REGION 5
CHICAGO, IL 60604
April 28, 2025

ELECTRONIC MAIL
RETURN RECEIPT REQUESTED

Michael Gerdenich
BASF Corporation
1609 Biddle Avenue
Wyandotte, Michigan 48192-3729
Michael.gerdenich@basf.com

Re: Comprehensive Interim Measure Remedy Response to EPA Comments on the 60% Basis of Design, EPA ID: MID064197742

Dear Mr. Gerdenich:

The *60% Basis of Design* (60% Design) was submitted by BASF for EPA review on March 4, 2024. On November 8, 2024, EPA reviewed the 60% Design and sent a letter to BASF with requirements and comments. As part of the regular meetings with BASF, a portion of the EPA comments on the 60% Design were discussed on January 23, February 13, and March 6, 2025, with an updated comments tracking table provided to EPA on the same dates, respectively. The EPA response to BASF's response to comments that were discussed on January 23, 2025 are provided in Attachment A. On the items that have not been fully addressed, please submit an updated response to that comment within 30 days of receipt of this letter.

Please note that EPA may require additional revision before or after EPA review of the 95% Design on these comments or aspects of the 60% and 95% Basis of Design Plans. The EPA looks forward to continuing development of the Comprehensive Groundwater Interim Measure.

Sincerely,

VALERIE VOISIN Digitally signed by VALERIE VOISIN
Date: 2025.04.28 08:13:01 -05'00'

Valerie Voisin
Project Manager, Remediation Branch
Land, Chemicals, and Redevelopment Division

ENCLOSURES
Attachment A: Table 1 Comment Tracking Table on 60% Basis of Design
Attachment B: Table 2 Comment Tracking Table on 60% Basis of Design
Attachment C: Table 3 Comment Tracking Table on 60% Basis of Design

cc:
Doug Lam, US EPA LCRD RB Project Manager
Avroham Lapp, US EPA LCRD RB Section Supervisor
Elizabeth Garver, Michigan EGLE Environmental Manager
Marc Messina, Michigan EGLE Geologist
Christina Herbert, Michigan EGLE

Attachment A: Table 1 Comment Tracking Table Responses to Comments on the 60% Basis of Design

Comment Number	EPA Comment	Date(s) Discussed with EPA	BASF Response to Comment	EPA Response to Comment
6	Section 4.2.1, PDF Page 35, Rip Rap Shoreline: This section describes the driven sheet pile as an appropriate technology to implement along the rip rap shoreline; however, the 60% Design does not reference design calculations demonstrating that a bulkhead wall with tiebacks is not needed at this location. Section 4.3.1.2 (Barrier Alignment), notes that the alignment along the rip rap protected shoreline is set at an offset distance that allows for the construction of the wall using conventional techniques and is protective of the existing shoreline. However, details on how this offset distance was determined and how the shoreline is protected were not provided. a. BASF Action Item: In the written response to comments due on or before March 30, 2025, provide the requested design information and a discussion of how the offset distance was determined and how it protects the shoreline.	02/13/2025	The riprap shoreline will remain in place and the subsurface barrier wall installed inland approximately 35 to 52 feet from the top of riverbank. No removal of the riprap shoreline is required for the subsurface barrier wall installation, meaning that this wall segment of the barrier system will not be used as a bulkhead or retaining wall. It will provide the same purpose as the steel sheet pile in Perry Place and DeSana Drive, a non-structural hydraulic barrier. The alignment of the subsurface barrier wall along the riprap shoreline was established from limits of the proposed collection trench system and from existing site features. The subsurface barrier wall has a typical offset distance of 25 feet from the collection trench which was aligned to provide sufficient distance for trenching purposes from the existing fire-water pond embankment. These considerations resulted in the barrier wall alignment shown in the 60% design drawings. When considering the alignment of the barrier along the riprap shoreline, the resulting offset from the river bank is considered sufficient for protecting the bank from temporary construction loads during wall installation. In addition, given the barrier wall offset from the fire-water pond embankment, the installation equipment will have sufficient room to install the wall upland of the barrier alignment, allowing for further distance from and protection of the bank during construction.	EPA finds the response to our comment acceptable. Please include references to the design calculations demonstrating that offset distance is effective.
7	Section 4.3.1.1, PDF Page 35, Material Selection, 1st paragraph: This paragraph states that the hydraulic conductivity for this wall type will meet the criteria established from the site groundwater model of 1×10-6	02/13/2025	Published hydraulic conductivity values for steel sheet piles with Larssen interlocks will be provided in the 95% design for both unsealed and sealed joints. Regarding the SSP joint sealant product, it is noted that the 60% specifications	EPA finds the response to our comment acceptable. Please ensure a copy of references is provided in the 95% Design for the SSP joint sealant and the

	centimeters per second (cm/sec) and, when considering the application of a sealant at each interlock joint, is expected to range between 1×10-6 and 1×10-7 cm/sec. a. BASF Action Item: i. Attach a copy of the reference for the typical hydraulic conductivity of the proposed sheet pile section to the 95% Design. ii. Attach a copy of the reference for the typical hydraulic conductivity of the proposed sheet pile with joint sealant applied to the 95% Design. iii. Discuss the efficacy of Solid Solution Products (SSP) joint sealants and any necessary application requirements to improve efficacy update the details of the application of the join sealant as needed. iv. In the written response to comments due on March 30, 2025, provide a description and calculations on how BASF will demonstrate the required maximum sheet pile wall hydraulic conductivity of 1 x 10-6 to 1 x 10-7 centimeters per second (cm/sec).		listed two sealant products or an equivalent. If SSP joint sealant is proposed by the contractor, it will be reviewed for equivalency in accordance with the project specifications. In response to clarification on the SSP join sealant product, EPA has indicated no additional information is required. Calculations supporting the required barrier wall hydraulic conductivity will be prepared using guidance and methodology published by ArcelorlMittal for design and practical approach to impervious sheet pile walls. The rational method for estimating the hydraulic conductivity of sheet pile walls was developed by ArcelorMittal through testing and research of steel sheet pile interlocks. These calculations will be included in the written response to comments submittal on or before March 30, 2025.	calculated steel sheetpile wall hydraulic conductivity.
8	Section 4.3.1.1, PDF Page 35, Material Selection, 3rd paragraph: This paragraph states that for the steel sheet pile walls, the estimated section loss of approximately 0.26 inch or 50% of the pile's design thickness of 0.48 inch over an assumed 50-year design life. a. BASF Action Item: In the 95% Design, provide a justification for why this section loss will not result in degradation of the interim	02/13/2025	The 60% design report estimated a corrosion loss for the full design life remedy (50 years) and considered worse case industrial soil conditions for the subsurface barrier wall sheet pile sections. Calculations for estimating the corrosion loss are provided in Appendix J of 60% BOD Report, starting on page 2. Since the subsurface barrier is a non-structural wall, the estimated loss of thickness with time is not a concern when evaluating wall strength criteria.	Please provide additional information in a general response to our comment or reference the section describing the procedures for the replacement and fixing of sections of the sheet pile wall once it has experienced excessive thickness loss. The OMM plan should include a monitoring schedule or SOP for replacing

	measure's performance and provide reference to sections detailing the repair and maintenance of the perimeter barriers.		As a barrier for groundwater flow, a 50% loss in thickness means that approximately 50% of the pile thickness will remain after 50 years and will continue to perform as an impervious steel section. At the sheet pile interlocks, a combination of the Larssen interlock type and the long-term sealant properties will continue to provide the watertight resistance for countering degradation due to corrosion. For operation and maintenance of the subsurface barrier wall, text will be incorporated into Section 4.3.1.1 that references the OMM Manual for the 95% Design.	sections of the steel-sheet pile once they've exceeded their expected lifespan.
9	Section 4.3.1.2, PDF Page 36, Barrier Alignment, 1st paragraph: This paragraph speaks to a watertight connection to the existing bulkhead is required at its eastern end and will consist of overlapping jet grout columns at the intersection of the two sheet pile walls. a. BASF Action Item: In the written response to comments due on March 30, 2025, provide a rationale for proposing jet columns rather than interlocking new SSP with existing SSP.	02/13/2025	While a pile interlock connection to the existing bulkhead sheet pile would be preferred, the 60% design included a jet grouting approach should an existing sheet pile connector not be present for the headwall piles to tie into. This area of the proposed headwall will continue to be evaluated and field data collected to further advance this detail for the 95% design.	EPA finds the response to our comment acceptable.
10	Section 4.3.1.3, PDF Page 37, Pile Depths: This section states that suitable materials will be used to backfill trenches prior to sheet pile installation; however, suitable materials are not defined. Since pre-trenching may be required for the sheet pile wall driving installation, what are the compaction controls for "suitable" backfill for those trenches to meet the requirements of the earth pressure designs? a. BASF Action Item: In the written response to	02/13/2025	Prior to pile driving, the alignment of the sheet pile wall will be pre-trenched, as a minimum, through the surficial materials (i.e., concrete or asphalt pavement) and in zones of known debris or obstructions. Excavated materials from the pre-trenching activities will be staged for potential re-use as backfill. Suitability of re-use material will depend upon debris content, size, etc. and conformance with the material specification for General Fill included in Specification 31 23 05 (Excavation and Fill).	EPA finds the response to our comment acceptable.

	comments due on March 30, 2025, describe these materials and reference the appropriate specifications in Appendix K in the 95% Design.		Placement of General Fill as backfill for pre-trenches will be in general conformance with Table 31 23 05-A of Specification 31 23 05. Implementation of backfilling activities below the design top of the pile will allow for placement of the fill materials to a minimum equivalent consistency (i.e., density) as the adjacent existing soil conditions. This placement approach considers that the subsurface barrier is a non-structural wall, typical narrow pre-trench widths, and that the vibratory action of the hammer/installation process would contribute to further consolidating backfill soils through the pre-trench portion of the piles. Consideration will also be given to groundwater conditions during backfilling of pre-trench and may require substituting a self-compacting stone for the General Fill backfill. Excavation materials found to be unsuitable will be staged separately and loaded for offsite disposal.	
13	Section 4.3.1.2, PDF Page 36, 3rd Paragraph: This paragraph notes that where the alignment falls beneath existing overhead power lines that cross James DeSana Drive, installation of sheet piling is not possible and incorporating another wall technology is required. As shown on the Design Drawings, overlapping jet grout columns beneath the power lines is proposed. Jet grouting in the power line area may not be possible either since the grout rig may not be able to safely access the area. There is potential for the temporary relocation of overhead power lines during construction. a. BASF Action Item: Provide these details and consideration within the 95% Design.	02/13/2025	For the 60% design, initial discussions with specialty contractors indicated sufficient vertical clearance for jet grouting beneath the overhead power lines along DeSana Drive. For the 95% design, continued review of barrier wall options and discussions with specialty contractors on construction methods will be completed.	Please provide what material or materials that would be considered other than jet grouting for this section of the perimeter barriers in the event that utility lines are an issue during construction.

21	Section 4.3.2.2.2, PDF Page 41 2nd Paragraph: This paragraph speaks to an allowable lateral deflection of 4 inches has been assumed for the headwall and is based on criteria developed for other projects of similar bulkhead height and conditions and barrier requirements. Lateral deflection of 4 inches may be excessive. Tieback design must account for this movement. a. BASF Action Item: In the 95% Design, provide the basis/reference for the four-inch allowable lateral deflection for the entire length sheet piles walls that are designed for a required maximum hydraulic conductivity.	02/13/2025	Allowable deflection of 4 inches based on estimated allowable strain for steel. Given sealants low modulus and high elasticity, an allowable wall deflection of 4 inches will not minimize the sealants effectiveness given its higher allowable strain when compared to steel.	EPA finds the response to our comment acceptable.
35	Section 4.4.1.1.2, PDF Page 48, Paragraph 4: This paragraph describes repairs through this perimeter barrier section will generally include placement of metal plates at the lift holes, sealing between existing pipe penetrations and surrounding sheet piles, sealing of wale bolt connections showing signs of leakage, and placement of fill in eroded areas to the original design grade. Is there evidence of soil leakage through the wall, i.e., documentation of contaminated sediment or shoaled material? Do shoaled material locations correspond to openings in the sheet piles? a. BASF Action Item: Provide this information within the 95% Design within the written response to comments due on March 30, 2025	02/13/2025	No observations of soil leakage through the wall or shoaled materials outside the wall were noted during the diver survey of the existing bulkhead. No sediment sampling was conducted as part of the diver survey.	EPA finds the response to our comment acceptable.
37	Section 4.4.1.2.2, PDF Page 49, Paragraph 3: With respect to corrosion or section loss, the diver survey noted nine areas of corrosion across this section, with two of the areas described as containing significant or heavy corrosion. As shown on the data charts included in Appendix C, one thickness	02/13/2025	Areas of corrosion noted during the diver survey were generally above the water line and associated with wall features such as lift holes, wale bolt connections, or pile interlocks. Corrosion in these areas can be attributed to varying moisture levels in contact with the bulkhead. Areas of corrosion in submerged	Please see the EPA response to comment 8 for further detail.

	measurement point within the Light Dock section is below this tolerance range and eight points are above it. Additionally, twelve thickness measurement points are below this tolerance range and could be indicative of steel thickness loss from corrosion. a. BASF Action Item: Provide a rationale for the section loss or corrosion noted within the diver survey within the 95% Design and provide a preliminary justification on section thickness and it's lifespan within the written response to comments due on March 30, 2025.		sections of the bulkhead were limited and the factors contributing to the section loss in these areas are unknown. Design Drawings (Appendix G) indicate the locations on the existing bulkhead where repairs are required to address observations from the diver survey. Areas from the diver survey that noted heavy corrosion are included in this existing bulkhead repair schedule. From further review of the thickness testing results included in Appendix C, the data shows that the existing bulkhead is performing as anticipated when compared to estimated corrosion losses over the 30 year timeframe since installation, with majority of the test data showing pile thicknesses above the estimated zone of section loss. This data supports the findings from the visual inspections of the existing bulkhead that it is in good condition. Consistent with the repair approach shown in the 60% Design Drawings, the existing bulkhead will continue to be monitored and maintained over the lifetime of the remedy and areas of concern will be addressed and repaired as appropriate for maintaining the performance of the barrier system. Requirements of the existing bulkhead maintenance and monitoring will be included in the OMM Manual for the 95% Design.	
42	Section 6.2, PDF Page 58, Resin Pre-Design Study: For clarity, the forthcoming pilot test report in the 95% Design must explain how BASF selected the Purolite PFA694 resin and quantity. a. BASF Action Item: The resin and quantity are part of the specifications and as such, a rationale for using it is needed in the text of the 95% Design.	02/13/2025	BASF selected the Purolite PFA694 since it is one of the leading PFAS resins commercially available and has been tested and proven to remove PFAS from groundwater at the site. Testing of Purolite PFA694 resin is ongoing at the site with the resin pilot test. As of January 2025 PFOS/PFOA breakthrough of the resin has not been observed but once it is other commercially available resins may also be tested	EPA finds the response to our comment acceptable.

			as discussed in the Resin Pilot Work Plan submitted on October 25, 2022. This rationale for using Purolite PFA694 will be added to the BODR text of the 95% Design, note we do not anticipate submitting a separate pilot test report with the 95% Design package.	
43	Section 6.4.6, PDF Page 65: This section states that to "An existing onsite construction water treatment system was used to determine the target EBCT, and the maximum design flow rate of 120 gpm was used to establish the parameters for the GAC design." a. BASF Action Item: Provide more detail on how this existing system was used in development of the onsite construction water treatment system.	02/13/2025	The existing construction water system was designed based on the existing West Track system both of which have an GAC EBCT of 40 minutes and have been successfully treating groundwater to below permit levels. This EBCT was therefore used as the design basis for the treatability lab test (Rapid Small Scale Column Test, RSSCT) that was conducted for the barrier remedy treatment system to confirm reactivated GAC was capable of treating VOCs and SVOCs to below POTW limits. Results of the treatability lab test were favorable and therefore the 40 minute EBCT was carried forward for the full-scale system. This additional detail will be added to the 95% Design BODR.	EPA finds the response to our comment acceptable.
84	Appendix K, PDF Page 3372, Technical Specifications, Section 31 23 05-7, Excavation and Fill: This section needs to define “select fill.” a. BASF Action Item: In the 95% Design, revise the specifications to include this definition.	02/13/2025	"Select Fill" will be removed from the technical specifications, references to "Select Fill" will be revised to refer to one of the defined material types.	EPA finds the response to our comment acceptable. Please add reference to sections or paragraphs that define the fill type and material selected.
85	Appendix O, PDF Page 3620, Draft Waste Management Plan, Section 5.2, Management of Waste in Stockpiles: The first bullet of this section states, “Soil staged adjacent to the trench and excavation do not require secondary containment and are not required to be covered at the end of the day; however, erosion and sediment controls are required and will be installed.” For clarity this	02/13/2025	The following text will be added to this section of the 95% design along with a reference to the SESC Permit: "Erosion and sediment controls to be installed around trench spoils include temporary silt fence and temporary compost filter sock. Straw wattles may be used as an alternative in areas of pavement or where staking is otherwise not feasible." The trenches are not expected to remain	Please add the anticipated amount of sediment to be removed, the duration that it will be stockpiled, and the means that excavated sediment will be disposed for non-hazardous waste sediments. Please work with EGLE as required to obtain a SESC

	section needs to identify the erosion and sediment controls required (e.g., silt fence, tarps, temporary seeding, etc.) and reference the Soil Erosion and Sediment Control (SESC) Permit. a. BASF Action Item: Revise this section to address this issue in the written response to comments due on March 30, 2025.		open long enough that temporary seeding or tarping would be required.	permit as needed for this remedy proposal. Please see the EPA response to comment number 86 below for further detail.
86	Appendix O, PDF Page 3620, Draft Waste Management Plan, Section 5.2, Management of Waste in Stockpile, Page 6: This section indicates silt fence around the stockpiled waste will be visually inspected following all storm events to ensure erosion and sedimentation controls are properly maintained. However, this section does not define a storm event (e.g., 0.5 inches of rain or equivalent snowfall) and reference the Soil Erosion and Sediment Control Permit. a. BASF Action Item: For clarity, define a storm event within the 95% Design and provide a preliminary justification within the written response to comments due on March 30, 2025.	02/13/2025	The following text will be added to this section of the 95% design along with a reference to the SESC Permit: "Silt fence and other erosion and sediment control practices will be inspected once every 14 calendar days *and* within 24 hours after storm events that produce 0.25" or more of rain in a 24-hour period (or snow melt from a 3.25" accumulation) as outlined in the EPA Construction General Permit for Stormwater Discharges."	Please refer to comment number 85 above and include the information provided from the email from BASF sent on 4/24/2025.
87	Appendix O, PDF Page 3620, Draft Waste Management Plan, Section 6.1, Regulations Applicable to Waste Impacted with PFAS: This section states, “Disposal is being evaluated on a case-by-case basis, and disposal methods vary based on the disposal facility. The Project Waste Advisor will keep the project team informed of current and upcoming regulations and guidance associated with disposal requirements for PFAS-impacted waste.” a. BASF Action Item: This approach is appropriate; however, this section needs to clarify how the project team will be updated	02/13/2025	The following text will be added to this section of the 95% Waste Management Plan: "For each phase of work involving disposal of PFAS-impacted waste the project team will reach out to the Project Waste Advisor for an update to ensure any regulation changes are incorporated into the disposal plan."	Please include a schedule for regular reporting to EPA on the progress of constructing the groundwater remedy including updates to sediment disposal on a regular basis.

	(e.g., progress reports, annual reporting, etc.). In the 95% Design, revise this section to address this issue.			
88	Drawings Comment 1: A1-79820: This drawing shows a sludge line from the equalization tank. How will sludge that accumulates 200k gal contingency tank be handled? a. BASF Action Item: In the 95% Design, please provide clarification to this drawing.	02/13/2025	The exterior storage tank will be cleaned out on an as needed basis using mechanical means to address any solids accumulation that may occur. To minimize solids transfer from this tank to the system, the transfer pump intake will be elevated off the bottom of the tank. Clarification will be added to the 95% Design.	EPA finds the response to our comment acceptable.
89	Drawings Comment 2 General: Perimeter barrier remedy drawings: Why not show the sumps in the profile view on these drawings? It is difficult to decipher from these drawings whether the drain system is connected or if the collection drains only drain to one sump. a. BASF Action Item: In the 95% Design, provide clarification to this drawing.	02/13/2025	The drain system is connected directly to the sumps, the number of sumps connected to a drain depends on the length of each drain and is noted on Table 9A. Proposed Drain Lengths and Sump Extraction Rates of the BODR main text. The sumps are not shown on the drawings as the profiles follow the continuous conveyance alignment rather than the individual drains. The sump detail is shown on DWG 0154-SITE-C1-79781.	EPA finds the response to our comment acceptable.
91	Drawings Comment 3: C1-79781: The sump typical (1) shows the concrete valve vault with an opening right below the discharge pipes that seemingly has no purpose. a. BASF Action Item: In the 95% Design, provide clarification in this drawing.	02/13/2025	This apparent extra opening right below the discharge pipe on the profile view will be removed for the 95% Design. Openings in the valve box are only needed where there are pipe penetrations.	EPA finds the response to our comment acceptable.
92	Drawings Comment 4: C1-79781: Collection Trench typical (2) and (3) - what is the purpose of an impermeable material above the drain? a. BASF Action Item: In the 95% Design, provide clarification to this drawing.	02/13/2025	The impermeable material above the drain will be installed to prevent surface water from infiltrating directly into the highly permeable backfill material within the drain. This clarification will be added to the 95% Design.	EPA finds the response to our comment acceptable.
93	Drawings Comment 5: C1-79781: The drawing references a bill of materials for the pump sizing. EPA suggests including the drawing number for this or including the pump	02/13/2025	A reference to the Bill of Materials Appendix R will be added to the drawing in the 95% Design.	EPA finds the response to our comment acceptable.

	information in the civil sheets. a. BASF Action Item: In the 95% Design, provide clarification to this drawing.			

Attachment B: Table 2 Comment Tracking Table Responses to Comments on the 60% Basis of Design

Comment Number	EPA Comment	Date(s) Discussed with EPA	BASF Response to Comment	EPA Response to Comment
4	Section 3.4.2.1, PDF Page 26, Lines of Evidence to Support Inward Gradient Thresholds: The last bullet in this section notes that lowering groundwater levels quickly and/or significantly may change the hydrogeologic and/or transport conditions that have been established over time. a. BASF Action Item: In the written response to comments due on or before March 30, 2025, include an evaluation of the Corrective Action Objectives as the remedy relates to quickly changing groundwater levels that may change the hydrogeologic and/or transport conditions that have been established over time.	01/23/2025	The Corrective Action Objective (CAO) for the perimeter barrier remedy is to mitigate groundwater discharge offsite. In order to accomplish this, the remedy includes a physical barrier that will isolate onsite groundwater from the Detroit River and adjacent properties. In addition, the perimeter barrier remedy includes a hydraulic barrier that will be established by an inward gradient induced by the groundwater collection and extraction system. The extracted groundwater is sent to a groundwater treatment system that is designed based on the current groundwater concentrations at the perimeter of the Site that have reached a steady state over decades. While inducing a gradient will be required to meet the proposed performance standards, inducing excessive gradients may change the hydrogeologic and/or transport conditions that have been established. Changing the hydrogeologic and/or transport conditions have the potential to effect groundwater concentrations moving toward the perimeter by mobilizing mass that is not mobile under natural gradient conditions. If groundwater concentrations entering the treatment system are outside the range of concentrations that the system was designed to treat, there is a operational risk of not being able to meet discharge limits. The influent to the groundwater treatment system will be monitored as part of O&M. Details of the influent monitoring and associated actions (i.e. what will be done if concentrations are outside the basis of design concentrations) will be detailed in the O&M Plan.	The 95% Basis of Design document must include evaluation of the hydrogeologic and transport conditions against the CAOs for the perimeter barrier remedy. This evaluation must compare those different scenarios that could happen which have the ability to affect the perimeter barrier remedy to prevent mitigate discharge from going offsite.
38	Section 5.1.1, PDF Page 53, Summary of Groundwater Modeling Results: This section speaks to the perimeter drain induces a vertical gradient in the units below the fill such that deeper groundwater in the sand unit is captured by the extraction system. However, an	1/23/2025	As summarized in Section 4.2 of Appendix B, "Groundwater capture of the drain system was evaluated using the MODular flow ALLocation (MODALL) program (Potter et al., 2008). This program uses the same MODFLOW-calculated cell-by-cell flow output as MODPATH (Pollock, 1989), but rather than tracking individual particle	EPA finds the response to our comment acceptable. Please include the steps taken to update or improve the groundwater model over the years and multiple workplans. Include a figure(s) of

	evaluation of potential vertical flux from deeper units is not provided. Discuss simulated water budgets and explain whether silt/clay/peat unit separating fill from the deeper sand unit would preclude significant groundwater discharge from the latter to the perimeter drains. The discussion should also qualify the expected performance of the extraction well and associated twenty-one sump network in maintaining the inward gradient for the fill unit as well as an upward vertical gradient induced by the perimeter drain on the deeper units. BASF Action Item: In the 95% Design, revise this section to include the requested additional details for clarity in understanding future operational and maintenance aspects of the remedy.		paths, it directly computes the zone-of-capture. The results of the steady-state simulation and capture zones for the top three model layers are shown on Figure 11. The results show that under the 0.1 foot gradient conditions, the groundwater along the perimeter boundary is captured by the drain system in model layers 1 through 3. The perimeter drain remedy induces a vertical gradient in the lower model layers (the perimeter drains and sumps are present in model layer 1). The steady-state flow rate for the drain system is 27.2 gpm." A note will be added to Figure 11 to clarify that the drain is only present in the fill (model layer 1).	the MODPATH outputs for the vertical gradient.
39	Section 5.1.2, PDF Page 54, Groundwater Extraction System: This section indicates that drain lengths and locations required to hydraulically capture groundwater were established based on groundwater model simulations, Appendix B (Draft Groundwater Modeling Report). While it is understood that a non-continuous drain was simulated in the model, it is not clear how the model accounted for the intermittent nature of the collection drains, as presented in the design drawings. For example, there are cases where there is gap in the collections drains of 100-300 feet. As such, it is not clear if this system will create the inward gradient across the entire site boundary.	1/23/2025	For the 30% design, the groundwater model was used to determine the optimal drain and sump placement to meet the proposed performance metrics. The drain alignments and sump locations were selected based on results of the groundwater model capture analysis. Drain lengths and setbacks were optimized during this iterative design process until capture was demonstrated along the entire shoreline. The 60% design then built upon the 30% layout and optimized the drain and sump placement further based on the geophysics survey results and records of historical infrastructure to avoid obstructions while maintaining capture along the shoreline. This section will be revised in the 95% design to provide additional information on the design of the collection drains and any additional data used to determine the location of the drains.	Please include these steps taken and details in the appropriate sections of the 95% Design. Also include a figure in the model that depicts the groundwater capture by the drains proposed for the remedy design. This could also be a MODPATH output.

	a. BASF Action Item: In the 95% Design, revise this section to provide additional information on the design of the collection drains and any additional data used to determine the location of the drains.			
40	Section 5.1.2, PDF Page 54: This section mentions that there will be two spare extractions well conveyance lines installed on sump 12 near Drain 6. EPA's review was not able to locate this in the drawings. It is also unclear why this sump would need spare lines when it is not located very close to the extraction well in the North-East corner of the site. a. BASF Action Item: Add additional information as to the two spare extraction lines within the 95% Design and provide a written response to comments due on March 30, 2025.	1/23/2025	The spare extraction well lines are shown on layout Drawing 0154-SITE-C1-79756 with a call out "PIPE STUB WITH WELDED HDPE CAP" and P&ID Drawing 0154-SITE-A2-79822. These spare lines were added as contingency in case additional extraction wells are needed in the future. Additional detail will be added to the 95% design to show their location close to Sump 12 and their size/length.	EPA finds the response to our comment acceptable.
41	Section 5.1.2, PDF Page 54: The section notes that sumps will extend approximately 5 feet below the drain invert, but the sump detail on C1-79781 shows a 2' sump. a. BASF Action Item: Please correct this discrepancy in the 95% Design.	1/23/2025	The detail on the drawing is correct, the sump extends 2' below the drain invert. The text in Section 5.1.2 will be revised to be consistent in the 95% Design.	EPA finds the response to our comment acceptable.
49	Appendix B, PDF Page 1900, Draft Groundwater Modeling Report, Section 2.1, Model Domain and Grid: Since the basic underpinnings of the model were converted from Block Centered Flow to an Unstructured Grid, the underlying	1/23/2025	A history of model updates will be added to the document. Sensitivity analyses were conducted as part Hydraulic PDI (date) and were not updated as part of the 60% design but will be updated for the 95% design. The groundwater model was developed by WHI in 2002. It was a 5 layer model with grid cell	EPA finds the response to our comment acceptable. Please add a summary of the sensitivity analysis conducted on the model and ensure that the models are identified as either steady-state

	math should have been confirmed by conducting a sensitivity analysis of the model parameters to verify consistent variance between the two mathematical approaches. Define the base units for time and distance. Also, the types of layers were not discussed or supported. According to the listing file, all five layers were convertible (LAYCON = 3); please provide justification for these choices. Sensitivity analysis is not addressed in this document. If addressed in prior efforts, it should be acknowledged by citing the document that covered the topic. Additionally, a sensitivity analysis of this configuration of the model should have been conducted with the remedy features to determine what parameters the model is sensitive to so that there can be confidence in the solution. a. BASF Action Item: In the 95% Design, include a history of updating the model, including the grid, and the sensitivity analysis conducted.		spacing ranging from 25 x 25 ft to 50 ft x 50 ft. This model was run using Modflow 88. The groundwater model was updated in 2015 and refined the model grid to be a uniform grid spacing of 25 x 25 ft. The model remained a 5-layer model. The version of modflow used in this analysis was updated to be MODFLOW 2005. The 2015 model was calibrated to more recent conditions (October 2014) and hydraulic parameters were updated to represent more recently collected data. The model was again updated in 2021 as part of the Hydraulic PDI. he model grid to be a uniform grid spacing of 25 x 25 ft. The model remained a 5 layer model. The modflow version used was MODFLOW 2005. The hydraulic parameters were updated to reflect the results of the Hydraulic PDI. The model was calibrated with two steady-state time periods (March 2019 and March 2021). The model was again updated in 2023. The model grid and layering was the same as the 2021 model. The modflow version was updated to be MODFLOW-USG such that connected- linear networks could be used to evaluate the perimeter barrier remedy. The model grid and layering was the same as the 2021 model. The model was calibrated under both steady-state and transient conditions. The perimeter barrier remedy was evaluated under both steady-state and transient conditions.	and transient models in the 95% Design.
50	Appendix B, PDF Page 1901, Draft Groundwater Modeling Report, Section 2.2, last paragraph. a. BASF Action Item: In the 95% Design, clarify that both the fill (Model Layer 1) and native sand (Model Layer 3) are a part of the unconfined aquifer.	1/23/2025	Both the fill (Model Layer 1) and native sand (Model Layer 3) are a part of the unconfined aquifer, this will be clarified in the 95% Design.	EPA finds the response to our comment acceptable.
51	Appendix B, PDF Page 1901, Draft Groundwater Modeling Report, Section 2.3.1 Groundwater Extraction: The section speaks to that the extraction rate	1/23/2025	Pumping rates for the three extraction well fields on the Site: A, B, and C are based on a totalizer installed on the system effluent, this basis will be clarified in the 95% Design.	EPA finds the response to our comment acceptable.

	is known to be on the order of 2 gallons per minute. a. BASF Action Item: In the 95% Design, clarify the basis for the estimate above.			
52	Appendix B, PDF Page 1901, Draft Groundwater Modeling Report, Section 2.3.2 Drains: Conceptualization of the remediation system relies on the new Connected Linear Network (CLN) feature of MODFLOW-USG, which is insufficiently documented in the report. a. BASF Action Item: In the 95% Design, provide additional information on the CLN and its implementation.	1/23/2025	The use of connected linear networks was summarized in section 4.1.2 of Appendix B. The section stated *"A non-continuous drain was simulated behind the new/upgraded wall at an invert elevation of 567 ft IGLD 85 (two feet below the 30 year low elevation of the Detroit River). The drains were simulated as a connected linear network (CLN). CLNs are a newer option in MODFLOW-USG to implement boundary conditions (Panday et al. 2013). As the name suggests, this package provides a generic framework to represent connected features. It is a separate flow process that is solved simultaneously with the groundwater flow (GWF) process. Different CLN to GWF connectivity options give the CLN package the flexibility to simulate a variety of features like ponds, lakes, rivers, wetlands, multi-aquifer pumping wells, or drain systems with periodic sumps. Furthermore, because the CLN network is essentially a separate modeled flow system, boundary conditions can be applied independent of the GWF system.* *The interconnectivity of CLN cells (or nodes) is specified using the same approach as the unstructured discretization package for the GWF system. Namely, for each CLN cell, there is a listing of those cells to which it is connected. This flexibility allows for a surface water network that can better represent the interconnectivity of rivers, creeks, ponds, lakes, and wetlands than is possible with the boundary packages commonly used with other MODFLOW versions like the river, drain, streamflow-routing (SFR), or lake (LAK)*	EPA finds the response to our comment acceptable.

			packages. Because the flow is conserved within a particular CLN network, it better simulates the groundwater flow through features like ponds and lakes, for which the net exchange of groundwater is zero."	
53	Appendix B, PDF Page 1901, Draft Groundwater Modeling Report, Section 2.3.3 General Head Boundaries: More information is needed for the conductance values for this section. a. BASF Action Item: In the 95% Design, provide the conductance values and how they were determined. Also clarify whether the assigned water levels were based on field measurements and whether they were assigned uniformly north to south, Layer 1 through Layer 5.	1/23/2025	Additional details regarding the general head boundary conductance values and how they were determined will be added to the 95% BOD Report. The water levels were based on historical groundwater elevation contour maps. The conductance used for the general head boundary was modified during the calibration process and ranged from 20 to 720 ft2/day. The general head boundary is located in the upper three model layers.	EPA finds the response to our comment acceptable. Please also include figures for the transient model from different timestamps to depict groundwater movement.
54	Appendix B, PDF Page 1901, Draft Groundwater Modeling Report, Section 2.3, Figure 5: The figure presents the hydraulic conductivity (K) distribution assigned to Model Layers 1 through 5. a. BASF Action Item: In the 95% Design, to improve readability of layer-specific K zones, please revise to the color legend utilized to the legend used in the Hydraulic PDI Report.	1/23/2025	In the 95% Design, the color legend will be revised to utilized to the legend used in the Hydraulic PDI Report.	EPA finds the response to our comment acceptable.
55	Appendix B, PDF Page 1902, Draft Groundwater Modeling Report, Section 2.3.5 Constant Head: Clarification is needed for the Fire Pond in the groundwater model. a. BASF Action Item: In the 95% Design, add a description of the Fire Pond and	1/23/2025	The Fire Pond was not included in the groundwater model because it is lined and not hydraulically connected to the groundwater system. This rationale will be added to the 95% design.	EPA finds the response to our comment acceptable.

	provide a rationale for not including the Fire Pond in the groundwater model.			
56	Appendix B, PDF Page 1902, Draft Groundwater Modeling Report, Section 2.3.7 Recharge: More information is needed in regard to recharge values and references in Appendix B. a. BASF Action Item: In the 95% Design, provide some examples of the type of cover and the recharge values, with references to data used, that were utilized for that cover type in the groundwater model portion of the design document.	1/23/2025	The Site has a stormwater model, which will be used to validate the recharge assumptions (as described in comment 63). This will be discussed in detail in the 95% design.	EPA finds the response to our comment acceptable. Please provide additional information for the calculations, references, and sources for recharge in this groundwater model.
57	Appendix B, PDF Page 1903, Draft Groundwater Modeling Report, Section 3, last paragraph, third sentence: Clarification is needed regarding the comparison of the groundwater model residuals to the referenced text on PDF Page 1903. Although "Anderson et al. (2015) indicates that there are no established industry guidelines regarding the acceptable magnitude of residual statistics," in modeling practice the normalized root mean squared error of less than 10% is often used. Both the steady-state and transient model calibrations presented in the report have not attained this criterion. a. BASF Action Item: Add information on the model's comparison to the residual statistics in this paragraph in the 95% Design and provide a preliminary response in the written response to comments due on March 30, 2025.	1/23/2025	Information regarding the model's comparison to the residual statistics will be added to this paragraph. Additionally, the standard modeling practice of scaled standard deviation and/or normalized root mean squared error of less than 10% will be added to the paragraph in the 95% BOD Report. The following text will be added to discussions regarding both the steady-state and transient model validation sections of the 95% design. *"Results of the calibration are presented graphically on Figure X in a scatter plot of simulated versus observed head values. As shown on Figure X, a majority of the data points generally fall near a 1:1 ratio line. Groundwater elevations are generally both over-predicted in the mid-range of observed heads, as well as under-predicted where under-predicted values tend to fall more within higher observed head ranges. The residual mean, residual standard deviation, residual sum of squares, and the absolute residual mean (the average of the absolute value of all the residuals) were*	EPA finds the response to our comment acceptable.

			calculated to be x feet, x feet, xx square feet (ft2), and x feet, respectively. The residual mean is close to zero and the absolute residual mean and the standard deviation have similar values, also indicating a well calibrated model. *Residual statistics for the xx water-level calibration targets indicate the scaled residual standard deviation, which is the residual standard deviation divided by the range of observed heads and assess overall model fit adjusted for scaling effects, is below the targeted 10 percent range at xx percent indicating a well-calibrated groundwater flow model. The normalized root mean square error is xx, which is below the industry standard of 10 percent. Of the xx Site calibration targets, xx% are within the 10% range of observed water levels (xx ft)."*	
58	Appendix B, PDF Page 1904, Draft Groundwater Modeling Report, Section 3.2.1 Transient Model Setup: The recharge multiplier in Table 2 needs clarification. Clarify whether last column multiplier is applied to each zone. The multiplier seems to be linear with the exception of the first stress period. Since the model's base units are feet and days, it seems that the first stress period should have the same multiplier.	1/23/2025	The recharge multiplier, outlined in the last column of Table 2 of Appendix B, was applied to each recharge zone. The transient calibration presented in the 95% BOD report will use infiltration rates from the 2D stormwater model for a time period in August 2020 when there were transducers deployed at the site. This will be used instead of the transient calibration presented in the 60% BOD because it provides more water level data over a discrete time period that show responses to transient changes in both recharge and river elevation.	EPA finds the response to our comment acceptable.
59	Appendix B, PDF Page 1906, Draft Groundwater Modeling Report, Section 4.1.2, page 7, first sentence: The sentence states that "the instantaneous near 30-year historical river low-elevation level of 569.5 feet observed in 1995." However, the hydrograph on Chart 1 shows higher elevations in 1995.	1/23/2025	The hydrography on Chart 1 of Appendix B shows the daily mean water levels based on water levels collected every 6 minutes from the NOAA gauge dating back to 1995. The instantaneous 6- minute river level low of 569.54 ft. IGLD 85 was observed on November 13, 2003, the daily mean water level for that day however was 570.25 ft. IGLD 85. This will be clarified in the 95% Design.	EPA finds the response to our comment acceptable.

	a. BASF Action Item: In the 95% Design, clarify or resolve the discrepancy above.			
60	Appendix B, PDF Page 1906, Draft Groundwater Modeling Report, Section 4.1.3 Drains: The documentation does not clearly state if the placement of the drain nodes representing the sumps was based on what is designed or if drain sump placement in the model will determine sump placement in the construction of the remedy. It appears that the CLN features empty to singular drain nodes that represent the sump. a. BASF Action Item: In the 95% Design, clarify this part of the model described above.	1/23/2025	The groundwater model was used to determine the optimal sump placement to meet the proposed performance metrics. The CLN features empty into the drain nodes that represent each sump. This will be clarified in the 95% Design.	EPA finds the response to our comment acceptable.
61	Appendix B, PDF Page 1907, Draft Groundwater Modeling Report, Section 4.1.4 Extraction Well: The documentation speaks to one extraction well was employed, but does not state the reason why, where it was placed, or its extraction rate. a. BASF Action Item: Please add this information in the 95% Design and provide a preliminary response in the written response to comments due on March 30, 2025.	1/23/2025	The single extraction well is located in the northeast corner of the Site, where it is not feasible to place a collection drain due to the number of utilities, the existing bulkhead tie-backs, and the Outfall 001 pond. This well is needed to ensure the proposed performance metrics can be achieved in this area. This rationale will be added to the 95% design report.	EPA finds the response to our comment acceptable.
62	Appendix B, PDF Page 1907, Draft Groundwater Modeling Report, Section 4.2, second paragraph, last sentence a. BASF Action Item: In the 95% Design, add an underlined word into: “The perimeter drain remedy induces a vertical upward	1/23/2025	The sentence will be updated to add the underlined word: upward “The perimeter drain remedy induces a vertical upward gradient in the lower model layers ….”	EPA finds the response to our comment acceptable.

	gradient in the lower model layers ….” to clarify the sentence.			
63	Appendix B, PDF Page 1907, Draft Groundwater Modeling Report, Section 4.2: EPA review of data provided by the national weather service shows that Detroit receives over 30 inches of precipitation annually, yet the results of the model show only 7 inches of recharge in the high conditions. Recharge is a key piece of information for the design of the drain and treatment system. a. BASF Action Item: Provide more detail on how the recharge conditions are arrived at in the written response to comments due on March 30, 2025.	1/23/2025	Precipitation is not the same as groundwater recharge. Only a portion of precipitation becomes groundwater recharge, other portion include runoff, evaporation, transpiration, etc. The 2D stormwater model for the Site will be used to validate the recharge assumptions and provide more certainty regarding these assumptions. Arcadis will provide more detail on how the recharge conditions will be arrived at based on the stormwater model in the 95% design report. A USGS study in the Great Lakes Region estimated that 5.2 inches per year ends up as recharge to groundwater, which corresponds to approximately 13% of annual precipitation (5.2 in/yr recharge in Detroit / 40 in/yr of annual precipitation https://pubs.usgs.gov/sir/2005/5284/#N1117A).	EPA finds the response to our comment acceptable.
66	Appendix D, PDF Page 2143, Draft Geophysical Survey Results Report, Section 1, Background and Objectives, 7th Paragraph, Last Sentence The number and model of seismographs was not fully described in the 60% Design. a. BASF Action Item: In the 95% Design, describe the model of seismograph, number of seismograph channels, and frequency of the vertical component geophones (e.g., 8 Hertz) used at the end of the paragraph identified in the beginning of this comment.	1/23/2025	A single 24-channel Geometrics Geode seismograph was used. The vertical geophones were 4.5 Hertz. All equipment details were provided in Appendix A Geophysical Method Details of the DRAFT Geophysical Survey Results Report (Appendix D), specifically the seismograph and vertical geophone info can be found on Pg A-13 in the MASW Data Acquisition Section. This Appendix will be folded into the main body of the Geophysical Survey Results Report in the 95% Design.	EPA finds the response to our comment acceptable.
67	Appendix D, PDF page 2145, Draft Geophysical Survey Results Report, Section 3, Geophysical Methods, Data Collection, and Data Processing, 2nd Paragraph, 6th Sentence: This sentence states, “The eddy currents are caused by the interaction of the primary electro-magnetic field created by the transmitter	1/23/2025	This sentence will be changed to *"The transmitter generates a pulsed primary magnetic field when its coil is energized, inducing electrical eddy currents in nearby conductive objects. The decay of the eddy currents is then detected and measured by the coils. EM61 waits between each pulse until the response from the conductive subsurface dissipates, and then measures the*	EPA finds the response to our comment acceptable.

	coil and buried conductive bodies such as metallic utilities, rebar within reinforced concrete, buried debris, or other metal objects." However, this description is not accurate. a. BASF Action Item: Change this description for accuracy and clarity to indicate the transmitter generates a pulsed primary magnetic field when its coil is energized, inducing electrical eddy currents in nearby conductive objects. Also, explain that the decay of the eddy currents is then detected and measured by the coils. Further, describe that the EM61 waits between each pulse until the response from the conductive subsurface dissipates, and then measures the prolonged response from buried metal which is recorded in millivolts (mV). Lastly, describe the time gates indicating that the EM61 measures multiple time gates (216, 366, 660, and 1,266 microseconds) to provide more informative instrument responses. Provide these updates in the 95% Design.		*prolonged response from buried metal which is recorded in millivolts (mV)."* The three time gates centered at 256, 406, and 706 microseconds (µsec) after shut-off and from the upper receiver coil at 706 µsec after shut-off as described on Pg A-1 of Appendix A Geophysical Method Details of the DRAFT Geophysical Survey Results Report (Appendix D). This Appendix will be folded into the main body of the Geophysical Survey Results Report in the 95% Design.	
68	Appendix D, PDF Page 2145, Draft Geophysical Survey Results Report, Section 3, Geophysical Methods, Data Collection, and Data Processing, 2nd Paragraph, 7th Sentence: The text states, "The EMD instrument stores the position of the instrument (based on a differential global positioning system [DGPS] antenna mounted on the frame) and the received signal strength from the receiver coil (in millivolts) in a nearly continuous manner as it is moved along transects by the operator." However,		This sentence will be revised to "The EMD instrument (EM61) data logger stores the position of the instrument (based on a differential global positioning system [DGPS] antenna mounted on the frame) and the received signal strength from the receiver coil (in millivolts) in a nearly continuous manner as it is moved along transects by the operator. EMD data is merged with latitude and longitude coordinates via a National Marine Electronics Association (NMEA) stream." Additional details on EMD Data Collection Procedures can be found on Pg A-2 of Appendix A Geophysical Method Details of the DRAFT	EPA finds the response to our comment acceptable.

	the EM61 instrument does not store the DGPS coordinates. The DGPS coordinates and EM61 data are streamed to the data logger (typically an Archer or Allegro) where they are digitally recorded and merged. a. BASF Action Item: Revise this sentence for accuracy to state that the collected EM61 data was merged with northing and easting coordinates via a National Marine Electronics Association (NMEA) stream. Provide this in the 95% Design.		Geophysical Survey Results Report (Appendix D). This Appendix will be folded into the main body of the Geophysical Survey Results Report in the 95% Design.	
69	Appendix D, PDF Page 2145, Draft Geophysical Survey Results Report, Section 3, Geophysical Methods, Data Collection, and Data Processing, 2nd Paragraph: The EM61 collection rate and transects spacing is not fully provided. a. BASF Action Item: In the 95% Design, add a description of the EM61 data collection rate (sampling rate) used and nominal transects spacing.	1/23/2025	The EM61 data collection rate (sampling rate) used was 10 readings per second and the nominal transects spacing was 3 feet. This information can be found on page A-2 of Appendix A Geophysical Method Details of the DRAFT Geophysical Survey Results Report (Appendix D). This Appendix will be folded into the main body of the Geophysical Survey Results Report in the 95% Design.	EPA finds the response to our comment acceptable.
71	Appendix D, PDF Page 2146, Draft Geophysical Survey Results Report, Section 4, Test Pit Excavation, 2nd Paragraph, 4th Sentence: The text states, "Fourteen of these test pits were excavated during the field event, the remaining six were deemed unnecessary based on findings from the completed test pits." However, it is not clear why these additional test pits were not necessary.	1/23/2025	The remaining six test pits (TPs-5, 6, 7, 9, 11, and 12) were determined to be unnecessary because of their proximity to other excavated test pits with similar EM61 anomaly signatures. Specifically, EM61 data at TP-11 and TP-12 showed a similar parallel linear anomaly as TP-13 which was determined to be a concrete footing associated with the former train trestle. TP-5, 6, 7, and 9 had similar EM61 anomaly signatures as TP-2, 3, 4, 8, and 10 which when excavated were determined to be miscellaneous debris or DBO, not a historical structure that would have the potential to inhibit	EPA finds the response to our comment acceptable.

	a. BASF Action Item: In the 95% Design, explain in the text why the remaining six test pits were unnecessary.		construction. In addition to adaptively revising the test pit plan to remove specific test pits, 8 test pits were added to the scope (TP-13B, TP-14B, TP-16B, TP-19B, TP-20A, TP-20B, TP-20C, and TP-20D). These test pits were added along the northern section of the South Dock where the majority of the historical infrastructure was known to have been located. This explanation will be added to the 95% design.	
74	Appendix D, PDF Page 2158, Draft Geophysical Survey Results Report, Table 4, Characteristic Historical Features, Field Observations, and Geophysical Evidence, 3rd Row, Last Column: The text states, "It appears the EM61 survey did not cover the southern half of Section B or the Section A deadman anchor." a. BASF Action Item: In the written response to comments due on March 30, 2025, explain in the text why this area was not covered and indicate whether or not this leaves a significant data gap.	1/23/2025	Locating the deadman wall was not specifically an objective of the EM-61, the survey was conducted to identify obstructions along the alignment of the collection system. The drain alignment in behind the existing bulkhead wall is set back behind the tie backs and deadman walls. Based on historical drawings the deadman wall for Sections A and B is estimated to be approximately 16 feet from the headwall in this area. For clarity this statement will be revised to "The EM61 survey did not cover the southern half of Section B or the Section A deadman anchor, however historical records show them to be set back 16 feet from the headwall." This is not a data gap for construction of collection system since it is outside the area where the drain will be installed.	EPA finds the response to our comment acceptable.

Attachment C: Table 3 Comment Tracking Table Responses to Comments on the 60% Basis of Design

Comment Number	EPA Comment	Date(s) Discussed with EPA	BASF Response to Comments	EPA Response to Comments
Inward Gradient	From the EPA Letter sent to BASF dated 11/08/2024: "Accordingly, BASF must include a method to demonstrate that the collection system combined with the perimeter barriers remains effective in containing and collecting groundwater on-site. BASF must propose and implement a plan for alternative methods to inspect, monitor and track the groundwater migration into the groundwater collection and treatment trench. Included in this effort, BASF must also add engineering specifications and contingencies for climate change; including but not limited to, flooding, river changes, and precipitation changes. On or before March 30, 2025, BASF is required to address EPA's comments on certain design details regarding the inward gradient and incorporate the relevant sections of the design proposal."	3/6/25	USEPA and BASF have agreed upon a performance metric of maintaining a 0.5' gradient between the trench and the 30-day average of the river elevation. With the impermeable barrier across the downgradient perimeter of the Site, the groundwater can no longer discharge to the river or offsite. Groundwater can only go into the collection trench where it is pumped to the treatment system. If the groundwater collection trench is not effective in containing, collecting, and/or conveying groundwater, the groundwater will back up and flood the Site. Flooding of the Site is not acceptable for BASF operations. As such the perimeter barrier system is being designed with contingencies to ensure this condition does not occur (discussed below). Site inspections for evidence of flooding will be performed as part of O&M activities for the perimeter barrier system. BASF is committed to developing a resilient design for the perimeter barrier remedy. The 60% design included the following contingencies to ensure effective containment of groundwater and to account for climate change, to the extent practical: 1) a drain pipe invert depth of 567 feet IGLD 85, approximately 2.5 feet below the instantaneous near 30 year river low-elevation level which provides the flexibility to maintain a 0.5 foot inward gradient for any average river elevation above 567.5 feet IGLD 85, 2) low permeability material to be installed in the drains above the stone backfill to reduce direct infiltration into the trench, 3) duty stand by extraction pumps in each sump providing the	EPA and BASF had discussions via Teams on 3/6/2025 and 3/13/2025 regarding the need for additional measures to monitor or confirm that the groundwater on-Site is being collected by the groundwater collection and treatment trench. Additionally, the EPA letter on the 60% BOD, dated 11/8/2024, had a requirement for an additional monitoring method to track the movement of groundwater into the collection and treatment trench. The 95% Basis of Design should include a method to confirm that site-wide groundwater is being collected by this remedy. This will also aid in confirming that gaps or pathways off-Site are unlikely after construction of the perimeter barriers. Additionally, the groundwater collection trench needs to incorporate transducers to show the height of the groundwater collection trench in real time on a continuous basis. Show the model output for the capture zone on the groundwater table after construction. Using the model output, provide locations for piezometers and transducers that can monitor the rate of groundwater collection.

			capacity to pump twice the design flow, 4) a 200,000 gallon influent storage tank designed to provide extra storage capacity as needed, 5) a treatment system design flow rate of 120 gpm which is two to three times higher than the average modeled steady state flow rates for normal and high recharge conditions, and 6) additional area inside the groundwater treatment system building for future expansion if needed. As part of the 95% design these contingencies will be reassessed and updated based on updated modeling results. Engineering specifications will also be included with the 95% design.	
5	Section 3.4.3.2, PDF Page 29, Start-Up Period: This section indicates that during the start-up period, the performance standard approach will be assessed to confirm that the proposed averaging time frame and compliance gradient requirements result in an achievable and protective drain compliance elevation. However, the 60% Design does not include criteria for this assessment and how the assessment will be implemented. a. BASF Action Item: In the written response to comments due on or before March 30, 2025, ensure that the discussion addresses criteria during the startup period. Also, add how the design includes the capacity to address any future changes that may be needed over the design life of the remedy, since the remedy is designed to be operated into perpetuity.	3/6/25	A detailed start-up plan will be included with the 95% design as part of the OMM Manual. Further advancement of the 95% design is needed to develop the exact criteria that will be used to assess compliance during the startup period. This information will be presented to EPA during a future monthly meeting but will not be ready prior to March 30, 2025. The 95% design will include an OMM Manual that will include a monitoring plan to assess the need for design changes based on performance of the system. Additionally the 60% design included the following contingencies to ensure effective containment of groundwater and to account for future changes, to the extent practical: 1) a drain pipe invert depth of 567 feet IGLD 85, approximately 2.5 feet below the instantaneous near 30 year river low-elevation level which provides the flexibility to maintain a 0.5 foot inward gradient for any average river elevation above 567.5 feet IGLD 85, 2) low permeability material to be installed in the drains above the stone backfill to reduce direct infiltration into the trench, 3) duty stand by extraction pumps in each sump providing the capacity to pump twice the design flow, 4) a 200,000 gallon influent storage tank designed to	EPA finds the response to our comment acceptable.

			provide extra storage capacity as needed, 5) a treatment system design flow rate of 120 gpm which is two to three times higher than the average modeled steady state flow rates for normal and high recharge conditions, and 6) additional area inside the groundwater treatment system building for future expansion if needed. As part of the 95% design these contingencies will be reassessed and updated based on updated modeling results.	
14	Section 4.3.2.1.2, PDF Page 37, Upper Trenton Channel Dredging Project: This section indicates the new bulkhead design accommodates this current dredge prism design and assumes a 10-foot offset from the face of the headwall starting at the current sediment surface elevation. However, it is not clear why the potential dredging up to the wall was not also included as a contingency. The Final Basis of Design Report – Remedial Design – Upper Trenton Channel, Detroit River Area of Concern, Wyandotte, Michigan and the EPA Great Lakes Architect Engineer Services (GLAES) Contract, Task Order 0018/Contract No. EP- R5-11-09, dated October 2019, prepared by CH2M HILL, Inc., indicates that the volumes associated with the offsets and allowances would be refined during the remedial design process. a. BASF Action Item: In the written response to comments due on March 30, 2025, provide ways to address removing sediment near the wall as any contamination that is left behind (not dredged due to the shoreline offsets and utility offsets and/or capped) are potentially available for transport.	3/6/25	Sediments are being addressed as part of the UTC project. The UTC design is leaving a 10 foot offset that will be covered with the appropriate residuals management material. Reference to the cover with that will be placed as part of the UTC project will be added to Section 4.3.2.1.2 of the 95% BODR.	EPA recognizes that the two projects have an offset that is not removed via the GLNPO Dredging Project.

25	Section 4.3.2.3.3, PDF Page 44, Backfill Placement: This section indicates details of the backfill materials and placement requirements that will continue to be refined in the next design phase. For completeness, ensure these details in the 95% Design also include a freeze-thaw evaluation for proposed flowable, cementitious grout. This section notes that consolidation will likely occur in the clay unit at the bottom of the sheet pile walls. Were the sheet pile wall earth pressure calculations performed using after settlement conditions for that clay layer? Is there concern that the embedment depth should be adjusted for post- consolidation clay elevations? Has consolidation testing been performed on the in-situ clay to determine the amount of potential settlement? a. BASF Action Item: In the written response to comments due on March 30, 2025, add details of backfill placement and include these details in the relevant sections of the design proposal.	3/6/25	The 60% design assumed the strength of the clay layer is representative of its existing strength and did not account for increase in clay strength from consolidation. Since sheet pile depths in the 60% design extend through the clay layer to the bedrock surface, there is not a concern for an adjustment of the pile depth based on post-consolidation elevations. The 95% design will address items related to backfill materials and placement methods below the deck of the South Dock. Evaluations will include freeze-thaw, settlement estimates using existing consolidation data for the clay layer and addressing effects of backfill placement on earth pressure assumptions. Results of the constructability and value engineering studies will also be considered in selection of backfill materials. Further advancement of the 95% design is needed to develop final backfill details, therefore this information will not be available by March 30, 2025 but will be provided in a future monthly meeting with the EPA and in the 95% Design.	EPA finds the response to our comment acceptable.
27	Section 4.3.2.3.1, PDF Page 43, 1st Paragraph: This paragraph speaks to rock shoes welded to the sheet pile tips will be required to penetrate through the glacial till layer and provide a sound connection to the clay layer. Does the bulkhead sheet pile stability require a minimum embedment of the sheet into the top of the clay layer? Does sheet pile installation need rock socketing? Will glacial erratics and other obstructions cause damage to the steel sheet pile walls during installation?	3/6/25	The 60% design for the headwall sheet piles requires embedment into the glacial till. Embedment into the bedrock in the form of shear pins or rock sockets is not required for the assumed loading conditions of the 60% design. The requirement for rock shoes was included to promote advancement of the pile through the stiff glacial till layer, with the added benefit of seating the pile in the bedrock surface. Results of the constructability and value engineering studies will be considered moving forward with the 95% design and embedment requirements of the headwall piles may change.	EPA finds the response to our comment acceptable.

	a. BASF Action Item: In the written response to comments due on March 30, 2025, provide this detail to the questions above.			
29	Section 4.3.2.3.2, PDF Page 43, Paragraph 3: This paragraph speaks to at the anchor wall, the connection point will continue at the same elevation and intersect the concrete cap at approximately 12 inches below the top. a. BASF Action Item: In the written response to comments and the revised relevant section of the design proposal due on March 30, 2025, add a discussion of how deep the tie rods will be installed below surrounding final grade.	3/6/25	Estimated tie rod depths at the concrete cap range from approximately 2.5 feet to 3.2 feet below existing grade. Note that modifications to the anchor wall as a result of the constructability and value engineering studies may modify tie rod depths.	EPA finds the response to our comment acceptable.
30	Section 4.3.2.3.3, PDF Page 44, 2nd Paragraph: This paragraph states that settlement monitoring of the fill surface will be performed to assess the progress of consolidation in the clay unit and to minimize strain on the tie rods due to settlement of the fill. a. BASF Action Item: In the written response to comments and the revised relevant section of the design proposal due on March 30, 2025, provide a plan for settlement monitoring, and trigger events to add fill material and the OMM plan.	3/6/25	The materials selected for filling beneath the South Dock will affect the estimated settlement of the underlying clay unit. Findings from the constructability and value engineering studies will be used to select the backfill materials for the 95% design and accordingly estimate the consolidation of the clay. This information will be used to develop the settlement monitoring program and requirements for placement of additional fill material. Further advancement of the design is needed to develop the settlement monitoring program and trigger events to add fill material, therefore this information will not be available by March 30, 2025 but will be provided in a future monthly meeting with the EPA and in the 95% Design.	EPA finds the response to our comment acceptable.
31	Section 4.3.2.3.3, PDF Page 44, 2nd Paragraph: This paragraph describes details of the backfill materials and placement requirements will continue to be refined in the next design phase. Design has been changed to an A-frame anchor wall. This change allows for locating the A-	3/6/25	The 60% design assumed the area beneath the dock would be backfilled mostly with granular material. Lateral earth pressures for the backfill material were based on a unit weight and friction angle typical for a coarse aggregate. An active lateral earth pressure was assumed for this material along with the assumption that the existing bulkhead (i.e.,	EPA finds the response to our comment acceptable.

	frame structure closer to the headwall; however, the structure will require positioning within the anchor zone (existing timber piles and tie rods) of the Wakefield wall to avoid substantial historical foundations. What is the assumed type of backfill material for this report? How is backfill loading included in the bulkhead design calculations? Does the anchor wall interfere with the groundwater treatment collection system in any locations? a. BASF Action Item: Provide these details on the backfill materials in the relevant revised section of the design proposal and a description in the written response to comments due on March 30, 2025		Wakefield Wall) provided no lateral support for the existing upland soils and there was no support of the concrete deck from the existing timber piles. Findings from the constructability and value engineering studies will be used to select the backfill materials for the 95% design and further refine the bulkhead loadings. The location of the anchor wall does not interfere with the components of the groundwater collection system. Where there is interference between the proposed anchor wall and the existing bulkhead anchor system, the headwall design does allow for placement of backfill materials beneath the dock for providing stability to the Wakefield Wall when existing anchor components are removed for the proposed anchor wall construction.	
32	Section 4.3.2.3.3, PDF Page 44, 2nd Paragraph, Alignment Layout Anchor Walls: Discuss the offset of the alignment layouts and depths of the anchor wall vs. the groundwater collection system trenches. Will the anchor wall interfere with the groundwater collection system flow path? a. BASF Action Item: Provide this discussion within the 95% Design and provide a preliminary justification within the written response to comments due on March 30, 2025.	3/6/25	Per groundwater modeling results the location of the anchor wall does not interfere with the ability of the groundwater collection system to maintain the compliance inward gradient of 0.5 feet. As part of the constructability and value engineering studies the type of anchor wall is being evaluated (deadman vs A-frame with H-piles or micropiles) and the groundwater model is being used to evaluate any impact the anchor wall may have on the groundwater collection system and its ability to maintain the compliance inward gradient. This evaluation will be detailed in the 95% design.	EPA finds the response to our comment acceptable.
44	Section 9, PDF Page 75, Future Considerations: This section describes future potential optimization actions to be taken after completion of the design; however, a mechanism for tracking these optimizations (e.g., as part of performance monitoring or OMM) is not presented.	3/6/25	Post-construction optimization items (including identification, progress, and completion) will be tracked in compliance reports. Informal updates will be provided during routine meetings with EPA.	EPA finds the response to our comment acceptable.

	BASF Action Item: Provide further detail on tracking potential optimization actions within the 95% Design and provide written response to comments due on March 30, 2025.			
45	Section 12.1, PDF Page 78, Perimeter Barrier: This section proposes inspecting the barrier sections of the remedy every five years. It also notes the frequency will be adjusted, if needed, based on inspection reports or drain compliance elevation monitoring of the groundwater extraction system. Describe the settlement and deflection monitoring methods to be used in this section (i.e., survey plates, vibrating wire piezometers, inclinometers, etc.). EPA requires that settlement and deflection inspections occur annually and after five years, BASF can propose a reduced frequency if BASF can document that no significant settlement or deflection has occurred. a. BASF Action Item: Provide this inspection schedule within the 95% Design and provide a written response to comments due on March 30, 2025.	3/6/25	With respect to settlement monitoring of the backfill materials beneath the south dock, further details will be included in the 95% design and based on the findings of the constructability and value engineering studies currently in progress. For required deflection monitoring of the bulkhead, permanent targets would be installed near the top of the sheet piles for surveying.	EPA finds the response to our comment acceptable.
46	Section 12.2, PDF Page 78: This section states that "The system will routinely compare data and alert operators of any alarm conditions and/or increasing drain levels " a. BASF Action Item: Is the plan for the piezometer readings to automatically adjust the pump to increase the flow based on the river compliance elevation, or to feed that information to an operator who	3/6/25	The pump speed will be automatically adjusted to increase or decrease flow based on the compliance piezometer and the 30-day average river elevation calculated from elevations measured in stilling wells. Following an alarm or shutdown, a notification will be sent to the system operator informing them of the system status. The operator will acknowledge the alarm, inspect and repair the system as needed, and restart the system once the alarm/shutdown condition has been addressed. Many key	EPA finds the response to our comment acceptable. Please see the response to the “Inward Gradient” comment for further detail on monitoring of the collection trench.

	will adjust the flows? Provide these details on piezometer readings and changes to pumping raters in the 95% Design. b. BASF Action Item: Provide additional detail for the procedure following alarms, shutoffs, and other components in the 95% Design.		components of the system have redundancy (pumps, level sensors, floats) to limit system downtime in the event of equipment failure. These details will be added to the 95% design.	
48	Appendix A, PDF Page 121, Draft Perimeter Conceptual Site Model, Section 4, Conclusions: This section indicated groundwater stability trends were considered and incorporated into the basis of design for the groundwater treatment system; however, no details on how this was considered and incorporated are provided. a. BASF Action Item: Provide a discussion on how the stability trends affected the design in the written response to comments due on March 30, 2025 and in the 95% Design.	3/6/25	As part of the design, the mercury concentration trends were reviewed relative to the concentrations tested in the treatability study that is being used as the basis for the treatment system. As presented in the CSM, thirty-one wells across the downgradient perimeter of the Site were evaluated for stability trends for mercury and PFOS. Based on the data available for trend evaluation, there was no significant trends identified for PFOS concentrations. For mercury, 8 wells had a decreasing trend, 19 wells had no trend, and 3 were increasing. The wells with increasing trends had a maximum mercury concentrations detected in the approximate range of 30 to 310 ng/L. Treatability testing was completed with blended perimeter groundwater containing a mercury concentrations at 580 ng/L. Since over 90% of the perimeter wells have no trend or are decreasing, and the only wells with potentially increasing concentrations trends have a maximum concentrations of half of the design concentration, the basis of design was deemed conservative and appropriate.	EPA finds the response to our comment acceptable.
78	Appendix J: PDF Page 2670, General Assumptions: The assumed dredge prism design along the South Dock includes a 10-foot offset from the face of the South Dock deck, then continuing at a 3H:1V downward dredge slope until transitioning to a flatter dredge slope at distances between 65 and 105 feet from the dock.	3/6/25	The dredged areas will not be backfilled but a residual management cover materials will be placed over the 10 foot offset and the slide slope as part of the UTC project. The 60% bulkhead design conservatively did not include this additional residual cover material, the 95% design will be updated to include the cover material.	EPA recognizes that the two projects have an offset that is not removed via the GLNPO Dredging Project.

	a. BASF Action Item: Please provide a response and necessary changes to the 95% Design for the following questions. Will dredged areas be backfilled with residual cover material, if so, is the final grade checked in the bulkhead design? This information will need to be confirmed with USEPA GLNPO GLLA UTC Dredging Project.			
79	Appendix J, PDF Page 2670, General Assumptions, Table 1, notes 3 and 4: Note 3 states "Due to earth pressure theory and modeling inputs, the slopes on the river side post dredging operations (passive side, approximately 3H:1V) were assumed as a flat plane at a reduced elevation based on geometry of the failure wedge (see Attachment 2 for profile wedges). Note 4 states "For modeling purposes, the existing fill/sediment surface slope on the active side was conservatively assumed as a flat plane with an elevation approximately mid-height or lower than the existing fill/sediment surface slope." a. BASF Action Item: Evaluate the scenario in this appendix for conditions with the river side mudline at the dredge elevation planned beyond the 10 ft wall offset in the written response to comments due on March 30, 2025.	3/6/25	The dredge surface used for the 95% design of the bulkhead will be coordinated with the UTC dredging project. The 95% design will incorporate any revisions to the UTC dredge surface where it differs from dredge surface assumptions used in the 60% design. Although the projected toe of the 3H:1V dredge slope is beyond the limits of the passive soil wedge, soil wedge diagrams and Plaxis models developed for the bulkhead design will be updated to show the toe of the 3H:1V dredge slope to demonstrate consistency with the UTC dredge surfaces.	EPA recognizes that the two projects have an offset that is not removed via the GLNPO Dredging Project.
83	Appendix J, 2671 – 2680, Design Calculations: For the Bulkhead Headwall Design parameters, certain backfill soil parameters were chosen for the design. a. BASF Action Item: In the 95% Design, please confirm that the backfill properties required for the Headwall Designs are included in the specifications (Section 31	3/6/25	Materials proposed for backfill beneath the South Dock are specified in Paragraph 2.1.E of Specification Section 31 23 05 (Excavation and Fill) and this specification will be referenced in CQAP for the project. Note that modifications to the backfill materials as a result of the constructability and value engineering studies may modify the specified material requirements.	EPA finds the response to our comment acceptable.

	23 05) and construction quality assurance plan for the project.			