10 Water Quality

10.1 Introduction
This chapter describes the effects of the proposed Edinburgh Tram Line One on water resources along the route including:

- aquatic features;
- surface water quality;
- hydrogeology and groundwater resources; and
- drainage and flooding.

10.2 Approach to the Assessment

10.2.1 General Approach
The assessment of impacts on water resources has been based on a desktop study. Surface watercourses and aquifers crossed by, and in the vicinity of, the proposed alignment have been identified and described in terms of their baseline characteristics. Potential impacts and mitigation have been identified through:

- consultation with the Scottish Environment Protection Agency (SEPA), City of Edinburgh Council (CEC) and other statutory and non-statutory consultees;
- a desk based review of baseline water quality data, existing drainage and flooding patterns;
- review of the proposed construction methodology with respect to the use of water during construction and drainage patterns at proposed construction sites;
- assessment of potential effects on water quality with respect to drainage and run-off implications on the Water of Leith and Firth of Forth; and
- assessment of the effect of any increased risk to flooding for the surrounding area as a result of the project.

In carrying out the assessment, the following have been taken into account:

- national policy in respect of surface and groundwater standards and objectives;
- relevant Local Plan objectives relating to water resources in the area; and
- SEPA’s guidelines on pollution prevention during construction.

10.2.2 Evaluation Criteria

Policy Relating to Surface and Groundwater Use
National Planning Policy Guidelines (NPPGs), currently being replaced by Scottish Planning Policy (SPP), provide guidance for developers. NPPG 7 Planning and Flooding (soon to be amended by SPP 7) sets out guidance for development within areas of flood risk, including the responsibilities of planning authorities in regulating and controlling development in areas of flood risk, in order to prevent increased risk of flooding in the future. The note emphasises the need to apply sustainability principles to the prevention of flooding and the control of future development. If a development is located within a floodplain, a flood risk assessment may be required. Developers should consult with the Local Authority and SEPA at the earliest opportunity.
NPPG 13 Coastal Planning is also relevant to the proposed scheme and sets out how planning can contribute to sustainable development and biodiversity along Scotland’s coasts. As stated in Chapter 4, development plan policies must distinguish between policies for developed, undeveloped and remote coastline and how the planning system should respond to the risk of flooding and coastal erosion.

Planning Advice Note (PAN) 61 promotes the use of Sustainable Urban Drainage Systems (SUDS). SUDS provide more natural approaches to run-off management and, when incorporated into developments, help to prevent increases in flood or water pollution risk downstream of the development. SUDS will be incorporated into the scheme where practical and appropriate.

SEPA is responsible for the protection of water resources within Scotland under the Environment Act 1995 (1). It is an offence to cause pollution of controlled water, either deliberately or accidentally and consent must be obtained from SEPA for any discharges to controlled waters including rivers and the sea. SEPA also have responsibility for the flood defence and maintenance issues for all ‘main rivers’ under the Environment Act 1995.

The following SEPA policies on water resources have been taken into account within this assessment.

- SEPA Policy No.15 – Regulation of Urban Drainage;
- SEPA Policy No.19 – Groundwater Protection for Scotland; and
- SEPA Policy No. 26 – Policy on the Culverting of Watercourses.

Pollution Prevention Guidelines (PPGs) prepared by SEPA set out best practice and indicative mitigation measures to minimise potential impacts of construction works. The following PPGs have been taken into account in this assessment:

- Pollution Prevention Guidelines No.5: Works in, Near or Liable to affect Watercourses; and
- Pollution Prevention Guidelines No.6: Working at Construction and Demolition Sites.

CEC is responsible for flooding issues within Edinburgh. As a result of flooding in late 2000, CEC commissioned a Flood Assessment Report (2) in late 2001 to assess potential flood risks within Edinburgh. The report identified flood prevention measures to be implemented within the city, which include construction of floodwalls, pump stations and floodgates. This assessment has taken these proposed measures into account in considering potential impacts.

### Statutory Water Quality Standards

The water quality of Scotland’s rivers is classified by SEPA. Each river is assessed and given a grade as Excellent, Good, Fair, Poor or Seriously Polluted (classes A1, A2, B, C and D respectively). The classification scheme uses water chemistry, biology, aesthetic and toxicity assessments to determine the classification of water quality.

The vulnerability of groundwater to pollution is dependent on the presence and nature of the overlying soils and drift deposits, the geology and the depth to the water table. This will determine the rate at which a contaminant can migrate into the water. Consequently, groundwater abstractions in the UK have designated inner and outer protection zones, defined according to the above criteria. SEPA’s approach to controlling and preventing the pollution of groundwater is set out in its Groundwater Protection Policy for Scotland (SEPA Policy No.19).

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(1) Controlled waters include all watercourses and water contained in underground strata (or groundwater)
10.3 Baseline Water Resources

10.3.1 Aquatic Features

The primary watercourses in the corridor of the tram route, as shown in Figure 9.1, are:

- the Water of Leith; and
- the Firth of Forth.

The Water of Leith is the main watercourse within the City of Edinburgh and flows in a general northeast direction through Edinburgh. The Water of Leith flows from the Pentland Hills through Balerno and a number of Edinburgh suburbs, including Colinton, Longstone, Murrayfield, Roseburn, Dean Village, Stockbridge, Warriston and Bonnington before entering the Firth of Forth at Leith Port.

The proposed scheme crosses the Water of Leith at two locations: within the Roseburn Railway Corridor at the Coltbridge Viaduct and along Ocean Drive near Leith Port. At each of these crossings, the scheme will use existing bridge structures. Minor alterations and improvements to accommodate the tram will be completed prior to implementation of the scheme.

Construction works will be located within the tidal area of the Forth, designated as a Special Protection Area (SPA) and Site of Special Scientific Interest (SSSI) (see Chapter 9). This will involve the erection of a footway with concrete footings in the intertidal area along Starbank Road. The predicted impacts on natural heritage are discussed in detail in Chapter 9.

10.3.2 Surface Water Quality and Sensitivity

SEPA recently undertook a water quality assessment of the Water of Leith. The classification for relevant sections of the watercourse in 2002 is shown below in Table 10.1.

Table 10.1 Water of Leith Water Quality Classification

<table>
<thead>
<tr>
<th>Location</th>
<th>Classification</th>
<th>Description Of Water Crossing</th>
<th>Nearest Scheme Crossing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murrayfield</td>
<td>C</td>
<td>Poor</td>
<td>Coltbridge Viaduct</td>
</tr>
<tr>
<td>Anderson Place</td>
<td>A2</td>
<td>Good</td>
<td>Ocean Drive</td>
</tr>
</tbody>
</table>

Overall, SEPA has classified the Water of Leith as a salmonid water of high amenity (1).

A status report on the geology/hydrogeology of the route was undertaken by Envirocheck in 2002(2). The report listed known discharge consents, integrated pollution controls, integrated pollution prevention and control measures and groundwater vulnerability. A summary of findings is provided in Table 10.2.

Table 10.2 Summary of Envirocheck Report

<table>
<thead>
<tr>
<th>Item</th>
<th>Presence On Site</th>
<th>Presence within 250m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discharge Consents</td>
<td>None</td>
<td>7</td>
</tr>
<tr>
<td>Integrated Pollution Prevention and Control Consents</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Pollution Incidents to Controlled Waters</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Water Abstractions</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

(1) Capable of sustaining a salmonid fish population. The ecosystem may have been previously modified by human activity.
(2) Envirocheck Report for Mott MacDonald, August 2002
10.3.3 Hydrogeology and Groundwater Resources

The Envirocheck Report stated that the scheme is within an area of a minor aquifer, which contains fractured or potentially fractured rocks that do not have a high primary permeability or other variations of varying permeability. Short sections of the scheme in the city centre are within an area of non-aquifer with formations of rock of negligible permeability, generally regarded as containing insignificant quantities of groundwater.

Drift deposits were also identified in the Envirocheck Report. These were low permeability and included till, peat, lacustrine deposits, clay-with-flints and brick earths.

In consultation with SEPA it was confirmed that there are no source protection zones (1) designated along the tram alignment. The area in general, is underlain by strata of the Calciferous Sandstone Measures, which are classified as moderately permeable on the Groundwater Vulnerability Map of Scotland. There are also small areas underlain by igneous rocks (such as Arthur’s Seat), which are classified as weakly permeable. Areas in the vicinity of the Water of Leith are associated with alluvium.

10.3.4 Drainage and Flooding

Drainage

Much of the area along the route is developed and is hard surfaced with drainage. The majority of the route runs along existing roads and surface run-off is drained via a series of underground sewers and storm drains.

Within the Roseburn Railway Corridor the gradient of the surrounding land varies with surface water run-off draining into an existing system of stormwater drains.

Flooding

The CEC flood assessment report (see Section 10.3) recommended a series of works associated with a Flood Prevention Order to be approved by the Scottish Executive. These included flood alleviation works along the Water of Leith to prevent flooding from extreme flows. The replacement of existing arbitrary flood defences such as property boundary walls, most of which were never designed as such, is a significant part of the work required. The major flood prevention measures are not located near to the scheme. Some minor construction works are planned for the watercourse banks to the south of the Coltbridge Viaduct.

It is presently uncertain when the Flood Prevention works will commence. However, it is possible that construction of flood defence works could coincide with construction of the tram.

10.4 Potential Impacts

10.4.1 Temporary Construction Impacts

Construction activities, such as foundation work and road resurfacing, may require the use of water on site. Possible site run-off and discharges may impact on the water quality of the Water of Leith and the Forth during the construction phase of the project.

Potential impacts that could arise during the construction of the scheme include:

(1) Source protection zones are areas of land in which certain potentially polluting activities are restricted in order to protect groundwaters.
10.4.1 Temporal Impacts

- direct discharges to ground and surface water from run-off during the construction phase, possibly containing increased loads of suspended solids and/or contaminants;
- accidental spillage or leakage resulting from storage of potentially polluting substances during construction, affecting groundwater and surface waters;
- disposal of drainage and effluent from construction sites, and from any concrete batching plant used at construction compounds;
- localised increased flooding from increased siltation in surface watercourses as a result of construction site run-off;
- localised increases in flooding as a result of any construction activities affecting land drainage;
- direct loss, disturbance or other effects on aquatic habitats and species of nature conservation value (see Chapter 9);
- pollution and increased sediment loads entering the Water of Leith and Firth of Forth during associated works in close proximity to these watercourses; and
- changes in surface water hydrology caused by compaction of soils and increase in impermeable surfaces, such as within the Roseburn Railway Corridor and between Craigleith and Ferry Road.

10.4.2 Permanent Impacts

Permanent impacts on water resources could result from:

- installation of additional hardstanding areas in the vicinity of the Water of Leith and the Firth of Forth, increasing the likelihood of direct run-off and affecting the water quality of the affected watercourses; and
- permanent alteration to the drainage system along the Roseburn Railway Corridor by excavation and earthworks impacting upon future drainage patterns within this area.

10.4.3 Long-term Operational Impacts

Operational impacts of the scheme could result from:

- a vehicle washing facility operating within the depot site. The operation of the facility will use water and result in discharge that is potentially contaminated with washing detergents and dirt/oil from the tram vehicles;
- run-off from the tramway during operation (as a result of rainfall) which may be contaminated with oils from tram vehicles and tramway maintenance activities;
- run-off and infiltration to surface and ground water and contamination by possible accidental spillages during maintenance.

10.5 Mitigation

Mitigation to minimise the risk of potential impacts during construction and operation is likely to include the following:
• all surface water discharges from construction activities will pass through sediment traps (such as settlement lagoons or tanks) in order to reduce suspended solids prior to discharge. Similarly, decontaminating filters and oil separators will be incorporated into the site drainage systems in order to minimise the risk of contamination to surface waters (SEPA PPG No.5 (1));

• all construction works will be undertaken in accordance with SEPA’s Pollution Prevention Guidelines and in particular PPG6 (2);

• the contractor will implement the requirements stated in PPG6. The guidance states that it is essential that particular care with all works involving concrete and cement especially if working near a river, stream or surface water drain is undertaken. Suitable provision will be made for the washing out of concrete mixing plant, and such washings will not be allowed to flow into any drain or watercourse;

• construction vehicles will be maintained to reduce the risk of hydrocarbon contamination and will only be active when required. Other construction materials will be managed in such a way as to effectively minimise the risk posed to the aquatic environment, particularly for construction along Starbank Road;

• disturbance to areas close to watercourses will be reduced to the minimum necessary for the work. Exposed soil areas, such as within the Roseburn Railway Corridor, will be minimised in order to reduce the potential for increased siltation and contaminated run-off. Where it is necessary to introduce new areas of hardstanding surfaces, guidance from SEPA on Sustainable Urban Drainage System (SUDS) will be followed during the detailed design stage;

• a flood risk assessment will be undertaken for the detailed design to ensure local flooding risks are not increased. The flood risk assessment will be submitted to SEPA and CEC to ensure that planned flood prevention measures for the detailed design are considered to be adequate;

• a construction method statement will be submitted for approval by the relevant statutory authorities prior to commencement of construction. The method statement will outline mitigation measures designed to minimise potential impacts upon the water quality of the Firth of Forth, including temporary coffer dams and/or a floating curtain of geotextile material to surround the works. Mitigation measures outlined in the method statement will require approval by relevant statutory authorities prior to implementation;

• biodegradable products will be used in the vehicle washing facility;

• bins will be provided on site for collection of construction waste; and

• dust suppression techniques will be applied to all soil stockpiles.

(1) Scottish Environmental Protection Agency, Pollution Prevention Guidelines No.5 - Works in, Near or Liable to Affect Watercourses.
(2) Scottish Environmental Protection Agency, Pollution Prevention Guidelines No.6 - Working at Construction and Demolition Sites.
10.6 Impact Assessment

10.6.1 Temporary Construction Impacts

The scheme crosses the Water of Leith at two points along the alignment at Coltbridge Viaduct and on Ocean Drive. Whilst the scheme will use existing structures to cross the Water of Leith at these points, construction has the potential to increase sediment run-off near the two watercourse crossings during the short term when activities are overhead or close to the river banks.

Implementation of mitigation measures outlined in Section 10.5 will control the risk of impacts to the water quality of the Water of Leith (see Table 10.1). Requirements for specific pollution prevention measures will be discussed with SEPA and implemented during construction.

Construction works along Starbank Road extend beyond the existing seawall. Construction plant will be located within the tidal area of the Firth of Forth for construction of the buttresses. This may impact upon water quality through accidental fuel spillage and sediment disturbance. A construction method statement will be prepared by the contractor detailing mitigation measures to minimise the risk of accidental spillages and sediment disturbances. The method statement will be submitted for approval by the relevant statutory authorities (SNH, SEPA and CEC) prior to commencement of construction. All measures in the method statement will be implemented.

As outlined in Chapter 2, construction of the scheme will involve excavation of trenches up to 1.2 metres deep for the laying of tram tracks. Whilst the sensitivity of groundwater to contamination arising from construction works is considered to be low, mitigation measures will be implemented during construction to ensure that groundwater resources in the vicinity of the scheme are not adversely affected.

10.6.2 Permanent Impacts

The tram tracks incorporate extensive ducting beneath the base slab and this will be laid concurrently with the drainage. Connecting ducts/pipes across the tram tracks above the base slab will normally follow laying of the rails. Along the on-street sections of the scheme, these ducts/pipes will be connected to the existing urban drainage system and reduce the potential for alterations to the existing drainage regime.

Existing drainage will be utilised where the scheme runs on-street and in off-street sections such as the Roseburn Railway Corridor and between Craigleith and Ferry Road, new drainage systems will be installed where existing drainage systems are inadequate. The contractor will identify opportunities along the scheme alignment for the implementation of SUDS in accordance with SEPA requirements and guidelines. The contractor will ensure that the detailed drainage design will create no significant impacts on downstream flooding as a result of run-off discharges. All detailed mitigation measures will be discussed and approved by SEPA prior to construction.

10.6.3 Operational Impacts

Discharges from the vehicle washing facility at the depot site may be contaminated with washing detergents and dirt/oil from the tram vehicles. The contractor will use biodegradable products for vehicle washing. Excess water from the depot will be treated via an oil/grit interceptor prior to discharge in accordance with consents from Scottish Water or SEPA for discharge to the public sewer or a to a watercourse.

Run-off from the tramway during operation (as a result of rainfall) may become contaminated with oils from tram vehicles and tramway maintenance activities. Drainage systems will be required to
incorporate suitable oil and sediment traps to prevent discharge of potentially polluting run-off to urban drainage systems or watercourses.

The contractor will ensure that all SEPA requirements and guidance are implemented during operation of the tram to minimise the risk of accidental spillages of contaminants and resulting discharges into controlled waters.