

13 December 2019

FLOOD RISK ASSESSMENT

Site Address: North of Fairlie Bowling Club, Main Road, Fairlie, Largs, Ayrshire

Proposal: Formation of a garden centre and restaurant with associated landscaping and road works

Prepared for: RDK Construction Ltd

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Contents Amendment Record

This report has been issued and amended as follows:

Revision	Description	Date	Signed
1.0	Final	13 December 2019	

Executive Summary

This Flood Risk Assessment has been prepared in support of a forthcoming planning application for the formation of a garden centre and restaurant with associated landscaping and road works.

SEPA was consulted on a previous planning proposal at the site. This was for the erection of 20 (revised to 19) affordable housing units (16/01176/PP) and in their response dated 20 December 2016 they requested a Flood Risk Assessment or other information to demonstrate that the development accords with the principles of Scottish Planning Policy⁽¹⁾ with respect to a minor unnamed watercourse at the previous site's northern boundary. For the revised proposal this watercourse will lie between a proposed plant sales area and a tree nursery and planting area.

The predominant flow entering the watercourse at the site comes from a culvert. This travels beneath the A78 trunk road and on site discharges into a deep and wide channel which carries the flow towards the sea. This FRA has determined that flows within the subject watercourse are significantly constrained by the culvert as the cross-sectional area of the channel is at least 25x that of the culvert intake.

The culvert's intake lies c. 19 m from its outfall and should the intake become surcharged during a 1:200 year event the overland flow route for floodwater will be north into the grounds of the Kelburn Castle Country Centre. This is because of the lower lying bank and land on the north side of the intake. In a flood event water will overtop the bank and travel north towards the unnamed burn which lies north of the entrance to the Country Centre.

Should surcharge occur during a 1:200 year event it is likely to cause flooding of the A78 north of the site. However, this flood water will not reach the site due to its higher elevation thereby permitting access to the A78 heading south.

Although SEPA's response focuses on the watercourse towards the north end of the site we have also considered surface water flooding. Given that the site lies on top of a raised beach of sand, gravel, pebbles and cobbles we are confident that an appropriate soakaway system can be designed to address the risk of surface water flooding.

For a coastal flood event the railway line embankment lies approximately 2 m above the western extent of the site and the embankment supporting the access road to the boatyard is at higher elevation. These embankments provide protection against the 1:200 year coastal flood extent and also protect the site from wind driven waves from the direction of longest fetch/highest wind speeds i.e. the southwest.

The findings of this assessment are that the site is not predicted to lie within the functional floodplain of the minor unnamed watercourse nor is it at risk of surface water or coastal flooding. Although, surcharge of the culvert during a 1:200 year flow event is likely to cause flooding of the A78 north of the site safe access and egress is available to the south.

The conclusion of this FRA is that the land proposed for development does not form part of a functional floodplain. It is therefore considered to be compliant with the recommendations of SPP⁽¹⁾, PPI 8⁽²⁾ and TFRGS⁽³⁾.

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List of Abbreviations

AOD	Above Ordnance Datum
ATK	Anderson Turnbull Kiloh
CFB	Coastal Flood Boundary
CIRIA	Construction Industry Research and Information Association
DSLR	Digital Single Lens Reflex Camera
FEH	Flood Estimation Handbook
FFL	Finished Floor Level
FRA	Flood Risk Assessment
GPS	Global Positioning System
ID	Inside Diameter
NAC	North Ayrshire Council
OS	Ordnance Survey
PPI 8	North Ayrshire Council Local Development Plan POLICY PI 8 – Drainage, SuDS and Flooding
SEPA	Scottish Environment Protection Agency
SPP	Scottish Planning Policy 2014: Managing Flood Risk and Drainage
SuDS	Sustainable Drainage System
TFRGS	Technical Flood Risk Guidance for Stakeholders
VCP	Vitrified Clay Pipe

Section 1.0 Introduction

Identification of need

- 1.1 The potential for fluvial flooding of the land proposed for development comes from a minor unnamed watercourse which is culverted beneath the A78 trunk road and flows east to west in an open channel across the land proposed for development. The channel lies between the proposed plant sales area and the tree nursery and planting area.
- 1.2 It is understood that no culverting of the channel is proposed i.e. it will remain open post development.
- 1.3 For a previous planning application at this location, for nineteen affordable housing units with associated landscaping and road works (16/01176/PP), SEPA were consulted on the planning proposal by NAC. In their response dated 20 December 2016 (PCS/150501) SEPA requested a Flood Risk Assessment or other information to demonstrate that the development accords with the principles of Scottish Planning Policy⁽¹⁾.
- 1.4 Although SEPA's 2016 response focused on the watercourse towards the north end of the proposed plant sales area we have also provided comments on surface water and coastal flood risk.
- 1.5 The purpose of this FRA is to demonstrate that the land can be developed as per the new proposal with an acceptable risk of flooding and that the development will not increase the risk of flooding elsewhere.
- 1.6 The assessment has been carried out in accordance with the recommendations of SPP⁽¹⁾, PPI 8⁽²⁾ and TFRGS⁽³⁾.

Site Details

- 1.7 The land proposed for development currently comprises of grassland (plates 1 to 3) and the proposal is to construct a garden centre and restaurant with associated landscaping and road works. There is currently no direct vehicular or pedestrian access to the site. A new shared access is proposed for the development and Fairlie Bowling Club.
- 1.8 The site is located at the north end of Fairlie and is relatively level, lying at a height of 3.7 to 4.0 m AOD⁽⁴⁾. It is bounded by the car park serving Fairlie Bowling Club to the south and fields to the north, the Largs to Glasgow rail line to the west and a cycle path adjacent to the A78 trunk road to the east.
- 1.9 Historically the site has occasionally been used as rough grazing for livestock.

Information used to compile this report

- 1.10 This report is based on information from the following:
 - (i) Site visit.
 - (ii) Garmin GPSmap 62stc - locations were photographed using the GPS to obtain coordinates (displayed accuracy ± 3 m). The photographs in this report were taken from the same locations using a Nikon DSLR.
 - (iii) The extreme "still water" level at the site based on the Coastal Flood Boundary Method⁽⁵⁾.
 - (iv) SEPA's climate change allowances for flood risk assessment in land use planning⁽⁶⁾.
 - (v) FEH Web Service (<https://fehweb.ceh.ac.uk/>).
 - (vi) ArcGIS Mapping.
 - (vii) SEPA indicative flood map.
 - (viii) Topographical survey of site and watercourse⁽⁴⁾.

Section 2.0 Indicative and Historical Flooding

- 2.1 The proposed development is considered to fall within SEPA's "Least Vulnerable Uses"⁽⁷⁾ and as such needs to be assessed at upper end of the probability range (i.e. close to 0.5% (1:200 year)).
- 2.2 SEPA's indicative flood map shows an **estimate** of the areas of Scotland with a medium likelihood (0.5% probability) of being flooded in any given year. Copyright does not permit the map to be reproduced here but the map (last updated 23/04/19) is available at:
<https://www.sepa.org.uk/environment/water/flooding/flood-maps/>
- 2.3 SEPA's 2016 response for the previous planning application focused on the watercourse towards the north end of the site. The flood map does not indicate any fluvial flooding from this source because the map does not take account of catchment areas that are <300 ha. The map does however, indicate fluvial flooding for the medium likelihood event which appears to be overland flow from the Kel Burn some 340 m north of the site. The landform north of the site slopes downhill in a northerly direction (plate 4). Thus, it is the author of this report's view that the indicated out of bank flow towards the site from the Kel Burn is the result of inaccuracies in the underlying digital terrain data used to make the predictions.
- 2.4 The map also indicates a medium likelihood of surface water flooding at the NW and SE extents of the land proposed for development. The flooding shown doesn't appear to mirror actual ground levels at the site. For example, ground levels at the NW extent of the site are similar to those at the SW extent (plates 2 and 3) and no significant depressions in the landform were observed during the site visit nor appear in the topographical survey data. The same applies to the flooding shown at the SE extent. This is located on the left-hand side of plate 3. This too indicates inaccuracy in the digital terrain data used for the flood map at this location.
- 2.5 The flood map does not indicate a risk of coastal flooding for a 1:200 year event. However, the map does not include SEPA's recently released allowances for climate change⁽⁶⁾. Ground levels at the site's seaward extent are >4 m AOD. However, these may lie below the CFB 1:200 year still water level + climate change uplift i.e. 3.65 m AOD⁽⁵⁾+ 0.85 m⁽⁶⁾. However, the railway line embankment lies approximately 2 m above the site from north to south and the embankment supporting the access road to the boatyard is at higher elevation. These embankments therefore lie at significant height above the 1:200 year coastal flood extent and also protect the site from wind driven waves from the direction of longest fetch/highest wind speeds i.e. the southwest.
- 2.6 In 2017 (for the previous planning application at the site i.e. 16/01176/PP) the North Ayrshire Council's Flood Risk Management Officer requested video evidence of the size and integrity of the culvert beneath the railway line. The video and an addendum to the FRA were provided to address items 1 and 2 of NAC's revised flooding response dated 14 March 2017. It is understood that this submission met the Council's requirements especially given that the culvert is of sound integrity, discharges onto the shore at c. 7 m from the Mean High Water Springs contour and its 0.5 m ID diameter is similar to that of the culvert beneath the A78. Its presence is therefore not considered to increase the likelihood of flooding at the site.
- 2.7 Details of historical flooding of all types have been sought from relevant sources. As far as can be determined there is no information on the extent and depth of any flood events affecting the site.
- 2.8 The British Hydrological Society's "Chronology of British Hydrological Events"⁽⁸⁾ was checked to provide any evidence of flood events. No entries exist at or near to the location of the proposed development.

Section 3.0 Hydrological Assessment

Description of watercourse

- 3.1 The subject watercourse is a minor unnamed burn. Its catchment area upstream of the site is small and therefore it is not available on the FEH Web Service. However, from OS contour mapping we have estimated this to be circa 20.2 ha.
- 3.2 Flow from the catchment enters a 0.55 m ID circular pipe (plate 9) which travels beneath the A78/cycle track and discharges into the open channel (plate 13) towards the north end of the proposed development site (plates 14 to 17). Somewhere beneath the A78/cycle track the 0.55 m ID pipe connects into a 0.55 m H x 0.7 m W ID elliptical vitrified clay pipe which forms the outfall (plate 12).
- 3.3 The field to the north provides little additional catchment to the flow from the culvert as it slopes away from the watercourse. The field to the south of the watercourse i.e. the area proposed for built development will provide some additional flow but given its size (c. 0.51 ha) this is not deemed to be significant for a 1:200 year event.

Constraint to fluvial flow at or towards the site

- 3.4 The constraint to fluvial flow at the site is the culvert intake (plates 8 and 9). This has an ID of 0.55 m which provides a cross-sectional area of 0.2 m². This is significantly smaller than the minimum cross-sectional area of the open channel which from the site visit and the topographical survey⁽⁴⁾ was estimated to be in excess of 5.0 m². Even when taking into consideration the higher roughness of the open channel and the slightly lower slope it provides significant capacity to convey the maximum discharge from the culvert.
- 3.5 Should the culvert intake be surcharged during a 1:200 year event the flood water will flow north down a steep incline into the field shown in plate 11. The location where flood water would overtop the north bank which is at lower elevation than the south is shown in plate 10.
- 3.6 The field shown in plate 11 is already subject to waterlogging due to poor drainage which results in water flowing through a break in the wall adjacent to the A78 (plates 6 and 7) and pooling on the trunk road (plates 5 and 6). Note that the slope of the road is north i.e. away from the site.
- 3.7 It is not known whether the wall has been repaired since our site visit but assuming it has/will be then for a 1:200 year flood event water will flow behind it in northerly direction towards the unnamed burn which lies north of the entrance to the Kelburn Castle Country Centre. This flood water will not reach the site due to the lower lying land in this location (best viewed in plates 4 and 6).

Section 4.0 Discussion

- 4.1 In the site investigation report⁽⁹⁾, which was prepared by ATK Partnership for the previous planning application, they advise that some form of flood protection on the development side of the channel is introduced. In their report it is suggested that this could take the form of gabion baskets built along the banking of the watercourse.
- 4.2 Although this suggestion provides some additional mitigation for flood risk it is considered very unlikely that there will be a risk of the watercourse's banks collapsing. Indeed, the channel already has significant capacity for flood flows and as such flood flows will not be deep. This, as stated in Section 3.0, is due to the culvert intake upstream impeding flow into the channel.
- 4.3 A blockage of the culvert beneath the railway line is deemed unlikely. However, in the unlikely event that it does occur, the topographical survey⁽⁴⁾ shows that upstream of the intake the north bank is at a lower level (i.e. the 4 m AOD contour does not extend all of the way to the culvert intake as it does on the south bank) and flood water will therefore overtop this bank and flow north i.e. away from the proposed built development.
- 4.4 The ATK Partnership report⁽⁹⁾ mentions that the Bowling Club floor level was set at 4.43 m AOD and that it would seem reasonable that a similar finished floor level be adopted for the housing, helping to mitigate any possible flooding. Although this would seem sensible we do not consider the FFL to be important in terms of flood risk as the site is not predicted to flood. Indeed if the site were to flood to this level it would form an "island of development" and not be compliant with SPP⁽¹⁾.
- 4.5 Although it is not deemed to form a functional floodplain for a 1:200 year event the field to the north of the watercourse is generally lower lying than where built development is proposed.
- 4.6 Underlying the topsoil at the site is a raised beach comprising of sand, gravel, pebbles and cobbles⁽⁹⁾. The porous nature of the raised beach provides optimum conditions for the design of a soakaway. Design in accordance with CIRIA principles and their SuDS Manual⁽¹⁰⁾ is deemed to be appropriate mitigation for surface water flooding at the site.
- 4.7 Safe access to and egress from the development during extreme flood events, including access by emergency vehicles, needs to be considered. For a 1:200 year fluvial event surcharge of the culvert is likely to cause flooding of the A78 north of the site. However, this flood water will not reach the site due to its higher elevation thereby permitting access to the A78 heading south.

Section 5.0 Conclusions

- 5.1 Scottish Planning Policy⁽¹⁾ states in paragraph 255 that “the planning system should promote flood avoidance by safeguarding flood storage and conveying capacity, and locating development away from functional floodplains and medium to high risk areas.” It further defines (glossary) that “For planning purposes, the functional floodplain will generally have a greater than 0.5% (1:200 year) probability of flooding in any year”. Built development should not therefore take place on the functional floodplain.
- 5.2 The findings of this assessment are that the site is not predicted to lie within the functional floodplain of the unnamed watercourse nor is it at risk of surface water or coastal flooding. Although surcharge of the culvert during a 1:200 year flow event is likely to cause flooding of the A78 north of the site, access to the A78 will continue to be available heading south.
- 5.3 The conclusion of this FRA is that the land proposed for development does not form part of a functional floodplain. The development may therefore proceed without risk of flooding and will not increase the probability of flooding elsewhere. It is therefore considered to be compliant with the recommendations of SPP⁽¹⁾, PPI 8⁽²⁾ and TFRGS⁽³⁾.

Files Accompanying this FRA

The following file accompanies this report:

1. FAIR-1219-1A.pdf

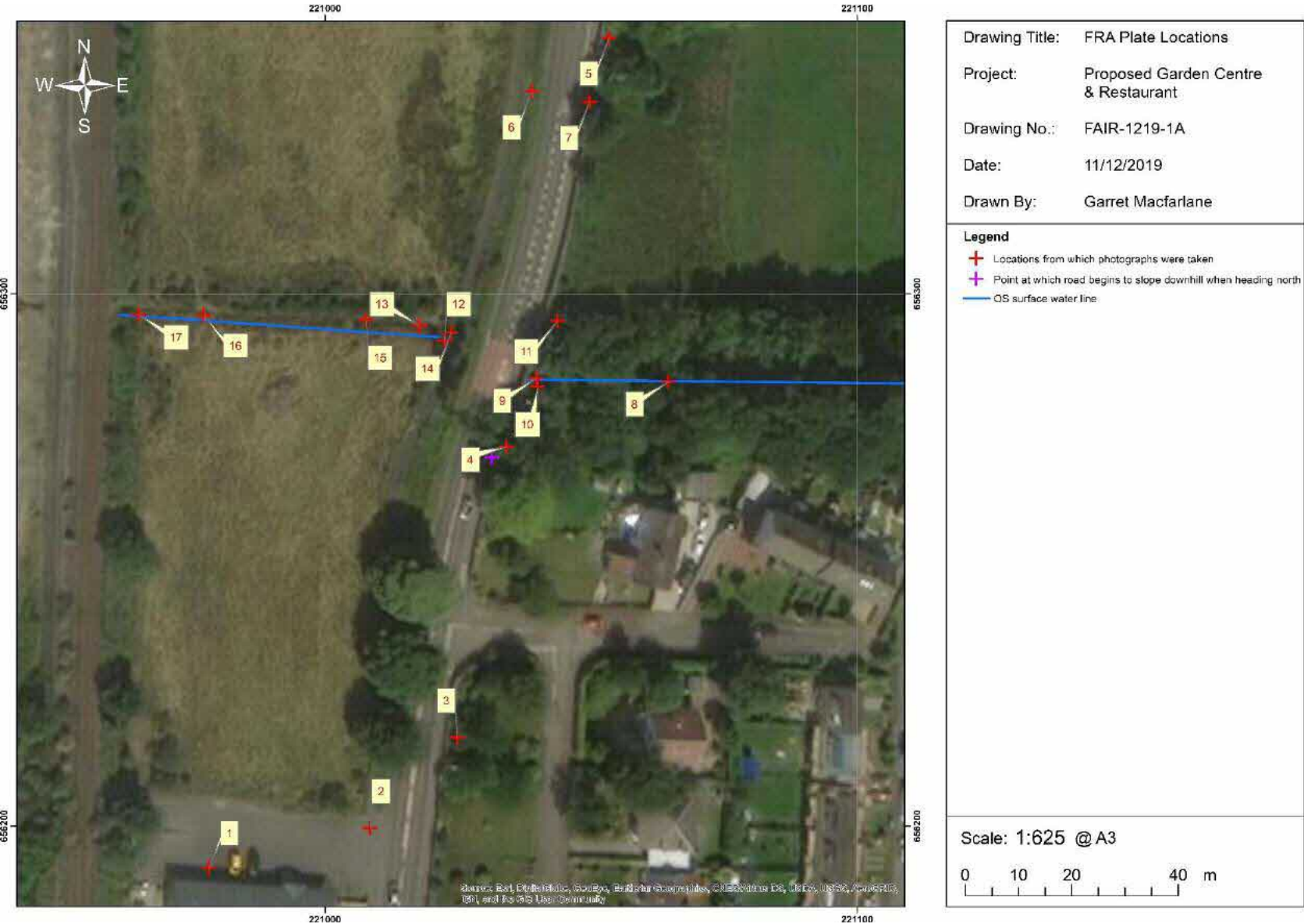
- 2.

Drawing showing locations from which photographs were taken

References

- (1) Scottish Planning Policy: Managing Flood Risk and Drainage. The Scottish Government. June 2014. [Website Link](#).
- (2) North Ayrshire Council Local Development Plan POLICY PI 8 – Drainage, SuDS and Flooding. Adopted 20 May 2014. [Website Link](#).
- (3) Technical Flood Risk Guidance for Stakeholders. Version 12. Scottish Environment Protection Agency. May 2019. [Website link](#).
- (4) 16_01176_PP-EXISTING_SITE_PLAN_AND_TOPOGRAPHICAL_SURVEY-711659.pdf Available on NAC Planning Portal (titled “Existing site plan and topographical survey”). This is the topographical survey for the previous development proposal. [Website Link](#).
- (5) Coastal Design Sea Levels - Coastal Flood Boundary Extreme Sea Levels 2018 (August 2019 update). [Website link](#).
- (6) Climate change allowances for flood risk assessment in land use planning. LUPS-CC1. Scottish Environment Protection Agency. 26 April 2019. [Website link](#). Accompanying map available [here](#).
- (7) Flood risk and Land Use Vulnerability Guidance. LUPS-GU24. Scottish Environment Protection Agency. 10 July 2018. [Website link](#).
- (8) Chronology of British Hydrological Events. Online database. The British Hydrological Society. 2007. [Website Link](#).
- (9) Site Inspection Report. Proposed Affordable Housing, Irvine Road, Fairlie. ATK Partnership. Civil & structural Engineering Consultants. 23 November 2016. Available on NAC Planning Portal (titled “Site investigation report”). This is the topographical survey for the previous development proposal. [Website Link](#).
- (10) The SuDS Manual C753. CIRIA. 11 November 2015. [Website Link](#).

Appendix A: Figures



NB: Do not scale from this drawing as it has been resized to fit this document (a pdf of the drawing accompanies this report)

Figure 1: Locations from which photographs were taken.

Appendix B: Photographs



Plate 1: Looking north towards proposed development site. Bowling Club car park in foreground. Photograph taken from NS 20978 56192.



Plate 2: Looking north towards proposed development site from where cycle track meets Bowling Club car park. Photograph taken from NS 21008 56200.



Plate 3: Looking north with proposed development site on left of frame (the gorse in the distance runs along the banks of the subject watercourse). Photograph taken from NS 21025 56217.



Plate 4: Looking north with subject watercourse on left of frame (the gorse behind the tree lies either side of the watercourse channel). Photograph taken from NS 21034 56271. NB: Beyond the site boundary/watercourse the landform slopes north.



Plate 5: Looking southwest towards subject watercourse. This plate shows pooling of water on the A78 near the foot of the hill (i.e. beyond the site). Photograph taken from NS 21053 56348.



Plate 6: Looking east towards the source of the water pooling on the A78. The break in the wall was caused by a car crash. The field behind the wall is poorly drained and run-off flows onto the road. Photograph taken from NS 21039 56338.



**Plate 7: Source of A78 flooding.
Photograph taken from NS 21050 56336.**



**Plate 8: Subject watercourse upstream of A78 culvert intake.
Photograph taken from NS 21065 56283.**



Plate 9: A78 culvert intake (0.55 m ID pipe with corrugated inner walls and trash screen with circa 100 mm spaced bars). Top of wall is c. 2.2 m above screen. Photograph taken from NS 21040 56284.



Plate 10: Watercourse at A78 culvert intake. Flow route during surcharge will be north into adjacent field (next plate). Photograph taken from NS 21040 56283.



Plate 11: Adjacent field.
Photograph taken from NS 21044 56295.



Plate 12: Culvert outfall (ID: 0.55 m H x 0.7 m W elliptical VCP pipe).
Photograph taken from NS 21022 56291.



**Plate 13: Channel of subject watercourse at culvert outfall.
Photograph taken from NS 21018 56294 looking upstream.**



**Plate 14: Channel of subject watercourse downstream of culvert outfall.
Photograph taken from NS 21024 56293 looking downstream.**



Plate 15: Channel of subject watercourse.
Photograph taken from NS 21008 56295 looking upstream. Staff in same location as plate above.



Plate 16: Channel of subject watercourse.
Photograph taken from NS 20977 56296 looking upstream.



**Plate 17: Channel of subject watercourse in front of railway line culvert.
Photograph taken from NS 20965 56296 looking downstream.**