AECOM
501 Sycamore Street
Suite 222
Waterloo, Iowa 50703
www.aecom.com

319-232-6531 tel
319-232-0271 fax

August 22, 2024

Mr. Mike Smith
Iowa Department of Natural Resources
900 East Grand
Des Moines, Iowa 50319

Subject: Spring 2024 Water Quality Sampling
Winneshiek County Landfill
IDNR #96-SDP-1-74P
AECOM #60711359

Dear Mike,

This letter summarizes the results of groundwater sampling for the Spring 2024 water quality monitoring events at the Winneshiek County Landfill. The Spring 2024 event commenced on June 11, 2024, and was completed on July 03, 2024. AECOM received the last of the laboratory data for the Spring 2024 event on July 24, 2024; and statistical analyses were completed on August 12, 2024.

For the Spring 2024 event, 28 of the 28 groundwater detection monitoring points in the current Hydrologic Monitoring System Plan (HMSP) were successfully sampled. Surface water detection monitoring points SW-1, SW-2, and SW-5 were sampled. Underdrain groundwater detection monitoring point GU-1 was sampled. Underdrain groundwater detection monitoring point GU-2 was not sampled due to no flow. Leachate manholes MH-1AA and MH-4-2 were sampled. Leachate lagoon Bays 1 and 2 were sampled in May 2024.

All groundwater monitoring wells were sampled using bladder pumps, and water quality parameters (pH, specific conductance, temperature, and turbidity) measured using an Aqua TROLL 500 Multiparameter Sonde with flow-thru cell as part of low-flow sampling. Surface water was sampled using a disposable container to grab water samples from the stream. Underdrain monitoring points, leachate lagoon bays, and leachate manholes were sampled using an extensible sampling pole with attached container to grab water samples from the manhole.

All historical and current Appendix I and Appendix II sample results for the shallow (water table), deep (bedrock), surface water, and leachate manholes (C1 – Shallow, C2 – Deep and C3 – Manholes) will be included in the 2024 AWQR Appendix C. Background has been revised to reflect one aquifer across the site and create a pooled data set from upgradient water table and bedrock wells. Section 4 briefly describes the revision. A summary of results with unverified statistically significant increases (SSIs) or above a groundwater protection standard (GWPS) are presented in SAWQR Table 6. A summary of ongoing verified statistically significant increase above background (SSIs) are presented in Table 7. A summary of ongoing and newly identified statistically significant levels above groundwater protection standards (SSLs) are presented in Table 8. Verification of wells with unverified SSIs or parameters greater than GWPSs will be determined by resampling as part of pass 1-of-2 verification resampling as noted in the HMSP. Resampling will occur in August 2024.

1. Semi-Annual Monitoring

1.1 Water Table (Shallow) Wells

Of all the water table monitoring points not in assessment monitoring, six wells had at least one unverified statistically significant increase (SSI) over background for interwell tests. The semi-annual detected results are presented in 2024 AWQR Table 6.

Monitoring wells MW-2R, MW-3, MW-7A, MW-18, MW-22, MW-24A, MW-25A, MW-34A, MW-38A, MW-40A, MW-41A, MW-42A, MW-45A, and MW-101 had no prediction limit exceedances (confirmed SSIs) or results above groundwater protection standards (GWPS).

Water table well MW-33A has an initial PL exceedance for Arsenic. This well also has an unverified detection of Acetone. This well will be resampled in August 2024.

Water table wells MW-4B, MW-43A, and MW-46A had an initial PL exceedance for Silver. These well will be resampled in August 2024.

Water table well MW-39A has an initial PL exceedance for Zinc. This well will be resampled in August 2024.

No new positive double quantification analyses for organic compounds were noted at any of the water table monitoring points not in assessment monitoring.

1.2 Bedrock (Deep) Wells

Of all the bedrock monitoring points not in assessment monitoring, no bedrock wells had any confirmed SSIs over background for interwell tests. The semi-annual detected results are presented in Table 6. Monitoring wells MW-18 and MW-22 had no SSIs or results above a GWPS.

Monitoring well MW-35 has an unverified PL exceedance for Thallium. This well will be resampled in August 2024.

No new positive double quantification analyses for organic compounds were noted at any of the bedrock monitoring points not in assessment monitoring.

1.3 Surface Water

Surface water monitoring points SW-1 (upstream), SW-2 (downstream), and SW-5 (downstream) were sampled. Downstream samples at SW-2 and SW-5 had no confirmed SSIs when compared to SW-1. As compared to groundwater, there were no surface water results for arsenic, cobalt or nickel greater than the GWPS. In addition, SW-2 and SW-5 had no organic detections above the reporting limits in Spring 2024.

1.4 Groundwater Underdrains

Landfill cell groundwater underdrain GU-1 was sampled. Underdrain GU-2 could not be sampled due to insufficient flow. Underdrain GU-1 had mainly inorganic metals detected, Barium and Nickel. None of the detections were above a GWPS. In addition, GU-1 had no organic detections above the reporting limits in Spring 2024. There is no discharge of underdrain groundwater to the surface, Trout River, or the tributary of the Trout River adjacent to the landfill. Since underdrain groundwater is treated as leachate and directed to the leachate lagoon, resampling is not required. Landfill cell groundwater underdrains GU-1 and GU-2 will be sampled again in Fall 2024 if there is sufficient flow.

1.5 Leachate Manholes

Leachate manholes MH-1AA and MH-4-2 for Cell 4 were sampled. Leachate results for MH-1AA and MH-4-2 were mainly metals, Antimony, Arsenic, Barium, Chromium, Cobalt, Copper, Lead, Nickel, and Zinc.

Only, Cobalt was detected at 3.39 µg/L (< site groundwater PL (3.40 µg/L NPL)) in MH-1AA and 7.77 µg/L in MH-4-2 which is greater than the Iowa GWPS of 2.1 µg/L (> site groundwater PL (3.40 µg/L NPL).

There were organic detections in MH-1AA which included 2-Butanone, Acetone, Benzene, Ethylbenzene, Toluene and Xylenes. None of the organic detections exceed a GWPS. All leachate is diverted to the leachate lagoons. There were no organic detections for manhole MH-4-2.

1.6 Leachate Lagoons

Leachate Lagoon Bay 1 and Bay 2 were sampled in May 2024.

Lagoon Bay 1 receives:

- West Toe Drain
- Cell 5 Expansion Area Ground Water

Lagoon Bay 2 receives:

- Cell 4 Leachate
- Central Toe Drain
- Cell 5 Leachate
- Cell 5 Expansion Area Leachate

Leachate Lagoon Bay 1 results were mainly inorganics and metals. Arsenic was detected at 4.73 µg/L which is less than the GWPS of 10 µg/L. Barium was detected at 42.9 µg/L which is less than the GWPS of 2000 µg/L. Chromium was detected at 8.27 µg/L which is less than the GWPS of 100 µg/L. Copper was detected at 6.62 µg/L which is less than the GWPS of 1,300 µg/L. Lead was detected at 0.743 µg/L which is less than the GWPS of 15 µg/L. Nickel was detected at 73.8 µg/L which is less than the GWPS of 100 µg/L. Silver was detected at 1.26 µg/L which is less than the GWPS of 100 µg/L. Zinc was detected at 51.6 µg/L which is less than the GWPS of 2,000 µg/L.

Leachate Lagoon Bay 2 results were mainly inorganics and metals. Arsenic was detected at 4.91 µg/L which is less than the GWPS of 10 µg/L. Barium was detected at 84.7 µg/L which is less than the GWPS of 2000 µg/L. Chromium was detected at 9.77 µg/L which is less than the GWPS of 100 µg/L. Copper was detected at 6.91 µg/L which is less than the GWPS of 1,300 µg/L. Nickel was detected at 70.9 µg/L which is less than the GWPS of 100 µg/L. Zinc was detected at 56.4 µg/L which is less than the GWPS of 2,000 µg/L. There were no VOCs, SVOCs, Pesticides, or PCBs detected in Leachate Lagoon Bay 1 or Bay 2 sample results.

The Leachate Lagoon effluent is evaporated over Bay 2 or recirculated over C5EXP when the weather allows according to the permit. No leachate has been discharged from the site since the lagoons came online in 2016. Leachate lagoon sample results will be included in Appendix D of the 2024 AWQR.

2. Assessment Monitoring

Water table monitoring wells MW-4, MW-29A, MW-31A, MW-33A, MW-43A, MW-44A, and MW-46A and bedrock monitoring wells MW-11 and MW-35 are in assessment monitoring. Table 7 presents the water table and the bedrock assessment wells compared to Iowa statewide standards for a protected groundwater source. A summary of ongoing and newly identified statistically significant levels above groundwater protection standards (SSLs) are presented in Table 8.

Monitoring well MW-4 had an SSI for Barium. This well was last sampled for Appendix II as part of the June 2023 sampling event. This well has been sampled for Appendix II three times since 2015 with no detections of Appendix II specific constituents.

Well MW-29A had SSIs for Cobalt (> 2.1 µg/L GWPS), and Nickel which exceeded PLs. Only the Cobalt UCL is above the IDNR Statewide groundwater protection standards (GWPS) (Table 7). No organics have been detected in sampling over time. Well MW-29A was sampled for Appendix II as part of the Fall 2020, Spring 2021, and March 2022 sampling events. The only detected Appendix II parameter was Sulfide in Spring 2021. Sulfide has been sampled six times since then and all results have been nondetect. Well MW-29A will be sampled for Appendix II again in Spring 2027.

Monitoring well MW-31A had SSIs for Cobalt, and Nickel. Well MW-31A is downgradient of Cells 4 and 5EXP. Only Cobalt UCL is above the IDNR Statewide GWPS (Table 7). Well MW-31A is in assessment monitoring and has been sampled three times for full Appendix II parameters: 2020, 2021 and 2022. The only Appendix II parameters (not in Appendix I) detected was Endosulfan I with 2 detections out of 10 samples (80% ND). Well MW-31A will be sampled for Appendix I in Fall 2024 and Appendix II again in Spring 2027.

Well MW-33A had Arsenic and Cobalt SSIs for Spring 2024. Only Arsenic LCLs are above the IDNR Statewide GWPS (Table 7). Well MW-33A is in assessment monitoring and has been sampled twice for full Appendix II parameters: 2021 and 2022. There were no detected Appendix II only parameters (not in Appendix I). Well MW-33A will be sampled for Appendix I in Fall 2024 and Appendix II again in Fall 2027. In addition, wells MW-4, MW-4B, and MW-33A are located adjacent to a perimeter toe drain which was installed in 1993 on the west, north and east sides of Areas 1, 2 and 3 as a remedy. The toe drains capture groundwater from these areas which is discharged to the leachate lagoons.

Monitoring well MW-43A is downgradient of MW-29A and screened at the same elevation. Cobalt in MW-43A was estimated at 3.49 µg/L as compared to Cobalt of 11.2 µg/L at MW-29A. Cobalt at MW-44A was nondetect and SW-5 was estimated at 0.679 µg/L as compared to Cobalt of 3.49 µg/L at MW-43A. This demonstrates Cobalt is attenuating as groundwater flows downgradient from MW-29A and discharges to the tributary of Trout River.

Monitoring well MW-44A is downgradient of MW-29A and screened at the same elevation. Cadmium in MW-44A was estimated at 0.389 µg/L as compared to cadmium of <0.1 µg/L at MW-29A. Nickel at MW-44A was estimated at 21.6 µg/L as compared to nickel of 63.9 µg/L at MW-29A.

Monitoring well MW-46A had a Nickel SSI with 26.6 µg/L which is greater than the 20.9 µg/L PL. This value is less than the 100 µg/L GWPS. This well will be sampled for Appendix II in Fall 2024.

Monitoring well MW-11 had an SSI for Zinc in 2024. Well MW-11 has been difficult to sample due to being dry or having low groundwater levels from 2013 – 2021. Well MW-11 was sampled for Appendix II in Spring 2023 and 2024. Water table well MW-31A which is nested with MW-11 provides shallow groundwater quality downgradient of Cells 4 and 5EXP. Together MW-31A and MW-11 provide information on vertical extent of Cobalt. Well MW-11 was nondetect for Cobalt in Spring 2023 and 2024. There were no detections of Appendix II only parameters not in Appendix I. Well MW-11 will be sampled for Appendix II again in Spring 2029 if there is sufficient groundwater.

Bedrock well MW-35 had confirmed SSIs for Cobalt (>3.40 µg/L site GWPS). (Table 7). This well is scheduled to be sampled for Appendix I parameters again in Fall 2024 as part of semi-annual monitoring. Well MW-35 was sampled for Appendix II as part of the Fall 2020 and Spring 2021 sampling events. There were no detections of Appendix II only parameters not in Appendix I. Well MW-35 will be sampled for Appendix II again in Spring 2026.

3. Assessment of Corrective Measures

An Assessment of Corrective Measures (ACM) study was initiated in August 2022 due to cobalt concentrations greater than the IDNR GWPS of 2.1 µg/L (SSL). The spring sampling event is a continuation additional data collection. In addition to groundwater, surface water and leachate data collection, selected groundwater monitoring wells were sampled for presence of landfill gas.

Table 8 presents a summary of ongoing and newly identified SSLs in groundwater. Four wells, MW-29A, MW-31A, MW-43A and MW-35 exceed the site GWPS for cobalt which represented by the site groundwater prediction limit (PL) of 3.4 µg/L. One well, MW-33A exceeded the arsenic IDNR GWPS of 10 µg/L. As noted, MW-33A is located adjacent to a perimeter toe drain which was installed in 1993 on the west, north and east sides of Areas 1, 2 and 3 as a remedy. The toe drains capture groundwater from these areas which is discharged to the leachate lagoons.

3.1 Landfill Gas Survey

Monitoring wells MW-1, MW-7A, MW-11, MW-12A, MW-24A, MW-25A, MW-26A, MW-27A, MW-29A, MW-30, MW-31A, MW-35, MW-36, MW-39A, MW-38A, MW-40A, MW-42A, MW-100, and MW-101 were sampled for presence of VOCs, CH_4(%), H_2S (ppm), O_2(%), and CO (ppm) in air. Field sample results are attached to this letter.

In general, there was one well, MW-7A which had detected VOCs. Several monitoring wells detected hydrogen sulfide (H_2S). This indicates reducing conditions occur downgradient of Landfill Cell 4. These reducing conditions may be mobilizing cobalt in soil and bedrock and be the cause of increased cobalt in groundwater. These wells will be resurveyed for landfill gas again in Fall 2024.

4. HMSP

The HMSP (Document No. 110516) will be revised and resubmitted per IDNR comment letter dated 8/9/2024. As part of that update, the site-conceptual model for groundwater flow and a site-specific cobalt GWPS were developed and updated.

4.1 Site-conceptual Model for Groundwater Flow

Conceptual Site Models (CSMs) of a hydrogeologic system provide an overall understanding of groundwater and contaminant flow beneath landfills based on an interpretation of available regional and site hydrogeologic data. CSMs are based on consideration of site area topography, landfill construction, site geology (including geologic units beneath the landfill area and their thickness, extent, and properties), the water table in the uppermost sediments, and groundwater flow in the uppermost bedrock.

The Winneshiek County Landfill consists of five different landfill areas that are regulated by the Iowa DNR (HMSP Figure 2). Common to the different landfill areas are site geology and groundwater flow across the site.

The Winneshiek County Landfill lies within the Paleozoic Plateau region of northeastern Iowa. Deep valleys, numerous rock outcroppings, high bluffs, and an angular step relief characterize the Paleozoic Plateau's terrain where bedrock is the primary control on topography (Horick 1989; Prior 1991).

The landfill is located on a generally eastward sloping upland that is part of an interfluve bordered on the east by an unnamed, northward flowing tributary to the Trout River and on the northwest by an unnamed, northward flowing drainageway that connects and drains to the Trout River. Total relief prior to landfill construction was on the order of 80 feet. The landfill is constructed sloping to the east-northeast from a hillslope summit in the southwestern part of the site near monitoring wells MW-1, MW-1R (abandoned), MW-19R, and MW-37A.In uplands, the thin Quaternary deposits include loess overlying either remnants of Pre-Illinoian-age glacial diamicton ("till") that locally contains isolated lenses of fluvioglacial material or Quaternary-age colluvium. On side slopes, the loess overlies either Quaternary-age colluvium or, where the colluvium is absent, bedrock. In lowlands, the thin Quaternary-age deposits consist of fine-grained alluvium. East of Cell 4 and the landfill road, fine-grained colluvium and alluvium fill overlies Ordovician-age Maquoketa Formation and Galena Formation bedrock.

Beneath the Quaternary-age deposits is a gently dipping Ordovician-age bedrock sequence that consists of the upper and lower Elgin Member of the Maquoketa Formation and the underlying Galena Group Dubuque Formation. The contact between the Maquoketa Formation and the underlying Dubuque Formation is an unconformity (an uneven erosion surface). In parts of the eastern and northeastern portion of the site, the Maquoketa Formation has been eroded away and is absent. In that area, alluvium overlies the Dubuque Formation which forms the base of the Trout River and tributaries.

Different geologic units are present while traversing downslope, west to east, from the uplands located by monitoring wells MW-1, MW-1R, MW-19R, and MW-37A toward the Trout River at the Winneshiek County

Landfill, and the water table crosscuts these units which include Quaternary-age loess, Pre-Illinoian-age glacial deposits, Quaternary-age colluvium, Maquoketa Formation shale, and Dubuque Formation limestone. In the Trout River lowlands east of the landfill, the water table is in the Quaternary-age alluvium or top of weathered Dubuque Formation limestone. Over the site, there is a groundwater divide present in the water table. On the east part of the site or divide, shallow water table flow is downslope to the northeast toward the tributary of the Trout River; along the western and northwestern part of the site adjacent to Area 1 and Area 2, shallow water table flow is to the northwest from MW-37A toward a surface water drainageway and an unnamed tributary of the Trout River near MW-41A. Landfill areas at the Winneshiek County Landfill were constructed above the water table.

The uppermost bedrock beneath the site is a gently dipping Ordovician-age bedrock sequence that consists of the upper and lower Elgin Member of the Maquoketa Formation and the underlying Galena Group Dubuque Formation.

Groundwater flow in the Maquoketa Formation aquitard is primarily downward to the top of the Galena and then horizontal groundwater flow in the Galena Group aquifer. Groundwater flow in the Galena Group is expected to be primarily east toward the Trout River, a regional groundwater discharge point.

At Winneshiek, water table groundwater and bedrock groundwater act as one groundwater bearing unit from the southwest part of the site which transitions and combines into one water table groundwater aquifer on the east side of the site. This groundwater discharges to the Trout River and its tributaries.

Groundwater levels in both sediments and bedrock support one groundwater bearing unit. Nested monitoring wells MW-3/MW-18, MW-35/MW-39A confirm the groundwater downgradient of MW-1/MW19R combine.

Monitoring Well	Groundwater Elevation (ft MSL)
MW-3	1141.75
MW-18	1142.08
MW-39A	1123.04
MW-35	1123.01

The existence of groundwater springs on the east side of the site adjacent to the pond supports groundwater flows vertically downward to the top of an impermeable layer and then flows along bedding planes discharging to Trout River.

Based on these considerations, a single set of prediction limits for both shallow and bedrock locations were developed.

4.2 Site-specific GWPS for Cobalt

This purpose of this section is to present the results of estimating a site-specific groundwater protection standard for cobalt. Background data for cobalt is based on upgradient interwell shallow groundwater monitoring wells. Wells included are: MW-1, MW-1R, MW-19R, and MW-37A. Except for MW-19R, sample dates span from May 2014, when low-flow sampling began, through June 2024.

Sampling from these non-impacted monitoring points has indicated the measured background concentrations of total cobalt are occasionally above the GWPS in wells screened in the groundwater monitoring zone. Previously described site conceptual groundwater flow is recharge from precipitation moves vertically downward into glacial aged sediments consisting of loess, glacial tills, colluvium, and recharges bedrock composed of Maquoketa shale and claystone and Galena Group limestone. The Maquoketa bedrock has been eroded as part of the last glaciation from west to east across the site as part of development of the Trout River to where the top of bedrock on the east side consists of Galena Group limestone. The Galena Group limestone is a uniform microcrystalline limestone with few fractures. Hence groundwater flows along the Maquoketa Group claystone and shale contact with Galena discharging as springs to tributary of Trout River. As such, groundwater chemistry is a mix of upgradient water table and bedrock groundwater flowing and mixing to east which then discharging to the Trout River.

Given the above, development of a site-specific background GWPS for cobalt is suitable. The paragraphs below provide a detailed discussion and justification for a background GWPS for cobalt.

For Winneshiek, monitoring wells are sampled for Appendix I which includes 15 total metals including Cobalt, indicator parameters field pH, field specific conductance, Total Suspended Solids (TSS) and field turbidity. Only background statistics were estimated for cobalt.

The process for estimating GWPS for annual sample results comparisons includes analysis for trends, outliers, goodness-of-fit (GOF), and prediction limits (PL). Currently, background for the facility includes data from May 2014 through Spring 2024.

First, detection monitoring data for each monitoring well used in site-specific GWPS were tallied for sample size (n), count of nondetects and percentage of nondetects per well for cobalt. For wells with 90-100% nondetect per parameter, no outliers, trends or goodness of fit.

Next, detection monitoring data, both raw and log transformed, for each monitoring well used in site-specific GWPS were analyzed for outliers using Rosner's or Dixon's methods depending on sample size. If there are significant outliers in the detection monitoring data which may be attributed to errors in field sampling, lab methods, changes in lab detection limits, or lab data recording, identified errors, which can be resolved, would be corrected and outliers removed. If not, the outlier, would remain in the data set.

Next, if there were no significant outliers, the monitoring well detection monitoring data was analyzed for trends using the Helsel (2012) NADA Akritas-Theil-Sen slope and Kendall's tau methods. If there were no significant trends within the past 10 years of detection monitoring data, the background data set was pooled to estimate the site-specific cobalt GWPS.

Next, if there were no significant outliers, the pooled background chemistry data would be analyzed for statistical distribution using goodness-of-fit tests. Data will be tested for normal, lognormal and gamma distributions. If the data did not follow one of those distributions, nonparametric methods were used to estimate the nonparametric prediction limits.

Based on goodness-of-fit (distribution), nonparametric prediction limits were estimated. The site-wide prediction limit for cobalt in groundwater is estimated to be 3.40 µg/L and is being used in lieu of IDNR GWPS of 2.1 µg/L for all groundwater comparisons. Documentation will be provided as part of revisions to draft HMSP.

If you have questions or need further information, please contact me at (319) 232-6531 or Russ Henning at (920) 819-1902.

Yours sincerely,

Christopher G. Oelkers, PE
Enclosures: Results Summary Tables

cc: T. J. Schissel, Winneshiek Co. LF
Craig Chumbley, AECOM
Russ Henning, P.G., AECOM
Nate Kilburg, AECOM

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Table 6
Summary of Well/Detected Constituent Pairs with No Immediately Previous SSIs
2024 Semi-Annual Water Quality Report
Winneshiek County Landfill
Permit No. 7-SDP-1-75P

Well	Constituent	Units	GPS	Spring 2023	Summer 2023 Resample	Fall 2023	January Resample	Spring 2024 Event	Background Sitewide Standard
Shallow Wells									
MW-2R	Barium	µg/L	2000	96.7	--	118	--	91	292 LnPL
MW-4	Cobalt	µg/L	3.40	<0.17	--	1.54	--	1.85	3.4 NPL
MW-4	Nickel	µg/L	100	<1.9	--	5.36	--	6.27	20.9 NPL
MW-4	Silver	µg/L	100	<0.5	--	<0.5	--	1.21	1.24 NPL
MW-4B	Barium	µg/L	2000	183	--	267	413*	184	292 LnPL
MW-4B	Silver	µg/L	100	<0.5	--	<0.5	--	5.37*	1.24 NPL
MW-7A	Barium	µg/L	2000	323	366	451	--	190	292 LnPL
MW-24A	Barium	µg/L	2000	132	--	--	--	152	292 LnPL
MW-24A	Nickel	µg/L	100	7.85	--	--	--	8.53	20.9 NPL
MW-25A	Barium	µg/L	2000	189	--	219	--	178	292 LnPL
MW-29A	Arsenic	µg/L	10	4.37	--	6.49	--	4.54	4.57 NPL
MW-29A	Barium	µg/L	2000	187	--	163	--	151	292 LnPL
MW-29A	Silver	µg/L	100	<0.5	--	<0.5	--	1.1	1.24 NPL
MW-31A	Barium	µg/L	2000	220	--	247	--	243	292 LnPL
MW-33A	Acetone	µg/L	6300	<3.1	--	--	--	37.7*	10 RL
MW-33A	Arsenic	µg/L	10	1.16 J	--	--	--	24.3*	4.57 NPL
MW-33A	Barium	µg/L	2000	108	--	--	--	255	292 LnPL
MW-33A	Cobalt	µg/L	3.40	0.396 J	--	--	--	4.51*	3.4 NPL
MW-33A	Lead	µg/L	15	<0.24	--	--	--	0.692	3.25 NPL
MW-34A	Barium	µg/L	2000	65.5	--	69.3	--	70.1	292 LnPL
MW-38A	Barium	µg/L	2000	133	--	141	--	153	292 LnPL
MW-39A	Barium	µg/L	2000	138	--	145	--	152	292 LnPL
MW-39A	Zinc	µg/L	2000	<6.4	--	<6.4	--	68.3*	18.6 NPL
MW-40A	Barium	µg/L	2000	216	--	228	--	210	292 LnPL
MW-40A	Cobalt	µg/L	3.40	1.51	--	1.86	--	1.69	3.4 NPL
MW-40A	Nickel	µg/L	100	19	--	17.4	--	11.1	20.9 NPL
MW-41A	Barium	µg/L	2000	145	141	169	--	125	292 LnPL
MW-42A	Barium	µg/L	2000	83.4	125	101	--	128	292 LnPL
MW-42A	Cobalt	µg/L	3.40	0.518	2.46	2.56	--	2.56	3.4 NPL
MW-42A	Nickel	µg/L	100	8.62	19.3	14.8	--	16.6	20.9 NPL
MW-43A	Barium	µg/L	2000	180	250	274	--	163	292 LnPL
MW-43A	Silver	µg/L	100	<0.5	<0.5	<0.5	--	9.36*	1.24 NPL
MW-44A	Barium	µg/L	2000	157	239	253	--	137	292 LnPL
MW-44A	Silver	µg/L	100	<0.5	<0.5	<0.5	--	1.01	1.24 NPL
MW-45A	Barium	µg/L	2000	218	--	137	--	103	292 LnPL
MW-46A	Barium	µg/L	2000	262	--	275	--	213	292 LnPL
MW-46A	Silver	µg/L	100	<0.5	--	<0.5	--	9.06*	1.24 NPL
MW-101	Barium	µg/L	2000	175	--	--	--	177	292 LnPL
MW-101	Cobalt	µg/L	3.40	0.232 J	--	--	--	1.36	3.4 NPL
MW-101	Nickel	µg/L	100	9.62	--	--	--	6.92	20.9 NPL
Deep Wells									
MW-11	Barium	µg/L	2000	15.4	--	--	--	14.3	292 LnPL
MW-11	Nickel	µg/L	100	21.6	--	--	--	16.3	20.9 NPL
MW-18	Barium	µg/L	2000	--	--	--	--	60.5	292 LnPL
MW-22	Barium	µg/L	2000	148	--	159	--	137	292 LnPL
MW-22	Nickel	µg/L	100	4.45 J	--	9.26	--	6.65	20.9 NPL
MW-35	Barium	µg/L	2000	264	--	467	--	280	292 LnPL
MW-35	Nickel	µg/L	100	18.7	--	32.7*	--	17.6	20.9 NPL
MW-35	Thallium	µg/L	2	0.337 J	--	0.371 J	--	1.14*	0.26 NPL

Table 6
Summary of Well/Detected Constituent Pairs with No Immediately Previous SSIs
2024 Semi-Annual Water Quality Report
Winneshiek County Landfill
Permit No. 7-SDP-1-75P

Well	Constituent	Units	GPS	Spring 2023	Summer 2023 Resample	Fall 2023	January Resample	Spring 2024 Event	Background Sitewide Standard
Surface Water							--		
SW-2	Barium	µg/L	2000	101	--	94.1	--	104	201 NPL
SW-2	Lead	µg/L	15	0.867	--	<0.24	--	0.583	7.08 NPL
SW-5	Barium	µg/L	2000	91.4	--	90	87.1	70.1	201 NPL
SW-5	Cobalt	µg/L	4.36	0.287 J	--	0.181 J	<0.17	0.679	4.36 NPL
SW-5	Lead	µg/L	15	0.388 J	--	<0.24	<0.24	0.689	7.08 NPL

Notes:

* Current result is above background, if confirmed by next sample an SSI will be identified
NPL = Nonparametric prediction limit
LnPL = Lognormal Prediction Limit
NS = No standard; insufficient background data to estimate PL/NPL
PL = Normal Parametric prediction limit
RL = Reporting limit
-- = not sampled

60711359/400/405/2024 SAWQR/Table 6.xlsx

Table 7
Summary of Ongoing and Newly Identified SSIs
2024 Annual Water Quality Report
Winneshiek County Landfill
Permit No. 96-SDP-1-74P

Well	Parameter	Units	Spring 2024 Event	Total Number Sample Events (n)	Percent Nondetects	LCL	IDNR Statewide Standard	Exceeds Standard ?	Background Sitewide Prediction Limit	Sample Dates		
										Initial Exceedance	Resample(s)	5th background sample
Shallow (Water Table)												
MW-4	Barium	µg/L	**485**	21	0.0	355.00	2000	No	292 LnPL	5/2/2014	11/4/2014; 5/6/2015; 9/18/2015	3/31/2016
MW-29A	Cobalt	µg/L	**11.2**	12	0.0	8.87	3.40	YES	3.4 NPL	11/20/2019	2/26/2020; 6/30/2020; 8/26/2020	11/20/2020
	Nickel	µg/L	**63.9**	12	0.0	55.3	100	No	20.9 NPL	2/6/2020	6/30/2020; 8/26/2020; 11/3/2020	5/24/2021
MW-31A	Cobalt	µg/L	**3.48**	12	0.0	2.22	3.40	No	3.4 NPL	11/5/2019	2/7/2020; 6/18/2020; 8/26/2020	11/18/2020
	Nickel	µg/L	**30.3**	12	0.0	31.1	100	No	20.9 NPL	11/5/2019	2/7/2020; 6/18/2020; 8/26/2020	11/18/2020
MW-33A	Arsenic	µg/L	**24.3**	12	8.3	11.0	10	YES	4.57 NPL	11/18/2019	2/12/2020; 6/30/2020; 8/25/2020	11/3/2020
	Cobalt	µg/L	**4.51**	12	16.7	1.0	3.40	No	3.4 NPL	11/18/2019	2/12/2020; 6/30/2020; 8/25/2020	11/3/2020
MW-43A	Arsenic	µg/L	**6.28**	6	0.0	7.1	10.00	No	4.57 NPL	9/1/2022	12/6/2022; 6/7/2023; 8/28/2023	11/2/2023
	Cobalt	µg/L	**3.49**	6	0.0	3.5	3.40	YES	3.4 NPL	9/1/2022	12/6/2022; 6/7/2023; 8/28/2023	11/2/2023
	Nickel	µg/L	**17.3**	6	0.0	22.2	100.00	No	20.9 NPL	9/1/2022	12/6/2022; 6/7/2023; 8/28/2023	11/2/2023
MW-44A	Cadmium	µg/L	**0.389**	6	16.7	0.091	5	No	0.209 NPL	8/31/2022	16/6/2022; 6/7/2023; 8/28/2023	11/2/2023
	Nickel	µg/L	**21.6**	6	0.0	25.084	100	No	20.9 NPL	8/31/2022	16/6/2022; 6/7/2023; 8/28/2023	11/2/2023
MW-46A	Nickel	µg/L	**26.6**	3	0.0	NA	100	No	20.9 NPL	11/13/2023	1/23/2024; 6/11/2024	--
Deep (Bedrock)												
MW-11	Zinc	µg/L	**60**	7	0	77.573	2000	No	18.6 NPL	10/31/2018	12/17/2018; 6/3/2021; 8/3/2021	9/7/2022
MW-35	Cobalt	µg/L	**4.96**	12	0	5.274	3.40	YES	3.4 NPL	11/15/2019	2/12/2020; 7/6/2020; 8/25/2020	11/5/2020

Notes:
NS = No statewide standard exists.
NPL = Nonparametric prediction limit; PL = parametric prediction limits
NA = Not applicable or not established.
Interwell NPL for organics equals reporting limits for the measurements shown
False positive rate for all comparisons to statewide standards is 1.0%.
Only 2024 data is presented here; refer to appendices for complete historical data used in the statistical tests.
60711359/400/405/2024 SAWQR/Table 7.xlsx

Table 8
Summary of Ongoing and Newly Identified SSLs
2024 Annual Water Quality Report
Winneshiek County Landfill
Permit No. 96-SDP-1-74P

Well	Parameter	Units	Spring Event	Total Number Sample Events (n)	Percent Nondetects	UCL	IDNR Statewide Standard	Exceeds Standard?	Background Sitewide Prediction Limit	Sample Dates Initial Exceedance	UCL < GWPS 1st Year	UCL < GWPS 2nd Year	UCL < GWPS 3rd Year
Shallow (Water Table)													
MW-29A	Cobalt	µg/L	**11.2**	12	0.0	12.59	3.40	YES	3.4 NPL	11/20/2019	--	--	--
MW-31A	Cobalt	µg/L	**3.48**	12	0.0	15.5	3.40	YES	3.4 NPL	11/5/2019	--	--	--
MW-33A	Arsenic	µg/L	**24.3**	12	8.3	32.5	10	YES	4.57 NPL	11/18/2019	--	--	--
MW-43A	Cobalt	µg/L	**3.49**	6	0.0	4.7	3.40	YES	3.4 NPL	9/1/2022	--	--	--
Deep (Bedrock)													
MW-35	Cobalt	µg/L	**4.96**	12	0	7.73	3.40	YES	3.4 NPL	11/15/2019	--	--	--

Notes:
NS = No statewide standard exists.
NPL = Nonparametric prediction limit; PL = parametric prediction limits
NA = Not applicable or not established.
Interwell NPL for organics equals reporting limits for the measurements shown
False positive rate for all comparisons to statewide standards is 1.0%.
Only 2024 data is presented here; refer to appendices for complete historical data used in the statistical tests.
60711359/400/405/2024 SAWQR/Table 8.xlsx

Table 11
Summary of Landfill Gas Readings in Groundwater Monitoring Wells
2024 Annual Water Quality Report
Winneshiek County Landfill
Permit No. 96-SDP-1-74P

Monitoring Well	CH4(%)	O2(%)	CO (ppm)	H2S (ppm)	VOC (ppm)
MW-1	0	19.8	0	0	0
MW-7A	0	19.8	0	0	1.9
MW-11	0	19.8	0	0	0
MW-12A	0	19.6	0	0	0
MW-25A	0	15.3	0	0	0
MW-26A	0	19.2	0	0	0
MW-27A	0	13.6	0	0.5	0
MW-29A	0	19.3	0	0	0
MW-30	0	19.7	0	0	0
MW-31A	0	10.2	0	0	0
MW-35	0	19.2	0	0.5	0
MW-36	0	19.6	0	0.5	0
MW-38A	0	19.1	0	0.5	0
MW-39A	0	19.5	1	0.5	0
MW-40A	0	19.5	0	0.5	0
MW-42A	0	19.5	0	0.5	0
MW-43A	0	19.7	0	0	0
MW-44A	0	19.7	0	0	0
MW-100	0	19.8	0	0	0
MW-101	0	19.7	0	0	0