Appendix 11.4

Hydromorphology Assessment Part 3

Annex 11.4.3 - Hydromorphological Catchment Assessment - 12

Catchment No.	**12**
Catchment Name	-

Channel Nature	Nature of water course	Natural
	Size of water course	Minor

Quantitative Spatial Elements	Catchment Area (km^2)	0.04
	Average slope in catchment (°)	10
	% Catchment over 750m (for snow melt risk)	0

WFD classification	Water, flows and levels	Good
	Physical condition	High
	Overall ecological status	Poor

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 12)	Gaick Psammite formation-Psammite	Resistant to weathering, impermeable
	Is an alluvial fan present at or near the crossing?	No	

Environmental designations (see Drawing 11.4.3.1 c, Catchment 12)	Ramsar	No	
	SAC	Drumochter Hills	Acidic scree, alpine and subalpine heaths, blanket bog, dry heaths, monntane acid grasslands , mountain willow scrub, plants in crevices on acid rocks, species-rich grassland with mat-grass in upland areas, tall herb communities, wet heathland with cross-leaved
	SPA	Drumochter Hills	Dotterel breeding, merlin breeding
	SSSI	Drumochter Hills	Breeding bird assemblage, fluvial geomorphology of Scotland, montane assemblage, vascular plant assemblage

Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 12	
	Is peat present in the catchment?	No	
	Is there a bog burst risk?	No	
	Current valley side or terrace erosion	No	
	Potential valley side or terrace erosion	No	
	Hill slope failures (including peat slides and debris flows and slides)	No	
	Hill slope failures coupled to channel	No	
	Vertical incision present in catchment	No	
	Bank erosion/lateral migration	No	
	Unvegetated bars	No	
	Wooded/forested areas in catchment	No	Felling has occurred - may have change drainage and sediment supply patterns
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 12)	Track and bridge in upper catchment	
	Comment on sediment source potential in catchment	Little sediment supply to channel	
	Comment on sediment supply potential to crossing	Limited channels to supply sediment to crossing	

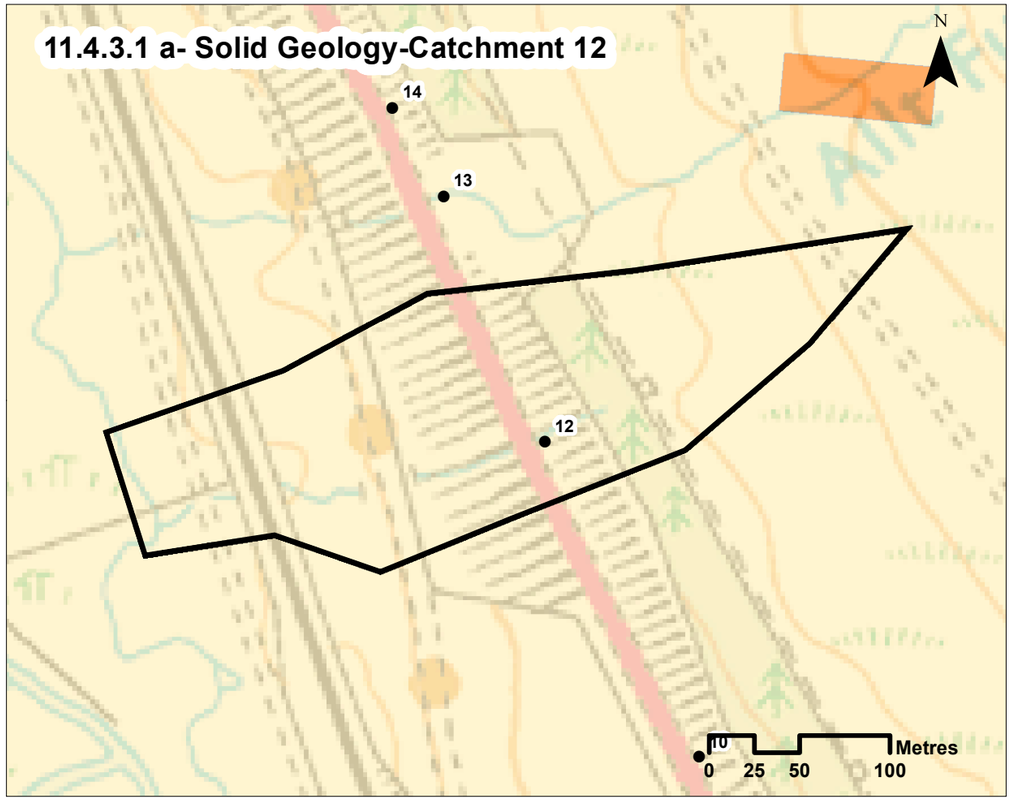
Morphology and Process- Reach upstream of crossing	Channel morphology	Plane bed	
	Predominant sediment size	Boulder to Gravel	
	Unvegetated bars	None	
	Vertical incision	Low	
	Deposition	Low	
	Lateral migration/bank erosion	High	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 12)	None	
	Impact of infrastructure	None	
	Channel realignment	Unclear from mapping but channel appears to have been straightened, creating a steeper gradient and also takes drainage (increased discharge)	

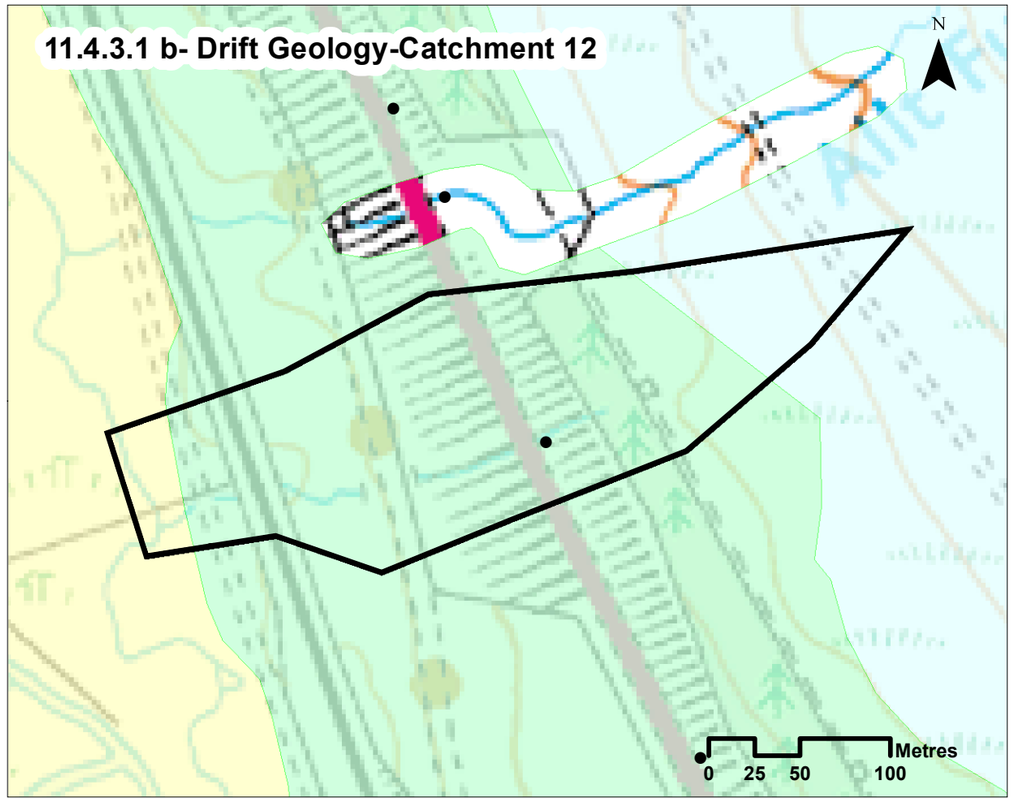
Morphology and Process- At crossing	Channel morphology	Engineered	
	Predominant sediment size	Boulder to Gravel	
	Estimated discharge at 1:200 event (m^3/s)	0.23	
	Unvegetated bars	No	
	Vertical incision	High	At crossing, but appears more stable upstream of cascade
	Deposition	Medium	
	Lateral migration/bank erosion	High	Due to incision
	Damaged/unstable drains or armouring	None	Channel appears altered to take drains

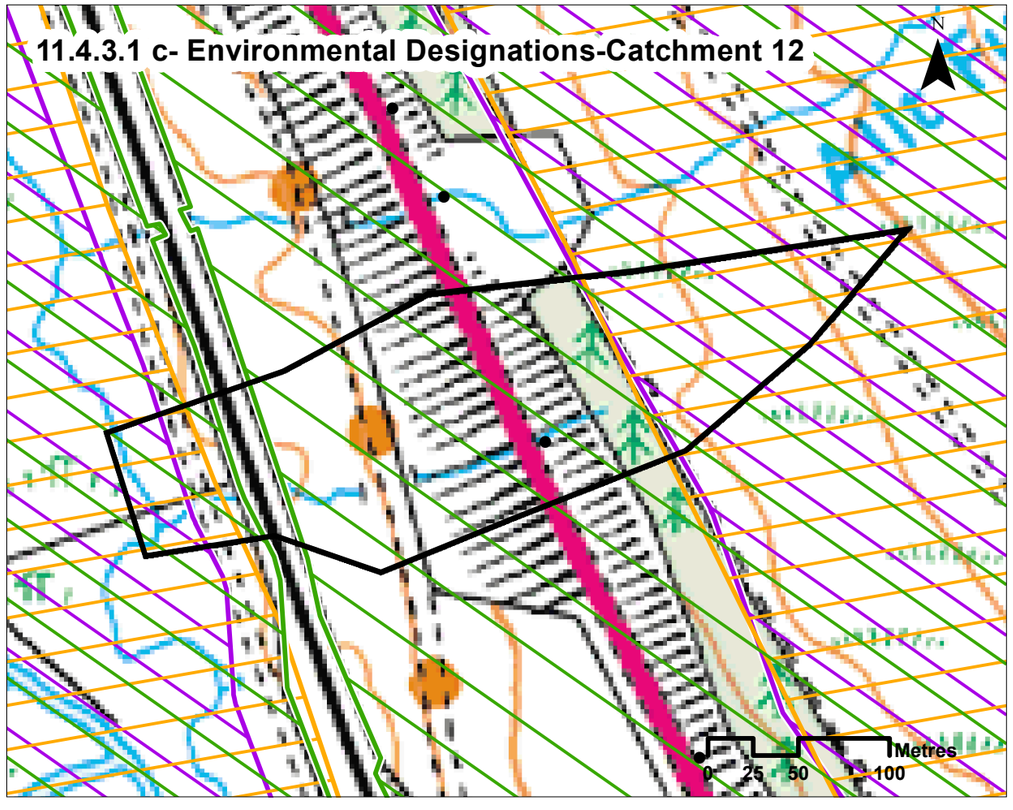
Morphology and Process- Reach downstream of crossing	Channel morphology	Plane bed	Bedrock through embankment
	Predominant sediment size	Boulder to Gravel	
	Unvegetated bars	No	
	Vertical incision	High	
	Deposition	Medium	
	Lateral migration/bank erosion	Medium	Due to incision
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 12)	NMU crossing	
	Impact of infrastructure	Both will fix channel bed and bank positions and impound flood flows	
	Channel realignment	Unclear from mapping but channel appears to have been straightened and must descend c.15m high embankment, creating a steeper gradient	

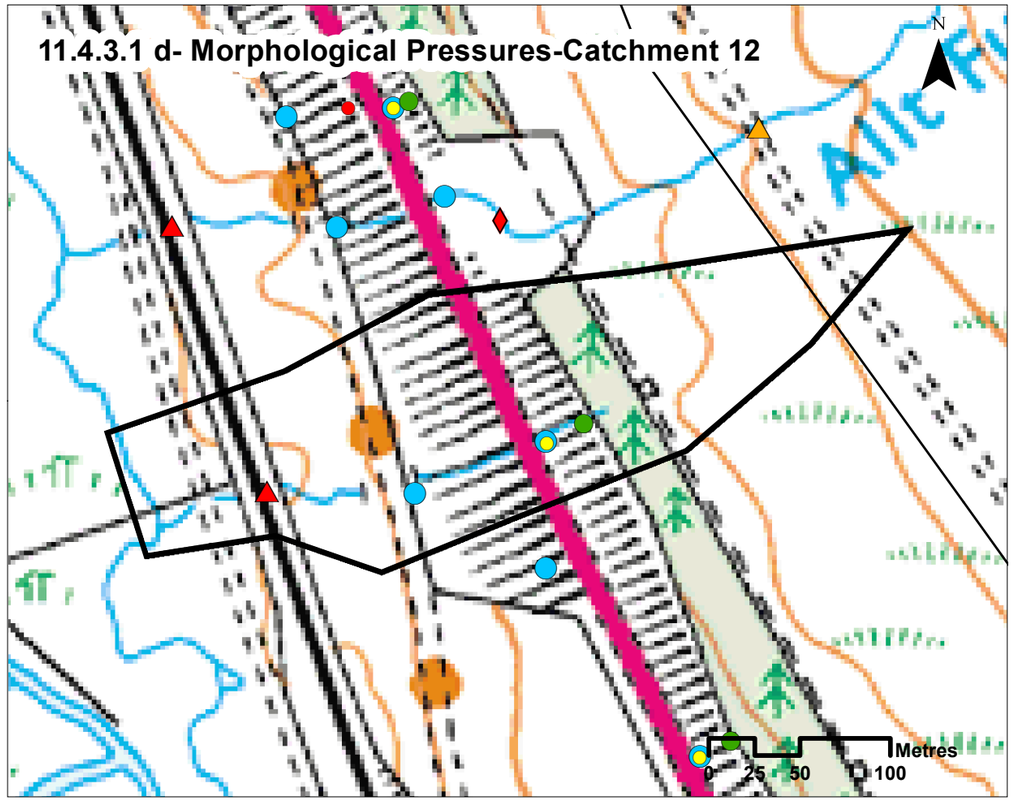
Summary behaviour	Channel is vertically unstable and incising (producing sediment and damaging the crossing) to adjust to a more stable bed slope at the crossing and downstream. Upstream of the cutting on the upslope side of the road the channel appears stable. The downslope side of the road is an embankment (70m wide in plan, c.15m high) with its toe at the NMU route. The channel is set below the level of this embankment and appears to be incised to bedrock. Downslope of the NMU route, the channel passes through more erodible hummocky glacial deposits and into which the channel has incised. This incision is likely to have occurred due to increases in channel discharge related to a) Felling has occurred since road construction that that may have changed drainage and sediment supply patterns to the crossing b) greater discharges from the natural catchment and c) *possible* capture of additional discharge from neighbouring channels during very high flow events, which would make estimated discharge very low.

Photograph 11.4.3.38-Upstream of crossing









Legend

General
- Crossing location

Solid Geology
- Gaick Psammite Formation - Psammite

Drift Geology
- Peat
- Glaciofluvial Ice Contact Deposits
- Gaick Plateau Moraine Formation
- Hummocky Glacial Deposits
- Ardverikie Till Formation - Diamicton
- Glaciofluvial Sheet Deposits
- Alluvium
- River Terrace Deposits
- Alluvial Fan Deposits
- Head
- Talus - Rock Fragments
- Talus Cone

Environmental Designations
- Special Site of Scientific Interest
- Special Area of Conservation
- Special Protection Area

Morphological Pressures
- Railway Bridge
- Track/Footbridge
- Culvert
- Cascade
- Step in Bed
- Catchpit
- Dam or Weir
- Power Lines

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TRANSPORT SCOTLAND
CEIDEADH ALBA

A9 DUALLING
PERTH TO INVERNESS
Glen Garry to Dalwhinnie

PROJECT 7 GLEN GARRY TO DALWHINNIE EIA

Drawing 11.4.3.1 Catchment 12 Catchment Overview

DESIGN:	DRAWN:	CHK:	APP:
EL	EV	EL	EL

DATE: 18/07/2017

PROJ: 495298

DWG: A9P07-CFJ-EWE-Z_ZZZZZ_ZZ-DR-EN-0001

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Possibility of capture of some flow from adjacent catchment during very high flow events.

Between NMU route and railway, channel is incising into humocky glacial deposits.

Channel descends this slope on bedrock
Possibly original channel gradient. despite steeper made ground either side.

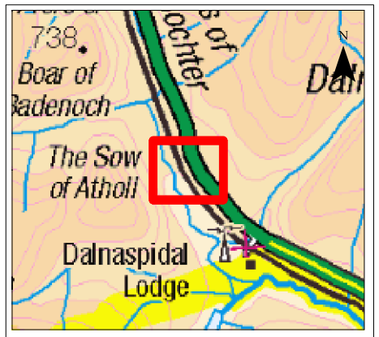
Felling has taken place on steep slope- may have changed drainage and sediment supply patterns

Channel takes additional flows from slope drain

16 15 14 13 12 11 10 9 8

N

Metres
0 37.5 75 150



Legend

- Major crossing
- Minor crossing
- Other crossing
- Break in slope
- Incision
- Crossing catchment

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TRANSPORT SCOTLAND / A9 DUALLING PERTH TO INVERNESS

PROJECT 7 GLEN GARRY TO DALWHINNIE EIA

DRAWING 11.4.3.2. Catchment 12 Baseline Assessment

DESIGN:	DRAWN:	CHK:	APP:
EL	EL	AB	EL

DATE: 10/07/2017

PROJ: 495298

DWG: A9P07-CFJ-EWE-Z_ZZZZZ_ZZ-DR-EN-0002

SHEET:	REVISION:	SUITABILITY:
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Annex 11.4.3 - Hydromorphological Catchment Assessment - 13-14

Catchment No.	**13-14**
Catchment Name	-

Channel Nature	Nature of water course	Natural
	Size of water course	Major

Quantitative Spatial Elements	Catchment Area (km^2)	0.7
	Average slope in catchment (°)	9.5
	% Catchment over 750m (for snow melt risk)	7

WFD classification	Water, flows and levels	Good
	Physical condition	High
	Overall ecological status	Poor

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 13-14)	Gaick Psammite formation-Psammite	Resistant to weathering, impermeable
	Is an alluvial fan present at or near the crossing?	No	

Environmental designations (see Drawing 11.4.3.1 c, Catchment 13-14)	Ramsar	No	
	SAC	Drumochter Hills	Acidic scree, alpine and subalpine heaths, blanket bog, dry heaths, monntane acid grasslands , mountain willow scrub, plants in crevices on acid rocks, species-rich grassland with mat-grass in upland areas, tall herb communities, wet heathland with cross-leaved
	SPA	Drumochter Hills	Dotterel breeding, merlin breeding
	SSSI	Drumochter Hills	Breeding bird assemblage, fluvial geomorphology of Scotland, montane assemblage, vascular plant assemblage

Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 13-14	
	Is peat present in the catchment?	Yes	
	Is there a bog burst risk?	Yes	
	Current valley side or terrace erosion	Yes	
	Potential valley side or terrace erosion	Yes	
	Hill slope failures (including peat slides and debris flows and slides)	Yes	
	Hill slope failures coupled to channel	Yes	
	Vertical incision present in catchment	Yes	
	Bank erosion/lateral migration	Yes	
	Unvegetated bars	No	
	Wooded/forested areas in catchment	Yes	But not around channel
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 13-14)	Upstream track	
	Comment on sediment source potential in catchment	Some sediment produced within the wider catchment, thought most is due to incision and erosion local to the crossing	
	Comment on sediment supply potential to crossing	Steep slopes have potential to supply sediment, local erosion provides sediment to crossing	

Morphology and Process- Reach upstream of crossing	Channel morphology	Cascade	
	Predominant sediment size	Boulders and cobbles	
	Unvegetated bars	None	
	Vertical incision	High	
	Deposition	Low	
	Lateral migration/bank erosion	High	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 13-14)	Weir/Step	
	Impact of infrastructure	Fixing bed level, reducing energy, reducing downstream sediment supply	
	Channel realignment	None	

Morphology and Process- At crossing	Channel morphology	Engineered	
	Predominant sediment size	None	
	Estimated discharge at 1:200 event (m^3/s)	4.16 (Crossing 13) 0.29 (Crossing 14)	
	Unvegetated bars	None	
	Vertical incision	High	
	Deposition	None	
	Lateral migration/bank erosion	None	
	Damaged/unstable drains or armouring	None	

Morphology and Process- Reach downstream of crossing	Channel morphology	Cascade	
	Predominant sediment size	Cobble and gravel	
	Unvegetated bars	None	
	Vertical incision	Medium	
	Deposition	Medium	
	Lateral migration/bank erosion	Medium	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 13-14)	NMU and Railway crossing culvert	
	Impact of infrastructure	Fixing bed and banks	
	Channel realignment	None	
Summary behaviour	Crossing has increased instability in the channel, initiating incision and lateral erosion. Sediment is transported through the A9 and NMU crossings and deposited at and downstream of the railway crossing as an alluvial fan.		

Photograph 11.4.3.39-
Upstream, bedrock cascade

Photograph 11.4.3.40-
Downstream

Photograph 11.4.3.41-Downstream, channel
incising

Photograph 11.4.3.42-Upstream to stone weir,
fixing bed level, to reduce upstream channel
incision

Photograph 11.4.3.43-Entrance to culvert

Photograph 11.4.3.44-erosion of valley side

Photograph 11.4.3.45-Downstream of small road crossing

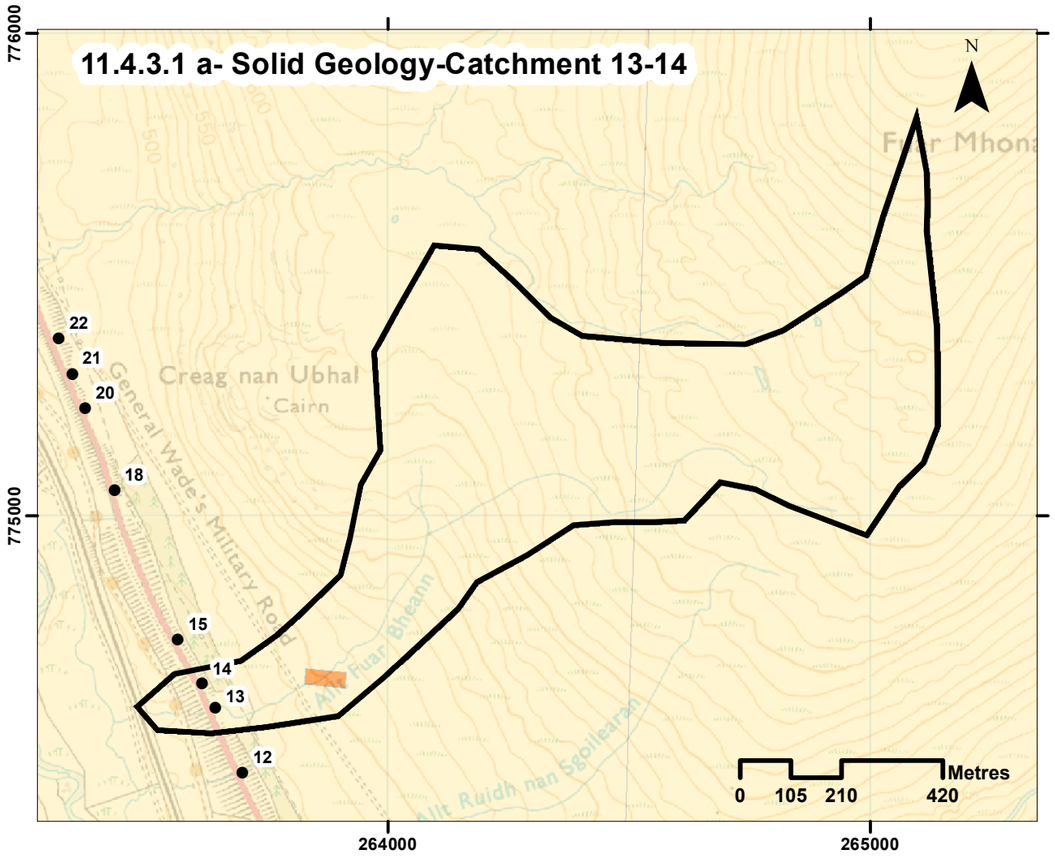
Photograph 11.4.3.46-Downstream of NMU crossing

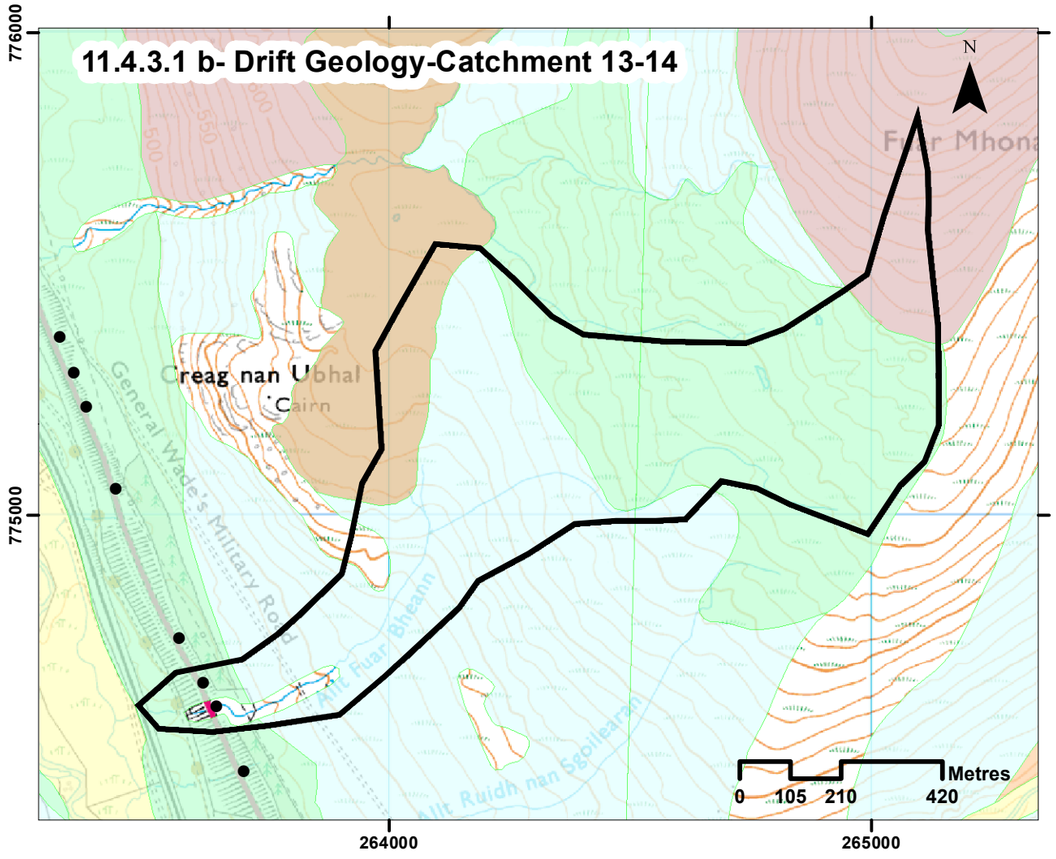
Photograph 11.4.3. 47-Upstream to small road crossing

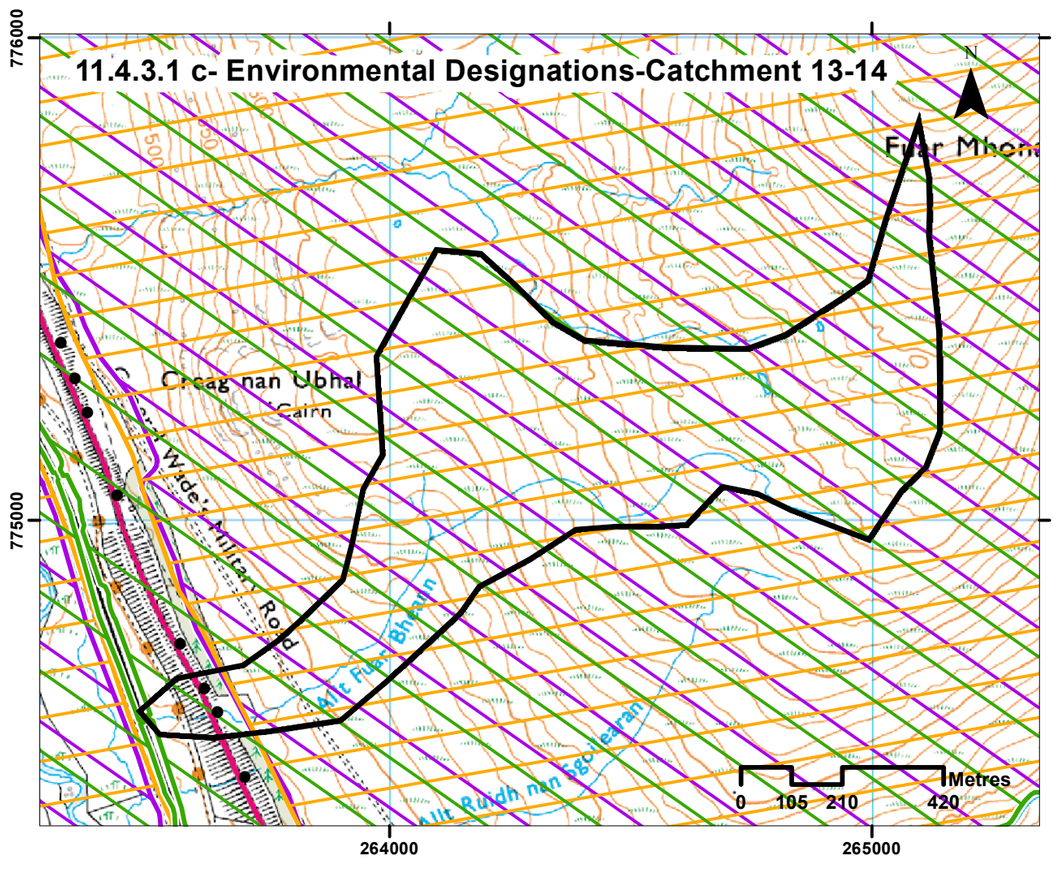
Photograph 11.4.3.49- Upstream

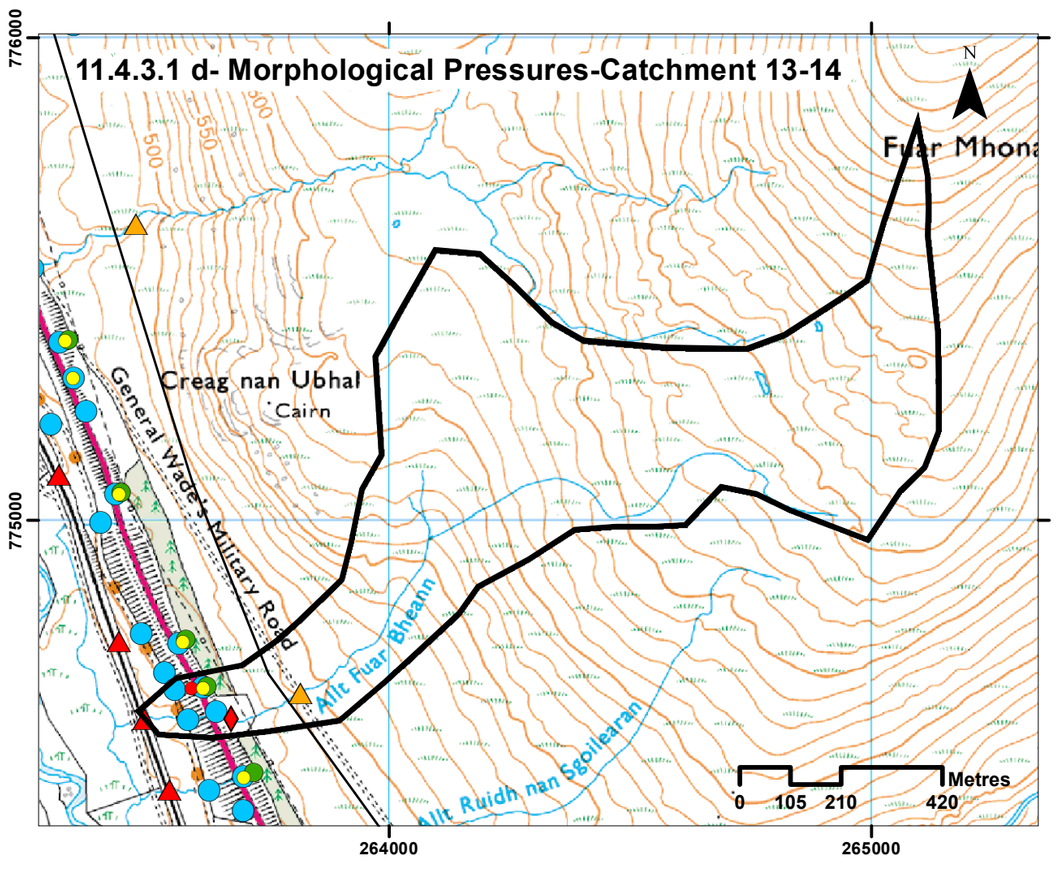
Photograph 11.4.3.48-Additional outfall- crossing 14 downstream of NMU

Photograph 11.4.3.50- Some erosion to concrete/boulder cascade on exit of crossing









Legend

General
- Crossing location

Solid Geology
- Gaick Psammite Formation - Psammite
- North Britain Siluro-Devonian Calc-Alkaline Dyke Suite - Felsite

Drift Geology
- Peat
- Glaciofluvial Ice Contact Deposits
- Gaick Plateau Moraine Formation
- Hummocky Glacial Deposits
- Ardverikie Till Formation - Diamicton
- Glaciofluvial Sheet Deposits
- Alluvium
- River Terrace Deposits
- Alluvial Fan Deposits
- Head
- Talus - Rock Fragments
- Talus Cone

Environmental Designations
- Special Site of Scientific Interest
- Special Area of Conservation
- Special Protection Area

Morphological Pressures
- Railway Bridge
- Track/Footbridge
- Culvert
- Cascade
- Step in Bed
- Catchpit
- Dam or Weir
- Power Lines

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TRANSPORT SCOTLAND
A9 DUALLING PERTH TO INVERNESS Glen Garry to Dalwhinnie

PROJECT 7 GLEN GARRY TO DALWHINNIE EIA

Drawing 11.4.3.1 Catchment 13-14 Catchment Overview

DESIGN:	DRAWN:	CHK:	APP:
EL	EV	EL	EL

DATE: 18/07/2017

PROJ: 495298

DWG: A9P07-CFJ-EWE-Z_ZZZZZ_ZZ-DR-EN-0001

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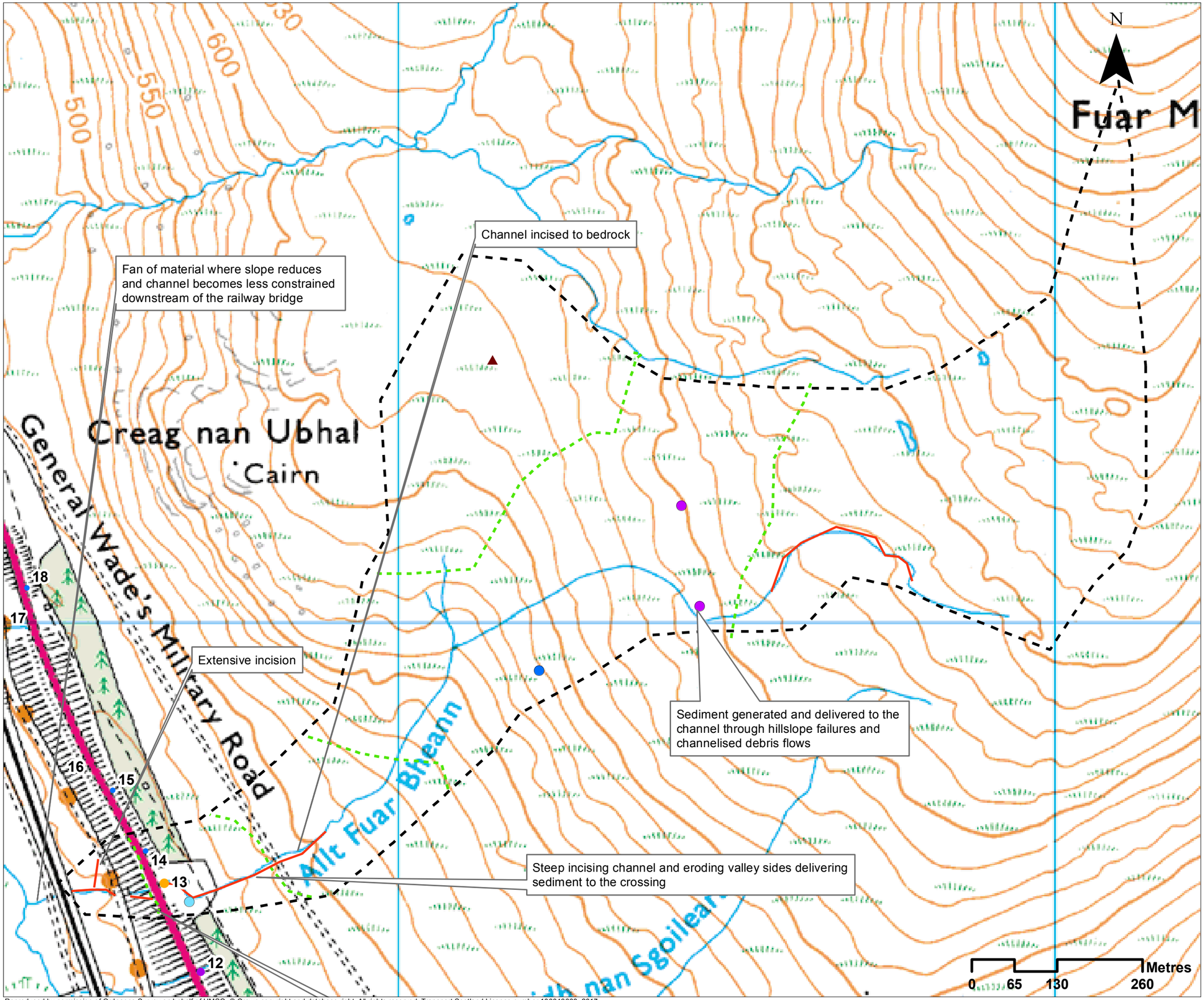

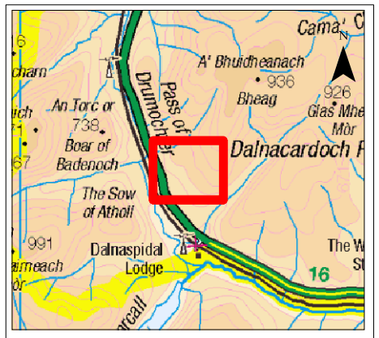

Legend

- Major crossing
- Minor crossing
- Other crossing
- Peat
- Coupled debris flow
- Hill slope failure
- Valley side erosion
- Break in slope
- Incision
- Crossing catchment

REV	SUIT	DATE	DESCRIPTION	BY	APP

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TRANSPORT SCOTLAND — A9 DUALLING PERTH TO INVERNESS

PROJECT 7 GLEN GARRY TO DALWHINNIE EIA

DRAWING 11.4.3.2.
Catchment 13&14 Baseline Assessment

DESIGN:	DRAWN:	CHK:	APP:
EL	EL	AB	EL

DATE: 27/07/2017

PROJ: 495298

DWG: A9P07-CFJ-EWE-Z_ZZZZZ_ZZ-DR-EN-0002

SHEET:	REVISION:	SUITABILITY:
1 OF 1	C01	A3

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Annex 11.4.3 - Hydromorphological Catchment Assessment - 20-22

Catchment No.	**20-22**
Catchment Name	-

Channel Nature	Nature of water course	Drain
	Size of water course	Other

Quantitative Spatial Elements	Catchment Area (km^2)	0.2
	Average slope in catchment (°)	11
	% Catchment over 750m (for snow melt risk)	0

WFD classification	Water, flows and levels	Good
	Physical condition	High
	Overall ecological status	Poor

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 20-22)	Gaick Psammite formation-Psammite	Resistant to weathering, impermeable
	Is an alluvial fan present at or near the crossing?	Yes	Possible vegetated fan near crossing 20

Environmental designations (see Drawing 11.4.3.1 c, Catchment 20-22)	Ramsar	No	
	SAC	Drumochter Hills	Acidic scree, alpine and subalpine heaths, blanket bog, dry heaths, monntane acid grasslands , mountain willow scrub, plants in crevices on acid rocks, species-rich grassland with mat-grass in upland areas, tall herb communities, wet heathland with cross-leaved
	SPA	Drumochter Hills	Dotterel breeding, merlin breeding
	SSSI	Drumochter Hills	Breeding bird assemblage, fluvial geomorphology of Scotland, montane assemblage, vascular plant assemblage

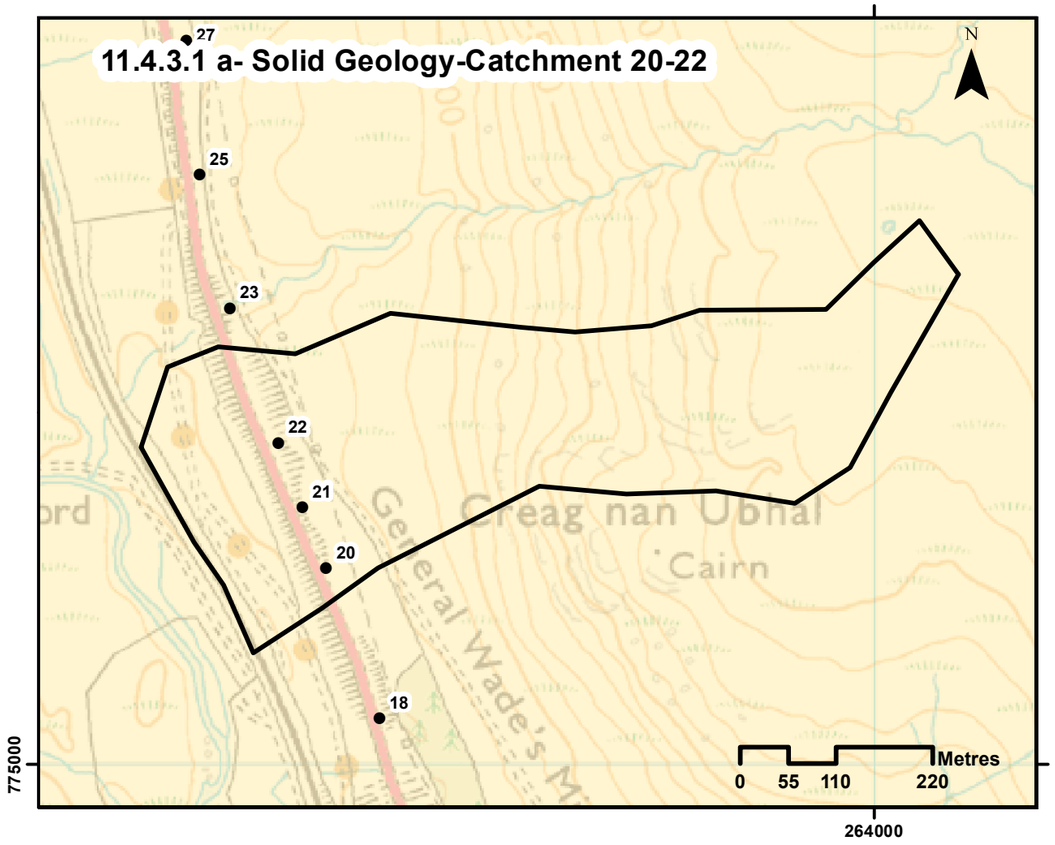
Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 20-22	
	Is peat present in the catchment?	Yes	Extensive deposits on flatter ground in upper catchment.
	Is there a bog burst risk?	Yes	Low risk but possible. Unlikely to be high magnitude
	Current valley side or terrace erosion	Yes	
	Potential valley side or terrace erosion	Yes	
	Hill slope failures (including peat slides and debris flows and slides)	Yes	
	Hill slope failures coupled to channel	No	
	Vertical incision present in catchment	Yes	
	Bank erosion/lateral migration	Yes	
	Unvegetated bars	No	
	Wooded/forested areas in catchment	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 20-22)	Track crossing	
	Comment on sediment source potential in catchment	Sediment is available within the catchment	
	Comment on sediment supply potential to crossing	Very steep, channelized slopes supply sediment to the drains	

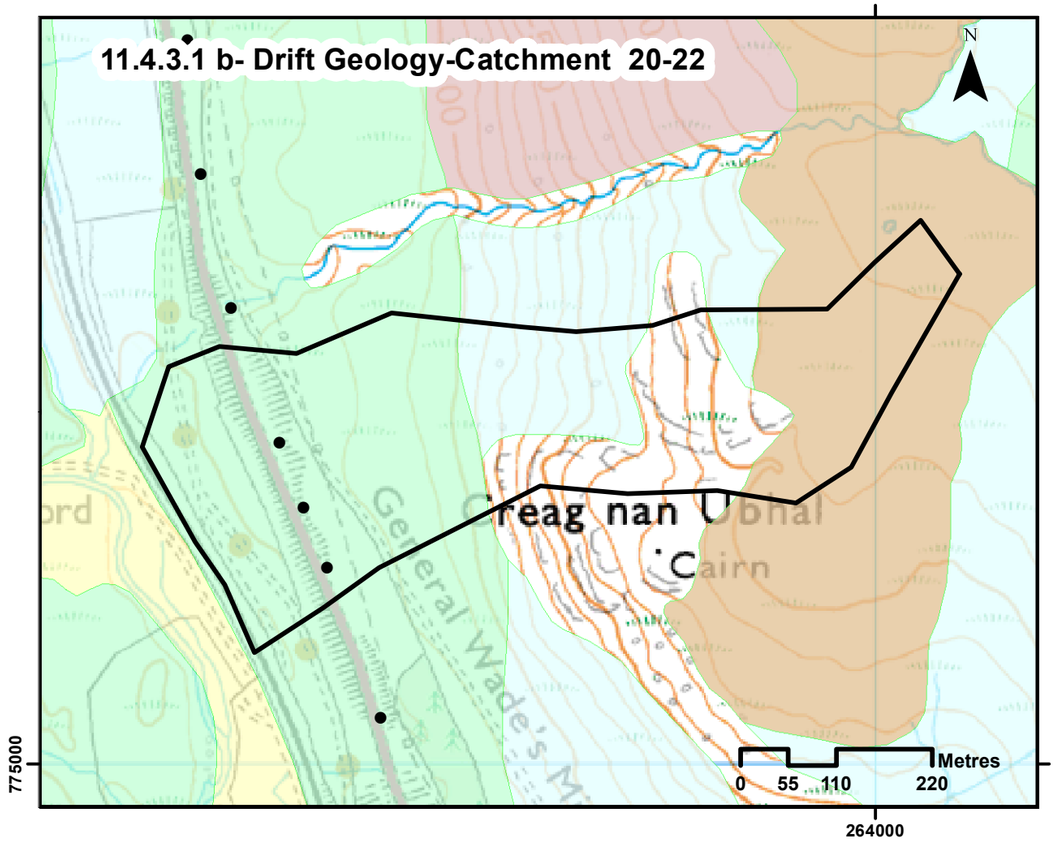
Morphology and Process- Reach upstream of crossing	Channel morphology	Engineered	
	Predominant sediment size	None	
	Unvegetated bars	None	
	Vertical incision	Low	
	Deposition	None	
	Lateral migration/bank erosion	Low	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 20-22)	None	
	Impact of infrastructure	None	
	Channel realignment	Yes	All formalised drains

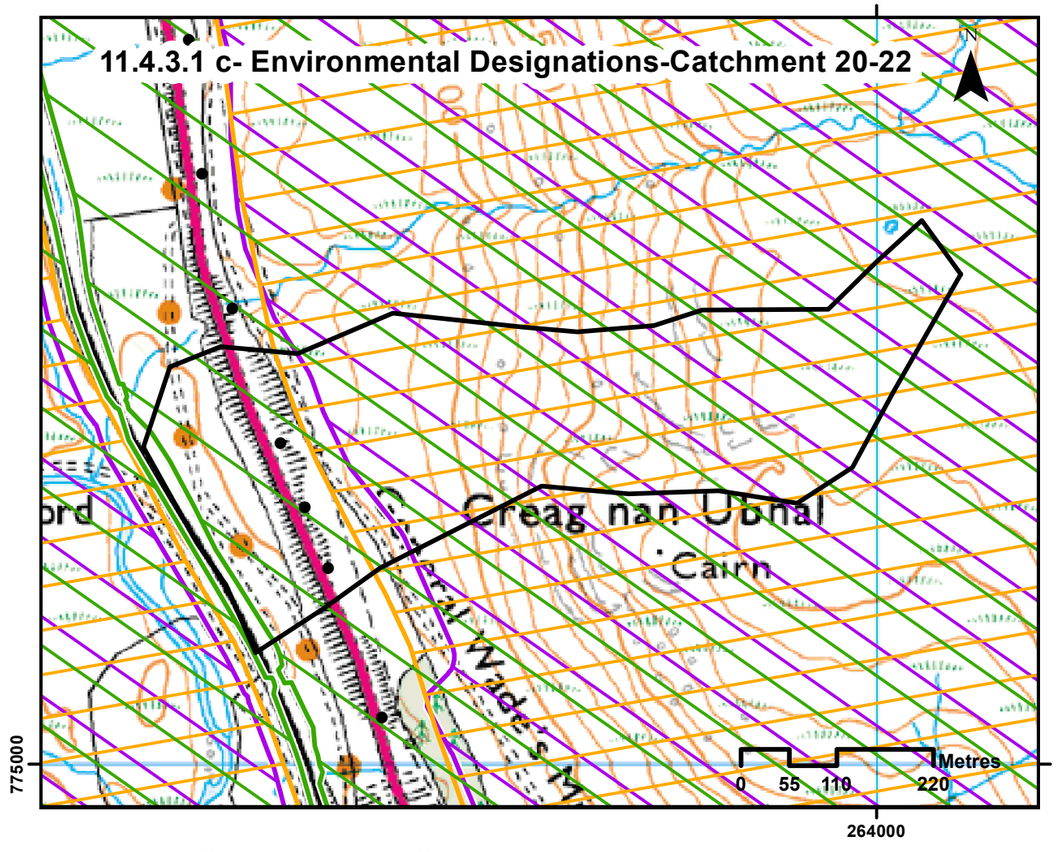
Morphology and Process- At crossing	Channel morphology	Engineered	
	Predominant sediment size	None	
	Estimated discharge at 1:200 event (m^3/s)	0.965	Crossing 20
	Unvegetated bars	None	
	Vertical incision	Medium	Crossing 20
	Deposition	None	
	Lateral migration/bank erosion	None	
	Damaged/unstable drains or armouring	Yes	

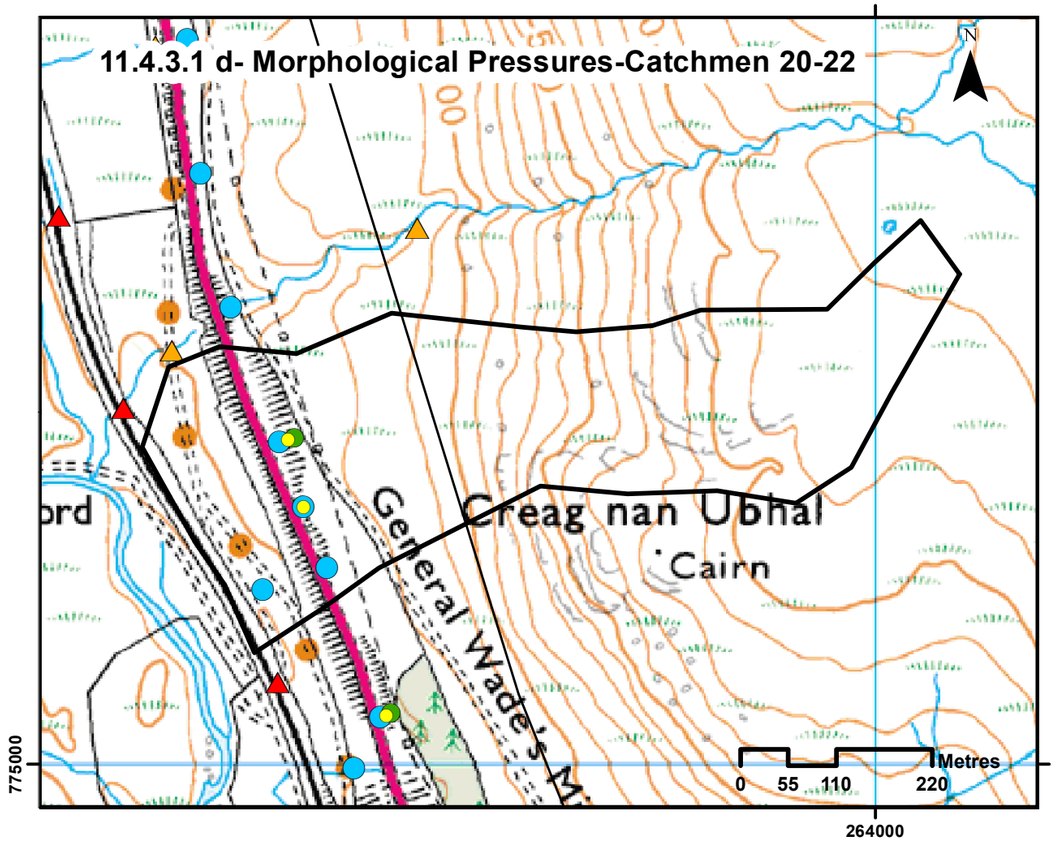
Morphology and Process- Reach downstream of crossing	Channel morphology	Engineered	
	Predominant sediment size	None	
	Unvegetated bars	None	
	Vertical incision	None	
	Deposition	None	
	Lateral migration/bank erosion	None	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 20-22)	Railway crossing	
	Impact of infrastructure	Fixing channel position	
	Channel realignment	None	

Summary behaviour	Small hillslope drainage channels have been formalised as part of the A9. Channels relatively stable but some erosion and vertical instability (crossing 20).









Legend

General
- Crossing Location
- Catchments

Solid Geology
- Gaick Psammite Formation - Psammite
- North Britain Siluro-Devonian Calc-Alkaline Dyke Suite - Microdiorite

Drift Geology
- Peat
- Glaciofluvial Ice Contact Deposits
- Gaick Plateau Moraine Formation
- Hummocky Glacial Deposits
- Ardverikie Till Formation - Diamicton
- Glaciofluvial Sheet Deposits
- Alluvium
- River Terrace Deposits
- Alluvial Fan Deposits
- Head
- Talus - Rock Fragments
- Talus Cone

Environmental Designations
- Special Site of Scientific Interest
- Special Area of Conservation
- Special Protection Area

Morphological Pressures
- Railway Bridge
- Track/Footbridge
- Culvert
- Cascade
- Catchpit
- Power Lines

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TRANSPORT SCOTLAND
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PROJECT 7 GLEN GARRY TO DALWHINNIE EIA

Drawing 11.4.3.1 Catchment 20-22 Catchment Overview

DESIGN:	DRAWN:	CHK:	APP:
EL	EV	EL	EL

DATE: 18/07/2017

PROJ: 495298

DWG: A9P07-CFJ-EWE-Z_ZZZZZ_ZZ-DR-EN-0001

SHEET:	REVISION:	SUITABILITY:
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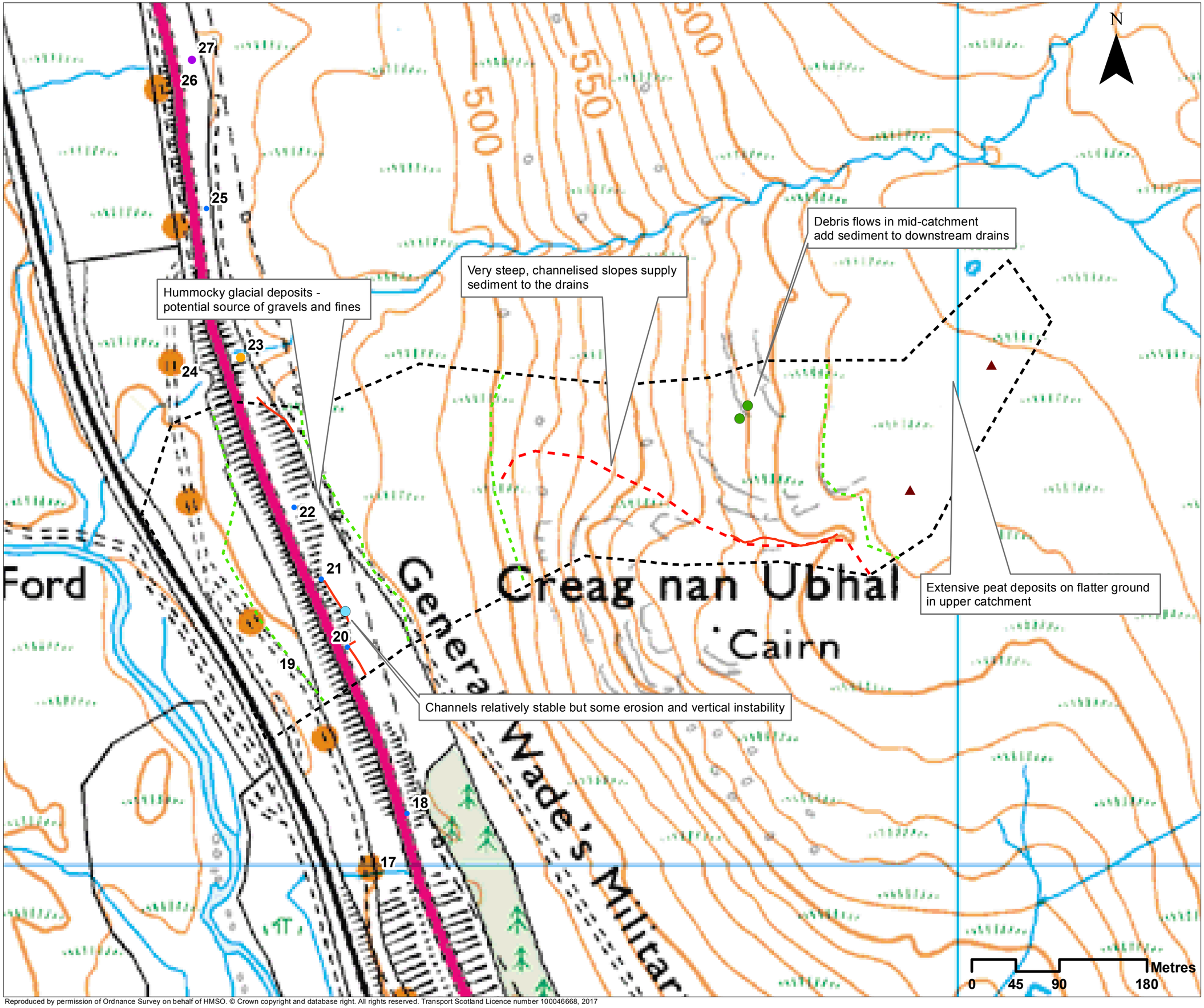

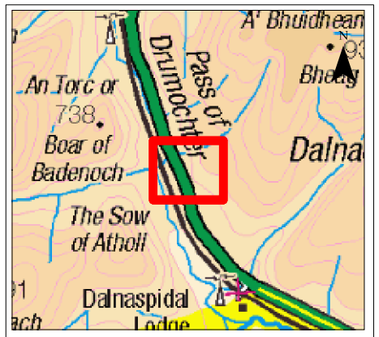

Legend

- Crossing catchment
- Major crossing
- Minor crossing
- Other crossing
- Peat
- Debris flow
- Valley side erosion
- Break in slope
- Terrace
- Incision

REV	SUIT	DATE	DESCRIPTION	BY	APP

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TRANSPORT SCOTLAND / CONRADH ALBA

A9 DUALLING PERTH TO INVERNESS Glen Garry to Dalwhinnie

PROJECT 7 GLEN GARRY TO DALWHINNIE EIA

DRAWING 11.4.3.2.
Catchment 20-22 Baseline Assessment

DESIGN:	DRAWN:	CHK:	APP:
EL	CC	EL	EL

DATE: 10/07/2017

PROJ: 495298

DWG: A9P07-CFJ-EWE-Z_ZZZZZ_ZZ-DR-EN-0002

SHEET:	REVISION:	SUITABILITY:
1 OF 1	C01	A3

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Annex 11.4.3 - Hydromorphological Catchment Assessment - 23

Catchment No.	**23**
Catchment Name	-

Channel Nature	Nature of water course	Natural
	Size of water course	Major

Quantitative Spatial Elements	Catchment Area (km^2)	2.44
	Average slope in catchment (°)	13.13
	% Catchment over 750m (for snow melt risk)	50%

WFD classification	Water, flows and levels	Good
	Physical condition	High
	Overall ecological status	Poor

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 23)	Gaick Psammite formation-Psammite	Resistant to weathering, impermeable
	Is an alluvial fan present at or near the crossing?	No	

Environmental designations (see Drawing 11.4.3.1 c, Catchment 23)	Ramsar	No	
	SAC	Drumochter Hills	Acidic scree, alpine and subalpine heaths, blanket bog, dry heaths, monntane acid grasslands , mountain willow scrub, plants in crevices on acid rocks, species-rich grassland with mat-grass in upland areas, tall herb communities, wet heathland with cross-leaved
	SPA	Drumochter Hills	Dotterel breeding, merlin breeding
	SSSI	Drumochter Hills	Breeding bird assemblage, fluvial geomorphology of Scotland, montane assemblage, vascular plant assemblage

Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 23	
	Is peat present in the catchment?	Yes	Extensive peat deposits in lower gradient mid-catchment slopes
	Is there a bog burst risk?	Yes	Low but possible
	Current valley side or terrace erosion	Some	
	Potential valley side or terrace erosion	Yes	
	Hill slope failures (including peat slides and debris flows and slides)	Yes	
	Hill slope failures coupled to channel	Yes	
	Vertical incision present in catchment	Possible	
	Bank erosion/lateral migration	Possible	
	Unvegetated bars	Yes	
	Wooded/forested areas in catchment	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 23)	Upstream track crossing	
	Comment on sediment source potential in catchment	Sediment inputs will come from the steep slopes in the upper catchment	
	Comment on sediment supply potential to crossing	Steep confined channels will transport sediment to the crossing, however the reduction in slope in the middle of the catchment will reduce the volume and speed of sediment supply to the crossing	

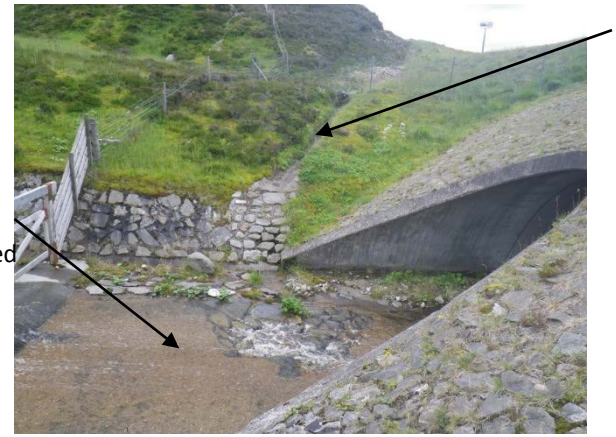
Morphology and Process- Reach upstream of crossing	Channel morphology	Cascade	
	Predominant sediment size	Boulders and cobbles	
	Unvegetated bars	Some	
	Vertical incision	Low	
	Deposition	Medium	
	Lateral migration/bank erosion	Medium	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 23)	Track crossing	
	Impact of infrastructure	Fixing channel banks	
	Channel realignment	None	

Morphology and Process- At crossing	Channel morphology	Engineered	For c. 20m u/s of crossing and c.40m d/s of crossing (as far as NMU crossing)
	Predominant sediment size	None	
	Estimated discharge at 1:200 event (m^3/s)	12	
	Unvegetated bars	None	
	Vertical incision	None	
	Deposition	None	
	Lateral migration/bank erosion	Medium	
	Damaged/unstable drains or armouring	Yes	Will be adding some sediment to the channel

Morphology and Process- Reach downstream of crossing	Channel morphology	Plane bed	Downstream of NMU crossing
	Predominant sediment size	Cobble boulder	
	Unvegetated bars	Yes	
	Vertical incision	Medium	
	Deposition	Medium	
	Lateral migration/bank erosion	Medium	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 23)	NMV crossing	
	Impact of infrastructure	NMV- Fixing bed level, creating step, some downstream incision	
	Channel realignment	None	
Summary behaviour	Sediment provided from the upper catchment to the crossing over time. Localised erosion directly upstream of the crossing providing a local sediment source. NMU crossing is then fixing channel bed and bank positions, creating a large step in the channel bed and causing some incision. Differential erosion taking place upstream and downstream of engineered section, creating risk of undermining or outflanking engineering.		

Photograph 11.4.3.51-Some gravel deposition at old road crossing

Photograph 11.4.3.52-Upstream to culvert exit



Photograph 11.4.3.53-Crossing inflow

Photograph 11.4.3.54-Upstream of crossing

Photograph 11.4.3.55-Downstream to culvert entrance

Small pockets of gravel deposition at channel margins

Photograph 11.4.3.56-Upstream

Photograph 11.4.3.57- Cascade morphology in confined channel

Exposed unvegetated material left after pylon installation

Photograph 11.4.3.58- Cascade morphology in confined channel

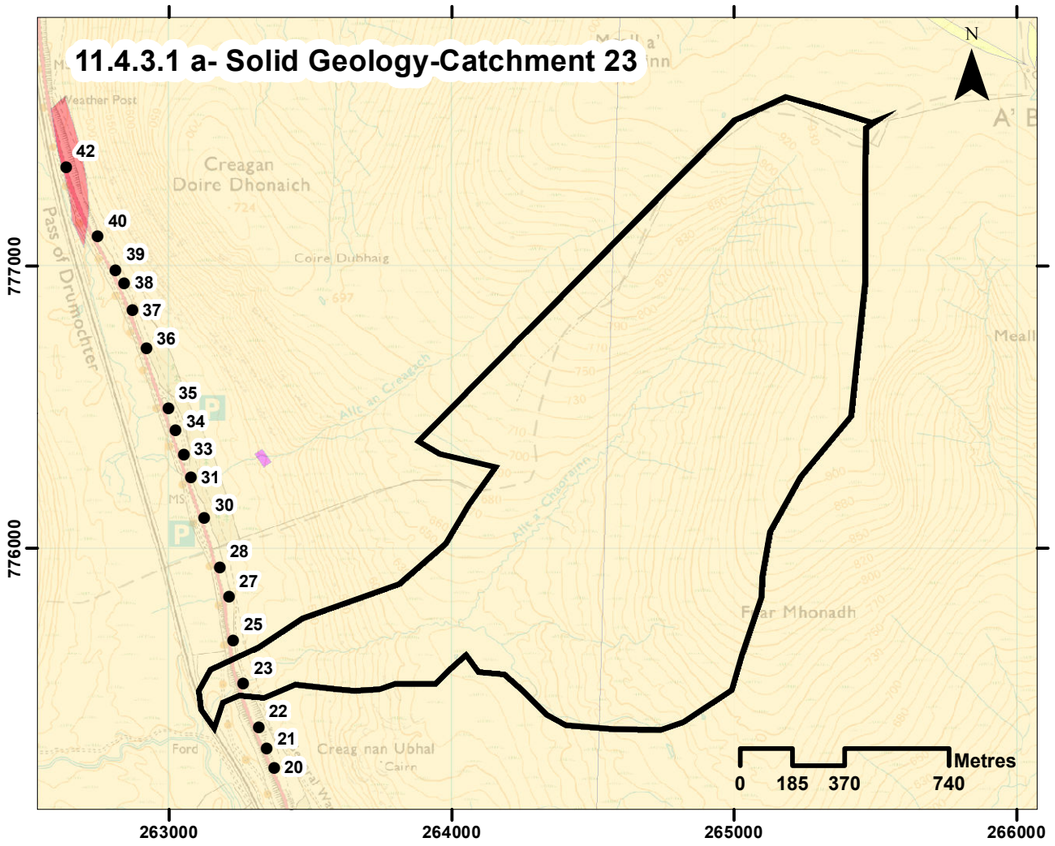
Photograph 11.4.3.59-Upstream to bedrock falls

Photograph 11.4.3.60-From valley top towards channel

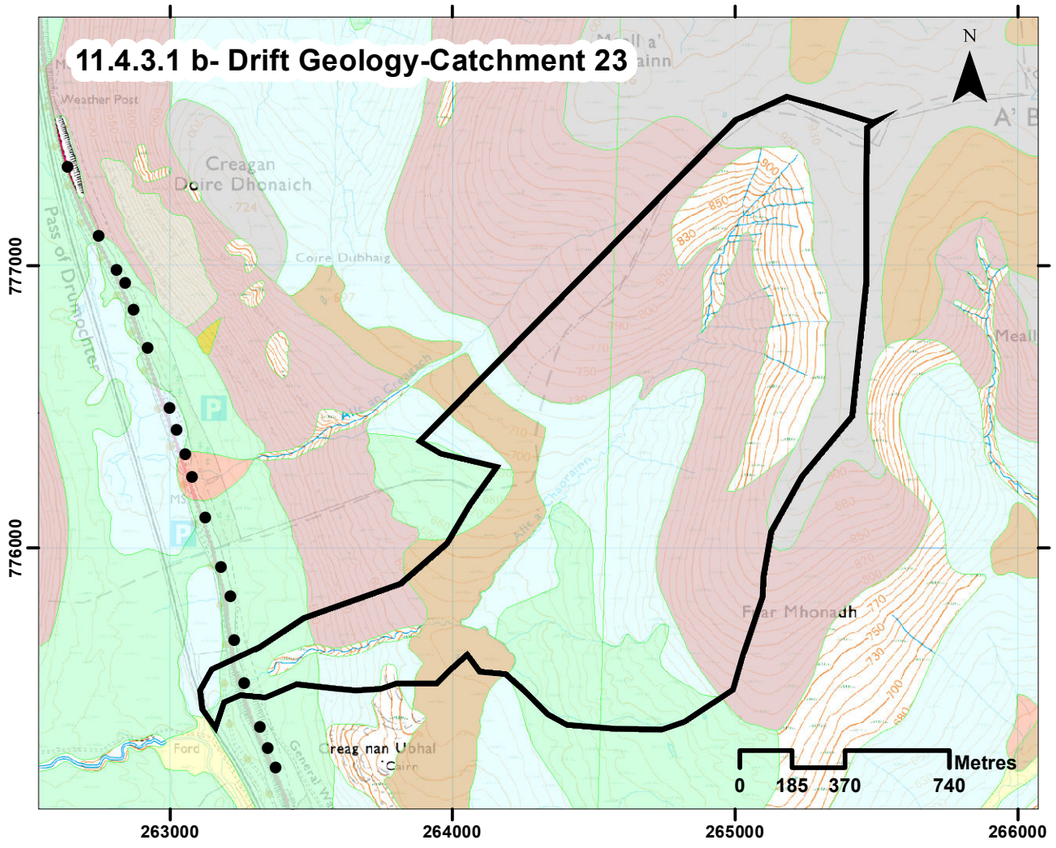
Photograph 11.4.3.61-Downtream to railway crossing

Photograph 11.4.3.62-Upstream to small road crossing

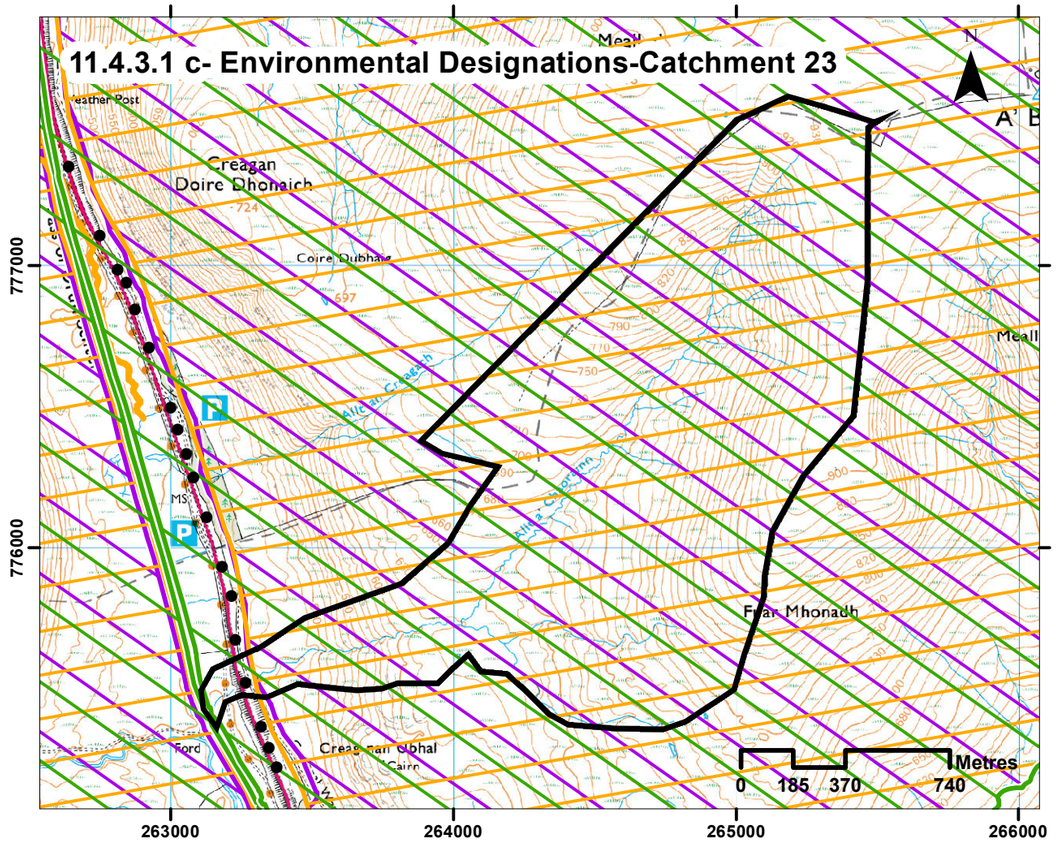
11.4.3.1 a- Solid Geology-Catchment 23



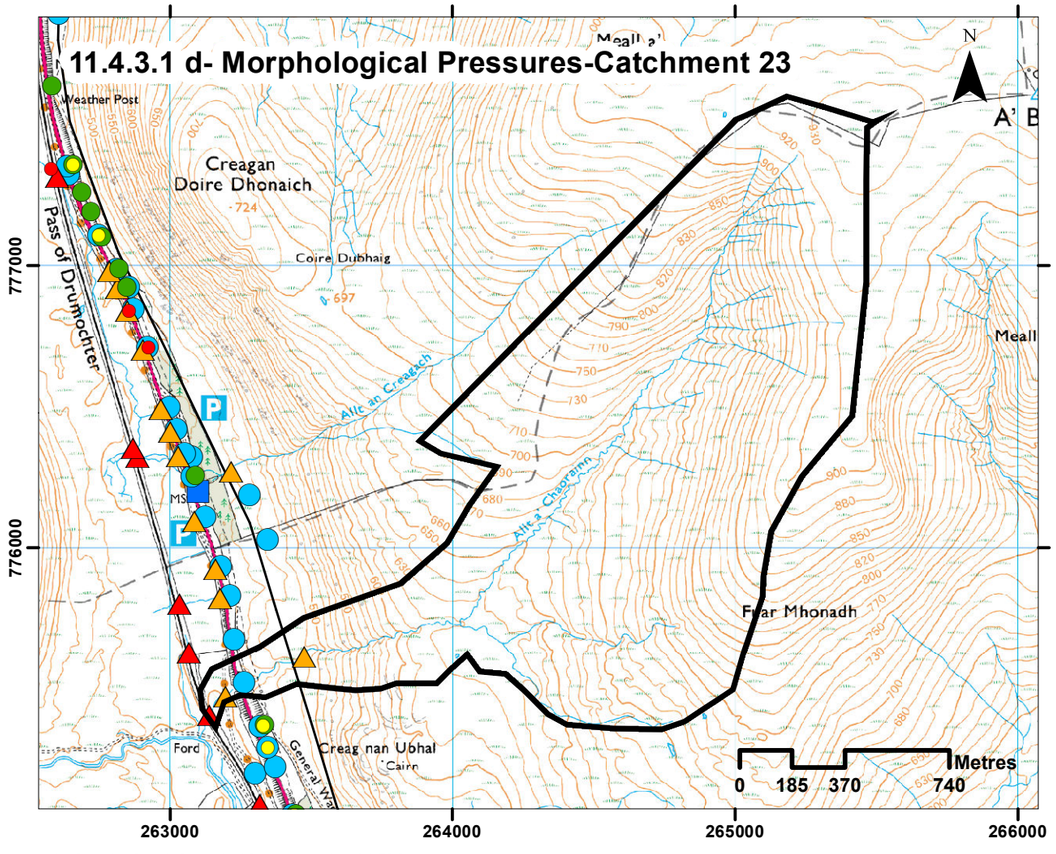
11.4.3.1 b- Drift Geology-Catchment 23



11.4.3.1 c- Environmental Designations-Catchment 23



11.4.3.1 d- Morphological Pressures-Catchment 23



Legend

General
- Crossing location

Solid Geology
- Gaick Psammite Formation - Psammite

Drift Geology
- Peat
- Glaciofluvial Ice Contact Deposits
- Gaick Plateau Moraine Formation
- Hummocky Glacial Deposits
- Ardverikie Till Formation - Diamicton
- Glaciofluvial Sheet Deposits
- Alluvium
- River Terrace Deposits
- Alluvial Fan Deposits
- Head
- Talus - Rock Fragments
- Talus Cone

Environmental Designations
- Special Site of Scientific Interest
- Special Area of Conservation
- Special Protection Area

Morphological Pressures
- Railway Bridge
- Track/Footbridge
- Culvert
- Cascade
- Step in Bed
- Catchpit
- Discharge Location
- Power Lines

REV	SUIT	DATE	DESCRIPTION	BY	APP

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TRANSPORT SCOTLAND
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PROJECT 7 GLEN GARRY TO DALWHINNIE EIA

Drawing 11.4.3.1 Catchment 23 Catchment Overview

DESIGN:	DRAWN:	CHK:	APP:
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DATE: 18/07/2017

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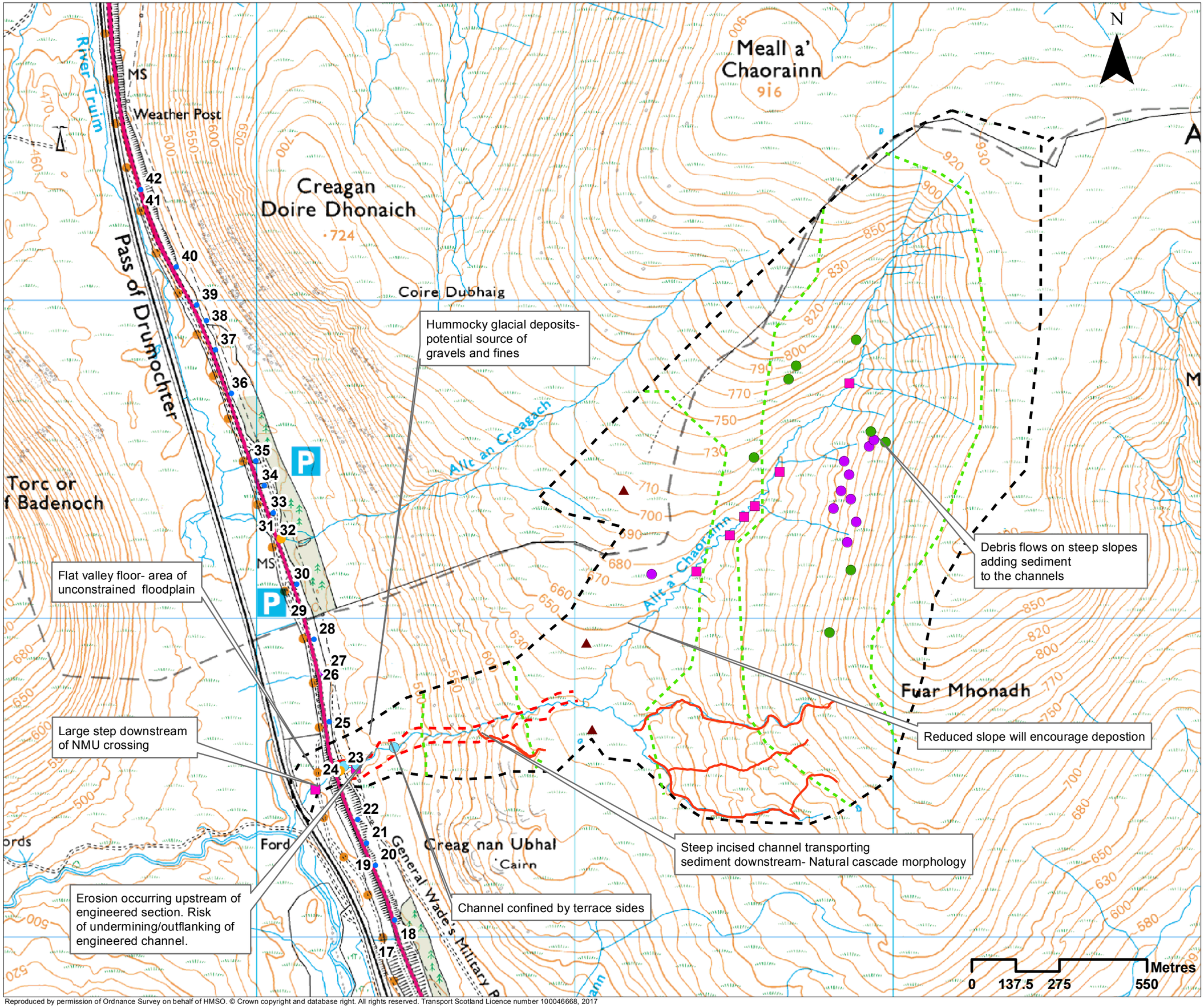

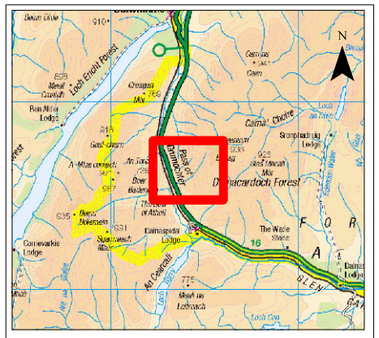

Legend

- Major crossing
- Minor crossing
- Other crossing
- Peat
- Coupled debris flow
- Debris flow
- Valley side erosion
- Unvegetated bar
- Break in slope
- Terrace
- Incision
- Crossing catchment

REV	SUIT	DATE	DESCRIPTION	BY	APP

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TRANSPORT SCOTLAND

A9 DUALLING PERTH TO INVERNESS Glen Garry to Dalwhinnie

PROJECT 7 GLEN GARRY TO DALWHINNIE EIA

DRAWING 11.4.3.2. Catchment 23 Baseline Assessment

DESIGN:	DRAWN:	CHK:	APP:
EL	EL	AB	EL

DATE: 10/07/2017

PROJ: 495298

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1 OF 1	C01	A3

Annex 11.4.3 - Hydromorphological Catchment Assessment - 25-29

Catchment No.	**25-29**
Catchment Name	**-**

Channel Nature	Nature of water course	Natural
	Size of water course	Minor

Quantitative Spatial Elements	Catchment Area (km^2)	0.41
	Average slope in catchment (°)	11
	% Catchment over 750m (for snow melt risk)	0

WFD classification	Water, flows and levels	Good
	Physical condition	High
	Overall ecological status	Poor

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 25-29)	Gaick Psammite formation-Psammite	Resistant to weathering, impermeable
	Is an alluvial fan present at or near the crossing?	No	

Environmental designations (see Drawing 11.4.3.1 c, Catchment 25-29)	Ramsar	No	
	SAC	Drumochter Hills	Acidic scree, alpine and subalpine heaths, blanket bog, dry heaths, monntane acid grasslands , mountain willow scrub, plants in crevices on acid rocks, species-rich grassland with mat-grass in upland areas, tall herb communities, wet heathland with cross-leaved
	SPA	Drumochter Hills	Dotterel breeding, merlin breeding
	SSSI	Drumochter Hills	Breeding bird assemblage, fluvial geomorphology of Scotland, montane assemblage, vascular plant assemblage

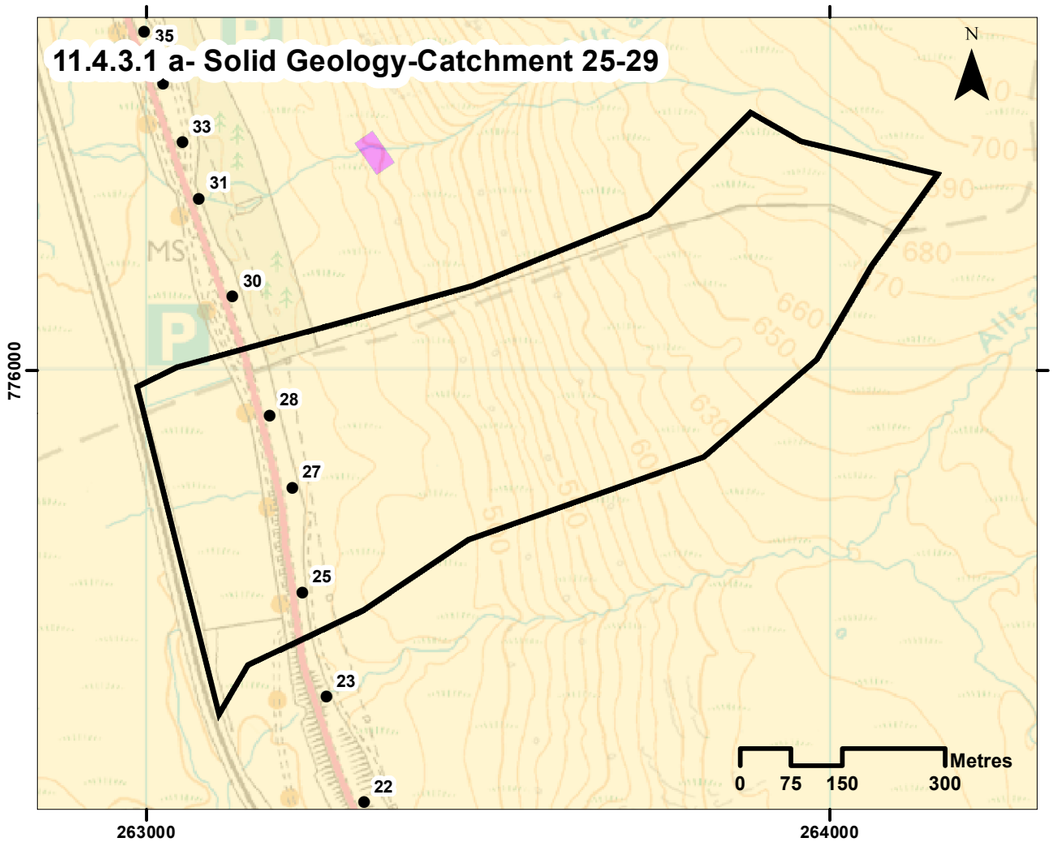
Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 25-29	
	Is peat present in the catchment?	Yes	Limited deposits in upper catchment
	Is there a bog burst risk?	Yes	Negligible
	Current valley side or terrace erosion	No	
	Potential valley side or terrace erosion	No	
	Hill slope failures (including peat slides and debris flows and slides)	Yes	
	Hill slope failures coupled to channel	No	
	Vertical incision present in catchment	Yes	
	Bank erosion/lateral migration	Yes	
	Unvegetated bars	No	
	Wooded/forested areas in catchment	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 25-29)	Track crossing	
	Comment on sediment source potential in catchment	Sediment available from debris flows, with potential for these to couple with channel. Most sediment appears to be supplied from locally incising channels and drains	
	Comment on sediment supply potential to crossing	Steep slopes will deliver sediment to the channels, however deposition is likely as the slope reduces before the crossing	

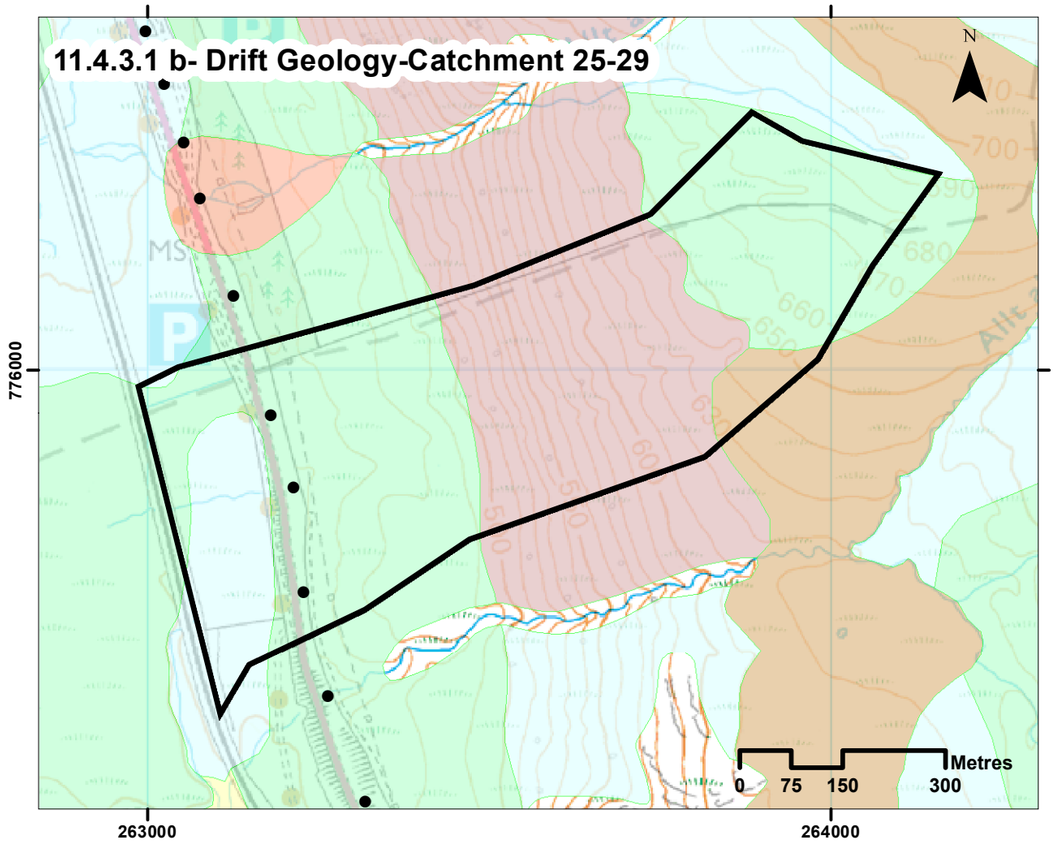
Morphology and Process- Reach upstream of crossing	Channel morphology	Plane bed	
	Predominant sediment size	Gravel	
	Unvegetated bars	None	
	Vertical incision	Medium	
	Deposition	Low	
	Lateral migration/bank erosion	Low	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 25-29)	None	
	Impact of infrastructure	None	
	Channel realignment	Yes	Drains and straightened channels

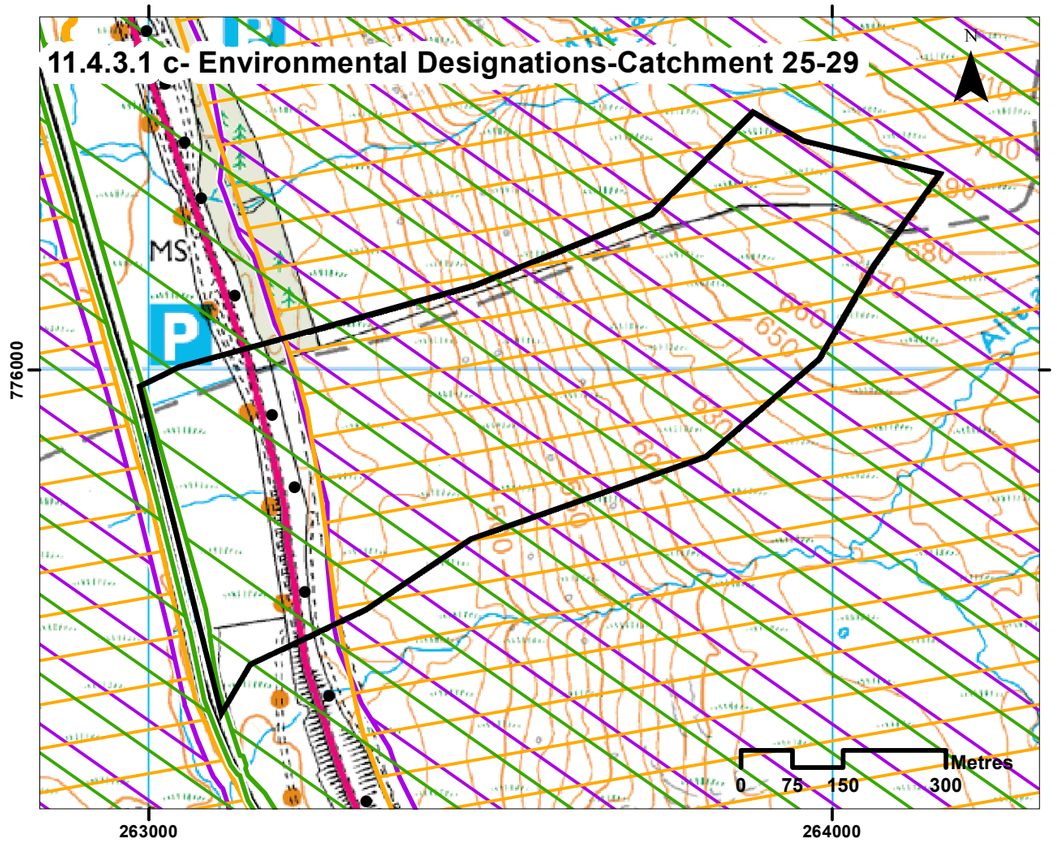
Morphology and Process- At crossing	Channel morphology	Engineered	
	Predominant sediment size	Gravel	
	Estimated discharge at 1:200 event (m^3/s)	-	Design flow 0.82 m^3/s
	Unvegetated bars	None	
	Vertical incision	None	
	Deposition	Medium	
	Lateral migration/bank erosion	None	
	Damaged/unstable drains or armouring	Yes	Incision in drains

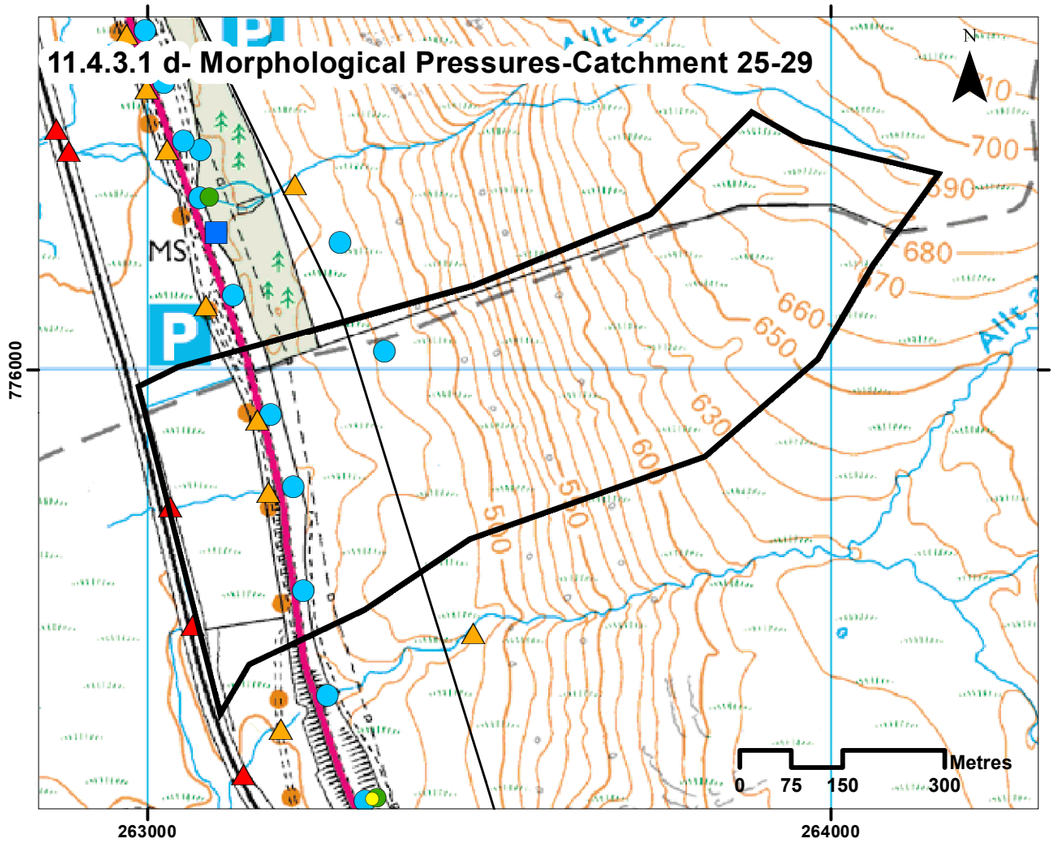
Morphology and Process- Reach downstream of crossing	Channel morphology	Plane bed	
	Predominant sediment size	Gravel	
	Unvegetated bars	None	
	Vertical incision	Low	
	Deposition	Medium	
	Lateral migration/bank erosion	None	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 25-29)	Railway crossing	
	Impact of infrastructure	Fixing channel position	
	Channel realignment	None	

Summary behaviour	Change in drainage network through the creation of drains and channel straightening. Channels appear to be incising and adding sediment to the channel upstream of the crossing, causing deposition within the crossing









Legend

General
- Crossing location
- Catchment Area

Solid Geology
- Gaick Psammite Formation - Psammite

Drift Geology
- Peat
- Glaciofluvial Ice Contact Deposits
- Gaick Plateau Moraine Formation
- Hummocky Glacial Deposits
- Ardverikie Till Formation - Diamicton
- Glaciofluvial Sheet Deposits
- Alluvium
- River Terrace Deposits
- Alluvial Fan Deposits
- Head
- Talus - Rock Fragments
- Talus Cone

Environmental Designations
- Special Site of Scientific Interest
- Special Area of Conservation
- Special Protection Area

Morphological Pressures
- Railway Bridge
- Track/Footbridge
- Culvert
- Cascade
- Catchpit
- Discharge Location
- Power Lines

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TRANSPORT SCOTLAND
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PROJECT 7 GLEN GARRY TO DALWHINNIE EIA

Drawing 11.4.3.1 Catchment 25-29 Catchment Overview

DESIGN:	DRAWN:	CHK:	APP:
EL	EV	EL	EL

DATE: 27/07/2017

PROJ: 495298

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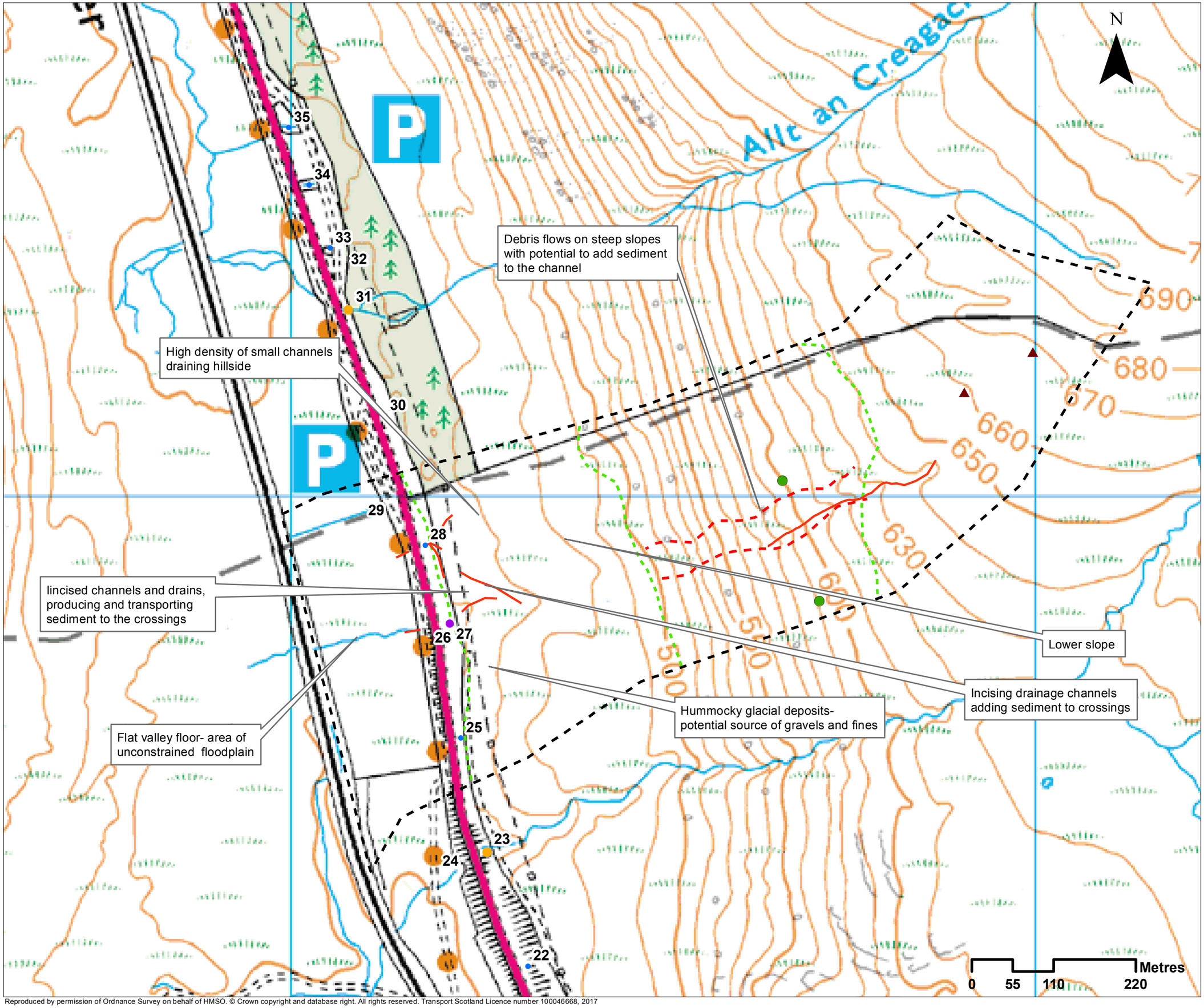

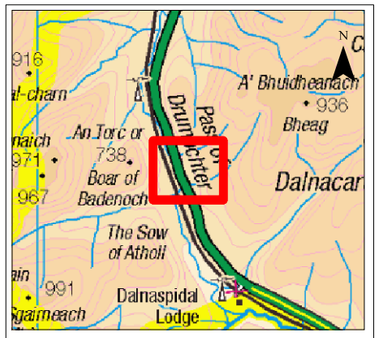

Legend

- Major crossing
- Minor crossing
- Other crossing
- Peat
- Debris flow
- Break in slope
- Terrace
- Incision
- Crossing catchment

REV	SUIT	DATE	DESCRIPTION	BY	APP

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A9 DUALLING PERTH TO INVERNESS Glen Garry to Dalwhinnie

PROJECT 7 GLEN GARRY TO DALWHINNIE EIA

DRAWING 11.4.3.2.
Catchment 25 - 29 Baseline Assessment

DESIGN:	DRAWN:	CHK:	APP:
EL	EL	AB	EL

DATE: 27/07/2017

PROJ: 495298

DWG: A9P07-CFJ-EWE-Z_ZZZZZ_ZZ-DR-EN-0002

SHEET:	REVISION:	SUITABILITY:
1 OF 1	C01	A3

Annex 11.4.3 - Hydromorphological Catchment Assessment - 31

Catchment No.	**31**
Catchment Name	-

Channel Nature	Nature of water course	Natural
	Size of water course	Major

Quantitative Spatial Elements	Catchment Area (km^2)	0.83
	Average slope in catchment (°)	10.5
	% Catchment over 750m (for snow melt risk)	48

WFD classification	Water, flows and levels	Good
	Physical condition	Good
	Overall ecological status	Good

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 31)	Gaick Psammite formation-Psammite	Resistant to weathering, impermeable
	Is an alluvial fan present at or near the crossing?	Yes	Large alluvial fan with apex at gorge exit. Little evidence of recent instability except at apex but risk of avulsion nonetheless

Environmental designations (see Drawing 11.4.3.1 c, Catchment 31)	Ramsar	No	
	SAC	Drumochter Hills	Acidic scree, alpine and subalpine heaths, blanket bog, dry heaths, monntane acid grasslands , mountain willow scrub, plants in crevices on acid rocks, species-rich grassland with mat-grass in upland areas, tall herb communities, wet heathland with cross-leaved
	SPA	Drumochter Hills	Dotterel breeding, merlin breeding
	SSSI	Drumochter Hills	Breeding bird assemblage, fluvial geomorphology of Scotland, montane assemblage, vascular plant assemblage

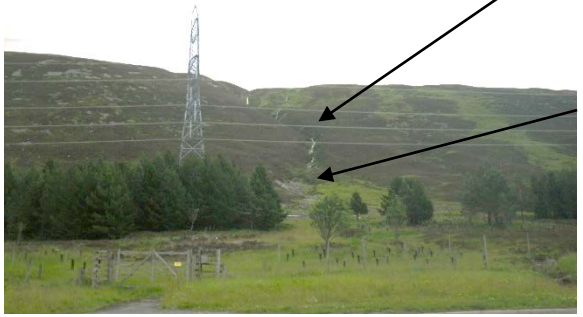
Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 31	
	Is peat present in the catchment?	Yes	
	Is there a bog burst risk?	Yes	
	Current valley side or terrace erosion	Yes	
	Potential valley side or terrace erosion	Yes	
	Hill slope failures (including peat slides and debris flows and slides)	Yes	
	Hill slope failures coupled to channel	Yes	
	Vertical incision present in catchment	Yes	
	Bank erosion/lateral migration	Yes	
	Unvegetated bars	No	
	Wooded/forested areas in catchment	Yes	Small chance of floating debris
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 31)	No	Except ETL track and bridge (see below)
	Comment on sediment source potential in catchment	High potential sediment input from coupled and channelized debris flows on steep slopes	
	Comment on sediment supply potential to crossing	Catchment susceptible to flashy floods due to snowmelt that have potential to transport sediment downstream. Channel is also incised, increasing potential for sediment supply to the crossing	

Morphology and Process- Reach upstream of crossing	Channel morphology	Step-pool	
	Predominant sediment size	Boulder-Cobble	
	Unvegetated bars	None	
	Vertical incision	Low	
	Deposition	Medium	
	Lateral migration/bank erosion	Low	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 31)	Track and bridge upstream of crossing	
	Impact of infrastructure	Fixing bank position	
	Channel realignment	None	

Morphology and Process- At crossing	Channel morphology	Engineered	
	Predominant sediment size	Cobbles and gravels	
	Estimated discharge at 1:200 event (m^3/s)	5.3	
	Unvegetated bars	None	
	Vertical incision	Medium	
	Deposition	Medium	
	Lateral migration/bank erosion	Low	
	Damaged/unstable drains or armouring	Yes	

Morphology and Process- Reach downstream of crossing	Channel morphology	Plane bed	
	Predominant sediment size	Gravels	
	Unvegetated bars	None	
	Vertical incision	None	
	Deposition	Low	
	Lateral migration/bank erosion	None	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 31)	Railway crossing	
	Impact of infrastructure	Fixing channel position	
	Channel realignment	None	

Summary behaviour	High sediment supply from steep slope, Catchment susceptible to flashy floods due to snowmelt. Crossing on an alluvial fan so area of past large scale deposition, and risk of avulsion (flow abandoning current channel and cutting new channel).



Photograph 11.4.3.63-Upstream to catchment

Photograph 11.4.3.64-Downstream of crossing

Photograph 11.4.3.65-Culvert exit

Photograph 11.4.3.66- Culvert entrance

Photograph 11.4.3.67-Damaged concrete bed on entrance to the culvert

Photograph 11.4.3.68-
Upstream to catchment

Photograph 11.4.3.69-Cascade morphology

Photograph 11.4.3.70-Downstream- Low gradient channel

Photograph 11.4.3.71-Debris flow tracks

Photograph 11.4.3.72-Reduced channel slope downstream

Photograph 11.4.3.73-Upstrem to steep upper catchment

Photograph 11.4.3.74-Some scour to concrete bed

Incision damaging concreate bed and starting to destabilise banks

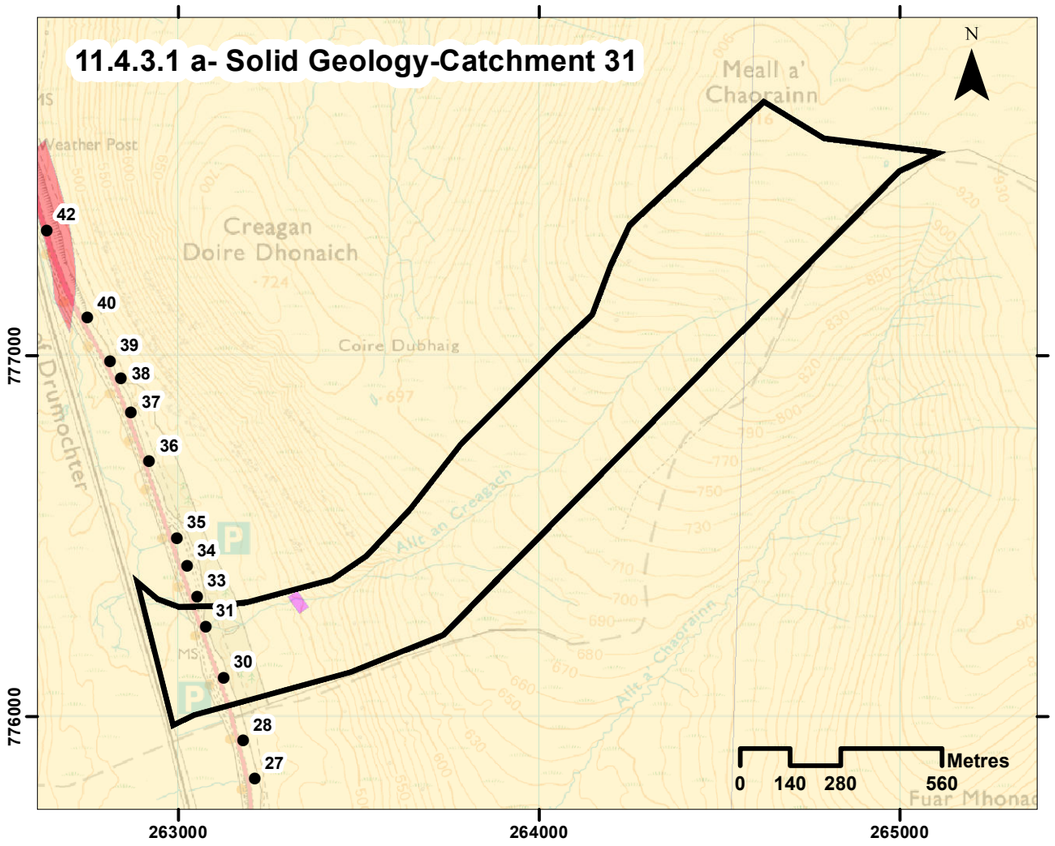
Incision undercutting engineered banks

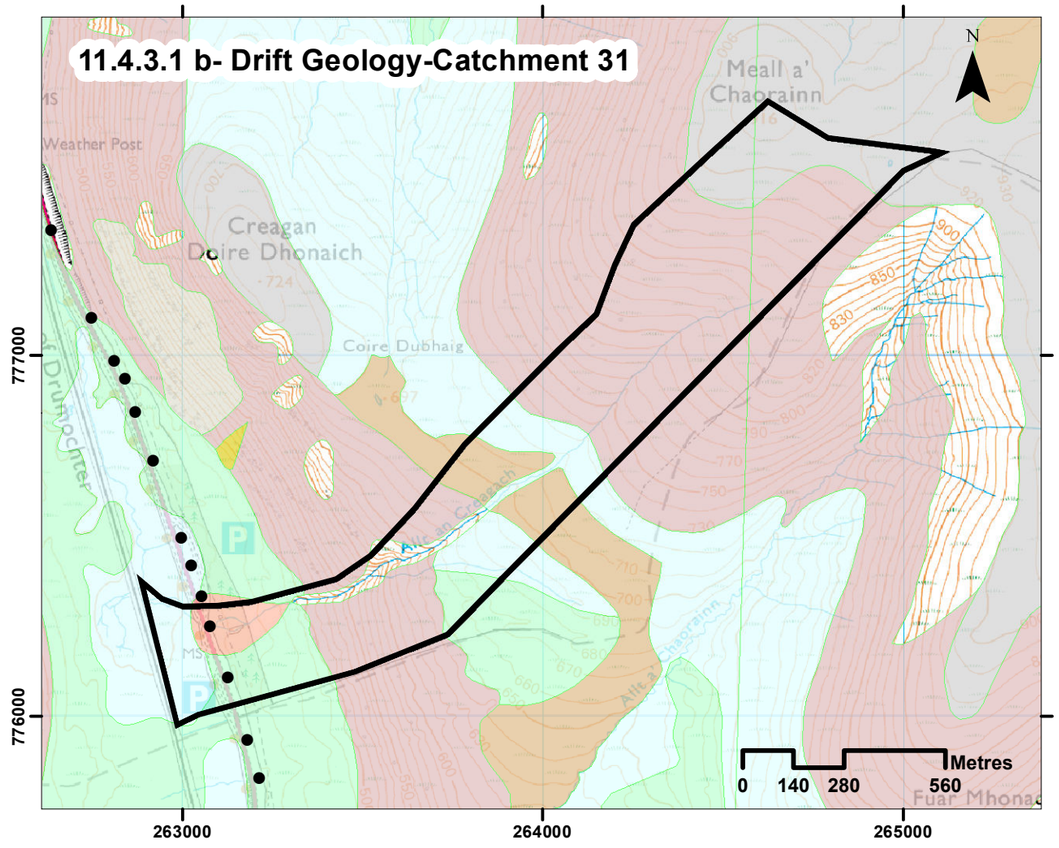
Photograph 11.4.3.75-Upsteam

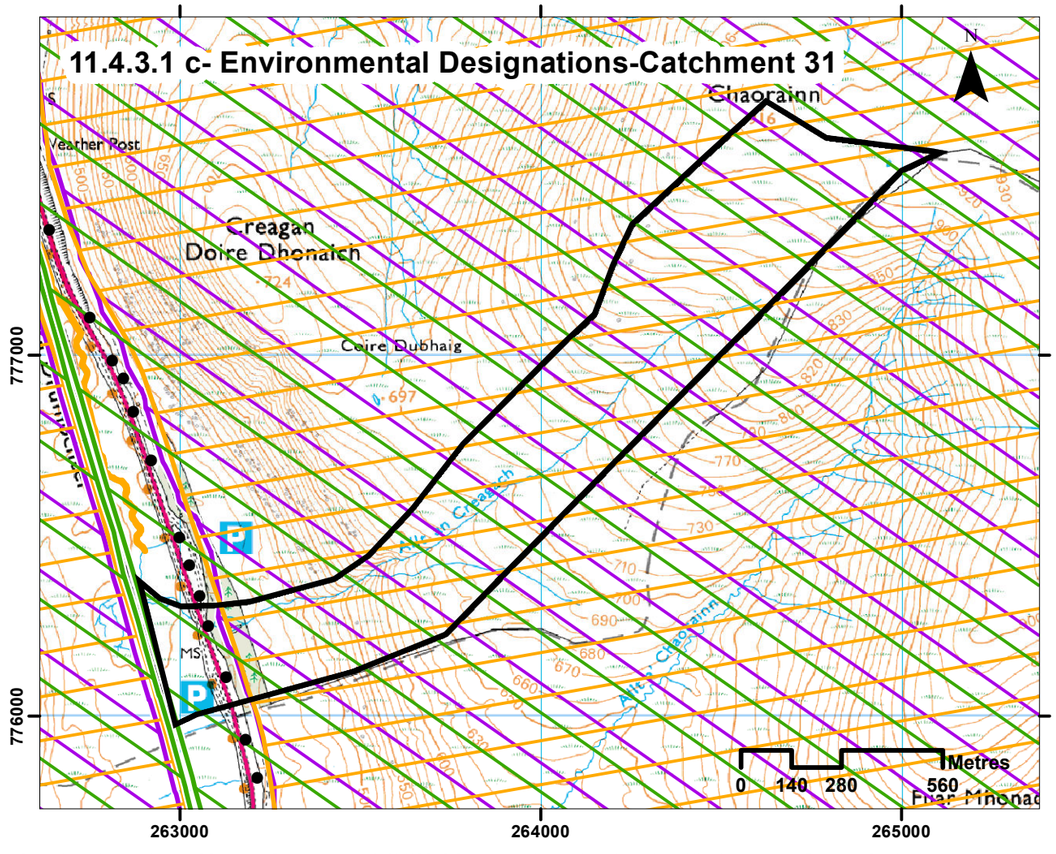
Photograph 11.4.3.76-Downstrem to culvert

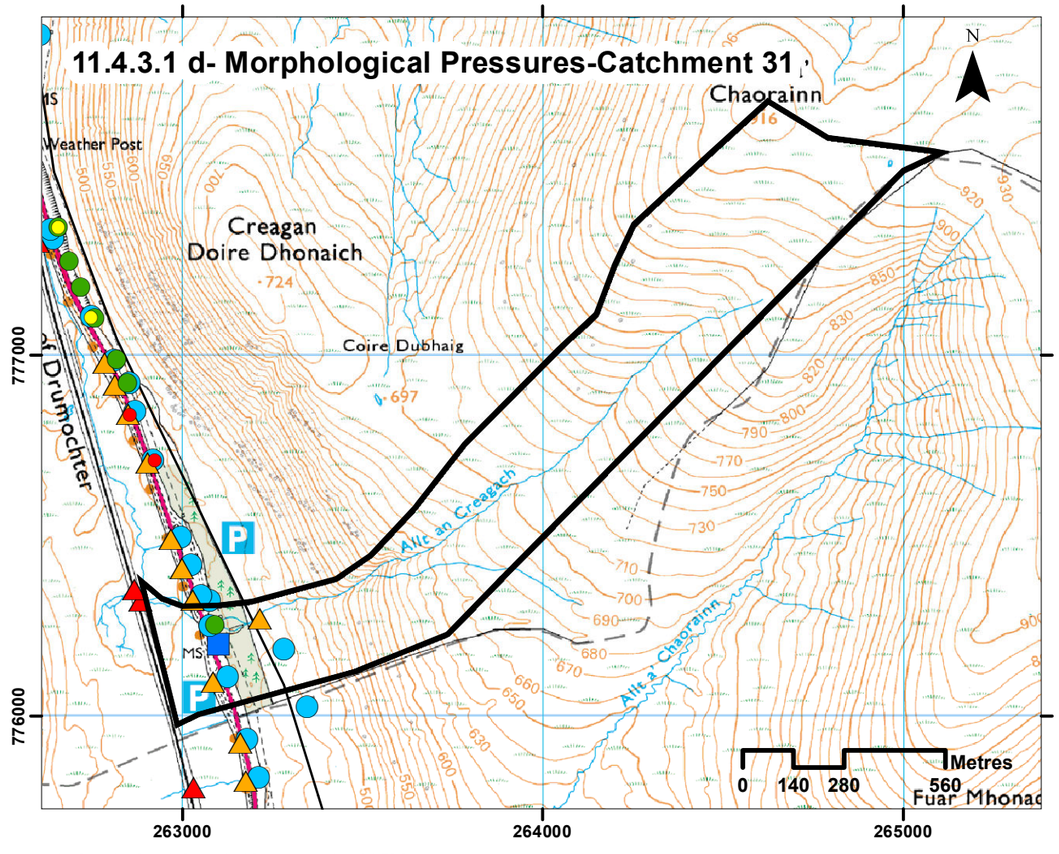
Photograph 11.4.3.77- Crossing 43 exit

Photograph 11.4.3.78-Downstream of crossing 43- short section of plane bed river









Legend

General
- Crossing location

Solid Geology
- Gaick Psammite Formation - Psammite

Drift Geology
- Peat
- Glaciofluvial Ice Contact Deposits
- Gaick Plateau Moraine Formation
- Hummocky Glacial Deposits
- Ardverikie Till Formation - Diamicton
- Glaciofluvial Sheet Deposits
- Alluvium
- River Terrace Deposits
- Alluvial Fan Deposits
- Head
- Talus - Rock Fragments
- Talus Cone

Environmental Designations
- Special Site of Scientific Interest
- Special Area of Conservation
- Special Protection Area

Morphological Pressures
- Railway Bridge
- Track/Footbridge
- Culvert
- Cascade
- Step in Bed
- Catchpit
- Discharge Location
- Power Lines

REV	SUIT	DATE	DESCRIPTION	BY	APP

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TRANSPORT SCOTLAND
A9 DUALLING PERTH TO INVERNESS Glen Garry to Dalwhinnie

PROJECT 7 GLEN GARRY TO DALWHINNIE EIA

Drawing 11.4.3.1 Catchment 31 Catchment Overview

DESIGN:	DRAWN:	CHK:	APP:
EL	EV	EL	EL

DATE: 18/07/2017

PROJ: 495298

DWG: A9P07-CFJ-EWE-Z_ZZZZZ_ZZ-DR-EN-0001

SHEET:	REVISION:	SUITABILITY:
1 of 1	C01	S3

Some forestry- local change to hydrology and potential increase in sediment and floating debris inputs in the short to medium term

Very steep incised channel, producing and transporting sediment

Flat valley floor- area of unconstrained floodplain

Valley side errosion adding sediment to the channel

Channelised debris flows

Lower slope and area of extensive deposition (now vegetated)

Crossing on aluvial fan. Risk of avulsion.

Hummocky glacial deposits- potential source of gravels and fines

Meall a' Chaorainn

Creagan Doire Dhonaich

Coire Dubhaig

Allt an Creagach

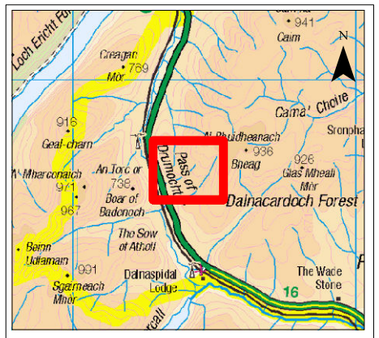
Allt a' Chaorainn

Post

MS

P

N



Legend

- Major crossing
- Minor crossing
- Other crossing
- Peat
- Coupled debris flow
- Debris flow
- Valley side erosion
- Break in slope
- Incision
- Crossing catchment

0 90 180 360 Metres

REV	SUIT	DATE	DESCRIPTION	BY	APP

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TRANSPORT SCOTLAND

A9 DUALLING PERTH TO INVERNESS Glen Garry to Dalwhinnie

PROJECT 7 GLEN GARRY TO DALWHINNIE EIA

DRAWING 11.4.3.2. Catchment 31 Baseline Assessment

DESIGN:	DRAWN:	CHK:	APP:
EL	EL	AB	EL

DATE: 10/07/2017

PROJ: 495298

DWG: A9P07-CFJ-EWE-Z_ZZZZZ_ZZ-DR-EN-0002

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1 OF 1	C01	A3

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