Attachment E

Groundwater Monitoring

TABLE OF CONTENTS – ATTACHMENT E

TABLE OF CONTENTS – ATTACHMENT E

List of Tables

E. GROUNDWATER MONITORING PROCEDURES

The geology and hydrogeology in the vicinity of the Greenbelt II Landfill has been investigated in detail over the past 35 years by D'Appolonia Associates, Canonie Engineers, Baker Engineering, ATEC Associates and most recently Weaver Consultants Group. A comprehensive report entitled "Hydrogeologic Assessment, Greenbelt II Landfill," (Hydrogeologic Assessment) was prepared in February, 1993 to provide the data necessary to implement a groundwater monitoring program at the Greenbelt II Landfill. The Hydrogeologic Assessment summarizes work completed prior to February 1993, published geologic information specific to Porter County, Indiana, and the results of a field study and site assessment performed in 1992. As additional Greenbelt II Landfill cells have been developed (i.e., Cells A, B, and C), several supplemental hydrogeologic reports have been prepared since completion of the Hydrogeologic Assessment in February 1993. These investigations have added to the database of hydrogeologic information available for the Greenbelt II Landfill. The following supplemental hydrogeologic reports have been prepared since 1992:

- "Addendum to Hydrogeologic Assessment - Greenbelt II Landfill Cell A," dated October 1993;
- "November 1997 Hydrogeologic Investigation", dated February 27, 1998; and
- "Supplemental Hydrogeologic Investigation (June 1999)", dated August 26, 1999.

The 1998 and 1999 hydrogeologic reports were prepared in support of new monitoring well installation activities and submitted to IDEM in accordance with the applicable permit conditions. Both of these reports have been previously reviewed and approved by IDEM.

The historic hydrogeologic reports are included in this Permit in electronic Adobe Acrobat (.pdf) format only (see **Appendices E-1, E-2, E-3**, and **E-4**).

E-1 Exemption from Groundwater Protection Requirements

A waiver from the Subpart F groundwater monitoring requirements is not being requested. Therefore, this section does not apply.

E-2 Interim Status Groundwater Monitoring Data

The Greenbelt II Landfill was added to the permit for the Greenbelt I Landfill in the mid 1990s. Therefore, no groundwater monitoring was performed under interim status at the Greenbelt II

Landfill. Because interim status monitoring was not performed at the Greenbelt II Landfill, this section is not applicable.

E-3 General Hydrogeologic Information

A detailed discussion of the hydrogeologic properties of the uppermost aquifer and any hydraulically interconnected underlying aquifers is presented in the various hydrogeologic investigation reports prepared for the facility (see **Appendices E-1, E-2, E-3,** and **E-4**). These reports discuss:

- Regional Geology;
- Site Geology;
- Regional Hydrogeology; and
- Site Hydrogeology.

The summary discussion of the hydrogeological characteristics of the uppermost aquifer presented below is based upon information contained in the above referenced reports.

Hydrostratigraphically, the uppermost aquifer at the site extends from the ground surface to approximately 520 NGVD or 80 feet below ground surface. The aquifer is the combined hydrostratigraphic Units 1 and 3 as discussed by Rosenshein (1968) and stratigraphically the Atherton Formation. The majority of the Unit 1 at this site is either absent from sand mining or mainly positioned above the water table because of the proximity to the regional discharge, Lake Michigan. The vertical extent of Unit 1 is difficult to discern because of the disturbances caused by the sand mining, but appears to extend approximately 15 to 20 feet into the subsurface. The hydraulic conductivity of the aquifer ranges from 1.2×10^{-2} cm/s at its upper reaches to 5.8×10^{-3} cm/s in the lower portions of the unit. The closeness of these hydraulic conductivity values is within the error range of the Hvorslev method and within the professionally accepted practice of reporting single well conductivity testing as only orders of magnitude (i.e. 10^{-2}, 10^{-3} etc.).

Beneath the aquifer is an alternating sequence of lacustrine, clays, silty clays, clay loams and loamy sands called the Lagro Till Formation. The lithostratigraphy of this unit is markedly different than the overlying aquifer. Samples of Lagro Till encountered during the most recent hydrogeologic investigation performed in June 1999 were, according to the USDA classification system, composed primarily of gray clay, with interbedded layers of fine sand and loamy sand. The approximate top of the till ranged from 526 to 531 NGVD (75 to 85 ft. below ground

surface). The upper contact of the till was fairly sharp, and nearly always overlain by a fine to loamy fine sand. Laboratory permeability testing performed on samples from the Lagro Till were found to range from 1.01 x 10^{-8} cm/sec to 1.04 x 10^{-7} cm/sec, indicating that for hydrostratigraphic purposes, the Lagro Till can be classified as an aquitard to the overlying Atherton Formation.

E-4 Topographic Map Requirements

A topographic map of the area surrounding the Greenbelt II Landfill is presented as **Appendix E-5**. This topographic map contains the following information:

- Point of Compliance;
- Groundwater monitoring wells; and
- Hazardous waste management area.

The property boundary around the Midwest Plant is shown on **Figure A-1A** in Attachment A of the Permit. The groundwater flow direction and rate for the A and B zones of the uppermost aquifer is presented on groundwater contour maps included in **Appendices E-1, E-2, E-3,** and **E-4**. The most recent information is included in the "Supplemental Hydrogeologic Investigation (June 1999)" (see **Appendix E-4**). Potentiometric contour lines are also presented on geologic cross sections contained in this report.

E-5 Contaminant Plume Description

None of the indicator parameters have been confirmed as present in the groundwater and attributable to the Greenbelt II Landfill. Accordingly, there is no plume of contamination and this Section is not applicable.

E-6 General Monitoring Program Requirements

The permittee will implement a groundwater detection monitoring program in accordance with the procedures described in this section of the Permit. The permittee's detection monitoring system includes monitoring wells and piezometers installed in the uppermost aquifer beneath the facility. Based on several hydrogeologic investigations undertaken by the permittee, the detection monitoring well network enables detection and measurement of a potential release of hazardous constituents at the point of compliance for the Greenbelt II Landfill (see **Appendix E-5**). The Greenbelt II Landfill detection monitoring program consists of the monitoring wells and piezometers shown on **Table E-2**.

E-6a *Description of Wells*

To monitor the groundwater beneath the facility, two types of wells, of similar construction, are used:

- Detection monitoring wells - located at the point of compliance around the facility; and
- Piezometers - located either outside or inside the point of compliance and used to assist in evaluating groundwater flow directions.

Table E-2 depicts the designations for each of the monitoring wells and piezometers, as well as, their positions vertically (i.e., A, B, C, D, and I zones) and laterally (upgradient vs. downgradient). The rationale for the placement of the wells is based on the subsurface geologic information discussed in the Hydrogeologic Assessments previously referenced. The locations of the existing wells are shown on the Topographic Map included as **Appendix E-5**. Well coordinates are listed in Table 1 at **Appendix E-6** (i.e., the Groundwater Sampling and Analysis Plan).

The existing wells incorporated in the detection and piezometer networks were installed in accordance with standard procedures previously reviewed and approved by IDEM as specified in previous permits.

E-6a(1) Compliance Point

The compliance point encompassing the Greenbelt II Landfill is depicted on the Topographic Map included as **Appendix E-5**. Detection wells at the point of compliance will not exceed 50 feet from the waste limit without IDEM consent.

E-6a(2) Unaffected Background Measurement

Analytical data used for purposes of calculating background concentrations will be from monitoring wells unaffected by the Greenbelt II Landfill. As described below in Section E-6c, an intrawell statistical method will be utilized. Background data collected from 1994 until March 2023 will be used for purposes of calculating the initial background concentrations. Most of this data was used to calculate background concentrations in accordance with the facility's previous hazardous waste management permits. Consistent with the approach implemented under the permits issued by IDEM in March 2003, October 2008, December 2013, and April 2019, a nonparametric intrawell prediction limit statistical approach is being proposed herein. Groundwater monitoring data obtained during the life of the current permit and prior permits has

demonstrated that the facility has not impacted groundwater. Therefore, this data continues to be suitable for use as background data.

E-6b *Description of Sampling/Analysis Procedures*

The sampling and analysis procedures for the detection groundwater monitoring program are presented in a Groundwater Sampling and Analysis Plan (SAP). The SAP is presented in **Appendix E-6**. A laboratory Quality Assurance Manual from the currently contracted analytical laboratory for the groundwater sampling and analysis program is provided in the SAP as Appendix A.

E-6c *Procedures for Establishing Background Quality*

E-6c(1) Data Currently Available

Background concentrations for the indicator parameters are summarized in **Table E-3** and the analytical results are contained in **Appendix E-7**. The initial set of background data consists of semi-annual and Appendix IX samplings from the period March 1994 to March 2023. Background data will be updated in accordance with the procedures outlined in Section E-6d(8).

E-6c(2) Background Groundwater Quality Data

Groundwater samples in the background data set consist of temporally and spatially independent concentrations and are expressed in appropriate units to be used in the statistical test to evaluate whether or not a release of contamination to the groundwater has occurred. Data will be reported with a minimum of one significant digit (for example, 0.01 mg/L).

E-6c(3) Background Sampling Frequency

The initial background data set sampling frequency consists primarily of semi-annual data collected under the prior detection monitoring program. Intrawell statistical analysis is being proposed herein. Therefore, data will be compared to background data previously collected from the same well. The initial background data set for most parameters will be comprised of data collected during the period from March 1994 to March 2023. Certain historical data for cadmium and vanadium reported with an estimated quantitation limit (EQL) higher than the current EQLs is not included as background and has been removed from **Appendix E-7** (shown as ~~strikethrough~~).

IDEM has previously accepted the majority of the above data for use as background under the prior hazardous waste management permit issued in April 2019. This data is suitable for use as background data since the Greenbelt II Landfill has not adversely impacted downgradient groundwater in accordance with the groundwater water monitoring procedures specified in the facility's hazardous waste management permit issued by IDEM in April 2019. The background data set will be periodically updated in accordance with the procedures outlined in Section E-6d(8).

E-6d *Statistical Procedures*

Consistent with the statistical procedures implemented under the permit issued by IDEM in April 2019, an intrawell statistical evaluation procedure is being proposed herein. Intrawell statistical analysis is particularly useful because it removes the spatial variation that may be present with upgradient–downgradient comparisons.

A parametric statistical approach can only be applied to background data where a sufficient percentage of the data has been quantified above the EQL. Most of the background data for the indicator parameters contain a high percentage of nondetected data. If a high percentage of nondetected data is present, an intrawell nonparametric prediction limit will be employed.

Historically, the indicator parameters have been reported with a limit equal to the EQL. The EQL shall be the concentration provided in **Table E-1**. No data will be reported at a concentration below the EQL, since this concentration will only be an estimated value.

Spatial variability has been a concern for certain indicator parameters in the past, due primarily to varying subsurface soil units. However, use of intrawell statistical methodology eliminates the concern over spatial variability. Existing background data at most wells has been collected over a period of many seasons, therefore seasonal variation (if present) will be included in the background utilized for nonparametric prediction limits.

In accordance with ASTM (1998) and Gibbons (1994), if the detection frequency is less than 25%, intrawell nonparametric prediction limits will be used. The nonparametric intrawell prediction limit will be the highest detected concentration in the background data set. However, to attain 99% confidence level for an individual comparison, a minimum of 13 background data points are needed with one verification sample, 7 are needed with two verification samples, and

5 are needed with three verification samples (Gibbons, 1994). Well over 13 background samples are now available for each indicator parameter at each well.

E-6d(1) Parametric Analysis of Variance (ANOVA)

Parametric Analysis of the Variance (ANOVA) will not be utilized. Therefore, this section is not applicable.

E-6d(2) Nonparametric ANOVA (Based on Ranks)

Nonparametric ANOVA will also not be utilized. This section is not applicable.

E-6d(3) Tolerance or Prediction Interval Procedure

As described in greater detail below in Section E-6d(5), an intrawell nonparametric prediction limit procedure is being proposed for future evaluation of groundwater quality data. This approach is consistent with the statistical evaluation procedures being implemented under the permit issued by IDEM in April 2019.

E-6d(4) Control Chart Approach

The Combined Shewart-CUSUM control chart method will not be used. Therefore, this section is not applicable.

E-6d(5) Nonparametric Prediction Limits

Rarely have indicator parameters been detected at concentrations above the EQL. A nonparametric approach provides a convenient way of dealing with low detection frequencies with minimal distributional assumptions. The nonparametric prediction limit will be the maximum historical concentration of an indicator parameter in the background data set. If the indicator parameter has not been detected, the corresponding EQL becomes the prediction limit.

To derive the intrawell prediction limit for the appropriate indicator parameter at the appropriate wells, the background data set at **Appendix E-7** has been evaluated to compute the detection frequency and historical maximum concentration for each parameter at each monitoring well. If the detection frequency of the indicator parameter at a monitoring well is zero, the nonparametric intrawell prediction limit is the EQL. The results of this evaluation and prediction limit for each indicator parameter at each monitoring well are summarized in **Table E-3**.

E-6d(6) Verification Samples

An important assumption related to verification sampling is the assumption that the samples are independent of each other. Independence implies that the samples belong to the same sample set, but are different both temporally and spatially. At the Greenbelt II Landfill, the groundwater seepage velocity has historically been calculated to range from approximately 0.5 to 1.0 foot per day. If a preliminary statistically significant increase (SSI) trigger is observed, the schedule specified for collection of verification samples is within 45-60 days of the collection of the original sample. During the 45-60 day period between collection of the original and verification sample, based on the above groundwater seepage velocity, groundwater would have traveled a minimum of 25 feet and a maximum of 60 feet, which is sufficient for the samples to be considered temporally independent.

E-6d(6)(a) Number of Verification Samples Required

Verification sampling will be implemented in accordance with the procedures described in this section of the Permit. If appropriate, the initial result will be verified. Verification sampling will be implemented in the event that the concentration of an indicator parameter initially exceeds the intrawell prediction limits. Prediction limits provide a specific level of confidence, and the verification scheme employed will be dependent upon attaining at least 99% confidence for each individual comparison.

The number of verification samples required for each comparison utilizing an intrawell nonparametric prediction limit was based upon attaining at least a 99% confidence level for an individual comparison required by the applicable regulations. The appropriate verification sampling scheme was selected based upon Tables 2.6, 2.7, and 2.8 in Gibbons (1994). These tables are included in **Appendix E-9**. These tables represent the probability that at least one of two, three, or four samples will be below the maximum of n background measurements at each of k monitoring wells. Table 2.6 represents the case of one original sample and one verification sample; Table 2.7 represents one original sample and two verification samples; and Table 2.8 represents one original sample and three verification samples. For each parameter at each well, the verification scheme selected is dependent upon the number of background data points present at each well. A minimum number of background data points are required at each well so that at least 99% confidence is attained for each individual comparison. Based on Table 2.6, a minimum of 13 background samples are required using one verification sample. Using Table 2.7, a minimum of 7 background samples are required using two verification samples. Finally,

using Table 2.8, a minimum of 5 background samples are required using three verification samples.

The verification scheme selected was the program that resulted in at least 99% confidence for an individual comparison, given the existing number of background points for each constituent at each well.

A summary of the background data available for parameters and wells that will be evaluated using nonparametric prediction limits is provided on **Table E-3**. The number of background data points available for each indicator parameter at each well, the number of verification samples required for each indicator parameter and the false positive rate (i.e., Type I error rate) for each indicator parameter is shown on **Table E-3**. The false positive rate is calculated by taking 1 minus the probability obtained from either Table 2.6, Table 2.7, or Table 2.8 using the available number of background data points as *n*. Note that the facility-wide false positive rate is shown on **Table E-3**, and was estimated using Tables 2.6, 2.7, and 2.8 in Gibbons (1994), based on the total *n* and number of comparisons performed using each verification scheme. **Table E-3** will be revised whenever the background database is updated or whenever monitoring wells are added or deleted from the facility monitoring network.

E-6d(7) Proposal to Collect Additional Background Data

As shown on **Table E-3**, a minimum of 13 background data points are available that meet the required EQLs for each constituent at each well. Therefore, the existing background data set is sufficient so that only one verification sample is needed for each constituent at each well to attain at least 99% confidence for an individual comparison. Consequently, no additional background data will be needed.

E-6d(8) Updating the Background Data Set

As monitoring continues and the process is shown to be in control, the existing background data set at **Appendix E-7** and **Table E-3** shall be updated to incorporate new analytical concentrations. New data shall be combined with, not replace the existing background data set.

The existing background data set at **Appendix E-7** shall be updated at each two year anniversary, beginning with the first sampling event following the effective date of the permit issued after IDEM's review of this Permit. For example, if the effective date for this permit renewal is March 2024, then the first sampling event performed under the permit renewal would

be March-April 2024. Under this scenario, the background data would then be updated following the March-April 2026 sampling event. Information concerning the update of the background database will be submitted to IDEM in the routine semi-annual groundwater monitoring reports described at Section E-7d(8), but could also be submitted under separate cover.

Each time the background data set is updated, the sample date, result, unit of measurement, quantitation limit, and method will be specified for each new background concentration and added to **Appendix E-7**. Additionally, **Table E-3** of Appendix E will be revised to reflect the characteristics of the new data set. In summary, the following tasks will be performed each time the background data set is updated:

- Background data will be evaluated for QA/QC and visually screened for outliers and consistent EQLs. Outliers and nondetect values reported at concentrations greater than the prediction limit will not be added to the background data set unless these concentrations are found to be representative of background concentrations;
- The detection frequency of the background data will be retabulated; and
- Facility wide-false positive rate and required number of verification samples will be reevaluated using the procedure described above in Section E-6d(6)(a).

If during the last two years, any verification sample for the indicator parameters do not subsequently confirm the initial sample concentration exceedance above the corresponding prediction limit, the initial concentration will be considered a false positive. For purposes of recomputing the background data set, the unconfirmed initial sample concentration will be replaced by the concentration of the verification sample. However, if the initial sample concentration is confirmed, the concentration of the verification sample will not be added to the background data set at the end of each two year period, unless the concentration is demonstrated to be representative of background. Additionally, the original sample concentration also will not be added to the background database if the original preliminary SSI is confirmed by verification sampling and the concentration is not found to be representative of background.

E-6d(9) Reporting Procedures

The groundwater monitoring data will be statistically evaluated following each groundwater sampling event in accordance with the procedures presented in Section E-7d(4).

Groundwater data will be submitted digitally via e-mail to, **geologydata@idem.in.gov**. The facility name and a brief description of the file contents will be included in the subject heading of the e-mail. The electronic version will be submitted as an ASCII, tab-delimited text file or EXCEL file and contain the facility's name, and permit number. Field parameters and analytical results must include the fields listed below.

1. Permit
2. Well Name;
3. Sample Type: Regular, duplicate(s), trip blank(s), equipment blank(s), field blank(s), verification re-sample(s) and replicate(s);
4. Species Name: Chloride, sodium, ammonia, etc.;
5. Concentration (results – must be numeric characters only);
6. Units: mg/l, ug/l, standard units for pH, degrees Celsius (°C), or degrees Fahrenheit (°F) for temperature, and umhos/cm for specific conductance;
7. Detected: Yes or no;
8. Detection Limit (numeric characters only);
9. Analytical methods;
10. Estimated Value: Indicate "Yes" if the reported value is an estimated value. If a value is estimated, use the "Comment" field to explain why the value was estimated;
11. Comment: Analytical lab and/or field personnel comments regarding the reported results.

E-6d(10) Alternative Approach

No alternative approaches are being proposed for use. Therefore, this section is not applicable.

E-7 Detection Monitoring Program

A detection groundwater monitoring program is proposed for implementation. Information, data, and analysis documenting the absence of hazardous constituents in the groundwater supporting implementation of a detection monitoring program has been submitted to IDEM in the form of the semi-annual groundwater monitoring reports prepared in accordance with the facility's last hazardous waste management permit issued by IDEM in April 2019. The summary of the

analytical database is also included in the historical analytical database for the facility presented in **Appendix E-7**. This data indicates that a release of hazardous constituents has not been documented, based upon existing groundwater quality data.

E-7a *Indicator Parameters, Waste Constituents, Reaction Products to be Monitored*

The permittee has selected a suite of parameters that are indicative of potential groundwater impact based on the characteristics of the materials disposed in the Greenbelt II Landfill. The selection has been based on site-specific technical evaluations. The indicator parameters are believed to be the most accurate and reliable indicators of impacts and are less likely to provide erroneous results (i.e., false positives or negatives).

The proposed indicator parameters were selected based on:

- The low probability of organics in groundwater at the site, either naturally or from leachate;
- The presence of inorganic parameters within the leachate;
- The relative mobility and retardation with respect to groundwater flow, and their stability and persistence in the environment;
- The results of previous groundwater assessments; and
- Their ease of detection with minimal sampling and analytical interferences.

Groundwater indicator parameters and monitoring constituents are presented in **Table E-1**.

E-7a(1)(a) Waste Characterization

Hazardous wastes deposited in the Greenbelt II Landfill are limited to dewatered, wastewater treatment sludges (F006) and various nonhazardous sludges historically produced at the Midwest Plant. The F006 sludges have been characterized as discussed in Attachments B and C of this Permit.

As shown on Tables 1 and 2 of the 1993 Hydrogeologic Assessment found in **Appendix E-1** of the Permit, the wastes consist of primarily elemental metals. No organic or radioactive constituents have been consistently shown to be in the hazardous waste stream disposed in the Greenbelt II Landfill. The listing parameters for F006 (cadmium, chromium, nickel, and cyanide) are present in the waste.

E-7a(1)(b) Behavior of Waste Constituents in Groundwater

The behavior of the waste constituents of the Greenbelt II Landfill wastes is well documented in published literature. Metals are conservative and flow within the saturated zone either at the same rate as the groundwater, or at a fraction thereof. In a rough manner, the rate of migration of the Greenbelt II Landfill waste constituents can be approximated by the distribution coefficients (K_d) of the waste constituents. Table 14 of the 1993 Hydrogeologic Assessment replicates K_d values from the IDEM-approved Greenbelt I Landfill Interim Status Ground Water Quality Assessment Plan. The low K_d values for cyanide, nickel and cadmium suggest that those constituents will migrate approximately at the same rate as the groundwater (approximately 0.5 to 1 foot per day). Therefore, if released from the Greenbelt II Landfill in leachate, these contaminants will be easily and quickly detected in the groundwater by semi-annual monitoring for indicator parameters.

E-7a(1)(c) Detectability of Indicator Parameters

The indicator parameters can be analyzed in the laboratory with existing standard SW-846 methods. No special analytical method sampling or handling techniques are required. **Table E-1** contains the SW-846 methods and Estimated Quantitation Limits (EQLs) for each Indicator Parameter. The EQLs are the lowest concentrations that can be quantified within levels of precision and accuracy for routine laboratory operations.

The analytical laboratory currently selected to perform the groundwater analyses is ALS Environmental (ALS) of Holland, Michigan. ALS will follow the laboratory Quality Assurance Manual located in Appendix A to the Groundwater Sampling and Analysis Plan (SAP) in **Appendix E-6**. A laboratory other than ALS may perform the analytical testing, as long as the procedures specified in the above Quality Assurance Manual are followed.

E-7b *Groundwater Monitoring System*

The permittee will implement a groundwater detection monitoring program in accordance with the procedures described in this section. The detection monitoring system includes monitoring wells and piezometers installed in the uppermost aquifer beneath the facility. Based on several previous hydrogeologic investigations, the detection monitoring well network enables detection and measurement of potential releases of hazardous constituents at the points of compliance for the Greenbelt II Landfill (see Topographic Map provided as **Appendix E-5**). The Greenbelt II

detection monitoring program consists of the monitoring wells and piezometers shown in **Table E-2**.

With the addition of Cell D to the Greenbelt II Landfill at some point in the future, existing monitoring wells located north of Cell A will be abandoned. However, as indicated on Figure 53d in the Hydrogeologic Assessment presented as **Appendix E-1**, no additional monitoring wells will be installed with the addition of Cell D.

E-7b(1) Monitoring Wells

To monitor the groundwater beneath the facility, two types of wells, both of similar construction, are used. These are:

- Detection monitoring wells - located at the point of compliance around the facility; and
- Piezometers - located either outside or inside the point of compliance and used to assist in evaluating groundwater flow directions.

Table E-2 depicts the designations for each of the monitoring wells and piezometers, as well as, their positions vertically (i.e., A, B, C, D, and I zones) and laterally (upgradient vs. downgradient). The rationale for the placement of the wells is based on the subsurface geologic information discussed in the Hydrogeologic Assessments. The locations of the existing wells are shown on the Topographic Map included as **Appendix E-5**. Well coordinates are listed in Table 1 to the Groundwater SAP (**Appendix E-6)**.

E-7b(2) Well Construction

The existing wells incorporated in the detection and piezometer networks were installed in accordance with standard procedures previously reviewed and approved by IDEM within prior permits.

The materials used for existing wells were selected on the basis of strength, corrosion resistance, low interference with parameters to be monitored and compatibility with the drilling methods employed. Each well was installed in the target hydrogeologic zone using 2-inch PVC well screen and riser pipe, granular material adjacent to and above each screen and a bentonite seal in the annular space above each sand pack. A combination of bentonite pellets, Volclay grout and cement-bentonite grout was used to seal the remaining annular space of the borehole. A locking steel protective cover was embedded in concrete to protect each well and provide security. Each groundwater monitoring well is surrounded by a concrete sampling pad. Monitoring well and

piezometer construction diagrams are contained in Appendix B to the groundwater SAP found at **Appendix E-6**.

If future soil borings, monitoring wells, or piezometers, are required to be installed, the procedures described in **Appendix E-8** will be followed.

E-7c *Background Groundwater Concentration Values for Proposed Parameters*

E-7c(1) Data Currently Available

Background values for the indicator parameters are summarized in **Table E-3** and a summary of the analytical results are contained in **Appendix E-7**. The initial background data consists primarily of semi-annual sampling events from March 1994 to March 2023. Background data will be updated in accordance with the procedures outlined above in Section E-6d(8).

E-7c(2) Background Groundwater Quality Data

Groundwater samples in the background data set consist of temporally and spatially independent concentrations and are expressed in appropriate units to be used in the statistical test designed to assess whether or not a release of contamination to the groundwater has occurred.

E-7c(3) Background Sampling Frequency, Quantity, and Values

The background data set consists primarily of semi-annual sampling (and some verification sampling results) during final permit status (March 1994 - March 2023). This sampling interval has resulted in collection of independent samples from each well in the system.

The quantity of background groundwater samples and the appropriate background parameters are shown on **Table E-3**.

E-7d *Proposed Sampling and Analysis Procedures*

E-7d(1) Sample Collection

Groundwater sampling procedures are presented in the Groundwater Sampling and Analysis Plan (SAP) at **Appendix E-6**.

E-7d(2) Sample Preservation and Shipment

Sample preservation and shipment procedures are presented in the SAP at **Appendix E-6**.

E-7d(3) Procedures for Measuring Groundwater Elevation

Procedures for measuring groundwater elevation are presented in the SAP at **Appendix E-6**.

E-7d(4) Procedures for Evaluating a Statistically Significant Increase

Following receipt of laboratory analytical results, the permittee will statistically evaluate the groundwater analytical concentration of each indicator parameter in each monitoring well. This will be comprised of a comparison to the corresponding prediction limit.

If no indicator parameter sample concentration is greater than the corresponding prediction limit, the initial test is "SATISFIED" indicating that statistical evidence of a release of hazardous constituents to the groundwater is not present. However, if any indicator parameter sample concentration is greater than the corresponding prediction limit, the initial test is "TRIGGERED" indicating that statistical evidence of a release of hazardous constituents to the groundwater may be present.

If the initial test is triggered, the permittee, within sixty (60) days of the initial sample date, will collect one verification sample for each indicator parameter(s) from the monitoring well(s) in which the trigger(s) occurred. If no indicator parameter resample concentration is greater than the corresponding intrawell prediction limit, the verification sample test is "SATISFIED" indicating that statistical evidence of a release of hazardous constituents to the groundwater is not present.

If the concentration of the verification sample is greater than the corresponding prediction limit, the verification sample test is "VERIFIED" indicating that statistical evidence of a release of hazardous constituents to the groundwater is present.

E-7d(5) Annual Groundwater Flow Evaluation

An evaluation of the groundwater flow conditions will be made with each semi-annual groundwater monitoring report. Therefore, a separate “Annual Report” will not be required. Information specified at Section E-7d(8) will be included in each semi-annual groundwater monitoring report, including groundwater contour maps, cross sectional groundwater flow nets, and calculations concerning the seepage velocity.

E-7d(6) Analytical Procedures

Laboratory analytical procedures are described in the Quality Assurance Manual at Appendix A to the SAP in **Appendix E-6**.

E-7d(7) Chain of Custody

Chain of custody procedures are presented in the SAP at **Appendix E-6**.

E-7d(8) Data Review, Record Keeping and Reporting

Achieving the objective of a groundwater monitoring program is dependent upon accurate analytical results to provide proper statistical interpretation. The accuracy of the analytical results is the primary responsibility of the laboratory; however, additional data review will be undertaken to assess further data accuracy. The goals for the review are to:

- Provide for reporting of accurate results;
- Review QA/QC documentation;
- Identify results which appear inconsistent with historical trends;
- Correct erroneous data;
- Provide interpretation of anomalous data and reasons for the anomalies; and
- Identify the necessity to resample to confirm reported values.

Resolution and documentation of erroneous or anomalous data may simply include a confirmation from the laboratory of the reported data or a new report being issued. Data itself will not be changed unless the reported results were in error due to data transcription or a mathematical error in calculating the constituent concentration, or an error in laboratory analytical procedures had occurred. The laboratory utilized for sample analysis is capable of producing Quality Assurance/Quality Control documentation in accordance with IDEM's guidance.

Within ***forty five (45)*** **days** of receipt of the final laboratory analytical results, the permittee will enter detection groundwater monitoring information into the facility record. This information will include sampling documentation, analytical results, statistical calculations, inspection and maintenance records, and evaluations required in the permit.

Within ***forty five (45)*** **days** of receipt of laboratory analytical results, the permittee will submit to the OLQ Hazardous Waste Permit Section Chief a report including the following information:

(a) A copy of each groundwater sampling field data sheet and field log book entries. Copies must be legible, complete and accurate.

(b) A copy of the chain of custody form(s).

(c) A copy of the purge rate monitoring record for each monitoring well(s) sampled.

(d) A copy of the completed inspection record for sampling equipment, monitoring wells and piezometers.

(e) Copies of laboratory analytical results, including the laboratory QA/QC information specified in Section 5.2 of the SAP (see **Appendix D-6**). Each indicator parameter will be recorded and reported in a form necessary for the determination of a statistically significant increase.

(f) Groundwater data will be submitted digitally in accordance with the following guidelines: submitted via e-mail to the e-mail address, **geologydata@idem.in.gov**. The facility name and a brief description of the file contents will be included in the subject heading of the e-mail. The electronic version will be submitted as an ASCII, tab-delimited text or EXCEL file and contain the facility's name, and permit number. Field parameters and analytical results must include the fields listed below.

(i) Sample Date: Month, day and year.

(ii) Well Name.

(iii) Sample Type: Regular, duplicate(s), trip blank(s), equipment blank(s), field blank(s), verification re-sample(s) and replicate(s).

(iv) Species Name: cadmium, chromium, lead, etc.

(v) Concentration (results) – numeric only.

(vi) Concentration Units: mg/l, ug/l, standard units for pH, degrees Celsius (°C), or degrees Fahrenheit (°F) for temperature, mvolts for Eh, and umhos/cm for specific conductance;

(vii) Detected: Yes or no.

(viii) Detection Limit (numeric only);

(ix) Analytical methods.

(x) Estimated Value: Indicate "Yes" if the reported value is an estimated value. If a value is estimated, use the "Comment" field to explain why the value was estimated.

(xi) Comment: Analytical lab and/or field personnel comments regarding the reported results.

(g) Table of values/concentrations summarizing analytical results and field measurements for each groundwater indicator parameter and monitoring constituent. These tables may be prepared using the Sanitas, or equivalent, software. Each table will specify the following:

(i) Location.

(ii) Sample date.

(iii) Monitoring well ID and monitoring zone.

(iv) Groundwater monitoring constituent.

(v) Units of measure.

(vi) Concentration or value.

(vii) Analytical method.

(h) Summary tables statistically comparing each groundwater indicator parameter analytical concentration to the appropriate prediction limit. Each summary table will include:

(i) Location.

(ii) Sample date.

(iii) Monitoring well ID and monitoring zone.

(iv) Each indicator parameter and measured analytical concentration.

(v) Units of measure.

(vi) Method detection limit.

(vii) Corresponding Estimated Quantitation Limit.

(viii) Corresponding Prediction Limit used to evaluate data.

(ix) Result (pass/fail) of each statistical comparison.

(i) A time-trend plot for each analytical parameter detected (i.e., where the concentration is greater than the EQL) illustrating the analytical concentration and the appropriate prediction limit. If the concentration of the indicator parameter has never been detected above the reporting limit, a time-trend plot will not be prepared. The x-axis will display time and the y-axis concentration. Detects and nondetects will be plotted using different symbols. Each graph will include:

(i) Facility ID.

(ii) Sample dates.

(iii) Monitoring well ID and monitoring zone.

(iv) Groundwater monitoring constituent.

(v) Units of measure.

(vi) Concentration or value with connecting lines between measurements.

(vii) Prediction Limit.

(j) Table summarizing groundwater elevations measured at each monitoring well and piezometer which include:

(i) Location.

(ii) Sample date.

(iii) Monitoring well ID and monitoring zone.

(iv) Total well depth.

(v) Top and bottom screen elevations.

(vi) Reference elevation (top of inside well casing).

(vii) Groundwater elevation.

(k) For each regular semi-annual sampling event, groundwater flow maps and calculation of flow velocity for each monitoring zone. Each flow map will be drawn at a horizontal scale of 1 inch to not more than 300 feet and illustrate the following:

(i) Facility ID and location.

(ii) Boundaries of the waste units and current points of compliance.

(iii) Legend including; north arrow, scale and well/piezometer symbol designation;

(iv) Date static water levels obtained.

(v) Monitoring zone.

(vi) Location and ID of each well and piezometer.

(vii) Water level elevation of each well and piezometer (to the nearest one-hundredth of a foot relative to the National Geodetic Vertical Datum). Groundwater elevations will be summarized in a table.

(viii) Groundwater contours/equipotentials. The contour interval must be sufficient to show groundwater flow patterns.

(ix) Groundwater flow arrows.

(l) Each time the background data set is updated, the sample date, result (concentration), unit of measurement and analytical method for each new background concentration will be added to **Appendix E-7**. **Table E-3** will be revised to reflect the characteristics of the new data set. Printouts of the updated background database and **Table E-3** will be submitted to IDEM. Each report will identify the most current background dataset.

(m) A brief narrative discussion summarizing the results, required evaluations and future course of action.

(n) For each regular semi-annual monitoring event, calculated groundwater flow velocities. Groundwater flow velocity will be calculated for each zone of flow on the basis of site-specific values for hydraulic conductivity and measured gradients. Groundwater flow rates will be calculated using the following equation:

$$V_S = \frac{K(dh)/(dl)}{n}$$

Where:

V_S = Seepage Velocity (cm/sec)

K = Hydraulic Conductivity

n = Effective porosity (the permittee will provide an accurate value and the rationale for its determination)

dh/dl = Hydraulic gradient

E-7e *Statistically Significant Increase in any Constituent or Parameter Identified at any Compliance Point Monitoring Well*

If the permittee verifies that statistically significant evidence of groundwater contamination exists as defined in Section E-7d(4) at any monitoring well at the compliance point, then the following must take place:

(1) Within **seven (7) days**, notify the IDEM Commissioner of this finding in writing. The notification must indicate what chemical parameter(s) or constituent(s) have shown statistically significant evidence of impacts.

(2) Within **forty-five (45) days**, sample the groundwater in all monitoring wells and evaluate whether constituents in the list of Appendix IX of Part 40 CFR 264 (Appendix IX) are present, and if so, in what concentrations. Pursuant to 40 CFR 264.98(g)(2) , based upon the waste characteristics of the hazardous materials placed within the Greenbelt II Landfill, the Appendix IX parameters monitored will be limited to dissolved metals. Historic waste characterization data has demonstrated that VOCs, SVOCs, pesticides, herbicides, PCBs, and dioxins/furans are not expected to be present in the hazardous waste; therefore, these constituent groups will not be included within the scope of the Appendix IX monitoring. Presence is defined as the occurrence of an Appendix IX constituent in a monitoring well at a concentration that is greater than the corresponding reporting limit specified in **Table E-4. Within ninety (90) days**, the permittee will submit the results of this evaluation and the information required in Section E-7d(8) to the OLQ Geology Section Chief.

(3) The permittee may resample the groundwater and repeat the analyses for those compounds detected in Section E-7e(2) **within sixty (60) days** of the initial Appendix IX sampling event. If the results of the verification sample(s) confirm the initial results, then these constituents will form the basis for compliance monitoring. If the owner or operator does not resample for the compounds found pursuant to Section E-7e(2), the constituents found during the initial Appendix IX analysis will form the basis for compliance monitoring.

(4) If the permittee concludes on the basis of the Appendix IX laboratory analytical results from the verification sample(s) that hazardous constituent(s) are <u>not</u> present in the groundwater, the permittee will continue with the groundwater detection monitoring

program as described in Section E-7. However, if the permittee confirms on the basis of laboratory analytical results that Appendix IX hazardous constituents are present in the groundwater, the permittee will, **within ninety (90) days**, submit to the OLQ Hazardous Waste Permit Section an application for a permit modification to establish a compliance monitoring program. The application must include the following information:

(i) An identification of the concentration of each Appendix IX constituent found in the groundwater at each monitoring well at the compliance point.

(ii) Any proposed changes to the groundwater monitoring system at the facility necessary to meet the requirements of a compliance monitoring program in 40 CFR 264.99.

(iii) Any proposed changes to the monitoring frequency, sampling and analysis procedures, or methods or statistical procedures used at the facility necessary to meet the requirements of compliance monitoring as described in 40 CFR 264.99.

(iv) For each hazardous constituent found at the compliance point, a proposed concentration limit, or a notice of intent to seek an alternate concentration limit for a hazardous constituent. All data necessary to justify an alternate concentration limit sought under 40 CFR 264.94(b) shall be submitted within 180 days.

(5) Submit an engineering feasibility plan for a corrective action program in accordance with the requirements of 40 CFR 264.100 to the IDEM Commissioner within **one-hundred and eighty (180) days,** unless all hazardous constituents identified under Section E-7e(2) are listed in Table 1 of 329 IAC 3.1-9-2(11) and their concentrations do not exceed the respective values given in that Table, or the permittee has sought an alternate concentration limit under 40 CFR 264.94(b) for every hazardous constituent identified in Section E-7e(2).

(6) If the permittee wishes to demonstrate that a source other than the landfill caused the increase, the permittee will follow the procedures described at Section E-7e(7).

(7) The permittee may demonstrate that a source other than the RCRA landfill caused the increase, or that the increase resulted from error in sampling, analysis, or evaluation. The permittee may make this demonstration in addition to, or in lieu of, submitting a permit

modification application for a groundwater compliance monitoring program. However, the permittee is not relieved of the requirement to submit a permit modification application within the specified period unless the demonstration made under this Section successfully shows that a source other than the landfill caused the detection, or that detection resulted from error in sampling, analysis, or evaluation. In such cases, the permittee must, from the date of confirming the presence of Appendix IX parameters:

(i) Within **seven (7) days**, notify the IDEM Commissioner that the permittee intends to make a demonstration.

(ii) Within **ninety (90) days**, submit a report to the IDEM Commissioner that demonstrates that a source other than a regulated unit caused the increase, or that the increase resulted from error in sampling, analysis, or evaluation.

(iii) Within **ninety (90) days**, submit to the IDEM Commissioner an application for a permit modification to make any appropriate changes to the detection monitoring program at the facility.

(iv) Continue to monitor in accordance with the detection monitoring program at the facility.

(8) If the permittee or the IDEM Commissioner determines the detection monitoring program no longer satisfies the requirements of the regulations, the permittee must, within **ninety (90) days** of the determination or, written notice by the IDEM Commissioner, submit an application for a permit modification to make any appropriate changes to the program which will satisfy the regulations.

E-8 Compliance Monitoring Program

There has been no evidence to date to substantiate that groundwater has been impacted by the Greenbelt II Landfill. Therefore, pursuant to 40 CFR 270.14 (c)(7) and 329 IAC 3.1-13-1, the permittee is not required at this time to establish a compliance monitoring program. Section E-8 is therefore not applicable to this Permit.

E-9 Corrective Action Program

As previously stated, there has been no evidence to date to substantiate that groundwater has been impacted by the Greenbelt II Landfill. Therefore, pursuant to 40 CFR §§ 270.14(c)(8) and 264.100 and 329 I.A.C. §§ 3.1-13-1 and 3.1-9-1, the permittee is not required at this time to

establish a corrective action program. Section E-9a through E-9e is therefore not applicable to this Permit.

E-10 References

ASTM Designation 6312-98, 1998 (Reapproved 2005). Standard Guide for Developing Appropriate Statistical Approaches for Ground-Water Detection Monitoring Programs.

Gibbons, R.D. 1991. Ground Water, Vol. 29, pp. 729-736.

Gibbons, R.D. 1994. Statistical Methods for Groundwater Monitoring. New York: Wiley.

Gilbert, R.O. 1987. Statistical Methods for Environmental Pollution Monitoring. New York: Van Norstrand Reinhold, 320 pp.

Snedecor, G.W., and W.G. Cochran, 1980. Statistical Methods, Ames, Iowa: Iowa State University Press.

USEPA 1989. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities: Interim Final Guidance. Washington, D.C.: Office of Solid Waste, U.S. Environmental Protection Agency.

USEPA 1992a. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities: Addendum to Interim Final Guidance. Washington, D.C.: Office of Solid Waste, U.S. Environmental Protection Agency. Draft.

USEPA 1992b. Statistical Training Course for Groundwater Monitoring Data Analysis, EPA/530-R-93-003.

Attachment E – Groundwater Monitoring

TABLES

TABLE E-1

GREENBELT II LANDFILL

GROUNDWATER INDICATOR PARAMETERS		
Indicator Parameters	SW-846 Method[3]	EQL (ug/l[1])
Cadmium (dis.)	6000 Series	5 [2]
Chromium (dis.)	6000 Series	50 [2]
Lead (dis.)	6000 Series	10
Mercury (dis.)	7470	2
Nickel (dis.)	6000 Series	50
Silver (dis.)	6000 Series	50 [2]
Vanadium (dis.)	6000 Series	10
Free Cyanide	SW846-9014 or OIA-1677	40
GROUNDWATER MONITORING CONSTITUENTS		
Sulfate	9056	10 mg/L
pH	Field Measurement	SU
Specific Conductance	Field Measurement	umhos/cm
Temperature	Field Measurement	Degrees F
Field Turbidity	Field Measurement	NTU

EQL = Estimated Quantitation Limits are the lowest concentrations of analytes in groundwater that can be reliably determined within specified limits of precision and accuracy by the indicated methods under routine laboratory operating conditions.

[1] Source – Appendix IX - Groundwater Monitoring List, 52, FR 25946

[2] Source – Table 1 of 329 IAC 3.1-9-2(11)

[3] Currently promulgated SW-846 method will be utilized.

6000 series methods refers to the most current promulgated method for 6010 or 6020.

TABLE E-2

GROUNDWATER MONITORING SYSTEM COMPONENTS

GREENBELT II LANDFILL

WELL/ PIEZOMETER NUMBER	LOCATION	DETECTION MONITORING WELLS	PIEZOMETERS
6	Upgradient		A,C,D
7	Upgradient		A,C,D
8	Upgradient		A,B,D
GP-13	Downgradient		A,B
17	Reserved		
18	Downgradient		A,C,I
24	Downgradient	A,B	
25	Downgradient	A,B	
28	Downgradient	A,B	
29	Downgradient	A,B	
30	Downgradient	A,B	
31	Downgradient	A,B	
32	Downgradient	A,B	
33	Downgradient	A,B	

Notes:

Monitoring wells used for measurement of groundwater elevation and collection/laboratory analysis of groundwater samples.

Piezometers used for measurement of groundwater elevation only.

Table E-3
Summary of Existing Background Data

Parameter	Monitoring Well	No. of Background Data Points* (n)	Det. Freq. (%)	Maximum Detected Concentration (ug/L)	Intrawell Prediction Limit (ug/L)	Number of Verification Samples Required	Probability That Sample and Resample(s) are Below Max. of n Background Points	Type I Error Rate (%)
Cadmium (dissolved)	MW-G24A	34	0	100% Nondetect	5	1	0.9985	0.15
Cadmium (dissolved)	MW-G24B	34	0	100% Nondetect	5	1	0.9985	0.15
Cadmium (dissolved)	MW-G25A	34	0	100% Nondetect	5	1	0.9985	0.15
Cadmium (dissolved)	MW-G25B	34	0	100% Nondetect	5	1	0.9985	0.15
Cadmium (dissolved)	MW-G28A	34	0	100% Nondetect	5	1	0.9985	0.15
Cadmium (dissolved)	MW-G28B	34	0	100% Nondetect	5	1	0.9985	0.15
Cadmium (dissolved)	MW-G29A	34	0	100% Nondetect	5	1	0.9985	0.15
Cadmium (dissolved)	MW-G29B	34	0	100% Nondetect	5	1	0.9985	0.15
Cadmium (dissolved)	MW-G30A	34	0	100% Nondetect	5	1	0.9985	0.15
Cadmium (dissolved)	MW-G30B	34	0	100% Nondetect	5	1	0.9985	0.15
Cadmium (dissolved)	MW-G31A	34	0	100% Nondetect	5	1	0.9985	0.15
Cadmium (dissolved)	MW-G31B	34	0	100% Nondetect	5	1	0.9985	0.15
Cadmium (dissolved)	MW-G32A	34	0	100% Nondetect	5	1	0.9985	0.15
Cadmium (dissolved)	MW-G32B	34	0	100% Nondetect	5	1	0.9985	0.15
Cadmium (dissolved)	MW-G33A	34	0	100% Nondetect	5	1	0.9985	0.15
Cadmium (dissolved)	MW-G33B	34	0	100% Nondetect	5	1	0.9985	0.15
Chromium (dissolved)	MW-G24A	48	0	100% Nondetect	50	1	0.9992	0.09
Chromium (dissolved)	MW-G24B	49	0	100% Nondetect	50	1	0.9992	0.08
Chromium (dissolved)	MW-G25A	49	0	100% Nondetect	50	1	0.9992	0.08
Chromium (dissolved)	MW-G25B	49	0	100% Nondetect	50	1	0.9992	0.08
Chromium (dissolved)	MW-G28A	49	0	100% Nondetect	50	1	0.9992	0.08
Chromium (dissolved)	MW-G28B	49	0	100% Nondetect	50	1	0.9992	0.08
Chromium (dissolved)	MW-G29A	49	0	100% Nondetect	50	1	0.9992	0.08
Chromium (dissolved)	MW-G29B	49	0	100% Nondetect	50	1	0.9992	0.08
Chromium (dissolved)	MW-G30A	46	0	100% Nondetect	50	1	0.9991	0.09
Chromium (dissolved)	MW-G30B	46	0	100% Nondetect	50	1	0.9991	0.09
Chromium (dissolved)	MW-G31A	46	0	100% Nondetect	50	1	0.9991	0.09
Chromium (dissolved)	MW-G31B	46	0	100% Nondetect	50	1	0.9991	0.09
Chromium (dissolved)	MW-G32A	46	0	100% Nondetect	50	1	0.9991	0.09
Chromium (dissolved)	MW-G32B	46	0	100% Nondetect	50	1	0.9991	0.09
Chromium (dissolved)	MW-G33A	42	0	100% Nondetect	50	1	0.9990	0.10
Chromium (dissolved)	MW-G33B	46	0	100% Nondetect	50	1	0.9991	0.09

Table E-3
Summary of Existing Background Data

Parameter	Monitoring Well	No. of Background Data Points* (n)	Det. Freq. (%)	Maximum Detected Concentration (ug/L)	Intrawell Prediction Limit (ug/L)	Number of Verification Samples Required	Probability That Sample and Resample(s) are Below Max. of n Background Points	Type I Error Rate (%)
Free Cyanide	MW-G24A	36	0	100% Nondetect	40	1	0.9987	0.13
Free Cyanide	MW-G24B	36	0	100% Nondetect	40	1	0.9987	0.13
Free Cyanide	MW-G25A	36	0	100% Nondetect	40	1	0.9987	0.13
Free Cyanide	MW-G25B	36	0	100% Nondetect	40	1	0.9987	0.13
Free Cyanide	MW-G28A	35	0	100% Nondetect	40	1	0.9986	0.14
Free Cyanide	MW-G28B	36	0	100% Nondetect	40	1	0.9987	0.13
Free Cyanide	MW-G29A	36	0	100% Nondetect	40	1	0.9987	0.13
Free Cyanide	MW-G29B	36	0	100% Nondetect	40	1	0.9987	0.13
Free Cyanide	MW-G30A	36	0	100% Nondetect	40	1	0.9987	0.13
Free Cyanide	MW-G30B	37	0	100% Nondetect	40	1	0.9988	0.12
Free Cyanide	MW-G31A	33	0	100% Nondetect	40	1	0.9984	0.16
Free Cyanide	MW-G31B	37	0	100% Nondetect	40	1	0.9988	0.12
Free Cyanide	MW-G32A	36	0	100% Nondetect	40	1	0.9987	0.13
Free Cyanide	MW-G32B	36	0	100% Nondetect	40	1	0.9987	0.13
Free Cyanide	MW-G33A	36	0	100% Nondetect	40	1	0.9987	0.13
Free Cyanide	MW-G33B	34	0	100% Nondetect	40	1	0.9985	0.15
Lead (dissolved)	MW-G24A	61	0	100% Nondetect	10	1	0.9995	0.05
Lead (dissolved)	MW-G24B	62	1.6	10	10	1	0.9995	0.05
Lead (dissolved)	MW-G25A	62	0	100% Nondetect	10	1	0.9995	0.05
Lead (dissolved)	MW-G25B	62	0	100% Nondetect	10	1	0.9995	0.05
Lead (dissolved)	MW-G28A	52	0	100% Nondetect	10	1	0.9926	0.74
Lead (dissolved)	MW-G28B	52	0	100% Nondetect	10	1	0.9926	0.74
Lead (dissolved)	MW-G29A	52	0	100% Nondetect	10	1	0.9926	0.74
Lead (dissolved)	MW-G29B	52	0	100% Nondetect	10	1	0.9926	0.74
Lead (dissolved)	MW-G30A	46	0	100% Nondetect	10	1	0.9991	0.09
Lead (dissolved)	MW-G30B	46	0	100% Nondetect	10	1	0.9991	0.09
Lead (dissolved)	MW-G31A	46	0	100% Nondetect	10	1	0.9991	0.09
Lead (dissolved)	MW-G31B	46	0	100% Nondetect	10	1	0.9991	0.09
Lead (dissolved)	MW-G32A	46	0	100% Nondetect	10	1	0.9991	0.09
Lead (dissolved)	MW-G32B	46	0	100% Nondetect	10	1	0.9991	0.09
Lead (dissolved)	MW-G33A	46	0	100% Nondetect	10	1	0.9991	0.09
Lead (dissolved)	MW-G33B	46	0	100% Nondetect	10	1	0.9991	0.09

Table E-3
Summary of Existing Background Data

Parameter	Monitoring Well	No. of Background Data Points* (n)	Det. Freq. (%)	Maximum Detected Concentration (ug/L)	Intrawell Prediction Limit (ug/L)	Number of Verification Samples Required	Probability That Sample and Resample(s) are Below Max. of n Background Points	Type I Error Rate (%)
Mercury (dissolved)	MW-G24A	61	0	100% Nondetect	2	1	0.9995	0.05
Mercury (dissolved)	MW-G24B	62	0	100% Nondetect	2	1	0.9995	0.05
Mercury (dissolved)	MW-G25A	62	0	100% Nondetect	2	1	0.9995	0.05
Mercury (dissolved)	MW-G25B	62	0	100% Nondetect	2	1	0.9995	0.05
Mercury (dissolved)	MW-G28A	52	0	100% Nondetect	2	1	0.9926	0.74
Mercury (dissolved)	MW-G28B	52	0	100% Nondetect	2	1	0.9926	0.74
Mercury (dissolved)	MW-G29A	52	0	100% Nondetect	2	1	0.9926	0.74
Mercury (dissolved)	MW-G29B	52	0	100% Nondetect	2	1	0.9926	0.74
Mercury (dissolved)	MW-G30A	46	0	100% Nondetect	2	1	0.9991	0.09
Mercury (dissolved)	MW-G30B	46	0	100% Nondetect	2	1	0.9991	0.09
Mercury (dissolved)	MW-G31A	46	0	100% Nondetect	2	1	0.9991	0.09
Mercury (dissolved)	MW-G31B	46	0	100% Nondetect	2	1	0.9991	0.09
Mercury (dissolved)	MW-G32A	46	0	100% Nondetect	2	1	0.9991	0.09
Mercury (dissolved)	MW-G32B	46	0	100% Nondetect	2	1	0.9991	0.09
Mercury (dissolved)	MW-G33A	46	0	100% Nondetect	2	1	0.9991	0.09
Mercury (dissolved)	MW-G33B	46	0	100% Nondetect	2	1	0.9991	0.09
Nickel (dissolved)	MW-G24A	61	0	100% Nondetect	50	1	0.9995	0.05
Nickel (dissolved)	MW-G24B	62	0	100% Nondetect	50	1	0.9995	0.05
Nickel (dissolved)	MW-G25A	62	0	100% Nondetect	50	1	0.9995	0.05
Nickel (dissolved)	MW-G25B	62	0	100% Nondetect	50	1	0.9995	0.05
Nickel (dissolved)	MW-G28A	52	0	100% Nondetect	50	1	0.9926	0.74
Nickel (dissolved)	MW-G28B	52	0	100% Nondetect	50	1	0.9926	0.74
Nickel (dissolved)	MW-G29A	52	0	100% Nondetect	50	1	0.9926	0.74
Nickel (dissolved)	MW-G29B	52	0	100% Nondetect	50	1	0.9926	0.74
Nickel (dissolved)	MW-G30A	46	0	100% Nondetect	50	1	0.9991	0.09
Nickel (dissolved)	MW-G30B	46	0	100% Nondetect	50	1	0.9991	0.09
Nickel (dissolved)	MW-G31A	46	0	100% Nondetect	50	1	0.9991	0.09
Nickel (dissolved)	MW-G31B	46	0	100% Nondetect	50	1	0.9991	0.09
Nickel (dissolved)	MW-G32A	46	0	100% Nondetect	50	1	0.9991	0.09
Nickel (dissolved)	MW-G32B	46	0	100% Nondetect	50	1	0.9991	0.09
Nickel (dissolved)	MW-G33A	46	0	100% Nondetect	50	1	0.9991	0.09
Nickel (dissolved)	MW-G33B	46	0	100% Nondetect	50	1	0.9991	0.09

Table E-3
Summary of Existing Background Data

Parameter	Monitoring Well	No. of Background Data Points* (n)	Det. Freq. (%)	Maximum Detected Concentration (ug/L)	Intrawell Prediction Limit (ug/L)	Number of Verification Samples Required	Probability That Sample and Resample(s) are Below Max. of n Background Points	Type I Error Rate (%)
Silver (dissolved)	MW-G24A	48	0	100% Nondetect	50	1	0.9992	0.09
Silver (dissolved)	MW-G24B	49	0	100% Nondetect	50	1	0.9992	0.08
Silver (dissolved)	MW-G25A	49	0	100% Nondetect	50	1	0.9992	0.08
Silver (dissolved)	MW-G25B	49	0	100% Nondetect	50	1	0.9992	0.08
Silver (dissolved)	MW-G28A	49	0	100% Nondetect	50	1	0.9992	0.08
Silver (dissolved)	MW-G28B	49	0	100% Nondetect	50	1	0.9992	0.08
Silver (dissolved)	MW-G29A	49	0	100% Nondetect	50	1	0.9992	0.08
Silver (dissolved)	MW-G29B	49	0	100% Nondetect	50	1	0.9992	0.08
Silver (dissolved)	MW-G30A	46	0	100% Nondetect	50	1	0.9991	0.09
Silver (dissolved)	MW-G30B	46	0	100% Nondetect	50	1	0.9991	0.09
Silver (dissolved)	MW-G31A	46	0	100% Nondetect	50	1	0.9991	0.09
Silver (dissolved)	MW-G31B	46	0	100% Nondetect	50	1	0.9991	0.09
Silver (dissolved)	MW-G32A	46	0	100% Nondetect	50	1	0.9991	0.09
Silver (dissolved)	MW-G32B	46	0	100% Nondetect	50	1	0.9991	0.09
Silver (dissolved)	MW-G33A	46	0	100% Nondetect	50	1	0.9991	0.09
Silver (dissolved)	MW-G33B	46	0	100% Nondetect	50	1	0.9991	0.09
Vanadium (dissolved)	MW-G24A	34	0	100% Nondetect	10	1	0.9985	0.15
Vanadium (dissolved)	MW-G24B	34	0	100% Nondetect	10	1	0.9985	0.15
Vanadium (dissolved)	MW-G25A	34	0	100% Nondetect	10	1	0.9985	0.15
Vanadium (dissolved)	MW-G25B	34	0	100% Nondetect	10	1	0.9985	0.15
Vanadium (dissolved)	MW-G28A	34	0	100% Nondetect	10	1	0.9985	0.15
Vanadium (dissolved)	MW-G28B	34	2.9	13	13	1	0.9985	0.15
Vanadium (dissolved)	MW-G29A	34	0	100% Nondetect	10	1	0.9985	0.15
Vanadium (dissolved)	MW-G29B	34	0	100% Nondetect	10	1	0.9985	0.15
Vanadium (dissolved)	MW-G30A	34	0	100% Nondetect	10	1	0.9985	0.15
Vanadium (dissolved)	MW-G30B	34	2.9	11	11	1	0.9985	0.15
Vanadium (dissolved)	MW-G31A	34	0	100% Nondetect	10	1	0.9985	0.15
Vanadium (dissolved)	MW-G31B	34	0	100% Nondetect	10	1	0.9985	0.15
Vanadium (dissolved)	MW-G32A	34	0	100% Nondetect	10	1	0.9985	0.15
Vanadium (dissolved)	MW-G32B	34	2.9	17	17	1	0.9985	0.15
Vanadium (dissolved)	MW-G33A	34	0	100% Nondetect	10	1	0.9985	0.15
Vanadium (dissolved)	MW-G33B	34	0	100% Nondetect	10	1	0.9985	0.15
Total # comparisons with 1 verif sample:			128	Total n for comparisons with 1 verif sample:			5643	0.06

Note:
*Most recent sample date is March 2023.

Table E-4

Analytes & Reporting Limits - Appendix IX Metals and General Chemistry

Analyte	SW-846 Method	Reporting Limit (mg/L)
Antimony	6000 Series	0.3
Arsenic	6000 Series	0.01
Barium	6000 Series	0.2
Beryllium	6000 Series	0.003
Cadmium	6000 Series	0.005
Chromium	6000 Series	0.05
Cobalt	6000 Series	0.07
Copper	6000 Series	0.06
Lead	6000 Series	0.01
Nickel	6000 Series	0.05
Selenium	6000 Series	0.02
Silver	6000 Series	0.05
Thallium	6000 Series	0.4
Tin	6000 Series	8
Vanadium	6000 Series	0.01
Zinc	6000 Series	0.02
Mercury	7470	0.002
Cyanide, Free (1)	9014 or OIA-1677	0.04
Sulfide, Total	9030	10
Sulfate	9056	10

1) Cyanide samples are performed with a laboratory filtration prep .

Currently promulgated SW-846 Methods may be used, if different from above.

APPENDIX E-1

Hydrogeologic Assessment

See VFC Document # 83546904, pages 1241 - 1891

APPENDIX E-2

Addendum to Hydrogeologic Assessment

Greenbelt II Cell A

See VFC Document # 83546904, pages 1892 - 2101

APPENDIX E-3

November 1997 Hydrogeologic Investigation

See VFC Document # 83546904, pages 2102 - 2334

APPENDIX E-4

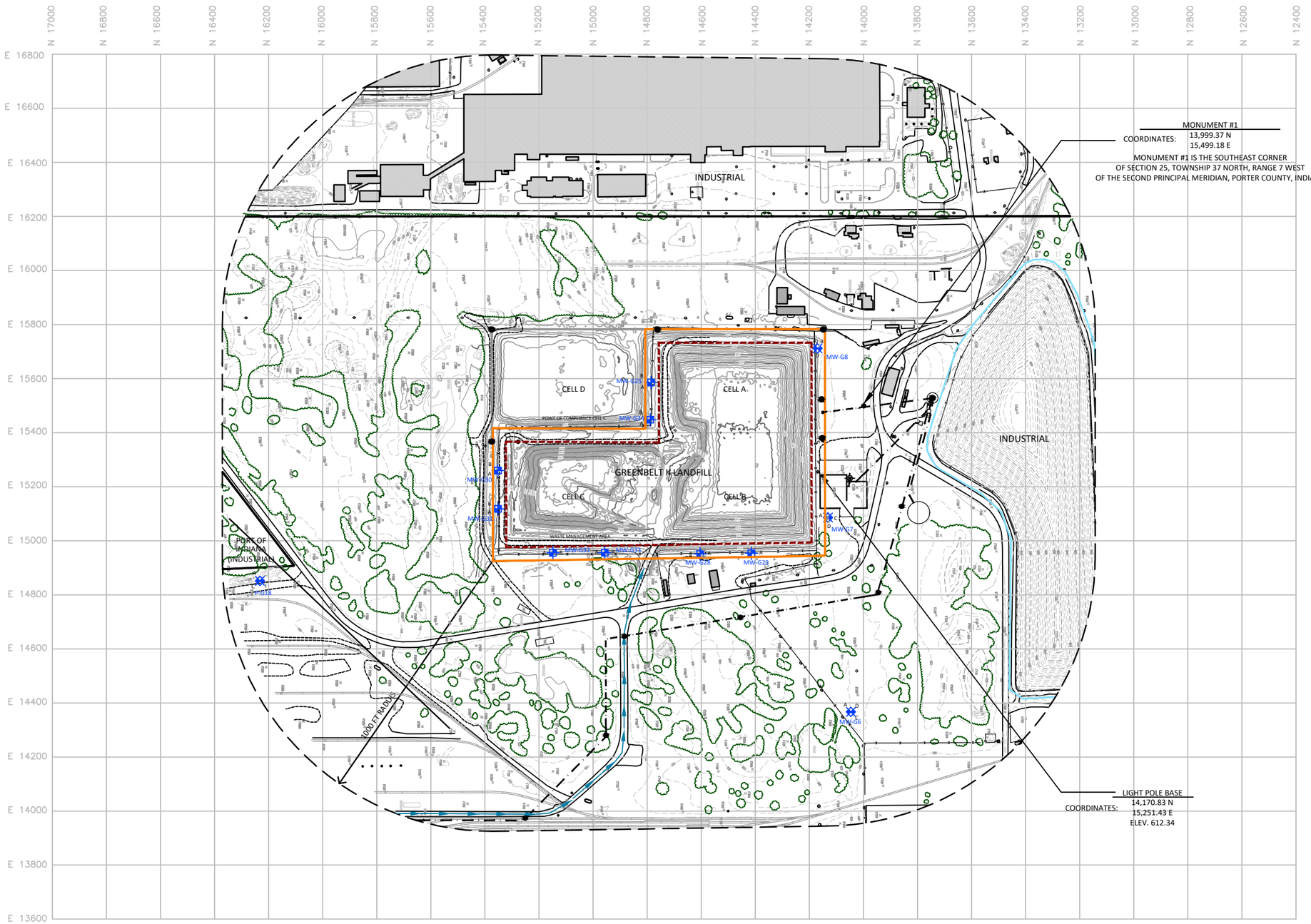
Supplemental Hydrogeologic Investigation (June 1999)

Greenbelt II Cell A

See VFC Document # 83546904, pages 2335 - 2612

APPENDIX E-5

Topographic Map



LEGEND

- POINT OF COMPLIANCE
- WASTE BOUNDARY
- SURVEYED PARCEL BOUNDARY (GREENBELT I LANDFILL)
- APPROXIMATE FACILITY PROPERTY BOUNDARY
- SEWER LINE
- FENCE
- HAUL ROUTE
- RAILROAD TRACKS
- MONITORING WELL (MW-G28 A B)
- PIEZOMETER (P-G8 A B)
- CONTOUR INTERVAL 10 FT
- CONTOUR INTERVAL 2 FT
- VEGETATION
- MANHOLE
- BUILDING
- WITHDRAWAL WELL

NOTES:

1. SITE PLAN DEVELOPED FROM AERIAL SURVEY PERFORMED ON FEBRUARY 20, 2003 BY WILLIAMS AERIAL AND MAPPING, INC. AND UPDATED BY FIELD SURVEYS PERFORMED BY WEAVER CONSULTANTS GROUP ON 5/30/2023 IN CELL A, B, C AND CELL D.

2. PROPERTY LINES ADAPTED FROM SURVEY BY DLZ INDUSTRIAL, LLC. PROJECT 0350-6010, DRAWING NUMBER 6010PL DATED MAY 13, 2003 AND US STEEL MIDWEST PLANT DRAWING 901-0171 DATED JUNE 9, 2003.

3. NO SIGNIFICANT SURFACE WATER BODIES ARE LOCATED WITHIN 1,000 FEET OF THE GREENBELT II LANDFILL.

4. THERE IS NO 100 YEAR FLOODPLAIN LOCATED WITHIN 1,000 FEET OF THE GREENBELT II LANDFILL.

5. THERE ARE NO DRAINAGE OR FLOOD CONTROL BARRIERS WITHIN 1000 FEET OF THE GREENBELT II LANDFILL

6. AREAS INSIDE GREENBELT II WASTE BOUNDARY USED FOR UNLOADING

7. PLANT UPDATES OF SEWER LINE PER N.A. WATER SYSTEMS DRAWING A744-0305 (WASTE PRETREATMENT FACILITIES, CHROME TREATMENT & OIL SEPERATION, GREENBELT LANDFILL PIPELINE, PLAN VIEW) DATED 7/30/10.

N

APPROXIMATE GRAPHIC SCALE

400 0 200 400 800

1 inch = 400 ft.

PREPARED FOR: USS

TOPOGRAPHIC MAP

GREENBELT II LANDFILL
US STEEL CORPORATION - MIDWEST PLANT
PORTAGE, IN

Weaver Consultants Group
CHICAGO, ILLINOIS
(312) 922-1030 www.wcgrp.com

DRAWN BY:	RMD
REVIEWED BY:	MM
DATE:	8/7/2023
FILE:	1146-301-08
CAD:	GB II - SiteLayout.dwg

APPENDIX E-5

APPENDIX E-6

Groundwater Sampling and Analysis Plan

October 2023
Project No. 1146-301-01

GROUNDWATER SAMPLING AND ANALYSIS PLAN

Greenbelt II Landfill
United States Steel Corporation
Midwest Plant
Portage, Indiana

GROUNDWATER SAMPLING AND ANALYSIS PLAN
GREENBELT II LANDFILL

TABLE OF CONTENTS

GROUNDWATER SAMPLING AND ANALYSIS PLAN
GREENBELT II LANDFILL

TABLE OF CONTENTS

LIST OF TABLES

LIST OF EXHIBITS

LIST OF FIGURES

LIST OF APPENDICES

1. INTRODUCTION

United States Steel Corporation (USS) will operate and maintain a groundwater monitoring system capable of detecting statistically significant changes in groundwater quality occurring downgradient of the facility. The groundwater monitoring system at the Greenbelt II Landfill consists of a network of monitoring wells and piezometers as shown on **Table 1**. With respect to groundwater flow, monitoring wells are positioned both upgradient and downgradient of the facility. During regular semi-annual monitoring events, samples will be collected from monitoring wells and water level elevations will be measured for monitoring wells and piezometers. Groundwater elevations will be used to estimate hydraulic gradients, groundwater flow directions and flow velocities.

The purpose of this Sampling and Analysis Plan is to provide a framework for the consistent collection of groundwater samples which are verifiable and representative of existing groundwater conditions.

Procedures for inspection of the groundwater monitoring system and sampling equipment, groundwater sample collection, water level measurement, sample preservation and handling, chain of custody documentation, and the analysis of the samples collected at the Greenbelt II Landfill are described in the following sections. Sampling and analysis of groundwater at the Greenbelt II Landfill will be performed in accordance with the procedures and methods outlined in this plan. Deviation from this plan requires approval from the Indiana Department of Environmental Management (IDEM).

2. OVERVIEW OF GROUNDWATER MONITORING REQUIREMENTS

2.1 General Groundwater Monitoring Requirements

The IDEM Permit stipulates that groundwater quality will be assessed at least semiannually during the active life of the facility and the post-closure period. **Table 2** below provides a list of the sampling and analysis parameters for the Greenbelt II Landfill.

TABLE 2

Greenbelt II Landfill Indicator Parameters
United States Steel Corporation
Midwest Plant

ANALYTE	SW-846 METHOD[1]	EQL (ug/l)
Cadmium (dis.)	6000 series	5
Chromium (dis.)	6000 series	50
Lead (dis.)	6000 series	10
Mercury (dis.)	7470	2
Nickel (dis.)	6000 series	50
Silver (dis.)	6000 series	50
Vanadium (dis.)	6000 series	10
Free Cyanide	SW846-9014 or OIA-1677	40
Sulfate	9056	10 mg/L

EQL = Estimated Quantitation Limits are the lowest concentrations of analytes in groundwater that can be reliably determined within specified limits of precision and accuracy by the indicated methods under routine laboratory operating conditions.

[1] Currently promulgated SW-846 method will be utilized.
6000 series methods refers to the most current promulgated method for 6010 or 6020.

Field measurements of pH, specific conductivity, temperature, and turbidity will be collected and recorded of the purged and sampled groundwater. These parameters along with sulfate constitute the groundwater monitoring constituents.

2.2 Groundwater Quality Background

The background groundwater quality database for the detection monitoring program is summarized in Appendix E-7 of the Permit.

2.3 Pre-Sampling Preparation

Preparation for a successful sampling event must begin in advance of field sampling operations. As much as possible, sampling events will be scheduled at least two weeks in advance of the sampling event. This allows time for preparation and assembly of sampling equipment, sampling bottles, labels, chain of custody forms, and Field Data Sheets. Prior to sampling, the monitoring equipment will be assembled and carefully inspected to verify proper working order and supply. Worn or discolored equipment will be replaced or repaired. Batteries for field meters will be checked and if necessary, replaced, including the following:

- QED Model MP10 Digital Controller;
- Heron Dipper-T2 Series #1200 Water Level Meter (or equivalent depth to water level meter); and
- YSI ProDSS Water Quality Flow Cell/Probe with in-line Turbidity Meter (or equivalent water quality meter/turbidity meter combination).

Functionally equivalent equipment may be utilized without modification to the SAP.

The expiration date of the calibration buffers will be checked. If expired, fresh buffers will be obtained. The Flow Cell will be calibrated and checked for drift and stability. The supply of incidental sampling equipment, including the 0.45 micron filters and a calibrated bucket will be evaluated. Results will be documented on the Semi-Annual Ground Water Inspection form (**Exhibit 5**). The signature of the person who performed the inspection and date of inspection will be recorded on the inspection form. Necessary repairs to the monitoring well network that are identified during the inspections will be conducted in accordance with a schedule which verifies that the issue will not influence the collection of groundwater samples. If required, the repairs will be conducted prior to the next groundwater sampling event.

Although every effort will be made to adhere to established schedules, sampling schedules are subject to change based on factors beyond the facility's control, such as weather. No sampling will occur at the Greenbelt II Landfill during inclement weather conditions (i.e., when precipitation in the form of rain or snow will potentially contaminate samples, when winds are high enough to cause blowing sand and other materials to uncontrollably contaminate samples, or when the weather is so cold that it interferes with the operation of equipment or the sampling crew's ability to exercise effective quality control). The decision to postpone or delay a sampling event will be at the discretion of the Project Manager and will be reported to the IDEM, if such a delay extends beyond the calendar month(s) for which the sampling event was originally scheduled.

3. GROUNDWATER SAMPLE COLLECTION

Regular semi-annual sampling events will consist of sampling representative groundwater from the monitoring wells referenced on **Table 1**.

Prior to sampling, water levels will be measured in monitoring wells and piezometers. If an insufficient volume of water is measured within a well, the procedures as outlined in Section 3.2.2 and/or Section 3.2.3 will be implemented, depending on the conditions encountered. **Table 1** identifies the well/piezometer construction details, total depths, and referenced elevations.

Detection groundwater monitoring at the Greenbelt II Landfill will be conducted on a semi-annual basis. Therefore, twice a year, groundwater samples from the monitoring wells and water levels from monitoring wells and piezometers listed on **Table 1** will be collected. The months of March-April and September-October are designated as the sampling event periods.

3.1 Sampling Personnel

Field sampling personnel are key to overall quality control of the data. Key responsibilities and tasks which must be performed by field personnel include:

- Reviewing the Sampling and Analysis Plan. Field sampling personnel should develop an understanding of sampling locations, methods, sample quantities, and personnel protective measures required;
- Verifying that a copy of the Sampling and Analysis Plan and equipment manuals are available for reference at the monitoring well head when groundwater samples are collected;
- Verifying that samples are representative of the conditions and the matrix from which the sample was collected by following the procedures outlined in the Sampling and Analysis Plan;
- Verifying that only equipment specified in the Sampling and Analysis Plan are used to collect groundwater samples;
- Calibrate field meters at the beginning of the sampling day to verify proper operation. Document the calibration with the field meter identification, date and time of calibration, calibration standards used (including expiration dates), calibration results, and the name of the person who performed the calibration in the Daily Safety Briefing and Calibration Form (Exhibit 1). Calibration procedures are included in the equipment manuals;
- Properly preserving, packaging, and shipping samples so that they arrive at the laboratory unaltered; and

- Implementation of chain-of-custody procedures and the proper documentation of field conditions and field measurements such as pH, temperature, specific conductance.

3.2 Groundwater Sampling Procedures

The procedures which will be used to sample groundwater at the Greenbelt II Landfill are as follows.

A copy of this Sampling and Analysis Plan (SAP) will accompany the sampling team on groundwater sampling events. A copy of the Groundwater Quality Assurance Manual from the laboratory is included in **Appendix A** to this SAP. **Table 3** specifies sample container types, types of preservatives, holding times, and analytical methods for groups of parameters in the facility-specific list of Appendix IX hazardous constituents in 40 CFR 264.

The team will review the well sampling sequence and identify the first well scheduled for sampling. Wells will be located on the facility map (**Figure 1**) prior to proceeding to the proper sampling location. At well locations, general observations of site and weather conditions will be noted on the Field Data Sheet. Monitoring wells and piezometers will be carefully observed for signs of deterioration or other problems (e.g. rusted or broken locks, crumbling or cracked surface pad, missing well cap, standing water, etc.). If problems are observed, they will be noted on the Semi-Annual Groundwater Inspection Form (**Exhibit 5**) and reported to the facility in a timely manner.

3.2.1 Groundwater Elevation and Sample Representativeness

The static water level in monitoring wells and piezometers will be measured (Note: water level measurements must be taken from all wells in a cluster prior to purging any of the wells in the cluster). Depth measurements will be referenced from the top of the inner PVC well casing. Measurements will be taken to the nearest hundredth (0.01) of a foot and shall consistently be taken from the mark placed on the top of the inner PVC well casing. The elevations of the casings in the monitoring well system shall be related to a permanent reference point, using United States Geological Survey datum (feet NGVD). The most recently surveyed elevation of the inner PVC well casing, steel outer protective cover, concrete surface pad, and ground elevation for wells and piezometers is included in **Table 1**. Construction diagrams for the monitoring wells and piezometers are provided in **Appendix B**.

If visible damage is observed to a piezometer or monitoring well during sampling activities (i.e., slumping or settlement), it will be resurveyed in order to maintain the accuracy of the reporting of groundwater elevation.

To calculate the static water elevation, the static water level measurement will be subtracted from the elevation of the top of the casing. The recorded elevation of the top of casing of each well and piezometer is listed on **Table 1**.

The installation and use of dedicated tubing and pumps in monitoring wells makes the precise measurement of total well depth during each sampling event impractical. A standard depth to water level probe cannot fit past the dedicated bladder pumps in a two inch well. Removing the pumps during each sampling event would significantly increase the possibility of contaminating either the pumps or the dedicated tubing, and defeat the purpose of the dedicated sampling equipment.

The primary purpose of total well depth measurements in the past was to evaluate sample representativeness (i.e., the greater the siltation, the higher the potential for producing samples that are turbid). More recently, measurements of sample turbidity are used to directly evaluate sample representativeness. Since total well depth will not be measured, each well sampled will be evaluated for field turbidity. This will eliminate the requirement of monitoring total well depth.

Because the piezometers do not contain dedicated pumps, total well depth measurements will be obtained from piezometers during semi-annual monitoring events.

3.2.1.1 Decontamination of Non-Dedicated Equipment

The monitoring well network is purged and sampled utilizing dedicated equipment. However, water levels are obtained from piezometers and monitoring wells utilizing one of the meters included in this SAP. Therefore, these meters will be decontaminated before being introduced to a monitoring well or piezometer. The head of the indicator will be cleaned in a non-phosphate detergent wash. The probe will be abraded with a bristled brush in the detergent. The probe will then be rinsed in distilled or deionized water. The measuring tape will be wiped with clean paper towels soaked in distilled or deionized water as the tape is removed from the well or piezometer. Once the tape has been returned to the reel, the tape will again be rinsed with distilled or deionized water.

3.2.2 Purging and Sampling Activities

Purging and sampling activities will be performed using dedicated MicroPurge bladder pumps and tubing. The specifications of the pumps and tubing are provided in **Table 4**, and will be as follows:

- Stainless steel construction;
- Teflon bladder; and
- Teflon-lined polyethylene tubing.

In addition to the above dedicated bladder pumps and tubing, the following components will be required in order to purge and sample each monitoring well:

- The QED Model MP10 Digital Controller;
- YSI ProDSS Multiparameter Water Quality Flow Cell/Probe with in-line Turbidity Meter (or equivalent water quality/turbidity meter combination);
- The Heron Dipper-T2 Series #1200 Water Level Meter;
- A source of compressed air; and
- A calibrated bucket.

Operation and Maintenance User Guides for the MicroPurge bladder pumps, QED MP-10 Digital Controller, YSI ProDSS Water Quality Flow Cell/Probe, and Heron Dipper-T2 Series #1200 are included in **Appendix C**. Functionally equivalent equipment may be utilized without modification to the SAP.

The air compressor is connected to the pump controller, which is then connected to the air supply line at the monitoring well. The in-line flow cell is connected to the tubing discharging from the well so that the water being purged from the well can be analyzed in-line before exiting to a calibrated bucket.

The monitoring wells will be purged using the QED Model MP10 Digital Controller (controller box) and a supply of compressed air. Pursuant to various USEPA guidance documents, the dedicated bladder pump intakes have been placed at the approximate midpoint of the screened intervals. If during a monitoring event the groundwater elevation is found to have fallen below the pump intake, the pump intake will be lowered to a depth not closer than six inches from the bottom of the well screen. Given the relatively slow pump rates, six inches should be a sufficient enough distance above the well bottom to minimize the amount of sediment drawn into the pump. If the groundwater elevation falls below six inches above the bottom of the well screen or if stabilization criteria for the field parameters cannot be met due to the close proximity of the

pump intake to the bottom of the well, then the procedures described in Section 3.2.3 (Low Water Sampling Contingency Procedures) will be implemented to obtain a groundwater sample.

The controller box regulates the supply of compressed air added to the bladder pump. Timed on/off cycles of compressed air alternatively squeeze the flexible bladder to displace water out of the pump, and release it to allow the pump to refill by submergence, minimizing disturbance that could affect sample chemistry. The bladder prevents contact between the pump drive air and the sample.

After the above components are installed properly, purging should be conducted at a rate which minimizes the stress (i.e., drawdown) to the groundwater system. In order to achieve this objective, the groundwater elevation/drawdown will be regularly measured and recorded on the Field Data Sheet during the purging process. Typically, flow rates on the order of 0.1 to 0.5 Liters per minute (0.03 to 0.13 gallons per minute) are used, however this will be dependent upon site-specific hydrogeology.

Stabilization of field parameters, pH, specific conductance, temperature, and turbidity will be used to assess when formation water is accessed during purging. The assessment of stabilization of field measurements will be made on a well-by-well basis, and will be based on the pattern of measurements observed at the individual monitoring well. The field parameters will be continuously measured and recorded on the Field Data Sheet in intervals of three (3) to five (5) minutes.

Monitoring wells will be initially purged at a rate of approximately 0.10 gallons per minute. This initial rate may be adjusted for each well, with the objective being to purge at a rate which creates minimal drawdown (i.e. +/- 0.3 feet), although during initial pump start-up, drawdown may temporarily exceed this, before recovery.

Note that an initial minimum purge volume must be removed so that representative groundwater from the aquifer is accessed. This volume is equal to the volume contained in the pump and associated tubing. The volume contained in the pump and associated tubing for the deepest well currently monitored (i.e. MW-G25B) is approximately 0.3 gallons. Therefore, obtaining field measurements at a frequency of three to five minutes, at flow rates as low as 0.1 gallons per minute, will allow for independent field measurements.

Stabilization is considered to be achieved when three consecutive measurements, taken at three (3) to five (5) minute intervals, are within the following limits:

- pH (+/- 0.5 standard pH units);
- Specific conductance (+/- 25 umhos);
- Temperature (+/- 1.0 °F); and
- Field turbidity (+/- 5 NTU).

Measurements of temperature, pH, specific conductance and drawdown will be recorded on the Field Data Sheet at intervals of three to five minutes as described above.

The purging equipment will not be allowed to come into contact with the ground surface or other potential sources of contamination. The low flow purging and sampling techniques will not create a perturbation in the hydraulic gradient of sufficient magnitude as to cause a reversal in hydraulic gradient. This will verify that groundwater quality in the vicinity of the monitoring well is representative of the discrete interval the well is intended to monitor.

The average and maximum flow rates will be recorded on the Field Data Sheet. The Field Data Sheet form is discussed in detail in Section 4.0. An example of this form is included as **Exhibit 2**. The sequence of purging and sampling will be from shallower to deeper wells within a cluster. If an additional set of purging/sampling equipment is available to sampling team members, wells may be purged and sampled simultaneously. Purge water will be collected in graduated containers to tabulate the total amount of purged water. The total quantity of water purged will be recorded on the Field Data Sheet. Purged water from monitoring wells will be discarded away from the well footing.

Groundwater samples will be collected for chemical analyses immediately after pumping or purging is complete. Sampling team members will wear fresh, clean latex or nitrile gloves to minimize the possibility of well cross-contamination and to safeguard the health of sampling team members. Sampling will occur using the same dedicated pumps and tubing that were utilized during purging. In order to maintain equilibrium within the aquifer being sampled, the flow rate used during sample collection must be similar to the flow rate maintained during the purging process.

Water samples for dissolved metals analysis will be filtered through a 0.45 micron high capacity in-line filter. The dedicated bladder pumps can be equipped with fittings to allow in-line filtration as the water exits the well. This will be the primary method of field filtration. The dissolved metals sample will be propelled through the filtration device and the sample will be immediately placed into the preserved bottle as the sample exits the filter membrane.

Appropriate preservatives will be added to the containers in the laboratory prior to sampling (see Section 3.3 for a detailed discussion of preservation methods). Samples will be filtered at a rate which does not cause splashing or noticeable aeration of the sample. The sample container will be tilted approximately 45 degrees to allow the sample to run gently down the slope of the container. The sample container will be protected from blowing dust and other sources of contamination during the filtering process.

The sample appearance, including color, turbidity, odor or other notable physical characteristics, will be recorded on the Field Data Sheets (**Exhibit 2**).

Samples to be collected at the Greenbelt II Landfill will include the indicator parameters identified in **Table 2**. Samples will be collected in the following order:

- Temperature, pH, Specific Conductance, Turbidity (field parameter measurements recorded during purging and sampling);
- Dissolved Metals;
- Free Cyanide; and
- Sulfate.

At wells selected for quality control, the sampling procedures outlined in Section 5.2 will be followed.

Samples will be stored on ice in coolers immediately after collection. Samples will be maintained at 6°C or lower. Proper chain-of-custody procedures will be followed. These procedures are described in Section 4.4. Proper preservation of groundwater samples will be documented by recording sample temperatures prior to shipment to the laboratory on the Field Data Sheets, as outlined in Section 4.3 of the SAP. In addition, the temperature inside the coolers containing the samples will be verified by the laboratory upon receipt of the coolers and recorded on either the chain-of-custody forms or elsewhere in the laboratory report.

3.2.3 Low Water Sampling Contingency Procedures

If insufficient water is available in the well casing for sampling or if stabilization criteria for the field parameters included in Section 3.2.2 cannot be met due to the close proximity of the pump intake to the bottom of the well, the first step will be the redevelopment of the well. The redevelopment will include forcing water in and out of the monitoring well screen to move silt and clay particles out of the filter pack around the well screen and into suspension within the well. Water movement is effected using a surge block, bailer, rotary or Waterra pump, or compressed gas. The sediment-laden water is removed from the monitoring well using a pump,

bailer, or air compressor. Surging of the well is continued until the water removed is essentially free of suspended silt and clay particles.

If insufficient water is available after redevelopment efforts, then a replacement monitoring well will be installed within ten feet of the original well. IDEM will be notified of the monitoring well installation activities. The replacement well will be installed in accordance with procedures described in Appendix E-8 of the Permit. Following completion of field activities, a monitoring well completion report will be prepared and submitted to the IDEM in accordance with Appendix E-8.

The replacement monitoring well screen will be installed at a depth lower than the original well, with an approximate two foot overlap (i.e., assuming a 10 ft. well screen is installed, approximately 8 feet deeper than the original well). The pump will be fitted with new tubing from the manufacturer of the bladder pumps in order to lower the pump so that it may be installed within the screened interval of the replacement well. The tubing will be shipped within a sealed package and will not require decontamination. The original well will be maintained in the event the water level rises above the top of the screen in the replacement well. At the beginning of a sampling event, an evaluation of the groundwater level will be made from both the original and replacement monitoring wells. If the water level has risen above the screen within the replacement well (deeper well), the pump will then be transferred to the original monitoring well since the deeper well will no longer intersect the water table, and there will be at least two feet of water present in the original well. If the water level is within the two foot zone where the original and replacement wells overlap, then sampling could be conducted from either well because both wells will be screened across the water table. If a replacement well has been installed at a specific location, only one well intersecting the water table will be sampled at that location during a semi-annual sampling event.

3.3 Sample Preservation, Handling, Packaging and Shipment

To minimize the degradation/modification of chemicals in water samples during transit and storage, samples will be containerized and preserved as outlined in **Table 3** for the compounds of interest. Samples will be cooled to 6°C or less immediately following their collection in the field. Sufficient ice will be placed in the cooler to verify that the required temperature is maintained during shipment. The inside cooler temperature will be measured immediately prior to shipping/transport and recorded on the Field Data Sheets. The cooler temperature will be measured upon receipt in the laboratory and recorded on the chain-of-custody document or included elsewhere within the laboratory report. If samples are shipped by common carrier, a sample seal will be affixed on the exterior of the shipping container.

Sample containers and necessary preservatives will be provided by the laboratory conducting the analysis. Sample containers will be new and certified sterile prior to their use. Sufficient quantities of base or acid preservatives will be placed in the sample containers by the laboratory. Quantity of preservative will be based upon previous knowledge of site groundwater pH and the volume of the container. Efforts to preserve the integrity of the samples will be initiated at the time of sampling and will continue until analyses are performed.

Water-proof labels will be firmly affixed to the sample containers and will include the project name, sample identification, the date and time the sample was collected, the analysis required, the initials of the person who collected the sample, and the type of preservative used. A representative sample label is shown as **Exhibit 3**.

4. SAMPLE MANAGEMENT AND DOCUMENTATION

4.1 Introduction

The goal of a Sample Management and Documentation Program is to verify that documents related to measurement data are accountable after sampling is conducted.

Documents included in the program are:

- Field Data Sheets;
- Chain-of-Custody Records; and
- Analytical Data from Laboratories

Unless prohibited by weather, waterproof ink is used in recording data on serialized accountable documents.

4.2 Serialized Documents

Documentation to be compiled during sampling event will include: Daily Safety Briefing and Calibration Form (**Exhibit 1**), Field Data Sheets (**Exhibit 2**), Sample Label (**Exhibit 3**), Chain of Custody (**Exhibit 4**) and Semi-Annual Groundwater Inspection Checklist (**Exhibit 5**).

4.3 Field Data Sheets

Field Data Sheets will be compiled during sampling events. Field measurements and observations are recorded on the Field Data Sheets with pertinent information necessary to explain and reconstruct sampling operations. The Field Data Sheets will document the following:

- Site;
- Names of sample collectors;
- Purpose of the sampling event;
- Elevation of reference point on the inside well casing;
- Well identification;
- Field turbidity measurements;
- Determinations for field groundwater monitoring constituents;
- Sample appearance;
- Static water level;
- Well evacuation equipment;
- Sample withdrawal equipment;
- Samples filtered;

- Date and time of collection, including well sampling sequence;
- Sample identification numbers;
- Type of sample containers;
- Sample preservation types and amounts;
- Parameters requested for analysis;
- Field observations related to sampling;
- Unusual problems or deviation from standard procedures;
- Well condition;
- Climatic conditions;
- Corrections will be dated and initialed; and
- Cooler temperature prior to shipment to the laboratory.

The Daily Safety Briefing and Calibration Form, sample bottle label, Field Data Sheet, and chain of custody form developed for the Greenbelt II Landfill are shown in the **Exhibits** to the SAP. Sample identification documents, chain-of-custody records, and the handling and presentation of laboratory data are discussed thoroughly in **Appendix A**.

4.4 Chain of Custody Procedures

In order to properly maintain the integrity of samples from the time of collection to the time of analyses, a chain-of-custody program must be followed. At the end of the sampling day, coolers containing samples for analysis will have a sample seal affixed on the exterior of the cooler (shipping container). A chain-of-custody form will be prepared as part of the sample documentation. The cooler will then be transported to the laboratory by a member of the sampling team or a representative of the laboratory will take possession of the cooler at the Midwest Plant. The sampling team member will then relinquish possession of the coolers to the laboratory representative. When the cooler is opened by the laboratory, the internal temperature will be measured and noted within the laboratory report. The number of containers will be verified with the number indicated on the chain of custody form.

If the laboratory is not equipped to perform all analysis required, then the laboratory will follow a similar chain of custody procedure as described for the field to laboratory transfer. If a common carrier is used, a sample seal will be placed on the shipping container prior to transport, and a copy of the chain of custody will accompany the shipping container. An example of the form that will be used to track the chain-of-custody of groundwater samples is shown as **Exhibit 4**. A similar, but not identical form may be utilized, as long as the same information is included on the alternate form.

5. QUALITY CONTROL AND ANALYTICAL PROCEDURES

5.1 Introduction

The purpose of this section is to verify QA/QC in sampling and analysis by the use of Control Samples. To successfully comply with this QA/QC Program, it is essential that controls are initiated and maintained throughout the analysis of samples. Field QA/QC procedures such as the use of proper sampling technique and decontamination procedures were discussed in earlier sections of this plan. Additional QA/QC measures include the use of control samples.

The permittee will employ the following types of control samples (blanks, duplicates, spikes, etc.) to ensure the accuracy of data collected. The correct application of the different types of control samples is discussed in the following paragraphs.

5.2 Control Samples

Control samples are those which are introduced into the train of actual samples as a monitor on the performance of the sampling procedures and the analytical system. A control sample may consist of a standard or natural matrix.

Types of control samples include duplicates, trip blanks, and spikes. Each type provides a different form of quality control for the analytical system, as follows:

5.2.1 Field Duplicates

- A field duplicate is a second sample collected at the same time and location as an original (regular) sample. Field duplicates help assess the precision and reliability of the sampling system, laboratory instruments and procedures, and field sampling activities. They will not provide indications of matrix effects or accuracy.
- Field duplicate samples will be collected concurrently with regular samples (i.e. both regular and duplicate containers of a monitoring parameter will be filled before proceeding to the next monitoring parameter) using the order of parameters specified in Section 3.2.2. Sufficient volume of water must be present in the well so that both regular and duplicate samples can be collected in a single purge and sample effort for the required parameters.
- The time and location of duplicate samples will be omitted from the container labels and chain-of-custody form. For later reference, the time and location of the duplicate samples will be recorded on the Field Data Sheet (which is not submitted to the laboratory). One field duplicate sample will be collected for every 10 wells sampled for analysis.

5.2.2 Trip Blanks

- Trip blanks provide an indication of positive interferences introduced in the field or laboratory. Trip blanks are used to assess contaminant introduction due to: (1) interaction between the sample and the container, or (2) a handling procedure which alters the sample analysis results. They will not provide information on matrix effects, accuracy, precision, or natural background.
- Trip blanks are created at the laboratory by filling a designated sample container with reagent grade deionized water. The trip blanks must then accompany the independent samples throughout the sampling event. Because trip blanks are containerized off site, a trip blank is not deemed a sample until it physically enters the facility monitoring/compliance boundary.
- The trip blanks will be analyzed for volatile organic compounds (VOCs) only. A minimum of one trip blank will be analyzed per day that VOC containers are shipped/transported to the laboratory. If VOC containers for the sampling event are shipped/transported to the laboratory on the same day, then one trip blank will be included with the shipment and analyzed. If no VOCs are included on the analytical list for a sampling event, then no trip blank will be required.

5.2.3 Matrix Spike/Matrix Spike Duplicate

- Spikes in standard matrices can provide information on accuracy but will not indicate matrix effects or natural background levels.
- Spikes of natural samples in conjunction with analyses of unspiked natural samples can provide information on matrix effects, natural background, and accuracy. Matrix spike/matrix spike duplicate samples will be obtained by filling appropriate sample bottles with groundwater in accordance with procedures outlined in this SAP from an on-site monitoring well sampled during the sampling event. The matrix spike/matrix spike duplicate samples will be labeled in a unique manner. One matrix spike/matrix spike duplicate will be collected for every 20 ground water samples collected.

In case of sample breakage, the replacement sample(s) will be collected within 14 days of notification by the laboratory. The laboratory has been instructed to notify the sampling crew of any broken samples within 72 hours of delivery to the laboratory.

Analytical results submitted to IDEM will include at a minimum the following items:

- Signed chain-of-custody form;
- Sampling dates;
- Analysis dates;
- Analytical methods used;
- Estimated quantitation limits (EQL); and
- Quality control (QC) results.

The QA/QC results submitted to IDEM will include at a minimum summary reports containing the following items:

- Method of standard addition (ICP) or serial dilution analysis (ICP) (as applicable);
- Tuning criteria (GC-MS);
- Initial and continuing calibration results;
- Method blank results;
- Internal standard areas (GC-MS, ICP-MS);
- Matrix spike/matrix spike duplicate (MS/MSD) results;
- Laboratory control sample results; and
- Surrogate recoveries (GC-MS).

Raw data consisting of chromatograms, recorder outputs, mass spectrum reports, computer printouts, charts, graphs, bench sheets or other data will be available upon request for at least three years, but will only be provided to IDEM in response to a written request by IDEM prior to the sampling event.

The results of analyses performed on quality control samples will be reported along with the analytical results obtained for the groundwater samples. The analytical methods used are described in the Quality Assurance Manual included in **Appendix A**. The analyses are currently performed by ALS Environmental (ALS) of Holland, Michigan.

Another qualified analytical laboratory other than ALS could perform future analysis, so long as the specifications and procedures included in the Quality Assurance Manual in **Appendix A** are followed.

The semi-annual groundwater monitoring reports will include a narrative summary of quality control (QC) results. The summary should include field deviations from the SAP, as well as laboratory quality control problems stemming from the system, instrumentation, analyst, or sample matrix. Corrective measures should be identified and described, if corrective measures were needed.

6. REVISIONS TO THIS SAMPLING AND ANALYSIS PLAN

In accordance with 40 CFR 270.42, the permittee shall obtain the approval of the IDEM for any modification to the approved Sampling and Analysis Plan prior to implementation of that modification. Approved modifications shall contain a revision control number and date on each page.

Tables

(Note: Table 2 included in text)

Revised October 2023

Table 1

Greenbelt II Landfill Monitoring Well and Piezometer Data
United States Steel Corporation
Midwest Plant

Identification	Type	Installation Date	Screen Depth Below Ground	Elevation					Location	
				Bottom of Screen	Existing Ground	Top of Pad	Top of PVC	Top of Procover	Northing	Easting
MW-G6A	P	Mar-89	20.24	585.24	605.48	605.69	607.62	607.34	14047.98	14357.36
MW-G6C	P	Mar-89	48.52	556.98	605.50	605.73	607.27	607.56	14048.14	14370.73
MW-G6D	P	3/20-21/89	84.04	521.48	605.52	605.78	607.46	607.18	14048.20	14363.64
MW-G7A	P	Mar-89	22.17	588.01	610.18	610.20	611.88	612.10	14132.47	15092.46
MW-G7C	P	Mar-89	48.18	562.13	610.31	610.39	611.82	612.13	14129.81	15078.67
MW-G7D	P	3/13/1989	81.84	528.38	610.22	610.17	611.93	612.20	14131.10	15085.85
MW-G8A	P	Mar-89	19.57	588.62	608.19	607.54	608.92	609.20	14171.73	15716.91
MW-G8B	P	Mar-89	47.98	559.91	607.89	607.78	609.42	609.70	14168.01	15705.59
MW-G8D	P	3/13/1989	77.51	530.41	607.92	607.70	609.06	609.35	14169.66	15711.58
PG-18A	P	12/21/1992	21.08	582.22	603.30	603.34	605.79	606.56	16237.17	14863.80
PG-18C	P	12/17/1992	55.01	548.38	603.39	603.39	605.85	606.45	16234.93	14858.98
PG-18I	P	12/16/1992	70.08	533.54	603.62	603.59	605.93	606.59	16232.62	14851.41
GP-13A	P	9/13/2010	20.0	584.46	604.46	605.09	607.32	607.53	16459.63	15854.83
GP-13B	P	9/13/2010	35.0	569.46	604.46	605.18	607.36	607.53	16454.83	15851.97
MW-G24A	MW	10/13/1993	25.00	591.06	615.87	616.05	618.26	618.81	14788.78	15441.51
MW-G24B	MW	10/13/1993	43.00	573.20	615.76	616.62	618.61	619.16	14788.91	15447.94
MW-G25A	MW	10/12/1993	26.00	591.13	617.08	617.10	618.82	619.25	14784.65	15578.35
MW-G25B	MW	10/12/1993	46.00	571.32	617.06	617.30	618.98	619.52	14785.31	15585.64
MW-G28A	MW	7/16/1998	17.80	588.48	606.29	606.67	608.48	609.39	14596.46	14952.11
MW-G28B	MW	7/20/1998	34.00	572.26	606.26	606.66	609.25	609.67	14604.16	14950.75
MW-G29A	MW	7/16/1998	16.90	589.16	606.10	606.39	609.16	609.72	14414.59	14953.48
MW-G29B	MW	7/17/1998	33.70	572.42	606.12	606.42	609.19	609.61	14421.81	14951.78
MW-G30A	MW	12/4/2000	24.50	584.26	608.76	609.41	610.90	611.19	15352.03	15252.57
MW-G30B	MW	12/4/2000	36.00	572.70	608.70	609.43	610.91	611.24	15351.65	15259.76
MW-G31A	MW	12/5/2000	25.00	584.93	609.93	610.69	612.15	612.41	15351.64	15117.83
MW-G31B	MW	12/5/2000	40.00	570.02	610.02	610.69	612.13	612.42	15352.14	15124.77
MW-G32A	MW	12/5/2000	21.50	583.83	605.33	606.22	607.86	608.23	15148.52	14955.64
MW-G32B	MW	12/5/2000	36.50	568.85	605.35	606.33	607.70	608.04	15142.07	14956.36
MW-G33A	MW	12/5/2000	21.00	585.24	606.49	607.31	608.32	608.66	14963.29	14955.40
MW-G33B	MW	12/5/2000	37.00	569.24	606.24	607.20	608.28	608.61	14956.74	14955.92

NOTES: Bottom of Screen Elevations taken from Monitoring Well Construction Diagrams, as listed in Attachment E of the facility permit.

Table 3
Sample Container, Preservative, and Holding Times

Greenbelt II Landfill
United States Steel Corporation
Midwest Plant

Parameter	Sample Size	Container Type	Preservative (Amount)	Field Filtered	Holding Time
Indicator Parameters					
Metals (except Mercury)	250 mL	Plastic	HNO3 to pH<2	Yes	6 months
Mercury	250 mL	Plastic	HNO3 to pH<2	Yes	28 days
Free Cyanide	250 mL	Plastic	NaOH to pH >/= 12	No	14 days
Sulfate	250 mL	Plastic	None	No	14 days
Sulfide*	500 ml	Plastic	NaOH / ZnAc	No	14 days

Note:
Plastic sample containers will be polyethylene with polypropylene lined caps.
*Only applicable if limited Appendix IX monitoring is required.

Table 4
List of Standard Equipment

Greenbelt II Landfill
United States Steel Corporation
Midwest Plant

ITEM	BRAND-TYPE
Dedicated Bladder Pumps - Stainless Steel Construction with dura-flex Teflon bladder.	QED Environmental Systems, Inc.
Teflon-lined Polyethylene Tubing	QED Environmental Systems, Inc.
Model MP10 Digital Controller	QED Environmental Systems, Inc.
3020 Oil-less Electric Compressor	QED Environmental Systems, Inc.
YSI ProDSS Multiparameter Water Quality Flow Cell/Probe with in-line Turbidity Meter (or equivalent)	YSI Incorporated
Dipper-T2 Series #1200 - 100' Length Electronic Water Level Indicator	Heron Instruments Inc.
Calibrated Container	Incremented one gallon bucket
FF8200 High Capacity 0.45-Micron Filters (or equivalent)	QED Environmental Systems, Inc. (or equivalent)
Decontamination Water (distilled and reagent grade)	NA

Notes:
NA - Not Applicable, Not Available, or Not Existing

Exhibits

Exhibit 1: Daily Safety Briefing and Calibration Form

Exhibit 2: Field Data Sheet

Exhibit 3: Sample Label

Exhibit 4: Chain of Custody Record Form

Exhibit 5: Semi-Annual Groundwater Inspection Checklist

DAILY SAFETY BRIEFING AND CALIBRATION FORM
US STEEL MIDWEST FACILITY, PORTAGE, INDIANA

Meeting Conducted by: _____ Date: _____

I have read the Health and Safety Plan for the project and I understand it, and agree to comply with all of its provisions. I understand that I could be prohibited from working on the project for violating any of the health and safety requirements specified in the Plan.

	Name (Print)	Signature
WCG Site Safety Officer		
WCG Site Personnel	_____	_____
WCG Site Personnel	_____	_____
	_____	_____

SAFETY BRIEFING ITEMS

	DISCUSSED Yes	DISCUSSED No
Protective Clothing/Equipment		
Chemical and Physical Hazards		
Control Methods		
Air Monitoring Action Levels and Requirements		
Hospital Name/Address/Directions		

INSTRUMENT CALIBRATION FORM

Calibration Performed By:

Instrument Manufacturer:

Instrument Model:

Instrument Serial Number:

Calibration Date/Time:

Standards Used/Expiration Dates:

UNITED STATES STEEL CORPORATION – MIDWEST PLANT
FIELD DATA SHEET

Date: _____

Site Name: U.S. Steel Greenbelt II File Number: 1146-301-01

Purpose For Sampling: GB II Semi-Annual Groundwater Monitoring Event

Well I.D.: _____ Sample I.D.: _____

Total Depth (Top of PVC): _____ ft. Water (Top of PVC): _____ft. Water Column _____ ft.

PVC Elev: _____ ft. (NGVD) Groundwater Elev: _____ ft. (NGVD)

Weather Conditions: Sunny Partly Cloudy Cloudy Temp _____ Wind _____

Time Purged: From: _____ To: _____ Well Diameter: 2 in.

Max Purge Rate: _____ gpm Volume Purged:_____ gal.

Avg Purge Rate: _____ gpm Purge Device: Dedicated Bladder Pump

Sampling Device: Dedicated Bladder Pump

Time Sampled: From: _____ To: _____

Sample Appearance: _____

Laboratory Analysis	Container Size	Container Type	Preservative/Type	Field Filtered	Head Space
METALS (*)	250 ml	Plastic	HNO_3 to pH <2	Yes	Yes
FREE CYANIDE	250 ml	Plastic	NaOH to pH > 12	No	Yes
SULFATE	250 ml	Plastic	None	No	Yes

*Metals include: Cadmium, Chromium, Lead, Mercury, Nickel, Silver, and Vanadium

Measurement ID* (3-5 minute intervals)	Time of day	Groundwater Level	Drawdown (feet)	pH (SU) (+/- 0.5 SU)	Sp. Cond. (umhos) (+/- 25 umhos)	Temp (°F) (+/- 1 °)	Turbidity (NTU) (+/- 5 NTU)
1							
2							
3							
4 (optional)							
5 (optional)							
6 (optional)							
7 (optional)							
8 (optional)							
9 (optional)							
10 (optional)							

Shipping Container Temperature: 6°C

Signature of Sampler: _____

Field Team Members: _____

Remarks: _____

*Stabilization will be considered achieved when three consecutive measurements, taken at 3 to 5 minute intervals, are within the limits specified above. If greater than 10 measurements are required, record on separate sheet of paper.

ALS Laboratory Group

3352 128th Avenue
Holland, MI 49424
Ph. 616.399.6070

Client:_____

Sample ID:_____

Date:_____ Time:_____ Collected By:_____

Analysis:_____ Preserv:_____

Chain of Custody Form

Page _____ of _____

☑ ALS Environmental
3352 128th Avenue
Holland, Michigan 49424
(Tel) 616.399.6070
(Fax) 616.399.6185

ALS Project Manager:		ALS Work Order #:	

Customer Information		Project Information		Parameter/Method Request for Analysis	
Purchase Order		Project Name		A	
Work Order		Project Number		B	
Company Name		Bill To Company		C	
Send Report To		Invoice Attn.		D	
Address		Address		E	
				F	
City/State/Zip		City/State/Zip		G	
Phone		Phone		H	
Fax		Fax		I	
e-Mail Address				J	

No.	Sample Description	Date	Time	Matrix	Pres. Key Numbers	# Bottles	A	B	C	D	E	F	G	H	I	J	Hold

Sampler(s): Please Print & Sign

Shipment Method:

Turnaround Time: (Business Days) ☐ Other _____
☐ 10 BD ☐ 5 BD ☐ 3 BD ☐ 2 BD ☐ 1 BD

Results Due Date:

Relinquished by:	Date:	Time:	Received by:	Date:	Time:
Relinquished by:	Date:	Time:	Received by:	Date:	Time:
Relinquished by:	Date:	Time:	Received by:	Date:	Time:
Relinquished by:	Date:	Time:	Received by (Laboratory):	Date:	Time:
Logged by (Laboratory):	Date:	Time:	Checked by (Laboratory):		

Notes:

ALS Cooler ID	Cooler Temp	QC Package: (Check Box Below)	
		☐ Level II: Standard QC	☐ Level III: Raw Data
		☐ TRRP LRC	☐ TRRP Level IV
		☐ Level IV: SW846 Methods/CLP like	
		☐ Other: _____	

Note: Any changes must be made in writing once samples and COC Form have been submitted to ALS.

Preservative Key: **1**-HCl **2**-HNO_3 **3**-H_2SO_4 **4**-NaOH **5**-$Na_2S_2O_3$ **6**-$NaHSO_4$ **7**-Other **8**-4°C

Revised October 2023

UNITED STATES STEEL CORPORATION GREENBELT II LANDFILL
Semi-Annual Groundwater Inspection Checklist

1. Monitoring Wells and Piezometers

A. Are any wells visibly damaged? Y N

B. Wells properly labeled? Y N

C. When obtaining water levels or samples, were any obstructions inside the well noted? Y N

D. Did the bailer or level indicator reach the measured bottom of the screen? Y N

E. Are the locks operable? Y N

F. Outer protective casing providing adequate security? Y N

G. Condition of surface pads sufficient? Y N

H. Any maintenance required? Y N

Specify: _____

_____

_____

2. Sampling Equipment

A. Is any equipment visibly damaged? Y N

B. Does any equipment need replacement? Y N

C. Any difficulty in achieving equipment calibration? Y N

D. List equipment inspected by type and serial number:

_____ _____

_____ _____

_____ _____

3. Required Action

If any question was answered "yes" above, specify below the problem, required maintenance, and expected resolution. After correction of the problem, enter below the results and provide signature.

_____

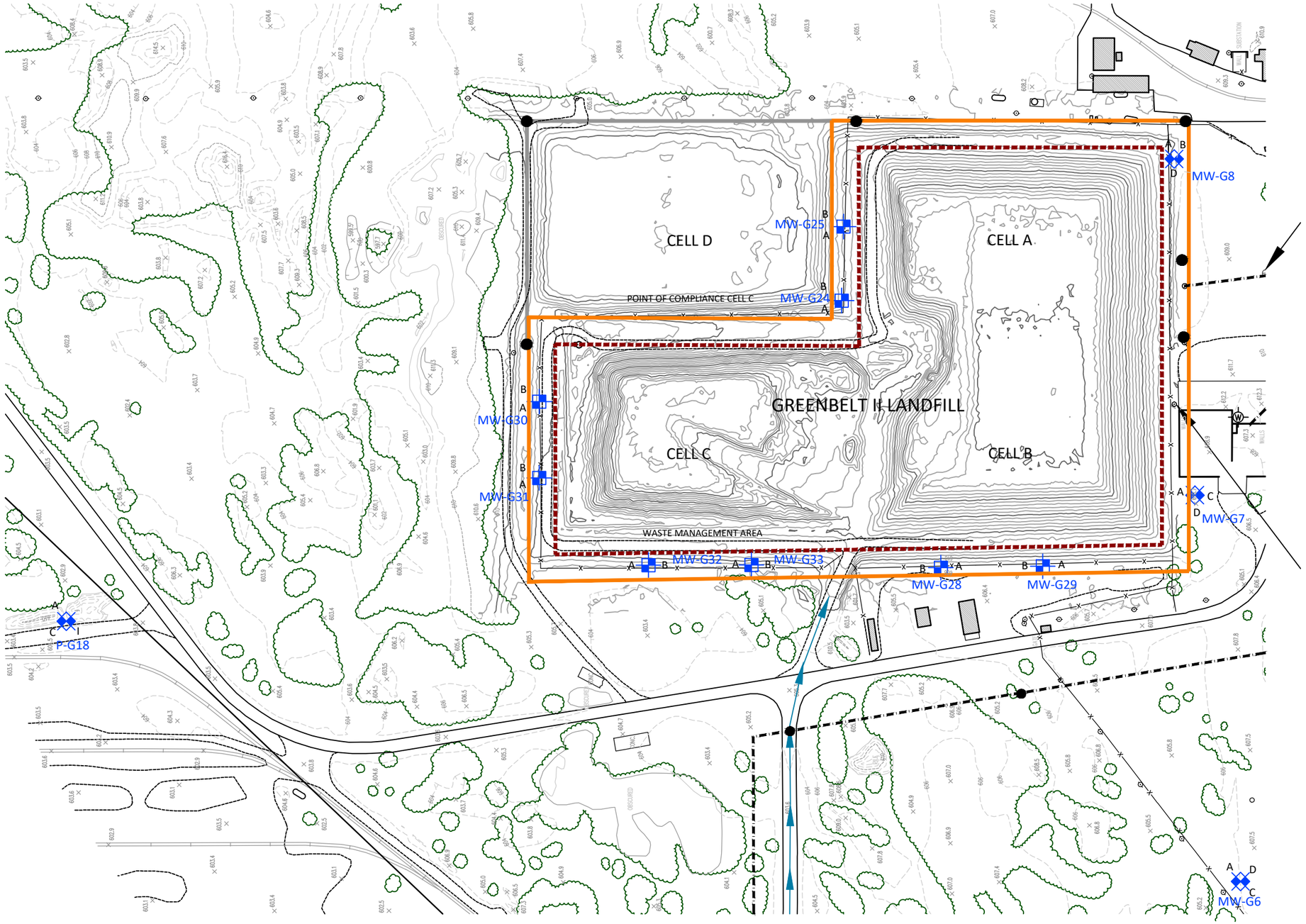
_____

_____

_____ _____

Inspector **Date**

Figures



LEGEND

- POINT OF COMPLIANCE
- WASTE BOUNDARY
- MW-G28 / P-G8 — MONITORING WELL / PIEZOMETER
- CONTOUR INTERVAL 10 FT
- CONTOUR INTERVAL 2 FT
- SEWER LINE
- FENCE
- HAUL ROUTE
- RAILROAD TRACKS
- VEGETATION
- MANHOLE
- BUILDING

NOTE:

1. SITE PLAN DEVELOPED FROM AERIAL SURVEY PERFORMED ON FEBRUARY 20, 2003 BY WILLIAMS AERIAL AND MAPPING, INC. AND UPDATED BY FIELD SURVEYS PERFORMED BY WEAVER CONSULTANTS GROUP ON 5/30/2023 IN CELL A, B, C, AND CELL D.

N

APPROXIMATE GRAPHIC SCALE

200 0 100 200 400

1 inch = 200 ft.

PREPARED FOR: USS

MONITORING WELL LOCATIONS

GREENBELT II LANDFILL
US STEEL CORPORATION - MIDWEST PLANT
PORTAGE, IN

Weaver Consultants Group
CHICAGO, ILLINOIS
(312) 922-1030 www.wcgrp.com

DRAWN BY:	RMD
REVIEWED BY:	CS
DATE:	9/4/2023
FILE:	1146-301-08
CAD:	GB II - SiteLayout.dwg

FIGURE 1

Appendix A
Quality Assurance Manual

See VFC Document # 83546904, pages 2650 – 2700

Appendix B

Monitoring Well/Piezometer Details

See VFC Document # 83546904, pages 2701 – 2737

Appendix C

Operation & Maintenance User Guides

See VFC Document # 83546904, pages 2738 – 2940

APPENDIX E-7

Summary of Groundwater Monitoring Data (1994 to 2023)

See VFC Document # 83546904, pages 2941 – 3072

APPENDIX E-8

Monitoring Well/Piezometer Installation Methods

See VFC Document # 83546904, pages 3073 – 3076

APPENDIX E-9

Statistical References

See VFC Document # 83546904, pages 3077 – 3084