Appendix 4B

CBSD Review of Aurora Project Biodiversity Baseline Studies

University of Guyana
Faculty of Natural Sciences
Centre for the Study of Biological Diversity

MEMORANDUM

From: C. R. Bernard, Review Team Leader

To: Alex Riley, Environmental Manager, GGI

Copied: Kaslyn Holder-Collins; H. Sambhu and Gary Mendonca, Dean, FNS

Date: 12 March 2013

Subject: **Review of Aurora Project Biodiversity Baseline Studies (Final Report)**

This Memorandum serves to report on the work of scientists from the Centre for the Study of Biological Diversity (CSBD), of the University of Guyana, in reviewing the Biodiversity Baseline Studies done by the Guyana Goldfields Inc for its Aurora Project. It is set out into three main sections:

1. Tasks, method and rationale
2. Review Team Personnel
3. Main Conclusions
4. Appendix I: CSBD Comments on the Biodiversity Baseline

Task, methods and rationale

The tasks undertaken were according to the approved proposal signed by GGI on 5 October 2012. The objectives set out were:

1. Conduct a review by a recognized biodiversity non-governmental organization (NGO) of methods and biodiversity baseline studies for the Aurora Project Environmental and Social Impact Assessment (ESIA);
2. Review the key finding of the Biodiversity Baseline that the project area contains no critical habitat as defined in IFC Performance Standard 6; and,
3. Provide a basis for an ongoing partnership between GGI and CSBD as the Aurora Project moves into construction and operation.

And the scope of work included reviewing:

1. Biodiversity baseline data collection methodology;

2. Biodiversity baseline field reports and lists of species observed; and
3. Biodiversity baseline.

Before the commencement of work team members met with Mr Alex Riley of GGI for a teleconference with Mr Robert Langstroth of ENVIRON to discuss matters related to the review and particularly to have a detailed look at the analysis that led to the key finding in relation to IFC Performance Standard 6 (IFC PS6). Subsequently the team worked individually to review information in their thematic area as identified in proposal and make brief notes on their review. The review team then met in mid January and discussed their individual reviews and agreed on the review points as a group. The Lead Reviewer compiled those points and a draft report was submitted for review by GGI. Members of the review team met again with Mr Alex Riley of GGI for a teleconference with Mr Robert Langstroth of ENVIRON to discuss the observations of the team and come to agreement on future modifications of the baseline report and the final conclusions of the review. Based on that discussion this review report was finalized.

The approach taken in the review was to look first at the methodology in detail to determine if they were based on sound science considering the purpose for which the data was required. The quality of the methods used would have a direct bearing on the value of the findings and the soundness of the conclusions drawn there from. The findings were then reviewed in light of the methods used; and with this consideration was given to the validity of the conclusion/key finding. An assessment was also done for available data for the various taxa sampled to determine if sufficient secondary and tertiary data was incorporated into the analysis.

The review makes observations related to the reporting and the actual work done.

Review Team Personnel

The review team comprised of three personnel attached to the CSBD. Details on their roles in the review and their key qualification and experience are listed below:

Calvin R. Bernard - Lead Reviewer and specialist in aquatic organisms, birds and ecosystems

Mr Calvin Bernard is recognized for being very knowledgeable and skilled in assessing biological/ecological systems and having a good understanding of the impacts various activities and human interventions have on ecosystems. These have been gained over years of training and experiences as a researcher. Mr Bernard has made contributions to environmental management in Guyana in two main ways. Firstly, he has both conducted and guided research which not only assessed the biotic environment, but which has sought to understand the interactions between human actions and the ecosystem. In 2000 he also co-authored a draft review of environmental management in the mining sector in Guyana and Suriname. Secondly, he has also been called upon to make contributions on critical regional, national and sectoral policy and regulatory documents related to environment, biodiversity and natural resources management. In particular he has contributed to; 1. biodiversity and conservation planning

activities of the World Wide Fund for Nature (WWF), Conservation International and Iwokrama; 2. the development and validation of codes of practice for the mining sector; and, 3. the development of management plans for fisheries and other natural resources. Calvin has served and a Co-Manager of the Centre for the Study of Biological Diversity, University of Guyana and member of the National Biodiversity Committee and the Guyana Wildlife Scientific Authority. Calvin holds an MSc in Development Management from the Open University, UK and a BSc in Biology from the University of Guyana. He has approximately 16 years of experience working in biodiversity.

Hemchandranauth Sambhu – Specialist in terrestrial insects, Amphibians, reptiles and Mammals

Mr. Hemchandranauth Sambhu has recently joined the University of Guyana and CSBD, but came from a post with the Iwokrama International Centre where he had been for approximately 12 years. His work focused on biodiversity management and conservation and entailed biological, environmental and social impact assessments, feasibility studies and establishing community based businesses that focus on the commercialization of forest products and development of natural resources management plans. His work afforded him a close working relation with organizations such as Conservation International, World Wide Fund for Nature (WWF), Guyana Environmental Protection Agency, University of Guyana and Guyana Zoological Park. His work in biological assessments has focused on a wide range of animals, including amphibians, reptiles, birds and mammals and has led to his author/co-author-ship of several peer reviewed publications. He has also assisted in the development of systems for continuous monitoring of biodiversity in relation to human pressures on ecosystems. Mr. Sambhu holds an MSc in Plant and Environmental Sciences from the University of Warwick, UK and a BSc in Biology from the University of Guyana. He has a total of 14 years of experience working in biodiversity.

Kaslyn Holder- Collins - Plants

Ms. Kaslyn Holder-Collins has served as a scientific officer at the CSBD with responsibility for the curation of the herbarium collections for the past 7 years. Over these years she has researched and taught in various areas of plant taxonomy and diversity. Apart from overlooking the herbarium collections at the CSBD, she also serves in the system for verification of biodiversity collections for export by researchers which involves the CSBD and the Environmental protection agency. By virtue of her role at the CSBD, she has interacted and built strong relationships with botanical experts working in Guyana. She has amassed a fair knowledge of Guyana's floral diversity, but more critically developed skills to further explore and evaluate knowledge in this area. Recently she worked with the World Wide Fund for Nature assisting then with a survey of the orchids of Kaieteur National Park and has co-authored 'A Beginner's Guide to Flowers of the Garden City, Georgetown, Guyana' which is in review. Kaslyn holds a BSc in Biology, a Post

Graduate Diploma in Education both form the University of Guyana, and is currently reading for an MSc in Education. She has approximately 10 years of experience working in biodiversity.

Main Conclusions

The following are the main conclusions of the review team:

1. In light of our observations and the modifications of the biodiversity baseline report that are agreed to, we corroborate the main finding in relation to IFC PS6.
2. Once the report is modified based on the agreements reached in discussion the CSBD endorses the methods, findings and conclusions.
3. Based on our observations and the data provided during our final discussion with ENVIRON (which is to be incorporated into the report) we determined that there is no need for additional field work prior to final decisions on the commencement of the project.

Appendix I

CSBD Comments on Biodiversity Baseline

Comments with specific recommendations

The following comments were made by the review team. Consideration was given to the likelihood of completeness/sufficiency of the report and the ways in which the information is presented as well as the evident quality of the methods used. Where recommendations are made, an indication is given regarding the resolution of each comments based on the discussion with Robert Langstroth of ENVIRON. The final version of the biodiversity baseline will work towards the resolution of each comment as specified in this table.

COMMENT	RESOLUTION
In paragraph 2 under **8** it is stated, "but in the Cuyuni basin, the natural condition has been altered by human impacts". This statement is neither substantiated with sufficient primary data, nor does it make reference to any available published data sources. The statement may be true, but can be dismissed for the above mentioned reasons and therefore needs to be supported in the report.	Reference is to be included.
Imagery used in the report to illustrate information was insufficiently detailed in some instances. Figure 8.1-1 had no labels or colour coding on the sample points and transects, so there was no way of associating the lines on the image with the coordinates given in Table 8.5-1 and there was no coordinate information for the sample points. These details need to be incorporated into the figure and the data on points must be added to the document. Figure 8.4-1 has a poorly visible legend which made the image of little use in the document. More useful imagery was located on the Guiana Shield Facility (GSF) web pages at http://www.guianashield.org/index.php/component/docman/cat_view/34-priority-setting-workshop/56-conservation-priorities?Itemid=176. Consideration could be given to using the better quality more useful imagery from the GSF site. Figure 8.5.5-1 did not have data labels for the sampling points to allow for association of the data in Table 8.5.5-1 with the map and not all points identified in the table are represented on the Map. The water bodies that were sampled were not visible in the same image. This is important given that the image is illustrating aquatic sampling points. This figure would be far more useful if the terrain details were removed and details on the streams added against a white background. Figures 8.9-1 and 8.9-2 do not follow scientific conventions, but this is more a matter of analysis of data and will be further dealt with in bullet 42.	This is to be addressed as far as is practicable.
The information provided on the consultants/scientists involved in the project was insufficient as there was no data provided on the lead specialists in the Biodiversity field teams. However based on professional knowledge of all the leaders identified, there is confidence that in the quality of the observations for all groups except bats. A CV for the leader identified would allow for further consideration. It would be extremely useful to have this information provided in the report as an appendix and to use terms like expert field ornithologist and herpetologist particularly when describing the methods for birds and herps. This will allow the reader to be confident that the data for those highly technical, heavily personnel dependent observations was well collected.	This information is to be included in the report.
Information presented in 8.2.1 on the timing and duration of the various studies since 2006 would be more	This is to be included in the report as

COMMENT	RESOLUTION
meaningful if effort was represented as person days as opposed to just days. This would be valuable, for example, in determining if there was any real difference in the efforts between the GSE surveys of October 2006 and February to March 2007. If 12 persons were involved in 2006 and 8 in 2007 then the person days of effort is the same, but if 12 persons were involved in both surveys then different efforts were expended. This kind of information would enhance the analysis of the accumulation of species.	far as possible.
The final sentence in paragraph 2 of 8.2.1 states that for mammals the sampling methods were supplemented by interviews with "Guyanese experts". It is not clear if these were science trained individuals who worked in the area before or local residents and mine workers who have traverse the terrain for years and are therefore 'local experts'. This needs to be clear.	The text is to be restructured to clarify the term.
There was insufficient use of imagery in the report in that all spatial information should have been illustrated on maps for the best communication. Coordinates in a table have very little value to someone reading a report because they cannot easily visualise the distribution of the points in space and there is particularly no understanding of the altitudinal and gradient complexity between points and along transects. The paths for the secondary transects are presented in the body of the report, but mean very little as they are not on a map.	To improved as far as possible.
The information in 8.4 is very valuable and fairly accurate. Apart from the data gathered during commissioned works done for GGI that are mentioned in 8.4.1, the reference to the published data is more useful in 8.4 as they are all regional level publications. This section would benefit significantly from data specific to the Cuyuni River Basin and it can be gathered for many of the groups from online searchable repositories. This has been validated. A list of species known from the broader region would have been a valuable reference point to guide work at the site.	This data is to be included.
No reference is made to the 2011 work on fishes of the Cuyuni River lead by Dr Brian Sidlauskas of Oregon State University. The data from this study would be a valuable inclusion into the analysis, but even if the data is not available to GGI the point that it exist should be made.	This work is to be included in the report as a reference for fishes of the Cuyunini River.
The general layout of the methods sections of the report is unconventional but that in itself is not a major issue. Conventionally, methods on taxonomic groups would be ordered from lowest complexity to the highest (fishes to mammals for vertebrates) and methods for flora precede those for fauna. There should ordinarily be some reference made to assessing the local diversity of ecosystems/habitats preceding the work on specific taxonomic group and informing the selection of sites. Only macro/meso level ecosystems are considered in the study/report.	This will be done as far as it does not affect the layout of the report as it relates to specifically addressing the IFC performance standards.
The general description of the survey methods in 8.5 provides no information on how the specific samples sites were selected. This is a matter of survey design and is one of the fundamental issues that need to be made clear because survey design is absolutely critical to the generation of valuable data. This information should be made explicit in the main report. There is also discrepancies in the number of transects used. Figure 8.1-1 and Table 8.5-1 provide information on 4 transects while the text in paragraph 2 under 8.5 indicate that there were 8 transects. The lengths of the various transects also need to be affirmed as the statements in field reports indicate transects of 1700m and 3600m while the main report indicates that they were 600m to 2000m with one exception of 3500m. From examining	Information on the survey design was satisfactorily detailed in discussion and is to be included in the report. The discrepancies are also to be corrected.

COMMENT	RESOLUTION
the image in figure 8.1.1, there was no transects in the riparian vegetation, but this conflict with statements in the report that the riparian subsystem was sampled. This needs to be clarified.	
Because this report utilizes data from all surveys since 2006 it would be necessary that the methods used to gather the data across the years be reflected in this singular report. It is also important that the methods be grounded in literature for validity.	The need for this has been acknowledged. However, because there have been multiple firms conducting studies over the years, it may be difficult. It is to be addressed at least by inclusion of the information in the annex of the report.
Notwithstanding the previous statement, the methods described for bats were deemed to be acceptable with some concerns for unevenness of efforts between wet and dry season and the timing of mist netting that would have excluded some species that are only active later in the night. The use of droppings to indicate the size of a colony is flawed in our estimation and if valid the appropriate reference should be provided. Information on the sampling for nonvolant mammals on the one hand needs to be enhanced with details on the deployment of traps in both space and time and personnel responsible for visual and auditory identifications. On the other hand, the survey methods would have had low levels of effectiveness in surveying small cats (which are usually very illusive and stay away from tracks used by humans) and would have excluded small rodents[1] (which is a significant group in the neotropics).	Greater details on the methods are to be included in the report.
The description of the methods for survey of birds also needs to be enhanced by identification of the personnel responsible for auditory and visual identification because of the skill level required for effective surveys. Otherwise the method described is acceptable.	The information is to be included in the report.
The question of personnel responsible for auditory identifications for amphibians also needs to be answered. However, for such an extensive study, the use of pitfall traps with flashing is common but was not employed. This needs to be justified. Because amphibians and reptiles range from completely aquatic to completely terrestrial species, the distribution of sampling sites needed to be more specific. It is not clear that there were aquatic sites, including river transects for amphibians and reptiles and in it not clear which of the sites or transects were specifically used to sample these two groups.	Greater details on the methods are to be included in the report.
Methods used for sampling fishes also require greater details in the report to account for several things. Firstly, there is no clear indication about the stream order of the streams sampled and the path they take in course to the Cuyuni River proper. Secondly, there is no information on the dimensions of the streams and their general ecology in terms of water colour and sediments, and whether these are representative of the different kinds of stream in the area. The information also indicates that the Cuyuni River proper was excluded from sampling. Ordinarily it would have been	A more complete report on the methods will be provided in a modified report.

[1] Though in the results under 8.7.6 the use of Sherman traps is mentioned without details.

COMMENT	RESOLUTION
expected that this river would have been sampled at suitable upstream and downstream locations to establish a baseline prior to any mining at Aurora. While all evidence suggests that the river ecosystem has been degraded by small miners, there is still need for an account to be taken of the baseline in the river. The work of Dr. Sidlauskas may compensate for this error. The equipment used for sampling needs to be described in greater detail to provide information on mesh sizes for nets and hook sizes along with any baits used. There are also some discrepancies between the field reports which mention the use of hand nets, and the main report which does not. Importantly, small species would have been ineffectively sampled with the equipment identified, and nocturnal species which are not caught in gillnets (e.g., knife fishes and small catfishes) would not have been sampled.	
The survey methods for plants would have been limited only by the site selection. This issue needs to be addressed for an accurate confidence level to be ascertained for the data on plant species. Additionally, the method for calculation of the abundance is not very clear as issues of nature and size of plants considered are not made explicit but need to be factored in for the calculation of useful figures of relative abundances based on number of individuals.	Greater details on the methods are to be included in the report.
In general it must be noted that while there may be short comings in the science applied in the methods and there has been lapses in the reporting, a significant amount of effort has been expended to document the biodiversity at Aurora. The layout of the results is unconventional as is the methods. But it is the fact that the groups are ordered differently than in the method that makes for difficult reading. The convention for the layout is the same as detailed above for the methods. But having the two sections in sync is what is most important.	This will be done as far as it does not affect the layout of the report as it relates to specifically addressing the IFC performance standards.
There is high confidence in the completeness of the plant survey in all zones recognizable from the satellite imagery except for the riparian forest. The listing of the species in the appendix needs to have a number of issues addressed, among these are: a. Family names should be changed e.g Compositae should be renamed to Asteraceae, Guttiferae to Clusiaceae b. Some species were not under their correct family names e.g *Cecropia angulate* should be under Cecropiaceae instead of Moraceae] c. Some names were spelt incorrectly e.g. *Thyrosodium Guianese* should be *Thyrosodium guianensis* and *Unonopsis glaucopetale* should be *Unonopsis glaucopetala* d. Some names were updated e.g *Tapirra marchandii* is now *Tapirira obtuse* e. Arecaceae and Palmae refers to the same family, however Arecaceae is the updated name, thus all palms should be merged. f. *Jessenia bataua* was stated as not in the Guianas by Henderson, however *Oenocarpus bataua* is the synonyms g. Some species could not be found in the Checklist of the Plants of the Guianas e.g *Aspidosperma luadum* h. *Desmoncus polyacanthos* is a palm and is not referred to as “Hold me back”. The common name is appropriated to plants of a completely different family and it would be useful to correct this with	These are to be corrected in an updated report.

COMMENT	RESOLUTION
consideration for is it was a palm or shrub that was observed.	
The report presents a fair narrative of the flora of the area, but the relative abundances needs to be judged with a better understanding of the method used as stated before. The statement made in the first paragraph of 8.6, "None of the plant species identified in the Aurora concession are known to be endangered, locally endemic, or of significance to any local human communities" is contradicted by other statements and the evidence provided. *Virola surinamensis* is correctly listed in the appendix as an endangered species. *Catostemma commune* and *Swartzia leiocalycina* are listed on page 22 as endemic to Guyana, though they are not. Many of the species identified are known timber species and the report speaks to the issue of logging in the area. Additionally the some plants such as *Cecropia sp.* are used in local traditional herbal medicines.	An acceptable treatment for *Virola surinamensis* was presented in discussion and is to be included in the report. The other issues are to be corrected based on evidence in references.
It is unclear what was intended to be placed under 8.7. While it is labelled as 'Terrestrial Fauna', it contains information on aquatic ecosystems in paragraphs 2 and 3 and general information about the state of the system in the remaining paragraphs. This structure needs to be addressed and it would perhaps be most valuable following on with how it is introduced in paragraph 1.	Modifications are to be made to the report accordingly.
The data on amphibians of the area appears to be fairly complete, but based on the issues mentioned in relation to the methods it is unclear how species such as the completely aquatic Suriname toad (*Pipa pipa*) would have been sampled. This issue needs to be cleared up.	This should be addressed in the report when the record of the methods used is better detailed.
One frog (*Stefania evansi*) was identified as a country endemic but concerns over this in relation to IFC PS6 were not addressed.	An acceptable treatment for *S. evansi* was detailed in discussion and will be included in the report.
There are some issues with the spelling of names for amphibians in the appendix that needs to be addressed.	These are to be corrected in an updated report.
It is unclear why the reptilian groups are treated in separate sections. The data for all groups seems fairly complete, though without river transects it is unclear how a proper assessment of the caiman community could have been done. The methods also did not lend to providing information on caiman populations on the rivers though this would have been valuable baseline information. It was also noted that the researcher who assessed the Giant Otter population reported a Smooth-fronted caiman (*Paleosuchus trigonatus*) in her report but this species was not listed in the main report. The species listing for reptiles in the appendix needs to be grouped based on taxa (Turtles, Caiman, Lizards and snakes).	It was cleared in the discussion that there were surveys of the Cuyuni River and these details are to be included in an updated report. The other issues raised are also to be addressed in the updated report.
The statement made in 8.7.2, "Yellow-footed tortoise is listed as Vulnerable although it is widely distributed and abundant in Guyana and northern South America" needs to be substantiated with a literature reference.	References exist and will be included in the updated report.
The data on birds seems fairly complete and this group may be less affected by the issue of survey design in relation to site selection. There are however two contradictory statements on the total number of species observed. The first sentence in 8.7.5 and the last sentence on page 33 need to be reconciled one to the other.	The error causing the contradiction is to be corrected.

COMMENT	RESOLUTION
While the decision to dismiss the observation of the sun parakeet in 2006 and 2007 may be justified, the historical range for the species is known to extend to a point just north of the Mazaruni River but not as far as the Cuyuni River. (See http://www.birdlife.org/datazone/speciesfactsheet.php?id=1572). The observation of the Harpy eagle at the site needs to be treated as it relates to IFC PS6, specifically in relation to Habitats of significant importance to Critically Endangered and/or Endangered species.	The argument that this does not trigger IFC PS6 is accepted but its treatment in the local context is to be addressed.
The statement made in the first paragraph on page 51 in relation to the psittacidae, "These species are not rare in Guyana, and have 'healthy' populations of significant numbers throughout their distribution within Guyana", needs to be validated with reference to literature.	A reference in support of the statement is to be included.
Recognizing the limitations of the methods used, the survey for mammals has provided fairly complete data. The list of species needs to however identify those species that were only noted based on interviews and those observed during surveys as the confidence levels are different for the two.	The distinction is to be incorporated into the report.
Paragraph 4 on page 53 indicate that no bats were caught at a location even though they could be seen flying. This seems to be a matter of net placement and the duration for which the nets are placed in the same location. It is not possible to compare the findings of the seasons as is done in the final paragraph on page 53 because there was unevenness of efforts. The reasons given to explain the differences are therefore invalid.	The report is to be modified accordingly.
It was highlighted before that the study has not recognized basin specific historical records where they exist, hence, the statement on no previous work on fish of the Cuyuni at the commencement of 8.8 needs to be adjusted.	Adjustment is to be made in the report.
Notwithstanding the issues mentioned before about the selection of sites and methods, the surveys of fishes seems to be tending towards completeness. The final list could benefit from some attention given to identifications made where a subfamily name is used as a genus, synonyms for a fish appear together in the list, one species is identified but it is more likely a member of a different species known from the river basin and another genera is not know from the basin. Effort should be made to incorporate data from historical studies and if possible from the 2011 study by Dr Sidlauskas.	Report is to be modified to accommodate this recommendation.
Given the methods described, some species of fish listed are unlikely to have been caught. It would be valuable to ensure that all methods used are reported on.	The report is to be modified accordingly.
The document does not provide a final descriptive summary of the fish, but rather just short descriptions of the finding at different sites and times. A final summary would be valuable.	The report is to be modified accordingly.
In paragraph 3 on page 56 there is reference to "one particular creek", this reference should be removed and replaced with a name or a description of the location of the creek.	The report is to be modified accordingly.
The methodology for developing the plots of cumulated species and effort measured in years is flawed. For more	The analysis is to be redone according

COMMENT	RESOLUTION
valuable analysis the effort needs to be broken down per trip with consideration for the number of persons involved in the field expeditions as active recorders of species. The increment of the species accumulation should be the individual trips. The plot needs to be made of cumulated efforts against cumulated species and would be most meaningful if it is done for the individual taxa. It is important to note that when a species accumulation curve plateaus, it is to be interpreted that there are no more species to be discovered in the areas being sampled and using the methods applied. Application of this analysis from individual sites to a larger area is therefore dependant on the representativeness of the sites sampled in relation to the entire area and, the appropriateness of the sampling technologies to capture all possible organisms at the sites.	to the recommendation as far as the data is available.

Sincerely,

Calvin R. Bernard

Team Leader

(Immediate Past de facto Manager, CSBD)