

Hydropower Sustainability Assessment Forum

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## IHA Sustainability Protocol Assessments Evaluation

February 2009

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An Analysis of Current IHA Sustainability Protocol Assessments  
and Recommendations for Further Improvement

Sustena  Partners



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## Introduction

### Scope of the Assignment.

The Hydropower Sustainability Assessment Forum (HSAF) aims to establish a broadly endorsed sustainability assessment tool to measure and guide hydropower performance towards increased industry standards of sustainability. The Forum's work centers on the International Hydropower Association's (IHA) Sustainability Assessment Protocol ("the Protocol").

The existing Protocol is Version 6, dated July 2006. Several assessments of hydropower schemes have been undertaken using this and earlier versions of the Protocol. In addition, there is documentation providing critiques, recommendations, and other commentary on the Protocol and the associated assessment process. Because these various assessments and critiques have been documented to various degrees and in different forms, this assignment is an important opportunity to bring those contributions together.

This report has two objectives: (1) to consolidate the information, opinions, and recommendations contained in the various assessments and other documentation, and (2) to set forth the views of the authors on the Protocol based on their analysis of applications to date, and their recommendations for further action and improvement. The aim is to provide advice that will guide the development of a revised Protocol, and guide development of the trialing program for the draft revised Protocol.

Although assessments using previous versions of the Protocol were studied for background and reference, the focus of this assignment is on documentation drawn from experiences with the current Version 6 of the Protocol. This report is not concerned with any analysis or critique of the assessment results particular to any one scheme, but is focused solely on the process of assessment and how the Protocol has fared so far as an assessment tool.

### Documents Reviewed.

There are currently 8 documents providing feedback on Version 6 of the Protocol. They are listed below. Two of the documents, (1) and (2), were compiled to evaluate the effectiveness of the Protocol itself. The other six documents, (3) to (8), are assessments undertaken using Protocol Version 6.

**Table 1.1. List of all documents considered in scope of report.**

	<b>Title / Description</b>	<b>Date Published</b>	<b>Source</b>
(1)	<b>Application of the IHA Sustainability Assessment Protocol: Case Studies of Blanda Hydropower Plant (Iceland) and Upper Seti Hydropower Project (Nepal)</b> <ul style="list-style-type: none"><li>- This document is a postgraduate dissertation by a student of Sustainable Development at the University of Cambridge. It is unique in that it sets out specifically to test and analyze the application of the Protocol as a tool for measuring sustainability, comparing and critiquing the Protocol against other existing sustainability measures.</li></ul>	August 2008	P. Karki
(2)	<b>Review of the Norwegian Experience in the Use of the IHA Sustainability Protocol</b> <ul style="list-style-type: none"><li>- A report evaluating the Protocol as an assessment tool, based on three completed surveys about the Protocol. The report includes valuable feedback from government regulators, owners/operators, and registered auditors.</li></ul>	May 2008	NVE, Statkraft, and DNV
(3)	<b>Kárahnjúkar Hydropower Project Test Assessment</b> <ul style="list-style-type: none"><li>- Det Norske Veritas (DNV) assessed this scheme as it was nearing completion. The assessment is particularly useful as a comparative document since it is the first assessment done by a registered 3<sup>rd</sup> party auditing and certification company.</li></ul>	June 2008	DNV

(4)	<b>Blanda Hydropower Operating Assessment</b> <ul style="list-style-type: none"> <li>- An assessment of an operating hydropower project completed as part of a university dissertation (Cambridge)</li> <li>- The results are also summarized in Document 2</li> <li>- Contains a valuable set of audit questions devised for each Aspect and a sub-Aspect scoring methodology, both of which could be usefully developed into guidance notes</li> </ul>	March 2008	Landsvrkjun & P.Karki
(5)	<b>Dahuashi Hydropower Project Assessment</b> <ul style="list-style-type: none"> <li>- Scheme was assessed by the Norwegian Water Resources and Energy Directorate (NVE) as part of an audit required for the Ministry of Finance to decide whether to purchase CDM credits from the project.</li> <li>- This is the only assessment that has been done using the Protocol to benchmark a project for external recognition</li> </ul>	January 2008	NVE
(6)	<b>Kembs Hydropower Project Assessment</b> <ul style="list-style-type: none"> <li>- An internal audit using primarily internal personnel.</li> <li>- Closely aligned in terms of approach to Serre-Ponçon.</li> </ul>	March 2007	EDF
(7)	<b>Serre-Ponçon Hydropower Project Assessment</b> <ul style="list-style-type: none"> <li>- An internal audit using primarily internal personnel.</li> <li>- Example of an assessment of a large storage power plant in a multi-station cascade</li> </ul>	March 2007	EDF
(8)	<b>Guandong Province Scheme Assessment</b> <ul style="list-style-type: none"> <li>- Business Improvement assessment using the Protocol Aspects as guidance for a risk and opportunity analysis of a hydropower scheme.</li> </ul>	August 2006	Chinese Hydropwr Company & H. Locher

The following commentaries and assessments derived from previous versions of the Protocol (2, 3 and 4) were also considered in this assignment:

	<b>Title / Description</b>	<b>Date Published</b>	<b>Source</b>
(9)	<b>Gariiep and Van de Kloof Hydropower Assessments (South Africa)</b> <ul style="list-style-type: none"> <li>- Based on Version 4 of the Protocol, with some influence from Version 6 elements as Version 6 was under development at the time.</li> <li>- Makes specific recommendations for modifications to Aspects of Version 4</li> <li>- Contains valuable practical recommendations for auditing preparation and procedures.</li> </ul>	February 2006	Eskom
(10)	<b>Schei and Erikson Conference Paper Containing Helgeland and Trolheim Hydropower Project Assessments</b> <ul style="list-style-type: none"> <li>- Based on Versions 2 and 3 of the Protocol.</li> <li>- Makes valuable strategic comments on the development and use of the Protocol</li> </ul>	August 2005	Statkraft
(11)	<b>Hydro Quebec's Experience With the IHA Protocol: Conference Presentation</b> <ul style="list-style-type: none"> <li>- Based on Versions 2 and 3 of the Protocol.</li> <li>- No specific detail of individual projects, but provides high level comments on each Section together with general recommendations for future use of the Protocol</li> </ul>	August 2005	Hydro Quebec
(12)	<b>Wuskawatim Hydropower Scheme Assessment (Canada)</b> <ul style="list-style-type: none"> <li>- Based on of the February 2004 version of the Protocol.</li> <li>- Provided valuable strategic comments on the use of the Protocol and specific comments on the various Aspects as they existed in the early version.</li> <li>- Covers Sections A and B</li> </ul>	Sept. 2004	Manitoba Hydro
(13)	<b>Andhikhola Hydropower Scheme Assessment (Nepal)</b> <ul style="list-style-type: none"> <li>- Based on the February 2004 version of the Protocol.</li> <li>- An early application of the Protocol to an existing scheme that attempted to cover all phases of the development of a small hydro project by addressing each Section of that version of the Protocol– A, B and C.</li> </ul>	February 2004	Energy Systems (Nepal)

## Summary of Assessments and Protocol Evaluations

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### Assessors' Commentary on the Protocol.

Over 15 hydropower projects or schemes have now been assessed under various Versions of the Protocol, providing a valuable body of commentary on the Protocol from a range of assessors. Considered feedback on the Protocol has been made by DNV, EDF, Energy Systems (Nepal), Hydro Quebec, Hydro Tasmania, P. Karki, H. Locher, Manitoba Hydro, NVE, Statkraft, and WWF. The assessments cover 5 'New projects' (Protocol Section B) and 10 'Operating hydropower facilities' (Protocol Section C), including one project assessed using Protocol Sections A & B and one project assessed using Protocol Sections A, B & C.

Although there are different Aspects to consider for each Version and Section of the Protocol, collectively the assessors have been able to make a number of generic comments and suggestions on the use of the Protocol and its value as a measuring tool and guide. Here we have consolidated the wide range of views into one place. The summarized comments are cross referenced back to the source documents (numbers in parentheses) so that a detailed follow up can be made if desired.

Commentary and recommendations:

1. *Protocol Effectiveness Recognized* : It is recognized that the World Commission on Dams, although based on sound strategic priorities, does not constitute a suitable operational tool for objective third party assessments of hydropower projects (1) (2) (5). The Protocol is praised as a useful tool, potentially capable of being adopted as an effective measurement of sustainability and international best practice, if lifted to industry standard levels and if it has broad acceptability (1). The current image of the Protocol as a tool of the Hydropower industry must be changed if it is achieve that broad acceptability (2).
2. *Role of Protocol – Transparency vs. Sustainability*: Is the Protocol more of a “transparency tool” than a sustainability tool (3)? The Aspects focus to a large extent on the presence of specific analysis/documents (e.g EIA) and process of communicating these to the stakeholders that are affected by the aspect. There is less focus on the actual results found in the analysis than that the analysis has been carried out.
3. *Scoring*:
  - *Relevance of Overall Score*: There was no overall score calculated in Assessment (3) as the assessor had reservations as to how one overall score might best be provided.
    - For example, is the sum most appropriate, or the average? Sum is not appropriate in cases where some aspects are not applicable, whilst an average might hide that some few but essential aspects have very low scores.
    - Alternatively, should the total score focus on the number of aspects scoring higher than a specific threshold (e.g. score 3 or better)?
  - *Weighting of Aspects*: There is concern about how the aspects should be weighted (1) (2) (3) (9) (10) (11). This stems from the concern that particular issues are more prevalent or relevant than others to particular schemes and that these should be highlighted early on and/or the scoring should reflect these differences in a sensitive way. It was suggested that certain aspects deserve a heavier weight or more consideration than others, and that this may change from country to country.
  - *Consider case for N/A*: Where the issue addressed in the aspect is not an issue relevant for the project being assessed, should the score be 5 because it isn't a problem, or should the aspect be classified as N/A because it isn't an issue (1) (2) (3)?
  - *Use without scoring*: Interest was expressed in the use of the Protocol as a checklist (12) without scoring each Aspect. In one instance this was done successfully as a Risk and Opportunity analysis (8)

4. *Overlap Between Aspects:* Most assessors had difficulty with the overlaps between various aspects and this is covered in detail later in this report. The Aspects should be sharpened where room for subjective analysis is too wide (1) (2) (9) (12).
5. *Timing of Assessment:* For Section B assessments it was proposed (3) that the assessment should preferably be made before the construction works start, i.e. during or immediately after the planning phase of the project. However, in large and complex projects all planning activities are not necessarily initiated or completed simultaneously. What if the actual construction work deviates from the original plans? As an example: What if the auditor discovers inconsistency between the planned and agreed action and the real/actual action (i.e. resettled groups are not compensated as stated in the plan/agreement)? It is suggested that section B should exclusively focus on the planning process, which must be stated clearly, even though construction has started (and might deviate from the plans).
  - Projects can be in various stages of development: pre-feasibility, feasibility or design phase, and may not be ready to supply all the answers to the audit. For example, answers to questions relating to Section B11, Safety, may be a bit early to ask in a project at a pre-feasibility/feasibility stage. Guidance is needed on how this should be addressed when conducting an audit. (1)
6. *Options assessment:* Does the Protocol handle the 'no development option' effectively (3) (1)? This question was raised by an assessor (3) undertaking a Section B audit. Controversies around hydropower developments are often related to if there should be a development or not. Such issues should be covered somewhere in the Protocol.
7. *Benchmarking:* What should a project be compared with (3)? Should it be the same for all international projects, or should there be graded benchmarks for projects carried out in countries with similar standards/public involvement/democratic systems? Is best practice always the benchmark? (1) (2)
8. *Baselines:* How should assessments be handled if there are no baseline environmental studies (3) (8)?
9. *Application to Project type:* The Protocol emphasizes reservoir projects (1) (2). Aspects pertinent to run-of-river schemes (and other type-and environment-specific aspects) are missing.
  - For example Section B19 deals exclusively with reservoir sedimentation. Discussion of sedimentation in run-of-river schemes is absent. The fact that many hydropower projects in the Himalayas and Andes are being planned and developed as run-of-river projects requires greater emphasis on sustainability in terms of sediment management (1).
  - Additionally, in countries with cold climates such as Iceland, ice can significantly affect the sustainability of the project in terms of operations (1) (2). The Protocol does not address this issue.
10. *Guidance Notes:* There was a strong desire for guidance notes that would assist with the interpretation of many of the Aspects (1) (2) (3) (4) (9) (11) (12). Guidance notes are a set of documentation that accompanies the Protocol and include further details on the definition of each Aspect and precisely how it is to be assessed and evaluated. Guidance notes may include case study examples illustrating how the Aspect was assessed in specific circumstances, discussion on how particular issues relevant to that Aspect should be handled, or 'benchmarking' advice that helps the assessor measure and correctly score the project for that Aspect in a way that is consistent with the underlying aims of the Protocol. There is also a need for a glossary of standard definition terminology (9). A set of auditing questions was developed by Karki (4) reflecting the need for a standardized set to be developed.

*11. Reporting Format:* Guidance was requested on reporting format, preferably in the form of a template which helps direct the auditor and creates consistency and comparability among assessments (1) (2) (11).

*12. Auditing and Auditor Training:* Training of auditors should be established (2) which concentrates on development of auditing skills so that they are able to better understand the context of the various Aspects and give a more quantitative and less subjective assessment. Because hydropower involves so many disciplines, it is considered necessary that an auditor has substantial experience in the hydropower sector (1). Broad and long-term experience is preferred to narrow specializations and experience of a short duration.

- Audits in geographically and culturally different parts of the world have shown the need for sensitivity towards language and culture (1) (6) (7).
- Availability and quality of evidence should be emphasised (2) (11) and more examples of adequate documentary evidence given.

*13. GHG:* Emissions of CO<sub>2</sub> and CH<sub>4</sub> from hydro power reservoirs are of significant interest but are not directly addressed in the Protocol (1) (3).

*14. Full Life-Cycle Analysis:* Holistic financial accountability should be included as part of the economic evaluation (or dealt with separately). Efforts should be made to drive understanding of the overall systems of which hydropower projects are a part, including full life-cycle analyses of schemes (1).

*15. Ethical Foundation:* The Protocol does not address the issue of corruption and transparency (1). Chronic corruption undermines public trust and the political sustainability of hydropower as an option for societies to consider; it leads to conflict, corruption in land allocation and deters investors and financiers concerned about their reputation, risk and other costs.

*16. Benefits sharing and direct benefits to the local community:* Although section B9 addresses the predicted extent and severity of economic and social impacts on directly affected stakeholders, the discussion is weak on direct benefits to the local community (1). At present the benefits vary around the world. For example, in Brazil, a certain percentage of the income must go to the local community. This is an area that could be further considered in the Protocol.

**Table 2.1. Overview of Version 6 Protocol Assessments to Date**

Scheme & Source	Project Sz	Country	Version & SAP Section	Assessor	Project Type and Stage	Assessors Response to SAP	General comments
<b>Kárahnjúkar</b> (Landsvirkjun)	690 MW	Iceland	6 B-New Project	DNV	Storage, high head  (12.1W/ m <sup>2</sup> )  Almost complete	<ul style="list-style-type: none"> <li>• Difficulty distinguishing overlaps between Aspects</li> <li>• Scoring concerns</li> <li>• Benchmarking concerns</li> <li>• Reservations as to how one overall score might best be provided</li> <li>• Is SAP more of a 'transparency tool' than a 'sustainability tool'</li> <li>• SAP places focus on the existence of process rather than the results of analysis carried out</li> </ul>	<ul style="list-style-type: none"> <li>• Would benefit from guidance notes</li> <li>• Limited project sustainability improvement suggestions</li> <li>• Lacks descriptive summary of the level of sustainability</li> <li>• Experienced independent assessors add credibility to assessment</li> </ul>
<b>Blanda</b> (Landsvirkjun)	150 MW	Iceland	6 C-Operating	P. Karki	Storage, high head (2.4W/m <sup>2</sup> ) Commissioned 1991	<ul style="list-style-type: none"> <li>• Auditor created his own Aspect questionnaire and sub-Aspect scoring methodology</li> <li>• Created radar plot representation of overall sustainability</li> <li>• Used an aggregate score to base conclusions</li> </ul>	<ul style="list-style-type: none"> <li>• Would benefit from guidance notes</li> <li>• Scoring issues arose</li> </ul>
<b>Dahuashui</b> (NVE)	180 MW	China	6 C-Operating	NVE	Run of River (23.6W/m <sup>2</sup> ) Commissioned 2007	<ul style="list-style-type: none"> <li>• Lower scores were awarded on aspects where "sufficient documentation" wasn't available. It is unclear how insufficient evidence should affect scoring or what qualifies as "sufficient evidence" for each aspect</li> </ul>	<ul style="list-style-type: none"> <li>• Reads as a transparency document... is the goal transparency or sustainability?</li> <li>• Up front list of all evidence consulted is thorough and necessary, but should include contact info</li> <li>• Explanation of methodology is very helpful. Further notes and instructions should make a detailed explanation unnecessary, but this section should be included as a way of presenting objective notes on methodology and outlining any questions</li> </ul>
<b>Kembs</b> (EDF)	155 MW	France	6 C-Operating	EDF internal	Run of River  Commissioned 1932	<ul style="list-style-type: none"> <li>• Recognised potential for language barriers to constrain auditing process</li> <li>• Recognised the need for independent assessment in some instances</li> </ul>	<ul style="list-style-type: none"> <li>• Limited formal evidence used</li> <li>• Useful Risk and Opportunity summary chart provided</li> <li>• used a useful pocket summary of SAP Aspects</li> <li>• would benefit from guidance notes</li> <li>• Some project improvement suggestions made</li> </ul>
<b>Serre-Ponçon</b> (EDF)	324 MW	France	6 C-Operating	EDF internal	Storage in a cascade Commissioned 1966	As for Kembs	As for Kembs
<b>Guangdong, China Scheme</b>	100 MW	China	6 C-Operating	H.Locher	Run of River	<ul style="list-style-type: none"> <li>• Focus is on business improvement and how to use Protocol in that application. Confidential and informal.</li> <li>• No specific comments made—focus is on the scheme not the Protocol</li> </ul>	<ul style="list-style-type: none"> <li>• Provides good example of a business improvement, risk/ opportunity approach, as a result assessment was not scored</li> <li>• Confidential and informal, but makes improvement suggestions</li> </ul>
<b>Upper Seti</b>	128MW	Nepal	6 B-New Project	P.Karki	Storage Planning Stage	<ul style="list-style-type: none"> <li>• Developed a three component summary framework of the scheme under economic, environmental and social pillars.</li> </ul>	<ul style="list-style-type: none"> <li>• Useful radar plot as summary of level of Sustainability</li> </ul>

## Specific Feedback on Section B Aspects

There are a number of specific matters to be considered in relation to Section B Aspects. These are identified below:

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### B1 Political risk and regulatory approval

- **DNV** (3) - It may be *difficult to distinguish between the medium layer scores (2-3-4)*

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### B2 Economic viability

- **DNV** - *To what extent should economic viability be documented and demonstrated?*
- **Karki** (2) – Recommends that this Aspect should explicitly require an analysis of “holistic financial accountability,” ensuring that the costs or benefits associated with externalities are adequately covered.
- **RG/MB** – *Should external commercial benchmarks be used to assess the validity of the internal economic evaluations? How independent should the economic assessment be?*

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### B3 Additional economic benefits

- **DNV** - Protocol requirements are suitable. They benefit from being quite wide as the economic effects in one project may differ significantly from those in another.

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### B4 Planned operational efficiency and reliability

- **DNV** - The assessment of a hydropower station’s design and network assets seems at a much higher-level (with few technical details assessed) compared with the assessment of many of the environmental impacts.

Furthermore, *what represents best practice with respect to “hydrological resources and assets”?* The assessors believe this should be understood. Is it planning the use of the inflowing water in an optimal/balanced way, with an acceptable risk profile, and based on economical, technological and environmental factors.

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### B5 Project management plan

- **DNV** - Uncertain as to *what extent and depth a review of this Aspect should take.*

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### B6 Site selection and design optimisation

- **DNV** - This Aspect seems reasonably clear, but there seems *potential for overlap with Aspect B14.*

Critique of Aspect wording:

1. Regarding the definition: Should it be considered defining “avoidance of unique environmental and cultural heritage sites” as something less strict/lower quality? E.g. could also include important habitats, threatened species affected, etc.
2. Term: Maximisation of environmental opportunities? Construction ‘always’ means negative impacts on the environment – should this be rephrased?

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### B7 Community and stakeholder consultation and support

- **DNV** - The Protocol sets somewhat *difficult requirements for scoring this aspect*, especially in cases where there is significant public opposition despite the developer having executed a very thorough process for stakeholder involvement, and generally facilitated an inclusive and open process – in accordance with good sustainable business practices. However, these “positive points” are lost because they are weighted against the general public opposition. A “negative” score for lack of community support should hence be reflected, but so should the efforts for having a thorough inclusive stakeholder process in place.

*Perhaps the best alternative would be to separate public acceptance and stakeholder involvement into two Aspects, as they are both essential components concerning the sustainability performance of a project.*

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## B8 Social impact assessment and management plan

- **DNV** - Full score on performance with regards to social impact assessment and management plan requires the following: Strong community and regulatory support for any actual or planned mitigation, compensation, and / or enhancement strategies. This text somewhat fails to capture the developer's efforts to execute / implement the planned initiatives around social impact, and rather brings focus back to community support – which is *already addressed in aspect B7*.

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## B9 Predicted extent and severity of economic and social impact on directly affected stakeholders

- **DNV** - In the context of a project in a remote location with no one living nearby the reservoir area needing to be resettled, Aspect B9 seems somewhat excessive to (*or almost a repetition of*) the previous Aspects B8 and B3. This might of course be less of a case for projects with significant direct local impact, e.g. with substantial resettlement schemes.
- **Karki** – Although the Aspect addresses the predicted extent and severity of economic and social impacts on directly affected stakeholders, the discussion is weak on direct benefits to the local community. At present these benefits vary around the world (for example Brazil requires a certain percentage of income go to the local community), and this is an area that should be further considered.
- **Statkraft** – B9 could be seen to repeat B8, or it is not immediately clear what is new in B9, since the two Aspects could be seen to overlap the meaning and their relative importance is difficult to judge.

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## B10 Enhancement of public health and minimisation of public health risks

- **DNV** - *Can be reasoned that workers during the construction phase should be included under this Aspect*. It is only a temporary issue, however construction of a hydropower project typically requires a large temporary workforce for a relatively long period and it seems feasible to include considerations of their health and safety conditions when assessing the overall sustainability of the project.

Hydropower developments tend to involve subcontractor engagements of significant scope (particularly during the often long construction phases) and excluding ethical supply chain management in a sustainability assessment seems somewhat lacking.

*Alternatively, the issue of workers conditions during construction phase could be included under aspect B15.*

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## B11 Safety

- **Karki** – At a pre-feasibility/feasibility and planning stage, it may be a bit early in the project to ask for answers to some of the questions addressed in this Aspect. How should this be handled?
- **RG/MB** – *Need guidance notes addressing timing of assessment and the relevance of safety questions at the time of assessment.*

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## B12 Cultural heritage

- **DNV** - In assessing this Aspect, *a paradox that may apply to several of the aspects arises*: If there are no cultural heritage issues of great significance the developer receives the highest score (5), not because a very thorough 'Comprehensive cultural heritage assessment process, consistent with relevant legislation and international standards' was conducted (since there was no need for such a process), but rather because the few minor issues relevant were in fact addressed. Is this the correct assessment conclusion?

*Is the fact that the project doesn't really affect cultural heritage sites in itself a qualifier for a high score? Or should it rather be an indicator of an N/A type score? Or even a lowered grade? The latter doesn't seem fair either, as it would be pointless to require a very comprehensive heritage assessment process where there quite clearly wasn't a need for it.*

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### B13 Environmental impact assessment and management system

- **DNV** - The timing of the assessment is an issue to be clarified in the Protocol. DNV *assumed that Section B purely assesses the project planning and not the actual construction* even though the construction may have started when the assessment is made.
- **RG/MB** – How should as constructed outcomes as opposed to planning affect scoring under Section B?

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### B14 Threshold and cumulative environmental and social impacts

- **DNV** - Where a project is the first new hydropower plant in the region, cumulative environmental and social aspects in a river basin-perspective are *irrelevant to be considered*. In cases where this Aspect is relevant, it should be investigated whether there is *a potential overlap with Aspect B6* (site selection and design optimisation).
- **RG/MB** – *Note DNV could not score this item as they considered it not relevant in the context of the project they assessed.*
- **Karki** – *It is recommended that the Protocol address the issue of system-level planning, using tools such as Strategic Environmental Assessment (SEA), and considers cradle to grave life-cycle thinking. Also the demonstrated need for the project should also be addressed within Section B.*

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### B15 Construction and associated infrastructure impacts

- **DNV** - This Aspect may also touch upon land management issues, as the construction of transmission lines, roads, housing, etc are all land management/land use issues. DNV understands this aspect of the Protocol to be about outer environment and not SHE (safety, health and human environment) *contrary to an internal pre-assessment for the same scheme*, which focuses on SHE elements for this Aspect.
- **RG/MB** – *lack of clarity of what is included in scope of this item, can overlap with B10*

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### B16 Land management and rehabilitation

- **DNV** - It is *not fully clear whether soil erosion should be evaluated as part of this Aspect* or under other Aspects (i.e. B19).

Regarding understanding of this Aspect's 'Example of evidence 5' – Site sediment controls or planning – *Do they mean sediments from the construction? It is assumed that aspect B16 focuses on sediments originating from the site where the hydropower plant/dam is located.* Furthermore, we assume that aspect B19 focuses on the sediment/erosion issues in the upstream/downstream areas, causing problems both to the operation of the hydropower plant/dam and other users/interest groups in the catchment area.

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### B17 Biodiversity and pest species

- **DNV** - The concept of biodiversity is difficult to quantify/measure for all types of waters in all types of eco-regions, and only *becomes more difficult to assess in more complex ecosystems.*

The Performance column focuses on the level of agreement, which is *difficult to quantify*. The Planning column focuses a little more on the understanding, which is good. DNV assume then that this column is to capture the elements and effects of collection of data/research on the ecosystem.

Regarding understanding of Example of Evidence 2: (a) Ecosystem values as a resource to the population living nearby? *How does one assess the ecosystem value?* Should one use willingness to pay/contingency valuation studies or other methods? Are such studies too comprehensive for a standard EIA study; (b) Should a plan to avoid the introduction of alien species/avoid migration be required?

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## B18 Environmental flows and reservoir management

**DNV** - *How should the case be handled where no interests seem to be present and no environmental flow is proposed. Will this warrant a maximum score, a minimum score, or not applicable? What if the authorities give flow requirements not proposed by an EIA-report, should the score then be lowered? This is a similar situation to the paradox discussed under B12 - Cultural Heritage.*

The Process column defines that social and economic consequences of a given environmental flow should be assessed. Is this correct?

Other issues (noted by both **DNV** and **Statkraft**):

B18 doesn't adequately cover reservoir-specific issues.

There is no distinction between changing a river into a lake vs. changing a river into a larger river.

- **RG/MB** – *DNV did not score this Aspect so how does this impact the overall assessment of sustainability - Environmental flows are a significant issue and an N/A score implies this Aspect needs further assessment advice.*

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## B19 Sedimentation and erosion

- **DNV** - Regarding Protocol 'Example of Evidence 4': 'Regulatory Licence requirements' Is this something the hydropower constructor should be asked for? DNV assumes that the constructor must have such a licence, but it should be the authorities that issue this. *Is this understanding correct?*
- **Karki** – This Aspect deals exclusively with reservoir sedimentation. Discussion of sedimentation in run-of-river schemes is absent. The fact that many hydropower projects in the Himalayas and Andes, in particular, are being planned and developed as run-of-river projects requires greater emphasis on sustainability in terms of sediment management.

In addition, in countries with cold climates, ice can significantly affect the sustainability of the project in terms of operations. *The Protocol does not address this.*

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## B20 Water quality

- **DNV** - The Aspect reads: "...water quality issues in the reservoir and downstream of the power station". *Why only these parts of the river system? Less water might cause less dilution, which is the case where 'dry' rivers receive sewage and the receiving capacity is very much reduced (e.g. Måna River flowing through Rjukan in Norway) or other changes in water chemistry upstream due to withdrawal of water.*

The bullet points are a mix of requirements to the Water Quality plan and the actual impact of the hydropower scheme.

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## General Observations and Ideas Arising from this Review

### I. Defining Application and Clarity of Purpose

There is wide recognition that after appropriate revision, the Protocol can be an effective tool for measuring the sustainability and performance of the hydropower industry (1) (2) (5). However, there are still varying opinions amongst the authors and assessors as to the end purpose of the Protocol. Some of the documents explicitly express this doubt (2) (3). Others hint at it through questions addressing the relevance of a total score or how projects should be benchmarked (1) (2) (3). In other cases, this sense is gained from the diversity of reporting methodologies and the varied goals of the reports.

As discussed in the following section of this report, there are several possible uses for the Protocol, each of which has its merits and drawbacks. Version 6 makes reference to 'Different Types of Audits' when discussing the gathering of 'Objective Evidence', however this should be taken further to clarify the range of objectives for using the Protocol and how the Protocol would be used in each case.

#### Options for the Use and Application of the Protocol

The assessment documents fall broadly into three categories, reflecting potential uses of the Protocol and purposes of assessment:

1. **Business Improvement** – where an informal assessment is done with limited or no scoring with a focus purely on Risk and Opportunity assessment for the project owner (8) (9).
2. **Pre-Assessment** – where an internal assessment is done to rate a scheme for an owner to gauge its sustainability status on a confidential basis. This can guide performance improvement initiatives or give confidence to proceed with an assessment for external recognition (3) (4) (6) (7) (10) (12) (13).
3. **Assessment for External Recognition**, such as CDM qualification (5).

Each type of assessment will have different expectations regarding format, caliber of evidence and support requirements as indicated by the table below.

**Table 3.1. Comparing Three Potential Uses of the Protocol.**

Potential Use of Protocol	Approach	Required support	Result
<b>Business Improvement</b> <i>(internal, confidential)</i>	<ul style="list-style-type: none"> <li>• Use Protocol to guide a risk and opportunity analysis that supports business improvement and risk management planning</li> </ul>	<ul style="list-style-type: none"> <li>• Protocol as reference</li> <li>• 'Pocket Guide' to Aspects (see Appendix II)</li> <li>• Scoring not necessary</li> <li>• Assessor with broad hydro experience</li> <li>• Risk and Opportunity Analysis (8)</li> <li>• Standard report format helpful but not necessary</li> </ul>	<ul style="list-style-type: none"> <li>• Owner gains increased awareness of the standards being set by the international hydropower industry</li> <li>• Owner gains confidential feedback on strengths and opportunities for improvement and risk mitigation to incorporate into planning / operation</li> </ul>
<b>Pre- Assessment</b> <i>(preparing for External Recognition; for comparison to other schemes/standard)</i>	<ul style="list-style-type: none"> <li>• Undertake internal, confidential assessment using suitably trained personnel</li> <li>• Owner could engage 3<sup>rd</sup> party auditor if desired</li> </ul>	<ul style="list-style-type: none"> <li>• Protocol</li> <li>• Extensive Guidance Notes</li> <li>• Internal Auditor with Protocol training</li> <li>• Project Scored</li> <li>• Risk and Opportunity Analysis included</li> <li>• Standard Reporting Format (2) (6) (7)</li> </ul>	<ul style="list-style-type: none"> <li>• Owner able to estimate performance as compared to "best practice" and other assessed schemes and to make improvements as appropriate</li> <li>• Audit report and evidence will assist if Owner undertakes subsequent External Recognition Audit</li> </ul>
<b>External Recognition</b> <i>(for Certification/Financing/Community Recognition)</i>	<ul style="list-style-type: none"> <li>• Undertake 3<sup>rd</sup> party assessment using registered audit company and suitably experienced and trained Auditor</li> <li>• Audit report capable of standing external scrutiny</li> </ul>	<ul style="list-style-type: none"> <li>• Protocol</li> <li>• Extensive Guidance Notes</li> <li>• External Auditor with Protocol training/ certification</li> <li>• Project rigorously scored</li> <li>• Standard Reporting Format/Template</li> <li>• Standard approach to the 'Summary Statement of Level of Sustainability' (2)</li> </ul>	<ul style="list-style-type: none"> <li>• Owner in a position to use Audit Report in the public arena and to gain external benefits</li> </ul>

## II. The Need for a Consistent Reporting Methodology

There is much discussion by assessors about the need for a common reporting format and assessment method (such as the auditing questions and sub-scoring method devised by Karki), which would provide increased clarity and enable comparisons of projects on an international level. Consistent reporting will also assist in revealing issues with each Aspect and assist the HSAF to further refine the Protocol.

The lack of a consistent reporting framework has made it difficult to readily compare the range of assessments completed to date, and, unless rectified, future trialing work will not be as effective as it could be. Specifically, while Documents 3 through 8 all provide important examples of hydropower sustainability assessments using Version 6, the reporting approaches vary widely—some are internal evaluations; one is specifically focused on a risk and opportunity business improvement; two are 3rd-party assessments, with one (3) completed by a registered auditing company (DNV); some present the data and conclusions in concise paragraph format (8), others use various types of graphs and visuals, and some take directly from the format of the Protocol itself (5) (13). All of the reports have a different style, different methodologies, and different display of data and evidence (with little consensus on what exactly should be included in a final report). Even with the understanding that differences in purpose will continue to exist among reports (as discussed in the previous Section), guidance on format would be of great assistance in increasing the comparability of reports and data, and therefore in improving the Protocol as a tool.

It is instructive to note the approach taken to reporting by the CDM Executive. There is rigorous attention paid to the format of all CDM project reporting that is complied by the many registered assessment bodies since the CDM Executive deals with thousands of projects that must be compared with its benchmark criteria.

Protocol assessment reporting could be readily addressed using the Version 6 assessments completed to date, and the suggestions in this report, to develop a reporting template ready for trials with the revised Protocol. A template would make the task of doing an assessment less daunting, and therefore might help to increase the frequency of trials and take-up of the Protocol. It would be valuable if the past V6 assessments were transcribed into the new template form so that the work done to date is readily accessible and comparable.

### How to Summarize Sustainability?

One of the common challenges with the various assessment conclusions was to find a suitable way to summarize the sustainability performance of a project. Expressing an average score alone does not adequately summarize the complexities of a sustainability assessment. Karki (2) offered some valuable ideas that should be considered when a standardized reporting framework is devised.

To gain an appreciation of the spread of performance against each Aspect, Karki proposed (2) the use of a Radar plot which is visually quite effective:

Summary Scores for Two Projects



Furthermore, we have drawn on a scheme summary framework proposed by Karki (2) and by Hydro Quebec (11) to suggest the following means of summarizing the result of an assessment. As Karki suggests, sustainability requires the integration of three components: economic development, social development, and environmental protection, as independent, mutually reinforcing pillars (IHA 2003).

**Table 3.2. Proposed Sustainability Summary Framework, modified from Karki (2).**

<b>Project Name:</b>		
<b>Score Statement</b> <i>(eg. 3.7 with a range from 2 to 5)</i>		<b>Sustainability Summary for Project</b>
<b>Economics</b> <i>(Incl. Aspects...#...)</i>	<ul style="list-style-type: none"> <li>• Score summary               <ul style="list-style-type: none"> <li>○ <i>Average...</i></li> <li>○ <i>Range...</i></li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Summary statement(s)</li> </ul>
<b>Social</b> <i>(Incl. Aspects...)</i>	<ul style="list-style-type: none"> <li>• Score summary               <ul style="list-style-type: none"> <li>○ <i>Average...</i></li> <li>○ <i>Range...</i></li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Summary statement(s)</li> </ul>
<b>Environment</b> <i>(Incl. Aspects...)</i>	<ul style="list-style-type: none"> <li>• Score summary               <ul style="list-style-type: none"> <li>○ <i>Average...</i></li> <li>○ <i>Range...</i></li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Summary statement(s)</li> </ul>

### III. A Pocket Guide to Section C Aspects

When using the Protocol as an informal business improvement or risk and opportunity assessment tool on existing hydropower facilities, several assessments (8) (7) (6) included a summarized Aspects guide they had developed, which is attached at Appendix II. This provides a very useful ‘pocket guide’ to holistically conduct a simplified sustainability assessment.

#### IV. Systematic Trialing

The planned trialing of the revised Protocol needs to address areas that have had limited coverage in the 15 documented assessments to date. Trialing should target:

- Projects with known challenges so that the criteria used for scores in the range 1 through 3 can be tested, since almost all of the scored assessments awarded Aspect scores of “3” or above, with a high proportion of “5” scores;
- Additional projects in developing countries;
- Some projects in the smaller size category of say less than 30MW, and include projects <10MW as more testing is need to verify the suitability of the Protocol to very small projects;
- Projects that are in the feasibility stage;
- More ‘New Projects’.

Guidance notes (as defined in item 10 page 4) for many of the Aspects and an extensive definitions glossary should be developed in advance of the trials.

The Protocol trials need to be systematic and consistently documented. It will be important to use the trials to begin to develop a library of case notes that explain how an Aspect was assessed in different project contexts. This is particularly important for Aspects where a higher amount of subjectivity is required to make a judgment on the score. Such notes could be modified to cater for confidentiality concerns.

The engagement of a professional auditing partner should be considered to assist in the trialing process. It will be important to ensure that all the assessors in the trialing process are well trained in the application of the revised Protocol. The pool of trained assessors should also be encouraged to discuss difficulties in scoring during their trial assessments and required to comment on guidance notes as part of the trial assessment.

‘Recommendations for Audit Preparation and Process’ were prepared during one of the past assessments (9) and they are included in this report as Appendix I as an input to the development of the future trialing process.

## Conclusions

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As a result of our review of the existing Protocol assessments we suggest that the HSAF should:

- 1) **Review the 16 compiled recommendations made by the various assessors at pages 3 & 4**
- 2) **Consider the detailed comments made against each Section B Aspect as compiled at Appendix I**
- 3) **Provide clear direction on the objectives and use of the Protocol**
- 4) **Update the 'Pocket Guide' to key Aspects for Operating Hydropower Facilities to align with the revised Protocol.**
- 5) **Adopt a systematic approach to the future trials of the revised Protocol incorporating the suggestions made on page 14**
- 6) **Initiate the development of a standardized assessment reporting format**
- 7) **Commence the development of guidance notes to support each Aspect as proposed at item 10, page 4**

## Appendix I. Recommendations for Audit Preparation and Process

*Extract From Document 9 - (Locher & Collier)*

### **MISC Preparatory Guidance**

- In the case of joint ownership (e.g. dam owned by Department of Water Affairs, power station owned by power company), assessment must involve both parties.
- Audits are most valuable where an independent assessor, e.g. an NGO or member of the university, research consultancy or civil society, can be included as a member of the audit team.
- Audit will be greatly enhanced by including members of relevant government agencies, independent consultants, members of local community, stakeholder groups or catchment management authorities, etc.

### **Prior preparation by Scheme owner/operator – up to 10 person-days:**

- Need to assign a main contact person for the auditors, who will co-ordinate all aspects of the audit;
- Need to delegate individuals to be responsible for each one of the 20 aspects;
- Each delegate must allow on average ½ day preparation for each aspect to determine and contact appropriate experts and obtain evidence;
- Each delegate must identify what they believe the rating should be and ensure they have the evidence available to support this rating;
- Main contact person will prepare a schedule for the visit which will be provided to the auditors prior to the visit.

### **Prior preparation by Auditors/Assessors – up to 6 person-days:**

- Need to review website of owner/operator, read Annual report, search web for references on the scheme and read prior to undertaking the audit; search for protected areas (e.g. Ramsar sites) etc.
- Need to ensure that they have a good regional map.

### **Scheme visit**

- Allow 1-1½ days depending on scheme location and distances to be travelled;
- Where possible include visits to the reservoir and downstream river system as well as the dam and power station, and include interviews with local stakeholders.
- **Interviews:**
  - Allow a minimum 1.5 days in total.
  - Each delegate is interviewed in turn, providing what they believe the rating should be and tabling the evidence to support the rating. Delegates must ensure that they can enable contact with relevant experts if required.
  - Interview for each aspect may take from 15-30 minutes.
  - Auditors need to allow time during their visit to review documents and make further enquiries / phone calls.

## Appendix II. 'Pocket Guide' to key Aspects for Operating Hydropower Facilities

ASPECT	FOCAL AREAS	BASIS FOR RATING	EXAMPLES OF OBJECTIVE EVIDENCE
<b>Governance</b>	The governance of the business in terms of ability to meet sustainability objectives.	<ul style="list-style-type: none"> <li>Clearly defined vision, values, ethical standards, strategies and business principles.</li> <li>Independently certified management systems.</li> <li>Efficient and effective business structure.</li> <li>Transparent performance reporting process.</li> <li>Regulatory compliance.</li> </ul>	<ul style="list-style-type: none"> <li>Documentation of vision, values, strategy, business principles, business policies, codes of conduct.</li> <li>Management system audits and certifications.</li> <li>Performance reporting (internal and external).</li> <li>Stakeholder/shareholder feedback.</li> <li>Independent assessments.</li> </ul>
<b>Economic Viability</b>	Economic viability of the operations.	<ul style="list-style-type: none"> <li>Business planning, auditing, monitoring, performance reporting.</li> <li>Economic performance.</li> <li>Satisfies shareholder expectations.</li> <li>Meets agreed benchmarks and targets.</li> </ul>	<ul style="list-style-type: none"> <li>Business plan, business charter documentation of agreed benchmarks and targets.</li> <li>Annual reports and balance sheet.</li> <li>Audit reports, credit rating, independent assessments of economic performance.</li> </ul>
<b>Additional Economic Benefits</b>	Distribution of benefits to directly affected stakeholders and the broader community <sup>1</sup> .	<ul style="list-style-type: none"> <li>Identification and realisation of opportunities for additional benefits.</li> <li>Assessment and understanding of effectiveness of additional benefits.</li> </ul>	<ul style="list-style-type: none"> <li>Assessment reports.</li> <li>Development of plans.</li> <li>Surveys, interviews with stakeholders.</li> <li>Independent assessment of performance.</li> </ul>
<b>Markets and Innovation</b>	Short- and long-term market conditions.	<ul style="list-style-type: none"> <li>Assessment of market conditions and influences.</li> <li>Ability to respond to medium- and long-term market variability.</li> </ul>	<ul style="list-style-type: none"> <li>Market research, R&amp;D programs.</li> <li>Examples of new products, expansion into new markets, application of new solutions, response to market demands.</li> </ul>
<b>Operational Efficiency</b>	Management of the hydrological resource, in the power station assets (e.g. turbines), and in the network assets.	<ul style="list-style-type: none"> <li>Assessment of power station, network and hydrological efficiencies.</li> <li>Benchmarking against efficiency standards.</li> </ul>	<ul style="list-style-type: none"> <li>Efficiency identification, measurement and assessment process, including benchmarking.</li> <li>Energy production management system.</li> <li>Hydrological monitoring and analysis.</li> <li>Program of asset upgrades and efficiency improvements.</li> </ul>
<b>Operational Short-term and Long-term Reliability</b>	Operational reliability of the hydrological resource, power stations and network assets.	<ul style="list-style-type: none"> <li>Asset and hydrological resource management strategies / systems.</li> <li>Emergency preparedness program.</li> <li>Analysis of future reliability of hydrological resource.</li> <li>Strong reliability performance.</li> </ul>	<ul style="list-style-type: none"> <li>Management strategies and programs.</li> <li>Records of performance.</li> <li>Hydrological analysis, research into future hydrological reliability.</li> <li>Asset performance guarantees.</li> <li>Emergency / unusual event plans.</li> </ul>

<sup>1</sup> Can include direct or indirect employment, education and transfer of knowledge, improved health care, water supply, provision of electricity, new industries, recreation, roads etc

ASPECT	FOCAL AREAS	BASIS FOR RATING	EXAMPLES OF OBJECTIVE EVIDENCE
<b>Dam, Power Station and Associated Infrastructure Safety</b>	The degree to which asset safety is demonstrated as a priority for the business.	<ul style="list-style-type: none"> <li>• Safety programs and plans consistent with relevant national and/or international standards.</li> <li>• Strong safety performance.</li> </ul>	<ul style="list-style-type: none"> <li>• Inspection program and reports.</li> <li>• Issue identification and risk assessment.</li> <li>• Safety and legal compliance records.</li> <li>• Emergency preparedness.</li> <li>• Independent verifications.</li> </ul>
<b>Employee Safety, Occupational Health and Well-being</b>	Measures to address employee safety, occupational health and well-being	<ul style="list-style-type: none"> <li>• Safety, occupational health, and well-being employee programs and performance.</li> </ul>	<ul style="list-style-type: none"> <li>• Issue identification and risk assessment.</li> <li>• OH&amp;S programs and improvements.</li> <li>• OH&amp;S compliance records.</li> <li>• Training / competency records.</li> </ul>
<b>Employee Opportunity, Equity and Diversity</b>	Employee training, development, equity and diversity programs.	<ul style="list-style-type: none"> <li>• Programs are in place.</li> <li>• Employee feedback program with positive feedback.</li> </ul>	<ul style="list-style-type: none"> <li>• Workforce and succession planning.</li> <li>• Employee and management profile, competency levels.</li> <li>• Employee feedback program.</li> </ul>
<b>Suppliers and Service Providers</b>	Consideration of sustainability issues when purchasing goods and services, with regard to reputational risks or likelihood of non-compliance with business policies <sup>2</sup> .	<ul style="list-style-type: none"> <li>• Understanding of sustainability issues in purchasing of goods and services.</li> <li>• Goods and service provider assessment and selection process.</li> <li>• Strong organisational relationships with major suppliers and service providers with good performance on sustainability issues.</li> </ul>	<ul style="list-style-type: none"> <li>• Pre-qualification process for suppliers and service providers, purchasing policy and procedures, clear tender requirements.</li> <li>• Contracts and agreements with suppliers.</li> <li>• Evaluations of supplier performance and supply chain impacts.</li> </ul>
<b>Cultural Heritage</b>	The protection and conservation of historic and indigenous heritage values.	<ul style="list-style-type: none"> <li>• Understanding of heritage values and issues</li> <li>• Plans and programs consistent with relevant legislation and international standards and agreed with regulators and stakeholders.</li> <li>• Protection and conservation objectives met.</li> </ul>	<ul style="list-style-type: none"> <li>• Conservation plans, and heritage impact statements, plans and agreements.</li> <li>• Inspection of sites or restoration projects.</li> <li>• Interviews with regulators and stakeholders.</li> </ul>
<b>Community Acceptance</b>	Ongoing degree of community support for the scheme, and the processes used to maintain that support.	<ul style="list-style-type: none"> <li>• Stakeholder consultation process.</li> <li>• Community support or no significant community opposition.</li> </ul>	<ul style="list-style-type: none"> <li>• Written agreements, minutes of meetings with stakeholders.</li> <li>• Records of interviews, surveys, polls.</li> <li>• Documentation on consultation strategies, resources, timing, information sharing.</li> </ul>

<sup>2</sup> Considerations would include environmental performance, adoption of internationally recognised labour practices, human rights, support for local employment.

ASPECT	FOCAL AREAS	BASIS FOR RATING	EXAMPLES OF OBJECTIVE EVIDENCE
<b>Social Commitments</b>	Management and performance in relation to the original social commitments made at the time of scheme approval as well as current social commitments.	<ul style="list-style-type: none"> <li>• Identification of relevant social issues and incorporation into commitments.</li> <li>• Independently endorsed social management plans.</li> <li>• Compliance with all social commitments, stakeholder agreements and regulatory requirements.</li> </ul>	<ul style="list-style-type: none"> <li>• Records of the original and present social commitments, management programs to deliver on commitments, and performance on meeting social commitments.</li> <li>• Results of independent reviews/audits.</li> </ul>
<b>Directly Affected Stakeholders</b>	The success of avoidance, mitigation, compensation and enhancement programs addressing impacts on directly affected stakeholders.	<ul style="list-style-type: none"> <li>• Analysis of social and cultural effects on directly affected stakeholders.</li> <li>• Directly affected stakeholders, including vulnerable social groups, have not been socially or culturally disadvantaged.</li> <li>• Social and cultural enhancements have resulted from the project.</li> </ul>	<ul style="list-style-type: none"> <li>• Resettlement plans and compensation program, cultural enhancement program, public health program.</li> <li>• Surveys and interviews with directly affected stakeholders.</li> <li>• Independent audits and review.</li> </ul>
<b>Environmental Commitments and Management</b>	Management and performance in relation to original environmental commitments made at the time of scheme approval as well as current environmental commitments.	<ul style="list-style-type: none"> <li>• Environmental management system that is independently certified to a relevant international standard.</li> <li>• Compliance with original and current environmental commitments and all statutory requirements.</li> </ul>	<ul style="list-style-type: none"> <li>• Audit records on closure of EIA/EMP commitments, and on performance of the EMS.</li> <li>• Environmental license conditions, compliance records.</li> <li>• Policies and environmental plans.</li> </ul>
<b>Reservoir Management</b>	Effectiveness of the reservoir management regime to meet agreed environmental, social and economic outcomes.	<ul style="list-style-type: none"> <li>• Researched and defined environmental, social and economic objectives for reservoir management regime.</li> <li>• Community and regulator support for reservoir management regime.</li> </ul>	<ul style="list-style-type: none"> <li>• Documented research program, and environmental, social and economic objectives</li> <li>• Regulatory or other agreements.</li> <li>• Monitoring and review, surveys of stakeholder opinion.</li> </ul>
<b>Environmental Flows<sup>3</sup></b>	Effectiveness of the environmental flow regime to meet agreed environmental, social and economic outcomes.	<ul style="list-style-type: none"> <li>• Researched and defined environmental, social and economic objectives for environmental flow regime.</li> <li>• Community and regulator support for environmental flow regime.</li> </ul>	<ul style="list-style-type: none"> <li>• Documented research program, and environmental, social and economic objectives</li> <li>• Regulatory or other agreements.</li> <li>• Monitoring and review, surveys of stakeholder opinion.</li> </ul>
<b>Biodiversity and Pest Species</b>	Ecosystem values, habitat, and issues such as threatened species, fish passage, and pest species in the catchment, reservoir, and downstream areas.	<ul style="list-style-type: none"> <li>• Understanding of biodiversity issues, and program in place to address them.</li> <li>• Agreement with regulators and other stakeholders on ecosystem values.</li> <li>• Achievement of objectives and targets..</li> </ul>	<ul style="list-style-type: none"> <li>• Research and database on threatened species.</li> <li>• Documented agreements on ecosystem values.</li> <li>• Research on fish passage and pest barriers.</li> <li>• Physical infrastructure, e.g. fish lifts.</li> <li>• Biological monitoring data.</li> </ul>

<sup>3</sup> An environmental flow is a flow that is agreed to be delivered to meet needs other than power generation, for example maintaining a minimum base flow in the river year round to ensure adequate aquatic habitat area, or release of an annual flood flow of a given magnitude to water important floodplains

ASPECT	FOCAL AREAS	BASIS FOR RATING	EXAMPLES OF OBJECTIVE EVIDENCE
<b>Water Quality</b>	Management of water quality in the reservoir and downstream of the power station.	<ul style="list-style-type: none"> <li>• Understanding of water quality issues.</li> <li>• Water quality management program.</li> <li>• Scheme operations either enhance or do not cause deterioration of water quality.</li> <li>• Meets commitments and regulatory requirements.</li> <li>• Operator influence, if practicable, on the behavior of others to protect water quality.</li> </ul>	<ul style="list-style-type: none"> <li>• Water quality investigations and management program.</li> <li>• Monitoring data and reports.</li> <li>• Water license and water quality commitments.</li> <li>• Records of negotiations or agreements with others who influence water quality.</li> </ul>
<b>Sedimentation and Erosion</b>	Understanding of risks of sedimentation and erosion in the reservoir and downstream, and measures in place to manage risks.	<ul style="list-style-type: none"> <li>• Understanding of erosion and sedimentation issues, and stakeholder concerns.</li> <li>• Risk management program.</li> <li>• Participation in catchment management planning and implementation.</li> </ul>	<ul style="list-style-type: none"> <li>• Sedimentation and erosion risk investigation and management program, catchment management plans.</li> <li>• Performance reports on risk management strategies.</li> </ul>



**Prepared By: Roger Gill & Meg Bartos**

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