C-9 Spoil and Topsoil Management Plan

Aim and Objective

The purpose of **C-9 Spoil and Topsoil Management Plan** (STMP) is to describe the strategies for minimization of impacts of activities which involve the disturbance, movement and use of soils during construction works. The intention is to reuse as much material (topsoil, subsoil, spoil and rock) as possible in-situ rather than transporting, storing or disposing of it. The plan aims to:

- Retain topsoil for reuse in rehabilitation and revegetation of the site
- Minimise spoil removal and stockpiling
- Maximise beneficial reuse of spoil from the Project.

Summary of Impacts and Risks

Topsoil and spoil material will be generated from the following construction activities: widening and stabilizing existing access road (Lot 1); construction of new access roads (Lots 2 and 3); construction of headrace tunnel from dam to powerhouse; and construction of the dam itself. The volume of the excavated material is estimated to be 1,738,738 m^3, of which 63,845 m^3 is topsoil (**Annex C-9-I**). The current estimate of spoil far exceeds the volumes envisaged in the ESIA 2019.

Key impacts and risks include:

- Land requirements: Spoil generated during construction, and not suitable for filling and embankments, or other reuse, will need to be disposed within Core Land. Steep site topography limits the placement of spoil to a limited number of sites within Core Land. There are also implications for biodiversity, as topsoil storage and spoil disposal can require additional land and associated habitat clearance.
- Erosion and Dust: Disturbance of land by removing vegetation, reshaping topography and storing and disposing of topsoil and spoil make the material vulnerable to erosion. There is also the risk of dust generation through the transport and stockpiling of material.
- Transport: Storage and disposal of material requires additional transport movements by truck, with potential noise, dust, vibration and health and safety risks.

Definitions: Topsoil is the material at the top of the soil profile with high organic content, capable of supporting plant growth. Subsoil is deeper layers of soil below the topsoil.

Mitigation and Management Actions

#	Issue or Risk	Action	Timing / Frequency	Responsibility
C-9-1.	Design review of spoil generating activities and proposed spoil disposal sites	• The overall Project design shall be reviewed to ensure that the volume of excess spoil has been minimised, including cut and fill equalization along the access road and the maximum use of spoil for other required land forming (e.g. project sites, local community facilities, private uses), concrete aggregate (if suitable), road gravelling. • The potential environmental and social impacts of proposed topsoil storage and spoil disposal shall be reviewed to select the final sites. The location of sites shall: – Be located within Core Land or the Lot 1 right of way – Avoid community water sources, tambu areas and other culturally significant sites. – Be located on lower slope land (<15°) where possible, so that stable landforms can be created. – Be located on degraded or lower value land (e.g. eroded areas, grasslands, etc) wherever possible. – Avoid clearing areas of primary forest and other high value habitats (as identified in **P-2 Biodiversity Management Plan**) where possible. – Be located at least 20 m from drainage lines or streams, and outside the normal Tina River flood zone (1:5 year flood). • The layout of each disposal site (refer **Annex C-9-II**) shall be shown on large scale project drawings (at scale), showing the site boundary/extent of any vegetation clearance, cross-sections and slopes of the disposed spoil, site access points, layout of temporary and permanent controls to be installed (retaining walls, benching, culverts / diversion banks / other drains, sediment basins, topsoil and vegetation stockpiles, final landform contours. • The plan shall detail the design of each stormwater drain and sediment basin to be installed to settle out coarse and suspended sediment, including primary and secondary treatment.	Pre-construction	HEC Design Team HEC Project Manager HEC HSE Manager THL/OE (review)
C-9-2.	Spoil disposal site preparation	• The requirements of **C-3 Forest Clearance Plan** and **P-2 Biodiversity Management Plan** shall be followed prior to and during site clearance and excavation. • The spoil disposal site boundary, including truck, and machinery access point(s), retaining structures, temporary and permanent stockpiles, drains/diversion banks and sediment basin(s) shall be surveyed and clearly pegged prior to the commencement of related spoil generation. • THL shall review the pegged sites and approve them if they are marked out in accordance with the approved site plans. • All staff involved in spoil handling and disposal shall be walked through the pegged disposal sites and instructed on strict adherence to biodiversity requirements, environmental and social controls, and spoil handling and disposal at the site. • All necessary spoil disposal site preparation activities shall be completed prior to the commencement of spoil generation, handling and disposal. This shall include the construction of any initial retaining walls, sediment basins, permanent and temporary drains/banks, as required. • Vegetation clearance and topsoil stripping shall occur immediately prior to spoil disposal to minimize the period of time that the ground is exposed to erosion. • Each disposal site and associated controls shall be inspected by THL prior to the use of these areas. Spoil disposal shall be permitted to commence with a Hold Point release by THL if the site area and controls are in accordance with the approved layout plans.	Vegetation clearance and earthworks	HEC Construction Manager HEC HSE Manager THL/OE
C-9-3.	Beneficial reuse of topsoil and spoil	• Topsoil will be stripped and stockpiled separately on site for later reuse in rehabilitation of temporary facilities. As per the ESIA (2019) an estimated 327,900m^3 of topsoil will need to be temporarily stored on the project site, requiring a storage area of approximately 10 hectares.[1] Topsoil will be stockpiled at approved spoil disposal sites. • Spoil shall be used for productive purposes wherever possible, ideally close to where the spoil is generated e.g. aggregate, fill for final project landforms, community use. • Productive uses of spoil shall be reviewed and approved by THL prior to use, to ensure that the use is genuine and to avoid unauthorised dumping.	Vegetation clearance and earthworks	HEC Construction Manager THL/OE (review)

[1] The previous version of C-9 for Lot 2 and 3 estimated a volume of excavated soil at 862,614 m^3, of which 87,988 m^3 is topsoil. However, this number excludes spoil from the dam, powerhouse and tunnel site.

C-9-4.	Topsoil management (stripping and stockpiling)	• All topsoil shall be stripped separately from spoil (subsoil, gravel, and other materials) and conserved, for use in project site revegetation or for other productive uses. • Topsoil stockpile areas shall be located as close as possible to where the topsoil will be used, as much as possible. • Wherever possible, topsoil shall be handled once, from the point of generation to the point of reuse, to minimise temporary stockpiling and the related impacts. • Topsoil stockpiles will generally not exceed 2.5 m in height in order to maintain soil biota, except where site limitations exist (e.g. limited land below 10% slope). • Stockpile slopes will generally be no steeper than 2:1 (H:V). • Topsoil stockpiles to be retained for greater than 3 months shall be seeded with a cover crop (refer **C-4 Post Construction Rehabilitation and Revegetation Plan**) or covered with mulch within a fortnight of stockpile formation to stabilise them / minimise the erosion hazard.	Earthworks	HEC Construction Manager HEC HSE Manager
C-9-5.	Spoil handling, treatment, and disposal	• Workers responsible for spoil handling and disposal shall be instructed by HEC or its nominated subcontractor about the correct placement and compaction of spoil. • Prior to the commencement of each disposal site, HEC shall complete further pilot testing using Borehole Shear Tests and shall also determine the fill material properties for both the front face 'embankment' and the general spoil deposited behind this. Compaction requirements (lift heights, machinery types, number of passes) shall be established from the pilot test and monitored via regular Scalar Penetrometer testing and density testing. • Excess spoil shall be disposed of strictly in accordance with the approved site plans. • Wherever possible, spoil shall be handled once, from the point of generation to the point of disposal, avoiding temporary stockpiling and the related impacts. • Spoil shall be placed in horizontal layers at maximum depth as designed based on spoil properties (but not exceeding 30 cm) and suitably compacted with appropriate equipment. A nominal design parameter for compaction of the embankment is 18 kN/m^3. • Spoil shall be shaped into a stable landform as per the approved design and agreed final contours, with permanent drains, benching and retaining structures installed for long-term landform stability and to prevent erosion, as necessary. Where the landform exceeds 7 m in height, a bench shall be installed at vertical intervals of no greater than 6 m to provide slope stability. • Dust generation shall be suppressed during spoil handling, transport, placement, and compaction using such measures as covered loads, water spraying, dust screens, and revegetation. More detail on dust suppression is provided in the **P-15 Air Quality and Dust Control Plan**.	Earthworks	HEC Construction Manager THL/OE
C-9-6.	Tunnel spoil / slurry[2]	• Waste rock and spoil will be re-used on site as aggregate (if suitable) or disposed of at approved spoil disposal sites. • Wastewater slurry shall be treated in a dedicated treatment plant on site. Settled and treated water shall be reused in concrete batching, dust suppression, or discharged to land (ground soakage). Dewatered slurry (cake) shall be disposed of at approved spoil disposal sites.	Tunnelling	HEC Construction Manager
C-9-7.	Site stabilisation / rehabilitation	• Site stabilization works (final drainage works, topsoiling, seeding, planting, mulching, etc.) shall be undertaken on spoil disposal areas within one month of spoil disposal completion. If discrete areas of a disposal site are completed earlier, these areas shall be progressively stabilized. • THL shall inspect and approve the final disposal site landform prior to the commencement of topsoiling and revegetation. • Minimum treatment shall include spreading of topsoil, planting of a cover crop and inter-planting with native shrubs and tree species. Planting and maintenance shall be carried out in accordance with **C-4 Post-construction Rehabilitation and Revegetation Management Plan (PCRRMP)**. • HEC or its nominated subcontractor shall maintain site revegetation until the site is stabilized. This will entail monitoring the site at least every three months until a full groundcover is established, repairing areas that have eroded, and replanting areas with insufficient ground cover.	During and post-construction	HEC Construction Manager HEC HSE Manager

Monitoring Requirements

#	Title	Description	Target / Performance Indicator	Timing / Frequency	Responsibility
C-9-A.	Design review	Design review of spoil generating activities and proposed spoil disposal sites	Design sign-off	Prior to spoil disposal at each site	HEC Design Manager THL/OE (review)
C-9-B.	Weekly site inspections	THL shall inspect spoil disposal activities at each active site at least once a week, accompanied by HEC and its subcontractor/s. Any non-conformances and required corrective actions shall be verbally advised to HEC and its subcontractor during the site inspection, then in writing within 2 days of the inspection. Spoil management corrective actions shall be completed by the subcontractor/s as advised by THL.	Joint Site inspections completed No FOR or NCRs issued	Weekly	HEC Construction Manager HEC HSE Manager THL
C-9-C.	Site sign-off	Ensure that the site rehabilitation is complete and the site returned to a stable condition. The Works are not accepted by the Employer until Taking Over is issued. For site spoil sites this shall include: • all required permanent retaining structures, drains, etc have been installed. • the site is stabilised and permanent vegetative ground cover has been established.	Site is stabilized and revegetated. Taking Over is issued	At completion of site filling at each site	THL

Supporting Documents

Annex	Name	Description
C-9-I.	Spoil Calculation of Main Works	Provides information on the volume of spoil and topsoil produced by each construction activity.
C-9-II.	Site Spoil Layout Plans	Spoil disposal layout plans and drainage designs. Sites 1-1 and 1-2 are yet to be confirmed.
C-9-III.	Topsoil Resource Survey for Access Roads	Characteristics and volume of topsoil that will be produced for the construction and upgrade of access roads.

[2] The generation of waste material from the tunnel will be determined by the tunnelling method (which is yet to be determined) and geology.