Appendix 10.4

Potential Contamination Sources

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1 Introduction

1.1.1 In support of **Chapter 10** (**Volume 1**) of the Design Manual for Roads and Bridges (DMRB) Stage 3 Environmental Impact Assessment (EIA) report; this appendix presents the baseline details of potential contamination sources that have been identified within the study area for Project 7 – Glen Garry to Dalwhinnie of the A9 Dualling Programme, hereafter referred to as the Proposed Scheme. Potential pollutant linkage impacts in relation to the sources are also outlined within the context of a preliminary Conceptual Site Model (CSM), with mitigation identified as required in **Chapter 10** (**Volume 1**).

2 Approach and Methods

2.1.1 Potential contamination sources were identified based on a review of historical and current maps, consultations with Perth and Kinross Council (P&KC), The Highland Council (THC), Scottish Environment Protection Agency (SEPA) and site walkovers undertaken by the CH2M Fairhurst Joint Venture (CFJV). Ground investigation (GI) and monitoring data has also been considered as referenced in **Chapter 10** (**Volume 1**).

2.1.2 Published assessment criteria to assist considering soil, soil leachate, groundwater and ground gas monitoring results available were sourced from the following:

- *'Model Procedures for the Management of Land Contamination'*, Environment Agency (EA) (2004)
- *'Suitable for Use Limits for Human Health Risk Assessment'*, Land Quality Management (LQM)/ Chartered Institute of Environmental Health (CIEH) (2015)
- *'Category 4 Screening Levels for Assessment of Land Affected by Contamination'*, Department for Environment, Food and Rural Affairs (DEFRA) (2014)
- 'Position Statement (WAT-PS-10-01) *'Assigning Groundwater Assessment Criteria for Pollutant Inputs, Version 3.0'*, Scottish Environment Protection Agency (SEPA) (2014)
- BS 8485:2015 *'Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings'*, British Standards Institute (2015)
- Construction Industry Research and Information Association (CIRIA) C665 *'Assessing Risks Posed by Hazardous Ground Gases to Buildings'*, CIRIA (2007)
- EH40/ 2005 *'Workplace Exposure Limits, Second Edition'*, Health and Safety Executive (HSE) (2011)

3 Potential Contamination Sources

3.1.1 Twenty principal potential contamination sources have been identified in the study area as part of the assessment, together with 54 individual occurrences of made ground. Details of these are provided in **Table 1** in relation to whether these are online or offline, with their locations based on information available illustrated in **Drawings 10.31** to **10.37** (**Volume 3**).

Table 1: Potential Contamination Sources

Source Ref.	Potential Source Name	Chainage (approx.)	Position and Distance from Scheme	Potential Source Comments	Ground Investigation Information
Online Potential Contamination Sources					
GGD-01	Existing A9 Carriageway	Full chainage	Online	Identified from PSSR due to the consideration that made ground may be present associated with the existing carriageway or associated with embankments, together with potential for pollution associated with road run-off.	Several Advanced and Preliminary GI locations were located on or within the immediate vicinity of the existing A9 carriageway. Areas of made ground have been identified and reviewed individually (GGD-21 to GGD-74). Localised and detectable concentrations of inorganic and organic contaminants (incl. metals and hydrocarbons) have been identified in soil, soil leachate and groundwater testing, one instance of detected asbestos (GGD-73) was also recorded, and monitoring has identified elevated levels of methane, carbon dioxide and depleted oxygen concentrations in several locations (GGD-75).
GGD-02	Highland Main Line Railway	Full chainage	Adjacent to 50m west	Identified from PSSR due to the consideration that made ground may be present associated with the existing railway or embankments/ accesses, together with the potential for pollution associated with run-off.	Several Advanced and Preliminary GI locations located in the vicinity of the Highland Main Line railway but this was not investigated directly. Some localised areas of made ground were encountered possibly associated with establishment of the railway and associated embankments (GGD-34, GGD-25, GGD-56 and GGD-57). Individual review of these indicates localised slightly elevated concentrations of cadmium in soil leachate results in one location (GGD-34).
GGD-03	Former Electricity Pylons (Removed)	Full chainage	Online to 165m east	Identified from PSSR due to the consideration that made ground may be potentially present associated with former power line and associated pylon bases.	Several Advanced and Preliminary GI positions located nearby the approximate positions of the former pylon bases, but they were not investigated directly. Soil and soil leachate chemical testing did not identify any elevated contaminant concentrations.
GGD-04	Existing Electricity Pylons (Beauly Denny Power Line)	Full chainage	Adjacent to 160m east	Identified from PSSR due to the consideration that made ground may be present associated with the construction of the pylon bases and/ or associated access tracks.	Historical GI locations are available from the Beauly-Denny Power Line development. Though no chemical testing results are available from these, no made ground was identified.
GGD-05	Former telephone exchange	ch. 400	Online	Identified from PSSR at Dalnaspidal due to the consideration that made ground may be potentially present, with potential contaminants including asbestos, fuels and/ or lead acid batteries.	Several Advanced and Preliminary GI locations nearby, with areas of made ground (GGD-25 and GGD-26) identified and reviewed as individual sources. Testing information at GGD-25 indicated slightly elevated concentrations of some PAHs to exceed residential and open space criteria in soil, with soil leachate testing identifying exceedances of surface water and drinking water standards for similar.
GGD-06	Former tanks	ch. 500	Online/ Adjacent west	Identified from PSSR at Dalnaspidal. The use of the tank is unknown although it may have been used for fuel storage resulting in a potential contamination source.	Not investigated directly, but one Advanced GI location nearby encountered sandy gravelly clay and gravelly sand up to 2.20m bgl, but with no chemical testing results.
GGD-07	Buildings/ properties at Dalnaspidal	ch. 300 to ch. 600	Adjacent west	Identified from PSSR due to the consideration that made ground may potentially be present associated with the existing properties or access to them, with potential also for incidental contamination via fuel spills.	Several Advanced and Preliminary GI locations nearby. Areas of made ground identified and reviewed as individual source areas (GGD-27 and GGD-28), though no elevated contaminant concentrations were observed.
GGD-09	Radon affected sites	Various	Online/ Adjacent	Several areas identified within PSSR to be radon affected, as between 1% and 3% of homes are above the action level.	Not investigated but it is assumed these are from natural sources, likely representing low risks.
GGD-10	Buildings/ properties at former Cockburn Cottage	ch. 3,800	Online/ Adjacent east	Identified from PSSR as a former cottage in the Pass of Drumochter, with potential for made ground to be present within the vicinity.	Not investigated.
GGD-12	Buildings/ properties at Drumochter Lodge	ch. 7,400	Online/ Adjacent east	Existing properties at Drumochter Lodge identified from PSSR due to consideration that localised made ground may be present in the vicinity, together with asbestos associated with old construction and possible local fuel spills.	Not investigated directly, however Preliminary GI locations adjacent to the property boundaries encountered gravelly sand with cobbles with only one instance of made ground (GGD-66). Soil chemical testing did not identify any elevated contaminant concentrations in natural materials, though dibenzo(ah)anthracene exceeded residential standards in the sample of made ground at GGD-66.
GGD-13	Drumochter Ski Company, Drumochter	ch. 3,725	Online	Septic tank discharge record (Ref. S/86/17/A) (August 1986) for Downhill Skiing Facility in the Pass of Drumochter. Status is not supplied and discharge is noted to be to land. Associated with discharge consent feature DISC 7.6 identified in the water features survey within **Appendix 11.1** (**Volume 2**).	Not investigated.
GGD-18	Station Cottages, Dalnaspidal, Pitlochry PH18	ch. 600	Adjacent west	SEPA CAR License (Ref. CAR/R/1019303) for STE to land, corresponding to discharge consent feature (DISC 7.5) in the water features survey within **Appendix 11.1** (**Volume 2**).	Not investigated directly, however an Advanced GI location nearby encountered sandy gravelly clay and gravelly sand. No chemical testing results.
GGD-20	Drumochter Lodge, Dalwhinnie	ch. 7,375	10m east	SEPA CAR License (Ref. CAR/R/1051862) for STE to soakaway, corresponding to discharge consent feature (DISC 7.8) in the water features survey within **Appendix 11.1** (**Volume 2**).	Not investigated.
GGD-75	Ground Gas	Full chainage	Online/ adjacent	Conditions encountered during Advanced and Preliminary GI monitoring, nearby existing A9 carriageway and other potential source areas. The response zones of the borehole installations suggest that the concentrations encountered are likely to be attributable to natural sources, such as peat and other organic-rich soils/ sediments.	Isolated raised detections of methane (between 4.10 and 45% volume (v/v)) have been recorded in three monitoring locations, with concentrations exceeding the recommended safety threshold of 1% v/v. Each of the locations is situated to the west of the Proposed Scheme at ch. 800, ch. 2,025 and ch. 2,950 near Dalnaspidal and in the Pass of Drumochter, within installations screened in or across alluvial or made ground materials; suggesting these may be the potential source. Carbon dioxide concentrations exceed the short term occupational exposure limit (1.5% v/v) in 27 boreholes and the long-term exposure limit (0.5% v/v) in 35 boreholes on one or more occasion, with detected concentrations ranging between 0.10 and 8.00% v/v across the Proposed Scheme. Depleted oxygen concentrations below 19% v/v have been observed in 26 boreholes on one or more occasion, with levels considered to be very low (less than 16% v/v) in several instances and frequently coinciding with higher methane or carbon dioxide detections.

Source Ref.	Potential Source Name	Chainage (approx.)	Position and Distance from Scheme	Potential Source Comments	Ground Investigation Information
Online Individual Occurrences of Made Ground/ Visual or Olfactory Indications of Contamination (i.e. odours, staining)					
GGD-21	Preliminary GI Location (HP7-3-103)	ch. -100 (tie-in)	Online	Conditions encountered during Preliminary GI, nearby existing A9 (GGD-01).	Made ground encountered, comprising brown slightly clayey slightly gravelly sand with cobbles and fragments of tarmac. Soil chemical testing did not identify elevated contaminant concentrations.
GGD-22	Preliminary GI Location (HP7-3-104)	ch. 50	Online	Conditions encountered during Preliminary GI, nearby existing A9 (GGD-01).	Made ground comprising black and brown sandy gravelly topsoil with roots. Soil chemical testing did not identify any elevated contaminant concentrations.
GGD-23	Preliminary GI Location (TP7-3-108)	ch. 275	Online	Conditions encountered during Preliminary GI and not within the vicinity of any identified particular source.	Made ground encountered comprising light greyish brown sandy with metal road peg 600mm long. Soil chemical testing did not identify any elevated contaminant concentrations.
GGD-24	Preliminary GI Location (TP7-3-111)	ch. 325	Online	Conditions encountered during Preliminary GI and not within the vicinity of any identified particular source.	Made ground encountered comprising of light brown gravelly sand with medium cobble content and coke can, rags, tape and wood between 0.15m and 1.00m bgl. Soil chemical testing did not identify any elevated contaminant concentrations.
GGD-25	Advanced GI Location (TP7-002)	ch. 325	Online	Conditions encountered during Advanced GI, nearby existing A9 (GGD-01) and former telephone exchange (GGD-05).	Made ground encountered comprising light and dark brown slightly gravelly sand and dark grey bituminous material. A strong hydrocarbon odour was recorded between 0.30m and 0.80m bgl. Soil chemical testing indicated levels of some PAHs to exceed residential and open space criteria, including naphthalene, benzo(a)anthracene, chrysene, benzo(a)pyrene, benzo(b) fluoranthene, benzo(a)pyrene and dibenzo(ah)anthracene. Soil leachate testing identified exceedances of surface water and drinking water standards for similar PAHs.
GGD-26	Preliminary GI Location (BH7-3-104)	ch. 350	Online	Conditions encountered during Preliminary GI, nearby existing A9 (GGD-01) and former telephone exchange (GGD-05).	Made ground encountered, comprising dark brownish grey sandy silty gravel with fragments of tarmac, broken stone and cobbles. Soil chemical testing did not identify any elevated contaminant concentrations.
GGD-27	Advanced GI Location (TP7-039)	ch. 425	Online	Conditions encountered during Advanced GI, nearby buildings/ properties at Dalnaspidal (GGD-07).	Made ground encountered, comprising medium dense very dark greyish brown silty slightly gravelly peaty sand with fragments of brick and cobbles. Soil chemical testing did not identify elevated contaminant concentrations.
GGD-28	Preliminary GI Location (TP7-3-112A)	ch. 475	Online	Conditions encountered during Preliminary GI, nearby buildings/ properties at Dalnaspidal (GGD-07).	Made ground encountered, comprising dark brown slightly sandy pseudofibrous peat with roots, medium boulder content and fragments of glass between ground level and 0.65m bgl. Soil chemical testing did not identify any elevated contaminant concentrations.
GGD-29	Preliminary GI Location (TP7-3-113)	ch. 450	Online	Conditions encountered during Preliminary GI, nearby existing A9 (GGD-01).	Made ground encountered, comprising dark brown gravelly sand with cobbles and red brick fragments. Soil and soil leachate chemical testing did not identify any elevated contaminant concentrations.
GGD-30	Preliminary GI Location (TP7-3-114)	ch. 475	Online	Conditions encountered during Preliminary GI and not within the vicinity of any identified particular source.	Made ground encountered, comprising dark grey gravel of ballast. Soil chemical testing did not identify any elevated contaminant concentrations
GGD-31	Advanced GI Location (TP7-049)	ch. 800	Online	Conditions encountered during Preliminary GI and not within the vicinity of any identified particular source.	Possible made ground from former landslip encountered, comprising dark greyish brown clayey slightly gravelly sand with roots and cobbles. Soil chemical testing did not identify any elevated contaminant concentrations.
GGD-32	Preliminary GI Location (TP7-3-121)	ch. 1,050	Online	Conditions encountered during Preliminary GI, nearby existing A9 (GGD-01).	Made ground encountered, comprising dark brown sandy gravelly topsoil with rootlets and grey silty peaty sand and gravel. Soil chemical testing did not identify any elevated contaminant concentrations.
GGD-33	Advanced GI Location (TP7-041)	ch. 1,100	Online	Conditions encountered during Advanced GI and not within the vicinity of any identified particular source.	Possible made ground from former landslip encountered, comprising brown clayey slightly gravelly sand with cobbles. Soil chemical testing did not identify any elevated contaminant concentrations
GGD-34	Advanced GI Location (TP7-042A)	ch. 1,400	Online	Conditions encountered during Advanced GI and nearby Highland Main Line railway (GGD-02).	Made ground encountered, comprising grey and brown clayey gravelly sand with fragments of plastic, medium cobble content and some organic traces, fragments of rope and cobbles. Soil chemical testing did not identify any elevated contaminant concentrations, although cadmium was observed to exceed the surface water standards in soil leachate analysis.
GGD-35	Advanced GI Location (TP7-042)	ch. 1,175	Online	Conditions encountered during Advanced GI, nearby existing A9 (GGD-01) and Highland Main Line railway (GGD-02).	Made ground encountered, comprising greyish brown locally orange clayey gravelly sand with fragments of metal fence wire and high cobble and boulder content and reworked material between 0.15m bgl and 2.20m bgl. No chemical testing results.
GGD-36	Preliminary GI Location (TP7-3-123)	ch. 1,600	Online	Conditions encountered during Preliminary GI, nearby existing A9 (GGD-01).	Made ground encountered, comprising greyish brown gravel of mixed lithologies with a medium cobble content between ground level and 0.80m bgl. Soil chemical testing of a soil sample at 0.5m bgl did not identify any elevated contaminant concentrations
GGD-37	Advanced GI Location (TP7-007)	ch. 1,650	Online	Conditions encountered during Advanced GI, nearby existing A9 (GGD-01)	Made and possible ground encountered, comprising brownish grey slightly silty gravelly sand with fragments of wooden fence post and grey slightly silty gravelly sand with cobbles. No chemical testing results.
GGD-38	Advanced GI Location (TP7-008)	ch. 1,725	Online	Conditions encountered during Advanced GI nearby existing A9 (GGD-01).	Made ground encountered, comprising greyish brown slightly clayey sand with medium cobble and boulder content and reworked material between ground level and 1.30m bgl. Soil chemical testing did not identify any elevated contaminant concentrations
GGD-39	Advanced GI Location (TP7-010)	ch. 2,125	Online	Conditions encountered during Advanced GI, nearby existing A9 (GGD-01).	Made ground encountered, comprising very dark brown very gravelly peaty topsoil, between ground level and 0.20m bgl. No chemical testing results.

Source Ref.	Potential Source Name	Chainage (approx.)	Position and Distance from Scheme	Potential Source Comments	Ground Investigation Information
GGD-40	Preliminary GI Location (TP7-3-128)	ch. 2,550	Online	Conditions encountered during Preliminary GI, nearby existing A9 and cycle path (GGD-01).	Made ground encountered, comprising brown, pinkish red and dark grey silty sand and gravel with cobbles. Soil chemical testing did not identify any elevated contaminant concentrations, although soil leachate results recorded exceedances of drinking water and surface water standards for mercury and PAHs, including indeno(1,2,3-cd) pyrene and benzo(ghi)perylene.
GGD-41	Preliminary GI Location (TP7-3-131)	ch. 2,900	Online	Conditions encountered during Preliminary GI, nearby existing A9 (GGD-01).	Made ground encountered, comprising dark brown sandy peaty topsoil with rootlets and gravel and occasional fragments of glass, peat with an organic odour and patches of decaying heather. Soil chemical testing did not identify any elevated contaminant concentrations.
GGD-42	Advanced GI Location (BH7-010)	ch. 2,950	Online	Conditions encountered during Advanced GI and not within the vicinity of any identified particular source.	Made ground encountered, comprising dark brown and greyish-brown silty sand and gravel and pale orange brown slightly silty very sandy gravel. No chemical testing results.
GGD-43	Preliminary GI Location (TP7-3-133)	ch. 3,225	Online	Conditions encountered during Preliminary GI, nearby existing A9 and cycle path (GGD-01).	Made ground encountered, comprising brown very gravelly silty sand and grey sandy silty gravel with occasional fragments of timber up to 300mm in diameter. Soil chemical testing did not identify any elevated contaminant concentrations.
GGD-44	Advanced GI Location (TP7-014)	ch. 3,400	Online	Conditions encountered during Advanced GI, nearby existing A9 (GGD-01).	Made ground encountered, comprising dark brownish grey clayey sandy slightly gravelly topsoil and light brownish grey slightly silty gravelly sand with fragments of timber, rubber and fabric. Soil chemical testing identified levels of dibenzo(ah)anthracene to exceed residential standards. Soil leachate chemical testing also identified exceedances of surface water standards for cadmium and fluoranthene.
GGD-45	Preliminary GI Location (TP7-3-134)	ch. 3,500	Online	Conditions encountered during Preliminary GI, nearby existing A9 (GGD-01).	Made ground encountered, comprising dark grey and black very gravelly silty sand with cobbles, ceramic fragments, timber and tarmac. Soil chemical testing did not identify any elevated contaminant concentrations
GGD-46	Advanced GI Location (TP7-016)	ch. 3,625	Online	Conditions encountered during Advanced GI, nearby existing A9 (GGD-01).	Made ground encountered, comprising dark brown slightly clayey sandy slightly gravelly topsoil and silty gravelly sand with some organic matter. Soil chemical testing did not identify any elevated contaminant concentrations.
GGD-47	Advanced GI Location (BH7-012)	ch. 3,775	Online	Conditions encountered during Advanced GI, nearby existing A9 (GGD-01).	Made ground encountered comprising of tarmac between 0.20m and 0.70m bgl. No chemical testing results.
GGD-48	Preliminary GI Location (TP7-3-136)	ch. 4,200	Online	Conditions encountered during Preliminary GI and not within the vicinity of any identified particular source.	Made ground encountered, comprising dark brown very silty very gravelly topsoil with tarmac fragments and brown slightly silty sandy gravel of psammite and granite. Soil chemical testing did not identify any elevated contaminant concentrations.
GGD-49	Preliminary GI Location (TP7-3-137)	ch. 4,300	Online	Conditions encountered during Preliminary GI, nearby existing A9 (GGD-01).	Made ground encountered comprising of silty very gravelly sand with cobbles and occasional fragments of ceramic. Soil chemical testing did not identify any elevated contaminant concentrations.
GGD-50	Advanced GI Location (TP7-020)	ch. 4,500	Online	Conditions encountered during Advanced GI, nearby existing A9 (GGD-01).	Made ground encountered, comprising dark brown slightly clayey sandy gravelly topsoil, light greyish brown slightly gravelly sand and dark grey tarmac recovered as sandy gravel and cobble sized fragments with strong hydrocarbon odour. Soil chemical testing indicated levels of PAHs and TPHs greater than residential and open space standards, including benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(a)pyrene and dibenzo(ah) anthracene. Soil leachate chemical testing also identified exceedances of surface water standards for phenol as well as PAHs including anthracene, fluoranthene, benzo(b/k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd) pyrene and benzo(ghi)perylene.
GGD-51	Advanced GI Location (TP7-021)	ch. 4,675	Online	Conditions encountered during Advanced GI, nearby existing A9 (GGD-01).	Made ground encountered comprising very dense very dark brown very gravelly topsoil with high cobble and low boulder content between ground level and 0.20m bgl. No chemical testing results.
GGD-52	Preliminary GI Location (TP7-3-140)	ch. 4,900	Online	Conditions encountered during Preliminary GI, nearby existing A9 (GGD-01).	Made ground encountered, comprising brown silty very gravelly topsoil, brown silty sand and gravel with cobbles and brown silty very sandy gravelly amorphous peat. Soil chemical testing did not identify any elevated contaminant concentrations.
GGD-53	Preliminary GI Location (TT01)	ch. 4,925	Online	Conditions encountered during Preliminary GI and not within the vicinity of any identified particular source.	Made ground encountered, comprising dark brown and brown slightly sandy gravelly peaty silty topsoil and dark brown and orange brown silty sand and gravel with roots, inclusions of plastic netting and cobbles. No chemical testing results.
GGD-54	Preliminary GI Location (TT02)	ch. 5,000	Online	Conditions encountered during Preliminary GI and not within the vicinity of any identified particular source.	Made ground encountered comprising dark brown to reddish brown slightly peaty silty sandy gravelly topsoil with many rootlets and cobbles. No chemical testing results.
GGD-55	Preliminary GI Location (TT03)	ch. 5,100	Online	Conditions encountered during Preliminary GI and not within the vicinity of any identified particular source.	Made ground encountered comprising dark brown with orange patches very gravelly sandy peaty silt with high cobble content and inclusions of wood and decayed fibrous organics. No chemical testing results.
GGD-56	Preliminary GI Location (BH7-3-123)	ch. 5,100	Online	Conditions encountered during Preliminary GI and nearby existing A9 (GGD-01) and Highland Main Line railway (GGD-02).	Concrete/ tarmac encountered up to 0.20m bgl. No chemical testing results.
GGD-57	Preliminary GI Location (BH7-3-124)	ch. 5,150	Online	Conditions encountered during Preliminary GI and nearby existing A9 (GGD-01) and Highland Main Line railway (GGD-02).	Tarmac encountered up to 0.10m bgl. No chemical testing results.
GGD-58	Preliminary GI Location (TT04)	ch. 5,150	Online	Conditions encountered during Preliminary GI and not within the vicinity of any identified particular source.	Made ground encountered comprising dark brown silty sandy gravelly topsoil with rootlets and cobbles. No chemical testing results.

Source Ref.	Potential Source Name	Chainage (approx.)	Position and Distance from Scheme	Potential Source Comments	Ground Investigation Information
GGD-59	Advanced GI Location (TP7-023)	ch. 5,150	Online	Conditions encountered during Preliminary GI, nearby existing A9 (GGD-01).	Made ground encountered, comprising brownish grey slightly clayey sandy gravelly topsoil and dark brown locally orange clayey gravelly fine to coarse sand with fragments of tarmac and cobbles. Soil chemical testing did not identify any elevated contaminant concentrations, although soil leachate testing identified exceedances of surface water standards for anthracene and fluoranthene as well as an exceedance of drinking water standards for total PAH.
GGD-60	Preliminary GI Location (TP7-3-142)	ch. 5,700	Online	Conditions encountered during Preliminary GI and not in the vicinity of other source areas.	Made ground encountered, comprising dark brown slightly silty peaty sandy topsoil and sand and gravel with rootlets, inclusions of masonry and plastic bags. Soil chemical testing did not identify any elevated contaminant concentrations.
GGD-61	Preliminary GI Location (TP7-3-144)	ch. 6,025	Online	Conditions encountered during Preliminary GI, nearby existing A9 (GGD-01).	Possible made ground encountered comprising a 200mm thick lense of grey silty sandy gravel. Soil chemical testing did not identify any elevated contaminant concentrations.
GGD-62	Preliminary GI Location (TP7-3-145)	ch. 6,100	Online	Conditions encountered during Preliminary GI and not within the vicinity of any identified particular source.	Made ground encountered, comprising light brown silty sand and gravel, and black sandy topsoil with an organic odour and fence wire. Soil chemical testing did not identify any elevated contaminant concentrations.
GGD-63	Preliminary GI Location (TP7-3-146)	ch. 6,200	Online	Conditions encountered during Preliminary GI and nearby existing A9 (GGD-01)	Made ground encountered, comprising brown and black sandy gravelly peaty topsoil with many roots and occasional glass fragments. Soil chemical testing did not identify any elevated contaminant concentrations.
GGD-64	Preliminary GI Location (TP7-3-150)	ch. 6,750	Online	Conditions encountered during Preliminary GI, nearby existing A9 (GGD-01).	Made ground encountered, comprising banded unit with varying layer composition and thickness. Soil chemical testing did not identify any elevated contaminant concentrations.
GGD-65	Advanced GI Location (TP7-029)	ch. 6,900	Online	Conditions encountered during Advanced GI, nearby existing A9 (GGD-01).	Made ground encountered, comprising brown clayey sand gravelly topsoil with roots, cobbles, fragments of tarmac and a faint hydrocarbon odour between 0.25m and 0.45m bgl. Soil chemical testing did not identify any elevated contaminant concentrations, although soil leachate chemical testing identified total PAHs to exceed the drinking water standard.
GGD-66	Preliminary GI Location (BH7-3-134)	ch. 7,200	Online	Conditions encountered during Preliminary GI, nearby existing A9 (GGD-01).	Made ground encountered comprising greyish black sandy gravel with cobbles. Soil chemical testing at 0.10m bgl identified dibenzo(ah)anthracene to exceed residential standards, however a sample at 0.50m bgl did not identify any elevated contaminant concentrations.
GGD-67	Preliminary GI Location (TP7-3-157)	ch. 7,650	Online	Conditions encountered during Preliminary GI, nearby existing A9 and cycle track (GGD-01).	Made ground encountered comprising black silty slightly sandy peaty topsoil with inclusions of masonry, timber and steel rope and an organic odour. Soil chemical testing at 0.50m bgl identified dibenzo(ah)anthracene exceeding residential standards, however soil samples at 1.00m and 1.50m bgl did not identify any elevated contaminant concentrations. Soil leachate chemical testing identified total PAHs to exceed the drinking water standard.
GGD-68	Preliminary GI Location (TP7-3-163)	ch. 8,550	Online	Conditions encountered during Preliminary GI, nearby existing A9 (GGD-01).	Made ground encountered, comprising brown and grey gravelly sand and gravel of dolomite. Soil chemical testing did not identify any elevated contaminant concentrations.
GGD-69	Preliminary GI Location (BH7-3-144)	ch. 8,800	Online	Conditions encountered during Preliminary GI, and nearby existing A9 (GGD-01).	Made ground encountered comprising grey and black sandy gravel, with quartz, tarmac and cobbles with a hydrocarbon odour also noted between 0.55m and 1.40m bgl. Soil chemical testing results identified one concentration of dibenzo(ah)anthracene exceeding residential standards.
GGD-70	Advanced GI Location (TP7-036)	ch. 8,900	Online	Conditions encountered during Advanced GI, and nearby existing A9 (GGD-01).	Made ground encountered, comprising dark reddish brown slightly silty sandy slightly gravelly topsoil, tarmac and dark grey gravelly sand with fragments of tarmac, plastic and metal. Soil chemical testing did not identify any elevated contaminant concentrations, although soil leachate analysis identified an exceedance of drinking water standards for total PAHs.
GGD-71	Advanced GI Location (TP7-3-166)	ch. 9,000	Online	Conditions encountered during Advanced GI, and nearby existing A9 (GGD-01).	Made ground encountered comprising brown slightly sandy silty topsoil and gravelly sand with rootlets and cobbles. Soil chemical testing did not identify any elevated contaminant concentrations.
GGD-72	Preliminary GI Location (TP7-3-168)	ch. 9,200	Online	Conditions encountered during Advanced GI, and nearby existing A9 (GGD-01).	Made ground encountered, comprising brown and grey sand and gravel with inclusions of wood, masonry and pottery. Soil chemical testing did not identify any elevated contaminant concentrations.
GGD-73	Advanced GI Location (TP7-037)	ch. 9,500	Online	Conditions encountered during Advanced GI, and nearby existing A9 (GGD-01).	Made ground encountered, comprising brown slightly silty sandy gravelly topsoil with roots and cobbles with fragments of tarmac. Soil chemical testing identified a small bundle of chrysotile asbestos (0.001%). Soil leachate testing did not identify any elevated contaminant concentrations.
GGD-74	Preliminary GI Location (TP7-3-171)	ch. 9,575	Online	Conditions encountered during Advanced GI, and nearby existing A9 (GGD-01).	Made ground encountered, comprising dark brown and orange clayey gravelly fine to coarse sand with wire, tarmac, cobbles, black angular boulders of tarmac and blueish grey gravelly sand. Soil chemical testing did not identify elevated contaminant concentrations, although soil leachate testing identified an exceedance in surface water standards for mercury.
Offline Potential Contamination Sources					
GGD-08	Former Dalnaspidal Station and tanks	ch. 500 to ch. 600	20m west	Identified from PSSR as former railway station at Dalnaspidal with associated tanks in the vicinity. First recorded on historical mapping from 1872, with the potential for made ground, oil and fuel spills. Located outwith Proposed Scheme extents and downgradient.	Not investigated.
GGD-11	Buildings/ properties at Balsporran Cottage	ch. 3,800	65 to 115m west	Identified from PSSR, where sheepfold was indicated and later became Balsporran Cottage. Included due to the consideration that localised potential made ground may be present in the vicinity, together with asbestos associated with old construction and possible local fuel spills.	Not investigated.
GGD-14	Dalnaspidal Lodge, Ben Alder Estate, Calvine	ch. 150	350m west	SEPA CAR License (Ref. CAR/R/1051858) for STE to soakaway, corresponding to discharge consent feature (DISC 7.1) in the water features survey within **Appendix 11.1** (**Volume 2**).	Not investigated.

Source Ref.	Potential Source Name	Chainage (approx.)	Position and Distance from Scheme	Potential Source Comments	Ground Investigation Information
GGD-15	Dalnaspidal, Calvine, Pitlochry	ch. 300	220m west	SEPA CAR License (Ref. CAR/R/1065665) for STE to soakaway, corresponding to discharge consent feature (DISC 7.2) in the water features survey within **Appendix 11.1** (**Volume 2**).	Not investigated.
GGD-16	Dalnaspidal Steading, Dalnaspidal, Pitlochry	ch. 350	200m west	SEPA CAR License (Ref. CAR/R/1065480) for STE to soakaway, corresponding to discharge consent feature (DISC 7.4) in the water features survey within **Appendix 11.1** (**Volume 2**).	Not investigated.
GGD-17	Dalnaspidal Farm Buildings, Pitlochry	ch. 350	200m west	SEPA CAR License (Ref. CAR/R/1067645) for STE to soakaway, corresponding to discharge consent feature (DISC 7.3) in the water features survey within **Appendix 11.1** (**Volume 2**).	Not investigated.
GGD-19	Balsporran Cottages, Dalwhinnie	ch. 6,800	110m west	SEPA CAR License (Ref. CAR/R/1054810) for STE to soakaway, corresponding to discharge consent feature (DISC 7.7) in the water features survey within **Appendix 11.1** (**Volume 2**).	Not investigated.

4 Preliminary Conceptual Site Model

4.1.1 For each potential contamination source identified in **Table 1**, a generic qualitative assessment has been undertaken through the development of a preliminary CSM. The purpose of this is to evaluate the level of potential contamination risk that may be present in relation to the sources, as a direct result of activities associated with the construction or operation of the Proposed Scheme, which may interact with them as follows:

- direct disturbance of potential contamination sources (i.e. those within the Proposed Scheme footprint or permanent and temporary works boundaries)
- indirect disturbance of nearby potential contamination sources as a result of construction of the Proposed Scheme (i.e. interception within areas of excavation)

4.1.2 The preliminary CSM therefore represents an outline of potential direct and indirect pollutant linkages (PL) that may be present between sources of contamination, pathways by which they may move and ultimately, affected receptors during construction or operation. If any element of a linkage (contaminant, pathway or receptor) is missing, the linkage cannot pose a risk and is not considered. The potential receptors and pathways were compiled based on definitions in Part IIA of the Environmental Protection Act 1990, as described in **Table 10-7** in **Chapter 10** (**Volume 1**).

4.1.3 In order to establish the level of potential risk that may be present, the guidance set out within CIRIA C552 '*Contaminated Land Risk Assessment: A Guide to Good Practice*' (CIRIA, 2001) and *'CLR11 – Model Procedures for the Management of Land Contamination'* (EA, 2004) has been followed. These state that the designation of risk should be based on:

- the likelihood of the risk being present – taking into account the presence of a source and receptor, and the integrity of the pathway, versus
- the severity of the potential consequence should the risk be realised – taking into account the severity of the source, the sensitivity of the receptor and the duration of potential effects where appropriate

4.1.4 The output of the assessment is therefore reported as the 'likelihood' of a complete pollutant linkage being present, the 'consequence' (magnitude) of effect on likely receptors, followed by overall risk (significance), taking account of both likelihood and consequence, as defined in **Table 10-8** to **Table 10-10** within **Chapter 10** (**Volume 1**).

4.1.5 In order to make the assessment as specific as possible, the available desk-based and GI information for each potential contamination source area in **Table 1** has been considered, as well as evidence for potential or actual contamination to be present, the proximity of receptors and how these may interact with the local geology, hydrogeology and anticipated construction or operation phase activities. Based on this and the above, **Table 2** therefore presents the CSM evaluation of plausible direct and indirect pollutant linkages for the Proposed Scheme in support of the assessment described in **Chapter 10** (**Volume 1**).

Table 2: Preliminary Conceptual Site Model

Source Ref. and Name	Pollutant Linkage	Pathway	Receptors	Risk (Significance) Evaluation		
				Likelihood	Consequence	Significance
Online Potential Contamination Sources						
GGD-01 Existing A9 Carriageway	**Construction**					
	PL1	Ingestion, inhalation and dermal contact with soil, soil dust and fibres (asbestos), deep and shallow groundwater and surface water	Human Health (construction workers)	Likely	Mild	Moderate/ Low
	PL3	Ingestion, inhalation and dermal contact with wind-blown dust created during excavation works	Human Health (local residents and transient traffic (foot, road and rail))	Likely	Mild	Moderate/ Low
	PL7	Migration/ mobilisation of contaminated shallow groundwater through drift deposits or made ground	Water Environment (surface water) Ecological Receptors (GWDTE) Property (PWS and services)	Likely	Mild	Moderate/ Low
	PL10	Interception and discharge of contaminated groundwater during active or passive dewatering	Water Environment (surface water)	Likely	Mild	Moderate/ Low
	Operation					
	PL13	Ingestion, inhalation and dermal contact with soil, soil dust, fibres (asbestos), deep and shallow groundwater, surface water in the long-term during routine maintenance e.g. drainage inspections	Human Health (maintenance workers)	Low Likelihood	Mild	Low
	PL15	Ingestion, inhalation and dermal contact with wind-blown dust from contaminated soils reused within road features such as embankments and landscaped areas	Human Health (local residents and transient traffic (foot, road and rail))	Low Likelihood	Mild	Low
	PL22	Discharge of intercepted contaminated groundwater	Water Environment (surface water)	Low Likelihood	Mild	Low
GGD-02 Highland Main Line Railway	**Construction**					
	PL1	Ingestion, inhalation and dermal contact with soil, soil dust and fibres (asbestos), deep and shallow groundwater and surface water	Human Health (construction workers)	Likely	Mild	Moderate/ Low
	PL3	Ingestion, inhalation and dermal contact with wind-blown dust created during excavation works	Human Health (local residents and transient traffic (foot, road and rail))	Likely	Mild	Moderate/ Low
	PL7	Migration/ mobilisation of contaminated shallow groundwater through drift deposits or made ground	Water Environment (surface water) Ecological Receptors (GWDTE) Property (PWS and services)	Low Likelihood	Mild	Low
	PL10	Interception and discharge of contaminated groundwater during active or passive dewatering	Water Environment (surface water)	Low Likelihood	Mild	Low
	Operation					
	PL13	Ingestion, inhalation and dermal contact with soil, soil dust, fibres (asbestos), deep and shallow groundwater, surface water in the long-term during routine maintenance e.g. drainage inspections	Human Health (maintenance workers)	Low Likelihood	Mild	Low
	PL15	Ingestion, inhalation and dermal contact with wind-blown dust from contaminated soils reused within road features such as embankments and landscaped areas	Human Health (local residents and transient traffic (foot, road and rail))	Low Likelihood	Mild	Low
	PL22	Discharge of intercepted contaminated groundwater	Water Environment (surface water)	Unlikely	Mild	Very Low
GGD-03 Former Electricity Pylons (Removed)	**Construction**					
	PL1	Ingestion, inhalation and dermal contact with soil, soil dust and fibres (asbestos), deep and shallow groundwater and surface water	Human Health (construction workers)	Likely	Minor	Low
	PL3	Ingestion, inhalation and dermal contact with wind-blown dust created during excavation works	Human Health (local residents and transient traffic (foot, road and rail))	Likely	Minor	Low
	PL7	Migration/ mobilisation of contaminated shallow groundwater through drift deposits or made ground	Water Environment (surface water) Ecological Receptors (GWDTE)	Likely	Minor	Low
	PL10	Interception and discharge of contaminated groundwater during active or passive dewatering	Water Environment (surface water)	Likely	Minor	Low
	Operation					
	PL13	Ingestion, inhalation and dermal contact with soil, soil dust, fibres (asbestos), deep and shallow groundwater, surface water in the long-term during routine maintenance e.g. drainage inspections	Human Health (maintenance workers)	Low Likelihood	Minor	Very Low
	PL15	Ingestion, inhalation and dermal contact with wind-blown dust from contaminated soils reused within road features such as embankments and landscaped areas	Human Health (local residents and transient traffic (foot, road and rail))	Low Likelihood	Minor	Very Low
	PL22	Discharge of intercepted contaminated groundwater	Water Environment (surface water)	Low Likelihood	Minor	Very Low

Source Ref. and Name	Pollutant Linkage	Pathway	Receptors	Risk (Significance) Evaluation		
				Likelihood	Consequence	Significance
GGD-04 Existing Electricity Pylons (Beauly Denny Power Line)	**Construction**					
	PL1	Ingestion, inhalation and dermal contact with soil, soil dust and fibres (asbestos), deep and shallow groundwater and surface water	Human Health (construction workers)	Likely	Minor	Low
	PL3	Ingestion, inhalation and dermal contact with wind-blown dust created during excavation works	Human Health (local residents and transient traffic (foot, road and rail))	Likely	Minor	Low
	PL7	Migration/ mobilisation of contaminated shallow groundwater through drift deposits or made ground	Water Environment (surface water) Ecological Receptors (GWDTE)	Likely	Minor	Low
	PL10	Interception and discharge of contaminated groundwater during active or passive dewatering	Water Environment (surface water)	Likely	Minor	Low
	Operation					
	PL13	Ingestion, inhalation and dermal contact with soil, soil dust, fibres (asbestos), deep and shallow groundwater, surface water in the long-term during routine maintenance e.g. drainage inspections	Human Health (maintenance workers)	Low Likelihood	Minor	Very Low
	PL15	Ingestion, inhalation and dermal contact with wind-blown dust from contaminated soils reused within road features such as embankments and landscaped areas	Human Health (local residents and transient traffic (foot, road and rail))	Low Likelihood	Minor	Very Low
	PL22	Discharge of intercepted contaminated groundwater	Water Environment (surface water)	Low Likelihood	Minor	Very Low
GGD-05 Former Telephone Exchange	**Construction**					
	PL1	Ingestion, inhalation and dermal contact with soil, soil dust and fibres (asbestos), deep and shallow groundwater and surface water	Human Health (construction workers)	Likely	Medium	Moderate
	PL3	Ingestion, inhalation and dermal contact with wind-blown dust created during excavation works	Human Health (local residents and transient traffic (foot, road and rail))	Likely	Medium	Moderate
	PL7	Migration/ mobilisation of contaminated shallow groundwater through drift deposits or made ground	Water Environment (surface water) Ecological Receptors (GWDTE) Property (PWS and services)	Likely	Medium	Moderate
	PL10	Interception and discharge of contaminated groundwater during active or passive dewatering	Water Environment (surface water)	Likely	Medium	Moderate
	Operation					
	PL13	Ingestion, inhalation and dermal contact with soil, soil dust, fibres (asbestos), deep and shallow groundwater, surface water in the long-term during routine maintenance e.g. drainage inspections	Human Health (maintenance workers)	Low Likelihood	Medium	Moderate/ Low
	PL15	Ingestion, inhalation and dermal contact with wind-blown dust from contaminated soils reused within road features such as embankments and landscaped areas	Human Health (local residents and transient traffic (foot, road and rail))	Low Likelihood	Medium	Moderate/ Low
	PL22	Discharge of intercepted contaminated groundwater	Water Environment (surface water)	Low Likelihood	Medium	Moderate/ Low
GGD-06 Former tanks	**Construction**					
	PL1	Ingestion, inhalation and dermal contact with soil, soil dust and fibres (asbestos), deep and shallow groundwater and surface water	Human Health (construction workers)	Likely	Medium	Moderate
	PL3	Ingestion, inhalation and dermal contact with wind-blown dust created during excavation works	Human Health (local residents and transient traffic (foot, road and rail))	Likely	Medium	Moderate
	PL7	Migration/ mobilisation of contaminated shallow groundwater through drift deposits or made ground	Water Environment (surface water) Ecological Receptors (GWDTE) Property (PWS and services)	Likely	Medium	Moderate
	PL10	Interception and discharge of contaminated groundwater during active or passive dewatering	Water Environment (surface water)	Likely	Medium	Moderate
	Operation					
	PL13	Ingestion, inhalation and dermal contact with soil, soil dust, fibres (asbestos), deep and shallow groundwater, surface water in the long-term during routine maintenance e.g. drainage inspections	Human Health (maintenance workers)	Low Likelihood	Medium	Moderate/ Low
	PL15	Ingestion, inhalation and dermal contact with wind-blown dust from contaminated soils reused within road features such as embankments and landscaped areas	Human Health (local residents and transient traffic (foot, road and rail))	Low Likelihood	Medium	Moderate/ Low
	PL22	Discharge of intercepted contaminated groundwater	Water Environment (surface water)	Low Likelihood	Medium	Moderate/ Low

Source Ref. and Name	Pollutant Linkage	Pathway	Receptors	Risk (Significance) Evaluation		
				Likelihood	Consequence	Significance
GGD-07 Buildings/ Properties at Dalnaspidal, including GGD-18 (septic tank at Station Cottages)	**Construction**					
	PL1	Ingestion, inhalation and dermal contact with soil, soil dust and fibres (asbestos), deep and shallow groundwater and surface water	Human Health (construction workers)	Likely	Medium	Moderate
	PL3	Ingestion, inhalation and dermal contact with wind-blown dust created during excavation works	Human Health (local residents and transient traffic (foot, road and rail))	Likely	Medium	Moderate
	PL7	Migration/ mobilisation of contaminated shallow groundwater through drift deposits or made ground	Water Environment (surface water) Ecological Receptors (GWDTE) Property (PWS and services)	Likely	Medium	Moderate
	PL10	Interception and discharge of contaminated groundwater during active or passive dewatering	Water Environment (surface water)	Likely	Medium	Moderate
	Operation					
	PL13	Ingestion, inhalation and dermal contact with soil, soil dust, fibres (asbestos), deep and shallow groundwater, surface water in the long-term during routine maintenance e.g. drainage inspections	Human Health (maintenance workers)	Low Likelihood	Medium	Moderate/ Low
	PL15	Ingestion, inhalation and dermal contact with wind-blown dust from contaminated soils reused within road features such as embankments and landscaped areas	Human Health (local residents and transient traffic (foot, road and rail))	Low Likelihood	Medium	Moderate/ Low
	PL22	Discharge of intercepted contaminated groundwater	Water Environment (surface water)	Low Likelihood	Medium	Moderate/ Low
GGD-10 Buildings/ properties at former Cockburn Cottage	**Construction**					
	PL1	Ingestion, inhalation and dermal contact with soil, soil dust and fibres (asbestos), deep and shallow groundwater and surface water	Human Health (construction workers)	Likely	Mild	Moderate/ Low
	PL3	Ingestion, inhalation and dermal contact with wind-blown dust created during excavation works	Human Health (local residents and transient traffic (foot, road and rail))	Likely	Mild	Moderate/ Low
	PL7	Migration/ mobilisation of contaminated shallow groundwater through drift deposits or made ground	Water Environment (surface water) Ecological Receptors (GWDTE)	Likely	Mild	Moderate/ Low
	PL10	Interception and discharge of contaminated groundwater during active or passive dewatering	Water Environment (surface water)	Likely	Mild	Moderate/ Low
	Operation					
	PL13	Ingestion, inhalation and dermal contact with soil, soil dust, fibres (asbestos), deep and shallow groundwater, surface water in the long-term during routine maintenance e.g. drainage inspections	Human Health (maintenance workers)	Low Likelihood	Mild	Low
	PL15	Ingestion, inhalation and dermal contact with wind-blown dust from contaminated soils reused within road features such as embankments and landscaped areas	Human Health (local residents and transient traffic (foot, road and rail))	Low Likelihood	Mild	Low
	PL22	Discharge of intercepted contaminated groundwater	Water Environment (surface water)	Low Likelihood	Mild	Low
GGD-12 Buildings/ properties at Drumochter Lodge, including GGD-20 (septic tank)	**Construction**					
	PL1	Ingestion, inhalation and dermal contact with soil, soil dust and fibres (asbestos), deep and shallow groundwater and surface water	Human Health (construction workers)	Likely	Medium	Moderate
	PL3	Ingestion, inhalation and dermal contact with wind-blown dust created during excavation works	Human Health (local residents and transient traffic (foot, road and rail))	Likely	Medium	Moderate
	PL7	Migration/ mobilisation of contaminated shallow groundwater through drift deposits or made ground	Water Environment (surface water) Ecological Receptors (GWDTE)	Likely	Medium	Moderate
	PL10	Interception and discharge of contaminated groundwater during active or passive dewatering	Water Environment (surface water)	Likely	Medium	Moderate
	Operation					
	PL13	Ingestion, inhalation and dermal contact with soil, soil dust, fibres (asbestos), deep and shallow groundwater, surface water in the long-term during routine maintenance e.g. drainage inspections	Human Health (maintenance workers)	Low Likelihood	Medium	Moderate/ Low
	PL15	Ingestion, inhalation and dermal contact with wind-blown dust from contaminated soils reused within road features such as embankments and landscaped areas	Human Health (local residents and transient traffic (foot, road and rail))	Low Likelihood	Medium	Moderate/ Low
	PL22	Discharge of intercepted contaminated groundwater	Water Environment (surface water)	Low Likelihood	Medium	Moderate/ Low

Source Ref. and Name	Pollutant Linkage	Pathway	Receptors	Risk (Significance) Evaluation		
				Likelihood	Consequence	Significance
GGD-09 Radon affected sites	**Construction**					
	PL2	Migration of ground gases into shallow pits or site buildings	Human Health (construction workers)	Likely	Mild	Moderate/ Low
	PL4	Migration of ground gases into homes or workplaces through preferential pathways created during construction posing a potential asphyxiation/ explosion risk	Human Health (local residents and transient traffic (foot, road and rail)) Property (buildings)	Low Likelihood	Mild	Low
	Operation					
	PL14	Migration of ground gases into confined spaces e.g. service pits, accommodation buildings creating an asphyxiation/explosion risk	Human Health (maintenance workers)	Low Likelihood	Mild	Low
	PL16	Migration of ground gases into homes or workplaces through preferential pathways remaining following construction thus posing a potential asphyxiation/ explosion risk	Human Health (local residents and transient traffic (foot, road and rail)) Property (buildings)	Unlikely	Mild	Very Low
GGD-75 Ground Gas	**Construction**					
	PL2	Migration of ground gases into shallow pits or site buildings	Human Health (construction workers)	Likely	Medium	Moderate
	PL4	Migration of ground gases into homes or workplaces through preferential pathways created during construction posing a potential asphyxiation/ explosion risk	Human Health (local residents and transient traffic (foot, road and rail)) Property (buildings)	Unlikely	Severe	Moderate/ Low
	Operation					
	PL14	Migration of ground gases into confined spaces e.g. service pits, accommodation buildings creating an asphyxiation/explosion risk	Human Health (maintenance workers)	Low Likelihood	Medium	Moderate/ Low
	PL16	Migration of ground gases into homes or workplaces through preferential pathways remaining following construction thus posing a potential asphyxiation/ explosion risk	Human Health (local residents and transient traffic (foot, road and rail)) Property (buildings)	Unlikely	Severe	Moderate/ Low
Online Individual Occurrences of Made Ground/ Visual or Olfactory Indications of Contamination (i.e. odours, staining)						
Incidental occurrences of made ground or visual/ olfactory indications of contamination (GGD-21 to GGD-72 and GGD-74) that may be excavated, temporarily stored and/ or re-used as part of the Proposed Scheme construction	**Construction**					
	PL1	Ingestion, inhalation and dermal contact with soil, soil dust and fibres, deep and shallow groundwater and surface water	Human Health (construction workers)	Likely	Mild	Moderate/ Low
	PL3	Ingestion, inhalation and dermal contact with wind-blown dust created during excavation works	Human Health (local residents and transient traffic (foot, road and rail))	Likely	Mild	Moderate/ Low
	PL5	Leaching and migration of contaminants	Water Environment (superficial groundwater)	Likely	Medium	Moderate
	PL6	Migration of contaminants or contaminated shallow groundwater into the deeper rock aquifer	Water Environment (bedrock groundwater)	Likely	Medium	Moderate
	PL7	Migration/ mobilisation of contaminated shallow groundwater through drift deposits or made ground	Water Environment (surface water) Ecological Receptors (GWDTE) Property (PWS and services)	Likely	Medium	Moderate
	PL8	Runoff from contaminated source(s)		Likely	Medium	Moderate
	PL9	Migration of contaminated bedrock groundwater towards surface water receptor		Likely	Medium	Moderate
	PL11	Inhalation, ingestion and direct contact with contaminated soils, soil dust, fibres (asbestos) and water	Ecological receptors (agricultural land/ livestock)	Low Likelihood	Mild	Moderate/ Low
	PL12	Direct contact with made ground, superficial deposits, groundwater and bedrock materials	Property (buried concrete and services)	Likely	Minor	Low
	Operation					
	PL13	Ingestion, inhalation and dermal contact with soil, soil dust, fibres, deep and shallow groundwater, surface water in the long-term during routine maintenance e.g. drainage inspections	Human Health (maintenance workers)	Low Likelihood	Mild	Low
	PL15	Ingestion, inhalation and dermal contact with wind-blown dust from contaminated soils reused within road features such as embankments and landscaped areas	Human Health (local residents and transient traffic (foot, road and rail))	Low Likelihood	Mild	Low
	PL17	Leaching and migration of contaminants	Water Environment (superficial groundwater)	Low Likelihood	Medium	Moderate/ Low
	PL18	Migration of contaminated shallow groundwater into the deeper rock aquifer	Water Environment (bedrock groundwater)	Low Likelihood	Medium	Moderate/ Low
	PL19	Migration of shallow groundwater through drift deposits or made ground	Water Environment (surface water) Ecological Receptors (GWDTE) Property (PWS and services)	Low Likelihood	Medium	Moderate/ Low
	PL20	Runoff from contaminated source(s)		Low Likelihood	Medium	Moderate/ Low
	PL21	Migration of contaminated shallow groundwater through drainage channels and associated granular bedding materials or engineered structures		Low Likelihood	Medium	Moderate/ Low
	PL23	Inhalation, ingestion and direct contact with contaminated soils/ water	Ecological receptors (agricultural land/ livestock)	Unlikely	Mild	Very Low
	PL24	Direct contact with made ground, superficial deposits, groundwater and bedrock materials	Property (buried concrete and services)	Likely	Minor	Low

Source Ref. and Name	Pollutant Linkage	Pathway	Receptors	Risk (Significance) Evaluation		
				Likelihood	Consequence	Significance
Incidental occurrence of made ground with detected asbestos (GGD-73)	**Construction**					
	PL1	Ingestion, inhalation and dermal contact with soil, soil dust and fibres (asbestos), deep and shallow groundwater and surface water	Human Health (construction workers)	Likely	Medium	Moderate
	PL3	Ingestion, inhalation and dermal contact with wind-blown dust created during excavation works	Human Health (local residents and transient traffic (foot, road and rail))	Low Likelihood	Medium	Moderate/ Low
	Operation					
	PL13	Ingestion, inhalation and dermal contact with soil, soil dust, fibres (asbestos), deep and shallow groundwater, surface water in the long-term during routine maintenance e.g. drainage inspections	Human Health (maintenance workers)	Likely	Medium	Moderate
	PL15	Ingestion, inhalation and dermal contact with wind-blown dust from contaminated soils reused within road features such as embankments and landscaped areas	Human Health (local residents and transient traffic (foot, road and rail))	Low Likelihood	Medium	Moderate/ Low
Offline Potential Contamination Sources						
GGD-08 Former Dalnaspidal Station and tanks	**Construction**					
	PL1	Ingestion, inhalation and dermal contact with soil, soil dust and fibres (asbestos), deep and shallow groundwater and surface water	Human Health (construction workers)	Low Likelihood	Medium	Moderate/ Low
	PL7	Migration/ mobilisation of contaminated shallow groundwater through drift deposits or made ground	Water Environment (surface water) Ecological Receptors (GWDTE) Property (PWS and services)	Low Likelihood	Medium	Moderate/ Low
	PL10	Interception and discharge of contaminated groundwater during active or passive dewatering	Water Environment (surface water)	Low Likelihood	Medium	Moderate/ Low
	Operation					
	PL13	Ingestion, inhalation and dermal contact with soil, soil dust, fibres (asbestos), deep and shallow groundwater, surface water in the long-term during routine maintenance e.g. drainage inspections	Human Health (maintenance workers)	Unlikely	Medium	Low
	PL22	Discharge of intercepted contaminated groundwater	Water Environment (surface water)	Unlikely	Medium	Low
GGD-11 Buildings/ properties at Balsporran Cottage, including GGD-19 (septic tank)	**Construction**					
	PL1	Ingestion, inhalation and dermal contact with soil, soil dust and fibres (asbestos), deep and shallow groundwater and surface water	Human Health (construction workers)	Unlikely	Mild	Very Low
	PL7	Migration/ mobilisation of contaminated shallow groundwater through drift deposits or made ground	Water Environment (surface water) Ecological Receptors (GWDTE) Property (PWS and services)	Unlikely	Mild	Very Low
	PL10	Interception and discharge of contaminated groundwater during active or passive dewatering	Water Environment (surface water)	Unlikely	Mild	Very Low
	Operation					
	PL13	Ingestion, inhalation and dermal contact with soil, soil dust, fibres (asbestos), deep and shallow groundwater, surface water in the long-term during routine maintenance e.g. drainage inspections	Human Health (maintenance workers)	Unlikely	Mild	Very Low
	PL22	Discharge of intercepted contaminated groundwater	Water Environment (surface water)	Unlikely	Mild	Very Low
GGD-14 to GGD-19 Septic Tank discharges at Dalnaspidal	**Construction**					
	PL1	Ingestion, inhalation and dermal contact with soil, soil dust and fibres (asbestos), deep and shallow groundwater and surface water	Human Health (construction workers)	Unlikely	Mild	Very Low
	PL7	Migration/ mobilisation of contaminated shallow groundwater through drift deposits or made ground	Water Environment (surface water) Ecological Receptors (GWDTE) Property (PWS and services)	Unlikely	Medium	Low
	PL10	Interception and discharge of contaminated groundwater during active or passive dewatering	Water Environment (surface water)	Unlikely	Mild	Very Low
	Operation					
	PL13	Ingestion, inhalation and dermal contact with soil, soil dust, fibres (asbestos), deep and shallow groundwater, surface water in the long-term during routine maintenance e.g. drainage inspections	Human Health (maintenance workers)	Unlikely	Mild	Very Low
	PL22	Discharge of intercepted contaminated groundwater	Water Environment (surface water)	Unlikely	Mild	Very Low

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