UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5

DATE: February 15, 2011

SUBJECT: Comments on Responses by Geosyntec Consultants on behalf of Carus Corporation to U.S. EPA Technical Comments on the Revised Draft Report Biological Assessment of the Little Vermilion River Adjacent to the Matthiessen and Hegeler Zinc Company Site LaSalle, Illinois, 8 February 2011

FROM: James Chapman, Ph.D., Ecologist

TO: Demaree Collier, RPM

Comments are listed under the headings used in the 2/8/11 responses with excerpts or summary of the RESPONSE. Once addressed, comments are not repeated when an issue is raised again in a subsequent response.

1) Section 2.0 - METHODS - p. 3:

RESPONSE: Macroinvertebrate sampling for the biological assessment (BA) of the Little Vermilion River (LVR) could not be entirely consistent with Illinois Environmental Protection Agency (IEPA) 2007 protocol because that protocol does not address the application of the sampling method to half of a river, as EPA and its contractor, SulTRAC, required for the BA. This fact was acknowledged in Field Sampling Plan Addendum No. 1 (FSP), which stated (on page 21) that the sampling would be in "general accordance" with the protocol and that the sampling would be done "by distributing the jabs proportionally among the multiple habitats present."

COMMENT: The split river design had no impact whatsoever on the required allocation of bank-zone jabs and bottom-zone jabs per sample reach in the IEPA (2007) protocol. According to IEPA (2007) sampling protocol, jabs are to be distributed proportionally among multiple habitats, but the distribution should be evaluated separately for the bank-zone habitats (to proportionally allocate the specified number of band-zone jabs) and for the bottom-zone habitats (to proportionally allocate the specified number of bottom-zone jabs). The specified allocation of bank- and bottom-zone jabs for a given stream width is unchanged whether the sampling reach includes both banks and all of the bottom width between the opposing banks, or if the sampling reach includes only 1 bank and ½ of the adjacent bottom width. When both the number of banks and the width of bottom are divided in half to implement a split river design, the relative proportions of bank- and bottom-zones are unchanged.

The departure from the IEPA (2007) sampling protocol appears to have arisen from the same inattention to detail that resulted in invalid and inflated mIBI calculations in the initial draft submittal (May 2010) in which macroinvertebrate data were not standardized (by aggregating

taxonomic data to genus) according to the cited IEPA protocol. In discussions, the lead Geosyntec Consultants investigator stated he read the data standardization section of IEPA's mIBI guidance, but neglected to implement the required procedure.

RESPONSE: Lengthy discussion of conference call with Tetra Tech representatives involved in the preparation of Tetra Tech (2000).

COMMENT: The Tetra Tech representatives were contacted under the mistaken impression that they collected the macroinvertebrate field data analyzed in Tetra Tech (2000). Tetra Tech representatives initially stated they did not remember how the macroinvertebrate field data were collected, then stated that it was collected in proportion to habitat by reach, but, after further questioning, admitted they were not involved in the data collection and were tasked with analyzing an existing set of macroinvertebrate field data collected by IEPA, not Tetra Tech. Tetra Tech's opinion of the procedures utilized in a data collection effort that did not include Tetra Tech participation is a weak line of evidence, particularly when IEPA, the agency that did, in fact, collect the field data, states that the data were collected consistent with IEPA's macroinvertebrate sampling protocol.

Tetra Tech representatives offered two additional suggestions to help evaluate potential effects due to metals and to habitat differences. They asked whether there is evidence of on-site effects on Ephemeroptera (there are in some locations) as line of evidence for metals-related toxicity. The other was to more closely look at potential habitat differences between on-site and reference locations. In response to a verbal description of the reference and on-site conditions by Geosyntec Consultants, they expressed the opinion that the reference reach was not well matched with on-site on-site reaches, and, in the absence of site-related effects, would expect that the on-site locations would have higher mIBI scores compared to the reference location. They suggested that, because of the stream condition differences, roughly equivalent mIBI scores in reference and on-site locations could be an indication of on-site impacts. In other words, the Tetra Tech representatives consider habitat differences to be a possible confounding factor in interpreting the macroinvertebrate survey data collected for the Biological Assessment.

RESPONSE: Despite the marked differences between the 20-jab sampling method utilized in the 2001 sampling and the historic handpick method, Tetra Tech's analysis seemed to show that they performed about the same. As shown in Table 2 of Tetra Tech (2007), the 20-jab and handpick methods performed almost the same in correctly scoring known "most disturbed" sites using the 2000 Stream Condition Index. Tetra Tech also concluded that the revised Stream Condition Index (which ultimately became IEPA's mIBI index) "performed comparably to the old SCI with both the older data set (689 hand pick samples) and the pilot study data (158 – 20-jab 300 organism samples)."

The difference between the 20-jab sample allocation used by Geosyntec and the 20-jab sample allocation per the IEPA 2007 protocol is a minor sample method difference when compared to the difference between the handpick method and any version of the 20-jab method. Thus, while the general comparability in predictive results achieved by the handpick method and the 20-jab method underlying the Tetra Tech (2007) does not directly show the comparability of the two methods of allocating the 20-jabs, it suggests that they would likely produce comparable results.

COMMENT: The Response provides an indirect line of evidence that the sampling protocol departure is unlikely to result in large differences in outcome. However, other lines of evidence, also indirect, indicate that habitat differences can confound assessment of localized impacts through macroinvertebrate survey methods. Comparisons of benthic survey data from two freshwater habitats, riffle and snag, have shown significant effects of habitat on macroinvertebrate metrics and the consequent classification of stream quality. Findings are quoted a length below:

> "The weakness of using multi-habitat sampling for environmental assessment is that the taxa collected from a site may be weighted to the spatially dominant habitat type, and streams are assessed according to the particular habitat type represented rather than water quality or general environmental health ... Therefore, in making comparisons among streams, multi-habitat samples may introduce interhabitat variation that can potentially mask water quality differences among sites. …
>
> About 64% of the 47 macroinvertebrate measures we tested differed significantly between riffles and snags. Eighty percent intercepts of regressions between biotic indices and urban or agricultural land uses differed significantly between riffles and snags. The Hilsenhoff biotic index calculated from snag samples explained 69% of the variance of riffle samples and classified 66% of the sites into the same stream health group as the riffle samples. However, four multimetric indices for snag samples explained less than 50% of the variance of riffle samples and classified less than 50% of the sites into the same health group as the riffle samples. …
>
> The significant difference in macroinvertebrate measures between riffle and snag habitats, especially measures of feeding function and ETP groups, also potentially influences the outcome of macroinvertebrate environment assessments using multimetric indices. … It is substantial that for about half of our macroinvertebrate feeding measures, values for one habitat were more than double those for the other habitat, and for the other half of feeding measures, values for one habitat were 50% higher on average than for the other habitat. The EPT measures were 32% higher for one habitat than for the other habitat. If not corrected, such a large difference in the two macroinvertebrate groups between riffle and snag habitats could introduce substantial bias into the bioassessment results." (Wang, et al. 2006).
>
> "Analysis of covariance indicated that samples from snag and riffle habitats differed significantly in their response to the urbanization gradient for the Hilsenhoff biotic index (BI), Shannon's diversity index, and percent of filterers, shredders, and pollution intolerant Ephemeroptera, Plecoptera, and Trichoptera (EPT) at each stream site ($p \leq 0.10$). These differences suggest that although macroinvertebrate assemblages present in either habitat type are sensitive to detecting the effects of urbanization, metrics derived from different habitats should not be intermixed when assessing stream quality through biomonitoring. …
>
> Stream quality metrics calculated from samples collected from snag habitats consistently indicated more degraded stream quality than those calculated from samples collected at riffle habitats at the same site. It is likely, therefore, that the physical habitat in these streams

directly affects the estimation of water quality attributes based on the macroinvertebrates." (Stepenuck, et al. 2008).

Similarly, the sensitivity of macroinvertebrate metrics to dam-related stressors (combined physical stressors related to altered water flow and chemical stressors related to sediment accumulation) differ depending on whether the macroinvertebrate data were collected from bank-zone habitat or from bottom-zone habitat (both sampled upstream of dams) (Colas, et al. 2011). In this particular example, benthic metrics based on bank-zone sampling were more sensitive to dam-related effects compared to metrics based on bottom-zone sampling. The reported relative sensitivities of bank- and bottom-zone macroinvertebrate metrics in the lentic (impounded water) environment of the study are likely different from the relative sensitivities of bank- and bottom-zone metrics in a lotic (free flowing water) environment because of differences in the bottom-zone physical characteristics in standing and free-flowing waters. The relevant point for this discussion is not the specific sensitivities reported by Colas, et al. (2011), but the fact that macroinvertebrate samples from bottom- and bank-zone habitats gave different indications of the impact of local stressors.

These studies, while not directly measuring effect of the lotic bank- vs bottom-zone allocation issue raised by the departure from IEPA macroinvertebrate sampling protocol in the surveys performed for the Biological Assessment, provide lines of evidence that habitat-related confounding effects can affect multi-habitat benthic metrics and influence assignment of stream quality categories in investigated reaches.

IEPA is cognizant of the habitat confounding effect as reflected in the draft protocol for detecting facility-related impacts to streams in which benthic samples are segregated by habitat, each habitat is sampled with the same intensity, and upstream-downstream comparisons are performed exclusively on the basis of matched habitats defined as "the subset of identical habitat types (e.g., cobble in fast velocity etc.) that co-occur at each and every monitoring site in a given FRSS" (Facility Related Stream Survey) (IEPA 2010).

Colas, F., V. Archaimbault, and S. Devin. 2011. Scale-dependency of macroinvertebrate communities: Responses to contaminated sediments within run-of-river dams. Sci Total Environ 409: 1336-1343.

IEPA. 2010. Methods of Sampling Wadeable Stream Macroinvertebrates for Detecting Chemical Impacts from Point-Source Discharges. 11 August 2010. Draft.

Stepenuck, K., R. Crunkilton, M. Bozek, and L. Wang. 2008. Comparison of macroinvertebrate-derived stream quality metrics between snag and riffle habitats. J Amer Water Resour Assoc 44(3): 670-678.

Wang, L., B. Weigel, P. Kanehl, and K. Lohman. 2006. Influence of riffle and snag habitat specific sampling on stream macroinvertebrate assemblage measures in bioassessment. Environ Monitor Assessm 119: 245-273.

2) Section 2.4 - Benthic Macroinvertebrate Community Sampling - p. 13-14:

RESPONSE: Allocation of the proportional bank zone/bottom zone sampling method was specifically developed by IEPA to be applied to the full width of a stream segment -- not for river segments split in half length-wise. The IEPA 2007 sampling protocol simply has no discussion of how it should be applied in such a circumstance. That IEPA never contemplated such an application of its protocol seems obvious from their comments on the original Draft BAR. Those comments included questions suggesting that IEPA was uncertain whether the allocation percentages specified in the 2007 protocol for the full width of the river or half the width of the river would be used. In that context, it is unclear how EPA can support their interpretation of a sampling protocol developed by another agency with such certainty.

COMMENT: The RESPONSE correctly points out that IEPA (2007) does not discuss an approach for a split-river study design. The suggestion in IEPA's comments that the bank- and bottom-zone allocations should be based on a stream of one-half the width of LVR to accommodate the split-river design is incorrect because this would assume the presence of an additional set of banks in mid-stream. It should be noted that IEPA, in the same set of comments, correctly identified the original errors in the mIBI calculations of the initial draft of the Biological Assessment, but incorrectly identified the source of the error (attributed to failure to remove air breathing insects from the taxa lists, when the actual error was failure to aggregate taxa by genus, not by species). The misidentification of the source of the error in the original mIBI calculations had no bearing on the necessity of correcting the actual source of the error. Similarly, the mistaken comment on bank- and bottom-zone allocation does not change the fact that the departure from IEPA protocol introduces additional uncertainty in interpretation.

5) Section 3.2.5 - Fish Community Index of Biotic Integrity (fIBI) p. 30-31:

RESPONSE: Geosyntec will make appropriate revisions to the text of the Final BAR to make reference to the commenter's understanding of why the adjusted fIBI calculation was suggested.

While we have agreed to make these revisions, Geosyntec does not, for the record, recall the discussion at the 5 October 2010 resulting in the "explicitly stated" rationale described by the commenter. Rather, it seemed to us that the Revised BAR correctly reflected the reasons for the additional work. The Revised BAR is consistent with IEPA guidance that suggests an adjusted fIBI calculation if there is a concern with the precision or accuracy of the fIBI because "the total number of individuals in a sample is low" (IEPA, 2000). In addition, the IEPA guidance makes no reference to incompatibility of fish sampling methods and, in fact, has criteria for inclusion of sampling data irrespective of the methods of collection (IEPA, 2000 at page 9).

COMMENT: For the record, the explicitly stated rationale described by the commentator was, in fact, made by James Chapman, U.S. EPA, at the meeting to Geosyntec because it was obvious, by the arguments made by Geosyntec that the request to perform the adjusted fIBI calculation was inappropriate because the fish sample numbers met IEPA's requirements, that Geosyntec did not understand the reason for the request. Dr. Chapman explicitly clarified at the meeting that the request was not related to fish numbers but to provide a line of evidence whether the use of backpack electroshockers in this stream width may have introduced uncertainties for comparing

site values to IEPA regional values due to possible differences in sampling effectiveness. Geosyntec did not dispute this clarification, or continue to argue after the clarification that the adjusted fIBI calculation was inappropriate because the fish numbers met IEPA requirements.

As pointed out in the RESPONSE, the request to perform the adjusted fIBI calculation was not based on IEPA guidance, but was suggested as a means of evaluating the possible significance of the difference in the sample methods used by IEPA and Geosyntec. Since this aspect of the fish sampling methods (related to stream width) is not included in IEPA's protocol, no one is, or did, imply that the selection of backpack equipment for the Biological Assessment was inappropriate. IEPA identified the fish sampling method as a possible source of uncertainty, and suggested an approach to evaluate the potential significance. The rationale was clear to everyone except, apparently, Geosyntec, even after the misunderstanding was pointed out in the meeting.

Geosyntec consultants

Responses by Geosyntec Consultants on behalf of Carus Corporation to

U.S. EPA Technical Comments on the Revised Draft Report Biological Assessment of the Little Vermilion River Adjacent to the Matthiessen and Hegeler Zinc Company Site LaSalle, Illinois

8 February 2011

On 21 December 2010, the United States Environmental Protection Agency (EPA) delivered to Geosyntec Consultants (Geosyntec) technical comments on the November 2010 Revised Draft Report, Biological Assessment of the Little Vermilion River adjacent to Matthiessen and Hegeler Zinc Company Site, LaSalle, Illinois (Revised BAR). This document contains responses to those comments. The EPA comments appear in black italics, and Geosyntec's responses appear in normal font. Unless otherwise indicated, abbreviations and citations to reference documents used in these responses are consistent with the Revised BAR.

1) ***Section 2.0 - METHODS - p. 3:***

The method for macroinvertebrate sampling was inconsistent with the IEPA protocol (IEPA 2007) cited in the Field Sample Plan (FSP). Comparison of site macroinvertebrate Index of Biological Integrity (mIBI) values with IEPA " 'best value' (macroinvertebrates) based on IEPA's study and assessment of … macroinvertebrate communities in stream systems that are least disturbed by human impacts and similar in watershed/habitat characteristics to the Little Vermilion River" are invalid and should be removed from the Biological Assessment.

RESPONSE: Macroinvertebrate sampling for the biological assessment (BA) of the Little Vermilion River (LVR) could not be entirely consistent with Illinois Environmental Protection Agency (IEPA) 2007 protocol because that protocol does not address the application of the sampling method to half of a river, as EPA and its contractor, SulTRAC, required for the BA. This fact was acknowledged in Field Sampling Plan Addendum No. 1 (FSP), which stated (on page 21) that the sampling would be in "general accordance" with the protocol and that the sampling would be done "by distributing the jabs[1] proportionally among the multiple habitats present." As described in the Revised BAR, the sampling conducted on the LVR incorporated some modifications to the 2007 protocol applying best professional judgment exercised by experienced aquatic biologists to accommodate the split-river design. All of the sampling was conducted under SulTRAC's oversight with the intent that it would provide reasonably comparable data to a strict application of the 2007 protocol to the full river width.

As reflected in other comments and during discussions with EPA about these comments, EPA believes the mIBI values calculated for the LVR and included in the Revised BAR (see, e.g. Tables 3-19 through 3-27) are not comparable to IEPA's mIBI best values because of variations in sampling methods. Geosyntec allocated the required 20-jabs proportionally to the available

[1] For context, as described in the Revised BAR and IEPA (2007) (Attachment A to the FSP), the macroinvertebrate sampling involves the collection of organisms with a dip net via 20 "jabs" into a variety of habitats.

habitats whereas the 2007 sampling protocol calls for the 20-jabs to be allocated first between "bank zone" and "bottom zone" habitats and then, proportionally within those zones.

Additional investigation of the basis for the IEPA mIBI best values suggests, however, that they are not based on the bank zone/bottom zone sample allocation method described in the IEPA 2007 protocol. The IEPA mIBI best values were apparently finalized in a report prepared by Tetra Tech[2] and were based on sampling performed in 2001. Tetra Tech (2007) describes the sampling that eventually resulted in the computation of the mIBI best values, as follows:

"A more quantitative method was initiated in a pilot study in 2001 that is based on a 20-jab multi-habitat collection along with a 300-organism laboratory subsample. Individual jabs in the multi-habitat collection method are distributed among the habitats in proportion to their occurrence in the sample segment."

Because this description of the sampling method underlying the IEPA mIBI best values is consistent with the sampling performed for the BA of the LVR, it suggests that the methods are valid and the results comparable. To further investigate this, Geosyntec, EPA, and SulTRAC jointly contacted representatives of IEPA and Tetra Tech about the above statement.

IEPA responded that "[w]e operate on the fact that the database underlying the mIBI quality categories was performed according to the IEPA 2007 bank vs bottom zone allocation guidance." IEPA also cited a statement from Tetra Tech (2007) that indicated the samples were collected using the 20-jab, 300-organism subsample method and then concluded (without support) that that method always employed the bank zone/bottom zone allocation. IEPA also pointed to references to the 20-jab method in Figure 3 of Tetra Tech (2007) and then again concluded that because the 20-jab method was used, the bank zone/bottom zone allocation must also have been used. Neither IEPA's statement nor the citations to Tetra Tech (2007) are convincing. The noteworthy part of the statement is that IEPA says only that they "operate on the fact," which seems to indicate that they simply assume the bank zone/bottom zone allocations followed – not that they have the documentation to show it. IEPA's citations to Tetra Tech (2007) simply refer to use of the 20-jab method. But, those specific citations do not make any reference to how the 20 jabs were allocated, so on their own, these citations are not convincing. More importantly, IEPA's response never addresses the directly contradictory statement in Tetra Tech (2007) (quoted above) that the 20 jabs were allocated proportional to the available habitat. IEPA also does not explain how the sampling underlying the calculation of the mIBI best values in Tetra Tech (2007) could have been performed according to a 2007 protocol when the sampling was performed in 2001. While there could be rational explanations for these inconsistencies, IEPA has not provided them despite being given ample opportunity.

Representatives of Tetra Tech involved in the preparation of Tetra Tech (2007) indicated that they were familiar with IEPA macroinvertebrate sampling protocols and believed the statement quoted above regarding the sampling method was accurate, although they admitted that they did not perform the 2001 sampling themselves. As we understand it, it is also Tetra Tech's belief

[2] Tetra Tech (2007). Illinois Benthic Macroinvertebrate Collection Method Comparison and Stream Condition Index Revision. Prepared for Illinois EPA by Tetra Tech, Inc. November 2004; Revised March 2007.

that the 2001 sampling was proportioned by habitat rather than bank zone/bottom zone, as during that timeframe, it was common practice to proportion by habitat. The 2001 sampling supported the revision of IEPA's Stream Condition Index (SCI), which ultimately was renamed as IEPA's mIBI. To their memory, the bank zone/bottom zone allocation described in the 2007 protocol was developed after the 2001 sampling as part of an effort by IEPA Bureau of Water to further standardize the macroinvertebrate sampling method. Those recollections seem consistent with one of the recommendations in the Tetra Tech report (both the 2004 and 2007 revised versions): that IEPA continue efforts to standardize collection methods. This explanation for the evolution in methodology is consistent with the movement toward standardization and with the revisions seen in the subsequent Tetra Tech reports.

While these further investigations into the Tetra Tech report were not able to definitively determine how the samples underlying the IEPA mIBI best values were collected, the additional information suggests that the 2001 samples were collected based on habitat allocation, which is consistent with the methodology in which Geosyntec collected the samples for the LVR BA.

Finally, statements made by the Tetra Tech representatives further weaken EPA's "non-comparability" comment. When asked, the Tetra Tech representatives indicated that they did not believe that the allocation of the 20 -jabs proportional to the available habitat, as opposed to using the bank zone/bottom zone allocation approach, would materially impact the results or prevent a valid comparison of sample results to the IEPA mIBI best values – even if those values were based on bank zone/bottom zone allocation in the 2007 protocol. Tetra Tech's statement is also consistent with the conclusions of their 2007 report. One of the reasons that IEPA commissioned that report (see Tetra Tech (2007) at page 2) was to test whether the 20-jab sampling protocol could be used reliably in Illinois and to establish a cross-calibration for comparison of historical data collected using a "handpick method" to the data collected with the 20-jab protocol. Tetra Tech described the handpick method as "primarily a qualitative collection method" involving the collection of organisms "with a sieve from all available habitats," the sorting of taxa "in the field until no new taxa were evident to the field collector," and the submission of all organisms to the laboratory for identification. According to the Tetra Tech report, the handpick method had "the potential for bias among collectors due to potential uneven field collection efforts and numbers and types of organisms collected . . .." Despite the marked differences between the 20-jab sampling method utilized in the 2001 sampling and the historic handpick method, Tetra Tech's analysis seemed to show that they performed about the same. As shown in Table 2 of Tetra Tech (2007), the 20-jab and handpick methods performed almost the same in correctly scoring known "most disturbed" sites using the 2000 Stream Condition Index. Tetra Tech also concluded that the revised Stream Condition Index (which ultimately became IEPA's mIBI index) "performed comparably to the old SCI with both the older data set (689 hand pick samples) and the pilot study data (158 – 20-jab 300 organism samples)."

The difference between the 20-jab sample allocation used by Geosyntec and the 20-jab sample allocation per the IEPA 2007 protocol is a minor sample method difference when compared to the difference between the handpick method and any version of the 20-jab method. Thus, while the general comparability in predictive results achieved by the handpick method and the 20-jab method underlying the Tetra Tech (2007) does not directly show the comparability of the two methods of allocating the 20-jabs, it suggests that they would likely produce comparable results.

Based on the above, Geosyntec believes the conclusion stated in the comment is not well supported, and proposes no further modifications to the revised BAR.

Is the "reference reach … beyond any influence of the Matthiessen and Hegeler Zinc Company Site" outside of the deposition zone of air-borne chemicals from the site? If not, this, and similar statements, should be restated to indicate the reference reach was uninfluenced by the site except for possible air deposition.

RESPONSE: As discussed at the 11 January 2011 meeting between EPA, SulTRAC, Geosyntec and Carus representatives, comparison of stream sediment samples collected adjacent to the Site to samples collected upstream of the Site and even upstream of the reference reach indicate that the reference reach sediments have not been impacted by airborne deposition of contaminants from historic Site activities. In addition, the sample results of residential soils north of the Site (in the direction of the reference reach) generally show a lack of impacted soils between the Site and the reference reach. We propose to include brief summaries of this data in the Final BAR to support the statement noted in the comment.

2) ***Section 2.4 - Benthic Macroinvertebrate Community Sampling - p. 13-14:***

The statements following "The split river design…" are incorrect and should be revised.

"The IEPA protocol also assumes a certain percentage of the full wetted width is comprised of bank zone habitats and bottom zone habitats (IEPA, 2007). For example: if full wetted width of the stream falls in the designated range of 10-29 feet, the assumed width of each bank zone is 20 percent of the full wetted width. The split river study design complicates the precise application of this feature. With one bank zone and one-half the bottom zone (i.e., one-half the full stream wetted width) subject to sampling, emphasis was placed on allocating sample jabs proportionately among habitats actually present throughout the discrete east and west sample reach halves."

The split river study design has no impact on the allocation of bank-zone and bottom-zone sampling. The sampled segments of the LVR fall within the 30-59 ft mean wetted width category for which the assumed width of bank zone is 15% of wetted width per bank, and the sampling-effort allocation is 6 bank-zone dips and 14 bottom-zone dips (IEPA 2007 Table 1). Over the entire wetted width, bank-zone dips are 30% of the total 20 dips per reach, identical to the assumed proportion of bank-zone habitat (15% per bank * 2 banks per reach). When reaches are divided longitudinally, the bank- and bottom-zone proportions are unchanged (15% per bank ÷ 0.5 wetted width = 30% bank-zone habitat per split reach).

RESPONSE: Taking the comment as a whole, Geosyntec understands that the commenter disagrees with the statement that the split-river design complicated the application of the IEPA

sampling protocol. It is unclear what, if any, additional statements the commenter believes need to be removed, as the other quoted sentences have been reviewed and are believed to be accurate.

As to the particular statement that we understand to be the target of the comment, Geosyntec respectfully disagrees. The split-river design does impact application of the IEPA 2007 sampling protocol. Allocation of the proportional bank zone/bottom zone sampling method was specifically developed by IEPA to be applied to the full width of a stream segment -- not for river segments split in half length-wise. The IEPA 2007 sampling protocol simply has no discussion of how it should be applied in such a circumstance. That IEPA never contemplated such an application of its protocol seems obvious from their comments on the original Draft BAR. Those comments included questions suggesting that IEPA was uncertain whether the allocation percentages specified in the 2007 protocol for the full width of the river or half the width of the river would be used. In that context, it is unclear how EPA can support their interpretation of a sampling protocol developed by another agency with such certainty.

Adaptation and application of the IEPA sampling protocol to a split-river design is one of interpretation, which is subject to professional experience and judgment. EPA's interpretation and suggested application is just as much a modification of the protocol as the proportional allocation of sampling among available habitats presented in the Revised BAR. To accommodate EPA's request for the split-river design, Geosyntec interpreted and adapted the protocol (as described in the FSP) as necessary to obtain a representative sample of the macroinvertebrate community that would yield data appropriate for comparison with IEPA's mIBI best values.

3) ***Section 3.1.2 - Habitat Assessment for Macroinvertebrate Sampling - p.24:***

According to the table Macroinvertebrate Community Sampling Effort by Habitat Type, the specified allocation of 6 bank-zone and 14 bottom-zone dips occurred at only 2 sample locations, CAR002East and CAR002West. Bank-zone habitat was undersampled in CAR001East (20% of total), and oversampled in CAR001West (35%), CAR003East (60%) and West (40%), and CAR004East (55%) and West (50%) compared to IEPA (2007) protocol (30% of total dips for LVR wetted width). In other words, bank-zone habitat was oversampled in most locations by as much as 2-fold compared to IEPA (2007) protocol, and was undersampled by one-third at one location.

Sample allocation by visual estimation was inconsistent with the IEPA protocol (IEPA 2007) cited in the FSP.

"Sampling of different habitats was made proportional to the visual estimation of the different habitats within a particular LVR sample reach. For example; if by visual estimation ¾ of the habitat in a particular reach was composed of coarse substrates, then ¾ of the samples for that reach were collected from coarse substrates, and so on."

Contrary to the example given in which habitat proportions are estimated over a

sampling reach in aggregate, the IEPA (2007) protocol requires separate evaluations of the proportions of 3 bank-zone habitats (used to allocate the 6 bank-zone dips among bank-zone habitats) and 4 bottom-zone habitats (used to allocate the 14 bottom-zone dips among bottom-zone habitats).

Compliance with IEPA (2007) sampling protocols is a necessary condition for comparing site-specific mIBI values with IEPA threshold values based on these protocols. With the possible exceptions of CAR002East and CAR002West (depending on whether the within bank-zone and bottom-zone habitat dips were allocated according to IEPA (2007) protocol), this condition was not met and comparisons with IEPA threshold values should be removed from the document.

RESPONSE: As indicated in the response to comment # 1, Geosyntec acknowledged in the FSP that the application of the IEPA 2007 protocol to the LVR sampling would require certain modifications. Geosyntec also acknowledges that the proportion of bank zone and bottom zone habitats actually sampled for several reaches is different than the 6/14 proportion identified in the comment. But, Geosyntec does not agree that the 6/14 proportion is necessary for comparability to IEPA's best values or that EPA's characterization of reaches as being oversampled or undersampled biased the mIBI.

As stated in our response to comment #1, Geosyntec believes that EPA's position that the difference in allocation methods materially affected the mIBI is not supported.

The comment cites no information indicating that strict compliance with every aspect of the 2007 sampling protocol is a necessary condition for comparing site-specific mIBI values to the IEPA best values, and subsequent investigation did not establish that strict compliance is a necessary condition for comparison. For the reasons stated above, Geosyntec believes those comparisons are valid and provide useful information for evaluating the ecological condition of the LVR.

4) Section 3.1.2 - Habitat Assessment for Macroinvertebrate Sampling - p.25:

As noted above, the "more even" ratio of bank- and bottom-zone jabs at CAR003 and CAR004 is contrary to IEPA (2007) protocol.

The statement that "the resulting data are deemed suitable for calculating mIBI scores based on comparison of the multi-metric values to IEPA-established 'best values' for the purposes of evaluating ecological conditions adjacent to, and upstream of, the Site" is incorrect. Failure to follow IEPA (2007) sampling protocol invalidates comparison with "best values" based on the required protocols.

RESPONSE: As stated in the response to comment #1, Geosyntec acknowledged in the FSP that it would make some modifications to the IEPA 2007 sampling protocol in connection with the proposed macroinvertebrate sampling for the LVR. Geosyntec also acknowledges that the modifications resulted in ratios of bank zone and bottom zone samples for some reaches that

were different than those that might be specified depending on particular interpretations of the 2007 sampling protocol. For the reasons stated in response to comment #1, Geosyntec disagrees with the "non-comparability" conclusion of this comment and believes it is not supported. The comment cites no information indicating that strict compliance with every aspect of the 2007 sampling protocol is a necessary condition for comparing site-specific mIBI values to the IEPA best values, and subsequent investigation did not establish that strict compliance is a necessary condition for comparison. For the reasons stated above, Geosyntec believes those comparisons are valid and provide useful information for evaluating the ecological condition of the LVR.

5) ***Section 3.2.5 - Fish Community Index of Biotic Integrity (fIBI) p. 30-31:***

The presented rationale for calculating adjusted fIBI scores does not reflect the reasons discussed in the 10/5/10 Springfield meeting with IEPA. Inclusion of adjusted fIBI scoring was not "to provide some analysis of uncertainty associated with the somewhat lower fish sample counts", as incorrectly stated in the Revised Draft Report. The underlying issue is incompatibility in fish sampling methods. IEPA stated that the fish sampling method used at the site, backpack electroshocking, was not used by IEPA in any of the 40-ft wide streams that make up the database for developing regional fIBI values. IEPA expressed concern that backpack electroshocking may have resulted in relatively less efficient sampling that could reduce the reliability of the proportional metrics that contribute to the final fIBI value. The same issue of potentially unreliable proportional metrics arises when stream segments are undersampled, and the adjusted fIBI procedure is used to evaluate fish communities excluding the influence of proportional metrics. IEPA recommended including the adjusted fIBI as a line of evidence whether the sampling method implemented at the site may have resulted in lower sampling efficiency compared to IEPA practices in comparably sized streams. As explicitly stated at the meeting, the rationale for including the adjusted fIBI calculation was not because the total numbers of fish collected were considered inadequate at the site. The outcome of the adjusted fIBI indicates that sampling method differences did not introduce significant errors in proportional metrics. Revise text wherever the adjusted fIBI is discussed.

RESPONSE: Geosyntec will make appropriate revisions to the text of the Final BAR to make reference to the commenter's understanding of why the adjusted fIBI calculation was suggested.

While we have agreed to make these revisions, Geosyntec does not, for the record, recall the discussion at the 5 October 2010 resulting in the "explicitly stated" rationale described by the commenter. Rather, it seemed to us that the Revised BAR correctly reflected the reasons for the additional work. The Revised BAR is consistent with IEPA guidance that suggests an adjusted fIBI calculation if there is a concern with the precision or accuracy of the fIBI because "the total number of individuals in a sample is low" (IEPA, 2000). In addition, the IEPA guidance makes no reference to incompatibility of fish sampling methods and, in fact, has criteria for inclusion of sampling data irrespective of the methods of collection (IEPA, 2000 at page 9). Geosyntec acknowledges that a review of Appendix A to IEPA (2000) indicates that the 40-ft wide stream data underlying the fIBI regional calculations does not include any data based on backpack

electrofishing. But, that does not seem like a basis for EPA to describe data based on backpack electrofishing as potentially incompatible, when it is an Illinois Department of Natural Resources (IDNR)-approved method of collection (see Attachment A to the FSP) and when IEPA combined backpack electrofishing data with data collected using other methods to develop regional fIBIs for other stream widths (see Appendix A to IEPA, 2000). If backpack electrofishing data were somehow suspect or unique, it is hard to understand why IEPA would combine it with data from other methods.

6) ***Section 3.3.6 - Macroinvertebrate Index of Biotic Integrity (mIBI) - p. 38-43:***

This section should be removed because of lack of compliance with IEPA (2007) sampling protocols that does not allow for the use of IEPA mIBI.

RESPONSE: For the reasons stated in response to comment #1, Geosyntec disagrees with this comment and believes it is not supported.

7) ***Section 3.3.6, Page 38, Paragraph 2:***

This section describes the mIBI used to analyze the macroinvertebrate data. The paragraph states that metric values were converted to standardized scores. The appropriate IEPA reference should be provided to support this action.

RESPONSE: Geosyntec will add the requested reference in the Final BAR, assuming that other comments do not result in the deletion or significant modification of Section 3.3.6.

8) ***Section 3.3.6, Page 39, Paragraphs 0 and 1:***

This portion of the section overviews the mIBI and the MBI results. The discussion of MBI results refers to a "preliminary assessment value of 5.9." The origin and significance of this value are not clear at this portion of the report. The comparison to this benchmark should be accompanied by a discussion of the origin of this value and how it is to be used in assessing potential impacts at the site.

RESPONSE: Geosyntec will include revisions in the Final BAR to improve the clarity of this discussion, assuming that other comments do not result in the deletion or significant modification of Section 3.3.6.

9) ***Section 3.3.6.2, Pages 44 and 45:***

This section describes the statistical evaluation of the Shannon- Wiener Macroinvertebrate Diversity Indices (H') and Simpson's Index of Diversity (Ds) values between the upstream reference location and the downstream locations. It would also be helpful to provide a comparison at each station between the data from the east and west sides. This information could be used later in the report to support the discussion

on the differences between east and west sides of the river.

RESPONSE: Geosyntec believes the comparison between the data from the east and west sides of each sampled LVR segment are adequately presented in the table at the end of Section 3.3.6.2. We will add some additional text in Section 3.3.6.2 in the Final BAR that discusses the general relationship between the data for the east and west side of the stream segments.

10) ***Section 3.3.7 - Macroinvertebrate Community Assessment Summary - p. 46-47:***

Remove mIBI discussions.

RESPONSE: For the reasons stated in response to comment #1, Geosyntec believes the mIBI discussions are appropriately included in this summary section of the Revised BAR.

11) ***Section 3.3.7, Page 47, Paragraph 1:***

This paragraph discusses the number of taxa observed at various sampling locations, and includes a statement that at certain reaches the number of taxa was "high." Based on comments received during the meeting, this terminology about a high number of taxa should be replaced in the analysis with a reference to the percentage of taxa where comparison to IEPA's best value occurs.

RESPONSE: Geosyntec will include the requested revisions in the Final BAR, assuming that other comments do not result in the deletion of the discussion of IEPA best values in this section.

12) ***Section 3.3.7, Page 47, Paragraph 2:***

This paragraph discusses the lower metric scores for the Number of Ephemeroptera Taxa and Percent Scraper. The discussion notes that Ephemeroptera are sensitive to metals in the water and sediment, but also indicates that effect(s) of metals concentrations on the Ephemeroptera are inconclusive at CAR001 and CAR002. However, this statement of "inconclusiveness" is not accompanied by comparisons of metals concentrations in sediment or surface water at these sites with concentrations of metals in the same media at other locations. This information should be provided to support the conclusion.

RESPONSE: Geosyntec will revise this discussion in the Final BAR as suggested by the comment.

13) ***Section 3.4 - Discussion of Combined Fish and Macroinvertebrate Community Assessment Results - p. 48-49:***

Remove mIBI discussions.

RESPONSE: For the reasons stated in response to comment #1, Geosyntec believes the mIBI discussions are appropriately included in this summary section of the Revised BAR.

14) Section 3.5, Page 50, Paragraph 1:

This section discusses the mussel tissue analysis and notes the potential source of the elevated metal concentrations in the tissue. The text here should specify whether or not the mussels were allowed to purge their guts prior to analysis.

RESPONSE: The mussels were not intentionally depurated prior to analysis. Geosyntec will include this information in the Final BAR.

References
IEPA. 2007. Methods of Sampling Macroinvertebrates in Streams. Illinois Environmental Protection Agency Bureau of Water. Draft 04/11/2007.

RESPONSE: Because there is no text accompanying EPA's listing of the IEPA 2007 document, it is not clear what EPA intended its comment to be. It seems that the listing of the IEPA 2007 document was intended to be associated with comment 13 and that EPA apparently intended to indicate that the IEPA 2007 document should be removed from the list of references in the Revised BAR. If that was the intent of EPA's comment, Geosyntec does not agree that the document should be deleted from the Revised BAR Reference List. As noted above, Geosyntec disagrees with a number of EPA's comments related to the macroinvertebrate sampling. Regardless, it is still accurate to say that Geosyntec's macroinvertebrate sampling followed some aspects of the IEPA 2007 document. For example, the sampled stream segments were approximately 300 ft in length, the samples comprised 20 jabs or dips, and the samples were collected between June 1 and October 15, all as specified in that document. Accordingly, regardless of the resolution of other comments, it is appropriate for the Final BAR to contain some reference to the IEPA 2007 document, and it should be listed in the references for the Final BAR.