8.0 SOILS

8.1 ASSESSMENT METHODOLOGY

Section 39 (2)(b)(ii) of the Transport (Railway Infrastructure) Act 2001, requires that proposed developments are examined in terms of their likely significant impacts on soil.

The assessment of the proposed Luas Line A1 project by reference to soil includes the identification of potential effects on soil disturbed during the construction process (principally for the trackbed), the identification of areas of potential contamination where the removal of material might give rise to hazards during the construction and any potential issues arising from the disposal off-site of material excavated from the trackbed.

A qualitative ground quality assessment has been carried out using a source-pathway-receptor methodology. The starting point was to obtain and review existing information and to carry out a walkover of the route. Possible disturbance of contaminated land was regarded as the main impact that needed assessment, therefore, part of the review included the identification of potential contaminant sources in the vicinity of the route. These were then assessed to determine whether the construction of the route would disturb these areas, and whether such land would have an impact on the construction of the route.

8.1.1 Data Sources

The following sources of information were consulted during this assessment:

- Current and historic topographic mapping
- Geological and hydro-geological mapping
- Previous contamination surveys
- Environmental Protection Agency data:
  - landfill sites or other waste activities
  - pollution or contamination records
  - nearby IPC installations
  - environmental quality of nearby watercourses
- Local authority data:
  - recorded environmental health complaints
  - environmental quality of nearby watercourses
  - water abstractions within the vicinity of the alignment

The geology of the area through which the proposed Luas Line A1 alignment passes has been determined from the Irish Geological Survey Sheet 16 (Geology of Kildare-Wicklow).

Subsequent to this desk study a Site Investigation was undertaken comprising the excavation of 45 trial pits and the collection of soil samples to establish baseline environmental soil quality and geotechnical characteristics along the proposed route. Since the original walk over survey did not identify any potential sources of contamination it was decided, for precautionary purposes and to establish baseline soil quality to collect soil samples for environmental testing from every one in three trial pits (300m intervals) along the proposed route.

The 45 No. trial pits themselves were positioned at 100m intervals along the proposed route. The pits were excavated to depths ranging from 2.3 metres below ground level (mbgl) to 3.8 mbgl. The target depth for each pit was 3.5mbgl; however this was not achieved in some trial pits due to pit wall instability and subsequent collapse.

Soil samples were collected from each trial pit in accordance with best practice techniques. The samples were taken from within the first metre below ground level, as excavation and removal of the subsoils beyond this depth during the construction phase is not envisaged.

During the excavation the soil samples were screened for Volatile Organic Compounds (VOC) using a Photo-Ionisation Detector (PID) and visually assessed for the presence of contamination. The field screening did not identify the presence of any contamination.

On the advice of AGL Consulting, Geotechnical Engineers, the following tests were performed on selected soil samples to establish baseline soil quality:

- Water Contents
- Atterberg Limits
- Particle Size Distribution Tests
- CBR Tests
- pH
- Sulphate Content
- Chloride Content

Concurrently, the soil samples were also analysed for the following parameters:

Heavy Metals

- Lead
- Nickel
- Copper
- Zinc
- Arsenic
- Cadmium
- Chromium
- Mercury

Total Petroleum Hydrocarbons

- Diesel
- Petrol Range Organics (TPH)
- Benzene
- Toluene
- Ethyl benzene
- Xylene (BTEX Compounds)
- Polyaromatic hydrocarbons (PAH)

8.2 RECEIVING ENVIRONMENT

The route of the proposed Luas Line A1 and the location of 45 no. trial pits are shown in Appendix 8A.

The route is typically underlain by a thin topsoil layer, which overlies fill material or stiff brown sandy, gravely boulder clay. This in turn overlies dark grey stiff to hard, sandy gravely boulder clays. Typically the brown boulder clays are weathered shallow natural subsoil while the deeper dark or black boulder clays are the unweathered portion of these glacially deposited tills. Lenses of slightly clayey to very clayey sand and gravel were encountered within the brown and black boulder clay horizons.

8.2.1 Fill Material

The section of the route between trial pit 100 (TP-100) and trial pit 1200 (TP-1200) is generally underlain by fill material comprising firm to stiff brown slightly sandy clay with small amounts of wire, metal piping and brick fragments or glass. The full thickness of the fill was not proven in trial pit 200 (TP-200) due to the limitations of the excavator used, but it is at least 3.4 m thick. Sections of possible fill material ranging in depth from 0.3 – 33 m below ground level (mbgl) were encountered. Possible fill is characterised as localised pockets of less consolidated subsoils with a mix of brown and black boulder clays and no obvious graduation between the shallow brown and deeper black horizons, but contains no obvious waste material. The average thickness of fill with waste present in the matrix was 1.3m, over the 12no. trial pits.

A narrow band of fill material that was black in colour and which appeared to have been affected by hydrocarbon contamination was encountered in TP-400 at a depth of 0.7 mbgl. This band was only ten centimetres in thickness and comprised black to dark grey gravels with only a black clay matrix. The material appeared similar in composition to weathered tarmacadam. It is possible that this layer originated from the adjoining roadway when it was constructed.

The section between TP-1200 and TP-1800 is generally underlain by fill comprising firm to stiff brown slightly sandy clay with small amounts of wire and brick fragments or glass in some trial pits, typically no more than 0.9m below ground level. Possible fill was encountered in some trial pits up to 2.7 mbgl.

Fill material was only encountered in one trial pit between TP-1800 and TP-3300. The thickness of fill in TP-2600 is 1.9m and was similar in composition to previous fill areas comprising firm to stiff brown sandy clay with small amounts of wire and brick fragments or glass.

From TP-3200 to TP-4200, the fill material generally comprises firm to stiff brown slightly sandy clay with small amounts of ceramics, metal piping and brick fragments, tarmac or glass. Possible fill material was encountered from 2.5 – 2.8m below ground level in TP-3900. Possible fill is characterised as localised pockets of less consolidated subsoils with a mix of brown and black boulder clays and no obvious gradation between the shallow brown and deeper black horizons but contains no obvious waste material.

Fill material containing waste was recorded in TP-3550, TP-3800, TP-3900, TP-4000, TP-4200 and TP-4300. The waste typically comprises construction and demolition waste including plastic, timber, wire, brick, small amounts of tarmacadam and ash. The average thickness of the material is estimated at 0.75m thick.

8.2.2 Clays

The natural subsoils comprised brown firm to stiff slightly sandy, slightly gravely clays with occasional limestone cobbles and some limestone boulders. In some areas these brown clays are underlain by stiff to very stiff grey slightly sandy slightly gravely clays with occasional limestone cobbles. The depth of the brown clays varies along the route from greater than 3.5 mbgl between TP-2200 and TP-2900 to as little as 0.7 mbgl at ch-2100. In the final section of the route between TP-3200 and TP-4200 black boulder clays were encountered but were not proven during the site investigation. The penetration depth ranged from 0.3 – 1.3m.

8.2.3 Sands and Gravels

Lenses of sands and gravels were encountered between the brown and black boulder clay and extending into the deeper black boulder clay. The depth at which these sands and gravels are present is between 0.3mbgl and 3.6mbgl.

8.2.4 Bedrock

The bedrock underlying the site is Carboniferous Calp Limestone. This formation comprises a dark grey to black limestone and shale. The depth to bedrock beneath the proposed line is not known, however, possible bedrock was encountered in TP-300, TP-400 and TP-1900 at 2.5m, 3.3m and 3.1m respectively.

8.3 CONSTRUCTION IMPACTS AND MITIGATION

Ground disturbance will be required for the construction of the permanent way planned ESB substations, Luas stops and other proposed works. To accommodate the required levels, topsoil stripping followed by a cut and fill operation to varying depths is required. In general, at-grade ground disturbance will be limited to a maximum construction depth of 800-1200mm. The proposed construction compounds are likely to generate a limited amount of disturbance to the ground surface, resulting in the generation of dust.

The main impacts on the soil and subsoils during the construction phases will be:

- Excavation and removal of topsoil
- Contamination due to wastes
- Leakages during construction
- Induced erosion

Excavation and Removal of Topsoil

The construction of the proposed permanent way will entail the excavation and disposal of topsoil with an average depth of 225mm over a width upwards of 11m along some 91% of the proposed route. This equates to approximately 8,100m3 of topsoil. Where possible this will be incorporated in the permanent works as part of the proposed landscaping scheme. The remainder of the topsoil will be disposed of offsite with a large portion of it incorporated as landfill cover, in accordance with the waste management plan.

No soils of particular ecological or geological significance will be removed as most of the route comprises public open space or uncultivated agricultural land.

Contamination Due To Construction and Demolition Wastes

During the construction the potential for contamination associated with wastes will be minimised by the use of best practice guidance published by the Construction Industry Federation. A project specific Construction and Demolition Waste Management Plan (C&D WMP) has been prepared and is presented in Appendix 15A. The C&D WMP is discussed further in Chapter 15.0 'Waste Management'. It is likely that fill material containing waste will be encountered during the construction phase of the project. This fill material if excavated and removed from the site will constitute waste.

The laboratory test results of samples from the fill indicate that it is uncontaminated and may be suitable for recovery for land reclamation purposes subject to authorisation from the local authority. Also, it may be suitable to remain in place as cover or embankment material along the route provided that it is considered to be geotechnically feasible to do so. However, it is likely that some areas of the fill material may not be suitable to leave in place; for example, where there is a lot of glass, wire or other wastes present in the soil matrix. This may result in a portion of material that is unsuitable for use on-site, which will require off-site removal. Provided that this material is managed in accordance with the local authority waste permit regulations it will not result in a significant impact on the proposed development or on a potential reclamation area.

During the construction process, the contractor will be bound by the terms of the contract to exercise due care and attention in the handling and disposal of any potentially contaminated material in accordance with the Waste management Acts 1996-2003. Dust suppression measures, particularly for the construction compounds, shall also need to be incorporated into the terms of contract.

Leakages During Construction

Construction operations could give rise to leakages of oil, diesel or other contaminating materials, where such materials are stored for refuelling of construction machinery or other equipment. The Contractor will be obliged to provide bunded storage and tamper proof valves to any such storage tanks that are located on the construction site.

Induced Erosion

The potential for erosion of soils or subsoils during construction is considered to be low but will be mitigated by controlling traffic movement and diverting of surface water run-off via interceptor drains on portions of the route from which vegetation and top soils have been stripped.

8.4 OPERATIONAL IMPACTS AND MITIGATION

In respect of the proposed track alignment there will be no operational impacts other than the possible release of minor quantities of dust from the tram braking system and spillage of minor quantities of oil from the electrical substations. Issues related to dust are addressed in the Chapter 10.0 'Air Quality and Climatic Factors'.

The main impacts on the soil and subsoils during the operational phases will be:

- Leakages and the application of herbicides
- Settlement
- Erosion

Leakages and the Application of Herbicides

The ESB substations required to power the tram system will not be cooled by oils containing Polychlorinated biphenyls, (PCB's). Therefore, any spills of oil from the substations are considered unlikely and insignificant. No remedial or reductive measures are considered necessary. The potential for leakages due to the application of herbicides will be minimised by the application of best practice techniques in the handling and application of herbicides. Herbicides will not be stored along the railway line route and will only be transported to and from the line by personnel trained in their handling and application.

Settlement

During the operational phase, the track line will be monitored as part of the operational maintenance programme for the Luas route. Any settlement will be identified and addressed as soon as it is detected. However, it is envisaged that the risk of settlement will be insignificant if the line is to be constructed in accordance with the design specifications.

Erosion

During the operational phase, the potential for erosion is considered to be very slight, but will be mitigated by the construction of appropriately graded embankment slopes. Surface water drainage systems will be installed where necessary to prevent the risk of ponding of rainwater along the track line. There will also be a process of reseeding the soil stripped areas to restore grass and other vegetative cover.