Chapter 4

ANTICIPATED ENVIRONMENTAL IMPACTS OF THE PROJECT

4.1 Soil Erosion and Siltation

4.1.1 Soil erosion and siltation hazards during construction

As the weir and forebay tank are on flat land with an exposed surface bedrock due to minimal excavation, the possibility of soil erosion is low. However, as the penstock path, powerhouse and tailrace have a moderate to steep slope in some parts, when construction is done in these areas, erosion may occur.

Scale and nature of the impact: Above impacts are direct, short term and negative. As far as considered the scale, they are of medium level of significance for addressing, and need some remedial measures.

In the construction of the weir and intake, the possibility of moderate siltation is expected, as both components are close to the stream. There is a tendency for siltation to occur when the tailrace is constructed. As the other components are not close to the stream, the possibility of siltation in their construction is negligible.

4.1.2 River bank and riverbed erosion during the construction and operational phase

River bank erosion is expected to be moderate at the weir and tailrace and is negligible in the other components.. When there is a water output in the operational phase at the spill gate in the forebay tank, there is a tendency for river bank erosion.

Moderate riverbank erosion can be expected at the point of the Tail race construction. At present this location is covered by rock boulders and some river bank vegetation. Other area of river bank erosion is not expected to occur in the operational phase.

Scale and nature of the impact: Above impacts are direct, short term and negative. As far as considered the scale, they are of medium level of significance for addressing, and need some remedial measures.

4.1.3 Impacts during rehabilitation of access to the weir and powerhouse

An access road which needs to be renovated is located near the weir. As this is a relatively flat area, erosion is not likely to occur. A road approximately 50m in length needs to be cut to the power house, which may cause moderate level soil erosion.

Scale and nature of the impact: Above impacts are direct, short term and negative. As far as considered the scale, they are of medium level of significance for addressing, and need some remedial measures.

4.2 Water quality impacts

4.2.1 impacts of water quality during construction of weir and power house

When the power house and weir are being constructed, particularly the weir, mixing of cement and concrete with the stream will affect the water. During the transportation of building materials there is a possibility of water pollution due to discharge of fuel, materials etc.

Scale and nature of the impact: Temporary, No impact likely

4.2.2. Waste generation and pollution from temporary workers camp

Temporary workers camp would be establish in weir site which some waste water discharge from the sanitary facilities in the workers camp is expected.

. These changes however do not cause any long term significant impacts as they are limited to the construction phase.

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Scale and nature of the impact: Above impacts are direct, short term and negative. As far as considered the scale, they are of medium level of significance for addressing, and need some remedial measures.

4.2.3. Impacts on water quality and quantity at water intakes of drinking water supply schemes downstream at the weir

There are no drinking water supplies in the project area. Therefore such impact is unlikely.

Increase in water levels upstream under normal discharge due to the weir

4.2.2 Increase in stream flood water levels (for 50 years return flood).

Flood peak corresponding to 50 year flood is found as 25 m³/s. However, a frequent floods are expected during the rainy season. As the weir is firmly established on the stable mother rock, the flood effect will not cause any serious damage to the weir. (A contour map of the inundating area attach in Annex v-c).

4.3 Ecological impacts

4.3.1. Impacts terrestrial fauna and flora

The entire clearing operation will cause following;

- Some mortality of plant and animal species and reduction of area of occupancy
 of species (but not species extinction in the project influencing area. No point
 endemic species were recorded).
- Loss or degradation of animal and plants habitats.
- Fragmentation of faunal and floral habitats ecosystems and the species therein, need a certain amount of interconnectivity for processes to continue.
- Loss of area of occupancy of sensitive species (endemic & threatened).
- Native plants and animal mortality due to replacement of newly disturbed sites with invasive plants.

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Specially this can happened in the latter part of the penstock which runs through the forest patch.



Fig. 10 Part of the Semi-natural lowland rain forest patch in the proposed penstock path which proposed to restore after construction commenced.

Civil constructions will cause

- Direct damage to plant life (details given in 2.1.7 section)
- Soil disturbance works related to site preparation and improving road access facilities will result in fugitive dust emissions, movement of sediments and pollutants into the stream through rain run off, and increasing of unusual sediment loads in the stream and clogging of drainage lines, affecting the sustainability of micro ecosystems and species. Rainy season soil erosion/movement and its resultant increase in suspended solids in surface water will be more visible in streams. This will temporarily affect the health of fresh water ecosystem.
- Transportation of heavy machinery and construction material along with traffic movement will result in soil disturbance and air pollution (some fugitive dust emission) mainly affecting the vegetation in 10m buffer of the road network. Some deposition of air borne particles on foliage results in growth impedance of poorly adapted native flora. This situation gives completive advantage for already existing invasive plants for further invasion in wider area suppressing the native flora.

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• Spills from construction activities; solid and liquid waste such as scrap metals, cement debris, plastics, oils and other lubrication waste from machineries, spent organic solvents, sludge and solids from the paint and coatings, solid and/or hazardous wastes, toilet and kitchen waste generated from worker quarters etc. can ultimately pollute the terrestrial and wetland habitats outside the construction site if not properly managed. The immediate forested lands in 20m buffer, are the high risk habitats in this regard.

Flora:

Several sensitive plants (see below table) associated with stream habitat are likely to be affected (growth retardation and poor regeneration) within the stream abstracted zone.

Table:20 Stream associated sensitive plants likely to be affected.

Species	Endemic	NCS	GCS	Local name	FFPO
Hydnocarpus venenata Gaertn.	Endemic	LC		Makul	
Cyathea walkerae Hook.	Endemic	VU		treefern	
Vateria copallifera (Retz.) Alston	Endemic	VU	ENi	Hal	
Horsfieldia iryaghedhi (Gaertn.) Warb.	Endemic	VU	Cri		
Myristica dactyloides Gaertn.		LC	LCi	Malaboda	Protected
Farmeria metzgerioides (Trimen) Willis ex Hook.f.	Endemic	VU			

Impacts on aquatic fauna and flora due to low flows downstream and inundation upstream during the operational stage

- Reduction of water flow of the stream in water abstracted area affects the aquatic bio-diversity.
- Habitat loss results in loss of species richness and biodiversity.
- Spread of alien invasive species in areas where habitats have modified and human presence is more than usual.

The flood peaks of the catchment are expected to fairly large. The building of the weir will not cause significant changes in the already adjusted flood pattern in the area, as the maximum weir height is 1.25m. As the ponding area is relatively negligible when

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compared to the dimensions of the river area, the possibility of flooding is insignificant. Additionally no significant construction are located upstream.

Impact on aquatic faunal species;

Above the weir area only *Garra ceylonensis* have been recorded. This fish displays internal migration monuments, although not on a large scale. As the weir is formed, a permanent barrier will form for the preventing the monuments of fish. There should be remedial measures applied to mitigate this situation. (Silva, and Davis, 1986). Compensatory migration happens in many rivers when high water flows occur and small fish, larval or juvenile fish tend to get washed downstream. In order to compensate for this loss, adults travel upstream along the water current principally in the rainy season. This is an essential biological function for populations of river fish (Silva, 1993; Helfman, 2007; Dudgeon, 2008). The dams, even small weirs about 1ft high, could act as effective barriers for small species of migratory fish and other aquatic animals. Thus, extensive isolation of the fish populations in the upper reaches can genetically weaken and lead to possible local extinction. The river continuum concept states that every section of a river must be connected physically, chemically and biologically at least with temporal gaps (Helfman, 2007).

Periodic high flows are important for maintaining in-stream habitats particularly to flush fine sediments out of the system. The highest flows also play a role in maintaining channel carrying capacity and structure. Artificial low flows can create fine sediment deposits in the channel. This can lead to the clogging of interstitial spaces in the substrate, thereby reducing the available fish spawning habitat and invertebrate refugia. Additionally, low flows can disrupt the migration of migratory fishes and limit the distribution of spawning fish. The upper reaches of river catchments are significant for juvenile fish production; however, these areas may not be accessible to upstream migrating fish at low flows.

Scale and nature of the impact: All such impacts are direct, long term and negative.

As far as considered the scale, they are of high level of significance for addressing, and need remedial measures.

Anticipated reduction in downstream flow of the river

Due to a heavy intake for power generation purposes (0.83cum), a significant quantity of water is reduced between the weir site to the approximately 700m downstream. From there another similar size stream is connect to the main stream. There onward water reduction not significantly low.

This is of critical importance during the months of Jan-Feb (Dry season). The mean monthly flow ranges approximately $0.19 \text{ m}^3/\text{s}$ (January) $- 0.66\text{m}^3/\text{s}$ (June). In the other months, a fairly high amount of flow $0.3 - 0.5 \text{ m}^3/\text{s}$ is expected.

The distribution and assemblage of stream fauna and flora is directly affected by the reduced water velocity. The width, depth, velocity patterns and shear stresses within the river channel are changed when the discharge reduces. This can slightly change the distribution and availability of in-stream habitats, which in turn could possibly have some negative effects on fauna and flora. Reduction of flow in the area below the weir could cause increased growth of invasive species such as *Panicum maximum* and, *Clidemia hirta* in stream banks. Also some reduction of native water loving plants population in the stream expected. For an example; A rich population of *Dalzellia zeylanica* was observed on a rock in just above weir location and on a rock at 50m below the weir location. Which has tendency to reduce the population due to reduction of the water level.

Scale and nature of the impact: All such impacts are direct, long term and negative. As far as considered the scale, they are of medium level of significance for addressing, and need some remedial measures.





Fig. 11. *Dalzellia zeylanica* population growing on the rock just below the weir location. *Garra ceylonensis* feeding on *Dalzellia zeylanica* grown rock.

4.4. Impact on ground stability

4.4.1. Due to rock blasting, cutting filling of earth for construction of following project elements

The weir, headrace canal and forebay tank, are on the bedrock. No major impacts are expected in the bedrock stability. The rock blasting activities also not need for above construction of above components. However the penstock path does contain over bound deposits which have low stability and have been mentioned in the NBRO report as places which have a tendency for slope failure. The locations of the power house and access road will have no major impacts on the bedrock. The power house location and its proposed approach path are located on moderately steep terrain. Therefore due to excavation, removal of earth and movement of heavy equipment, there is a potential for earth slope failure.

4.4.2. Due to blocking of existing natural drainage for construction of open canal and penstock lines

No blockage of natural drainage is expected in the project area.

4.4.3. Due to removing of existing vegetation cover for the construction activities

The vegetation cover in the latter part of the penstock needs to be removed to an extent. Therefore, the unstable ground in this area could lead to a slope failure.

4.4.4. Impact on the existing building and other infrastructures due to construction activities.

The whole project area is under grassland or land with vegetation cover There are no buildings in the project area. Therefore likely no impact on buildings.

4.5. Sociological impacts

4.5.1. Impacts on bathing places of the downstream:

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The bathing point just 10m downstream of the proposed weir site / ponding area will have less water once the project is operational. However, only three families are using bathing spot occasionally and still it is manageable for the community under reduced water levels. Moreover, some 10m upstream of the ponding area and the ponding area itself can be used for bathing purpose. The bathing point at tail race is also have to be shifted to 10m upstream which is also socially manageable. At those both places (proposed bathing points) the arrangement of the in-stream rocky structures are in line with features of a good stream bathing point.

All such impacts are direct, long term and negative impacts. As far as considered the scale, they are tolerable and of low level of significance for addressing, and remedial measures are barely necessary.

4.5.2. Existing water usage of the downstream: No impacts are likely.

4.5.3. Impacts on land use pattern: As mentioned elsewhere in this report following modifications of different land use components are likely.

Minor road is likely to be better constructed/repaired for material transport to the project site.

The 5m strip of land flanking the penstock line will be devoid of tea plantation in upper areas, and in lower areas the forest cover of that 5m linear zone will be reduced temporarily.

The riverside forest patch ear marked for the power house site will be cleared.

Water area of the stream, within the water abstracted zone, will be reduced/narrowed along with occupation of weedy vegetation cover in that narrow belt receding zone of stream bank.

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4.5.4. Impacts on commercial activities: There will experience a general boom in rural commercial activities, mainly as spin off effect of the project.

Electrification benefits: The project proponent has been agreed with community for providing with the electricity from national grid for sustained supply of reliable electricity and this is like to have strong positive impact on human behaviour and act as a stimulus for productive community outputs with long term benefit for the village community. The planned erection of transmission posts across the village will provide the key physical structural facility for connecting the village houses to the national grid. Hence, almost 95% of community electrification cost supposed to be incurred by the government will be born by the developer. This would facilitate school going children to better pass examinations through doing in-house studies for long hours using electric lights, use of household electrical equipments and technology for human efficiency and knowledge enhancement, and communication for productive commercial activities.

Increased human engagements in income generation: The potential for new employment (labourers, carpenters, masons, smi-skilled technical personnel etc) and access to new services (material suppliers, food caterers, boarding houses, transport providers etc.) may draw people to the area around the project area. On the positive side, there may be a temporary increase in economic activity and employment for the local community, local skills development, and the possibility of increased money circulation due to increased local work force. Potential negative social and socioeconomic effects may include influx of strangers into local communities, disrupting existing rural economic systems and community structures affecting community values, family values and religion. There is a possibility that they might encourage black economy related to alcohols, substance abuse, prostitution and other illegal way of earning money. On the other hand, the local community members who are part of the construction work force may experience increase in their living standards temporarily during the construction period and once the construction phase is over, their rate of earning will go down. Those who are not prepared to face the reality may have stressful situation and this might promote black economy and deviant behaviour (crime, theft, alcoholism etc.). Such indirect short or long term negative impacts need to be addressed.

4.5.5. Impacts on existing cultivation: There will be a slight reduction of tea cultivation area due to project related structural elements over the land. A tea cultivated linear land area of 5mx100m will have to be allocated for the penstock line.

4.5.6. Impacts due to material transportation:

During the construction phase, the transport of material generates some social impacts. The principle negative impacts of transporting construction materials by road are: pollution from emissions from vehicles, noise and ground vibration, extreme bright lights in vehicles, dust and dirt, accidental spills, safety risks to pedestrians, nuisance to local community and visual effects. Sometimes transporting material will be blown away risking nearby people. Impacts due to material transported to the site include -accumulation of construction material trash and dispersing them into surrounding areas; spread of toxic/hazardous waste such as paints, thinners, solvents, oils and sharp metal pieces. Such indirect, short term negative impacts need to be addressed. The potential positive impacts include local job creation and skills development in transportation sector, with associated increase in living standards. Community many receive some income by selling locally available material such as granite rocks and timber.

- **4.5.7. Noise pollution and air pollution due to dust:** Noise and dust pollution are social stress factors likely to be problematic due to excavation and other construction activities, concrete mixing, explosives used for rock blasting, material transport and unloading of construction material. Such indirect, short term negative impacts need to be addressed.
- **4.5.8. Impacts on irrigation and flood protection work:** There is no rural irrigation scheme involved with the stream in this project area. The project has positive impact on flood protection work. It is reported that recently a child was killed due to heavy flood and torrential gush of the stream. This has happened at the river-crossing 50m downstream of the wire site. Diversion of stream water for hydro power generation results in some reduction of flood; making it safer for river crossing.

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4.5.9. Impact on small scale hydropower generation. Just below the proposed weir location there is an intake for the micro level hydropower plant just which supplying sufficient electricity for three households which can interrupted due to the proposed project.