						
Confidence Factor:	95.4%						
Concentration Trend:	Increasing						



Notes:

- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
- Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
- Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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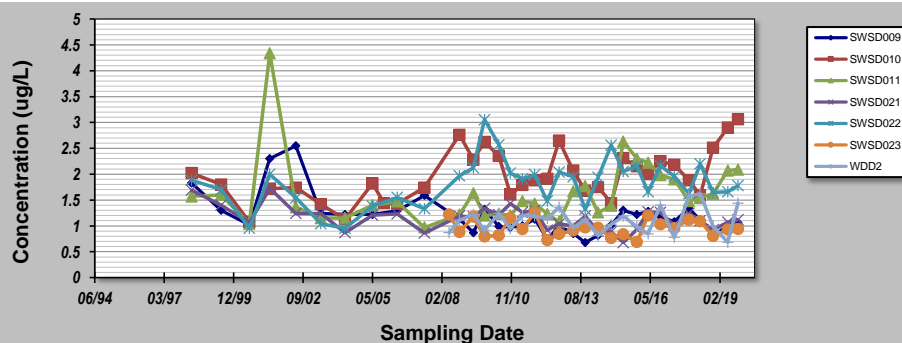
ATTACHMENT B-3
URANIUM-238 IN SEDIMENT

GSI MANN-KENDALL TOOLKIT for Constituent Trend Analysis

Evaluation Date: 13-May-20	Job ID: Sediment
Facility Name: NFSS	Constituent: U-238
Conducted By: [REDACTED]	Concentration Units: ug/L

Sampling Point ID:		SWSD009	SWSD010	SWSD011	SWSD021	SWSD022	SWSD023	WDD2
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Sampling Event	Sampling Date	U-238 CONCENTRATION (ug/L)						
1	Apr-98	1.83	2.02	1.57	1.69	1.88		
2	Jun-99	1.3	1.8	1.6	1.4	1.7		
3	Jul-00	1.021	1.08	1.04	1.068	0.951		
4	May-01	2.3	1.72	4.34	1.73	2		
5	May-02	2.55	1.74	1.36	1.24	1.54		
6	May-03	1.24	1.42	1.15	1.24	1.04		
7	Apr-04	1.22	1.13	1.15	0.869	0.953		
8	May-05	1.22	1.82	1.4	1.21	1.38		
9	Nov-05		1.44					
10	May-06	1.29	1.43	1.47	1.23	1.55		
11	Jun-07	1.59	1.74	0.969	0.863	1.33		
12	Jun-08						1.22	0.87
13	Oct-08	1.13	2.76	1.22	1.19	1.97	0.88	1.11
14	May-09	0.8679	2.282	1.633	1.173	2.123	1.179	1.219
15	Oct-09	1.32	2.623	1.2	1.338	3.055	0.7944	0.9161
16	May-10	0.9876	2.351	1.235	1.215	2.569	0.8181	1.24
17	Nov-10	0.969	1.61	1.2	1.43	2.02	1.15	0.945
18	Apr-11	1	1.79	1.48	1.26	1.91	0.937	1.2
19	Oct-11	1.13	1.88	1.43	1.3	1.99	1.26	1.19
20	Apr-12	0.741	1.91	1.23	0.915	1.48	0.727	1.14
21	Oct-12	0.999	2.65	1.08	1.04	2.04	0.845	1.36
22	Apr-13	0.852	2.07	1.67	0.996	1.95	0.911	0.963
23	Oct-13	0.677	1.68	1.77	1.19	1.32	0.971	1.13
24	Apr-14	0.815	1.75	1.26	0.895	1.94	0.965	0.811
25	Oct-14	1.01	1.44	1.39	0.884	2.56	0.767	1.03
26	Apr-15	1.3	2.31	2.63	0.679	2.05	0.838	1.19
27	Oct-15	1.22	2.15	2.3	0.93	2.16	0.687	0.986
28	Apr-16	1.28	2	2.22	1.27	1.66	1.2	0.846
29	Oct-16	1.18	2.25	1.98	1.26	2.16	1.03	1.4
30	Apr-17	1.08	2.18	1.9	1.01	1.96	0.957	0.777
31	Nov-17	1.34	1.88	1.48	1.24	1.62	1.12	1.57
32	Apr-18	1.12	1.59	1.54	1.1	2.2	1.09	1.62
33	Oct-18	0.802	2.51	1.62	0.925	1.65	0.805	1
34	May-19	1.01	2.9	2.07	1.07	1.66	0.93	0.68
35	Oct-19	1.06	3.06	2.09	1.12	1.78	0.94	1.44
36								
37								
38								
39								
40								
Coefficient of Variation:		0.33	0.25	0.39	0.20	0.25	0.17	0.22
Mann-Kendall Statistic (S):		-148	188	181	-135	102	-12	13
Confidence Factor:		98.9%	99.8%	99.8%	98.2%	94.1%	60.6%	61.6%
Concentration Trend:		Decreasing	Increasing	Increasing	Decreasing	Prob. Increasing	Stable	No Trend



Notes:

- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
- Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S=0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
- Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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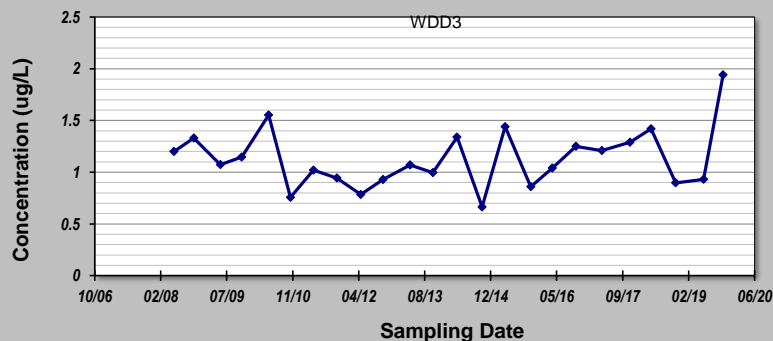
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GSI MANN-KENDALL TOOLKIT for Constituent Trend Analysis

Evaluation Date: 13-May-20	Job ID: Sediment
Facility Name: NFSS	Constituent: U-238
Conducted By: [REDACTED]	Concentration Units: ug/L

Sampling Point ID: **WDD3**

Sampling Event	Sampling Date	U-238 CONCENTRATION (ug/L)					
1	Apr-98						
2	Jun-99						
3	Jul-00						
4	May-01						
5	May-02						
6	May-03						
7	Apr-04						
8	May-05						
9	Nov-05						
10	May-06						
11	Jun-07						
12	Jun-08	1.2					
13	Oct-08	1.33					
14	May-09	1.074					
15	Oct-09	1.147					
16	May-10	1.553					
17	Nov-10	0.757					
18	Apr-11	1.02					
19	Oct-11	0.943					
20	Apr-12	0.784					
21	Oct-12	0.929					
22	Apr-13	1.07					
23	Oct-13	0.996					
24	Apr-14	1.34					
25	Oct-14	0.664					
26	Apr-15	1.44					
27	Oct-15	0.86					
28	Apr-16	1.04					
29	Oct-16	1.25					
30	Apr-17	1.21					
31	Nov-17	1.29					
32	Apr-18	1.42					
33	Oct-18	0.897					
34	May-19	0.93					
35	Oct-19	1.94					
36							
37							
38							
39							
40							
Coefficient of Variation:		0.26					
Mann-Kendall Statistic (S):		18					
Confidence Factor:		66.2%					
Concentration Trend:		No Trend					



Notes:

- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
- Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
- Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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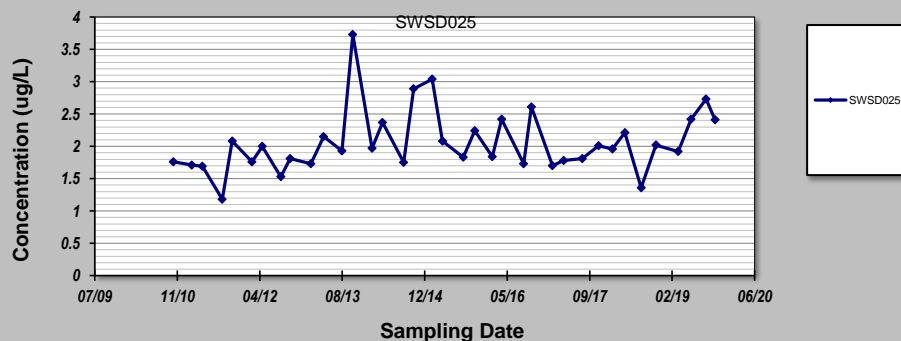
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GSI MANN-KENDALL TOOLKIT for Constituent Trend Analysis

Evaluation Date: 13-May-20	Job ID: Sediment
Facility Name: NFSS	Constituent: U-238
Conducted By: [REDACTED]	Concentration Units: ug/L

Sampling Point ID: **SWSD025**

Sampling Event	Sampling Date	U-238 CONCENTRATION (ug/L)					
1	Oct-10	1.76					
2	Feb-11	1.71					
3	Apr-11	1.69					
4	Aug-11	1.18					
5	Oct-11	2.08					
6	Feb-12	1.76					
7	Apr-12	2					
8	Aug-12	1.53					
9	Oct-12	1.81					
10	Feb-13	1.73					
11	Apr-13	2.15					
12	Aug-13	1.93					
13	Oct-13	3.73					
14	Feb-14	1.97					
15	Apr-14	2.37					
16	Aug-14	1.75					
17	Oct-14	2.89					
18	Feb-15	3.04					
19	Apr-15	2.08					
20	Aug-15	1.83					
21	Oct-15	2.24					
22	Feb-16	1.84					
23	Apr-16	2.42					
24	Aug-16	1.73					
25	Oct-16	2.61					
26	Feb-17	1.7					
27	Apr-17	1.78					
28	Aug-17	1.81					
29	Nov-17	2.01					
30	Feb-18	1.96					
31	Apr-18	2.21					
32	Aug-18	1.36					
33	Oct-18	2.02					
34	Mar-19	1.92					
35	May-19	2.42					
36	Aug-19	2.73					
37	Oct-19	2.41					
38							
39							
40							
Coefficient of Variation:		0.24					
Mann-Kendall Statistic (S):		161					
Confidence Factor:		98.3%					
Concentration Trend:		Increasing					



Notes:

- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
- Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
- Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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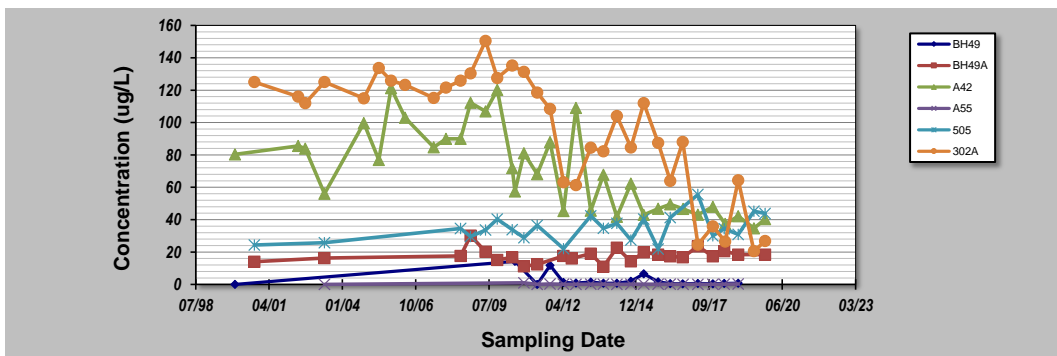
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ATTACHMENT B-4
TOTAL URANIUM IN GROUNDWATER

GSI MANN-KENDALL TOOLKIT for Constituent Trend Analysis

Evaluation Date: 18-May-20	Job ID: 2019 ESP
Facility Name: NFSS	Constituent: Total Uranium
Conducted By: [REDACTED]	Concentration Units: ug/L

Sampling Point ID:		BH49	BH49A	A42	A55	505	302A	
Sampling Event	Sampling Date	TOTAL URANIUM CONCENTRATION (ug/L)						
1	Jan-00	0		80.3				
2	Sep-00		14			24.4	125	
3	May-02			85.6			116	
4	Aug-02			83.9			112	
5	May-03		16.3	56	0	25.8	125	
6	Nov-04			99.7			115	
7	May-05			76.9			133.72	
8	Nov-05			121.22			125.86	
9	May-06			103.03			123.23	
10	Jun-07			84.67			115.18	
11	Nov-07			89.95			121.6	
12	Jun-08		17.62	89.95		34.6	125.82	
13	Oct-08		30.14	112.26		29.53	130.42	
14	May-09		20.23	106.88		33.59	150.47	
15	Oct-09		15.07	120.21		40.32	127.53	
16	May-10		16.72	71.91		33.82	135.23	
17	Jun-10	14.25		57.39				
18	Oct-10		11.23	81.07	0.99	28.82	131.3	
19	Apr-11	0	12.35	68.11	0.01	36.4	118.54	
20	Oct-11	11.84		87.88	0.23		108.48	
21	Apr-12	1.23	17.6	45.4	0.129	22.1	63.1	
22	Aug-12		16					
23	Oct-12	0.904		109	0.03		61.3	
24	Apr-13	1.47	19	45.6	0.111	42.4	84.5	
25	Oct-13	0.701	11	67.8	0.107	34.7	82.2	
26	Apr-14	0.723	22.7	41.8	0.076	37.8	104	
27	Oct-14	1.98	14.3	62.3	0.103	27.4	84.6	
28	Apr-15	6.59	19.9	43	0.13	40.4	112	
29	Oct-15	1.62	18.4	46.8	0.141	21.9	87.5	
30	Apr-16	0.505	17.3	49.5	0.134	41.3	64	
31	Sep-16	0.443	16.8				88.1	
32	Oct-16			46.7	0.059			
33	Apr-17	0.645	23.5	43.1	0.059	55.5	24.6	
34	Nov-17	0.408	17.4	47.9	0.039	30.1	35.9	
35	Apr-18	0.638	20.6		0.178	34.4		
36	May-18			37.4			26.5	
37	Oct-18	0.742	18.4	42.2	0.226	30.9	64.3	
38	May-19			34.7		45.2	20.6	
39	Oct-19		18.4	40.4		43.8	26.9	
40								
Coefficient of Variation:		1.66	0.23	0.37	1.43	0.24	0.39	
Mann-Kendall Statistic (S):		-28	57	-314	18	81	-289	
Confidence Factor:		84.4%	91.7%	>99.9%	73.8%	98.3%	>99.9%	
Concentration Trend:		No Trend	Prob. Increasing	Decreasing	No Trend	Increasing	Decreasing	



- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
- Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
- Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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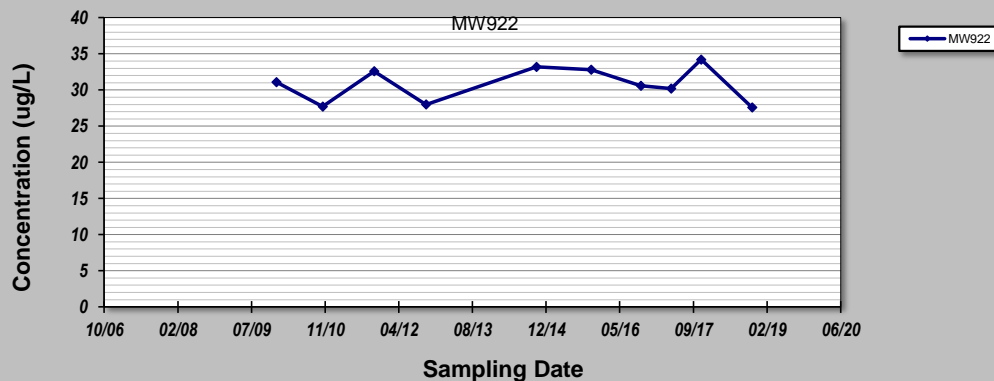
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GSI MANN-KENDALL TOOLKIT for Constituent Trend Analysis

Evaluation Date: 20-May-19	Job ID: 2018 ESP TM
Facility Name: NFSS	Constituent: TOTAL URANIUM
Conducted By: [REDACTED]	Concentration Units: ug/L

Sampling Point ID: **MW922**

Sampling Event	Sampling Date	TOTAL URANIUM CONCENTRATION (ug/L)					
1	Sep-00						
2	May-03						
3	Oct-03						
4	Apr-04						
5	Dec-09	31.1					
6	Jan-10						
7	Jun-10						
8	Oct-10						
9	Nov-10	27.71					
10	Apr-11						
11	Oct-11	32.6					
12	Apr-12						
13	Oct-12	28					
14	Apr-13						
15	Oct-13						
16	Apr-14						
17	Oct-14	33.2					
18	Apr-15						
19	Oct-15	32.8					
20	Apr-16						
21	Aug-16						
22	Sep-16	30.6					
23	Apr-17	30.2					
24	Nov-17	34.2					
25	Apr-18						
26	Oct-18	27.6					
27							
28							
29							
30							
Coefficient of Variation:		0.08					
Mann-Kendall Statistic (S):		1					
Confidence Factor:		50.0%					
Concentration Trend:		No Trend					



Notes:

- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
- Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
- Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

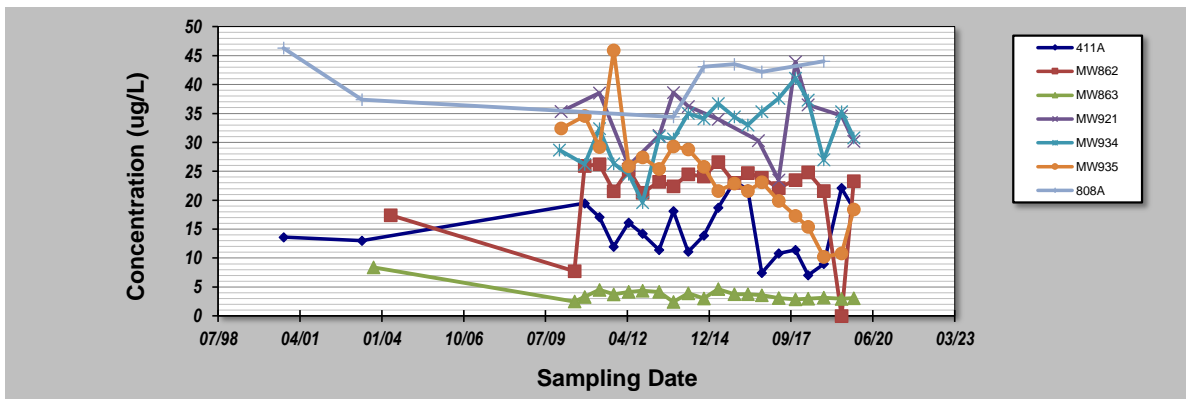
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GSI MANN-KENDALL TOOLKIT for Constituent Trend Analysis

Evaluation Date: **18-May-20**
 Facility Name: **NFSS**
 Conducted By:

Job ID: **2019 ESP TM**
 Constituent: **TOTAL URANIUM**
 Concentration Units: **ug/L**

Sampling Point ID:		411A	MW862	MW863	MW921	MW934	MW935	808A
Sampling Event	Sampling Date	TOTAL URANIUM CONCENTRATION (ug/L)						
1	Sep-00	13.6						46.3
2	May-03	13						37.4
3	Oct-03			8.39				
4	Apr-04		17.4					
5	Dec-09					28.67		
6	Jan-10				35.34		32.43	
7	Jun-10		7.73	2.5				
8	Oct-10	19.46	25.94	3.3		26.19	34.55	
9	Nov-10							
10	Apr-11	17.07	26.21	4.52	38.54	32.37	29.2	
11	Oct-11	11.94	21.56	3.74		26.3	45.89	
12	Apr-12	16.1	25.3	4.16	26	24.5	25.9	
13	Oct-12	14.2	21.3	4.37		19.6	27.4	
14	Apr-13	11.4	23.2	4.16	31.2	31	25.4	
15	Oct-13	18.1	22.4	2.44	38.6	30.6	29.3	34.4
16	Apr-14	11.1	24.5	3.93	36.2	35	28.8	
17	Oct-14	13.9	24.1	3.04		34.1	25.8	43.1
18	Apr-15	18.7	26.6	4.64	34	36.7	21.6	
19	Oct-15	23.2	23	3.75		34.4	22.9	43.5
20	Apr-16	21.9	24.7	3.77		33	21.6	
21	Aug-16				30.3			
22	Sep-16	7.45	23.9	3.58		35.3	23.1	42.2
23	Apr-17	10.8	22.1	3.09	23.5	37.6	19.9	
24	Nov-17	11.4	23.5	2.86	43.9	41.1	17.3	
25	Apr-18	7.03	24.8	2.97	36.5	37.3	15.4	
26	Oct-18	9	21.6	3.16		27	10.2	44
27	May-19	22.1	23.4	2.95	34.6	35.3	10.8	
28	Oct-19	18.5	23.3	3.07	30.2	30.8	18.4	
29								
30								
Coefficient of Variation:		0.32	0.18	0.33	0.16	0.16	0.34	0.10
Mann-Kendall Statistic (S):		-19	14	-71	-8	81	-145	3
Confidence Factor:		70.5%	66.1%	98.4%	66.2%	99.6%	>99.9%	61.4%
Concentration Trend:		Stable	No Trend	Decreasing	Stable	Increasing	Decreasing	No Trend



Notes:

- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
- Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
- Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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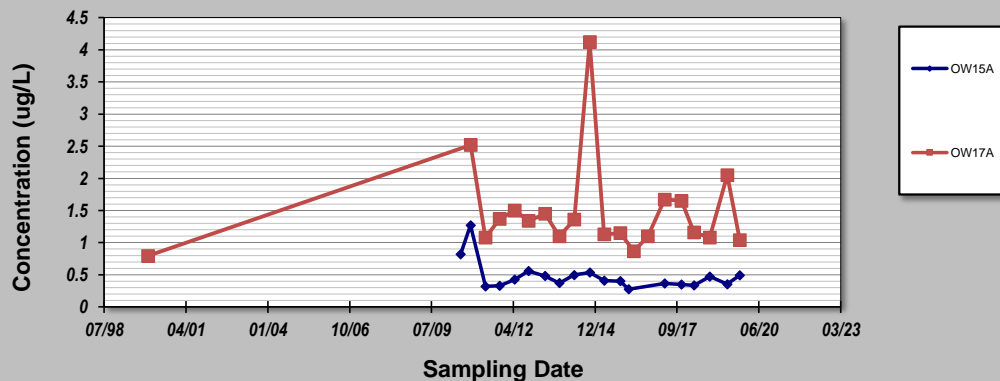
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GSI MANN-KENDALL TOOLKIT for Constituent Trend Analysis

Evaluation Date: **18-May-20**
 Facility Name: **NFSS**
 Conducted By:

Job ID: **2019 ESP TM**
 Constituent: **TOTAL URANIUM**
 Concentration Units: **ug/L**

Sampling Point ID:		OW15A	OW17A					
Sampling Event	Sampling Date	TOTAL URANIUM CONCENTRATION (ug/L)						
1	Jan-00		0.794					
2	Oct-00							
3	May-02							
4	May-03							
5	Jun-10	0.82						
6	Oct-10	1.27	2.52					
7	Apr-11	0.32	1.08					
8	Oct-11	0.33	1.37					
9	Apr-12	0.426	1.5					
10	Oct-12	0.56	1.34					
11	Apr-13	0.481	1.45					
12	Oct-13	0.372	1.1					
13	Apr-14	0.497	1.36					
14	Oct-14	0.535	4.12					
15	Apr-15	0.41	1.13					
16	Oct-15	0.402	1.15					
17	Feb-16	0.274						
18	Apr-16		0.867					
19	Sep-16		1.1					
20	Oct-16							
21	Apr-17	0.367	1.67					
22	Nov-17	0.348	1.65					
23	Apr-18	0.337	1.16					
24	May-18							
25	Oct-18	0.472	1.08					
26	May-19	0.353	2.05					
27	Oct-19	0.493	1.04					
28								
29								
30								
Coefficient of Variation:		0.48	0.50					
Mann-Kendall Statistic (S):		-39	-8					
Confidence Factor:		90.7%	58.9%					
Concentration Trend:		Prob. Decreasing	Stable					



Notes:

- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
- Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
- Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

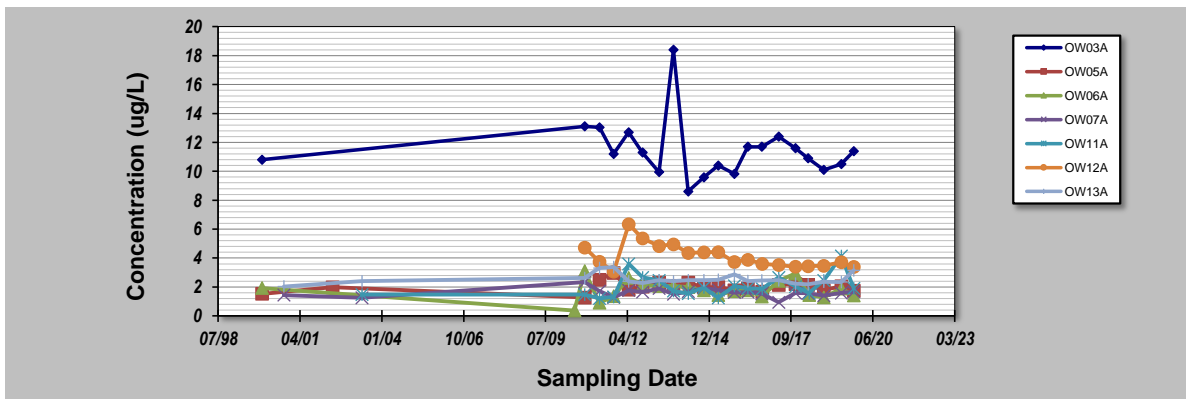
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GSI MANN-KENDALL TOOLKIT for Constituent Trend Analysis

Evaluation Date: **18-May-20**
 Facility Name: **NFSS**
 Conducted By:

Job ID: **2019 ESP TM**
 Constituent: **TOTAL URANIUM**
 Concentration Units: **ug/L**

Sampling Point ID:		OW03A	OW05A	OW06A	OW07A	OW11A	OW12A	OW13A
Sampling Event	Sampling Date	TOTAL URANIUM CONCENTRATION (ug/L)						
1	Jan-00	10.8	1.53	1.93				
2	Oct-00				1.44			2.04
3	May-02		1.98					
4	May-03				1.25	1.47		2.4
5	Jun-10			0.38				
6	Oct-10	13.11	1.27	3.11	2.34	1.47	4.72	2.62
7	Apr-11	13.04	2.5	0.91	1.71	1.21	3.75	3.31
8	Oct-11	11.2	2.98	1.37	1.28	1.32	3.06	3.37
9	Apr-12	12.7	1.82	2.64	1.77	3.6	6.34	2.39
10	Oct-12	11.3	2.03	2.14	1.66	2.67	5.36	2.28
11	Apr-13	9.95	2.3	2.07	1.9	2.45	4.83	2.47
12	Oct-13	18.4	2.08	2.07	1.51	1.73	4.95	2.4
13	Apr-14	8.61	2.31	1.99	1.68	1.55	4.36	2.47
14	Oct-14	9.58	1.96	1.78	1.94	1.96	4.4	2.47
15	Apr-15	10.4	2	1.45	1.79	1.25	4.41	2.5
16	Oct-15	9.82	1.78	1.71	1.62	2.08	3.73	2.87
17	Feb-16							
18	Apr-16	11.7	1.91	1.77	1.66	1.9	3.88	2.41
19	Sep-16	11.7		1.35	1.54			2.45
20	Oct-16		1.68			1.88	3.6	
21	Apr-17	12.4	2.15	2.42	0.936	2.67	3.52	2.47
22	Nov-17	11.6	2.21	2.93	1.58	2.02	3.41	2.24
23	Apr-18	10.9	2.14		1.57		3.44	2.19
24	May-18			1.45		1.58		
25	Oct-18	10.1	1.79	1.28	1.4	2.46	3.46	2.36
26	May-19	10.5	2.06	1.89	1.58	4.14	3.71	2.35
27	Oct-19	11.4	1.74	1.42	1.67	1.9	3.39	3.15
28								
29								
30								
Coefficient of Variation:		0.18	0.18	0.35	0.18	0.37	0.20	0.14
Mann-Kendall Statistic (S):		-27	-12	-26	-24	51	-89	-17
Confidence Factor:		79.8%	62.9%	77.2%	75.4%	94.8%	99.9%	68.4%
Concentration Trend:		Stable	Stable	Stable	Stable	Prob. Increasing	Decreasing	Stable



Notes:

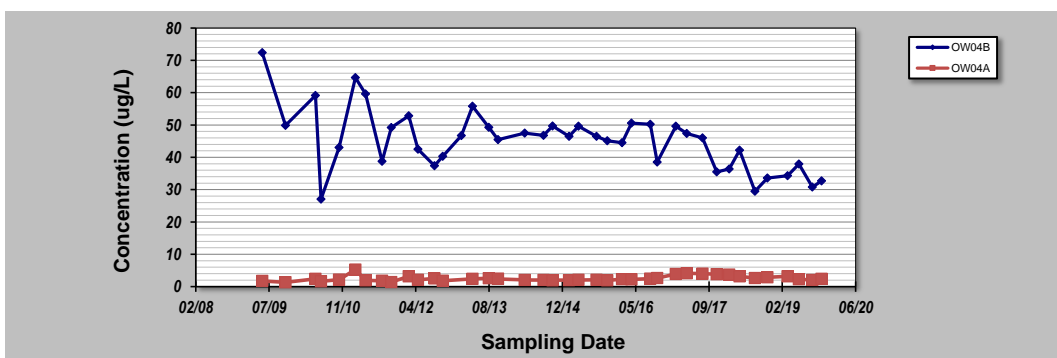
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- Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
- Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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GSI MANN-KENDALL TOOLKIT for Constituent Trend Analysis

Evaluation Date: 18-May-20	Job ID: 2019 ESP TM
Facility Name: NFSS	Constituent: TOTAL URANIUM
Conducted By: [REDACTED]	Concentration Units: ug/L

Sampling Point ID:		OW04B	OW04A				
Sampling Event	Sampling Date	TOTAL URANIUM CONCENTRATION (ug/L)					
1	May-09	72.4	1.76				
2	Oct-09	49.88	1.32				
3	May-10	59.12	2.38				
4	Jun-10	27.05	1.63				
5	Oct-10	43.04	2.17				
6	Feb-11	64.64	5.27				
7	Apr-11	59.58	1.93				
8	Aug-11	38.74	1.79				
9	Oct-11	49.22	1.4				
10	Feb-12	52.85	3.15				
11	Apr-12	42.5	2.11				
12	Aug-12	37.4	2.54				
13	Oct-12	40.3	1.82				
14	Feb-13	46.7					
15	Apr-13	55.8	2.38				
16	Aug-13	49.3	2.6				
17	Oct-13	45.5	2.44				
18	Apr-14	47.5	2.03				
19	Aug-14	46.8	2.05				
20	Oct-14	49.7	1.92				
21	Feb-15	46.5	1.99				
22	Apr-15	49.6	2.1				
23	Aug-15	46.5	2.11				
24	Oct-15	45.1	1.93				
25	Feb-16	44.5	2.26				
26	Apr-16	50.6	2.24				
27	Aug-16	50.2	2.45				
28	Oct-16	38.5	2.61				
29	Feb-17	49.6	3.89				
30	Apr-17	47.4	4.11				
31	Aug-17	46	4				
32	Nov-17	35.5	3.83				
33	Feb-18	36.4	3.68				
34	Apr-18	42.2	3.17				
35	Aug-18	29.5	2.66				
36	Oct-18	33.6	2.9				
37	Mar-19	34.3	3.19				
38	May-19	37.9	2.28				
39	Aug-19	30.8	2.03				
40	Oct-19	32.7	2.4				
Coefficient of Variation:		0.20	0.34				
Mann-Kendall Statistic (S):		-196	254				
Confidence Factor:		99.6%	>99.9%				
Concentration Trend:		Decreasing	Increasing				



Notes:

- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
- Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
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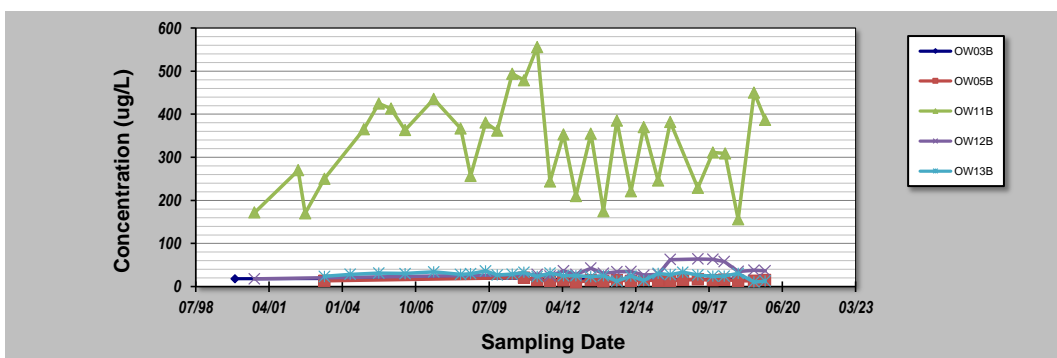
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GSI MANN-KENDALL TOOLKIT for Constituent Trend Analysis

Evaluation Date: 18-May-20	Job ID: 2019 ESP TM
Facility Name: NFSS	Constituent: TOTAL URANIUM
Conducted By: [REDACTED]	Concentration Units: ug/L

Sampling Point ID:		OW03B	OW05B	OW11B	OW12B	OW13B		
Sampling Event	Sampling Date	TOTAL URANIUM CONCENTRATION (ug/L)						
1	Jan-00	18.1						
2	Oct-00			172	17.9			
3	May-02			270				
4	Aug-02			170				
5	May-03		13.4	250		23.5		
6	Apr-04					28.5		
7	Nov-04			365				
8	May-05			424.69		31.4		
9	Nov-05			413.16				
10	May-06			363.13		30.22		
11	Jun-07			435.46		34.2		
12	Jun-08			366.69		28.13		
13	Oct-08			256.8		30.16		
14	May-09			380.51		36.35		
15	Oct-09			362.06		26.95		
16	May-10			493.76		28.75		
17	Oct-10	19.79	20.74	478.8		33.01		
18	Apr-11	16.92	14.74	555.94	28.25	23.41		
19	Oct-11	17.39	13.45	244.04	24.74	31.19		
20	Apr-12	15.6	14.4	353	36.6	25		
21	Oct-12	17	9.79	210	28.4	25.2		
22	Apr-13	17.1	14.9	355	42.8	22.9		
23	Oct-13	8.91	12.1	175	30.8	25.3		
24	Apr-14	17.6	15.1	385	34.3	12.7		
25	Oct-14	18.5	13.2	221	34.8	24.3		
26	Apr-15	19.2	15.5	370	26.5	14.2		
27	Oct-15	17.3	13.7	246	28.1	30.3		
28	Apr-16	16.1	13.2	382	62.8	27.8		
29	Sep-16	16.4				33.3		
30	Oct-16		15.5					
31	Apr-17	17	16.7	229	64.2	27		
32	Nov-17	17	15	311	63.3	24.1		
33	Apr-18	17.1	16.3		58.1	24.3		
34	May-18			309				
35	Oct-18	17.2	13.8	156	35.2	30.6		
36	May-19	15.2	13.6	450	38.2	10.8		
37	Oct-19	16.8	15.5	387	36.5	13		
38								
39								
40								
Coefficient of Variation:		0.13	0.15	0.31	0.37	0.25		
Mann-Kendall Statistic (S):		-38	36	0	65	-117		
Confidence Factor:		88.3%	87.0%	49.4%	99.3%	98.6%		
Concentration Trend:		Stable	No Trend	Stable	Increasing	Decreasing		



Notes:

- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
- Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S=0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
- Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

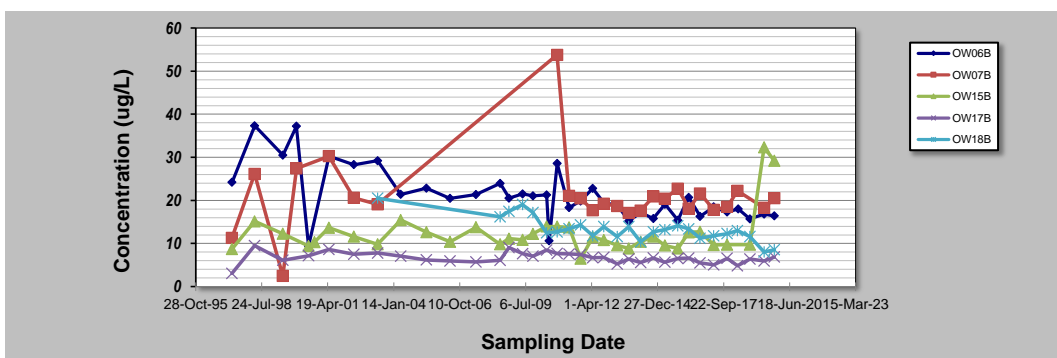
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GSI MANN-KENDALL TOOLKIT for Constituent Trend Analysis

Evaluation Date: 18-May-20	Job ID: 2019 ESP TM
Facility Name: NFSS	Constituent: TOTAL URANIUM
Conducted By: [REDACTED]	Concentration Units: ug/L

Sampling Point ID:		OW06B	OW07B	OW15B	OW17B	OW18B		
Sampling Event	Sampling Date	TOTAL URANIUM CONCENTRATION (ug/L)						
1	Apr-97	24.2	11.3	8.69	3.03			
2	Apr-98	37.3	26.12	15.14	9.52			
3	Jun-99	30.49	2.47	12.26	6.11			
4	Jan-00	37.2	27.44					
5	Jul-00	9.43		9.43	7.17			
6	Oct-00			10.3				
7	May-01	30.28	30.27	13.64	8.62			
8	May-02	28.3	20.6	11.6	7.52			
9	May-03	29.2	19.1	9.82	7.79	20.5		
10	Apr-04	21.39		15.42	7.07			
11	May-05	22.85		12.62	6.21			
12	May-06	20.48		10.42	5.93			
13	Jun-07	21.37		13.77	5.74			
14	Jun-08	23.93		9.83	6.08	16.17		
15	Oct-08	20.53		11.13	9.06	17.45		
16	May-09	21.49		10.83	7.65	19.03		
17	Oct-09	21.04		12.23	7.07	17.19		
18	May-10	21.28		13.98	8.47	12.5		
19	Jun-10	10.64						
20	Oct-10	28.59	53.75	13.93	7.66	12.68		
21	Apr-11	18.31	21.05	13.75	7.57	13.43		
22	Oct-11	19.85	20.45	6.5	7.44	14.3		
23	Apr-12	22.8	17.7	11.5	6.69	11.8		
24	Oct-12	19.4	19.2	10.8	6.8	13.9		
25	Apr-13	18.9	18.7	9.59	5.25	11.6		
26	Oct-13	15.2	17.1	8.84	6.4	13.9		
27	Apr-14	17.2	17.6	10.4	5.57	10.4		
28	Oct-14	15.8	20.9	11.6	6.64	12.7		
29	Apr-15	19.1	20.4	9.55	5.69	13.2		
30	Oct-15	15.4	22.7	8.83	6.53	14.1		
31	Apr-16	20.7	18.1	12.6	6.62	13.4		
32	Sep-16	16.3	21.6	12.7	5.48	11.2		
33	Apr-17	18.5	17.8	9.66	5.04	11.8		
34	Nov-17	17.3	18.5	9.72	6.56	12.3		
35	Apr-18		22.2		4.83	13		
36	May-18	18						
37	Oct-18	15.7		9.74	6.39	11.6		
38	May-19	16.8	18.3	32.3	5.96	8.02		
39	Oct-19	16.4	20.5	29.2	6.87	8.58		
40								
Coefficient of Variation:		0.29	0.41	0.41	0.19	0.22		
Mann-Kendall Statistic (S):		-368	-20	-20	-182	-161		
Confidence Factor:		>99.9%	67.0%	60.6%	99.5%	>99.9%		
Concentration Trend:		Decreasing	Stable	Stable	Decreasing	Decreasing		



Notes:

- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
- Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S=0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
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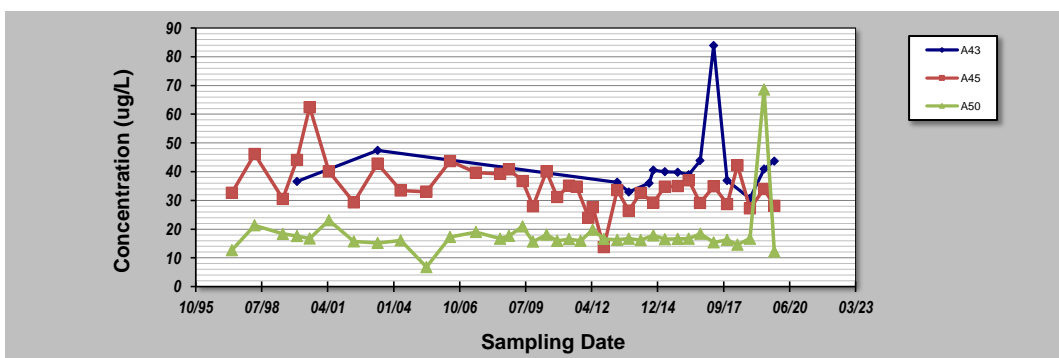
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GSI MANN-KENDALL TOOLKIT for Constituent Trend Analysis

Evaluation Date: 18-May-20	Job ID: 2019 ESP TM
Facility Name: NFSS	Constituent: TOTAL URANIUM
Conducted By: [REDACTED]	Concentration Units: ug/L

Sampling Point ID:		A43	A45	A50			
Sampling Event	Sampling Date	TOTAL URANIUM CONCENTRATION (ug/L)					
1	Apr-97		32.67	12.66			
2	Apr-98		46.16	21.33			
3	Jun-99		30.53	18.36			
4	Jan-00	36.6	44.1	17.6			
5	Jul-00		62.46	16.75			
6	May-01		40.09	23.09			
7	May-02		29.3	15.7			
8	May-03	47.4	42.8	15.2			
9	Apr-04		33.42	16.04			
10	May-05		33.02	6.77			
11	May-06		43.66	17.25			
12	Jun-07		39.62	18.98			
13	Jun-08		39.27	16.67			
14	Oct-08		40.78	17.67			
15	May-09		36.73	20.93			
16	Oct-09		27.99	15.65			
17	May-10		40.14	18.06			
18	Oct-10		31.2	15.94			
19	Apr-11		35.1	16.55			
20	Aug-11		34.81				
21	Oct-11			15.94			
22	Feb-12		23.92				
23	Apr-12		27.6	19.8			
24	Oct-12		13.7	16.6			
25	Apr-13	36.3	33.6	16.3			
26	Oct-13	32.9	26.4	16.7			
27	Apr-14		32.6	16.2			
28	Aug-14	36					
29	Oct-14	40.5	29.2	17.8			
30	Apr-15	40	34.8	16.5			
31	Oct-15	39.8	35	16.6			
32	Apr-16	38.9	37	16.7			
33	Sep-16	43.9	29.1				
34	Oct-16			18.4			
35	Apr-17	83.9	34.9	15.4			
36	Nov-17	36.9	28.7	16.3			
37	Apr-18		42.2	14.6			
38	Oct-18	30.7	27.2	16.7			
39	May-19	40.9	34	68.6			
40	Oct-19	43.7	28.1	12.2			
Coefficient of Variation:		0.30	0.23	0.50			
Mann-Kendall Statistic (S):		17	-202	-50			
Confidence Factor:		78.2%	99.6%	74.6%			
Concentration Trend:		No Trend	Decreasing	Stable			



Notes:

- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
- Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S=0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
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GSI MANN-KENDALL TOOLKIT

for Constituent Trend Analysis

Evaluation Date: **18-May-20**

Facility Name: **NFSS**

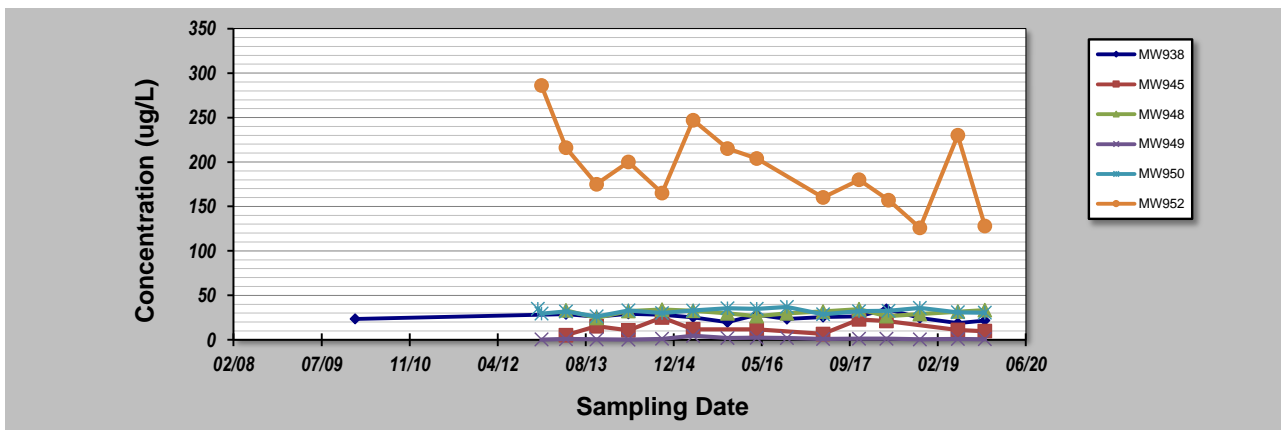
Conducted By:

Job ID: **2019 ESP TM**

Constituent: **TOTAL URANIUM**

Concentration Units: **ug/L**

Sampling Point ID:		MW938	MW945	MW948	MW949	MW950	MW952	
Sampling Event	Sampling Date	TOTAL URANIUM CONCENTRATION (ug/L)						
1	Dec-09							
2	Jan-10	23.42						
3	Nov-12					35		
4	Dec-12				0.363	29.4	286	
5	Feb-13							
6	Apr-13	28.7	5.25	33.1	0.803	31.8	216	
7	Aug-13							
8	Oct-13	25.9	15.3	24.6	0.469	26.3	175	
9	Apr-14	29.2	10.7	32.4	0.289	33.1	200	
10	Oct-14	28.3	25.2	33.9	1.12	30.1	165	
11	Apr-15	25.3	11.9	32.7	4.44	32.9	247	
12	Oct-15	19.7		29.7	2.1	35.4	215	
13	Apr-16	28.1	11.6	26.6	2.25	34.9	204	
14	Sep-16	23.3		29.7	2.04	36.9		
15	Oct-16							
16	Apr-17	25.5	6.55	31.9	1.02	28.7	160	
17	Nov-17	26.3	22.9	34.5	1.27	32.2	180	
18	Apr-18	34.7	21.2	26.6	1.14			
19	May-18					32.6	157	
20	Oct-18	24.4		29.1	0.506	36	126	
21	May-19	18.8	11.2	31.7	1.08	31	230	
22	Oct-19	21.6	9.71	33.4	0.721	30.6	128	
23								
24								
25								
Coefficient of Variation:		0.16	0.48	0.10	0.82	0.09	0.23	
Mann-Kendall Statistic (S):		-27	-1	-1	7	8	-41	
Confidence Factor:		89.9%	50.0%	50.0%	61.5%	62.2%	98.7%	
Concentration Trend:		Stable	Stable	Stable	No Trend	No Trend	Decreasing	



Notes:

- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
- Confidence in Trend = Confidence (in percent) that constituent concentration is increasing ($S > 0$) or decreasing ($S < 0$): $> 95\%$ = Increasing or Decreasing; $\geq 90\%$ = Probably Increasing or Probably Decreasing; $< 90\%$ and $S > 0$ = No Trend; $< 90\%$, $S \leq 0$, and $COV \geq 1$ = No Trend; $< 90\%$ and $COV < 1$ = Stable.
- Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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for Constituent Trend Analysis

Evaluation Date: **18-May-20**

Facility Name: **NFSS**

Conducted By:

Job ID: **2019 ESP TM**

Constituent: **TOTAL URANIUM**

Concentration Units: **ug/L**

Sampling Point ID:

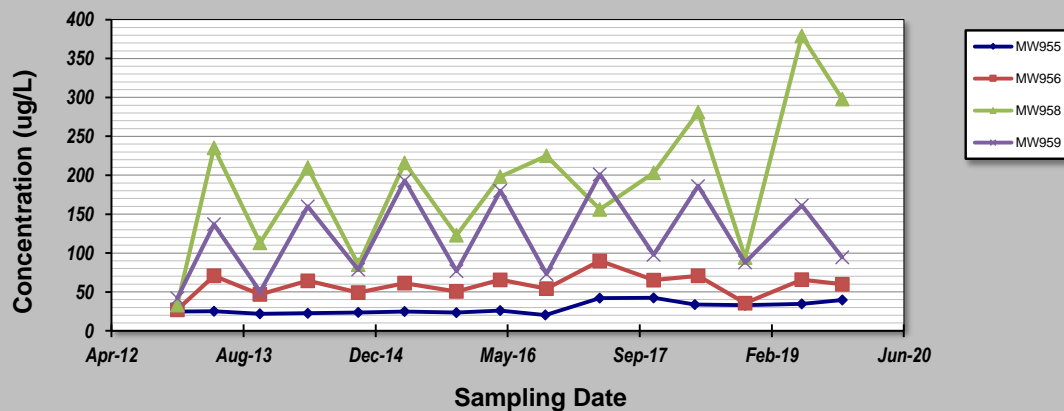
MW955

MW956

MW958

MW959

Sampling Event	Sampling Date	TOTAL URANIUM CONCENTRATION (ug/L)							
1	Dec-09								
2	Jan-10								
3	Nov-12								
4	Dec-12	24.7	27	33.2	41.7				
5	Feb-13								
6	Apr-13	25.2	70.8	235	137				
7	Aug-13								
8	Oct-13	22	46.8	113	50.3				
9	Apr-14	22.5	64.3	210	160				
10	Oct-14	23.7	49.1	84.8	78.6				
11	Apr-15	24.9	61.2	216	193				
12	Oct-15	23.3	50.5	123	76.8				
13	Apr-16	26.1	65.5	198	180				
14	Sep-16	20.3							
15	Oct-16		54.2	225	72.9				
16	Apr-17	42.1	89.8	156	201				
17	Nov-17	42.3	65.2	203	97.6				
18	Apr-18	33.8							
19	May-18		70.6	281	186				
20	Oct-18	32.8	35.5	94	88				
21	May-19	34.7	65.8	379	161				
22	Oct-19	39.6	59.8	298	94.3				
23									
24									
25									
Coefficient of Variation:		0.26	0.26	0.48	0.45				
Mann-Kendall Statistic (S):		49	23	39	25				
Confidence Factor:		99.2%	85.9%	97.1%	88.0%				
Concentration Trend:		Increasing	No Trend	Increasing	No Trend				



Notes:

- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
- Confidence in Trend = Confidence (in percent) that constituent concentration is increasing ($S > 0$) or decreasing ($S < 0$): $> 95\%$ = Increasing or Decreasing; $\geq 90\%$ = Probably Increasing or Probably Decreasing; $< 90\%$ and $S > 0$ = No Trend; $< 90\%$, $S \leq 0$, and $COV \geq 1$ = No Trend; $< 90\%$ and $COV < 1$ = Stable.
- Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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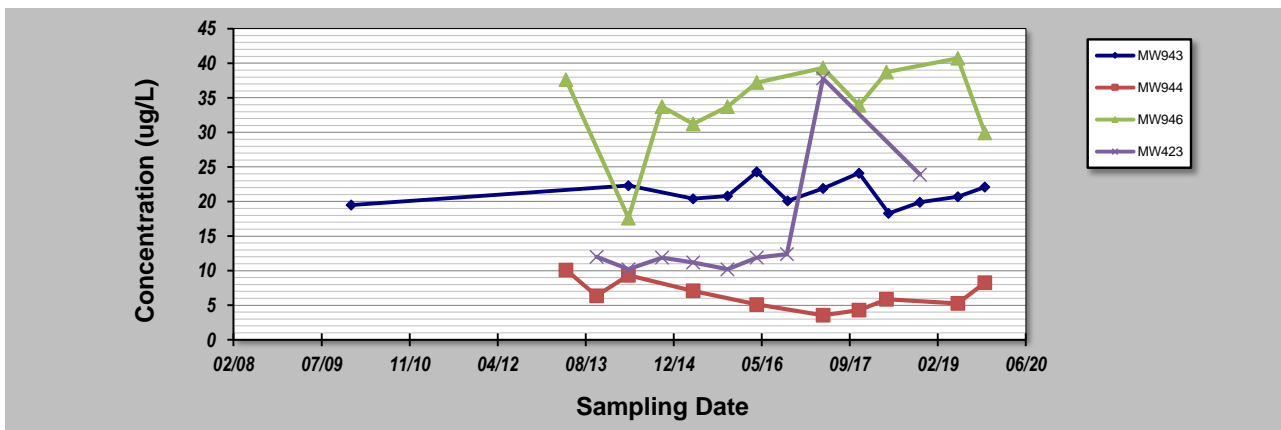
GSI MANN-KENDALL TOOLKIT

for Constituent Trend Analysis

Evaluation Date: **18-May-20**
 Facility Name: **NFSS**
 Conducted By:

Job ID: **2019 ESP TM**
 Constituent: **TOTAL URANIUM**
 Concentration Units: **ug/L**

Sampling Point ID:		MW943	MW944	MW946	MW423			
Sampling Event	Sampling Date	TOTAL URANIUM CONCENTRATION (ug/L)						
1	Dec-09	19.5						
2	Jan-10							
3	Nov-12							
4	Dec-12							
5	Feb-13							
6	Apr-13		10.1	37.6				
7	Aug-13							
8	Oct-13		6.37		12			
9	Apr-14	22.3	9.32	17.6	10.2			
10	Oct-14			33.7	11.9			
11	Apr-15	20.4	7.08	31.2	11.2			
12	Oct-15	20.8		33.7	10.2			
13	Apr-16	24.3	5.1	37.2	11.9			
14	Sep-16				12.4			
15	Oct-16	20.1						
16	Apr-17	21.9	3.56	39.3	37.8			
17	Nov-17	24.1	4.29	33.9				
18	Apr-18		5.87	38.7				
19	May-18	18.3						
20	Oct-18	19.9			23.9			
21	May-19	20.7	5.25	40.7				
22	Oct-19	22.1	8.27	29.9				
23								
24								
25								
Coefficient of Variation:		0.09	0.33	0.19	0.59			
Mann-Kendall Statistic (S):		2	-13	16	16			
Confidence Factor:		52.7%	85.4%	87.5%	94.0%			
Concentration Trend:		No Trend	Stable	No Trend	Prob. Increasing			



Notes:

- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
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Evaluation Date: **18-May-20**

Facility Name: **NFSS**

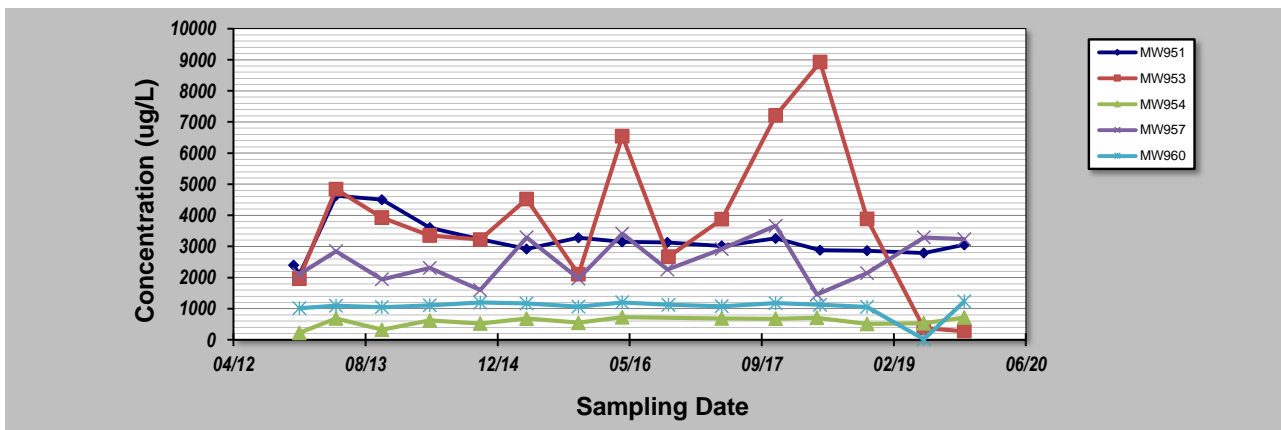
Conducted By:

Job ID: **2019 ESP TM**

Constituent: **TOTAL URANIUM**

Concentration Units: **ug/L**

Sampling Point ID:		MW951	MW953	MW954	MW957	MW960		
Sampling Event	Sampling Date	TOTAL URANIUM CONCENTRATION (ug/L)						
1	Dec-09							
2	Jan-10							
3	Nov-12	2400						
4	Dec-12	2090	1970	218	2100	1010		
5	Feb-13							
6	Apr-13	4631	4843	687	2846	1097		
7	Aug-13							
8	Oct-13	4502	3929	322	1944	1049		
9	Apr-14	3601	3351	620	2310	1109		
10	Oct-14	3231	3221	523	1600	1201		
11	Apr-15	2917	4523	682	3290	1165		
12	Oct-15	3280	2106	548	1967	1063		
13	Apr-16	3145	6547	724	3410	1204		
14	Sep-16	3130			2260			
15	Oct-16		2671			1124		
16	Apr-17	3018	3875	689	2913	1080		
17	Nov-17	3257	7207	680	3666	1177		
18	Apr-18			711	1459			
19	May-18	2879	8927			1126		
20	Oct-18	2861	3884	508	2141	1060		
21	May-19	2791	376	532	3290	16.1		
22	Oct-19	3052	277	720	3234	1232		
23								
24								
25								
Coefficient of Variation:		0.20	0.62	0.27	0.28	0.28		
Mann-Kendall Statistic (S):		-34	-5	27	22	17		
Confidence Factor:		93.0%	57.7%	92.1%	84.8%	78.2%		
Concentration Trend:		Prob. Decreasing	Stable	Prob. Increasing	No Trend	No Trend		



Notes:

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