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August 29, 2022
File: 213403364

VIA OnBase Electronic Forms Upload

Attention: Lisa Strobridge, P.G.
Pennsylvania Department of Environmental Protection
2 East Main Street
Norristown, Pennsylvania 19401

Dear Ms. Strobridge,

Reference: Response to Public Comments
Ecological Risk Assessment: Areas of Interest 1 through 9,
Sitewide PADEP Facility ID No. 780190
Former Philadelphia Refinery
3144 Passyunk Avenue
City of Philadelphia
Philadelphia County

1.0 INTRODUCTION

On June 30, 2022, Evergreen submitted an Ecological Risk Assessment (ERA) for Areas of Interest (AOI) 1 through 9 at the former Philadelphia Refinery (facility). As outlined in Evergreen's 2019 Public Involvement Plan for the Act 2 Remediation Process at the former Sunoco Philadelphia Refinery, Evergreen accepted public comments for a 30-day period following the submission of the ERA. The purpose of this letter is to provide the comments received from the public and Evergreen's responses to these comments for Pennsylvania Department of Environmental Protection (PADEP) and US Environmental Protection Agency (EPA) consideration of the ERA. This response letter amends the previously submitted ERA and completes the submission. This response letter and attachments will be posted to Evergreen's website upon submission to the PADEP in the same location as the ERA.

2.0 RESPONSE TO PUBLIC COMMENTS

This section presents the comments received from the public via email (phillyrefinerycleanup@ghd.com) and the website (https://phillyrefinerycleanup.info/). Evergreen received submissions from three commenting groups for the ERA (**Attachment A**). Two sets of comments were technical in nature and sent directly via email, one from the Clean Air Council (CAC) and one from the Delaware Riverkeeper Network (DRN). One comment was submitted via the website submission form which is not related to the content of the ERA nor Evergreen's remediation program, but rather the future use of the property. A copy is included in **Attachment A** for completeness. As comments received relevant to the ERA were technical in nature when considered in full, the responses provided herein are also technical and not "plain language" so that the comments could adequately be addressed and evaluated by PADEP as part of the ERA review.

Note that previously published Evergreen documents referenced in this letter have not been included as attachments but can be found on the website (https://phillyrefinerycleanup.info/).

RESPONSES TO CAC COMMENTS

Comment 1

The Department should disapprove the report because it does not follow the requirements of 25 Pa. Code 250.311 or the Department's Technical Guidance Manual, which Evergreen attempts to avoid by erroneously asserting that relevant data are not available.

Response to Comment 1

As will be further detailed in the response to Comment 1a, the section of code referenced by the CAC, 25 Pa. Code 250.311 is in reference to a remediation standard that is not Evergreen's selected standard, and the Department's Technical Guidance Manual provides recommendations, not requirements. As is further detailed in the response to Comment 1c, Evergreen has used data that is available and relevant.

Comment 1a

The regulations and Technical Guidance Manual require an assessment of direct impacts to ecological receptors through several steps, which Evergreen does not follow.

Response to Comment 1a

The section of the 25 Pa. Code Chapter 250 referenced by CAC in this comment, §250.311, outlines requirements under the Statewide Health Standards (SHS). As has been noted in previous responses to CAC comments, Evergreen is remediating the former Philadelphia Refinery under the Site-Specific Standard (SSS) and while certain portions of the SSS regulations reference back to language under the SHS, it can be misleading to quote the SHS requirements without additional context. The "assessment" referenced in the quoted section of §250.311(a) is not necessarily an ecological risk assessment in accordance with EPA guidance, as is suggested in Comment 1a. An assessment of potential risk to ecological receptors under the SHS can take a different form, as is outlined in the remainder of §250.311.

The sections of the code that relate directly to the former Philadelphia Refinery ERA under the SSS are §250.402 and §250.409. It should be noted that §250.402(c) contains similar language to §250.311(a) and references this SHS section regarding the types of receptors that should be evaluated. As outlined in the ERA, Evergreen has followed this process to identify ecological receptors of concern. Evergreen used the guidance in §250.402(d)(1) under the SSS and performed "An ecological risk assessment to determine if an impact has occurred or will occur if the release of a regulated substance goes unabated". This section of the regulations, in reference to the baseline risk assessment, does not outline a requirement as to the methodology for the processes. The next section, §250.402(d)(2) with regard to development of remediation levels, does provide specific references, and indicates that the remediator should perform "An ecological risk assessment conducted in accordance with Department-approved EPA or ASTM guidance to establish acceptable remediation levels or alternative remedies based on current and future use that are protective of the ecological receptors." It is true that Evergreen's approach of reviewing multiple lines-of-evidence for each potential ecological receptor does not follow each step of the outlined approaches. However, this is not required by the regulations as Evergreen has not sought to "establish acceptable remediation levels or alternative remedies based on current and future use that are protective of the ecological receptors." Instead, Evergreen has shown that establishing such remediation levels or alternative remedies are not necessary because substantial impacts to ecological species of concern are not expected based on multiple lines-of-evidence.

CAC points out some specific steps from the PADEP Technical Guidance Manual (TGM) section on ecological risk assessment under the SSS that were not expressly conducted in the ERA. The TGM is a reference document that provides remediators with assistance and recommendations for meeting the requirements of Act 2 and the 25 Pa. Code Chapter 250 as is outlined in the first section of the TGM in Section I (A)(2) "The Department has developed this manual to assist remediators in satisfying the requirements of the Land Recycling and Environmental Remediation Standards Act (35 P.S. §§ 6026.101-6026.908), commonly known as Act 2, and the regulations at 25 Pa. Code Chapter 250 (regulations). The manual provides suggestions and examples for the best approach to site characterization and remediation." The recommendations presented in the TGM are not requirements of Act 2 or the regulations. Act 2 allows remediators discretion while requiring them to adhere to the Act and the regulations. Evergreen uses many of the assessment tools and considerations referenced in the TGM to support the lines-of-evidence based approach; the CAC points out the deviations.

Comment 1b

In place of the steps contemplated by the Technical Guidance Manual, Evergreen uses conclusory, qualitative, and vague arguments, extending to its analysis of the Schuylkill river water and sediment and Mingo Creek.

Response to Comment 1b

In the details of this comment, CAC repeatedly refers to the SHS regulations. As previously discussed, these references can be misleading. The directly applicable sections of the regulations are §250.402 and §250.409.

As is outlined in Section 1.0 of the ERA, Evergreen does not dispute that it has taken an approach to the ecological risk assessment that makes modifications to the suggestions that are recommended in the TGM. There are several reasons that the weight-of-evidence approach is appropriate for the ERA at the former Philadelphia Refinery and many of these reasons apply to specific receptors and/or specific pathways, some of which will be discussed in further detail in the response that follows.

To conduct a qualitative risk assessment, both representative samples (or an appropriate substitute) and relevant toxicity reference values (TRVs) must be available. Two of the primary media of concern for the identified ecological receptors are surface water and sediment. These are also two media that are highly susceptible to background contamination and cross-contamination, particularly for tidally influenced rivers in areas with a long history of industry, such as the Schuylkill River. There is a strong case that potential samples collected would be influenced by other sources. However, Evergreen did use available sediment and surface water data as a consideration in the ERA. In addition, an alternative method was used to predict the contaminant contribution from the former Philadelphia Refinery to surface water of both Mingo Basin and the Schuylkill River. As outlined in the June 2022 Sitewide Fate and Transport Remedial Investigation Report (RIR), this was a detailed and conservative evaluation that used site-specific data, including many years of groundwater analytical data and an intensive review of site geology. The results of this analysis were incorporated into the ERA for both the Mingo Basin and the Schuylkill River which have applicability to fish species, certain avian species, and reptile species. It should also be noted that the calculations for the Mingo Basin are particularly conservative as they do not rely on dispersion within the surface water body.

With respect to the TRVs, as will be detailed further in the response to Comment 1e, Evergreen did not claim that there are no TRV values available for any of the species of concern. However, as stated in Section 4.0 of the ERA, the supporting data are not available for reptiles. Therefore, other lines of evidence are considered for the Eastern redbelly turtle. For the other species of concern, available data are considered and environmental fate and transport, uptake and bioaccumulation potential, and ecological toxicity of the Evergreen constituents of potential ecological concern (COPECs) are discussed and evaluated.

An additional consideration with respect to quantitative risk assessment for ecological receptors, particularly ones with near shore and on-shore habitats, is the uncertainty surrounding what changes to that habitat may be completed during upcoming development activities. Hilco Redevelopment Partners (HRP) is still in the planning stages of the project, but will likely fill in current onsite ponds, rendering moot data collected and evaluated during an ERA.

CAC also criticizes the manner in which Evergreen considers an additional set of screening values for sediment from the Ontario Ministry of the Environment. As is further detailed in the response to Comment 1d, these screening values were included as an alternative that suitably reflects site conditions.

Comment 1c

Evergreen erroneously asserts that proper analysis cannot be carried out because of lack of site and habitat characterization data.

Response to Comment 1c

In this comment, CAC points out soil and groundwater data that Evergreen has in general proximity to surface water bodies identified as habitats for ecological receptors. Evergreen does have a significant quantity of soil and groundwater data. The groundwater concentration data is not directly applicable to ecological receptors and was not used expressly as groundwater concentration data. However, it was used as the defining basis for the previously mentioned Sitewide Fate and Transport RIR to predict surface water concentrations in the Mingo Basin and the Schuylkill River. This is an appropriate method for evaluating surface water concentrations of COPECs in a scenario when surface water samples can be influenced by many other sources. The responses to Comments 4c, 5b, and 5c discuss the reasons that surface soil was not evaluated in detail. As previously discussed, even though sediment samples are highly susceptible to background contamination and cross-contamination available data were used.

Comment 1d

Evergreen erroneously concludes that there is no expected risk to species of concern based on water modeling for the Schuylkill River and Mingo Creek, and on sediment testing and analysis for the Schuylkill River.

Response to Comment 1d

Regarding surface water, fate and transport modeling supports the conclusion that potential risks from exposure to site-related constituents of concern (COCs) that were modeled in surface water in the Schuylkill River and Mingo Creek are negligible. It is true that the surface water modeling was performed for five of the Evergreen COCs as indicator parameters. As described in the Sitewide Fate and Transport RIR, the selection of these compounds (benzene, naphthalene, methyl tertiary-butyl ether, benzo(a)pyrene, and lead) was based on several criteria: prevalence, toxicity, mobility, and solubility. The details are found in Sections 2.2 and 2.3 of the Sitewide Fate and Transport RIR.

Groundwater concentrations of COPECs that are greater than Medium-Specific Concentrations (MSC) do not imply risks to aquatic ecological receptors as MSCs are based on potential human health impacts and do not take into account mixing and dilution in surface water.

Regarding sediment, CAC implies that Evergreen disregards USEPA BTAG screening values. Available sediment analytical results are screened to BTAG values; however, explanation is provided as to why it is appropriate to consider other values. The reasons will be expounded upon here. Bulk sediment concentrations of PAHs are known to be unreliable indicators of potential adverse effects to ecological receptors (USEPA, 2003; *Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures*). Pursuant to USEPA (2003) guidance, organic carbon-normalized concentrations are better predictors of the bioavailable fraction of the individual PAH compounds and thus of the potentially toxic fraction. Although several of the Region 3 BTAG screening levels take into account screening levels that have been derived using equilibrium partitioning (e.g., fluorene, naphthalene, phenanthrene), many Region 3 BTAG screening levels do not account for equilibrium partitioning (e.g., anthracene, benzo(a)anthracene, benzo(a)pyrene [BAP], chrysene, pyrene). Furthermore, as stated in the ERA, the Region 3 BTAG screening levels that use equilibrium partitioning in their derivation assume an organic carbon content of one percent. An organic carbon content of one percent is not representative of the sediment in the Schuylkill River in the near vicinity of the site, as measured organic carbon content averages 12.28 percent in this area. Since PAH bioavailability and toxicity are known to be highly correlated with organic carbon (USEPA, 2003) it is reasonable to account for the elevated organic carbon content of the Schuylkill River sediment when identifying appropriate sediment screening levels and the Ontario Ministry of the Environment screening values were additionally considered.

Comment 1e

Evergreen erroneously claims that following the required risk assessment is not possible due to lack of data regarding Toxicity Reference Value (TRV) for the species of concern.

Response to Comment 1e

The statement in the ERA “However, certain site characterization data are limited for the habitats that are the subject of this ERA and TRVs are not available for all species of concern” is accurate. TRVs are not available for reptiles, and the redbelly turtle is a reptile. Extrapolation of toxicity values derived for avian or mammalian receptors to reptilian receptors is not an acceptable practice due to the differences in physiology and metabolism.

The ERA used a weight-of-evidence approach that is consistent with the PADEP TGM and USEPA guidance (1997; *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments*).

Screening levels and TRVs for constituents in soil are not applicable to the ecological receptors evaluated in the ERA, which are mainly aquatic and/or riparian. Soil exposures for these receptors are minimal. The marsh wren and least bittern are not significantly exposed to soil as they are mostly aquatic/riparian feeders. As such, ecological soil screening levels are not applicable to these species. Peregrine falcons are not likely to be directly exposed to surface soil either.

Comment 2

Evergreen does not consider the additive effect of contaminants on species of concern, and does not provide a quantitative assessment of the cumulative impacts of contaminants.

Response to Comment 2

Although current human health risk assessment guidance (USEPA, 1989; *Risk Assessment Guidance for Superfund: Human Health Evaluation Manual*) provides methods for assessing the potentially cumulative cancer and non-cancer effects of multiple contaminants on humans, current ecological risk assessment guidance (USEPA, 1997) does not provide similar methodology for assessing cumulative effects from multiple contaminants.

The Agency for Toxic Substances and Disease Registry (ATSDR) recommendation of "A hazard index approach that assumes additive joint action and uses ATSDR Minimal Risk Levels" refers to human health evaluations and is not applicable to ecological receptors using current ecological risk assessment guidance. Pursuant to ATSDR, a Minimal Risk Level "is an estimate of the amount of a chemical a **person** [emphasis added] can eat, drink, or breathe each day without a detectable risk to health." A Minimal Risk Level is not applicable to ecological receptors.

Comment 3

Evergreen cannot cure the deficiencies in its assessment of impacts to avian species by referring to a letter from the Pennsylvania Game Commission (PGC), because that letter is only as reliable as the deficient information that was provided to it.

Response to Comment 3

The ERA used multiple lines-of-evidence in accordance with PADEP TGM and USEPA (1997) guidance and did not rely on the results of the Pennsylvania Natural Diversity Index (PNDI) search to draw conclusions regarding potential ecological risk. One of the main purposes of the PNDI search and follow-up agency correspondence is to aid in properly identifying the species of concern that should be included in the ecological risk assessment process. However, the Pennsylvania Game Commission did in fact respond to the PNDI search with the conclusion that "no impact is likely" for the avian species (marsh wren, least bittern, and peregrine falcon) identified in the original PNDI search. The information provided to the Pennsylvania Game Commission as part of the PNDI search was consistent with typical letters provided to the agencies that are a part of the PNDI process and was not deficient.

Comment 4

For the Eastern Redbelly turtle, Evergreen fails to provide an adequate risk assessment.

Response to Comment 4

The ecological risk assessment uses methods suggested in USEPA (1997) guidance. Quantitative population studies (particularly for upper trophic level receptors) are extremely problematic and often yield inconclusive or erroneous results.

Comment 4a

Evergreen erroneously determines habitat suitability by the presence or absence of redbelly turtles, rather than by determining risk according to the regulations and the Technical Guidance Manual.

Response to Comment 4a

A site-specific *Eastern Redbelly Turtle (Pseudemys rubriventris) Habitat Evaluation* (ERC, 2018, ERA Appendix E) was conducted by a qualified redbelly turtle (RBT) biologist/surveyor as recognized by the Pennsylvania Fish and Boat Commission and the U.S. Fish and Wildlife Service. The RBT habitat evaluation incorporated the assessment of hydrology, freshwater wetlands, soil composition, vegetation assemblages, ecotone areas, and surrounding land uses in relation to the habitat requirements of the RBT and determined that certain water bodies did not provide suitable habitat to support RBT populations. Subsequent to the habitat evaluation, a *Phase II Eastern Redbelly Turtle (Pseudemys rubriventris) Presence/Absence Survey* (ERC, 2019, ERA Appendix F) was conducted to determine if RBT were present in the onsite water bodies. As presented in the RBT presence/absence survey, there are few natural basking areas within Waterbody G; therefore, four (4) basking boards were deployed to provide basking substrate for turtles. In addition to the basking survey, The RBT biologist/surveyor also visually scanned and transected the shoreline of Waterbody G in an attempt to locate any old turtle nests or turtle shells. Searches for exposed soil, scrapes, and egg shells were made. While traversing the waterbody's edge, searches were also made for shells of deceased turtles. Based on the results of these observations, Waterbody G was determined to provide sub-optimal habitat and due to the sub-optimal habitat, it was determined that RBT were not inhabiting Waterbody G.

The RBT surveys were not specifically used to determine risks; however, if a receptor is not present in a given habitat (i.e., turtles are not present in a particular waterbody) then potential exposure pathways for that receptor are considered incomplete in relation to that waterbody and, by definition, there are no risks.

Comparisons of terrestrial soil concentrations of lead to screening levels for plants, birds, or mammals are not appropriate for the assessment of exposures to aquatic reptiles (e.g., RBT) as detailed in the response to Comment 4c.

Comment 4b

The Department should reject as vague and conclusory Evergreen's assertions that several potential exposure routes of contaminants to the redbelly turtles pose little or no risk.

Response to Comment 4b

Bulk sediment concentrations of COPECs provide little information regarding potential hazards to RBT as the USEPA Region 3 BTAG screening values and Ontario Ministry of the Environment Lowest Effect Level (LEL) and Severe Effect Level (SEL) levels are based on potential adverse effects to benthic invertebrate communities and not based on potential effects to upper trophic level receptors such as RBT.

The references provided by CAC are either misleading or do not support their assertions. For example, regarding CAC's assertion that Evergreen discounted potential exposure routes and toxicity to turtles, Meador (2008) states "Very few studies have been conducted on the responses of reptiles to PAH exposure," and "These studies generally describe the direct effects of oil on these species." Since oil is a complex mixture of constituents, it is not appropriate to attribute adverse effects observed in an exposed species to any single constituent. The causative agent of the observed effects is impossible to discern with any level of certainty. "Only after significant progress is made in understanding how individual PAHs act on myriad biological systems can we begin to tackle the problem of complex mixtures containing PAHs and other toxicants." (Meador, 2008). Although biotransformation rates in reptiles may be somewhat lower than those measured in mammals (which have been shown to be rapid), reptiles do metabolize and eliminate PAH metabolites. Furthermore, bioaccumulation in certain tissues does not directly equate to toxicity.

The results of the study conducted on snapping turtles including those at the John Heinz National Wildlife Refuge (JHNWR) by Van Meter, et al. (2006) were inconclusive, with no direct evidence that exposure to PAHs resulted in adverse effects in snapping turtles:

- "Embryos from John Heinz National Wildlife Refuge exposed to crude oil did not show a linear association between severity of deformities and level of crude oil exposure. There was no clear trend among these embryos as even control embryos had a lethal deformity rate of 50%. This was the highest rate of lethal deformities of all treatment groups."
- "Exposure to BaP did not have a significant effect on survival rates among JHNWR, Algonquin Provincial Park, or Michigan embryos."
- "Chemical treatment did not have a significant effect on righting response time. Righting response times of control hatchlings were variable and often hatchlings treated with crude oil or BaP were able to right themselves faster than control turtles."

These studies elucidate the fact that the potential effects on turtles exposed to contaminants in surface water and sediment are not well understood at this time and that linkage of constituent concentrations in abiotic media (e.g., soil, surface water, sediment) to adverse effects is inconclusive and potentially misleading.

Comment 4c

Evergreen ignores potential exposure to redbelly turtle eggs from surface soil contamination, which can affect their viability.

Response to Comment 4c

Current practice in ecological risk assessment of upper trophic level feeding guilds is to estimate total exposures of receptors via the ingestion pathway. Other pathways (e.g., inhalation, dermal absorption) are considered insignificant compared to ingestion and are not quantitatively assessed. The potential effects of lead in soil on turtle eggs has not been studied thoroughly. The study conducted by Burger (1998) exposed turtle hatchlings via injection, which is not analogous to eggs that may or may not absorb lead from soil through the shell. Dosing hatchling turtles via injection cannot be correlated to absorption through the egg shell and potentially incorporated into a turtle embryo. These exposures are entirely different. Furthermore, "Hatchlings from 1995 showed no significant differences in growth, survival, or behavior between control and lead-injected animals at a dose of 0.05 and 0.1 mg/g." (Burger, 1998).

Ozdilek and Ozdilek (2007) studied sea turtles from a beach in an area that receives "untreated domestic wastewater" and "all types of untreated domestic and industrial wastewaters" and attempted to correlate observed adverse effects to concentrations of metals found in the egg shells (not the embryos). Contaminants other than metals, that were likely present in the domestic and industrial wastewaters, were not considered when trying to correlate observed effects to constituent concentrations in egg shells. Furthermore, it is not possible to assign adverse effect causation to any specific constituent detected in egg shells when numerous metals were detected in the tested egg shells and none of the other chemicals found in domestic and industrial wastewater were analyzed.

It is not clear why CAC references a Region 3 BTAG marine sediment screening benchmark when the waterbodies at the Site are freshwater. The USEPA Region 3 BTAG marine sediment screening level for lead is based on potential adverse effects to marine benthic invertebrate communities and is not applicable to potential effects in turtles. Similarly, the USEPA Eco-Soil Screening Levels for lead in soil for avian and mammalian wildlife are not applicable to turtles and are not relevant for the assessment of turtles or other reptiles.

Since the potential effects of constituents in soil to turtle eggs is not well understood, a meaningful quantitative evaluation of the potential effects of site-related contamination on redbelly turtle eggs is not possible.

Comment 4d

The presence/absence survey for the redbelly turtles does not comply with the Technical Guidance Manual, and it does not support the claim that they are not adversely impacted by exposure to contaminants on the site.

Response to Comment 4d

The Eastern Redbelly Turtle (*Pseudemys rubriventris*) Habitat Evaluation (ERC, 2018, ERA Appendix E) and the Phase II Eastern Redbelly Turtle (*Pseudemys rubriventris*) Presence/Absence Survey (ERC, 2019, ERA Appendix F) support the USEPA (1997) concept that if receptors are not present in a certain area/habitat, then exposures are incomplete and therefore, potential risks are not possible.

USEPA ecological risk assessment guidance (1997) states "For an exposure pathway to be complete, a contaminant must be able to travel from the source to ecological receptors and to be taken up by the receptors via one or more exposure routes." USEPA ecological risk assessment guidance (1997) further states "If an exposure pathway is not complete for a specific contaminant (i.e., ecological receptors cannot be exposed to the contaminant), that exposure pathway does not need to be evaluated further." Consistent with this USEPA ecological risk assessment guidance, since several water bodies onsite do not provide suitable RBT habitat and site-specific surveys of these waterbodies determined that RBT were not present, , it was concluded that risks to RBT at these locations were negligible.

A quantitative comparison of RBT populations at the site to a reference area would not yield any relevant information. As referenced by CAC, J.E. Stone (2010) studied turtle distribution with respect to human "impact". Human impact was qualitatively classified with respect to potential human intervention with no consideration given to potential chemical "contamination". Stone (2010) concluded that human activity alone had an adverse effect on turtle populations. If this conclusion is accurate, then it would not be possible to distinguish between effects caused by human activity and effects caused by chemical contaminants, or both. This master's thesis does not provide any information regarding the potential impacts to turtles from chemical contamination and is not relevant to this ecological risk assessment.

Comment 5a

Evergreen fails to provide data regarding avian species onsite, and erroneously relies on generalities that do not properly account for the site.

Response to Comment 5a

The facility is currently undergoing significant alteration due to the demolition of the former refinery operations at the site and redevelopment. As such, ecological habitat at the site is anticipated to undergo significant changes. At the current stage of redevelopment, it would be impossible to distinguish between changes in avian populations at the site due to human intervention (I.e., site redevelopment) and potential chemical contamination.

Contrary to the assertion made by CAC regarding the rapid metabolism of PAHs by birds, the study by Custer, et al. (2001) conducted on a refinery site in Casper, Wyoming determined "the main route of exposure of PAHs to tree swallow and house wren chicks was probably through the diet. All five of the PAHs found in swallow and wren carcasses at the refinery site were present at high concentrations in the dietary samples. Additionally, the total PAHs in dietary samples at the refinery site were 28 and 38 times higher than found in swallow and wren carcasses. The high ratio of diet to carcass PAHs was expected because of the rapid rate of metabolism of these compounds by birds."

Further validation that birds rapidly metabolize PAHs is provided by Dhananjayan and Muralidharan (2013) who reported that "Levels of contaminants measured in the tissues of vultures are comparable with the levels documented in a number of avian species and are lower than those reported to have caused deleterious effects". Dhananjayan and Muralidharan (2013) also state that "PAHs are rapidly metabolized in birds", which corroborates similar statements presented in the ERA. Dhananjayan and Muralidharan (2013) did not determine any correlation between residual levels of PAHs in tissues of white-backed vultures and corresponding environmental media concentrations or potential adverse effects. This study simply presents data that suggests PAHs were detected in vulture tissues and no conclusions were drawn about their origin or effects.

Evergreen has the following comments regarding the additional studies referenced by CAC in Comment 5a:

- The study by Gonzalez-Gomez, et al. (2020) illustrates how birds exposed to PAHs metabolize and sequester PAHs in external tissues (e.g., feathers) thereby mitigating exposure and potential hazards. This study substantiates statements in the ERA that “PAHs are readily metabolized and excreted” by birds.
- According to Perez, et al. (2007), vertebrates are not good models to assess oil contamination because of their great ability to metabolize PAHs. In common with all vertebrates, birds have well-developed mixed function oxygenase (MFO) systems that can rapidly metabolize parent PAHs into hydrophilic products that are more easily excreted. In a study conducted with yellow-legged gulls in an area of a marine oil spill, total PAH concentrations in the blood of gulls decreased 3-fold in just one year, down to the values from unoiled colonies (Perez, et al., 2007). These results suggest that “PAHs are readily metabolized and excreted” by birds.
- The study by Provencher, et al. (2020) did not directly address PAH metabolism and elimination by birds.
- Waszak, et al. (2020) report that “Birds, like other vertebrates, generally display high oxidative P-450 enzyme activity and can quickly metabolize and easily excrete most of consumed PAHs”. Waszak, et al. (2020) further state “All birds are equipped with a well-developed mixed-function oxidase (MFO) system that facilitates biotransformation and detoxification of exogenous chemicals, including PAHs”.
- As presented in Eisler, 1987, “PAH levels in fish are usually low because this group rapidly metabolizes PAHs; furthermore, higher molecular weight PAHs, do not seem to accumulate in fish.”
- The study by Olayinka, et al. (2019) was not designed to assess the accumulation or metabolism of PAHs in fish, the favored prey item of least bittern, and as such this study does not provide information that is useful in the ERA.
- The study by Dhananjayan and Muralidharan (2013) was not designed to assess the accumulation or metabolism of PAHs in fish. However, the authors did state that “The absence or rather low detection of certain PAHs in the fish samples may be attributed to their rapid depuration or biotransformation. The accumulation and depuration of PAHs in fish can be influenced by various factors including route and duration of exposure, lipid content of tissues, environmental factors, differences in species, age, and sex, and exposure to other xenobiotics.”

Comment 5b

The report discounts and fails to properly account for potential exposure routes, in particular to lead, that can affect the risk assessment of the marsh wren (*Cistothorus palustris*).

Response to Comment 5b

Terrestrial soil does not represent a significant exposure medium for marsh wrens. Ingestion of insects with an aquatic life stage is the most significant exposure pathway for marsh wrens, and current methodologies for estimating exposures in ecological risk assessment only account for ingestion pathways. Ecological risk assessment methods do not exist for estimating exposures via non-ingestion pathways (e.g., inhalation, dermal absorption).

The New Jersey Audubon Society (2009) report suggests several possible pathways of exposure to contaminants in the New Jersey Meadowlands for birds, but the report does not provide any data regarding dietary or other sources of contaminants in birds.

The marsh wren is not an avian ground insectivore. Avian ground insectivores (e.g. Northern flicker) feed preferentially on invertebrates that live in terrestrial soil (e.g., earthworms). Marsh wrens consume mostly insects but also aquatic invertebrates and spiders, which they glean from the water surface, on stems and leaves of emergent vegetation, and the marsh floor (Kale, 1965; Welter, 1935). They sometimes also feed by flycatching (Welter, 1935). Organisms that are aquatic for all or part of their lives are an important component of the diet of marsh wren adults and nestlings. As presented in the ERA, terrestrial soil is not a significant exposure medium for marsh wrens. Since marsh wrens and avian ground insectivores have different feeding strategies, a screening level of 11 milligrams per kilogram lead in soil is not directly applicable to marsh wrens.

Comment 5c

The report improperly discounts and fails to properly account for potential exposure routes, in particular to lead, that can affect the risk assessment of the Least bittern (*Ixobrychus exilis*).

Response to Comment 5c

The potential exposure routes described in the ERA are the most significant exposure routes for least bittern. Nests are usually built in areas of tall cattails, reeds, or rushes and they feed mainly on small fish such as minnows, sunfishes, and perches. Based on their preference for building nests in aquatic vegetation and their preferred prey being aquatic (i.e., fish), exposure to terrestrial soil is minimal. Other exposure routes are possible but would only contribute a minor portion of the overall exposures potentially experienced by least bittern. Food ingestion is the most significant exposure pathway in ecological risk assessment and least bitterns' dietary preference is small fish. As such, the most significant exposure pathway for least bitterns is through ingestion of fish.

RESPONSES TO DRN COMMENTS

Note: Responses to the DRN comments were prepared by Harold M. Brundage III of Environmental Research and Consulting, Inc. (ERC). Mr. Brundage authored the "Ecological Risk Assessment for Hickory Shad, Shortnose Sturgeon, and Atlantic Sturgeon in the Schuylkill River Adjacent to the PES Philadelphia Refining Complex, Areas of Interest 1 through 9", dated May 1, 2020 (ERC, 2020) (Assessment), which was provided as Appendix G of the overall ecological risk assessment for the facility prepared by Stantec (2022).

DRN Comment 1

DRN is concerned that the Ecological Risk Assessment fails to account for the full panoply of risks posed to the endangered Atlantic sturgeon and shortnose sturgeon. In particular, the genetically unique population of Atlantic sturgeon in the Delaware River is at a precariously low level, with the most recent estimate of the breeding population size being merely 125–250 adults.[1] Given the dire status of this species, Evergreen must rigorously investigate any potential risk caused by contamination from the Site, and the Pennsylvania

Department of Environmental Protection ("PADEP") and United States Environmental Protection Agency ("USEPA") must ensure that cleanup at the site is protective of endangered species.

The Assessment relies primarily on the assumption that because sturgeon seldom travel up the Schuylkill River, they will not be exposed to contaminants from the Site. However, the Site is immediately upstream from the Schuylkill's confluence with the tidal Delaware River, which is federally-designated critical habitat for the Atlantic sturgeon. As explained in USEPA's Ecological Risk Assessment Guidance for Superfund document, additional sampling further downstream from a site may be necessary in circumstances where contaminants of concern extend beyond initial sampling areas.[2]

Response to DRN Comment 1

We are aware of the recent estimates of the size of the breeding population (N_s) of Atlantic sturgeon in the Delaware River. N_s is the number of adults that produce at least one offspring during a single breeding season, which sets a lower bound on the size of the spawning run and should not be conflated with the number of fish on the spawning grounds or the census population size. Please note that Mr. Brundage, who prepared the subject risk Assessment (ERC, 2020, ERA Appendix G), as well as these responses, was a co-author of the Ecological Applications paper[1] cited by DRN.

While it is correct that the use of the Schuylkill River by sturgeons appears to be limited, it is inaccurate to say that the Assessment relied primarily on this minimal occurrence when assessing risk. Although the occurrence and abundance of the species of concern was considered, as this relates to exposure probability (i.e., no occurrence = no exposure), the Assessment was based primarily on comparison of best available data on sediment and water quality in the Schuylkill River adjacent to the site (see ERC, 2020, ERA Appendix G Section 4.3.2) to various ecological screening benchmarks and effect concentrations for the COCs obtained from the literature (see ERC, 2020, ERA Appendix G Section 4.4).

DRN Comment 2

The Assessment does not address the degree to which contaminated sediment from the Schuylkill River deposits in the Delaware River.[3] The Assessment also does not address the movement of benthic invertebrates (either by their own volition or by current) from the areas of contaminated sediment in the Schuylkill River to the Delaware River. Additionally, the Assessment fails to differentiate between early-life-stage and adult Atlantic and shortnose sturgeon in evaluating sensitivity to contaminants, particularly via consumption of sediment and benthic invertebrates.[4]

In order to best inform remedial action at the site, the responsible parties and all government entities with oversight responsibilities must consider the effect of contaminants on all life stages of endangered sturgeon species in the Delaware River. To do so, the Assessment must be revised to evaluate the pathways of exposure in the Delaware River.

Response to DRN Comment 2

The Partnership for the Delaware Estuary report[3] cited by DRN discusses the amount of sediment transported from the *non-tidal* portions of the Delaware River and various tributaries to the *tidal* Delaware River. This should not be confused with sediment transport from the *tidal* Schuylkill River, where flow dynamics are very different from those in the non-tidal river. Nonetheless, inclusion of exposure pathways in the Delaware River in the Assessment would not be helpful because it is virtually impossible to link contamination in the Delaware River directly with the subject site. Contamination in the Delaware River cannot be attributed to any particular source, as previously mentioned, given the long pollution history of this part of the river, and the mixing and weathering of contaminants from numerous sources (both historical and more recent), exacerbated by the tidal nature of the river, which results in contaminants being transported upriver as well as down. It should be noted that the Pollutant Dispersal model developed by Baird (Sitewide Fate and Transport RIR, Appendix L) for the site, although considering aqueous phase contaminants, not sediment, indicated that the transport of dissolved contaminants from the site to the Delaware River was not significant.

Although the movement of benthic organisms was not specifically addressed, the main text of the ERA considered the ingestion of benthic invertebrates, as well as ingestion of water and sediment, and concluded that ingestion did not pose significant risk to the species of concern (Sections 6.4. 6.5, and 6.6).

DRN criticizes the Assessment for failing to “differentiate between early-life-stage and adult Atlantic and shortnose sturgeon in evaluating sensitivity to contaminants”. That is because there is no ecotoxicological information for the site COCs specific to any life stage of shortnose or Atlantic sturgeon (see Section 4.4 of ERC, 2020 in ERA Appendix G). A literature review was conducted as part of the Assessment to identify ecotoxicological data for the COCs with the following hierarchy of relevancy: 1) effects on shortnose and Atlantic sturgeon (no literature found), 2) effects on other sturgeon species (one publication found on effects of lead in sediment on white sturgeon fry), and 3) effects on non-sturgeon fish species (several publications found for lead and PAHs, including effects of dissolved PAHs on fish embryos). Comparison of COC concentrations adjacent to the site to the ecotoxicological concentrations from the literature indicated that adverse effects were unlikely (see Section 4.4 of ERC, 2020, in ERA Appendix G for details of this assessment).

Moreover, it was not necessary to explicitly consider sturgeon early life stages in the Assessment because these life stages do not occur at or near the site nor in the proximal reach of the Delaware River. Shortnose sturgeon spawn in the non-tidal Delaware River some 65-89 kilometers (km) upriver, and eggs and larvae do not occur anywhere near the site. Atlantic sturgeon spawn at least 19 km downriver of the Schuylkill River confluence, eggs and early (yolk-sac) larvae remain at or near the spawning site, and older (post yolk-sac) larvae are unlikely to move upriver towards the site (see Section 3.4.2 of ERC, 2020 in ERA Appendix G).

[1] White, Shannon L., Nicholas M. Sard, Harold M. Brundage III, Robin L. Johnson, Barbara A. Lubinski, Michael S. Eackles, Ian A. Park, Dewayne A. Fox, and David C. Kazyak. 2022. “Evaluating Sources of Bias in Pedigree-Based Estimates of Breeding Population Size.” Ecological Applications e2602. https://doi.org/10.1002/eap.2602

[2] U.S. Envtl. Prot. Agency, Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Risk Assessments – Interim Final at 6-2 (1997), available at http://semspub.epa.gov/src/document/HQ/157941

[3] Gebret, J.A., R. Searfoss. “Chapter 4—Sediments” in the Technical Report for the Delaware Estuary & Basin. Partnership for the Delaware Estuary. PDE Report No. 12-01. June 2012. pp. 108 (estimating the mean annual sediment discharge from the non-tidal Delaware, the Schuylkill, and the Brandywin, to be 1.28 million metric tons).

[4] R. Christopher Chambrs, Dawn D. Davis, Ehrn A. Habeck, Nirmal K. Roy, & Isaac Wirgin, “Toxic Effects of PCB126 and TCDD on Shortnose Sturgeon and Atlantic Sturgeon.” 31 Envtl. Toxicololgy & Chemistry 2324–37 (2012) (evaluating effects of chemical contaminants on early-life-stage sturgeon).

Reference: Response to Public Comments Sitewide Remedial Investigation Report Addendum, Former Philadelphia Refinery

Regards,

Stantec Constulting Services Inc

Richard Prann	**Jenny Kachel P.G.**
Associate Environmental Scientist	Geologist

Enclosure: Attachment A – Public Comments
c. Tiffani Doerr (Evergreen)
Scott Cullinan (Evergreen)
Kevin Bilash (USEPA)
India McGhee (City of Philadelphia)
Jennifer Menges (Stantec)

ATTACHMENT A

Public Comments

CLEAN AIR COUNCIL

Pennsylvania Department of Environmental Protection

Evergreen Resources Management Operations
a series of Evergreen Resources Group, LLC
On behalf of Sunoco, Inc. (R&M), now known as Sunoco (R&M), LLC

Former Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, Pennsylvania
Sitewide PADEP Facility ID No. 780190

Ecological Risk Assessment: Areas of Interest 1 through 9
Report Date: June 30, 2022

Prepared by:
Stantec Consulting Services Inc.

Written Comments by Clean Air Council

July 30, 2022

Via email: phillyrefinerycleanup@ghd.com

Clean Air Council ("the Council") appreciates the opportunity to provide comments on Evergreen Resources Management Operations' ("Evergreen's") Ecological Risk Assessment for Areas of Interest 1 through 9 at the former Philadelphia refinery. The reports were prepared by Evergreen on behalf of Sunoco, Inc. (R&M), now known as Sunoco (R&M), LLC ("Sunoco"). Sunoco is the party legally responsible for contamination prior to its sale of the property in 2012.

The Council is a non-profit environmental organization headquartered at 135 South 19th Street, Suite 300, Philadelphia, Pennsylvania, 19103. For 50 years, the Council has worked to improve air quality across Pennsylvania. The Council has members throughout the Commonwealth who support its mission of protecting and defending everyone's right to a healthy environment.

Evergreen submitted the report to the Pennsylvania Department of Environmental Protection ("the Department") under Act 2 of 1995. *See* Evergreen, Act 2 Documents. The report was submitted pursuant to the Consent Order and Agreement (2003) and the Consent Order and Agreement (2012). The report is being submitted pursuant to a revised Consent Order. *See* First Amendment to Consent Order and Agreement (June 26, 2020), page 5 of 77 (setting deadline of report by June 30, 2022).

Evergreen states that it will address comments submitted by July 30, 2022:

> June 22, 2022
> Page 2 of 2
>
> https://phillyrefinerycleanup.info/comment-submission-form, via email at phillyrefinerycleanup@ghd.com, or via US Postal Service to PO Box 7275, Wilmington, DE 19803. Evergreen will address all comments and questions related the Fate and Transport RIR and the ERA submitted between June 30, 2022 and July 30, 2022 in correspondence to PADEP/EPA that will be incorporated into the agencies' review as they will not consider the reports final until any comments/questions have been addressed.

See Letter dated June 22, 2022, page 2, Ecological Risk Assessment_Public Notices_June2022.

All documents cited in these comments are hyperlinked. The yellow or orange highlighting in the quoted and snipped passages was added to direct attention to relevant text. The comments refer repeatedly to the Department's Technical Guidance Manual**.**

<u>**Index to Comments**</u>

1. The Department should disapprove the report because it does not follow the requirements of 25 Pa. Code 250.311 or the Department's Technical Guidance Manual, which Evergreen attempts to avoid by erroneously asserting that relevant data are not available.

    a. The regulations and Technical Guidance Manual require an assessment of direct impacts to ecological receptors through several steps, which Evergreen does not follow.

    b. In place of the steps contemplated by the Technical Guidance Manual, Evergreen uses conclusory, qualitative, and vague arguments, extending to its analysis of the Schuylkill river water and sediment and Mingo Creek.

    c. Evergreen erroneously asserts that proper analysis cannot be carried out because of lack of site and habitat characterization data.

    d. Evergreen erroneously concludes that there is no expected risk to species of concern based on water modeling for the Schuylkill River and Mingo Creek, and on sediment testing and analysis for the Schuylkill River.

    e. Evergreen erroneously claims that following the required risk assessment is not possible due to lack of data regarding Toxicity Reference Value (TRV) for the species of concern.

2. Evergreen does not consider the additive effect of contaminants on species of concern, and does not provide a quantitative assessment of the cumulative impacts of contaminants.

3. Evergreen cannot cure the deficiencies in its assessment of impacts to avian species by referring to a letter from the Pennsylvania Game Commission (PGC), because that letter is only as reliable as the deficient information that was provided to it.

4. For the Eastern Redbelly turtle, Evergreen fails to provide an adequate risk assessment.

    a. Evergreen erroneously determines habitat suitability by the presence or absence of redbelly turtles, rather than by determining risk according to the regulations and the Technical Guidance Manual.

    b. The Department should reject as vague and conclusory Evergreen's assertions that several potential exposure routes of contaminants to the redbelly turtles pose little or no risk.

    c. Evergreen ignores potential exposure to redbelly turtle eggs from surface soil contamination, which can affect their viability.

d. The presence/absence survey for the redbelly turtles does not comply with the Technical Guidance Manual, and it does not support the claim that they are not adversely impacted by exposure to contaminants on the site.

5. For avian species, Evergreen fails to provide an adequate risk assessment.

    a. Evergreen fails to provide data regarding avian species onsite, and erroneously relies on generalities that do not properly account for the site.

    b. The report discounts and fails to properly account for potential exposure routes, in particular to lead, that can affect the risk assessment of the marsh wren (*Cistothorus palustris*).

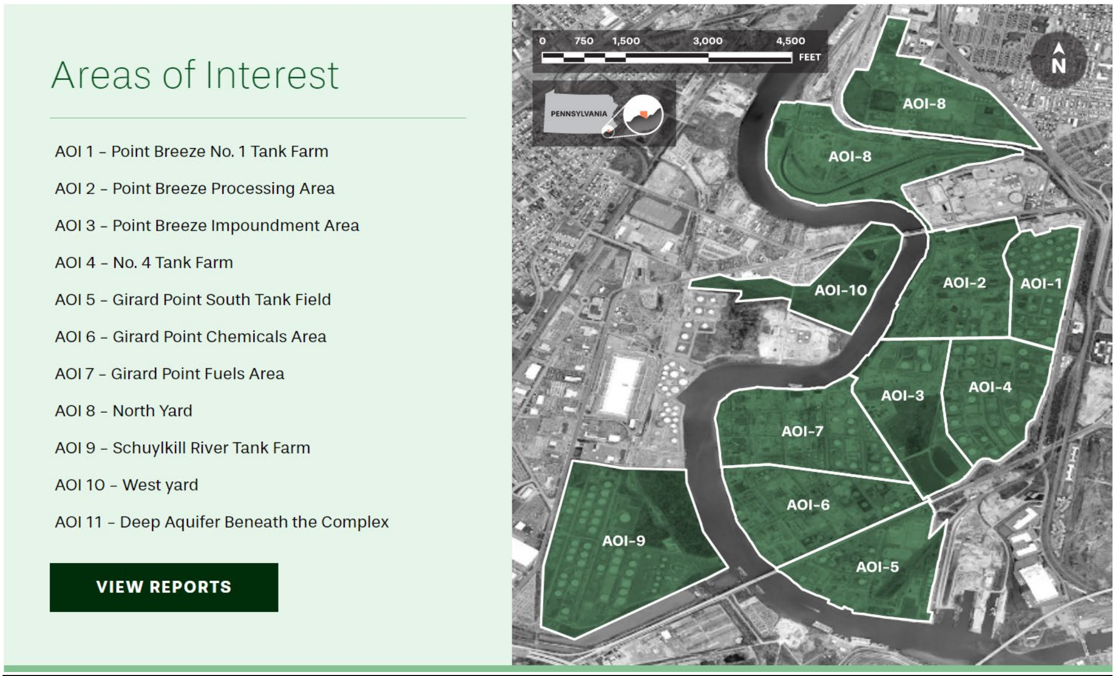
    c. The report improperly discounts and fails to properly account for potential exposure routes, in particular to lead, that can affect the risk assessment of the Least bittern (*Ixobrychus exilis*).

Table of Relevant Reports

Area of Interest	Title	Date
AOI 3 Point Breeze Impoundment Area	2017 Report (part 1) 2017 Report (part 2)	March 20, 2017
AOI-9 Schuylkill River Tank Farm	2015 Report (part 1) 2015 Report (part 2) 2017 Report Addendum (part 1) 2017 Report Addendum (part 2) 2021 Second Remedial Investigation Report Addendum Response to Public Comments, Second Remedial Investigation Report Addendum, Area of Interest 9	December 31, 2015 February 8, 2017 September 30, 2021 November 29, 2021
PFAS	January 2022 Shallow Aquifer PFAS Sampling Results	April 7, 2022
Sitewide	Sitewide Remedial Investigation Report Addendum	May 20, 2022
Sitewide	2022 Fate and Transport Remedial Investigation Report Part 1 (groundwater flow model) Part 2, Section I (Contaminant Fate and Transport Assessment) Part 2, Section II (Contaminant Fate and Transport Assessment) Part 2, Section III (Contaminant Fate and Transport Assessment)	June 30, 2022
		June 30, 2022

AOI-1 through AOI-9	Ecological Risk Assessment (AOI-1 through AOI-9)	

Areas of Interest



Source: Evergreen, [Home - PRLR]

Summary of Comments

The Council is providing comments on the Ecological Risk Assessment for Areas of Interest 1 through 9. For all the following reasons, the Department should disapprove the report and require that it be revised to comply with the requirements of the chapter 250 regulations and the expectations of the Technical Guidance Manual.

The regulations and Technical Guidance Manual require an assessment of direct impacts to ecological receptors through several steps, which Evergreen does not follow. Evergreen attempts to avoid these steps by erroneously asserting that relevant data are not available. In place of these steps, Evergreen uses conclusory, qualitative, and vague arguments.

An attempt at Fate and Transport analysis for the Schuylkill river water and sediment and Mingo Creek is flawed and does not demonstrate a lack of potential impact on marine species of concern. Evergreen erroneously asserts that proper analysis cannot be carried out because of lack of site and habitat characterization data. In fact, such data could have been collected during Evergreen's ongoing sampling activities onsite, or retrieved from historical Act 2 reports. Evergreen erroneously claims that following the required risk assessment is not possible due to lack of data regarding Toxicity Reference Value (TRV) for the species of concern. In fact, such data is available, or could be obtained using EPA approved methods of extrapolation between species.

Benzene, toluene, ethylbenzene and xylenes (BTEX) are contaminants of ecological concern known to have an additive adverse effect. But Evergreen does not consider the additive effect of BTEX on species of concern.

Evergreen's receipt of a letter from the Pennsylvania Game Commission does not cure the deficiencies in its assessment of impacts to avian species, since the Game Commission was not provided with relevant information.

For the Eastern Redbelly turtle, Evergreen fails to provide an adequate risk assessment. It erroneously determines habitat suitability by the presence or absence of redbelly turtles, rather than by following the regulations and the Technical Guidance Manual. It ignores potential exposure to redbelly turtle eggs from surface soil contamination, which can affect their viability. The presence/absence survey does not comply with the Technical Guidance Manual, and it does not provide meaningful information regarding the exposure of the turtle population to contaminants on the site.

For the avian species, Evergreen fails to provide an adequate risk assessment. It fails to survey or otherwise assess the population of avian species onsite, and erroneously relies on generalities. The report discounts potential exposure routes (including that for lead) that can affect the risk assessment for the marsh wren (*Cistothorus palustris*). The report discounts potential exposure routes (including that for lead) that can affect the risk assessment for the Least bittern (*Ixobrychus exilis*).

Comments

1. **<u>The Department should disapprove the report because it does not follow the requirements of 25 Pa. Code 250.311 or the Department's Technical Guidance Manual, which Evergreen attempts to avoid by erroneously asserting that relevant data are not available</u>.**

According to Evergreen, the purpose of the report is to evaluate the "likelihood that adverse impacts to ecological receptors are occurring, or may occur":

> **9.0 SUMMARY AND CONCLUSIONS**
>
> Based on Evergreen's goals under Act 2, Stantec has completed an ERA for the facility. The ERA evaluated the likelihood that adverse impacts to ecological receptors are occurring, or may occur, at the facility located at 3144 Passyunk Avenue, Philadelphia, Pennsylvania.

See Ecological Risk Assessment, page 9.53 (emphasis added). But Evergreen has not undertaken an assessment of current or potential adverse impacts. Nor has Evergreen followed the chapter 250 regulations or the Department's Technical Guidance Manual. Erroneously asserting that there is a lack of data for conducting a proper assessment, Evergreen developed its own approach, which is deficient. The Department should disapprove the report.

A. The regulations and Technical Guidance Manual require an assessment of direct impacts to ecological receptors through several steps, which Evergreen does not follow.

The chapter 250 regulations clearly require an assessment of "direct impacts" to ecological receptors, for the protection of the environment:

> **§ 250.311. Evaluation of ecological receptors.**
>
> (a) In addition to any protection afforded under other requirements for meeting surface water and air quality standards and MSCs under this chapter, based on the screening process in this section, direct impacts from regulated substances to the following receptors shall be assessed and addressed to implement a remedy that is protective of the environment:
>
> (1) Individuals of threatened or endangered species as designated by the United States Fish and Wildlife Service under the Endangered Species Act (16 U.S.C.A. §§ 1531—1544).
>
> (2) Exceptional value wetlands as defined in § 105.17 (relating to wetlands).
>
> (3) Habitats of concern.
>
> (4) Species of concern.

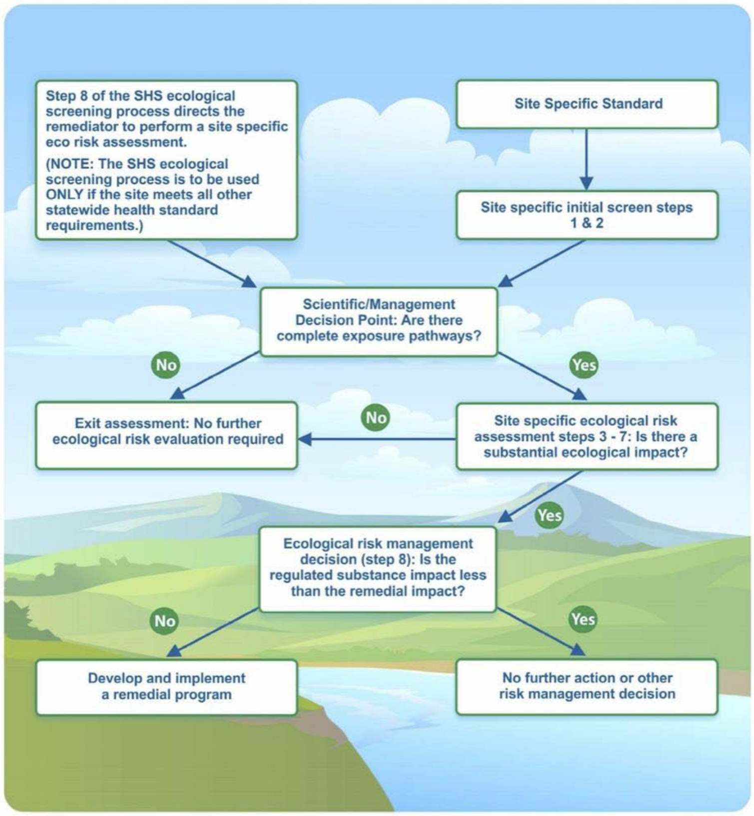
See 25 Pa. Code 250.311(a) (emphasis added).

In its Technical Guidance Manual, the Department specifies how the assessment should be conducted. It recommends an approach that modifies that of the Environmental Protection Agency under the Superfund program:

> The Department recommends the use of EPA's interim final guidance on Ecological Risk Assessment Guidance for Superfund (EPA, 1997), with some modification, as the process for designing and conducting site-specific ecological risk assessments. To accommodate the provisions of Act 2, points of emphasis and specific modifications of the EPA process are detailed in this document. In addition, other EPA guidance on ecological risk assessment and specific ASTM standards for ecological risk procedures and methods should be utilized as appropriate to achieve the objectives noted above. This approach contains the same fundamental concepts and components found in the Statewide health ecological screen. However, the Statewide health ecological screen cannot be applied to sites attaining the site-specific standard because that process assumes all of the SHS MSCs have been met. If a site is directed to the site-specific ecological risk assessment process in Step 8 of the Statewide health ecological screen, Steps 3 through 8 of the site-specific ecological risk assessment process as described in Section III.I.2 of this guidance should be applied to the evaluation.

See Pennsylvania Department of Environmental Protection, Technical Guidance Manual, Section III, page III-136 (March 27, 2021) (emphasis added). The Department has outlined an eight-step approach. *See id.,* Section III, page III-136 through III-143. The Department summarizes this eight-step approach in the Figure below:

Figure III-11: Site-Specific Ecological Risk Assessment Procedure



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See id., page III-143, Figure III-11 (Site-Specific Ecological Risk Assessment Procedure). The methodology includes several <u>quantitative</u> steps for evaluating the risk posed to species of concern and habitats from contaminants.

This comment provides examples of steps in this process that Evergreen has ignored, making its report fatally flawed.

1. Step 1 – Fundamental Components (Site Visits)

Under Step 1, the Technical Guidance Manual states that site visits should be evaluated carefully:

> **a) Step 1 - Fundamental Components**
>
> The following items should be evaluated carefully in the context of site-specific conditions:

....

> • Site Visits - evaluate receptors and chemical migration pathways.

See id., Section III, page III-137 (emphasis added). The Ecological Risk Assessment includes a botanical survey (Appendix D), surveys regarding the population and habitat of the redbelly turtles (Appendix E and F) and the fish species (Appendix G). But there are no site visits or surveys regarding the avian species of concern.

Also, the Ecological Risk Assessment does not present any information regarding chemical migration pathways.

2. Step 2 - Preliminary Exposure Estimate and Risk Assessment

Under Step 2, Evergreen should perform a preliminary exposure estimate and risk assessment, based on either a community-based analysis or a hazard quotient method:

> **b) Step 2 - Preliminary Exposure Estimate and Risk Assessment**
>
> If complete exposure pathways are identified, the regulated party has the option to evaluate the exposure and risk to selected assessment endpoints (Step 1) by either:
>
> • Community-based analysis such as Rapid Bioassessment Protocols for fish or aquatic macroinvertebrates (EPA, 1989) or
>
> • Hazard Quotient Method (EPA, 1997) with emphasis on representative exposure conditions and toxicity data that most directly relate to the assessment endpoints selected in Step 1. Refer to the EPA website for the Region 3 BTAG (Biological Technical Assistance Group) screening tables and the SSL (Soil Screening Levels) tables, as well as the NOAA website for the SQuiRT (Screening Quick Reference Tables) ecological screening values.

See id. (emphasis added). But Evergreen undertook neither option. It simply ignored the guidance document.

3. Step 4 - Problem Formulation

Under Step 4, Evergreen should develop a study design, and it has the option of utilizing bioaccumulation factors or measuring bioaccumulation directly:

d) **Step 4 - Problem Formulation: Conceptual Site Model, Measurement Endpoint Selection, and Study Design**

The focus in this step should be on the prioritized exposure pathways identified in Step 3, emphasizing development of a study design which will determine if there is a causal relationship between a regulated substance and any substantial ecological impact that may be detected at a site.

Regarding bioaccumulation and tissue studies, the regulated party has the option of:

- Utilizing bioaccumulation factors reported in the literature which are most relevant to habitats or species of concern at the site; or
- Measuring bioaccumulation directly through tissues analysis and environmental media analysis.

Note that bioconcentration or bioaccumulation in and of itself is not evidence of environmental injury or a substantial ecological impact. Tissue levels should be related to a toxicity effect in a species of concern in order to be considered relevant in the evaluation.

Since the habitats and species of concern are readily identified and evaluated through field studies, the investigator should emphasize population/community evaluations over less direct measures of potential impact such as laboratory toxicity testing, literature references, or media chemistry, recognizing that a combination of these evaluations is usually conducted. In addition, laboratory toxicity testing should only be conducted with species that may potentially inhabit or survive at the subject site.

The conclusion of this step should describe the measurement endpoints (EPA, 1992; Suter, 1993; EPA, 1997) for the prioritized exposure pathways and provide a clear outline of the study design.

See id., Section III, page III-139 (emphasis added). Again, Evergreen undertook neither option. It simply ignored the guidance document.

4. Step 5 - Site Assessment for Sampling Feasibility

Under Step 5, Evergreen should conduct a site assessment for sampling feasibility:

e) **Step 5 - Site Assessment for Sampling Feasibility**

Ensure that the measurement endpoints are present in sufficient quantity or abundance so that sampling and analysis can be collected across a gradient of contamination and include a representative reference area.[1] If necessary, the measurement endpoints should be modified to ensure the study objectives can be met (EPA, 1997).

[1] Reference area is defined as an area not contaminated by regulated substances originating on the site and used for comparison to the site (EPA, 1997). In addition, a reference area should be near the site and have similar geochemical, physical, and biological conditions, but be uncontaminated with regulated substances from the subject site (i.e., unimpacted by the site).

See id. (emphasis added). Without such a comparison across contamination gradients, it is not possible to accurately assess the viability and health of ecological receptors, and determine whether the presence of contaminants at a given concentration adversely affects species of concern.

B. In place of the steps contemplated by the Technical Guidance Manual, Evergreen uses conclusory, qualitative, and vague arguments, extending to its analysis of the Schuylkill river water and sediment and Mingo Creek.

Instead of following the Technical Guidance Manual, Evergreen has undertaken to fashion its own approach with its own test:

> The PADEP recommends the use of the USEPA Ecological Risk Assessment Guidance for Superfund (ERAGS) (USEPA, 1997), with some modification, as the process for designing and conducting ERAs within the Act 2 framework. Within this guidance, the standard ERA practice is to identify ecological receptors of concern that could potentially be exposed to site-related constituents of potential ecological concern (COPECs), compare detected concentrations of COPECs to ecological screening values, and to compare food chain exposures to toxicity reference values (TRV) based on the protection of ecological receptors. However, certain site characterization data are limited for the habitats that are the subject of this ERA and TRVs are not available for all species of concern. Therefore, the standard ERA approach has been modified for this ERA. In lieu of the standard quantitative ERA approach, multiple lines of evidence are utilized to determine the likelihood that species of concern could be at risk of adverse ecological impacts from exposures related to legacy refining operations COPECs.

See Ecological Risk Assessment, page 1.1 (emphasis added). Here Evergreen acknowledges the USEPA guideline document upon which the Technical Guidance Manual is based, but it does not mention the Technical Guidance Manual. Moreover, Evergreen defines the goal of the report as determining "the likelihood that species of concern could be at risk of adverse ecological impacts." (Ecological Risk Assessment, page 1.1). This ignores the regulations, which require that "direct impacts from regulated substances to the following receptors shall be assessed and addressed to implement a remedy that is protective of the environment." *See* 25 Pa. Code 250.311.

The question is what is the current and future risk, given the levels of contamination on the property. Evergreen ignores this question.

To illustrate, the following are examples of general pronouncements by Evergreen that certain things are "not expected" for the marsh wren. Note that identical or similar language is used for other species of concern, in this report:

> **6.1 RISK CHARACTERIZATION FOR MARSH WREN**
>
> Risks to the marsh wren are discussed in this section with respect to each of the potential routes of exposure.
>
> **Ingestion of Onsite Pond and Mingo Creek Flood Control Basin Surface Water.** VOCs are not expected to be present in high concentrations in the surface water in the onsite ponds and Mingo Creek Flood Control Basin as they rapidly volatilize if present in surface water. Modeling results of VOC concentrations in Mingo Creek Flood Control Basin were below ecological screening values. Additionally, marsh wrens are not expected to drink a significant amount of water from the ponds or the Mingo Creek Flood Control Basin as they get the vast majority of their daily water requirement from their diet (e.g. aquatic invertebrates and insects). Therefore, substantial ecological impacts to marsh wrens from exposures to VOCs in surface water in the onsite ponds and Mingo Creek Flood Control Basin are not expected.

> The solubility of PAHs in surface water is low; therefore, PAH concentrations in surface water in the onsite ponds and Mingo Creek Flood Control Basin are expected to be low if present. Modeling results of PAH concentrations in Mingo Creek Flood Control Basin were below ecological screening values. Additionally, marsh wrens are not expected to drink a significant amount of water from the ponds or the Mingo Creek Flood Control Basin as they get the vast majority of their daily water requirement from their diet (e.g. aquatic invertebrates and insects). Therefore, exposures of marsh wrens to PAHs in surface water in the onsite ponds and Mingo Creek Flood Control Basin are expected to be minimal. Additionally, birds can rapidly metabolize PAHs and readily eliminate their metabolites. Therefore, substantial ecological impacts to marsh wrens from exposure to PAHs in surface water in onsite ponds and Mingo Creek Flood Control Basin are not expected.
>
> Lead may be present in surface water in the onsite ponds and Mingo Creek Flood Control Basin. However, modeling results of lead concentrations in Mingo Creek Flood Control Basin were below ecological screening values, and marsh wrens are not expected to drink a significant amount of water from the ponds and Mingo Creek Flood Control Basin as they get the vast majority of their daily water requirement from their diet (e.g. aquatic invertebrates and insects). Therefore, substantial ecological impacts to marsh wrens from exposures to lead in surface water in the onsite ponds and Mingo Creek Flood Control Basin are not expected.

See Ecological Risk Assessment, pages 6.35-6.36 (emphasis added).

By not following the process as set forth in 25 Pa. Code 250.311 and the Technical Guidance Manual, Evergreen's methodology is insufficient and does not address the risk to ecological receptors and species of concern. For example, contamination in the surface water of the identified pond habitats was not tested or discussed. Contamination in the habitat soils was not tested, and soil contamination impact on the species of concern was not examined. In species where a survey was conducted (e.g. the redbelly turtles), Evergreen does not make a comparison of the population to uncontaminated sites, which is expected under the Technical Guidance Manual for determining the viability and health of the population.

Evergreen performed dispersion modeling for the Schuylkill River and did an analysis of river sediment and the fate and transport of some contaminants in the surface water of Mingo Creek. Fate and Transport Report (2022), part 2, Section III, Appendix L – Schuylkill River Dispersion Modeling, PDF 960-1014 of 1014. However, these analyses are deficient as detailed in the following section D. Briefly, Evergreen does not examine the risk posed by all the Chemicals of Potential Ecological Concern. Also, instead of applying the EPA Region III Biological Technical Advisory Group (BTAG) benchmarks, Evergreen uses an alternate methodology from the Ontario Ministry of the Environment (Persaud, et al., 1993, Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. Aug., 1993) that erroneously normalizes the concentrations of contaminants.

By disregarding the detailed steps of the Technical Guidance Manual (*e.g.,* Step 1, Step 2, Step 4, and Step 5), and disregarding EPA's screening values, Evergreen fails to properly assess the risk to ecological receptors.

C. Evergreen erroneously asserts that proper analysis cannot be carried out because of lack of site and habitat characterization data.

Evergreen identifies a number of Chemicals of Potential Ecological Concern (COPECs):

4.0 CONSTITUENTS OF POTENTIAL ECOLOGICAL CONCERN

The constituents that are the subject of this ERA and those from which Evergreen is seeking a release from liability are identified as "Evergreen Petroleum Short List" constituents, hereafter referred to as Evergreen COPECs. The constituents identified as Evergreen COPECs are the following:

Evergreen COPECs

Constituent	CAS No.	PADEP Act 2 COPEC[1]
Volatile Organic Compounds:		
Benzene	71-43-2	X
Cumene	98-82-8	
Dichloroethane, 1,2-	107-06-2	
Ethylbenzene	100-41-4	X
Ethylene dibromide	106-93-4	
Methyl tertiary butyl ether	1634-04-4	
Toluene	108-88-3	X
Trimethylbenzene, 1,2,4-	95-63-6	
Trimethylbenzene, 1,3,5-	108-67-8	
Xylenes	1330-20-7	X
Semivolatile Organic Compounds, PAHs:		
Anthracene	120-12-7	
Benzo(a)anthracene	56-55-3	
Benzo(a)pyrene	50-32-8	X
Benzo(b)fluoranthene	205-99-2	
Benzo(g,h,i)perylene	191-24-2	
Chrysene	218-01-9	
Fluorene	86-73-7	X
Naphthalene	91-20-3	X
Phenanthrene	85-01-8	X
Pyrene	129-00-0	X
Metals:		
Lead	7439-92-1	X

[1]COPEC = constituent of potential ecological concern under PADEP Act 2

See Ecological Risk Assessment, page 4.14 (emphasis added).

Throughout the report, Evergreen erroneously asserts there is a lack of data regarding contaminants on relevant onsite habitats. Here are some examples of this assertion:

7.0 UNCERTAINTY ANALYSIS

Uncertainties are inherent in any ecological risk assessment simply due to the risk assessment process and procedures. A summary of some of the potentially significant areas of uncertainty specific to this ERA are presented below.

- There are no surface water or sediment data from onsite ponds or the Mingo Creek Flood Control Basin. Therefore, quantitative assessment of exposures and subsequent risks is not possible.
- Limited surface water (1 sample) and sediment (6 samples) data are available from the Schuylkill River in the vicinity of the facility. These data likely do not represent exposures experienced by shoreline-dwelling species since the sediment samples were collected for pre-dredging sediment characterization within the existing shipping channel.
- The limited available sediment data from the Schuylkill River were collected prior to maintenance dredging of the river and may not represent current conditions of the sediment in the Schuylkill River or near-shore sediment. The Schuylkill River is routinely dredged by the United States Army Corps of Engineers.
- Currently, there are some areas of water bodies and wetlands throughout the facility which are primarily associated with manmade ponds and drainage features. These small water bodies may be decommissioned/filled during development activities.
- Sediment screening values are based on toxicity to benthic invertebrates and may not be applicable to fish or other aquatic species.
- Most fish toxicity data are for dissolved concentrations in water, resulting in a shortage of toxicity data relating toxicity of constituents in sediment to fish and other aquatic species other than benthic invertebrates.
- Toxicity data for reptiles is lacking, thereby precluding the quantitative assessment of risks to reptiles (e.g. turtles).

See Ecological Risk Assessment, page 7.51 (emphasis added). Evergreen also makes the assertion here:

> The Schuylkill River, the Mingo Creek Flood Control Basin, and several onsite ponds are the surface water bodies that are the focus of this ERA. The locations of these waterbodies are presented in **Figure 4**. Surface water and sediment characterization data are not available for the onsite ponds, and limited data are available for the Schuylkill River in the vicinity of the facility.

See id., page 5.27 (emphasis added). This forms the putative basis for Evergreen's effort to avoid the Technical Guidance Manual and offer up its flawed qualitative assessment.

Evergreen cannot use any alleged lack of data to avoid a proper risk assessment, because it could have easily sampled onsite areas at or near the identified habitats. In fact, it and other consultants for Sunoco have been working on this remedial investigation for over a decade. Taking water and soil samples is a routine task in the ordinary course of business.

For example, Evergreen's ability to collect samples in the identified habitats is demonstrated by the soil samples taken by Evergreen in AOI-9 in 2021 and January 2022, in anticipation of changing the current Site Specific Standard for lead to a direct contact numeric value of 1,000 mg/kg:

> In anticipation of these potentially forthcoming changes, Evergreen identified areas near the perimeter of the former Philadelphia Refinery where lead concentrations exceeded 1,000 mg/kg as these areas will likely eventually require delineation to the "new" lead NRDC MSC in surface soil for future Act 2 activities beyond remedial investigations. On several dates in 2021 and in January 2022, Stantec used a stainless-steel hand auger to collect shallow (0 to 2 ft bgs) soil samples near the property boundaries. A total of 34 samples were collected and submitted to Eurofins Lancaster Laboratories or SGS North America, Inc. for lead analysis via USEPA Method 6010. Analytical results and a comparison to the non-residential soil to groundwater (S to GW) MSC, the current SSS, and the current NRDC MSC as a stand-in for the potential "new" MSC, can be found in **Table 2-1** and are also depicted on **Figure 2-1** (AOIs 1-8 and AOI 10) and **Figure 2-2** (AOI 9). Delineation to 1,000 mg/kg was achieved in all sampling areas except for the northwest corner of AOI 9, which is discussed further in this report.

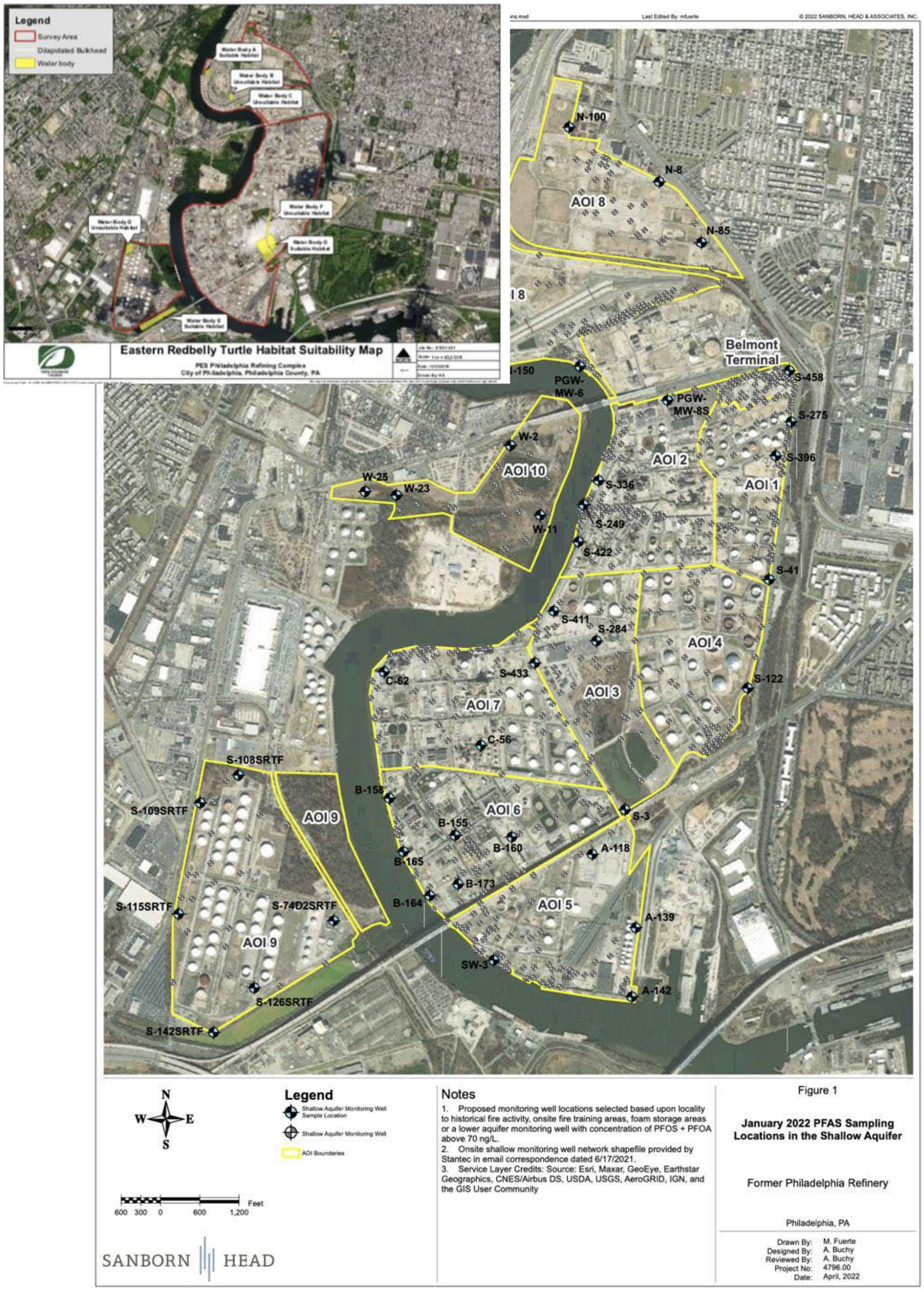
See Sitewide Remedial Investigation Report Addendum (May 20, 2022), page 5 (emphasis added). Note that soil sampling for the ecological analysis in AOI-9 would have been relevant to the Mingo Creek habitat identified in the report. If data are lacking, it is only because Evergreen chose not to take samples from areas in or near the habitats for the identified species of concern.

In its response to comments on the addendum to the remedial investigation report for AOI-9, Evergreen acknowledged that surface water in Mingo Basin and the Schuylkill River are potential receptors:

> **Comment E11**
>
> In conclusion, Evergreen has inadequately assessed the movement of groundwater at the site in the context of increased precipitation, irregular and permeable land formations, immense and mobile soil and groundwater pollution, large accumulations of nearby impervious areas and aging, overburdened adjacent PWD water infrastructure. It is absurd that Evergreen is currently relying on "ballpark" estimates of water volumes pumped from the Mingo Basin with an immense range, "in the ballpark of 0.1 to 60 million gallons per day." Evergreen goes so far to say that "most of the larger pumping events correlate to significant area rainfall" without detailing the frequency of either significant rainfall or larger pumping events. This water is directly pumped in the Schuylkill River and is potentially highly contaminated because of water pollution caused by AOI 9. DEP must require that Evergreen conduct further research into these conditions and current contamination at the Schuylkill River Tank Farm. Thank you for considering this comment and please address the many deficiencies in this RIR.
>
> **Response to Comment E11**
>
> As described in Section 4.7 of the Second Addendum, Evergreen recognizes surface water in both Mingo Basin and the Schuylkill River as potential receptors from constituents of concern originating from AOI 9. Evergreen has conducted representative characterization activities to understand the magnitude and extent of the impacts. As described in Section 6 of the Second Addendum, Evergreen will complete a Sitewide Fate and Transport RIR which will further assess petroleum-related contaminants in groundwater and into surface water, including Mingo Basin and the Schuylkill River.
>
> It should be noted that the volume of water pumped from Mingo Basin varies as it relates to rainfall, sewer flow, creek flow, and groundwater discharges. The quoted volumes were estimated by the Philadelphia Water Department (PWD) for Evergreen's understanding of pumping operations. The purpose of the exercise is to understand the component of water pumped due to groundwater seepage into the basin for Evergreen's groundwater model calibration. As shown on Second Addendum Figure 4-16, there is a component of routine pumpage that doesn't correlate to rainfall and is a reasonable approximation of groundwater seepage into the basin. The pathway of contaminant transport from groundwater into the surface basin and mixing into the Schuylkill River will be evaluated in the sitewide fate and transport assessment through application of calibrated numerical models.

See Response to Public Comments, Second Remedial Investigation Report Addendum, Area of Interest 9 (November 29, 2021), Response to Comment E11, page 15 of 16 (emphasis added). But the Ecological Risk Assessment does not refer to these characterization activities or their results.

In addition, Evergreen could have conducted water sampling in connection with its recent investigation for PFAS chemicals in the shallow aquifer. *See* January 2022 Shallow Aquifer PFAS Sampling Results (April 7, 2022). Many of the locations of the wells used for PFAS sampling (shown in the figure below) were located near the identified habitats for species of concern (as shown in the superimposed inset).


Legend
Survey Area
Dilapidated Bulkhead
Water body
Eastern Redbelly Turtle Habitat Suitability Map
PES Philadelphia Refining Complex
City of Philadelphia, Philadelphia County, PA
Last Edited By: mfuerte
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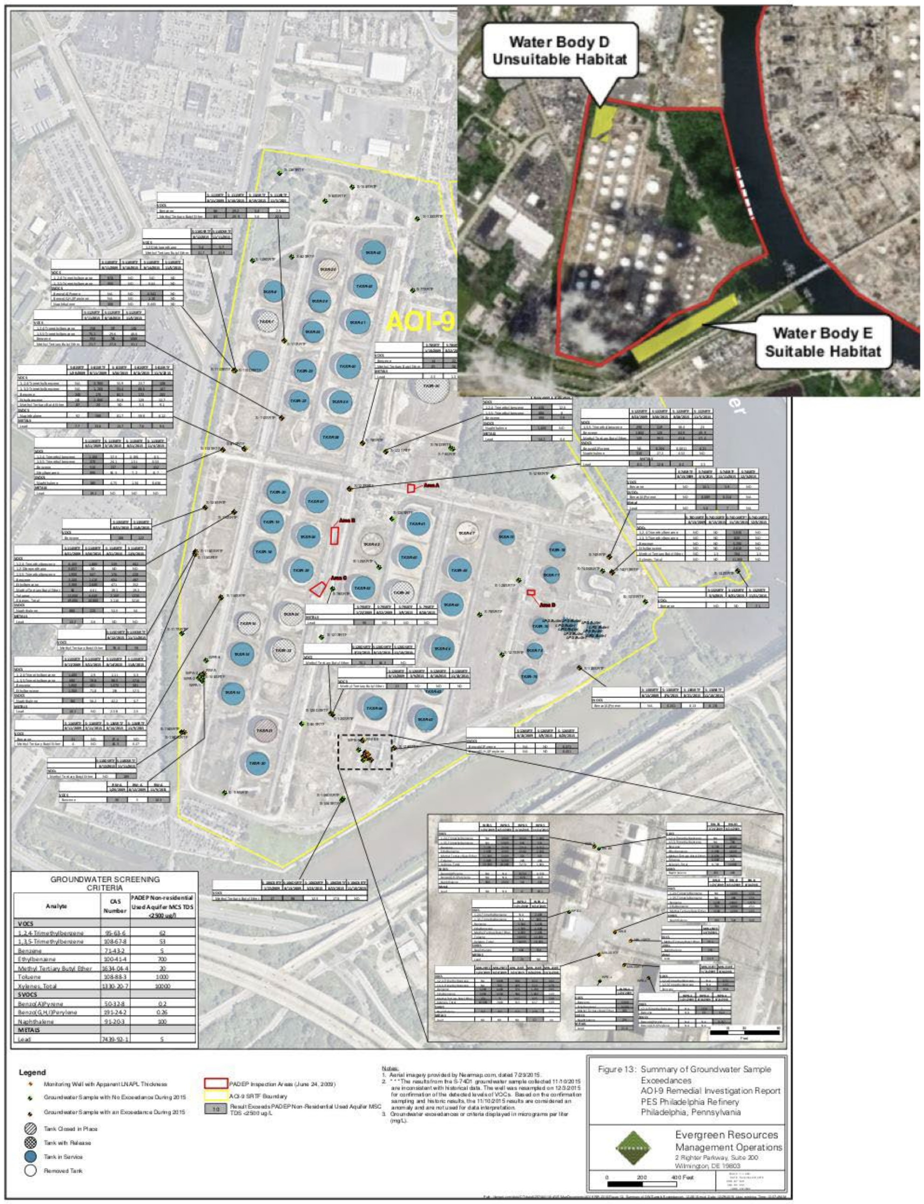
N-100
N-8
AOI 8
N-85
Belmont Terminal
S-458
PGW-MW-6
PGW-MW-8S
S-275
W-2
AOI 10
AOI 2
S-396
AOI 1
W-25
W-23
S-336
S-249
W-11
S-422
S-41
S-411
S-284
AOI 4
C-62
S-433
S-122
AOI 7
AOI 3
C-56
S-108SRTF
B-158
AOI 9
AOI 6
S-109SRTF
S-3
B-155
B-160
A-118
B-165
B-173
B-164
AOI 5
S-115SRTF
S-74D2SRTF
A-139
SW-3
A-142
S-126SRTF
S-142SRTF
N
W
E
S
Legend
Shallow Aquifer Monitoring Well Sample Location
Shallow Aquifer Monitoring Well
AOI Boundaries
Feet
600 300 0 600 1,200
Notes
1. Proposed monitoring well locations selected based upon locality to historical fire activity, onsite fire training areas, foam storage areas or a lower aquifer monitoring well with concentration of PFOS + PFOA above 70 ng/L.
2. Onsite shallow monitoring well network shapefile provided by Stantec in email correspondence dated 6/17/2021.
3. Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Figure 1
January 2022 PFAS Sampling Locations in the Shallow Aquifer
Former Philadelphia Refinery
Philadelphia, PA
Drawn By: M. Fuerte
Designed By: A. Buchy
Reviewed By: A. Buchy
Project No: 4796.00
Date: April, 2022
SANBORN HEAD

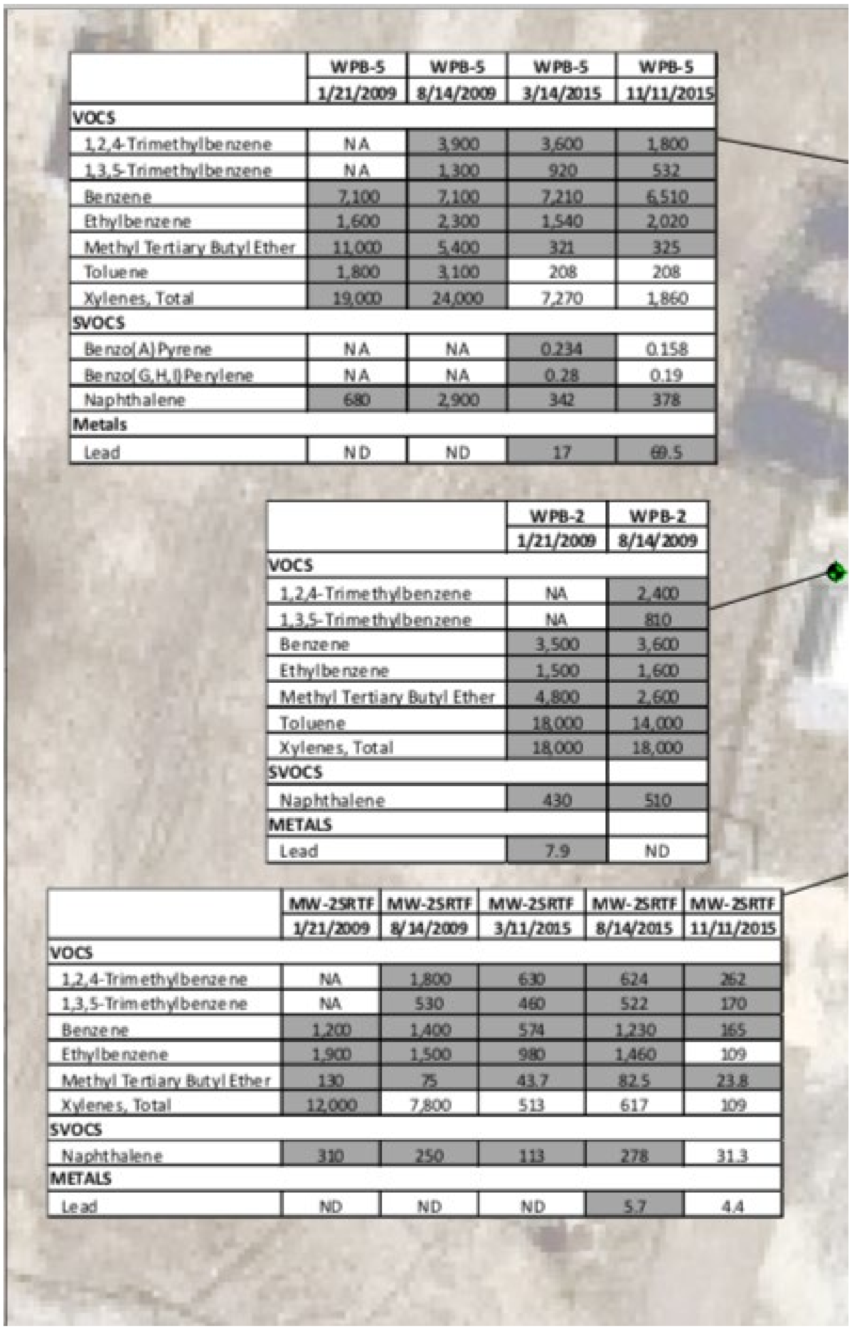
See January 2022 Shallow Aquifer PFAS Sampling Results (April 7, 2022), Figure 1, PDF 7 of 152. The inset shows the redbelly turtle habitats locations from the Ecological Risk Assessment, page 306 of the PDF.

Of course, Evergreen also has a number of remedial investigation reports from which it could obtain relevant data regarding soil and groundwater contamination at, or near, the habitats of the species of concern. *See generally* Philadelphia Refinery Legacy Remediation, Act 2 Documents (Evergreen's website). To illustrate, see the exceedances in groundwater near Mingo creek, one of the main habitats identified in the report:



See Remedial Investigation Report (AOI-9) (December 31, 2015), Figure 13. The inset shows the location of a habitat of one of the species of concern, the redbelly turtle, taken from the Ecological Risk Assessment (page 306).

Enlarging the sampling values identified near the habitat of Mingo Creek shows exceedances for lead and all the VOC that are Chemical of Potential Ecological Concern (benzene, toluene, ethylbenzene and xylenes) highlighted in gray by Evergreen:

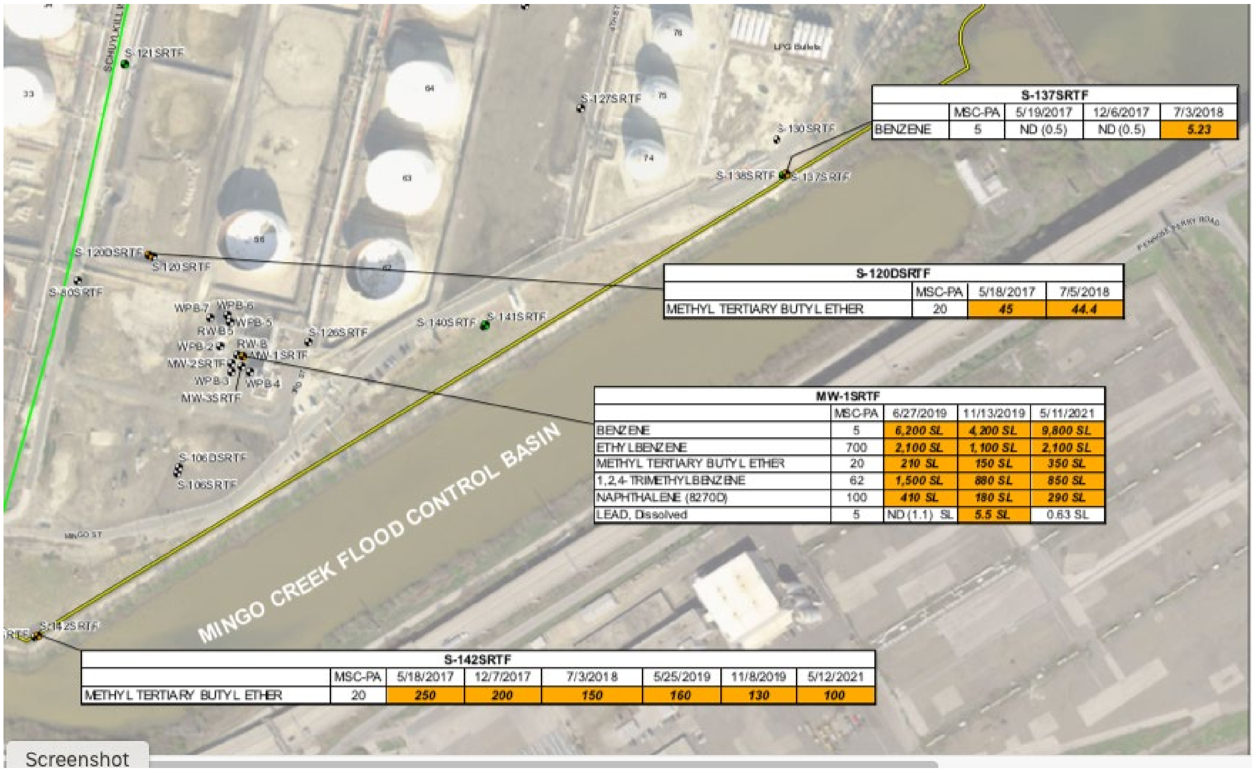


	WPB-5 1/21/2009	WPB-5 8/14/2009	WPB-5 3/14/2015	WPB-5 11/11/2015
VOCS				
1,2,4-Trimethylbenzene	NA	3,900	3,600	1,800
1,3,5-Trimethylbenzene	NA	1,300	920	532
Benzene	7,100	7,100	7,210	6,510
Ethylbenzene	1,600	2,300	1,540	2,020
Methyl Tertiary Butyl Ether	11,000	5,400	321	325
Toluene	1,800	3,100	208	208
Xylenes, Total	19,000	24,000	7,270	1,860
SVOCS				
Benzo(A)Pyrene	NA	NA	0.234	0.158
Benzo(G,H,I)Perylene	NA	NA	0.28	0.19
Naphthalene	680	2,900	342	378
Metals				
Lead	ND	ND	17	69.5

	WPB-2 1/21/2009	WPB-2 8/14/2009
VOCS		
1,2,4-Trimethylbenzene	NA	2,400
1,3,5-Trimethylbenzene	NA	810
Benzene	3,500	3,600
Ethylbenzene	1,500	1,600
Methyl Tertiary Butyl Ether	4,800	2,600
Toluene	18,000	14,000
Xylenes, Total	18,000	18,000
SVOCS		
Naphthalene	430	510
METALS		
Lead	7.9	ND

	MW-25RTF 1/21/2009	MW-25RTF 8/14/2009	MW-25RTF 3/11/2015	MW-25RTF 8/14/2015	MW-25RTF 11/11/2015
VOCS					
1,2,4-Trimethylbenzene	NA	1,800	630	624	262
1,3,5-Trimethylbenzene	NA	530	460	522	170
Benzene	1,200	1,400	574	1,230	165
Ethylbenzene	1,900	1,500	980	1,460	109
Methyl Tertiary Butyl Ether	130	75	43.7	82.5	23.8
Xylenes, Total	12,000	7,800	513	617	109
SVOCS					
Naphthalene	310	250	113	278	31.3
METALS					
Lead	ND	ND	ND	5.7	4.4

See id. More recent investigations also show contamination in perched and unconfined aquifer near Mingo Creek:



See [2021 Second Remedial Investigation Report Addendum] (AOI-9), Enlargement from Figure 4-9a, Perched and Unconfined Aquifer SHS Exceedances (2017-2021). Exceedances are highlighted in orange by Evergreen.

The groundwater contamination found in this area could be an indicator of associated surface contamination, especially samples from the shallow wells.

Similarly, Evergreen's Act 2 reports show high contamination levels in surface soil near the relevant habitats, which are discussed in detail below (*See* Comment #4 regarding soil risk to the redbelly turtles, and Comment #5 regarding soil risk to the avian species of concern).

Evergreen's claim that the required ecological risk assessment cannot be carried out because of insufficient contaminant data is erroneous and misleading. The required data could have been extracted from remedial investigation reports, or obtained during recent sampling efforts.

D. Evergreen erroneously concludes that there is no expected risk to species of concern based on water modeling for the Schuylkill River and Mingo Creek, and on sediment testing and analysis for the Schuylkill River.

Evergreen erroneously states that the Fate and Transport Remedial Investigation Report supports the notion that impacts to species of concern in the surface water of Mingo Creek and the Schuylkill River are unlikely:

> **Schuylkill River Surface Water.** Tetra Tech (2017) collected and analyzed one water sample from the tidal Schuylkill River at Station SW1, co-located with sediment Station SR3 (**Appendix G, Figure** 7). Of the Evergreen COPEC PAHs, benzo(b)fluoranthene was detected in the filtered (i.e., dissolved concentration) sample, and phenanthrene and pyrene were detected in the unfiltered (i.e., total concentrations) sample (**Appendix G, Table** 6). None of the other PAHs on the Evergreen COPECs were detected in the surface water sample. The reported concentration of pyrene, although flagged as an approximate (J) value, exceeded the BTAG screening value (USEPA, 2006b). The detected concentration of phenanthrene was less than the BTAG screening value and there is no BTAG screening value for benzo(b)fluoranthene. Lead was not detected in the surface water sample. The June 30, 2022 Sitewide Fate and Transport Remedial Investigation Report (RIR) prepared by Stantec includes modeling of concentrations of site constituents in groundwater (using MODFLOW and MT3DMS) and into surface water in the Schuylkill River (using Delft3D-FM). The surface water modeling was performed by W.F. Baird & Associates Coastal Engineers Ltd (Baird), and Baird's summary report, Schuylkill River Numerical Modeling of Pollutant Dispersion, is included as an appendix to the Sitewide Fate and Transport RIR. Numerical modeling was performed for benzene, MTBE, benzo(a)pyrene, naphthalene, and lead as representative proxies for site constituents of concern. The results were compared to BTAG screening values and Pennsylvania Code Title 25 Chapter 93 (Chapter 93), Water Quality Standards, Fish and Aquatic Life Criteria. Both the Criteria Continuous Concentrations (CCC) and Criteria Maximum Concentrations (CMC) are considered. Results of the surface water modeling, included in Section 5 of Baird's report, showed predicted contaminant concentrations below the BTAG or Chapter 93 screening values.
>
> **Mingo Basin Surface Water.** The Sitewide Fate and Transport RIR includes modeled discharges of contaminants to Mingo Basin from groundwater in Table 4.3 of Baird's report. These values were reviewed as a conservative representation of potential concentrations of site contaminants in Mingo Basin, as dispersion within the basin was not considered. Conservative potential contaminant concentrations are below the BTAG and Chapter 93 screening values.

See Ecological Risk Assessment, pages 5.28 - 5.29 (emphasis added). But Evergreen's modeling does not support the conclusion because Evergreen examined only five Chemicals of Potential Ecological Concern (COPECs):

> Consistent with groundwater modeling, five COCs were identified for simulation in the surface water model, including benzene, MTBE, BaP, naphthalene, and lead. Stantec provided groundwater flow rates and COC flux values generated from the GWF and groundwater transport models for the regions along the facility banks of the Schuylkill River. These groundwater flows and COC loadings were applied to the Delft3D model of the Schuylkill River by releasing the COC into the bottom layer of the river model. Groundwater and COCs were released in a time varying manner, with peak groundwater flows into the river occurring at low tide. were released in a time varying manner, with peak groundwater flows into the river occurring at low tide.

See 2022 Fate and Transport Remedial Investigation Report, part 2, Section I, page 5.43 (emphasis added). Namely, the modeling did not account for contaminants of concern such as toluene or ethylbenzene, which were found at values much higher than the state Medium-Specific Concentration in groundwater at or near these sites (*see for example* 2021 Second Remedial Investigation Report Addendum (AOI-9), Enlargement from Figure 4-9a, Perched and Unconfined Aquifer SHS Exceedances (2017-2021) reproduced above).

Because of the selective identification of contaminants, the potential risk from toluene, ethylbenzene, and xylenes was not assessed. The effect of contamination depends on both the level of contamination (namely, concentration), and the concentration of the chemical that is considered safe for the identified species of concern.

The guidance document from EPA Region III specifies a value of 110 ug/l for benzene, and 25 ug/l for ethylbenzene – a more stringent value. *See* EPA Region III BTAG Marine Sediment Screening Benchmarks (July 2006). Therefore, meeting a value for benzene does not necessarily mean meeting a value for ethylbenzene.

By considering only some of the contaminants of concern, the Ecological Risk Assessment fails to identify potential locations where concentrations of contaminants could impact species of concern.

Second, Evergreen attempts to downplay and explain away exceedances of the EPA Region III BTAG screening levels in the Schuylkill River bulk sediments by suggesting the need to partition polyaromatic hydrocarbons (PAHs) to organic carbon:

> The Evergreen COPEC PAHs were detected in the Schuylkill River bulk sediment sample results, but no VOCs were detected. Most of the reported PAH concentrations and all of the lead concentrations exceeded USEPA Region 3 Biological Technical Advisory Group (BTAG) screening values (USEPA, 2006a). PADEP (2019) Act 2 guidance recommends that constituent concentrations be initially screened against BTAG values. The BTAG screening values are conservative and do not consider the partitioning of PAHs to organic carbon, which ameliorates bioavailability and toxicity. The toxicity of PAHs can be more realistically assessed by normalizing their concentrations by the percent organic carbon in the sediment. The 2017 Schuylkill River sediment samples had high organic carbon concentrations, ranging from 46,000 to 320,000 mg/kg and averaging 122,833 mg/kg (12.28%) for the six sediment sample locations, characteristic of highly organic silty material.

See Ecological Risk Assessment, pages 5.27-5.28 (emphasis added).

This is misplaced because EPA indicates that partition coefficients were already accounted for when developing the BTAG sediment benchmark values:

> ## Hierarchy for Selection of Freshwater Sediment Benchmarks
>
> - Preference was given to benchmarks based on chronic direct exposure, non-lethal endpoint studies designed to be protective of sensitive species
> - Values derived by statistical- or consensus-based evaluation of multiple studies were given first priority
> - Equilibrium partitioning values were selected for contaminants with 2.0< log Kow <6.0 if empirical values based on multiple studies were not available
> - Absent consensus or equilibrium partitioning values, single study toxicity values were selected
> - Marine values were used for freshwater only if a suitable freshwater value did not exist

See Freshwater Sediment Screening Benchmarks | US EPA. Therefore, Evergreen's argument that these values do not account for partitioning is incorrect. It is important to note that these benchmarks were developed by EPA Region III, namely, the Mid-Atlantic region where the site is located.

Instead of the EPA-BTAG benchmarks, Evergreen suggests the use of more lenient Lowest Effect Levels (LELs) and Severe Effect Levels (SELs) developed for the Ontario Ministry of the Environment (Persaud, et al., 1993, Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. Aug., 1993):

> The Ontario Ministry of the Environment (Persaud, et al., 1993) developed LEL and severe effects level (SEL) screening values for PAHs normalized to an assumed organic carbon concentration of 1% that can be further adjusted to site-specific organic carbon concentrations. The PAH concentrations in the Schuylkill River sediment samples, except fluorene, phenanthrene, and pyrene at Station SR6, were less than the LEL when normalized by the average organic carbon concentration for the six samples. The carbon-normalized concentrations of fluorene, phenanthrene, and pyrene at SR6 were greater than the LEL but less than the SEL (**Appendix G, Table 4**).
>
> The Ontario Ministry of the Environment also developed LEL and SEL concentrations for lead in sediment (with no adjustment for organic carbon concentration). The reported lead concentrations in the Schuylkill River sediment samples were greater than the LEL but were less than the SEL concentration (**Appendix G, Table 4**).

See Ecological Risk Assessment, page 5.28 (emphasis added). This argument lacks merit because this methodology is supposed to be applied only in cases where the Total Organic Carbon (TOC) is less than 10%:

Table 2b: Provincial Sediment Quality Guidelines for Polycyclic Aromatic Hydrocarbons.
(values in µg/g (ppm) dry weight unless otherwise noted)

Compound	No Effect Level	Lowest Effect Level	Severe Effect Level (µg/g organic carbon)*
Anthracene	-	0.220	370
Benz[a]anthracene	-	0320	1,480
Benzo[k]fluoranthene	-	0.240	1,340
Benzo[a]pyrene	-	0.370	1,440
Benzo[g,h,i]perylene	-	0.170	320
Chrysene	-	0.340	460
Dibenzo[a,h]anthracene	-	0.060	130
Fluoranthene	-	0.750	1,020
Fluorene	-	0.190	160
Indeno[1,2,3-cd]pyrene	-	0.200	320
Phenanthrene	-	0.560	950
Pyrene	-	0.490	850
PAH (total)	-	4	10,000

(Guidelines could not be calculated for Acenaphthene, Acenaphthylene, Benzo[b]fluorene and Naphthalene due to insufficient data. These will be calculated when sufficient data is available.)

Lowest Effect Levels and Severe Effect Levels are based on the 5th and 95th percentiles respectively of the Screening Level Concentration (SLC) (see Section 4.2.4) except where noted otherwise.

- Insufficient data to calculate guideline.

* Numbers in this column are to be converted to bulk sediment values by multiplying by the actual TOC concentration of the sediments (to a maximum of 10%), e.g. analysis of a sediment sample gave a B[a]P value of 30 ppm and a TOC of 5%. The value for B[a]P in the Severe Effects column is first converted to a bulk sediment value for a sediment with 5% TOC by multiplying 1443 x 0.05 = 72 ppm as the Severe Effect Level guideline for that sediment. The measured value of 30 ppm is then compared with this bulk sediment value and is found to not exceed the guideline.

See Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario (August 1993), page 5 (emphasis added).

While these regulations were updated in 2008, the revised limitations on sediment carbon content remained (Ontario Ministry of the Environment, Guidelines for Identifying, Assessing and Managing Contaminated Sediments in Ontario, Identification and Assessment, Table 2b).

But according to Evergreen's own report, the Schuylkill River sediment has higher carbon concentrations greater than 10%:

> sediment. The 2017 Schuylkill River sediment samples had high organic carbon concentrations, ranging from 46,000 to 320,000 mg/kg and averaging 122,833 mg/kg (12.28%) for the six sediment sample locations, characteristic of highly organic silty material.

See Ecological Risk Assessment, page 5.28 (emphasis added). Therefore, Evergreen has misapplied the guidance document from the Ontario Ministry of the Environment to samples where the TOC is higher than 10% (SR5 and SR6).

Moreover, several Evergreen samples exceeded the Lowest Effect Levels (LELs) of the 1993 Ontario guidance document, which are more lenient than the BTAG screening values of EPA Region III:

Table 4. Analysis results for bulk sediment samples collected in the Schuylkill River adjacent to the PES Philadelphia Refining Complex.

Sample location	SR1	SR2	SR3	SR4	SR5	SR6	EPA Region 3 BTAG[1]	LEL[2]		SEL[2]	
Sample date	8/18/17	8/18/17	8/18/17	8/18/17	8/18/17	8/18/17	SV mg/kg	mg/kg at 1% OC	mg/kg at 12.28% OC	mg/kg carbon	mg/kg at 12.28% OC
Total organic carbon (mg/kg)	46000	61000	52000	58000	200000	320000					
VOCs (mg/kg)											
Benzene	ND	ND	ND	ND	ND	ND					
Cumene	ND	ND	ND	ND	ND	ND					
Dichloroethane, 1,2-	ND	ND	ND	ND	ND	ND					
Ethylbenzene	ND	ND	ND	ND	ND	ND					
Ethylene dibromide	ND	ND	ND	ND	ND	ND					
Methyl tert butyl ether	ND	ND	ND	ND	ND	ND					
Toluene	ND	ND	ND	ND	ND	ND					
Trimethylbenzene, 1,2,4-	NA	NA	NA	NA	NA	NA					
Trimethylbenzene, 1,3,5-	NA	NA	NA	NA	NA	NA					
Xylenes	ND	ND	ND	ND	ND	ND					
SVOCs (mg/kg)											
Anthracene	0.140	0.210	0.270	0.170 J	0.430	2.200	0.0572	0.22	2.70	370	45.44
Benzo(a)anthracene	0.280	0.580	0.810	0.540	0.720	3.800	0.108	0.32	3.93	1480	181.74
Benzo(a)pyrene	0.350	0.610	0.770	0.630	0.710	3.000	0.150	0.37	4.54	1440	176.83
Benzo(b)fluoranthene	0.440	0.780	0.980	0.840	0.940	3.400	NSV	NSV	NSV	NSV	NSV
Benzo(g,h,i)perylene	0.310	0.600	0.750	0.530	0.510	1.700	0.170	0.17	2.09	320	39.30
Chrysene	0.400	0.710	0.870	0.720	0.860	3.400	0.166	0.34	4.18	460	56.49
Fluorene	0.098	0.100	0.160	0.120 J	0.500	2.800	0.0774	0.19	2.33	160	19.65
Naphthalene	0.180	0.170	0.140	0.110 J	0.440	1.300	0.176	NSV	NSV	NSV	NSV
Phenanthrene	0.450	0.630	0.960	0.620	1.700	9.100	0.204	0.56	6.88	950	116.66
Pyrene	0.700	1.000	1.200	1.000	1.500	6.300	0.195	0.49	6.02	850	104.38
Metals (mg/kg)											
Lead	85	95	89	95	72	120	35.80	31		250	

See Ecological Risk Assessment, Appendix G, Table 4. The colored shading is used by Evergreen to indicate exceedances, the yellow shading denotes exceedances of the BTAG screening values of EPA Region III, and the orange shading denotes exceedance of both the BTAG screening values and the Lowest Effect Levels (LELs) in the Ontario guidance document.

Therefore, the Fate and Transport analysis does not demonstrate a lack of impact or a lack of risk to fish species from the Schuylkill River sediment.

E. Evergreen erroneously claims that following the required risk assessment is not possible due to lack of data regarding Toxicity Reference Value (TRV) for the species of concern.

Evergreen erroneously claims it is not possible to assess risk to species of concern using the eight-step process in the Technical Guidance Manual, suggesting the use of an alternative, weaker "likelihood" approach:

> receptors. However, certain site characterization data are limited for the habitats that are the subject of this ERA and TRVs are not available for all species of concern. Therefore, the standard ERA approach has been modified for this ERA. In lieu of the standard quantitative ERA approach, multiple lines of evidence are utilized to determine the likelihood that species of concern could be at risk of adverse ecological impacts from exposures related to legacy refining operations COPECs.

See Ecological Risk Assessment, page 1.1 (emphasis added). This is erroneous because many resources are available to evaluate the risks to the species of concern.

For example, the presence of contaminants in soil can adversely affect several of the identified species of concern (see details in Comments # 4 for the redbelly turtles and Comment # 5 for the avian species). The Office of Solid Waste and Emergency Response (OSWER) has prepared a guidance document containing data regarding Toxicity Reference Values (TRV) and Lowest-Observed-Adverse-Effect Level (LOAEL) doses for lead in soil. *See* U.S. EPA, Ecological Soil Screening Levels for Lead Interim Final OSWER Directive 9285.7-70 (March 2005). The Directive includes values for lead toxicity to plants (Table 3.1) and avian TRV (Table 5.1 and Table 5.2).

Similarly, the same office has prepared a guidance document for ecological soil screening levels for Polycyclic Aromatic Hydrocarbons (PAHs). *See* U.S. EPA, Ecological Soil Screening Levels for Polycyclic Aromatic Hydrocarbons (PAHs) Interim Final OSWER Directive 9285.7-78 (June 2007). This guidance document provides relevant data regarding TRV, including those for avian species (Appendix 5.1 and Appendix 5.2).

It is acknowledged that Evergreen's report does cite quantitative data from some studies; for example, the effects of contaminants on aquatic life:

> Data on the toxicity of benzene to freshwater biota are limited primarily to fish studies. Ninety-six hour LC_{50} values for bass (*Marone saxatilis*), crab larvae (*Cancer magister*), and grass shrimp (*Palaemonetes pugio*) exposed to benzene are 5.8 to 0.9 mg/L; 220 mg/L; 1,108 mg/L; and 27 mg/L, respectively (Verschueren, 1983, as cited in NLM, 1996). Federal Water Quality Criteria do not exist for the protection of freshwater aquatic life from exposure to benzene (EPA, 1986). The lowest effect level (LEL) listed by EPA (1986) for acute exposure is 5,300 micrograms per liter (µg/L). However, Suter and Tsao (1996) recommend acute and chronic advisory values of 815 and 45.5 µg/L, respectively, for the protection of freshwater biota. Lowest chronic toxicity values of benzene to fish and daphnids are 8,250 µg/L and greater than 98,000 µg/L, respectively (Suter and Tsao, 1996). The Effect Concentration for 20% of Test Population (EC_{20}) for fish can be used as a benchmark indicative of production within a population. It is the highest tested concentration causing less than a 20 percent reduction in either the weight of young fish per initial female fish in a life cycle or partial life-cycle test or the weight of young per egg in an early life stage test (Suter and Tsao, 1996). The value for benzene is 21 µg/L (Suter and Tsao, 1996).

See Ecological Risk Assessment, page 4.16. It also does so here:

> Specific data on the toxicity of toluene to wildlife are limited. Laboratory studies have shown the nervous system to be sensitive to toluene toxicity (Benignus, 1981, as cited in NLM, 1996). Exposure to toluene may result in alterations in the central nervous system (Bjornaes and Lu, 1988, as cited in NLM, 1996). An oral LD_{50} value for rats exposed to toluene is 636 mg/kg (RTECS, 1996). Inhalation LC_{50} values of rats and mice exposed to toluene are greater than 26,700 ppm/1 hr and 400 ppm/2 hr, respectively (RTECS, 1996). A dermal LD_{50} value for rabbits exposed to toluene is 12.124 g/kg (RTECS, 1996). The lowest published lethal inhalation concentrations of toluene to rabbits and guinea pigs are 55,000 ppm/40 min and 1,600 ppm, respectively (RTECS, 1996). The lowest published lethal oral dose of toluene to rabbits is 50 mg/kg (RTECS, 1996). Toluene can be fetotoxic at inhalation concentrations as low as 500 ppm/24 hr or at oral doses as low as 9 g/kg (RTECS, 1996). Teratogenic effects have been reported in the offspring of pregnant mice exposed to toluene at an inhalation concentration as low as 200 ppm/7 hr during days 7 to 16 of pregnancy (RTECS, 1996). Toluene has been shown to be genotoxic (RTECS, 1996). Signs of toluene poisoning include muscular tremors, disturbances in behavior, and staggered gait (Clarke, et al., 1981, and Browning, 1965, as cited in NLM, 1996).

See id. page 4.17. But Evergreen made no attempt to use these data to assess impacts on the species of concern.

Even where data for species of concern may not be directly available, there may be information regarding related species that could be used following established procedures. *See* U.S. EPA, Guidance for Developing Ecological Soil Screening Levels OSWER Directive 9285.7-55 (Revised February 2005), Section 1.0 ("This guidance describes the process used to derive a set of risk-based ecological soil screening levels (Eco-SSLs) for many of the soil contaminants that are frequently of ecological concern for plants and animals at hazardous waste sites and further provides guidance on using Eco-SSLs."). This information can then be extended to other species: "Toxicity data are not available for all contaminants or wildlife species that may be considered in an ecological risk assessment. Consequently, extrapolation of toxic responses observed in avian and mammalian test species to the wildlife endpoint species of interest is necessary." (Sample BE, Arenal CA. Allometric Models for Interspecies Extrapolation of Wildlife Toxicity Data | SpringerLink, doi: 10.1007/s001289900924) (emphasis added). *See also* U.S. EPA, Notice of availability of final Guidelines for Ecological Risk Assessment, 63 Fed. Reg. 26,846 (May 14, 1998), and the comprehensive EPA Guidance for Applying Quantitative Data to Develop Data-Derived Extrapolation Factors for Interspecies and Intraspecies Extrapolation (September 2014).

To illustrate with respect to species of concern, Evergreen could compensate for any alleged lack of data for the peregrine falcon (*Falco peregrinus*) by using the TRVs and LOAELs for lead in soil for the Red-tailed hawk (Table 5.2 on page 9 and Appendix 5.1, Ecological Soil Screening Levels for Lead Interim Final OSWER Directive 9285.7-70). Because the peregrine falcon and the red-tailed hawk feed on small mammals and other birds (*See* National Audubon Society, Guide to North American Birds: Peregrine Falcon, Red-Tailed Hawk), it would be reasonable to extrapolate the TRV and LOAEL for the red-tailed hawk to the peregrine falcon by accounting for their differences in size and body mass following the EPA methodology.

It is erroneous for Evergreen to assert that it is not possible to conduct a risk assessment that accounts for the toxicity of contaminants on the species of concern because of lack of TRV data.

2. **<u>Evergreen does not consider the additive effect of contaminants on species of concern, and does not provide a quantitative assessment of the cumulative impacts of contaminants</u>.**

The report discusses potential ecological effects of contaminants as if they presented separate and independent pathways of exposure. This is flawed because it has been found that contaminants act through similar mechanisms can act in an additive manner.

This concept of additivity applies in particular to benzene, toluene, ethylbenzene and xylenes (BTEX). The additivity of BTEX is manifested in two ways. First, because these compounds present the same physiological and biological pathways, analysis of their cumulative impact on different species should be considered. The cumulative effects of BTEX have been shown to be present in organisms ranging from *Euglena gracilis*, a unicellular protist (Peng C., et al, Toxic effects of individual and combined effects of BTEX on Euglena gracilis - ScienceDirect) to mice (Andrews LS, et al. https://www.sciencedirect.com/science/article/abs/pii/0006295277901800) and humans.

Accordingly, the Agency for Toxic Substances and Disease Registry states that a hazard index approach should assume "additive joint action" from these four compounds:

> A hazard index approach that assumes <u>additive joint action</u> and uses ATSDR Minimal Risk Levels (MRLs) and guidance values based on neurological impairment is recommended for exposure-based assessments of possible neurotoxic health hazards from the four components.

See Agency for Toxic Substances and Disease Registry, Interaction Profile for: Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX) (May 2004), page ix (Summary).

Moreover, the presence of more than one of these compounds could interfere with the metabolization of the other individual compound, so that the toxicity effects are prolonged. This is made clear by the Agency for Toxic Substances and Disease Registry:

> Metabolic interactions between benzene and toluene have been investigated in a number of other studies, including *in vitro* metabolism assays in rat and mouse liver microsomes (Andrews et al. 1977; Sato and Nakajima 1979) and *in vivo* (inhalation, subcutaneous, and intraperitoneal) metabolism studies in rats, mice, and humans (Andrews et al. 1977; Brondeau et al. 1992; Ikeda et al. 1972; Inoue et al. 1988; Sato and Nakajima 1979). Most of these studies examined the effects of toluene on the metabolism of benzene. The findings are consistent with the PBPK studies in indicating that toluene and benzene are inhibitors of each other's metabolism, the magnitude of inhibition is dose-dependent (i.e., may not occur at low levels of exposure), and toluene may have a greater suppressive effect on benzene metabolism than benzene on toluene metabolism. Although the dose-dependency of the metabolic interactions is well-documented, only limited empirical information is available regarding the threshold of these interactions for inhalation exposures (Brondeau et al. 1992; Inoue et al. 1988; Sato and Nakajima 1979).

See Agency for Toxic Substances and Disease Registry, Interaction Profile for: Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX), page 14 (emphasis added).

Evaluating the cumulative impact of BTEX chemicals is possible. For example, Haddad, et al have shown that the physiological effects of BTEX can be assessed using a combined toxicokinetic approach (Haddad S, et al, Validation of a physiological modeling framework for simulating the toxicokinetics of chemicals in mixtures).

Second, the degradation rate of BTEX mixtures could be slowed down when compared to that of the individual components. This was found by Bielefeldt and Stensel:

> ### Abstract
>
> A quantitative evaluation of the biodegradation rates of mixtures of volatile aromatic compounds (benzene, toluene, ethylbenzene, xylenes [BTEX]) was conducted. Three different mixed bacterial cultures grown on BTEX or benzene were used in batch biodegradation tests with individual and mixed BTEX compounds. The bacteria degraded each compound faster when it was present alone than when it was a component of a BTEX mixture. The biodegradation rates in the mixtures were predicted using a basic competitive inhibition model to account for the effects of up to five BTEX compounds. Under the limiting assumptions of similar individual half-saturation coefficients (K_s) for the multiple compounds and substrate concentrations significantly greater than K_s, the competitive inhibition model could be simplified to demonstrate that the biodegradation rate of any individual compound in the multi-component mixture should be proportional to its individual maximum specific degradation rate and the concentration of the compound relative to the total mixture concentration. Comparison of measured BTEX mixture degradation to predictions from this simplified model showed this model yielded estimates of similar accuracy to the more rigorous competitive inhibition equation. This is the first report of a quantitative evaluation of the biodegradation of five-compound mixtures.

See A.R. Bielefeldt and H.D. Stensel, Modeling competitive inhibition effects during biodegradation of BTEX mixtures - ScienceDirect (emphasis added). The effect of mixing of degradation rate inhibition can be explained by the "[t]hree types of basic inhibitions, possible in the biodegradation of any mixture i.e. (i) self-substrate inhibition, (ii) interactive inhibition among VOCs of similar chemical nature and (iii) inhibition due to dissimilar VOC species" (Datta, et al. Modeling the biodegradation kinetics of aromatic and aliphatic volatile pollutant mixture in liquid phase - ScienceDirect).

Although the kinetics of degradation of the individual compounds and the mixture depend on the type of organism, Evergreen could account for the potential inhibitory effect of the mixture by using an approach such as that presented by Bielefeldt and Stensel using a competitive inhibition approach (*see* A.R. Bielefeldt and H.D. Stensel, Water Research, 33, 707, 1999, Modeling competitive inhibition effects during biodegradation of BTEX mixtures - ScienceDirect).

By not accounting for the cumulative effect of BTEX, Evergreen underestimates both their impact on species of concern, and the period over which species would be exposed to contaminants. Evergreen should include compound additivity effects by applying relevant models when examining BTEX, rather than focusing on the effects of each component separately.

3. **<u>Evergreen cannot cure the deficiencies in its assessment of impacts to avian species by referring to a letter from the Pennsylvania Game Commission (PGC), because that letter is only as reliable as the deficient information that was provided to it.</u>**

In vain, Evergreen attempts to cure the deficiencies in its assessment relating to avian species of concern by appealing to a determination of the Pennsylvania Game Commission ("the Commission") regarding the expected risk to avian species:

> - Although the marsh wren (aquatic invertebrates), peregrine falcon (small birds & waterfowl), and least bittern (small fish & insects) have different feeding strategies, potential exposures to COPECs are not expected to be significant. VOCs and lead do not bioaccumulate significantly in the preferred food items and PAHs are readily metabolized and excreted by birds. Additionally, the jurisdictional agency (PGC) determined that no impacts to the marsh wren, peregrine falcon, and least bittern are anticipated.

See Ecological Risk Assessment, pages 9.59-9.60 (emphasis added). This is flawed reasoning because Evergreen did not prepare a proper ecological risk assessment under the regulations and the guidance document. *See* Comment #1 above.

As detailed in the letter sent by Stantec (Evergreen's contractor) to the Commission on June 19, 2018 and June 20, 2018, the information provided included the Pennsylvania Natural Diversity Inventory (PNDI) Project Environmental Review Receipt and two figures (a Site Location Map and a Site Plan). *See* Ecological Risk Assessment, page 125 and page 152 of the PDF; one letter relates to AOI 1-8, and one relates to AOI-9). The Evergreen applications to the Commission do not include a survey that would demonstrate the presence (or absence) of the avian species of concern onsite. They do not provide any information regarding the type, distribution and concentration of chemicals of ecological concern.

Therefore, the Commission's determination of "no impact anticipated" could not be an informed one. The Commission's letter states that the determination is based on "PNDI records indicate species or resources of concern are located within the vicinity of the project. However, <u>based on the information you submitted</u> concerning the nature of the project, the immediate location, and our detailed resource information, the Commission has determined that no impact is likely" in the response letter from July 27, 2018 (page 126 of the PDF) and August 1, 2018 (*see id.*, page 153 of the PDF).

Similar correspondence was repeated in 2022, when Stantec (Evergreen's contractor) provided the Commission with only the site location maps and site plan figures (*see id.,* pages 166-168 and page 187-190 of the PDF).

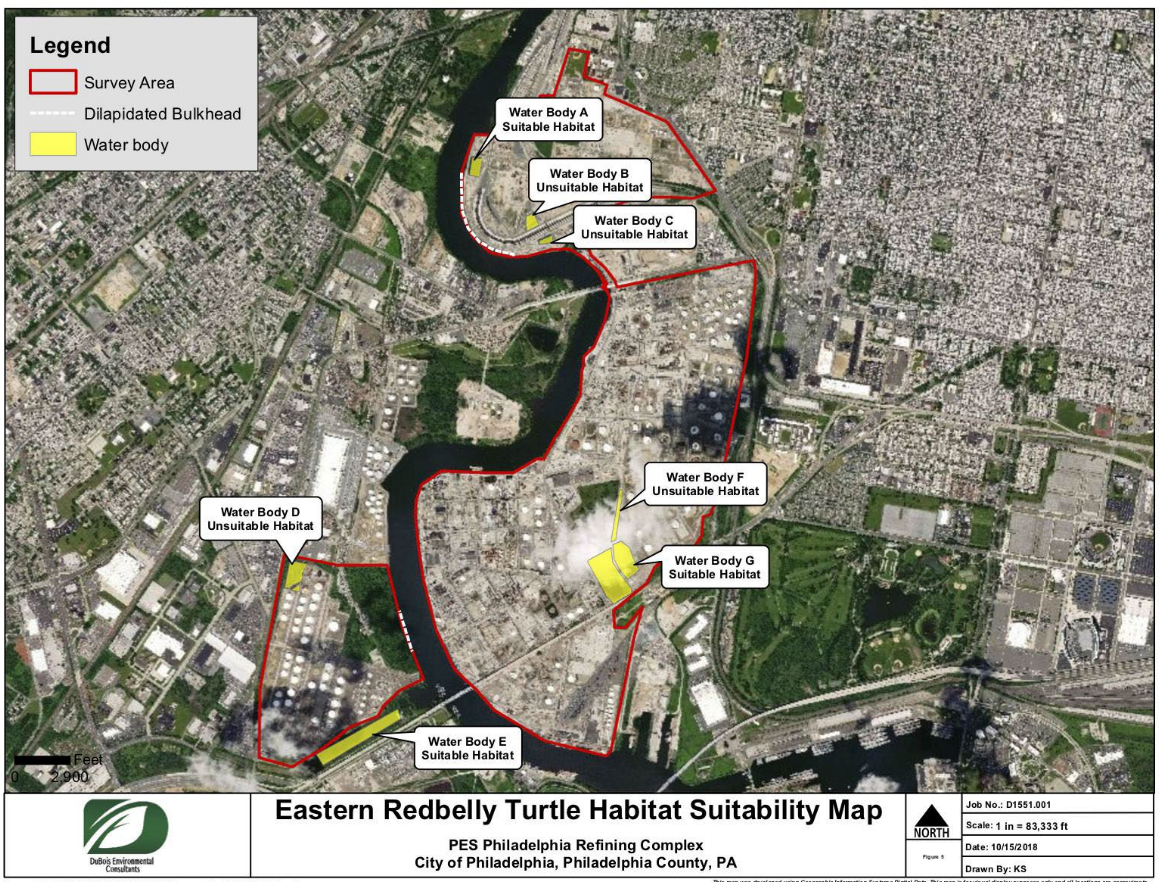
As demonstrated in Comment #1, Evergreen's assessment of impacts to species of concern and their habitats is deficient and does not comply with the chapter 250 regulations and the Technical Guidance Manual. No determination by the Commission can cure this deficient assessment, in particular since Act 2 is administered by the Department (a pollution agency) rather than by the PGC (a conservation agency).

4. <u>For the Eastern Redbelly turtle, Evergreen fails to provide an adequate risk assessment.</u>

The Eastern Redbelly Turtle (Pseudemys rubriventris) is a species of concern. It is exposed to contaminants on the site. With respect to the risk of exposure to onsite contamination for the population, the report does not follow the quantitative analysis required by the regulations and contemplated by the Technical Guidance Manual. As a result, Evergreen underestimates the impact of the contaminants and the risk to the population of redbelly turtles.

a. Evergreen erroneously determines habitat suitability by the presence or absence of redbelly turtles, rather than by determining risk according to the regulations and the Technical Guidance Manual.

The report identifies several suitable habitats for the redbelly turtles in the 2018 survey, as listed in Appendix E and identified in Figure 5 (Ecological Risk Assessment, page 306 of the PDF):



These include the Schuylkill River, waterbody A, waterbody E (Mingo Creek), and waterbody G. Specifically, the report states that "Water body G is considered suitable redbelly turtle habitat." (*see id*. page 297 of the PDF).

Evergreen repeats this conclusion in the body of the report:

> As described in the Eastern Redbelly Turtle (*Pseudemys rubriventris*) Habitat Evaluation (**Appendix E**), potentially suitable habitats for the Eastern redbelly turtle occur in onsite ponds (specifically Waterbodies A and G), Waterbody E [Mingo Creek Flood Control Basin], and the adjacent Schuylkill River (**Figure 4**). Based on these results, a presence/absence survey was conducted for these waterbodies, except the Schuylkill River as it was assumed that Eastern redbelly turtles are present in the Schuylkill River.

See Environmental Risk Assessment, page 5.33 (emphasis added). The Pennsylvania Fish and Boat Commission also supports the conclusion that waterbody G is a suitable habitat for the redbelly turtle:

> **Eastern Redbelly Turtle (*Pseudemys rubriventris*, Threatened)**
> You provided an evaluation of habitats on site by Bryon DuBois to determine their potential to support the species of concern. Mr. DuBois identified several existing water bodies (A and G) on the site, as well as the Schuylkill River, and the vegetated areas in proximity to these water bodies as potential habitat for the Eastern Redbelly Turtle. I concur with the results of this evaluation; therefore, impacts to these features should be avoided.

See id., page 120 of the PDF (emphasis added).

In the presence/absence survey in 2019, redbelly turtles were not found in waterbody G:

> A presence/absence survey was conducted in June and July 2019 by DEC (**Appendix F**). The objective of the presence/absence survey was to identify any Eastern redbelly turtles through the direct observation of basking individuals. Turtles are ectothermic and leave the water to thermoregulate their body temperature under the warm sun. Basking locations often consist of exposed logs, overhanging tree limbs, or floating debris exposed to sufficient sunlight. To observe potential basking individuals, visual observations consisted of DEC personnel traversing the periphery of the waterbody, while scanning with 10x power zoom binoculars. In addition to the basking survey, the shorelines of the potential habitats were observed to locate any old turtle nests or turtle shells.
>
> As described in the Phase II Eastern Redbelly Turtle (*Pseudemys rubriventris*) Presence/Absence Report (**Appendix F**), Eastern redbelly turtles were positively identified in Waterbody A and Waterbody E (Mingo Creek Flood Control Basin). Redbelly turtles were not identified in Waterbody G.

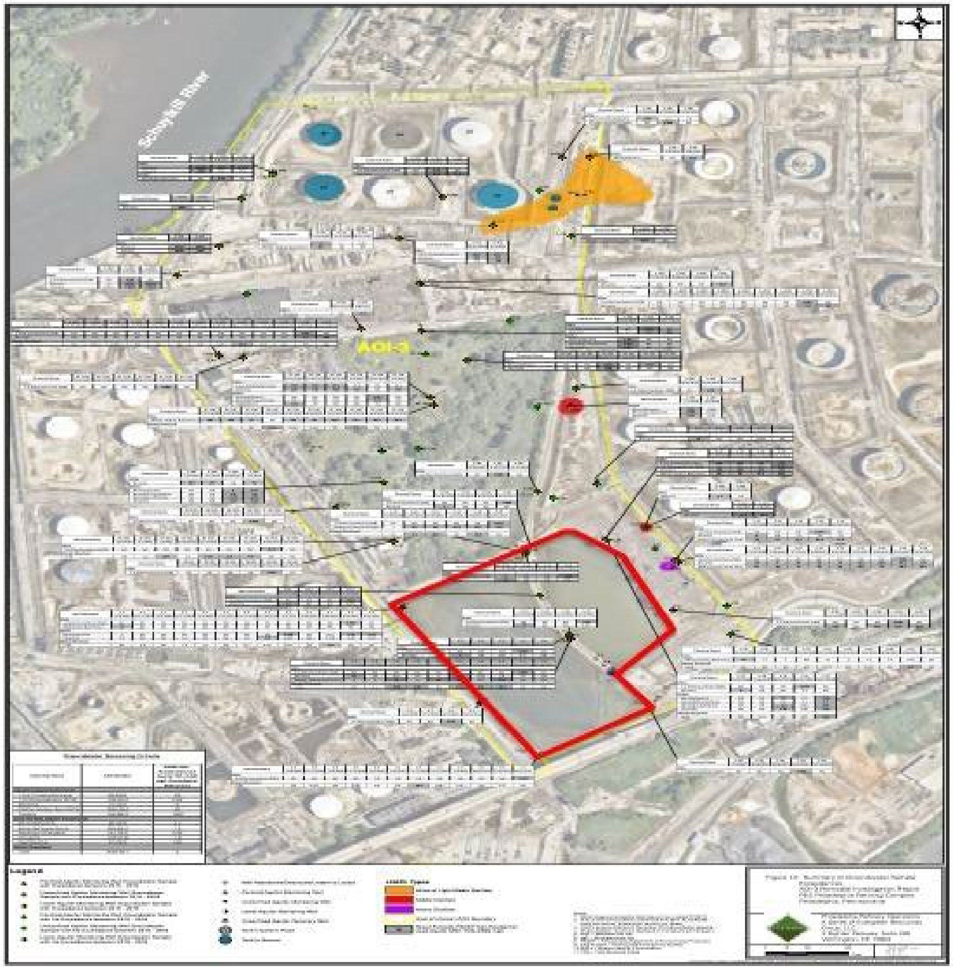
See id., page 5.34 (emphasis added). This led Evergreen to make the following conclusory assertion:

> However, Waterbody G was determined to provide sub-optimal habitat, no Eastern redbelly turtles were observed, and it was concluded that redbelly turtles do not inhabit Waterbody G.

See id. page 6.50.

Erroneously, Evergreen made a final determination of habitat suitability based on the presence or absence of redbelly turtles. Notably, Evergreen does not explain why Waterbody G is "sub-optimal." Evergreen does not undertake an analysis of the specific contaminants in the vicinity of these waterbodies, let alone evaluate whether contaminants have contributed to their absence in Waterbody G.

This is problematic because groundwater sampling near Waterbody G shows various contaminants and the presence of LNAPL which could affect the quality of the waterbody as a habitat for the redbelly turtle:



See Remedial Investigation Report (AOI-3) (2017), Figure 14: Summary of Groundwater Sample Exceedances, PDF page 171 of 760. (The red line was added by the Council to highlight the location of waterbody G).

For example, the groundwater sampling wells directly surrounding waterbody G show exceedances of the groundwater standard of 5 ug/l for lead:

Well number	Lead concentration (ug/l)
s-25	6.2
s-13	9.5
s-13	38.2
s-13	13.6

s-1	11.6
s-8	2590
s-8	239
s-8	10.5
s-8	225
s-8	10.2

Note that in some wells, multiple samples were taken over the period of the report.

Surface soil on the boundary of waterbody G was also shown to be highly contaminated. For example, there was a measurement of 5,550 mg/kg of lead in BH-10-02, and another measurement of 722 mg/kg for lead in BH-15-9 (data from Table 4 of the Remedial Investigation Report (AOI-3) (2017)). To put these numbers into context, although the EPA Ecological Soil Screening Levels for Lead Interim Final OSWER Directive 9285.7-70 does not set a value for reptiles, it sets values of 120 mg/kg for plants, 11 mg/kg for avian species, and 56 mg/kg for mammalian species.

Evergreen's conclusion that waterbody G is "sub-optimal" as a redbelly turtle habitat only because turtles were not found there, discounts possible effects of water and soil contamination, represents circular logic, and is not justified.

b. The Department should reject as vague and conclusory Evergreen's assertions that several potential exposure routes of contaminants to the redbelly turtles pose little or no risk.

Evergreen identifies several potential exposure routers to the redbelly turtles:

> surface water and sediment within their home range. As presented in the Eco-CSM, the Eastern redbelly turtle could be exposed to COPECs via the following exposure routes:
>
> - Ingestion of COPECs in surface water and sediment from the Schuylkill River
> - Ingestion of plants and animals that have accumulated COPECs from surface water and sediment in the Schuylkill River
> - Ingestion of COPECs in surface water and sediment from onsite ponds and the Mingo Creek Flood Control Basin
> - Ingestion of plants and animals that have accumulated COPECs from surface water and sediment in onsite ponds and the Mingo Creek Flood Control Basin

Ecological Risk Assessment, page 5.32. However, Evergreen makes repeated assertions that "substantial ecological impacts to Eastern redbelly turtles … are not expected," discounting these exposure routes without quantitative substantiation using arguments such as "VOCs are <u>not expected</u> to be present in high concentrations in the surface water or sediment in the onsite ponds and Mingo Creek Flood Control Basin as they rapidly volatilize" (*see id*. page 6.47), or "modeling results of lead concentrations in the Schuylkill River were below ecological screening values." (*see id.* page 6.49).

Evergreen asserts that limited data are available for the redbelly turtle:

> **Eastern Redbelly Turtle Risks.** Limited data from the Schuylkill River indicate COPECs are present in surface water and sediment at relatively low levels, and modeling efforts show concentrations of COPECs below ecological screening values in surface water; however, no data are available for the onsite ponds or the Mingo Creek Flood Control Basin that provide suitable habitat for Eastern redbelly turtle. Modeling efforts performed for Mingo Creek Flood Control Basin show concentrations of COPECs below ecological screening values. Toxicity data are not available for turtles that could be used to quantify potential risks.

Id., page 6.59 (emphasis added). However, as discussed in detail in Comment #1, Evergreen is responsible for any lack of data because it had an obligation to conduct sampling as part of the remediation investigation. Moreover, in the few samples that Evergreen considered – of the Schuylkill river sediment – there were exceedances for contaminants above the BTAG benchmarks and the (lenient) Ontario LEL (*see id.* Table 4 Appendix G).

In addition, Evergreen discounts the exposure routes by making general pronouncements without supporting evidence. For example, it boldly states that "[t]urtles can rapidly metabolize PAHs and readily eliminate their metabolites." *See id.*, page 6.47-6.48. In addition to not being substantiated, it is contradicted by a number of studies. For example, although reptiles are less likely to develop cancer because of PAH exposure, they may accumulate higher concentrations in tissue:

> Biotransformation rates of PAHs for reptiles (and amphibians) are generally lower than what is measured in mammals. Consequently, many of these species are less likely to form tumors because of the reduced potential for conversion to reactive metabolites. Conversely, because reptiles (and amphibians) do not biotransform PAHs as rapidly as other species, they are susceptible to other adverse effects, because tissue concentrations can accumulate to much higher levels than that expected for other vertebrates.

(J P Meador, 2008, https://www.researchgate.net/profile/James-Meador/publication/253328923_Polycyclic_Aromatic_Hydrocarbons/links/5b806733299bf1d5a724d0a7/Polycyclic-Aromatic-Hydrocarbons.pdf).

This is consistent with studies that reported elevated PAH levels in both plasma and tissues of sea turtles, suggesting that they cannot metabolize PAH quickly (M. Camacho, et al, Mar. Pollut. Bull., 64 (2012), pp. 1974-1980, https://www.sciencedirect.com/science/article/abs/pii/S0025326X12002639?via%3Dihub; S. Casini, I. et al, Sci. Total Environ., 631–632 (2018), pp. 1221-1233, https://www.sciencedirect.com/science/article/abs/pii/S0048969718308684?via%3Dihub; M. Camacho, et al, Sci. Total Environ., 481 (2014), pp. 303-310. https://www.sciencedirect.com/science/article/abs/pii/S0048969714002253).

PAHs have been found to have adverse and likely long-lasting effects on reptiles in general, and turtles in particular. For example, a study conducted on common snapping turtle (*Chelydra serpentina*) embryos and hatchlings collected from the John Heinz National Wildlife Refuge in Philadelphia found that "[e]xposure to PAHs had a significant effect on survival rates in embryos from one clean reference site, but not in embryos from the other sites. There was a positive linear relationship between level of exposure to PAHs and severity of deformities in embryos collected from two of the clean reference sites", and concluded that "[e]xposure to

PAHs and crude oil had a significant effect on survival and deformity rates among snapping turtle embryos, although there was considerable variation in embryos among clean sites and between clean and contaminated sites." (Van Meter, et al, [Polycyclic aromatic hydrocarbons affect survival and development of common snapping turtle (Chelydra serpentina) embryos and hatchlings - ScienceDirect]).

One of the main arguments made by Evergreen to support the lack of risk to the redbelly turtles is based on their habitation of the identified waterbodies:

> for Eastern redbelly turtles and they have also been observed in these habitats (**Appendix F**). Based on the fact that Waterbody A, the Mingo Creek Flood Control Basin, and the Schuylkill River shoreline provide suitable habitat for the Eastern redbelly turtle and redbelly turtles have re-colonized Waterbody A after significant removal efforts, the local Eastern redbelly turtle population does not appear to be adversely impacted by conditions in Waterbody A, the Mingo Creek Flood Control Basin, or the Schuylkill River as a result of current refinery operations.

Ecological Risk Assessment, Page 6.59 (emphasis added). This conclusion is unsubstantiated, since the turtle population was not compared to a similar, uncontaminated area as required by the Technical Guidance Manual. This issue is discussed in more detail below (section D).

c. Evergreen ignores potential exposure to redbelly turtle eggs from surface soil contamination, which can affect their viability.

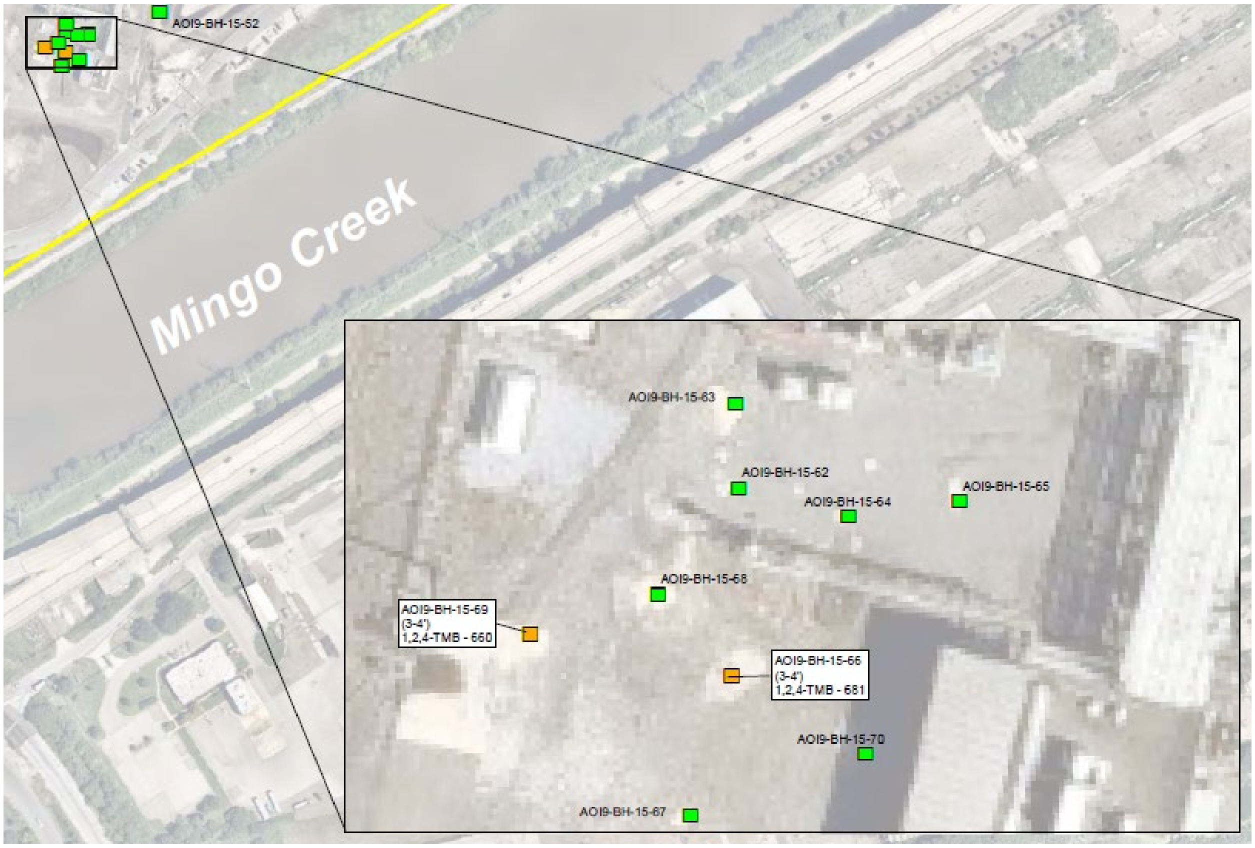
As noted in (b), Evergreen's report identified several routes of exposure for the turtles, all of which are related to ingestion of surface water or food. *See* Ecological Risk Assessment, page 5.32. However, Evergreen ignores a potential exposure route due to soil contamination – in particular, that relating to the turtle eggs.

Evergreen acknowledges that the turtles wander and breed on land:

> **3.2.7 Eastern Redbelly Turtle (*Pseudemys rubriventris*)**
>
> The Eastern redbelly turtle is distributed in the Mid-Atlantic coastal plain from southern New Jersey to North Carolina and westward along the Potomac River to eastern West Virginia. There is a disjunct population in Plymouth County, Massachusetts. In Pennsylvania, the turtle was historically common along the Delaware River and its major tributaries and along the lower Susquehanna River. Habitat destruction and pollution have almost eliminated this species from those areas. The turtle inhabits relatively large deep water bodies including creeks, lakes, ponds, and marshes. The omnivorous turtle occurs in both freshwater and brackish conditions and prefers water bodies with soft, muddy bottoms and an abundance of aquatic vegetation (Davis, et al., 1992). This species also depends on abundant basking sites and spends a great deal of time basking on logs and downed trees (PNHP, 2011). The Eastern redbelly turtle wanders on land in early spring and fall during the breeding period. It typically lays eggs in a nest dug in soft soil in an open area usually within 100 yards of water. It often nests in tilled or disturbed soil. A clutch of eight to twenty eggs is laid in June to July, hatching 10-15 weeks later. The turtle reaches sexual maturity in 5-6 years (Davis, et al., 1992).

See Ecological Risk Assessment, pages 3.12 - 3.13 (emphasis added). But Evergreen does not use this information in undertaking the risk assessment.

This is important because remedial investigation reports show lead contamination in the soil near some of the identified turtle habitats. For example, sampling near Mingo Creek shows high concentrations of lead in nearby surface soil:



See [Remedial Investigation Report]() (AOI-9) (2015), Figure 11: Summary of Surface Soil Sample Exceedances, PDF page 177 of 180. The following is a summary of some of these lead concentrations:

Surface Soil Sample	Concentration
BH-15-69	1140 mg/kg
BH-15-66	1060 mg/kg
BH-15-70	936 mg/kg
BH-15-64	785 mg/kg

See id., Table 5: Summary of Surface Soil Analytical Results, pages 70-106.

Even if there are limited data on the effect of lead on redbelly turtle eggs, Evergreen could have applied data regarding the effect of lead on other turtle species' eggs and hatchlings. Lead was shown to adversely affect behavior, growth, and survival of slider turtle (T. scripta) hatchlings (Joanna Burger, J Toxicology and Environmental Health, Part A, 55:7, 495, 1998, https://www.tandfonline.com/doi/abs/10.1080/009841098158296). High lead concentrations were linked to egg infertility in C. mydas (Ozdilek and Ozdilek, Impact of corrosive trace elements on sea turtle eggs during embryonic growth).

To evaluate whether these measured concentrations of lead in soil present in the surface soil where the redbelly turtle eggs are laid (namely, an order of magnitude between 700-5500 mg/kg), the following screening levels are relevant:

1. EPA's marine sediment value for lead is 30 mg/kg (*see* EPA Region III BTAG Marine Sediment Screening Benchmarks (July 2006), and

2. EPA's Eco-Soil Screening level for lead is 11 mg/kg for avian wildlife, and 56 mg/kg for mammals (*see* Ecological Soil Screening Levels for Lead Interim Final OSWER Directive 9285.7-70 (March 2005), Table 2.1). Even for plants, the value is much lower than those identified, at 120 mg/kg.

As demonstrated above, many soil samples near water at the site are far in excess of these screening levels.

Evergreen should conduct testing of the soil surrounding the identified habitats to characterize the levels of contamination, and provide a quantitative evaluation of the effect of this contamination on the redbelly turtle eggs. The argument that turtles survive in these areas is not persuasive, since Evergreen does not provide any evidence regarding the number or fraction of unviable eggs because of contamination in the soil.

d. The presence/absence survey for the redbelly turtles does not comply with the Technical Guidance Manual, and it does not support the claim that they are not adversely impacted by exposure to contaminants on the site.

The mere presence of a species does not necessarily indicate that local ecological conditions are adequate for maintaining the health of the population. More is expected under the Technical Guidance Manual, which contemplates conducting sampling and analysis across a gradient of contamination, and comparison with an area that is not contaminated:

> **e) Step 5 - Site Assessment for Sampling Feasibility**
>
> Ensure that the measurement endpoints are present in sufficient quantity or abundance so that sampling and analysis can be collected across a gradient of contamination and include a representative reference area.[1] If necessary, the measurement endpoints should be modified to ensure the study objectives can be met (EPA, 1997).
>
> [1] Reference area is defined as an area not contaminated by regulated substances originating on the site and used for comparison to the site (EPA, 1997). In addition, a reference area should be near the site and have similar geochemical, physical, and biological conditions, but be uncontaminated with regulated substances from the subject site (i.e., unimpacted by the site).

See Technical Guidance Manual, Section III, page III-139 (March 27, 2021) (emphasis added). Evergreen failed to do this in its studies of the redbelly turtle.

Without such a comparison to a relevant reference area, the Department cannot reasonably approve a report with a conclusory statement that the species "does not appear to be adversely impacted":

> Conestoga-Rovers & Associates (2013) completed a wildlife salvage effort within Waterbody A and removed 50 turtles from this waterbody; four of which were Eastern redbelly turtles (**Appendix E**). Since the completion of this wildlife salvage effort, Eastern redbelly turtles have re-colonized Waterbody A as evidenced by the observation of Eastern redbelly turtles in Waterbody A in 2019 (**Appendix F**). Furthermore, the Mingo Creek Flood Control Basin and the Schuylkill River shoreline have been shown to provide suitable habitat for Eastern redbelly turtles and they have also been observed in these habitats (**Appendix F**). Based on the fact that Waterbody A, the Mingo Creek Flood Control Basin, and the Schuylkill River shoreline provide suitable habitat for the Eastern redbelly turtle and redbelly turtles have re-colonized Waterbody A after significant removal efforts, the local Eastern redbelly turtle population does not appear to be adversely impacted by conditions in Waterbody A, the Mingo Creek Flood Control Basin, or the Schuylkill River or by current refinery operations.

See Ecological Risk Assessment, page 6.50 (emphasis added).

This is important because in her thesis J.E. Stone found a broad distribution in observed turtle numbers, depending upon impacts by humans. Specifically, as shown in the figure below she observed a much smaller number of redbelly turtles in wetlands more impacted by humans when compared to areas less impacted:

31

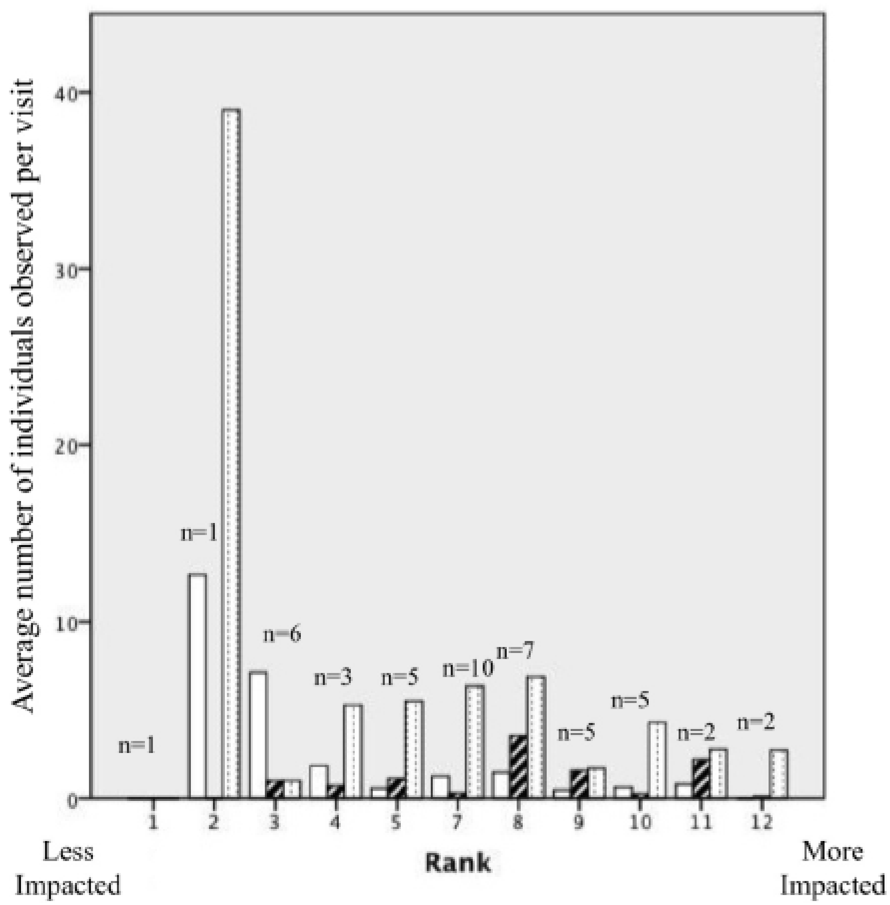


Figure 7: *Pseudemys rubriventris* (white bars), *Trachemys scripta* (striped bars), and *Chrysemys picta* (dotted bars) at wetlands by rank where 1 is least impacted and 12 is most impacted. n = number of wetlands. No turtles were observed at the four wetlands of rank 6.

See Julia Elizabeth Stone, Distribution and abundance of non-native red-eared slider turtles (Trachemys scripta elegans) and native red-bellied turtles (Pseudemys rubriventris) (June 2010), page 31. Namely, although redbelly turtles were found in the more impacted habitats, their numbers were 1/20 of the numbers in the less impacted habitats.

A similar trend was found when comparing wetland areas in public parks to those that were not:

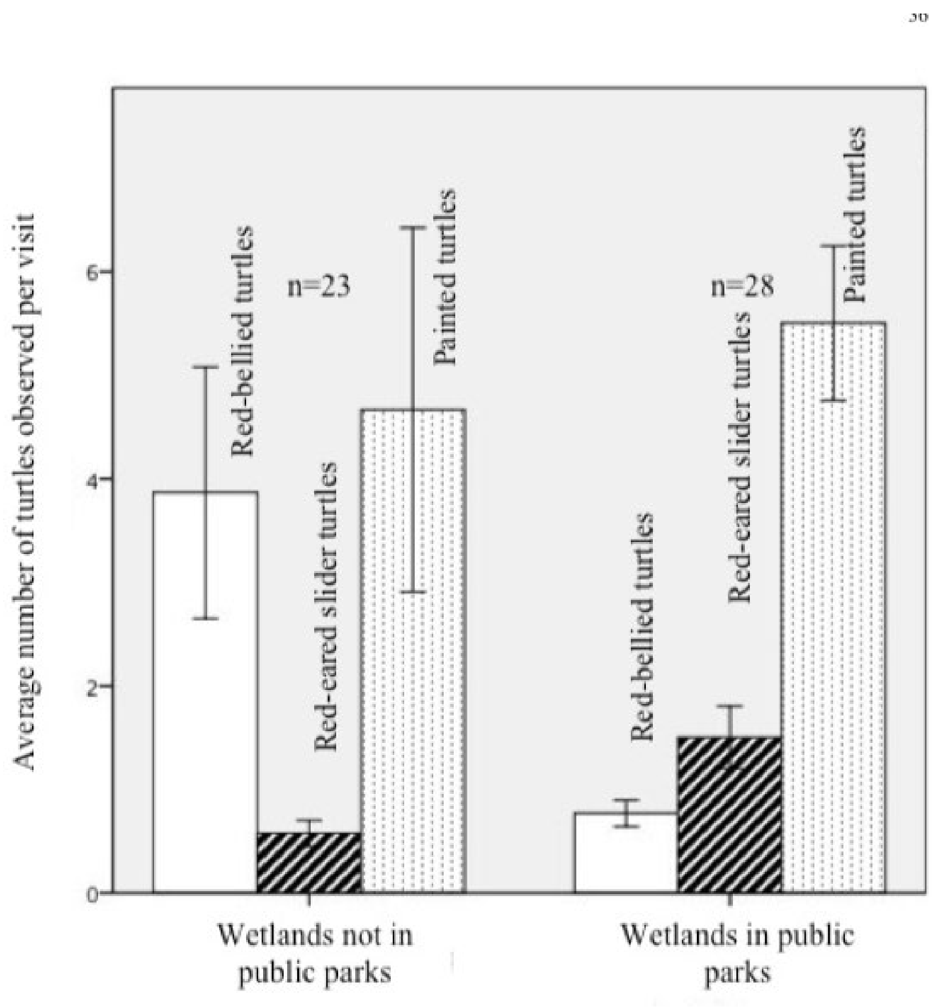


Figure 10: Average number of *P. rubriventris* (white bars), *T. scripta* (striped bars) and *C. picta* (dotted bars) observed per visit to wetlands in public parks and not in public parks. n = number of wetlands. Error bars are +/- 1 standard error.

See id., page 36.

Therefore, the Department should not accept Evergreen's circular suggestion that presence of redbelly turtles is tantamount to suitability of habitat, and even less the suggestion that this is an adequate substitute for the quantitative analysis contemplated by the Technical Guidance Manual.

5. <u>For avian species, Evergreen fails to provide an adequate risk assessment.</u>

a. Evergreen fails to provide data regarding avian species onsite, and erroneously relies on generalities that do not properly account for the site.

Evergreen's report acknowledges three avian species of concern: (1) Marsh wren (*Cistothorus palustris*), (2) Peregrine falcon (*Falco peregrinus*), and (3) Least bittern (*Ixobrychus exilis*). *See* Ecological Risk Assessment, page 3.7. But unlike other categories of species of concern (for example, the surveys for redbelly turtles in Appendix E and Appendix F), Evergreen did not even attempt to conduct a survey of these species. Evergreen disregarded Step 4 of the Technical Guidance Manual, which contemplates field studies:

> Since the habitats and species of concern are readily identified and evaluated through field studies, the investigator should emphasize population/community evaluations over less direct measures of potential impact such as laboratory toxicity testing, literature references, or media chemistry, recognizing that a combination of these evaluations is usually conducted. In addition, laboratory toxicity testing should only be conducted with species that may potentially inhabit or survive at the subject site.

See id., page III-139 (Step 4 - Problem Formulation: Conceptual Site Model, Measurement Endpoint Selection, and Study Design) (emphasis added). Evergreen did not undertake laboratory studies as a substitute for literature references, to assess either the population onsite or the effects of contaminants on the avian species. As a result, Evergreen's attempt to characterize the risk and impact of contaminants is deficient.

Evergreen also disregards the process in the Technical Guidance Manual for comparing the population to that of an uncontaminated reference site:

> e) **Step 5 - Site Assessment for Sampling Feasibility**
>
> Ensure that the measurement endpoints are present in sufficient quantity or abundance so that sampling and analysis can be collected across a gradient of contamination and include a representative reference area.[1] If necessary, the measurement endpoints should be modified to ensure the study objectives can be met (EPA, 1997).
>
> ---
>
> [1] Reference area is defined as an area not contaminated by regulated substances originating on the site and used for comparison to the site (EPA, 1997). In addition, a reference area should be near the site and have similar geochemical, physical, and biological conditions, but be uncontaminated with regulated substances from the subject site (i.e., unimpacted by the site).

See Technical Guidance Manual, Section III, page III-139 (March 27, 2021) (emphasis added).

Instead of the quantitative assessment contemplated by the Technical Guidance Manual, Evergreen offers qualitative and vague statements such as the following:

> **Marsh Wren Exposures.** Potentially suitable habitats for the marsh wren occur both in onsite ponds and the adjacent Schuylkill River where emergent vegetation is present.
>
> ….
>
> **Peregrine Falcon Exposures.** Potentially suitable habitats for the peregrine falcon occur both onsite and in nearby offsite locations.
>
> ….
>
> **Least Bittern Exposures.** Potentially suitable habitats for the least bittern occur along the shorelines of onsite ponds and the adjacent Schuylkill River where emergent vegetation is present.

See Ecological Risk Assessment, page 9.55 (Section 9, Summary and Conclusion). Namely, Evergreen does not offer any relevant data regarding the habitats and the avian population, relying instead on conjecture. To illustrate, the following is a discussion relating to the marsh wren:

> **Marsh Wren Risks.** Limited data from the Schuylkill River indicate COPECs are present in surface water and sediment at relatively low levels, and modeling efforts show concentrations of COPECs below ecological screening values in surface water. COPEC data are not available for the onsite ponds or the Mingo Creek Flood Control Basin, but modeling efforts for Mingo Creek Flood Control Basin show concentrations of COPECs below ecological screening values. VOCs and lead do not bioaccumulate in food items of the marsh wren (insects) and PAHs are readily metabolized and excreted by the marsh wren. Therefore, substantial ecological impacts to marsh wrens from exposure to site-related COPECs at the facility are unlikely. Furthermore, the jurisdictional agency (PGC) determined that no impact to the marsh wren is anticipated.

See id., page 9.57. Again, Evergreen offers a risk assessment that does not follow the regulations or the Technical Guidance Manual, reaching unsubstantiated "no impact" conclusions.

Evergreen does not substantiate its assertion that "PAHs are readily metabolized and excreted by the marsh wren." *See id*. This assertion is also contradicted by the study of Custer, et al, who found high PAH levels in house wrens (Custer, T.W., et al, Polycyclic aromatic hydrocarbons, aliphatic hydrocarbons, trace elements, and monooxygenase activity in birds nesting on the North Platte River, Casper, Wyoming, USA - Custer - 2001 - Environmental Toxicology and Chemistry - Wiley Online Library). Other studies have found bioaccumulation of PAHs in a variety of bird species (*see* Dhananjayan and Muralidharan, Levels of Polycyclic Aromatic Hydrocarbons, Polychlorinated Biphenyls, and Organochlorine Pesticides in Various Tissues of White-Backed Vulture in India; X. González-Gómez, et al, Non-invasive biomonitoring of organic pollutants using feather samples in feral pigeons (Columba livia domestica) - ScienceDirect; C. Pérez, et al, https://www.researchgate.net/profile/Cristobal-Perez-4/publication/5529441_Monitoring_Polycyclic_Aromatic_Hydrocarbon_Pollution_in_the_Marine_Environment_after_the_Prestige_Oil_Spill_by_Means_of_Seabird_Blood_Analysis/links/5a546b9daca2725638cbadc8/Monitoring-Polycyclic-Aromatic-Hydrocarbon-Pollution-in-the-Marine-Environment-after-the-Prestige-Oil-Spill-by-Means-of-Seabird-Blood-Analysis.pdf; J .F. Provencher, et al, Polycyclic aromatic compounds (PACs) and trace elements in four marine bird species from northern Canada in a region of natural marine oil and gas seeps - ScienceDirect; I. Waszak, et al, Estimation of native and alkylated polycyclic aromatic hydrocarbons (PAHs) in seabirds from the south coast of the Baltic Sea | SpringerLink).

Evergreen also asserts there is no risk to the least bittern because "PAHs do not bioaccumulate in fish (least bittern's preferred food) to a significant degree." *See* Ecological Risk Assessment, page 9.58. This is erroneous because studies have found that PAHs do accumulate in fish (*see*, for example, Olayinka OO, et al, Polycyclic Aromatic Hydrocarbons in Sediment and Health Risk of Fish, Crab and Shrimp Around Atlas Cove, Nigeria - PMC; Dhananjayan and Muralidharan, Polycyclic Aromatic Hydrocarbons in Various Species of Fishes from Mumbai Harbour, India, and Their Dietary Intake Concentration to Human).

Evergreen states that substantial ecological impact is not expected to the avian species of concern at the facility, dismissing the potential exposure routes using vague and unsupported statements.

b. The report discounts and fails to properly account for potential exposure routes, in particular to lead, that can affect the risk assessment of the marsh wren (*Cistothorus palustris*).

The site is known to be heavily contaminated by several contaminants, including the soil in vicinity of the habitat areas relevant to the marsh wren (*see* Comment #4(b) above as it relates to the redbelly turtles). The report lists the following exposure routes to the marsh wren:

- Ingestion of COPECs in surface water from the Schuylkill River
- Ingestion of insects that have accumulated COPECs from surface water and sediment in the Schuylkill River
- Ingestion of COPECs in surface water from onsite ponds and Mingo Creek Flood Control Basin
- Ingestion of insects that have accumulated COPECs from surface water and sediment in onsite ponds and Mingo Creek Flood Control Basin

See Ecological Risk Assessment, page 5.29. However, Evergreen concludes that "substantial impacts … are not expected":

> Although it is assumed that the Evergreen COEPCs are present in surface water and sediment in the onsite ponds, the Schuylkill River, and the Mingo Creek Flood Control Basin adjacent to the facility, based on the lines of evidence presented in this section, substantial impacts to marsh wrens at the facility are not expected. Furthermore, the jurisdictional agency (PGC) determined that no impact to the marsh wren is anticipated.

See id., page 6.37 (emphasis added). From the reasoning provided in the report (*e.g.,* the suggestion that insects ingested by the marsh wren do not accumulate lead and other contaminants), one would get the impression that exposure and accumulation of lead and other contaminants in marsh wrens is unlikely, regardless of site contamination. *See id.*, pages 6.35 - 6.37.

Evergreen's assumptions are contradicted by a report submitted to the New Jersey Meadowlands Commission that found lead in the eggs, feathers and blood of marsh wrens. *See* New Jersey Audubon Society, Contaminant Levels and their Effects in Birds Breeding in the

Hackensack Meadowlands (December 14, 2009), pages 30-32. That report identified several pathways of exposure;

> Birds take up lead into their tissues through diet and inadvertent soil consumption. In people, Pb is of particular concern for infants and young children because it can affect their developing brain and nervous system (Eisler 1985). Similarly, the presence of lead in blood can have serious health consequences for birds, including reduced weight gain for nestlings, reduced organ growth, and a reduced ability to sustain necessary metabolic function (Eisler 1985, Burger 1995, Burger and Gochfeld 2000a). Lead levels of 4 ppm in feathers are associated with negative effects including delayed parental and sibling recognition, impaired thermoregulation, locomotion, depth perception, and feeding behavior, thereby resulting in lowered nestling survival (Burger and Gochfeld 2000a, Burger 1995). Adverse physiological effects in birds may occur at blood lead levels as low as 0.4 ppm (Eisler 1988). Lead contamination in the NY/NJ Harbor is relatively high and originates from various sources such as leaded gasoline, lead paint chips and residues, pesticides, and incinerator and other industrial emissions (Steinberg at al. 2004). Consequently, tissue lead levels in this region also tend to be elevated (Burger pers. comm.)

See id., page 30 (emphasis added).

The dust-bath presents another potential exposure route for marsh wrens to soil contamination that was not included in Evergreen's report. *See e.g.,* Ethical Birder, Marsh Wren Dust-bathing ("Wrens will often bathe in water and then dust. It is thought that sifting dust through the plumage helps to control parasites"; Ehrlich et al., Bathing and Dusting "Wrens and House Sparrows frequently follow a water bath with a dust bath".).

As discussed above, soil near the Mingo Creek and the waterbody habitats identified in the report is highly polluted with lead, as well as benzene and some other contaminants. *See e.g.,* Remedial Investigation Report (AOI-9) (December 31, 2015), Figure 13. It is likely that contamination from the soil would present a risk of exposure to the birds.

It is well-documented that lead and other contaminants can cause an adverse effect on birds in general, and the marsh wren in particular. For example, the New Jersey Meadowlands report found a negative correlation between blood lead levels and body weight in Marsh Wrens:

> We found a negative correlation between blood lead levels and body weight in Marsh Wrens in 2006 and in Tree Swallows in 2007. This is the type of sublethal effect we would anticipate when contaminant concentrations are high, but not high enough to cause nestling mortality. We did not observe any obvious signs of lead poisoning, and most of the chicks with high lead values fledged successfully. However, lower body weights at fledging can result in lower juvenile survival.

See New Jersey Audubon Society, Contaminant Levels and their Effects in Birds Breeding in the Hackensack Meadowlands, page iii (emphasis added).

The EPA's OSWER Directive 9285.7-70 for lead sets a value of 11 mg/kg as lead Eco-SSL for Avian ground insectivores, a class that includes the marsh wren. *See* Ecological Soil Screening Levels for Lead Interim Final OSWER Directive 9285.7-70 (March 2005), Table 5.2. This value is based on food and soil ingestion, indicating that soil contamination by lead does in fact transfer by the mechanism of ingestion. *See id.*

The impact of site contamination on the marsh wren has not been examined by Evergreen as required by the Technical Guidance Manual. Instead, Evergreen has dismissed exposure routes. Evergreen should conduct a survey of the marsh wren, and it should apply the risk analysis steps as required by the 25 Pa. Code 250.311 regulations and the Technical Guidance Manual.

c. The report improperly discounts and fails to properly account for potential exposure routes, in particular to lead, that can affect the risk assessment of the Least bittern (*Ixobrychus exilis*).

Evergreen's report identifies a number of potential exposure routes for the least bittern:

1. Ingestion of COPECs in surface water and sediment from the Schuylkill River
2. Ingestion of fish and other animals that have accumulated COPECs from surface water and sediment in the Schuylkill River
3. Ingestion of COPECs in surface water and sediment from onsite ponds and Mingo Creek Flood Control Basin
4. Ingestion of fish and other animals that have accumulated COPECs from surface water and sediment in onsite ponds and Mingo Creek Flood Control Basin

See Ecological Risk Assessment, page 5.30. But Evergreen does not mention that the least bittern nests preferentially in places where water patches are interspaced with stands of woody vegetation where the birds, and their eggs could be exposed to the high levels of contaminants in the soil near the identified waterbodies onsite. *See e.g.,* TheCornellLab, Least Bittern Life History. This potential exposure route should have been accounted for in the risk assessment.

Thank you for your consideration of the comments of the Council.

____
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July 30, 2022

VIA ELECTRONIC MAIL
Evergreen Resources Group, LLC
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Re: June 30, 2022 Ecological Risk Assessment and Sitewide Fate & Transport RIR

The Delaware Riverkeeper Network and the Delaware Riverkeeper, Maya K. van Rossum, (collectively, "DRN") submit the following comments on Evergreen's June 30, 2022 Ecological Risk Assessment ("Assessment") and Sitewide Fate & Transport RIR for the former Philadelphia Refinery ("Site")

DRN is concerned that the Ecological Risk Assessment fails to account for the full panoply of risks posed to the endangered Atlantic sturgeon and shortnose sturgeon. In particular, the genetically unique population of Atlantic sturgeon in the Delaware River is at a precariously low level, with the most recent estimate of the breeding population size being merely 125–250 adults.[1] Given the dire status of this species, Evergreen must rigorously investigate any potential risk caused by contamination from the Site, and the Pennsylvania Department of Environmental Protection ("PADEP") and United States Environmental Protection Agency ("USEPA") must ensure that cleanup at the site is protective of endangered species.

The Assessment relies primarily on the assumption that because sturgeon seldom travel up the Schuylkill River, they will not be exposed to contaminants from the Site. However, the Site is immediately upstream from the Schuylkill's confluence with the tidal Delaware River, which is federally-designated critical habitat for the Atlantic sturgeon. As explained in USEPA's Ecological Risk Assessment Guidance for Superfund document, additional sampling further downstream from a site may be necessary in circumstances where contaminants of concern extend beyond initial sampling areas.[2]

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[1] White, Shannon L., Nicholas M. Sard, Harold M. Brundage III, Robin L. Johnson, Barbara A. Lubinski, Michael S. Eackles, Ian A. Park, Dewayne A. Fox, and David C. Kazyak. 2022. "Evaluating Sources of Bias in Pedigree-Based Estimates of Breeding Population Size." Ecological Applications e2602. https://doi.org/10.1002/eap.2602

[2] U.S. Envtl. Prot. Agency, Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Risk Assessments – Interim Final at 6-2 (1997), available at http://semspub.epa.gov/src/document/HQ/157941

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The Assessment does not address the degree to which contaminated sediment from the Schuylkill River deposits in the Delaware River.[3] The Assessment also does not address the movement of benthic invertebrates (either by their own volition or by current) from the areas of contaminated sediment in the Schuylkill River to the Delaware River. Additionally, the Assessment fails to differentiate between early-life-stage and adult Atlantic and shortnose sturgeon in evaluating sensitivity to contaminants, particularly via consumption of sediment and benthic invertebrates.[4]

In order to best inform remedial action at the site, the responsible parties and all government entities with oversight responsibilities must consider the effect of contaminants on all life stages of endangered sturgeon species in the Delaware River. To do so, the Assessment must be revised to evaluate the pathways of exposure in the Delaware River.

Sincerely,

Maya K. van Rossum
the Delaware Riverkeeper

Tracy Carluccio
Deputy Director

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[3] Gebret, J.A., R. Searfoss. "Chapter 4—Sediments" in the Technical Report for the Delaware Estuary & Basin. Partnership for the Delaware Estuary. PDE Report No. 12-01. June 2012. pp. 108 (estimating the mean annual sediment discharge from the non-tidal Delaware, the Schuylkill, and the Brandywin, to be 1.28 million metric tons).

[4] R. Christopher Chambrs, Dawn D. Davis, Ehrn A. Habeck, Nirmal K. Roy, & Isaac Wirgin, "Toxic Effects of PCB126 and TCDD on Shortnose Sturgeon and Atlantic Sturgeon." 31 Envtl. Toxicololgy & Chemistry 2324–37 (2012) (evaluating effects of chemical contaminants on early-life-stage sturgeon).

DOERR, TIFFANI L

From: noreply@phillyrefinerycleanup.info
Sent: Friday, July 15, 2022 8:09 PM
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Subject: New submission from Comment Submission Form

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5825 Theodore St Philadelphia, Pennsylvania 19143 United States Map It	
Report or Topic	
General Comment	
Comment	
Should be a park	