

Appendix A13.3: Surface Water Indirect Dewatering Assessment

1.1 Introduction

- 1.1.1 This appendix provides an assessment of the expected dewatering impacts on surface water features within the study area, supporting Chapter 13 (Geology, Soils, Groundwater and Land Contamination). The assessment has been carried out in two stages.
- 1.1.2 The initial assessment considered potential impacts on all surface water features identified within the potential zone of influence of dewatering at proposed excavations (including cuttings, widenings, attenuation ponds and structures). This initial assessment exercise is deemed to be extremely conservative.
- 1.1.3 The second tier of assessment utilised ground investigation (GI) data and scheme design cross sections to enable the refinement of the initial assessment.

1.2 Initial Assessment – First Tier

- 1.2.1 The initial assessment is based on simple estimates of the zone of influence of dewatering, calculated using the Sichardt method (Preene et al. 2016), around each excavation considered likely to intercept groundwater, consistent with the approach defined in Chapter 13, Section 13.5 (Potential Impacts and Effects). Any surface water feature within the zone of influence for a cutting expected to intercept groundwater was then included within the first tier. The magnitude of impact for each surface water feature has been derived based on the expected groundwater drawdown at the location of the surface water feature. It was assumed that a degree of hydraulic connectivity exists between groundwater and the surface water receptor. The significance of effect derived was based on the methodology described in Chapter 13, Section 13.3 (Approach and Methods).
- 1.2.2 The outcome of the initial assessment is presented below in Table A13.3-1 with the receptors encountering significant effects (considered to be moderate or greater) coloured red. In Table A13.3-1 the Cutting ID prefix identifies the purpose of the proposed cutting as follows:
- C – Mainline road cutting
 - CS – Side road cutting
 - W – Widening of existing road cutting
 - Pond – Drainage attenuation pond
 - Swale – Drainage swale
 - FPL – Flood plain development
 - CWF - Culvert
 - CSTR – Structures (e.g. bridge, retaining wall)
 - CPED – Pre-earthworks drainage

Table A13.3-1: Initial Screening of Indirect Dewatering Impacts and Effects on Surface Water Features

Cutting ID	Water Feature ID	Value/ Receptor	Magnitude of Impact	Significance of Effect
W2B	WF001	Low	Negligible	Neutral
CS4B	WF005	Low	Minor	Neutral
	WF005A	Low	Minor	Neutral
	WF006	Very High	Minor	Moderate/Large
CS7B	WF005A	Low	Minor	Neutral
	WF006	Very High	Negligible	Neutral
CS9A	WF005A	Low	Negligible	Neutral
	WF006	Very High	Negligible	Neutral
	WF007	Low	Negligible	Neutral
CS25	WF006	Very High	Negligible	Neutral
	WF009	Low	Negligible	Neutral
	WF011	Low	Negligible	Neutral
	WF011A	Low	Negligible	Neutral
FPL1	WF006	Very High	Negligible	Neutral
	WF009	Low	Negligible	Neutral
	WF011	Low	Negligible	Neutral
	WF011A	Low	Negligible	Neutral
	WF012	Low	Negligible	Neutral
Pond G	WF006	Very High	Negligible	Neutral
Swale G	WF006	Very High	Negligible	Neutral
C13	WF006	Very High	Major	Very Large
	WF012A	Low	Major	Slight/Moderate
	WF012B	Low	Major	Slight/Moderate
	WF013	Low	Moderate	Slight
W11	WF006	Very High	Negligible	Neutral
	WF012B	Low	Negligible	Neutral
	WF013	Low	Negligible	Neutral
Pond I	WF006	Very High	Minor	Moderate/Large
	WF012A	Low	Negligible	Neutral
	WF012B	Low	Negligible	Neutral
	WF013	Low	Negligible	Neutral
	WF014	Low	Negligible	Neutral

Cutting ID	Water Feature ID	Value/ Receptor	Magnitude of Impact	Significance of Effect
	WF016	Low	Minor	Neutral
	WF018	Low	Negligible	Neutral
	WF019	Low	Negligible	Neutral
	WF020	Low	Negligible	Neutral
	WF021	Low	Negligible	Neutral
	WF022	Low	Negligible	Neutral
	WF023	Low	Negligible	Neutral
	WF024	Low	Negligible	Neutral
	WF025	Low	Negligible	Neutral
	WF031	Low	Negligible	Neutral
CWF05A	WF005	Low	Negligible	Neutral
	WF005A	Low	Negligible	Neutral
	WF006	Very High	Negligible	Neutral
	WF007	Low	Negligible	Neutral
CWF07	WF004	Low	Negligible	Neutral
	WF005	Low	Negligible	Neutral
	WF005A	Low	Negligible	Neutral
	WF006	Very High	Negligible	Neutral
	WF007	Low	Negligible	Neutral
	WF186	Low	Negligible	Neutral
	WF008	Low	Negligible	Neutral
	WF187	Low	Negligible	Neutral
CWF09B	WF187	Low	Negligible	Neutral
	WF009	Low	Minor	Neutral
	WF011	Low	Negligible	Neutral
CWF09 - FRC	WF009	Low	Negligible	Neutral
	WF011	Low	Minor	Neutral
CWF13	WF006	Very High	Negligible	Neutral
	WF013	Low	Negligible	Neutral
	WF014	Low	Negligible	Neutral
CWF16	WF006	Very High	Negligible	Neutral
	WF016	Low	Negligible	Neutral
CWF18	WF006	Very High	Negligible	Neutral

Cutting ID	Water Feature ID	Value/ Receptor	Magnitude of Impact	Significance of Effect
	WF014	Low	Negligible	Neutral
	WF016	Low	Negligible	Neutral
	WF018	Low	Negligible	Neutral
	WF019	Low	Negligible	Neutral
	WF020	Low	Negligible	Neutral
	WF021	Low	Negligible	Neutral
	WF022	Low	Negligible	Neutral
	WF023	Low	Negligible	Neutral
CSTR2	WF004	Low	Negligible	Neutral
	WF005	Low	Negligible	Neutral
	WF005A	Low	Negligible	Neutral
	WF006	Very High	Negligible	Neutral
	WF007	Low	Negligible	Neutral
	WF186	Low	Negligible	Neutral
CSTR10	WF006	Very High	Negligible	Neutral
	WF187	Low	Negligible	Neutral
	WF009	Low	Negligible	Neutral
	WF011	Low	Negligible	Neutral
	WF011A	Low	Negligible	Neutral
CSTR11	WF006	Very High	Negligible	Neutral
	WF009	Low	Negligible	Neutral
	WF011	Low	Negligible	Neutral
CSTR18	WF013	Low	Negligible	Neutral
CSTR20	WF006	Very High	Minor	Moderate/Large
	WF014	Low	Minor	Neutral
	WF016	Low	Negligible	Neutral
CPED13	WF009	Low	Negligible	Neutral
CPED14	WF013	Low	Negligible	Neutral
CPED17	WF16	Low	Negligible	Neutral

* Culverted watercourses are expected to have some degree of isolation from groundwater and therefore distance measurements used to inform the "Magnitude of Impact" are taken from the open channel section as indicated from OS mapping.

1.3 Detailed Assessment – Second Tier

- 1.3.1 The initial assessment identified potential effects of Moderate or greater significance on one surface water feature (WF006, The River Tay) as a result of potential dewatering associated with four cuttings (CS4B, C13, Pond I and CSTR20).

The detailed assessments for each of these cuttings are described below and are based on consideration of all available relevant information, including available GI, groundwater level monitoring data and the local topography. The significance of effect was then predicted based on the methodology described in Chapter 13, Section 13.3 (Approach and Methods).

CS4B

- 1.3.2 The proposed cutting is an access track which will run adjacent to the A9 carriageway between ch1760 and ch1960. The cutting has a maximum depth of 5.36 m (56 mAOD) and would be constructed in fine to coarse sand and fine to coarse gravel deposits. The River Tay (WF006) is located 20 m east of the cutting at an elevation of circa 49 mAOD. The first tier assessment was based upon the maximum cutting depth and the minimum depth to groundwater which indicated a drawdown of 4.30m at CS4B.
- 1.3.3 Given that the River Tay is present at an elevation significantly below the base of the cutting groundwater drawdown effects on the river associated with this cutting would be reduced and, along with the large size of the WF006 (River Tay) water body, the magnitude of impact is expected to be negligible, resulting in an effect significance of Slight.

C13

- 1.3.4 Cutting C13 is a widening cut into the hillside above the Highland Main Line railway and River Tay, between mainline ch6130 and ch6500. The cutting has a maximum depth of approximately 17.62 mbgl (70.59 mAOD) and is likely to be constructed primarily in low permeability metamorphic bedrock. The preliminary assessment of the dewatering for this cutting indicates that it may have a large/very large impact on WF006 (River Tay), located 200m north-east at an elevation of circa 46 mAOD.
- 1.3.5 A review of the GI information shows that the base of the excavation is located at 70.59 mAOD while nearby monitoring information indicates groundwater to be at an elevation of 94.22 mAOD and therefore this cutting is likely to cause groundwater drawdown. However, it is not considered that the induced drawdown will have a significant effect upon the River Tay for the following reasons:
- The vertical offset between the base of the cutting and the elevation of the river;
 - The distance between the cutting and the River Tay; and
 - The anticipated low permeability of the bedrock deposits.
- 1.3.6 Any drawdown effects are expected to be relatively limited in scale and unlikely to propagate to the River Tay. Considering the large size of the River Tay water body, the potential magnitude of the impact is considered to be negligible on WF006 (River Tay), resulting in an effect significance of Slight.

Pond I

- 1.3.7 The attenuation pond is located immediately to the west of the mainline between ch7790 and ch7990. The cutting has a maximum depth of 12.28 mBGL (53.75 mAOD) and would be constructed in fine to coarse Gravel deposits which are assumed to be underlain by low permeability metamorphic bedrock. The River Tay (WF006) is located 20 m west of the cutting at an elevation of circa 47 mAOD.
- 1.3.8 The attenuation pond would be excavated into a small hump of elevated ground between the existing A9 and the River Tay. This accounts for the maximum excavation depth of 12.28 mBGL used in the screening assessment. The base of excavation is located at 53.75 mAOD which is significantly above the elevation of the maximum groundwater level recorded in the vicinity of Pond I (48.95 mAOD) and therefore the potential groundwater drawdown used for the screening assessment was overly conservative.
- 1.3.9 Considering this, it is unlikely that any groundwater drawdown effects associated with this attenuation pond would impact the River Tay (WF006) so the magnitude of impact is expected to be negligible, resulting in an effect significance of Slight.

CSTR20

- 1.3.10 The Tay Bridge is located between mainline ch7430 and ch7720, the cutting occurs where the foundations of the bridge meet the valley sides above the River Tay. The cutting has a maximum depth of 7.50 mBGL (52.80 mAOD) and would be constructed into fine to medium Sand deposits. The River Tay is located beneath the structure at an elevation of circa 45 m AOD.
- 1.3.11 The base of the cutting is located 7m higher in elevation than the River Tay. The proposed construction would be modifying the existing bridge and would represent only a relatively small change from the current situation.
- 1.3.12 Construction of the Tay Bridge Foundations will require temporary dewatering that will have a moderate effect on local watercourses, and subsequently a lower degree of effect during operation. The potential impact will be localised and considering the size of the River Tay water body any potential impact is not expected to be significant.

1.4 Detailed Assessment Summary

- 1.4.1 The detailed assessment of potential dewatering impacts and effects on surface water features has established that no significant effects on surface water features from indirect dewatering are predicted. A summary of the predicted impacts and effects following the second tier of assessment is provided in Table A13.3-2.

Table A13.3-2: Summary of Detailed Assessment of Indirect Dewatering Impacts on Surface Water Features.

Cutting ID	Surface Water Feature ID	Importance of Receptor	First Tier Assessment		Second Tier Assessment	
			Magnitude of Impact	Significance of Effect	Magnitude of Impact	Significance of Effect
CS4B	WF06 (River Tay)	Very High	Minor	Moderate/Large	Negligible	Slight
C13	WF06 (River Tay)	Very High	Major	Very Large	Negligible	Slight
Pond I	WF06 (River Tay)	Very High	Minor	Moderate/Large	Negligible	Slight
CSTR20	WF06 (River Tay)	Very High	Minor	Moderate/Large	Negligible	Slight

1.5 References

Documents and Reports

Preene, M., Roberts, T.O.L., Powrie, W., (2016), Groundwater Control: Design and Practice, second edition, CIRIA, C750. British Library Cataloguing in Publication Data. ISBN: 978-0-86017-755-5. Available at <https://www.ciria.org/ItemDetail?iProductCode=C750&Category=BOOK&WebsiteKey=3f18c87a-d62b-4eca-8ef4-9b09309c1c91> (Accessed February 2025).