MEMORANDUM

DATE: December 9, 2025

TO: Wastewater File #6-90-00-1-07
IPL Ottumwa Midland Landfill

LOCATION: Section 34, Township 73N, Range 14W
Wapello County
41° 5' 33" N / 92° 27' 18" W
Field Office 6, EPA Region 7

FROM: Wendy Hieb

RE: Rationale for NPDES Permit

Background

Interstate Power and Light Company owns and operates the IPL Ottumwa Midland Landfill (hereinafter "IPL OML") which is a coal combustion residual (CCR) landfill located in Wapello County near Ottumwa, Iowa. The landfill is different from IPL Ottumwa Generating Station, the coal-fired steam electric power plant, which is approximately 12 miles from IPL OML at a separate site on the other side of the Des Moines River.

The landfill consists of the existing landfill area, constructed in 1995, and a multi-phase expansion known as the North Expansion, with Phase 1 completed in 2015. IPL OML utilizes an underdrain tiling system to lower the groundwater table beneath the landfill's bottom liner to achieve the required separation between the waste and groundwater table. The landfill underdrain system consists of perforated piping encased in coarse aggregate and geotextile fabric. A landfill liner separates the underdrain piping from the leachate collection pipe above. The DNR's Solid Waste and Contaminated Sites Section oversees the permitting, design, construction, operation, and monitoring of landfills, including OML. The constructed liner system at OML includes a 4' low permeability liner overlain by a leachate drainage layer and associated leachate collection pipe as required by the associated landfill regulations to protect the groundwater. The leachate generated at OML is not discharged at this site.

Groundwater collected by the underdrain system consists solely of background groundwater that does not contact any landfilled waste or any other industrial process at the facility. These groundwater discharges are sampled and monitored as part of a landfill's environmental monitoring program that includes upgradient and downgradient monitoring wells. This includes statistical analysis and comparison of downgradient and underdrain groundwater to upgradient groundwater. If it is determined that the groundwater in an underdrain has been impacted by the landfill, the discharge must be collected and then treated as if it is leachate.

To date, the groundwater underdrains have not shown they are impacted by the landfill. Instead, they exhibit characteristics similar to the upgradient groundwater, so the underdrain groundwater is considered naturally occurring. Therefore, there is no discharge of unmanaged combustion residual leachate at OML through the groundwater underdrain system or otherwise based on current information, and the DNR continues to require monitoring and reporting of the groundwater underdrain systems to the Solid Waste and Contaminated Sites Section on an annual basis.

Attachment 1 includes a line drawing that demonstrates the facility's underdrain system routing. The underdrain system in the existing landfill area is referred to as "GU-EX". The North Expansion Phase 1 (completed) and Phase 2 (future) underdrain systems are referred to as "GU-1" and "GU-2", respectively. Existing valving in place allows for the independent streams to be isolated, if necessary. The combined groundwater from GU-EX and GU-1 collected by the underdrain system will be treated via bag filters and discharged via Outfall 001 to a series of wetlands that drain via two unnamed streams to the Des Moines River.

Other wastewaters produced at the facility include landfill leachate and industrial storm water. Neither of these discharges are included in the proposed NPDES individual permit coverage and are managed separately. Landfill leachate is collected in an on-site basin and hauled to the Ottumwa Water Pollution Control Facility under an industrial user permit and storm water is discharged under Iowa DNR NPDES General Permit 1.

The standard industrial classification (SIC) code(s) applicable to this facility are 4953, Refuse Systems, and 4911, Electric Services. This is new discharge and the first NPDES permit issued.

Receiving Water Body

Outfall 001 discharges to a series of wetlands (general use) to Unnamed Creek 1 (presumed A1, B(WW-1)) to Unnamed Creek 2 (presumed A1, B(WW-1)) to the Des Moines River (A1, B(WW-1) HH).

General use segments are intermittent watercourses, which typically flow only for short periods of time following precipitation and whose channels are normally above the water table. These waters do not support a viable aquatic community during low flow and do not maintain pooled conditions during periods of no flow.

The general use segments are to be protected for livestock and wildlife watering, aquatic life, noncontact recreate on, crop irrigation, and industrial, agricultural, domestic and other incidental water withdrawal uses.

A1 waters are protected for primary contact recreation activities such as swimming, diving, and water skiing where there is a considerable risk of people ingesting water in sufficient quantities to pose a health hazard. B(WW-1) streams are suitable to maintain warm water game fish populations. They are also suitable for a resident aquatic community that includes a variety of native nongame fish and invertebrate species. HH (human health) waters are those in which fish are routinely harvested for human consumption.

Wastewater Volumes

Construction of the treatment design was authorized by the department in the Construction Schedule G dated October 9, 2024 Project No. W2025-0026A (attached) and confirmed by the Facility Plan dated November 25, 2025. This documentation includes the design flows and loads: a greatest monthly average effluent flow (ADW) equal to 0.0014 million gallons per day (MGD) and a greatest daily maximum effluent flow (AWW) equal to 0.084 MGD. These flows were used to calculate the water quality-based effluent limits (WQBELs) shown in the attached wasteload allocation (WLA) dated July 31, 2025.

Total Maximum Daily Loads (TMDLs)

See TMDL section on page 4 of the WLA dated July 31, 2025.

Pollutants of Concern

Pollutants of concern for outfall 001 include: pH, chloride, iron, and sulfate. For other pollutants listed in the permit renewal application, effluent limits were not considered necessary for one of the following reasons: the pollutant was not expected to be present in the discharge; the result reported for the pollutant was less than the laboratory's reporting level which, in turn, was less than the water quality standard (WQS); or, the pollutant was not expected to be present in an amount that can be treated or otherwise removed and no WQS are available. Iowa's WQS are found in the Iowa Administrative Code (IAC) at 567 IAC Chapter 61.

Effluent Limitations

There are no federal ELGs or NSPS applicable to the facility's wastewater discharge. Therefore, any technology-based effluent limits (TBELs) must be developed using best professional judgment (BPJ). WQBELs are included in the permit if there is reasonable potential for violation of the limit, unless the TBEL is more stringent than the WQBEL for a given pollutant. Several factors may be considered when determining reasonable potential. One of the most common factors used, particularly when limited data are available, is whether the maximum reported concentration is greater than 50% of the limit from the WLA. Other factors are considered as necessary.

<u>pH</u>

The TBEL based on best professional judgement for pH is a range of 6.0 to 9.0 s.u., which is a limit commonly used in Iowa permits as well as federal effluent limitation guidelines. The WLA dated July 31, 2025 states that "technology-based limits will not violate WQS." And thus, the BPJ TBELs are included in the proposed permit.

<u>Chloride</u>

The facility's permit renewal application included a chloride effluent sample result of 29 mg/L. The July 31, 2025, WLA calculated monthly average and daily maximum concentration limits for chloride which were equal to 389 mg/L and 629 mg/L, respectively. The aforementioned sample result is below 50% of the chloride limit calculated in the WLA. Therefore, there is no reasonable potential for the discharge to cause or contribute to a WQS violation, and WQBELs for chloride are not included in the proposed permit.

<u>Iron</u>

The facility's treatment method, bag filters, are designed to remove particulate iron and thus there is reasonable potential for the discharge to cause or contribute to a WQS violation for iron and, in order to ensure the treatment is working as designed, iron limits must be included. The July 31, 2025, WLA calculated monthly average and daily maximum concentration limits which were both equal to 3.7 mg/L for iron and these WQBELs are included in the proposed permit.

<u>Sulfate</u>

The facility's permit renewal application included a sulfate effluent sample result of 890 mg/L. The July 31, 2025, WLA calculated monthly average and daily maximum concentration limits which were both equal to 1,514 mg/L for sulfate. The aforementioned sample result is above 50% of the sulfate limit calculated in the WLA. Therefore, there is reasonable potential for the discharge to cause or contribute to a WQS violation, and WQBELs for sulfate are included in the proposed permit.

<u>Other Pollutants</u>

Since this is a new discharge, an Antidegradation Alternatives Analysis was completed and submitted to the Department and subsequently approved on October 31, 2025. See Attached. On Pages 5 and 6 of Antidegradation Alternatives Analysis dated September 19th, 2025, "Table 2: Estimated Effluent Concentrations" included a more comprehensive list of pollutants than required by Form 2 of the NPDES application and provided estimated effluent concentrations for all of the pollutants shown below in Table 1. The antidegradation alternatives analysis predates construction completion of outfall 001, thus the estimated effluent concentrations in the combined underdrain water are based on 1% to 3% flow from GU-1 and 97% to 99% flow from GU-EX based on monitoring data collected from the underdrains since 2018. Based on the provided data, the Department does not believe there is reasonable potential for the discharge to cause or contribute to a WQS violation for the pollutants listed in Table 1, given that all estimated effluent concentrations in Table 2 of the antidegradation analysis dated September 19, 2025, are below the July 31, 2025 WLA limits with the exception of Iron, which is covered in a previous section, and thus limits are not included in the proposed permit.

However, since the data provided are for the separate underdrains, GU-1 and GU-EX, and no data is available for the final combined discharge of GU-EX and GU-1, the Department is adding an additional, one-time monitoring requirement for all the pollutants listed in Table 1 to the proposed permit to determine if reasonable potential exists for the discharge to cause or contribute to a water quality violation for those parameters. Should reasonable potential exist the permit will be re-opened and limits added. Pollutants already covered in previous sections with limits and accompanying monitoring have been omitted from Table 1.

Table 1. Additional Pollutants with One-Time Monitoring Requirement

Aluminum	Fluoride
Ammonia As N	Lead
Antimony	Lithium
Arsenic	Magnesium
Barium	Manganese
Beryllium	Mercury
Biochemical Oxygen Demand	Molybdenum
Boron	Nickel
Cadmium	Oil & Grease
Calcium	Selenium
Chemical Oxygen Demand	Silver
Chloride	Temperature
Chromium	Thallium
Chromium (VI)	Total Kjeldahl Nitrogen
Cobalt	Total Organic Carbon
Copper	Total Suspended Solids
Cyanide, Total	Zinc
Dissolved Oxygen	

Monitoring Requirements

Effluent monitoring frequencies for outfall 001 were initially evaluated based on the Supporting Document for Permit Monitoring Frequency Determination ("Supporting Document") cited at 567 IAC 63.3.

Table 2. Output from Supporting Document

Pollutant	Pollutant Group	Potential Category	Flow Category	Monitoring Frequency
Iron	1	5	4	1/2 Weeks – 1/Month
Sulfate	1	5	4	1/2 Weeks – 1/Month

Table 3. Proposed Effluent Monitoring Frequencies for Outfall 001

Pollutant	Frequency	Sample Type	Monitoring Basis
Flow	1x per Month	24-Hour Total	Supporting Document
Iron	1x per Month	Grab	Supporting Document
pH	1x per Month	Grab	Supporting Document
Sulfate	1x per Month	Grab	Supporting Document

Antibacksliding

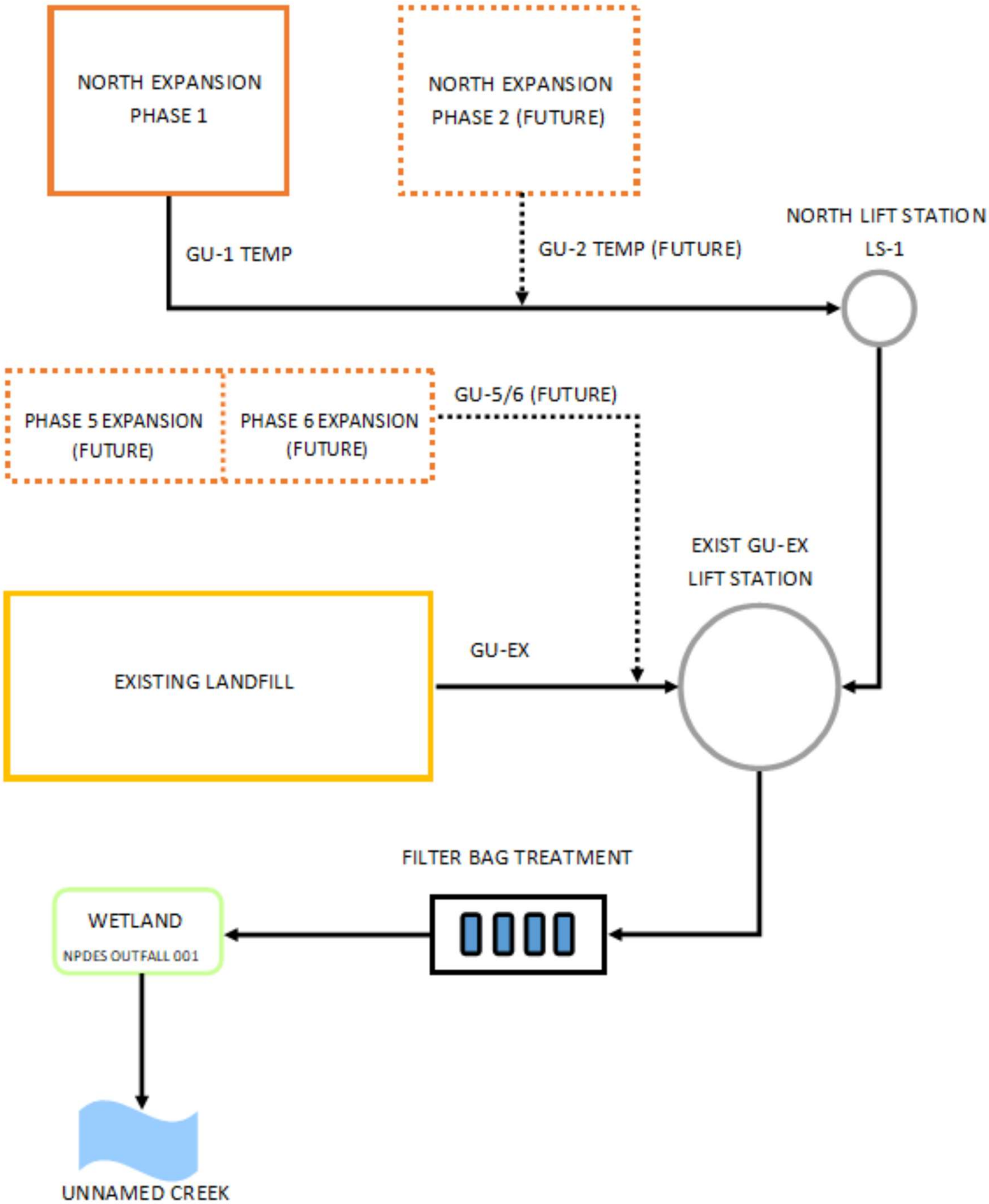
CWA sections 303(d)(4) and 402(o) and implementing regulations at 40 CFR 122.44 contain anti-backsliding provisions. Since this will be the first NPDES permit issued to this facility, backsliding is not occurring. This permit will set the baseline for the anti-backsliding review during future permit renewals.

Attachment 1:

Line Drawing

Attachment 1 – Flow Diagrams
IPL Ottumwa Midland Landfill

Facility Underdrain Routing
(Figure 4 from HR Green 2025 Antidegradation Alternatives Analysis)



Attachment 2:

Schedule G Authorization

October 18, 2024

Interstate Power and Light Company
Attn: Derek Roberts
20775 Power Plant Road,
Chillicothe, IA 52548

SUBJECT: Construction Schedule G- Design Flows and Loads Review
RE: OML Force Main Construction
DNR Project No.: W2025-0026A

Dear: Derek Roberts

The department has reviewed the Construction schedule G, design flows and loads, and the revised report dated October 09, 2024 and all other subsequent correspondence for the Interstate Power and Light Company. We are in agreement with the proposed flows and loads and the construction schedule G is authorized. Below is the summary of the design flows and loads:

Design Hydraulic Loading, Million Gallons per Day (MGD)

Average Dry Weather (ADW)	0.0014
Average Wet Weather (AWW)	0.084
Maximum Wet Weather (MWW)	0.084
Peak Hourly Wet Weather (PHWW)	0.084

Design Organic Loading, Pounds per Day:

	30 Day Max. Average lbs/day	Daily Max. lbs/day
BOD5	2.1	2.1
TSS	2.6	2.6
TKN	0.15	0.15

You may proceed with the Waste load allocation process by contacting the Waste load allocation section.

If you have any questions or comments concerning this project, please feel free to contact me at 515/725-8420 or email emmanuel.nathi@dnr.iowa.gov.

Sincerely,

Emmanuel Nathi Digitally signed by Emmanuel Nathi Date: 2024.10.18 09:14:28 -05'00'

Emmanuel Nathi
Environmental Engineer
IDNR Wastewater Engineering Section

Copy (via electronic delivery): SCS Engineers; Attn: Eric J. Nelson, P.E (enelson@scsengineers.com)
DNR FO # 6 (Washington, Iowa)
Ian Willard – Waste Load Allocation
DNR Sewage File 6-90-00-1-07

Iowa Department of Natural Resources
Wastewater Section
Construction Permit Application
SCHEDULE G, Treatment Project Design Data
Exhibit 11C

DNR USE ONLY
Project No. ________
Permit No. ________

Date Prepared	Project Identity
9/20/2024	Interstate Power and Light Company - OML Force Main Construction
Date Revised	Record Number: W2025-0026A
10/9/2024	**See attached letter for further information**

1. Project Description	OML Force Main Construction			
2. Design Flows	Present Year (2024)		Design Year (2045)	
Design Condition →	AWW (MGD)	MWW (MGD)	AWW (MGD)	MWW (MGD)
Domestic/Commercial Flow	N/A	N/A	N/A	N/A
Industrial	N/A	N/A	N/A	N/A
Flow	N/A	N/A	N/A	N/A
Rated Flow	N/A	N/A	N/A	N/A
Other Flow (specify)	0.0014	0.084	0.0014	0.084
Infiltration/Inflow	N/A	N/A	N/A	N/A
Total	0.0014	0.084	0.0014	0.084
Flow	0.0014	0.084	0.0014	0.084
Rated Flow	N/A	N/A	N/A	N/A

Average Dry Weather Flow (ADW):	Peak Hourly Wet Weather Flow (PHWW):	Demographic Data:
0.0014 MGD (present year)	0.084 MGD (present year)	Population N/A (present year)
0.0014 MGD (design year)	0.084 MGD (design year)	Population N/A (design year)

3. Organic Design Loadings		Present Year (2024)		Design Year (2045)	
Design Condition→		Max. 30 day (#/day)	Max. Day (#/day)	Max. 30 day (#/day)	Max. Day (#/day)
Domestic/Commercial	BOD_5	N/A	N/A	N/A	N/A
	TSS	N/A	N/A	N/A	N/A
	TKN	N/A	N/A	N/A	N/A
Industrial	BOD_5	N/A	N/A	N/A	N/A
	TSS	N/A	N/A	N/A	N/A
	TKN	N/A	N/A	N/A	N/A
Other (Specify)	BOD_5	2.1	2.1	2.1	2.1
	TSS	2.6	2.6	2.6	2.6
	TKN	0.15	0.15	0.15	0.15
Total	BOD_5	2.1	2.1	2.1	2.1
	TSS	2.6	2.6	2.6	2.6
	TKN	0.15	0.15	0.15	0.15

4. Effluent Limitations		BOD_5		TSS		NH_3-N (most stringent month)		Other		Other	
		Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max
Operation Permit	mg/l										
Effluent Limits*	#/day										

*Date of Waste Load Allocation (WLA) determination: WLA submitted 6/13/24

**Effluent Limitations entered shall be the more stringent value between the existing NPDES Permit and the WLA or an approved antidegradation analysis

5. Major Industrial/Commercial contributors or Significant Industrial User: N/A

Waste Contributors	Pre-Treat (Y/N)	Operation		Design Loadings						
				Flow		BOD5 #/day	Susp. Solids #/day	TKN #/day	Oil & Grease #/day	#/day
		Hrs/ Day	Days/ Week	Ave. MGD	Max. MGD					

6. SCHEDULE G SUPPLEMENTAL CHECKLIST MUST ACCOMPANY THIS FORM

Iowa Department of Natural Resources
Wastewater Engineering Section
SCHEDULE G SUPPLEMENTAL CHECKLIST/GUIDANCE DOCUMENT

Submittal and approval of design flows and organic loading for proposed wastewater treatment facilities is an integral step in the design of a new or expanded treatment facility. The following recommendations are intended to help provide estimates of design flows and organic loadings to address Section 14.4 of Chapter 14, thus expediting the design flow/loading approval process. It is the consulting engineer's responsibility to provide all relevant assumptions, calculations, justifications, and data to support the values entered into cells one through three of Exhibit 11C/Schedule G, Treatment Project Design Data.

THE FOLLOWING ITEMS (IF APPLICABLE) MUST ACCOMPANY ALL SCHEDULE G SUBMITTALS. CHECK YES IN THE BOXES BELOW IF INCLUDED. IF ITEMS ARE NOT APPLICABLE, N/A MUST BE CHECKED AND AN EXPLANATION PROVIDED. **IF NEITHER BOX IS CHECKED, SCHEDULE G WILL NOT BE ACCEPTED FOR REVIEW.**

YES	N/A	
☑	☐	A summary table or spreadsheet should be prepared that shows the calculations used to determine the design loadings provided for ADW, AWW, MWW, PHWW, along with any equations/information used to determine peaking factors.

- Have a rational basis in the design flow and loading calculations submittal.
- Sewer replacement and/or new interceptors may cause peak instantaneous flows to increase rather than decrease.
- Avoid drought conditions when estimating ADW design flows. Dry weather in the context of the flow definition for ADW means no rainfall, but the groundwater conditions are normal.
- Compare seasonal water use records where appropriate and identify correlations.
- Consider sanitary sewer overflows, sewer surcharging and basement backups in estimating peak wet weather flows.
- Consider groundwater elevations and a wide variety of rainfall and wet weather events (including rapid snow melt) at high groundwater conditions when estimating wet weather flow equalization requirements.
- In the absence of continuous flow metering, assume that the ratio of PHWW/MWW without wet weather flow equalization could be 2 or more.
- Do not assume that equalization of wet weather flows to a level below AWW-30 is feasible.

YES	N/A	
☐	☑	MOR Data provided from owner or DNR for treatment plants and pump stations.

- Design flows lower than the monitoring and reported data cannot be suggested without documented evidence and a valid written explanation.
- Consider at least 5 years of flow data or more as needed when projecting wet weather design flows.
- Use daily and monthly monitoring reports from the facility.
- Consider the reliability of operating records, locations for sampling and measurement, and degree of accuracy of flow monitoring and sampling.
- Consider installation of continuous flow monitoring and recording equipment where appropriate (lift stations, influent channels, etc.) to determine peak hour flows.

YES	N/A	
☐	☑	Site exhibit delineating residential, commercial, and industrial areas with their corresponding acreages to support the design flows used. If exact flows/loadings are known for industrial areas are known, please provide the source/accuracy of the data. Census data or other relevant source shall be provided to support population growth or decline.
☐	☑	Results of any Infiltration/Inflow studies performed to support proposed flow reduction

- Infiltration/inflow reduction cannot be suggested without valid data to support the assumptions.
- Elimination of inflow sources cannot be assumed to reduce infiltration.

YES	N/A	
☐	☑	Any information regarding bypassing or compliance issues relevant to the project's design

- Include previous sanitary sewer bypasses when estimating present year and design year flows.

Attachment 3:

Waste load Allocation

IPL Ottumwa Midland Landfill

(Proposed Discharge to Southern Wetland Complex)

This Package Contains

Wasteload Allocation Calculations & Notes

ENVIRONMENTAL SERVICES DIVISION
WATER QUALITY-BASED PERMIT LIMITS

SECTION VI: WATER QUALITY-BASED PERMIT LIMITS

Facility Name: IPL Ottumwa Midland Landfill, STP — NPDES Number: New Discharge

Parameters	Ave. Conc. (mg/l)	Max. Conc. (mg/l)	Ave. Mass (lbs/d)	Max. Mass (lbs/d)
Outfall No. 001	**ADW = 0.0014 MGD & AWW = 0.084 MGD**			
CBOD5	–	63	–	44.2
COD	–	63	–	44.2
Total D.O.	Minimum Concentration (mg/l)			
January - December	1.0			
Ammonia - Nitrogen				
January	3.5	15.4	2.4	10.7
February	4.0	14.4	2.8	10.0
March	2.1	14.9	1.5	10.3
April	1.6	16.0	1.1	11.1
May	1.8	15.6	1.2	10.7
June	1.4	14.9	0.9	10.2
July	1.0	18.3	0.7	12.5
August	1.0	16.9	0.7	11.5
September	1.1	17.1	0.7	11.7
October	1.6	16.1	1.1	11.1
November	2.4	15.0	1.6	10.4
December	2.5	16.2	1.7	11.2
Chloride	389	629	272	441
Sulfate	1,514	1,514	1,060	1,060
pH	Technology-Based Limits Will Not Violate WQS			

Stream Network/Classification of Receiving Stream: Series of Wetlands (General Use) to Unnamed Creek 1 (Presumed A1, B(WW-1)) to Unnamed Creek 2 (Presumed A1, B(WW-1)) to Des Moines River (A1, B(WW-1) HH)

Annual critical low flows in Series of Wetlands at the outfall:
1Q10 flow 0 cfs, 7Q10 flow 0 cfs, 30Q10 flow 0 cfs

Annual critical low flows in Unnamed Creek 1 at the mouth of Series of Wetlands:
1Q10 flow 0 cfs, 7Q10 flow 0 cfs, 30Q10 flow 0 cfs

Annual critical low flows in Des Moines River at the mouth of Unnamed Creek 2:
1Q10 flow 245.8 cfs, 7Q10 flow 271.3 cfs, 30Q10 flow 318.1 cfs, 30Q5 flow 437.3 cfs, harmonic mean flow 1,776.9 cfs

Performed by: Nolan Underwood

Antidegradation Review Requirement

A tier II antidegradation review is required. See Section 2 for details.

The antidegradation review conducted in this wasteload allocation is based on the current information available. Antidegradation could also be triggered during the NPDES permitting process based on new information.

ENVIRONMENTAL SERVICES DIVISION
WATER QUALITY-BASED PERMIT LIMITS

SECTION VI: WATER QUALITY-BASED PERMIT LIMITS

Facility Name: IPL Ottumwa Midland Landfill NPDES Number: New Discharge

Parameters	Ave. Conc. (mg/l)	Max. Conc. (mg/l)	Ave. Mass (lbs/d)	Max. Mass (lbs/d)
Outfall No. 001	**ADW = 0.0014 MGD & AWW = 0.084 MGD**			
Toxics				
Arsenic (III)	1.500E-01	3.400E-01	1.051E-01	2.382E-01
Barium	6.800E+01	6.800E+01	4.764E+01	4.764E+01
Beryllium	5.000E-01	5.000E-01	3.503E-01	3.503E-01
Boron	3.350E+00	3.350E+00	2.347E+00	2.347E+00
Cadmium	1.374E-03	5.845E-03	9.623E-04	4.095E-03
Chloride	389	629	272	441
Chromium (VI)	1.143E-02	1.629E-02	8.011E-03	1.141E-02
Cobalt	1.700E+00	1.700E+00	1.191E+00	1.191E+00
Copper	1.687E-02	2.690E-02	1.182E-02	1.884E-02
Cyanide	5.200E-03	2.200E-02	3.643E-03	1.541E-02
Fluoride	8.077E+00	8.077E+00	5.658E+00	5.658E+00
Iron	3.700E+00	3.700E+00	2.592E+00	2.592E+00
Lead	7.693E-03	1.974E-01	5.389E-03	1.383E-01
Manganese	3.386E+00	3.386E+00	2.372E+00	2.372E+00
Nickel	9.376E-02	8.433E-01	6.569E-02	5.908E-01
Selenium	5.000E-03	1.930E-02	3.503E-03	1.352E-02
Silver	1.247E-02	1.247E-02	8.734E-03	8.734E-03
Sulfate	1,514	1,514	1,060	1,060
Thallium	5.980E-01	5.980E-01	2.773E-01	4.189E-01
Zinc	2.156E-01	2.156E-01	1.510E-01	1.510E-01

WLAs/Permit Limits for the IPL Ottumwa Midland Landfill's Waste Water Discharge

These wasteload allocations and water quality-based permit limitations are for the IPL Ottumwa Midland Landfill's proposed wastewater discharge to a series of wetlands. The wasteload allocations/permit limits are based on the Water Quality Standards (IAC 567.61) and the "Iowa Wasteload Allocation (WLA) Procedure," effective November 11, 2020.

The water quality-based limits in this WLA are calculated to meet the surface water quality criteria to protect downstream uses. There could be technology-based limits applicable to this facility that are more stringent than the water quality-based limits shown in this WLA. The technology-based limits could be derived from either federal guidelines based on different industrial categories or permit writer's judgment.

Section 1. Background:
IPL Ottumwa Midland Landfill proposes discharging a stream of wastewater consisting of groundwater from the landfill underdrain system into a series of wetlands south of the facility (proposed location, 41° 4' 30.4" N, 92° 27' 1.1" W).

Route of flow and use designations:
The series of wetlands, consisting of one smaller wetland, a ditch, and a larger wetland, are all general use water bodies for aquatic life and has no recreational use.

At the mouth of the series of wetlands, Unnamed Creek 1 is a presumed A1, B(WW-1) designated use water body. Unnamed Creek 1 flows into Unnamed Creek 2, presumed A1, B(WW-1), prior to entering the Des Moines River.

The following designations have been adopted in Iowa's state rule described in the rule-referenced document of "Surface Water Classification," effective July 24, 2019.

At the mouth of Unnamed Creek 2, Des Moines River is an A1, B(WW-1) HH designated use water body.

Critical low flow determination:
The annual critical low flows in series of wetlands are estimated to be all zero since general use segments are intermittent watercourses that typically only flow for short periods of time following precipitation. The annual critical low flows in Unnamed Creek at the mouth of the series of wetlands are estimated based on the Regional Regression Equations (RRE) from "Methods for estimating selected spring and fall low-flow frequency statistics for ungaged stream sites in Iowa, based on data through June 2014" (2016).

The annual critical low flows in Des Moines River at the mouth of Unnamed Creek 2 are estimated based on the Drainage Area Ratio (DAR) method from "Methods for estimating selected low-flow frequency statistics and harmonic mean flows for streams in Iowa" (2012, revised 2017)" (2012, revised 2017) and flow statistics obtained at USGS gage station 05488500, located on the Des Moines River at Tracy, Iowa. Another USGS gage lies downstream of the stream juncture at Ottumwa, Iowa. However, between the gage and the juncture lies both a dam and the Ottumwa Water Works intake, altering the resulting gage data. Thus, the downstream gage is not used for any flow determinations.

Table 1: Annual critical low flows

Location	D.A. (mi^2)	1Q10 (cfs)	7Q10 (cfs)	30Q10 (cfs)	30Q5 (cfs)	Harmonic mean (cfs)
Unnamed Creek 1 at the mouth of Series of Wetlands	0.34	0[1]	0[1]	0[1]	-	-
Des Moines River at the mouth of Unnamed Creek 2	13,300	245.8	271.3	318.1	437.3	1776.9
Des Moines River at the Tracy Iowa gage	12,500	231.0	255.0	299.0	411.0	1,670.0
1) Flows were censored to zero based on the USGS probability of zero flow report						

Section 2. Antidegradation Review:
According to the "Iowa Antidegradation Implementation Procedure," effective February 17, 2010 (IAC 567-60.7(2).d.(4)), all new or expanded regulated activities (with limited exceptions, such as unsewered communities) are subject to antidegradation review requirements.

Table 2: Antidegradation review analysis

Item #	Factor or scenario	Antidegradation determination	Analysis/comments
1	Design capacity increase	Yes ☒, No ☐, or Not Applicable ☐	1: New Outfall
2	Significant Industrial Users (SIU) contributing new pollutant of concern (POC)	Yes ☐, No ☐, or Not Applicable ☒	
3	New process contributing new pollutant of concern (POC)	Yes ☐, No ☐, or Not Applicable ☒	
4	Less stringent water quality-based limits?	Yes ☐, No ☐, or Not Applicable ☒	
5	Outfall location change	Yes ☒, No ☐, or Not Applicable ☐	1: New Outfall
Conclusion and discussion: Due to Items 1 and 5, a tier II antidegradation review is required. The antidegradation review conducted in this WLA is based on the current information available. Antidegradation could also be triggered during the NPDES permitting process based on new information.			

Section 3. Total Maximum Daily Load (TMDL) Limitations:
The following impaired water bodies in the discharge route are contained in the 2024 Iowa Integrated Report:

- Des Moines River for bacteria (indicator: *E. coli*) and fish kill due to unknown toxicity

This facility has not been assigned any allocations from TMDLs at this time.

The results presented in this report are wasteload allocations based on meeting the State's current water quality standards in the receiving water body. Additional and/or more stringent effluent limits may be applicable to this discharge based on approved TMDLs for impaired water bodies, which may provide watershed based wasteload allocations. Information on impaired streams in Iowa and approved TMDLs can be found at the following website: https://programs.iowadnr.gov/adbnet/Docs/TMDL.

Section 4. Calculations:
The WLAs/permit limits for this outfall are calculated based on the facility's Average Dry Weather (ADW) design flow of 0.0014 MGD and its Average Wet Weather (AWW) design flow of 0.084 MGD.

Only wasteload allocations/permit limits (water quality-based effluent limits) calculated using DNR approved design flows can be applied in NPDES permits. Water quality-based effluent limits calculated using proposed flows that have not been approved by the DNR for permitting and compliance may be used for informational purposes only.

The water quality-based permit concentration limits are derived using the allowed stream flow and the ADW design flow, while the loading limits are derived using the allowed stream flow and the AWW design flow.

Toxics:
To protect the general use wetlands:
The protection of the general use wetlands from toxics is achieved by assuring the WLA does not exceed a value set at ½ 96hrLC50 for critical species in the general use wetlands. Additionally, there are livestock watering guidelines of 1,500 mg/l for chloride and 2,000 mg/l for sulfate that affect the chronic criteria. Since the annual critical low flows in the general use wetlands are estimated to be all zero, the ½ 96hrLC50 value applies at "end-of-pipe."

To protect the downstream designated use reach:
The acute criteria apply at the end of the Zone of Initial Dilution (ZID), and the chronic criteria apply at the end of the Mixing Zone (MZ). Since the annual critical low flows in Unnamed Creek 1 at the mouth of the wetland complex are estimated to be all zero, the criteria apply at "end of the general use wetlands" instead of the end of the MZ and the ZID.

Default effluent and background chloride and sulfate concentrations of 34 mg/l and 63 mg/l, respectively, are used in the applicable criteria. A default hardness of 200 mg/l for background and effluent is used for applicable criteria. Default background concentrations are used for other toxics in cases where there is sufficient stream data.

Effective November 11, 2020, water quality criteria for metals (excluding aluminum) are expressed as dissolved in IAC 567.61. Using EPA dissolved metal translators, water quality-based effluent limits in this WLA are expressed as total recoverable.

To protect the human health (HH) use:
For pollutants that are non-carcinogenic and have criteria for HH protection, the criteria apply at the end of the MZ, which in this case is 25% of the 30Q5 flow in Des Moines River at the mouth of Unnamed Creek 2.

For pollutants that are carcinogenic and have criteria for HH protection, the criteria apply at the end of the MZ, which in this case is 25% of the harmonic mean flow in the Des Moines River at the mouth of Unnamed Creek 2.

Final limits:
The maximum limits are the more stringent between the limits for the protection of the general use stream those for the protection of the aquatic life use, and those for the protection of the HH use.

The limits for the toxics are based on a sampling frequency of 1/week.

Ammonia Nitrogen:
To protect the general use wetlands:
The protection of general use wetlands is considered in the form of "free from acutely toxic conditions." This provision is achieved by assuring the WLA does not exceed a value set at ½ 96hrLC50 for critical species in the stream. The Fathead Minnow is selected as the critical species. For ammonia nitrogen, the ½ 96hrLC50 for the Fathead Minnow is noted in Table 3 at the pH and temperature values associated with mechanical facilities, as shown in Table 4. The background category is based on the characteristics of flexible holding time prior to discharge and industrial type POCs, which most aligns with the pH and temperature granted to mechanical facilities. Since the annual critical low flows in the general use wetlands are estimated to be all zero, the ½ 96hrLC50 values apply at "end of pipe."

Table 3: Instream ½ 96hrLC50 values for ammonia nitrogen

Months	1/2LC50 (mg/l)
January	39.4
February	36.8
March	38.1
April	40.7
May	39.4
June	37.4
July	45.6
August	42.0
September	42.7
October	40.7
November	38.1
December	41.4

Table 4: Standard effluent pH and temperature values for mechanical facilities

Months	pH	Temperature (°C)
January	7.67	12.4
February	7.71	11.3
March	7.69	13.1
April	7.65	16.2
May	7.67	19.3
June	7.70	22.1
July	7.58	24.1
August	7.63	24.4
September	7.62	22.8
October	7.65	20.2
November	7.69	17.1
December	7.64	14.1

To protect the downstream designated use reach:
To protect designated use water bodies, standard stream background pH, temperatures, and concentrations of NH3-N are mixed with the discharge from the facility's effluent pH and temperature values to calculate the applicable instream WQS criteria. The monthly background pH, temperatures, and NH3-N concentrations shown in Table *5* are used for the wasteload allocation/permit limits calculations.

Since the annual critical low flows in the receiving stream at the outfall are all zero, the criteria apply at "end of the general use wetlands" instead of the end of the MZ and the ZID. At the mouth of the wetland complex, Unnamed Creek 1 is a presumed B(WW-1) stream; therefore, early life protection will begin in March and run through September. The monthly background pH, temperatures, and NH3-N concentrations shown in Table 5.

Ammonia nitrogen decay in the general use wetlands is taken into consideration. The decay is estimated by using a first order decay model with a length of 680 ft and a decay rate of 0.3/day at 20°C. Velocities are an average velocity over the 680 ft, calculated using a reach length weighted average. Velocities for each reach can be seen in the CBOD5/Total Dissolved Oxygen section below. Flow velocities of 0.086 fps for ADW conditions and 0.294 fps for AWW conditions are used in the general use wetlands.

Final limits:
The more stringent between the limits for the protection of the general use wetlands and those for the protection of the designated use stream serve as the permit limits. Table 6 shows the calculated final ammonia nitrogen wasteload allocations for this facility.

Table 5: Background pH, temperatures, and NH3-N concentrations

Months	pH	Temperature (°C)	NH_3-N (mg/l)
January	8.1	0.3	0.02
February	8.0	0.1	0.08
March	8.1	1.5	0.12
April	8.3	9.3	0.03
May	8.2	15.0	0.03
June	8.2	19.4	0.02
July	8.2	23.5	0.02
August	8.2	24.3	0.02
September	8.3	20.2	0.02
October	8.3	14.2	0.02
November	8.3	8.0	0.02
December	8.3	0.8	0.03

Table 6: Wasteload allocations for ammonia nitrogen for the protection of aquatic life[3]

Months	ADW-based[1]		AWW-based[2]	
	Acute (mg/l)	Chronic (mg/l)	Acute (mg/l)	Chronic (mg/l)
January	15.4	3.5	15.3	3.4
February	14.4	4.0	14.3	4.0
March	14.9	2.1	14.8	2.1
April	16.0	1.6	15.8	1.5
May	15.6	1.8	15.3	1.8
June	14.9	1.4	14.6	1.3
July	18.3	1.0	17.8	1.0
August	16.9	1.0	16.4	1.0
September	17.1	1.1	16.7	1.1
October	16.1	1.6	15.8	1.6
November	15.0	2.4	14.8	2.3
December	16.2	2.5	16.0	2.5
1: Bases for concentration limits 2: Bases for mass loading limits				

CBOD5/Total Dissolved Oxygen:

Protection of the general use wetlands:

Streeter-Phelps DO Sag Model is used to simulate the decay of CBOD and dispersion of total Dissolved Oxygen (DO) in the receiving water downstream from the outfall. The criterion is that the discharge cannot cause the DO level in the general use wetlands to be below 1.0 mg/l.

The parameter values used in the modeling are listed below:

Background:

The temperature and ammonia nitrogen levels are shown in Table 5. The ultimate CBOD and DO levels are assumed to be 6.0 mg/l and 6.0 mg/l, respectively.

Effluent:
The temperatures are shown in Table 4. The CBOD5 level used in the modeling is 63 mg/l for ADW conditions and 133 mg/l for AWW conditions. The ammonia nitrogen values used in the modeling are the calculated acute wasteload allocations shown in

Table 6. Both ADW and AWW flows and the ammonia nitrogen limits associated with them are used in the modeling.

Receiving stream parameters, small wetland:
There is an average water channel slope of 0.00656 (the water channel elevation changes from 760 ft to 758 ft over a distance of approximately 305 ft, estimated based on the GIS LiDAR 2-ft contour coverage).

Field Use Attainability Assessment (UAA) had no sites along the small wetland. Therefore, a Flowmaster analysis using three cross sections of the small wetland were used to estimate the width, depth, and velocity in the small wetland using Manning's equations. Due to the vegetation growth and possibility of low retention, the standard weedy stream roughness coefficient of 0.045 was selected. Based the stream width, depth, and velocity at ADW and AWW conditions are estimated and are shown in Table 7.

Table 7: Stream width, depth, and velocity (small wetland)

Flow Condition	Flow (cfs)	Width (ft)	Depth (ft)	Velocity (fps)
ADW	0.00217	7.8	0.0051	0.05
AWW	0.12995	22.9	0.0309	0.18

Reaeration:
Due to the width and shallow flow, USGS pool-riffle (Melching and Flores, 1999) best represents reaeration in the small wetland.

Receiving stream parameters, ditch to large wetland:
There is an average water channel slope of 0.06897 (the water channel elevation changes from 758 ft to 748 ft over a distance of approximately 145 ft, estimated based on the GIS LiDAR 2-ft contour coverage).

Field Use Attainability Assessment (UAA) had no sites along the ditch. Therefore, a Flowmaster analysis using three cross sections of the ditch were used to estimate the width, depth, and velocity in the ditch using Manning's equations. The ditch has several ditch checks along its length, therefore a manning's roughness coefficient of 0.078, commonly used for areas with larger riprap, was selected. Based the stream width, depth, and velocity at ADW and AWW conditions are estimated and are shown in
Table 8.

Table 8: Stream width, depth, and velocity (ditch between wetlands)

Flow Condition	Flow (cfs)	Width (ft)	Depth (ft)	Velocity (fps)
ADW	0.00217	1.7	0.0111	0.12
AWW	0.12995	5.5	0.0583	0.40

Reaeration:
Due to mixing caused by the frequent ditch checks, USGS pool-riffle (Melching and Flores, 1999) best represents reaeration in the ditch between wetlands.

Receiving stream parameters, large wetland:
There is an average water channel slope of 0.03361 (the water channel elevation changes from 748 ft to 740 ft over a distance of approximately 238 ft, estimated based on the GIS LiDAR 2-ft contour coverage).

Field Use Attainability Assessment (UAA) had no sites along the large wetland. Therefore, a Flowmaster analysis using two cross sections of the large wetland were used to estimate the width, depth, and velocity of the large wetland using Manning's equations. Due to the vegetation growth and possibility of low retention, the standard weedy stream roughness coefficient of 0.045 was selected. Based the stream width, depth, and velocity at ADW and AWW conditions are estimated and are shown in Table 9.

Table 9: Stream width, depth, and velocity (large wetlands)

Flow Condition	Flow (cfs)	Width (ft)	Depth (ft)	Velocity (fps)
ADW	0.00217	1.7	0.0083	0.15
AWW	0.12995	5.3	0.0458	0.54

Reaeration:
Due to the width and shallow flow, USGS pool-riffle (Melching and Flores, 1999) best represents reaeration in the Large wetland.

Discussion and conclusion:
The modeling results show that the effluent, which could have an allowed maximum effluent CBOD5 level of 63 mg/L, and ammonia nitrogen levels as shown in Table 6, and a minimum DO level of 1.0 mg/l, will not cause the DO level in the receiving stream to be below 1.0 mg/l at any time.

<u>Protection of the downstream designated use water body (Unnamed Creek 1)</u>:
Streeter-Phelps DO Sag Model is also used to simulate the decay of CBOD and dispersion of total DO in the downstream designated use stream. The criterion is that the discharge cannot cause the DO level in warm waters to be below 5.0 mg/l.

The parameter values used in the modeling are listed below:

Background:
The temperature and ammonia nitrogen levels are shown in Table 5. The ultimate CBOD and DO levels are assumed to be 6.0 mg/l and 6.0 mg/l, respectively.

Effluent:
The temperatures are shown in Table 4. The CBOD, ammonia nitrogen, and DO values are obtained from the modeling on the general use wetlands after the large wetland.

Receiving stream parameters:
There is an average water channel slope of 0.01384 (the water channel elevation changes from 740 ft to 696 ft over a distance of approximately 3,180 ft, estimated based on the GIS LiDAR 2-ft contour coverage).

Field Use Attainability Assessment (UAA) had no sites along Unnamed Creek 1. Therefore, a Flowmaster analysis using four cross sections of Unnamed Creek 1 were used to estimate the width, depth, and velocity of Unnamed Creek 1 using Manning's equations. Due to the vegetation growth and a meandering stream bed, the standard weedy stream roughness coefficient of 0.045 was selected. Based the stream width, depth, and velocity at ADW and AWW conditions are estimated and are shown in Table 10.

Table 10: Stream width, depth, and velocity (Unnamed Creek 1)

Flow Condition	Flow (cfs)	Width (ft)	Depth (ft)	Velocity (fps)
7Q10 + ADW	0.00217	0.9	0.0188	0.13
7Q10 + AWW	0.12995	3.1	0.1000	0.42

Reaeration:
Due to the shallow flow and meandering stream features, USGS pool-riffle (Melching and Flores, 1999) best represents reaeration in Unnamed Creek 1.

Discussion and conclusion:
The modeling results show that the effluent, which could have an allowed maximum effluent CBOD5 level of 63 mg/l, ammonia nitrogen levels as shown in

Table *6*, and a minimum DO level of 1.0 mg/l, will not cause the DO level in the designated use receiving stream to be below 5.0 mg/l at any time.

COD:
It is conservatively assumed that ultimate CBOD (CBODu) is approximately equivalent to COD and that all COD will be biologically available in the wetland complex and Unnamed Creek 1.

The CBODu was estimated using the following equation:

CBODu = CBOD5*(1/(1-exp(-5*K_d))

Where K_d is the CBOD decay rate for a given month, which in turn was determined by the following equation:

$K_d = K_{20} * 1.047^{(T-20)}$

Where T is the monthly effluent temperature, as shown in Table 3. K_{20} is the CBOD decay rate at 20 °C, which is determined using the following equation:

$K_{20} = K_{d0} + b * (V/d)$

Where K_{d0} is the laboratory CBOD decay rate at 20 °C, the value is assumed to be 0.2/day. b is the bed activity coefficient, determined to be 0.491. V is the flow velocity and d is the depth, as shown in Table 7. The COD concentration limit was determined to be 63 mg/l, and the mass loading was 44.2 lbs/day, which was derived based on the AWW facility flow.

Iron:
Iron criteria are defined in the issue paper "Iron Criteria and Implementation for Iowa's Surface Waters" (November 11, 2020). A dissolved iron criterion of 1 mg/l applies at the end of the ZID for both general use and designated use streams. However, a site-specific iron toxicity study, submitted by the facility in June, 2025, demonstrated a NOEC of 3.7 mg/L. The site-specific iron NOEC is used as the iron criteria for this site and applies at the end of the ZID. Since the annual critical low flows in the small wetland are estimated to be all zero, the criteria apply at "end of pipe" instead of the end of the ZID.

Boron, Cobalt, and Manganese:
There are no numerical criteria for manganese, boron, nor cobalt in Iowa's water quality standards. However, the water quality standards specify, in the form of narrative criteria, that all surface waters shall be free from materials attributable to wastewater discharges or agricultural practices in concentrations or combinations which are acutely toxic to human, animal, or plant life (567 IAC 61.3(2)d).

This narrative criterion is implemented through the concept of establishing a no effect level or LC0 as described in the 'Iowa Wasteload Allocation Procedure'. The LC0 or the estimate of the concentration that will not be acutely toxic is determined by calculating the value of ½ the 48 or 96-hour LC50 for the most sensitive resident species. In cases with multiple applicable 48 or 96-hour LC50 values, the Species Mean Acute Value (SMAV) was used.

There is limited toxicity data available for manganese, cobalt and boron. The criteria are shown in Table 11. Since the annual critical low flows in the small wetland are estimated to be all zero, the criteria apply at "end of pipe" instead of the end of the MZ and the ZID.

Table 11: Narrative Criteria for Select Toxics

Toxic	Criterion (mg/l)	Toxicity End Point	Toxicity Testing Organism
Boron	3.35	½ 48-hour LC50	Daphnia magna
Cobalt	1.7	½ 96-hour LC50	Fathead minnow
Manganese	3.386	1/2 SMAV	Midge

pH:
To protect the general use stream:
Iowa currently does not have numerical criteria for the protection of general use streams. The narrative criteria stated in IAC 567.61.3.(2) apply.

To protect the downstream designated use stream:
Iowa Water Quality Standards (IAC 567.61.3.(3).a.(2) and IAC 567.61.3.(3).b.(2)) require that pH in Class A or Class B waters "shall not be less than 6.5 nor greater than 9.0." The criteria apply at the end of the MZ, which is 25% of the 7Q10 flow in Unnamed Creek 1 at the mouth of Series of Wetlands.

pH change in the general use stream:
Effluent pH change may occur in the general use wetland complex; however, the pH change is difficult to model without substantial amount of site-specific data. Based on professional judgment, the technology-based pH limits of 6.0 – 9.0 will be protective of the WQS in the designated use stream due to pH change in the general use wetland complex before reaching the designated use segment.

Section 5. Permit Limitations:
The acute and chronic WLAs are used as the values for input into the current permit derivation procedure. The water quality-based limits are shown on Page 1-2 of this report.

Attachment 4:

Antidegradation Alternatives Analysis

Ottumwa-Midland Landfill
Underdrain Outfall Relocation

Antidegradation Alternatives Analysis

September 19, 2025

HR Green Project No: 2402268

Prepared For: Alliant Energy – Interstate Power and Light Company

Exhibit 9A
Iowa Department of Natural Resources
Wastewater Engineering Section
Preliminary Review of Antidegradation Alternatives Analysis

For situations where a DNR construction permit will be required for construction, installation or modification of a disposal system, this document is intended to supplement the Iowa Wastewater Facilities Design Standards to satisfy the requirements of the Iowa Antidegradation Implementation Procedure (Iowa AIP). When a DNR construction permit will not be required, this document may be used as guidance in development of an alternatives analysis to demonstrate compliance with Iowa's antidegradation policy (567 IAC 61.2(2)). **Where antidegradation applies and construction is required, DNR-approval of the antidegradation alternatives analysis is required prior to submittal of a facility plan.**

1. ☐ Is the preferred alternative a non-degrading alternative as defined in the Iowa AIP and agreed to by the DNR? *If "yes", the remainder of this checklist does not need to be completed.*

2. ☐ Has the alternatives analysis been dated and certified by an engineer licensed to practice within the State of Iowa?

3. ☐ Is an executive summary of the alternatives analysis provided including descriptions of the purpose(s) of the project and/or analysis, a summary of the results of the analysis and identification of the preferred alternative?

4. ☐ Have the public notification and intergovernmental coordination and review requirements as described in Sections 4.1 & 4.2 of the Iowa AIP been fulfilled?
   - ☐ Public notice with 30-days notification and proof of publication
   - ☐ Public notice copied to applicable agencies (include date):

Required Agencies	Date
EPA Region VII	________________
US Fish & Wildlife Service	________________
Iowa Environmental Council	________________
Environmental Law & Policy Center	________________
Winnebago Tribe of Nebraska	________________
Sac and Fox Tribe of the Mississippi in Iowa	________________
Iowa DNR Field Office	________________
County Environmental Health Department	________________

Other Agencies (where applicable)	Date
Iowa League of Cities (municipal projects only)	________________
Other state whose waters may be affected	________________
Industrial contributors	________________
Other applicable agencies	________________

   - ☐ Summary of comments received and responsiveness summary included?

5. ☐ Are the existing and design wastewater flows and loadings for the planning period identified?

6. ☐ Are the receiving stream network use designations and impairment status identified?

7. ☐ Are the existing NPDES effluent limits and proposed effluent limits (based on both calculated numeric water quality criteria wasteload allocations and any applicable approved TMDL wasteload allocations) for all discharging alternatives identified?

8. ☐ Are all pollutants of concern including the assigned Tier protection level for each POC identified?

9. ☐ Alternatives and estimated present worth values:

Alt. No.	Description	Present Worth Value
1.		$
2.		$
3.		$
4.		$
5.		$
6.		$
7.		$
8.		$

10. ☐ Were present worth values for all practicable alternatives developed using the same discount rate?

Discount Rate Used ____________________

11. ☐ Classification and reasonableness of alternatives evaluated:

Alt. No.	BPCA, NDA or LDA?	Is the Alternative Reasonable?			
		Practicable?	Economically Efficient?	Affordable?	Reasonable?
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					

12. ☐ Does the analysis include a description and schematic of each alternative evaluated?

13. ☐ Does the analysis include a pollutant-by-pollutant comparison of degradation for each discharging alternative found to be reasonable?

14. ☐ Preferred Alternative: ______________________________

15. ☐ Is the preferred alternative the least degrading reasonable alternative?

16. ☐ For alternatives found to be practicable and economically efficient but not affordable, is the basis for the affordability determination explained and documented?
    ☐ DNR Affordability Analysis worksheet included

17. ☐ Is a demonstration of the projects' Social and Economic Importance (SEI) included within the alternatives analysis?

PROOF OF PUBLICATION

STATE OF IOWA
WAPELLO COUNTY
I, Kyle Ocker, being duly sworn on my oath, say that I am the General Manager of the Ottumwa Courier, a newspaper printed in said Wapello County, Iowa and of general circulation there in, and that the advertisement
PUBLIC NOTICE
HR GREEN INC
hereto attached was published in said newspaper for one consecutive weeks to-wit:

08/09/2025

Subscribed and sworn to before me, and in my presence, by the said 12th day of August, 2025

NOTARIAL SEAL IOWA
TRACI COUNTERMAN
Commission Number 786024
My Commission Expires
September 29, 2026

Traci Counterman

Traci Counterman

Notary Public

In and for Wapello County

Printer's Fee: $ 24.53

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Public Notice Date: August 9, 2025

Antidegradation Alternatives Analysis for Interstate Power and Light in Ottumwa, Iowa

Notice is hereby given that Interstate Power and Light (IPL) in Ottumwa, Iowa has completed a draft antidegradation alternatives analysis. The action being considered is the addition of a new outfall to discharge landfill underdrain water to a Wetland Complex. The Wetland Complex is designated as a General Use water body.

Anyone wishing to comment on the proposed treatment alternatives must do so in writing within 30 days of the date shown at the top of this notice. Comments may be submitted to Matt Wildman electronically at mwildman@hrgreen.com. Electronic copies of this notice, the draft antidegradation alternatives analysis, and supporting information may be requested by contacting Matt Wildman at (319) 841-4000 or the above email address. A summary of any comments received will be submitted to the Iowa Department of Natural Resources (DNR). The final antidegradation alternatives analysis will be subject to DNR review and approval.

Professional Engineering Certification

LICENSED PROFESSIONAL ENGINEER MATTHEW J. WILDMAN 17910 IOWA	I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa. Date: 9/19/2025 **MATTHEW J. WILDMAN, P.E.** License No. **17910** My renewal date is **December 31**, **2025** Pages or sheets covered by this seal: **The enclosed Antidegradation Alternatives Analysis.**

Ownership of Document

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY

The Ottumwa-Midland Landfill (”the landfill”) utilizes an underdrain tiling system to lower the groundwater table beneath the landfill’s bottom liner to achieve the required separation between the waste and groundwater table. Groundwater collected by the underdrain system (consisting solely of background groundwater that does not contact any landfilled waste) is currently stored on-site in a series of tanks and is transported to the Ottumwa Water Pollution Control Facility for subsequent treatment and discharge.

The facility discharges stormwater under the National Pollutant Discharge Elimination System (NPDES) General Permit No. 1, “Stormwater Discharge Associated with Industrial Activity”. The Iowa Department of Natural Resources (DNR) has communicated to Interstate Power and Light (IPL) that landfill underdrain water does not meet the definition of “uncontaminated groundwater” as defined in NPDES General Permit No. 1. Thus, an individual NPDES permit is needed. An Antidegradation Alternatives Analysis is required to evaluate potential degradation to the various receiving water bodies.

This Antidegradation Alternatives Analysis considers four alternatives, with varying scales of degradation, that will allow IPL to discharge water from the underdrain system in the most practical and least degrading manner.

1. Non-Degrading Alternative (NDA) – Continue to Transport Underdrain Water Off-Site
2. Base Pollution Control Alternative (BPCA) - Discharge Underdrain Water to the Des Moines River
3. Less Degrading Alternative (LDA) - Iron Removal via Bag Filters and Discharge to Wetlands
4. Less Degrading Alternative (LDA) – Reverse Osmosis and Discharge to Wetlands

Each alternative was evaluated based on its practicality, economic efficiency, and level of degradation. Alternative 1: Continue to Transport Underdrain Water Off-Site is considered impractical as a long-term solution for factors related to economic efficiency and sustainability. Alternative 2: Discharge Underdrain Water to the Des Moines River, was found to be economically efficient and practical. However, Alternative 3: Iron Removal via Bag Filters and Discharge to Wetlands was also found to be economically efficient and practical, while causing less degradation to the downstream water bodies. Alternative 4: Reverse Osmosis and Discharge to Wetlands was evaluated as an additional less degrading alternative but was found to be economically inefficient and impractical because concentrate would need to be disposed of continuously.

The preferred alternative is Alternative 3: Iron Removal via Bag Filters and Discharge to Wetlands. This is a feasible alternative that minimizes degradation in the receiving stream and will allow continued operation of the landfill underdrainage system. Historical water quality data indicates that waste load allocation (WLA) limits can be met by treating the underdrain water before discharge. While Alternative 3 requires treatment of underdrain water for as long as the landfill contains waste, it is reasonable because of the relatively inexpensive and simple treatment required to ensure water quality limits are met.

2.0 INTRODUCTION

2.1 EXISTING TREATMENT FACILITIES

The Ottumwa-Midland Landfill is a coal combustion residual (CCR) landfill located in Wapello County, near Ottumwa, Iowa (Permit #90-SDP-8-92P). The landfill consists of the existing landfill area, constructed in 1995, and a multi-phase expansion known as the North Expansion, with Phase 1 completed in 2015. The landfill is routinely monitored in accordance with IDNR approved plans and designs to ensure no release of waste material to the environment occurs. Regular monitoring includes upgradient and downgradient groundwater, leachate, underdrain water, and nearby surface water. No discharge of leachate is proposed by this project. Underdrain water does not contact waste, and data is regularly submitted to IDNR to show that the liner remains intact.

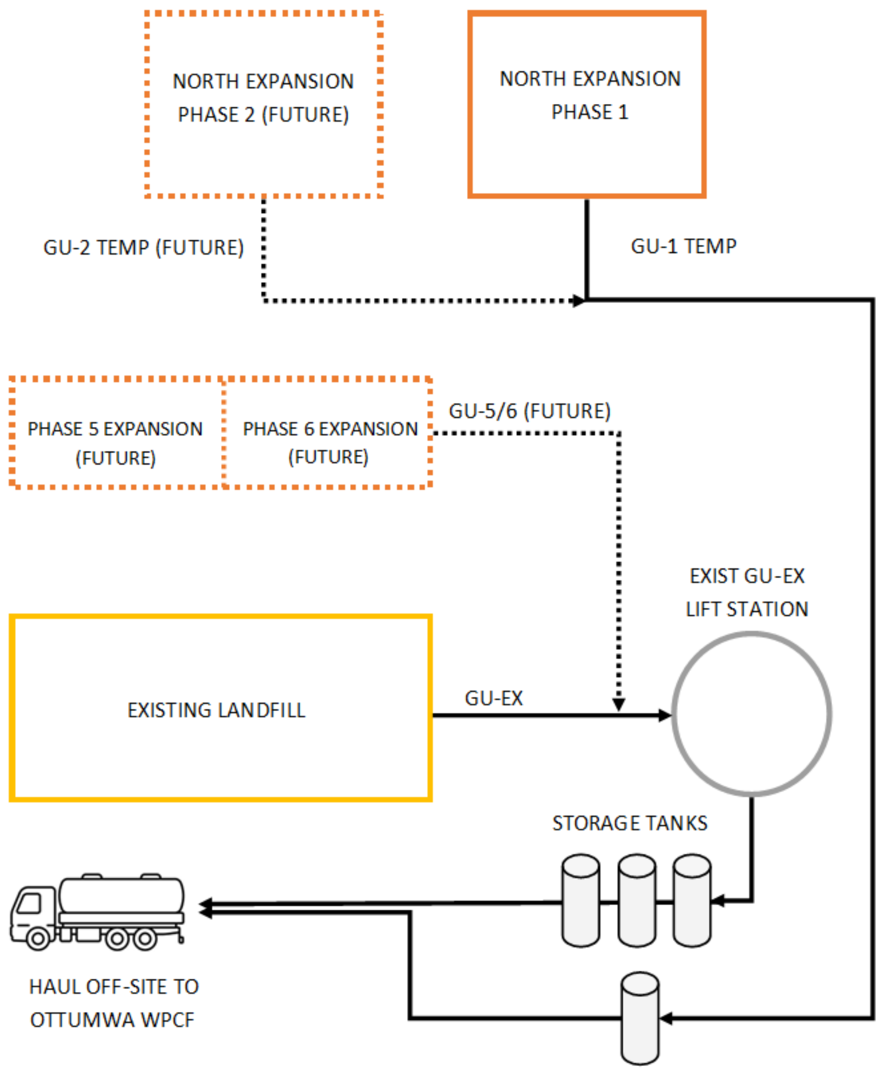

FIGURE 1: EXISTING SYSTEM PROCESS FLOW DIAGRAM

The landfill underdrain system consists of perforated piping encased in coarse aggregate and geotextile fabric. A landfill liner separates the underdrain piping from the leachate collection pipe above. Leachate is collected and diverted into a lined pond, where it is hauled off-site on a regular basis. Groundwater from the underdrain system serving the Existing Phase combines with stormwater runoff from Sedimentation Basin No. 1. Existing valving in place allows for the independent streams to be isolated, if necessary. The underdrain system in the existing landfill area is referred to as “GU-EX”. The North Expansion Phase 1 and Phase 2 underdrain systems are referred to as “GU-1 Temp” and “GU-2 Temp”, respectively. Water collected from the underdrain system is temporarily stored onsite and then hauled away to the Ottumwa Water Pollution Control Facility for subsequent treatment and discharge. Refer to Figure 1 for a process flow diagram associated with the existing underdrain system.

Underdrains from future expansion areas Phases 2 through 6 have been permitted by the Iowa DNR for future construction. The combined flow from current and potential future underdrain flows are calculated to be approximately 1,400 to 84,000 gallons per day (gpd) of underdrain water.

2.2 RECEIVING STREAM CONSIDERATIONS

The BPCA and LDA include several bodies of water that would be impacted by the proposed underdrain water discharge, including the nearby Wetland Complex, Unnamed Creek 1, Unnamed Creek 2, and the Des Moines River. Information about each of these water bodies is provided below.

STREAM DESIGNATIONS AND LOW FLOW CHARACTERISTICS

- Wetland Complex: A series of wetlands are located near the landfill. According to the July 31, 2025 WLA, these wetlands are assumed to have an annual critical low flow of 0 cubic feet per second (cfs) and are characterized as General Use. General Use segments do not meet the criteria for "designated use" segments because they do not consistently maintain flow and/or are incapable of supporting a viable aquatic life due to periods of dryness.

- Unnamed Creeks 1 and 2: Unnamed Creek 1 is located at the mouth of the wetlands and eventually combines with Unnamed Creek 2. Both Unnamed Creeks 1 and 2 have an annual critical low flow of 0 cfs and are characterized as A1, B(WW-1) water ways. The designated use of A1, B(WW-1) is automatically assigned because the Unnamed Creeks do not have a Field Use Attainability Assessment (UAA) at this particular location.

- Des Moines River: Unnamed Creek 2 combines with the Des Moines River several miles downstream of the landfill. The Des Moines River is classified as an A1, B(WW-1, HH) water way, with a 7Q10 annual critical low flow of 271 cfs at the mouth of Unnamed Creek 2.

Class A1 waters are protected for primary contact where significant ingestion of the water is likely. Class B(WW-1) waters are suitable to maintain warm water fish populations with a resident aquatic community, including a variety of nongame fish and invertebrate species. HH waters contain fish that are routinely harvested for human consumption or waters that are designated as a drinking water supply.

STREAM IMPAIRMENTS

Based on the 2024 Iowa DNR Water Quality Assessment, the Des Moines River (segment 04-LDM-1010) is "not supported" for Class A1 or Class B(WW-1) due to levels of indicator bacteria (E. coli) that exceeded state criteria and on a history of fish kills. The Class HH (fish consumption) use remains assessed as "fully supported" based on fish tissue sampling data.

2.3 EFFLUENT LIMITATIONS

A WLA has been prepared for each outfall location included in this Antidegradation Alternatives Analysis: the Wetland Complex and the Des Moines River. The Des Moines River outfall location WLA was prepared on December 13, 2024 and the Wetland Complex WLA was prepared on July 31, 2025. A summary of the proposed WLA limits is provided in Table 1. The full WLAs for the Des Moines River and Wetland Complex are provided in Appendix A and B, respectively.

TABLE 1: WLA LIMITS FOR POTENTIAL OUTFALL LOCATIONS

Parameter	Des Moines River		Wetland Complex	
	Ave. Conc. (mg/l)	Max. Conc. (mg/l)	Ave. Conc. (mg/l)	Max. Conc. (mg/l)
$cBOD_5$	-	7,739,579	-	63
COD	-	9,719,650	-	63
Total DO (Jan – Dec)	Minimum Concentration (mg/l) – WQBL Not Required		Minimum Concentration 1.0 (Jan. – Dec.)	
Ammonia - Nitrogen				
January	17,158	17,158	3.5	15.4
February	20,618	20,618	4.0	14.4
March	16,910	16,910	2.1	14.9
April	11,609	11,609	1.6	16.0
May	14,112	14,112	1.8	15.6
June	14,136	14,136	1.4	14.9
July	14,140	14,140	1.0	18.3
August	14,138	14,138	1.0	16.9
September	11,635	11,635	1.1	17.1
October	11,634	11,634	1.6	16.1
November	11,632	11,632	2.4	15.0
December	11,609	11,609	2.5	16.2
Chloride	1,472,364	1,472,364	389	629
Sulfate	3,590,702	3,590,702	1,514	1,514
Arsenic (III)	148.8	841.5	0.15	0.34
Barium	18,430	507,200	68	68
Beryllium	813.7	1,238	0.5	0.5
Boron	8,292	8,292	3.35	3.35
Cadmium	14.47	14.47	0.001374	0.005845
Chromium (VI)	40.33	40.33	0.01143	0.01629
Cobalt	4,208	4,208	1.7	1.7
Copper	66.58	66.58	0.01687	0.0269
Cyanide	54.45	54.45	0.0052	0.022
Fluoride	19,370	19,370	8.077	8.077
Iron	2,475	2,475	3.7	3.7
Lead	210.1	488.6	0.007693	0.1974

TABLE 1: WLA LIMITS FOR POTENTIAL OUTFALLS (CONTINUED)

Parameter	Des Moines River		Wetland Complex	
	Ave. Conc. (mg/l)	Max. Conc. (mg/l)	Ave. Conc. (mg/l)	Max. Conc. (mg/l)
Manganese	8,381	8,381	3.386	3.386
Nickel	2,087	2,087	0.09376	0.8433
Selenium	47.77	47.77	0.005	0.0193
Silver	30.86	30.86	0.01247	0.01247
Thallium	20.69	1,480	0.598	0.598
Zinc	533.5	533.5	0.2156	0.2156

3.0 DESIGN CONDITIONS

3.1 DESIGN WASTEWATER CHARACTERISTICS

The GU-1 underdrain collector has been observed as consistently low flow to dry and under recent conditions is estimated to contribute approximately 1% of the combined underdrain water on average. Monitoring in July 2025 indicated that the GU-1 underdrain contribution is closer to 3% in wet weather months. Therefore, estimated effluent concentrations in the combined underdrain water are based on 1% to 3% from GU-1 and the remaining 97% to 99% from GU-EX. Estimated effluent concentrations are listed in Table 2 based on monitoring data collected from the underdrains since 2018. Non-detect parameters are labeled as “ND”.

TABLE 2: ESTIMATED EFFLUENT CONCENTRATIONS

Analyte	Units	Estimated Maximum Concentration		Estimated Average Concentration	
		3% GU-1	1% GU-1	3% GU-1	1% GU-1
Aluminum	mg/L	ND	ND	ND	ND
Antimony	mg/L	ND	ND	ND	ND
Arsenic	mg/L	0.002142	0.002181	0.000836	0.000852
Barium	mg/L	0.06343	0.06381	0.035342	0.035299
Beryllium	mg/L	ND	ND	ND	ND
Boron	mg/L	1.0006	1.0002	0.898756	0.907871
Cadmium	mg/L	7.5E-06	2.5E-06	4.78E-06	1.59E-06
Calcium	mg/L	200.9	200.3	176.35	175.45
Chromium	mg/L	ND	ND	ND	ND
Chromium (VI)	mg/L	ND	ND	ND	ND
Cobalt	mg/L	0.0043	0.0041	0.002732	0.002587
Copper	mg/L	0.0105	0.0107	0.002148	0.00219
Iron, Total	mg/L	6.70689	6.83563	1.970379	2.009126
Iron, Dissolved	mg/L	0.00255	0.00085	0.00255	0.00085
Lead	mg/L	0.001206	0.001135	0.000192	0.000181
Lithium	mg/L	0.02666	0.02622	0.025145	0.024715

TABLE 2: ESTIMATED EFFLUENT CONCENTRATIONS (CONTINUED)

Magnesium	mg/L	103.33	103.11	49.53907	49.27493
Manganese	mg/L	0.6803	0.5801	0.382976	0.319944
Mercury	mg/L	ND	ND	ND	ND
Molybdenum	mg/L	0.08549	0.087163	0.049108	0.050055
Nickel	mg/L	0.006563	0.005634	0.003581	0.002917
Selenium	mg/L	0.009369	0.009523	0.001749	0.001776
Silver	mg/L	ND	ND	ND	ND
Thallium	mg/L	ND	ND	ND	ND
Zinc	mg/L	0.053519	0.044973	0.027367	0.025715
Chloride	mg/L	31.64	31.88	16.08993	16.08331
Fluoride	mg/L	0.7555	0.7585	0.34695	0.34565
Sulfate	mg/L	961.91	961.97	593.42	595.54
Ammonia As N	mg/L	ND	ND	ND	ND
Total Kjeldahl Nitrogen	mg/L	0.0345	0.0115	0.01725	0.00575
Biochemical Oxygen Demand	mg/L	0.42	0.14	0.17145	0.05715
Chemical Oxygen Demand	mg/L	ND	ND	ND	ND
Cyanide, Total	mg/L	ND	ND	ND	ND
HEM (Oil & Grease)	mg/L	ND	ND	ND	ND
Total Dissolved Solids	mg/L	1632.4	1630.8	1139.579	1137.955
Total Organic Carbon	mg/L	3.14	3.18	3.14	3.18
Total Suspended Solids	mg/L	11.931	12.177	4.575167	4.6695
Field pH	Std. Units	7.6799	7.6933	7.23633	7.24811
Field Specific Conductance	umhos/cm	1883.13	1885.71	1224.339	1216.913
Field Temperature	deg C	23.222	23.274	19.5041	19.5547
Oxidation Reduction Potential	mV	165.554	164.118	165.554	164.118
Oxygen Dissolved	mg/L	8.1136	8.1712	8.1136	8.1712
Turbidity	NTU	2.9044	2.8748	2.9044	2.8748

When comparing average and maximum estimated effluent concentrations to their respective average or maximum WLA limits, all estimated effluent concentrations in Table 2 are below the WLA limits for both the Wetland Complex and Des Moines River outfalls, with the exception of Total Iron. The estimated maximum effluent Total Iron concentration is 6.7 to 6.8 mg/L. This exceeds the Wetland Complex Total Iron average and maximum WLA limits of 3.7 mg/L. It does not, however, exceed the Des Moines River average and maximum WLA limits of 2,475 mg/L. Therefore, if the combined underdrain water is discharged to the Wetland Complex, removal of the naturally occurring concentrations of iron is required to consistently meet Total Iron effluent limits.

The following metals were detected in the discharge but were not assigned a WLA limit: calcium, lithium, magnesium, and molybdenum. There are no numerical criteria for these parameters in Iowa's water quality standards. However, the water quality standards specify, in the form of narrative criteria, that all surface waters shall be free from materials attributable to wastewater discharges or agricultural practices in concentrations or combinations which are acutely toxic to human, animal, or plant life (567 IAC 61.3(2)d). In April 2025, IPL sampled and tested the combined proposed discharge for Whole Effluent Toxicity and there was no acute toxicity present. Therefore, concentrations of these parameters observed in the wastewater are not expected to cause acute toxicity in the environment.

3.2 POC IDENTIFICATION AND TIER PROTECTION LEVEL

Pollutants of Concern (POCs) for the underdrain operation are listed in Table 3 and include all parameters that have a reasonable potential to be present in the underdrain water. In general, the primary source of degradation is from iron, due to the potential to exceed effluent limits for the Wetland Complex discharge location.

TABLE 3: POLLUTANTS OF CONCERN

POC	Secondary or WQBEL	Beneficial Use Affected	Tier
Arsenic	Yes	Human Health, Aquatic Life	2
Barium	Yes	Human Health, Aquatic Life	2
Beryllium	Yes	Human Health, Aquatic Life	2
Boron	Yes	Human Health, Aquatic Life	2
Cadmium	Yes	Human Health, Aquatic Life	2
Calcium	No	Human Health, Aquatic Life	2
Chloride	Yes	Aquatic Life	2
Cobalt	Yes	Human Health, Aquatic Life	2
Copper	Yes	Human Health, Aquatic Life	2
Cyanide	Yes	Human Health, Aquatic Life	2
Fluoride	Yes	Human Health, Aquatic Life	2
Iron	Yes	Human Health, Aquatic Life	2
Lead	Yes	Human Health, Aquatic Life	2
Lithium	No	Human Health, Aquatic Life	2
Magnesium	No	Human Health, Aquatic Life	2
Manganese	Yes	Human Health, Aquatic Life	2
Molybdenum	No	Human Health, Aquatic Life	2
Nickel	Yes	Human Health, Aquatic Life	2
Selenium	Yes	Human Health, Aquatic Life	2
Sulfate	Yes	Aquatic Life	2
Total Kjeldahl Nitrogen	Yes	Aquatic Life	2
Zinc	Yes	Human Health, Aquatic Life	2

4.0 IDENTIFICATION AND DISCUSSION OF ALTERNATIVES

Four alternatives have been evaluated that will allow IPL to discharge underdrain water in the most practical and least degrading manner. The following alternatives are classified as a Non-Degrading Alternative (NDA), Base Pollution Control Alternative (BPCA), and Less Degrading Alternative (LDA). The NDA provides an alternative that will not result in any further degradation. The LDAs result in less degradation in comparison to the BPCA.

4.1 ALTERNATIVE 1: CONTINUE TO TRANSPORT UNDERDRAIN WATER OFF-SITE (NDA)

The first alternative that was evaluated consists of the continued transport of underdrain water to the Ottumwa Water Pollution Control Facility for subsequent treatment and discharge to the Des Moines River. The process flow diagram associated with Alternative 1 is provided in Figure 2 and is identical to the existing process described in Section 2.1.

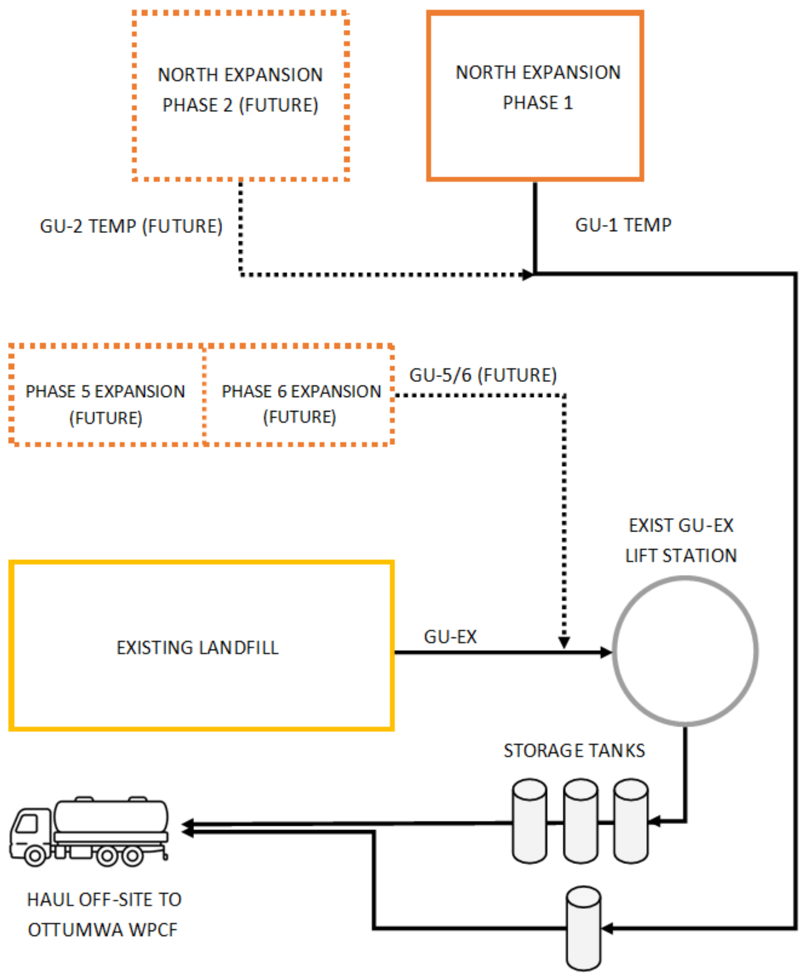

FIGURE 2: ALTERNATIVE 1 (NDA) PROCESS FLOW DIAGRAM

Capital costs for this alternative include the on-site storage tanks required to collect the underdrain water in between truck hauls. Estimated operation and maintenance (O&M) costs associated with hauling and disposing of the underdrain water are based on the maximum theoretical daily volume of underdrain water (84,000 gpd). Costs include $927,000 per year in hauling ($7.25/ton), $613,200 in disposal fees ($0.02/gallon), and $127,800 per year in load fees (based on 14 trucks per day and $25 per truck).

The Engineer's Opinion of Probable Construction Cost (OPCC) for Alternative 1 is provided in Table 4. The 20-year life cycle cost is based on the federal water resources planning discount rate of 3.0% for fiscal year 2025. This option is economically inefficient and unsustainable based on the carbon footprint associated with the hauling. Winter hauling would also require significant infrastructure upgrades that are not accounted for in the estimated costs in Table 4. It is also unknown if the Ottumwa Water Pollution Control Facility will accept the underdrain water indefinitely, making this alternative impractical in the long-term.

TABLE 4: ALTERNATIVE 1 OPCC (NDA)

Item No.	Item Description	Qty.	Units	Unit Price	Total
1	Storage Tanks	1	LS	$843,000	$843,000
Total Preliminary Opinion of Probable Construction Cost					$843,000
Engineering, Legal, and Administrative					$84,300
Total Cost + Contingency (20%)					$1,112,800
Annual Cost					
2	Operations & Maintenance	1	PER YR	$1,668,000	$24,816,000
Total Life Cycle Cost					**$25,929,000**

4.2 ALTERNATIVE 2: DISCHARGE UNDERDRAIN WATER TO THE DES MOINES RIVER (BPCA)

The second alternative that was evaluated involves discharging underdrain water to a new outfall at the Des Moines River. The process flow diagram associated with Alternative 2 is provided in Figure 3.

This alternative will require a new effluent lift station (LS-1) to collect the combined underdrain flow and a lift station (LS-4) to divert the combined Phase 1 and 2 North Expansion underdrain flows to LS-1, in addition to piping/valving provisions between structures. The combined underdrain water will discharge to an onsite storage pond (to accommodate potential periods of future downstream maintenance) prior to discharge. Approximately three miles of 4" HDPE force main will also be required to convey the combined underdrain discharge from LS-1 to Outfall 001.

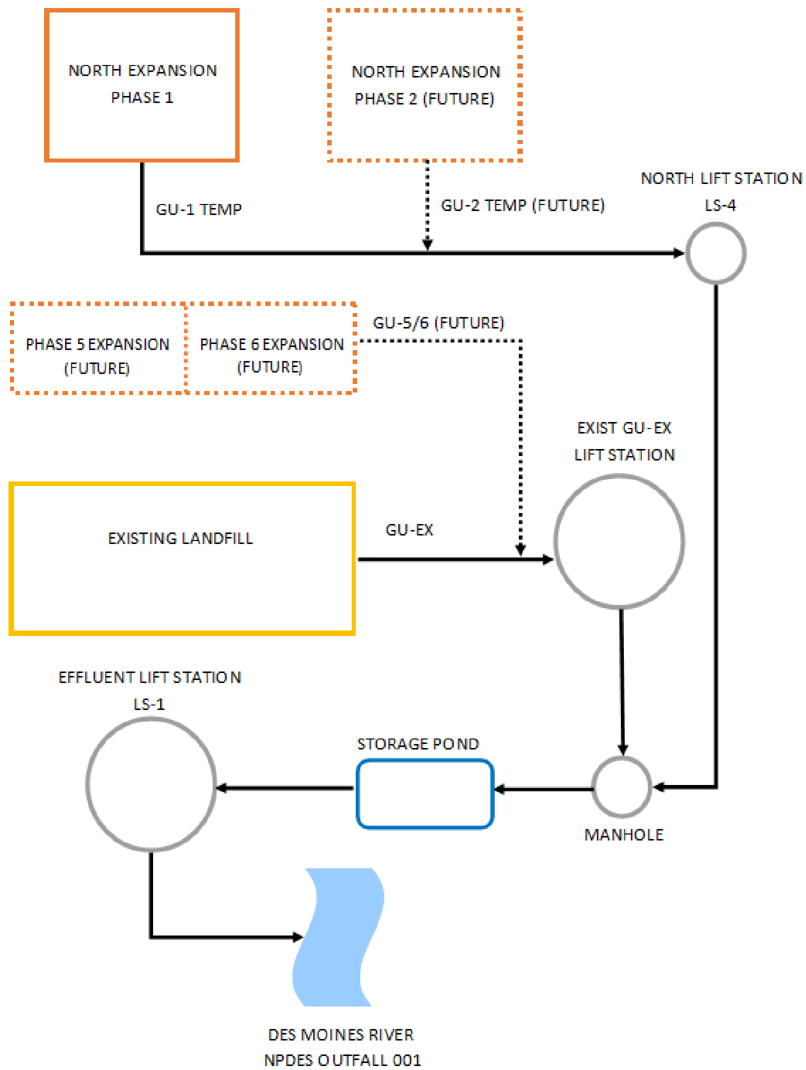

FIGURE 3: ALTERNATIVE 2 (BPCA) PROCESS FLOW DIAGRAM

Capital costs associated with Alternative 2 include furnishing and installing new lift stations, modifications to the existing GU-EX Lift Station, storage pond, site piping and valves between the proposed structures, force main piping from LS-1 to NPDES Outfall 001, together with related subsidiary and incidental work (site restoration, materials testing, construction staking, mobilization, etc.). O&M costs include labor to operate and maintain the system, maintenance fees and repair work, power consumption associated with the lift station pumps, and replacement parts.

The OPCC for Alternative 2 is provided in Table 5. Capital costs are based on contractor bids that were submitted for the proposed work in 2025. The 20-year life cycle cost is based on the federal water resources planning discount rate of 3.0% for fiscal year 2025.

TABLE 5: ALTERNATIVE 2 OPCC (BPCA)

Item No.	Item Description	Qty.	Units	Unit Price	Total
1	Lift Station No. 1	1	LS	$824,500	$824,500
2	Lift Station No. 4	1	LS	$144,500	$144,500
3	Site Piping and Valves	1	LS	$299,100	$299,100
4	Storage Pond	1	LS	$1,431,600	$1,431,600
5	Force Main to Des Moines River	1	LS	$1,967,600	$1,967,600
				Total Preliminary Opinion of Probable Construction Cost	$4,667,300
				Engineering, Legal, and Administrative	$466,800
				Total Cost + Contingency (20%)	$6,161,000
Annual Cost					
6	Operations & Maintenance	1	PER YR	$31,300	$466,000
				Total 20-Year Life Cycle Cost	**$6,627,000**

4.3 ALTERNATIVE 3: IRON REMOVAL VIA BAG FILTERS AND DISCHARGE TO WETLANDS (LDA)

The third alternative that was evaluated involves removing particulate iron via bag filters and discharging to the nearby Wetland Complex. The process flow diagram associated with Alternative 3 is provided in Figure 4. Particulate iron would need to be removed to below 3.7 mg/L to comply with the WLA limits for the Wetland Complex. Filter bags would be used to strain the iron out of the underdrain water and the bags would be disposed appropriately once their useful life has been expended. The bags would be contained within a filter housing system and located within a heated enclosure. O&M costs associated with Alternative 3 are anticipated to be similar to those in Alternative 2, including labor to operate and maintain the system, maintenance fees and repair work, power consumption, and replacement parts. The OPCC for Alternative 3 is provided in Table 6. The 20-year life cycle cost is based on the federal water resources planning discount rate of 3.0% for fiscal year 2025.

TABLE 6: ALTERNATIVE 3 (LDA) OPCC

Item No.	Item Description	Qty.	Units	Unit Price	Total
1	General Requirements	1	LS	$300,000	$300,000
2	Lift Station	1	LS	$150,000	$150,000
3	Filter Treatment System	1	LS	$15,000	$15,000
4	Process Piping and Valves	1	LS	$100,000	$100,000
5	Electrical and Mechanical	1	LS	$200,000	$200,000
6	Heated Enclosure	100	SF	$350	$35,000
7	Site Piping and Valves	1	LS	$250,000	$250,000
				Total Preliminary Opinion of Probable Construction Cost	$1,050,000
				Engineering, Legal, and Administrative	$105,000
				Total Cost + Contingency (20%)	$1,386,000
Annual Cost					
8	Operations & Maintenance	1	PER YR	$31,300	$466,000
				Total Life Cycle Cost	**$1,852,000**

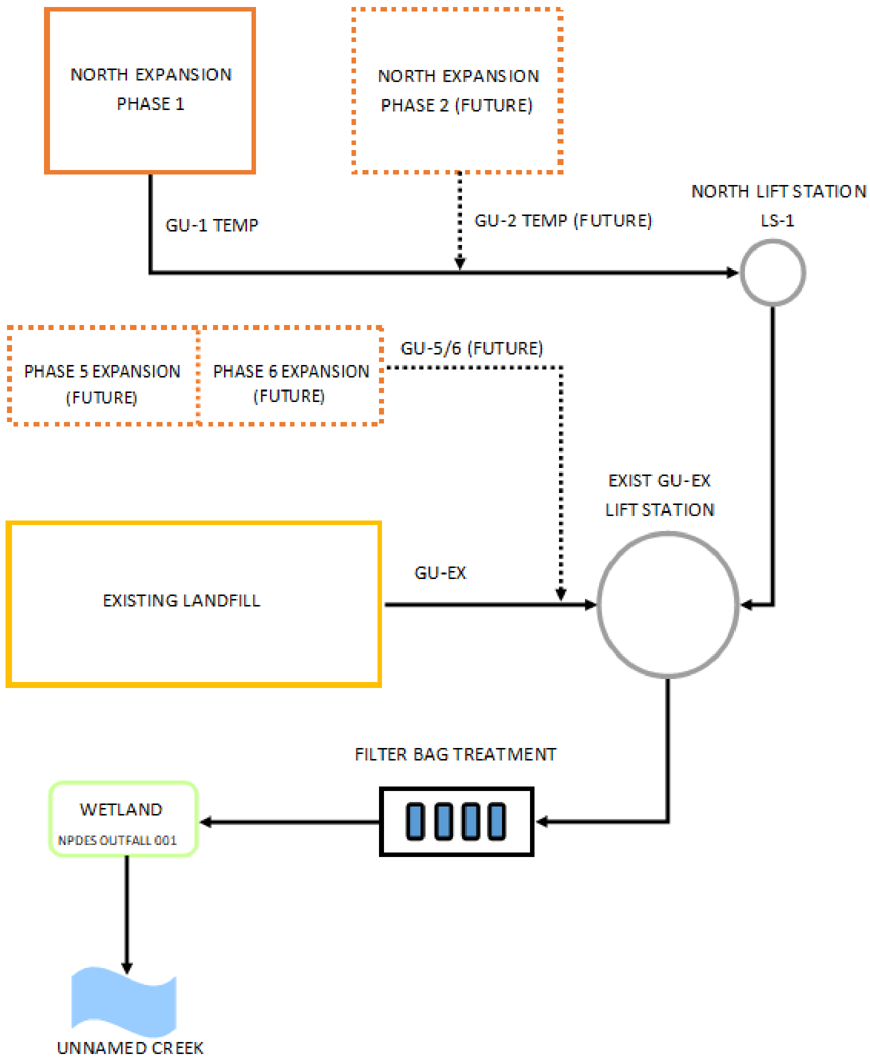

FIGURE 4: ALTERNATIVE 3 (LDA) PROCESS FLOW DIAGRAM

4.4 ALTERNATIVE 4: REVERSE OSMOSIS TREATMENT AND DISCHARGE TO WETLANDS (LDA)

The fourth alternative that was evaluated involves Reverse Osmosis treatment and discharging to the nearby Wetland Complex. Prior to Reverse Osmosis filtration, pre-treatment would be required to remove particulate iron. The process flow diagram associated with Alternative 4 is provided in Figure 5.

Particulate iron would need to be removed to below 3.7 mg/L to comply with the WLA limits for the Wetland Complex. Identical to Alternative 3, filter bags would be used to strain the iron out of the underdrain water. A new storage reservoir and lift station would be used downstream of the bag filters to pump into the Reverse Osmosis skids. Skids would be sized to handle the maximum underdrain flow of 84,000 gpd with built-in redundancy (no bypassing/blending of flows necessary). pH adjustment via sodium hydroxide feed would be needed downstream of the Reverse Osmosis skids to increase pH to be within water quality standards. An antiscalant feed would also be necessary for membrane pre-conditioning. These chemicals would theoretically increase degradation associated with this alternative.

The Reverse Osmosis skids, pH adjustment chemicals and feed skids, and antiscalant system, would be housed within a new building.

Approximately 25% of the underdrain flow would become concentrate following Reverse Osmosis filtration. This concentrate would need to be stored on-site (up to 21,000 gpd) and hauled to the Ottumwa Water Pollution Control Facility.

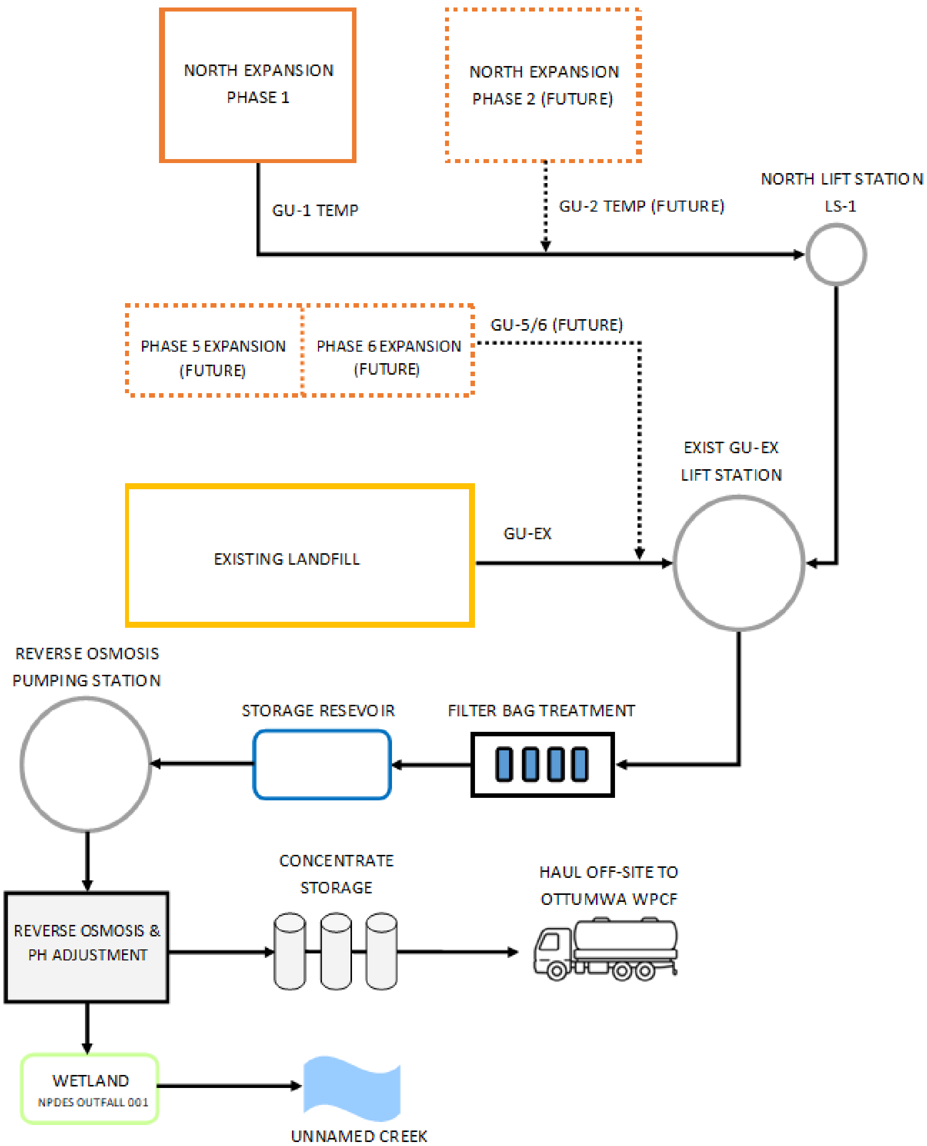

FIGURE 5: ALTERNATIVE 4 (LDA) PROCESS FLOW DIAGRAM

O&M costs associated with Alternative 4 include chemical costs for pH adjustment and antiscalant chemical addition, power consumption from the various equipment, replacement parts, and hauling/dumping fees for the concentrate. The OPCC for Alternative 4 is provided in Table 7. The 20-year life cycle cost is based on the federal water resources planning discount rate of 3.0% for fiscal year 2025.

TABLE 7: ALTERNATIVE 4 (LDA) OPCC

Item No.	Item Description	Qty.	Units	Unit Price	Total
1	General Requirements	1	LS	$825,000	$825,000
2	Filter Bag Treatment	1	LS	$1,050,000	$1,050,000
3	Storage Pond	1	LS	$1,431,600	$1,431,600
4	Pump Station	1	LS	$110,000	$110,000
5	Reverse Osmosis Equipment	1	LS	$1,025,000	$1,025,000
6	pH Adjustment System	1	LS	$75,000	$75,000
7	Antiscalant Chemical Feed	1	LS	$75,000	$75,000
8	Concentrate Storage Tanks	1	LS	$211,000	$211,000
9	Process Piping and Valves	1	LS	$105,000	$105,000
10	Electrical and Mechanical	1	LS	$514,000	$514,000
11	Treatment Building	1000	SF	$500	$500,000
12	Generator	1	LS	$50,000	$50,000
13	Site Piping and Valves	1	LS	$350,000	$350,000
Total Preliminary Opinion of Probable Construction Cost					$6,321,600
Engineering, Legal, and Administrative					$632,200
Total Cost + Contingency (20%)					$8,344,600
Annual Cost					
14	Operations & Maintenance	1	PER YR	$558,500	$8,310,000
Total Life Cycle Cost					**$16,654,600**

4.5 PRESENT WORTH COSTS

Table 8 summarizes the 20-year present worth costs for each alternative. The present worth costs are based on a federal discount rate of 3.0% for water resources planning in fiscal year 2025.

TABLE 8: PRESENT WORTH COSTS

Alternative	Description	Present Worth Costs
1 (NDA)	Continue to Transport Underdrain Water Off-Site	$25,929,000
2 (BPCA)	Discharge Underdrain Water to the Des Moines River	$6,627,000
3 (LDA)	Iron Removal via Bag Filters and Discharge to Wetlands	$1,852,000
4 (LDA)	Reverse Osmosis Treatment and Discharge to Wetlands	$16,654,600

The classification and evaluation of each alternative from a practicality and economic standpoint is described below and summarized in Table 9.

- Alternative 1, Continue to Transport Underdrain Water Off-Site, is considered economically inefficient due to the cost associated with hauling and disposing of the underdrain water. This option is also impractical and unsustainable when compared to Alternatives 2 and 3.
- Alternative 2, Discharge Underdrain Water to the Des Moines River, is economically efficient and practical. This alternative also complies with WLA limits without the need for further treatment.
- Alternative 3, Iron Removal via Bag Filters and Discharge to Wetlands, is economically efficient and practical. This alternative requires treatment that would need to be continued in perpetuity. This alternative is considered less degrading than the BPCA from a water quality standpoint.
- Alternative 4, Reverse Osmosis Treatment and Discharge to Wetlands, is economically inefficient and impractical. This alternative requires costly treatment, including chemical addition, that would need to be continued in perpetuity, in addition to off-site disposal of a concentrate stream.

TABLE 9: ALTERNATIVES CLASSIFICATION & EVALUATION

Alternative	Practicable?	% of BPCA	Economically Efficient?	Affordable?	Reasonable?
1	No	391%	No	No	No
2	Yes	100%	Yes	Yes	Yes
3	Yes	28%	Yes	Yes	Yes
4	No	251%	No	No	No

4.6 PREFERRED ALTERNATIVE

The preferred alternative is Alternative 3: Iron Removal via Bag Filters and Discharge to Wetlands. This is a feasible alternative that minimizes degradation in the receiving stream and will allow continued operation of the landfill underdrainage system. Historical water quality data indicates that water quality limits can be met by treating the underdrain water before discharge. While Alternative 3 requires treatment of underdrain water for as long as the landfill contains waste, it is reasonable because of the relatively inexpensive and simple treatment required to ensure water quality limits are met. Because of the low estimated costs and the less degradation offered by Alternative 3, it is the preferred alternative. Refer to Table 10 for a summary of pros and cons associated with each alternative.

TABLE 10: ALTERNATIVES PROS/CONS SUMMARY

Alternative	Pros	Cons
1) Continue to Transport Underdrain Water Off-Site	- No degradation to water bodies (to be combined/treated at Ottumwa Water Pollution Control Facility and discharged to Des Moines River)	- Economically inefficient (highest capital and O&M costs) - Unsustainable - Additional costs associated with upgrades for winter transport - Ottumwa Water Pollution Control Facility may not accept waste long-term - Spill risk from storage and transport
2) Discharge Underdrain Water to the Des Moines River	- Minimal O&M (no treatment required)	- Introducing new pollutant stream to Des Moines River - High capital cost - Wetland and stream crossings required for pipeline to River

TABLE 10: ALTERNATIVES PROS/CONS SUMMARY (CONTINUED)

3) Iron Removal via Bag Filters and Discharge to Wetlands	- Less degrading than Alt. 2 due to iron removal - Lower capital cost than Alt. 2 & 4 - Lower O&M costs than Alts. 1 & 4 - Use natural "treatment" capability of wetlands prior to Des Moines discharge (per prior Joint comments)	- Treatment required to meet iron limits for Wetland Complex; treatment is needed for the life of the landfill (in perpetuity) - Introducing new pollutant stream to Wetland Complex
4) Reverse Osmosis Treatment and Discharge to Wetlands	- Less degrading than Alt. 2 and Alt. 3 due to reduction of additional pollutants of concern	- Economically inefficient (significantly higher capital and O&M costs than Alt. 2 & 3) - Concentrate would need to be hauled to Ottumwa Water Pollution Control Facility - Treatment is needed for the life of the landfill (in perpetuity) - Introducing new pollutant stream to Wetland Complex - Additional degradation to receiving wetland complex from water treatment chemical use - Spill risk from storage and use of water treatment chemicals

4.7 RELATIVE DEGRADATION

Table 11 compares the degradation of the alternatives on a pollutant-by-pollutant basis. Each alternative was evaluated to show the potential degradation to the respective water bodies where discharge will occur.

- Alternative 1 will be hauled to the Ottumwa Water Pollution Control Facility and therefore results in zero degradation. Wastewater effluent from the Ottumwa Water Pollution Control Facility is ultimately discharged to the Des Moines River, however, this discharge point is not evaluated for the purposes of this Antidegradation Alternatives Analysis.
- Alternative 2 uses the Des Moines River as a new outfall location and will introduce a new pollutant stream, resulting in degradation (although concentrations would be below WLA limits). Therefore, a "+1" was assigned to each pollutant.
- Alternative 3 will reduce naturally occurring concentrations of iron in the underdrain water prior to discharging to the Wetland Complex. The water quality should otherwise be identical to Alternative 2. Therefore, a "+1" was assigned to all pollutants, excluding iron which was assigned a "+0.5".
- Alternative 4 will reduce naturally occurring concentrations of the pollutants of concern via Reverse Osmosis treatment, including pre-treatment of particulate iron, identical to Alternative 3. Therefore, a "+0.5" was assigned to all pollutants.

TABLE 11: RELATIVE DEGRADATION TO RECEIVING WATER BODY

Pollutant of Concern	Relative Degradation Alternative No. 1	2	3	4
Arsenic	0	+1	+1	+0.5
Barium	0	+1	+1	+0.5
Beryllium	0	+1	+1	+0.5
Boron	0	+1	+1	+0.5
Calcium	0	+1	+1	+0.5
Chloride	0	+1	+1	+0.5
Cobalt	0	+1	+1	+0.5
Copper	0	+1	+1	+0.5
Cyanide	0	+1	+1	+0.5
Fluoride	0	+1	+1	+0.5
Iron	0	+1	+0.5	+0.5
Lead	0	+1	+1	+0.5
Lithium	0	+1	+1	+0.5
Magnesium	0	+1	+1	+0.5
Manganese	0	+1	+1	+0.5
Molybdenum	0	+1	+1	+0.5
Nickel	0	+1	+1	+0.5
Selenium	0	+1	+1	+0.5
Sulfate	0	+1	+1	+0.5
Total Kjeldahl Nitrogen	0	+1	+1	+0.5
Zinc	0	+1	+1	+0.5

5.0 JUSTIFICATION OF DEGRADATION

Alternative 3: Iron Removal via Bag Filters and Discharge to Wetlands, is a practical and feasible alternative that will allow the continued operation of the landfill underdrain system and the landfill itself. Minimal treatment is required to ensure water quality standards are met and it avoids the degradation to the Des Moines River under Alternative 2. Historical water quality data indicates that Alternative 3 is capable of complying with WLA limits for the proposed outfall and the beneficial uses of the receiving wetland and stream network will be maintained.

The Ottumwa Generating Station is served by the landfill and offers an essential service to the local community by providing local employment and a reliable source of electricity. The underdrain system is required to continue to discharge to maintain landfill stability and comply with the disposal permit issued by the IDNR, regardless of whether the generating station or landfill were to cease operations. Degradation is justified because the landfill is required to maintain a separation between the groundwater table and liner.

6.0 SOCIAL AND ECONOMIC IMPORTANCE

Social and Economic Importance (SEI) factors for Ottumwa, Iowa, in comparison to the state average, are shown in Table 12. SEI factors for Ottumwa indicate that the local economic and population trends are lower than the average trends for the State of Iowa. This implies that Ottumwa is more susceptible to social and economic disruption than the average town in Iowa. Implementation of the preferred alternative is not anticipated to impact the local community. As a regulated utility, IPL has an obligation to prevent unnecessary increases to energy customer costs. Alternative 3 offers significant cost savings long-term compared to the other alternatives while minimizing degradation of the receiving water bodies.

TABLE 12: OTTUMWA SEI FACTORS

Factor	Ottumwa Average	Notes	Source	Iowa Average
Employment Rate	59.8%	Employment Status: Population 16 Years and Older	2023: American Community Survey 5-Year Estimates	64.4%
Unemployment Rate	3.7%	Employment Status: Population 16 Years and Older	2023: American Community Survey 5-Year Estimates	1.8%
Median Household Income	$56,994	Income in the Past 12 Months: Total Households	2023: American Community Survey 5-Year Estimates	$71,433
Poverty Level	18.9%	Poverty Status in the Past 12 Months	2023: American Community Survey 5-Year Estimates	11.3%
Population Trends	+2.0%	Between 2010 and 2020	2010 Census Data and 2020 Census Data	+4.7%

7.0 APPENDIX A – WLA FOR DES MOINES RIVER OUTFALL

IPL Ottumwa Midland Landfill

This Package Contains

Wasteload Allocation Calculations & Notes

ENVIRONMENTAL SERVICES DIVISION
WATER QUALITY-BASED PERMIT LIMITS

SECTION VI: WATER QUALITY-BASED PERMIT LIMITS

Facility Name: IPL Ottumwa Midland Landfill NPDES Number: TBD

Parameters	Ave. Conc. (mg/l)	Max. Conc. (mg/l)	Ave. Mass (lbs/d)	Max. Mass (lbs/d)
Outfall No. 001	**ADW = 0.0014 MGD & AWW = 0.084 MGD**			
CBOD5		7,739,579		90,400
COD		9,719,650		113,528
Total D.O.	Minimum Concentration (mg/l)			
January – December	Water Quality Based Limits Are Not Required			
Ammonia – Nitrogen				
January	17,158	17,158	211	211
February	20,618	20,618	251	251
March	16,910	16,910	208	208
April	11,609	11,609	148	148
May	14,112	14,112	176	176
June	14,136	14,136	176	176
July	14,140	14,140	179	179
August	14,138	14,138	178	178
September	11,635	11,635	149	149
October	11,634	11,634	148	148
November	11,632	11,632	147	147
December	11,609	11,609	148	148
Chloride	1,472,364	1,472,364	17,625	17,625
Sulfate	3,590,702	3,590,702	42,968	42,968
pH	3.8-14.0 Standard Units			

Stream Network/Classification of Receiving Stream: Des Moines River (A1 B(WW-1) HH) to (A1, B(WW-1) HH, C)

Annual critical low flows in Des Moines River at the outfall:
1Q10 flow 245.8 cfs, 7Q10 flow 271.8 cfs, 30Q10 flow 318.1 cfs, 30Q5 flow 437.3 cfs, harmonic mean flow 1,776.9 cfs

Annual critical low flows in Des Moines River at or just upstream of the Ottumwa Water Works Class C:
1Q10 flow 247.6 cfs, 7Q10 flow 273.4 cfs, 30Q10 flow 320.4 cfs, 30Q5 flow 440.6 cfs, harmonic mean flow 1,790.2 cfs

Performed by: Nolan Underwood

Antidegradation Review Requirement

A tier II antidegradation review is required. See Section 2 for details.

The antidegradation review conducted in this wasteload allocation is based on the current information available. Antidegradation could also be triggered during the NPDES permitting process based on new information.

ENVIRONMENTAL SERVICES DIVISION WATER QUALITY-BASED PERMIT LIMITS				
SECTION VI: WATER QUALITY-BASED PERMIT LIMITS Facility Name: IPL Ottumwa Midland Landfill — NPDES Number: TBD				
Parameters	Ave. Conc. (mg/l)	Max. Conc. (mg/l)	Ave. Mass (lbs/d)	Max. Mass (lbs/d)
Outfall No. 001	**ADW = 0.0014 MGD & AWW = 0.084 MGD**			
Toxics				
Arsenic (III)	1.488E+02	8.415E+02	1.737E+00	1.006E+01
Barium	1.843E+05	5.072E+05	2.153E+03	6.063E+03
Beryllium	8.137E+02	1.238E+03	9.504E+00	1.479E+01
Boron	8.292E+03	8.292E+03	9.912E+01	9.912E+01
Cadmium	1.447E+01	1.447E+01	1.729E-01	1.729E-01
Chloride	1,472,364	1,472,364	17,625	17,625
Chromium (VI)	4.033E+01	4.033E+01	4.821E-01	4.821E-01
Cobalt	4.208E+03	4.208E+03	5.030E+01	5.030E+01
Copper	6.658E+01	6.658E+01	7.959E-01	7.959E-01
Cyanide	5.445E+01	5.445E+01	6.509E-01	6.509E-01
Fluoride	1.937E+04	1.937E+04	2.318E+02	2.318E+02
Iron	2.475E+03	2.475E+03	2.959E+01	2.959E+01
Lead	2.101E+02	4.886E+02	2.458E+00	5.841E+00
Manganese	8.381E+03	8.381E+03	1.002E+02	1.002E+02
Nickel	2.087E+03	2.087E+03	2.495E+01	2.495E+01
Selenium	4.777E+01	4.777E+01	5.711E-01	5.711E-01
Silver	3.086E+01	3.086E+01	3.689E-01	3.689E-01
Sulfate	3,590,702	3,590,702	42,968	42,968
Thallium	2.069E+01	1.480E+03	2.419E-01	1.769E+01
Zinc	5.335E+02	5.335E+02	6.378E+00	6.378E+00

WLAs/Permit Limits for IPL Ottumwa Midland Landfill's Wastewater Discharge

These wasteload allocations and water quality-based permit limitations are for IPL Ottumwa Midland Landfill's wastewater discharge. The wasteload allocations/permit limits are based on the Water Quality Standards (IAC 567.61) and the "Iowa Wasteload Allocation (WLA) Procedure," effective November 11, 2020.

The water quality-based limits in this WLA are calculated to meet the surface water quality criteria to protect downstream uses. There could be technology-based limits applicable to this facility that are more stringent than the water quality-based limits shown in this WLA. The technology-based limits could be derived from either federal guidelines based on different industrial categories or permit writer's judgment.

Section 1. Background:

IPL Ottumwa Midland Landfill discharges a stream of wastewater consisting of groundwater from the landfill underdrain system into Des Moines River (proposed location, 41° 3' 39.86" N, 92° 28' 56.78" W).

Route of flow and use designations:

At the proposed outfall, Des Moines River is an A1 B(WW-1) HH designated use water body. After approximately 5.13 miles, the Des Moines River gains Class C protections at the City of Ottumwa Water Works. The designations have been adopted in Iowa's state rule described in the rule-referenced document of "Surface Water Classification," effective July 24, 2019. Based on the pollutants of concern, the use designations of water bodies further downstream will not impact the resulting limits for this facility.

Critical low flow determination:

The annual critical low flows in Des Moines River at the outfall are estimated based on the Drainage Area Ratio (DAR) method from "Methods for estimating selected low-flow frequency statistics and harmonic mean flows for streams in Iowa" (2012, revised 2017) and flow statistics obtained at USGS gage station 05488500, located on the Des Moines River at Tracy, Iowa. Another USGS gage lies downstream of the outfall at Ottumwa, Iowa. However, between the gage and the outfall lies both a dam and the Ottumwa Water Works intake, altering the resulting gage data. Thus, the downstream gage is not used for any flow determinations.

Table 1: Annual critical low flows

Location	D.A. (mi^2)	1Q10 (cfs)	7Q10 (cfs)	30Q10 (cfs)	30Q5 (cfs)	Harmonic mean (cfs)
Des Moines River at the outfall	13,300	245.8	271.3	318.1	437.3	1,776.9
Des Moines River Ottumwa Water Works Class C	13,400	247.6	273.4	320.5	440.6	1,790.2
Des Moines River at the Tracy Iowa gage	12,479	231.0	255.0	299.0	411.0	1,670.0

<u>Mixing Zone (MZ) and Zone of Initial Dilution (ZID)</u>:
Approximately 1,740 feet downstream of the facility's proposed outfall, the perennial stream Unnamed Creek junctures with the Des Moines River. Based on 567 IAC 61.2(4)"b"(2) and "e"(2) the maximum allowable mixing zone length is 2,000 feet and is restricted by the distance to the juncture of two perennial streams for toxics and ammonia nitrogen. Therefore, the MZ and ZID are proportionately reduced to (1,740 / 2,000) 87% of their default values for toxics and ammonia nitrogen. Note, this limitation does not apply to pH. A summary of restrictions can be found below in Table 2.

Table 2:MZ and ZID

Pollutant	Default		Shortened	
	ZID	MZ	ZID	MZ
Toxics	2.5%	25%	2.18%	21.8%
Ammonia Nitrogen	2.5%	25%	2.18%	21.8%
pH	--	25%	--	25%

Section 2. Antidegradation Review:
According to the "Iowa Antidegradation Implementation Procedure," effective February 17, 2010 (IAC 567-61.2(2).e), all new or expanded regulated activities (with limited exceptions, such as unsewered communities) are subject to antidegradation review requirements.

Table 3: Antidegradation review analysis

Item #	Factor or scenario	Antidegradation determination	Analysis/comments
1	Design capacity increase	Yes ☒, No ☐, or Not Applicable ☐	1: New Outfall
2	Significant Industrial Users (SIU) contributing new pollutant of concern (POC)	Yes ☐, No ☐, or Not Applicable ☒	
3	New process contributing new pollutant of concern (POC)	Yes ☐, No ☒, or Not Applicable ☐	
4	Less stringent water quality-based limits?	Yes ☐, No ☒, or Not Applicable ☐	
5	Outfall location change	Yes ☒, No ☐, or Not Applicable ☐	1: New Outfall
Conclusion and discussion: Due to Items 1 and 5, a tier II antidegradation review is required. The antidegradation review conducted in this WLA is based on the current information available. Antidegradation could also be triggered during the NPDES permitting process based on new information.			

Section 3. Total Maximum Daily Load (TMDL) Limitations:
The following impaired water bodies in the discharge route are contained in the 2024 Iowa Integrated Report:

- Des Moines River for bacteria (indicator: *E. coli*) and fish kill due to unknown toxicity

This facility has not been assigned any allocations from TMDLs at this time.

The results presented in this report are wasteload allocations based on meeting the State's current water quality standards in the receiving water body. Additional and/or more stringent effluent limits may be applicable to this discharge based on approved TMDLs for impaired water bodies, which may provide watershed based wasteload allocations. Information on impaired streams in Iowa and approved TMDLs can be found at the following website: https://www.iowadnr.gov/environmental-protection/water-quality/watershed-improvement/water-improvement-plans.

Section 4. Calculations:
The WLAs/permit limits for this outfall are calculated based on the facility's Average Dry Weather (ADW) design flow of 0.0014 MGD and its Average Wet Weather (AWW) design flow of 0.084 MGD.

Only wasteload allocations/permit limits (water quality-based effluent limits) calculated using DNR approved design flows can be applied in NPDES permits. Water quality-based effluent limits calculated using proposed flows that have not been approved by the DNR for permitting and compliance may be used for informational purposes only.

The water quality-based permit concentration limits are derived using the allowed stream flow and the ADW design flow, while the loading limits are derived using the allowed stream flow and the AWW design flow.

Toxics:
The toxics wasteload allocations will consider the procedures included in the 2000 revised WQS and the 2007 chemical criteria.

To protect the aquatic life use:
The acute criteria apply at the end of the Zone of Initial Dilution (ZID), and the chronic criteria apply at the end of the Mixing Zone (MZ). In this case, 21.8% of the 7Q10 flow and 2.18% of the 1Q10 flow in Des Moines River at the outfall are used as the MZ and the ZID, respectively.

Default effluent and background chloride and sulfate concentrations of 34 mg/l and 63 mg/l, respectively, are used in the applicable criteria. A default hardness of 200 mg/l for background and effluent is used for applicable criteria. Default background concentrations are used for other toxics in cases where there is sufficient stream data.

Effective November 11, 2020, water quality criteria for metals (excluding aluminum) are expressed as dissolved in IAC 567.61. Using EPA dissolved metal translators, water quality-based effluent limits in this WLA are expressed as total recoverable.

To protect the human health (HH) use:
For pollutants that are non-carcinogenic and have criteria for HH protection, the criteria apply at the end of the MZ, which in this case is 21.8% of the 30Q5 flow in Des Moines River at the outfall.

For pollutants that are carcinogenic and have criteria for HH protection, the criteria apply at the end of the MZ, which in this case is 21.8% of the harmonic mean flow in Des Moines River at the outfall.

To protect the Class C use:
The City of Ottumwa water works lies approximately 5.13 miles downstream of the outfall on the Des Moines River.

For pollutants that are non-carcinogenic and have criteria for maximum contaminant level (MCL), the criteria apply at the end of the MZ, which in this case is 100% of the 30Q5 flow in the Des Moines River at the nearest Ottumwa Water Works water intake.

For pollutants that are carcinogenic and have criteria for maximum contaminant level (MCL), the criteria apply at the end of the MZ, which in this case is 100% of the harmonic mean flow in the Des Moines River at the nearest Ottumwa Water Works water intake.

Final limits:
The maximum limits are those calculated for the protection of the aquatic life use and the average limits are the more stringent between those for the protection of the aquatic life use, those for the protection of the HH use, and those for the protection of the downstream Class C use.

The limits for toxics are based on a sampling frequency of 1/week.

Ammonia Nitrogen:
Standard stream background pH, temperatures, and concentrations of NH3-N are mixed with the discharge from the facility's effluent pH and temperature values to calculate the applicable instream criteria for the protection of Des Moines River.

Based on the ratio of the stream flow to the discharge flow, 2.18% of the 1Q10 flow and 21.8% of the 30Q10 flow in Des Moines River at the outfall are used as the ZID and the MZ, respectively. At the outfall, Des Moines River is a B(WW-1) stream; therefore, early life protection will begin in March and run through September.

The monthly background pH, temperatures, and NH3-N concentrations shown in Table 4 are used for the wasteload allocation/permit limits calculations. Table 5 shows the statewide monthly effluent pH and temperature values for mechanical facilities. The background category is based on the characteristics of flexible holding time prior to discharge and industrial type POCs, which most aligns with the pH and temperature granted to mechanical facilities. Table 6 shows the calculated ammonia nitrogen wasteload allocations for this facility.

Table 4: Background pH, temperatures, and NH3-N concentrations

Months	pH	Temperature (°C)	NH_3-N (mg/l)
January	8.1	0.3	0.02
February	8.0	0.1	0.08
March	8.1	1.5	0.12
April	8.3	9.3	0.03
May	8.2	15.0	0.03
June	8.2	19.4	0.02
July	8.2	23.5	0.02
August	8.2	24.3	0.02
September	8.3	20.2	0.02
October	8.3	14.2	0.02
November	8.3	8.0	0.02
December	8.3	0.8	0.03

Table 5: Standard effluent pH and temperature values for mechanical facilities

Months	pH	Temperature (°C)
January	7.67	12.4
February	7.71	11.3
March	7.69	13.1
April	7.65	16.2
May	7.67	19.3
June	7.7	22.1
July	7.58	24.1
August	7.63	24.4
September	7.62	22.8
October	7.65	20.2
November	7.69	17.1
December	7.64	14.1

Table 6: Wasteload allocations for ammonia nitrogen for the protection of aquatic life

Months	ADW-based[1]		AWW-based[2]	
	Acute (mg/l)	Chronic (mg/l)	Acute (mg/l)	Chronic (mg/l)
January	17,158	108,395	302	1,809
February	20,618	123,965	358	2,070
March	16,910	63,308	297	1,057
April	11,609	47,836	211	798
May	14,112	54,701	252	913
June	14,136	41,273	251	689
July	14,140	31,537	256	526
August	14,138	29,920	254	499
September	11,635	33,190	213	554
October	11,634	49,169	212	821
November	11,632	73,646	210	1,229
December	11,609	78,273	212	1,307
1: Bases for concentration limits 2: Bases for mass loading limits				

CBOD5/Total Dissolved Oxygen:

Streeter-Phelps DO Sag Model is used to simulate the decay of CBOD and dispersion of total Dissolved Oxygen (DO) in the receiving water downstream from the outfall. The criterion is that the discharge cannot cause the DO level in the receiving stream (warm water) to be below 5.0 mg/l.

The parameter values used in the modeling are listed below:

Background:
The temperature and ammonia nitrogen levels are shown in Table 4. The ultimate CBOD and DO levels are assumed to be 6.0 mg/l and 6.0 mg/l, respectively.

Effluent:
The temperatures are shown in Table 5. The CBOD5 level used in the modeling is 7,739,579 mg/l. The ammonia nitrogen values used in the modeling are the calculated acute wasteload allocations shown in Table 6. Both ADW and AWW flows and the ammonia nitrogen limits associated with them are used in the modeling.

Receiving stream parameters:
There is an average water channel slope of 0.00022 (the water channel elevation changes from 644 ft to 640 ft over a distance of approximately 17,985 ft, estimated based on the GIS LiDAR 2-ft contour coverage).

USGS gage 05489500, which was located on Des Moines River at Ottumwa, IA, had field measurement data, such as stream flow, cross sectional area, stream width, and velocity. The Ottumwa gage is utilized for DO reaeration modeling as it most concerns the downstream effects of the facility effluent. Flow values use in modeling are still derived from the upstream USGS gage at Tracy, Iowa. The stream depth is not reported; however, it can be derived using the following equation:

Depth = Cross Sectional Area / Width

Regression equations of Ln(Velocity) vs. Ln(Flow) and Ln(Depth) vs. Ln(Flow) were established with acceptable R-squared values. The stream depth was also calculated.

Ln(Velocity) = 0.3466Ln(Flow) - 2.099; $R^2 = 0.7895$
Ln(Depth) = 0.4906Ln(Flow) - 2.8431; $R^2 = 0.7827$
Width = Flow / (Depth * Velocity)

The gage station is located approximately 5.5 miles downstream of the outfall. Therefore, it is assumed that the above equations are valid in the Des Moines River at the outfall.

The stream width, depth, and velocity at annual critical 7Q10 + ADW and annual critical 7Q10 + AWW conditions were estimated using the above equations.

Table 7: Stream width, depth, and velocity

Flow Condition	Flow (cfs)	Width (ft)	Depth (ft)	Velocity (fps)
7Q10 + ADW	271.30	348.7	0.91	0.85
7Q10 + AWW	271.43	348.8	0.91	0.85

Reaeration:
Due to the size and velocity of the Des Moines River at the proposed outfall, USGS channel-control (Melching and Flores, 1999) best models reaeration conditions at the outfall and is utilized for DO calculations.

Discussion and conclusion:
The modeling results show that the effluent, which could have an allowed maximum effluent CBOD5 level of 7,739,579 mg/l and ammonia nitrogen levels as shown in Table 6, will not cause the DO level in the receiving stream to be below 5.0 mg/l at any time. Numerical DO limits are not required.

COD:
It is conservatively assumed that ultimate CBOD (CBODu) is approximately equivalent to COD and that all COD will be biologically available in the stream.

The CBODu was estimated using the following equation:

$$CBODu = CBOD5*(1/(1-\exp(-5*K_d))$$

Where K_d is the CBOD decay rate for a given month, which in turn was determined by the following equation:

$$K_d = K_{20}*1.047^{(T-20)}$$

Where T is the monthly effluent temperature, as shown in Table 5. K_{20} is the CBOD decay rate at 20 °C, which is determined using the following equation:

$$K_{20} = K_{d0} + b * (V/d)$$

Where K_{d0} is the laboratory CBOD decay rate at 20 °C, the value is assumed to be 0.2/day. b is the bed activity coefficient, determined to be 0.06. V is the flow velocity and d is the depth, as shown in Table 6. The COD concentration limit was determined to be 9,719,650 mg/l, and the mass loading was 113,528 lbs/day, which was derived based on the AWW-based concentration limit of 161,956 mg/l.

Iron:
Iron criteria are defined in the issue paper "Iron Criteria and Implementation for Iowa's Surface Waters" (November 11, 2020). A dissolved iron criterion of 1 mg/l applies at the end of the ZID for both general use and designated use streams. In this case, the ZID is 2.18% of the 1Q10 flow in Des Moines River at the outfall. Water quality-based effluent limits for iron in this WLA are expressed as total recoverable.

Boron, Cobalt, and Manganese:
There are no numerical criteria for manganese, boron, nor cobalt in Iowa's water quality standards. However, the water quality standards specify, in the form of narrative criteria, that all surface waters shall be free from materials attributable to wastewater discharges or agricultural practices in concentrations or combinations which are acutely toxic to human, animal, or plant life (567 IAC 61.3(2)d).

This narrative criterion is implemented through the concept of establishing a no effect level or LC0 as described in the 'Iowa Wasteload Allocation Procedure'. The LC0 or the estimate of the concentration that will not be acutely toxic is determined by calculating the value of ½ the 48 or 96-hour LC50 for the most sensitive resident species. In cases with multiple applicable 48 or 96-hour LC50 values, the Species Mean Acute Value (SMAV) was used.

There is limited toxicity data available for manganese, cobalt and boron. The criteria are shown in Table 8. This applies at the end of the ZID. In this case, 2.18% of the 1Q10 flow in the Des Moines River at the outfall is used as the ZID.

Table 8: Narrative Criteria for Select Toxics

Toxic	Criterion (mg/l)	Toxicity End Point	Toxicity Testing Organism
Boron	3.35	½ 48-hour LC50	Daphnia magna
Cobalt	1.7	½ 96-hour LC50	Fathead minnow
Manganese	3.386	1/2 SMAV	Midge

pH:

Iowa Water Quality Standards (IAC 567.61.3.(3).a.(2) and IAC 567.61.3.(3).b.(2)) require that pH in Class A or Class B waters “shall not be less than 6.5 nor greater than 9.0.” The criteria apply at the end of the MZ, which is 25% of the 7Q10 flow in Des Moines River at the outfall.

Section 5. Permit Limitations:

The acute and chronic WLAs are used as the values for input into the current permit derivation procedure. The water quality-based limits are shown on Pages 1 and 2 of this report.

8.0 APPENDIX B – WLA FOR WETLAND COMPLEX OUTFALL

IPL Ottumwa Midland Landfill

(Proposed Discharge to Southern Wetland Complex)

This Package Contains

Wasteload Allocation Calculations & Notes

ENVIRONMENTAL SERVICES DIVISION
WATER QUALITY-BASED PERMIT LIMITS

SECTION VI: WATER QUALITY-BASED PERMIT LIMITS

Facility Name: IPL Ottumwa Midland Landfill, STP — NPDES Number: New Discharge

Parameters	Ave. Conc. (mg/l)	Max. Conc. (mg/l)	Ave. Mass (lbs/d)	Max. Mass (lbs/d)
Outfall No. 001	**ADW = 0.0014 MGD & AWW = 0.084 MGD**			
CBOD5	–	63	–	44.2
COD	–	63	–	44.2
Total D.O.	Minimum Concentration (mg/l)			
January - December	1.0			
Ammonia - Nitrogen				
January	3.5	15.4	2.4	10.7
February	4.0	14.4	2.8	10.0
March	2.1	14.9	1.5	10.3
April	1.6	16.0	1.1	11.1
May	1.8	15.6	1.2	10.7
June	1.4	14.9	0.9	10.2
July	1.0	18.3	0.7	12.5
August	1.0	16.9	0.7	11.5
September	1.1	17.1	0.7	11.7
October	1.6	16.1	1.1	11.1
November	2.4	15.0	1.6	10.4
December	2.5	16.2	1.7	11.2
Chloride	389	629	272	441
Sulfate	1,514	1,514	1,060	1,060
pH	Technology-Based Limits Will Not Violate WQS			

Stream Network/Classification of Receiving Stream: Series of Wetlands (General Use) to Unnamed Creek 1 (Presumed A1, B(WW-1)) to Unnamed Creek 2 (Presumed A1, B(WW-1)) to Des Moines River (A1, B(WW-1) HH)

Annual critical low flows in Series of Wetlands at the outfall:
1Q10 flow 0 cfs, 7Q10 flow 0 cfs, 30Q10 flow 0 cfs

Annual critical low flows in Unnamed Creek 1 at the mouth of Series of Wetlands:
1Q10 flow 0 cfs, 7Q10 flow 0 cfs, 30Q10 flow 0 cfs

Annual critical low flows in Des Moines River at the mouth of Unnamed Creek 2:
1Q10 flow 245.8 cfs, 7Q10 flow 271.3 cfs, 30Q10 flow 318.1 cfs, 30Q5 flow 437.3 cfs, harmonic mean flow 1,776.9 cfs

Performed by: Nolan Underwood

Antidegradation Review Requirement

A tier II antidegradation review is required. See Section 2 for details.

The antidegradation review conducted in this wasteload allocation is based on the current information available. Antidegradation could also be triggered during the NPDES permitting process based on new information.

ENVIRONMENTAL SERVICES DIVISION
WATER QUALITY-BASED PERMIT LIMITS

SECTION VI: WATER QUALITY-BASED PERMIT LIMITS

Facility Name: IPL Ottumwa Midland Landfill NPDES Number: New Discharge

Parameters	Ave. Conc. (mg/l)	Max. Conc. (mg/l)	Ave. Mass (lbs/d)	Max. Mass (lbs/d)
Outfall No. 001	**ADW = 0.0014 MGD & AWW = 0.084 MGD**			
Toxics				
Arsenic (III)	1.500E-01	3.400E-01	1.051E-01	2.382E-01
Barium	6.800E+01	6.800E+01	4.764E+01	4.764E+01
Beryllium	5.000E-01	5.000E-01	3.503E-01	3.503E-01
Boron	3.350E+00	3.350E+00	2.347E+00	2.347E+00
Cadmium	1.374E-03	5.845E-03	9.623E-04	4.095E-03
Chloride	389	629	272	441
Chromium (VI)	1.143E-02	1.629E-02	8.011E-03	1.141E-02
Cobalt	1.700E+00	1.700E+00	1.191E+00	1.191E+00
Copper	1.687E-02	2.690E-02	1.182E-02	1.884E-02
Cyanide	5.200E-03	2.200E-02	3.643E-03	1.541E-02
Fluoride	8.077E+00	8.077E+00	5.658E+00	5.658E+00
Iron	3.700E+00	3.700E+00	2.592E+00	2.592E+00
Lead	7.693E-03	1.974E-01	5.389E-03	1.383E-01
Manganese	3.386E+00	3.386E+00	2.372E+00	2.372E+00
Nickel	9.376E-02	8.433E-01	6.569E-02	5.908E-01
Selenium	5.000E-03	1.930E-02	3.503E-03	1.352E-02
Silver	1.247E-02	1.247E-02	8.734E-03	8.734E-03
Sulfate	1,514	1,514	1,060	1,060
Thallium	5.980E-01	5.980E-01	2.773E-01	4.189E-01
Zinc	2.156E-01	2.156E-01	1.510E-01	1.510E-01

WLAs/Permit Limits for the IPL Ottumwa Midland Landfill's Waste Water Discharge

These wasteload allocations and water quality-based permit limitations are for the IPL Ottumwa Midland Landfill's proposed wastewater discharge to a series of wetlands. The wasteload allocations/permit limits are based on the Water Quality Standards (IAC 567.61) and the "Iowa Wasteload Allocation (WLA) Procedure," effective November 11, 2020.

The water quality-based limits in this WLA are calculated to meet the surface water quality criteria to protect downstream uses. There could be technology-based limits applicable to this facility that are more stringent than the water quality-based limits shown in this WLA. The technology-based limits could be derived from either federal guidelines based on different industrial categories or permit writer's judgment.

Section 1. Background:
IPL Ottumwa Midland Landfill proposes discharging a stream of wastewater consisting of groundwater from the landfill underdrain system into a series of wetlands south of the facility (proposed location, 41° 4' 30.4" N, 92° 27' 1.1" W).

Route of flow and use designations:
The series of wetlands, consisting of one smaller wetland, a ditch, and a larger wetland, are all general use water bodies for aquatic life and has no recreational use.

At the mouth of the series of wetlands, Unnamed Creek 1 is a presumed A1, B(WW-1) designated use water body. Unnamed Creek 1 flows into Unnamed Creek 2, presumed A1, B(WW-1), prior to entering the Des Moines River.

The following designations have been adopted in Iowa's state rule described in the rule-referenced document of "Surface Water Classification," effective July 24, 2019.

At the mouth of Unnamed Creek 2, Des Moines River is an A1, B(WW-1) HH designated use water body.

Critical low flow determination:
The annual critical low flows in series of wetlands are estimated to be all zero since general use segments are intermittent watercourses that typically only flow for short periods of time following precipitation. The annual critical low flows in Unnamed Creek at the mouth of the series of wetlands are estimated based on the Regional Regression Equations (RRE) from "Methods for estimating selected spring and fall low-flow frequency statistics for ungaged stream sites in Iowa, based on data through June 2014" (2016).

The annual critical low flows in Des Moines River at the mouth of Unnamed Creek 2 are estimated based on the Drainage Area Ratio (DAR) method from "Methods for estimating selected low-flow frequency statistics and harmonic mean flows for streams in Iowa" (2012, revised 2017)" (2012, revised 2017) and flow statistics obtained at USGS gage station 05488500, located on the Des Moines River at Tracy, Iowa. Another USGS gage lies downstream of the stream juncture at Ottumwa, Iowa. However, between the gage and the juncture lies both a dam and the Ottumwa Water Works intake, altering the resulting gage data. Thus, the downstream gage is not used for any flow determinations.

Table 1: Annual critical low flows

Location	D.A. (mi^2)	1Q10 (cfs)	7Q10 (cfs)	30Q10 (cfs)	30Q5 (cfs)	Harmonic mean (cfs)
Unnamed Creek 1 at the mouth of Series of Wetlands	0.34	0[1]	0[1]	0[1]	–	–
Des Moines River at the mouth of Unnamed Creek 2	13,300	245.8	271.3	318.1	437.3	1776.9
Des Moines River at the Tracy Iowa gage	12,500	231.0	255.0	299.0	411.0	1,670.0
1) Flows were censored to zero based on the USGS probability of zero flow report						

Section 2. Antidegradation Review:
According to the "Iowa Antidegradation Implementation Procedure," effective February 17, 2010 (IAC 567-60.7(2).d.(4)), all new or expanded regulated activities (with limited exceptions, such as unsewered communities) are subject to antidegradation review requirements.

Table 2: Antidegradation review analysis

Item #	Factor or scenario	Antidegradation determination	Analysis/comments
1	Design capacity increase	Yes ☒, No ☐, or Not Applicable ☐	1: New Outfall
2	Significant Industrial Users (SIU) contributing new pollutant of concern (POC)	Yes ☐, No ☐, or Not Applicable ☒	
3	New process contributing new pollutant of concern (POC)	Yes ☐, No ☐, or Not Applicable ☒	
4	Less stringent water quality-based limits?	Yes ☐, No ☐, or Not Applicable ☒	
5	Outfall location change	Yes ☒, No ☐, or Not Applicable ☐	1: New Outfall
Conclusion and discussion: Due to Items 1 and 5, a tier II antidegradation review is required. The antidegradation review conducted in this WLA is based on the current information available. Antidegradation could also be triggered during the NPDES permitting process based on new information.			

Section 3. Total Maximum Daily Load (TMDL) Limitations:
The following impaired water bodies in the discharge route are contained in the 2024 Iowa Integrated Report:

- Des Moines River for bacteria (indicator: *E. coli*) and fish kill due to unknown toxicity

This facility has not been assigned any allocations from TMDLs at this time.

The results presented in this report are wasteload allocations based on meeting the State's current water quality standards in the receiving water body. Additional and/or more stringent effluent limits may be applicable to this discharge based on approved TMDLs for impaired water bodies, which may provide watershed based wasteload allocations. Information on impaired streams in Iowa and approved TMDLs can be found at the following website: https://programs.iowadnr.gov/adbnet/Docs/TMDL.

Section 4. Calculations:
The WLAs/permit limits for this outfall are calculated based on the facility's Average Dry Weather (ADW) design flow of 0.0014 MGD and its Average Wet Weather (AWW) design flow of 0.084 MGD.

Only wasteload allocations/permit limits (water quality-based effluent limits) calculated using DNR approved design flows can be applied in NPDES permits. Water quality-based effluent limits calculated using proposed flows that have not been approved by the DNR for permitting and compliance may be used for informational purposes only.

The water quality-based permit concentration limits are derived using the allowed stream flow and the ADW design flow, while the loading limits are derived using the allowed stream flow and the AWW design flow.

Toxics:
<u>To protect the general use wetlands</u>:
The protection of the general use wetlands from toxics is achieved by assuring the WLA does not exceed a value set at ½ 96hrLC50 for critical species in the general use wetlands. Additionally, there are livestock watering guidelines of 1,500 mg/l for chloride and 2,000 mg/l for sulfate that affect the chronic criteria. Since the annual critical low flows in the general use wetlands are estimated to be all zero, the ½ 96hrLC50 value applies at "end-of-pipe."

<u>To protect the downstream designated use reach</u>:
The acute criteria apply at the end of the Zone of Initial Dilution (ZID), and the chronic criteria apply at the end of the Mixing Zone (MZ). Since the annual critical low flows in Unnamed Creek 1 at the mouth of the wetland complex are estimated to be all zero, the criteria apply at "end of the general use wetlands" instead of the end of the MZ and the ZID.

Default effluent and background chloride and sulfate concentrations of 34 mg/l and 63 mg/l, respectively, are used in the applicable criteria. A default hardness of 200 mg/l for background and effluent is used for applicable criteria. Default background concentrations are used for other toxics in cases where there is sufficient stream data.

Effective November 11, 2020, water quality criteria for metals (excluding aluminum) are expressed as dissolved in IAC 567.61. Using EPA dissolved metal translators, water quality-based effluent limits in this WLA are expressed as total recoverable.

<u>To protect the human health (HH) use</u>:
For pollutants that are non-carcinogenic and have criteria for HH protection, the criteria apply at the end of the MZ, which in this case is 25% of the 30Q5 flow in Des Moines River at the mouth of Unnamed Creek 2.

For pollutants that are carcinogenic and have criteria for HH protection, the criteria apply at the end of the MZ, which in this case is 25% of the harmonic mean flow in the Des Moines River at the mouth of Unnamed Creek 2.

<u>Final limits</u>:
The maximum limits are the more stringent between the limits for the protection of the general use stream those for the protection of the aquatic life use, and those for the protection of the HH use.

The limits for the toxics are based on a sampling frequency of 1/week.

Ammonia Nitrogen:
<u>To protect the general use wetlands:</u>
The protection of general use wetlands is considered in the form of "free from acutely toxic conditions." This provision is achieved by assuring the WLA does not exceed a value set at ½ 96hrLC50 for critical species in the stream. The Fathead Minnow is selected as the critical species. For ammonia nitrogen, the ½ 96hrLC50 for the Fathead Minnow is noted in Table 3 at the pH and temperature values associated with mechanical facilities, as shown in Table 4. The background category is based on the characteristics of flexible holding time prior to discharge and industrial type POCs, which most aligns with the pH and temperature granted to mechanical facilities. Since the annual critical low flows in the general use wetlands are estimated to be all zero, the ½ 96hrLC50 values apply at "end of pipe."

Table 3: Instream ½ 96hrLC50 values for ammonia nitrogen

Months	1/2LC50 (mg/l)
January	39.4
February	36.8
March	38.1
April	40.7
May	39.4
June	37.4
July	45.6
August	42.0
September	42.7
October	40.7
November	38.1
December	41.4

Table 4: Standard effluent pH and temperature values for mechanical facilities

Months	pH	Temperature (°C)
January	7.67	12.4
February	7.71	11.3
March	7.69	13.1
April	7.65	16.2
May	7.67	19.3
June	7.70	22.1
July	7.58	24.1
August	7.63	24.4
September	7.62	22.8
October	7.65	20.2
November	7.69	17.1
December	7.64	14.1

To protect the downstream designated use reach:
To protect designated use water bodies, standard stream background pH, temperatures, and concentrations of NH3-N are mixed with the discharge from the facility's effluent pH and temperature values to calculate the applicable instream WQS criteria. The monthly background pH, temperatures, and NH3-N concentrations shown in Table *5* are used for the wasteload allocation/permit limits calculations.

Since the annual critical low flows in the receiving stream at the outfall are all zero, the criteria apply at "end of the general use wetlands" instead of the end of the MZ and the ZID. At the mouth of the wetland complex, Unnamed Creek 1 is a presumed B(WW-1) stream; therefore, early life protection will begin in March and run through September. The monthly background pH, temperatures, and NH3-N concentrations shown in Table 5.

Ammonia nitrogen decay in the general use wetlands is taken into consideration. The decay is estimated by using a first order decay model with a length of 680 ft and a decay rate of 0.3/day at 20°C. Velocities are an average velocity over the 680 ft, calculated using a reach length weighted average. Velocities for each reach can be seen in the CBOD5/Total Dissolved Oxygen section below. Flow velocities of 0.086 fps for ADW conditions and 0.294 fps for AWW conditions are used in the general use wetlands.

Final limits:
The more stringent between the limits for the protection of the general use wetlands and those for the protection of the designated use stream serve as the permit limits. Table 6 shows the calculated final ammonia nitrogen wasteload allocations for this facility.

Table 5: Background pH, temperatures, and NH3-N concentrations

Months	pH	Temperature (°C)	NH_3-N (mg/l)
January	8.1	0.3	0.02
February	8.0	0.1	0.08
March	8.1	1.5	0.12
April	8.3	9.3	0.03
May	8.2	15.0	0.03
June	8.2	19.4	0.02
July	8.2	23.5	0.02
August	8.2	24.3	0.02
September	8.3	20.2	0.02
October	8.3	14.2	0.02
November	8.3	8.0	0.02
December	8.3	0.8	0.03

Table 6: Wasteload allocations for ammonia nitrogen for the protection of aquatic life[3]

Months	ADW-based[1]		AWW-based[2]	
	Acute (mg/l)	Chronic (mg/l)	Acute (mg/l)	Chronic (mg/l)
January	15.4	3.5	15.3	3.4
February	14.4	4.0	14.3	4.0
March	14.9	2.1	14.8	2.1
April	16.0	1.6	15.8	1.5
May	15.6	1.8	15.3	1.8
June	14.9	1.4	14.6	1.3
July	18.3	1.0	17.8	1.0
August	16.9	1.0	16.4	1.0
September	17.1	1.1	16.7	1.1
October	16.1	1.6	15.8	1.6
November	15.0	2.4	14.8	2.3
December	16.2	2.5	16.0	2.5
1: Bases for concentration limits 2: Bases for mass loading limits				

CBOD5/Total Dissolved Oxygen:

Protection of the general use wetlands:

Streeter-Phelps DO Sag Model is used to simulate the decay of CBOD and dispersion of total Dissolved Oxygen (DO) in the receiving water downstream from the outfall. The criterion is that the discharge cannot cause the DO level in the general use wetlands to be below 1.0 mg/l.

The parameter values used in the modeling are listed below:

Background:

The temperature and ammonia nitrogen levels are shown in Table 5. The ultimate CBOD and DO levels are assumed to be 6.0 mg/l and 6.0 mg/l, respectively.

Effluent:
The temperatures are shown in Table 4. The CBOD5 level used in the modeling is 63 mg/l for ADW conditions and 133 mg/l for AWW conditions. The ammonia nitrogen values used in the modeling are the calculated acute wasteload allocations shown in

Table 6. Both ADW and AWW flows and the ammonia nitrogen limits associated with them are used in the modeling.

Receiving stream parameters, small wetland:
There is an average water channel slope of 0.00656 (the water channel elevation changes from 760 ft to 758 ft over a distance of approximately 305 ft, estimated based on the GIS LiDAR 2-ft contour coverage).

Field Use Attainability Assessment (UAA) had no sites along the small wetland. Therefore, a Flowmaster analysis using three cross sections of the small wetland were used to estimate the width, depth, and velocity in the small wetland using Manning's equations. Due to the vegetation growth and possibility of low retention, the standard weedy stream roughness coefficient of 0.045 was selected. Based the stream width, depth, and velocity at ADW and AWW conditions are estimated and are shown in Table 7.

Table 7: Stream width, depth, and velocity (small wetland)

Flow Condition	Flow (cfs)	Width (ft)	Depth (ft)	Velocity (fps)
ADW	0.00217	7.8	0.0051	0.05
AWW	0.12995	22.9	0.0309	0.18

Reaeration:
Due to the width and shallow flow, USGS pool-riffle (Melching and Flores, 1999) best represents reaeration in the small wetland.

Receiving stream parameters, ditch to large wetland:
There is an average water channel slope of 0.06897 (the water channel elevation changes from 758 ft to 748 ft over a distance of approximately 145 ft, estimated based on the GIS LiDAR 2-ft contour coverage).

Field Use Attainability Assessment (UAA) had no sites along the ditch. Therefore, a Flowmaster analysis using three cross sections of the ditch were used to estimate the width, depth, and velocity in the ditch using Manning's equations. The ditch has several ditch checks along its length, therefore a manning's roughness coefficient of 0.078, commonly used for areas with larger riprap, was selected. Based the stream width, depth, and velocity at ADW and AWW conditions are estimated and are shown in
Table 8.

Table 8: Stream width, depth, and velocity (ditch between wetlands)

Flow Condition	Flow (cfs)	Width (ft)	Depth (ft)	Velocity (fps)
ADW	0.00217	1.7	0.0111	0.12
AWW	0.12995	5.5	0.0583	0.40

Reaeration:
Due to mixing caused by the frequent ditch checks, USGS pool-riffle (Melching and Flores, 1999) best represents reaeration in the ditch between wetlands.

Receiving stream parameters, large wetland:
There is an average water channel slope of 0.03361 (the water channel elevation changes from 748 ft to 740 ft over a distance of approximately 238 ft, estimated based on the GIS LiDAR 2-ft contour coverage).

Field Use Attainability Assessment (UAA) had no sites along the large wetland. Therefore, a Flowmaster analysis using two cross sections of the large wetland were used to estimate the width, depth, and velocity of the large wetland using Manning's equations. Due to the vegetation growth and possibility of low retention, the standard weedy stream roughness coefficient of 0.045 was selected. Based the stream width, depth, and velocity at ADW and AWW conditions are estimated and are shown in Table 9.

Table 9: Stream width, depth, and velocity (large wetlands)

Flow Condition	Flow (cfs)	Width (ft)	Depth (ft)	Velocity (fps)
ADW	0.00217	1.7	0.0083	0.15
AWW	0.12995	5.3	0.0458	0.54

Reaeration:
Due to the width and shallow flow, USGS pool-riffle (Melching and Flores, 1999) best represents reaeration in the Large wetland.

Discussion and conclusion:
The modeling results show that the effluent, which could have an allowed maximum effluent CBOD5 level of 63 mg/L, and ammonia nitrogen levels as shown in Table 6, and a minimum DO level of 1.0 mg/l, will not cause the DO level in the receiving stream to be below 1.0 mg/l at any time.

<u>Protection of the downstream designated use water body (Unnamed Creek 1)</u>:
Streeter-Phelps DO Sag Model is also used to simulate the decay of CBOD and dispersion of total DO in the downstream designated use stream. The criterion is that the discharge cannot cause the DO level in warm waters to be below 5.0 mg/l.

The parameter values used in the modeling are listed below:

Background:
The temperature and ammonia nitrogen levels are shown in Table 5. The ultimate CBOD and DO levels are assumed to be 6.0 mg/l and 6.0 mg/l, respectively.

Effluent:
The temperatures are shown in Table 4. The CBOD, ammonia nitrogen, and DO values are obtained from the modeling on the general use wetlands after the large wetland.

Receiving stream parameters:
There is an average water channel slope of 0.01384 (the water channel elevation changes from 740 ft to 696 ft over a distance of approximately 3,180 ft, estimated based on the GIS LiDAR 2-ft contour coverage).

Field Use Attainability Assessment (UAA) had no sites along Unnamed Creek 1. Therefore, a Flowmaster analysis using four cross sections of Unnamed Creek 1 were used to estimate the width, depth, and velocity of Unnamed Creek 1 using Manning's equations. Due to the vegetation growth and a meandering stream bed, the standard weedy stream roughness coefficient of 0.045 was selected. Based the stream width, depth, and velocity at ADW and AWW conditions are estimated and are shown in Table 10.

Table 10: Stream width, depth, and velocity (Unnamed Creek 1)

Flow Condition	Flow (cfs)	Width (ft)	Depth (ft)	Velocity (fps)
7Q10 + ADW	0.00217	0.9	0.0188	0.13
7Q10 + AWW	0.12995	3.1	0.1000	0.42

Reaeration:
Due to the shallow flow and meandering stream features, USGS pool-riffle (Melching and Flores, 1999) best represents reaeration in Unnamed Creek 1.

Discussion and conclusion:
The modeling results show that the effluent, which could have an allowed maximum effluent CBOD5 level of 63 mg/l, ammonia nitrogen levels as shown in

Table *6*, and a minimum DO level of 1.0 mg/l, will not cause the DO level in the designated use receiving stream to be below 5.0 mg/l at any time.

COD:
It is conservatively assumed that ultimate CBOD (CBODu) is approximately equivalent to COD and that all COD will be biologically available in the wetland complex and Unnamed Creek 1.

The CBODu was estimated using the following equation:

CBODu = CBOD5*(1/(1-exp(-5*K_d))

Where K_d is the CBOD decay rate for a given month, which in turn was determined by the following equation:

$K_d = K_{20} * 1.047^{(T-20)}$

Where T is the monthly effluent temperature, as shown in Table 3. K_{20} is the CBOD decay rate at 20 °C, which is determined using the following equation:

$K_{20} = K_{d0} + b * (V/d)$

Where K_{d0} is the laboratory CBOD decay rate at 20 °C, the value is assumed to be 0.2/day. b is the bed activity coefficient, determined to be 0.491. V is the flow velocity and d is the depth, as shown in Table 7. The COD concentration limit was determined to be 63 mg/l, and the mass loading was 44.2 lbs/day, which was derived based on the AWW facility flow.

Iron:
Iron criteria are defined in the issue paper "Iron Criteria and Implementation for Iowa's Surface Waters" (November 11, 2020). A dissolved iron criterion of 1 mg/l applies at the end of the ZID for both general use and designated use streams. However, a site-specific iron toxicity study, submitted by the facility in June, 2025, demonstrated a NOEC of 3.7 mg/L. The site-specific iron NOEC is used as the iron criteria for this site and applies at the end of the ZID. Since the annual critical low flows in the small wetland are estimated to be all zero, the criteria apply at "end of pipe" instead of the end of the ZID.

Boron, Cobalt, and Manganese:
There are no numerical criteria for manganese, boron, nor cobalt in Iowa's water quality standards. However, the water quality standards specify, in the form of narrative criteria, that all surface waters shall be free from materials attributable to wastewater discharges or agricultural practices in concentrations or combinations which are acutely toxic to human, animal, or plant life (567 IAC 61.3(2)d).

This narrative criterion is implemented through the concept of establishing a no effect level or LC0 as described in the 'Iowa Wasteload Allocation Procedure'. The LC0 or the estimate of the concentration that will not be acutely toxic is determined by calculating the value of ½ the 48 or 96-hour LC50 for the most sensitive resident species. In cases with multiple applicable 48 or 96-hour LC50 values, the Species Mean Acute Value (SMAV) was used.

There is limited toxicity data available for manganese, cobalt and boron. The criteria are shown in Table 11. Since the annual critical low flows in the small wetland are estimated to be all zero, the criteria apply at "end of pipe" instead of the end of the MZ and the ZID.

Table 11: Narrative Criteria for Select Toxics

Toxic	Criterion (mg/l)	Toxicity End Point	Toxicity Testing Organism
Boron	3.35	½ 48-hour LC50	Daphnia magna
Cobalt	1.7	½ 96-hour LC50	Fathead minnow
Manganese	3.386	1/2 SMAV	Midge

pH:
<u>To protect the general use stream</u>:
Iowa currently does not have numerical criteria for the protection of general use streams. The narrative criteria stated in IAC 567.61.3.(2) apply.

<u>To protect the downstream designated use stream</u>:
Iowa Water Quality Standards (IAC 567.61.3.(3).a.(2) and IAC 567.61.3.(3).b.(2)) require that pH in Class A or Class B waters "shall not be less than 6.5 nor greater than 9.0." The criteria apply at the end of the MZ, which is 25% of the 7Q10 flow in Unnamed Creek 1 at the mouth of Series of Wetlands.

<u>pH change in the general use stream</u>:
Effluent pH change may occur in the general use wetland complex; however, the pH change is difficult to model without substantial amount of site-specific data. Based on professional judgment, the technology-based pH limits of 6.0 – 9.0 will be protective of the WQS in the designated use stream due to pH change in the general use wetland complex before reaching the designated use segment.

Section 5. Permit Limitations:
The acute and chronic WLAs are used as the values for input into the current permit derivation procedure. The water quality-based limits are shown on Page 1-2 of this report.