Appendix 7.2

Catchment Delineation to Access Tracks

SPEN

Glenmuckloch to Glenglass Reinforcement Project

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Final report

Prepared by Kaya Consulting/LUC/SPEN

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SPEN

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Introduction

1.1 The new overhead line connection forming the Glenmuckloch to Glenglass Reinforcement Project (GGRP) covers a length of approximately 9.3km and a number of temporary access tracks have been identified along the route to enable tower construction, the stringing of the OHLs, and other ancillary works such as construction laydown areas. Construction and design details of the temporary access are provided in **Chapter 4** of the EIA Report and tor the purposes of assessment all temporary tracks are considered to be removed after OHL commissioning. The new access track to Glenmuckloch Substation is a permanent access, which will remain in place.

1.2 The OHL route is all within the wider River Nith valley and there are numerous small watercourses draining down the hillslopes towards the access tracks.

1.3 Kaya Consulting was commissioned by SPEN to delineate catchments along the route, identifying catchment areas that flow toward the temporary access tracks. Key locations with sensitive receptors downstream (e.g. watercourses) and areas where the topography funnels flow towards a sensitive receptor have been identified.

1.4 The scope of work is as follows:

- Catchment delineation to new accesses along route using 0.5m resolution LiDAR digital terrain data.
- Desk-based identification of key areas where issues may arise as a result of pollution to the water environment from access tracks (e.g. watercourses/sensitive receptors down gradient of tracks or large upstream catchment areas over a threshold size or with steep slopes).
- Site visit to ground truth selected catchments.
- Initial sizing of Sustainable Drainage Systems (SuDS) and land-take required. It is recommended that upstream clean water is diverted away from access tracks to minimise the amount of surface water run-off entering the working area (and thus becoming 'dirty').
- Preparation of this summary report and accompanying GIS files, reporting methodology, results of catchment delineation and mapping and indicative sizing of SuDS to inform the EIA Report.

1.5 It should be noted that this report is not an outline drainage strategy for the GGRP Project. The report summarises the findings of the catchment delineation work and makes initial recommendations for the locations and types of SuDS required for the accesses associated with the GGRP.

Methodology

1.6 The terrain data was loaded into GIS software, with project infrastructure, showing access track routes. Watershed analysis was carried out in the GIS software to delineate the catchments draining to each access track section.

1.7 The initial results of the catchment delineation provided the total catchment area draining to each section of access track and provided detailed surface water flow paths. This was checked with constraints mapping collected in the field (e.g. watercourses, wetlands, marshes) and Ordnance Survey (OS) 1:10,000 mapping.

1.8 Using information on existing watercourses and drains shown on OS maps, and verified in the field, the catchment areas draining to tracks were split in the GIS software to reflect natural catchments and drainage divides (i.e. at watercourse crossing points). Upstream of watercourse crossings, surface water will drain towards the watercourse and pass under the track via an appropriately sized culvert. In these cases, surface water run-off upstream of the access track will not necessarily be a problem, as clean upstream water will pass under the track without being affected by the construction works.

1.9 By delineating catchments at watercourse crossings and removing them from subsequent analysis, the catchments remaining are those draining directly to the access tracks. These catchments could result in pollution and sedimentation entering the downstream water environment.

Results

1.10 The catchments draining to watercourses and to the access tracks are shown in **Figure 1** and indicate that, due to the topography, the access tracks sometimes intercept and cut across natural surface flow paths, which ideally should not be blocked or constrained.

1.11 The catchment areas draining to the access tracks were numbered sequentially from 1 to 26 (south to north). Small areas less than 0.5ha were removed from the analysis. It is noted that there is no catchment draining towards the permanent track to the Glenmuckloch Substation, as it sits on a drainage divide. Catchment areas (in hectares) are provided in **Table 1**.

1.12 Flows were estimated for each catchment area using the both the Institute of Hydrology IH 124 method and the Flood Estimation Handbook (FEH) statistical method, based on QMED scaling, both of which are suitable for estimating design flows for small, rural ungauged catchments. Flows were calculated using regional values of catchment characteristics, combined with the local catchment area. The 1 in 200-year flow estimated using each method is presented in **Table 1** for each catchment. The results of the two flow estimation methods are comparable, with the FEH method generally giving higher design flows. The final design flow for each catchment was taken as the higher of the two methods, usually the FEH method.

1.13 Estimated 1 in 200-year flows from the catchments are relatively low and range from 0.07m^3/s (Area 11) to 1.09m^3/s (Area 3), with an average of 0.37m^3/s.

1.14 It is noted that the OHL construction accesses are temporary and will be removed after commissioning of the OHL. The 1 in 200-year is an extreme estimate of the flows that could be generated by local surface water runoff to the accesses, and in reality is unlikely to occur during the 16 month period from construction to commissioning. However, it provides an indication of extreme flows that could occur and provides a method for planning space for adequate mitigation/SuDS at this early stage.

Initial Drainage and SuDS Mitigation Recommendations

1.15 Constraints data was loaded into the GIS and reviewed, together with catchment and flow pathway data, to help identify the level of embedded SuDS required for each drainage area. The constraints data includes watercourses, watercourse crossings, private water supplies (PWS) (if any) and environmental designations (including SSSIs). It is noted that there are no PWS or designated sites within or close to the GGRP accesses.

1.16 Each area draining to the tracks was coded in terms of the embedded mitigation (i.e. SuDS) required and the potential impact if the mitigation failed.

1.17 The type of embedded mitigation required was classed as either 'standard' or 'complex' depending on the size and slope of catchment area draining to the track and the downstream receptor. It is noted that there are no locations in the GGRP where 'complex' mitigation was required. Embedded 'standard' mitigation for the access tracks is described in **Chapter 7** and **Appendix 3.3** of the EIA Report and would typically include:

- If the access tracks intercept natural surface flow paths, drainage measures will be incorporated which will include adequately sized culverts under the access track that do not restrict flow and which allow watercourses, intercepted field drains and ephemeral streams/surface water flow to pass. The location of culverts required will be identified by the drainage design contractor, informed by the detailed flow path analysis undertaken for this report, the locations of watercourse crossings, and from detailed site identification of field drains prior to construction. Watercourses and intercepted field drains should be allowed to pass under the track and should ideally not be captured by either the upgradient or downgradient ditches to avoid potential contamination of this 'clean' water.
- Drainage ditches, with check-dams, running parallel to the access track on the upslope side to intercept surface water run-off draining towards the track. The drainage ditch will be set a sufficient distance back from the access track, to avoid contamination of the intercepted water from construction/operation of the access track. A width of around 5-10m on the upslope side of the access tracks should be allowed for construction of drainage ditches.
- Drainage ditches will have adequate capacity to reduce the chance of water overtopping into open ground.

- Drain lengths will be limited to reduce increased discharge rates associated with artificial drains, and culverts provided at appropriate distances along the drain to allow un-impacted surface water to pass under the track. 'Clean' drainage should be kept separate from 'dirty' drainage. 'Clean' drainage and watercourse can pass under the track and pass onwards without being treated/attenuated.
- Ditches in the form of swales will be located parallel to the downslope side of the access track to capture run-off and sedimentation from the access tracks. Temporary check dams/silt fences can be installed in the informal channel to slow flows and provide further silt removal, if required. This would be for treatment of 'dirty' drainage. Discharge from the ditches/swales would be able to discharge over ground at regular intervals along the ditch. Anti-scour measures would also be incorporated. Recommendations for sizing of swales is set out below.

1.18 'Complex' mitigation on the access tracks would comprise a second level of SuDS treatment and could include silt traps and settlement ponds at the discharge location of the downstream swale. These would be constructed at key locations (i.e. upstream of watercourses and at surface water discharge points) to intercept and contain sediment and to attenuate surface water runoff to greenfield rates. As noted above there are no locations in the GGRP where 'complex' mitigation was required. Design details of the SUDS measures during construction will be provided in the Pollution Prevention Plan (PPP) which will be submitted to SEPA prior to construction to obtain a Construction Site Licence (CSL) under the CAR Regulations.

1.19 The impact of potential failure of mitigation was classified for each area draining to the track as either:

- low impact (e.g. failure of SuDS is upstream of an area where the 'dirty' runoff would flow across an area of grassland or land and would disperse/settle naturally before entering the water environment); or
- high impact (e.g. failure of SuDS could directly impact a watercourse or other sensitive receptor or designated site).

1.20 Thus, each area was classified as either 1 or 2 as outlined below:

- 1 – standard embedded mitigation with low impact if fails;
- 2 – standard embedded mitigation with high impact if fails; and

1.21 The classification above was used in combination with the flow estimates for each area to define the level of mitigation required (and the area to be set aside for embedded construction SuDS), as follows and shown in **Table 1**.

- **200-year flow <0.8 m^3/s and Class 1 (low impact if fails):** Swale 1 - a temporary swale with dimensions 1m depth, 1m base channel width and side slopes of 1 in 3. This will require a swale of total width 7m. To provide access for maintenance a strip of land around 12m width should be provided on the downstream side of the track to accommodate the swale.
- **200-year flow >0.8 m^3/s and Class 1 (low impact if fails):** Swale 2 – to accommodate larger flows a wider swale channel will be required. Flows will be accommodated within a swale with dimensions 1m depth, 2m base channel width and side slopes of 1 in 3. This will require a swale of total width 8m. Again, to provide access for maintenance, a strip of land around 12m width should be provided on the downstream side of the track.
- **Class 2 (high impact if fails):** Swale 3 – it is recommended that the larger swale (i.e. 2m base channel width) is used for class 2 areas. This wider flow/settlement area will allow additional attenuation and settling of pollutants before release. In these areas, it is recommended that a total width of approximately 20m is set aside for SuDS to allow embedded mitigation to be put in place.

Watercourse Crossings

1.22 As discussed above, flows draining to watercourses should pass under the temporary access tracks via appropriately sized crossings.

1.23 However, during construction, temporary construction SuDS will be put in place at each watercourse crossing to ensure no sedimentation from construction works or pollution from plant or machinery can enter the watercourse. This could be a series of settlement ponds or settlement tanks and silt fences. Watercourse crossings of existing and new access tracks are shown in **Figure 1**. An area of 20m width either side of the watercourse and 20m upstream and downstream of the crossing (i.e. 40m x 40m) will allow for sufficient temporary SuDS to be put in place during construction as good practice embedded mitigation. This should be sufficient for all crossings and is likely to be an over-estimate of the area required for small watercourses.

Table 1: Summary of catchment areas draining to tracks, classification and mitigation

ID	Area (ha)	Mitigation	Level of Impact if fails	Reason for impact	Class	Flow FEH QMED Method	Flow IH124 Method	1 in 200-year flow (m3/s)	Type of Embedded Mitigation
1	2.06	Standard	Low		1	0.240	0.090	0.240	Swale 1
2	1.05	Standard	Low		1	0.135	0.046	0.135	Swale 1
3	12.16	Standard	Low		1	1.089	0.529	1.089	Swale 2
4	2.99	Standard	Low		1	0.330	0.130	0.330	Swale 1
5	0.75	Standard	Low		1	0.101	0.033	0.101	Swale 1
6	9.73	Standard	Low		1	0.901	0.424	0.901	Swale 2
7	2.23	Standard	Low		1	0.257	0.097	0.257	Swale1
8	3.70	Standard	Low		1	0.396	0.161	0.396	Swale 1
9	1.04	Standard	Low		1	0.134	0.045	0.134	Swale 1
10	4.83	Standard	Low		1	0.496	0.210	0.496	Swale 1
11	0.52	Standard	High	Quintin's Burn	2	0.075	0.023	0.075	Swale 3
12	1.57	Standard	Low		1	0.191	0.068	0.191	Swale 1
13	0.63	Standard	Low		1	0.088	0.027	0.088	Swale 1
14	6.61	Standard	High	Unnamed watercourse	2	0.648	0.288	0.648	Swale 3
15	1.23	Standard	Low		1	0.154	0.053	0.154	Swale 1
16	0.58	Standard	Low		1	0.082	0.025	0.082	Swale 1
17	6.98	Standard	Low		1	0.679	0.304	0.679	Swale 1
18	2.59	Standard	Low		1	0.292	0.113	0.292	Swale 1
19	4.35	Standard	High	Polmeur Burn	2	0.454	0.189	0.454	Swale 3
20	4.00	Standard	High	Polmeur Burn	2	0.423	0.174	0.423	Swale 3
21	1.81	Standard	Low		1	0.215	0.079	0.215	Swale 1
22	5.19	Standard	Low		1	0.528	0.226	0.528	Swale 1
23	10.80	Standard	High	River Nith	2	0.984	0.470	0.984	Swale 3
24	2.05	Standard	Low		1	0.239	0.089	0.239	Swale 1
25	0.72	Standard	Low		1	0.098	0.031	0.098	Swale 1
26	1.10	Standard	High	Stank Burn	2	0.140	0.047	0.140	Swale 3

Figures

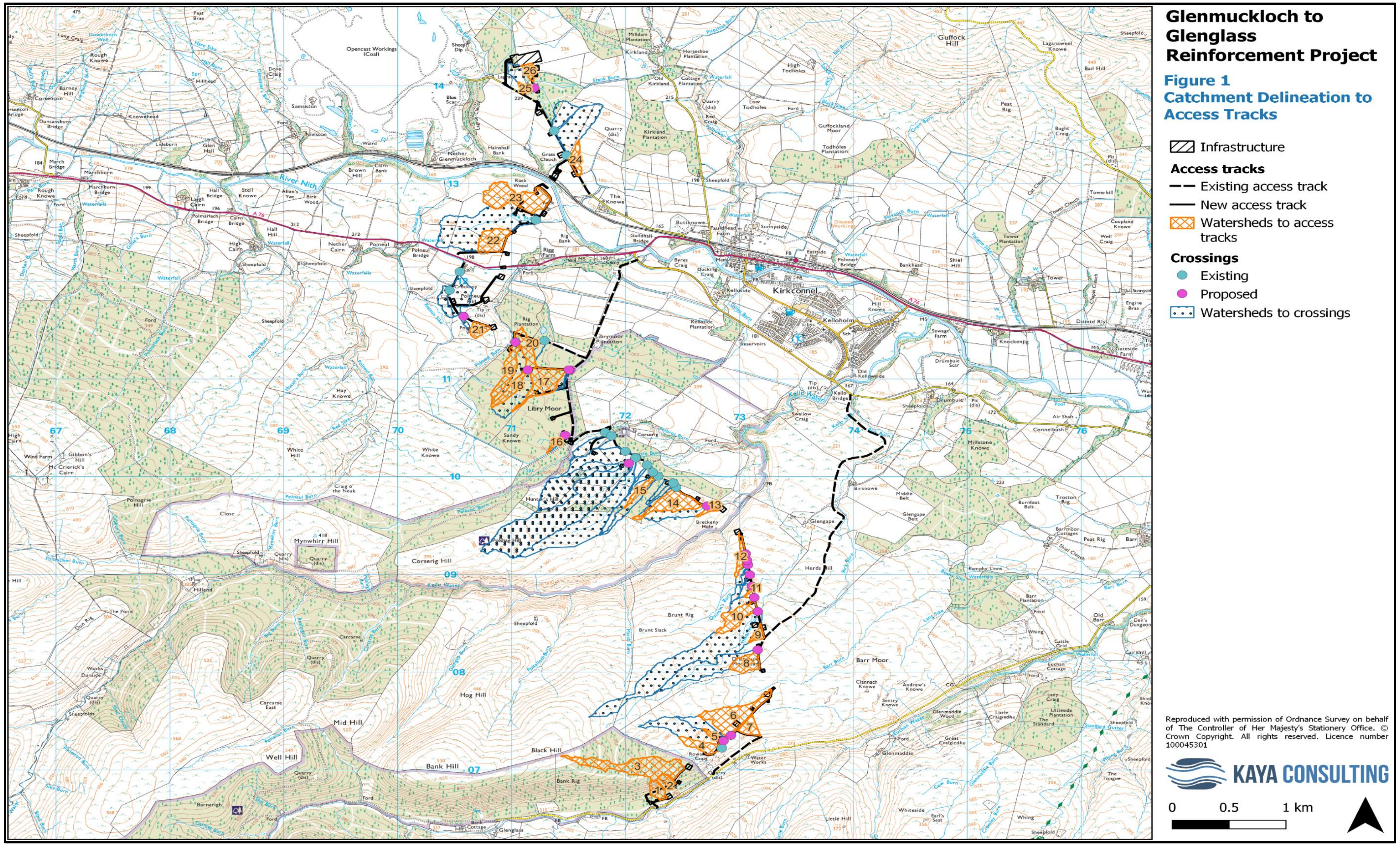

Figure 1: Catchment Delineation to Access Tracks