pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

September 10, 2020

Mr. Gregory D. Martin, P.G.
Roux Associates
402 Heron Drive
Logan Township, NJ 08085

Re: Bishop Tube Site
2019 Feasibility Study Report
Response to DEP Comment Letter

Dear Mr. Martin:

The Department of Environmental Protection ("DEP") has reviewed the proposed revisions to the Feasibility Study ("FS"), submitted by Roux Associates, Inc. ("Roux"), on behalf of Johnson Matthey Inc. and Whittaker Corporation (the "Bishop Tube Project Team"), on August 14, 2020. These revisions were intended to address DEP's June 18, 2020 response to Roux's April 2, 2020 letter, which provided responses to DEP's October 28, 2019 FS comment letter. DEP utilized a General Technical Assistance Contractor, Groundwater & Environmental Services, Inc. ("GES") to aide in its review. With the exception of the specific responses to proposed revisions described below, DEP accepts the additional modifications proposed in the August 14, 2020 submittal. DEP's remaining comments are listed below in text boxes presented at the end of each subject comment. The comments preceding the text box exhibit previous comments made by DEP, GES, and Roux.

Section 1.2 – Clarification of FS Scope

DEP FS Comment #2: DEP acknowledges that the current property owner, Constitution Drive Partners, L.P. ("CDP"), proposed addressing unsaturated soils as part of a planned redevelopment effort for the former Bishop Tube property ("Property"). However, CDP's plans for redevelopment have not been approved by the municipality. In addition, DEP has previously asked Roux to coordinate its RI and FS work with CDP and stated that DEP may request additional analysis of soil remediation, depending on the progress of soil remediation work. Unsaturated soils remain contaminated by historic operations on the Property and continue to act as a source of groundwater contamination. These soils also continue to pose current or potential future exposure risks through vapor intrusion and direct contact. Consequently, the unsaturated soils should be addressed in any comprehensive remedy for the Site. Any costs associated with a DEP-funded evaluation of soil cleanup alternatives and/or remedial action may be recoverable by DEP from responsible parties.

ROUX'S 4/2/2020 RESPONSE: DEP advised the BT Team that a) it had retained GES to prepare a Remedial Alternatives Analysis for Soils ("RAA-Soils") and b) the anticipated RAA-Soils is intended to complement the revised FS Report. As a result, DEP advised the BT Team that no response to Comment #2 was necessary.

DEP's June 18, 2020 letter: To clarify, DEP tasked GES with evaluating technologies for addressing unsaturated soils. GES will be providing a discussion in the RAA-Soils of technologies which may address both saturated and unsaturated soils (i.e., groundwater within the overburden zone). We anticipate that the GES discussion will include excavation, in situ thermal treatment, in situ mixing coupled with ISCR or ISCO, and multi-phase extraction. As we have discussed on the phone, DEP requests that the BT Team add a section or supplemental evaluation to the FS that discusses and evaluates remedial approaches for addressing saturated soils as a part of the comprehensive remedy for the Site. The GES evaluation should be cited in this discussion.

DEP FS Comment #2:

The FS Report includes the following sentence in multiple locations:

> "*It is anticipated that soil conditions for all constituents of concern ("COCs") may be addressed in the future by CDP. In order to select remedial action(s) for the Site, any CDP remedial action for soil on the Property needs to be considered in conjunction with the Bishop Tube Project Team's FS Report which focuses on groundwater*."

Although that was the belief at the time the FS was initiated, uncertainties exist regarding CDP's intentions, redevelopment plans for the Property, and extent of involvement in the remediation of the Site. Please update these sentences to reflect that soils will be addressed by the *remediator* and that DEP tasked GES to prepare a Remedial Alternatives Analysis ("RAA"), which needs to be considered in conjunction with the FS Report.

3.2 Geologic and Hydrogeological Framework

DEP New Comment A

On page 23 a bullet was added to address RIR Comments #39A, 39B, and 47. Please revise the paragraph as described below. Note, the new language is underlined for your reference. DEP does not expect any of these added phrases to remain underlined in the final report.

> *"A tributary of LVC on the eastern side of the Property ~~acts as~~ may be evidence of a cross-cutting zone of structural weakness (i.e., a zone of cross-cutting fractures)…… It has been proposed that when the groundwater intersects this zone of structural weakness there is preferential transport to the north and across Lancaster Avenue……These observations are consistent with the empirical groundwater data for the Site. However, data gaps in the northeastern corner of the Site Property to the east of MW-9 will require additional investigation in future pre-design activities to determine potential flow control by the tributary of LVC".*

Section 3.3.2.1 VOCs

DEP New Comment B

On page 27, in the first sentence of the first bullet the word *"adequately"* was deleted. DEP requests that this word not be deleted as that has not been fully demonstrated. The text should now read as follows:

"*The soil and groundwater data for both TCA and TCE adequately defines the nature and extent of the CVOC source areas contributing to groundwater conditions beneath the Property for purposes of this FS*."

Section 3.3.2.2 – Metals

DEP FS Comment #4. Please review the first bullet comment in the GES FS comment letter, regarding results from the SMP wells. (See GES FS Comments, pg. 2). The first conclusion in this section states that soil-to-groundwater (SGW) MSC exceedances in two SMP wells do not affect the outcome of this FS. Were soil samples collected from these monitoring wells, or is Roux referring to groundwater MSCs? In either case, a basis for concluding that these exceedances have no effect on the FS should be provided.

GES Comment: There are exceedances of the Residential Used Aquifer Soil-to-Groundwater Medium Specific Concentrations (RUA SGW MSC) for multiple parameters in several SMP wells on the east side of the stream. It is stated that these exceedances do not affect the completion of the FS without basis or explanation.

ROUX'S 4/2/2020 RESPONSE: Roux examined the comment above and concluded that the SMP well exceedances referred to in the FS Report and addressed in DEP's comment above are exceedances of the Residential Used Aquifer ("RUA") Groundwater medium-specific concentrations ("MSCs") for inorganics. The text of the statement referred to by DEP will be corrected to replace the reference to soil-to-groundwater ("SGW") MSCs with RUA Groundwater ("GW") MSCs. As discussed with DEP, these SMP wells were installed by Baker Environmental, on behalf of DEP, and the BT Team is not aware of soil samples being collected from them.

In addition, consistent with our discussions with DEP with respect to both the RIR and the FS Report, the BT Team agreed that the following footnote will be added to the revised FS Report (in Subsection 3.3.2.2, third bulleted list, first bullet, last sentence): "DEP believes that supplemental groundwater sampling for select metals may be warranted off-Property, but such sampling is not necessary for satisfactory completion of the RIR and FS Report and can be incorporated into future pre-design activities."

DEP's June 18, 2020 letter indicated that Roux's April 2nd proposed modifications adequately address DEP's comment.

DEP FS Comment #4:

Please update footnotes 28 and 29 to indicate that additional sampling for metals and fluoride respectively is not required for satisfactory completion of both the RIR and FS Report as proposed in your April 2, 2020 response.

Section 3.3.3 – Surface Water and Sediments

DEP New Comment C

While reviewing the proposed FS modifications for consistency with proposed RIR modifications, the following inconsistency was noted between a minor change to Appendix R (Ecological Risk Assessment) of the RIR and certain sections of the FS Report and the RIR.

RIR Appendix R Sections 1.2 and 3.1 were modified by replacing the word "background" with "*upgradient*" in the description of the surface water and sediment sampling area *"…extends from the area of the Amtrak railroad bridge south of the Property (i.e., ~~Background~~ Upgradient samples) to an area just north of the Conrail railroad underpass…*" This change is acceptable to DEP and, for consistency, should also be made to FS Report Section 3.3 (1st paragraph on p. 35) and Section 4.6 (2nd paragraph) and RIR Section 7.4.2 (4th paragraph), Section 9.4 (1st non-bulleted paragraph on p. 112), Section 11.3.3 (1st paragraph on p. 141), and Section 11.4.6 (2nd paragraph).

Section 5.2 – Groundwater

DEP FS Comment #5. Please review and respond to GES's comment regarding depictions of the onsite Functional Areas (FAs), particularly FA GW-1c-S. (See GES FS Comments, pg. 2) Please revise the text and figure as necessary.

GES Comment: As shown in Figure 17 of the FS, the off-site Functional Areas (FAs) match the plume extents while the on-site FAs do not. In particular, the area to the east and west of FA GW-1c-S is not included in any FA. If there are data to support excluding certain areas it would be relevant to summarize or reference in the FS, otherwise these areas should be incorporated into one of the FAs.

ROUX'S 4/2/2020 RESPONSE: Consistent with our discussions with DEP, the BT Team agreed to revise Figure 17 to expand Functional Area ("FA") GW-1c. This FA will be expanded laterally by connection of a) the west side of FA GW-1c to the southwest corner of FA GW-1a and b) the east side of FA GW-1c to the southwest corner of FA GW-1b. A consensus was reached between DEP, GES and the BT Team that this change was to satisfy the visual representation of FA GW-1c on Figure 17 and that this modification will not change the FS analysis for this FA.

DEP's June 18, 2020 letter requested that Roux provide the referenced additional proposed text/figure modifications.

DEP FS Comment #5:

The revision to the FA GW-1c-S appears to be consistent with Roux's April 2, 2020 proposed revisions. However, the functional area should match the contours in RIR Figure 46.

Section 7.1.4 – Little Valley Creek PRGs

DEP FS Comment #8: The text asserts that application of the Human Health Criteria is not appropriate in this case. The Department disagrees with this assertion, and it should be noted that waters of the Commonwealth, including Little Valley Creek ("LVC"), an exceptional value stream, are protected for all designated uses, including human consumption. As such, the FS should expand its evaluation of impacts of contamination to this surface water and address how remedial measures will comply with regulatory requirements.

ROUX'S 4/2/2020 RESPONSE: Consistent with our discussions with DEP, the BT Team agreed to modify the text of the revised FS Report to address DEP's comment. The specific language of concern to DEP (see Subsection 7.1.4, pg. 53) is as follows: "The Default Surface Water ("SW") Criteria for human health were developed using conservative surface water exposure assumptions [that are not applicable in all situations]. For example, these Default SW Criteria for human health assume that surface water is being used as a primary source of drinking water. If this is not the case, then these numeric criteria do not reflect appropriate exposure assumptions [and would not be applicable]. This and other assumptions inherent in the calculation of Default SW Criteria for human health are not consistent with the actual uses of surface water in the vicinity of the Site." [As directed by DEP, the language in brackets above will be removed from the revised FS Report]. In addition, DEP's comment suggests the FS evaluation should somehow be expanded to comply with regulatory requirements for surface water. In response to this comment, the BT Team pointed out (see Subsection 7.1.4, paragraph 2) that surface water FA Little Valley Creek ("LVC")-1 and its extent is defined in the FS Report by empirical surface water data that exceed DEP Chapter 93 human health criteria. Thus, no change to the text of the FS Report is required to address this portion of the comment above.

DEP's June 18, 2020 letter requested that a reference for the statement regarding the assumptions used in the development of the human health criteria, as well as the application of the criteria. 25 Pa. Code § 93.8c states that probable modes of exposure for human health criteria include, but are not limited to, ingestion from drinking water and fish consumption, inhalation, and dermal absorption…

DEP FS Comment #8:

The following sentence begins in the last paragraph (Surface Water – Chapter 93 Criteria) on page 63: *"……For example, these Default SW Criteria for human health assume that surface water is being used as a primary source of drinking water….."* This text is not consistent with 25 Pa. Code Chapter 93 and 25 Pa. Code Chapter 16 or EPA Methodology for Deriving Ambient Water Quality Criteria for Protection of Human Health (2000), which reference both exposures from drinking water and fish consumption in the development of human health criteria. Please replace the phrase "*as a primary source of drinking water"* with "*for drinking water and fish consumption."*

Footnote 61 was added as follows:

"See for example 25 Pa. Code, Chapter 98.8c which states: "The human health criteria, which include ***probable*** *modes of exposure (such as, but not limited to ingestion from drinking water and fish consumption, inhalation and dermal absorption)….[emphasis added]. The reference to "probable" includes a "mode of exposure" derived from "ingestion from drinking water", a primary source of estimated risk in the Chapter 93, Table 5 Default SW Criteria. Where surface water is*

not used for drinking water, then this "probable" mode of exposure does not exist. Surface water is not used for drinking water at the Site or in the surface water study area as defined herein."

Chapter 93.8 is incorrectly cited as Chapter 98.3. Please remove the emphasis on the word "*probable*", and remove the second and third sentences. Keep the fourth sentence and add a final sentence that references the Human Health Risk Assessment (HHRA) in the RIR.

Section 7.2 RAOs and BMPs

DEP FS Comment #9: The first bullet item notes that one home in the Site area utilizes a private well. During the course of RI activities, risks associated with the use of this well have been addressed by a POET system. The POET system used at the property requires proper operation and regular monitoring and maintenance to ensure that this pathway remains eliminated. The FS should address this exposure pathway.

ROUX'S 4/2/2020 RESPONSE: Based on discussions with DEP, this comment refers to an existing POET system located at 54 Conestoga Road.8 Consistent with our discussions with DEP, the BT Team agreed to incorporate future POET operation and maintenance activities (and related costs) for one home utilizing this engineering control into the revised FS Report. Where applicable, modifications will be made to text, tables and appendices in the revised FS Report.

DEP's June 18, 2020 letter that Roux provide proposed text modifications and identify the specific tables and appendices that would be revised. In addition, the text should mention the potential for future installation of wells or potential use of POETs at other homes in the vicinity.

DEP FS Comment #9:
Please note that DEP feels that the estimates provided in Tables 16 and E1 seem high considering the low concentrations of TCE observed in pre-filter sampling conducted prior to the recent ownership change. No FS modifications are requested.

DEP FS Comment #11: DEP does not agree that the Indoor Air Quality sampling to-date has demonstrated that there are no current indoor air conditions that exceed target risk thresholds. (See DEP's 2019 RIR comments.)

ROUX'S 4/2/2020 RESPONSE: Consistent with our discussions with DEP, it was agreed that the previously submitted responses to DEP's RIR Comments #27B and #28 address this comment by recognizing that there is no current unacceptable exposure but that monitoring for potential future changed conditions was warranted. Briefly, the response to DEP's RIR Comment #27B included an agreement to add supplemental language to the RIR. It is proposed that the following language being added to the RIR will also be added as a footnote to the revised FS (Subsection 7.2, third bullet, first sentence): "As part of a future remedial action performance monitoring plan to demonstrate the continued absence of IAQ9 concerns, supplemental IAQ monitoring may be warranted for 54 Conestoga Road and/or other properties." As described in Comment #10 above, the response to DEP's RIR Comment #28 acknowledges that the selected remedial action should include a) monitoring for changes in land use (i.e., new or modified occupied structures), b) monitoring for changes in groundwater use or conditions, and c) continued monitoring of certain currently occupied structures (e.g., 54 Conestoga Road) to ensure continued protectiveness. Measures to monitor and respond to changed conditions are already contained in the FS Report, thus, no changes to the FS Report were required by DEP to address this portion of the comment above.

DEP's June 18, 2020 letter requested the inclusion of a footnote to state that background air contaminants are not included with the Site-related COCs in the cumulative risk calculations for indoor air. As suggested for the RIR (See comment #25B.)

DEP FS Comment #11:

Footnote 66 was added as follows:

> *"In conformance with DEP's clarification of its protocols, background air contamination (i.e., indoor air contaminants not attributed to VI) is not included in the indoor air cumulative risk calculations for the Site-related COCs."*

In the parentheses, please add the phrase "S*ite-related*" in front of VI to provide additional clarification.

DEP FS Comment#12: DEP understands that an area of groundwater contamination should naturally attenuate over time assuming there is no input from additional sources. However, this has not been adequately demonstrated with the current data set provided in the 2019 RIR. A statistically significant data set will be required in order to establish decreasing trends and plume retraction. In addition to identifying measures which are reasonably expected to hasten the retraction of the off- Property plume over time, reducing the migration of off-Property contaminants of concern ("COC") should be included as a response action objective ("RAO").

ROUX'S 4/2/2020 RESPONSE: Consistent with our discussions with DEP, it was agreed that the previously submitted response to DEP's RIR Comment #44 addresses this comment by describing and defending the statistical trend evaluations completed as one of several lines of evidence which identify probable stable or decreasing trends in the groundwater concentrations[10]. The response to DEP's RIR Comment #44 also recognized that additional monitoring of groundwater quality will be necessary in the future and was contemplated and included in the remedial alternatives outlined in the FS. Such future monitoring is expected to continue to confirm the trends described in the RIR. As requested by DEP and discussed in the response to DEP's RIR Comments #21 and #44, the BT Team agreed to replace the term "demonstrated" with "probable" or "probably" when referring to the stable or decreasing trends in groundwater concentrations. Although not discussed directly with DEP, the BT Team proposes to make similar changes agreed to in the RIR, where appropriate, in the revised FS Report.

In addition, DEP's comment requests that the phrase "reducing the migration of off-Property COCs" be included in the response action objectives ("RAOs"). To address this, the BT Team proposes to modify the RAO language (see Subsection 7.1.4, RAO section, bullet #4) as follows: "Identify remedial measures that a) would not produce undesirable side-effects, b) are compatible with observed natural attenuation mechanisms active at the Site, c) [are reasonably expected to reduce the migration of COCs off of the Property, and d)] are reasonably expected to hasten the retraction of the off-Property plume over time. [The added language to address this comment is in brackets].

DEP's June 18, 2020 letter requested that the RAO language change be applied to Sections 7.2 and 11.4.

DEP FS Comment #12:
For consistency, in the third paragraph of Section 9.2.1, d) please replace "may" with "are reasonably expected to…." as proposed in the April 2, 2020 letter.

Section 9.4.4 – Conceptual BMPs for Little Valley Creek

DEP FS Comment #17. It should be noted that active measures to address source areas (i.e., soils) and groundwater (GW-1a-S, GW-1b-S, GW-1d, and GW-2a-S) may also help meet the antidegradation ARAR.

ROUX'S 4/2/2020 RESPONSE: Consistent with our discussions with DEP and as previously described in response to DEP Comment #13 above, it was agreed that BMPs are appropriate to address diffuse discharges to surface water as part of the anti-degradation requirements. The remedial measures for groundwater presented in the FS Report and the remedial measures for soils to be presented in the anticipated RAA-Soils being prepared by GES may serve to address, indirectly, anti-degradation goals established by Chapter 93. To address this comment, the BT Team proposes to add a footnote to Subsection 9.4.4 as follows: "In addition to the BMPs to address the anti-degradation goals, the remedial measures identified for soils and groundwater in the anticipated RAA-Soils and FS Report, respectively, may indirectly address anti-degradation goals established by Chapter 93."

DEP's June 18, 2020 letter indicated that Roux's April 2nd proposed modifications adequately address DEP's comment.

DEP FS Comment #17:
The word "*indirectly*" was not included in the revised text. Please include "indirectly" as was proposed in the April 2, 2020 letter.

Section 11.4.(2-7).2 – Balancing Criteria

DEP FS Comment #20. Please refer to the GES comment regarding ICs. (See GES FS Comments, pg. 4) Implementation of ICs as described would involve passage of a local ordinance or involve a regulatory process (through the county health department). These processes are not controlled by DEP and may be difficult to implement. Alternatives to the passage of ordinances or adoption of new regulations may include environmental covenants with all property owners within the Site boundary and routine monitoring of the Site area to assure that unacceptable exposure does not occur. These potential difficulties and alternatives should be discussed in the text.

GES Comment:
- In describing the short-term effectiveness of RA#2 (MNA) (FS Section 11.4.2.2), the time required to implement ICs is described as "minimal".
- In the Preliminary Screening Tables, ICs are identified as being "easily implemented".
- It is GES' opinion that to obtain deed restrictions/environmental covenants on the number of properties required could take substantial time and may in fact be quite challenging.

ROUX'S 4/2/2020 RESPONSE: As is customary in preparing an FS, FS screening criteria for each RA are described comparatively to one another and those comparisons are premised upon professional judgment and/or experience. Consistent with discussions with DEP and GES, the BT Team acknowledged that establishment of institutional controls ("ICs") (e.g., deed restrictions/environmental covenants) could take substantial time and may be challenging for some properties; however, these issues are expected to require shorter timeframes relative to the timeframes to design, permit, and implement active RAs considered in the FS. The BT Team, DEP, and GES agreed to add a statement, as applicable, in Subsection 11.4.2.2 and the Preliminary Screening Tables of the revised FS Report as follows: "The time and level of effort required to implement ICs are expected to be minimal and relatively easy compared to the timeframe and level of effort to design, permit, and implement active RAs."

DEP's June 18, 2020 letter indicated that Roux's April 2nd proposed modifications adequately address DEP's comment.

DEP FS Comment #20:
The proposed revisions were made in Section 11.4.2.2 and in the Preliminary Screening Tables as described in the April 2 letter, however, these revisions should be carried through in Sections 11.4.3.2, 11.4.4.2, 11.4.5.2, 11.4.6.2, and 11.4.7.2 in the same subsection (i.e., Short-Term Effectiveness).

DEP FS Comment #21: Timeframes for achieving measurable remedial objectives should be considered and discussed in the FS for each alternative in the descriptions of long-term effectiveness and permanence.

ROUX'S 4/2/2020 RESPONSE: The timeframes outlined in the FS for RA implementation and performance monitoring (pre-monitored natural attenuation ["MNA"]) were variable based on the RA, but the total duration for all Ras (inclusive of MNA) was set to 30 years as an FS-traditional basis for comparison. As agreed with DEP and GES, no changes to the timeframes in the FS Report are warranted and this comment will be addressed by adding a sentence or footnote, as applicable, in Sections 11.4.(3-7).2 of the revised FS Report as follows: "The timeframes for RA implementation and performance monitoring (pre-MNA) are specific to each RA. The total duration (inclusive of MNA) is set to 30 years for all Ras as a basis for comparison. Some refinement of timeframes for achieving measurable remedial objectives may be possible based on pre-design activities for the selected RA, which will provide information on timeframe-affecting conditions. However, because the overall timeframes for all Ras considered are at least 30 years, timeframe is not a particularly important/meaningful evaluation criterion for distinguishing among remedial alternatives. The appropriate design work plans will necessarily reflect any changes to the timeframes estimated in this FS."

DEP's June 18, 2020 letter indicated that the proposed footnote does not address DEP's comment, which was aimed at gaining additional comparative information regarding long-term effectiveness and evaluating whether MNA is capable of achieving RAOs in a reasonable time period versus another alternative, such as ISCO which may result in immediate reductions. The letter requested that the following text be deleted from the proposed footnote: *"However, because the overall timeframes for all RAs considered are at least 30 years, timeframe is not a particularly important/meaningful evaluation criterion for distinguishing among remedial alternatives."* The letter also requested that Roux propose additional text to compare the different remedial alternatives and provide a discussion of the comparative analysis by ranking each alternative in terms of timeframes for reducing offsite migration and hastening plume retraction (both RAOs).

DEP FS Comment #21:

To provide additional context, please replace the proposed text with this suggested language:

"*The timeframes for RA implementation and performance monitoring (pre-MNA) are specific to each RA. The total duration (inclusive of MNA) is set to 30 years for all RAs as a basis for comparison. Some refinement of timeframes for achieving measurable remedial objectives may be possible based on pre-design activities for the selected RA, which will provide information on timeframe-affecting conditions. The appropriate design work plans will necessarily reflect any changes to the timeframes estimated in this FS Report.*"

Appendix A, B, and C

DEP FS Comment #27. Please review and respond to GES's comment regarding grid spacing for in-situ injection options. (See GES FS Comments, pg. 5)

GES Comment: A grid approach with 10-foot radius of influence for overburden is typical but may not be appropriate or necessary to administer amendment for ISCO, ISCR, or ERD in fractured bedrock as assumed in Appendix A, B, and C and Table E-2. A predesign investigation which may include tracer testing, hydraulic testing, and/or borehole geophysics to better understand connections between fractures would likely substantially reduce the number of injection points needed for bedrock treatment.

ROUX'S 4/2/2020 RESPONSE: The 10-foot radius of influence for in-situ injections is based on a) professional judgment and b) a conservative density (i.e., more dense than suggested by GES) of injection points in recognition of the variable overburden thickness, pinnacled bedrock surface conditions, and the complex fractures in shallow bedrock with varying degrees of transmissivity. Based on discussions with DEP it was agreed that a) pre-design work would be required, if this remedial alternative is selected by DEP, to more accurately establish an injection spacing design and b) that there was no material effect on remedial decision-making given the assumed 10-foot spacing in the FS Report. Consistent with our discussions with DEP, the BT Team will add the following language as text or a footnote, as applicable, in Appendices A, B, and C of the revised FS Report: "A conservative 10-foot radius of influence was used for in-situ amendment injections. Based on DEP input, this assumption may be overly conservative, especially with regard to the shallow bedrock aquifer. However, since this assumption is uniformly applied to all of the applicable in-situ injection remedial alternatives, the assumption does not affect remedy selection. The assumed 10-foot radius of influence is predicted to be a minimum radius of influence for shallow bedrock and a more refined estimate of the injection radius of influence for both overburden and shallow bedrock may be determined, if this remedial alternative is selected by DEP, from pre-design testing."

DEP's June 18, 2020 letter indicated that Roux's April 2nd proposed modifications adequately address DEP's comment.

DEP FS Comment #27:

The proposed footnote was added in Appendix A (FN 6, 9, 16, 20), Appendix B (FN 6, 8, 14, 17), and Appendix C (FN 3). However, in the footnote the wording proposed in the April 2, 2020 letter was modified by changing "*conservative*" to "*conservatively small*". Since the GES comment was specifically referring to the ROI estimated for bedrock (not the overburden), the more general term "*conservative*" should be used to describe the estimate.

Appendix E Table E-2

DEP Comment #29. Please respond to GES's comments (first 2 bullets) regarding the technical basis for EHC® In Situ Chemical Reduction Reagent, permanganate and persulfate loading rates. (See GES FS Comments, pg. 6)

GES Comments

- Loading rates for EHC and permanganate need more technical basis.
- Oxidant demand (oxidant volumes) are typically based on COC and non-COC mass (natural oxidant demand). The FS states mass cannot be calculated. What was the basis for the persulfate mass loading rate from the vendor which then served as the basis for the EHC and permanganate loading rates?

ROUX'S 4/2/2020 RESPONSE: As discussed with DEP and as described in the response to DEP Comment #19, preliminary/gross approximations of COC mass were calculated for the GW-1a-S FA (i.e., the source area with the highest COC concentrations) and these preliminary/gross approximations were used to estimate initial in-situ remediation amendment demand factors for GW-1a-S FA that were extrapolated for use in other FAs. In response to the DEP's Comment #19, the BT Team proposed to add a footnote to the revised FS Sections 11.4.(3-6).2 regarding implementability as follows: "The preliminary/gross approximations of COC mass and the assumptions used to calculate in-situ amendment demands are provided in applicable appendices of this FS Report. An attempt at more detailed mass calculations would not be any more accurate in establishing in-situ amendment demands for the Site. If this remedial alternative is selected by DEP, then refinement of in-situ amendment demands for the Site would be expected to occur as part of future pre-design and/or pilot test studies."

Consistent with our discussions with DEP, the BT Team agreed to add supplemental text to applicable appendices to describe the methods employed to estimate amendment demands and related loading rates. A description of the methods employed and summary of the supplemental text is presented below.

The process for calculating in-situ remediation amendment quantities for RA evaluation in the FS Report consisted of establishing a base amendment loading rate for each remedy type (i.e., ISCO, in-situ chemical reduction [ISCR], ERD, and in-situ activated carbon [ISAC]). Base amendment loading rates were derived using a combination of COC stoichiometry involving gross COC mass approximations established from COC concentrations and groundwater volumes in the GW-1a-S FA (i.e., the source area with the highest COC concentrations), an assumed natural oxidant demand (e.g., 2 grams of oxidant per kilogram of soil in overburden), and amendment specifics (e.g., oxidizing potential), with additional input from amendment vendors, engineering experience from other projects, and published technical information. To determine the amendment volume required for each FA-specific RA evaluation, amendment loading rates were applied to the pore volumes requiring treatment within each FA. When determining the amendment volumes for each FA, amendment demand factors were adjusted slightly based on engineering judgment to account for amendment persistence, ability to distribute the amendment throughout the targeted treatment volume, ability to maintain the amendment in the targeted area, and amendment-specific

downgradient effects. Input regarding these factors was also solicited from in-situ amendment injection contractors.

Consistent with our discussions with DEP, the amendment loading design processes described above will be presented in greater detail within each of the conceptual remedial approach appendices where in-situ remedies are included in the RA evaluation (i.e., Appendices A, B, and C). Additional amendment loading design detail will also be provided in the design spreadsheets included in Appendix E (Cost Estimates for Remedial Process Options).

DEP's June 18, 2020 letter requested that Roux provide the referenced additional proposed text/figure modifications.

DEP FS Comment #29:
Please revise the Introduction Section text in Appendix B to reference the correct FA (i.e., GW-2a-S).

We request that Roux provide all of the proposed text revisions, figures, and/or tables by September 25, 2020. We respectfully believe that the requested changes are not time-intensive and can be accomplished within this timeframe. If Roux requires further clarification or wishes to discuss the comments provided above, please incorporate time for these discussions into the requested timeframe.

If you have any questions or wish to schedule a technical discussion, please feel free to contact Dustin Armstrong at darmstrong@pa.gov or by phone at 484.250.5723.

Sincerely,

/s/ Dustin A. Armstrong

Dustin A. Armstrong
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Dustin A. Armstrong
Environmental Protection Specialist
Environmental Cleanup and Brownfields

/s/ Richard M. Staron

Richard M. Staron
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Richard M. Staron, P.G.
Professional Geologist Manager
Environmental Cleanup and Brownfields

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